A REVIEW OF THE CURRENT STATE OF

BIOENERGY DEVELOPMENT IN G8 +5 COUNTRIES

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Dear Colleagues,

Bioenergy has rapidly emerged as a top priority on the international agenda. The Global Bioenergy Partnership builds its activities upon three strategic pillars: energy security, food security and sustainable development. It was established to implement the commitments taken by the G8 +5 Countries in the 2005 G8 Summit in Gleneagles, and was recently invited by the G8 Summit in Heiligendamm to “continue its work on biofuel best practices and take forward the successful and sustainable development of bioenergy”.

This Report represents a strategic tool to respond to this mandate furthering the global goal of sustainable bioenergy development.

Bioenergy production and use is increasing inexorably all over the world and although priorities may vary, its reasons are shared by most countries:

- rising oil prices and energy security considerations are forcing countries to look for alternative fuels;
- biofuels can play a role in rural development in some countries, providing energy access to remote communities and creating employment;
- last but certainly not least, climate change benefits that can be realized through reduction of GHG emissions.

We are keenly aware that a fast growth in bioenergy demand and supply bears some risks for food security and for the environment. Rising demand for bioenergy has already caused a surge in the use of grain and other food crops for energy and some crop commodities prices have risen. Bioenergy also poses environmental challenges, for instance increasing mono-cropping practices and greater fertiliser and pesticide use may jeopardise water and soil quality. Perhaps of highest concern is land use change and the risk that large areas of natural forests and grasslands be converted to energy crop production, which not only would threaten biodiversity preservation and other ecosystem services, but also result in additional greenhouse gas emissions.

In this respect, sustainability is a key objective and it is wise to put in place the necessary safeguards to ensure sustainable management of the entire production chain – feedstock production, processing and use of biofuels. An enormous amount of work needs to be done to develop, disseminate and implement these safeguards and best practices. If bioenergy production systems are not developed so that they can be sustained over time, bioenergy supply will not reach its potential and therefore will not deliver the expected benefits.

Life cycle analysis, labelling and “certification of origin” of biofuels should be agreed internationally and introduced into the global energy market. GBEP is already looking into the harmonization of methodologies to measure GHG impacts of biofuels used for transportation as contribution to this end. Certification and labeling mechanisms should be used to ensure sustainable development, environmental gains and to promote social equity but not to introduce barriers to trade.

Accelerating bioenergy innovation and tackling its main challenges will require strong cooperation, and the Global Bioenergy Partnership aims to play an important role. This overview of current bioenergy developments in G8 +5 Countries should help identify where there is common ground in policy priorities and opportunities for international cooperation, as well as provide guidance on what still needs to be done for a sustainable development of bioenergy.

The Global Bioenergy Partnership should take advantage of the current momentum to make sustainability criteria and best practices a major area of its work.

Take action now!

Corrado Clini
GBEP Chair

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Executive Summary

Bioenergy sits at the intersection of three of the world's great challenges - energy security, climate change, and poverty reduction - and has received an enormous amount of attention in the past few years. Joint work on these issues is vital considering that together, the G8 +5 Countries account for about 55 percent of the world's population, 70+ percent of global GDP, and about 72 percent of world energy-related and industry CO_2 emissions (excluding deforestation).

Bioenergy statistics, while highly imperfect, are essential to understand the dynamics of bioenergy systems; evaluating the role played by different types of biofuels in the energy sector and supply sources; assessing the share of biomass used (directly and indirectly) for energy purposes; assessing the role of biofuel in GHG inventories; and formulating sound policies.

According to the best data available, bioenergy provides about 10 percent of the world's total primary energy supply (47.2 EJ of bioenergy out of a total of 479 EJ in 2005, i.e. 9.85 percent). Most of this is for use in the residential sector (for heating and cooking) and is produced locally. In 2005 bioenergy represented 78 percent of all global renewable energy produced.

A full 97 percent of biofuels are made of solid biomass, 71 percent of which used in the residential sector. Biomass is also used to generate gaseous and liquid fuels, and growth in demand for the latter has been significant over the last ten years. Biomass provides a relatively small amount of the total primary energy supply (TPES) of the G8 Countries (1-4 percent). By contrast, bioenergy is a significant part of the energy supply in the +5 Countries representing from 5-27 percent of TPES. China with its 9000 PJ/yr is the largest user of biomass as a source of energy, followed by India (6000 PJ/yr), USA 2300 PJ/yr, and Brazil (2000 PJ/yr), while bioenergy's contribution in Canada, France and Germany is around 450 PJ/yr.

The bioenergy share in India, China and Mexico is decreasing, mostly as traditional biomass is substituted by kerosene and LPG. However the use of solid biomass for electricity production is important, especially from pulp and paper plants. Bioenergy's share in total energy consumption is increasing in the G8 Countries especially Germany, Italy and the United Kingdom.

There are four key factors driving interest in bioenergy: rising prices for fossil fuels, in particular oil prices; energy security; climate change; and rural development. Bioenergy markets are largely policy dependent in most of the world, as the production of biofuels in most countries is not at this point competitive with fossil fuels. Nearly all countries reported that energy security and climate change are the most important drivers of their bioenergy development activities. Overall there are few differences between the policy objectives of G8 Countries and the +5 Countries. Rural development, although important to some G8 Countries, is more central to the +5 Countries' focus on bioenergy development, and this is often aligned with a poverty alleviation agenda.

Feed-in tariffs, taxes, guaranteed markets (i.e. renewable energy and fuel mandates, and preferential purchasing), compulsory grid connections, other direct supports (i.e. grants, loan guarantees, subsidies, construction incentives, etc.), and R,D&D are the principal policy mechanisms being deployed by the G8 +5 Countries to encourage bioenergy development. Bioenergy markets are further influenced by general energy, agriculture and forestry, climate change, and environmental policies.

Feed-in tariffs are currently the world's most widespread national renewable energy policy and are in use in over half of the G8 +5 Countries. They are often crafted for renewable energy generally but are sometimes directed at bioenergy specifically. The feed-in tariff is the policy tool that has been most effective in stimulating renewable energy markets, however feed-in tariffs need to be differentiated by technology and biomass treated individually, in order to specifically boost bioenergy.

A variety of tax incentives and penalties are used by governments to foster bioenergy development and they are one of the most widely used support instruments. Taxes affect the cost-competitiveness of bioenergy vs. substitutes and therefore bioenergy viability in the marketplace.

National targets and public incentive systems have been effectively used in many countries, in particular for liquid biofuels for transport. Among the G8 +5 Countries, only Russia has not created a transport biofuel target. Voluntary quota systems or targets are common for biomass energy for heat, power and transport fuels in the G8 Countries, however, blending mandates enforceable via legal mechanisms are becoming increasingly utilized. Blending targets are less established in the +5 Countries but they are under discussion or awaiting approval. Preferential purchasing by governments can also be a powerful tool when effectively implemented. In policies relating to biofuels for transport, there is a trend towards policies such as blending mandates which don't require direct government funding, although publicly financed support remains significant.

Most countries use some form of direct loans or grants. The G8 +5 Governments are conducting research and development in their own laboratories and institutes and many are supporting public private partnerships and various forms of demonstration projects. Direct supports and R,D&D are being used in a number of G8 Countries to accelerate the commercial development of second generation biofuels for transportation.

A few governments are moving towards performance focused policies. Rather than mandate an amount of fuel to be consumed, these governments are mandating the amount of GHG reductions required. This strategy to harness market forces is rapidly gaining interest in Kyoto signatory countries that are looking for the most cost-effective GHG emission strategies.

There is a growing recognition that while biofuels could be potentially very "green" they are not always produced in the most environmentally friendly manner. In many countries, new schemes are under way to promote sustainability as well as link funding to sustainability. The European Union and some of its member states are working toward sustainability standards to attach to mandatory targets. Brazil has created its “social seal” and has tied it to its blending mandates.

The importance of developing bioenergy in a sustainable manner is universally recognized, yet no international sustainability assurance system exists for biofuels or bioenergy more broadly. Sustainability requirements will eventually need to be agreed upon internationally, applied locally and to all biomass regardless of end use, if leakage effects or impact shifting is to be avoided.

There is a move towards harmonization of technical standards regionally and internationally. This is vital for quality assurance, equipment compatibility, and the facilitation of trade. Historically, biomass and biofuel trade flows have been limited, as most of the production has been for domestic consumption. However, in the coming years, international trade in biofuels and feedstocks is expected to escalate rapidly to satisfy increasing worldwide demand.

The World Trade Organization (WTO) does not currently have a trade regime specific to biofuels. International trade in biofuels falls, therefore, under the rules of the General Agreement on Tariffs and Trade (GATT 1994). In addition to the WTO, several regional and bilateral trade agreements, mostly involving the United States and the EU, currently regulate biofuels trade. International trade in biofuels and related feedstocks may provide win-win opportunities for some countries: for several developed countries imports are a necessary precondition for meeting the self-imposed blending targets; for several developing countries producing and exporting biofuels may provide new business opportunities and new end-markets for their agricultural products. For small and medium-sized developing countries, export markets may be necessary to initiate their industries, however, tariffs and other barriers are currently restricting trade.

Government policies play a key role in influencing investment in bioenergy. When carefully balanced with environmental and social conditions, such policies will also determine the long-term viability of this important emerging opportunity.

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Acronyms

AAFC Agriculture and Agri-Food Canada
ABIP Agricultural Bioproducts Innovation Program of Canada
ACP African Caribbean and Pacific
ADEME Agence Pour l'Environnement et la Maîtrise de l'Energie
AEEG Italian Regulatory Authority for Electricity and Gas
AII French Agency for Industrial Innovation
APEC Asia-Pacific Economic Cooperation
ASGISA Accelerated and Shared Growth Initiative for South Africa
ASEAN Association of Southeast Asian Nations
ASTM American Society for Testing and Materials
BDFZ German Research Centre for Biomass
BOPI Biofuels Opportunities for Producer Initiatives
BNDES Brazilian Development Bank
BSI Better Sugarcane Initiative
BSO Biofuel Sustainability Ordinance
CAFTA US-Central America Free Trade Agreement
CAP Common Agriculture Policy
CBERA Caribbean Basin Economic Recovery Act
CBI Caribbean Basin Initiative
CBTPA Caribbean Basin Trade Partnership Act
CDM Clean Development Mechanism
CEN European Committee for Standardization
CEF Central Energy Fund
CFS Canadian Forest Service
CHP Combined Heat and Power
CIAA Brazilian Inter-Ministerial Board for Sugar and Ethanol
CIPE Inter-Ministerial Board for Economic Programming for Italy
CNG Compressed Natural Gas
CNPC China National Petroleum Corporation
CONAMA National Council for the Environment
CONACYT Mexican National Council of Science and Technology
CREB Clean Renewable Energy Bonds
CRE Mexican Energy Regulatory Commission
CTE-SS Committee on Trade and Environment Special Session
CTFCA Canadian Transportation Fuel Cell Alliance
DDGs Dried Distillers Grains with Solubles
DBERR UK Department for Business, Enterprise and Regulatory Reform
DEFRA UK Department for Environment, Food and Rural Affairs
DOE U.S. Department of Energy
DOD U.S. Department of Defense
DOT U.S. Department of Transportation
DME South African Department of Minerals and Energy
DNA South African Designated National Authority
DTI UK Department of Trade and Industry
EC European Commission
EEC UK Energy Efficiency Commitment
EC DG European Commission Directorate General

EcoABC Eco Agriculture Biofuels Capital Initiative
EBA Everything But Arms Initiative
EBB European Biodiesel Board
EEG Germany's Renewable Energy Act
EIA Energy Information Administration, US Department of Energy
ENEA Italian Agency for New Technologies, Energy and Environment
EPA US Environmental Protection Agency
EPACT Energy Policy Act
EPFL École Polytechnique Fédérale de Lausanne
ERC Energy Research Centre
EMBRAPA Brazilian Agricultural Research Corporation
EWG Energy Working Group
EGNRET Expert Group on New and Renewable Energy Technologies
EU European Union
EEP Ethanol Expansion Programme
EPA U.S. Environmental Protection Agency
ESCO Energy Service Company
ESMAP Energy Sector Management Assistance Programme
ETBE Ethyl tertiary butyl ether
FAEE Fatty Acid Ethyl Ester
FAME Fatty Acid Methyl Ester
FAO Food and Agriculture Organization of the United Nations
FFV Flexible Fueled Vehicles
FLO Fairtrade Label Organization
FSC Forest Stewardship Council
FTA US and Canada Free Trade Agreement
GATT General Agreement on Tariffs and Trade
GBEP Global Bioenergy Partnership
GEF Global Environment Facility
GHG Greenhouse Gas
GIS Geographical Information System
GOM Government of Mexico
GM General Motors
GREET Greenhouse gases Regulated Emissions and Energy use in Transportation
GSP Generalized System of Preferences
GTZ German Technical Cooperation
HS Harmonized System
IAA Sugar and Ethanol Institute
IATP Institute for Agriculture and Trade Policy
IBF International Biofuels Forum
IBSA India-Brazil- South Africa
IDB Inter-American Development Bank
IEA International Energy Agency
IFOAM International Federation of Organic Agricultural Movements
IGCC Integrated Gasification Combined Cycle
ILO International Labour Organization
ITABIA Italian Biomass Association
ISO International Standards Organization
INMETRO National Institute of Metrology, Standards and Industrial Quality of Brazil
I- WESTAT Interactive-Wood Energy Statistics of FAO

LAFRE Law for the Utilization of Renewable Sources of Energy
LCFS Low Carbon Fuel Standard
LFG Landfill Gas
LPG Liquified Petroleum Gas
LSPEE Mexican Public Electricity Service Act
MAPA Ministry of Agriculture, Livestock and Food Supply of Brazil
MDB Multilateral Development Bank
MEA Multilateral Environmental Agreement
MERCOSUR Southern Common Market
MFN Most-Favoured Nations
MIT Massachusetts Institute of Technology
MSW Municipal Solid Waste
MTBE Methyl tertiary-butyl ether
NAFTA North American Free Trade Agreement
NAMA Negotiating Group on Non-Agriculture Market Access
NBA National Biofuels Action
NBAP National Biomass Action Plan
NGB Non Grain Based
NDRC National Development and Reform Commission of China
NFFO Non-Fossil Fuel Obligation
NNFCC National Non-Food Crops Centre
NIST US National Institute of Standards and Technology
NRCan National Resources Canada
OECD Organisation for Economic Co-operation and Development
OERD Office of Energy Research and Development
OPA Ontario Power Authority
PCHs Small Hydroelectric Centrals
PDD Project Design Document
PERD Programme on Energy Research and Development
PFV Powering Future Vehicles
PIN Project Idea Note
PM Particulate Matter
PROBIO National Biofuel Programme for Italy
PROINFA Brazilian Renewable Energy Incentive Program
PRONAC Mexican National Sugar Development Plan
PNVBAF Italian National Programme for the utilization of Agriculture and Forest Biomass
PNERB Italian National Programme of Biomass Renewable Energies
PSE Mexican Sectoral Programme of Energy
PTC Production Tax Credit
R & D Research & Development
R, D & D Research, Development & Demonstration
RE Renewable Energy
RECS Renewable Energy Certificate System
RES Renewable Energy Sources
RES-E Renewable Energy Source Electricity
RES-H Renewable Energy Source Heat
RETP Renewable Energy Technologies Programme
RFA Renewable Fuels Association
RFS Renewable Fuels Standard
REPI Renewable Energy Production Incentive

RO Renewable Obligation
RPS Renewable Portfolio Standards
RSB Roundtable on Sustainable Biofuels
RTRS Roundtable for Responsible Soy
RTFO Renewable Transport Fuel Obligation
SBA Sustainable Biodiesel Alliance
SENER Mexican Ministry of Energy
SIEPCRM Integrated Energy Services for Small Rural Mexican Communities
SINOPEC China Petroleum and Chemical Corporation
SVO Straight Vegetable Oil
TB Treated Biogas
TEAM Technology Early Action Measures
TGAP Taxe Générale sur les Activités Polluantes
TIC Taxe Intérieure de consommation
TEC Common External Tariff
TFC Total Fuel Consumption
TPES Total Primary Energy Supply
TRQ Tariff Rate Quota
VAT Valued Added Tax
VEETC Volumetric Ethanol Excise Tax Credit
VOC Volatile Organic Compounds
UNEP United Nations Environment Programme
UNCTAD United Nations Conference on Trade and Development
UNIDO United Nations Industrial Development Organization
UNFCCC United Nations Framework Convention on Climate Change
USAID U.S. Agency for International Development
USDA U.S. Department of Agriculture
WTO World Trade Organization
WWF World Wildlife Fund

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Introduction

The Global Bioenergy Partnership (GBEP) was established to implement the commitments taken by the G8 +5 Countries in the 2005 Gleneagles Plan of Action to "promote the continued development and commercialisation of renewable energy by […supporting] wider, cost effective, biomass and biofuels deployment, particularly in developing countries where biomass use is prevalent".

In 2007 it was given a renewed mandate by the G8 Heiligendamm Summit to "continue its work on biofuel best practices and take forward the successful and sustainable development of bioenergy".

This report is part of GBEP's ongoing efforts to monitor the status of bioenergy development in the member countries and create a basis for future discussion of sustainability criteria and possible guidelines for sustainable bioenergy development.

It was requested by the GBEP Steering Committee and provides an overview of current bioenergy policies, strategies and legislation in G8 +5 Countries which represents a basis for recommendations on the future program of work of GBEP in order to promote sustainable development of bioenergy.

The information contained in the Executive Summary and Chapters 1 and 2 does not necessarily reflect the views of GBEP Partners. Additionally, with the exception of India, the information in the country profiles and hence the information used for the analysis and comparisons, are based upon the documentation suggested and/or made available by the countries themselves.

1 Bioenergy in the Global Energy Context

1.1 Bioenergy Contribution to World Total Energy Supply

Bioenergy provides about 10 percent of the world's total primary energy supply (47.2 EJ of bioenergy out of a total of 479 EJ in 2005, i.e. 9.85 percent).[1] Most of this is for use in the residential sector (for heating and cooking). In 2005 bioenergy represented 78 percent of all renewable energy produced. A full 97 percent of biofuels are made of solid biomass, 71 percent of which used in the residential sector.

Humans have depended on traditional bioenergy for millennia. Currently, over 85 percent of biomass energy is consumed as solid fuels for cooking, heating and lighting, often with low efficiency. Traditional bioenergy (fuelwood, charcoal which can only deliver heat) dominate bioenergy consumption in developing countries where up to 95 percent of national energy consumption relies on biomass.

Modern biomass is becoming increasingly important to countries as a low-carbon, distributed, renewable component of national energy matrices. Utilization of modern bioenergy is growing in OECD countries. Over recent years, especially co-firing of biomass materials in coal-fired boilers has increased, and some gasification technologies are nearing commercialisation.

1.2 Bioenergy Overview

A wide range of biomass sources can be used to produce bioenergy in a variety of forms. For example, food, fibre and wood process residues from the industrial sector, energy and short-rotation crops and agricultural wastes from the agricultural sector and forest residues, agroforest residues, and short rotation coppice from the forestry sector can be utilized to generate electricity, heat, combined heat and power, and other forms of bioenergy.

Traditional biomass including fuelwood, charcoal and animal dung, continue to be important sources of bioenergy in many parts of the world. To date, woodfuels represent by far the most common sources of bioenergy and not only for less developed regions. Woodfuels provide energy security service for large segments of society and woodfuels echnology is developing and expanding rapidly. Modern bioenergy relies on efficient conversion technologies for applications at household, small business and industrial scales.

Solid or liquid biomass inputs can be processed to be more convenient energy carriers. These include solid fuels (e.g firewood, wood chips, pellets, charcoal, briquetts), liquid fuels (e.g. bioethanol, biodiesel, bio-oil), gaseous fuels (biogas, synthesis gas, hydrogen) or direct heat from the production process.

[1] IEA database

Bioenergy Terms Defined

Bioenergy: energy derived from biomass.

Biofuels: energy carrier derived from biomass.

Biogas: a gas composed principally of methane and carbon dioxide produced by anaerobic digestion of biomass, comprising:

- landfill gas
- sewage sludge gas
- other biogas e.g. from anaerobic fermentation of animal slurries and of wastes in abattoirs, breweries and other agro-food industries.
- dedicated energy crops such as wheat, maize, etc.

Biohydrogen: hydrogen produced from biomass for use as an energy carrier by several routes e.g.:

- Gasification or pyrolysis of solid biomass
- Reforming of biogas
- Novel technologies based on use of photosynthetic algae or bacteria, or on fermentative bacteria.

First Generation Biofuels: produced from sugar, starch and oil content that is processed into liquid fuels using conventional technology.

Liquid biofuels: liquid fuels derived from biomass, comprising:

- Bioethanol
- biodiesel
- bioethanol
- biodimethylether
- raw vegetable oil
- synthetic diesel
- pyrolysis oil (biooil)

Modern bioenergy: relies on efficient conversion technologies for applications at household, small business and industrial scales.

Second Generation Biofuels: derived from lignocellulosic materials (e.g.agricultural residues, woody crops, grasses, waste materials, etc.) using advanced processes.

Solid biomass: covers solid non-fossil material of biological origin which may be used as fuel for bioenergy production. It comprises:

- Purpose grown wood (from agriculture or forestry)
- conventional crops (e.g. sugar, oil and starch crops)
- wood wastes (e.g. from forestry or wood processing activities)
- other solid wastes (e.g. straw, rice husks, nut shells, poultry litter, biodegradable fraction of municipal solid waste).

Traditional bioenergy*:* includes fuelwood and charcoal which can only deliver heat.

Woodfuels: (all types of fuels produced directly or indirectly from woody biomass, i.e. fuelwood, charcoal and black liquor (FAO UBET)) are included in IEA's "Primary Solid Biomass" (along with other solid fuels of non-woody origin).

1.2.1 Biomass for Heat and Power

Power (heat and electricity)

A variety of biomass resources are utilized through combustion, to generate bioenergy in the forms of electricity and heat. These biomass sources include residues from agro-industries (bagasse), residues left on the fields post-harvest (corn stalks), animal manure, wood wastes from forestry and industry, residues from food and paper industries, municipal solid wastes (MSW), sewage sludge, dedicated energy crops such as short-rotation perennials (eucalyptus, poplar, willow) and grasses (miscanthus and switchgrass),[2] and biogas from the digestion of agricultural and other organic wastes. Some estimates project that the cumulative residue and organic waste could provide between 40EJ and 170EJ of energy per year, globally.[3]

Biomass can be converted for power generation using several processes. Generally, the majority of biomass-derived electricity is produced using a steam cycle process, in which biomass is burned in a boiler to generate high-pressure steam, that flows over a series of aerodynamic blades causing a turbine to rotate, which in response turns a connected electric generator to produce electricity.[4] [5] Compacted forms of biomass such as wood pellets and briquettes can also be used for combustion. This system is known as the direct-fired system and is similar to the electricity generation process of most fossil-fuel fired power plants. Figure 1.1 illustrates the direct firing process.

Biomass can also be burned with coal in a boiler of a conventional power plant to yield steam and electricity. Co-firing biomass with coal is currently the most cost-efficient way of incorporating renewable technology into conventional power production because much of the existing power plant infrastructure can be used without major modifications.[6] [7] Co-combusting coal and biomass in large-scale coal plants is claimed to have significantly higher combustion efficiency (up to 45 percent) than dedicated-biomass plants (30 to 35 percent using dry biomass and 22 percent for MSW)[8] According to the U.S. Department of Energy and the Coal Utilization Research Council, conventional pulverized coal in modern plants can yield 45 to 50 percent efficiency and have the potential to achieve 70 to 80 percent efficiency with advances in future gasification technologies.[9] [10] Co-firing technology options have been tested in Northern Europe, the United States, and Australia in approximately 150 installations using woody and agricultural residues.[11]

[2] IEA 2007, Energy Technology Essentials, Biomass for Power Generation and CHP, January 2007 (available at http://www.iea.org/textbase/techno/essentials3.pdf)

[3] Utrecht Centre for Energy Research (UCE-UU), Global Restrictions on Biomass Availability for Import to the Netherlands (GRAIN), July 2001 (available at http://www.uce-uu.nl/index.php?action=1&menuId=1&type=project&id=3&)

[4] US Department of Energy, Distributed Energy Program, Biomass Power Fact Sheet. Last updated: May, 2006 (available at http://www.eere.energy.gov/de/biomass_power.html)

[5] US Department of Energy, Energy Efficiency and Renewable Energy: Biomass Program, Electrical Power Generation. Last Updated: 03/15/2007 (available at http://www1.eere.energy.gov/biomass/electrical_power.html)

[6] DOE, d.e.p Biomass Fact Sheet

[7] DOE eere.energy.gov

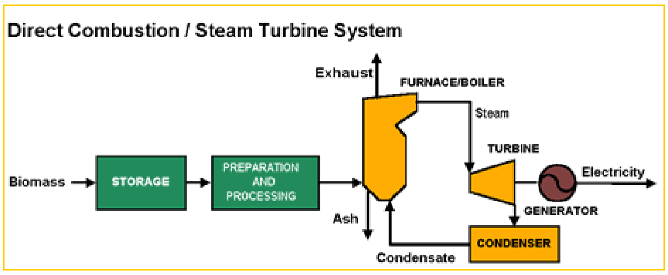
[8] IEA 2007

[9] U.S. Department of Energy, Fossil Energy, Coal Gasification R&D Program, (available at www.fossil.energy.gov/programs/powersystems/gasification/index.html)

[10] Coal Utilization Research Council, Electricity from Coal: Advanced Combustion Technologies, (available at www.coal.org/facts/combustion.htm)

[11] IEA 2007

Figure 1.1 – Direct Combustion



Source: DOE d.e.p. biomass power

1.2.2 Biogas for Heat and Power

Anaerobic Digestion

Biogas can also be created through *anaerobic digestion* of food or animal waste by bacteria, in an oxygen-starved environment. The final product of this form of digestion is a biogas that contains a high volume of methane along with carbon dioxide. Methane-rich biogas can be used for heating or for electricity generation in a modified internal combustion engine.[12] Advanced gasification technologies are necessary to produce biogas with sufficient energy for fuelling turbines.

The conversion of animal wastes and manure to methane/biogas can bring significant environmental and health benefits. Methane is a GHG that is 22-24 times more powerful as CO_2 in trapping heat in the atmosphere[13]. By trapping and utilizing the methane, GHG impacts are avoided. In addition, pathogens present in manure are killed by the heat generated in the biodigestion process and the material left at the end of the process provides a valuable fertilizer. Biodigestion is employed successfully in various countries, and particularly in China and India where is has contributed to energy provision to rural populations, abatement of negative environmental impacts of livestock production, and the production of organic fertilizer. Its impact on sanitation, clean cooking and heating and in the creation of small and medium enterprises in rural areas is very positive.

Gasification

Through the process of *gasification*, solid biomass can be converted into a fuel gas or biogas. Biomass gasifiers operate by heating biomass in a low oxygen content, high temperature environment that breaks it down to release a flammable, energy-rich synthesis gas or ‘syngas’.[14] This gas can be burned in a conventional boiler, or used instead of natural gas in a gas turbine to turn electric generators. Biogas formed through gasification can be filtered to remove

[12] DOE d.e.p. biomass power
[13] Intergovernmental Panel on Climate Change (IPCC) Second Assessment Report – Climate Change 1995. as cited in U.S. Environmental Protection Agency (EPA), Methane: Science (last updated 19 October, 2006) (available at http://www.epa.gov/methane/scientific.html)
[14] NREL learning, IEA 2007

unwanted chemical compound and can be used in efficient power generation systems known as ‘combined-cycles’, which can combine steam and gas turbines for electricity generation and can yield up to 60 percent efficiency of coal-fired plants.[15] The first integrated gasification combined cycle (IGCC) plant fuelled by 100 percent biomass (from straw) was successfully demonstrated in Sweden from 1996 to 2000[16]. IGCC plants elsewhere could become economically competitive using black-liquor from the pulp and paper industry as a feedstock, but further analysis is required.[17]

Biogas for Transport

Treatment of biogas obtained can make it suitable for use as a transport fuel. Due to a low methane content (60 to 70 percent) and a unsuitably high amount of contaminants, untreated biogas is unsuitable for transportation.[18] Treated biogas (TB) – sometimes called "biomethane" - resulting from processes that remove carbon dioxide, water, and corrosive hydrogen sulphide and enhance the methane content (> 95 percent), and when compressed has properties similar to compressed natural gas (CNG), thereby making it suitable for use in automobiles.[19] Sweden currently leads the world in automotive biogas production, with a total fleet of approximately 4500 vehicles with 45 percent of its fuel supplied by biogas.[20]

1.2.2. Liquid Biofuels for Transport

Bioethanol available in the biofuel market today is produced by processing sugar or starch. Commercial bioethanol production starts by pulverizing the feedstock to facilitate processing. Once the feedstock has been broken down, the sugar content is dissolved out of the material and combined with yeast in an anaerobic chamber to undergo a fermentation process. In the resulting reaction, the yeast secretes enzymes to digest the sugar, deconstructing it into lactic acid, hydrogen, carbon dioxide and bioethanol. For starchy feedstock, an extra step is necessary prior to fermentation in order to break down the large starch molecules into simple sugars. This process, known as saccharification adds extra energy requirements to bioethanol production. After the fermentation stage, the product must be distilled to remove the yeast and byproducts and then dehydrated in order to reduce the 5 to 12 percent solution into a concentrated output of 95 to 99.8 percent bioethanol.

A variety of common sugar crops such as sugar cane, sugar beet and sweet sorghum, which contain a large proportion of simple sugars, are used as feedstock for bioethanol production. Common starchy feedstocks include corn, wheat, and cassava. The relative bioethanol yields of various crops are provided in Figure 1.2.

[15] DOE eere.energy.gov
[16] IEA 2007
[17] IEA 2007
[18] Worldwatch Institute, Biofuels for Transport: Global Potential and Implications for Energy and Agriculture (London: Earthscan, 2007), chapter 15, p259.
[19] Ibid.
[20] Jönsson, O., M. Persson, 'Biogas as Transportation Fuel', Swedish Gas Center, Fachtagung 2003.

Bioethanol can be blended with gasoline or burned in its pure form in slightly modified spark-ignition engines. A litre of bioethanol contains approximately 66 percent as much energy as a litre of gasoline. However, it has a higher octane level and when mixed with gasoline for transportation, improves the performance of gasoline by reducing the occurrence of engine knock problems that arise when the fuel combusts too soon during vehicle acceleration. Fuel bioethanol is referred to as an ‘oxygenate’ since its oxygen content improves fuel combustion in vehicles, thereby helping to reduce the emission of carbon monoxide, unburned hydrocarbons and carcinogens.

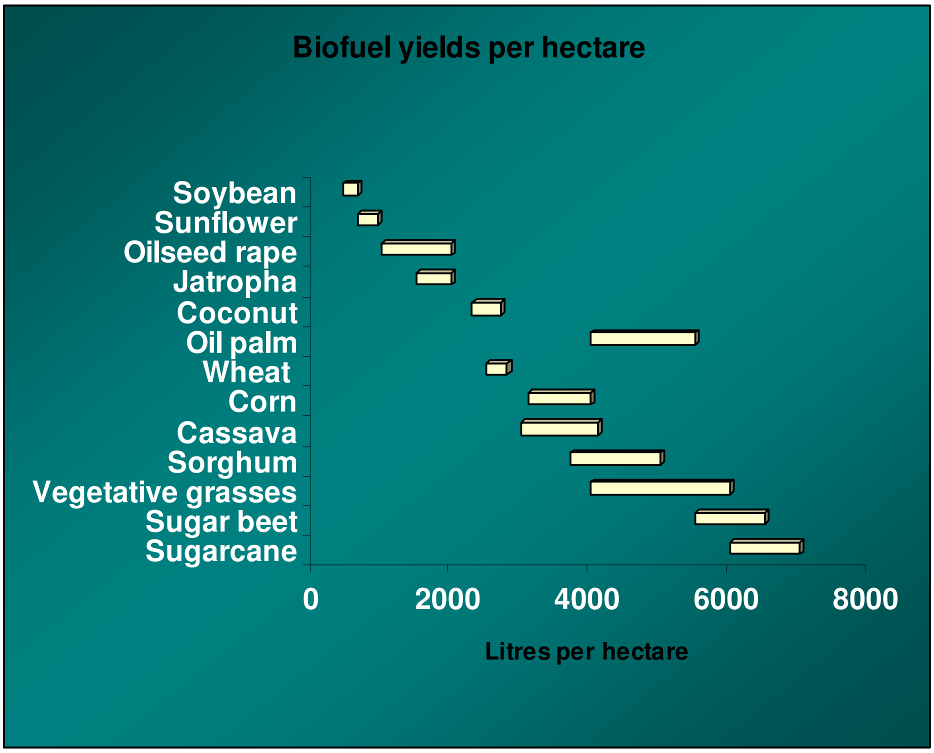
Consequently, the combustion of bioethanol also causes a heightened reaction with nitrogen in the atmosphere which can result in a marginal increase in nitrogen oxide (NO_x) gases. In comparison to gasoline, bioethanol contains only a trace amount of sulphur. Mixing bioethanol in gasoline therefore, helps to reduce the fuel’s sulphur content and thereby lowers emissions of sulphur oxide (SO_x), a component of acid rain and a carcinogen. However, due to bioethanol’s higher vapour pressure, at low level blends evaporative emissions are higher.

As the biomass fed into bioethanol production is created by the capture of carbon dioxide during photosynthesis, the emissions during bioethanol fuel combustion is generally recycling carbon back into the atmosphere. However, bioethanol’s net reduction of GHG emissions will vary depending on the amount of fossil fuel energy used during the entire bioethanol production process.

The United States is currently the largest producer of fuel bioethanol with a production capacity of 13.17 billion litres a year with corn as its primary feedstock[21]. Sugar cane is used as bioethanol feedstock by Brazil, currently the world’s second largest producer.

[21] Renewable Fuel Association (RFA), U.S. Fuel Bioethanol Industry Biorefineries and Production Capacity, August 1, 2007. (available at http://www.bioethanolrfa.org/industry/locations/)

Figure 1.2– Estimated per-acre bioethanol yields for various crop types[22]



In 2006, total world bioethanol production reached 51.3 billion litres.[23] The United States continued as the leader in global bioethanol production with an output of 20 billion litres in 2006 and an expected 26 billion litres by the end of 2007.[24] As the world's second largest bioethanol producer, Brazil produced about 17.8 billion litres of bioethanol derived from sugar cane in 2006 with a projected 20 billion litres for 2007.[25] Jointly, the United States and Brazil produce almost 90 percent of the world's fuel bioethanol.[26] As regional leaders in bioethanol production for 2007, China and India are projected to produce 3.7 billion litres and 2.3 billion litres respectively. Production in 2006 for Asia was recorded at 6.5 billion litres with 2007 numbers likely to reach 7.4 billion litres. In the EU, fuel bioethanol production is forecast to rise to approximately 2.3 billion litres in 2007 from 1.6 billion litres in 2006. As the largest producer of fuel bioethanol in the EU, France is set to produce an estimated 1.2 billion litres in 2007 followed by Germany at 850 million litres. Table 1.1 summarizes world production of bioethanol, and key producers from the period of 2000-2006.

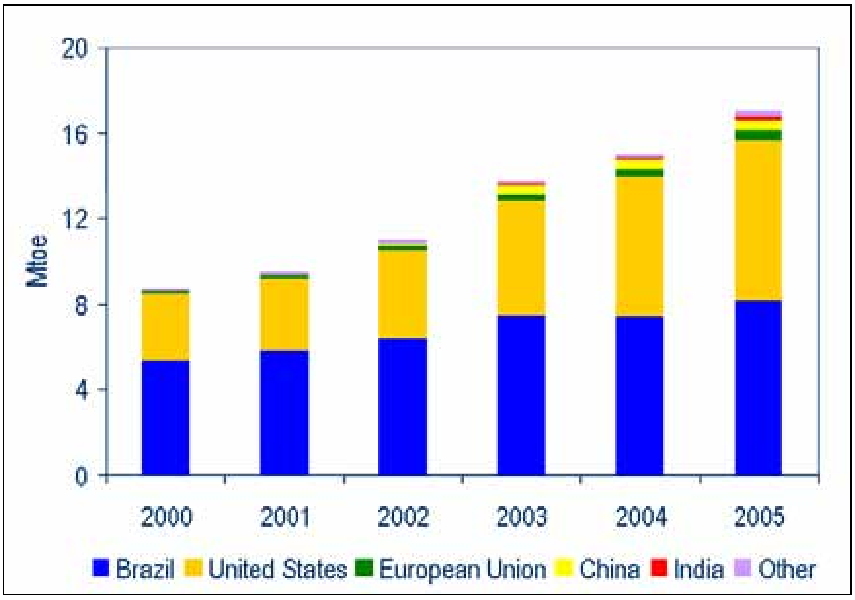
[22] The energy content of biodiesel (~34-36MJ/l) is greater than that of ethanol (~21MJ/l). So readers should not directly compare biodiesel (top half of diagram) with ethanol (bottom half) purely on a l / ha basis
[23] F.O. Licht, May 09 2007, World Bioethanol and Biofuels Report. Vol.5, No.17
[24] Ibid.
[25] Ibid.
[26] Rodrigo Pinto and Suzanne Hunt, Worldwatch Institute, 2007, Vital Signs, "Biofuel Flows Surge"

Table 1.1 – World Production of Bioethanol – Top Producers by Region 2000-2007 (billion litres)

Country/Region	2000	2001	2002	2003	2004	2005	2006
Canada	0.21	0.22	0.23	0.23	0.23	0.25	0.57
U.S.A.	7.6	8.12	9.59	12.06	14.31	16.21	19.85
N & C America	8.2	8.75	10.22	12.7	14.96	16.86	20.85
Brazil	10.61	11.5	12.61	14.73	14.66	16.06	17.82
S. America	11.07	11.95	13.04	15.18	15.14	16.57	18.59
France	0.81	0.81	0.84	0.81	0.83	0.91	0.95
Germany	0.28	0.29	0.27	0.28	0.23	0.35	0.76
E.U.	2.42	2.58	2.51	2.47	2.45	2.79	3.44
China	2.97	3.05	3.15	3.4	3.5	3.5	3.55
India	1.72	1.78	1.8	1.77	1.23	1.1	1.65
Asia	5.79	5.96	6.14	6.47	5.93	5.81	6.43
World	29.41	31.32	34.07	39.01	40.71	44.29	51.32

Source: F.O. Licht, May 09 2007, World Bioethanol and Biofuels Report. Vol.5, No.17

Figure 1.3 - Global Bioethanol Production



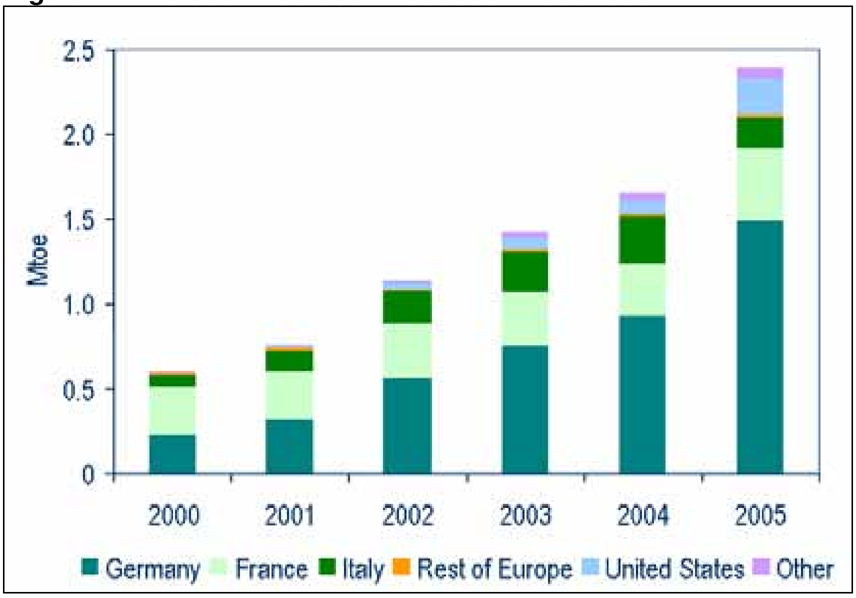
Source: F.O. Licht, May 09 2007, World Bioethanol and Biofuels Report. Vol.5, No.17

Biodiesel is made by combining vegetable oil or animal fat with an alcohol and a catalyst through a reaction known as *transesterification*. A mixture of 80 to 90 percent oil, 10 to 20 percent alcohol and an acid or base catalyst are heated to produce a volume of biodiesel equivalent to the original volume of oil/fat. Oil for biodiesel production can be extracted from nearly any oilseed crop. Globally, the most popular oilseed sources are rapeseed in Europe and soybean in the United States. In tropical and sub-tropical nations, palm, coconut and jatropha oils are utilized for biodiesel production. A small amount of animal fat, from fish and animal processing operations, is also used to make biodiesel. As a wide variety of oils can be used to produce biodiesel, resulting fuels can have a greater range in physical properties, like viscosity and combustibility, than bioethanol.

Biodiesel can be blended with traditional diesel fuel or burned in its pure form in compression ignition engines. Biodiesel contains 88 to 95 percent as much energy as diesel. However, biodiesel improves the lubricity of diesel and raises the cetane value, thereby making the fuel economy of both diesel and biodiesel generally comparable. The higher oxygen content in biodiesel aids in the completion of fuel combustion, which reduces particulate air pollutants, carbon monoxide and hydrocarbons. Similar to bioethanol fuel, biodiesel contains a negligible amount of sulphur thereby contributing the reduction of sulphur oxide emissions from vehicles.

World biodiesel production surpassed 6 billion litres in 2006. Europe led biodiesel production in 2006, producing 3.96 million tons of fuel using rapeseed, sunflower and other oilseeds. The EU is projected to produce 4.72 million tons for 2007. As the leader in biodiesel production, Germany produced 3.8 million tons (2.5 billion litres) of biodiesel in 2006 and its production capacity is set to rise by 40 percent to 5.4 million tonnes by the end of 2007.[27] The United States is currently the second largest producer of biodiesel and is estimated to produce about 1.8 million tons in 2007, up from 1.3 million in 2006.[28] France, Italy and several small suppliers also grew their biodiesel output.[29] Production rates increased rapidly in Malaysia, China, Colombia and Brazil in 2006 contributing to world biodiesel expansion.[30] Figure 1.4 summarizes Global Biodiesel Production 2000-2005.

Figure 1.4 – Global Biodiesel Production 2000-2005



Source: F O Licht (2006). World Ethanol Markets: The Outlook to 2015. Special Report No 138, Adapted as Fig 14.3 in IEA World Energy Outlook, 2006

[27] F.O. Licht, August 08, 2007, World Bioethanol and Biofuels Report. Vol. 5, No.23
[28] F.O. Licht, March 2007, World Bioethanol and Biofuels Report.
[29] Rodrigo Pinto and Suzanne Hunt, Worldwatch Institute, 2007, Vital Signs, “Biofuel Flows Surge”
[30] Ibid.

Straight vegetable oil (SVO) is a potential fuel for diesel engines that can be produced from a variety of sources. These include oilseed crops such as rapeseed, sunflower, soybean and palm. Used cooking oil from restaurants and animal fat from meat processing industries can also be used as fuel for diesel vehicles.

Due to its high viscosity in temperate climates, pure SVO is not always suitable for normal diesel engines. Conventional engines must be refitted with a second fuel system including a mechanism for pre-heating the oil in order to use SVO as fuel. Modern engines are developing to be increasingly electronic with combustions systems that are incompatible with SVO. As SVO thickens at colder temperatures, its blending with diesel has been problematic. However, characteristics of SVO are particular to the choice of oilseed and different types of plant oil are known to affect engine performance differently.

Advanced Fuels – "Second Generation Fuels"

As the most abundant biological material on Earth, cellulosic biomass such as wood, tall grasses, and forestry and crop residues are projected to greatly expand the quantity and variety of feedstock available for biofuel production. In comparison to the conventional starch and oilseed crops that can contribute only a fraction of the plant material towards biofuel production, cellulosic energy crops can produce more biomass per hectare of land since the entire crop is available as feedstock for conversion to fuel, and can be grown on land that is not prime agricultural land.

Second generation liquid biofuels are attractive from a sustainability standpoint for a number of reasons. By using cellulosic biomass, fossil fuel use is displaced by feedstock that is not directly competing with its use for food production. Waste biomass can be used, which would not require additional land for production as it is readily available from present forests and agricultural land uses and would otherwise decompose. However, it is important to consider that decomposing biomass plays a crucial role in maintaining soil fertility and texture. Excessive withdrawls for bioenergy use could have negative effects. Additionally, the greatest potential for reducing GHG emissions lies in the development of advanced second-generation feedstock and biofuels (See Figure 2.1 in chapter 2). Most studies project that future, advanced fuels from perennial crops, woody and agricultural residues could dramatically reduce life cycle GHG emissions relative to petroleum fuels. Some options hold the potential for net emissions reductions that exceed 100 percent — meaning that more CO_2 would be sequestered during the production process than the equivalent emissions released during its life cycle — if fertilizer inputs are minimized, and biomass or other renewable sources are used for process energy.[31] In addition, fast-growing perennials such as short-rotation woody crops and tall grasses can

[31] Lew Fulton et al., Biofuels for Transport: An International Perspective, Paris, International Energy Agency, 2004), pp. 61-62; Eric D. Larson, Liquid Biofuel Systems for the Transport Sector: A Background Paper, Draft for discussion at the Global Environment Facility Scientific and Technical Advisory Panel Workshop on Liquid Biofuels, New Delhi, 29 August – 1 September 2005; Mark A Delucchi, Research Scientist, Institute of Transportation Studies (ITS), University of California at Davis, e-mail to Janet Sawin, Worldwatch Institute, 10 March 2006; and Delucchi, A Multi-Country Analysis of Lifecycle Emissions from Transportation Fuels and Motor Vehicles (Davis, CA: Institute of Transportation Studies, University of California at Davis, May 2005), p. 44, all cited in Worldwatch Institute, Biofuels for Transport: Global Potential and Implications for Energy and Agriculture (London: Earthscan, 2007), chapter 11

grow on a wide variety of soils and often so, on poor, degraded soil where production of food crops is not optimal due to erosion concerns and other limitations.

Due to its tensile strength, cellulose biomass is harder to break down for conversion to liquid fuels. However, this property makes it more robust for handling, reducing costs for maintaining biomass quality compared to food crops. Additionally, storage is easier for cellulosic biomass as it resists deterioration, especially when compared to sugar-based crops. Cellulosic biomass can often be bulky and require developed transportation infrastructure to deliver it to processing plants after harvest. Loss of dry cellulosic biomass (and hence energy content) during the harvest and transportation process can be minimized if moisture content and exposure to oxygen are kept at a minimum in order to retard decomposition.[32]

Cellulosic biomass is made up of three main constituents: cellulose, hemicellulose and lignin. Cellulose is a robust molecule formed of long chains of glucose. Hemicellulose, with comparatively less carbon content than cellulose, is easier to break down with heat or chemicals. Lignin is responsible for providing the rigidity to the structure of plants and trees. Different plants and trees can have varying mixes of these three components, with a typical range of 40 to 55 percent cellulose, 20 to 40 percent hemicellulose and 10 to 25 percent lignin.[33]

Production of biofuels from cellulosic feedstock uses a variety of technologies that target different components of the biomass. As cellulosic biomass is more resistant to being broken down when compared to starch, sugar and oils, the difficulty of converting it into liquid fuels inherently makes the conversion technology more expensive even though the cost of the cellulosic feedstock itself is lower than for current, first-generation feedstock. The two primary methods of procuring liquid fuels and energy from cellulosic biomass are *thermo-chemical conversion* and *biochemical conversion*.

The most common thermo-chemical conversion process used to developed advanced fuels currently includes *gasification* and *Fischer-Tropsch (F-T) synthesis*. In gasification, biomass is converted to synthesis gas, or 'syngas' (see Biomass for Heat and Power) that contains carbon monoxide, carbon dioxide, hydrogen and methane. Syngas can be converted to an assortment of fuels such as hydrogen, bioethanol (dimethyl ether, DME) as well as synthetic diesel and synthetic gasoline. The gasification pathway converts all of the biomass into syngas which can be converted into liquid fuel, thereby producing more fuel per ton of biomass.[34]

Hydrolysis is a form of biochemical conversion for transforming biomass into liquid fuel. Hydrolysis can convert biomass to bioethanol by using acids that break the bonds of the larger cellulose molecule to form smaller sugar molecules ready for fermentation. The process is currently expensive and a drawback of using it for cellulosic feedstock is the low fuel yield

[32] International Energy Agency (IEA), Good Practice Guidelines, Bioenergy Project Development and Biomass Supply, March 2007

[33] Worldwatch Institute, Biofuels for Transport: Global Potential and Implications for Energy and Agriculture, London: Earthscan, 2007, chapter 4

[34] Darmouth College and Natural Resources Defense Council (NRDC) The Role of Biomass in America's Energy Future (RBAEF), Sponsored by DOE, the Energy Foundation and the National Commission on Energy Policy, (available at http://engineering.dartmouth.edu/other/rbaef/index.shtml)

caused by the over-disintegration of the hemicellulose sugar before fermentation. Hydrolysis using enzymes and microbial digestion is also currently being developed that look to optimize sugar extraction from cellulose and hemicellulose.[35]

Pyrolysis, a process that heats biomass in anoxic conditions, although well-established in small plants, has yet to be used on a large scale. Pyrolysis can be classified as conventional, fast or flash depending on the temperature, heating rate, particle size and solid residence time of the process. Fast pyrolysis of biomass yields a liquid product called pyrolysis oil or bio-oil that can readily transported and stored. Most forms of cellulosic biomass maybe used as pyrolysis input. In laboratory conditions, nearly 100 types of plant biomass have been tested such as agricultural wastes (straw), olive pits, nut shells, forestry wastes such as bark and thinnings.[36] However, large scale pyrolysis facilities are yet to be developed and in most instances, it may be desirable to use a combination of different conversion methods for different types of biomass in one production facility in order to optimize and regulate the amount of required process energy.

Algae

Micro-algae are unicellular aquatic plants that produce vast amounts of plant oil that can be used for the sustainable production of biodiesel. Although categorized currently as a first-generation feedstock due to conventional conversion technologies used for its processing, algae holds great potential as a prolific next-generation feedstock with its long-term economic capacity yet to be tested. Microalgae can be cultivated in a wide variety of conditions ranging from arid regions with poor soil quality, to salt water and water from polluted aquifers.[37] The per hectare yield is estimated to be many times greater than tropical oil seeds.

The primary necessities of algae production are carbon dioxide and nitrogen oxide (NO_x), which creates the opportunity for the development of integrated systems where micro-algae are 'fed' by the emissions of coal, petroleum and natural gas power plants. In recent developments, the Massachusetts Institute of Technology (MIT) has demonstrated a new technology for utilizing micro-algae to absorb power plant emissions. Large enough algal colonies could reduce NO_x levels by about 80 percent and CO_2 by 30 to 40 percent, while simultaneously producing raw plant oil for its use in producing bioenergy.[38] Species of algae that are optimal for such functions have the capacity to produce 40 to 50 percent oil by weight.[39] The economics of algae as an energy feedstock are still challenging, however recent research and innovation are like to make algae a cost-effective option in the future.[40]

Future Biofuel Production: The 'Biorefinery Concept'

A 'biorefinery' is a conceptual model for future biofuel production where both fuels and high value co-product materials are produced. Akin to chemicals produced in petroleum refineries, biorefineries would simultaneously produce biofuels as well as bio-based chemicals, heat and power. Fuels would represent the bulk of total biorefinery production, while chemicals and other

[35] Mark Laser and Lee Lynd (2006) Report to Worldwatch Institute, Mark Laser and Lee Lynd, Thayer School of Engineering, Dartmouth College, 13 January 2006. as cited in Worldwatch Institute, Biofuels for Transport: Global Potential and Implications for Energy and Agriculture (London: Earthscan, 2007), chapter 5
[36] Mohan. Dinesh, Chalres U. Pittman, Jr., and Philip H. Steele, Pyrolysis of Wood/Biomass for Bio-oil: A Critical Review. American Chemical Society. March 10, 2006
[37] John Sheehan et al (1998) A Look Back at the US Department of Energy's Aquatic Species Program: Biodiesel from Algae, Golden, CO, NREL.
[38] 'Algae – like a breath of mint for smokestacks', USA Today, 10 January 2006;
[39] Ibid.
[40] Sheehan et al, op cit. note xxxii

materials would generate the bulk of the profits.[41] A limited market exists for organic chemicals that are currently considered high-value, 'specialty' products produced from petrochemical feedstocks and processed in separate plants. Biorefineries would present more economical option where bio-based chemicals are co-products of liquid fuel.

Future biorefineries would be able to mimic the energy efficiency of modern oil refining through extensive heat integration and co-product development. Heat that is released from some processes within the biorefinery could be used to meet the heat requirements for other processes in the system. This is already being done in some bioenergy production facilities.

Advanced Fuels Outlook

Conversion of cellulosic biomass into advanced fuels is likely a decade or two away from contributing a significant proportion of the world's liquid fuels. Currently there are a number of pilot and demo plants either operating or under development around the world. Biochemical and thermochemical conversion pathways are likely to expand commercially in the next 8 to 15 years depending upon the speed and success of pilot projects currently underway, sustained research funding, and other support from governments over this period, as well as world oil prices and private sector investment. The emergence of cellulosic biofuels as the forerunner of liquid fuels will also depend greatly on government support provided to risk-averse investors to build cellulosic-conversion facilities. This is especially crucial as compared to conventional biofuel plants, large capital expenditures are inherent in building new cellulosic fuel plants and investors lack guarantees that advanced fuels will remain competitive in the long-run due to high petroleum prices. Even though next generation fuels may very well be cheaper than gasoline if petroleum prices remain consistently high, in the near future, they are still likely to remain more expensive than conventional first-generation production technologies. Even though it is likely to take many years before cellulosic fuel can compete with conventional fuels, in the near future they could supply a growing share of the global fuel mix.

Biohydrogen

Biomass can be converted into biohydrogen (that is the first step of the biogas production). Biohydrogen can have better energy efficiency than biogas in end use in fuel cell technology. Another interesting route to biohydrogen is the water photolysis assisted with bio-organisms and solar radiation. Extracting hydrogen from biomass is a long term option. Basic research and development projects are still needed to move towards commercialized industrial processes.

1.2.3 Bioenergy Trade

Bioenergy trade is expected to become more important in the next decades driven by sustained high and increasing fossil fuel prices, concerns regarding domestic energy security, and the

[41] Worldwatch Institute, Biofuels for Transport: Global Potential and Implications for Energy and Agriculture, London: Earthscan, 2007, chapter 5

goal to create a diversified energy supply mix and a consequent strong political motivation to enhance bioenergy and other renewables. Most producers of transport biofuels today are producing for domestic use. However, world bioethanol trade over the last few years has been growing substantially and is projected to continue increasing in the coming years. (See also section Import/Export Trends).

Some processed biomass trade is occurring, indicating prospective growth in the world market for biomass for energy production. International trade of wood pellets has occurred in several countries in the EU including Sweden, Netherlands and nations of the Baltic Sea. The major trade flows over the last few years have occurred from Estonia, Latvia, Lithuania and Poland to Sweden, Denmark, Germany and Netherlands. Austria remains the strongest trader in Central Europe.

Swedish imports of biomass in 2003 were estimated to be between 18 to 34 PJ.[42] Sweden imported tall oil and pellets from North America and the Baltic States, pellets and logging residues from Belarus, and MSW and recovered wood from mainland EU. Additionally, Canada and Finland exported approximately 350 000 tonnes of pellets to Sweden in 2003.[43] The Netherlands imported an estimated 1.2 million tonnes of biomass for use in power plants. These included palm kernel shells (residue from palm oil production) from Malaysia and wood pellets from other EU nations.[44] According to the IEA, these examples and various analyses show that biomass can be economically transported over longer distances, provided that transport occurs in bulk (such as by train or ship), and that biomass can be increased in density to reduce its volume and make transport more cost-effective.

While biomass tends to be quite bulky, it can be densified to make transport more efficient. Compact, densified biomass can take the form of wood pellets, charcoal briquettes and manufactured logs that can be readily fed into a combustion system. Pellets can be made from dehydrated wood wastes, waste paper and agricultural residues that can be mechanically compressed into a product that has less than one-third the original volume.[45]

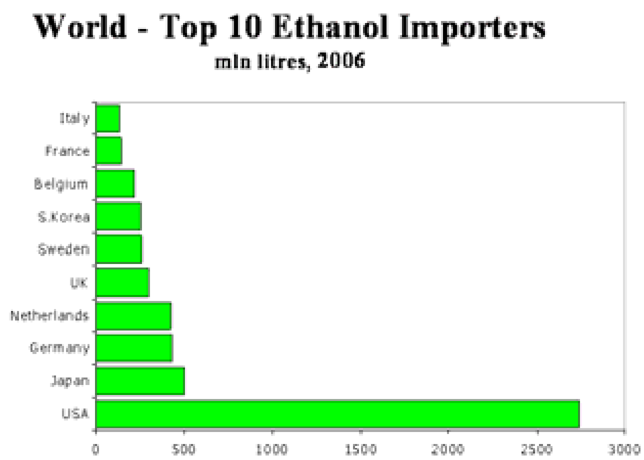
Import/Export Trends[46]

The volume of bioethanol traded worldwide grew to around 7.814 billion litres in 2006, compared with 5.9 billion in 2005 and 3.2 billion in 2002. The rise was mostly attributed to the noticeable increase in trade reported in Brazil when 2006 exports reached 3.5 billion litres, up 0.9 billion litres from 2005, a threefold increase over 2002 figures. Record alcohol prices resulted as China shipped more than 1 billion litres in 2006, mostly in response to higher demand in the United States. Despite record levels of shipments from Brazil, the world market share of the North and South America remained 60 percent, while Asia-Pacific gained market

[42] available at http://www.bioenergytrade.org/downloads/t40opportunitiesandbarriersforbioenergytradefi.pdf and http://www.bioenergytrade.org/downloads/schlamadingeretal.optionsfortradingbioenergy.pdf and EUBIONET Biomass EU trade summary
[43] Ibid.
[44] Ibid.
[45] Cornell U. (available at http://www.grassbioenergy.org/downloads/Bioenergy_Info_Sheet_7.pdf)
[46] Global ethanol and biodiesel trade flow and trend data obtained from analyst F.O. Licht's World Bioethanol and Biofuels Report.46

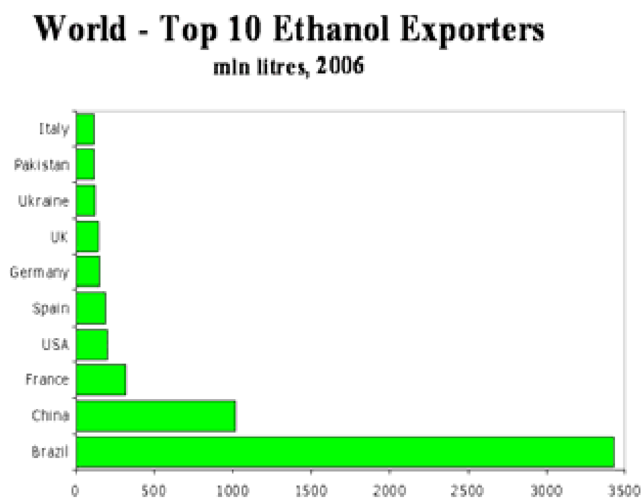
footing to 17 percent, up 7 percent from 2005. European exports accounted for less than 20 percent of the world market while Africa contributed 4 percent of all bioethanol shipments. Analysts estimate that United States' bioethanol import demand is unlikely to be as strong in 2007 in comparison to the year before. In comparison Brazil sales are projected to reach approximately 3.8 to 3.9 billion litres in 2007. Figure 1.5 and Figure 1.6 show the top 10 bioethanol importers and exporters in 2006. Table 1.2 and Table 1.3 summarize world bioethanol imports and exports from 2002 – 2006 by region.

Figure 1.5



Source: F.O. Licht

Figure 1.6



Source: F. O. Licht

North and South America

An ethanol deficit on the United States market and record sugar cane production between 2005-2007 resulted in an all time high in Brazilian bioethanol exports. In 2006, Brazil's total shipments amount to over 3.4 billion litres compared to 2.6 billion litres in 2005 and 800 million litres in 2002. Additional dehydration capacity being developed in Central America and the Caribbean due to the Caribbean Basin Initiative (CBI) is likely to contribute towards the United States' duty-free import quota. According to analyst F.O. Licht, CBI countries will be allowed to ship 1.3 billion litres of duty free alcohol this year compared with 1.015 billion in 2006. In 2006, total imports from CBI countries in the CBI Group amassed to 780 million litres or 77 percent of the total tariff rate quota which was an improvement of 43 percent in 2005 and 37 percent in 2004.

European Union

Total exports from the EU rose to 1.31 billion litres in 2006. France continued to be the largest European exporter with a total of 320 million litres. Spain was the second largest in 2006 with a more than fivefold increase of shipments to almost 190 million litres due to domestic oversupply. Germany was the largest importer of bioethanol in 2006 with 430 million litres. With a trend of growing imports and the largest gasoline market, Germany is likely to develop into the most active bioethanol consumer in the coming years. In 2002, Germany's imports were 200 million litres with exports of 69 million litres and in 2005 the shipments and increased to 150 million litres. Sweden also realized a growth in its bioethanol imports with total 2006 arrivals of 257 million litres in 2006, compared to 169 million litres the year before.

Asia-Pacific

In 2006, Asian exports doubled to 1.3 billion litres from 615 million litres in 2005. This surge was mostly attributed to a six-fold increase in Chinese shipments which reached 1.02 billion litres in 2006, compared to 162 million litres in 2005. Pakistan was the next largest exporter in the Asia Pacific region with bioethanol shipments of around 116 million litres. The largest importers in Asia for 2006 were Japan with 500 million litres, and South Korea whose imports reached a record high of 252 million litres compared to 242 million litres in 2005.

Table 1.2 - World Bioethanol Imports 2002-2006 (billion litres)

Country/Region	2002	2003	2004	2005	2006
Total Americas	0.86	1.32	1.59	1.57	3.72
Total Africa	0.09	0.1	0.16	0.22	0.15
E.U.	1.05	1.13	1.60	2.00	2.36
Asia	0.86	0.86	1.25	1.55	1.05
World	2.86	3.40	4.62	5.35	7.29

Table 1.3 - World Bioethanol Exports 2002-2006 (h litres)

Country/Region	2002	2003	2004	2005	2006
Total Americas	1.48	1.57	3.20	3.54	4.66
Total Africa	0.18	0.2	0.17	0.38	0.33
E.U.	0.90	1.09	0.98	1.26	1.31
Asia	0.58	0.84	0.50	0.61	1.34
World	3.22	3.81	4.96	5.93	7.81

Most of the reviewed biomass products are mainly consumed locally in the countries where they were produced, but in the case of products such as sawn timber, paper and paperboard, palm oil and wood pellets, remarkable shares of the total production are exported.

Table 1.4 - An overview of world biomass production and international trade in 2004

Product	World Production in 2004	Volume of international trade in 2004
Industrial wood and forest products		
Industrial round wood	1 646 Mm^3	121 Mm^3
Wood chips and particles	197 Mm^3	37 Mm^3
Sawn timber	416 Mm^3	130 Mm^3
Pulp for paper production	189 Mt	42 Mt
Paper and paperboard	354 Mt	111 Mt
Agricultural products		
Maize	725 Mt	83 Mt
Wheat	630 Mt	118 Mt
Barley	154 Mt	22 Mt
Oats	26 Mt	2.5 Mt
Rye	18 Mt	2 Mt
Rice	608 Mt	28 Mt
Palm Oil	37 Mt	23 Mt
Rapeseed	46 mt	8.5 Mt
Rapeseed oil	16 Mt	2.5 mt
Solid and liquid biofuels		
Ethanol	41 Mm^3	3.5 Mm^3
Biodiesel	3.5 Mt	<0.5 Mt
Fuel wood	1 772 Mm^3	3.5 Mm^3
Charcoal	44 Mt	1 Mt
Wood pellets	4 Mt	1 Mt

Source: FAOSTAT. 2006. On-line database of FAO (available at http://faostat.fao.org/)

2 Policy Overview

Bioenergy markets are largely policy driven in most of the world, therefore decision makers today need a thorough understanding of: government priorities; the forces driving bioenergy development; the policies that are being used and what impacts they are having (both intended and unintended) on the market, socially and environmentally; and what related policies (agricultural for example) are influencing biofuels markets. Governments are trying to understand and weigh the pros and cons of various bioenergy options and begin to deal with the environmental and social implications.

This chapter provides an overview of national policies influencing bioenergy development, and outlines the sustainability issues and strategies for ensuring that production can be sustained over time. It summarizes the current policy situation related to bioenergy trade and highlights regional policies which impact bioenergy industries. Section 2.6 details bioenergy production and consumption in the G8 +5 Countries, and the chapter ends with main conclusions on the policies and implementing mechanisms used by the G8 +5 Governments.

2.1 Key Drivers

There are four key factors driving interest in bioenergy: rising energy prices, in particular oil prices; energy security; climate change; and rural development.

2.1.1 High Energy Prices

Soaring energy costs, especially oil prices, are motivating nations to find energy alternatives for their transport, heat and power sectors. In 2006, oil prices rose for a fourth consecutive year as a result of increasing global demand, and production declines in many nations – in some of them due to political disruptions. To appreciate the speed with which prices rose during only a few years, one needs to consider that the average price of oil was $62 per barrel in 2006, $58 per barrel in 2005, $52 per barrel in 2004, $32 per barrel in 2003, and $27 per barrel in 2002.[47] In September of 2007, oil prices peaked at over $80 per barrel, not far from the record inflation adjusted price of $90 per barrel in 1980.

2.1.2 Energy Security

A second driver of bioenergy growth is the aim of many nations to reduce their vulnerability to price increases and supply disruptions thereby increasing their energy security. Increased oil and gas prices are putting great strain on national budgets in import-dependent nations. Bioenergy is seen as a key mean of diversifying energy supplies and reducing dependency on a few exporters of oil and natural gas.

[47] 2005 price from Janet Sawin and Ishani Mukherjee, Worldwatch Institute, 2007, “Fossil Fuel Use Up Again”; 2004 and 2003 prices from Janet Sawin and Ishani Mukherjee, Worldwatch Institute, 2006, “Fossil Fuel Use Continues to Grow”; 2002 price from Energy Information Administration, Spot Prices (available at http://tonto.eia.doe.gov/dnav/pet/pet_pri_spt_s1_a.htm)

In European G8 Countries, for example, dependence on natural gas from Russia is seen as a serious energy security risk, and Japan is working to develop ethanol imports as a means of energy source diversification. The United Kingdom is facing the depletion of its North Sea oil fields in the next two decades, as well as reductions in natural gas yields. China also views biomass as a means of increasing energy security.

2.1.3 Climate Change

The third factor driving bioenergy development relates to the commitments of nations to reduce their GHG emissions to mitigate global climate change. A growing group of nations are working towards GHG neutrality and many of them are incorporating bioenergy as a key element of their efforts to develop new economic models based on low-carbon emissions. Also of note is that in a March 2007 Council Decision, the EU committed to a 20 percent GHG reduction by 2020. In a similar vein, the United States has committed to reduce greenhouse gas intensity by 18% by 2012 and biofuels are an important part of that strategy.

As described in Section 2.4.1, depending on the feedstocks and production pathways chosen, and future advancements in processing technology, energy derived from biomass to produce power, heat and fuels for transport has the potential to significantly reduce life-cycle GHG emissions when compared to fossil fuels – and at costs which could well become lower than various other GHG reduction options (e.g., solar PV).

2.1.4 Rural Development

A fourth key driver in many contexts is the potential for rural development and especially the revitalization of agricultural sectors. Although it is still mainly unclear how resource poor farmers might participate in bioenergy schemes, biomass energy systems could contribute to maintaining employment and creating new jobs in rural areas, avoiding land abandonment and reducing in-country migration to cities. New crop types, improved farming practices and the ability to use agricultural and forestry residues provide the potential for new and diversified income streams for farmers and landowners. Local production and use of modern bioenergy could contribute to rural development and poverty alleviation, if countries promote a sustainable context.

2.1.5 Other Drivers

Air Pollution

Burning biomass with modern technologies or using liquid biofuels in engines may result in lower emissions of regulated air pollutants compared to the use of fossil fuels. For example, solid biomass and liquid biofuels results in minimal emissions of sulphur oxides (SOx), which in turn results in lower particulate matter (PM) emissions. Use of biofuels as liquid fuel oxygenates can reduce emissions of carbon monoxide (CO, an ozone precursor), and control pollutants contributing to photochemical smog. Biofuels also have lower emissions of heavy metals as well as a number of carcinogenic substances. Furthermore, biofuels can be used to replace lead in gasoline. Still, liquid biofuels such as ethanol may increase emissions of volatile organic compounds (VOC) if not controlled properly in car tanks, and fuelling stations.

Soil Protection and Land Reclamation

Growing biomass feedstocks can help restore degraded land and reclaim land through the use of energy crops for bioremediation. Short rotation woody crops and other perennials can also be used for recovering abandoned lands and restoring their ecological functions, increasing soil cover and organic content of soils, thus increasing water retention and carbon stocks.

Residues and Waste treatment

Hundreds of million tons of residues and wastes are produced every year. Even after considering other uses of some of these, such as animal feed, compost, traditional energy and other industrial uses, there is still a significant resource which can be used, and in many cases needs to be disposed of in an environmentally sound way. In dry climates, recovery of residues from logging and thinning could reduce fire risks in forests. Straw, rice husk, sawdust, bark, animal wastes, black liquor, bagasse, pruning and thinning residues, municipal solid wastes and many other wastes, can be used as source of energy. For example, in the EU, recovery of energy from the biodegradable fraction of municipal solid waste could be a valuable means for reducing the volume of wastes sent to landfill, as required by the Landfill Directive. In the United States, biowaste helps fuel approximately 425 operational landfill gas (LFG) energy projects and 89 waste-to-energy facilities, with a power generating capacity of nearly 2.700 MW of clean electricity. Increasingly strict waste legislation in many industrialized countries and increasing urbanization in developing countries will lead to waste treatment becoming a stronger driver for bioenergy production.

2.1.6 Objectives Stated in Country Policy Frameworks

Table 2.1 summarises the key objectives as stated in the main policy documents of the countries considered in this report.

Table 2.1 - Main Objectives of Bioenergy Development[A]

Country	Objectives						
	Climate Change	Environment	Energy Security	Rural Development	Agricultural Development	Technological Progress	Cost Effectiveness
Brazil	X	X	X	X	X	X	X
China	X	X	X	X	X		
India			X	X		X	X
Mexico	X	X	X	X		X	
South Africa	X		X	X			
Canada	X	X	X			X	
France	X		X	X	X		
Germany	X	X		X	X	X	X
Italy	X	X	X	X	X		
Japan	X	X			X	X	
Russia	X	X	X	X	X	X	
UK	X	X	X	X			X
US	X	X	X	X	X	X	
EU	X		X	X	X	X	

[A] As stated in country summaries and key policy documents

Energy security and climate change are the most important objectives and nearly all countries report these as drivers of their bioenergy development activities. No country highlights less than three key objectives. This renders successful bioenergy development a challenge as it tries to reach multiple goals, which are not always compatible. For instance, energy security considerations favour domestic feedstock production (or at least diversified suppliers), whereas climate change considerations and cost-effectiveness call for sourcing of feedstocks with low emissions and costs, and for G8 Countries this often means importing feedstocks and/or fuels from developing countries.

Overall there are few differences between the policy objectives of G8 Countries and the +5 countries. Rural development is more central to the +5 countries' focus on bioenergy development, although important to some G8 Countries, and this is often aligned with a poverty alleviation agenda. Bioenergy development is also seen as an opportunity to increase access to modern energy, including electrification, in rural areas. The rural development objectives of the wealthier G8 Countries focus more on rural revitalization. Similarly, in the +5 countries, agricultural objectives envisage new opportunities not just for high end commercialised energy crop production, but also for poorer small scale suppliers.

2.2 Overview of Bioenergy Policies Across Countries

Current policies are strongly influencing bioenergy production levels, production methods and types of bioenergy carriers and feedstocks in a number of countries. Support policies for different forms of bioenergy take different forms, the most prevalent of which are outlined below, followed by a brief overview of other related policy areas that influence bioenergy production and use, as well as a discussion of patterns, similarities and differences between the objectives set by countries and the policy instruments developed. (For summaries of individual country policy situations related to bioenergy, see Annex I.)

2.2.1 Direct Bioenergy Policies

Key Policy Mechanisms

Feed-in Tariffs – Pricing: A feed-in tariff is a regulatory, minimum guaranteed price per kWh that an electricity utility is obliged to pay to private producers of renewable power that is fed into its existing grid. A feed-in tariff could also refer to the total payment per kWh received by an independent producer of renewable power, including any production subsidies and/or refunds from taxes. In a few cases, a feed-in tariff signifies only the premium paid over and above the market price of electricity.[48]

Feed-in tariffs can be based on the 'avoided costs' of the non-renewable power producers or the utility price charged to the consumer, supplemented by a premium to account for the socio-environmental benefits of renewable electricity. In some countries, feed-in tariffs are differentiated depending on the renewable technology used (i.e. wind, solar, biomass, etc.). Additionally, the system of setting these tariffs can be either fixed in order to provide long-term certainty of investment to renewable energy producers or, they can be periodically adjusted to allow for flexibility in the event of unforeseen costs.[49]

Feed-in tariffs are currently the world's most widespread national renewable energy policy instrument[50] and are in use in over half of the G8 +5 Countries. Feed-in tariffs encourage investment in renewable energy production generally and in bioenergy when focused on bioenergy, but may result in higher electricity prices. However, transaction costs can be lower

[48] Monthorst, P. E. (1999), "Policy Instruments for Regulating the Development of Wind Power in a Liberated Electricity Market", in: Larsen, G., K. Westermann, and P. Noergaard, eds. (1999), Contributions from the Department of Wind Energy and Atmospheric Physics to *EWEC '99 in Nice France*, Riso National Laboratory, Roskilde, Denmark, pp. 7-12.; Haas, R., T. Faber, J. Green, M. Gual, C. Huber, G. Resch, W. Ruijgrok, and J. Twidell (2001): Promotion Strategies for Electricity from Renewable Energy Sources in EU Countries, Institute of Energy Economics, Vienna University of Technology, Austria.; Huber, C., T. Faber, R. Haas, and G. Resch (2001): *Promoting Renewables: Feed-In Tariffs or Certificates*, IEW 2001, Institute of Power Systems and Energy Economics, Vienna University of Technology, Vienna, all cited in Sijm, J.P.M., The Performance of Feed-in Tariffs to Promote Renewable Electricity in European Countries. November 2002, Energy Research Center of the Netherlands (ECN) (available at http://www.ecn.nl/docs/library/report/2002/c02083.pdf)

[49] Sijm, J.P.M., The Performance of Feed-in Tariffs to Promote Renewable Electricity in European Countries. November 2002, Energy Research Center of the Netherlands (ECN) (available at http://www.ecn.nl/docs/library/report/2002/c02083.pdf)

[50] Rickerson, Wilson, and Robert C. Grace. "The Debate over Fixed Price Incentives for Renewable. Electricity in Europe and the United States: Fallout and Future Directions." A White Paper Prepared for The Heinrich Böll Foundation. February, 2007.

due to the fact that feed-in tariffs create a guaranteed price for renewable energy, which often significantly reduces the time necessary to negotiate a power purchase agreement.

The main criticism of feed-in tariffs has been their shortcoming in ensuring minimum-cost electricity generation and to foster innovations. But some G8 Countries use dynamic feed-in tariffs and offer specific tariff elements for innovations to address that problem.

The cost of this policy is generally paid by utilities that then pass the cost on to consumers. In China, however, there is an explicit cost sharing policy which spreads the costs between the utilities and the customers.

Taxes: A variety of tax incentives and penalties are used by governments to foster bioenergy development. Taxes are one of the most widely used bioenergy support instruments. Taxes have a dramatic affect on the cost competitiveness of bioenergy vs. substitutes, and therefore dramatically impact their viability in the marketplace. In theory at least, taxes can be gradually increased or decreased as markets evolve. Governments either forgo some tax revenue – in the case of tax breaks – or gain revenue, from added taxes on competing, non-renewable fuels, or on CO_2 emissions from competing fuels for example. If net revenue flows into government coffers are decreased, it is ultimately tax payers who pay the cost. Using tax breaks for bioenergy can be quite costly. Another downside is that tax policy can be difficult politically to modify. However, all of the European countries and several of the other G8 +5 Countries have started gradually abolishing tax breaks they have been offering to promote biofuels, and are moving to obligatory blending.

Guaranteed Markets - Renewable Energy and Fuel Mandates, Preferential Purchasing: National targets and public incentive systems are key drivers in the development and growth of most modern bioenergy industries, in particular in liquid biofuels for transport. Russia is the only country among the G8 +5 Countries that has not created a transport biofuel target. Voluntary quota systems or targets are common for biomass energy for heat, power and transport fuels in the G8 Countries, however, blending mandates enforceable via legal mechanisms are becoming increasingly utilized. Blending targets are less common in the +5 countries, although Brazil has a mandatory ethanol blending requirement, India is creating mandatory transport biofuel targets, and Mexico and China seem to be moving towards bioenergy targets (see Table 2.2).

The distinction between voluntary and mandatory is critical since voluntary targets can be influential, but do not have the impact of legally binding mandates. This was evident in the EU, for example, when all but two of the EU member countries failed to achieve the voluntary biofuels for transport blending target of 2 percent by 2005.

Other means of guaranteeing a market for bioenergy have been commonly used by the G8 +5 Governments and have proven to be powerful tools where properly implemented. For example, renewable portfolio standards (RPS) for bioelectricity and blending mandates for transport biofuels have proven highly effective in stimulating production. In comparison to feed-in tariffs which offer a long-term, fixed price payment to renewable energy generators, an RPS seeks to create price competition between renewable energy generators to meet defined targets at the lowest cost. (A maximum cost is typically set through a price cap instrument.)[51] With blending mandates, the cost is carried by the industry and consumers. Governments do not need to provide direct funding.

In a few countries, green certificates have been created so that utilities can buy and sell them if they have renewable energy generation in excess of the mandate or if they cannot meet the mandated level. In Italy for example, electricity suppliers can generally fulfill the obligation by buying green certificates from authorized new renewable energy plants, by building new renewable energy plants, or by importing electricity from new renewable energy plants from countries with similar instruments on the basis of reciprocity.

Preferential purchasing by governments can also be a powerful tool when considering the purchasing power of governments. The Canadian Government, for example, committed to purchasing 20 percent of its electricity from renewable energy sources. The importance of effective implementation of purchasing practices is highlighted by the United States' experience with a federal preferential bio-products purchasing policy that has been implemented very slowly. Table 2.2 summarizes voluntary and mandatory bioenergy targets set by the G8 +5 Countries.

[51] Rickerson, Wilson, and Robert C. Grace. "The Debate over Fixed Price Incentives for Renewable. Electricity in Europe and the United States: Fallout and Future Directions." A White Paper Prepared for The Heinrich Böll Foundation. February, 2007.

Table 2.2 - Voluntary and Mandatory Bioenergy Targets for Electricity, Heat and Transport Fuels[A]

Country	Targets (M= mandatory; V= voluntary)		
	Electricity	Heat	Transport Fuels
Brazil	Inclusion of 3.300 MW of energy into National Energy Grid supplied in equal amounts from wind, biomass and small hydroelectric is required (M)	no targets	mandatory blend of 20 to 25% anhydrous ethanol w/ gasoline; minimum blending of 2% (B2) biodiesel to diesel by 2008 and 5% (B5) by 2013
China	China is finalizing a revised target for 16% of primary energy from renewables by 2020, including large hydro, plans include a target for 30 GW of biomass power by 2020	no targets	15% of its transportation energy needs through use of biofuels by 2020
India	no targets	no targets	A 5% blending mandate for ethanol will be established before end of 2007, and Planning Commission proposed to raise mandate to 10%. Regarding biodiesel, Committee for the Development of Biofuels has decided 20% of diesel consumption as blending target for 2011/2012.
Mexico	>1,000 MW of RES by 2006 (M)	no targets currently, (targets under consideration)	no targets currently, (targets under consideration)
South Africa	4% by 2013 (V)	no targets	up to 8% by 2006 (V), (10% target under consideration)
Canada	no targets	no targets	5% renewable content in gasoline by 2010 & 2% renewable content in diesel fuel by 2012
France	21% RES by 2010 (M)	50% increase from 2004 until 2010 in heat from RES (M)	5.75% by 2008, 7% by 2010, 10% by 2015 (V); 10% by 2020 (M =EU target)

Germany	12.5% by 2010, 20% by 2020 (M)	no targets	6.75% for 2010, which is set to rise to 8% by 2015; 10% by 2020 (M =EU target)
Italy	25% by 2010 (V)	no targets currently, (targets under consideration)	5.75% by 2010 (M); 10% by 2020 (M =EU target)
Japan	biomass power generation & waste power generation in the amount of 5,860,000 kl, as converted to crude oil, by 2010 (V)	biomass thermal utilization in the amount of 3,080,000 kl (this amount includes biomass-derived fuel – 500,000 kl – for transportation), as converted to crude oil, by 2010 (V)	500,000 kl, as converted to crude oil, by 2010 (V)
Russia	no targets in place, considering a 7% RES target by 2020	no targets	no targets
UK	10% by 2010, 15.4% by 2016 (M)	> 10,000 MWe of installed combined heat and power (CHP) capacity by 2010 w/ > 15% of government buildings using CHP	5% biofuels by 2010 (M); 10% by 2020 (M =EU target)
US	no national targets but individual states are pursuing a variety of incentive programmes	no targets	A mandatory Renewable Fuel Standard (RFS) – 9 billion gallons of renewable fuels in 2008 and progressively increases to 36 billion gallons by 2022 with 21 billion gallons coming from advanced biofuels such as cellulosic ethanol. Non-renewable fuels are not considered in the RFS.
EU	20% RES as overall target for all Member States by 2020 (M)	no targets	10% by 2020 (M =EU target)

[A] **As stated in country summaries and key policy documents**

Compulsory Grid Connections: Compulsory grid connection policies for renewable energy producers – or specifically bioenergy producers in some cases – are in place in less than half of the G8 +5 Countries. The EU countries and China, Mexico and Japan require that utilities grant access to the grid system to private renewable energy producers. This is a policy tool for overcoming the grid access barrier that is common for small and/or private energy producers. By itself, it is not a critically important policy, and often it is paired with feed-in tariff policies or other policies requiring that utilities compensate renewable energy producers appropriately.

Other Direct Support: Governments issue grants, loan guarantees, subsidies and other forms of direct support for bioenergy production and use systems. It is common for state/province or local governments wanting to create jobs and economic activity to give incentives for building bioenergy production plants in their area. Direct supports are used in a number of G8 Countries to help accelerate the commercial development of second generation biofuels for transportation.

Most countries are using some form or forms of direct loan or grant supports. Direct financial supports have the advantage of easily quantified results, however, their outcomes tend to be limited to individual projects, as opposed to further reaching support instruments. These supports are generally paid for directly by governments.

Research, Development, & Demonstration (R,D,&D)

Basically all of the G8 +5 Governments are conducting research and development in their own laboratories and institutes and many are supporting public private partnerships and various forms of demonstration projects. Some governments fund companies to do bioenergy R&D. For example, the United States funded a private company to work to dramatically reduce the cost of advanced enzymes for second generation liquid transport fuel production. In addition to working on second generation liquid transport fuels, some countries are also working on Hydrogen as a transport fuel.

Bioenergy R&D has generally been aimed at developing technology for increasing conversion efficiency, identifying sustainable feedstock and developing cost-effective conversion methods for advanced fuels[52] however, the Canadian Government provides support for cross-sector research networks conducting scientific R&D on modeling and impact scenarios for a bio-based economy in Canada (see Canada summary in Annex II).

Publicly funded R&D produces information and technology that, in contrast to private sector R&D, is publicly available. The downside is that limited, and/or inconsistent budgets can be a problem for government research initiatives. Also, in some instances, losing top talent to higher paying private sector jobs is a problem. In the case of government sponsored R&D, obviously it is the government (and thus tax payers) who pays, but joint public-private R&D efforts are becoming more common where private companies contribute resources.

2.2.2 Indirect Policy

Bioenergy development is influenced by more than bioenergy-specific policies. This section will elaborate on the significance of policy measures in other policy arenas for bioenergy markets.

[52] Pacheco, Michael A., National Renewable Energy Laboratory (NREL), The National Bioenergy Center and Biomass R&D Overview. May 20, 2004. (available at http://www.nrel.gov/docs/gen/fy04/36831c.pdf)

Energy

In some countries, broader energy policies influence bioenergy. For example, phasing-out (subsidized) domestic coal - as in the United Kingdom and Germany - and phasing-out nuclear (as in Germany) indirectly favour bioenergy by restricting electricity generation choices.

General energy access policies, like Brazil's "Luz para todos" may indirectly encourage bioenergy production. The Chinese national renewable energy law, intended to significantly increase the overall production of renewable energy, will likely encourage investment in modern bioenergy.

Agricultural and Forestry Policy

Agricultural and forestry policies have had a significant influence on the bioenergy industry. In the United States and EU, the agricultural industries have helped drive the development of bioenergy. Agricultural subsidies, for example, influence both the production levels of bioenergy feedstocks but also the price. In the EU, farmers are paid 45 €/ha/yr if they produce bioenergy crops. Agricultural policies also commonly influence production systems and methods of feedstock production, for instance through environmental provisions to ensure sustainable production methods and/or to control expansion of cropland into pristine areas. Many agricultural and forestry policies are oriented towards creating or maintaining domestic employment in these sectors. In Canada, for instance, there is a bioenergy initiative of the agriculture section of the government designed to provide an opportunity for agricultural producers to diversify their economic base and participate in the biofuels industry through equity investment/ownership in biofuels production facilities (see Canada country summary in Annex I for details). Agricultural policies have been subject to controversy, especially related to international trade issues. Agricultural supports can also be extremely expensive.

Climate Change Policy

All of the G8 +5 Countries cite climate change as a motivation for their interest in bioenergy. Climate change policy is influencing bioenergy policy in a number of countries. Some blending mandates and other support policies have minimum life-cycle GHG reductions requirements for bioenergy to be counted towards the mandate, to receive the tax credit, and/or to receive other supports. This raises the challenge of developing and harmonizing GHG accounting methodologies for different bioenergy types and production systems. GBEP is in the process of developing a framework for the harmonization of methodologies in collaboration with outside partners.

The most important policy development related to bioenergy in the transport sector is the trend towards emissions results focused policy rather than bioenergy quantity goals. In the United Kingdom, for example, cars are now taxed based on their CO_2 emissions. In some states within the United States too, there are GHG reduction focused policy developments in the transport sector (see Text Box below).

California's Low Carbon Fuel Standard

California is the fifth largest economy in the world[53] and is an acknowledged leader in environmental policy, a status enshrined in the United States Clean Air Act. Thus, it is not surprising that early in 2007, Governor Schwarzenegger signed an Executive Order that established a Low Carbon Fuel Standard (LCFS) for transportation fuels in California, calling for at least a 10 percent reduction in their carbon-intensity by the year 2020.[54] At the time it was created, the LCFS was the first significant policy in the U.S. designed specifically to reduce GHG emissions from transportation fuels and to stimulate innovation in new, low-carbon fuels.[55] The LCFS requires fuel providing companies in the state to supply a mix of fuels that meet a declining standard of GHG intensity (measured in CO_2 grams per unit of energy in their fuel). Measured for lifecycle emissions of fuels, the LCFS includes all emissions from fuel consumption and all intermediate steps of processing and production. Furthermore, the LCFS will utilize market-based mechanisms to extend choices to suppliers for reducing emissions while responding to consumers. More specifically, fuel providers may buy and blend a low-carbon ethanol into gasoline products or purchase credits from power utilities supplying low-carbon electronic units for electric vehicles. Variations of the California LCFS is currently under serious discussion in several American states and Canadian provinces, is part of several bills before the U.S. Congress, and has been proposed for adoption in the EU.

The LCFS has potentially dramatic implications for the global bioenergy industry as it provides a substantive and broadly-supportive rationale for supporting bioenergy, along with a new focus on GHG emissions. This policy has the potential to both dramatically expand the bioenergy sector, induce major technological innovations, and allow the agricultural sector to be part of the solution to climate change.

Environment Policy

Environment policies are relevant to bioenergy in two key ways: on the one hand in providing support for bioenergy as a pollution reduction strategy, and on the other in regulating the bioenergy production and use practices. The promotion of bioenergy can be proposed as a measure in environmental policy, for instance in combating climate change by mandating blending targets for transport fuels to reduce overall GHG emissions from transportation. An example for environmental regulation of bioenergy practices is the requirement by the State Government of Sao Paulo to phase out the practice of burning the cane fields before harvest in order to reduce air pollution, and to directly control the environmental impacts of the bioenergy industry itself.

2.2.3 Cross-Country Overview of Key Policy Instruments

Countries not only state multiple goals for bioenergy development, they also employ a great variety of policy instruments to strengthen and shape the growth of bioenergy markets.

Table 2.3 summarizes the key policy instruments used by the G8 +5 Countries in the context of their energy policy frameworks today and indicates some of the new policy instruments under development or awaiting approval.

[53] SJ Business Journal, "California now world's fifth-largest economy", June 15, 2001, (available at http://sanjose.bizjournals.com/sanjose/stories/2001/06/11/daily58.html)
[54] "Executive Order S-01-07: Low Carbon Fuel Standard" which is on a different URL on the Governor's website. Probably the most informative website to provide for the reader is the Air Resources Board site on the LCFS. (available at www.arb.ca.gov)
[55] "A Low Carbon Fuel Standard for California." (available at http://repositories.cdlib.org/its/tsrc/UCB-ITS-TSRC-RR-2007-2/ and http://repositories.cdlib.org/its/tsrc/UCB-ITS-TSRC-RR-2007-3/)

Table 2.3 - Key Policy Instruments[A]

Country	Energy Policy							
	Binding Targets/Mandates[1]	Voluntary Targets[1]	Direct Incentives[2]	Grants	Feed in tariffs	Compulsory grid connection	Sustainability Criteria	Tariffs
Brazil	E, T		T					Eth
China		E,T	T	E,T	E, H	E,H		n/a
India	T, (E*)		E	E,H,T	E			n/a
Mexico	(E*)	(T)	(E)			(E)		Eth
South Africa		E, (T)	(E),T					n/a
Canada	E**	E**,T	T	E,H,T				Eth
France		E*,H*,T	E,H,T		E			as EU below
Germany	E*,T		H	H	E	E	(E,H,T)	as EU below
Italy	E*	E*,T	T	E, H	E	E		as EU below
Japan		E,H,T				E		Eth, B-D
Russia		(E,H,T)	(T)					n/a
UK	E*,T*	E*,T	E,H,T	E,H	E		T	as EU below
US	T, Eth	E**	E,T, Eth, B-D	E,T				Eth
EU	E*, T	E*,H*, T	T	E,H,T		E	(T)	Eth.;B-D

[A] **Based upon information provided by the countries and summarized in the country annexes.**

E: electricity
H: heat
T: transport
Eth: ethanol
B-D: biodiesel

** target applies to all renewable energy sources*
*** target is set at a sub-national level*
(..) *policy instrument still under development/awaiting approval*
[1] *blending or market penetration*
[2] *publicly financed incentives: tax reductions, subsidies, loan support/guarantees*

2.2.4 Comparative Analysis – Patterns, Effectiveness, & Impacts

Trends – Heat and Power

The feed-in tariff is a policy tool that has been very effective in stimulating renewable energy markets. Feed-in tariffs have thus far driven rapid renewable energy capacity expansion in several EU member nations while RPS polices have not. The problem for biomass is that when the feed-in tariff is focused broadly on renewable energy, the lowest cost renewable energy source will tend to be developed first, and this is generally wind. When feed-in tariffs are differentiated by technology and biomass is treated individually, they have been effective in promoting bioenergy (heat or power or CHP depending on the way the policy is written).

Trends – Transport Fuels

In policies relating to biofuels for transport, there is a trend away from high cost policies (to governments) and towards policies like blending mandates which don't require direct government funding. However, publicly financed support remains significant. A recent report by the Global Subsidies Initiative estimates that public support by the United States, EU and Canada for ethanol and biodiesel alone amounted to approximately $5 billion in 2006.[56] Governments are increasing their spending on R&D, especially related to the accelerated commercialization of second generation biofuels.

Despite the move towards mandatory blending targets in many countries, as mentioned previously, a few governments are moving towards performance focused policies. Rather than mandate an amount of fuel to be consumed, these governments are mandating the amount of GHG reductions required. This strategy to harness market forces is gaining interest in countries that are looking for the most cost-effective GHG emission reduction strategies. In addition to the United Kingdom's Renewable Transport Fuel Obligation and the State of California's Low Carbon Fuel Standard (see Text Box), the European Commission (Directorate General for the Environment) is considering a type of fuel quality directive that would require a gradual reduction in GHG emissions from transport fuels each year for the next approximately ten years.

Trends – Sustainability Policy (see Section 2.4 for a detailed overview)

There is a trend away from "across the board" biofuels support and towards recognition that while biofuels are potentially very "green" they are not always produced in the most environmentally friendly manner. In many countries, new schemes are under way to promote sustainability as well as link funding to sustainability. The EU and several EU member states are the only governments that have developed sustainability standards and have attached them to mandatory targets. Brazil has created its "social seal", and has tied it to its blending mandates, but it is not a comprehensive sustainability scheme. Other large (current and future) energy

[56] Steenblick, R, Biofuels – at what cost?, Government support for ethanol and biodiesel in selected OECD countries, September 2007

consuming countries, including India and China, are not currently working on sustainability standards and certification schemes.

2.2.5 Institutional Arrangements

The Ministries (or Agencies) charged with the implementation of bioenergy strategies varies across countries. In a few countries, the realization that coordination among relevant Ministries is necessary for successful implementation of bioenergy priorities has led to coordination attempts among the Ministries. As bioenergy is for the most part still not commercially competitive, government plays an important role in stimulating growth. However, countries, in particular Canada, the United Kingdom and the United States, are increasingly fostering public-private partnerships to promote innovation and technological progress, and to put in place workable schemes to ensure sustainability.

2.2.6 Duration, Consistency, and Phase Out

Timeframes should be considered carefully when crafting policy. Some policies have clear timeframes written into them. Policies without clear end dates run the risk of becoming embedded. Some policies are designed to phase out as the support they provide becomes unnecessary. Both China and Germany are reducing fiscal incentives for transport biofuel production and are switching to blending mandates.

On the opposite side of things, the consistency of policy support is also a critical consideration. Without a long term support in place, many potential producers may not have the confidence to invest.

2.2.7 Priorities and Policy Combinations

Bioenergy production cannot be optimized for all things, therefore, depending on the priorities of governments, generally policies favour either maximum GHG emissions impacts, or maximum energy security impact, or maximum development impact. Government priorities manifest themselves clearly in the policy tools employed. In all of the G8 +5 Countries a combination of policies are used. The policy situations in each country are significantly complicated by local, state/province policy as well as by international trade and other policy instruments on the regional and global level, which are the topic of the following section.

2.3 Regional Policies

While in the past most policy development to support bioenergy was done on the national level, as production increases and cross-boarder trade becomes more substantial, regional efforts are becoming increasingly common. More emphasis has been put on regional cooperation as producers and politicians realize that harmonized policies are necessary for continued bioenergy market growth.

2.3.1 Bioenergy Technical Standards

National standards for the trade of pellets has been adopted by a number of EU countries such as Sweden, Austria and Germany, with the establishment of region-wide standards currently underway by the European Committee for Standardization (CEN). Pellet standards have established a common size requirement for pellets to facilitate storage and use as feed for automatic burners, as well as established criteria for pellet quality. CEN standards currently classify solid biomass according to composition, allowing it to be traced back along its production chain. Pellet quality has been recognized as an issue of vital importance for pellets meant for domestic use in heating stoves that do not have the advanced cleaning and processing facilities of large-scale biomass plants. CEN also defines a moisture content standard of 10 percent of pellets by weight for domestic uses, in order to maintain uniform energy density and combustion efficiency of the pellets.

2.3.2 Biofuels for Transport Standards

As relatively new fuels in most markets, bioethanol and biodiesel are accompanied by more uncertainties regarding their performance than conventional gasoline and diesel. In the absence of globally accepted quality standards, there is a heightened possibility of sub-par batches of fuels entering the market thereby reducing consumer confidence in biofuels, a factor that is crucial as biofuels make up an increasing share of the transport fuel market. In particular, biodiesel quality can be greatly influenced by the type of feedstock used as input in its production since the saturated fat content of various vegetable oils can differ greatly, affecting the fuel's physical characteristics and performance.

Most standards in place today aim to secure biofuel user confidence regionally and are yet to be integrated internationally. For example, the United States has adopted American Society for Testing and Materials (ASTM) standard D 6751 for biodiesel blends up to 20 percent with conventional diesel that are legally registered by the United States' Environmental Protection Agency and considered safe for use.[57]

In the absence of global criteria some countries have adopted the standards of neighbouring countries and/or trading partners. For example, the ASTM initiated the development of biodiesel standards in 1994 which later became incorporated into the national specifications of Brazil, countries of the EU, Japan, Philippines, South Korea, Australia and South Africa.[58]As the demand for non-fossil biofuels increases, nations are likely to collaborate to adopt, refine and build upon existing biofuel quality standards in order to facilitate, along with the development of international trade policies (see Section 2.5), the globalization of biofuels as a standard commodity.

[57] Worldwatch Institute, *Biofuels for Transport: Global Potential and Implications for Energy and Agriculture* (London: Earthscan, 2007), chapter 9, p150-153
[58] Ibid.

Efforts are indeed underway to move towards harmonized global specifications. The United States and Brazil have agreed to “a roadmap to achieve greater compatibility of biofuels standards and codes” to be completed by the end of 2007. The establishment of uniform standards and codes is a key element of their strategy to expand the biofuels marketplace.[59] This work is being done in collaboration with the industry and standards organizations of the United States (the United States National Institute of Standards and Technology (NIST)), Brazil (the National Institute of Metrology, Standards and Industrial Quality of Brazil (INMETRO), and European Union (The European Committee for Standardization (CEN)) under the International Biofuels Forum (IBF). IBF members include Brazil, the United States, the European Commission, China, India, and South Africa.[60]

2.3.3 Regional Agreements

The Caribbean Basin Initiative (CBI) has had a strong influence over biofuel trade flows, especially in the Western Hemisphere. Apart from the CBI, there are several other regional trade agreements that will most likely impact future biofuel trade between member countries. The Southern Common market (MERCOSUR) was formed in 1991, to allow free trade between member countries with the eventual goal of economic integration within South America. Mercosur as the world's fourth largest trading bloc, after the EU, NAFTA and ASEAN, current members of Mercosur include Argentina, Brazil, Paraguay, Uruguay and Venezuela[61] with Chile, Bolivia, Colombia, Ecuador and Peru as associate members[62]. CAFTA-DR is the second largest free-trade zone in Latin America for U.S. exports that was created by the CBI countries. It has eliminated 80% of export tariffs since its creation in 2004, with the remaining tariffs being scheduled to be phased out over the next 10 years[63]. For further details and explanations of key trade agreements impacting biofuels commerce, see Annex II.

[59] White House. Office of the Spokesman. Washington DC. Media Note. “Memorandum of Understanding Between the United States and Brazil to Advance Cooperation on Biofuels”. March 9, 2007.
[60] Embassy of the United States, Advancing Cooperation on Biofuels: U.S-Brazil Steering Group Meeting, 20 August, 2007, Washington, DC. (available at http://brasilia.usembassy.gov/index.php?action=materia&id=6006&submenu=1&itemmenu=10)
[61] Full member status is currently under way.
[62] European Commision, European Union in the World-External Relations. The EU’s Relations with Mercosur. Updated, November 2005,; Marcos Sawaya Jank, Geraldine Kutas, Antonio Josino Meirelles Neto, Andre Meloni Nassar, Joaquim Henrique da Cunha Filho, EU-Mercosur Negotiations on Agriculture: Challenges and Perspectives, Institute for International Trade Negotiations (ICONE), ,September 10, 2004, Sao Paolo.
[63] US Department of State, International Information Programs, “Central America Free Trade Agreement – Dominican Republic” . Last updated March 2007, (available at http://usinfo.state.gov/wh/americas/regional_trade/drcafta.html)

2.4 Sustainability Considerations

2.4.1 The Sustainability Challenge – An Overview

Environmentally Sustainable

Bioenergy can provide dramatic environmental gains but also has the potential to cause great harm if not produced sustainably. The sustainability of bioenergy depends largely on how the risks associated with its development are managed. Areas of concern include land use and climate implications of large-scale feedstock production and potential social inequity.

The overall lifecycle impacts of bioenergy depend on a number of factors, the most vital of which pertain to land-use changes (particularly sensitive land or land with high conservation value), choice of feedstock and the level of management (including its energy yield per hectare and intensity of fossil input) and the refining process (including the production of co-products and the type of process energy).

Feedstock production is arguably the most important factor in determining the sustainability of bioenergy production. The type of feedstock used and the manner in which it is produced are critical in determining the level of soil erosion and depletion of soil nutrients, use of agro- or forest-chemicals and fertilizers, waste production and management, impact on biodiversity, GHG emission levels, impact on air quality, and the sustainable management of the quantity and quality of surface and ground water. Environmental issues related to *conversion and end use* of bioenergy are predominantly related to GHG emissions, air quality, and water quantity and quality.

One of the greatest threats posed by expanding cultivation is the conversion of natural ecosystems. Increased pressure on forests is also a key concern. Clearing forest areas for agricultural purposes causes the obliteration of species and their natural habitats, and leads to the irreversible loss of species, ecosystem functions and services. It also has a dramatic GHG impact (see next section for more information). Wide-scale destruction of wildlands can additionally affect the hydrologic cycle and impact the climate by reducing regional rainfall and increasing local temperatures.

The impact on soil quality largely varies by the type of feedstock, the intensity of cultivation and the length of crop rotation periods. Heavy use of chemical fertilizers and pesticides are known to cause acidification of soils and surface waters. Intensive farming also causes soil erosion, which is especially a problem in areas with long dry periods followed by heavy rains, steep slopes and unstable soil. Erosion leads to a depletion of soil organic matter and the resulting nutrient runoffs can cause eutrophication in nearby surface waters, affecting other plants and wildlife.

Concerns have also been raised that rapid biofuel growth and mono-cropping practices of preferred varieties will lead to a reduction in agricultural biodiversity with negative repercussions on food security. On the other hand, the use of perennial species such as trees and switchgrass for bioenergy may create more favourable habitats for biodiversity compared to conventional crop production.

By utilizing bioenergy instead of fossil fuels, it is possible to avoid many of the environmental impacts caused by non-renewable energy sources. In addition, sustainable biomass production for liquid biofuels could reduce the negative environmental impacts relative to conventional industrialized agriculture if farming practices aim to maximize total energy yield rather than the oil, starch or sugar contents of crops, diversify biomass input varieties and reduce chemical inputs. In areas where development pressure is a problem, adding value to agricultural or forest lands can help stave off development, maintaining green space and productive lands.

Climate Change

Bioenergy offers significant potentials for emission reductions in electricity, heat and transportation, however there is a wide range in net GHG emissions impacts of different forms of bioenergy. Key factors determining net bioenergy GHG impacts include: land use changes, feedstock type and agricultural practices, type of energy being replaced, manner of conversion and end use. These and other factors must be assessed as part of a full life-cycle accounting of GHG impacts.

Current production and use of biofuels could reduce GHG emissions relative to petroleum-based fuels or could increase them, depending on the pathways chosen for their production. The most critical factor in the GHG balance of bioenergy production is the land-use issue. If virgin forest, for example, is destroyed in order to plant bioenergy crops, the GHG benefits of displacing fossil fuels with the biofuel produced on that land will be negated for decades. Fertilizer use and tillage practice also greatly influence net GHG impacts. Research done by Crutzen et al. indicates that N_2O emissions from fertilizers may be 3-5 times higher than previously thought, translating to much higher GHG emissions.[64]

The climate impact of various forms of bioenergy also depends greatly on their fossil energy balance. Unlike fossil fuels, biomass fuels have the potential to be "carbon-neutral" over their life cycles, emitting only as much carbon as feedstock plants absorbs from the atmosphere as they grow, however this is generally not the case in practice due to GHG emissions produced in the feedstock production, processing, and distribution.

Considerable uncertainty hampers “across the board” estimates of the potential GHG emission reductions from various types of bioenergy. The analysis is complex because of wide variation in the use of by-products, agricultural practices in growing the feedstocks and efficiencies of processes. Reduction potentials must therefore be seen as indicative.

While a range of estimates exist, currently the largest GHG reductions are generally achieved through the use of biomass to produce heat and electricity. Biomass combustion

[64] P. J. Crutzen, A. R. Mosier, K. A. Smith, and W. Winiwarter. N2O release from agro-biofuel production negates global warming reduction by replacing fossil fuels. Atmospheric Chemistry and Physics Discussions, 7, 11191–11205, 2007 (available at www.atmos-chem-phys-discuss.net/7/11191/2007/)

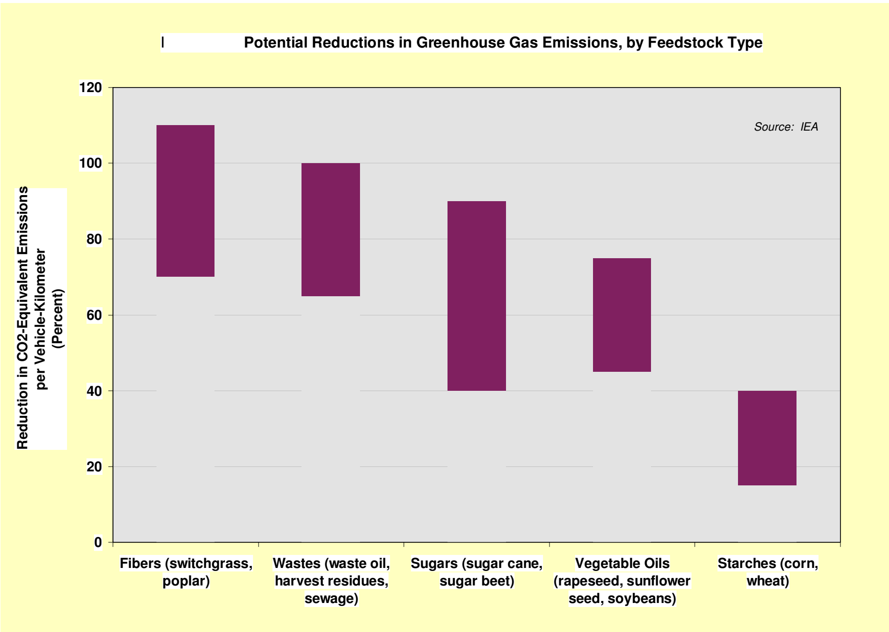
replacing coal and oil has significant reduction potentials. As mentioned previously, biogas from organic waste not only reduces CO_2 emissions compared to fossil fuels but also avoids methane emissions related to the decomposition of organic wastes.

Electricity and heat from biomass can generate greater savings than transport fuels. Liquid biofuels for transportation are currently a relatively expensive carbon reduction strategy, however advanced biofuels hold significant potential to reduce costs and increase GHG reductions. Second generation biofuels, including cellulosic bioethanol, are expected to produce significant GHG savings – possibly of up to 80 percent. Among the currently used commercial technologies, Brazilian bioethanol produces the largest savings – estimated to be up to 90 percent of GHG emissions compared to fossil fuels[65]. Maize or corn based bioethanol production produces far lower savings, with estimates of average reductions of around 13 percent.[66]

Decision makers aiming to make the biggest climate bang for their buck today will focus, therefore, on biomass for heat and power using the most efficiency conversion methods rather than biofuels for transportation. This equation will certainly change, however, as advanced biofuels (second generation) develop.

Policy makers supporting bioenergy for climate reasons will also have to make a strong effort to prevent carbon emissions from land conversion. The largest climate risk related to bioenergy is the chance that virgin habitats will be burned or otherwise converted to conventional crops, resulting in massive one-time carbon emission.

Figure 2.1 - Potential Reductions in GHG Emissions, by Feedstock Type



[65] IEA 2007
[66] Farrell et al, 2006: Ethanol Can Contribute to Energy and Environmental Goals, Science, Vol. 311. no. 5760, pp. 506 - 508

Socially Sustainable

Along with environmental concerns, social issues are fundamental to the sustainability of bioenergy. Much of the focus has been on the environmental impacts of bioenergy, but the social implications could also be dramatic. What follows is a brief overview of some of the key factors relating to the social sustainability of bioenergy.

Clean, reliable energy provision itself is a critical factor in development and poverty alleviation. The social sustainability of bioenergy expansion will be determined in part by the ability of modern bioenergy markets to extend into poor communities in developing nations, in order to revitalize rural economies, which are often set back due to unreliable energy services. The challenges of traditional bioenergy include indoor air pollution (linked to traditional biomass use for cooking) which counts among the major causes of ill-health and death in developing countries, and the large time commitment needed. Women in least developed countries may spend more than one third of their productive life collecting and transporting wood. Additional help needed from children often prevents them from attending school.

Key social considerations related to modern biofuels industry include: job creation; ownership; access to food; land and water; labour conditions; and rural development generally. Bioenergy is possibly the most labour intensive energy source and there is little doubt that bioenergy development will bring about significant job creation where opportunities will exist in feedstock production, handling and processing; distribution and marketing. New positions would include high-skill science, engineering and business-related employment, medium-level technical jobs and – depending on the scale of production (large scale plantations, or medium and small scale operations) and on the degree of mechanisation – new employment opportunities arise for unskilled workers. Development of bioenergy will have a much more dramatic impact on rural livelihoods when the production involves the participation and ownership of plants by small-scale farmers, their proximity to conversion facilities that are suitable to rural settings and a fair share of the accrued revenue.

Liquid biofuel production from edible crops is booming in a world where an estimated 850 million people worldwide suffer from chronic hunger. Population growth and consumption in rich countries is putting an enormous strain on water, soil and agro-ecosystems; and rich countries continue to subsidize domestic commodity agriculture. The subsequent rise in food prices has caused, and will continue to cause significant debate. On the one-hand, the food-insecure are the people least able to pay more for food and the poorest are migrating to cities or across national borders. On the other hand, the majority of the world's poor still live in agricultural areas. If they can benefit from increased prices for agricultural crops, they will be better off and less likely to move to urban slums.

Ensuring that farmers and producers get a fair share of the profits will be a challenge. Poor households in many developing countries do not have formal title over their land and formal rights over water. As land values increase in biofuel production regions, the poor are more likely to be shoved off of their land. Large scale biofuel plantations can threaten their access to land and water. This also applies to marginal and degraded lands, which some countries, including India, have singled out for bioenergy development. What appears to many to be abandoned land may in fact provide important subsistence functions to the most vulnerable.

Labour conditions in sustainable bioenergy production should be an improvement on existing standards. Labour issues include child and forced labour, working conditions, health and safety, and adequate remuneration.

Economic Sustainability

Economic sustainability is an essential pillar of sustainability. Unlike financial sustainability which demands that financial returns to a particular project or technology are positive, economic sustainability implies that the total costs to society, including financial costs, environmental and social costs, should be outweighed by the benefits. For the private sector to invest in bioenergy without sustained government support, however, the financial returns must be positive.

Key factors determining the viability of bioenergy production include:

- policy/regulatory/tax frameworks
- prices of alternative/competing energy sources (coal electric, wind, oil, etc.)
- feedstock costs and availability
- co-product markets
- consumer demand
- infrastructure compatibility
- labour costs
- capital/financing costs
- technological advances/breakthroughs.

Bioenergy without subsidies are currently not competitive with their (also subsidezed) fossil fuel counterparts, with the exception of Brazilian charcoal (often used in the steel industry) and sugarcane ethanol (see Table 2.4 and Table 2.5 below), wood based heating in Northern Europe, and importantly industrial applications based on residues from production processes, for instance in sugar factories and timber mills. It should be noted that a comprehensive accounting of subsidies for fossil fuels so as to be able to make a fair comparison among fuels is beyond the scope of this study. While carbon credits might be influential in the future, currently the carbon market does not have a large influence over the economics of bioenergy production.

Table 2.4 - Fuel Ethanol Costs and Prices of Gasoline, 2004 (Euros per energy-equivalent liter)

	Ethanol	Gasoline (w/tax)	Gasoline (w/o tax)
United States	0.36(corn)	0.45	0.32
Europe	0.70(wheat)	1.09	0.34
Brazil	0.27(sugar cane)	0.69	0.33

Adapted from: Worldwatch Institute (2006). Biofuels for Transportation, Washington, DC.

Note: Bioethanol prices are adjusted for the difference in energy content per litre of ethanol (0.67 the energy of gasoline)

Table 2.5 - Biodiesel Costs and Prices of Diesel, 2004 (Euros per energy-equivalent liter)

	Biodiesel	Diesel (w/tax)	Diesel (w/o tax)
United States	0.50(soy)	0.47	0.31
Europe	0.56(rape)	1 .06	0.33
Brazil	0.52(soy)	0.40	0.32

Adapted from: Worldwatch Institute (2006). Biofuels for Transportation, Washington, DC.

Note: Biofuel prices are adjusted for the difference in energy content per litre of biodiesel (0.9 the energy of diesel)

2.4.2 Addressing Sustainability Issues

The majority of the work currently being done around the world to comprehensively address the complex sustainability questions surrounding biofuels development is being driven with voluntary initiatives. However it is clear that sustainability performance standards backed by the power of law will be necessary to prevent negative impacts.

The leading strategy at the international level, and in many cases at the national level, is to create sustainability standards that can then be applied by various actors (government, industry, independent organization, etc.) using some form of certification scheme or other mechanism for ensuring compliance. There is currently no international set of sustainability standards or sustainability assurance mechanisms for biofuels. There are, however, several international efforts underway, as well as national and sub-national initiatives at different levels of development.

A number of sustainability schemes exist for related products (i.e. forestry and traditional agricultural products). There are significant differences in breadth and comprehensiveness, for instance, some systems are crop specific and others cover biomass broadly. Some cover only feedstock production and others look at the entire production chain.

The creation of sustainability assurance schemes for biofuels is inherently complicated, in part because the range of crops and other materials that could serve as biofuel feedstock is very wide and will become even wider when next generation biofuels production is commercialized. This is in addition to the enormous range production contexts which include local and regional growing conditions and agro-ecosystems, agricultural production methods, and policy and cultural contexts.

This section will outline key international, voluntary efforts as well as leading national and sub-national efforts.

Mandatory – International Level

There are no international legally binding sustainability regulations for biofuels, but some related international law will be applicable – climate change commitments, endangered species treaties, and trade agreements for example. One option could be to integrate sustainable biofuel standards into existing international systems like the International Standards Organization (ISO). Another option could be the creation of a multilateral environmental agreement (MEA) for biofuels. However because of the nature of such agreements the standards are unlikely to be rigorous, the process to create an MEA is very long, and full implementation by signatories often happens slowly if at all.

In lieu of a global sustainability system, some regional governance bodies and national governments are integrating sustainability requirements into national policies. In January 2007 the European Commission created a binding 10 percent target for the share of biofuels in gasoline and diesel in each EU Member State by 2020, to be accompanied by the introduction of a sustainability scheme for biofuels. This scheme is currently under development.

Mandatory – National Level

A number of aspects of sustainability are addressed under national environmental and human welfare laws – water and air pollution regulations and minimum wage requirements for example. However, the broader sustainability issues that the rapid growth of bioenergy raises which span landscapes and economic sectors – competition with food production, land allocation conflicts, fair income and ownership distribution, and net GHG emissions of production operations, for example - are generally not captured by specific national environmental, agriculture, and other laws (many of which were enacted without taking bioenergy into account).

In the new context that the rapid increase of bioenergy production creates, some governments did not wait for international or regional institutions to take the lead.

Key National Efforts: In the United Kingdom, a sustainability standards development process has been connected to their Renewable Transport Fuel Obligation (RTFO) which will come into effect in 2008 and will require that 5 percent of all fuel sold in the United Kingdom comes from a renewable source by 2010. No sustainability requirement is tied to the renewable transport fuel obligation at this time, however, biofuel producers will have to report on the GHG balance, and environmental impact of their biofuels.

"Reporting is seen as a 'stepping-stone' towards a mandatory assurance scheme that rewards biofuels based upon their carbon intensity and seeks to penalise feedstock produced unsustainably. This first step is necessary due to the limited initial availability of data; the need to demonstrate the robustness of the criteria and methodology; and to reduce the risk of challenge under trade rules."[67]

This information will be used to develop sustainability standards, which should be imposed on any extension of the RTFO. The Low Carbon Vehicle Partnership has been asked to lead the development of carbon and sustainability standards through a multi-stakeholder process. Starting in 2010, the government will reward biofuels under the RTFO based on the amount of carbon the fuel saves. This will be subject to compatibility with EU and WTO requirements and future consultation on the environmental and economic impacts. Starting in April 2011, the government will reward biofuels only if they meet appropriate sustainability standards.[68]

In 2006 the Netherlands started a process to develop sustainability criteria for biomass used for energy. The development of these criteria and indicators to measure compliance has been ongoing, and groundwork is being laid for the creation of pilot projects to field test these criteria and indicators for the eventual development of monitoring and certification systems.[69] The government is currently in the process of incorporating sustainability indicators into Dutch policy, however, due to WTO restrictions, it is not possible to implement sustainability criteria as minimum standards in formal rules and regulations.[70] Instead, companies will be obliged to report on the sustainability criteria. This reporting obligation is under development, and GHG calculation methodologies are being refined for use in this process.[71]

The German Government recently changed its liquid biofuels support laws. They are phasing out their tax exemptions for liquid biofuels (except for advanced liquid biofuels) and are phasing in liquid biofuels blending quotas with mandatory sustainability requirements as per their Biofuels Quota Law. These standards are currently under development and will relate principally to sustainable production of feedstocks (especially from agriculture), natural habitat protection, and minimum GHG reductions. These German government sustainability requirements should be released in a Biofuel Sustainability Ordinance (BSO) in the fall of 2007. The BSO will include "a detailed scheme for the approval of certification systems, the accreditation of certifying bodies, and the validation of certificates."[72]

Sub-National Efforts

A number of state, city, and local level initiatives exist, but generally are still under development. In the United States, for example, biofuel sustainability regulations are being developed in California, Minnesota, Oregon and Washington.

The City of Portland, Oregon in the United States, has passed a Renewable Fuels Standard with procurement options being assessed on a point system. While there are not

[67] LCVehicle summary doc) (available at http://www.lowcvp.org.uk/cutting-carbon/biofuels.asp)
[68] Ibid.
[69] Kampman, Bettina, Frans Rooijers, and Jasper Faber. "A Strategy on Climate-Neutral Fuels". CE Delft. Holland. July 2006
[70] Lammers, Ella. SenterNovem. Email to Suzanne Hunt. August 23, 2007
[71] Energy Transition Task Force. "Criteria for Sustainable Biomass Production: Final Report of the Project Group 'Sustainable Production of Biomass'" July 2006. Holland
[72] Fritsche 2007

comprehensive sustainability requirement, the law delineates ‘preferred’ and ‘acceptable’ feedstocks and the evaluation criteria include distance travelled of the raw feedstock, intermediaries, and finished biofuel.[73]

Voluntary – International Level

Some form of international regulation would be preferable to regional or national systems because this would allow acceptance of these standards under international trade law. One of the key barriers today to the development of sustainability standards for biofuels is the concern that they will create an additional barrier to trade and will be used by some countries to protect their domestic industries (See Sections 1.2.3 and 2.5 for more on Trade). As mentioned previously, most existing initiatives, and initiatives in progress, are voluntary systems. Brief descriptions of key international initiatives are below.[74]

The Global Bioenergy Partnership (GBEP) is engaged in ensuring the sustainable production of bioenergy. In the light of the 2005 G8 Gleneagles Plan of Action and of the 2007 G8 Heiligendamm Summit Declaration, this Report is a basis to advance work in this area.[75]

The United Nations Environment Programme (UNEP) is currently in the process of defining sustainability criteria for biofuels. They acknowledge that this initial set of criteria will need to be further developed and suggest that concrete targets be set, and tools be developed to help implement them. UNEP is working in close cooperation with partners in governments, industry and civil society, including the Roundtable of Sustainable Biofuels, and will provide the link between the technical findings of this group and the GBEP and other intergovernmental processes. [76]

FAO is implementing an ambitious project on “Bioenergy and Food Security” that is developing an analytical framework for the assessment of food security impacts of expanded bioenergy systems based on food crops and second generation bioenergy systems. UNEP, the Food and Agriculture Organization of the United Nations (FAO) and the United Nations Industrial Development Organization (UNIDO) are preparing a Global Environment Facility (GEF) project that will provide guidance to countries on the environmental and socioeconomic conditions that support sustainable production, conversion and use of liquid biofuels.[77]

The Roundtable on Sustainable Biofuels (RSB) is the key international multi-stakeholder initiative to develop sustainability standards for biofuels. The Roundtable is being lead and funded by the Swiss EPFL (École Polytechnique Fédérale de Lausanne) Energy Center. Their first draft principles for sustainable biofuels production are available for review.[78] [79] Examples of

[73] City of Portland, Oregon Request for Proposals for Biodiesel and Ultra Low-Sulfur Diesel Motor Fuels. Solicitation No. 106848.)
[74] For a more comprehensive list of certification and standards initiatives that relate both directly and indirectly to bioenergy, see Lewandowski and Faaij 2006 or the UNEP 2007 biofuels working papers.
[75] Global Bioenergy Partnership (GBEP), last updated 28 August 2007, (available at http://www.globalbioenergy.org/)
[76] UNEP working papers 2007 (available at www.unep.org)
[77] Food and Agriculture Organization (FAO) U.S., Bioenergy and Food Security Project - (available at http://www.fao.org/nr/ben/befs/)
[78] Anyone can comment on these draft principles by going to www.bioenergywiki.net.
[79] Frie, Christoph, Edgard Gnansounou, and Hans Puettgen. White Paper: Sustainable Biofuels Program: The Need for Biofuel Certification/Labeling École Polytechnique Fédérale de Lausanne, November 2006

draft principles are: "Biomass production should not lead to the destruction or damaging of areas of high biodiversity," and "biomass production should not degrade or damage soils."[80]

IEA Task 40 is an international working group headed under the Bioenergy Agreement of the International Energy Agency formed to deal with International trade of biomass and bioenergy, its implications and prospects. One of their key priorities is the development of a sustainable biomass supply and thus they work on certification, standardization and terminology for sustainable biomass trade and provide important information and analysis for ongoing sustainability assurance efforts.[81]

Related International Certification Schemes

Related systems, namely forestry and agricultural certification systems are being used as models, and/or other aspects of the systems are being adapted for broader biomass certification systems. Some of the most prominent are:

The Sustainable Agriculture Standard from the Sustainable Agriculture Network led by the Rainforest Action Network "covers the management of farms of all different sizes and includes aspects relating to agricultural, social, legal, labour and environmental issues, in addition to sections on community relations and occupational health and safety."[82] One of the ten principles is "Wildlife Protection". The associated criterion is "The farmer must keep an inventory of the wild animals held in captivity on the farm and implement policies and procedures to regulate and reduce their tenancy. Endangered or threatened species must not be held in captivity." Two of the criteria associated with this criterion are: "The farm is able to demonstrate a reduction over time in the number of animals held in captivity; no additional animals on the farm are put into captivity," and "the animals' owners have the respective permits required by national laws."[83]

The Forest Stewardship Council (FSC) was formed to promote environmentally appropriate, socially beneficial and economically viable management of the world's forests. FSC certifies forest land and forest products (e.g. wood, paper, wooden value-added products, non-timber forest products, buildings). It also accredits independent third party organizations who can then certify forest managers and forest product producers to FSC standards.[84] An example of one of their ten principles is "The legal and customary rights of indigenous peoples to own, use and manage their lands, territories, and resources shall be recognized and respected." Two of the associated criteria are, "Indigenous peoples shall control forest management on their lands and territories unless they delegate control with free and informed consent to other agencies," and, "Forest management shall not threaten or diminish, either directly or indirectly, the resources or tenure rights of indigenous peoples."

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[80] Bioenergy Wiki, Roundtable on Sustainable Biofuels (RSB) Comments Process, Last updated 29 Auguest, 2007 (available at http://www.bioenergywiki.net/index.php/RSB_comments_process#Original_and_Current_Edits_of_ Principles)
[81] International Energy Agency (IEA) Task 40, Sustainable International Bioenergy Trade (available at www.fairbiotrade.org)
[82] Rainforest Alliance, Sustainable Agriculture Standard, Sustainable Agriculture Network, 2005 (available at http://www.rainforest-alliance.org/programs/agriculture/certified-crops/documents/standards_2005.pdf)
[83] Sustainable Agriculture Standard. Sustainable Agriculture Network. November 2005. (available at www.rainforest-alliance.org)
[84] Forest Stewardship Council (FSC), last updated 6 September, 2007 (available at http://www.fsc.org/en/)

The International Federation of Organic Agricultural Movements (IFOAM) is the global umbrella organization for the organic movement that unites more than 750 member organizations in 108 countries. IFOAM's mission is “leading, uniting and assisting the organic movement in its full diversity.” “IFOAM provides a market guarantee for integrity of organic claims” and, “unites the organic world through a common system of standards, verification and market identity. It fosters equivalence among participating IFOAM accredited certifiers, paving the way for more orderly and reliable trade whilst acknowledging consumer trust in the organic ‘brand’”.[85]

Fairtrade Label Organization (FLO) International was created to improve the position of the poor and disadvantaged producers in the developing world, by setting the Fairtrade standards, and by creating a framework that enables trade to take place at conditions respecting their interest. Members of FLO International encourage industry and consumers to support fairer trade and to purchase FLO certified products.[86]

Feedstock Specific Initiatives

The Roundtable on Sustainable Palm Oil was launched by the World Wildlife Fund (WWF) in cooperation with palm industry stakeholders to research and develop definitions and criteria for the sustainable production and use of palm oil and to facilitate the development and implementation of best practices.[87] An example of one of their Principles is, “Use of appropriate best practices by growers and millers” and several of the associated criteria are, “Operating procedures are appropriately documented and consistently implemented and monitored,” “practices maintain soil fertility at, or where possible improve soil fertility to, a level that ensures optimal and sustained yield,” and “Practices maintain the quality and availability of surface and ground water.”[88]

The Better Sugarcane Initiative (BSI) "is a collaboration of progressive sugarcane retailers, investors, traders, producers and NGOs” who are working together to develop baselines and internationally-applicable measures to define sustainable sugar cane production. “The end result of BSI will be a set of performance-based measures and baselines, which can be used by companies and investors across the globe as sourcing and investment screens and by producers to enhance the long-term sustainability of production.”[89]

The Roundtable for Responsible Soy (RTRS) was only created in 2005 and is moving more slowly than the other commodity initiatives, however it has a similar strategy and objective: “the goal of the RTRS is to set up a multi-stakeholder and participatory process that promotes economically viable, socially equitable and environmentally sustainable production, processing and trading of soy”.[90]

[85] International Federation for Organic Agriculture Movements (IFOAM), last updated 29 August, 2007 (available at http://www.ifoam.org/)
[86] Fairtrade Labelling Organizaitons International (FLO), last updated 25 July, 2007 (available at http://www.fairtrade.net/)
[87] Roundtable on Sustainable Palm Oil (RSPO), last updated 14 September 2007 (available at http://www.rspo.org/)
[88] RSPO Principles and Criteria for Sustainable Palm Oil Production. Public release version. 17 October 2005.
[89] Better Sugarcane Initiative (BSI) (available at http://www.bettersugarcane.org/)
[90] Roundtable on Responsible Soy (RTRS) (available at http://www.responsiblesoy.org/)

Voluntary – National and Sub-National Level

The Social Fuel Stamp was created as part of Brazil's National Program of Biodiesel Production and Use. It attempts to encourage socially sustainable biofuels production by providing tax incentives for biodiesel producers to purchase feedstocks from small family farms in poorer regions of the country. To receive the stamp, producers must agree to: "purchase minimum percentages of raw materials from family farmers, 10 percent from regions North and Mid-West; 30 percent from the South and Southeast and 50 percent from the Northeast and the Semi-Arid Region; and they must "enter into contracts with family farmers establishing deadlines and conditions of delivery of the raw material and the respective prices, and to provide them with technical assistance." Participating companies may benefit from a partial or total reduction of federal taxes.[91] [92] While this seal is not mandatory, it is now required by the government for fuel to be counted towards national blending mandates.

The Institute for Agriculture and Trade Policy (IATP), an international non-governmental organization based in the United States, is working to develop voluntary sustainable standards for biomass production and harvesting as an Associate Member of the ISEAL Alliance. Draft global principles that address social and environmental aspects have been developed with Friends of the Earth and are available for comment and review at *www.sustainablebiomass.org*. Based on the feedback received, final principles will be developed and will inform how and to what extent IATP moves forward with the development of criteria and a certification system for sustainable biomass standards. Initial research and field work with farmers is now being undertaken, with a focus on perennial grasses and agricultural crop residues. IATP is also participating in the Minnesota state-based efforts to develop criteria for sustainable production of native perennial grass feedstocks.[93]

The Sustainable Biodiesel Alliance (SBA) is a non-profit organization founded by biodiesel advocates Annie Nelson and Daryl Hannah and members of the sustainable biodiesel community. The SBA was created to promote sustainable biodiesel practices and to develop a certification and labeling system for biodiesel in the United States. They are working in tandem with the Roundtable on Sustainable Biofuels on voluntary sustainability standards and a certification system. They are also developing sustainability guidelines for companies to use right away while full certification schemes are still under development.[94]

The Private Sector

A number of companies, especially in Europe, consider "sustainability" a key driver in bioenergy development. A few companies are developing their own 'sustainable procurement policies'. The Essent corporation in Europe for example, developed the Essent Green Gold audit and certification system to guarantee the sustainable sourcing of biomass. However, the majority of

[91] Tax reductions/exemptions are defined by the national biodiesel tax legislation.
[92] Brazilian Government. "Biodiesel: The New Fuel from Brazil" National Program of Biodiesel Production and Use (PNPB). (available at http://www.biodiesel.gov.br/docs/Folder_biodiesel_ingles_paginado)
[93] Kleinschmit, Jim. Personal Communication with Suzanne Hunt. August 2007
[94] Sustainable Biodiesel Alliance, www.fuelresponsibly.org

companies concerned about sourcing or selling sustainable biofuels are engaging in the multi-stakeholder processes (which are viewed as much more legitimate by consumers). BP, Dupont and other large corporate players are engaged in the international Roundtable for Sustainable Biofuels. This process is expected to take at least a year or more to develop standards that could be applied, so at the urging of a number of companies in the United States, the Sustainable Biodiesel Alliance is developing basic sustainability guidelines for companies to use in the meantime (as mentioned above). Businesses are interested in seeing that strategies to ensure sustainability are transparent, consistent over time and create a level playing field among market participants. There are indications that there is some support in the private sector for broad sustainability criteria, but there is also concern about the burden of detailed reporting requirements. In addition, companies that want to participate in sustainability standards development are becoming increasingly concerned with the proliferation of standards development initiatives and what they perceive as a fragmentation of standards development initiatives. They want clarity and guidance as to how best to engage and in which processes.

The Multilateral Development Banks

The MDBs may play a more active role in developing and applying sustainability assurances in the future. They recently created an MDB biofuels working group. Of the MDBs the IDB is most engaged in biofuels, although they are just beginning to engage in efforts to address sustainability assurances for biofuels.

2.4.3 Key Findings

No international sustainability assurance system exists for biofuels or bioenergy more broadly. As described above, several international processes to create such a system are underway, however, even these do not deal with all concerns due to the potential for impact shifting. This occurs when feedstock from existing fields/plantations is used for biofuels that was originally used for other applications which leads to unsustainably produced feedstocks being used, or to new plantations/fields being created, to supply these other applications. The fungibility of feedstocks, land, and other inputs for feed, fuel, and food is leading some to call for a universal framework for sustainability requirements.

Enforcement is critical to the functioning of any of these schemes. While a discussion of enforcement strategies is beyond the scope of this summary, it must be acknowledged as central. The capacity of countries to enforce protections, or even to enact them in the first place, is highly variable. In many developing countries, where much of the investment interest is focused, the pressure to reduce regulations and oversight in order to attract foreign investment is an additional challenge. These factors point to the need for international assurance systems.

Ultimately sustainability requirements will need to be agreed upon internationally, applied locally, and applied to all biomass regardless of end use if leakage effects or impact shifting is to be avoided.

2.5 Trade Considerations

Historically, biomass and biofuel trade flows have been limited, as most of the production has been for domestic consumption. However, in the coming years, international trade in biofuels and feedstocks is expected to escalate rapidly to satisfy increasing worldwide demand. Worries about high fossil fuels prices, energy security concerns and climate change mitigation efforts are indeed expected to feature highly in the international agenda in the years to come. This will likely translate into the increasing use of blending targets. Considering that several countries will not be in a position to produce enough biofuels to satisfy their demand and that some countries and regions are endowed with conditions which allow them to produce biofuels and feedstock competitively, an international market for those products is already emerging.

2.5.1 Significance of Policy Intervention for Trade Patterns/Development

Given the increasingly important place that bioenergy occupies in international energy markets, policies that liberalize or constrict trade of bio-based energy products are likely to greatly impact future production and consumption patterns. These policies are greatly influenced by regional trade agreements that individual countries are part of (see below and Annex II), domestic policies on the use of bio-based energy (Annex I), and regional or individual country standards for bioenergy products. Among solid biomass, biogas and liquid biofuels, the development of domestic liquid fuel stocks and international liquid fuel markets has generated most interest given the impending concerns regarding transport fuel security.

2.5.2 Trade Bodies and Agreements

There are a number of multilateral, regional and national policy instruments that currently have an impact on international trade of biomass and biofuels and will become increasing important as trade expands. The WTO provisions that may be relevant for biofuels will become more high profile in the years to come (see below and Annex II). In addition to the WTO, several regional and bilateral trade agreements, mostly involving the United States and the EU, currently regulate biofuels trade. As an example among these, the United States-Caribbean Basin Initiative (CBI) allows for some duty-free trade for ethanol. More specifically, if produced from at least 50 percent local (CBI) feedstocks, ethanol may be imported duty-free into the United States market. If the local feedstock content is lower, limitations apply on quantity of duty-free ethanol. Nevertheless, up to 7 percent of the United States market may be supplied duty-free by CBI ethanol containing no local feedstocks. In this case, hydrous ethanol produced in other countries (mainly Brazil), can be shipped to a dehydration plant in a CBI country for reprocessing. After the ethanol is dehydrated, it is imported duty free into the United States. Until recently imports of dehydrated (anhydrous) ethanol under the CBI were far below the 7 percent cap (approximately 3 percent in 2005), though the situation is changing as agribusinesses are increasingly investing in ethanol plants in Central America and the Caribbean[95]

The WTO does not currently have a trade regime specific to biofuels: International trade in biofuels falls, therefore, under the rules of the General Agreement on Tariffs and Trade (GATT 1994), which covers trade in all goods, as well as under the rules of other relevant WTO Agreements, such as the Agreement on Technical Barriers to Trade, the Agreement on the Application of Sanitary and Phytosanitary measures, the Agreement on Subsidies, etc. Agricultural products are subject to the GATT and to the general rules of the WTO insofar as the Agreement on Agriculture does not contain derogating provisions. While many Panel and Appellate Body decisions have ensured the effective integration of agriculture in the general WTO discipline, specific provisions of the Agreement allow certain aspects of these exemptions to persist. The ongoing WTO negotiations will decide whether and to what extent agriculture should continue to be allowed to enjoy a status that derogates from the WTO.

The Agreement on Agriculture covers products from chapter 1 to chapter 24 of the Harmonized System, with the exception of fish and fish products and the addition of a number of specific products, such as hides and skins, silk, wool, cotton, flax, modified starches, etc. The discipline of the Agreement on Agriculture is based on the three pillars, namely market access, domestic subsidies and export subsidies. One of the main features of the Agreement on Agriculture is that it allows Members to pay subsidies in derogation from the Agreement on Subsidies.[96]

Defining a product as an agricultural or an industrial product has, therefore, important implications, since the multilaterally agreed rules applying to these two categories of products are different; WTO members enjoying a large margin of manoeuvre as far as agricultural products are at stake and much less as far as industrial products are at stake.

Paragraph 31 (iii) of the Doha Development Agenda has launched negotiations on “the reduction or, as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services.” Negotiations on environmental goods have been carried out by the Committee on Trade and Environment Special Session (CTE-SS) and by the Negotiating Group on Non-Agriculture Market Access (NAMA). Negotiations on environmental services have been conducted within the Special Sessions of the Council for Trade in Services. According to some WTO members, renewable energy products - which could include bioethanol and biodiesel and related products, such as parts and components of biodiesel and bioethanol plants and "flexi fuel" engines and vehicles - could be classified as environmental goods. Many disagreements among countries on the identification of environmental goods, on the scope and approach to take to liberalize trade in such products, and on mechanisms for regularly updating the product list to account for constantly moving targets, have hampered any conclusive result.

[95] For a discussion of which different trade agreements impact the biofuels market, see Annex II.
[96] The Agreement classifies these support measures in two major groups: domestic support measures (blue and yellow boxes) and general support exempt from reduction commitments (green box) on the one hand, and export subsidies on the other hand.

2.5.3 Policy Instruments that Impact on Trade

Tariffs

In order to protect domestic agriculture and biofuel industries, tariffs may be imposed by some nations on both raw materials and final products. The trend so far has been to apply significant import duties on ethanol, the finished product, as well as on biofuel feedstock. In general, tariff escalation exercised by some nations favours the production of raw materials in the exporting countries and the production of the final products in the importing countries. Considering that the industrial processing is the phase where much of the value is added, tariff escalation makes it more difficult for countries producing raw materials to process and manufacture value-added products for export.

For the market of finished biomass products and raw materials, several international trade policy barriers exist presently. Most agricultural residues that contain traces of starch are classified as animal fodder and are thus subject to EU import levies. For example, rice residues that comprise of 0-35 percent starch are levied at 44 €/tonne.[97]

Countries with large markets (the United States, Japan and the EU) present a major constraint to exporters since they are completely or partially inaccessible due to trade barriers. The United States applies MFN duties of 2.5 percent for imports from most-favoured nations (MFN) as defined by the WTO and a 20 percent duty is applied for other importers. Ad valorem duties in Japan for biomass amounts to 27 percent (MFN) influencing the competitiveness of foreign imports. General transport tariffs have also increased significantly in the past few years impacting biomass trade. Wood pellets incurred a total cost of 7-7.5€/GJ in the Netherlands in 2004, with 1.75 €/GJ being for transport tariffs. Table 2.6 provides an up to date overview of tariffs on biofuels in major OECD bioenergy markets:

[97] Junginger, M., M. de Wit and A. Faaij, 2006, IEA Bioenergy task 40 – Country report for the Netherlands – update 2006, Copernicus Institute – Department of Science, Technology and Society, Utrecht, the Netherlands, p. 28. as cited in Martin Junginger (main editor), André Faaij, Peter-Paul Schouwenberg, Chris Arthers, Douglas Bradley, Gustavo Best, Jussi Heinimö, Bo Hektor, Patrick Horstink, Angela Grassi, Kees Kwant, Øyvind Leistad, Erik Ling, Malgorzata Peksa, Tapio Ranta, Frank Rosillo-Calle, Yves Ryckmans, Martijn Wagener, Arnaldo Walter, Jeremy Woods, November 2006, Sustainable International Bioenergy and Trade: Securing Supply and Demand.

Table 2.6 - Applied tariffs on undernatured ethyl alcohol (HS 2207.10) in several representative countries, as of 1 January 2007

Country	Applied MFN tariff (local currency or ad valorem rate)	At pre-tariff unit value of $ 0.50/litre		Exceptions (in addition to other WTO member economies with which country has a free-trade agreement) or notes
		Ad valorem equivalent (percent)	Specific-rate equivalent (US$/litre)	
Australia	5% + AU$ 0.38143/litre	51%	0.34	USA, New Zeland
Brazil	0%	0%	0.00	Lowered from 20% in March 2006
Canada	CA$ 0.0492/litre	9%	0.047	FTA partners
European Union	€ 19.2/Hl (hectolitre)	52%	0.26	EFTA countries, developing countries in GSP
Switzerland	CHF 35 per 100 kg	46%	0.232	EU, developing countries in GSP
United States	2.5% + $ 0.51/gallon	28%	0.138	FTA partners, CBI countries

Source: Steenblick, R, Biofuels – at what cost?, Government support for ethanol and biodiesel in selected OECD countries, September 2007

Quotas

Import quotas, such as those employed by the EU, regulate sugar imports through a complex system of duty free tariff quotas for sugar from different exporters. As mentioned above, duty-free under CBI is linked to a quota system. Duty-free ethanol imports under quotas have also played a role during the negotiations of the United States-Central America Free Trade Agreement (CAFTA). However, CAFTA did not introduce major changes. It does not increase overall preferential access to the United States ethanol market but it does establish country-specific shares for El Salvador and Costa Rica within the existing CBI quota. The other CAFTA countries retain existing CBI benefits on ethanol.

Other Barriers to Trade

Other barriers to trade can take the form of technical regulations or sustainability requirements. In order to enter multiple markets, biofuel exporters may incur extra costs to adjust their products to different technical requirements and to prove compliance with such requirements. In a similar way, sustainability certification for feedstock and fuels may act as trade barriers.

There is currently no specific customs classification for bioethanol for biofuel production in the harmonized system commodity description and coding system (HS). Ethanol is traded under the code 22 07 that includes denaturated (HS 22 07 20) and undenaturated (HS 22 07 10) alcohol, both of which can be used for fuel production. Biodiesel has recently been reclassified by the World Customs Organization under the HS code 3824 90 – an industrial code which includes a large spectrum of chemical products and preparations of the chemical or allied industries (including those consisting of mixtures of natural products) not elsewhere specified or included.

In collecting and analyzing data on trade flows in biofuels and tariff regimes thereon, some basic difficulties are encountered: first, the lack of proper HS codes for distinct biofuels; second, the multiple potential uses of feedstocks, which makes it difficult to track the percentage of agriculture production devoted to biofuel manufacturing as opposed to feed and food consumption or other industrial uses. However, break-downs of final uses of feedstocks are carried out by some countries at the national or regional grouping levels.

The situation is complicated further by the vast array of products – from different feedstocks to different final products - that make up global trade in bioenergy. As bioenergy trade becomes increasingly more important with accelerating global demand, custom classification issues will need to be streamlined to facilitate international trade and identify clearly the rules which apply to each biofuel.

Domestic markets in several countries are not only protected by tariff and non-tariff barriers, but as well by subsidies and other incentives provided by national sub-nation and local authorities. Incentives include exemption from or reduction of fuel-excise taxes, grants for the construction of plants, subsidies for the production of feedstocks and other kinds of tax holidays.

Additionally, the risk of contamination from pathogens or pests contained in imported biomass has been limiting factor restricting biomass trade. For example, untreated round woodchips with bark, from outside the EU are in most cases not allowed or subject to very strict inspection before being imported. Agricultural residues that qualify as both fodder and biomass may not be imported if they don’t meet certain fodder quality criteria.

2.5.4 Key Findings

International trade in biofuels and related feedstocks could provide win-win opportunities: for several developed countries imports are a necessary precondition for meeting the self-imposed blending targets; for several developing countries producing and exporting biofuels may provide new business opportunities and end-markets for their agricultural products. For small and medium-sized developing countries, export markets may be necessary to initiate their industries. Several developing countries – with land to devote to biomass production, a favourable climate to grow them, and low-cost farm labour – are well placed to become efficient producers. Nevertheless, biofuels face tariffs and non-tariff measures. This can offset lower production costs in producing countries, represent significant barriers to international trade, and have negative repercussions on investments in the sector. A more liberal trade regime would greatly contribute to the achievement of the economic, energy, environmental and social goals that countries are pursuing.[98]

[98] The emerging biofuels market: Regulatory, trade and development implications, UNCTAD/DITC/TED/2006/4, New York and Geneva, 2006.

2.6 Bioenergy Consumption in G8 +5 Countries

This section provides an overview of current status/trends of different bioenergy consumption in G8 +5 Countries. Additional and more detailed information on production, consumption and trade of bioenergy is presented, on a country basis, in the Annex I. This aggregated overview is based on the statistics on renewables produced by IEA (IEA 2007), which maintains the most complete and consistent information system on energy matters. In spite of IEA efforts, however, biofuels statistics should be taken with caution because biofuels are either largely informal or of very recent development, all factors that affect the completeness and reliability of recorded data (ref. Annex III on bioenergy data).

In most countries, for instance, the use of wood traded as fuelwood and charcoal through informal markets is not properly reflected in existing statistics. The experience gained by FAO field projects shows that in most cases the actual fuelwood consumption is considerably higher than that mentioned in the national statistics.

Nevertheless, these statistics are considered accurate enough for an understanding of the status of bioenergy in G8 +5 Countries and its contribution to the national energy mix.

2.6.1 Biofuel Contributions to National Energy Consumption

Table 2.7 shows the quantitative biofuels' Total Primary Energy Supply, which represents the amount available within the countries for internal use.[99] China with its 9000 PJ/yr is the largest user of biomass as a source of energy followed by countries such as India (6000 PJ/yr), USA 2300 PJ/yr, and Brazil (2000 PJ/yr) while the bioenergy contribution in countries such as Canada, France and Germany is around 450 PJ/yr.

In Figure 2.2 and Figure 2.3 the consumption trends from 1995 to 2005 can be appreciated. It can be noted that they increase at a quite high pace over time especially in countries such as Brazil, Germany, Italy and United Kingdom while in other countries like France, Japan, India and Mexico remain stabilized. Russia is the only one country in which its consumption is decreasing.

[99]Total Primary Energy Supply (TPES) is made of production + imports – exports –international bunkers ± stock change (IEA 2007).

Table 2.7 - Total Primary Energy Supply (TPES) from biofuels (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Canada	409	408	418	437	480	481	451	487	489	510	525
France	440	467	438	453	439	430	437	406	420	419	422
Germany	139	143	195	210	207	229	246	271	312	348	441
Italy	52	51	59	63	69	74	79	76	81	121	123
Japan	191	193	199	183	190	196	180	187	191	190	198
Russia	259	221	190	157	208	163	158	151	149	143	146
United Kingdom	52	54	57	55	56	61	64	70	82	96	115
United States	2554	2607	2531	2601	2507	2551	2285	2256	2474	2633	2697
G8 Countries	4097	4144	4086	4160	4156	4186	3900	3904	4198	4460	4666
Brazil	1728	1706	1719	1756	1838	1794	1823	1951	2110	2277	2801
China	8610	8656	8703	8750	8906	8973	9053	9127	9202	9277	9360
India	5862	5918	5978	6039	6144	6230	6313	6389	6464	6539	6620
Mexico	328	329	338	343	337	333	337	333	336	337	348
South Africa	479	487	495	504	516	529	539	545	551	547	564
+5 Countries	17006	17095	17233	17392	17741	17859	18064	18345	18662	18977	19693

Figure 2.2

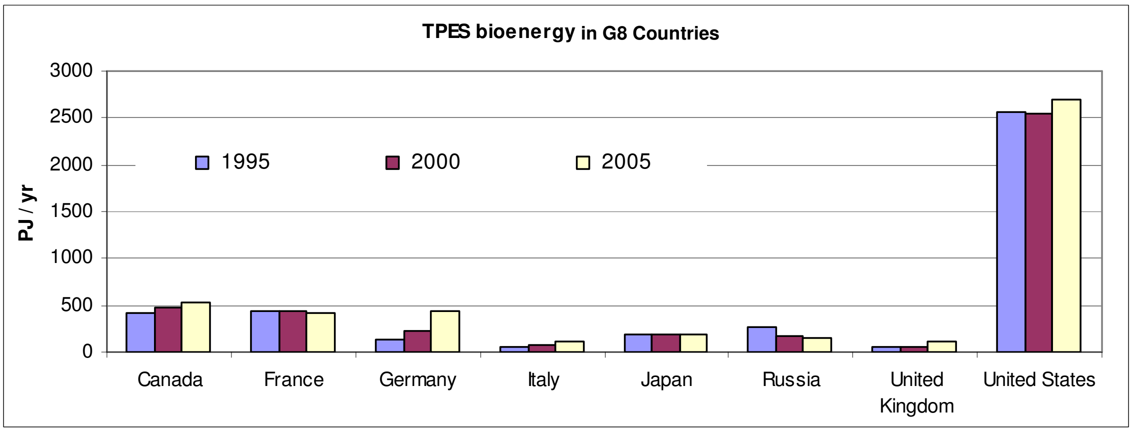


Figure 2.3

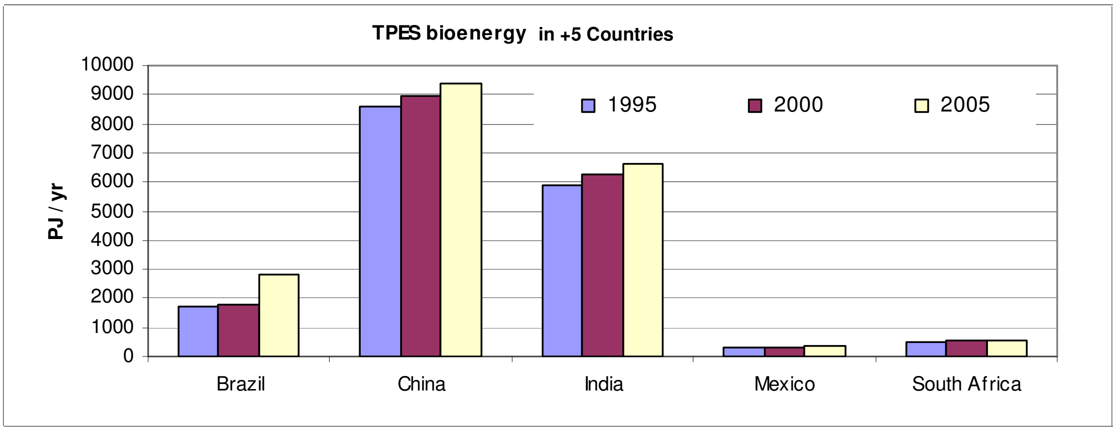


Table 2.8 shows the share of bioenergy to the national energy mix from 1995 to 2005. Its contribution to TPES reaches almost 30 percent in the case of Brazil and India but in countries such as United Kingdom and Russia is a meagre 1 percent. In countries such as Canada, France, Germany and USA varies between 3 and 4 percent.

The bioenergy share in India, China and Mexico is decreasing (see Figure 2.4 and Figure 2.5). It is most likely that the reduction of biofuels share is the result of the increased utilization of kerosene and LPG by the household sector.

On the contrary, the biofuel contribution is increasing in the G8 Countries especially Germany, Italy and United Kingdom where their annual consumption grew at a rate of 4-6 percent during the last few years, especially in Germany and United Kingdom (see Figure 2.4).

Table 2.8 - Total Primary Energy Supply (TPES) from biofuel (% of all-fuels' TPES)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Canada	4.2	4.1	4.2	4.4	4.6	4.6	4.4	4.7	4.5	4.5	4.6
France	4.4	4.4	4.2	4.2	4.1	4.0	3.9	3.6	3.7	3.6	3.6
Germany	1.0	1.0	1.3	1.4	1.4	1.6	1.7	1.9	2.1	2.4	3.1
Italy	0.8	0.8	0.9	0.9	1.0	1.0	1.1	1.0	1.1	1.6	1.6
Japan	0.9	0.9	0.9	0.9	0.9	0.9	0.8	0.9	0.9	0.9	0.9
Russia	1.0	0.8	0.8	0.6	0.8	0.6	0.6	0.6	0.6	0.5	0.5
United Kingdom	0.6	0.6	0.6	0.6	0.6	0.6	0.7	0.7	0.8	1.0	1.2
United States	2.9	2.9	2.8	2.8	2.7	2.6	2.4	2.4	2.6	2.7	2.8
G8 Countries	2.2	2.2	2.2	2.2	2.2	2.1	2.0	2.0	2.1	2.2	2.3
Brazil	26.6	25.0	23.9	23.7	24.1	23.1	23.3	24.3	26.0	26.5	29.8
China	19.6	19.0	19.1	19.2	19.4	19.4	19.6	18.2	16.2	14.0	13.0
India	36.1	35.3	34.3	33.9	32.5	32.4	32.3	31.9	31.5	30.0	29.4
Mexico	5.9	5.7	5.7	5.5	5.4	5.3	5.3	5.1	5.0	4.9	4.7
South Africa	10.9	11.0	11.1	11.1	11.3	11.4	11.8	12.4	11.1	10.2	10.7
+5 Countries	22.2	21.6	21.4	21.3	21.3	21.2	21.4	20.6	19.2	17.4	16.9

Figure 2.4 – Percent of biofuel to all fuels TPES – G8 Countries

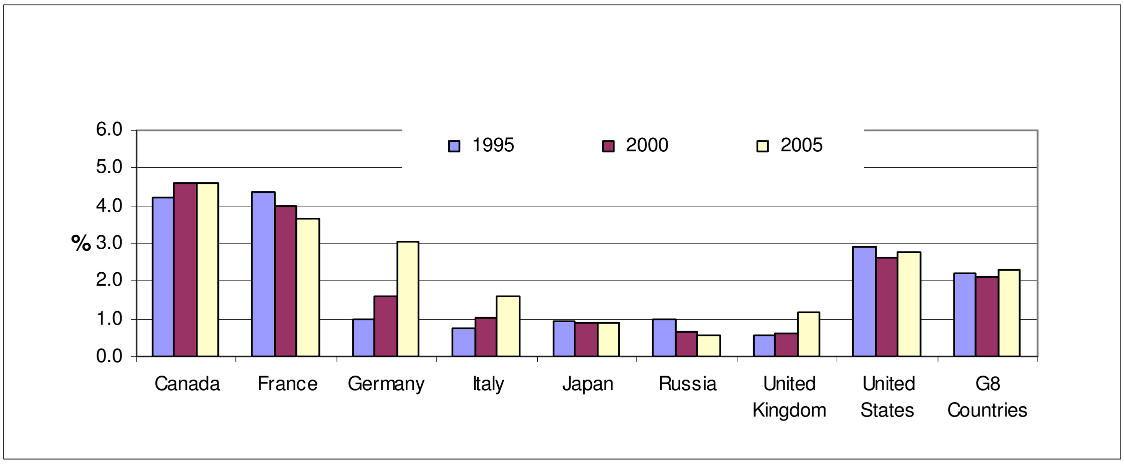
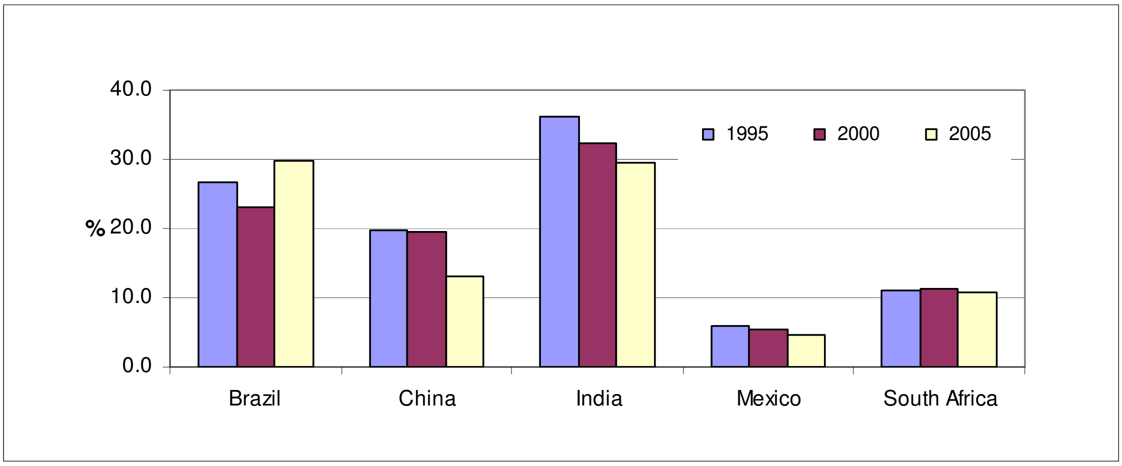


Figure 2.5 – Percent of biofuel to all fuels TPES – +5 Countries



Consumption of Biofuel by Sectors (end-users)

The analysis of main end-users of bioenergy also deserves attention. The Table 2.9 shows the aggregated biofuel consumption in all G8 +5 Countries which reaches more than 24000 PJ/yr for the year 2005 and they have been growing at a 4-5 percent annually since 2003, at a faster rate than in previous years.

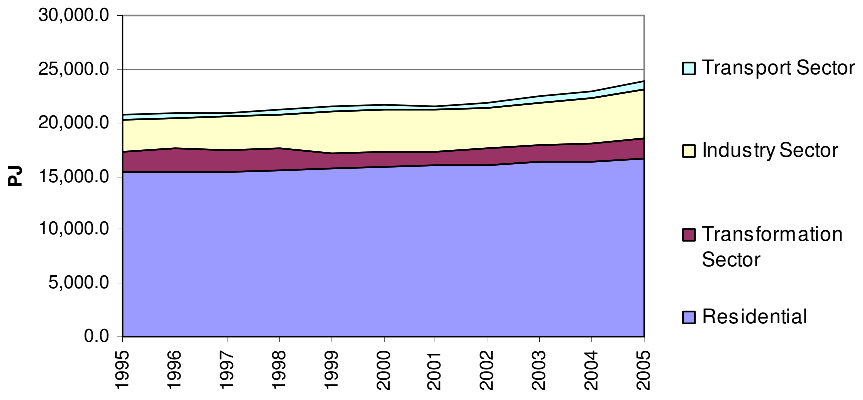
The Figure 2.6 also confirms that, overall, the main end user of bioenergy is the residential sector, with a share ranging between 72.6 percent in 1995 and 68.4 percent in 2005 (see also Figure 2.7) followed by industries with 19 percent and transportation biofuels (biodiesel and bioethanol) with only 3 percent.

Table 2.9 - Aggregated G8 +5 Countries biofuel consumption by fuel category and sector of use

G8+5 total		1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Values in PJ												
All biofuels	Domestic Supply	21,111.8	21,246.5	21,324.4	21,557.4	21,900.7	22,048.9	21,968.3	22,251.7	22,859.6	23,440.8	24,363.6
	Transformation Sec	2,021.1	2,085.3	2,090.1	2,046.1	1,326.0	1,363.9	1,393.7	1,567.1	1,615.0	1,731.9	1,919.3
	Industry Sector	2,931.4	2,904.2	3,032.8	3,155.6	4,002.8	3,989.2	3,832.1	3,799.7	3,973.4	4,200.8	4,525.1
	Transport Sector	410.9	395.0	408.4	416.2	422.7	420.0	396.8	465.5	521.5	630.2	748.1
	Residential	15,333.2	15,456.4	15,396.0	15,550.8	15,717.5	15,847.5	15,944.9	16,004.8	16,282.8	16,406.9	16,656.7
Solid Biom	Domestic Supply	20,539.0	20,683.2	20,739.8	20,950.6	21,203.5	21,325.4	21,228.7	21,396.9	21,923.9	22,348.8	23,112.2
	Transformation Sec	1,949.4	2,005.3	1,997.2	1,946.5	1,216.1	1,228.6	1,237.6	1,390.6	1,424.6	1,523.1	1,680.1
	Industry Sector	2,903.3	2,877.9	3,008.4	3,128.9	3,912.9	3,898.3	3,729.3	3,683.5	3,877.4	4,096.8	4,421.3
	Transport Sector											
	Residential	15,301.5	15,423.2	15,361.9	15,516.0	15,675.6	15,799.9	15,880.4	15,926.3	16,186.1	16,290.0	16,515.6
Gas from E	Domestic Supply	112.2	122.4	136.3	145.1	227.9	253.9	301.8	355.2	368.0	408.9	458.1
	Transformation Sec	71.7	80.1	92.9	99.6	109.8	135.3	156.0	173.8	187.4	205.7	226.5
	Industry Sector	4.4	4.8	4.8	5.8	69.7	63.6	76.7	97.8	75.3	76.1	81.9
	Transport Sector											
	Residential	31.7	33.2	34.0	34.8	41.9	47.6	64.5	78.5	96.8	116.9	141.2
Biogasoline	Domestic Supply	187.2	172.2	213.4	237.8	259.6	259.4	266.0	330.0	398.5	459.6	512.4
	Transformation Sec											
	Industry Sector											
	Transport Sector	184.8	169.0	211.7	234.2	253.4	264.2	277.5	335.0	393.5	456.3	514.2
	Residential											
Biodiesels(	Domestic Supply	7.1	10.3	12.9	12.3	14.2	21.8	25.6	34.4	45.9	67.1	109.5
	Transformation Sec											
	Industry Sector											
	Transport Sector	7.1	10.5	13.8	12.0	14.1	21.8	25.6	34.9	45.2	67.4	109.4
	Residential											
Other Liqui	Domestic Supply	266.3	258.4	222.1	211.5	195.6	188.4	146.1	135.2	123.2	156.5	171.4
	Transformation Sec							0.2	2.8	3.0	3.1	12.7
	Industry Sector	23.7	21.5	19.6	20.8	20.2	27.2	26.1	18.4	20.7	27.9	21.9
	Transport Sector	219.0	215.4	182.9	169.9	155.2	133.9	93.7	95.6	82.8	106.5	124.5
	Residential											

The contribution of biogasoline (mainly bioethanol) is still relatively small but its demand is rapidly growing (from 187 to 512 PJ between 1995 and 2005) at the annual rate of 17 percent. On the other hand, the consumption of biodiesel in 2005 is also marginal when compared to solid biomass with only a contribution of 110 PJ/yr. It should be also noted that the consumption of biodiesel grows very rapidly.

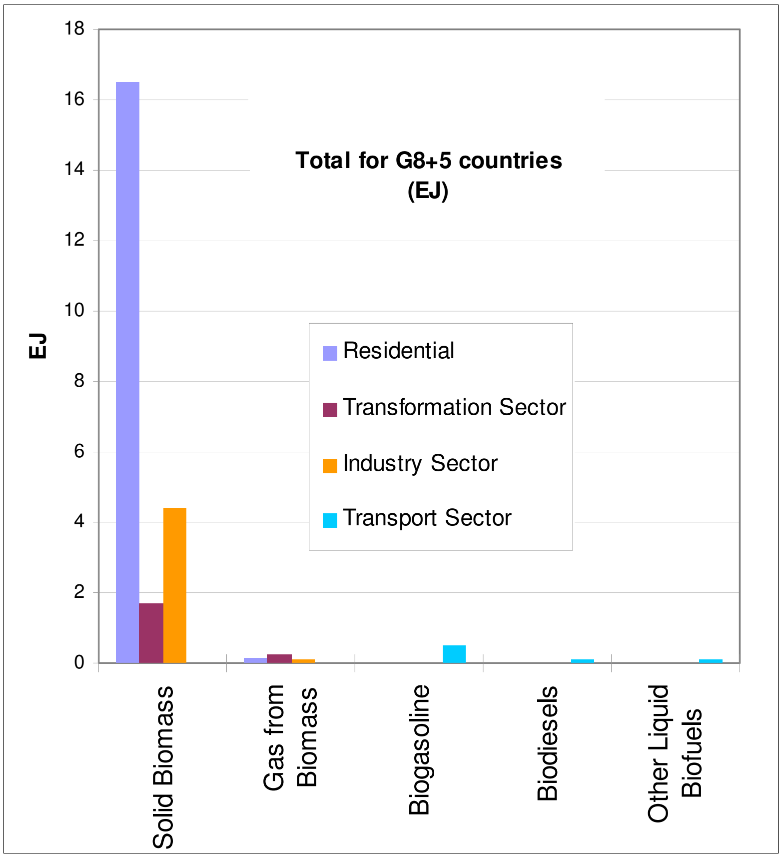
Figure 2.6 - Biofuel consumption in G8 +5 Countries (all biofuel categories)



From the Table 2.9 and the Figure 2.7 it may be noted that 95 percent of the total biomass used for energy is derived from solid biomass and the rest (5 percent) are constituted by liquid and gaseous biofuels.

The same table indicates that solid biomass is making the major contribution to national energy mix.

Figure 2.7 - Biofuel consumption in 2005 in G8 +5 Countries by biofuel type and sector of use



2.7 Main Conclusions

Together, the G8 +5 Countries account for about 55 percent of the world's population, 70+ percent of global GDP, and about 72% of world energy related and industry CO_2 emissions (excluding deforestation) (G8 +5 Countries emit 16.1t CO_2 eq per capita on average versus 4.2 t/cap for non Annex 1 countries – according to the IPCC).[100] Therefore, the G8 +5 Countries must take the lead in transforming energy and transport sectors to low carbon systems that are sustainable in the long term. The G8 +5 Countries must play a leadership role and collaborate effectively if these new industries are to reach their fuel potential while avoiding environmental

[100] Sims, Ralph. Email Communication to Suzanne Hunt. October 5, 2007.

and social pitfalls. R,D&D is an area where coordination among nations is urgently needed, especially for accelerating the commercialization of second generation biofuels for transportation.

Government policies play a determinant role in the financial attractiveness of biofuels, and, in turn, a correct and complete information is essential for the formulation of sound policies.

The information provided in this section, complemented with the information provided for individual countries in Annex I, shows as completely and consistently as possible the status and the trends of bioenergy use in G8 +5 Countries, which is characterized by the following key issues:

- Bioenergy is an important source of energy in all the G8 +5 Countries. However, their contribution at national level varies considerably from country to country.
- Most of the bioenergy consumed in G8 +5 Countries is produced locally.
- Most of the bioenergy (81 percent) have been used in countries such as Brazil, China, India, South Africa and Mexico where the contribution of solid biomass (mainly fuelwood and charcoal) constitute the largest share.
- Most of the bioenergy (more than 70 percent) is used by the residential sector followed by the industrial sector for the production of heat and electricity, for which it represents a cost effective option at current fossil fuel prices.
- The consumption of solid biomass by the industrial sector has considerably increased in the last decade in G8 Countries. Most likely this trend will continue due to several technical, economic and environmental advantages
- The contribution of solid biomass for bioelectricity production (by the industrial sector) is also very important with a great contribution from black liquor of pulp and paper plants especially in G8 Countries
- The use of first generation liquid biofuels as engine fuels is still marginal, but rapidly growing in the last few years of the analysis. However, they have also generated many concerns of experts and civil society. Perhaps, the second-generation technologies will be able to give higher contributions, depending on technological breakthroughs
- Still, solid biomass (woody biomass from forests, farm lands and wood industries, other solid biomass from agro-industries and agricultural by-products) provides the largest share of bioenergy and is likely to remain so for many years to come.
- Bioenergy statistics are essential for, among other things, understanding the dynamics of bioenergy systems; evaluating the role played by different types of biofuels in the energy sector and supply sources; assessing the share of biomass used (directly and indirectly) for energy purposes; assessing the role of biofuel in GHG inventories; and formulating sound bioenergy policies.
- Current statistics are not fully representing the real contribution of bioenergy, especially concerning informal sectors, and are not up-to-date enough to reflect specific biofuels supply/demand dynamics. Thus, they are not fully adequate to the tasks mentioned above

and a stronger coordinated effort to produce reliable and timely information is urgently needed.

2.7.1 International Harmonization

A joint FAO-IEA energy definition task force should be created to propose universal terminology, reporting methodologies, etc. related to bioenergy to facilitate information gathering, sharing, and analysis. UN-Energy should be involved as a forum for launching the results internationally. A database could be developed for bioenergy where all of the various sources can be combined and compared so that user can have access to all of this information. FAO's Interactive-Wood Energy Statistics (i-WESTAT) could be used as a model or could be expanded to include all bioenergy.

2.7.2 Interministerial Mechanisms

The harmonization and the integration of policies across government agencies is necessary. Governments should seek effective mechanisms to integrate the respective priorities in their bioenergy policies. Sector of particular interest are: energy, agriculture, trade and industry.

2.7.3 Sustainable Bioenergy Development

Bioenergy has a key role to play in the future global energy system: however, if not developed sustainably, rapid bioenergy development could exacerbate challenges rather than help solve them. A concerted effort to identify, develop, and disseminate best management practices is needed. In some cases. there is very little effort going on at the federal government level regarding bioenergy best practices in the G8 +5 Countries.

Policies are driving growth but not necessarily sustainable growth. Government policies are causing rapid growth in bioenergy production. However without any sustainability performance requirements attached to these policies, unintended consequences are arising.

Sustainability assurance strategies have a key role to play in promoting good management of natural resources and improvement of rural livelihoods. The private sector has stressed that a harmonization of incentive structures at an international level would improve the business climate in bioenergy markets.[101]

As mentioned previously, the WTO legal context restricts mandatory (legally binding) social sustainability standards, especially for working conditions. Therefore, "other" policies (such as bilateral agreements between exporters and importers) are needed, and "alignment policies" such as best practice, project-finance related standards. The G8 Countries are the key donors in bi- and multilateral, development assistance and play a dominant role in defining project investments in lower income countries. Coordination of standards for such investments

[101] GBEP Dialogue between Private Sector, GBEP and WEC Italy, March 7, 2007

is needed. These sustainability assurances would not be subject to WTO rules that create a barrier to sustainability standards utilization in other contexts.

Labelling and certification of biofuels and related feedstocks may eventually be instrumental to ensure that widespread biofuel production and use will be sustainable. Certification and labelling remain, however, a rather complex issue. Efforts should ensure that the development of sustainability criteria and certification systems contribute to reaching environmental objectives without creating unnecessary barriers to international trade, especially to exports from developing countries. Emphasis could be placed on best practices, guidelines and a better use of existing knowledge related to land and water resources associated by capacity building in countries that could be significant exporters of biofuels. Such an approach could also contribute to poverty alleviation and less carbon intensive production systems.

Some important countries (e.g. Brazil, United States, India, and China) could make important contributions to sustainability standards and certification schemes. A focus on collaboration with these countries would expand the reach and influence of sustainability standards.

2.7.4 Climate Change

Climate change is a key driver behind bioenergy development in almost all G8 +5 Countries. In order to maximize GHG emission reductions and minimize costs, bioenergy support policies are increasingly focusing on biogas and CHP. Bioenergy policies focused on maximizing GHG emissions reductions should focus on emissions impacts rather than bioenergy quantity targets.

2.7.5 Trade

Reducing and eliminating trade barriers and phasing out trade-distorting subsidies would contribute to establishing a level playing field for the bioenergy sector and should be considered a key objective. Investors in prospective biofuels export facilities need to be assured that markets will be open and they will be able to exploit economies of scale.

Support policies that phase out over time have been used successfully in some countries to ensure that government supports do not become an entrenched, inefficient use of government support.

Domestic and regional policies can positively affect bioenergy trade flows. For example, the EU has passed several biofuels support policies over the past few years including a biofuels directive in 2007, building upon former legislation EC 2003/30, which requires a 10% biofuels penetration level for transport fuel in all EU countries by 2020 effectively guaranteeing a market. It is widely acknowledged that most EU countries will have to import some fuel to achieve this target thus the policy is stimulating trade. Already production is ramping up in Asian, African and Eastern European countries to trade to and within the EU.

ANNEX I – Country Profiles

1 Country Profile - BRAZIL

1.1 Overview

The Brazilian energy mix is one of the cleanest in the world and currently more than 45 percent of all energy consumed in Brazil comes from renewable sources, reflecting the combined use of hydroelectricity (14.8 percent), wood and charcoal (12.6 percent), sugarcane products (14.6 percent) and other renewables (3.0 percent). The relative contribution of renewable and non-renewable sources in the Brazilian internal energy supply remained mostly stable between 2005 and 2006. This behavior reflects the growth in sugar cane products and other renewables, and the proportional parallel increase of petroleum and its co-products, uranium and natural gas.

The use of sugar cane in the internal renewable energy supply increased from 31 percent in 2005, to 32.4 percent in 2006, representing 14.6 percent of total internal energy supply. Wood and vegetal coal showed a slight reduction in the internal renewable energy supply, decreasing from 29.2 percent in 2005 to 27.9 percent in 2006.

Power plants with biomass as their energy source represent 3.7 percent of Brazilian annual electricity generation, or about 4 GW. Sugarcane bagasse, lixivia, wood, biogas and rice chaff stand out among the different types of biomass used for this purpose. Sugarcane bagasse alone fed 237 cogeneration thermopower plants, or 74 percent of the total installed capacity of biomass-based power plants, standing for 2.7 percent of electricity generation in Brazil. Of the total amount of energy generated via sugarcane bagasse, 85 percent was consumed by the sugar and ethanol sector itself, while the remainder was traded with local electricity dealers. This mode of generation is expected to triple in 2016, both due to the opening of new units and modernization of the already established power plants.

Compared with 2005 numbers, in 2006 Brazil had:

- An increase of 5.5 percent in the production of oil, 34 percent in its exports, and 2.5 percent of reduction in oil imports;
- Maintenance of natural gas production levels and an increase of 8.8 percent in imports;
- Increase of 4.5 percent in power generation and 4.4 percent in electric energy imports;
- Increase of 12 percent in sugar-cane production, 17.8 percent in sugar production and 10.8 percent in ethanol production, as well as an increase of 50 percent in ethanol exports.

Table 1.1– [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	12%	41%	27%
8 772	1 053	3 606	2 390

Source: IEA, 2005

1.2 Country Objectives and Drivers

The Brazilian biofuels strategy addresses energy security and sustainability concerns, factors that have encouraged various countries to seek alternatives to fossil fuels and adopt measures to reduce GHG emissions. In the case of Brazil, this strategy consists of a variety of actions, organized under three approaches: global, regional and bilateral.

In its global approach, Brazil has advocated the adoption of international standards and technical requirements that would facilitate the establishment of a global market for such products. In order to create a coordinating mechanism among the largest producers and consumers of biofuels, the International Biofuels Forum was created in March 2007, in New York. Additionally, Brazil's goal is to stimulate scientific studies and technological innovations that ensure both the long-term sustainability of biofuels production and ways of preventing the production of biofuels from interfering with food production.

Regionally, Brazil has advocated the energy integration of South America by promoting diversification of the energy mix in the countries of the region and by providing incentives for renewable sources of energy. To this end, the Mercosur Memorandum of Understanding was signed to expand cooperation in this area. By integrating the chains of production, distribution and sale of ethanol and biodiesel in the region and including applicable regulations and inspections, the aim is to promote a more effective use of the South American countries' important competitive advantages in the biofuels field, acknowledging that the region presently has an opportunity to produce wealth and development in a sustainable manner.

The third aspect of Brazil's engagement - working bilaterally - covers technical cooperation initiatives, including research on alternative sources for producing biofuels, as well as promoting scientific and academic exchanges. Making such exchanges operational has been achieved by signing memoranda with India, South Africa (i.e. IBSA), Chile, Denmark, Ecuador, Paraguay, Sweden, Uruguay, and other countries. The recent Memorandum of Understanding signed with the United States also provides for Brazil-U.S. cooperation in third countries to foster the development of biofuels.

The Brazilian Federal Government has issued *Agroenergy Policy Guidelines* prepared by an interministerial team. The document provides for the creation of the Interministerial Management Council to manage the agroenergy policy in accordance with the following general guidelines: Development of Agroenergy; Agroenergy and food production; Technology development; Community energy self-sufficiency; Job and income generation; Optimizing the use of areas affected by anthropic actions; Optimization of regional vocations; Leadership in the international biofuel market; and, Compliance with environmental policy. For the internationalization of the sector, the document highlights four main guidelines: Process based on Government-Government actions; policies to attract investments focused on the production for external market; International promotion; and logistics.

Linked to the overall policy of the federal government as set forth in the mentioned document, the Ministry of Agriculture, Livestock and Food Supply put together a program that meets the bioenergy needs of the country. The goal of the *Brazilian Agroenergy Plan* is to ensure the competitiveness of Brazilian agribusiness and support specific public policies, such as social inclusion, regional development, and environmental sustainability. For the purpose of this plan, agroenergy is made up of four main groups: ethanol, biodiesel from animal and plant sources of fat; planted energetic forests; and agricultural, forest and agroindustrial residues and wastes (including sugar cane bagasse).

The primary objective of the Brazilian Agroenergy Plan is to provide direction for the efforts of Brazilian science, technology and innovation organizations. These objectives comply with the guidelines of the *Research, Development and Innovation Program,* which should focus on raw material technology development and process improvement, and with the creation of *Embrapa Agroenergy.*

1.3 Bioenergy Policy by Subsector

Power Generation

Law 9.991 (2000) - Ministry of Mines and Energy. Establishes a specific percentage from the net operational revenue of generation companies (1 percent), transmission companies (2 percent), and distribution companies (0.75 percent) designated for R&D of the National Electric Sector.

Brazilian Renewable Energy Incentive Program (PROINFA) - Ministry of Mines and Energy. Establishes the inclusion of 3.300 MW of energy into the National Energy Grid supplied in equal amounts by wind sources, biomass and small hydroelectric centrals (PCHs). Created in April 2002 (law 10.438, revised by law 10.762 of November 11 2003), to secure the participation of a greater number of States, incentives to national industries, and the exclusion of low-income consumers from the payment share of this new energy.

National Program for the Universalization of Access and Use of Electric Energy - "Luz para Todos" – Ministry of Mines and Energy and Eletrobras. Launched in 2004, the program’s target is to guarantee the access and use of modern energy in all Brazilian rural areas, resulting in two million additional connections by 2008, including the use of renewable sources to feed stationary generators in remote areas.

Heat Production

No specific policy addressing heat generation from biomass has been recognized.

Transport

Brazil has accumulated important expertise in the biofuels area, particularly regarding the use of ethanol as automotive fuel. The Brazilian experience with the use of ethanol fuel as a gasoline additive dates back to the 1920s. However, it was only in 1931 that fuel produced from sugar cane began to be officially blended with gasoline, which at that time was imported. The National

Petroleum Council (CNP) was created in 1938 and played the role of a regulatory agency for fuels determining the directives for the market and regulating the use of the ethanol as a fuel. Despite these early initiatives, however, it was only in 1975, with the launching of the National Ethanol Program (ProAlcool), that the Brazilian government created the necessary conditions for the sugar and ethanol industry to become, three decades later, one of the most modern in the world, having achieved significant results from both environmental and economic perspectives. Over the last 30 years, the use of ethanol as a substitute for gasoline has contributed to the reduction of domestic oil consumption in nearly one billion barrels of oil equivalent, which represents 8 years of present gasoline consumption in the domestic market or 22 months of Brazil's current oil production. In terms of economics, savings related to avoided oil imports amount to more than $ 60 billion, considering current prices, which is comparable to the current Brazilian external public debt. The main goals of ProAlcool were to introduce into the market a mixture of gasoline and anhydrous ethanol and to provide incentives for the development of vehicles that were fueled exclusively with hydrated ethanol. In chronological terms, one can describe four separate stages in the large-scale production and use of ethanol fuel in Brazil.

In the first, from 1975 to 1979, following the first oil crisis in 1973 and, with the drop in sugar prices in the international market, the Brazilian government decided to offer incentives to increase the production of ethanol for use as a gasoline additive. Thus, in addition to preventing the sugar and ethanol industry from having idle capacity, the aim was to reduce Brazil's dependence on fossil fuels.

The second stage (1979 to 1989) is viewed as the peak of the ProAlcool program. During that period, a series of tax and financial public incentives were created, benefiting everyone from ethanol producers to final consumers. It began with the second oil crisis in 1979 when the price of this international commodity once again rose sharply in the global market. However, due to the drop in oil prices and an increase in the price of sugar in the international market over the next ten years, among other factors, the late 1980s were characterized by episodes of scarcity of hydrated ethanol in Brazilian gas stations, which seriously undermined consumer confidence and had serious repercussions on sales of cars fueled with ethanol in Brazil.

The third stage, from 1989 to 2000, was characterized by the dismantling of the set of government economic incentives for the program as part of a broader deregulation that affected Brazil's entire fuel supply system. The new economic order brought by the Constitution of 1988 explicit limits for State intervention in economic matters. In this context, in 1990, the Sugar and Ethanol Institute (IAA) and the National Petroleum Council (CNP), which had regulated the Brazilian sugar and ethanol industry for over six decades, were extinct. Thus, as a result of lower oil prices in international markets, the government gradually eliminated subsidies and price controls. The first price to be liberated was sugar. Then, in 1996, as oil prices recovered, the anhydrous ethanol price was liberated and finally, in 1999, the prices of sugarcane and hydrated ethanol were free. The planning and implementation of the industry's production, distribution and sales decisions, once Government-oriented, became activities of the private sector. With the growing obsolesence of the ethanol-based vehicles fleet, the use of hydrated ethanol as fuel declined year after year. On the other hand, however, the mixture of anhydrous ethanol with gasoline was again written into law by the government, which, in 1993, established the requirement that 22 percent anhydrous ethanol must be added to all gasoline distributed at retail gas stations in Brazil. In practice, this governmental requirement generated a firm and predictable anhydrous ethanol market that is still in effect today, with the Inter-Ministerial Board for Sugar and Ethanol (CIMA) establishing the required percentage, which can range, after law revisions in 2001 and 2003, from 20 to 25 percent.

The fourth stage began in 2000 with the revitalization of ethanol fuel, and was marked by the liberalization of prices for the products in the whole chain of commercialization in 2002. Ethanol exports increased further due to high oil prices in world markets and the introduction of flex-fuel vehicles in 2003 (powered by any mixture of hydrated ethanol and gasoline). During this stage, the dynamics of the sugar and ethanol industry began to depend much more on market mechanisms, particularly in the international market, than on government incentives. The industry made investments, expanded its production, underwent technological modernizations, and today sugarcane ethanol is efficiently produced in Brazil at prices that are internationally competitive.

There were 320 sugar and ethanol mills in Brazil in 2005, with a total installed processing capacity in excess of 430 million tonnes of sugar cane. Together they could produce up to 30 million tonnes of sugar and 18 billion litres of ethanol[102]. The sugar industry generates around one million direct jobs, and six millions indirect jobs. The use of ethanol fuel during the period from 1970 to 2005 avoided the emission of 644 million metric tonnes of CO_2.

National Program for the Production and Use of Biodiesel – Ministry of Mines and Energy. The *Biodiesel law* (Lei 11.097/05) established minimal percentiles of 2 percent (B2) and 5 percent (B5) of biodiesel to diesel, to be accomplished by 2008 and 2013, respectively. Reflecting social inclusion and regional development concerns, a system of tax incentives and subsidies was established for the production of the raw materials for biodiesel on small family farms in the North and Northeast regions of Brazil, especially in the semi-arid areas.

In order to effectively add 2 percent biodiesel to the diesel produced and sold in Brazil, the annual production will have to reach 820 million litres, beginning in 2008. Based on early results, however, the government is forecasting that it will be possible to achieve that target and possibly even surpass it.

Other policies:

The *"Social Fuel" Label* (Decree 5.297/04 – 5.457/05), established different levels of fiscal incentives, up to complete fiscal exemption. For companies to have access, it is necessary to demonstrate the acquisition of minimal percentiles of raw material from small farmers, involving price rules and technical assistance to these suppliers. In addition, the IPI rate *(Imposto sobre*

[102] Brazil: Total Production of Ethanol 2006-2007 equals 17,763,133 m^3, and Total Production of Sugar 2006-2007 equals 29,681,578 tons. Source: UNICA (Sugar Cane Industry Union) (available at www.unica.com.br)

Produtos Industrializados – Brazil Federal Tax on industrialized goods on the biodiesel production chain (Decree 5.298/04) was adjusted to zero. In September 2005, the National Council for Energy Policy anticipated for January 2006 the blend of 2 percent (B2) of biodiesel into diesel. The new date was restricted to biodiesel with the "Social Fuel" label.

Mandatory Fuel Blend – the mandatory blend of anhydrous ethanol to gasoline is regulated by Law 8.723/1993, which establishes additional mandatory actions for automobile and fuel producers to reduce emission levels of CO, NO and other contaminant elements, according to Brazilian environmental policy, managed by the National Council for the Environment (CONAMA). This Law was modified by Law 10.203/2001, and Law 10.696/2003, in order to create a range between 20 and 25 percent, within which the Government will mandate the effective blend.

In 2001, Decree 3.966 assigned to the Ministry of Agriculture, Livestock and Supply (MAPA), the competence to determine blend rates, after consulting the Inter-Ministerial Board for Sugar and Ethanol (CIMA). The current blend, 25 percent, was established by "Portaria" 143, released on June 27th, 2007.

Differentiated IPI (Brazilian Federal Tax on Industrialized Goods) rates for vehicles – Decree 4.317/2002 establishes differentiated IPI rates for flex-fuel vehicles, which can be powered by either hydrous ethanol or gasoline, or any mixture of the two. Flex-fuel vehicles receive incentives that are analogous to those granted to ethanol vehicles in the past, with lower Federal taxation than their counterparts running on gasoline.

1.4 Results and Challenges

The sugar and ethanol industry is among the productive sectors that employs a substantive number of workers in Brazil. It creates about one million direct jobs (including in family companies and cooperatives) and six million indirect jobs. Working conditions on sugar cane farms are, generally speaking, better than in other industrial sectors of the Brazilian economy. The average family income of these employees ranks in the upper 50 percentile. The Brazilian government monitors the industry to ensure that labor laws and regulations respected. The occurrence of forced labor in sugar plantations is residual and the government has intensified its inspections, thereby curbing abuses.

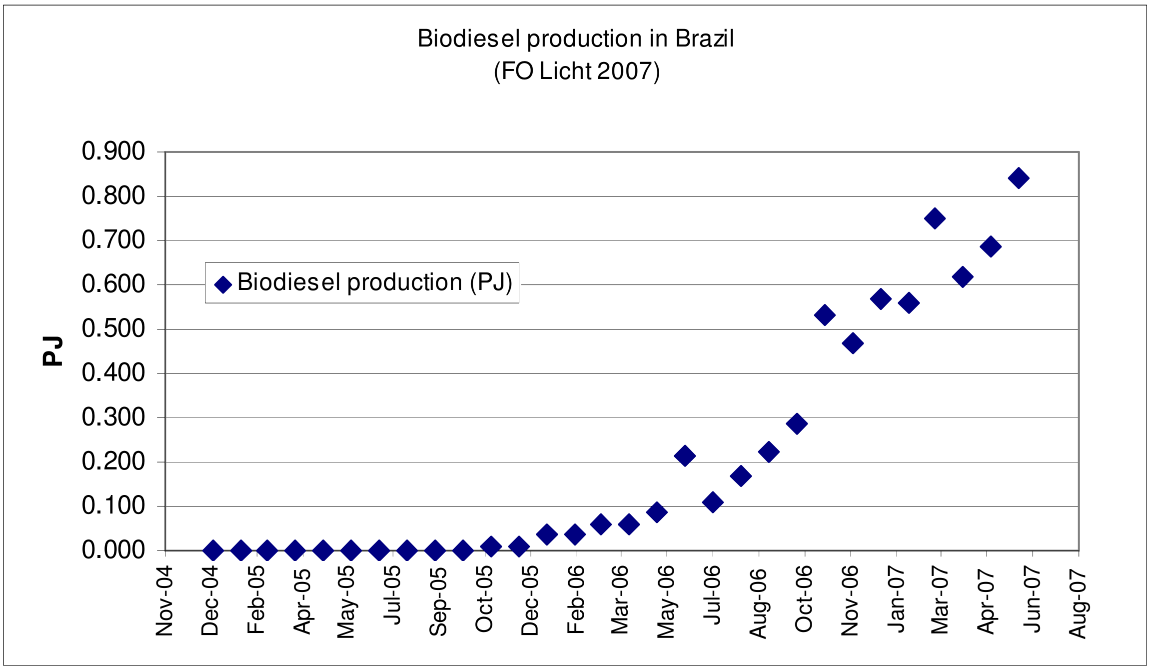
An analysis of the growth sustained by the industry provides evidence to challenge the argument that growing sugar cane for the purpose of producing ethanol is harmful to the environment. On the contrary, biofuels have had positive social and environmental impacts, by recovering previously deforested areas, providing crop rotation and aeration of farmlands used for food production, in addition to employing almost one million workers, including through a system of family cooperatives. The production of sugar cane uses low levels of pesticides, has the largest program of biological pest control in Brazil, has the lowest level of soil erosion, recycles all its wastes, does not undermine the quality of water resources, and accounts for the largest area of organic production in the country.

Moreover, the significant increase seen in sugar-cane agriculture in Brazil, which is concentrated mainly in the state of São Paulo, (distant from the Amazon region, and occupying only 0.8 percent of Brazil's land area) is primarily the result of productivity gains and research efforts. Over the last few decades, productivity gains have surpassed 30 percent, reducing the need to expand the cultivated farmland.

Brazil faces internal and external challenges that involve government policies and the large public and private investments required to meet the growing domestic and foreign demand. Such challenges require coordinated planning and action by both government and private sector. It is important to seek partnerships and collaborate activity, particularly with other sugar-cane producing countries and those that have a large demand, particularly the United States, and to work together to define international technical specifications for fuel alcohol. Another consideration on the Brazilian external agenda is to work diligently to increase business liquidity and fluidity in the biofuel market, which would require some adaptation of the legislation and much networking with and among the private production sector and the trade sector in Brazil and abroad. Internally, an important challenge to be tackled is the expansion of the sugar and ethanol industry, including considerations on spatial concentration of production and a renewed focus on greater energy efficiency on the part of producing units. The alternative to concentration is directly linked to another challenge: the need for investments in transportation infrastructure in the country's hinterlands.

Concerning the biodiesel program, the greatest challenge at the moment is to meet the goals established in the National Program for Biodiesel Production and Use. Another challenge is to take advantage of the potential of different regions of the country and derive the greatest social benefits from biodiesel production by applying advanced technology not only to traditional crops, but also new cultures. Large investments in RD&I would be necessary over a long period of time in order to produce the most adequate raw material for each region and a sufficient amount of each raw material to supply the biodiesel industry in an economically viable manner. Lastly, the expansion of biofuels in the country will also depend on technological innovations, improvement of industrial processes and increasing the efficiency of the energy sources.

Figure 1.1


Biodiesel production in Brazil
(FO Licht 2007)
PJ
0.900
0.800
0.700
0.600
0.500
0.400
0.300
0.200
0.100
0.000
Biodiesel production (PJ)
Nov-04
Dec-04
Feb-05
Apr-05
May-05
Jul-05
Sep-05
Oct-05
Dec-05
Feb-06
Mar-06
May-06
Jul-06
Aug-06
Oct-06
Nov-06
Jan-07
Mar-07
Apr-07
Jun-07
Aug-07

1.5 Country Policy Table - Brazil

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry of Agriculture, Livestock and Food Supply (MAPA)	Mandatory Fuel Blend	Policy - Target	Yes	Transport Fuels (Producers and Suppliers)	Established mandatory blend of 25% of anhydrous ethanol to gasoline. Beginning on July 1st, 2007. (MAPA - Portaria 143 - June 27,2007)	
Ministry of Finance	Differentiated IPI (Brazilian Federal Tax on Industrialized Goods) rates for vehicles	Policy - Incentive	Yes	Transport		Establishes differentiated IPI rates for vehicles running on hydrous ethanol and gasoline. For IPI purposes, Flex-fuel vehicle matches those that run exclusively on hydrous ethanol.
Ministry of Environment	Law 8723 (October 28, 1993) - Reduction on the emissions of hazardous gases from vehicles	Policy - Target	Yes	Transport - Automobile producers and fuel producers		Establishes mandatory actions from automobile and fuels producers to reduce emissions levels of CO, NOx and other contaminant elements according to Brazilian environmental policy.
Ministry of Mines and Energy; National Oil Agency (ANP)	National Program for the Production and Use of Biodiesel	Policy - Target/Incentive program	Yes	Bioenergy producers, including small farmers	The Biodiesel law (Lei 11.097/05) established minimal percentiles of 2%(B2) and 5%(B5) of biodiesel to diesel, to be accomplished from January 2008 and 2013 respectively. The "Social Fuel" Label (Decree 5.297/04 – 5.457/05), which established different levels of fiscal incentives-to the complete fiscal exemption. For companies to have access, it is necessary to demonstrate the acquisition of minimal percentiles of raw material from small farmers, involving price rules and technical assistance to these suppliers. In addition, it was established zero aliquot for IPI (Imposto sobre Produtos Industrializados – Brazil Federal Tax on industrialized goods) on the biodiesel production chain (Decree 5.298/04)	
Ministry of Agriculture, Livestock and Food Supply (MAPA)	National Agroenergy Plan	Activity - Incentives/R&D	No	Bioenergy producers, bioenergy suppliers, farmers, agro-industry.	The Plan directs the course of the strategic actions of the federal government as regard its overall policy. Its primary purpose is to provide the bearings for the efforts of the Brazilian science, technology, and innovations organizations ensuring the competitiveness of the Brazilian agribusiness.	
Ministry of Agriculture, Livestock and Food Supply (MAPA)	Research, Development and Innovation Program (RD&I)	Activity - Research and Development	No	Bioenergy producers, bioenergy suppliers, farmers, agro-industry.	As a program of the National Agroenergy Plan, it includes RD&I on ethanol and the cogeneration of energy from sugar cane; biodiesel from animal and plant source; forest biomass; and residues and waste from agriculture; and agro-industry.	
Ministry of Agriculture, Livestock and Food Supply (MAPA)	Embrapa Agroenergy Unit (Embrapa-Brazilian Agricultural Research Corporation)	Activity - Research and Development	No	Bioenergy producers, bioenergy suppliers, farmers, agro-industry.	Embrapa Agroenergy Unit will create a decentralized research unit focusing on agroenergy topics and issues to act as the central link of the country's Agroenergy Research System and the core component of the Brazilian Agroenergy Plan.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Sets blending mandates on the end-use product, promoting the use of cleaner fuels.		
		Promotes the use of bioethanol and stimulates market growth.		
		Promotes the use of cleaner fuels		
A set of normative instruments aiming to promote the basis for the production and commercialization of biodiesel in the country, including special incentives for the inclusion of small farmers into the biodiesel production chain, and the development of regional potential for the production of biodiesel.			Small farmers have access to Pronaf's credit line, as well as technical assistance from the Ministry of Agro Development. For the biodiesel industrial sector, the Brazilian Development Bank (BNDES) makes available special financing plans for fixed investments (equipments, installations, etc).	In September 2005, the National Council for Energy Policy anticipated for January 2006 the blend of 2%(B2) of biodiesel into diesel. The new date refers to biodiesel with "Social Fuel" label.
For the purpose of this plan, agroenergy is composed of four main groups: ethanol and energy cogeneration from sugar cane; biodiesel from animal and plant sources of fat; forest biomass and residues; and agricultural and agroindustrial residues and wastes.				
RD&I should focus on raw material technology development and process improvement on the agroenergy field.			MAPA intends to gather and articulate companies and institutions as a consortium for either operational or sponsorship purposes. The central objective will be to design and execute the National RD&I program taking into account regional specificities.	The guidelines of RD&I agenda are to ensure the sustainability of the energy matrix; job and income generation; rational use of areas affected by anthropic actions; Brazilian leadership in biomarkets; energy autonomy at the community level; support to public policies; energy savings along agribusiness chains; and elimination of health risks.
Organize and develop a technology research, development and innovation, and transfer programmes that guarantees the sustainability and competitiveness of the agroenergy chain.				

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry of Mines and Energy	Brazilian Renewable Energy Incentive Program (PROINFA)	Activity - Incentive Program	Yes	Bioenergy Suppliers	Establishes the inclusion of 3.300MW of energy into the National Energy Grid supplied in equal amounts by wind energy sources, biomass and small hydroelectric centrals (PCHs).	
Ministry of Mines and Energy	Law 9.991 (2000)	Policy - Research & Development	Yes	Academic/Research Institutions		Establishes a specific percentage from the net operational revenue of generation companies (1%), transmission companies (2%), and distribution companies (0,75%) to be designated for R&D of the National Electric Sector.
Ministry of Mines and Energy and Eletrobras	National Program for the Universalization of Access and Use of Electric Energy - "Luz para Todos"	Activity - Target Program	Yes	Energy Suppliers	The program's target is to guarantee the access and use of modern energy in the entire Brazilian rural areas, resulting in additional 2 million connections by 2008, including the use of renewable sources to feed stationary generators in remote areas.	

For the purposes of this table:
"Policy" is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). "Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Increased use of renewables from wind source, biomass and small hydroelectric centrals in the generation of electricity.	The Brazilian Development Bank (BNDES) established a credit line that finances up to 70% of the project, excluding imported goods and services, as well as the acquisition of land.The energy produced by selected units will be acquired by Centrais Eletricas Brasileiras S.A (Eletrobras), which will secure a 20 years contract starting at the beginning of operations.	
		Provides incentives for the development of new technologies and processes in the energy sector. This policy could impact production, conversion and/or use if applied for the agroenergy development.		
		Increase use of renewable energy, especially biomass, for the generation of electricity in rural and remote areas.		

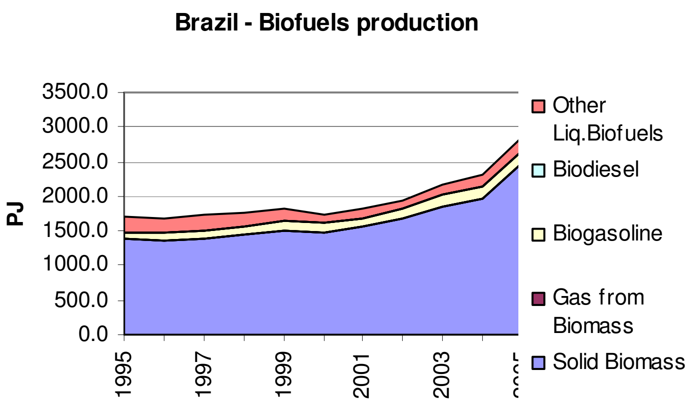
1.6 Brazil Bioenergy Outlook

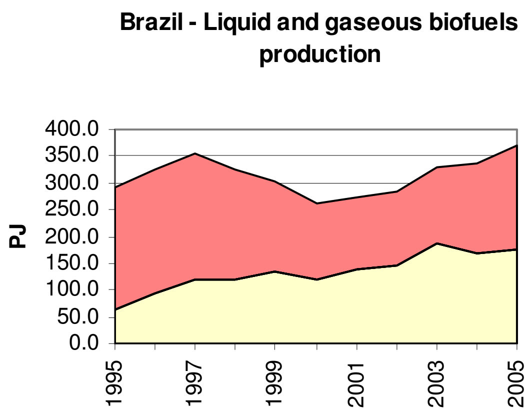
Table 1.2 - Brazil – Biofuel production

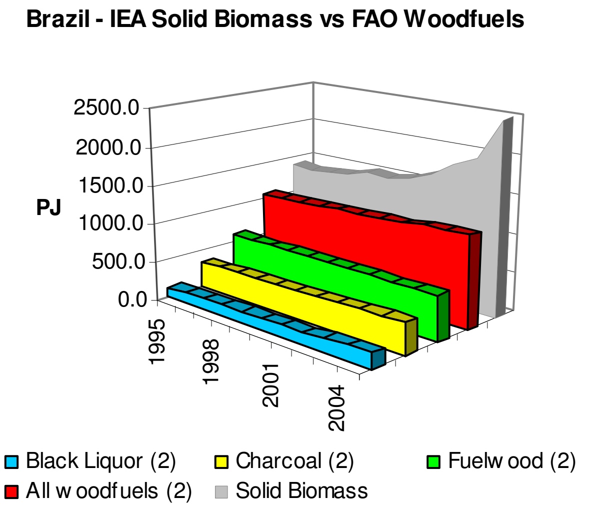
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Biofuels	1694.0	1691.6	1749.4	1757.3	1816.9	1746.2	1824.7	1951.2	2170.4	2313.1	2862.7
Solid Biomass	1400.6	1368.0	1394.7	1432.5	1514.6	1486.1	1551.9	1667.0	1842.6	1977.2	2493.6
Gas from Biomass											
Biogasoline	63.0	93.5	121.0	120.8	132.7	121.5	136.7	147.6	188.6	167.0	175.7
Biodiesel											
Other Liq.Biofuels	230.4	230.1	233.8	204.0	169.6	138.6	136.1	136.6	139.2	168.9	193.3
All woodfuels (2)	1062.2	1073.4	1081.6	1094.7	1109.3	1118.8	1125.3	1129.5	1173.0	1186.8	1191.4
Fuelwood (2)	602.3	600.2	598.0	596.5	595.4	594.0	591.7	589.5	587.3	585.1	582.9
Charcoal (2)	337.5	344.1	350.8	357.3	364.2	371.2	377.5	384.0	390.5	397.2	404.0
Black Liquor (2)	122.5	129.1	132.8	140.9	149.8	153.6	156.1	156.1	195.2	204.5	204.5

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	-2.3	2.0	2.7	5.7	-1.9	4.4	7.4	10.5	7.3	26.1
Gas from Biomass										
Biogasoline	48.4	29.4	-0.2	9.9	-8.5	12.5	8.0	27.7	-11.4	5.2
Biodiesel										
Other Liquid Biofuels	-0.1	1.6	-12.7	-16.9	-18.3	-1.8	0.3	2.0	21.3	14

(2) = Based on FAO data







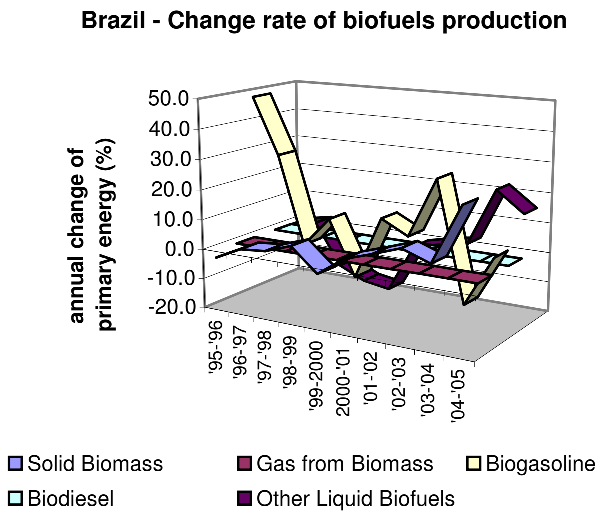


Table 1.3 - Brazil – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	52.5	28.8	19.2	3.5	8.3	0.2	2.6	0.1	0.1	0.1		
Solid Biomass	0.0	0.1	0.0	0.2	0.2	0.2						
Gas from Biomass												
Biogasoline	10.3		7.5	3.1				0.1	0.1	0.1		
Biodiesel												
Other Liquid Biofuels	42.1	28.8	11.6	0.3	8.2		2.6					
All woodfuels (2)	0.2	0.2	0.2	0.5	0.3	0.6	0.6	0.6	0.6	0.2	0.2	
Fuelwood (2)	0.0			0.2	0.0	0.0		0.0	0.0	0.0	0.0	
Charcoal (2)	0.2	0.2	0.2	0.3	0.3	0.6	0.6	0.6	0.6	0.2	0.2	

(2) = Based on FAO data

Table 1.4 - Brazil – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	8.7	4.7	3.8	3.1	8.9	5.0	7.0	16.9	16.8	51.5	66.9	
Solid Biomass												
Gas from Biomass												
Biogasoline								0.3	1.3	1.8	12.3	
Biodiesel												
Other Liquid Biofuels	8.7	4.7	3.8	3.1	8.9	5.0	7.0	16.6	15.5	49.7	54.6	
All woodfuels (2)	0.4	0.3	0.3	0.3	0.3	0.2	0.3	0.8	0.8	1.2	1.1	
Fuelwood (2)	0.1	0.0	0.0					0.5	0.5	0.6	0.7	
Charcoal (2)	0.3	0.3	0.3	0.3	0.3	0.2	0.3	0.3	0.3	0.6	0.5	

(2) = Based on FAO data

Table 1.5 - Brazil – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
All biofuels	Dom. Supply	1,733.0	1,709.6	1,720.6	1,757.7	1,838.3	1,794.6	1,823.6	1,950.8	2,110.3	2,277.1	2,801.4
	Transform.	225.4	205.9	205.2	193.4	207.3	215.7	219.9	235.4	274.6	307.8	468.4
	Industry	827.7	821.4	845.0	893.7	954.7	920.5	970.2	1.020.8	1.130.8	1.223.7	1.459.3
	Transport	291.5	302.7	290.8	284.8	284.4	256.7	223.0	251.7	239.0	266.9	288.9
	Residential	276.5	269.6	272.7	278.4	287.0	294.7	307.0	342.1	356.8	361.9	451.6
Solid Biomass	Dom. Supply	1,391.6	1,360.7	1,387.7	1,426.2	1,507.7	1,478.5	1,545.5	1,660.5	1,835.0	1,969.1	2,484.9
	Transform.	225.4	205.9	205.2	193.4	207.3	215.7	219.9	235.4	274.6	307.8	468.4
	Industry	804.0	799.9	825.4	872.9	934.5	893.2	944.1	1.002.4	1.114.1	1.204.7	1.447.0
	Transport											
	Residential	276.5	269.6	272.7	278.4	287.0	294.7	307.0	342.1	356.8	361.9	451.6
Gas from Biomass	Dom. Supply											
	Transform.											
	Industry											
	Transport											
	Residential											
Biogasoline	Dom. Supply	75.1	90.5	110.8	120.0	135.0	127.7	132.2	157.9	159.1	163.4	167.4
	Transform.											
	Industry											
	Transport	72.6	87.3	107.9	114.9	129.2	122.8	129.3	156.1	156.2	160.4	164.4
	Residential											
Biodiesels	Dom. Supply											
	Transform.											
	Industry											
	Transport											
	Residential											
Other Liquid Biofuels	Dom. Supply	266.3	258.4	222.1	211.5	195.6	188.4	146.0	132.4	116.2	144.6	149.1
	Transform.											
	Industry	23.7	21.5	19.6	20.8	20.2	27.2	26.1	18.4	16.7	19.0	12.3
	Transport	219.0	215.4	182.9	169.9	155.2	133.9	93.7	95.6	82.8	106.5	124.5
	Residential											

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

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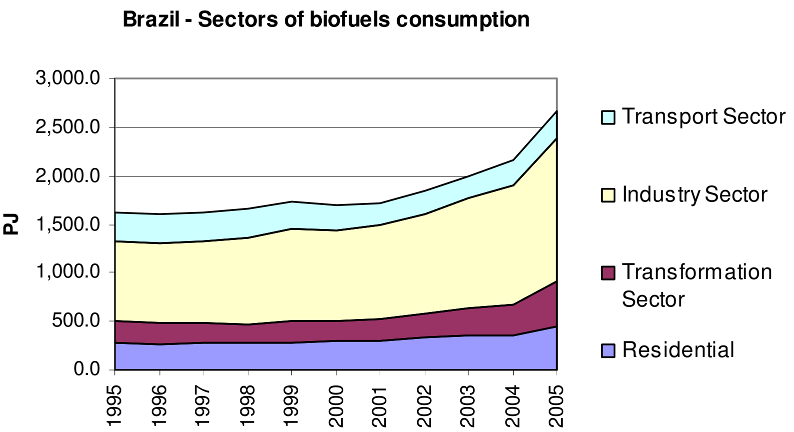


Country Profile - CANADA

2.1 Overview

In Canada, fossil fuels, such as petroleum and coal, have traditionally served as the main source of energy. Between 1984 and 2004, the share of oil in total energy consumption has remained mostly constant, while natural gas has increased from 21 percent to 25 percent of the energy supply. The increase in use of natural gas promoted a decrease in the use of coal, whose share of total energy consumption fell from 12 percent to 9 percent over the same time period.[103]

In an effort to reduce the adverse environmental effects of traditional energy sources, alternative sources - such as wind, solar, hydro, and bioenergy - have been integrated into the country's overall strategy. In 2004, total energy consumption in Canada amounted to the oil equivalent of 8,445 PJ[104]. Renewable energy sources (hydro and combined renewables and waste) generated 15.3 percent of total energy consumed.[105]

Canada is a net exporter of oil, natural gas, coal, and electricity serving as the most important sources for U.S. energy imports. In 2004, total energy supply was 20,070 PJ (indigenous production of 16,642 PJ + energy imports of 3,428 PJ) of which 9,038 PJ were exported.[106]

Table 2.1 – [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	49%	16%	5%
11 386	5 609	1 842	528

Source: IEA, 2005

2.2 Country Objectives and Drivers

Bioenergy expansion in Canada is driven by the country's desire to promote environmental responsibility and limit GHG emissions while promoting economic and industrial development and strengthening Canada's science and technology base. The main objectives of the current federal energy policy are to ensure that:

1. Canada has secure, reliable access to competitively-priced, environmentally-friendly energy supplies;

2. The development of Canada's energy resources and associated technology provides economic benefit to Canadians; and

[103] EIA (2006) International Energy Annual 2004. Energy Information Administration (EIA), U.S. Department of Energy, Washington, DC. Updated May-July 2006. (available at http://www.eia.doe.gov/iea/carbon.html)
[104] APEC, Energy Handbook 2004, Section 3. Asian-Pacific Economic Cooperation (APEC), Japan. (available at www.ieej.or.jp/egeda/general/info/pdf/2004section3.pdf)
[105] IEA, Share of Total Primary Energy Supply 2004: Canada. International Energy Agency (IEA), Paris, France (available at http://www.iea.org/textbase/stats/pdf_graphs/CATPESPI.pdf)
[106] IEA, 2004 Energy Balances for Canada. International Energy Agency (IEA), Paris, France (available at http://www.iea.org/Textbase/stats/balancetable.asp?COUNTRY_CODE=CA)

3. Canada obtains a reasonable level of energy security where energy needs are met and energy production and consumption are environmentally responsible.

2.3 Bioenergy Policy by Subsector

In Canada, jurisdiction over energy policy is divided between the federal and provincial governments. The provinces own their energy resources and orchestrate the development of energy policies, regulations, and implementation strategies associated with the management of these resources. Federal energy policies primarily focus on inter-provincial and international movement of energy, energy technology development, and on projects extending beyond a province's boundaries. Because of this distribution of control, energy programmes in Canada are a shared responsibility between the federal and provincial governments and have created a dynamic where federal bioenergy activities primarily focus on the development of incentive and R&D mechanisms to promote the use of renewable energy sources in the energy supply.

In effect since 1995, the Energy Efficiency Act gives the Government of Canada the authority to make and enforce regulations, primarily for the purpose of establishing performance and labeling requirements for energy-using products, doors and windows that are imported or shipped across provincial borders. The Act requires the manufacturers and importers of certain types of energy-using products to meet standards for the energy efficiency of these products. The companies are required to register their products with Natural Resources Canada (NRCan) with information which includes the energy efficiency of the product. In conjunction with Revenue Canada, NRCan then tracks the import of products and ensures that standards are met. The programmes most visible component is the “EnerGuide” label which denotes products that have met the energy efficiency guidelines.

Ottawa has recently poured half a billion Canadian dollars into the largest biofuel fund in the world, open to companies ready for large, demonstration-scale projects of next generation biofuels. This fund, as announced in September 2007, will be managed by Sustainable Development Technology Canada, a not-for-profit, arm’s length foundation started in 2001.

In early 2007 the government set aside C$345 million ($299 million) to fund two programmes: the Agricultural Bioproducts Innovation Program (to receive C$145 million) and the ecoAgriculture Biofuels Capital Initiative (ecoABC) (to receive C$200 million). These programmes provide assistance to farmers and rural communities to promote the development of biofuels and other bio-products.

Managed by Agriculture and Agri-Food Canada, the Agricultural Bioproducts Innovation Program (ABIP) provides support for cross-sector research networks conducting scientific R&D on modeling and impact scenarios for a bio-based economy in Canada. For the purposes of this programme “bioproducts” are defined as “a commercial or industrial product that is composed in whole, or in significant part, of renewable domestic agricultural materials (including plants, animals, and microorganisms)”. The ABIP is focused on the production and development of feedstocks and systems suitable for conversion to bio-products; development of efficient biomass conversion technologies; and agro-commodity diversification through technologies relevant to production of bio-products (e.g. industrial chemicals, biomaterials and health products). It is anticipated that the ABIP will fund between 10 and 25 networks. The maximum amount a network may receive over the duration of the programme is $25 million. An individual recipient within a network(s) may receive no more than $15 million over the duration of the programme.

An additional programme in the agriculture sector, the Co-operative Development Initiative (Ag-CDI) ($3.25 M over 2 years) provides support to individuals, groups and communities wishing to develop co-operatives as a way to take advantage of opportunities associated with biofuels and other value-added activities.

Power Generation

An international commitment aims to reduce Canada's GHG emissions to 6 percent below 1990 levels (596 Mtoe)[107] by 2008-2012.

Despite its best efforts, by 2004 GHG output had risen 27 percent above 1990 levels. Generation of thermal electricity contributed 18 percent of Canada's 2003 GHG emissions and 27 percent of total emissions growth between 1990 and 2003.[108] To provide some leadership in the reduction of GHG, the federal government has instituted the "Purchases of Electricity from Renewable Resources Program." The objective of this program, managed by NRCan, is to purchase 20 percent of the Government of Canada's electricity from emerging renewable energy sources with low environmental impact, replacing use of electricity generated using high-carbon sources.

Additionally, NRCan has increased its R&D in clean coal technology to further reduce GHG emissions in electricity production. Emerging CO_2 capture and sequestration is tied to work in this area. Although sequestration research has been ongoing for several years, the cost of capturing CO_2 is a significant barrier. A number of companies are discussing ways to develop a CO_2 pipeline for enhanced oil recovery in the Western Canada Sedimentary Basin. Similar opportunities also exist in Alberta, Saskatchewan and within the "industry for future" partnerships.

Several Canadian provinces have initiated measures to promote use of energy from renewable sources - such as mandatory and voluntary renewable electricity targets, request-for-proposals, government procurement, and standard-offer contracts for renewable electricity. The Standard Offer Program helps Ontario meet its renewable energy supply targets by offering a standard pricing regime and access to the energy market for small electricity generators. Since its launch in November 2006, the Ontario Power Authority's (OPA) Renewable Energy Standard

[107] EC (2005). Canada's Greenhouse Gas Inventory: Overview 1990-2003. Environment Canada (EC), Ottawa Canada. (available at: http://www.ec.gc.ca/pdb/ghg/inventory_report/2003_factsheet/2003ghgfac_e.pdf)
[108] EC (2003). Canada's Greenhouse Gas Inventory 1990-2003. Environment Canada (EC), Ottawa, Canada. (available at http://www.ec.gc.ca/pdb/ghg/inventory_report/2003_report/toc_e.cfm)

Offer Program has signed 104 contracts with small renewable generators.[109] Through activities such as these, the estimated amount of renewables expected from provincial and territorial RPS programmes and target is 9,140 MW by 2017[110].

Heat Production

Activities for domestic heat and building construction are primarily focused on increasing the energy efficiency. Canada gives incentives for increased energy efficiency in newly constructed homes and buildings to reduce energy consumption and decrease CO_2 emissions.

Through the EnerGuide for Houses Retrofit Incentive Program, the government targeted homeowners and homebuilders to promote construction and retrofit of housing to increase energy efficiency. The programme promoted the use of energy efficient technologies and practices in housing, an increase in the percentage of new housing built to higher standards such as R-2000, and attaining an EnerGuide for New Houses rating of 80 points or higher. Under this programme, managed by Natural Resources Canada, a homeowner could receive a maximum grant of $5,000 per property (and a total of $500,000 per individual or entity for multiple eligible properties over the life of the programme).[111] The programme was discontinued in 2006 but will continue to pay out grants until March 31, 2007.

NRCan also targets Canadian builders, designers and organizations with the aim of accelerating change in building design and construction practices, and to encourage individual organizations to increase the energy efficiency of their operations. One such programme, to promote energy efficiency in the building sector, is the Commercial Building Incentive Program. This program provides fiscal incentives to owners of newly constructed commercial, institutional and multi-unit residential buildings where the project has implemented energy efficient technologies and systems that exceed the efficiency levels prescribed by the Model National Energy Code for Building by at least 25 percent. Industrial facilities (new and retrofitted) receive incentives under a similar program called the "Industrial Building Incentive Program." To take advantage of the industrial program, proposed new building designs must incorporate technologies and systems that consume at least 15 percent less energy than a standard (or reference building) based on the Model National Energy Code for Buildings; retrofitted buildings must consume at least 10 percent less energy through specific process improvements.[112]

Transport

Canada aims as national targets:

- 5 percent renewable content in gasoline by 2010 and 2 percent renewable content in diesel fuel by 2012

[109] OPA. Renewable Energy Standard Offer Program. Ontario Power Authority (OPA). Ontario, Canada (available at http://www.powerauthority.on.ca/sop/)
[110] available at http://www.cec.org/files/pdf/ECONOMY/FREM_en.pdf
[111] OEE, Grants and Incentives. (available at http://oee.nrcan.gc.ca/corporate/incentives.cfm?attr=4#retrofit)
[112] OEE (2006). The State of Energy Efficiency in Canada. Natural Resources Canada, Office of Energy Efficiency (OEE). (available at http://oee.nrcan.gc.ca/Publications/statistics/see06/pdf/see06.pdf)

- 25 percent improvement in the fuel efficiency of new light-duty vehicles sold in Canada by 2010

The above-mentioned national blending targets of 5 percent of gasoline and 2 percent of diesel will amount to a need for about 2.1 billion litres (555 million gallons US) of renewable fuel per year in 2010 and almost another 600 million litres (159 million gallons US) by 2012.[113]

To attain these targets, the ecoAgriculture Biofuels Capital Initiative (ecoABC) provides producers with incentives for participation in new renewable fuels production capacity. The individual funding arrangements are based on the producer's contributions to the biofuels facilities and their contribution to eligible project costs (capped at the lesser 25 percent of total project costs or a maximum of $25 million per project).[114] The programme builds on the existing Biofuels Opportunities for Producers Initiative by providing an opportunity for agricultural producers to participate in the increase of new renewable fuels production capacity.

The Biodiesel Initiative was announced August 2003 under the Climate Change Plan for Canada and builds on the federal government's announcement to exempt biodiesel from the fuel excise tax for diesel ($0.04/L). The initiative allocates C$11.9 million over four years (2003 – 2007) to address technical and market barriers to the development of a biodiesel industry based on low-cost feedstocks.[115] As of 1 April 2008, excise tax exemptions for renewable fuels will be eliminated. Incentive will continue to be provided through the ecoENERGY for biofuel programme (incentive rates will be up to 0.10 $/litre for renewable alternatives to gasoline and up to 0.20 $/litre for renewable alternatives to diesel for the first 3 years, then decline thereafter. The ecoENERGY for Biofuels Initiative ($1.5 B over 9 years) aims to boost Canada's production of renewable fuels such as ethanol and biodiesel by providing operating incentives to producers of renewable alternatives to gasoline and diesel based on production levels and other factors.

To complement the Biodiesel Initiative and reach the national targets, the government enacted the ecoABC Initiative. EcoABC is a federal C$200 million program that provides repayable contributions for the construction or expansion of transportation biofuel production facilities. Managed by Agriculture and Agri-Food Canada, the ecoABC Inititiave is designed to provide an opportunity for agricultural producers to diversify their economic base and participate in the biofuels industry through equity investment/ownership in biofuels production facilities.

Exploring the possibility of hydrogen fuels, the Canadian Transportation Fuel Cell Alliance (CTFCA), managed by Natural Resources Canada (NRCan), is an important element of the federal government's climate change strategy. The C$33 million initiative was established in 2001 and has received funding through to March 2008 and focuses its efforts on showcasing hydrogen fuelled vehicles and hydrogen fuelling station demonstration projects. It also evaluates options for the production and delivery of hydrogen to light-, medium- and heavy-duty

[113] Green Car Congress. "Canada Sets Biofuels Targets". December 22, 2006 (available at http://www.greencarcongress.com/2006/12/canada_sets_bio.html)

[114] AAC (2007). "Capitol Formation Assistance Program". Agriculture and Agri-Food Canada (AAC) Ottawa, Canada (available at http://www.agr.gc.ca/index_e.php?s1=prog&s2=cfap-pafc)

[115] NRCan et al. (2003). "Biodiesel", Natural Resources Canada (NRCan). Ottawa, Canada (available at http://www.biofuels.arc.ab.ca/BTSC/NRCan/default.ksi)

vehicles, monitors the resulting GHG emission reductions and develops training, certification and safety standards in support of hydrogen and fuel cell technologies.

To expand motor vehicle efficiency, the Motor Vehicle Fuel Efficiency Initiative is to bring about a 25 percent improvement in the fuel efficiency of new light-duty vehicles sold in Canada by 2010. NRCan reached agreement with the automotive industry to reduce GHG emissions from this sector. Through this voluntary initiative, the automotive industry will seek reduction in GHG emissions of 5.3 megatonnes (Mt) annually from light-duty vehicle use by 2010. This 5.3 Mt target goes beyond fuel consumption reductions by incorporating reductions in all GHG emissions associated with vehicle use[116].

2.4 Results and Future Challenges

Natural Resources Canada (NRCan) is the primary federal government department responsible for energy. NRCan has the lead in general energy policy. It works with other government departments to promote energy efficiency, sustainable environmental practices around renewables, issues related to energy in transportation, research and development and the general balance between energy policy goals and other objectives relating to Canada's economic development. These are the source of the federal policies that are current enacted in Canada to promote the use of alternative sustainable energy.

Canada's financial incentive policies encourage final users of energy to employ energy efficiency and renewable energy technologies and practices. Currently, the federal government offers financial incentives for wind energy, ethanol plants, natural gas vehicles and refueling infrastructure.

Companies and institutions work with NRCan on a voluntary basis to establish and achieve energy efficiency objectives. NRCan's voluntary initiatives target large consumers of energy in the commercial/institutional and industrial sectors and organizations whose products are important determinants of energy use. The initiatives involve industry-government agreements and, for groups of large industrial energy users, energy efficiency target setting. The Federal Government provides a variety of support services to assist and stimulate action by companies and institutions on energy efficiency, including developing standards and training.

Other activities undertaken in Canada promote and support the development and dissemination of more energy-efficient equipment, processes and technologies, and alternative energy technologies. Research and development activities provide the scientific knowledge needed to develop the technologies, codes, standards and regulations required for the sustainable use of energy.

The federal government provides national leadership in energy science and technology by undertaking in-house research in its laboratories, contracting out research activities to other organizations and carrying out the federal funding initiatives, which are the only federal

[116] NRCan (2006). Improving Energy Performance in Canada – Report to Parliament Under the Energy Efficiency Act For the Fiscal Year 2005-2006. Natural Resources Canada (NRCan), Ottawa, Canada (available at http://oee.nrcan.gc.ca/Publications/statistics/parliament05-06/pdf/parliament05-06.pdf)

interdepartmental investment funds with a focus on the energy sector and its economic and environmental effects.

Canada is aligning its environmental policymaking with economic and market realities to protect its environment and promote the development of green technologies by Canadian firms. By partnering with industry, creating financial incentives, undertaking research and development, and innovative project the government hopes to create a healthy environment and vibrant economy.

2.5 Country Policy Table - Canada

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Agriculture and Agri-Food Canada (AAFC)	Agri-Opportunities Program (February 2007 - March 31, 2011)	Activity - Incentive	Yes	Agriculture		(Agriculture) Aims to accelerate the commercialization of new agricultural products, processes or services that are currently not produced or commercially available in Canada, and are ready to be introduced to the marketplace by providing a maximum repayable contribution of $10 M per project and per recipient regardless of the number of projects over the life of the program (target contribution per project is 33% of total project costs).
Agriculture and Agri-Food Canada (AAFC)	Agricultural Bioproducts Innovation Program (ABIP) (Announced December 20, 2006)	Activity - R&D / Education		Government / Industry / University	Supports new and existing research networks and encourages the development of clusters to build greater research capacity in agricultural bioproducts and bioprocesses. A network may receive, in support of a number of inter-related projects, funding up to a maximum of $25 M and an individual project may receive no more than $15 M over the duration of the program.	
Agriculture and Agri-Food Canada (AAFC)	Agriculture - Co-operative Development Initiative (Ag-CDI) (October 2007 - March 2009)	Activity - Education / Support	No	Transport Fuels (Agricultural Producers)	Provides support to individuals, groups, and communities wishing to develop co-operatives as a way to take advantage of opportunities associated with biofuels and other value-added opportunities in the agricultural sector.	
Agriculture and Agri-Food Canada (AAFC)	Biofuels Opportunities for Producers Initiative (BOPI) (Announced July 2006 - 2008)	Activity - Education / Support		Transport Fuels (Agricultural Producers)	Helps farmers and rural communities hire experts who can assist in developing business proposals and undertake feasibility and other studies necessary to create and expand biofuels production capacity involving significant (greater than 1/3) ownership by agricultural producers.	
Agriculture and Agri-Food Canada (AAFC)	ecoAgriculture Biofuels Capital Initiative (ecoABC) (April 23, 2007 - March 31, 2011)	Activity - Incentive	Yes (Authority under Section 4 of the Department of Agriculture and Agri-Food Act)	Transport Fuels (Agricultural Producers)	Provides repayable contributions of up to $25 M per project or 25% of eligible project costs (which ever is less) for the construction or expansion of transportation biofuel production facilities. Funding is provided for projects that use agricultural feedstocks to produce biofuels and that have new agricultural producer equity investments in the projects equal to, at minimum, 5% of the total eligible project costs.	
Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan)	Ethanol Expansion Program (EEP) (October 20, 2003 - March 31, 2007)	Activity - Incentive	Yes (Authority under the federal Energy Efficiency Act (1992); and the Department of Agriculture and Agri-Food Act)	Transport Fuels (Industry / Infrastructure)	Aims to increase the production and use of fuel ethanol in Canada and reduce transportation related GHG emissions by providing repayable contributions, amounting to $99.3 M for the construction or expansion of ethanol plants. The EEP sets the goal of having 35% of the consumption of gasoline-type fuels be E10 by 2010, ethanol demand should represent 3.5% of all gasoline-type fuels by 2010.	

Impact on Production Stream			Funding Mechanism	Comments
Production	**Conversion**	**Use**		
Generates increased demand for primary agriculture products and provides opportunities for agricultural producers to participate in value-added enterprises.		Provides funds to projects that focus on new agri-food, agriculture or bioproducts, that can be expected to increase market opportunities for the Canadian agricultural industry across the value chain and addresses a gap in the commercialization of agricultural products, processes or services.	$134 M federal program	This program is not applicable to transportation fuels.
Promotes research and development activities in areas such as biofuels, other forms of bioenergy, biochemicals, etc.		Promotes technology transfer and commercialization activities in areas such as biofuels, other forms of bioenergy, biochemicals, etc.	$145 M federal program	It is anticipated that the ABIP will support 10-25 networks.
Provides specialized and expert assistance to farmers, groups, and communities that wish to explore using the co-operative model as a way to participate in value-added opportunities such as biofuels.			$3.25 M federal initiative	
Encourages greater involvement in biofuel production facilities by agricultural producers allowing them to become participants in the value chain and increase their share of the benefits from renewable fuels production beyond delivering feedstock.			$20 M federal initiative (Up to $13 M was available in 2006-2007 and $7 M is available in 2007-2008)	This program is an initiative under the Advancing Canadian Agriculture and Agri-Food (ACAAF) program and is delivered through the industry councils in each province or territory which administer the ACAAF program.
Provides an opportunity for agricultural producers to diversify their economic base and participate in the biofuels industry through equity investment / ownership in biofuels production facilities. Helps farmers overcome the challenges of raising the capital necessary for the construction or expansion of biofuel production facilities.	Enables the construction and expansion of biofuel facilities.		$200 M federal program ($186 M is available for contributions)	
Promotes the production of ethanol.	Enables the construction and expansion of ethanol plants.	Promotes the use of ethanol.	$100 M federal program	This program is a component of the Future Fuels Initiative. Although project submissions to the EEP terminated in 2005, program activities are expected to last until 2018 (9 ethanol projects are supported for which contributions are repayable in the coming years).

Implementing Agency	Policy/ Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Agriculture and Agri-Food Canada (AAFC) and Natural Resources Canada (NRCan)	Future Fuels Initiative (2001)	Activity - Incentive / Education		Transport Fuels (Industry / Infrastructure / Consumers)	Plans to accomplish a four-fold (by 750 million litres) increase in Canada's annual ethanol production and use. That could mean 25% of Canada's total gasoline supply would contain 10% ethanol. Contingent loan guarantees are provided to encourage financing for new plants that produce ethanol from biomass if all or part of the excise gasoline tax on ethanol is imposed before December 31, 2010.	
Alberta Government - Ministry of Energy	Bioenergy Infrastructure Development Grant Program (2008 - 2009)	Activity - Incentive		Infrastructure	Leverages industry / investors / municipal funds (maximum is 35% of eligible costs for capital projects) to develop and expand the distribution infrastructure to connect Alberta produced ethanol, biodiesel, and biogas (methane) to the marketplace.	
Alberta Government - Ministry of Energy	Bioenergy Producer Credit Program (April 1, 2007 - March 31, 2011)	Activity - Incentive		Industry (Suppliers)	Encourages the production and incorporation of bioenergy products (ethanol, biodiesel, biogas-electrical) within the marketplace and helps Alberta industry effectively compete with other jurisdictions that provide programs and tax exemptions to distributors who blend biofuels. Credits are given to producers of biofuels or biogas of $0.14/litre (production capacity less than 150 M litres/year, up to a maximum of $15 M/year) or $0.09/litre (production capacity of or greater than 150 M litres/year, up to a maximum of $20 M/year and total of $75 M for the project). Those generating electricity receive $0.02/kWh (production capacity of or greater than 3 MW) or $0.06/kWh (production capacity less than 3 MW).	
Alberta Government - Ministry of Energy	Bioindustrial Network Development	Policy Initiative - Strategy	No	Industry	Facilitate the demonstration and integration of bioenergy processing with existing manufacturing processors for increased regional development and demonstrate "cluster" efficiency - through the strategic integration and clustering of key processors providing a significant improvement in competitiveness and reduced environmental impact.	
Alberta Government - Ministry of Energy	Biorefining Commercialization and Market Development Program (2008 - 2009)	Activity - Incentive / Education		Industry	Leverages industry funds (maximum is 20% of eligible costs for capital projects and 50% of eligible costs for non-capital projects) to focus on biofuel research commercialization, technology transfer, new generation co-operatives, capacity building, market development, and advocacy for ensuring market acceptance. This program supports feasibility studies, opportunity analysis, and product development costs related to concept and technology evaluation, technical assistance, and equipment development; in addition to market research costs related to specific product opportunities, costs related to buyer presentations, product reformulation, and transportation of samples.	
Alberta Government - Ministry of Energy	Energy Microgeneration Standards and Policy Revisions	Policy Initiative - Strategy	No	Industry / Infrastructure	Clearly define the regulatory protocols required to establish processing plants like biogas digesters and biodiesel processing facilities and through a cross-ministry approach ensure a timely and transparent review of investment applications better meeting the needs of industry.	
Alberta Government - Ministry of Energy	Investment Support through Existing Programs that Align with Bioenergy Development	Policy Initiative - Incentive	No	Investment Programs	Programs include Agriculture Financial Services Corporation (AFSC) lending programs, New Generation Cooperative Initiatives, Industry Development Research Funds, AVAC commercialization funding, Municipal Industrial Wastewater Infrastructure for Agricultural Processing Program, and Rural Development Project Fund.	
Alberta Government - Ministry of Energy	National Renewable Fuel Standard and Energy Market Targets	Policy Initiative - Target / Criteria	No	Transport Fuels	Align to a 5% national renewable fuels standard by 2010 to create market stability that will benefit existing renewable fuel industries and establish a future market for newly established fuel technologies. Within the overall renewable fuels mandated target, support ethanol and biodiesel mandates should be specifically designated to ensure the emerging biodiesel industry has an opportunity to capture some of the benefits of a renewable fuels mandate.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Promotes the production of ethanol.	Provides funding for the development new ethanol plants and provides a liaison with provinces/territories and industries that are interested in ethanol plant expansion.	Promotes the use of ethanol and provides for funding of activities such as public education on fuel ethanol, analysis of fuel ethanol markets, and producer economics.	$3 M over 5 years to provide market information to retail consumers $140 M in contingent loan guarantees from the NBEP	This initiative is part of the Government of Canada’s Action Plan 2000 on Climate Change and renews the National Biomass Ethanol Program (NBEP) launched in the mid-1990s to help overcome lender resistance to investing in ethanol plants as a result of uncertainty about the excise tax policy.
		Develops and expands the distribution infrastructure (micro-generation interconnections and biogas processing and pipeline infrastructure) of biofuel and energy transmission in Alberta.	$6 M provincial program	This approved initiative is part of Alberta's Nine-Point Bioenergy Plan. This initiative supports rural development regional distribution priorities facilitating the application of new technology in biofuel and energy transmission and distribution infrastructure.
Encourages the production of bioenergy products.		Enables the introduction of renewable products into the traditional fuels and energy marketplace.	$209 M for renewable fuels $30 M for commercialization support (from the Energy Innovation Fund)	This approved initiative is part of Alberta's Nine-Point Bioenergy Plan and replaces the existing Alberta ethanol fuel tax exemption policy of $0.09/litre.
	Promote bioenergy processing.			This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.
Develops/expands/ strengthens Alberta's biodiesel, biogas, and ethanol production capacity in response to market opportunities.		Supports bioenergy market growth.	$24 M provincial program	This approved initiative is part of Alberta's Nine-Point Bioenergy Plan.
	Provide guidelines for the establishment of processing plants.			This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.
Support bioenergy development.		Support bioenergy development.		This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.
		Set renewable fuels mandates to support the ethanol and biodiesel industry.		This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.

Implementing Agency	Policy/ Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Alberta Government - Ministry of Energy	Specified Risk Material (SRM) Disposal Protocol	Policy Initiative - Education	No	Government	Investigate and establish regulatory protocol with the federal government in the safe disposal of SRMs through appropriate bioenergy technology adaptation.	
Alberta Government - Ministry of Energy	Taxation and Investment Instruments for the Bioenergy Sector	Policy Initiative - Education	No	Government	Work with Federal counterparts to investigate options to improve capital flow to bioenergy industry.	
British Columbia Government - Ministry of Finance	Renewable Fuels Incentive	Policy - Incentive	Yes	Transport Fuels	Road Tax Exemption: $0.1375/L in the Greater Vancouver Service Region and $0.0775/L outside of this region for ethanol; $0.1425/L in the Greater Vancouver Service Region and $0.0825/L outside of this region for biodiesel (provided the ethanol and biodiesel are consumed in British Columbia).	
Department of Finance Canada	Accelerated Capital Cost Allowance for Class 43.1 (1996)	Policy - Incentive	Yes	Industry	Encourages business and industry to reduce energy waste and to use renewable energy sources for energy production equipment by providing an accelerated capital cost allowance at a rate of 30%.	
Department of Finance Canada	Removal of Excise Tax Exemption for Renewable Fuels (April 1, 2008)	Policy - Incentive	No (Under Development)	Transport Fuels	Eliminates the excise tax exemptions for ethanol and biodiesel.	
Department of Finance Canada	Tax Exemptions for Renewable Fuels (Excise Tax Act) (1992: ethanol, 2003: biodiesel - March 31, 2008)	Policy - Incentive	Yes	Transport Fuels (Producers / Suppliers)	Encourages the production and use of renewable fuels in Canada by implementing an exemption from the federal excise tax of $0.10/litre on ethanol and $0.04/litre on biodiesel.	
Environment Canada (EC)	Federal Regulation Requiring Renewable Fuels (Announced December 2006)	Policy - Target / Criteria	No (Under Development)	Transport Fuels	Will require 5% renewable content based on the gasoline pool by 2010 and 2% renewable content in diesel and heating oil by 2012, upon successful demonstration of renewable diesel fuel use under the range of Canadian conditions. This requirement is approximately equivalent to a renewable fuel content requirement for 5% of on-road diesel fuel.	
Manitoba Government - Department of Science, Technology, Energy, and Mines	Renewable Fuels Incentive (until August 2007)	Policy - Incentive		Transport Fuels	Provincial Fuel Tax Credit for ethanol: $0.20/litre, provided the ethanol is produced and consumed in Manitoba.	
	Renewable Fuels Incentive (September 2007 - August 2010)				$0.15/litre, provided the ethanol is produced and consumed in Manitoba.	
	Renewable Fuels Incentive (September 2010 - August 2013)				$0.10/litre, provided the ethanol is produced and consumed in Manitoba.	
Manitoba Government - Department of Science, Technology, Energy, and Mines	Renewable Fuels Incentive	Policy - Incentive		Transport Fuels	Provincial Fuel Tax Credit for biodiesel: $0.115/L, provided the biodiesel is consumed in Manitoba.	
Manitoba Government - Department of Science, Technology, Energy, and Mines	Renewable Fuels Mandate	Policy - Criteria		Transport Fuels	Requires 10% ethanol content in 85% of gasoline.	
Natural Resources Canada (NRCan)	Biodiesel Initiative (Announced August 2003 - 2007)	Activity - Education		Transport Fuels (Industry)	Addresses technical and market barriers to the development of a Canadian biodiesel industry based on low-cost feedstocks such as yellow grease and severed canola.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
	Provide guidelines for safe disposal of SRMs.			This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.
		Support the bioenergy industry.		This proposed policy initiative is part of Alberta's Nine-Point Bioenergy Plan.
		Promotes use of ethanol and biodiesel.		
	Invests in co-generation and specified waste-fuelled electrical generation systems, heat recovery systems, and specified waste-fuelled heat production equipment.			
The ecoENERGY for Biofuels Initiative promotes domestic production of renewable fuels.				This measure is in accordance with the implementation of the ecoENERGY for Biofuels Initiative.
Promotes the production of renewable fuels.		Promotes the use of renewable fuels.		
		Set renewable fuels mandates to support the use of blended fuels.		These new regulations will require enough renewable fuel to reduce GHG emissions by about 4 megatonnes per year, the GHG equivalent of taking almost 1 M vehicles from the road.
Promotes the production of ethanol.		Promotes the use of ethanol.		
	Promotes the production of biodiesel.		Promotes the use of biodiesel.	
			Sets blending mandate to promote the use of ethanol.	
			Supports activities such as coordinating and advancing policy, removing technical and marketplace barriers, improving appropriate technologies, encouraging early adoption, and generating awareness.	$11.9 M federal program

Implementing Agency	Policy/ Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Natural Resources Canada (NRCan)	Biomass for Energy Program (2000)	Activity - R&D		Biomass Supply		(Agriculture / Forestry) Assesses biomass resources in the fields of forestry and agriculture and develops methods to grow fibre for the production of bioenergy. This includes harvesting technologies, transport system efficiencies, and storage systems as well as designing scenarios to improve supply.
Natural Resources Canada (NRCan)	Canadian Transportation Fuel Cell Alliance (CTFCA) (2001 - March 2008)	Activity - R&D		Transport Fuels		(Industrial) Demonstrates and evaluates fuelling options for fuel cell vehicles in Canada.
Natural Resources Canada (NRCan)	ecoENERGY for Biofuels (April 1, 2008 - March 31, 2017)	Activity - Incentive		Transport Fuels (Producers)		Aims to boost Canada's production of renewable fuels such as ethanol and biodiesel by providing operating incentives to producers of renewable alternatives to gasoline and diesel based on production levels and other factors. Incentive rates will be up to \$0.10/L for renewable alternatives to gasoline and up to \$0.20/L for renewable alternatives to diesel for the first 3 years, then decline thereafter. Incentives are available to eligible facilities meeting a minimum production volume (undetermined) constructed before March 31, 2011, subject to program volume limits (2 B litres of renewable alternatives to gasoline and 500 M litres of renewable alternatives to diesel with a cap of 30% of program volume limits per facility) for up to 7 years.
Natural Resources Canada (NRCan)	ecoENERGY for Renewable Power (April 1, 2007 - March 31, 2011)	Activity - Incentive		Electricity Suppliers	Aims to increase Canada's supply of clean electricity from renewable sources including biomass by providing \$0.01/kWh for up to 10 years to eligible low-impact, renewable electricity projects. The program will encourage the production of 14.3 terrawatt hours of new electricity from renewable energy sources, enough electricity to power about one million homes.	
Natural Resources Canada (NRCan)	ecoENERGY Technology Initiative (ecoETI) Bio-based Energy Systems Portfolio (Announced January 17, 2007 - 2011)	Activity - RD&D		Government / Industry / University	Harnesses the potential for bioresources to produce bioenergy, biofuels, industrial bioproducts and bioprocesses to help Canadian industry and communities meet the challenges of improving efficiency and reducing toxic air emissions.	
Natural Resources Canada (NRCan)	Program of Energy Research and Development (PERD) Bio-based Energy Systems and Technologies (BEST) Program (On-going)	Activity - R&D		Government / Industry / University	Supports the development of cost-effective technologies using biomass feedstock to produce bioenergy, biofuels, biomaterials, biochemicals, and bioprocesses to reduce the energy and greenhouse gas (GHG) intensity of Canadian industries and provide sustainable energy and product alternatives to consumers.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Identifies sources of increased biomass supply, for both existing and new biomass; develops efficient methods of growing, harvesting, collecting and transporting biomass; and demonstrates the sustainability of increased biomass supply which can potentially be employed for bioenergy production.			Funded by the Canadian Forest Service (CFS)	Identifies sources of increased biomass supply, for both existing and new biomass; develops efficient methods of growing, harvesting, collecting and transporting biomass; and demonstrates the sustainability of increased biomass supply which can potentially be employed for bioenergy production.
	Encourages advancements in hydrogen and fuel cell technologies that are potentially transferable for use with other bioenergy sources.		$33 M federal program	
This initiative encourages the production of renewable fuels and makes investment in production facilities more attractive by partially offsetting the risk associated with fluctuating feedstock and fuel prices.			Up to $1.5 B federal initiative	This initiative encourages the production of renewable fuels and makes investment in production facilities more attractive by partially offsetting the risk associated with fluctuating feedstock and fuel prices.
		Encourages the use of electricity produced from renewable sources.	$1.48 B federal program	
	Planned activities will develop new and improved technologies for producing energy from plants, wastes and microorganisms.	Activities focus on developing the knowledge for moving towards a bio-based economy, supporting the development of associated regulations, and contributing to the revitalization of rural economies and Aboriginal communities.	$230 M for ecoETI	
Activities focus on existing and new biomass supply.	Activities support biomass conversion and utilization technologies.	Activities focus on integrated bio-applications and cross-cutting activities.	Funded by the Office of Energy Research and Development (OERD)	Activities focus on existing and new biomass supply.

Implementing Agency	Policy/ Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Natural Resources Canada (NRCan)	Promoting Forest Innovation and Investment (Forest Industry Long-Term Competitiveness Initiative) (Announced February 8, 2007 - 2009)	Activity - R&D		Government / Industry		(Forestry) Supports 3 initiatives: 1) Restructuring the Forest Innovation System - Consolidation of Forest Engineering Research Institute of Canada (FERIC), Forintek Canada Corporation, and the Pulp and Paper Research Institute of Canada (PAPRICAN) into FPInnovations for greater efficiency and strength in innovation and R&D; 2) Investing in Transformative Technologies - Investments in forest innovation will provide for pre-competitive, non-proprietary research to address the development and adaptation of emerging and breakthrough technologies, such as forest biomass, forest biotechnology, and nanotechnology; and 3) Implementing the Canadian Wood Fibre Centre (CWFC) - The CWFC will focus on wood fibre research from forest to end use to increase Canada's knowledge of wood fibre quality and how best to grow and utilize it in the long term.
Natural Resources Canada (NRCan)	Technology and Innovation Research and Development (T&I R&D) Biotechnology Program (2003-2008)	Activity - R&D		Government / Industry / University	Supports R&D to increase biomass-derived energy and/or develop long-term solutions for GHG reduction.	
Natural Resources Canada (NRCan)	Technology Early Action Measures (TEAM) (1998)	Activity - RD&D		Government / Industry	Supports late-stage development projects and first-time demonstration projects designed to reduce GHG emissions nationally and internationally, at the same time sustaining economic and social development. The TEAM program was transferred to the Office of Energy Research and Development (OERD) effective September 1, 2007.	
New Brunswick Government	Renewable Portfolio Standard	Policy			Requires NB Power to purchase 10% of it electricity sales from new renewable sources by 2016.	
Nova Scotia Government - Department of Finance	Renewable Fuels Incentive (July 1, 2006)	Policy - Incentive		Transport Fuels	Motive fuel tax exemption of $0.154/L for biodiesel produced in Nova Scotia (biodiesel portion of blends only) that meets the American Society for Testing and Materials fuel-quality specification.	
Ontario Government - Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)	Ontario Biogas Systems Financial Assistance Program (September 6, 2007 - March 31, 2010)	Activity - Incentive		Agricultural Producers and Agri-Food Businesses	The program is designed to promote sustainable biogas production in the Ontario agri-food and rural sectors. Biogas systems can help achieve reductions in GHG emissions, increase production of renewable energy, promote use of digestate as a land-applied nutrient, improve biogas utilization, and foster agricultural innovation and economic opportunities. Phase 1 will support 70% of the costs of feasibility, design and planning studies, to a maximum of $35,000 per project. Phase 2 will provide 40% of construction, implementation and commissioning costs for biogas systems, to a maximum of $400,000 (total of Phase 1 & 2 per project).	

Impact on Production Stream			Funding Mechanism	Comments
Production	**Conversion**	**Use**		
Focuses on wood fibre research which may be transferable to bioenergy applications.	Supports the development of bioenergy related transformative technologies.		$70 M federal initiative	
	Activities focus mainly on: conversion of waste to bio-based gases; conversion of cellulosic materials into ethanol; more energy-efficient enzymes for separating natural fibres into valuable components; biomass conversion to heat and power; and combined heat and power technologies.		$115 M for T&I R&D	
	Encourages investment in innovative technology.		$56 M federal program	
Encourages the production of biodiesel.				
	Supports the development and implementation of biogas systems.		$9 M provincial program	

Implementing Agency	Policy/ Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ontario Government - Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)	Ontario Ethanol Growth Fund (OEGF) (Announced June 17, 2005)	Activity - Incentive		Transport Fuels (Producers) (Industry / Infrastructure)	Provides 1) capital assistance (not exceeding $0.10/L of plant capacity) in the form of capital grants or loan guarantees for eligible new or expanding ethanol plants being built in Ontario to help meet financial challenges; 2) operating grants (not exceeding $0.11/L of ethanol produced in a particular year for a maximum of 750 M litres per year paid over a period of up to 10 years) to eligible producers in production from 2007-2016 to address changing market prices; 3) support for independent blenders of ethanol and gasoline; and 4) a R&D fund to pursue opportunities for research and innovation.	
Ontario Government - Ministry of Agriculture, Food, and Rural Affairs (OMAFRA)	Renewable Fuels Incentive (June 2002)	Policy - Incentive		Transport Fuels	Excise tax exemption of $0.143/L for biodiesel, provided the biodiesel is consumed in Ontario.	
Ontario Government - Ministry of Finance	Renewable Fuels Mandate - Ontario Regulation 535/05 (January 1, 2007)	Policy - Criteria	Yes	Transport Fuels	Requires an annual average of 5% ethanol in gasoline.	
Ontario Power Authority	Standard Offer Program (March 21, 2006)	Activity - Incentive		Electricity Suppliers	Sets a fixed price (feed-in-tariff) for small renewable energy (including biomass energy) generation projects in order to make it easier and more cost effective for businesses and entrepreneurs to sell renewable power to the provincial grid.	
Quebec Government - Department of Finances	Renewable Fuels Incentive (2005-06 Budget) (April 1, 2006 - March 31, 2018)	Policy - Incentive		Transport Fuels	Variable Rate Income Tax Credit for Ethanol: up to $0.185/L, provided the ethanol is produced and consumed in Quebec. A maximum of $182.4 M in financial assistance is available to an eligible corporation for a maximum of 10 years.	
Quebec Government - Department of Finances	Renewable Fuels Incentive (March 23, 2006)	Policy - Incentive		Transport Fuels (Consumers)	Tax refund of $0.162/L on the purchase of pure (B100) biodiesel fuel (> 3000 L) that is not blended with any other type of fuel (provided the biodiesel is consumed in Quebec).	
Quebec Government - Department of Natural Resources and Wildlife	Renewable Fuels Mandate	Policy - Target	No (Proposal)	Transport Fuels	Sets a goal of 5% ethanol in gasoline by 2012 and expected to be met by next-generation cellulosic ethanol.	
Saskatchewan Government - Department of Industry and Resources	Renewable Fuels Incentive	Policy - Incentive	Yes	Transport Fuels	Fuel Distributor Tax Credit for Ethanol: up to $0.15/L, 5 years, provided the ethanol is produced and consumed in Saskatchewan.	Saskatchewan Government - Department of Industry and Resources
Saskatchewan Government - Department of Industry and Resources	Renewable Fuels Mandate (November 1, 2005 - January 14, 2007)	Policy - Criteria	Yes	Transport Fuels	Requires an average of 1% ethanol in gasoline.	Saskatchewan Government - Department of Industry and Resources
	Renewable Fuels Mandate (January 15, 2007)				Requires an average of 7.5% ethanol in gasoline.	
Saskatchewan Government - Department of Regional Economic and Co-operative Development	Saskatchewan Biofuels Investment Opportunity (SaskBIO) (August 10, 2007 - 2011)	Activity - Incentive		Transport Fuels (Agricultural Producers)	Provides repayable contributions of up to $10 M per project for the construction or expansion of transportation biofuels production facilities in Saskatchewan that have a minimum of 5% farmer-community investment.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Promotes the production of ethanol.	Supports the development and expansion of ethanol plants.	Promotes the use of blended fuels.	$520 M over 12 years (up to $32.5 M available for capital assistance for all proponents combined)	
		Promotes the use of biodiesel.		
		Sets blending mandate to promote the use of ethanol.		
		Through this program all small-scale renewable energy producers will be able to sell renewable power to the grid for 20 years. Over the next 10 years, this will add up to 1,000 megawatts of renewable power to Ontario's electricity system.		
Promotes the production of ethanol.				
		Promotes the use of biodiesel.		
		Sets blending mandate to promote the use of ethanol.		
		Promotes the use of ethanol.		
		Sets blending mandate to promote the use of ethanol.		
Provides an opportunity for farmers and communities to participate in the value-added biofuels industry in Saskatchewan through investment ownership in biofuels facilities.	Supports the development and expansion of ethanol plants.		$80 M provincial program	

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/Activity Target Area	Direct	Indirect
Sustainable Development Technology Canada (SDTC)	NextGen Biofuels Fund™ (November 2001)	Activity - RD&D		Industry / Infrastructure		Supports the late-stage development and pre-commercial demonstration of clean technology solutions: products and processes that contribute to clean air, clean water, and clean land, that arrest climate change, and improve the productivity and global competitiveness of the Canadian industry.
Sustainable Development Technology Canada (SDTC)	NextGen Biofuels Fund™ (2007-2015)	Activity - RD&D		Industry / Infrastructure		Supports the establishment of first-of-kind commercial scale demonstration facilities for the production of next-generation renewable fuels and co-products and accelerates the commercialization of new technologies in order to encourage the retention and growth of technology expertise and innovation capacity for cellulosic ethanol and biodiesel production in Canada.

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
	Supports the development of new technologies.		$550 M	
Supports the production of renewable fuels.			$500 M	

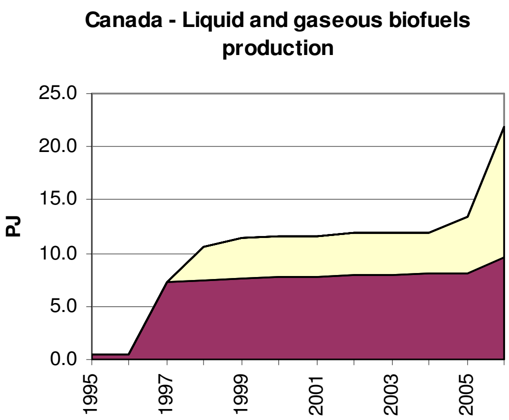
2.6 Canada Bioenergy Outlook

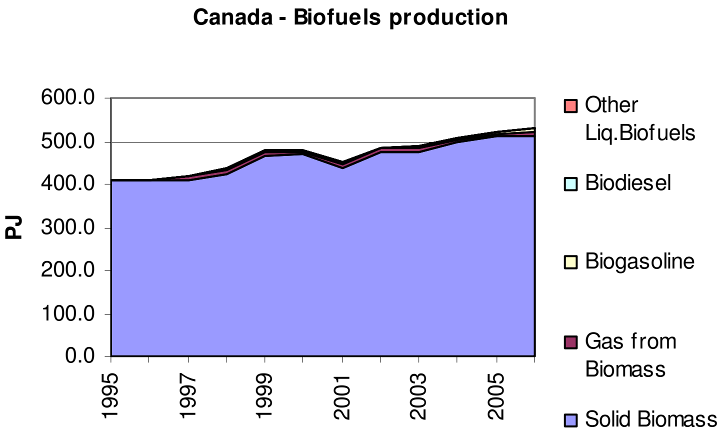
Table 2.2 - Canada – Biofuel production

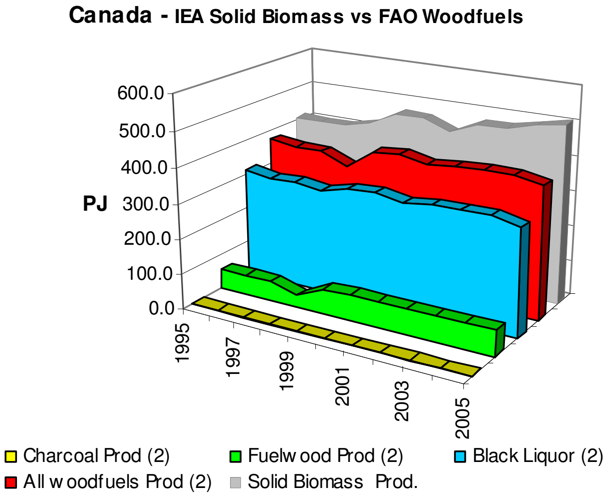
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	408.6	408.3	417.8	436.1	478.4	479.2	449.6	485.7	486.8	507.4	522.9	531.8
Solid Biomass	408.1	407.8	410.5	425.5	467.0	467.6	437.9	473.8	474.9	495.5	509.4	509.9
Gas from Biomass	0.5	0.6	7.3	7.4	7.6	7.8	7.8	8.0	8.0	8.0	8.0	9.6
Biogasoline				3.2	3.9	3.9	3.9	3.9	3.9	3.9	5.4	12.3
Biodiesel												
Other Liq.Biofuels												
All woodfuels (2)	372.2	361.6	363.7	332.8	387.7	394.4	380.6	389.7	390.9	392.2	376.4	
Fuelwood (2)	56.2	56.2	56.2	33.4	70.2	72.4	73.0	72.6	71.6	71.8	72.9	
Charcoal (2)												
Black Liquor (2)	316.0	305.3	307.5	299.4	317.5	322.0	307.6	317.1	319.3	320.4	303.5	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	-0.1	0.7	3.7	9.7	0.1	-6.3	8.2	0.2	4.3	2.8
Gas from Biomass	9.3	1,192	1.6	3.1	2.0		2.8		0.4	
Biogasoline				20.0						39.6
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data







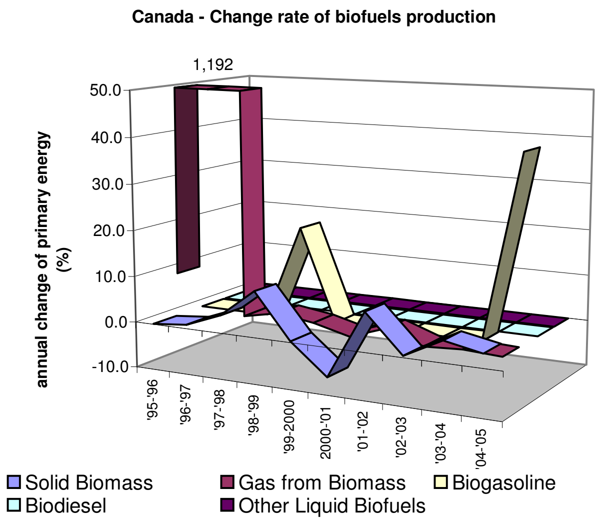


Table 2.3 - Canada – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels				1.7	1.7	2.1	2.1	2.1	2.6	2.6	2.1	1.1
Solid Biomass												
Gas from Biomass												
Biogasoline				1.7	1.7	2.1	2.1	2.1	2.6	2.6	2.1	1.1
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	1.1	1.1	1.4	1.2	1.2	0.8	1.0	1.2	1.0	2.1	2.8	
Fuelwood (2)	0.9	0.9	1.2	0.9	1.0	0.6	0.8	0.9	0.7	1.8	2.1	
Charcoal (2)	0.2	0.2	0.1	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.7	

(2) = Based on FAO data

Table 2.4 - Canada – Biofuel Export (PJ)

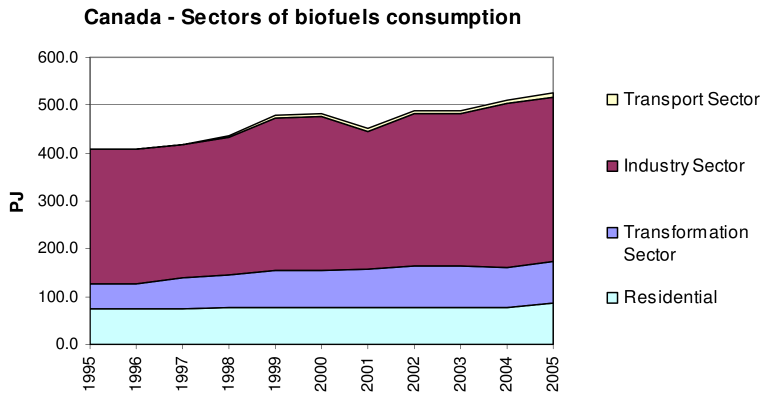
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels				0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Solid Biomass												
Gas from Biomass												
Biogasoline				0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.4	0.6
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	4.6	5.0	3.5	3.4	3.8	4.1	5.4	5.1	5.2	7.0	9.6	
Fuelwood (2)	4.6	5.0	3.4	3.3	3.7	4.0	5.3	5.1	5.1	6.9	9.6	
Charcoal (2)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	

(2) = Based on FAO data

Table 2.5 - Canada – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	*408.7*	*408.4*	*417.8*	*437.5*	*479.8*	*481.0*	*451.4*	*487.5*	*489.0*	*509.7*	*524.7*	*532.4*
	Transform.	53.0	54.9	65.7	69.8	79.2	78.5	82.2	86.4	86.5	84.2	87.8	
	Industry	283.0	280.4	277.4	287.2	318.9	320.1	286.7	318.4	319.3	342.1	344.4	
	Transport				4.5	5.1	5.6	5.6	5.6	6.0	6.0	7.1	
	Residential	72.7	73.1	74.8	76.0	76.6	76.8	76.9	77.1	77.2	77.3	85.4	
Solid Biomass	Dom. Supply	408.2	407.8	410.5	425.6	467.0	467.6	438.0	473.9	475.0	495.6	509.5	510.0
	Transform.	52.5	54.3	58.4	62.4	71.6	70.7	74.4	78.4	78.5	76.2	79.7	
	Industry	283.0	280.4	277.4	287.2	318.9	320.1	286.7	318.4	319.3	342.1	344.4	
	Transport												
	Residential	72.7	73.1	74.8	76.0	76.6	76.8	76.9	77.1	77.2	77.3	85.4	
Gas from Biomass	Dom. Supply	0.5	0.6	7.3	7.4	7.6	7.8	7.8	8.0	8.0	8.0	8.0	9.6
	Transform.	0.5	0.6	7.3	7.4	7.6	7.8	7.8	8.0	8.0	8.0	8.0	
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply				4.5	5.1	5.6	5.6	5.6	6.0	6.0	7.1	12.8
	Transform.												
	Industry												
	Transport				4.5	5.1	5.6	5.6	5.6	6.0	6.0	7.1	
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



3 Country Profile - CHINA

3.1 Overview

The energy industry of China is under pressure to meet the demands of its booming economic growth and at the same time, maintain its social responsibility to protect the environment. Although endowed with large quantities of fossil fuel sources, China's per-capita energy resources, which is less than half of the world's average, is relatively lacking due to the size of its population. This deficiency has become a factor constraining the sustainable development of the country's economy. Furthermore, as about 80 percent of the primary energy supply still comes from fossil fuels, there are clear environmental pollution issues.

Modern renewable energy sources account for only 7.5 percent (including large hydro*)* of China's primary energy demand. In addition to supplying modern renewable energy, traditional biomass also plays an important role in China's energy mix (12 percent). Renewable energy contributes 15 percent of that used in electricity generation, with hydro-power plants as the largest technology used[117].

China is the world's third largest producer of fuel ethanol after the United States and Brazil. Chinese fuel ethanol production is estimated at 1,450,000 tonnes in 2007, up from a recorded output of 1,300,000 tonnes in 2006, reporting a 12 percent increase from 2006[118]. More than 80 percent of ethanol is made from maize; other feedstock used includes cassava rice, sugar and paper pulp waste. Ethanol from sorghum is being produced on a trial basis[119].

Chinese ethanol exports have been increasing over the last five years and have jumped dramatically from 138,000 tonnes in 2005 to 865,000 tonnes in 2006 in reaction to higher world petroleum prices.[120] Most ethanol exported from China is "un-denatured" ethanol (principally to Japan and Korea where it is used for alcohol production[121]).

Due to high tariffs, China levies an import tariff of 30 percent on ethanol[122] and restrictive import policies fuel ethanol imports have been relatively minor and are unlikely to increase in the short run. However, feedstock imports for biofuel production will rise over the next few years to meet the increasing domestic demand of fuel ethanol production. In 2006, more than half of China's imports (4.5 million litres) are in effect more re-distribution than true import. This is a result of Chinese production being sent to tariff-free zones and "imported". The "imported" product is counted as import instead of reduced exports.[123]

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[117] REN21 Renewable Global Status report, 2006
[118] USDA-FAS, "China, People Republic of : Biofuels Annual Report 2007," GAIN Report - CH7039, January 6th, 2007
[119] UNCTAD, "The emerging biofuels market: regulatory, trade and development implications" United Nations 2006
[120] Masami Kojima, Donald Mitchell, and William Ward , "Considering Trade Policies for Liquid Biofuels", ESMAP report May 2007
[121] USDA-FAS 2007
[122] USDA-FAS, China, People Republic of: Biofuels An Alternative Future for Agriculture GAIN Report Number: CH6049 August, 8th , 2006
[123] USDA-FAS 2007

Biodiesel is still in the very early phases of testing and development. Its production in 2005 was between 100,000 and 200,000 metric tonnes (MT) with a production capacity of 1,020,000[124] with future production in 2007 estimated at around 300,000 metric tonnes.[125]

The feedstock used for biodiesel production includes waste cooking oil, some oil from oily plants, or animal fat. The product is low quality and not adequate for transportation purpose. Significant technological research is, however, underway. Official Customs data is not available for biodiesel trade. China does not currently import biodiesel because of the high price.

Biomass for cooking and heating in traditional ways is used especially in poor remote regions. Traditional biomass is still the *main source* of energy supply for 15 million rural Chinese, who do not yet have access to electricity. By the end of 2005, the installed capacity of modern biomass power was 2 GW[126].

Table 3.1 – [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	6%	15%	13%
71 894	4 192	10 505	9 360

Source: IEA, 2005

3.2 Country Objectives and Drivers

Rising oil import costs and concerns about rapidly growing demands for energy (growing at 15 percent annually) in a context of fluctuating world oil prices, are driving the government to seek alternative indigenous sources of energy. China's launch into biofuels production has also been motivated by the objective of stimulating rural economy, and improving farmers' income, through the creation of a new market for surplus grain in major Chinese corn-producing areas. Lastly, environmental protection and concerns for economic losses caused by environmental pollution in China,[127] has also motivated the current plan to substantially increase the percentage of renewable energy in its overall energy consumption and the adoption of the *Renewable Energy Law* dedicated to promote the development and use of renewable energy. This, the first national law dedicated to promote the development and use of renewable energy, came into effect on 1 January 2006. The "Renewable Energy Law", which draws particular attention to energy derived from biomass, confirms the importance of renewable energy in China's national energy strategy, encourages investment in the development of biomass, removes barriers to the development of the renewable energy market, and sets up a financial guarantee system for the development of renewable energy.

[124] USDA-FAS 2006
[125] USDA-FAS 2007
[126] EREC , "Global Energy [R]Evolution A Sustainable China Energy Outlook", April 2007
[127] In September 2006, the National Bureau of Statistics and the State Environmental Protection Administration jointly issued a aimed to address adjustments to GDP caused by environmental pollution. According to this report, the economic losses caused by environmental pollution in China in 2004 amount to 3.05% of China's GDP in 2004.

Fundamental principles of China's renewable energy legislation are the shared responsibility of companies and individuals, intervention of the government in establishing the market rules to encourage the creation of the market for energy resources, participation of companies and market players in investing in this sector, and promotion of mature and innovative technologies in an effort to solve rural energy access. In line with those principles, the "Renewable Energy Law" provides a comprehensive policy framework whose implementing regulations are to be formulated. Some of them have been already issued including those regarding the pricing mechanism, grid-connection and incentive policies.

The main policy instruments and mechanisms established through those implementing regulations for promoting bioenergy development are described below:

Establishment of renewable energy targets, including both economy-wide and technology specific targets. On the basis of medium and long-term targets and national RE development and utilization plan set at central level, and according to the economic context and availability of resources, each regional authority is obliged to set an RE plan for their own administrative regions. Mandatory renewable energy targets for individual utilities is considered too complicated and costly by the government, but China has confirmed that obligations under a quota system will be placed on generators, although not yet operational. Currently, only a feed-in tariff mechanism has been established to achieve the target.

Compulsory grid connection for renewable energy facilities to the State electricity grid. The Renewable Energy Law provides for the compulsory connection of renewable energy generators to the grid, and a regulation has been enacted to this effect[128]. The regulation deals with general rules governing grid connection, project management requirements, utility company responsibilities and generator responsibilities. Under the Regulation, a power generation project must be established upon obtaining the relevant licence or complying with relevant filing procedures with the department-in-charge.

3.3 Bioenergy Policy by Subsector

The principal document presenting the national renewable energy policy is the "National medium- to long term renewable energy development Plan". It has been recently formulated by the NDRC (National Development and Reform Commission) and should be published in the near future as a guide for development of the renewable energy industry and create certainty for investors, although still awaiting final, formal approval by the State Council. The table below shows the overall and technology-specific targets for 2010 and 2020 included in the latest draft of the Plan. If these targets are met, renewable energy would constitute approximately 16 percent of China's projected energy consumption by 2020.

[128] Power Generation Regulation, NDRC Energy, 2006

Table 3.2

Energy sources	by 2010	by 2020
Total primary energy supply (TPES)	79 131 PJ	97 008 PJ
Renewable Energy Share of TPES	10%	16%
Total Renewable Energy Consumption	7 913 PJ	15 533 PJ
Hydro	180 GW	300 GW
Wind	5 GW	30 GW
Photovoltaic	3 GW	18 GW
Biomass generation[129]	5,5 GW	30 GW
Solar Water heater	150 million m^2	300 million m^2
Biogas	19 billion m^3	48 billion m^3
Solid biomass fuel	10 million tonnes	50 million tonnes
Bio-ethanol	2,0 million tonnes	10 million tonnes
Bio-diesel	0,2 million tonnes	2 million tonnes
Solar Water heater	150 million m^2	300 million m^2

Source: Xinhua news Agency, October 2006, Zhong Guo Dian Li bao (China Electric Power news), June 2006

Although the Plan has not yet been published, the overall target has been announced publicly on several occasions and most of the components of the Plan (including measures to achieve the target) have been implemented already.

The approach used by the Chinese government for the development of renewable energies and biofuels for transportation focuses on establishing a market through government support and participation of state companies. Previous reforms have served to break the power sector monopoly and create competition within the power market via separation of power generators and utilities.

Under the Kyoto Protocol, China has no obligation to assume binding targets to reduce GHG emissions, but has institutional and reporting obligations.

In June 2007, China took a significant step forward in addressing the risks of climate change with the publication of a new National Climate Change Program (prepared by the National Development and Reform Commission, or NDRC). The Program outlines steps that China will take to meet the previously-announced goals of improving energy efficiency by 20 percent in 2010 over 2005 levels. The Program contains several statements relating to the promotion of renewable energy investment through "government investment, government concession and other measures" and clearly indicates the objective of introducing "the *obligation* of *national electricity grids* and *petroleum sales enterprises* under the Renewable Energy Law to purchase renewable energy products will be implemented". Regarding biomass energy development and utilization, the new National Climate Change Program gives significant importance to bioenergy based power generation, marsh gas, biomass briquette and biomass

[129] Agriculture & Forestry

liquid fuel. It foresees preferential measures in favour of bioethanol and other biomass fuels to promote biomass energy development and utilization to a considerable level.

Given that energy is such a priority, the State Council has appointed an *energy co-ordination task force* under the leadership of the Premier. This task force replaced the Ministry of Energy established in 1988. Renewable energy projects seeking government approval are required to comply with the national and provincial renewable energy plan, and with environmental assessment laws. NDRC oversees the application of government policy and/or funding support for the biomass power generation projects.

Under the institutional framework of China, the central government is responsible for the formulation of the national regulations which guide individual provinces. However, since there are great disparities between various provinces in terms of resource availability and industrial capacity and demand, in some cases provincial governments need to formulate detailed provisions for their area, within the central government's general policy framework.

Moreover, NDRC has recently invited proposals for the construction of 10-15 pilot plants based on non-grain feedstocks. Funding will be based on meeting specific technology and efficiency objectives. All production facilities must continue to sell their ethanol to the state - owned China Petroleum and Chemical Corporation (SINOPEC) or the China National Petroleum Corporation (CNPC).

Among the non-food feedstock the central government is willing to promote the use of cassava, already produced in southern China, as well as sorghum that can be produced nationwide and shows great potential in the country. Significant R&D initiatives have been started, included small scale test ethanol plants using cellulose, like straw.

Ethanol subsidies have been declining and may be phased out entirely by the end of the 11th Five-Year Period.

The policy direction, articulated in a recent NDRC report[130], is to increase demand by requiring ethanol use in State municipalities (Beijing, Shanghai, and Tianjin) and expand supply up to a production capacity of 6 million tonnes a year during the 11th five year, through government sponsored constructing of new ethanol production plants, including one in Guangxi Province (cassava-based) and one in Hubei Province (rice-based). Other proposals for the future detailed in the report includes the spill-over effects on agriculture related industries and the contribution to industrializing agriculture and boosting farmers' income and the development of new technologies and secure environmental conservation.

NDRC Department of Industry plays a central role in promoting expansion of ethanol industry through the coordination of a stakeholder group of industries and other representatives from government and provinces. Although it has initiated research on energy development through the use of biomass, and despite its pertinent role as the coordination point for feedstock

[130] On May 2006 the NDRC Department of Industry presented to the State Council's National energy leading Group an evaluation report of the National Ethanol Programme, from which it emerges a positive evaluation of the results achieved from the 5 year Programme. The report was titled in Chinese "The evaluation of auto ethanol test project and further step on bio-ethanol industries development"

production (both grain-based feedstock and non-grain based (NGB) feedstock), the Ministry of Agriculture does not participate in the NDRC subcommittee on biofuels promotion.

Although the Renewable Energy Law addresses all types of renewable energy, regulations and official support have been focused mainly on solar and wind projects and only recently has the Government given priority to biomass energy projects. Completion of detailed regulations and technical standards for biomass energy grid connection and power purchase as well as biomass utilization is expected in the near future.

Also envisioned is a Fund for Biomass Utilisation and Renewable Energy application in rural regions that could promote small decentralised electricity and heat generation for household applications- to be completed in 2007.

In fact, China has large potential for biomass resources from agriculture and forest residues and large wasteland that could be used for a larger bioenergy development in rural areas, while currently most agriculture residues are burned in the field.

Power Generation

China has announced and was finalizing a revised target for 16 percent of primary energy from renewables by 2020, including large hydro, an increase of 7.5 percent actual share in 2005. Development planning includes technology targets by 2020 of 30 GW of biomass power[131].

According to the new Renewable Energy Law, power grid operators (in addition to fuel and heat network operators and petroleum distributors) who fail to perform the above obligation may incur liability and may even be penalized. Under the “Power Generation Regulation”, power generating enterprises, especially large scale power generating enterprises, are also urged to invest in and fulfil the quota requirements for generating electricity using renewable energy as imposed by the government (but not yet imposed).

Moreover, in areas not covered by a power grid, the Government will fund the construction of independent renewable energy electricity generation systems to provide electricity locally.

The *price support mechanism*[132] established by China’s central government, designed to encourage investors to participate in the market, is based on feed-in tariff systems. The government - NDRC Department of Price - establishes fixed prices at which energy utilities must buy all energy produced by renewable energy enterprises, significantly reducing the time necessary to negotiate power purchase agreements and gain project approvals from Government authorities, thus decreasing transaction costs. Under the Renewable Energy Law, renewable energy prices are determined in accordance with various factors, among others: the characteristics of technology, the varied geographic locations and the need to facilitate the development and utilization of renewable energy on a reasonable commercial basis. Under the

[131] China’s targets are present in a draft renewable energy development plan that is pending approval by the government. The Chinese renewable energy law of February 2005 requires the government to publish the renewable energy development plan, including targets, by January 2006. From RE21 renew global status 2006

[132] Established through regulation on “Pricing and Cost Sharing for Renewable Energy Power Generation” - NDRC Price No.7, 2006)

current arrangement prices established under feed-in tariff laws are not differentiated according to source and technology used.

A *cost-sharing system* has been established targeting all consumers and power grid operators to collectively share the extra costs resulting from the development of renewable energy. In fact, the additional cost that power grid operators have to pay to purchase electricity generated from renewable energy at the tariff set by the government as above calculated, may be added to the price of electricity sold to end-users, by means of a tariff surcharge. The other component of the excess cost is shared by all energy utility companies nationwide and cannot be passed down to consumers. There is not yet any detailed formula to calculate the proportions of the costs to be paid by consumers and utilities respectively. The details of how the cost-sharing revenue will be divided among the 31 provinces, and how the additional costs will be borne by energy utilities, have not yet been clarified.

The *incentives scheme* (currently being drafted) includes *preferential tax treatment* and *financial support* through low interest loans or special purpose grants, or preferential tariff. Renewable energy projects that fall within the description of the Catalogue on Renewable Energy Industrial Development[133] may be entitled to preferential tax treatment and upon satisfying other requirements, funding designated. The exact forms that these schemes will take and the level of incentives which will be provided are not yet known.

Heat Production

No official heat targets exist in China.

The Renewable Energy Law provides regulations also for gas and heat sourced from biomass. The mechanism and incentives described above relate also to heat production from biomass (compulsory grid connection and “punishment and reward” system, the modalities for setting the purchase price).

Transport

The “Renewable Energy Law” obliges petroleum distributors to supply fuel generated from biomass resources into the distribution system only if it complies with relevant technical and quality standards, in accordance with applicable laws and regulations. Although these regulations have not yet been implemented, E10 blending mandates are on a trial period within a National Fuel Ethanol Programme, launched in 2002 in some regions of the Country.

A target of replacing 15 percent of its transportation energy needs through the use of biofuels has been set for 2020. This corresponds with 12 million tonnes and has been announced by the Government together with the plan of setting aside $101.1 billion by 2020 to promote biofuels[134].

[133] Circular on the Catalog Issue for the Guidance on Industrial Development of Renewable Energy by the National Development and Reform Commission (NDRC), promulgated and implemented on November 29, 2005（the Guidance Catalog)
[134] Financial Express October 4th 2006

To ensure development of liquid biofuels, the central government takes an active role in regulating both the supply and demand sides of the biofuel market.

The history of China's bioethanol development can be divided into three main phases: *research and development* of relevant technologies for bioethanol production, accompanied by a period of demonstration (1986-2001); *legislative* infrastructure (2001-2004); and *enforcement*, accompanied by pilot programmes that gradually expand, if successful (2004-present).

In addition to the mandatory obligation, the "Renewable Energy Law" includes a "reward and penalty" system designed to encourage the entire society, particularly companies, to develop and use renewable energy, financially penalizing those companies and individuals that do not meet the obligations as set by law.

China launched its *National Fuel Ethanol Program* in 2002 in five cities throughout China's central and north-eastern region. The sites were chosen for their abundance of maize which, at the time, was overproduced and under-priced. The sum of two billion yuan ($250 million) has been allocated for the five-year programme. In 2004 the trial programme was expanded to seven new provinces and certain cities extending the compulsory use of a 10 percent blend of bioethanol to gasoline (E10) in all those areas. The government planned to expand the E10 program to 27 cities within Shandong, Jiangsu, Hebei, and Hubei from 2006. The type of feedstock used in these ethanol projects is divided as follows: facilities in Heilongjiang, Jilin, and Anhui use corn, while the facility in Henan uses wheat. The Guagxi Xhuang autonomous region plans to build a fuel plant that will use cassava and is scheduled to begin operations in October 2007. The use of potato, sorghum, rice, and lignocelluloses for bio-ethanol production are in the experimental stages. Thanks to a series of incentives, subsidies and tax exemption measures[135] provided by the Programme, China's bioethanol production capacity reached 1,300,000 tonnes in 2006.

While the government has been addressing ethanol for the past twenty years, it only began including *biodiesel* in 2006 in its policy mix. There is no national standard for biodiesel use as a transportation fuel, and currently no national or provincial programmes to promote the use of biodiesel in transportation. Only in December 2006, the government announced that biodiesel made from animal fat or vegetable oil is not subject to consumption tax[136]. Consequently, present production is very limited, ranging between 100,000 and 200,000 MTons, although increased development of biodiesel is expected since the diesel market in China is twice that of the gasoline. The principal difficulty of biodiesel production is the lack of feedstock, resulting from the short supply of edible vegetable oils. China is the largest importer of soybeans and imports significant quantities of other oil-based products. Coupled with the lack of fatty organic matter, the lack of arable land exacerbates the difficulty of biodiesel production.

In May 2006, China took some preliminary steps towards biodiesel promotion by setting up the "Special Development Fund for Renewable Energy Resources" to encourage research, development, and production. Up to that time, only a few small biodiesel plants had been built.

[135] According to the Law Concerning Testing for the Extensive Use of Ethanol Blended Gasoline for Automobiles and the Regulations Concerning the Conduct of Testing for the Extensive Use of Ethanol Blended Gasoline for Automobiles
[136] Xinhua Business Weekly, 2006

Currently, about 80,000 tonne of biodiesel are produced from waste cooking oil. Biodiesel production from jatropha, Chinese pistachio and rapeseed is still in the testing phase. Last year China purchased nearly 3 million tonnes or 75 percent of its total palm oil imports from Malaysia and imported tapioca from Thailand[137]. Rapeseed is a promising oilseed for biodiesel and is a potential source of biodiesel production for China. Biodiesel from animal fats and oils, while a great potential for the future, is not being explored at present probably due to competition with feed demand.

3.4 Results and Future Challenges

Regarding R&D in RES, the national budget quota has been increasing steadily from 53 million yuan in 2001 to 325 million yuan in 2006 with an increased share for bioenergy (although wind and solar have the biggest share).

China has increased its annual production capacity of fuel ethanol to 1.3 million tonnes (2006) thanks to direct funding, preferential tax policies and subsidies provided in National Pilot Ethanol Programme. Through pilot projects running in several regions (northeast China, central China's Henan Province, north China's Hebei Province and east China's Anhui, Shandong and Jiangsu provinces), the government objective is to develop a stable ethanol supply system.

Corn has been used as the major feedstock for producing bioethanol determining an increase in the market demand for corn and consequently an increase of domestic corn price.

Concerned that ethanol fuel production using food crops could affect the food supply problem, the Chinese government has started to restrict production of ethanol from maize at the end of 2006 and announced further subsidies and tax breaks for both biofuel producers and farmers who raise feedstocks other than grains.

In the foreseeable future, the government will dominate ethanol development. Thus, while there are countless small private natural ethanol production plants in China producing food grade alcohol, the four ethanol fuel production plants are all run by state-owned enterprises.

Biodiesel is in the very early phases of testing and development, further development is foreseen thanks to favourable initiatives recently adopted by the Government.

Feedstock availability for biodiesel production is the main barrier to larger production. According to official sources (Director Jia Zhibang of the State Forestry Administration)[138] China plans to grow 13.33 million hectares of forests by 2020 to produce bio-diesel oil and fuels for power generation, and also plans to produce more than six million tonnes of biodiesel oil with materials from the forests and increase the installed capacity of power generation by more than 15 million KW by 2020.

Availability of arable land for biofuel production and food security concerns are the main critical issues for future bioenergy expansion that requires agricultural land, which may not be available in a sufficient amount to support the development of the industry.

[137] Reuters News, 2006
[138] Xinhua News Agency July 17, 2007

The support to electricity production from biomass has derived specially from the Renewable Energy Law, and its implementing regulations about subsidized prices setting and compulsory access to the grid. Although the framework has been set by the Law, a number of major issues still need to be addressed to give full effect to the intent of the Renewable Energy, as the provisions for preferential tax measures, financial incentives and low-interest loans, and the setting of a RES mandatory quota system.

Chinese experience in developing a renewable energy policy is recent and therefore the formulation and implementation of appropriate regulations will take time. Implementation of these regulations will also need to take into account existing support measures at a provincial level, and how the implementation of a national framework law will affect their continued operation.

Unfortunately, as the National Renewable Energy Development Plan containing guidelines for the renewable energy industry has not yet been published, there is still a measure of uncertainty for investors regarding regulations in the field. Detailed regulations on biomass energy grid connection and power purchase as well as biomass utilization are still to be completed.

A first official government review of the Renewable Energy Law was carried out by the NDRC in early 2007. The results of the review, including recommendations from Chinese industry stakeholders, were published on 20 April 2007. The review suggested the following policy measures:

- Implement a renewable portfolio standard as soon as possible to increase market confidence about prices;
- Accelerate the formulation of preferential tax and other fiscal policy;
- Accelerate the formulation and publication of national renewable energy targets and the long-term plan for renewable energy, and formulate and publish specific plans for wind energy, biomass, solar energy and other technologies. The purpose of the plan is to provide a ‘road map’ for development of all sectors in the renewable energy industry. Align policy mechanisms with long-term targets.
- Clarify responsibilities for implementation of renewable energy strategies and policies, both nationally and within each province;
- Clarify responsibilities for resource assessment and initiate data collection projects as soon as possible (with wind and biomass as a priority);
- Increase funding for research and development into high-tech and industrial equipment technology projects in the renewable energy sector;
- Streamline government approvals process to minimize the administrative burden of new project development on project participants.

3.5 Country Policy Table - China

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments		
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area
National Development & Reform Commission (NDRC)	Renewable Energy Law (adopted on 28/02/2005)	Policy- target, incentive, R&D and education	Yes	Industry, bioenergy producers. bioenergy suppliers
National Development & Reform Commission (NDRC)	National Renewable Energy Planning	Activity- targets	No	Industry, bioenergy producers, bioenergy suppliers
Ministry of Finance and NDRC	Bioethanol Programme	Activity- incentives	No	Bioethanol producers
Ministry of Finance	Special Fund for Renewable Energy development	Policy- Incentive, R&D	Yes	Industry, bioenergy producers
NDRC	Climate Change Programme (June 2007)	Activity-Target, Education	No	Industry
National Development & Reform Commission (NDRC)	Renewable Energy Law (adopted on 28/02/2005)	Policy- target, incentive, R&D and education	Yes	Industry, bioenergy producers. bioenergy suppliers
National Development & Reform Commission (NDRC)	National Renewable Energy Planning	Activity- targets	No	Industry, bioenergy producers, bioenergy suppliers
Ministry of Finance and NDRC	Bioethanol Programme	Activity- incentives	No	Bioethanol producers
Ministry of Finance	Special Fund for Renewable Energy development	Policy- Incentive, R&D	Yes	Industry, bioenergy producers
NDRC	Climate Change Programme (June 2007)	Activity-Target, Education	No	Industry

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Bioenergy		Impact on Production Stream			Funding Mechanism
Direct	Indirect	Production	Conversion	Use	
It provides the general framework for promoting the development and use of renewable energy.				It promotes use of biomass for electricity and fuel for transport	
It sets a target of 10 percent and 16% of total power capacity produced by RES (excluding large hydropower) by 2010 and 2020 respectively. This entails 5.5 GW and 30GW of biomass for power generation and other biomass energy use, 2 and 12 million tons biofuels production by 2010 and 2020 respectively.				It promotes use of biomass for electricity and fuel for transport	Incentives by feed in tariff
It provides incentives and subsides for biofuels production		It provides direct subsidies to bioethanol producers			
Provides subsides for the development of all types of renewable energy				Promotes the development and use of bioenergy	
It sets a target of improving energy efficiency by 20% in 2010 over 2005 levels, raising the proportion of renewable energy in the primary energy supply to 10% by 2020. It also provides for education and public awareness on environmental issues. It asks for a stable mechanism for renewable energy investments to be established through government investment, government concession and other measures in order to establish a sustainable and stably market for renewable energy. However, no specific measures are identified				It promotes biomass energy and biofuels development and utilization	
It provides the general framework for promoting the development and use of renewable energy.				It promotes use of biomass for electricity and fuel for transport	
It sets a target of 10 percent and 16% of total power capacity produced by RES (excluding large hydropower) by 2010 and 2020 respectively. This entails 5.5 GW and 30GW of biomass for power generation and other biomass energy use, 2 and 12 million tons biofuels production by 2010 and 2020 respectively.				It promotes use of biomass for electricity and fuel for transport	Incentives by feed in tariff
It provides incentives and subsides for biofuels production		It provides direct subsidies to bioethanol producers			
Provides subsides for the development of all types of renewable energy				Promotes the development and use of bioenergy	
It sets a target of improving energy efficiency by 20% in 2010 over 2005 levels, raising the proportion of renewable energy in the primary energy supply to 10% by 2020. It also provides for education and public awareness on environmental issues. It asks for a stable mechanism for renewable energy investments to be established through government investment, government concession and other measures in order to establish a sustainable and stable market for renewable energy. However, no specific measures are identified				It promotes biomass energy and biofuels development and utilization	

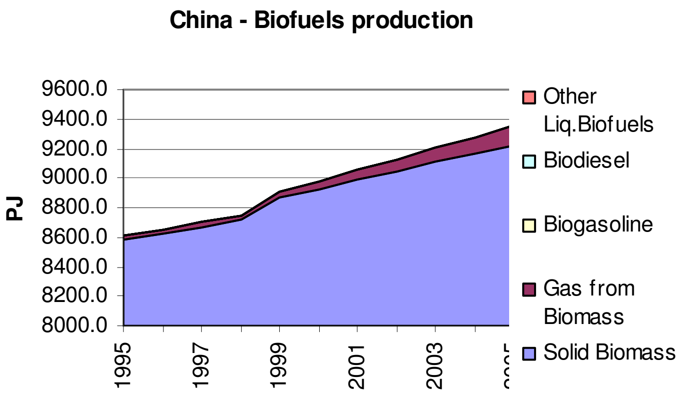
3.6 China Bioenergy Outlook

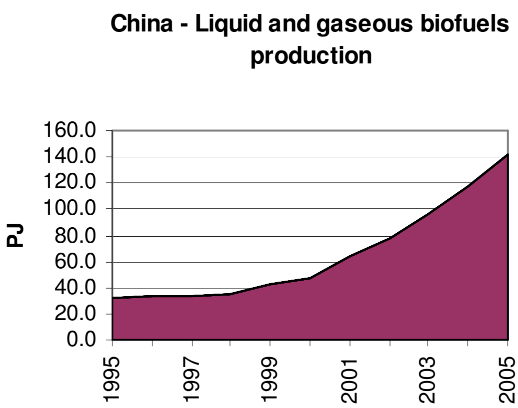
Table 3.3 - China – Biofuel production

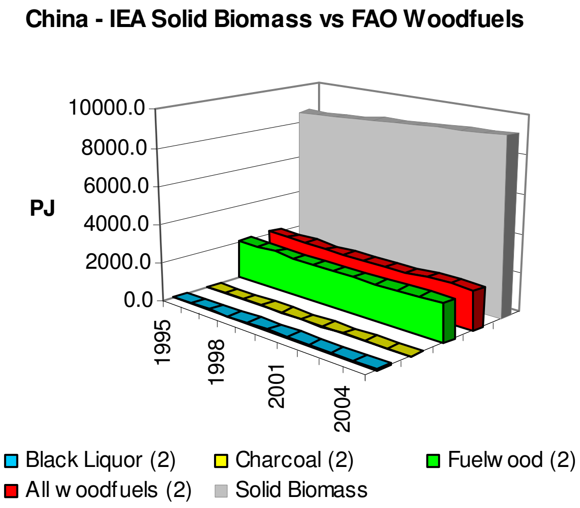
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Biofuels	8610.1	8656.0	8703.0	8750.3	8905.6	8973.2	9052.6	9127.0	9201.9	9276.8	9360.1
Solid Biomass	8578.4	8622.8	8669.0	8715.5	8863.6	8925.7	8988.2	9048.6	9105.1	9159.9	9218.9
Gas from Biomass	31.7	33.2	34.0	34.8	41.9	47.6	64.5	78.4	96.8	116.9	141.2
Biogasoline											
Biodiesel											
Other Liq.Biofuels											
All woodfuels (2)	2116.9	2080.4	2097.1	1966.9	1997.6	1998.8	2006.0	2006.0	2034.6	2054.5	2054.5
Fuelwood (2)	2085.0	2060.3	2063.8	1933.2	1933.2	1931.8	1932.9	1932.8	1959.9	1979.8	1979.8
Charcoal (2)	0.9	1.2	1.5	1.5	1.5	2.3	1.7	1.7	3.2	3.3	3.3
Black Liquor (2)	31.0	18.9	31.7	32.2	62.9	64.8	71.4	71.4	71.4	71.4	71.4

Production growth (%)											
Solid Biomass											
Gas from Biomass											
Biogasoline											
Biodiesel											
Other Liquid Biofuels											

(2) = Based on FAO data







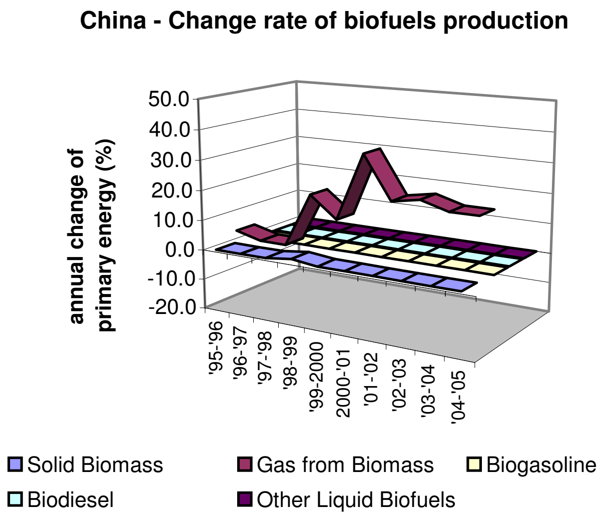


Table 3.4 - China – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.7	0.7	0.4	0.8	0.8	1.1	1.1	0.9	1.1	1.3	1.8	
Fuelwood (2)	0.6	0.7	0.4	0.7	0.7	0.4	0.2	0.3	0.3	0.4	0.2	
Charcoal (2)	0.1	0.0	0.0	0.1	0.1	0.8	1.0	0.7	0.8	1.0	1.6	

(2) = Based on FAO data

Table 3.5 - China – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	1.1	1.2	1.6	1.6	1.4	2.6	3.2	3.3	3.5	2.2	1.4	
Fuelwood (2)	0.3	0.2	0.2	0.1	0.2	0.0	0.1	0.1	0.2	0.1	0.2	
Charcoal (2)	0.8	1.0	1.4	1.4	1.2	2.5	3.0	3.2	3.3	2.1	1.2	

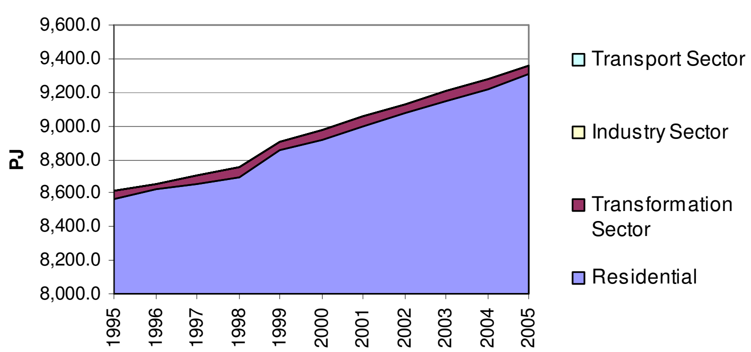
(2) = Based on FAO data

Table 3.6 - China – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	8,611.7	8,657.7	8,704.7	8,752.0	8,907.3	8,975.0	9,054.4	9,128.8	9,203.7	9,278.6	9,361.9	
	Transform.	48.6	29.8	49.3	53.9	54.8	55.2	55.6	56.0	56.4	56.8	57.1	
	Industry												
	Transport												
	Residential	8,563.	8,627.	8,655.	8,698.	8,852.	8,919.	8,998.	9,072.	9,147.	9,221.	9,304.	
Solid Biomass	Dom. Supply	8,580.0	8,624.5	8,670.7	8,717.2	8,865.3	8,927.4	8,989.9	9,050.3	9,106.9	9,161.7	9,220.7	
	Transform.	48.6	29.8	49.3	53.9	54.8	55.2	55.6	56.0	56.4	56.8	57.1	
	Industry												
	Transport												
	Residential	8,531.	8,594.	8,621.	8,663.	8,810.	8,872.	8,934.	8,994.	9,050.	9,105.	9,163.	
Gas from Biomass	Dom. Supply	31.7	33.2	34.0	34.8	41.9	47.6	64.5	78.5	96.8	116.9	141.2	
	Transform.												
	Industry												
	Transport												
	Residential	31.7	33.2	34.0	34.8	41.9	47.6	64.5	78.5	96.8	116.9	141.2	
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

China - Sectors of biofuels consumption



4 Country Profile - FRANCE

4.1 Overview

In 2005 the primary energy supply in France was measured at 11 555.5 PJ of which biomass contributed 422.8 PJ. Renewable Energy Sources (RES) comprises around 14 percent of the total electricity consumption; the production from solid biomass was 1.698 TWh in 2004 and 1.774 TWh in 2005, showing an increase of +4.5 percent.

The heat sector is responsible for the utilization of more than half of the primary energy consumption: the current production of heat from RES amounts to approximately 418.7 PJ while biomass forms the main renewable source with a consumption of 350 PJ.

Liquid Biofuels: France produced about 570 000 tonnes of biodiesel (Fatty Acid Methyl Ester - FAME) in 2006, with a related production of 730 000 tonnes of "seed cake" and 57 000 tonnes of glycerin; 70,000 tonnes of ethanol from wheat (88,000 tonnes of DDGs - Dried Distillers Grains with Solubles), 165,000 tonnes of ethanol from sugar beet (and 115,000 tonnes of feed by-products, 74,000 tonnes of liquid by-products).

This biofuel consumption has represented 1.76 percent of the total fuel consumption in transport in 2006.

Table 4.1– [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	52%	6%	4%
11 554	6 000	697	501

Source: IEA, 2005

4.2 Country Objectives and Drivers

Bioenergy policies in France are driven by three main objectives:

- prevention of Global Warming (reduction of GHG emissions);
- reduction of energy imports;
- development of rural areas;
- improvement of farm incomes and job creation fostering a new industry.

4.3 Bioenergy Policy by Subsector

There are several Policies contributing to create a framework for the development of bioenergy in France as the 2005 Energy Law ("Loi de programme fixant les orientations de la politique énergétique" 2005-781), the 2006 Agriculture Law ("Loi d'orientation agricole" 2006-11), and the Multi-annual Plan for the electricity production for the years 2005-2015. Moreover, financial incentives are included, year by year, in the Financial Law.

To develop new process and sources of bioenergy, different programmes of calls for proposals for innovative or R&D projects have been implemented:

- The *National Research Programme on Bioenergy* that finances R&D projects at 8 M€ per year;
- The calls for proposals organized in the framework of Competitiveness Poles, for innovative industrial projects;
- The *French agency for industrial innovation* (AII) that attributes subsidies and special credits for big bio-refinery projects.

The responsibilities for the development of Bioenergy are shared between the Ministry for Ecology and Sustainable Planning and Development, Ministry for the Economy Finance and Employment and the Ministry for Agriculture and Fisheries

Power Generation

The 2005 Energy law sets, in article 4, a *production of electricity from renewable sources of 21 percent by 2010*, compared to 14 percent in 2005.

The 2005 Energy law also requests the revision of the "Multi annual Plan for Electricity Investment". This document was published in 2006 and sets for electricity made from biomass a target of 1.000 MWe by 2010. To reach this target, two main instruments are implemented:

- Feed-in tariffs for biogas and biomass projects:
  - *Biogas tariff* (increased in 2006): 7.5 to 9 c€/kWh + 2 c€ co-digestion + 0 to 3 c€ for CHP (energy efficiency)
  - *Biomass tariff* (for combustion plants projects <5MW): revision in discussion (currently 5 c€/kWh)
- A system of call for tenders for biogas and biomass projects >5MWe:
  - One call for tender has been concluded in 2005: 15 projects (including 1 of biogas) has been selected, for 200 MWe.
  - A second call for tender has been launched at the end of 2006 for 300 MWe for CHP projects. The selection phase is not concluded yet.

Heat Production

The 2005 Energy law sets, in article 4, an *increase of heat production from renewable sources of 50 percent by 2010* (compared to 2004) and requests, in article 50, the publishing of a "Multi annual Plan for Heat Investment". This document has been developed, although not yet published, and shows that in a business-as usual scenario, the objective of +50 percent of RES heat should be reached between 2010 and 2015.

Biomass is the main source of RE for heat production representing 92 percent of RES heat in 2005. This proportion should remain important in the future with a 90 percent in 2010 and with a 84.5 percent in 2015.

The main instruments to favor biomass heat are the following:

- Reduced VAT (value added tax) of 5.5 percent for the renewable heat sold to collective grids;
- Public Support for collective biomass boilers (through the ADEME – Agence pour l'environnement et la maîtrise de l'énergie);
- Income-tax credit for inviduals that buy efficient boilers.

In order to develop efficient conversion process, CHP projects are fostered.

Transport

France, as all the EU Member States, has a voluntary target derived by the Directive 2003/30/CE setting a *minimum blend of biofuels* into the fuel placed to the market. Nevertheless, with the 2006 Agriculture Law the French Government established more stringent, even if not binding, targets (*5.75 percent by 2008, 7 percent by 2010 and 10 percent by 2015*).

Those targets, through the utilization of 2 Mha of land (1.6 Mha of rapeseed and sunflower; 0.25 Mha of wheat; 0.05 Mha of sugar beet), will drive the production of biofuel up to 3.5 Mt (80 percent from Biodiesel) and the construction of 20 new bio-refineries, with an expected creation of 25,000 new job posts.

To reach these targets, an incentive tax system based on two main instruments has been implemented:

1. The first is a *fuel tax rebate* which is granted to eligible producers of bioethanol and biodiesel. Indeed, since 1992, the annual Financial Law has established a partial exemption for biofuels. In particular the reduction of TIC (Taxe Intérieure de consommation) is authorized for certain biofuels plants after a European Tender. In 2006 the exemption was 0.33 €/hl for ethanol; 0.25 €/hl for FAME and synthetic biodiesel, 0.30 €/hl for Fatty Acid Ethyl Ester (FAEE).
2. The second instrument is an "*additional tax*" (Taxe Générale sur les Activités Polluantes – TGAP) which is *due by suppliers that do not comply with the national target* set by the law. This additional tax acts as a penalty for the fuel suppliers who do not incorporate enough biofuels into road fuels. This instrument has been introduced by the financial law for 2005.

4.4 Results and challenges

In the last years the French Government made significant steps forward for the development of the bioenergy sector: the development of a multi annual plan for electricity production that sets an increase of electricity produced by bioenergy up to 1000 MWe by 2010 and the system of incentives put in place to facilitate the reaching of the target, together with the establishment of biofuels blend targets linked to biofuels tax exemption and fines for not complying are driving a significant increase in bioenergy production (in 2004, 300,000 hectares were used for production of biofuels compared to the 766,000 hectares in 2006 and with a trend that should arrive at 2 millions Hectares in 2010).

For heat production from bioenergy, the incentives put in place do not seem to be sufficient to meet the 50 percent increase target established by the 2005 Energy Law. However, this target should be reached before 2015.

4.5 Country Policy Table - France

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments		
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area
EU	Regional Incentive for Agriculture: in accordance with EU Common Agricultural Policy (CAP) regulation CE n.1973/2004 and n. 660/2006.	EU policy - Incentives		Farmers
EU	Agricultural European fund for rural development	Policy (Direct aid)		Farmers and foresters
Ministry of Energy	Energy act	Not binding targets		Industries and individuals
Ministry of Finance		Incentive		Industries and individuals
Ministry of Finance		Incentive		Industries and individuals
Ministry of Finance		Incentive		Producers/suppliers
ADEME: Environment and Energy use Agency	Environmental protection and development of renewable energy	Incentive		Industries, farmers, local authorities
Ministry of the Environment, Water and Physical Planning	Rural excellence poles	Incentive		Industries, farmers, foresters
Ministries of finance, industry, environment, agriculture and interior affairs	Competitiveness pole	R&D		Industries, SME research and development
ADEME: Environment and Energy use Agency	National programme of research on bioenergies	R&D		Industries, Research Institutes, Universities

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.

Impact on Bioenergy		Impact on Production Stream			Funding Mechanism
Direct	Indirect	Production	Conversion	Use	
	(Agriculture) EU Directive originally provided a bonus to farmers for the retirement of agricultural land due to the mass production of agricultural goods in the EU. This act allows farmers to cultivate retired lands with energy crops. Additionally, it provides a bonus of 45 Euros per Hectare to farmers who produce energy crops on non-retired agricultural lands. Incentive is capped at 1.5 million hectares.	Promotes production of energy crops through financial incentives			
This aid could finance investments related to renewable energies	This aid could finance the implementation of training programmes on renewable energy, the service roads and forestry development				Instituted and partly financed by the European Commission
			Call for tender covering the electricity production produced from biomass, Obligation to purchase the electricity produced from biomass, Energy saving certificates		Consumers and producers of energy
VAT reduction for the subscription to the network for heat supply made from biomass. VAT reduction on wood energy supply				Incentive to use of biomass energy	State Budget
				Income tax rebate for the acquisition of certain equipment using biomass	
Partial exemption of the internal tax on fuels for biofuels and blending obligation for fuel suppliers				Stimulation of biofuel production thanks to tax incentives	State Budget
Incentive to the development of local biomass channels					State Budget
Incentive to the development of local biomass channels					
Calls for proposals for industrial development projects (including for bioenergies)	Stimulation of research and of development (Increase in competitiveness, new outlets, etc.)				
Calls for proposals for innovative research and development projects (between companies and research and development centers)	Stimulation of research and development (Increase in competitiveness, new outlets, etc.)				

"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). "Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

4.6 France Bioenergy Outlook

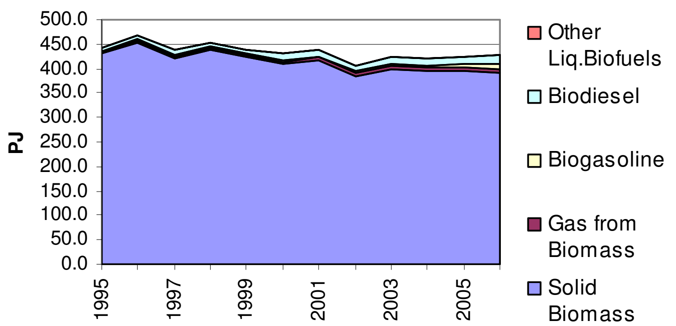
Table 4.2 - France – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	440.4	467.1	437.8	452.6	439.3	429.4	436.7	407.2	422.4	421.5	423.9	429.0
Solid Biomass	429.8	453.2	421.7	437.2	422.9	408.6	415.4	383.2	397.0	395.1	394.8	390.1
Gas from Biomass	3.4	3.5	3.6	3.6	4.0	6.1	6.7	8.3	8.5	8.7	8.7	9.5
Biogasoline	1.4	2.2	3.0	3.5	3.3	3.3	3.3	3.3	2.8	2.9	4.2	8.4
Biodiesel	5.8	8.2	9.5	8.3	9.1	11.4	11.4	12.4	14.2	14.9	16.2	21.0
Other Liq.Biofuels												
All woodfuels (2)	169.3	166.6	163.0	103.0	102.4	105.0	102.8	104.1	95.0	97.7	103.6	
Fuelwood (2)	123.9	124.2	115.5	55.9	57.5	59.1	59.2	60.6	56.0	57.7	62.8	
Charcoal (2)	2.4	2.2	2.1	3.4	3.4	1.8	1.8	2.2	1.5	1.6	1.6	
Black Liquor (2)	43.0	40.1	45.3	43.6	41.5	44.0	41.8	41.3	37.5	38.4	39.2	

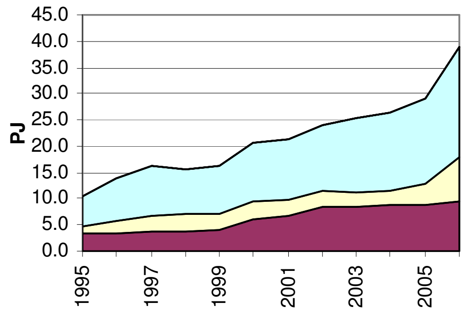
Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	5.4	-7.0	3.7	-3.3	-3.4	1.7	-7.8	3.6	-0.5	-0.1
Gas from Biomass	1.5	4	-1.2	11.2	53.0	9.8	24.9	1.9	2.1	0.7
Biogasoline	57.9	38.3	18.1	-7.1	2.2	-2.2		-15.4	5.2	44.4
Biodiesel	41.8	15.7	-12.4	9.1	25.0		9.0	14.7	4.8	9.2
Other Liquid Biofuels										

(2) = Based on FAO data

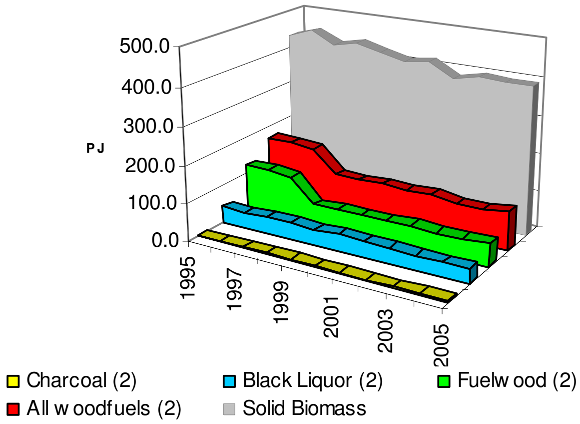
France - Biofuels production



France - Liquid and gaseous biofuels production



France - IEA Solid Biomass vs FAO Woodfuels



France - Change rate of biofuels production

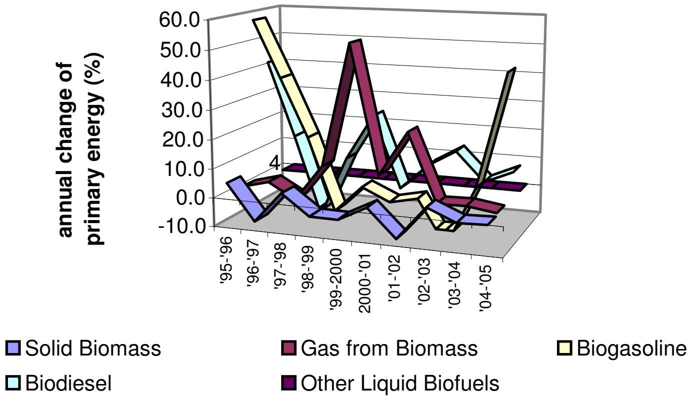


Table 4.3 - France – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels				0.2	0.2	0.3	0.4					
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel				0.2	0.2	0.3	0.4					
Other Liquid Biofuels												
All woodfuels (2)	2.3	2.8	3.1	3.3	3.1	3.8	3.1	3.3	4.4	5.5	6.2	
Fuelwood (2)	1.6	2.0	2.3	2.0	2.4	2.9	2.1	2.5	3.1	4.0	4.6	
Charcoal (2)	0.7	0.7	0.9	1.3	0.8	0.9	1.0	0.8	1.3	1.5	1.6	

(2) = Based on FAO data

Table 4.4 - France – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels								0.7	2.0	2.6	2.3	-0.5
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel								0.7	2.0	2.6	2.3	-0.5
Other Liquid Biofuels												
All woodfuels (2)	9.3	8.2	8.5	9.2	9.9	10.1	9.0	10.4	10.8	10.7	11.2	
Fuelwood (2)	8.7	7.7	7.9	8.6	9.3	9.6	8.5	9.9	10.3	10.1	10.6	
Charcoal (2)	0.7	0.6	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.6	0.5	

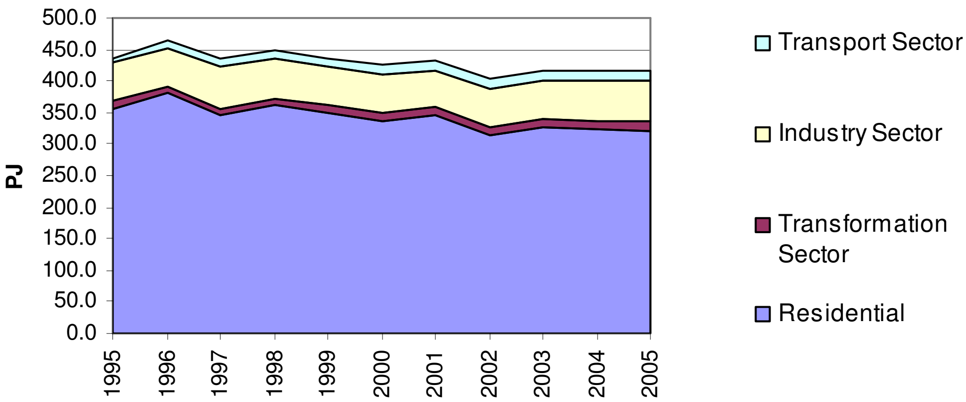
(2) = Based on FAO data

Table 4.5 - France – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	*440.5*	*467.2*	*437.8*	*452.9*	*439.6*	*429.8*	*437.2*	*406.6*	*420.5*	*419.0*	*421.7*	*429.7*
	Transform.	11.1	11.1	12.3	11.9	11.6	13.5	13.3	14.7	15.1	15.2	15.5	
	Industry	61.9	60.4	64.4	64.3	61.1	60.8	58.3	59.7	60.8	62.0	63.7	
	Transport	7.2	10.7	13.6	11.8	12.6	14.9	14.7	15.4	14.2	15.4	17.7	
	Residential	356.6	381.5	344.8	360.9	350.5	336.3	346.6	313.0	325.6	322.5	320.3	
Solid Biomass	Dom. Supply	429.9	453.3	421.7	437.3	423.0	408.7	415.5	383.2	397.0	395.2	394.8	390.2
	Transform.	10.3	10.4	11.5	11.1	10.5	10.6	9.7	9.7	9.9	9.9	10.1	
	Industry	61.4	59.8	63.8	63.6	60.4	60.1	57.5	58.8	59.9	61.0	62.7	
	Transport												
	Residential	356.6	381.5	344.8	360.9	350.5	336.3	346.6	313.0	325.6	322.5	320.3	
Gas from Biomass	Dom. Supply	3.4	3.5	3.6	3.6	4.0	6.1	6.7	8.3	8.5	8.7	8.8	9.5
	Transform.	0.8	0.8	0.8	0.8	1.1	3.0	3.6	5.0	5.2	5.3	5.4	
	Industry	0.5	0.6	0.7	0.7	0.7	0.7	0.7	0.8	0.9	1.0	1.0	
	Transport												
	Residential												
Biogasoline	Dom. Supply	1.4	2.2	3.0	3.5	3.3	3.3	3.3	3.3	2.8	2.9	4.2	8.4
	Transform.												
	Industry												
	Transport	1.4	2.2	3.1	3.6	3.3	3.3	3.0	3.2	2.7	2.9	3.9	
	Residential												
Biodiesels	Dom. Supply	5.8	8.2	9.5	8.6	9.3	11.7	11.7	11.7	12.2	12.3	13.9	21.5
	Transform.												
	Industry												
	Transport	5.8	8.5	10.5	8.3	9.3	11.7	11.7	12.2	11.5	12.6	13.8	
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

France - Sectors of biofuels consumption



5 Country Profile - GERMANY

5.1 Overview

In Germany more than two-thirds of renewable energy generation comes from bioenergy, followed by wind power, and hydro-electricity power.

In 2006, bioenergy contributed 4.3 percent to the coverage of the total primary energy demand in Germany. The bulk of the energy derived from biomass is for heat generation (58 percent in 2006). Bioenergy met 3.3 percent of the electricity requirements, 5.7 percent of the heat requirements, and 6.3 percent of the fuel requirements in 2006.

In 2005, the percentage of biogenic fuels in the total fuel consumption totaled 3.6 percent, rising to 6.6 percent in 2006 (excluded ships, railroad and airplanes). Biodiesel is currently used most commonly as pure fuel (as opposed to being used in a blend as is common in other countries). However, since 2004 blending with fossil diesel has increased. The annual production capacity of biodiesel currently amounts to almost 5 million tonnes. In the ethanol sector, three large plants, alongside smaller plants, are already producing bioethanol at an annual capacity of ca. 500 000 tonnes.

In 2006, energy crops were grown on approx. 1.6 million ha (13 percent of the arable land in Germany), including around 1.4 percent million ha for energy recovery. About 276 600 ha were used for the production of materials.

In Germany, an estimated 91 600 jobs are currently linked to the bioenergy industry. Of the total of €22.9 billion of domestic turnover achieved by the renewable energies sector, the bioenergy field accounted for around €9.1 billion (40 percent) in 2006.

Table 5.1– [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	62%	5%	3.5%
14 434	8 979	700	510

Source: IEA, 2005

5.2 Country Objectives and Drivers

The goals of the German energy policy as outlined in a recent energy summit are to ensure energy security, competitiveness and environmental sustainbility, including climate stability.
At National level, the following support schemes or regulatory framework should be pointed out in connection with the use of renewable resources and climate change:

- Energy Tax Act
- Biofuels Quota Act
- Renewable Energies Act
- Market Incentive Programme for Renewable Energies

- Renewable Resources Funding Programme
- Market Introduction Programme for Renewable Resources

5.3 Bioenergy Policy by Subsector

Power Generation

- *Renewable Energy Act:* Increases the proportion of renewable energy in Germany's electricity supply to 12.5 percent by 2010, 20 percent by 2020, and improved the funding condition for this activity. In particular, the funding that has been improved since 2004 has resulted in a substantial increase in feeding into the grid of electricity generated from biomass.
- The Renewable Energy Act replaced the Electricity Feed Act in the promotion of large-scale generation of electricity from all kinds of renewable energy sources. Under this new Act, grid operators shall be obliged to connect to their grid installations to purchase electricity from renewable sources as a priority, and to compensate the suppliers of this electricity. This obligation shall apply to the grid operator whose grid is closest to the location of the electricity generation installation, providing that the grid is technically suitable to feed in this electricity. The Renewable Energy Act will be amended in 2008, adding sustainability standards for bioenergy, increasing the feed-in tariffs for smaller-scale biogas plants.

Heat Production

- Market Incentive Reform Programme: This program was established in conjunction with the Environmental Tax Reform to exploit renewable energy sources for the production of heat and reduce GHG emissions.
- General Fund for Renewable Energy Sources (RES): Provides direct subsidies for the installation of biomass plants for heat production smaller than 100 kW: €52 per kW, maximum of €2046 per installation; and loans with special interest rates for the installation of biomass plants for heat production larger than 100 kW; installation or extension of biogas plants for the energetic use of agricultural waste products; and installation of biomass plants for combined heat and power production.
- The Renewable Heat Act is under discussion in the Parliament with CO_2 objectives of 40 percent reduction by 2020.

Transport

- *The Biofuel Quota Act*: Imposes requirements on fuel suppliers to sell a minimum quota of biofuels and offers tax privileges (through 2012) for blended biofuels sold above the quota and tax privileges (through 2015) for E-85 and Second Generation Biofuels used for transport. Biofuels used for agriculture remain tax-exempt. The quota can be met either by mixture or pure fuels. This regime envisages the meeting of a total energy quota of 6.75 percent for 2010, which is set to rise to 8 percent by 2015.

- The *Biofuel Quota Act* confers the authorization to tie the proof of quota exhaustion to such biofuels that:
  - verifiably meet specific requirements for a sustainable management of farmland in the production of biomass; and
  - meet specific requirements for the protection of natural habitats; and
  - show a specific potential for CO_2 cutbacks.
- *Energy Tax Act:* Makes use of EU Directive 2003/96/EC to provide tax relief for biofuels and bio-heating fuels produced from biomass and imposes mandatory biofuel blending targets (Biodiesel 4.4 percent, Bioethanol 2 percent; full taxation for biofuels within the quota: Biodiesel 47 ct / l Bioethanol 65 ct/l; a system of tradable biofuel credits and tax exemptions for biofuels above the quota until 31 Dec. 2009.
- *Vegetable Oil Quality Standard:* Sets the quality standards for vegetable oils to be used as fuels. It will be amended according to the EU Fuel Quality Directive (end of 2007).
- *Federal Pollution Prevention Act:* Lays down the first quality requirements for biodiesel as fuel and establishes targets for GHG emissions reduction in end-use biodiesel.

5.4 Results and Challenges

In 2005, the ruling coalition of the federal government committed itself in the coalition agreement to an energy policy geared to sustainability criteria (see Section 2.4 for more on sustainability standards and criteria development). The following targets are in the process of being implemented:

- By 2010, the share of renewable energies in electricity generation should rise to at least 12.5 percent and to at least 20 percent by 2020;
- Double the share of renewable energies of the total energy consumption by 2010, increase of 20 percent by 2020, and then increase it continuously along the lines of the National Sustainability Strategy;
- Substantial rise in the share of biomass in primary energy consumption in the medium-term perspectives; and
- Boost the share of biofuels in the total fuel consumption to 10 percent by 2020.

According to the commitments detailed in the coalition agreement, the introduction of a new instrument to step up the use of heat generated from renewable resources is under examination. Proposals have been made for a so-called “Regenerative Heat Act”, ranging from an investment cost model to a feed-in model along the lines of the Renewable Energies Act or the exhaustion of untapped biomass potential.

Following up on the EU biomass Action Plan, the federal government will present a national *Biomass Action Plan* this year that will highlight the strategic orientation of the future use of bioenergy, and the concrete need for action. This plan will provide for the efficient and sustainable expansion of the production of electric power, heat and fuels. A *German Research Centre for Biomass* (BDFZ) will be established in Leipzig and will be expanded into a center of excellence for bioenergy research. The BDFZ is to perform the task of carrying out practical research and development in the field of the energy exploitation of agricultural and forestry biomass, and shall assume a leadership in science role. The research activities will range from conditioning to conversion into electric power, heat, and fuels.

The federal government considers general policy conditions for trade necessary when it comes to the import of biomass and biofuels. These conditions should take into account both the need for a further liberalization of global trade as well as the target of a further expansion of biofuel production in Germany, and in the EU. The federal government is working to draw up sustainability standards and a certification system that would be applied equally to domestically produced bioenergy as well as imported bioenergy in an effort to assure sustainable production without creating trade barriers.

5.5 Country Policy Table - Germany

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
	Energy Tax Act (Amended) (Energiesteuergesetz)	Legislation - Incentive/Targets	Yes	Suppliers	Makes use of EU Directive 2003/96/EC to provide tax relief for biofuels and bioheating fuels produced from biomass and imposes mandatory biofuel blending targets (Biodiesel 4.4%, Bioethanol 2 %; full taxation for the biofuels within the quota: Biodiesel 47 ct / l Bioethanol 65 ct/l; a system of tradable biofuel credits and tax exemption for biofuels above the quota until 31st of Dec. 2009.	
Federal Ministry of Food, Agriculture, and Consumer Protection	Vegetable Oil Quality Standard (DIN 51605)	Legislation - Criteria	Pending	Producers	Sets the quality standards for vegetable oils to be used as fuels.	
Federal Ministry of Food, Agriculture, and Consumer Protection	100 Tractor Program	Activity - Research and Development	No	Farmers / Industry		(Agriculture) To develop a tractor engine design that will run on pure vegetable oil and meets the latest emissions standards.
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Federal Pollution Prevention Act - Tenth Ordinance	Legislation - Targets	Yes		Lays down the first quality requirements for biodiesel as fuel.	
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Renewable Energy Act (Erneuerbare - Energien - Gesetz) (EEG)	Legislation - Targets and Incentives	Yes	Suppliers	Increases the proportion of renewable energy in Germany's electricity supply to 12.5% by 2010, 20% by 2020, and improved the funding condition for this activity.	
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Market Incentive Reform Programme	Activity - Incentives	Yes	Suppliers / Industry		(Environment) This program was established in conjunction with the Environmental Tax Reform to exploit renewable energy sources for the production of heat and reduce GHG emissions.
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Federal Emission Control Act (Bundesimmissions-schutzgesezt) (Sections 1,2,4,9,17)	Legislation - Guidelines and Standards	Yes	Industry / Development		(Environment) Designed to promote practices for human beings, animals, plants, soils, water, the atmosphere, as well as other cultural assets and material goods that reduce harmful effects on the environment.
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Closed Substance Cycle and Waste Management Act (1994) (Kreislaufwirtschafts - und Abfallgesetz)	Legislation - guidelines	Yes	All Sectors		(Environment) Supports a "closed substance cycle" in order to preserve natural resources and secure ecological waste disposal - gives distinction between "waste for disposal" and "waste for recovery."

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Promotes the use of biofuels and bioheating fuels from biomass. Energy Tax Act (energiesteuergesetz) enacted in 2007 to tax biofuels from vegetable oils to balance overcompensations detected in the Petroleum Act of 2004. Implements a graduating tax scale for blended and unblended fuels from 0 cents per litre for pure plant oil to .45 cents per litre for blended biodiesel through 2012.		biogenic fuels and biofuels blended with fossil fuels are exempt from this tax incentive
		Standard designed to promote use and fault-free operation of farm tractors on vegetable oil based fuels.		
Develops opportunities for research and data collection to reduce GHG output during the production of agricultural crops.				
	Sets targets for reduction of GHG emissions in end-use biodiesel.			
	Creates incentive for electricity produced from cheap non-agricultural and non-forestry biomass and establishes a bonus program of 2 to 6 cents per kilowatt hour (cent/kWh) for electricity generated from agriculture and forestry biomass (i.e. energy crops or slurry).			
	Provides grants and loans to promote the expansion of heat production from biomass, solar, and geothermal energy.		Government set asides totaling approximately 745 Million Euros has generated market interest and increased investment volume to over 5 Billion Euros	
Develops standards and practices that would be replicable in the production of energy crops				
		Redefines the categories of waste products for disposal and waste product for recovery - further delineating the definitions provided by the EU Directive		

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Federal Forestry Act (Bundeswaldgesetz)	Legislation - guidelines	Yes	Industry / Farming		(Environment) Regulates timber supplies and safeguards forestlands and woodlands from cultivation for agricultural and energy purposes.
	State Forest Act - Westphalia (Forstgesetz)	Legislation - guidelines	Yes	Industry / Farming		(Environment) State level legislation to promote environmental practices for cultivation of forests that preserve soil and supply with a focus on use of forestry biomass for fuel, wood and charcoal burners.
Federal Ministry of Food, Agriculture, and Consumer Protection	Plant Protection Act (Pflanzenschutzgesetz)	Legislation - Targets	Yes	Industry / Farming		(Environment) Promotes more stringent regulations governing "plant protection agents" (fertilizers, pesticides); promoted shift to use of more biodegradable-eco friendly products and more selective implementation regimens.
Federal Ministry of Food, Agriculture, and Consumer Protection	Programme for the Retirement of Agricultural Land (Flachenstillegungsprogramme)	Activity - Incentives		Farmers / Industry	Originally provided a bonus to farmers for the retirement of agricultural land due to the mass production of agricultural goods in the EU. Act shifted in 1993 to also provide a bonus to farmers for the production of renewable energy crops in lieu of retiring agricultural lands.	
Ministry of Economics and Technology	General Fund for Renewable Energy Sources (RES) (Richtlinie zur Förderung von Maßnahmen zur Nutzung erneuerbarer Energien - Marktanreizprogramm zur Nutzung erneuerbarer Energien)	Activity - Incentive/Targets		Industry	Provides direct subsidies for the installation of biomass plants for heat production smaller than 100 kW: 52 € per kW, maximum of 2046 € per installation; and loans with special interest rates for the installation of biomass plants for heat production larger than 100 kW; installation or extension of biogas plants for the energetic use of agricultural waste products; and installation of biomass plants for combined heat and power production.	
Federal Ministry for the Environment, Nature Protection, and Nuclear Safety	Biofuels Quota Act 2007 (Biokraftstoffquotengesetz)	Activity - Incentive/Targets	Yes	Suppliers	Imposes requirement on fuel suppliers to sell a minimum quota of biofuels and offers tax privilege (through 2012) for blended biofuels sold above the quota and tax privilege (through 2015) for E-85 and Second Generation Biofuels used for transport. Biofuels used for agriculture remain tax-exempt.	

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Regulates the supply of forestry biomass usage and forestry land use to mitigate the environmental impact of crop development and promote sustainability of forestry products and lands.				
Reduced the environmental impacts of farming practices and provides positive outputs for soil and water quality.				
Promotes the use of agricultural land previously retired by EU Directive and promotes the development of energy crops on these lands.				
	Provides direct subsidies for the installation of biomass plants for heat production smaller than 100 kW: 52 € per kW, maximum of 2046 € per installation; and loans with special interest rates for the installation of biomass plants for heat production larger than 100 kW; installation or extension of biogas plants for the energetic use of agricultural waste products; and installation of biomass plants for combined heat and power production.		Government earmarked funds totalling over 265 Million Euros (1994-2003).	
Sets blending targets and increases minimum share of biofuels to 6.75% by 2010 and 8% by 2015 in				

biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

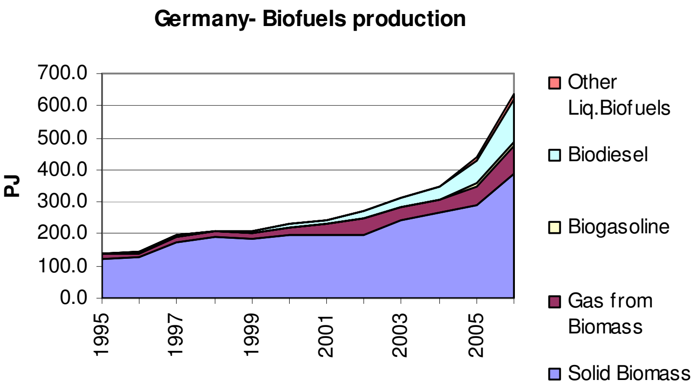
5.6 Germany Bioenergy Outlook

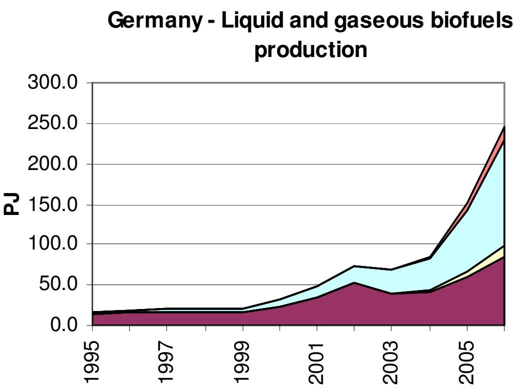
Table 5.2 - Germany – Biofuel production

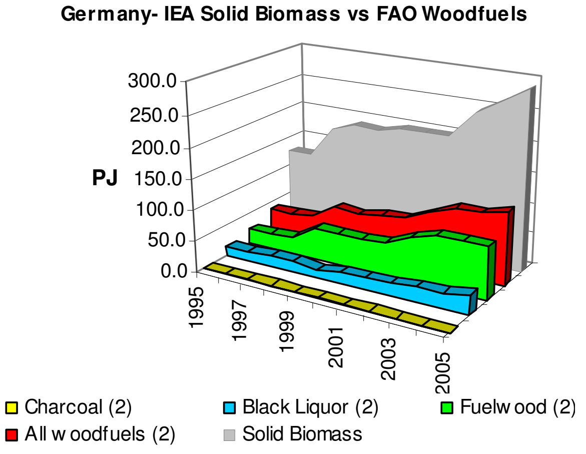
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	139.2	142.8	195.1	210.3	206.6	229.0	245.6	270.7	312.4	348.2	440.5	635.2
Solid Biomass	124.0	125.3	175.4	190.1	186.5	196.4	197.2	196.8	243.1	264.5	289.1	389.9
Gas from Biomass	13.9	15.4	16.4	16.5	15.2	23.3	35.3	53.2	38.7	42.0	60.0	85.2
Biogasoline										1.7	7.0	12.9
Biodiesel	1.3	2.0	3.4	3.7	4.8	9.3	13.0	20.5	29.8	39.1	74.3	130.7
Other Liq.Biofuels							0.2	0.2	0.8	0.8	10.2	16.5
All woodfuels (2)	39.9	40.4	44.0	68.4	62.9	71.1	74.7	91.6	107.8	108.6	117.5	
Fuelwood (2)	24.3	24.8	27.2	51.0	50.6	51.1	54.7	71.2	82.6	83.4	85.4	
Charcoal (2)												
Black Liquor (2)	15.6	15.6	16.8	17.3	12.3	19.9	19.9	20.4	25.2	25.2	32.2	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	1.1	39.9	8.4	-1.9	5.3	0.4	-0.2	23.5	8.8	9.3
Gas from Biomass	10.8	6	0.9	-8.1	53.7	51.1	50.7	-27.2	8.6	42.7
Biogasoline										300.0
Biodiesel	57.1	63.6	11.1	30.0	92.3	40.0	57.1	45.5	31.3	90.1
Other Liquid Biofuels							50.0	266.6		1,127

(2) = Based on FAO data







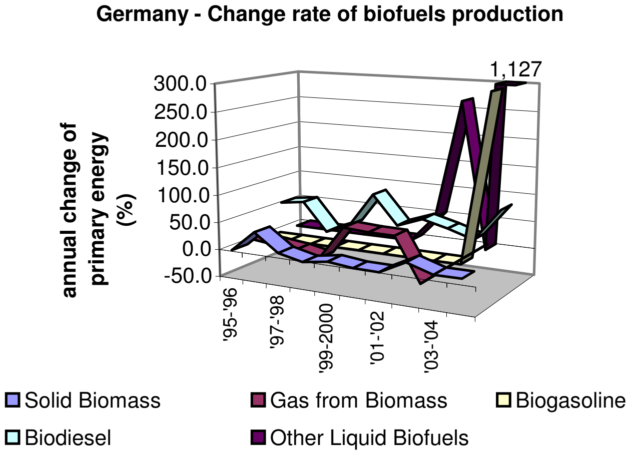


Table 5.3 - Germany – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	5.8	6.2	6.5	9.9	8.7	7.5	8.4	8.1	7.0	11.0	11.4	
Fuelwood (2)	3.2	3.5	3.8	7.0	5.2	4.1	4.9	4.6	3.5	6.8	7.4	
Charcoal (2)	2.6	2.7	2.7	2.9	3.5	3.5	3.5	3.5	3.5	4.3	4.0	

(2) = Based on FAO data

Table 5.4 - Germany – Biofuel Export (PJ)

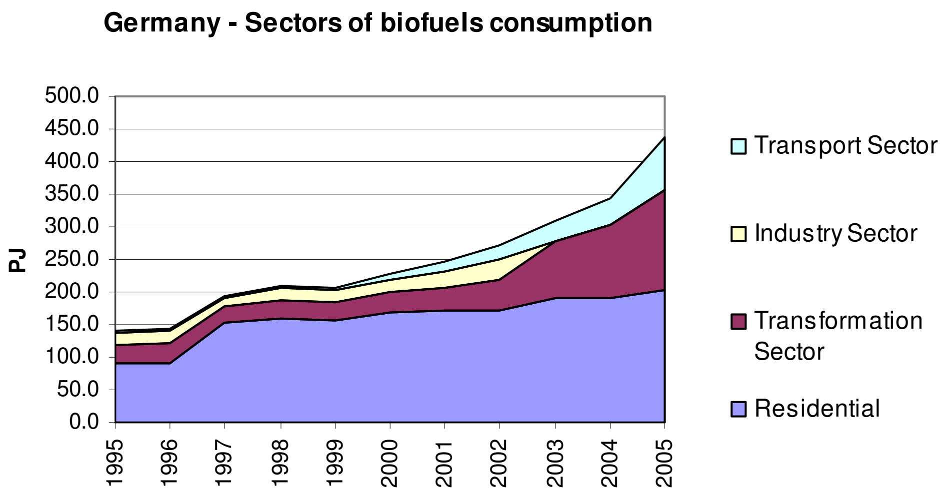
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	4.6	9.2	8.9	23.7	7.7	6.4	6.5	5.1	4.5	5.1	3.4	
Fuelwood (2)	4.6	9.2	8.8	23.7	7.5	6.3	6.4	5.0	4.4	5.0	3.4	
Charcoal (2)	0.1	0.1	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.1	0.1	

(2) = Based on FAO data

Table 5.5 - Germany – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	*139.2*	*142.8*	*195.1*	*210.4*	*206.6*	*229.1*	*245.7*	*270.8*	*312.4*	*348.2*	*440.6*	*635.3*
	Transform.	26.8	29.1	24.3	28.0	26.0	32.2	34.3	45.4	88.8	111.7	154.2	
	Industry	19.5	20.1	13.6	18.9	18.9	19.0	26.6	31.8				
	Transport	1.3	2.0	3.4	3.7	4.8	9.3	13.0	20.5	29.8	40.8	81.3	
	Residential	91.6	91.6	153.9	159.7	156.8	168.6	171.7	173.1	190.4	192.0	201.6	
Solid Biomass	Dom. Supply	124.0	125.3	175.4	190.1	186.6	196.4	197.2	196.9	243.1	264.5	289.1	390.0
	Transform.	16.2	17.3	11.5	16.1	15.7	13.8	11.5	9.8	52.8	72.5	87.5	
	Industry	16.2	16.4	10.0	14.3	14.1	14.0	14.0	14.0				
	Transport												
	Residential	91.6	91.6	153.9	159.7	156.8	168.6	171.7	173.1	190.4	192.0	201.6	
Gas from Biomass	Dom. Supply	13.9	15.5	16.4	16.5	15.2	23.3	35.3	53.2	38.7	42.0	60.0	85.2
	Transform.	10.7	11.8	12.8	11.9	10.4	18.4	22.7	35.4	35.2	38.4	56.5	
	Industry	3.3	3.6	3.6	4.6	4.8	5.0	12.6	17.8				
	Transport												
	Residential												
Biogasoline	Dom. Supply										1.7	7.0	12.9
	Transform.												
	Industry												
	Transport										1.7	7.0	
	Residential												
Biodiesels	Dom. Supply	1.3	2.0	3.4	3.7	4.8	9.3	13.0	20.5	29.8	39.1	74.3	130.7
	Transform.												
	Industry												
	Transport	1.3	2.0	3.4	3.7	4.8	9.3	13.0	20.5	29.8	39.1	74.3	
	Residential												
Other Liquid Biofuels	Dom. Supply							0.2	0.2	0.8	0.8	10.2	16.5
	Transform.							0.2	0.2	0.8	0.8	10.2	
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



6 Country Profile - INDIA[139]

6.1 Overview

India recognized the increasing role of renewable energy sources in the 1970s and since then has been pursuing several demonstrative programmes to facilitate the development of this sector.

The Planning Commission of India is responsible for defining the Multi Annual Plans then implemented by the states under the coordination of the Federal Ministry for Non Conventional Energy Sources (MNES).

The 11th Annual Plan for the years 2007-2012 proposed the following programmes:

(i) Grid-Interactive and Distributed Renewable Power;

(ii) Renewable Energy for Rural Applications;

(iii) Renewable Energy for Urban, Industrial & Commercial Applications;

(iv) Research, Design & Development for New & Renewable Energy; and

(v) Supporting Programmes.

Deployment activity is proposed to be implemented through the first three programmes; distributed renewable power would include that for captive use in industry. It is proposed that all research design and development activity is covered under a single umbrella programme. This activity is sought to be made product development oriented, with industry as lead partner and with clear well defined outcomes. Deployment and development activities are sought to be given a multiplier effect through supporting programmes.

One of the most successful supporting programmes, the Integrated Rural Energy Programme (IREP) was initiated in the Planning Commission during 7th Plan and was transferred to MNES in 1994-95. Support has been extended under this programme for preparation of state/district level energy plans, limited extension of renewable energy systems/devices and establishment of five regional training centers. The necessity to enhance the capability of states, especially in the implementation of renewable energy programmes, recognized in the 11th Multi Annual Plan, will encourage states to strengthen the administrative set-up and get local self-government institutions involved in planning and implementation process.

Table 6.1– [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	23%	31%	29%
22 496	5 091	7 002	6 620

Source: IEA, 2005

[139] The information contained in this country profile will be finalized once the Indian authorities send their input.

6.2 Country Objectives and Drivers

The development and deployment of renewable energy, products, and services in India is driven by the need to:

- decrease dependence on energy imports;
- sustain accelerated deployment of renewable energy system and devices;
- expand cost-effective energy supply;
- augment energy supply to remote and deficient areas to provide regular consumption levels to all section of the population across the country;
- switch fuels through new and renewable energy system/ device deployment.

6.3 Bioenergy Policy by Sub-sector

In 1992 the MNEs announced a new strategy and action plan to replace subsidy-driven programs with commercialization. Financial incentives were trimmed and fiscal incentives, such as assisted tax rates, along with soft loans, were introduced to encourage enterprise.

Now India faces the challenge of mobilizing investments for renewable power generation in order to encourage private sector investment for large-scale grid-connected projects, but also to mobilize resources for rural areas for off-grid generations.

The MNES coordinates the programmes implemented by the states through public utilities for buying power from renewable at subsidized rates.

Fiscal incentives are being offered to increase the viability of RE projects, the main incentive being 100 percent accelerated depreciation. Other incentives include a tax holiday, lower customs duty, sales tax, and excise tax exemption for RE projects.

The Indian Renewable Energy Development Agency is the main financing institution for renewable energy projects. It offers financing to the renewable projects with lower interest rates, which vary with the technology, depending on their commercial viability. Though interest rates are falling in India, they are not in the renewable sector for various reasons. The interest rates vary from 11 percent (for biomass cogeneration) to 14.5 percent (for wind).

The Clean Development Mechanisms of the Kyoto Protocol are playing in India a major role in making renewable energy projects more attractive.

Transport

According to the Committee for the Development of Biofuel set up by the India Planning Commission in 2003, a blending mandate of 5 percent for ethanol into gasoline and of 10 percent of biodiesel into diesel is achievable thanks to domestic production.

Ethanol production derived in 2003 principally from molasses (8.77 MMT with an increase up to 11.36 MMT in 2007), but a significant production of ethanol from sugar cane (7.33 MMT) was registered in 2006. A 5 percent blending mandate for ethanol will be established before the end of 2007, and the Planning Commission proposed to raise the mandate to 10 percent.

Regarding biodiesel, the Committee for the Development of Biofuels has decided 20% of diesel consumption as the blending target for 2011-2012.

Biodiesel production is currently deriving from Jatropha curcas using more that 11 Million hectares of land. A comprehensive demonstration project has been implemented since 2003, aimed to create a biodiesel market (facilitating the involvement of private investments), create the required infrastructures and start a process for the development of rural areas.

6.4 Results and upcoming challenges

India is a nation in transition. Increasing GDP is driving the demand for additional electrical energy as well as transportation fuels. Nevertheless poverty remains in areas with no energy services, while wealth grows in the new business hubs.

Despite his current generation capacity is from coal (2/3) and hydropower (1/3), India has vast resources of renewable energy in solar, wind, biomass and small hydro that potentially exceeds the present installed generation capacity.

Expanding electrical capacity is essential. Renewable energy remains a small fraction of installed capacity even if India is blessed with over 150 000 MW of exploitable renewable sources. Tapping into India's wind, solar, biomass and hydro, could bring high quality jobs from a domestic resource. Extending the electric grid between all states, and ultimately between neighbouring nations, will expand international trade and co-operation on the subcontinent.

6.5 Country Policy Table - India

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry of Non-Conventional Energy Sources	Sardar Swaran Singh National Institute of Renewable Energy (NIRE) - State Nodal Agency	R&D	Yes	Academic / Technology	NIRE coordinates state grant activities - using federally allocated funding - to promote technology development, testing and certification of renewable energy systems.	
Ministry of Non-Conventional Energy Sources	Solar Energy Center (SEC) - State Nodal Agency	R&D	Yes		Undertakes activities related to design, development, testing, standardization, consultancy, training and information dissemination in the field of solar energy.	
Ministry of Non-Conventional Energy Sources	Centre for Wind Energy Technology (C-WET) - State Nodal Agency	R&D	Yes		Focuses on areas not being taken up by the existing centres such as in biomass energy, energy recovery from wastes, new technologies, energy needs in rural areas and hybrid and integrated systems to promote commercialization, human resources development, training and international cooperation in these areas.	
Ministry of Non-Conventional Energy Sources	Indian Renewable Energy Development Agency (IREDA)	Fiscal Mechanism	Yes		A revolving fund that provides concessional financial support to energy efficiency/conservation and renewable energy sectors to promote self-sustaining investment in energy generation from renewable sources and energy efficiency for sustainable development.	
Ministry of Non-Conventional Energy Sources	Rural Electrification Corporation Ltd.	Fiscal Mechanism	Yes		A government established corporation that administers funds and grants from the Government of India and other sources for financing rural electrification generation projects of capacity up to 25 MW. The corporation also provides consultancy services and project implementation assistance in related fields including renewable energies; finances and executes small, mini and micro generation projects; and develops other energy sources. REC promotes, develops and finances viable decentralized power system organizations in cooperative, joint, and private sector ventures.	
TBD	Renewable Energy Policy	Targets	No - Legislation Pending		Legislation would establish a goal of 10% share for renewable energy or 10,000 MW in the power generation capacity to be added during the period up to 2012.	
Ministry of Non-Conventional Energy Sources	Guidelines to State Utilities for Buying Power from Renewable Sources	Incentives	No	Producers, Users	The MNES established guidelines and offers fiscal incentives for states participating in the program. The main fiscal incentives being offered to increase the viability of renewable projects are a 100% accelerated depreciation for installation of renewable technologies for the production of electricity; a tax holiday, lower customs duty, sales tax, and excise tax exemption for renewable energy projects.	

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
			Ministry provides annual funding allocations to State Nodal Agencies (SNA's) that are state controlled	

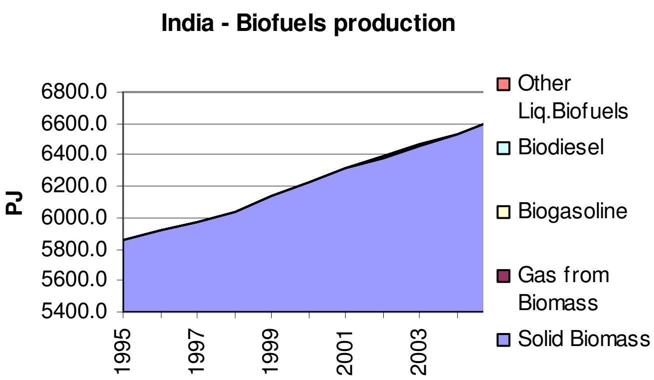
6.6 India Bioenergy Outlook

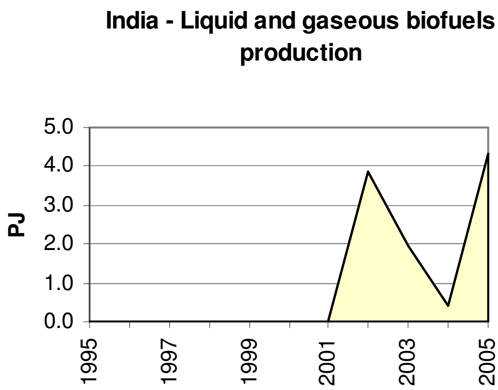
Table 6.2 – India – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
Total Biofuels	5861.7	5917.6	5978.2	6038.7	6143.9	6229.7	6312.8	6389.2	6463.8	6538.8	6620.1
Solid Biomass	5861.7	5917.6	5978.2	6038.7	6143.9	6229.7	6312.8	6385.3	6461.8	6538.3	6615.8
Gas from Biomass											
Biogasoline								3.9	2.0	0.4	4.3
Biodiesel											
Other Liq.Biofuels											
All woodfuels (2)	2855.0	2743.5	2748.7	2749.6	2750.6	2751.0	2750.6	2948.2	2963.6	3022.2	3040.7
Fuelwood (2)	2788.6	2677.1	2676.5	2675.8	2675.1	2674.5	2673.7	2838.6	2848.9	2936.0	2951.6
Charcoal (2)	49.8	49.8	50.1	50.5	50.8	51.2	51.6	85.6	88.7	52.8	53.2
Black Liquor (2)	16.6	16.6	22.1	23.3	24.6	25.4	25.4	24.0	26.0	33.4	35.9

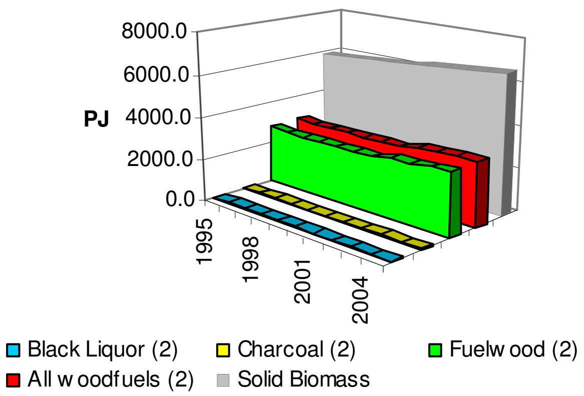
Production growth (%)										
Solid Biomass	1.0	1.0	1.0	1.7	1.4	1.3	1.1	1.2	1.2	1.2
Gas from Biomass										
Biogasoline								-49.7	-78.1	906.3
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data





India - IEA Solid Biomass vs FAO Woodfuels



India - Change rate of biofuels production

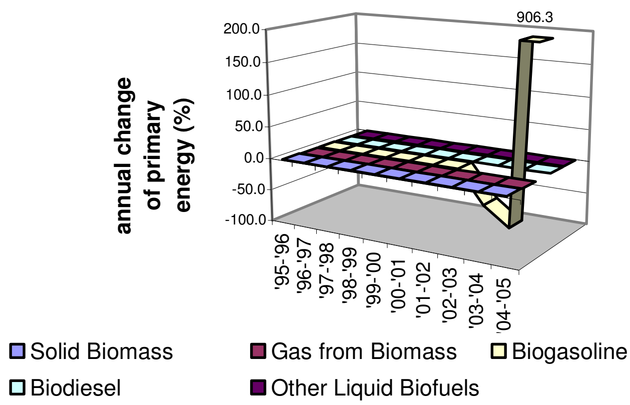


Table 6.3 – India – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)		0.0	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.1	0.1	
Fuelwood (2)		0.0	0.0	0.0	0.1	0.1				0.0	0.1	
Charcoal (2)						0.0	0.0	0.0	0.0	0.0	0.0	

(2) = Based on FAO data

Table 6.4 – India – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.2	0.1	0.1	0.1	0.1	0.2	0.2	0.1	0.2	0.1	0.2	
Fuelwood (2)	0.0	0.0	0.0	0.0	0.0					0.0	0.0	
Charcoal (2)	0.2	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.2	0.1	0.2	

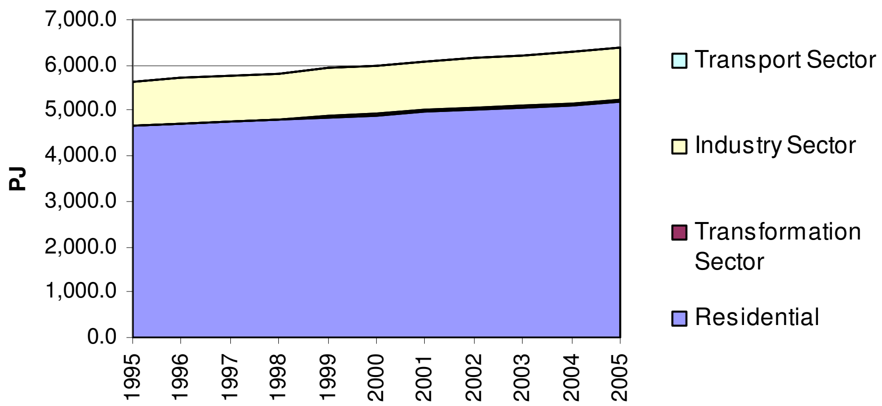
(2) = Based on FAO data

Table 6.5 – India – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	5,862.8	5,918.7	5,979.4	6,039.9	6,145.1	6,230.9	6,314.0	6,390.5	6,465.0	6,540.0	6,621.4	
	Transform.					23.3	32.3	43.7	44.2	44.7	45.3	45.8	
	Industry	990.0	999.6	1.011.8	1.024.8	1.052.3	1.070.6	1.085.0	1.099.1	1.113.5	1.128.0	1.142.7	
	Transport								3.9	2.0	0.4	4.3	
	Residential	4.665.5	4.709.8	4.754.5	4.797.7	4.849.8	4.901.9	4.954.0	5.006.2	5.062.6	5.119.6	5.177.3	
Solid Biomass	Dom. Supply	5,862.8	5,918.7	5,979.4	6,039.9	6,145.1	6,230.9	6,314.0	6,386.6	6,463.0	6,539.6	6,617.1	
	Transform.					23.3	32.3	43.7	44.2	44.7	45.3	45.8	
	Industry	990.0	999.6	1.011.8	1.024.8	1.052.3	1.070.6	1.085.0	1.099.1	1.113.5	1.128.0	1.142.7	
	Transport												
	Residential	4.665.5	4.709.8	4.754.5	4.797.7	4.849.8	4.901.9	4.954.0	5.006.2	5.062.6	5.119.6	5.177.3	
Gas from Biomass	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply								3.9	2.0	0.4	4.3	
	Transform.												
	Industry												
	Transport								3.9	2.0	0.4	4.3	
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

India - Sectors of biofuels consumption



7 Country Profile - ITALY

7.1 Overview

In Italy, domestic fossil fuel resources are very limited with over 80 percent of the fossil fuels used for national consumption, imported.

In 2005, gross electricity production from solid biomass in Italy was 22 337 TWh (estimate) against a total renewable sources value of 49.9 TWh (corresponding to 14.1 percent of total consumption)[140]. Biomass is the main contributor to Renewable Energy Sources (RES) heat production with over over 92 percent at 100.2 PJ (in 2004) showing an average annual growth of 3 percent. About 75 percent of solid biomass is nationally produced from agro-industrial residues, waste and wood residues; the remaining 25 percent is imported principally from Spain, Tunisia, Greece, Eastern Europe and the Americas. However, as confirmed by the Italian Biomass Association (ITABIA), the data on heat production from biomass seems to underestimated, probably because thermal energy from *self-produced* agro-industry is not included in official commercial statistics (Thermal energy from self-produced agro-industry residues is estimated at about 30 000 MW_{th}).

- Wood pellet seems to be an attractive option for the Italian market and continued development in this sector is foreseen during the next few years.
- Biofuels: Activity in the Italian biodiesel sector was initiated in 1993 and experienced strong growth between 1997 and 2005. The average annual growth was 29 percent; in absolute figures, 14.8 PJ were produced in 2005. In terms of production capacity, Italy has made significant progress with a total installed capacity of 35.9 PJ in 2006, representing the second highest biodiesel production capacity in the EU25, after Germany[141].
- Biodiesel is obtained mainly from seeds and oils (rapeseed and soybean oil), about 70 percent of which is imported (particularly from France and Germany)[142].
- The bioethanol industry is still in its early stages in Italy. Italian bioethanol is produced from national feedstock (wine alcohol, molasses/sugar beets, cereals). Future production will be mainly from cellulose waste material when the technology will be commercially available. Ethanol production for transportation use was 3,000,000 hl/year[143] but represents only 5 percent of expected bioethanol use in Italy.[144]

Table 7.1– [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	86%	6%	2.3%
7 753	6 671	478	175

Source: IEA, 2005

[140] Source: ENEA
[141] Source: EurObserv'ER 2006
[142] Source: ITABIA
[143] Source: assodistil 2006
[144] Source: AssoDistil

7.2 Objectives and Drivers

The production and use of bioenergy and biofuels in Italy has been encouraged by a number of policies with the reduction of GHG emissions, the diversification of fuel supply sources and the improvement of agricultural economy as its highest priorities.

7.3 Bioenergy Policy by Subsector

The principal document presenting the national energy policy is the National Energy Plan issued in 1998.

Although no new strategic plan has been established since then, a range of provisions and regulations were issued through laws or other specific legislative acts following the energy sector reform initiated at EU level[145]. The recent decentralization process applied in many sectors (thanks to the Bassanini Reform), has transferred more responsibility in decision-making and preparation of regional energy plans to the local authorities (particularly in the provinces). Unfortunately, the transfer of the competences in this field occurred without the support of national guidelines and monitoring instruments. Only recently the proposal of legislative decree 691/2006, although not yet implemented, established identification of RES and GHG reduction targets to be assigned and shared among the regions. Several policies currently support bioenergy development in the country and are detailed below.

The Ministry of Economic Development is the main body responsible for implementing the Italian energy policy, in conjunction with the Ministry of Environment, Land and Sea and the Ministry of Agriculture, Food and Forestry, responsible for activities related to the agricultural aspect. Regional and local authorities have also introduced some measures to promote bioenergy.

Apart from green certificates, other incentives are available for the promotion of biomass for electricity and heat production, including:

- White certificates (marketable documents which encourage energy saving) promote the development of boilers and high efficiency cogeneration of heat and power (CHP) fed by biomass, giving incentives to electricity and fuel distributors and related companies to operate energy conversion efficiency measures under the obligations set by Energy Saving Decrees 20/07/04 (1 January 2005). There is considerable potential in the use of CHP in Italy but only a negligible part of the residential heat demand in Italy is supplied by district heating. White certificates cannot be combined with green certificates.
- RECS-certificates: Use of these certificates, issued for every MWh of renewable energy on a voluntary basis, is still in its early stages in Italy.
- EU funds: These funds are managed directly by regions and local authorities and coordinated by the Ministry of Agriculture, Food and Forestry (Structural Funds and Rural Development Funds, CAP,). Details can be found in Annex II where EU policies are

[145] The liberalization of energy market has been implemented in Italy through legislative decree 79/99

analyzed. In fact, following the decentralization process, capital grants are now mainly given by Regions and local authorities through their own budget, while at central level the government intervenes with fiscal reduction measures and financing given for the creation and revamping of enterprises.

Power Generation

The Italian White Paper has set up an official target of 78 TWh/yr of electricity production from renewables. In order to start a renewable market in the electricity sector, the government has introduced a legislative decree (79/99) - requiring a tradable percentage obligation (with green certificates) - for producers of electricity that deliver electricity to the grid.

RES-E Directive has been acknowledged in Italy by Decree 387/2003. It sets a national reference target of 22 percent of renewable share in electricity production by 2010 (against the current 16 percent and the 25 percent share by 2010 indicated in the RES-E Directive). Nationally, producers and importers of electricity, producing or importing more than 100 GWh/year, are obliged to deliver a certain percentage of renewable electricity to the market every year (2 percent obligation for 2002 according to legislative decree 79/99 then increased of 0.35 percent per year from 2005 to 2007, with the quota reaching 3.05 percent in 2007 under decree 387/2003). The increase of the minimum quota for the period 2007-2009 has not yet been implemented. Electricity suppliers can fulfill the obligation by buying green certificates from authorized new renewable energy plants, by building new renewable energy plants, or by importing electricity from new renewable energy plants from countries with similar instruments on the basis of reciprocity.

In order to promote RES-E, Italy has adopted a quota system based on tradable green certificates including:

- Priority access to the grid system is granted to electricity from RES and CHP plants;
- An obligation for electricity generators to feed a given proportion of RES-E into the national grid. In case of non-compliance, sanctions are foreseen, but enforcement in practice is considered difficult because of ambiguities in the legislation.
- Tradable green certificates, which are tradable commodities issued for each 50 MWh, as modified by the Marzano decree[146], produced each year to qualified plants, providing that electricity is generated using any renewable energy sources. The price of this certificate on the market was € 109/MWh in 2005.

Certificates are only issued for new RES-E capacity during the first eight years of operation (period of certification was increased to 12 years by decree 24/10/2005 for plants fuelled with biomass and waste).

There are many obstacles to production of electricity from dedicated biomass plants (low efficiency of conversion plants, supply and transportation problems). Co-generation and co-combustion are more feasible (particularly if combined with district heating). Today, because of

[146] Law 23/08/2004 n. 239

the high cost of modern and more efficient biomass technologies, the green certificates for biomass do not seem sufficient to guarantee an adequate and further development of such technologies. Incentives are now only addressed to RES as defined in article 2 of the EU directive 2001/77/CE, therefore non-biodegradable waste and sources as refinery and urban wastes, and other non-renewable sources, are now excluded from the green certificate scheme. Electricity production from district heating and co-generation are no longer eligible for green certificate issue.

Heat Production

No official RES-H targets exist in Italy.

National legislation is currently being developed for RES-H. Up to 30 percent of capital costs (maximum limit of € 300 000) is provided for development of a heat generation infrastructure that incorporates biomass (pellets and chips) and other renewable energy sources used in the production of heat (150-1000 kW).

Transport

Directive 2003/30/CE, under which fuel suppliers are required to include a given percentage of biofuels in the total amount of fuel placed on the market, was adopted by Decree 128/2005 (the decree sets a reference value of 1 percent by 2005, and 2.5 percent by 2010 - lower than the 2 percent and 5,75 percent reference values in the EU Directive). The targets have progressively been adjusted to the EU Directive values through Law n.81 (11/03/2006) and Law 27/12/06 n.296 (Tax Law 2007).

The Italian Government, in the context of the G8, led the initiative towards the launch of the Global Bioenergy Partnership which aims to support wider, cost-effective biomass and biofuels deployment. The institutional framework governing bioenergy development in the country is composed by several Ministries acting within their own specific areas of competences.

In order to promote a national biofuels industry and market, and in view of the high cost of producing fuels from biomass, the government uses fiscal incentives and obligatory quotas (established in the Tax Law 2007).

Italian legislation, in accordance with Community rules on indirect taxes on energy products and electricity (Directive 2003/96/EC), established a number of provisions reducing the final cost of the products concerned by cutting taxation. This renders certain fuels produced from biomass competitive with the fossil fuels they replace and encourages their use.

Although legislation in favour of biodiesel has been in place since 1993, it has not been enforced until recently, causing a delay in the implementation of these measures.

Particularly, fiscal measures have targeted biodiesel and vegetable-based ethanol, substituting diesel oil and petrol respectively. Regarding biodiesel, the 2007 Tax Law (art.22-bis) establishes an excise duty reduction of 80 percent for biodiesel production up to 250 000 t/year[147]. A decree issued by the Minister for Economic Affairs and Finance may decrease this amount to prevent overcompensation of the additional costs involved in the production of biodiesel (compared with the cost of diesel oil). Average industrial production costs of biodiesel will be monitored to provide a basis for assessing whether or not there is overcompensation. For vegetable-based ethanol and derivatives used as fuel or fuel additives, Italian law (paragraph 372 of Tax Law 2007) provides for reduced excise duty with a ceiling on total expenditure of € 73 million.

In order to promote domestic production, a tax reduction priority for 70 000 ton is granted to national production coming from national agreements and contracts involving all players in the biofuel supply chain (from farms to biofuel distributors and final users). For that purpose, a registration system aimed at retracing the full biofuel chain and particularly the origin of energy feedstock, has been established.

Application of these rules was foreseen starting from 1 January 2007 after receiving authorization from the EC (received state aid approval for new biofuel tax exemptions), but lack of a transparent and clear policy framework and the lack of authorization from the EC DG Competition led to the relatively small amount of 99 600 hl ethanol (imported) actually placed on the market. Consequently, only €15 million have been used of the €73 million allocated per year in the period 2005-2007 to support bioethanol production. Total excise exemption is foreseen for pure vegetable oil used for auto-consumption in agriculture enterprises. Administrative, proportional sanctions are foreseen for distribution companies not complying with the obligation, and sanctions will increase the fixed amount benefiting from excise reduction although they will not be applied in 2007.

Other policies affecting bioenergy development:

Climate Change sector - Apart from the GHG reduction obligation dictated by the Kyoto Protocol that promotes bioenergy projects through the use of the CDM, CIPE Resolution 123/2002 (revision of national policies and measures for GHG reduction) introduces fuel blending for transportation with biodiesel of up to five percent as an optional measure to reduce GHG.

Agriculture sector - Incentives to biofuel deployment are indicated in the National Biofuel Programme (PROBIO) launched in 1999, with the objective of contributing to the national strategy for GHG reduction and promoting the agroenergy supply chain. The Program provided capital grants (5 billion Lira/yr- about 2 600 million €/yr) for the expansion of the national and state agroenergy production chains through interregional and regional demonstration projects and the dissemination of national bioenergy information.

Further support will come from the Rural Development Program - for the period 2007-2013. Through this Program, regional authorities can provide co-financing (up to 65 percent) for projects aimed at agro- and wood biomass and bioenergy production.

[147] Limits on biofuels volume eligible for tax exemption have been introduced. Before 2007 there was a total exemption from excise duty.

The Ministry of Agriculture, Food and Forestry has recently presented the first national framework agreement with the inclusion of farm associations as well as biofuel industry in a first step toward the creation of a national agroenergy chain that can offer new opportunities to the agriculture sector in the framework of the reformed Common Agriculture Policy (CAP).

7.4 Results and upcoming challenges

Italy has made significant progress in terms of production capacity of biofuel. Yet, the fact that ethanol is still missing from the energy market and development of ethanol is negligible, probably due to limited financial resources for demonstrative and support activities. The lack of a transparent and clear policy framework for the production and commercialization of bioethanol in a tax exemption regime has delayed the application of the law. New prospects come from a recently signed voluntary agreement for the annual production of 1 million hl and will benefit from the partial tax exemption foreseen in the Italian law.

Contrary to an increasing productive capacity and unlike results in other EU member countries, Italian production of biodiesel fuel decreased in 2005 since the reduction of tax relief due to budget limitations[148]. As for electricity generation from biomass, 32 plants have been installed with a total capacity of 400 MW, but unfortunately only a few of them use the heat produced for residential and industrial uses.

Public funds have been used almost exclusively for supporting district heating capital costs, while individual heating with wood is neglected. The Italian incentive policy has, until now, totally neglected the upstream side of the biomass path (cut, collection and transport); only existing Decree 124/02 provides some tax deduction for interventions limited to forest maintenance. Strategy outlined for the promotion of sustainable use of biomass and biofuels focuses on the following measures and criteria:

- Use of national resources;
- Creation of a national agroenergy supply chain;
- Balanced use of direct (tax reduction) and indirect (blending quota obligation) incentives;
- Progressive phase-out of tax reductions favoring an increase of the obligation quota;
- Possibility of revising tax reductions to prevent overcompensation;
- Revision of the green certificate scheme to give incentives for energy use from agriculture crops, waste and residues from livestock, forestry and food industry and for energy use from sustainable agricultural practices (pending).

It is difficult to reach EU targets for biofuels. Agroenergy crops for biofuels production could use a maximum of 20-30 percent of the total surface available for agricultural purposes (8,000,000 hectares) and still only reach a maximum potential of 5-6 percent biofuels use. Real development of biofuels production, distribution and utilization chains is not possible within the framework of the existing policies; there is a lack of a clear legislative framework and strong support measures, although progress in this direction has recently been made.

[148] Government sources

7.5 Best Practices

Several best practices regarding different aspects of the bioenergy sector have been developed:

Biomass district heating network - In the last decade, the biomass district heating networks spread widely in northern Italy, especially in the Autonomous Province of Bolzano and then throughout Piedmont, Lombardy, Aosta Valley and Province of Trento. Many of these plants are situated in remote municipalities of the Alpine valley where, due to the cold climate, the demand for thermal energy is drawn out over long periods of the year and where large quantities of woody materials are locally available.

The plants (about 60) have a size ranging from 1 to 20 MWh; the overall installed thermal power is about 400 MWh. The biomass used is mainly wood chips coming from wood industries. About 0.2 Mt/y of biomass is consumed at 40 percent of water content. The combustion technology is based on mobile grid boilers coupled with different systems for gas cleaning.

In the Italian northern valleys, the replacement of individual heating plants with a single centralized, efficient plant (the central district heating station) has produced a series of positive effects (whether from a technical-operational, economic, or environmental point of view) such as, for example:

- Less pollution: instead of operating hundreds of individual plants, there is only one central plant, which can best regulate combustion (greater energetic efficiency) and utilize advanced systems of emission control;
- Lower costs (excluding initial installation costs and predisposition to the network);
- Greater safety and comfort inside the living space: eliminating the possibility of gas leaks, explosions or fires;
- The elimination of maintenance responsibilities on the part of the consumers;
- The recovery of energy use of residual biomass that would otherwise be destined for dumping with consequent disposal costs;
- Broad social consensus.

Wood pellet for household uses - Wood pellets are going to be widely used in the household sector together innovative domestic appliances supported by an efficient promotion campaign.

Italy is the most important Mediterranean pellet market, with over 90 production sites. Nevertheless, national production of approximately 160 000 t/year cannot satisfy the growing demand, which is nearly 300,000 t/y, making it necessary to import large quantities of the product from abroad. The price of pellets varies from €150 to 200/t; nevertheless it is more convenient to use in respect to traditional fuels, and there is a steady rise in the number of companies producing the pellets.

In Italy, almost all pellets are used in over 125 000 domestic heaters, while less than 2 percent are used for larger heating boilers (approximately 500 units installed).

The penetration of biomass into the energy sector is strictly linked to the benefit that the citizen may gain from its use. These benefits range from the ease of handling the raw material to the use of a more efficient, viable and environmentally-sound appliances. The pellet chain is a good example of how the convenience of using biomass may be linked to technological innovation. As a matter of fact, the progressive evolution of the biomass market offers not only wood fuel from logs, but also from wood that is chopped or ground and pressed (pellets and briquettes), which is easier to transport and store. At the same time, environmentally compatible combustion technologies have reached levels of efficiency, reliability and comfort very similar to traditional plants running on gas or diesel fuel. Suffice to say that a modern heater or boiler running on biomass has an efficiency close to 90 percent, saving biomass feedstock and optimizing emission control in respect to old fireplaces and heaters. For those reasons the niche market for the production of thermal energy from biomass is shows constant growth, not just due to the economic convenience involved, but also in regard to the ever-increasing awareness of the use of renewable energy sources.

Biogas chains - In Italy the production of biogas in waste treatment plants, through anaerobic digestion, is sufficiently widespread. The main sources of biogas are:

- animal manure;
- organic residues present in controlled municipal dumps;
- activated sludge from waste-water treatment.

About 100 plants are installed for production of thermal energy used for the space heating of the breeding. Co-generation (combined production of heat and electricity) is currently the prevailing application in the centralised installations, while only in some tens of firm plants co-generation devices are used.

Stakeholders are always more conscious of the benefits of anaerobic digestion processes. It seems clear that biogas collection and use benefit the energy sector are also advantageous for the environment as the system reduces certain pollutants e.g. methane (a very effective GHG), ammonia, noxious organic compounds and unpleasant odors. In the future the two main processes for treating organic solid wastes - aerobic composting and anaerobic digestion- will be incorporated in order to minimize the drawbacks and enhance the advantages of both. This project frame will be beneficial for agriculture as well as for the livestock sector, and at the same time will overcome most of the barriers (not only technical) encountered in the disposal of all kinds of wastes. Furthermore, energy recovered from the treatment process will contribute to the national energy balance. Co-digestion, aerobic treatment and co-generation are therefore the stepping stones for the success of future activity in this area.

Development and demonstration of a process for the production of biodiesel from Jatropha Curcas seeds by enzyme extraction and ethyl trans-estherification - This project, developed in the framework of a Memorandum of Understanding between the Italian Ministry for the Environment, Land and Sea and Egypt, is aimed at implementing an integrated biodiesel production system using Jatropha Curcas seeds as raw material. This system will be optimized by means of the various activities to be developed for large-scale application. It includes the entire biodiesel production cycle: the cultivation of the Jatropha, the oil production process, the exploitation of the different by-products coming from the system itself, first of all the use of the cakes/pellets for energy recovery. The biodiesel production process will be based on the following last-generation technologies:

- presso-extrusion technology for extracting the oil from Jatropha seeds;
- etyhl-trans-estherification technology for producing biodiesel from vegetable oil.

Both the above-mentioned technologies are currently in use in Italy for biodiesel production from soybean and sunflowers seeds.

The expected results are:

- experimentation and fine-tuning of innovative biodiesel production technologies;
- reduction of investments for the construction of biodiesel plants and related production costs;
- promotion of the cultivation of vegetable crops such as Jatropha Curcas in order to effectively combat desertification which presently affects large tracts of land in developing countries;
- contribution to the reduction of GHG on the basis of a “cradle to grave” analysis (the cultivation of Jatropha Curcas, production of biofuel, and combustion of biofuel) is characterized by a reduced emission of CO_2 when compared to the equivalent fossil fuel production-combustion cycle.

Development of a biochemical method for extracting oil to be used in biodiesel production - The R&D research project, developed in the framework of a Memorandum of Understanding between the Italian Ministry for the Environment, Land and Sea and Egypt, aims at developing an innovative process for extracting oil to be used for the production of biodiesel fuel from seeds of the oleaginous Jatropha Curcas, currently under cultivation in Egypt . The proposed research activities focus on development and testing of a biochemical method involving an enzymatic - rather than mechanical/ solvent – oil extraction.

The proposed biochemical method overcomes the drawbacks of the current extraction systems; it is economically convenient and advantageous from the environmental point of view thanks to the conditioning and recycling of the generated residues and by-products.

Recovery and energy- Use of biogas produced from landfill - The project is implemented in the framework of cooperation between Italy and China. It covers wide range of activities, from research to training and consultancy and in the field of climate change, implementation of the Kyoto Protocol mechanisms and energy development projects in the western regions. The rationale is to develop projects in China in the sector of energy production from renewable sources, with particular emphasis on Landfill Gas (LFG) reuse for energy production, in accordance with the rules, modalities and guidelines of the CDM adopted under the Kyoto Protocol. The project can be divided in three components:

1. utilization of Ningxia landfill gas, with specific reference to the pilot site of Yinchuan;
2. utilization of methane in cattle farm, with specific reference to the pilot site of Pingjipu;
3. methodology research of biogas digester for household use.

Most of the Chinese landfills were not able to collect the biogas, resulting in large emissions of CH4 in the atmosphere. The project aims include installation of a 3 MW plant producing electricity to be fed into the grid, resulting in controlled emission in the atmosphere. Landfill emission control is a priority in China due to the increasing amount of waste produced in the Chinese urban areas. The large quantity of manure produced each day represents a serious pollution problem because it is accompanied by severe emissions into the atmosphere. The installation of a digester connected to a gas turbine can solve the problem of handling the manure with an environmentally-friendly practice and produce energy to be fed into the grid. Suitable households will be identified and a system of anaerobic digesters for farmers' waste will be designed. Exhaustive research is needed in order to obtain CDM certification for the emission reduction due to the household digesters.

Use of biomass for energy production – The use of biomass is an effective measure to control and reduce anthropogenic emission of GHG. China is the largest growing economy in the world and this involve several environmental issues. The use of coal and other fossil fuels creates severe damage to the environment, hence the use of biomass for energy generation has a great value for the emission reduction and energy security and independence.

As China has an abundance of agricultural residues, the project, established under a cooperation agreement between China and Italy, plans to design a 5 MW cogeneration plant based on the complete combustion of rice husk to introduce an economically viable example of biomass for energy plants. Use of large plants is not economical because of the high cost of biomass collection and use of small facilities is expensive, thus the 5 MW plant can provide a feasible solution to both problems.

The project has been developed in two stages, the first offering a general design and pre-feasibility of the project itself, while the second phase provides a more detailed analysis of the state of the art of technology, environmental and social implication of the project and design of the plant and equipment list. Results to be achieved by best practice:

- Identification of a suitable size and technology for biomass plants using rice husks in China;
- Design of the plant, of the collection system for rice husks and evaluation of potential benefits for proposal of the project as a Clean Development Mechanism activity under the Kyoto Protocol, with the preparation of the related documents (PIN and PDD);
- Evaluation of the cost/benefits ratio of the use of biomass for energy and for other applications;
- Promotion of the project to international institutions and awareness-raising regarding the use of biomass for energy production among the Chinese public and private sector.

Agroenergetic Integrated District "Valle dei Latini" - The project aims to respond to the environmental pollution problem in the Sacco River Valley (caused by local industries) through an integrated strategy of agricultural and rural development. Such a strategy implies the implementation and integration of three agro-energetic value chains within the local agriculture and economy, namely:

- Wood-energy: energy valorization of forests and pruning from grape and olive production plus production of wood through short rotation forestry. Local consumption of energy produced by the diffusion of specific eater machinery for the local institutions, farms and agro-tourism enterprises.
- Biodiesel: cultivation of sunflower and colza expressly for oil production, and transformation into biodiesel through tailored technology. Utilization of biodiesel in public transportation in Rome.
- Biogas produced by dedicated cultivation processes of fermentable crops and refuse from the manure sector. Biogas will be used to co-produce electricity and heat.

Major results include:

- Most public buildings are now heated through locally produced energy (wood, short rotation forestry, valorization of wine and olive oil production pruning waste);
- All of the area prohibited to food production has a new market orientation giving local farms the needed income and protecting the communities from health risks through the destination of the area to energy-wood production (creation of a barrier between food production and pollution);
- An integrated local chain for biodiesel production from vegetal oil (sunflower) is implemented and sustains local farmers' income (complete chain means a local association for sunflower production, oil extraction and transformation, bio diesel consumption for local public transports);
- Biogas production through the integration of manure with dedicated agricultural productions helps the income generation process of local agriculture and contribute to the generation of renewable energy.

Evaluation studies for the "Souss-Massa biogas project – This project is being implemented under a cooperation agreement between Italy and Morocco. Collection of data related to 100 biogas mini-plants installed in the region of Souss-Massa (Morocco) has been carried out in order to evaluate performances of such installations and potential evaluation for build up more units. Technical, financial and socio-economic evaluation of these installations has also been completed in order to facilitate the development of projects in other regions. Majors results already obtained:

- Data collected will be potentially useful to potentially set up a national strategy for biogas exploitation in rural villages and to potentially replicate projects;

- A number of tests have been carried out in order to evaluate best practices for adaptation of diesel engines to biogas utilization, as well as utilization of water heaters, cooling systems and ovens.

7.6 Country Policy Table - Italy

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry for Economic Development and Ministry of Environment, Land and Sea	Energy Saving Decrees 20/07/04 modifying the quantitative objectives established by the Law Decree n. 164 (23 May 2000) and the Law Decree n. 79 (16 March 1999). Came into force on January 1st, 2005.	Policy-targets	Yes	Electricity and gas distribution companies	Promotes energy conversion efficiency setting a target, in the five –year frame 2005-2009, of an energysaving of 0.2 Mtoe/year at the beginning and of 2.9 Mtoe/year within 2009. Actors under obligation can comply with it through energy efficiency projects or energy saving management directly implemented or through the purchase of energy saving "White Certificates" on the market. The mechanism is directed to the energy and gas distribution companies with over 100,000 clients. At least 50% of energy savings must be achieved through a corresponding reduction of consumption. The White Certificates can be exchanged by means of bilateral contracts, or in the frame of a specific market ruled by GME (Energy Market Administrator)	
Ministry for Economic Development (ex-Ministry for Production Activities)	Electricity Liberalization Act n.79 16/03/1999 according to Directive 96/92/CE on common rules for establishing an internal electricity market	Policy-target (quota obligation system based on tradable green certificate	Yes	Energy producers and importers	Requires energy producers and importers (producing or importing more than 100 GWh/year) to ensure that, starting from 2002, 2% of all electricity supplied to the national market came from plants fed by renewable sources entered in operation after 1 April 1999. The government can increase the quota to meet the renewable energy target (as it has been done by legislative decree 387/2003). Suppliers can fulfill the obligation by buying green certificates from entitled new renewable energy plants, by building new renewable energy plants, or by importing electricity from new renewable energy plants from countries with similar instruments on the basis of reciprocity. Priority access to the grid system is granted to electricity from RES and CHP plants.	
Ministry for Economic Development (ex-Ministry for Production Activities)	Decree 387/2003 according to EU Directive 2001/77/CE on the promotion of the electricity produced from renewable energy sources in the internal electricity market	Policy-target (quota obligation system based on tradable green certificate	Yes	Energy producers and importers	It acknowledges the EU framework for RES penetration in the electricity market. It sets a national reference target of 22% of renewables share in electricity production by 2010. It integrates Decree n.79 16/03/1999 on the following aspects: increases the minimum quota of 0.35% per year from 2005 to 2007, with the quota reaching 3.05% in 2007; proposes regional objectives of RES penetration (not implemented); sets rules for priority of dispatching; promotes dissemination campaign for the use of RES; simplifies procedures of authorization at local level (introduction of a single authorization); introduces the rule of origin.	
Ministry of Agriculture, Food and Forestry Policies	Law on Biofuels (Law n. 81 11/03/2006) that modified Decree 128/2005 through which Italy absorbed EC Directive 2003/30/EC	Policy - not binding Mandates and Targets	Yes	Producers / Suppliers (Transport)	Sets legal biofuel blending requirements on transport fuels through 2010 (1% starting from 1st July 2006, up to 5% by 2010 through incremental annual increases).	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
	Helps the realization of energy saving from biomass (thermal use) 1) installation of plants for the use of low enthalpy heat (for example heat from co-generation plants), using also wastes for space heating; 2) projects aimed at improving the efficiency of current energy conversion plants and 3) projects aimed at replacing traditional devices with innovative ones, for example, substituting electric water heaters or fossil fuels space heating plants with biomass fed district heating plants.		The AEEG (Italian Regulatory Authority for Electricity and Gas) grants the distribution companies a contribution of 100 €/year for 5 years for each **tonne/oil equivalent (TOE)** saved directly or indirectly by the white certificate marketing. This grant will cover part of the costs met by the distribution companies to reach own targets of energy saving. The remaining part can be covered by other resources, such as, state or regional funds, clients' participation shares, revenues from selling the surplus of white certification quotas with respects to the proper obligation	
		Establishes a credit market system for producers and suppliers, promoting an Increase in the use of biomass in the generation of electricity	Market mechanism (tradable green certificate)	Certificates are only issued for new RES-E capacity during the first 8 years of operation (period of certification has been increased to 12 years by decree 24/10/2005 for plant fuelled with biomass and waste. Sanctions are foreseen in case of non compliance but enforcement is difficult
		Promotes an increase in the use of biomass in the generation of electricity.		
		Sets blending mandate on the end-use product and promotes use of bioenergy and energy crops in the production of transport fuels.		Targets established with Law 81/2006 have not been reached due to the lack of agreement within the agroenergy production chain over the uncertainty about normative rules and consequences for fuels producers who do not comply with the blending mandates. No sufficient availability of feedstocks and limited industrial capacity for bioethanol production are also responsible for not achieving the targets. Moreover no sanctions are foreseen for not complying with the Law

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry for Economic Development and Ministry of Agriculture, Food and Forestry Policies	Law n.266/05 (Tax Law 2006)	Policy- incentives and grant		Farmer and industry	It foresees an exemption from excise duty for an annual quota of 200 000 tonnes of biodiesel under a six-year programme running from 1 January 2005 to 31 December 2010. Priority of excise exemption up to 20.000 ton is given to producers who sign on to supply chain contract programmes. It includes the production of electricity from RES among the income productive activities of farmers. It establishes a grant for the development of agroindustrial energy chain	
Ministry for Economic Development (a.k.a. Ministry for Production Activities)	Law 27/12/2006 n. 296 (Tax Law 2007)	Policy- binding targets (mandate) and Incentives	Yes	Producers/ Suppliers (Transport)	It requires fuel suppliers to include a given percentage (1% by 2005, 2,5% by 2008 and 5,75% by 2010) of biofuels in the total amount of fuel they place on the market. Apart from obligation it establishes a tax reduction (excise reduction) of 80% for biodiesel production up to 250.000 t/year.A tax reduction priority for 70,000t is provided for producers who sign on to the program. As regards vegetable-based ethanol, it provides for reduced rates of excise duty on vegetable-based ethanol and products derived used as fuel or fuel additives in order to encourage the use of this biofuel. For the year 2007, excise reduction foreseen for year 2006 are confirmed. Starting from 2008 reduced rates will be applied:(a) bioethanol produced from agricultural products: €289.22 per 1 000 litres;b) ethyl-tertio-butyl-ether (ETBE) produced from agricultural alcohol: €289.22 per 1000 litres; (c) additives and reformulates produced from biomass: 1) for lead-free petrol: €289.22 per 1 000 litres; 2) for diesel oil, excluding biodiesel: €245.32 per 1 000 litres. The programme provided for the application of the above reduced rates to bioethanol, with a ceiling on total expenditure of €73 million. Excise exemption is foreseen for pure vegetable oil used for auto consumption in agriculture enterprises. Rules about excise reduction will be applied starting from 1/1/2007 after receiving authorization from the EC (received state aid approval for new biofuel tax exemptions). Sanctions are foreseen for distribution companies not complying with the obligation. In 2007 sanctions will not be applied.	
Ministry of Environment, Land and Sea	Program for promoting RES for electricity and heat production (implementation of Decree n. 687)	Activity- Incentives	Yes	Industry (Small and Medium Suppliers)		
Ministry for Economic Development and Ministry of Environment, Land and Sea	Decree 3/11/2004, following the EU Directive 2004/8/EC	Policy/ incentives and grant	Yes	Public and private entities, ESCO, agriculture and forest firms	It promotes the diffusion of high-efficiency micro, small scale and cogeneration units with the main scope of verifying their feasibility and replication capabilities.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Provides funding to encourage optimization of the collection, transportation and transformation process of biomass	Provides funding for optimization of the conversion process from biomass.	It provides funding for feasibility studies for energy production from biomass.	€42,5 mil allocated by the tax law 2006 and other funding will derive from the tradable green certificates (once the discipline about TIC will be reviewed incorporating tradable green certificates for the promotion of the agroenergy sector)	
		Promotes use of biodiesel and bioethanol and stimulates market growth. Promotes development of national agroenergy production chain and identification of preferential criteria for biofuels use.		The size of the reduction may be amended, by means of a decree issued by the Minister for Economic Affairs and Finance, in order to prevent overcompensation of the additional costs involved in the production of biodiesel (compared with the cost of diesel oil). It is planned to monitor the average industrial production cost of biodiesel to provide a basis for assessing whether or not there is any overcompensation.
	Provides funding (up to 30% of costs) for development of heat generation infrastructure that incorporate biomass (pellets and chips) and other renewable energy sources used in the production of heat (150- 1000kW). The minimum plant production levels under this program are 150kW			Due to the lack of financial resources, applications received after 26/02/2007 are ineligible for financing.
	It promotes high efficiency co-generation from biomass plants, with a range of contributions depending on the type of primary energy source used (EU definitions included in the EU Directive). The right to the contribution is conditioned to the execution of monitoring campaigns on the energy and environmental results. Up to 30% of capital cost (maximum limit of 300.000 euro) for units fed by biomass or for hybrid units fed by natural gas-biomass		Provides capital contributions up to an overall amount of €30.000.000	

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy /Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
EU	Regional Incentive for Agriculture: in accordance with EU Common Agricultural Policy (CAP) - Council Regulation 1782/2003	EU policy - Incentives	Yes	Farmers		(Agriculture) EU Directive originally provided a bonus to farmers to set aside agricultural land due to the mass production of agricultural goods in the EU. This act allows farmers to cultivate retired lands with energy crops. Additionally, it provides a bonus of €45 per Hectare to farmers who produce energy crops on non-set aside agricultural lands. Incentive is capped at 1.5 million hectares.
EU	European Structural Funds (2007-2013)	EU policy - Incentives	Yes	Farmers and Industry		Agriculture - EU Funds addressed to Regional authorities for the promotion of biomass. They provide funding for: energy crop; electrical and thermal conversion plants and equipment and facilities linked to the development of the bioenergy supply chain
Ministry of Agriculture, Food and Forestry Policies and Regional authorities	National and State Programme for Rural Development (2007-2013)	Activity - Incentive and Education	Yes	Farmers and bioenergy producers		(Agriculture/ Rural Development) Provides grants (up to 65% of the total costs) for the development of state agroenergy sectors with a focus on increasing the competitiveness of bioenergy / biofuels vis-à-vis fossil fuels. It promotes demonstration projects for the agroenergy chain and infrastructure development.
Ministry of Agriculture, Food and Forestry Policies	National Programme for Agricultural and Forestry Biomass (PNVBAF) and National Programme for the Use of Biomass (PNERB), CIPE resolution of December 1999	Activity - Targets and Guidelines	Yes	Industry		Agriculture / Climate Change) Sets targets for the reduction of GHG (3-4% by 2010/12), using renewable energy from agro-forestry products and by-products, and development of ecocompatible agricultural methodologies - promoting the use of energy crops.
Ministry of Agriculture, Food and Forestry Policies	National Plan on Biomass Fuels (PROBIO)	Activity - Incentive and Education	No	Farmers/ bioenergy Producers / local administrations		(Agriculture/ Climate Change) - Beginning in 1999, with the objective of contributing to national strategy for GHGs reduction, provides capital grants (5 billion Lira /yr) for the expansion of the national and state agroenergy production chains through demonstration projects and dissemination activities designed to educate and disseminate national bioenergy information. Serves as the implementation mechanism for the PNVBAF and PNERB. Four interstate projects have been promoted in the first period 1999-2001: certification processes within the agroenergy production chain; production of energy from biomass in the South of Italy; energy from forestry biomass; development of biogas with hydrogen content.

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Promotes production of energy crops through financial incentives				Incentives in Italy had a limited use of set aside land for production of oilseed for biodiesel due to the serious economic and structural obstacles in Italy
	Provides funding for electrical and thermal conversion plants and equipment and facilities linked to the development of the bioenergy supply chain			
Promotes production of vegetable and wood biomass for energy use			€16.6 billion - over 5 years - allocated to the whole agriculture sector	
Provide National targets and guidelines for the development of an incentive framework (administrative, economic, fiscal) to promote the use of agroenergy crops and the use of byproducts with the goal of unifying the current fragmented normative framework and promoting standardization for end-use products.				
Promotes projects aiming at increasing energy crops cultivation for biodiesel production for fuel uses and heat production for residential uses. Promotes use of agriculture residues for heat production and teleheating. Promotes projects for biogas production from animal sludge			€7 milions for financing 19 demonstration projects in the period 1999-2001 (4 interstate projects and 15 at regional level). €4 950 761 have been allocated for 13 projects. In 2004 the budget available for PROBIO was €1 936 713	

provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). "Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

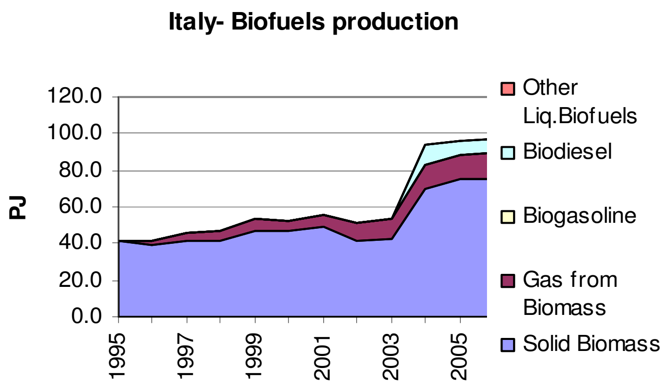
7.7 Italy Bioenergy Outlook

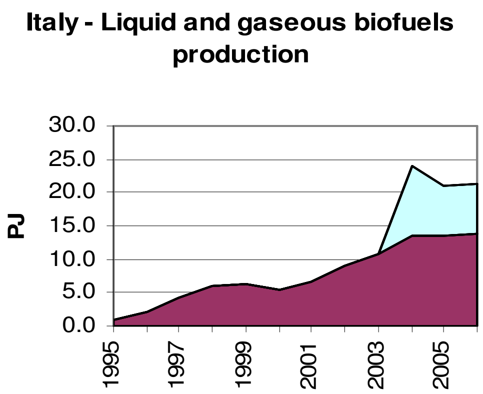
Table 7.2 - Itay – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	41.9	41.0	45.3	47.4	53.1	52.7	55.5	51.0	53.2	93.9	95.9	97.1
Solid Biomass	40.9	39.1	41.2	41.5	46.9	47.2	48.9	41.9	42.5	70.0	74.9	75.8
Gas from Biomass	0.9	2.0	4.1	6.0	6.2	5.5	6.6	9.0	10.7	13.4	13.6	13.9
Biogasoline												
Biodiesel										10.5	7.4	7.4
Other Liq.Biofuels												
All woodfuels (2)	55.1	52.1	56.2	58.1	71.7	61.2	55.6	52.8	59.7	61.8	57.6	
Fuelwood (2)	53.1	50.2	53.5	54.2	69.6	57.2	51.9	49.3	56.3	58.6	54.1	
Charcoal (2)	1.0	0.9	0.9	0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.3	
Black Liquor (2)	0.9	0.9	1.8	3.6	1.8	3.7	3.4	3.2	3.1	2.9	3.2	

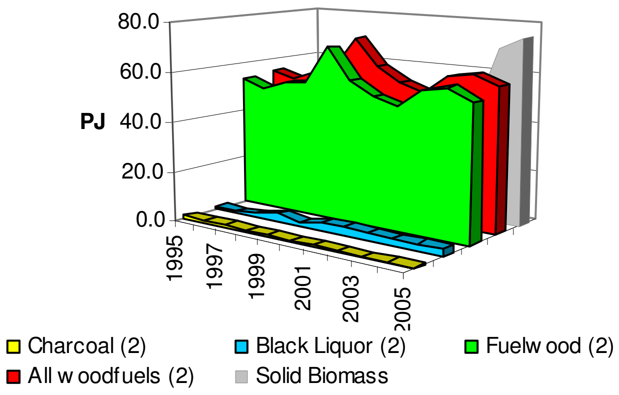
Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	-4.6	5.5	0.6	13.0	0.7	3.7	-14.3	1.3	64.7	7.1
Gas from Biomass	107.7	108	45.7	4.3	-11.9	20.1	37.4	18.2	24.9	1.5
Biogasoline										
Biodiesel										-30.1
Other Liquid Biofuels										

(2) = Based on FAO data





Italy- IEA Solid Biomass vs FAO Woodfuels



Italy - Change rate of biofuels production

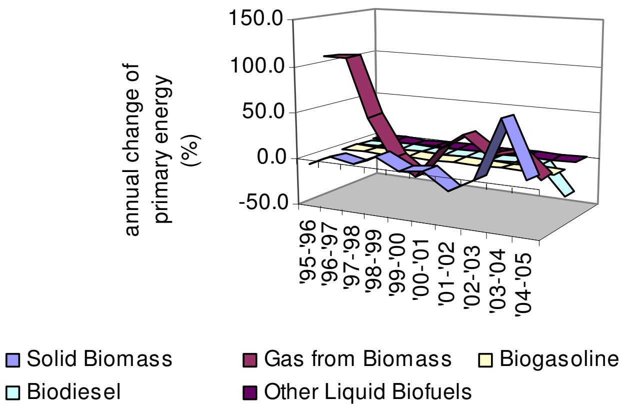


Table 7.3 - Italy – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	9.7	9.8	13.4	15.2	15.7	21.7	23.8	25.1	27.4	27.1	27.4	27.4
Solid Biomass	9.7	9.8	13.4	15.2	15.7	21.7	23.8	25.1	27.4	27.1	27.4	27.4
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	4.6	5.5	6.0	6.4	7.6	9.6	10.4	12.3	13.7	18.2	20.7	
Fuelwood (2)	3.6	4.4	4.8	5.2	6.4	8.2	9.1	11.0	12.2	16.7	19.0	
Charcoal (2)	1.0	1.1	1.2	1.2	1.2	1.4	1.3	1.3	1.4	1.5	1.8	

(2) = Based on FAO data

Table 7.4 - Italy – Biofuel Export (PJ)

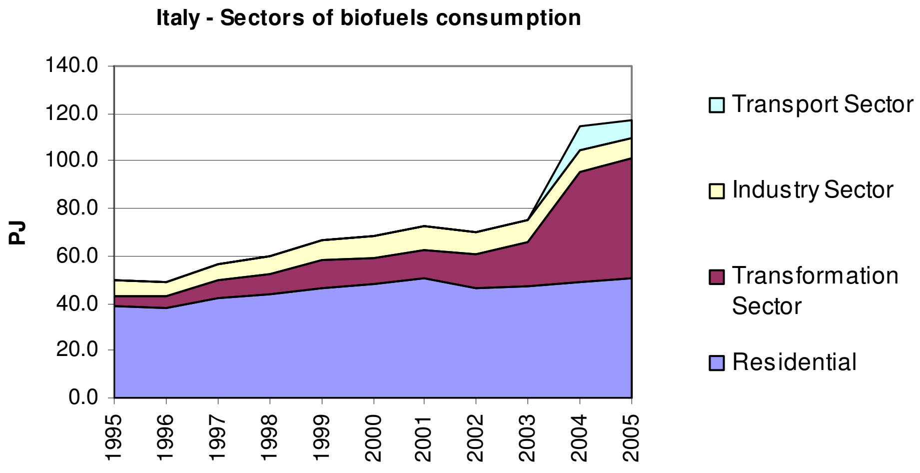
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels				0.1	0.0	0.1	0.1	0.1	0.1			
Solid Biomass				0.1	0.0	0.1	0.1	0.1	0.1			
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.0	0.1	0.1	0.0	0.0	0.1	0.0	0.1	0.0	0.0	0.0	
Fuelwood (2)	0.0	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Charcoal (2)	0.0	0.0	0.0	0.0		0.0		0.0	0.0	0.0	0.0	

(2) = Based on FAO data

Table 7.5 - Italy – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	*51.6*	*50.9*	*58.7*	*62.6*	*68.7*	*74.3*	*79.2*	*76.0*	*80.6*	*121.0*	*123.3*	*124.5*
	Transform.	3.8	5.0	7.5	8.5	11.4	10.8	12.6	14.0	18.3	46.3	50.1	
	Industry	6.9	5.7	6.4	7.9	8.5	9.5	10.0	9.6	9.3	9.2	8.9	
	Transport										10.5	7.4	
	Residential	39.0	38.2	42.4	43.6	46.5	48.3	50.2	46.5	47.2	49.1	50.8	
Solid Biomass	Dom. Supply	50.6	48.9	54.6	56.7	62.5	68.8	72.7	66.9	69.9	97.1	102.3	103.2
	Transform.	2.8	3.1	3.6	3.2	5.2	5.3	6.0	5.0	7.6	32.9	36.6	
	Industry	6.9	5.7	6.4	7.9	8.5	9.5	10.0	9.6	9.3	9.2	8.9	
	Transport												
	Residential	39.0	38.2	42.4	43.6	46.5	48.3	50.2	46.5	47.2	49.1	50.8	
Gas from Biomass	Dom. Supply	0.9	2.0	4.1	6.0	6.2	5.5	6.6	9.0	10.7	13.4	13.6	14.0
	Transform.	0.9	2.0	3.9	5.3	6.2	5.5	6.6	9.0	10.7	13.4	13.6	
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply										10.5	7.4	7.4
	Transform.												
	Industry												
	Transport										10.5	7.4	
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



8 Country Profile - JAPAN

8.1 Overview

In 2004, Japan's total primary energy consumption was 22 324 PJ, with renewables representing about 1 percent (262 PJ). Total electricity production was 93 Mtoe with biomass covering 1.1 percent (1 Mtoe); heat production was 2.2 Mtoe with biomass covering 22 percent (0.5 percent)[149].

The production of ethanol[150] in 2004 was 30 kl; the production of biodiesel[151] was of 4 500 kl.

Table 8.1– [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	83%	3%	1.2%
22 209	18 379	701	264

Source: IEA, 2005

8.2 Country Objectives and Drivers

The main drivers for the development of bioenergy are the mitigation of climate change, creation of a recycling-oriented society, development of the agricultural sector and the creation of competitive industrial technologies.

8.3 Bioenergy Policy by Subsector

The 2002 Biomass Nippon Strategy (as revised in 2006) is the main policy exemplifying the strategy for promoting biomass utilization in Japan.

Other policies on specific aspects are: the "Research and Development Program for Prevention of Global Warming", the "Program for the Establishment of a Regional System for Practical Use of Ecofuel" and the "Subsidy for establishment ecofuel plants and related infrastructure in Japan", the "Kyoto Protocol Achievement Plan" and "Roadmap for Increased Production of Domestic Biofuels".

Power Generation

The "Kyoto Protocol Target Achievement Plan" require both biomass power generation and waste power generation in the amount of 5 860 000 kl of oil equivalent by 2010.

The Biomass Nippon Strategy sets the technological target of reaching of 20 percent efficiency rate for the conversion of biomasses into electricity for plants operating 10 tonnes of

149 IEA Energy Statistics 2004
150 Mostly from sugarcanes
151 Mostly from rape seed and waste edible oil

biomass per day and an efficiency of 30 percent for plants operating more than 100 tonnes of biomass per day.

Heat Production

The "Kyoto Protocol Target Achievement Plan" envisions biomass thermal utilization in the amount 3 080 000 kl (this amount includes biomass-derived fuel – 500,000 kl of oil equivalent – for transportation) by 2010.

The Biomass Nippon Strategy sets the technological target of reaching an efficiency of 80 percent for the conversion of biomass into heat for plants operating 10 ton of biomass per day.

Transport

The "*Kyoto Protocol Target Achievement Plan*" envisions consumption of biomass derived fuel for transportation in the amount of 500,000 kl, as converted to crude oil, by 2010.

The Biomass Nippon Strategy promotes small-scale tests on 3 percent mixtures of ethanol to gasoline (E3) and the oil industry's demonstration activity using bioethanol as ETBE to verify its quality and safety at all stages of production to end-use. Moreover, the *Law for Quality Control of Gasoline and Other Fuels* (Law No. 88 1976, or "Quality Control Law"), sets a 3 percent mixture of ethanol to gasoline to be the upper limit to ensure the safety of vehicles and control the quality of gas emissions; for biodiesel the Quality Control Law of 2007 sets a limit at not to exceed 5 percent for mixture in gasoline

As a middle-long term plan (until 2030) the Roadmap for Increased Production of Domestic Biofuels promotes technical development and expanded production at a competitive price by using the lignocellulosic feedstock. Moreover, the government will consider the introduction of fiscal incentives to promote the use of biofuel.

Regarding imports, biofuels are object to a 0.16 dollar tariff.

No data are available on the actual quantities of biofuel imports.

8.4 Results and Challenges

The strategy implemented by the Japanese government seems to address the main technological and policy challenges related to the development of bioenergy, moreover the research and development activities carried out by the different ministries focusing on biofuels and electricity and heat production will help Japanese industries compete with countries that have a long tradition of bioenergy utilization.

8.5 Country Policy Table - Japan

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct
Ministry of Agriculture, Forestry and Fisheries Cabinet Office Ministry of Education, Culture, Sports, Science and Technology Ministry of Internal Affairs and Communications Ministry of Economy, Trade and Industry Ministry of Land, Infrastructure and Transport Ministry of the Environment	Biomass Nippon Strategy	Policy-Strategy	No	Government	Provides general support for three main goals by 2010: - utilizing more than 80% of waste biomass and more than 25% unused biomass in terms of carbon equivalent (i.e. electricity, heat, transportation fuels, etc.); - improving energy conversion efficiency; - launching 300 Biomass Towns which are local municipalities having a system for utilizing biomass.
Ministry of Agriculture, Forestry and Fisheries Cabinet Office Ministry of Education, Culture, Sports, Science and Technology Ministry of Internal Affairs and Communications Ministry of Economy, Trade and Industry Ministry of Land, Infrastructure and Transport Ministry of the Environment	Boosting the Production of Biofuel in Japan	Policy-Strategy	No	Government	Provides the roadmap for increased production of domestic biofuels.
Ministry of the Environment	Research and Development program for prevention of global warming	Activity-research and development	No	Industry/government/university	Promotes research and development activities for new technologies which contribute to curb the GHG emissions, such as energy-saving technologies and renewable energy including bioenergy.
Ministry of the Environment	Program for the Establishment of a Regional System for Practical Use of Ecofuel	Activity-Incentive Programme	No	Industry/ bioenergy producer/ supplier	Perform large-scale demonstration of the use of bioethanol blended gasoline in big cities and Miyako-jima Island in Okinawa to accelerate the widespread use of ecofuel.
Ministry of the Environment	Subsidy for establishment ecofuel plants and related infrastructure in Japan	Activity-Incentive Programme	No	Industry/ bioenergy producer/ supplier	Establish ecofuel plants and related infrastructure in Japan

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Activates agriculture, forestry, and fisheries, as well as associated rural communities	Improves energy conversion efficiency.	・Creates a Recycling-oriented society ・Develops new strategic industries.		Activates agriculture, forestry, and fisheries, as well as associated rural communities
Develops new energy crops	Promotes R&D for the production of biofuels from cellulosic feedstocks.			Develops new energy crops
	Support the development of the new technologies for the conversion of cellulosic biomass into ethanol etc.		Approx. 3.3 billion yen will be disbursed from government to support this activity.	
	Establish the overall systems for the demonstration(from conversion plants to gas filling facilities)		Approx. 2.8 billion yen will be disbursed from government to support this activity.	
	Support for the establishment of ecofuel plants and the conversion of related infrastructure		Approx. 0.8 billion yen will be disbursed from government to support this activity.	

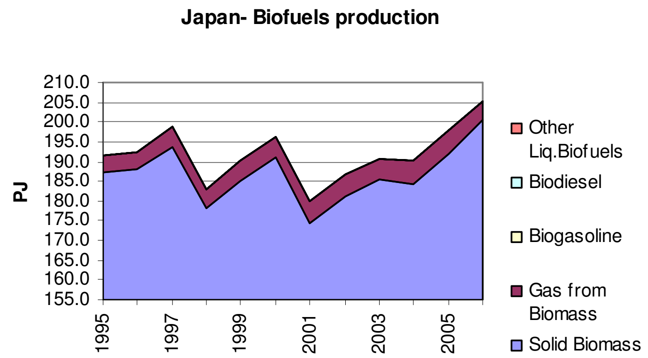
8.6 Japan Bioenergy Outlook

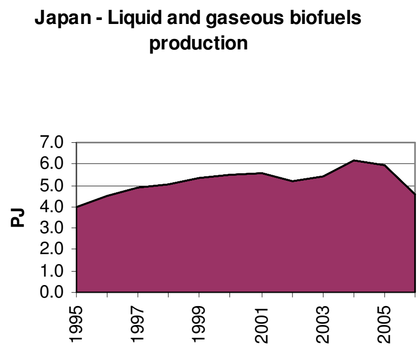
Table 8.2 - Japan – Biofuel production

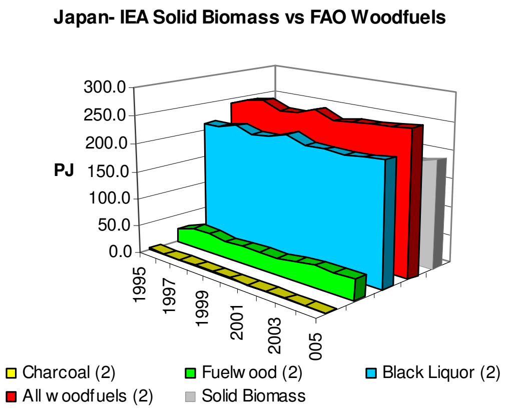
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	191.4	192.6	198.6	183.1	190.4	196.4	179.9	186.6	190.7	190.4	198.0	205.1
Solid Biomass	187.4	188.1	193.7	178.0	185.0	190.9	174.3	181.4	185.3	184.2	192.1	200.5
Gas from Biomass	4.0	4.5	4.9	5.1	5.4	5.5	5.6	5.2	5.4	6.2	5.9	4.6
Biogasoline												
Biodiesel												
Other Liq.Biofuels												
All woodfuels (2)	241.3	250.9	257.8	244.0	246.9	258.1	244.1	249.3	251.9	253.5	257.3	
Fuelwood (2)	24.9	34.9	34.4	29.2	30.0	30.8	29.9	35.1	39.3	37.9	38.6	
Charcoal (2)	4.2	2.6	2.5	2.5	2.1	1.7	1.6	1.3	1.2	1.1	1.1	
Black Liquor (2)	212.2	213.4	221.0	212.3	214.8	225.6	212.6	212.9	211.4	214.4	217.6	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	0.4	3.0	-8.1	3.9	3.2	-8.7	4.1	2.1	-0.6	4.3
Gas from Biomass	12.9	9	2.6	6.5	2.0	1.6	-6.5	4.3	14.0	-4.1
Biogasoline										
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data







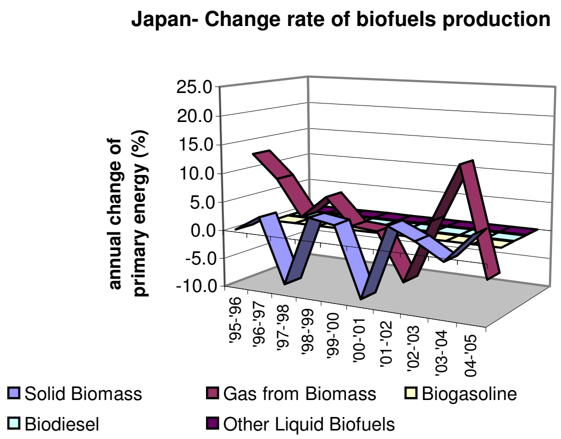


Table 8.3 - Japan – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	1.6	3.1	3.3	3.2	3.8	4.1	4.2	4.3	4.5	4.5	4.7	
Fuelwood (2)	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	
Charcoal (2)	1.6	3.1	3.2	3.2	3.6	4.0	4.1	4.2	4.4	4.4	4.6	

(2) = Based on FAO data

Table 8.4 - Japan – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	
Fuelwood (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
Charcoal (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.2	0.2	

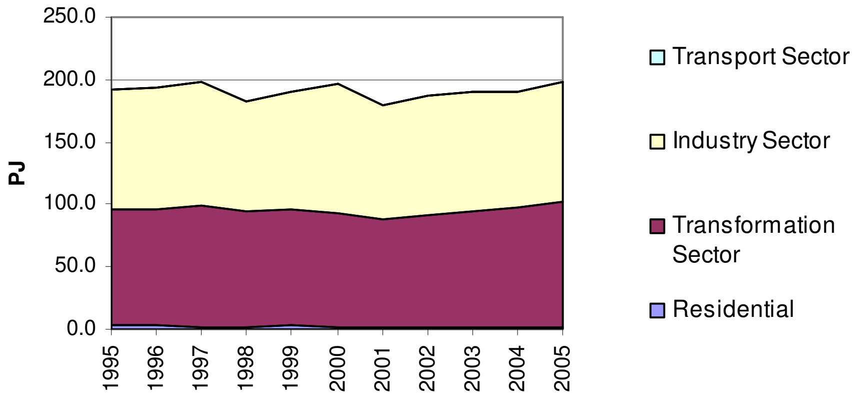
(2) = Based on FAO data

Table 8.5 - Japan – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	191.4	192.6	198.7	183.1	190.4	196.4	179.9	186.7	190.8	190.4	198.1	205.1
	Transform.	92.5	93.6	97.5	92.8	93.7	91.4	86.1	89.3	93.2	96.7	101.8	
	Industry	95.9	96.4	98.8	88.1	94.2	103.1	91.9	95.7	96.1	92.5	95.2	
	Transport												
	Residential	3.1	2.7	2.3	2.2	2.5	2.0	1.8	1.7	1.4	1.2	1.1	
Solid Biomass	Dom. Supply	187.4	188.1	193.8	178.0	185.0	191.0	174.3	181.5	185.3	184.2	192.1	200.6
	Transform.	88.5	89.0	92.6	87.8	88.3	85.9	80.6	84.1	87.8	90.5	95.9	
	Industry	95.9	96.4	98.8	88.1	94.2	103.1	91.9	95.7	96.1	92.5	95.2	
	Transport												
	Residential	3.1	2.7	2.3	2.2	2.5	2.0	1.8	1.7	1.4	1.2	1.1	
Gas from Biomass	Dom. Supply	4.0	4.5	4.9	5.1	5.4	5.5	5.6	5.2	5.4	6.2	6.0	4.6
	Transform.	4.0	4.5	4.9	5.1	5.4	5.5	5.6	5.2	5.4	6.2	6.0	
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

Japan - Sectors of biofuels consumption



9 Country Profile - MEXICO

9.1 Overview

Mexico is endowed with large quantities of fossil fuel sources (oil and natural gas) and is a net energy exporter country. Although extensive oil discoveries occurred in the 1970s, experts believe that the country's oil reserves may be depleting rapidly and will become insufficient to cover the country's energy needs. Furthermore, Mexico's energy consumption has grown considerably in the past ten years. Because of limited refining capacity, the country typically exports crude and imports refined gasoline and diesel. According to official sources[152], 87 percent of the energy originates from fossil fuels. The contribution from renewable energies (RE) is marginal and used mainly for heating purposes and for electricity generation. Biomass contributes 8 percent of primary energy consumption[153]. Principal biomass sources used in the country are sugar cane bagasse, mainly used for electricity and heat production for the sugar cane industry, and wood used mainly for heating and cooking. In 2004, 92 PJ of energy consumption was derived from sugar cane bagasse and 250 PJ derived from wood.[154] At the end of 2005 the Energy Regulatory Commission (CRE) authorized permits for electricity generation from biogas (19 MW to generate 120GWh/year), from sugar cane bagasse (70 MW to generate 105 GWh/year) and from hybrid system fuel oil-sugar cane bagasse (224 MW for producing 391 GWh/year).[155]

Mexico produces 49.2 million litres of ethanol (2006)[156] yearly, which are currently not used as fuel for transportation, but rather processed by the chemical and pharmaceutical industry. Currently, Mexican consumption of ethanol is 165 million litres per year, thus Mexico imports the remaining litres needed mainly from the United States, Brazil, Cuba and just recently, China.[157] The tariff regime foresees a mixed tariff (10 percent ad valorem +$0.36 per kilogram). The tariff is equal to 0 when importing from the United States.[158] Biodiesel is produced only on small scale demonstration projects, with a total production of approximately 3,300 MT per year.[159] Currently there are no full-size commercial biofuels plants in Mexico. Small, isolated experimental ethanol and biodiesel projects already exist but due to the lack of a domestic market and national biofuel public policy, these early initiatives have yet to develop into an integrated mature industry.

It is relevant to mention that Mexico has an important agricultural sector, potentially apt for bioethanol and biodiesel production.[160] Wood is the main energy source used for cooking by 25 million people living in rural areas and used also in a great number of small industries.

[152] Source: CMM 2005, made with data from the National Energy Balance 2004, SENER 2005.
[153] Masera, O. (Coordinador), "Bioenergía en México, un catalizador del desarrollo sustentable". CONAFOR. Multimundo, 2006
[154] Data from the Energy Information System of the Secreteria de Energia
[155] Masera 2006
[156] RFA, Industry statistics. Available at: http://www.ethanolrfa.org/industry/statistics, accessed on April 4, 2007.
[157] USDA-FAS, "Mexico: Biofuels Annual Report 2007," Gain Report no. MX7042, June 12, 2007
[158] USDA-FAS, "Mexico: Biofuels Annual Report 2006," Gain Report no. MX6503, June 26, 2006
[159] USDA-FAS 2007
[160] Libro Blanco de la Bioenergía en México, Red Mexicana de Bioenergía 2005, México.

Table 9.1– [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	46%	10%	4.7%
7 391	3 403	714	348

Source: IEA, 2005

9.2 Country Objectives and Drivers

Bioenergy is scarcely exploited (about 408 PJ), against a technical potential estimated between 3 035 and 4 550 PJ per year, representing between 54 percent and 81 percent of total national energy supply[161]. Of the estimated potential, the most significant sources are wood (between 27 percent and 54 percent) energy crops (26 percent) and biogas from municipal by-products wastes (0,6 percent). Moreover, estimates show that 73 million tonnes of agricultural and forest waste are potential sources of energy and that the use of the municipal solid waste, from the ten main cities[162], for electricity generation could lead to the installation of 803 MW and generate 4,507 MWh/year[163]. The growing interest in bioenergy comes in response to a number of domestic and global drivers to: stimulate the rural economy; diversify energy supplies and reduce GHG emissions.

9.3 Bioenergy Policy by Subsector

No specific bioenergy promotion program is currently operational in Mexico. However some recent initiatives have been taken by the government towards laying the groundwork for future regulatory and policy frameworks promoting bioenergy.

The principal document presenting the national energy policy is the Sectoral Program of Energy 2001-2006 (PSE for its acronym in Spanish) that, besides indicating the 2,5 percent energy saving goal to be reached by 2006, defines a national strategy for RES by mandating the incorporation of at least 1,000 MW of renewable energy sources to the installed electricity generation capacity by the year 2006 (excluding large hydropower plants), in order to double the contribution of RE compared to the 2000 value.

In order to achieve this goal, the PSE proposed the establishment of necessary actions that would allow private and public sectors to participate in the development of new renewable energy projects, including the following technologies: solar, wind, geothermal, small hydropower, biomass and biogas, among others.

This Program also contains the guiding principles of the Mexican Energy Policy: energy sovereignty, assurance of supply, social commitment, modernization of the energy sector,

[161] Masera 2006
[162] Ciudad de México, Guadalajara, Puebla, Nezahualcoytl, Tijuana, Ecatepec, Mérida, Acapulco, Ciudad Juárez, y Tlalnepantla.
[163] available at www.wheelabratortechnologies.com/WTI/CEP/nbroward.asp

growing private sector participation, orientation towards sustainable development and commitment to future generations. In this context, renewable energy sources play a key role.

The Sectorial Program of Energy for the period 2007-2012 is being designed by the Secretaría de Energia (SENER- Ministry of Energy) and will define guiding principles of Mexico's energy policy. Because of the interest generated in ethanol over the last year, it is highly probable that a biofuels section will be included in the new PSE

Regarding promotion of bioenergy, two laws (Law for the Utilization of Renewable Sources of Energy (LAFRE) and Law for the Promotion of Biofuels) have been proposed and are still in the approval process. They aim to establish the legal framework under which SENER will define its strategy for biofuels, biomass and other sources of energy. The Government of Mexico (GOM) took an important step recently initiating work on a feasibility study requested by the Secretaría de Energia[164] to GTZ, aimed to analyse the potential for ethanol and biodiesel use and production in Mexico and identify possible scenarios for ethanol adoption in Mexico.

The Ministry of Energy is the lead institution with regards to the country's energy policy and planning: it has a key role in the future application of LAFRE and the Law for the Promotion of Biofuels.

Power generation

The main policy to promote the use of RE is the "Law for the Utilization of Renewable Sources of Energy" (Ley para el Aprovechamiento de las Fuentes Renovables de Energía - LAFRE), currently debated in the Senate (Cámara de Senadores).

Other policy initiatives include:

- The modification of the Income Tax Law, which proposes a fiscal credit of 30 percent for the investment in RE electricity generation equipment (CONACYT) (Ley del ISR, art. 219). This law allows also companies to deduct the cost of energy transformation equipment from their revenue taxes in one fiscal year (Ley del ISR, art. 40). In theory this accelerated depreciation strategy can provide substantial improvements in the financial analysis of RE self-generated projects.
- Policy supporting bioenergy use in rural electrification include the 'Integrated Energy Services for Small Rural Mexican Communities' (SIEPCRM, for its acronym in Spanish). Within the next 5 years, the SIEPRCM intends to provide electricity to 50 000 homes in rural areas, using diverse technologies including small biomass generators and hybrid RE-diesel systems. Sixty percent of the communities to be linked to the power system are of indigenous population.
- The Interconnection Contract for Intermittent Sources with Credited Capacity was created by the Energy Regulatory Commission (CRE for its acronym in Spanish) and came into effect during the month of January 2006. This contract allows to calculate and credit the

[164] SENER-BID-GTZ (edit), "Potenciales y Viabilidad del Uso de Bioetanol y Biodiesel para el Transporte em Mexico" , México, November 2006

capacity that these projects provide to the electric grid. It is estimated that this will allow for the installation of more than 700 MW through permits granted by CRE[165].

- The "National Strategy for Climate Change" (see "transport section").
- Proposal for the introduction of a carbon tax on fossil fuels. The Carbon Dioxide Income generated will be destined for the promotion of RE.

Heat Production

No specific policy addressed to heat generation from biomass has been developed.

Transport

Today there is no mandatory biofuel blend in Mexico.

In April 2007, the Senate (Camara de Senadores) passed the Law for the utilization of biofuels, now waiting to be approved by the Federal Government. Since the approval of the law was surrounded by controversy and comments from deputies and civil society representatives, a revision of the Law is foreseen to be held in September 2007 before being sent to the Federal Government. However, 3 September 2007 President Calderón vetoed the proposed law stopping the negotiation process for the time being.

Other policy initiatives promoting the use of bioenergy for transport follow below:

- The National Sugar Development Plan (PRONAC) addresses ethanol production from sugar cane. Through it, the Mexican government highlights the need to diversify the sugar industry and foresees the participation of the industry in bioenergy production, seeking to build capacity to produce about 7 840 barrels a day (120 million gallons per year or 454 million litres) of ethanol by 2012. It also foresees the use of bagasse and biomass residues to cover the electricity needs of the mills. This amount of ethanol would allow the replacement of 35 percent of the gasoline oxygenate, MTBE, with ethanol. However, due to the current low efficiency and low productivity of the sector, major changes to the industry's structure will be necessary to make sugar production an important ethanol feedstock.
- The "National Strategy for Climate Change" (2007) which specifically recognises the role of bioenergy (for electricity, heat and fuel for transportation) in decreasing GHGs emissions. Conservative estimations about GHGs reduction from biomass sources by 2012 account to 5.7 million ton/CO_2.

[165] The Public Electricity Service Act (LSPEE), that regulates electricity provision in Mexico, does not allow the free purchase and selling of electricity to private investors, but it allows energy generation for either self-supply or to complement productive processes through cogeneration, subject to a permit by the Energy Regulatory Commission (CRE).

9.4 Results and Future Challenges

Although no specific bioenergy promotion program is currently operational in Mexico, some recent steps have been taken by the GOM aimed at improving the policy and regulatory framework, and therefore promoting the development of bioenergy.

Two laws are currently in the process of approval and although they lack clear targets, mandates and economic incentives, they aim to set the legal framework for future regulations and measures that could effectively enable bioenergy development and the creation of a national biofuel industry. However, concerned about the potential impact biofuels production will have on agriculture, food production and prices, and economic development, the Government of Mexico is proceeding cautiously and carefully analysing the opportunities and threats that will accompany biofuel production and consumption.

A veto has recently been put by President Calderón on the Biofuel Law proposal which stopped the approval process for the time being.

The need for R&D and strengthening of RE research groups of limited resources has been officially recognized by SENER that identified the need to strengthen RE research groups that currently have limited resources, resulting in incipient technological development in new areas like liquid fuel production, biomass gasification or hydrogen production through.

9.5 Country Policy Table - Mexico

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/ Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Intersecretarial Commission for Sustainable Rural Development	Law on the Promotion and Development of Bioenergy (2007)	Policy - strategy	Pending	Farmers /bioenergy producers	It provides guidelines for encouraging the use and production of bioenergy as a key element to achieve national energy self-sufficiency and sustainable development provide support for the agricultural sector and contribute to pollution reduction. The Preamble refers the goal of improving the air quality of metropolitan areas in Mexico. The Law states that the Intersecretarial Commission for Sustainable Rural Development will be responsible for: 1) elaborate programmes and strategies (at national, federal and municipal level) for promoting biofuels production from maize, sugar cane and oilseeds; 2) establish targets, blending requirements and date of entry into force of them; 3) formulate and implement economic incentive programmes to build biofuel plants; 4) promote R&D activities related to bioenergy; 5) advise farmers and producers on any issues related to the production of bioenergy feedstocks (including any change in bioenergy technology or agriculture practice); 6) realize dissemination and education activities. The Law provides for the Government to prioritize projects in particularly depressed areas and respects indigenous rights.	
Ministerio Publico de Fiscalia	Law on income taxation (Ley del ISR- 2004)	Policy- incentives	Yes	Industry	It sets a number of mechanisms that promote the utilization of renewable sources of energy: 1) allows accelerated depreciation for infrastructure projects that use renewable sources of energy; 2) allows fiscal credit of 30% to R&D projects	
Ministry of Agriculture and Rural Development (Secretaria de Agricultura Ganaderia, desarrollo rural, pesca y alimentacion)	National Sugar Development Plan (2007-2012)	Activity- strategy	Yes	Sugar cane Industry		Agriculture promotes the energy use of sugar cane through the diversification of sugar industry activities and the promotion of the use of bagasse and biomass residues for the electricity needs of the mills.
Comision Intersecretarial de Cambio Climatico	National Strategy for Climate Change (2007)	Activity- strategy	Yes	Industry- energy producers		Climate Change promotes the use of bioenergy (for electricity, heat and fuel for transportation) for reducing GHGs emissions

For the purposes of this table:
"Policy" is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). "Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism
Production	Conversion	Use	
It promotes production and use of bioenergy		It promotes production and use of bioenergy	The Secretary of Treasury shall include a budget item to finance the implementation of the programme deriving from the National Policy of Renewable Energy which shall be monitored by the Intersecretarial Commission for Sustainable Rural Development. Other sources of financing for the implementation of the bioenergy projects will come from the use of Clean Development Mechanism
	Provides financial incentives for development of infrastructure projects that incorporate biomass and other renewable energy sources		
Foresees 6.5 mil tons increase of sugar cane production for the production of 7840 barrels a day of ethanol by 2012. This amount of ethanol would allow the replacement of 35% of the gasoline oxygenate, MTBE, with ethanol.			
It promotes production, conversion and use of bioenergy	It promotes production, conversion and use of bioenergy	It promotes production, conversion and use of bioenergy	

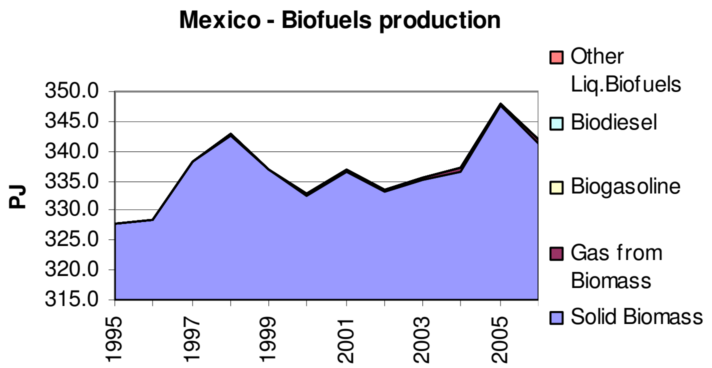
9.6 Mexico Bioenergy Outlook

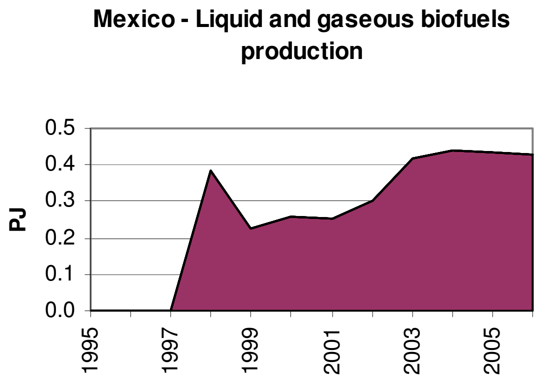
Table 9.2 - Mexico – Biofuel production

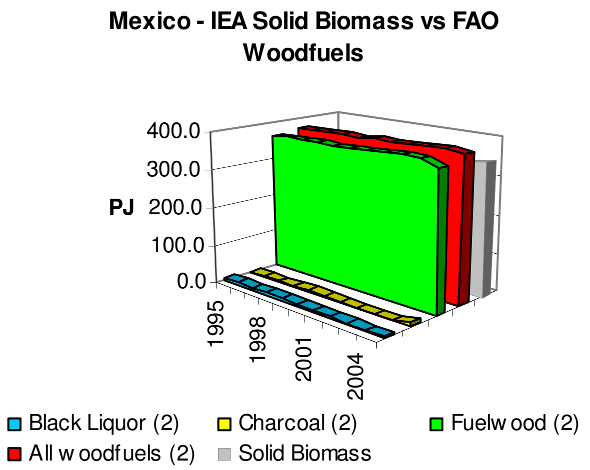
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	327.8	328.6	338.3	343.0	336.9	332.7	336.8	333.3	335.5	337.1	347.9	341.8
Solid Biomass	327.8	328.6	338.3	342.6	336.7	332.4	336.5	333.0	335.1	336.7	347.5	341.4
Gas from Biomass				0.4	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
Biogasoline												
Biodiesel												
Other Liq.Biofuels												
All woodfuels (2)	370.5	374.6	375.8	378.1	375.5	379.4	377.4	380.9	383.0	384.2	377.3	
Fuelwood (2)	363.3	366.3	367.6	366.3	363.4	367.6	369.3	374.8	376.9	376.8	361.4	
Charcoal (2)	0.8	0.9	1.1	2.5	5.1	4.1	4.2	2.3	2.2	3.1	11.8	
Black Liquor (2)	6.4	7.4	7.0	9.4	7.0	7.6	3.9	3.8	4.0	4.3	4.0	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	0.2	3.0	1.3	-1.7	-1.3	1.2	-1.0	0.6	0.5	3.2
Gas from Biomass				-42.1	14.7	-2.3	19.9	39.5	5.0	-2.0
Biogasoline	'95-'96	'96-'97	'97-'98	'98-'99	'99-2000	2000-'01	'01-'02	'02-'03	'03-'04	'04-'05
Biodiesel	0.2	3.0	1.3	-1.7	-1.3	1.2	-1.0	0.6	0.5	3.2
Other Liquid Biofuels				-42.1	14.7	-2.3	19.9	39.5	5.0	-2.0

(2) = Based on FAO data







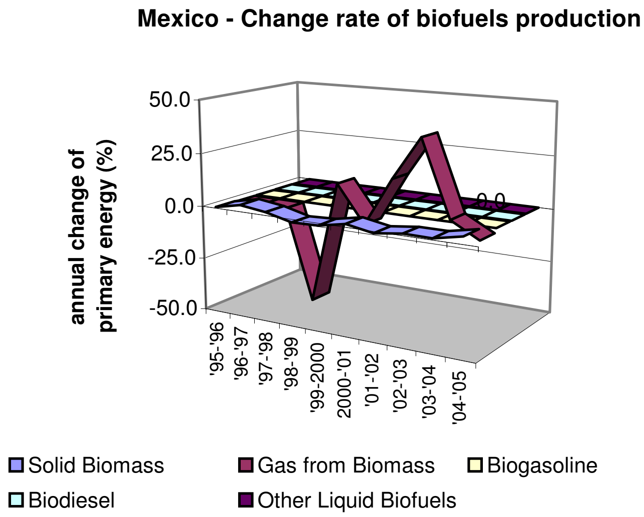


Table 9.3 - Mexico – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.1	0.0	0.0	0.0	0.1	0.3	0.2	0.1	0.1	0.1	0.2	
Fuelwood (2)	0.1	0.0	0.0	0.0	0.0	0.1	0.0	0.0	0.0	0.1	0.2	
Charcoal (2)	0.0	0.0	0.0	0.0	0.0	0.2	0.2	0.1	0.1	0.0	0.0	

(2) = Based on FAO data

Table 9.4 - Mexico – Biofuel Export (PJ)

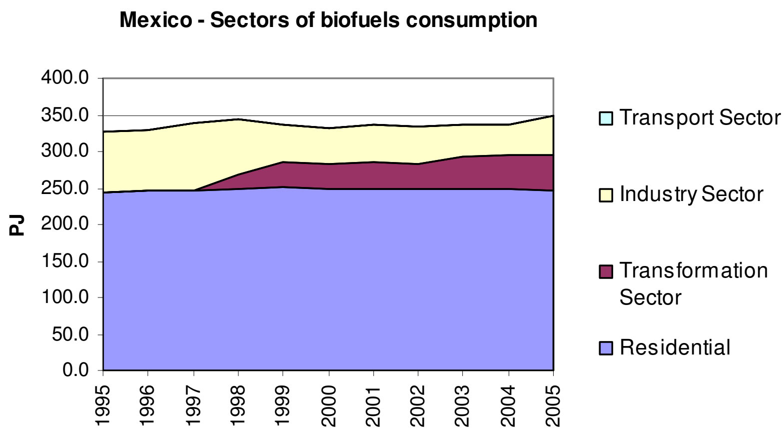
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.7	0.8	0.8	0.5	3.8	2.3	1.6	1.6	1.6	1.4	1.6	
Fuelwood (2)	0.2	0.1	0.1	0.1	2.7	1.1	0.1	0.1	0.1	0.3	0.3	
Charcoal (2)	0.6	0.7	0.7	0.4	1.1	1.2	1.5	1.5	1.5	1.1	1.3	

(2) = Based on FAO data

Table 9.5 - Mexico – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	327.9	328.7	338.4	343.1	337.0	332.8	336.9	333.4	335.6	337.2	348.0	341.9
	Transform.				20.9	36.4	34.2	35.7	35.1	45.5	46.6	48.1	
	Industry	84.0	83.2	91.4	73.6	50.4	48.7	51.8	49.5	41.8	42.8	52.7	
	Transport												
	Residential	243.8	245.4	247.0	248.6	250.2	249.9	249.4	248.8	248.3	247.7	247.2	
Solid Biomass	Dom. Supply	327.9	328.7	338.4	342.7	336.8	332.5	336.6	333.1	335.2	336.7	347.6	341.4
	Transform.				20.5	36.2	33.9	35.4	34.8	45.1	46.2	47.7	
	Industry	84.0	83.2	91.4	73.6	50.4	48.7	51.8	49.5	41.8	42.8	52.7	
	Transport												
	Residential	243.8	245.4	247.0	248.6	250.2	249.9	249.4	248.8	248.3	247.7	247.2	
Gas from Biomass	Dom. Supply				0.4	0.2	0.3	0.3	0.3	0.4	0.4	0.4	0.4
	Transform.				0.4	0.2	0.3	0.3	0.3	0.4	0.4	0.4	
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



10 Country Profile - RUSSIA

10.1 Overview

Russia is known to be rich in bioenergy resources: its cultivated agricultural lands comprise 9 percent of the total world reserves; forest (wood reserves) account for 25 percent of the world reserves. However, Russia's energy balance is dominated by fossils both in the transport sector than for power and heat generation. The share of renewable energy sources (RES) in electricity generation is very small: in 2002 just 0.5 percent of the total production, which amounts to 1 percent of the total annual energy consumption. The current share of biomass in the total energy balance is really negligible: it mainly relates to use of wood in households (5 mln households) (for these purposes over 50 million tonnes of wood are consumed).

Table 10.1– [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	82%	3%	1%
27 075	22 247	928	291

Source: IEA, 2005

10.2 Country Objectives and Drivers

Russia's Energy Strategy up to 2020 (approved by the Russian Government's Resolution dated 28.08.2003 No 1234), called for institution of a more active use of granulated peat and other types of wastes (including municipal solid wastes and agricultural/forestry residues) for electricity and heat generation. Russia's Energy Strategy up to 2030 (draft currently under discussion) proposes an increase of the RES's share in the total energy consumption after 2020 from 2 percent (initially planned) to 7 percent.

A bioenergy sector in the Russian economy is expected to be established through integration of related sectors of agro-industrial complex, transport, petroleum refining industry, farm machine industry. The current basis for activities aimed at developing the bioenergy sector is a state program coordinated by the Russian Ministry of Agriculture – the Federal program "Development of agriculture and regulation of the agricultural products' market, feedstock and food for 2008-2012" (approved by the Russian government on 14.07.2007 No 446). Among the measures envisaged by this program include: substantial increases in cultivated cropland areas (expected to be used mainly for rapeseed cultivation); technical modernization of the agricultural machines utilized in growing oil crops as well as development of manufacturing capabilities (which includes construction of large-scale facilities for biomass processing) and incentives for increased cultivation of energy crops. Among the incentives aimed at stimulating energy crop cultivation and production of biofuels and bio-additives (which are presently in place), are subsidized loans provided by the government for purchase of high energy crop seeds, purchase of equipments for cultivation of the said crops and for the construction of facilities for processing oil crops and others.

The key driver for development of bioenergy sector in Russia is the need to ensure:

- *Domestic (regional) energy security*: Primary energy resources are known to be unevenly distributed throughout the territory of the Russian Federation, some of them are located in the areas far away from the end users. As a result, high transportation costs have a considerable effect on the end price of energy products. Because of high oil prices in the world energy markets and the steadily growing demand for energy due to accelerated economic growth (taking into account the ambitious task to accelerate the rate of Russia's economic growth to 10 percent) it is vital to ensure a reliable supply of the country's population and its national economy with adequate and affordable energy resources and preclude any disruptions in the energy supply, especially to areas with decentralized energy supply or some far-away, mountainous, not easily-accessible regions, with severe climatic conditions where supply of energy resources is effected on a seasonal basis (the Far East, the Far North, the North Caucasus, Kaliningrad, the lake of Baikal and the Altay region). Diversification of the region's energy mix through enhanced use of locally available resources, predominantly from renewable energy sources, is believed to be one of the best ways to ensure their energy security.
- *Agricultural interests:* Some regions (Republic of Tatarstan, Kransnodar, Rostov and Volgograd Regions) with a substantial share of agriculture in their economic structure and some experience in growing energy crops (rapeseed, mainly) show strong interest in implementing bioenergy projects due to increased cultivated lands employment in rural area. Environmental security is a major concern (mitigation of harmful effects on the environment and climate change through reduction of CO_2 emissions). Substantial environmental benefits are obtained in case of biogas production from wastes.
- *Russia's integration into the world energy markets and its competitiveness in these markets:* Energy efficiency of the national economy, the most effective use of the available energy potential is recognized to be a top priority for Russia and a pre-condition for its transition from raw-materials-based development to innovative development.

10.3 Bioenergy Policy by Subsector

Recent steps have been taken to maximize use national bioenergy resources relating both to processing of biomass into different types of biofuels for transport and use of biogas for electricity and heat generation.

To coordinate work related to the preparation of the bioenergy investment projects, a National Bioenergy Association, embracing all interested stakeholders from industrial and agricultural sections, was established in early 2007.

Through the Federal Program "R&D in priority fields of development of scientific-technological complex in 2007-2012", coordinated by the Federal Agency of Science and Innovations, funding is provided for strategic research and development of innovative technologies for the bioenergy sector. Additional resources are also allocated by the private sector, as most of the projects are implemented on a public-private partnership basis.

Bioenergy-related projects currently funded through the programme include:

- a research project for designing a biostation for generation of electricity from agricultural residues;
- optimization of biogas technology in processing complex organic wastes (residues) generated by the agro-industrial complex of Russia;
- optimization of the universal biogas technology for environmentally-clean use of natural gas for electricity and heat cogeneration and obtaining synthetic liquid fuels;
- project aimed at developing methods of deep purification of biogas collected at the municipal solid waste sanitary landfills for obtaining an environmentally-clean source of energy; and
- a large-scale demonstration project that envisages construction ofa bioethanol production plant (the first stage of the production facility is planned for operation by the end of 2008; the whole complex is expected to be operative and reach designated production capacity by end 2010.

In early 2008 a Russian - EU coordinated call is planned to be announced to enhance strategic cooperation in the field of biomass cofiring (about €2 mln will be allocated for the project by each side).

To ensure implementation of President V. Putin's Executive Order dated 04.12.2006 No Pr-2097 directed to ensure accelerated development of biofuels production and use, a coordinated plan of action is being developed by the Russian government. Among others, it will include measures aimed at establishing legal and regulatory frameworks for production and use of biofuels (including taxation and customs regulations) as well as financial incentives for investors and innovations meant to facilitate the development of a biofuels market in Russia.

The current legal basis for biofuels is neglibile. It has been proposed that federal laws on "guidelines for bioenergy development in the Russian Federation" and on "use of alternative types of motor fuels" should be developed. The legislative bill of the second federal law was initiated and approved by the State Duma (the Russian Parliament) on 22 May 2007. It is expected to define the state policy in respect to use of alternative fuels, as well as regulate the relationship between biomass producers (agricultural energy crops and plants) and producers of biofuels and biodiesel engines.

The need for amending the currently effective federal law on "state regulation of production and distribution of ethyl alcohol and alcohol containing products" is frequently voiced as tax limitations established by it hinder development of the biofuels domestic market in Russia. The law is expected to regulate the establishment of conditions for investment and innovative activities in relation with development of the bioenergy sector. Among the tasks to be addressed include: development of national standards; training of specialists for the bioenergy sector; establishment of the technical basis for growing energy crops; manufacturing of equipment for energy crop cultivation; as well as for storage of high energy seeds and energy crop processing and use.

The National Bioenergy Association embracing all interested stakeholders from industrial and agricultural sections was established in early 2007 to coordinate the work related to preparation of the bioenergy investment projects.

10.4 Results and Future Challenges

It should be mentioned that presently a strong knowledge and expertise base exists in biomass processing (including processing of different types of wastes) and biogas generation, both for the biochemical and thermochemical systems, and there are a number of production technologies available now in Russia. The challenge is to substantially increase the production of biofuels by using innovative processes and technologies that are both competitive and sustainable.

10.5 Country Policy Table – Russia

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Ministry of Education & Science, Federal Agency for Science and Innovations	Federal Program "R&D in priority fields of development of scientific-technological complex in 2007-2012"	Research and Development, Education	Yes	Provides funding (based on state-private partnership) for strategic research and development of innovative technologies in bioenergy, in general, and biofuels, in particular.	Promotes innovative technologies of biofuels production and use in transport sector; as well as technologies of electricity generation from biomass.	Promotes introduction more efficient methods (technologies) of waste management
Ministry of Agriculture	Program of feedstock and biofuels production development	Incentive	Yes	Bioenergy producers & suppliers	Incentives for agricultural sector, forestry & new energy production opportunities	
Ministry of Industry and Energy	Program for converting hydrolyzed ethanol manufacturing facilities in bioethanol plants	Targets	Pending			
State Duma (the Russian Parliament)	Hearings on the national bioenergy policy	Incentive		Energy production sector & transport sector (including fuel production sector)		
State Duma (the Russian Parliament)	Hearings on the law delimitating usage of ethanol as biofuel and component of alcoholic beverage	Incentive	Pending decision		Allows mass ethanol production for transportation	Positive impact on agriculture industry development
Federal Assembly (the Upper Chamber of the Russian Parliament)	Development of standards to facilitate large-scale use of renewable energy sources, including use of biomass for energy	Targets	Pending decision	Energy production sector & transport sector (including fuel production sector), agricultural production sector		

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
3 large-scale projects to be implemented within the framework of the program will result in construction of a bioethanol production complex, establishment of biodiesel fuels production and lay down the foundation for complex use of different types of biomass			Fundamental R&D projects are funded by the government. Development of pre-commercialized technologies is funded by the state and private sector on the 50/50 basis.	3 large-scale projects to be implemented within the framework of the program will result in construction of a bioethanol production complex, establishment of biodiesel fuels production and lay down the foundation for complex use of different types of biomass
	conversion of the existing			

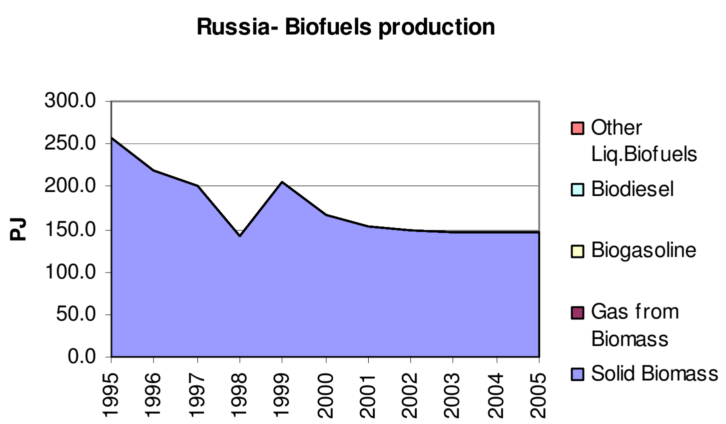
10.6 Russia Bioenergy Outlook

Table 10.2 - Russia – Biofuel production

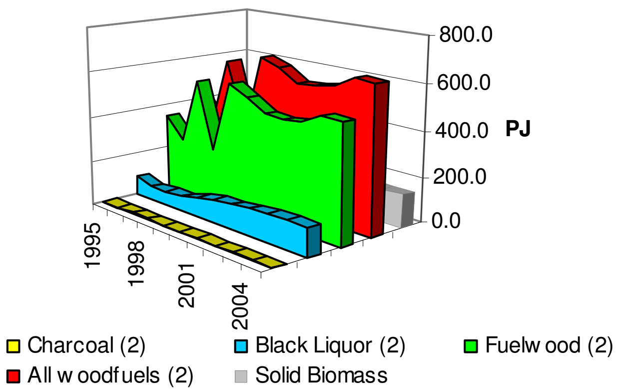
Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	258.0	218.8	200.2	141.1	205.1	167.7	153.4	149.6	145.6	145.9	146.7	
Solid Biomass	258.0	218.8	200.2	141.1	205.1	167.7	153.4	149.6	145.6	145.9	146.7	
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liq.Biofuels												
All woodfuels (2)	429.3	313.8	607.7	318.0	653.8	625.4	577.1	580.4	596.6	643.9	639.0	
Fuelwood (2)	345.3	249.9	543.1	249.7	563.7	519.6	465.6	460.6	472.3	517.1	511.6	
Charcoal (2)	1.4	0.9	1.7	1.4	1.5	1.8	1.8	1.8	1.8	1.8	1.8	
Black Liquor (2)	82.5	63.1	62.9	66.8	88.5	103.9	109.7	117.9	122.4	124.9	125.5	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	-15.2	-8.5	-29.5	45.4	-18.2	-8.5	-2.5	-2.6	0.2	0.6
Gas from Biomass										
Biogasoline										
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data



Russia- IEA Solid Biomass vs FAO Woodfuels



Russia - Change rate of biofuels production

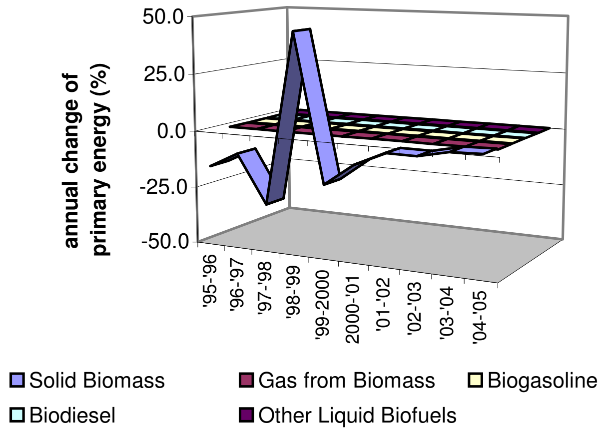


Table 10.3 - Russia – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)						0.0	0.2	0.1	0.1	0.0	0.0	
Fuelwood (2)						0.0	0.2	0.1	0.1	0.0	0.0	
Charcoal (2)							0.0		0.0	0.0	0.0	

(2) = Based on FAO data

Table 10.4 - Russia – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels			13.8									
Solid Biomass			13.8									
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	1.6	2.9	9.1	9.8	6.8	12.2	12.0	9.8	3.7	4.0	4.0	
Fuelwood (2)	1.6	2.9	9.1	9.8	6.8	12.1	12.0	9.7	3.7	4.0	4.0	
Charcoal (2)	0.0	0.0	0.0			0.0	0.0	0.1	0.1	0.1	0.1	

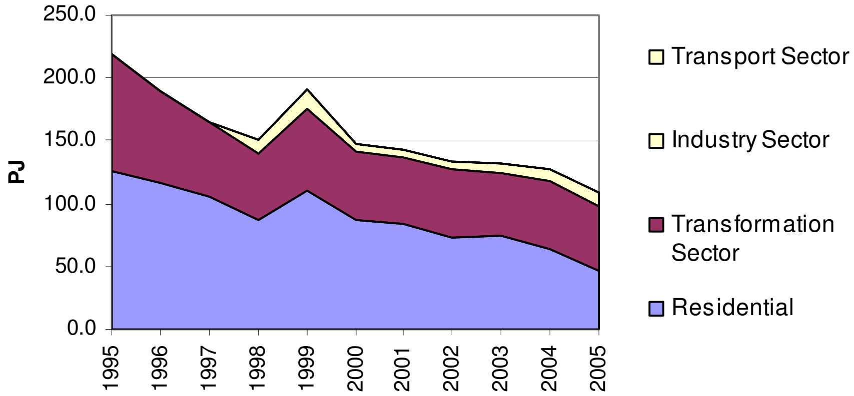
(2) = Based on FAO data

Table 10.5 - Russia – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	259.3	221.4	190.3	157.4	208.2	163.1	157.9	150.6	149.1	143.2	146.2	
	Transform.	93.8	72.5	58.6	53.1	64.3	53.5	51.8	54.3	49.7	54.3	50.4	
	Industry				10.6	16.5	7.4	6.8	6.2	7.2	9.3	11.0	
	Transport												
	Residential	125.4	116.8	105.9	86.7	110.7	87.3	84.1	72.6	74.4	64.2	47.1	
Solid Biomass	Dom. Supply	259.3	221.4	190.3	157.4	208.2	163.1	157.9	150.6	149.1	143.2	146.2	
	Transform.	93.8	72.5	58.6	53.1	64.3	53.5	51.8	54.3	49.7	54.3	50.4	
	Industry				10.6	16.5	7.4	6.8	6.2	7.2	9.3	11.0	
	Transport												
	Residential	125.4	116.8	105.9	86.7	110.7	87.3	84.1	72.6	74.4	64.2	47.1	
Gas from Biomass	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

Russia - Sectors of biofuels consumption



11 Country Profile - SOUTH AFRICA

11.1 Overview

South Africa relies heavily on domestic coal and imported oil to meet its energy needs (approximately 90 percent) and is well endowed with Renewable Energy sources (RES), although so far they have remained largely untapped.

The contribution of biomass (fuelwood and bagasse) to the country's commercial and non-commercial final energy supply is estimated at 20 percent, whereby non-commercial biomass sources are mainly from unsustainable use of fuelwood, dung and waste[166]. Fuelwood is the main source of energy in the rural domestic sector (over 65 percent)[167].

Other sources of biomass include bagasse in the sugar industry, wood, pulp and paper waste in the commercial forestry and paper industries, for in-house heat and electricity generation. In these industries there is already some heat and power generation taking place and there is potential for upgrading and expansion. With the sugar mills currently generating a significant amount of power for own use and even limited export, bagasse offers some of the best potential for independent power producers using renewable resources.

Transport is the highest-cost component of the South African economy and road transport dominates it. Road transport energy is provided by diesel and petrol, of which 60 percent is sourced from imported crude oil, the rest from local coal and natural gas converted into liquid (synthetic fuels)[168]. Ethanol production in 2005 accounted for 390 million litres[169] and bioethanol is produced mainly by sugar industry as potable alcohol for local and export markets.

South Africa is becoming an active exporter of ethanol taking advantage of preferential trade arrangements with the EU. Until December 2005, South Africa benefited from a 15 percent tariff reduction under the Generalised System of Preferences scheme. From January 2006 South Africa is subject to the full MFN duty.

A more recently explored ethanol-based option is ethanol gel, for cooking in cookstoves as substitute of paraffin. Initial market penetration has occurred in South Africa (since 2000) with the establishment of 30,000 litres/month production facilities[170].

There is no biodiesel production at this time but feasibility studies on biodiesel production from soybeans are currently under way.

Table 11.1– [PJ]

Total Primary Energy Supply	Exported	Renewable	Biomass
100%	22%	11%	10.7%
5 344	1184	586	574

Source: IEA, 2005

166 Energy policies for sustainable development in South Africa, Energy Research Centre (ERC), 2006.
167 Data from PROBEC - Programme for Biomass Energy Conservation in Southern Africa, GTZ
168 Manny Singh - Division of Central Energy Fund (Pty.) "Economics of biofuels for the transport sector in South Africa", Energy for Sustainable Development, 2006
169 Source: annual world production by country (available at http://www.ethanolrfa.org/industry/statistics)
170 Advancing Bioenergy for Sustainable Development Guideline for Policymakers and Investors, ESMAP

11.2 Country Objectives and Drivers

The dominant motivation for developing the biofuel industry is to stimulate economic growth and create job opportunities.

Other objectives behind the government's interest in bioenergy are the reduction of dependence on imported crude oil, protection of the country against volatility of oil prices, and climate change mitigation.

South African government has started actively investigating the suitability of different crops, providing support to small-scale farmers and developing technical standards for biofuels, showing encouraging activity for the expansion of this sector for both farmers and other interested stakeholders.

Maize and sugar (ethanol) as well as soya bean and sunflower (biodiesel) are identified as the potential crop to satisfy the country's biofuel production. However, South Africa has only 14 percent of its total area available for arable land and irrigation consumes about 60 percent of the national water supply. Surpluses in corn and sugar production occurred in 2004-2005 season; the possibility of using this surplus for ethanol production to meet more than 5 percent of its gasoline demand[171]. But since then, prices have picked up and successive harvests were poor, due also to the serious drought South Africa is experiencing.

11.3 Bioenergy Policy by Subsector

With the end of Apartheid, South Africa experienced a fundamental change in the energy policy as reflected in the White Paper on Energy Policy (1998). This policy establishes the energy policy direction for the country aiming at achieving guaranteed access to safe, reliable and affordable energy, liberalization of the energy sector including the transformation of the electricity distribution sector into regional electricity distributors, and introduction of greater levels of competition in electricity markets.

The Integrated Sustainable Rural Development Strategy (ISRDS 2000) puts major emphasis on providing energy services to rural areas for both basic needs and income generating activities, including non-grid electrification and mini-grids. The Department of Minerals and Energy (DME) as per a mandate in the White Paper on Energy Policy, has elaborated a Draft Energy Efficiency Strategy setting a national target for energy efficiency improvement of 12 percent by 2014 together with sectoral targets. In addition, it provides guidelines for energy efficiency interventions to be implemented through a phased approach. Bioenergy is not specifically addressed as an option for energy efficiency measures.

Acknowledgment of the potential and benefits of Renewable Energy (RE) applications and their promotion emerges in the White Paper on Renewable Energy that sets a target of 10000 GWh of renewable energy contribution to total energy consumption by 2013. The

[171] Department Of Minerals and Energy, "Draft Biofuels Industrial Strategy of the Republic of South Africa",November 2006, p.10.

renewable energy is to be utilised for electricity generation (4 percent of projected electricity demand), heat and biofuel production.

Although industries representatives and farmers are asking for an increase in the level of incentives proposed in the draft strategy, it is unlikely that subsidies will be introduced to support the biofuel programme. The country's farming sector underwent a massive cut in state subsidies in the post-apartheid era which is why the Government is concerned that subsidizing biofuels producers would spark an outcry from farmers[172].

At the moment, only biodiesel and ecodiesel are exempt from a percentage of fuel levies and taxes, under specific conditions[173].

Power Generation

The White Paper sets a target of 4 percent of projected electricity demand for 2013 to be reached with contribution from RES.

In order to reach the above target, the White Paper proposes a strategic Programme of Action to develop South Africa's RES, particularly for power generation. It recognizes the need to create a constructive environment in many areas: the introduction of fiscal and financial support mechanisms; the development of physical infrastructure to link RE supplies into existing grid; and the creation of an appropriate legal and regulatory framework to encourage the entry of multiple independent power producers into the current electricity sector and stimulate RE market creation. The approach envisaged foresees the facilitation of "early win" investments in commercially - proven technologies that can demonstrate the benefits of renewable energy and low level of national subsidies. Foreign investment through Global Environment Facility and Clean Development Mechanisms is expected as relevant contribution to domestic financial support.

The government has already started to apply the Renewable Energy Subsidy Scheme, with the objective of developing a sustainable market share of RE. The subsidization is given per unit of installed capacity. An investigation into appropriate financial and fiscal instruments to stimulate the implementation of RE technologies is ongoing.

According to current position[174], a combination of a set-aside[175], coupled with an investment incentive (subsidies and/or tax credit), could form the basis of utilising renewable energy funding for an initial power generation programme in South Africa. A decision about which option or combination would be in the best interests of South Africa will be based on a macroeconomic analysis and the outcome presented in the Renewable Energy Strategy (RES). The RES will translate the goals and objective detailed in the White Paper into practical

[172] Biofuel subsidy unlikely, says minister, Engineering news, 30 July 07
[173] Draft biofuels strategy to be presented to Cabinet in May By: Helene Le Roux, Creamer Media's Engineering News Online Published: 20 Apr 07
[174] White Paper on Renewable Energy (DME, 2003), pag 29
[175] Set-aside is a block of energy supply that is earmarked by law for renewable energy capacity. Potential renewable energy generators tender to provide the block of renewable energy supply. Winning projects receive financial support e.g. subsidy per kWh or a guaranteed fixed electricity tariff" - White Paper on Renewable Energy (DME), 2003

implementation steps. A mid-term assessment is foreseen at the end of 2008, which could bring a revision of the included objectives and provisions in light of progress made.

The Department of Minerals and Energy has the overall responsibility for renewable energy policy in South Africa in a framework of cooperative governance with other departments and concerned stakeholders.

The Central Energy Fund will assist the implementation of renewable energy through the extension of its operational support but implementing provisions have not been issued yet.

Heat Production

No official targets exist in South Africa and no specific policy addressed heat generation from biomass has been developed. Heat generation in South Africa is mainly for industrial use, while indoor heating is primarily supplied by either electricity or gas in the urban areas, biomass and coal are the predominant space heat sources in other areas.

Transport

Voluntary blending targets up to 9 percent exist since 2006 and a 10 percent blending target has been proposed. The development of the biofuels industry is one of three key priority sectors of the government's Accelerated and Shared Growth Initiative for South Africa (ASGISA) which aims to halve unemployment and poverty by 2014 by stimulating economic growth.

In December 2005 an Interdepartmental Biofuel Task team was established with the aim of developing the industrial strategy of the country's biofuels programme. A Draft Biofuel Strategy was released and approved by DME in December 2006[176]; the presentation and approval of a final document by the Cabinet was scheduled in May, after a broad stakeholder consultation process aimed to include diverse views regarding biofuels.

The Draft Biofuel Strategy outlines government's approach to addressing policy, regulations and incentives for biofuel industry. It proposes a 4.5 percent use of biofuels in liquid road transport fuels (gasoline and diesel) by 2013, contributing 75 percent to the national Renewable Energy target (10 000 GWh by 2013) with over a billion litres. The proposal should be met with the adoption of national blending specification of 8 percent for ethanol (E8) and 2 percent for biodiesel (B2)[177].

The driver to enable these volumes is utilization of the Petroleum Products Licensing system (Petroleum Products Amendment, Act n.58/2003) that will require existing petroleum wholesalers to buy biofuels according to the national market share. The Petroleum Act amendment establishes that the volume of licences for biofuel production are delivered according to the percentage of local content and the participation of the Black Economic Empowerment. The Draft Strategy claims that the above requirements could be achieved

[176] Department of Minerals and Energy, "Draft Biofuels Industrial Strategy of the Republic of South Africa," 2006
[177] South African Government, "An investigation into the Feasibility of Establishing a Biofuels Industry in the Republic of South Africa," October, 2006

without excessive support from the government and by using surplus agricultural capacity (maize and sugar) and expanding production on underused arable land.

Although recognizing the need for financial incentives to make the nascent biofuels market competitive with existing fossil fuels, the government wants to keep its financial support light, leaving to public and private sector funding the task of commercialising the biofuel technology.

Already existing support mechanisms and incentives like the ones described below, will be used and adjusted if necessary, by the government for creating an enabling investment environment:

- Currently 40 percent[178] fuel levy reduction applied on biodiesel could be extended to bioethanol based on the energy content[179],
- Renewable Energy Subsidy Scheme recently launched by the Department of Minerals and Energy to support investment in renewables,
- Accelerated tax depreciation of biofuel investments: 50 percent in 1st year, 30 percent in 2nd year, and 20 percent in 3rd.

Current agriculture programmes managed by the Department of Agriculture to support small scale farmers and emerging farmers that can be better targeted to biofuel production (support farmers in crop selection, hedging, agricultural methods, research and development, and contract negotiations with biofuels manufacturers), until a stable feedstock supply is established.

Additional support to the creation of the biofuel industry will come from a simple price hedge mechanism for biofuels prices taking into account low and high oil prices, to be established within the existing Equalization Fund. The principle is that it should balance upside benefits to motorists with downside benefits to biofuels producers[180] without implying additional cost for the state budget. The details need to be developed and agreed.

Finally, the Central Energy Fund (CEF), originally created for promoting synthetic fuel production can be extended to the promotion of biofuel. Government Investment through its agencies and existing funds are foreseen for promoting biofuels projects in those underutilised agricultural land (usually very poor areas) where the investment risk is higher. Contribution from the National Empowerment Fund and other specific incentives that may be introduced in the future, is encouraged. Following this provision, it has been recently announced that 5 small towns will benefit R3.2 billion for biofuel production from different types of feedstocks and managed by local farmers. Funding will come from the Industrial Development Corporation (IDC) and the Central Energy Fund[181].

[178] This was increased from 30 percent in the latest budget, February 2006.
[179] South Africa has a relatively low fuel levy by comparison with other countries, currently taxes and levies represent 27 percent of the gasoline and 25 percent of the diesel price (USDA-FAS, "South Africa: Biofuels Annual Report 2006," Gain Report no. SF6021, June 8, 2006)
[180] When oil prices exceed $ 65/bbl, no special incentives for the biofuels industry should be necessary in the longer term and the Fuel Levy reduction could eventually fall away. If the oil price is below $ 45/bbl, biofuels producers would need some form of additional support. For world oil prices above $ 65/bbl, the biofuels industry could pay in (back) and slightly reduce pump price increases
[181] Creamer Media's Engineering News Online, April 2007 (available at http://www.engineeringnews.co.za/eng/news/today/?show=78440)

Government procurement is also envisaged as an option to provide an alternative or additional market for biofuel (in case of failure by the petroleum sector to reach the proposed target)

The Ministery of Minerals and Energy is responsible for the governance of the liquid fuels industry in South Africa and for coordination of initiatives from the other Government Departments. Government has accepted a process of managed liberalization of the liquid fuels industry, to take place in a ten-year timeframe, with the aim of allowing time for the black empowerment companies to consolidate their positions within the industry.

No coordinated national bioenergy research program currently exists although various groups are working on the bioconversion of lignocellulosic biomass as feedstock for biofuels. South Africa recently joined IEA Bioenergy to interact with the liquid biofuel community.

Other policy initiatives promoting the use of biofuels for transport follow below:

- Cleaner Fuels Programme, approved by Cabinet, that aims to reduce emissions and environmental impact, has phase-out leaded petrol and reduced sulphur in diesel to a maximum of 0.05 percent (mass) from 2006.
- Climate change: South Africa ratified the Kyoto Protocol in 2002. Although South Africa is not committed to a specific timeframe to reduce GHG emissions, it counts on the opportunity to utilize international funding within Kyoto Protocol framework for the penetration of renewable energy into South Africa's energy mix. Large potential for low cost emission reduction options exist in South Africa having an energy-intensive economy and high dependence on coal for primary energy. The DME has established the Designated National Authority (DNA) to process CDM projects. Biofuels projects may apply for such CDM credits, however bioethanol CDM methodology needs to be further explored.

11.4 Results and Future Challenges

The policies set by the government aim to create the conditions for the development and commercial implementation of renewable technologies (including bioenergy technologies).

The White Paper on Renewable Energy sets a general framework and overall RES target without indicating concrete measures to be used in order to achieve the target. Implementing rules and a Renewable Energies Strategy are called upon to be developed in the future.

Until now the use of biofuels for transportation fuel has received major attention from the government compared to the other final uses. Timing for the proposed 10 percent blending will be largely determined by the level of support provided by the government which needs to ensure that the level of support is such that the interests of bio-ethanol investors and feedstock providers are balanced with those of fuel consumers and small-scale farmers.

11.5 Country Policy Table – South Africa

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department of Minerals and Energy (DME)	White Paper on Renewable Energy (2003)	Activity - strategy	No	Bioenergy producers	It sets out Government's vision, policy principles, strategic goals and objectives for promoting and implementing renewable energy in South Africa. It also sets a target of 10000 GWh of renewable energy contribution to final energy consumption by 2013.	
Department of Minerals and Energy (DME)	Draft biofuel industry strategy (2006)	Policy-incentives/targets	Pending	Fuel producers/refineries	It proposes a strategy approach for a biofuel industry development based on the following key elements: 1) Focus on domestic technologies already developed in South Africa, and on local feedstocks, 2) Mandatory take off of biofuel production to reach a 4,5% target (volume licensed under local content and BEE participation); additional volumes over percentage licensed will be sold on negotiated commercial terms. A 10% blend of ethanol into the petrol is proposed. Oil companies are identified by the Government as the most suited to be licensed for biofuel production under the blending target framework; 3) a moderate government support to be phased out once the industry has started and the 4,5% mandatory target achieved	
Department of Minerals and energy (DME)	Petroleum Products Amendment Act (Act No. 58 of 2003)	Policy-mandate/incentives	Yes	Fuel producers/sellers	It enables the Minister of Minerals and Energy to require licensed wholesalers and licensed producers to supply petroleum products made from “vegetable matter”, and to comply to certain specifications before they supply petroleum products made from other raw materials. It mandates specific fuel standards for biodiesel and fuel ethanol according to South African National Standards (SANS). It allows the integration of renewable energy derived liquid fuels such as bio-diesel and ethanol into petroleum industry regulatory framework.	
Ministry of Finance	Federal Gas Act (Act n. 48/2001)	Policy-incentives	Yes	Fuel producers/sellers	It allows fuel levy exemption for biodiesel of 30% from 2003, then increased to 40% from 2005. South Africa Revenue Service (SARS) allows for 100% exemption for small producers (less than 300m3 annually). It allows the integration of landfill gas into the gas industry regulatory framework.	
Department of Minerals and Energy (DME)	Draft Energy Efficiency Strategy	Activity-strategy	No	Industrial, commercial, residential and transportation sectors	It sets a national target for energy efficiency improvement of 12% by 2014 together with sectoral targets. Implementation plans for the Industrial Sector and Commercial and Public Building Sector are currently being finalized for action following approval of the Strategy. Plans for the Residential and Transport Sectors were foreseen to be developed during 2005.	
Ministry of Finance	CEF Act (Act N.38 1977)	Policy-incentives	Yes	Bioenergy and biofuels producers	It allows to impose levies on liquid fuels products for collection into the Central Energy Fund (CEF) and/or the Equalisation Fund. The fund is controlled by the DME in concurrence with the Ministry of Finance. The CEF was created for promoting synthetic fuel production and now proposed to be used also for promoting biofuel, and facilitate universal access to energy, including the increased use of renewable energy. The CEF provides operational support to the energy sector in the form of treasury services, including the raising of funds both locally and internationally. Mechanisms will be investigated to extend the operational support available from the Central Energy Fund to renewable energy programmes (including biomass projects, landfill gas and biofuels projects.)	

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement

Impact on Production Stream			Funding Mechanism
Production	Conversion	Use	
	It promotes biomass energy conservation through the use of more efficient renewable technologies such as improved woodstoves and ethanol gel stoves.	It promotes use of bioenergy	
It promotes production of local feedstock for biofuels.		It promotes the creation of a local market for the domestic biofuel industry.	Moderate government support (fuel tax reduction, capital investment incentives, Equalization Fund) is foreseen to facilitate a conducive environment for investments. Use of tradable carbon credits is seen as an important contribution for financing biofuel projects
		It promotes use of biofuels.	
		It promotes use of biofuels.	
	Promotes cogeneration using biomass industrial boilers. Promotes investigation on biomass -using appliances for residential sector		
	Promotes biomass projects, landfill gas and biofuels projects	It promotes use of bioenergy	

provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.
"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

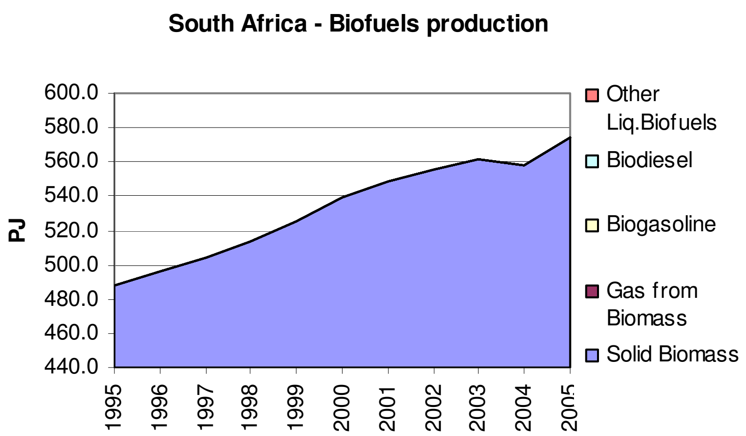
11.6 South Africa Bioenergy Outlook

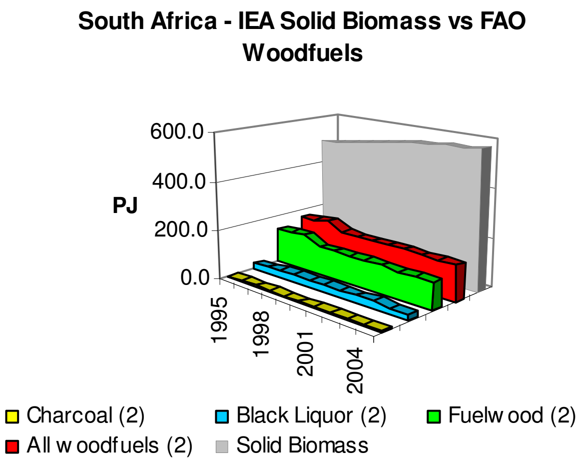
Table 11.2 - South Africa – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	487.9	496.2	504.1	513.2	525.8	538.9	548.9	555.4	561.3	557.4	574.3	
Solid Biomass	487.9	496.2	504.1	513.2	525.8	538.9	548.9	555.4	561.3	557.4	574.3	
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liq.Biofuels												
All woodfuels (2)	170.4	174.4	184.8	154.4	151.9	153.0	151.8	154.4	148.5	147.5	145.7	
Fuelwood (2)	145.0	149.0	153.0	119.4	119.4	119.4	119.4	119.4	110.4	114.8	111.1	
Charcoal (2)	0.8	0.8	0.8	1.3	1.3	1.3	1.3	1.3	6.2	3.9	5.8	
Black Liquor (2)	24.6	24.6	31.0	33.7	31.3	32.4	31.1	33.7	31.9	28.8	28.8	

Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	1.7	1.6	1.8	2.4	2.5	1.8	1.2	1.1	-0.7	3.0
Gas from Biomass										
Biogasoline										
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data





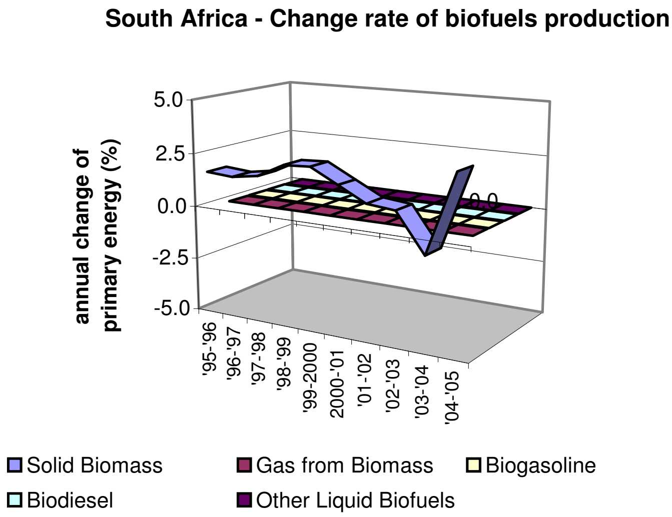


Table 11.3 - South Africa – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.7	0.7	0.3	0.3	0.2	0.2	0.3	0.0	0.2	0.3	0.4	
Fuelwood (2)	0.4	0.4	0.0	0.0	0.0							
Charcoal (2)	0.3	0.3	0.3	0.3	0.2	0.2	0.3	0.0	0.2	0.3	0.4	

(2) = Based on FAO data

Table 11.4 - South Africa – Biofuel Export (PJ)

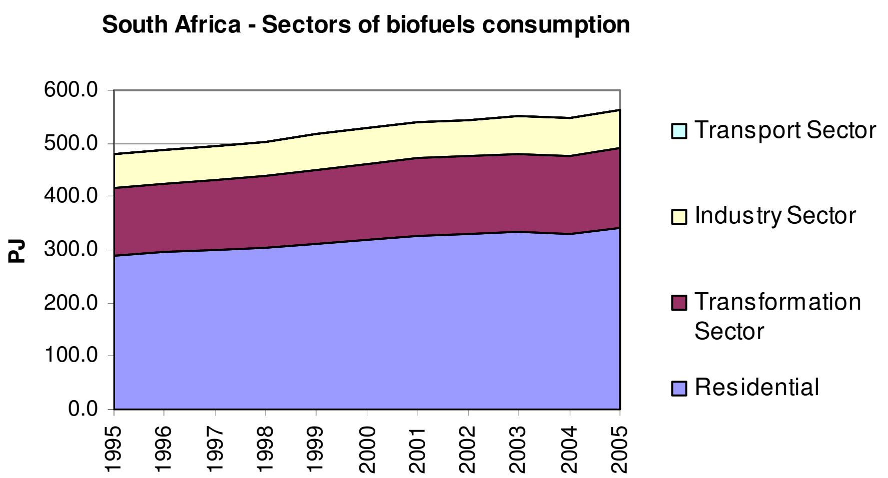
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	9.0	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.4	10.3	10.6	
Solid Biomass	9.0	9.1	9.3	9.5	9.7	9.9	10.1	10.3	10.4	10.3	10.6	
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	1.1	1.0	0.9	0.9	1.4	1.4	1.2	1.0	0.9	1.2	1.6	
Fuelwood (2)	0.1	0.0	0.0		0.0	0.0	0.0	0.0	0.1	0.1	0.1	
Charcoal (2)	1.0	1.0	0.9	0.9	1.4	1.4	1.2	1.0	0.8	1.1	1.5	

(2) = Based on FAO data

Table 11.5 - South Africa – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	479.0	487.2	494.9	503.9	516.2	529.1	538.9	545.3	551.1	547.2	563.8	
	Transform.	125.0	128.0	131.3	134.8	137.6	142.5	145.1	146.0	147.6	146.6	150.9	
	Industry	64.0	64.2	64.0	64.0	66.1	66.3	67.6	69.1	69.9	69.4	71.6	
	Transport												
	Residential	290.0	294.9	299.6	305.0	312.5	320.3	326.2	330.1	333.6	331.3	341.3	
Solid Biomass	Dom. Supply	479.0	487.2	494.9	503.9	516.2	529.1	538.9	545.3	551.1	547.2	563.8	
	Transform.	125.0	128.0	131.3	134.8	137.6	142.5	145.1	146.0	147.6	146.6	150.9	
	Industry	64.0	64.2	64.0	64.0	66.1	66.3	67.6	69.1	69.9	69.4	71.6	
	Transport												
	Residential	290.0	294.9	299.6	305.0	312.5	320.3	326.2	330.1	333.6	331.3	341.3	
Gas from Biomass	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biogasoline	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Biodiesels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



12 Country Profile - UNITED KINGDOM

12.1 Overview

Bioenergy expansion in the United Kingdom is driven by the potential it holds to provide an affordable, practical, renewable source of secure energy, while addressing climate change mitigation and promoting rural development.

In 2006, 81 percent of the United Kingdom's primary energy supply was produced from indigenous sources. The United Kingdom imported energy equivalent to 61 percent of total supply but exported energy equivalent to 40 percent of total supply. Total final energy consumption amounted to 7 100 PJ (169.6 million tonnes of oil equivalent). This is 3 098 PJ (74 Mtoe) less than total primary supply (10 207 PJ or 243.8 Mtoe) because of conversion and distribution losses, energy industry use, and non-energy uses. Of this total primary energy supply, 770 PJ (18.4 Mtoe) came from non-carbon sources such as nuclear power, hydroelectricity, and imports of electricity (net of exports) and a further 172 PJ (4.1 Mtoe) came from combustible renewables and wastes.

Renewable energy sources accounted for 1.8 percent of total primary energy supply in 2006. Of these sources, solid municipal waste combustion accounted for approximately 49 PJ (1.167 Mtoe), with biomass providing 29.5 PJ (0.704 Mtoe) and solid waste providing 19.4 PJ (0.463 Mtoe) of the energy supplied.

Table 12.1– [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	14%	2%	1.4%
9 794	1 351	168	138

Source: IEA, 2005

Table 12.2– [Ktoe]

SUPPLY	Coal	Crude Oil	Petroleum Products	Gas	Nuclear	Hydro	Wind and wave	Combustible renewables and waste (1)	Electricity	Heat	Total
Production	11376	83958	0	80013	16945	396	400	3579	0	0	196668
Imports	33299	64872	29335	20983	0	0	0	497	884	0	149870
Exports	-462	-54875	-31474	-10369	0	0	0	0	-238	0	-97417
International Marine Bunkers**	0	0	-2486	0	0	0	0	0	0	0	-2486
Stock Changes	-966	-391	-917	-553	0	0	0	0	0	0	-2827
TPES	43248	93564	-5543	90073	16945	396	400	4076	646	0	243808
TFC	2638	0	82044	53572	0	0	0	603	29474	1275	169606

(1) includes geothermal and solar heat

Source: Digest of UK Energy Statistics 2007, Tables 1.1 and 7.7

12.2 Country Objectives and Drivers

United Kingdom's energy policy is driven by four factors: the environment; energy reliability and security; affordability for the poor; and competitive pricing for businesses, industries, and households.

The key aims of the United Kingdoms's policies on renewable energy are:

- Meeting national and international targets for emission reductions, including GHG;
- Providing secure, diverse, sustainable, and competitive energy supplies;
- Stimulating the development of new technologies to promote sustainable long-term growth in renewables;
- Creating a competitive, United Kingdom-based renewables industry for domestic and export markets and thereby generating employment opportunities; and,
- Contributing to rural development.

The dominant motivation for developing renewable energy is climate change mitigation, although energy security is also rapidly emerging as another important factor. The United Kingdom has a legally binding target under the Kyoto Protocol to reduce its GHG emissions by 12.5 percent below 1990 levels by 2008-2012. In addition, the United Kingdom's draft Climate Change Bill[182] proposes a legally binding requirement to reduce United Kingdom carbon dioxide emissions by 26-32 percent by 2020 and 60 percent by 2050. The United Kingdom has also set a demanding target to meet 10 percent of electricity from renewable sources by 2010 and an ambition to meet 20 percent in 2020.

The UK Climate Change Programme 2006[183] sets out the government's policies and priorities for addressing climate change. The important role that renewable energy, including bio-energy, can play in delivering the United Kingdom's wider energy and climate change goals is recognized in the Programme as well as in the Energy White Paper[184] and UK Biomass Strategy[185], both published in May 2007. The Biomass Strategy incorporates the objectives of the Non-Food Crops Strategy, which provides a framework for the sustainable and competitive development of renewable materials and fuels from biomass.

12.3 Bioenergy Policy by Sub-Sector

The first policy to support renewable energy was the Fossil Fuel Levy, which was introduced in the 1989 Electricity Act through the Non-Fossil Fuel Obligation (NFFO). Under NFFO, suppliers were invited to enter into fixed-term contracts at premium rates for electricity. The overarching

[182] UK Draft Climate Change Bill (March 2007) (available at http://www.defra.gov.uk/environment/climatechange/uk/legislation/index.htm)
[183] UK Climate Change Programme 2006 (March 2006) – HM Government
[184] Energy White Paper (May 2007) – UK Department for Business, Enterprise and Regulatory Reform: (DBERR) (available at http://www.dti.gov.uk/energy/whitepaper/page39534.html)
[185] UK Biomass Strategy (March 2007) – DEFRA, Department for Transport and DBERR: (available at http://defraweb/environment/climatechange/uk/energy/renewablefuel/index.htm)

goal of this United Kingdom energy sector policy was to establish open, competitive markets for energy products and services, and reduce public ownership of electricity services.

The NFFO was later augmented by “The Renewable Obligation Order 2002” which placed a requirement on all licensed electricity suppliers in the United Kingdom to supply a specified and growing proportion of their sales from renewable sources – with the aim of achieving 10 percent by 2010, subject to the costs being acceptable to the consumer. Under the 2002 programme revision, corporations could also sign onto a climate change agreement. Energy generated from renewables would be exempt from the Climate Change Levy imposed on energy use by all businesses. Effective April 2001, this tax applies to gas, electricity, liquefied petroleum gas, and coal[186]. Fuel oils are exempt from the Climate Change Levy because they are already subject to the Hydrocarbon Duty Levy. If a company fails to reach the targets, they may remain in the Climate Change Agreement, but are ineligible to receive the tax discount for two years. If the company manages to meet the targets by the next review, the tax discount can be reinstated.

A further part of the United Kingdom’s renewable policy involves the development of renewable materials to provide energy, fuels and industrial products. The government recognizes the potential of these sectors and the important part they can play in helping to meet sustainable development targets, benefiting industrial competitiveness and the rural economy, and protecting the environment by replacing products made from fossil fuels.

Renewable materials, including biomass, produced by agriculture can be put to a wide variety of non-food uses. Crops can form the basis of renewable energy and fuels, and can form the feedstock for an increasing range of industrial materials such as starch based plastics and polymers, plant based lubricants, solvents and panelling for the automotive and construction industries. In addition they can be used for an array of novel uses such as toiletries, pharmaceuticals, antimicrobials or as part of a programme of bioremediation.

In November 2004 the United Kingdom Department of Environment, Food and Rural Affairs and the then Department of Trade and Industry jointly published "A strategy for non-food crops and uses - creating value from renewable materials"[187]. The strategy sets out an extensive range of actions to encourage the development and wider use of renewable materials. Implementation of the Strategy is overseen by a Project Board comprising representatives from government, industry, consumers, academia and other stakeholders, including representative of feedstock growers. The government-sponsored National Non-Food Crops Centre[188] (NNFCC) takes a lead role delivering strategy actions. The NNFCC was launched in 2003 and provides a single, authoritative source of information in the United Kingdom on the use and implementation of non food–crop products and technologies. The main function of the NNFCC is to derive, maintain and disseminate data on the non-food uses of crops and to help turn ideas into successful products and supply chains. The NNFCC has

[186] European Renewable Energy Council, “Renewable Energy Policy Review: United Kingdom,” May 2004
[187] UK Strategy for Non-food Crops and Uses (November 2004) – DEFRA and DTI (available at http://defraweb/farm/crops/industrial/non-food/strategy/index.htm)
[188] UK National Non-Food Crops Centre (available at http://www.nnfcc.co.uk/metadot/index.pl)

established a Strategy Group which provides strategic guidance to government on the future development of the non food crop sector.

The strategy is supported by a research and development programme. This aims to fund high quality, innovative, pre-competitive research that enhances the non-food uses of renewable materials for sustainable development and positive environmental outcomes, and which also have clear potential for commercial uptake. The programme encourages the exchange of knowledge between the private sector and the research based in furthering the non-food uses of renewable materials to support sustainable development.

The government published a two year progress report of the Strategy in 2006. This showed that significant progress had been achieved in the way the United Kingdom produces and uses bio-energy and renewable materials. In particular, there had been a fivefold increase in sales of biofuels in United Kingdom between 2004 and 2005, with production of biodiesel increasing at a similar rate between 2003 and 2005, while the amount of land being used for non-food crops increased by 75 percent over the same period. The strategic action plan has been revised in line with recommendations in the progress report for some re-focusing of the strategic actions.

Power generation

The national envisaged target is 10 percent of electricity supply from renewable energy by 2010 with a further aspiration to derive 20 percent of electricity from renewable sources by 2020[189].

In 2005, the Renewable Obligation Order was again revised. Under the 2005 amendment, the required percentage of electricity supplied from renewables will increase incrementally between 2011 and 2016 from 11.4 percent to 15.4 percent and level off at 15.4 percent through 2027[190].

Heat Production

There is a national target to produce at least 10,000 MWe of installed good quality CHP capacity by 2010 with at least 15 percent of electricity in government buildings being supplied in this way.

In 2004, the United Kingdom Government laid out its strategy for implementing CHP through 2010[191]. Developed by the Department for Environment, Food, and Rural Affairs, the strategy incorporates the full range of support measures to support the growth of CHP capacity, meet national targets, and lay the foundation for long-term growth. For example, Combined Heat and Power, including Combined Heat and Power from renewable sources, benefits from

[189] DTI, The Energy Challenge: Energy Review, UK Department of Trade and Industry (DTI), 2006. (Now Department for Business, Enterprise, and Regulatory Reform - BERR)
[190] BERR, Implementation Guidance for the Renewables Obligation Order 2005, Department for Business, Enterprise, and Regulatory Reform (BERR), 2005.
[191] DEFRA, The Governments Strategy for Combined Heat and Power to 2010, Department for Environment, Food, and Rural Affairs (DEFRA), 2004.

Enhanced Capital Allowances, exemption from the Climate Change Levy, and a favourable regime under the second phase of the EU Emissions Trading Scheme.

Renewable heat, usually, but not always, sourced from biomass, currently accounts for only around 1 percent of heat supply in the United Kingdom.[192] Primarily, the United Kingdom has supported the development of renewable heat through capital grant schemes (e.g. the Bioenergy Capital Grants Scheme and the Low Carbon Buildings Programme) and programmes to support growing and supplying biomass (e.g. the Energy Crops Scheme and the Bioenergy Infrastructure Scheme). Renewable heat through CHP has been supported through a wide range of mechanisms. Large renewable heat loads (over 20 MWth) receive incentives/benefits under the Emissions Trading Scheme.

The United Kingdom Government is currently seeking to secure sustainable investment to support further development of renewable heat and achieve the growth potential that has been identified in the sector. To meet targets, the United Kingdom Government recently enacted legislation to extend the scope of its Energy Efficiency Commitment (EEC) and promote micro-generation by energy suppliers, including biomass, as part of their activities. The statutory consultation on EEC 2008-11 is underway.

Transport

The main national target is the introduction of an obligation requiring transport fuel suppliers to ensure that biofuels make up 5 percent of their total road transport fuel sales by 2010.

By the end of 2006, biofuels made up around 0.5 percent of overall road transport fuel sales in the United Kingdom. These biofuels came from both imported and domestically produced feedstocks. Included as part of the Energy Act 2004, the Renewable Transport Fuel Obligation (RTFO) – which is due to come into effect in April 2008 - will require transport fuel suppliers to ensure that 5 percent of all road vehicle fuel is supplied from sustainable renewable sources by 2010. In practice, meeting this obligation will most likely be achieved by blending bioethanol and biodiesel (derived from sources such as palm oil, oilseed rape, cereals, sugar cane, sugar beet, and reprocessed vegetable oil) with fossil fuels. This program, managed by the United Kingdom Department for Transport, is expected to promote additional imports/trade and assist the United Kingdom in complying with the European Union biofuels directive, which sets a reference value for biofuel usage of 5.75 percent by the year-end 2010. The RTFO should reduce carbon emissions in the transport sector by around 2 - 3 percent.

In 2002, the Department for Transport published “Powering Future Vehicles (PFV) Strategy” which outlines some targets and policies for cutting GHG emissions from the transport sector. Several bioenergy activities have emerged as a result of the PFV framework such as the formation of the Low Carbon Vehicle Partnership and the voluntary Fuel Economy Labeling Scheme for new cars. The government’s overarching goal is to ensure that the United Kingdom takes a leading role in the global shift towards low carbon transport.

[192] DEFRA (2007), UK Biomass Strategy, Department for Environment, Food, and Rural Affairs (DEFRA), London, UK.

To promote stakeholder engagement and provide broad input, the PFV called for the establishment of a stakeholder partnership which begun in 2003. The Low Carbon Vehicle Partnership[193] plays a key role in helping the government deliver its objectives to promote the development, introduction and take-up of new low carbon vehicle technologies and fuels.

The United Kingdom Government revised the Vehicle Excise Duty ('road tax') – managed by the Driver and Vehicle Licensing Agency - so that cars registered on or after March 1, 2001 are taxed according to their CO_2 emissions. There has been a noticeable increase in the ownership of diesel cars, which produce lower CO_2 emissions, but generally produce increased particulates.

During 2005, a voluntary Fuel Economy Labeling scheme was also introduced for labels to be displayed on new cars. Managed by the Department for Transport and the Vehicle Certification Agency, this scheme brings the United Kingdom into line with European Directive 1999/94/EC. It aims to influence the behavior of consumers and manufacturers by disclosing information about the Vehicle Excise Duty and likely fuel costs[194] on vehicles sold in the United Kingdom.

12.4 Results and Future Challenges

Modern United Kingdom renewable energy policy objectives and targets incorporate the United Kingdom climate change programme targets introduced in November 2000 and lay out a strategy to achieve the United Kingdom's Kyoto targets for reducing GHG emissions. The national carbon dioxide emissions targets in the draft Climate Change Bill will, when implemented, continue to drive renewable energy policies forward. Keeping an eye on market and development opportunities, the United Kingdom is working to stimulate the development of new and renewable energy technologies where they have prospects of being economically attractive and environmentally acceptable in order to contribute to: a diverse, secure, and sustainable energy supplies; a reduction in pollutant emissions; and, the encouragement of internationally competitive renewable energy industries.

Bio-energy remains a key component of the United Kingdom's renewables policy. Key national instruments and incentives, including the Renewables Obligation and the Renewable Transport Fuel Obligation, are either in place or under active development.

The United Kingdom Government is committed to making the most of the potential of biomass heat and power, including anaerobic digestion. Through its Biomass Strategy, the United Kingdom aims to realize a major expansion in the supply and use of biomass. The United Kingdom Government estimates that biomass energy has the potential to produce about 6 percent of electricity demand by 2020. Currently only about 1 percent of United Kingdom heat demand is supplied by renewable sources, but it is believed that renewable heat, including biomass, has the potential to make a larger contribution to delivering low carbon heat in the

[193] Low Carbon Vehicle Partnership (available at http://www.lowcvp.org.uk/about-lowcvp/our-working-groups.asp)
[194] The Guardian, "Wake Up Call from Woking", June, 2005 (available at http://politics.guardian.co.uk/interviews/story/0,,1516676,00.html)

United Kingdom. It is anticipated that by 2020 some 1 million hectares of land will be used to support biomass production. This is in line with European Environment Agency estimates of land available to support environmentally sustainable biomass production in the United Kingdom. The England Woodfuel Strategy[195], published in March 2007, highlighted the potential of 1 million tonnes of currently under-utilized resource in existing under-managed woods. The United Kingdom intends to bring about an increase in biomass supply by:

- Sourcing an additional 1 million tonnes of wood from unmanaged woodlands;
- Increasing the recovery of wood for energy from managed woodlands by using waste timber products;
- Increasing land used for production of perennial energy crops by some 350,000 hectares, and
- Increasing utilization of organic waste materials.

The United Kingdom Government estimates that up to 3.5 million tonnes of carbon could be saved annually if all potentially available biomass is used for heat and electricity.

Following the review of the Non-Food Crops Strategy in 2006, a more focused action plan has been drawn up and this will focus in particular on:

- The development of biorefineries to provide a sustainable manufacturing base for energy, fuels, biomaterials and chemicals;
- Plant-based pharmaceuticals, nutriceuticals and bio-actives;
- Renewable construction materials, and
- Renewable chemicals, including oils, monomers and polymers.

12.5 Best Practices

In the United Kingdom, *construction and demolition* generates 90 million tonnes of waste annually – three times the waste produced by all United Kingdom households combined – and more than a fifth of the United Kingdom's hazardous waste. The energy used in constructing, occupying and operating buildings represents about half of GHG emissions in the United Kingdom. Therefore, the government believes that the potential for the use of new and innovative environmental technologies to promote sustainable development is strong in construction. To reduce waste generated from during construction, DEFRA is promoting the development of the renewable construction materials sector as one of its four priority areas under the Defra Renewable Fuels and Materials Programme.

The use of renewable materials in construction promotes carbon savings as most of these products are carbon negative rather than carbon neutral and require less fossil fuel energy to produce. For example, it takes 1.84 tonnes of CO_2 to make a tonne of dry hemp. Therefore each tonne of a hemp based construction material has carbon trapped within it equivalent to 330 kg of CO_2, thus removing the carbon from the atmosphere for the life of the

[195] A Woodfuel Strategy for England (March 2007) – Forestry Commission England

building.[196] Similarly, the use of renewable materials can add to the social benefits by improving the health of those in the construction sector working with the materials (natural sheep's wool or hemp fibre insulation is less toxic than some of the rockwall/fibre glass alternatives) and those living in the homes (i.e. hemp lime blocks are more 'breathable' than other materials, can improve the air flow and quality, and help avoid many of the 'symptoms' of sick building syndrome).

Another area in which the United Kingdom is exploring opportunity is *bio-lubricants*. Lubricants made from renewable bio-resources are not a new technology, but for the last 100 years, mineral oil based lubricants have predominated. However mineral oil has poor biodegradability, greater persistence in the environment and more pronounced toxicity. This fact prompted interest by the government to explore opportunities in vegetable based lubricants.

The use of synthetic esters derived from harvestable resources has proved highly successful in the United Kingdom in recent years. Product formulations have been developed, trialed and put into service for almost all lubricant applications with some of the performance pluses giving pronounced advantages.

[196] GBEP – UK Examples (provided by the UK Country Representative as part of this report)

12.6 Country Policy Table – United Kingdom

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department for Business, Enterprise and Regulatory Reform	Renewables Obligation (RO) (April 2002 - March 2027)	Policy - Targets	Yes	Electricity Suppliers	Requires electricity suppliers to provide an increasing amount of electricity from renewables (including biomass) until 2016/17. Target of 10% by 2010 and 20% by 2020 have been proposed.	
Department for Transport	Renewable Transport Fuel Obligation (RTFO) - (Proposed for Implementation in April 2008)	Policy - Targets/Criteria	Pending	Transport Fuels (Producers/Suppliers)	Will place legal requirement on transport fuel suppliers to ensure that a certain percentage of overall fuel sales is from a renewable source (up to 5% by 2011)	
Department for Environment, Food and Rural Affaris	EU Emissions Trading Scheme	Policy - Targets	Yes	Industry	Under the scheme's monitoring and reporting guidelines, biomass fuel is given a zero rating in terms of how much CO_2 it release's when used. Installations maybe able to meet their cap through the use of biofuel and be able to sell spare EU allowances (one allowance = 1 tCO_2)	(Industrial)The generation of a carbon price has incentivised industry to invest in carbon abatement technologies and to consider the use of alternatives to fossil fuel.
Department for Business, Enterprise and Regulatory Reform; Department for Environment Food and Rural Affairs, Big Lottery Fund	Bio-energy Capital Grant Scheme	Policy - Targets	No	Industry, commercial and community sectors	Provides capital grants to install dedicated biomass-fuelled heat, combined heat and power (CHP) and electricity generating projects.	
Department for Environment Food and Rural Affairs	Bio-energy Infrastructure Scheme	Policy -Targets	No	Farmers, foresters and feedstock supply businesses	Provides funding to help develop the supply chain required to harvest, store, process and supply short rotation coppice, miscanthus, other grasses, straw and woodfuel to heat and power end users.	
Department for Environment Food and Rural Affairs; Natural England	Energy Crops Scheme	Policy - Targets	No	Farmers	Grants to support the establishment of short rotation coppice and miscanthus for energy end-use. Production must meet environmental standards.	
Department for Business, Enterprise and Regulatory Reform	Low Carbon Buildings Programme	Policy - Targets	No	Householders, public, not-for-profit and commercial sectors.	Grants to support the installation of a range of microgeneration technologies, including bio-energy boilers/heaters	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Increased use of renewables from biomass in the generation of electricity.	Market driven, based on the sale of Renewable Obligation Certificates (ROCs) earned by renewable energy generators for each 1MWh of electricity generated, or re-cycling of a buy-out fund to companies presenting ROCs	Mandate increase requirements end in 2016/17 but policy in affect until March 2027.
		Sets blending mandate on the end-use product, including a requirement to report against sustainability criteria.		
		Increased use of biofuel by installations covered by the scheme.	Global carbon market valued at €22.5 billion in 2006	
Will help to stimulate the UK biomass feedstock supply chain.	Promote innovation and capacity building in low carbon boiler technology.	Promotes the efficient use of biomass for energy.	Grants of nearly £75 million made available since 2002. Further funding expected for 2008/09-2010/11	
Intended to stimulate production and supply of biomass feedstocks for energy.			£3.5 million available from 2005/06.	
Intended to stimulate production and supply of certain biomass feedstocks for energy.			The Scheme forms part of the England Rural Development Programme and is administered by Natural England who disburse payments.	Farmers can also receive the annual €45/ha Energy Aid payment for energy crops grown on non-set aside land for heat, power and transport, and the Single Payment for energy crops on set-aside land.
		Intended to stimulate the availability and application of a range of microgeneration technologies in the sectors covered by the scheme	Approximately £80 million available through two phases.	

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department for Transport	Refueling Infrastructure Grant Programme (July 2005)	Activity - Incentive Programme	No	Transport Fuels (Suppliers)	Increase in infrastructure for alternative refueling stations for road vehicles.	
Department for Business, Enterprise and Regulatory Reform	Regional Grant Assistance Programme (2005)	Activity - Incentive Programme	No	Industry / Infrastructure	Establishes bioenergy plants and related industries in the UK	
Department for Transport	Fuel Duty Incentive	Policy - Incentive Programme	Yes	Transport Fuels (Suppliers)	Provides a 20 pence duty differential on biodiesel and bioethanol with the level of duty incentive guaranteed through 2008/09	
Department for Environment Food and Rural Affairs; Natural England	National Non-Food Crops Centre	Activity – Centre of excellence and expertise in bio-energy technologies	No	Provides advice and information, supports strategic implementation and market innovation in bio-energy technologies	Is the UK's independent authority on plant-based renewable materials and technologies; brings products to market by building and strengthening supply chains supports producers, manufacturers and consumers; provides comprehensive information on all sectors; supports implementation of the UK Strategy for Non-food Crops	
Forestry Commission	Biomass Energy Centre	Activity – on-line advisory service in biomass	No	A one-stop-shop for information on biomass-derived solid, liquid and gaseous fuels, and associated conversion technologies	Provides information and advice of use to those operating in the bio-energy field. To improve understanding on a range of biomass fuels and conversion technologies	Also likely to be of indirect benefit as a source of advice to those such as farmers interested in getting involved in bio-energy field.
Department for Business, Enterprise and Regulatory Reform	Center of Excellence (CENEX)	Activity - Research and Development	No	Academic/Research Institutions		(Industrial) Promotes research and development UK wide of hydrogen and fuel cell demonstration programmes.
Department for Transport	Low Carbon Vehicle Partnership	Activity - Research and Development	No	Industry / Government	Develops a robust and user-friendly carbon saving calculation methodology for different biofuel product chains, and a biofuel standard to ensure biofuels are sourced sustainably and creates the Biofuels Sustainability Unit within the DfT which will take the LowCVP work forward and develop sustainability and carbon certification reporting frameworks to implement the RFTO	

For the purposes of this table:
"Policy" is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Promotes development of bioenergy infrastructure for consumer use		
	Provides funding for the development of bioenergy facilities in qualifying regions			Qualifying regions and industrial areas are not always aligned.
		Promotes use of biodiesel and bioethanol and stimulates market growth	This program has been the major bioenergy funding mechanism in the UK prior to the introduction of the RFTO	
Influences developments across all three parts of the production stream	Influences developments across all three parts of the production stream	Influences developments across all three parts of the production stream	A not-for-profit organization. Funded by Defra, partner organizations, subscriptions and commercial activities.	
Potential to influence developments across all three parts of the production stream	Potential to influence developments across all three parts of the production stream	Potential to influence developments across all three parts of the production stream	Funded by Government	
	Provides development of fuel cell technologies that are potentially transferable for use with other bio-energy sources		£15 Million disbursed over 4 years from UK Government to support this activity.	
	Assesses the comparative advantage of the UK is the development of bio/renewable energy looking at various renewable resources. Pilot work underway for Hydrogen and hydrogen fuel cells.			

"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). "Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

12.7 United Kingdom Bioenergy Outlook

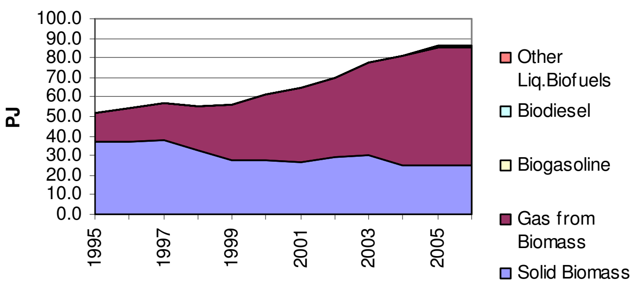
Table 12.3 - United Kingdom – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	51.9	54.0	56.7	55.1	56.3	61.5	64.4	69.7	77.5	81.4	86.0	86.0
Solid Biomass	37.1	37.3	37.6	33.2	27.6	27.6	26.5	29.5	30.2	24.7	25.3	25.3
Gas from Biomass	14.8	16.7	19.1	22.0	28.7	33.9	37.8	40.2	47.2	56.7	60.3	60.3
Biogasoline												
Biodiesel											0.4	0.4
Other Liq.Biofuels												
All woodfuels (2)	19.8	19.8	19.6	19.4	19.4	6.6	6.4	6.7	6.9	6.8	5.8	
Fuelwood (2)	17.6	17.8	17.4	17.5	17.5	5.0	4.8	4.7	4.7	4.7	5.6	
Charcoal (2)	0.1		0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	
Black Liquor (2)	2.1	1.9	2.0	1.7	1.7	1.4	1.4	1.8	2.1	2.0		

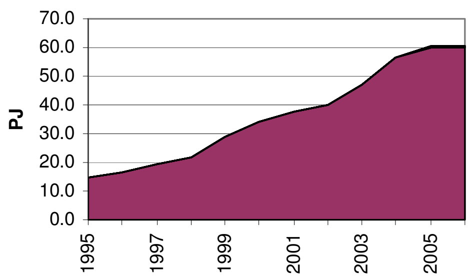
Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	0.6	0.8	-11.8	-16.7	-0.2	-3.9	11.3	2.5	-18.2	2.2
Gas from Biomass	12.7	15	14.9	30.5	18.3	11.6	6.2	17.5	20.0	6.4
Biogasoline										
Biodiesel										
Other Liquid Biofuels										

(2) = Based on FAO data

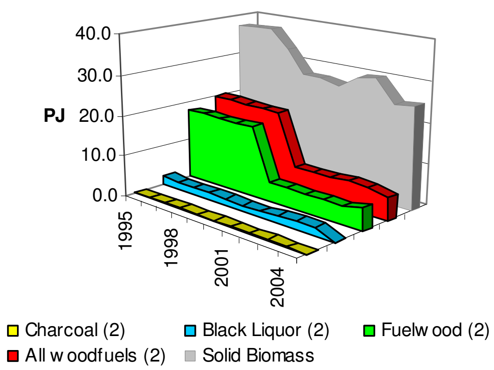
UK- Biofuels production



UK- Liquid and gaseous biofuels production



UK- IEA Solid Biomass vs FAO Woodfuels



UK- Change rate of biofuels production

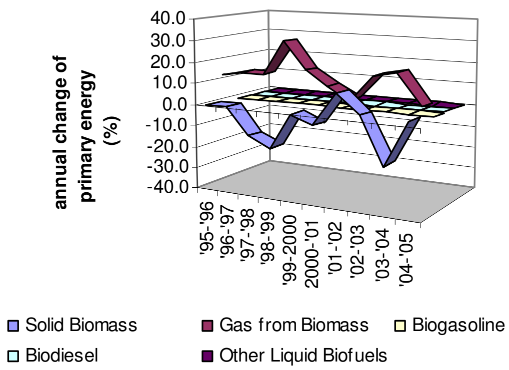


Table 12.4 - United Kingdom – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels								0.1	4.5	14.8	29.5	29.5
Solid Biomass									3.9	14.1	26.5	26.5
Gas from Biomass												
Biogasoline											1.9	1.9
Biodiesel								0.1	0.6	0.7	1.0	1.0
Other Liquid Biofuels												
All woodfuels (2)	1.9	2.4	1.8	2.0	1.6	2.1	2.1	2.1	2.4	2.5	3.5	
Fuelwood (2)	0.5	0.6	0.4	0.5	0.3	0.7	0.8	0.8	0.7	0.7	1.8	
Charcoal (2)	1.4	1.8	1.4	1.5	1.3	1.4	1.3	1.3	1.7	1.8	1.6	

(2) = Based on FAO data

Table 12.5 - United Kingdom – Biofuel Export (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	0.1	0.1	0.4	1.4	1.4	2.4	1.7	1.2	3.7	1.8	2.2	
Fuelwood (2)	0.1	0.0	0.3	1.4	1.4	2.3	1.6	1.1	3.4	1.6	2.0	
Charcoal (2)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.3	0.3	0.2	

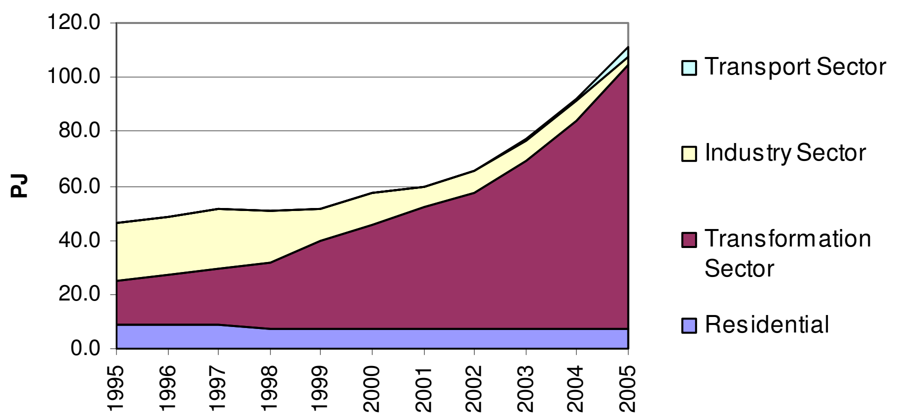
(2) = Based on FAO data

Table 12.6 - United Kingdom – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	51.9	54.0	56.7	55.1	56.3	61.5	64.4	69.8	82.0	96.2	115.5	115.5
	Transform.	16.7	18.4	21.2	24.6	32.9	38.3	45.4	50.6	62.3	76.4	97.2	
	Industry	21.4	21.8	21.8	18.8	11.7	11.7	7.4	7.4	7.4	7.4	3.4	
	Transport								0.1	0.6	0.7	3.4	
	Residential	8.5	8.5	8.5	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	
Solid Biomass	Dom. Supply	37.1	37.3	37.6	33.2	27.6	27.6	26.5	29.5	34.1	38.9	51.8	51.8
	Transform.	4.7	4.6	4.9	5.2	6.8	6.7	9.9	12.9	17.5	22.3	39.3	
	Industry	20.9	21.1	21.2	18.3	11.1	11.1	6.9	6.9	6.9	6.9	2.8	
	Transport												
	Residential	8.5	8.5	8.5	7.2	7.2	7.2	7.2	7.2	7.2	7.2	7.2	
Gas from Biomass	Dom. Supply	14.8	16.7	19.1	22.0	28.7	33.9	37.9	40.2	47.2	56.7	60.3	60.3
	Transform.	12.0	13.8	16.4	19.4	26.1	31.6	35.5	37.6	44.7	54.2	58.0	
	Industry	0.6	0.6	0.6	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	
	Transport												
	Residential												
Biogasoline	Dom. Supply											1.9	1.9
	Transform.												
	Industry												
	Transport											1.9	
	Residential												
Biodiesels	Dom. Supply								0.1	0.6	0.7	1.5	1.5
	Transform.												
	Industry												
	Transport								0.1	0.6	0.7	1.5	
	Residential												
Other Liquid Biofuels	Dom. Supply												
	Transform.												
	Industry												
	Transport												
	Residential												

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)

UK - Sectors of biofuels consumption



13 Country Profile - UNITED STATES

13.1 Overview

The United States' bioenergy initiatives are primarily designed to increase energy security for the transport sector and reduce GHG emissions while improving environmental quality and creating economic growth. Current United States biofuel production is primarily from ethanol from corn[197] with production levels reaching more than 314 PJ in 2005, followed by biodiesel from soybean which reached 8.4 PJ - a significant increase compared to the 2.9 PJ in 2004. Moreover 11.7 PJ of ethanol was imported in 2005, with a large portion of that from Brazil. The United States is also devoting significant resources towards the development and implementation of next generation biofuels technologies in order to help meet the President's goal of reducing gasoline consumption by 20 percent in ten years.

In 2005, the United States' primary energy consumption was 105,089 PJ with energy from biomass representing 3,479 PJ[198] (half of the 9 percent generated by renewable energy). Production levels for electricity from bioenergy was 60.8 TWh in 2004 and 61.8 TWh in 2005 - representing an increase of 1.6 percent.

In 2006, the United States' primary energy consumption was 105,360 PJ with energy from biomass representing 3,457 PJ[199]. Roughly three quarters of the biomass energy is use of wood and wood wastes to produce heat and electricity. The use of this wood energy has been relatively stable in the United States in recent years. The production of liquid biofuels, ethanol and biodiesel has been growing rapidly over the last few years and as of 2006 represents roughly a quarter of total bioenergy in the United States (Source: U.S. Energy Information Administration, 2006)

Table 13.1 – [PJ]

Total Primary Energy Supply	Imported	Renewable	Biomass
100%	31%	5%	3.2%
97 983	30 768	4 555	3 091

Source: IEA, 2005

13.2 Country Objectives and Drivers

There are several key goals of United States' bioenergy policy, including reducing dependence on imported oil, environmental considerations including climate change and addressing the need for replacement of oxygenate in motor gasoline, increased economic development, job creation in rural economies, expansion of new industries and technologies, and diversification of energy sources.

[197] Corn constitutes about 90 percent of the feedstock for ethanol production in the United States, the other 10 percent is largely grain sorghum, along with some barley, wheat, cheese whey and potatoes.
[198] EIA, Us Department of Energy
[199] EIA, Us Department of Energy

13.3 Bioenergy Policy by Sub-sector

There are several policies for the promotion of bioenergy in the United States, including the Energy Independence and Security Acts (EISA 2007), the Energy Policy Act of 2005 (EPACT 2005), the 2002 Farm Bill and the Biomass Research and Development Act of 2000 (as amended).

The 2002 Farm Security and Rural Investment Act contained an energy title designed to promote biofuels. The title included: biorefinery development grants, biomass research and development, and federal procurement of bio-based products.

The American Jobs Creation Act of 2004 extended an alcohol fuel mixture tax credit of 51 cents/gallon for mixtures containing ethanol (until 2010) and expanded the flexibility of these credits so that they apply to up to gasoline with up to 10 percent ethanol. The EPACT 2005 provisions included: creation of a Renewable Fuels Standard (RFS) that requires the production of 7.5 billion gallons (28 billion liters) of ethanol by 2012 (which was increased by the President's 20 in 10 proposal in January 2007 by nearly five times, to 35 billion gallons of alternative fuels by 2017), tax incentives for E85 refueling stations, tax and performance incentives, authorizations for loan guarantees, a bioenergy research and development program, and biorefinery demonstration projects. The new five-year Farm Bill for 2007 currently being debated in Congress, is expected to contain significant biofuels incentives. Enactment of the biofuels provisions could have significant impacts on the biofuels industry.

The United States state governments have also been strong supporters of biofuels. Twenty-six states have passed legislation supporting biofuels. Several states have legislation establishing mandates for biofuel blending and measures aimed to support bioenergy production and utilization. Minnesota has enacted a mandate for 20 percent ethanol in gasoline by 2013 and a 2 percent biodiesel blend. In 2005, North Dakota committed up to US$4.6 million over two years towards: a tax incentive for consumers who purchase E85, an investment tax credit for ethanol and biodiesel production facilities, and income tax credits and other benefits for biodiesel. In 2005, New York state began to implement a "Strategic Energy Action Plan" that included tax credits of up to US$10,000 for alternatively fueled vehicles. In 2006, New York state announced an initiative to make renewable fuels tax free and available at service stations throughout the state.

Authorized from 2002 through 2015, the Biomass Research and Development Initiative is a multi-agency effort to coordinate and accelerate all federal biobased products and bioenergy research and development activities.

The Initiative is guided by the Biomass Research and Development Act of 2000 (Title III of the Agricultural Risk Protection Act of 2000, P.L. 106-224). This Act was revised by Section 937 of EPACT2005. Administrated by the Department of Energy and the Department of Agriculture, during 2002 – 2006, the Initiative disbursed almost US$160 Million to finance projects in feedstock production, cellulosic biomass conversion technologies, and manufacturing of bio-based products in biorefineries. Nine cellulosic ethanol facilities are currently under construction in the United States. Other research and development activities have been proposed for the FY 2008.

The recently passed Energy Independence and Security Act (EISA) of 2007 has a number of provisions on biofuels and ramps up renewable fuel standard from 9 billion gallons in 2008 to 36 billion gallons by 2022 (replacing the RFS of the EPACT 2005). The RFS in EISA contains many of the aspects of Presidnet's Bush's "Twenty in Ten" plan to reduce the United States' gasoline consumption by 20 percent over the next 10 years. There are also a number of provisions in EISA to address buifuels sustainability. For example, under EISA, all biofuels production facilities that commenced construction after December 2007 must achieve "lifecycle" GHG emission reduction thresholds (compared to gasoline or diesel fuel replaced) of: 20 percent for conventional biofuels (e.g. corn ethanol), 50 percent for advanced biofuels (e.g. corn ethanol) and biomass-based diesel, 60 percent for cellulosic biofuel (i.e., second generation biofuels).

EISA also encourages the production and use of second generation biofuels. By 2022, 16 billion gallons (of the 21 billion advanced biofuel) must be considered cellulosic biofuel. U.S. R&D effort is intended to make next-generation technology cost competitive by 2012. Including the FY2009 Budget, the Administration has dedicated nearly $1 billion for research, development, and demonstration of cellulosic biofuels technology.Furthermore, only biofuels made from feedstocks that are grown on land previously cleared for cultivation before December 2007 can qualify as renewable fuels under EISA, with the aim of discouraging detrimental land-use changes (e.g. tropical deforestation).

The expansion of the biofuels industry requires the cooperation and coordination of many agencies of the U.S. government. The United States Department of Energy (DOE) and the United States Department of Agriculture (USDA) are the primary agencies responsible for the implementation of initiatives aimed at supporting the development of the bioenergy sectors in the United States of America. In addition, the Environmental Protection Agency issues regulations governing the implementation of the Renewable Fuels Standard. EPA is actually enhancing their GHG life-cycle analysis methodology for biofuels to include direct and indirect land use changes (e.g., accounting for potential expansion of agricultural or grazing land into tropical rainforest driven by increased demand for biofuel feedstocks). EISA provided EPA with additional authority to mitigate, to the extent practicable, air quality impacts associated with the expanded use of renewable fuels and the Agency is obliged to conduct environmental impact assessments of biofuels production every three years covering water, soil, air quality, biodiversity, and ecosystem health.

The Executive Order will ensure coordinated agency efforts on regulatory actions aimed at protecting the environment with respect to GHG emissions from motor vehicles, non road vehicles, and non road engines proceed in a manner consistent with sound science, analysis of benefits and costs, public safety, and economic growth. DOT is involved in regulating pipelines that might be used in the future to transport ethanol or ethanol-gasoline blends. The Department of Defense (DOD) is a large user of all kinds of transportation fuels and is interested in reducing fuel costs by using ethanol and biodiesel. It has an on-going test program to determine the feasibility of blending biofuels into their transportation infrastructure.

A first of its kind interagency workshop was held in November 2006 to develop a National Biofuels Action (NBA) Plan. The NBA Plan will improve government, industry, and other stakeholders' ability to work together to successfully meet the President's Advanced Energy Initiative goal for biomass: to make cellulosic ethanol cost competitive by 2012. The DOE Biomass Program, which was the direct recipient of the President's Advanced Energy Initiative increased funding, has also set a longer term goal to displace 30 percent of the 2004 United States' motor gasoline demand with biofuels by 2030. The DOE refers to these two goals as the Biofuels Initiative. The workshop gathered and organized the details of all federally funded activities, both current and planned, that will support the two goals of the Biofuels Initiative. This will range from basic to applied research as well as activities to support deployment and market readiness. Workshop participants helped identify gaps and overlapping efforts across the federal sector, as well as the areas of strength and focus for each agency in the area of biofuels. The meeting outcomes were used to develop the NBA Plan . Participating federal agencies included: USDA, DOE, National Science Foundation, DOT, EPA, Department of Interior, Office of Science and Technology Policy, Office of the Federal Environmental Executive, Department of Commerce, and DOD.

There is also now a Biomass R&D board, which helsp coordinate U.S. agencies work on bioenergy. The board is mandated by EPACT 2005 and recently formed an interagency sustainability group to facilitate strategic planning, coordinate federal activities, and develop domestic sustainability goals and benchmarks.

Power Generation

There are no national level mandated targets for the production of electricity from biomass in the United States

The Energy Policy Act of 2005 extended the Renewable Electricity Production Tax Credit (PTC), which is 1.9 cents/KWh for closed-loop biomass and 1 cent/KWh open-loop biomass and is provided to facilities that begin producing electricity by January 2008.The Renewable Energy Production Incentive (REPI) provides financial incentives payments for electricity produced and sold by new qualifying renewable energy generation facilities, REPI payments amount to1.5cents/KWh for the first ten years of operation. The Clean Renewable Energy Bonds (CREBs) were established by the Energy Tax Incentive Act of 2005, under Title III of the 2005 Energy Policy Act. CREB is a financing mechanism that can be issued by cooperative electric companies and governmental bodies (States or Territory) for public sector renewable energy projects; US$1.2 billion have been allocated for the period 2007 – 2026. The Renewable Energy System and Energy Efficiency Improvements Program, was established by the 2002 Farm Bill to make direct loans, loan guarantees and grants to agricultural producers and rural small business to purchase renewable energy systems (including biomass) and make energy efficiency improvements.

Heat Production

No specific policies addressing heat generation from biomass have been identified.

Transport

The Renewable Fuels Standard (RFS), established by the Energy Policy Act of 2005, mandates that all motor gasoline sold in the United States contain 9 billion gallons (34 billion litres) of renewable fuels in 2008, growing to 36 billion gallons (136.3 billion litres) in 2022. There is a 15 billion gallon (56.8 litres) cap on first generation corn (starch based) ethanol used to meet the RFS. The remaining 21 billion gallons (79.5 billion litres or 58 percent) must come from advanced or cellulosic biofuels.

Biofuels incentives started in the Carter Administration with the 1978 Energy Tax Act, following the oil price shocks of the 1970s. The act provided an excise tax exemption for alcohol fuel blends at 100 percent of the gasoline tax, which at the time was 4 cents per gallon. More recently, the American Jobs Creation Act of 2004 introduced the Volumetric Ethanol Excise Tax Credit (VEETC), a tax credit of 51 cents per gallon of ethanol for blenders and retailers. The VEETC was extended by the 2005 Energy Policy Act through 2010, and was expanded to include biodiesel. Producers of biodiesel who use agricultural feedstocks are eligible for a tax credit of US$1.00 per gallon, while producers of waste-grease biodiesel can receive a credit of 50 cents per gallon.

VEETC is applied to biofuels regardless of country of origin. The United States, however, imposes, a 54 cents/gallon other duty and charge on imported ethanol that has been extended by the Tax Omnibus Legislation of 2004 through January 2009, moreover, imports of ethanol are subject to a 2.5 percent Ad Valorem Tariff[200] .

Moreover the Energy Policy Act of 2005 also continued funding for the Biomass Program. The Act provided more than US$500 million to promote use of biotechnology and other advanced processes to make biofuels from lignocellulosic feedstocks cost-competitive with gasoline and diesel, to increase production of bio-products that reduce the use of fossil fuels in manufacturing facilities and to demonstrate the commercial application of integrated bio-refineries that use a wide variety of lignocellulosic feedstocks to produce liquid transportation fuels, high-value chemicals, electricity, and heat.

The 2002 Farm Bill included several provisions to promote the development of biorefineries, to provide incentives to feedstock producers and to realize education programs for farmers, local authorities and civil society about the benefits of production and utilization of biofuel. The new Farm Bill is currently being debated in Congress.

[200]Under the Caribbean Basin Initiative (CBI), countries in Central America and the Caribbean have had duty-free access to the United States since 1989 for ethanol from regional feedstocks. Access for ethanol derived from non-regional feedstocks has been limited by a CBI quota equal to 7 percent of total United States ethanol consumption.

The United States private sector has led the world in the development of Flexible Fueled Vehicles (FFV) which are capable of operating on either conventional gasoline or ethanol blends up to 95 percent (E85). The use of FFVs are the most flexible way to allow fuel ethanol consumption to rise beyond 10 percent of gasoline consumption. The United States' private sector is also expanding the ethanol distribution infrastructure. Ford and VeraSun Energy will establish a "Midwest Ethanol Corridor" by converting 40 existing fuel pumps in Illinois and Missouri to E85. General Motors (GM) announced that it will add 26 new E85 pumps in the greater Chicago area through a partnership with VeraSun Energy and Shell.

13.4 Results and Future Challenges

The most significant challenge faced by the United States is to rapidly reduce the cost of cellulosic ethanol feedstock production, transport, and conversion technologies. USDA is working to enhance sustainable strategies, systems and practices for bioenergy feedstock development, production, management and harvest. DOE's Office of Biomass Program is working on both the biochemical and thermochemical conversion platforms to bring the production cost down to competitive levels as quickly as possible. Another challenge is the construction of large number of commercial scale plants that utilize cellulosic feedstocks. The DOE has embarked upon a US$385 million program to construct 6 biorefineries that will utilize cellulosic biomass feedstocks and produce ethanol and a variety of bio-products. Additional challenges include: rapid ramp-up of flex-fuel vehicles that can use E85, and construction of infrastructure such as pipelines, retail dispenser pumps, rail, barge, and trucks to move biofuels from production centers into areas of demand. DOE is working with other federal agencies and the private sector to overcome these challenges and facilitate the growth of biofuels in the United States transportation sector.

13.5 Best practices

Several best practices regarding different aspects of the bioenergy sector have been developed.

Regarding *Resources Potential Assessments*, DOE and USDA have jointly published the report "Biomass as a Feedstock for a Bioenergy and Bioproducts Industry: The Technical Feasibility of a Billion-Ton Annual Supply"[201] in order to determine whether the land resources of the United States are capable of producing a sustainable supply of biomass sufficient to displace 30 percent or more of the country's 2004 petroleum consumption.

The report has generated a significant amount of questions and has highlighted the need for additional analysis in the area of feedstock resource assessment. The technical potential of

[201] available at http://www1.eere.energy.gov/biomass/publications.html

the resource base has been a valuable tool that can be used to bound estimates of the long-term potential for the contribution of biomass to the United States' energy picture.

Regarding *Life Cycle Analysis*, DOE's Argonne National Laboratory has developed a transportation analysis tool that allows users to accurately evaluate the energy and environmental benefits of advanced vehicle technologies and alternative transportation fuels. The GREET (GHGs, Regulated Emissions, and Energy use in Transportation)[202] model addresses the need for truly comparative full fuel cycle (or well-to-wheel) analyses, calculating, for a given vehicle and fuel system, consumption of total energy; emissions of CO_2-equivalent GHGs - primarily carbon dioxide, methane, and nitrous oxide; emissions of six criteria air pollutants. EPA is also mandated by EISA to develop LCA for biofuels.

Regarding *Reduction of Environmental Impacts*, the Nitrogen Neutrality Policy requires for structural and documentable / verifiable practices that offset predicted increased of nitrogen loadings as a consequence of the growing of biofuel feedstocks.

The policy is analogous to current agricultural policy called "conservation compliance" that is designed to prevent water quality impacts associated with sediment runoff from highly erodible lands or on which federally-supported commodity crops are grown. Research suggests that drainage management could reduce nitrate transport by 30 percent for regions where appreciable drainage occurs in the fall and winter[203]. Although water table management could potentially alter nitrification and de-nitrification reaction, reported reductions in nitrate export with controlled drainage are primarily due to reductions in the volume of flow rather than reductions in nitrate concentration. Some uncertainty arises from difficulties in closing water balances (and therefore N balances) in field studies, and an unknown amount of subsurface flow reduction could be due to lateral seepage and/or increased surface runoff[204]. Simulation studies predict increased surface runoff when higher water tables are maintained by controlled drainage[205], suggesting a potential tradeoff between reduced subsurface drainage and increased surface runoff. Although raising the water table can decrease the volume of infiltrating water entering drainage tile, higher water tables can also increase surface runoff resulting in increased erosion and loss of particulate contaminants such as soil bound phosphorus[206].

Regarding *Information Management and Public Education*, USDA announced the release of the Department's Energy Matrix: a navigational aid that resides on the USDA website that allows the public to search energy related programs that USDA has to offer[207] providing the

[202] available at http://www.transportation.anl.gov
[203] Cooke et. al., 2007
[204] Cooke et. al., 2007
[205] Skaggs et al. 1995; Singh and Helmers 2006
[206] available at http://www.epa.gov/sab/pdf/5-24-07_hap_draft.pdf
[207] USDA programs support framers, other rural residents, and the nation respond to energy-related issues and opportunities, ranging from basic scientific research to the development and commercialization of new technologies

public and potential recipients with an easy way to navigate the various programs to determine what might be available to meet their needs[208].

Moreover, USDA implements the Biodiesel Education Program that sponsor national conferences, conduct technical workshops and develop partnerships with stakeholders such as engine manufacturers, health organizations, environmental groups, fuel marketers, and State Department of Transportation Offices.

Regarding *International Activities*, the United States Forest Service with funding from USAID, recently completed a biomass project in Russia that focused on developing sustainable forest plantations for fuel wood. The Sustainable Forestry Project built capacity to develop and use GIS in both research and management applications, developed expertise in using prescribed burning for hazard reduction and site preparation for reforestation, improved silvicultural prescriptions and reforestation, improved harvest techniques and harvest equipment, and assessed the economic feasibility of expanded sustainable timber harvesting for biomass utilization.

[208] available at http://www.usda.gov/rus/index2/0208/EnergyPrograms.htm

13.6 Country Policy Table – United States

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Biomass Research and Development Board US Department of Agriculture	Biomass Research and Development Act of 2000, as amended	Legislative- R&D and Demonstration	Yes	Government		
Biomass Research and Development Technical Advisory Committee (Department of Energy / Department of Agriculture)	The Biomass Research and Development Act of 2000, as amended	Legislation - R&D and Demonstration	Yes	Education Institutions, private industry and environmental interest groups	Promotes development of new and emerging technologies for the use of biomass, including processes of production of bio-based fuels and biobased products	
Department of Agriculture	FARM ACT 2002	Legislation - Omnibus	Yes		sec IX Energy	Sec 1 commodities programmes; Sec 2 conservation; Sec 3 Trade; Sec 4 Nutrition Program; Sec 5 credit; Sec 6 Rural development; Sec 7 Research and related matters; Sec 8 Forestry; Sec 10 Miscellaneous.
Department of Agriculture	section 9002, Federal Procurement of Bio-based Products; Farm Act 2002	Legislation - Guidelines	Yes	Government	Establishes a new program for purchase of bio-based products by federal agencies, modeled on the existing program for purchase of recycled materials. A voluntary bio-based labeling program is included.	
Department of Agriculture	section 9003, Bio-refinery Grants; Farm Act 2002	Legislation - Incentives	Yes	Industry	Establishes a competitive grant program to support development of bio-refineries to convert biomass into multiple products such as fuels, chemicals and electricity.	
Department of Agriculture	section 9004, Biodiesel Fuel Education Program; Farm Act 2002	Legislation - Incentives and Education	Yes	Government / Private Entities	Establishes a competitive grant program to educate government and private entities with vehicle fleets, as well as the public, about the benefits of biodiesel fuel use	
Department of Agriculture	section 9005, Energy Audit and Renewable Energy Development Program; Farm Act 2002	Legislation - Information	Yes	Farmers, Ranchers, and Rural Small Business	Authorizes a competitive grant program for the administration of energy audits and renewable energy development assessments to include bioenergy and energy crops.	
Department of Agriculture	section 9006, Renewable Energy Systems and Energy Efficiency Improvements; Farm Act 2002	Legislation - Incentives	Yes	Farmers, Ranchers, and Rural Small Business	Establishes a loan / loan guarantee / grant program to assist eligible farmers, ranchers, and rural small businesses in purchasing renewable energy systems and making energy efficiency improvements.	
Department of Agriculture	section 9008, Biomass Research and Development; Farm Act 2002	Legislation - R&D	Yes	Academic Institutions	Promotes research and development activities for development of new and emerging bioenergy technologies and processes for production of bio-based fuels, including biomass.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
	Coordinates federal policies and procedures for promoting R&D and Demonstration activities leading to production of biofuel and biobased products		Same as Biomass R&D Advisory Committee	
	Promotes R&D and Demonstration activities to advance the availability of new technology for the conversion and the use of Biofuels and biobased products		$5 million from Commodity Credit Corporation for 2002 and $14 million/year in the period 2003/2007 + $200 million/year in the period 2006/2015	
			Conservation Security Program (CSP) provides payments and incentives for further environmental management and conservation by farmers who are already implementing such practices. This is a comparatively new program with spending amounts to $260 million annually	
Designed to increase the use of voluntary certification frameworks in the production of bio-based products			Mandates funding of $1 million annually through the Commodity Credit Corporation (CCC) for fiscal years (FY) 2002-07 for testing bio-based products.	
	Provides grants for up to 30% of the costs for development of new and emerging technologies for the use of biomass, including lignocellulosic biomass		Authorization only, no funding	
		Promotes the use of Biodiesel fuel in the by raising public awareness on the benefits of utilizing this biofuel source for transport	$1 million/year from Commodity Credit Corporation in the period 2002-2007.	
Promotes the use of biomass (and renewable in general) by showing to farmers, ranchers and rural small businesses the economic advantage of their use in production schemes			Authorization only, no funding	
		Supports end-use implementation and access to bioenergy for farmers, ranchers and rural small business.	$23 million/year from Commodity Credit Corporation in the period 2002-2007.	
	Promotes new and emerging technologies for use in the production of biofuels and bioenergy.		$54 million from Commodity Credit Corporation for 2002 and $63 million/year in the period 2003-2007	

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department of Agriculture	section 9010, Bioenergy Program; Farm Act 2002	Legislation - Incentive and Targets	Yes	Producers of Biodiesel and fuel grade ethanol from energy crops, oil seed, or vegetable oils that produce bioenergy.	Lays out targeted incentives based on production levels. Production less than 65,000,000 gallons of bioenergy reimbursed at 1 feedstock unit for every 2.5 feedstock units of eligible commodity used for increased production; Producers of more than 65,000,000 gallons of bioenergy reimbursed at 1 feedstock unit for every 3.5 feedstock units of eligible commodity used for increased production.	
Department of Energy	Energy Indipendence and Security Act 2007	Legislation - Omnibus	Yes	Industry/ Transport	Increases the supply of alternative fuel sources by setting a mandatory RFS. Reduces US demand for oil by setting a national fuel economy standards by 40 percent and save billions gallons of fossil fuel.	
Department of Energy	section 701, Use of Alternative Fuels by Dual-Fueled Vehicles; Energy Act 2005	Legislation - Mandates	Yes	Government	Requires U.S. Government vehicle fleets to use alternative fuels in dual-fuel vehicles unless the Secretary of Energy determines an agency qualifies for a waiver. Grounds for a waiver are: alternative fuel is not reasonably available to the fleet and the cost of alternative fuel is unreasonably more expensive that convention fuel.	
Department of Energy	section703, Incremental Cost Allocation; Energy Act 2005	Legislation - Mandates	Yes	Government	Requires the U.S. General Services Administration (and other federal agencies that procure vehicles for fleets) to spread the incremental vehicle costs of all vehicles.	
Department of Energy	section 704, Alternative Compliance for State and Flexibility; Energy Act 2005	Legislation - Strategy	Yes	Government	Establishes flexible compliance options under the Environmental Protection Act of 1992 to allow agencies to choose a petroleum reduction path for their vehicle fleets in lieu of acquiring Alternative Fuel Vehicles (AFVs). Program has a waiver requirement where agencies must provide evidence to DOE that their petroleum reduction program will achieve results equivalent to alternative fuel vehicles (AFVs) running on alternative fuels 100% of the time.	
Department of Energy	section 705, Report Concerning Compliance with Alternative Fueled Vehicle Purchasing Requirements; Energy Act 2005	Legislation - Mandates	Yes	Department of Energy	Establishes annual agency reporting date of February 15th, for Executive Order 13149 Compliance Reporting to Congress on use of Alternative Fuel Vehicles in government fleets.	
Department of Energy	section 706, Joint Flexible Fuel / Hybrid Vehicle Commercialization Initiative; Energy Act 2005	Legislation - R&D	Yes	Industry / Private Sector / Non Profit Sector	Establishes a research program to advance the commercialization of flexible fuel or plug-in hybrid vehicles. The Act requires vehicles to achieve at least 250 miles per petroleum gallon.	
Department of Energy	sec 1501, Extension and Modification of Renewable Electricity Production Credit; Energy Act 2005	Legislation - Targets and Mandates	Yes	Industry / Transport	This section establishes a program requiring gasoline sold in the United States to be mixed with increasing amounts of renewable fuel (usually ethanol) on an annual average basis. In 2006, 4 billion gallons of renewable fuels are to be mixed with gasoline, and this requirement increases annually to 7.5 billion gallons of renewable fuel by 2012. For 2013 and beyond, the required volume of renewable fuel will include a minimum of 250 million gallons of cellulosic ethanol.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Encourages increased purchase of eligible commodities (energy feedstocks) for the purpose of expanding production of bioenergy and supporting new production capacity.			$150 million/year from Commodity Credit Corporation in the period 2003-2007.	
Fuel producers are required to use at least 36 billion gallons of biofuel in 2022.	New biofuel production facilities must achieve minimum lifecycle GHG emission thresholds.	Provisions to improve energy efficiency in lighting and appliances. Federal buildings are requested to use EnergyStar products or products designated under the Energy Department's Feneral Energy Management Programme by the end of FY 2013		The bill wil update the Energy Policy and Conservation Act to set new appliance efficiency standards.
		Promotes use of biofuels in transport fleets used by government. - Leading by example.		This mandate modifies 42 USC 13212 (EPAct 1992 Section 303)
		Promotes the use of energy efficient vehicles in Government vehicle fleets.		Amending Section 303 of the Energy Policy Act of 1992
		Promotes use of biofuels and energy efficient transportation models at the government level.		Amending the Title V of the Energy Policy Act of 1992
		Establishes national reporting structure for review and analysis by Legislative bodies on government use and implementation of alternative fuel vehicles.		
Promotes development of alternative energy vehicles for transport with a goal of increasing energy efficiency.			Government allocation of $3,000,000 for fiscal year 2005 / $7,000,000 for fiscal year 2006 / $10,000,000 for fiscal year 2007 / $20,000,000 for fiscal year 2008	
		Establishes blending mandates and incrementally increases in the use of ethanol for transportation by setting minimum targets.		

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department of Energy	section 902, Bioenergy Program; Energy Act 2005	Legislation - R&D	Yes	Industry / Academic Institutions	Provides a framework for Department of Energy biomass and bio-product programmes to partner with industrial and academic institutions to advance the development of biofuels, bio-products, and bio-refineries.	
Department of Energy	section 941, Amendments to the Biomass Research and Development Act of 2000; Energy Act 2005	Legislation - R&D	Yes	Academic Institutions	Promotes development of crops and crop systems that improve feedstock production and processing; convert recalcitrant cellulosic biomass into intermediates that can be used to produce bio-based fuels and products; develop technologies that yield a wide range of bio-based products that increase the feasibility of fuel production in a bio-refinery; analyze biomass technologies for their impact on sustainability and environmental quality, security, and rural economic development.	
Department of Energy	section 942, Production Incentives for Cellulosic Biofuels; Energy Act 2005	Legislation - Incentives and Targets	Yes	Producers	Accelerate deployment and commercialization of biofuels; deliver the first 1,000,000,000 gallons in annual cellulosic biofuels production by 2015; ensure biofuels produced after 2015 are cost competitive with gasoline and diesel; and ensure that small feedstock producers and rural small businesses are full participants in the development of the cellulosic biofuels industry	
Department of Energy	section 932, Bioenergy Program; Energy Act 2005	Legislation - R&D	Yes	Industry / Academic Institutions	Directs the Department of Energy to conduct a program of research, development, demonstration, and commercial application for bioenergy, including: biopower energy systems; biofuels; bioproducts; integrated biorefineries that may produce biopower, biofuels, and bioproducts; cross-cutting research and development in feedstocks; and economic analysis.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
Sets goals for promoting use of biotechnology and other advanced processes to make biofuels from lignocellulosic feedstocks cost-competitive with gasoline and diesel, increasing production of bio-products that reduce the use of fossil fuels in manufacturing facilities, and demonstrating the commercial application of integrated bio-refineries that use a wide variety of lignocellulosic feedstocks to produce liquid transportation fuels, high-value chemicals, electricity, and useful heat.			$167,650,000 for fiscal year 2006; $180,000,000 for fiscal year 2007; and $192,000,000 for fiscal year 2008.	
Promotes development of crops and crops systems that improve feedstock production.	Creates systems for conversion of recalcitrant cellulosic biomass into intermediates that can be used to produce biobased fuels / develop of technologies to increase efficiency of bio refineries.			
Authorizes the establishment of incentives to ensure that annual production of one billion gallons of cellulosic biofuels is achieved by 2015.			$250,000,000	
Develop, in partnership with industry and institutions of higher education: advanced biochemical and thermochemical conversion technologies capable of making fuels from lignocellulosic feedstocks that are price-competitive with gasoline or diesel in either internal combustion engines or fuel cell-powered vehicles; advanced biotechnology processes capable of making biofuels and bioproducts with emphasis on development of biorefinery technologies using enzyme-based processing systems; advanced biotechnology processes capable of increasing energy production from lignocellulosic feedstocks, with emphasis on reducing the dependence of industry on fossil fuels in manufacturing facilities; and other advanced processes			$213,000,000 for fiscal year 2007; $251,000,000 for fiscal year 2008; and $274,000,000 for fiscal year 2009.	

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department of Energy	20 in 10 initiative	Executive Branch Initiative	Legislation introduced spring 07 and pending	Industry, Academic, State, Environmental , Government, Trade Associaton	35 billion gallons of ethanol equivalent alternative fuels by 2017	Increased alternative fuels vehicles, gas station, infrastructure; new feedstock investment models
Department of Energy	Advanced Energy Initiative	Executive Branch Initiative	DOE Budget reprioritized and approved by Congress in FTY07C/R	Industry, Academic, State, Environmental , Government, Trade Associaton	Making cellulosic ethanol cost competitive by 2012	Increased alternative fuels vehicles, gas station, infrastructure; new feedstock investment models
Department of Energy	Executive Order: Cooperation Among Agencies in Protecting the Environment with Respect to Greenhouse Gas Emissions From Motor Vehicles, Nonroad Vehicles, and Nonroad Engines	Executive Branch Directive	Not needed	Interagency coordination	Encourages DOE, DOT, DOE and EPA to work together to reduce greenhouse gases	Supports 20 in 10 goals
Biomass Research and Development Technical Advisory Committee (Departments of Energy and Agriculture)	section 941, Amendments to the Biomass Research and Development Act of 2000; Energy Act 2005	Legislation - FACA	Yes	Industry, Academic, State, Environmental Government, Trade Associaton, Analyst, Economist	Established a Federal Advisory Committee to advise the Secretary of Energy, the Secretary of Agriculture, and the points of contact concerning: the technical focus and direction of requests for proposals issued under the Initiative; and procedures for reviewing and evaluating the proposals; to facilitate consultations and partnerships among Federal and State agencies, agricultural producers, industry, consumers, the research community, and other interested groups to carry out program activities relating to the Initiative; and to evaluate and perform strategic planning on program activities relating to the Initiative.	
Biomass Research and Development Board (Departments of Energy and Agriculture)	section 941, Amendments to the Biomass Research and Development Act of 2000; Energy Act 2005	Legislation - Interagency Board	Yes	Government	Establishes an Interagency Board to coordinate programmes within and among departments and agencies of the Federal Government for the purpose of promoting the use of biobased industrial products by maximizing the benefits deriving from Federal grants and assistance; and bringing coherence to Federal strategic planning.	
Department of Agriculture	Environmental Quality Incentive Program	Incentives	Yes	All working agricultural lands	Provides assistance to agricultural producers in a manner that will promote agricultural production and environmental quality as compatible goals,	
Department of Agriculture	Conservation Security Program	Incentives	Yes	Working agricultural lands in selected watersheds	A voluntary conservation program that supports ongoing stewardship of private agricultural lands by providing payments for maintaining and enhancing natural resources.	
Department of Agriculture	Conservation Reserve Program	Incentives	Yes	Highly erodible soils and target conservation areas	Provides incentives to prevent expansion of agriculture, including bioenergy crops, into marginal lands for agriculture that are prone to soil erosion.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
35 billion gallons of ethanol equivalent alternative fuels by 2017	35 billion gallons of ethanol equivalent alternative fuels by 2017	35 billion gallons of ethanol equivalent alternative fuels by 2017	Regular budget process and congressional appropriations	
Production in 2010 and later	Conversion on 2010 and later	Use on 2010 and later	Regular budget process and congressional appropriations	
May favor renewable feedstocks versus hydrocarbon feedstocks	May favor renewable conversion processes versus hydrocarbon based conversion processes	May favor renewable fuels versus hydrocarbon fuels	None	
Advises on program activities and planning.	Advises on program activities and planning.	Advises on program activities and planning.		
Coordinates government activities and strategic planning.	Coordinates government activities and strategic planning.	Coordinates government activities and strategic planning.		
			Since EQIP began in 1997, USDA has entered into 117,625 contracts, enrolled more than 51.5 million acres into the program, and obligated nearly $1.08 billion to help producers advance stewardship on working agricultural land.	Applies to all agriculture, not restricted to bioenergy crops. Applies to establishment of new practices.
			Since its inception in 2004, 19,400 farms and ranches representing 15,800,000 acres in 280 different watersheds have been enrolled. In 2005, CSP made payments of $202 million.	Applies to all agriculture, not restricted to energy crops. Can apply to existing practices.
			As of 2005, CRP has a total of 34.9 million acres enrolled that if farmed would be very susceptible to erosion and runoff. CRP payments for land retirement in 2005 totaled $1.79 billion.	Applies to all agriculture, not restricted to bioenergy crops

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Department of Agriculture	Wetlands Reserve Program	Incentives	Yes	Restoration of wetlands marginal for agriculture	Provides incentives to prevent expansion of agriculture, including bioenergy crops, into marginal lands for agriculture that have a high environmental value.	
Department of Agriculture	Woody Biomass Utilization 2005 Grant Program, Public Law 108-447 & Public Law 108-148.	Grants	Yes	State foresters and local communities		
Department of Agriculture	Biomass for small-scale heat and power	R&D	Yes	Bioenergy users		
EPA	EPAct 2005 / Renewable Fuel Standard (RFS)	Policy / Regulation	Yes			
EPA	EPAct 2005 / National Clean Diesel Campaign	R&D / Education	Yes			
EPA	Clean Air Act	Policy / Regulation	Yes	Biofuels producers		
EPA	EPAct 2005	Policy / R&D	Yes		Vehicle/Engine testing, statistical analysis, emission inventory/air quality analysis, emission inventory/air quality analysis,	
EPA / Region		R&D			Grant to produce cheaper biodiesel by means of continuous production technology, reducing NOx by removing nitrogen compounds in feedstock, creating less toxic process by using ethanol derived from renewable sources.	
EPA / Region	Urban Biofuel Initiative	R&D		Restaurant, biofuels producers, flexfuel fleet managers	Facilitate the creation of a large-scale market for bio-diesel derived form waste cooking oil.	
EPA / National Science Foundation	Technology for a Sustainable Environment	R&D		Research Centre	Researching on conversion technologies; analysis of lifecycle tradeoffs for celluloses ethanol	
EPA	Pollution Prevention Act	R&D			Research on life cycle assessment of corn based ethanol used as fuel additive	

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).
"Direct" is defined as policies or activities that directly impact the energy sector. These items may include policies or activities that promote national/state bioenergy action plans; production and use of biofuels for transport (including blend mandate, type of fuel, market segment, target flexibility, enforcement provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
			Currently there are 7,831 projects on 1,470,998 acres enrolled in the program. The 2002 Farm Bill authorized the continuation of the program by enabling the Secretary of Agriculture to enroll up to 250,000 additional acres annually into the program.	Applies to all agriculture, not restricted to bioenergy crops
		Promote the use of alternate energy sources, benefiting local communities, while at the same time reducing the costs of forest management.	The Congressional language authorizes up to $5 million a year for forest product projects that increase the use of woody biomass from national forest system lands. Funding is planned to run from 2005 until 2009.	
		Provides technology to more efficiently utilize biomass for energy production in convenient forms	A program of the USDA Forest Service's Forest Products Laboratory	
		Works to bring greater access to biodiesel and E85 along key transportation corridors Funds demonstration projects Provides technical assistance to communities and industry regarding ethanol and biodiesel		
		Partners (restaurants, waste haulers, biodiesel producers, fleet mgrs) create community-based pollution reduction project in which feedstock collection, fuel production, and distribution are all in close proximity.		

"Production" relates to feedstock, farming practices, land use, or other aspects associated with the production of bioenergy agricultural crops (raw materials). “Conversion" refers to the practices (processing, refining, etc...) and energy efficiency methodologies used in the conversion of raw bioenergy materials into end-use products. "Use" refers to end-use (i.e. electricity, heat, fuel for transport, etc...). In this section of the table, we asked each country to show what part of the production stream would be affected by the listed policies and activities (i.e. Production, Conversion, Use).

13.7 United States Bioenergy Outlook

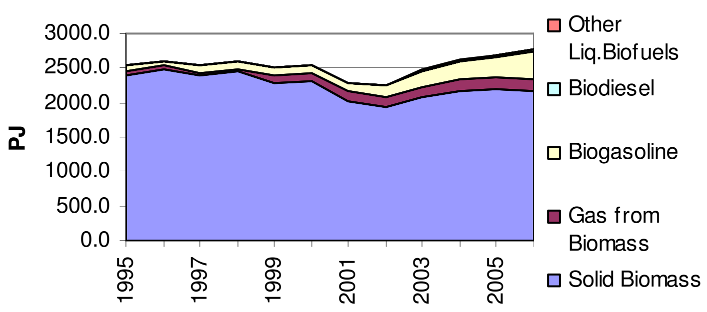
Table 13.2 - United States – Biofuel production

Production (PJ)	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	2552.2	2605.4	2533.3	2602.8	2508.6	2548.5	2286.5	2261.8	2469.9	2620.4	2689.2	2768.4
Solid Biomass	2400.8	2480.8	2384.3	2442.1	2272.1	2303.4	2021.3	1938.2	2078.8	2175.3	2191.7	2169.4
Gas from Biomass	42.8	46.5	46.8	49.4	118.6	123.9	137.3	152.4	152.2	156.6	159.8	169.1
Biogasoline	108.7	78.1	102.2	111.3	117.9	120.3	127.0	164.8	224.9	272.9	313.1	389.4
Biodiesel						0.9	0.9	2.1	3.3	4.5	12.4	29.2
Other Liq.Biofuels								4.4	10.7	11.1	12.2	11.4
All woodfuels (2)	2115.4	2022.3	1905.3	1910.2	1626.5	1613.4	1533.5	1506.7	1499.0	1536.1	1538.7	
Fuelwood (2)	858.8	792.3	649.6	670.8	407.6	403.4	404.1	372.5	369.7	379.9	382.1	
Charcoal (2)	23.0	24.3	24.7	25.1	26.8	28.5	28.0	29.5	30.3	28.7	29.0	
Black Liquor (2)	1233.7	1205.6	1231.0	1214.3	1192.1	1181.4	1101.4	1104.7	1099.1	1127.6	1127.6	

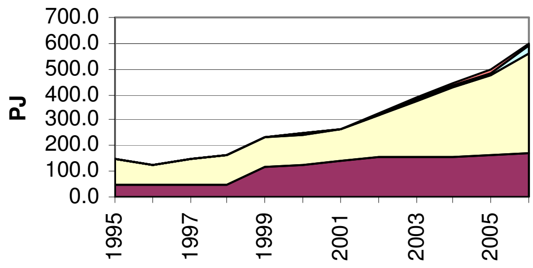
Production growth (%)	'95-'96	'96-'97	'97-'98	'98-'99	'99-'00	'00-'01	'01-'02	'02-'03	'03-'04	'04-'05
Solid Biomass	3.3	-3.9	2.4	-7.0	1.4	-12.2	-4.1	7.3	4.6	0.8
Gas from Biomass	8.8	1	5.5	140.2	4.5	10.8	11.0	-0.2	2.9	2.1
Biogasoline	-28.1	30.8	8.9	6.0	2.0	5.5	29.8	36.5	21.3	14.7
Biodiesel							142.9	58.8	35.8	175.5
Other Liquid Biofuels								141.2	4.1	10

(2) = Based on FAO data

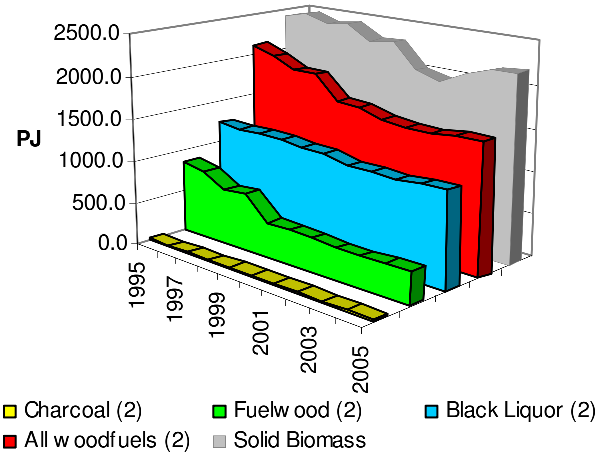
USA- Biofuels production



USA- Liquid and gaseous biofuels production



USA- IEA Solid Biomass vs FAO Woodfuels



USA- Change rate of biofuels production

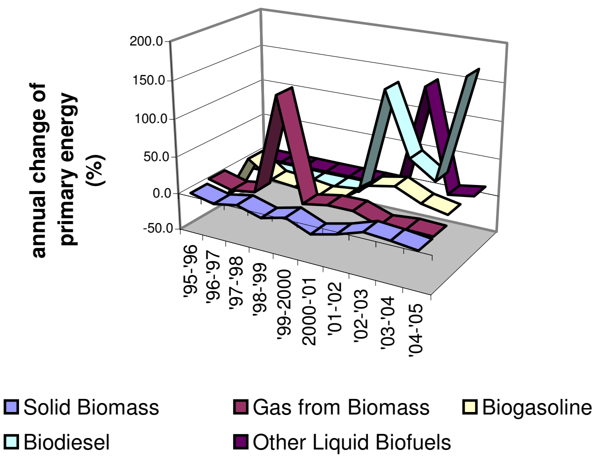


Table 13.3 - United States – Biofuel Import (PJ)

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels	1.3	1.0	0.3	0.2	0.3	0.4	1.1	1.0	0.7	9.7	8.9	58.5
Solid Biomass												
Gas from Biomass												
Biogasoline	1.3	1.0	0.3	0.2	0.3	0.4	1.1	1.0	0.7	9.7	8.9	58.5
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	5.9	5.1	5.1	4.7	5.1	5.6	7.1	7.3	6.7	7.3	7.5	
Fuelwood (2)	5.2	4.6	4.3	3.9	4.4	5.0	6.4	6.4	5.0	5.3	5.7	
Charcoal (2)	0.7	0.6	0.8	0.8	0.7	0.6	0.7	0.9	1.7	2.0	1.8	

(2) = Based on FAO data

Table 13.4 - United States – Biofuel Export (PJ)

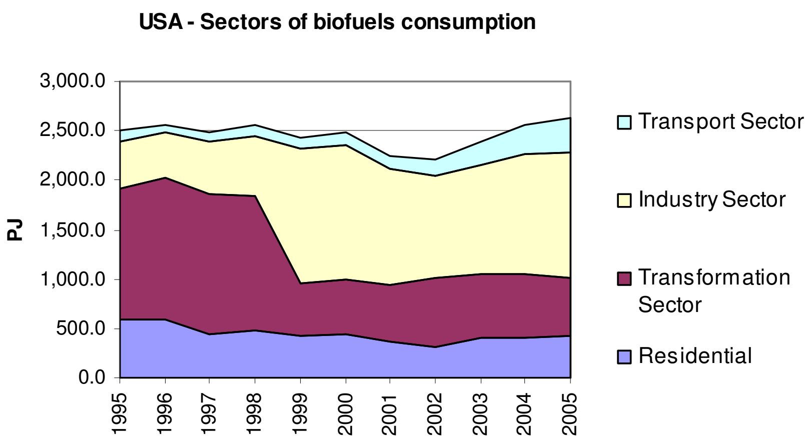
	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
Total Biofuels												
Solid Biomass												
Gas from Biomass												
Biogasoline												
Biodiesel												
Other Liquid Biofuels												
All woodfuels (2)	2.4	2.5	2.8	3.8	3.4	3.4	2.8	3.2	2.3	2.3	3.8	
Fuelwood (2)	1.5	1.6	2.0	3.0	2.8	3.0	2.4	2.8	1.8	1.8	3.1	
Charcoal (2)	0.9	0.9	0.9	0.8	0.6	0.5	0.4	0.4	0.5	0.5	0.6	

(2) = Based on FAO data

Table 13.5 - United States – Total Biofuel domestic supply (TPES) and sector of use (PJ)

	Sector of use	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006 Est.
All biofuels	*Dom. Supply*	2,554.7	2,607.3	2,531.2	2,601.8	2,507.3	2,551.4	2,285.0	2,255.0	2,469.6	2,633.0	2,697.0	2,816.6
	Transform.	1.324.	1.436.	1.417.	1.354.	547.5	565.7	568.0	695.7	632.4	644.1	592.0	
	Industry	477.1	451.1	538.3	603.7	1.349.	1.351.	1.169.	1.032.	1.117.	1.214.	1.272.	
	Transport	110.9	79.5	100.7	111.3	115.7	133.4	140.5	168.4	230.0	289.4	337.9	
	Residential	597.4	596.4	434.0	486.8	414.8	434.4	370.9	313.7	411.0	410.9	421.0	
Solid Biomass	Dom. Supply	2,401.2	2,481.2	2,384.8	2,442.6	2,272.5	2,303.8	2,021.7	1,938.5	2,079.2	2,175.7	2,192.1	2,169.8
	Transform.	1.281.	1.390.	1.370.	1.304.	494.7	502.4	494.0	620.0	552.5	562.0	510.7	
	Industry	477.1	451.1	538.3	603.7	1.285.	1.294.	1.107.	953.7	1.039.	1.130.	1.182.	
	Transport												
	Residential	597.4	596.4	434.0	486.8	414.8	434.4	370.9	313.7	411.0	410.9	421.0	
Gas from Biomass	Dom. Supply	42.8	46.6	46.8	49.4	118.6	124.0	137.4	152.4	152.2	156.6	159.8	169.1
	Transform.	42.8	46.6	46.8	49.4	52.8	63.3	74.1	73.2	77.8	79.8	78.7	
	Industry					63.6	57.4	62.8	78.7	73.9	74.6	80.4	
	Transport												
	Residential												
Biogasoline	Dom. Supply	110.7	79.5	99.6	109.8	116.1	122.8	125.0	159.4	228.7	285.1	320.5	437.2
	Transform.												
	Industry												
	Transport	110.9	79.5	100.7	111.3	115.7	132.6	139.6	166.3	226.6	284.9	325.5	
	Residential												
Biodiesels	Dom.						0.9	0.9	2.1	3.3	4.5	12.4	29.2
	Transform.												
	Industry												
	Transport						0.9	0.9	2.1	3.3	4.5	12.4	
	Residential												
Other Liquid Biofuels	Dom. Supply								2.6	6.2	11.1	12.2	11.4
	Transform.								2.6	2.2	2.3	2.6	
	Industry									4.0	8.8	9.6	
	Transport												
	Residential	2.401.	2.481.	2.384.	2.442.	2.272.	2.303.	2.021.	1.938.	2.079.	2.175.	2.192.	2.169.8

The sum of biofuel use in various sectors and the total domestic supply do not tally due to interproduct *transfers* and to *statistical differences* (IEA 2007)



ANNEX II - The Regional Dimension

This section describes key regional agreements and preferential agreements enabling analysis the implications of the regional context for national policies and targets. Please note that the WTO and its treatment of biomass energy products was discussed in depth in Section 2.5 as the key international trade body.

1 EUROPEAN UNION

The European Union (EU) has enacted bioenergy policies that are legally binding for Member States and therefore has been addressed in-depth. EU policies that influence directly and indirectly biofuel and bio-electricity production are ruled by a series of EU directives and regulations. EU Directives require Member States to achieve a particular result. Although Directives leave the Member Countries free to choose the means of achieving that result, the provisions and targets indicated in the directives are binding on the Member States. If a Member State fails to pass the required national legislation, or if the national legislation does not adequately comply with the requirements of the Directive, the European Commission may initiate legal action against the member state in the European Court of Justice

Common Agriculture Policy (CAP), and particularly its reform (in 2003) had a great impact in promoting biofuel production. CAP through its regulation[209], is directly absorbed into Member Countries' legislation without requiring national legislation.

In the following paragraphs main policies affecting bioenergy deployment are presented.

1.1 Overview

In the past decade, production and use of biofuels has increased substantially in the European Union. In 2005, 3.9 million tons of biofuel were produced. Biodiesel is the most important biofuel in the EU representing around 8 percent of Biofuels.[210] The sector has undergone very rapid growth with a 28.2 percent annual production increase since 2000- with Germany keeping its leading position with a production of more than half (52.4 percent) of EU biodiesel production. The main feedstock used is rapeseed (about 80 percent) and the rest is mainly from sunflower oil and soybean oil.[211]

Bioethanol represents 18.5 percent of the biofuels being used in transport in the EU[212]. Main feedstocks are sugar beet and cereals. EU industry has been slower in investing in ethanol production consequently ethanol production will not be sufficient to meet the demand. As a result, bioethanol imports are expected to increase in 2006, 2007, and will likely continue through 2010.

Biofuel related trade regimes[213]:

a) bioethanol. The EU imported more than 250 million litres of ethanol during the period 2002-2004. 30 percent of this volume was imported as normal Most Favoured Nation trade and subject to specific import duties (tariff) of euro 0.102/litre on denatured alcohol (HS 2207 20) and euro 0.192/litre on undenatured alcohol (HS 2207 10). The remaining 70 percent of EU alcohol imports entered under preferential trade arrangements as the Generalized Systems of

[209] Differently from Directive, Regulation is a legislative act of the European Union which becomes immediately enforceable as law in all member states simultaneously.
[210] EurObserv'ER, Barometre des Biocarburants, May 2006
[211] US-FSA report "EU-25 Bio-Fuels- Biofuels Annual 2006", GAIN Report Number: E36102, 7/11/2006
[212] EurObserv'ER, Barometre des Biocarburants, May 2006
[213] data from UNCTAD, "The emerging biofuels market: regulatory, trade and development implications", United Nations 2006

Preferences (GSP). From 1 January 2006 to 31 December 2008, according to the new GSP Regulation, tariff reduction for either denatured or undenatured alcohol will be not applicable any longer. However, unlimited and duty-free access to denatured and undenatured alcohol are eligible if the exporting country adheres to an incentive scheme for sustainable development and good governance. Duty-free and quota-free access is granted to the Less Developed Countries under the Everything But Arms (EBA) Initiative and under the Cotonou Agreement, (ACP countries).

b) biodiesel. No significant external biodiesel trade has occurred, against a relevant internal trade. An ad valorem duty of 6.5 percent is applied to EU imports of biodiesel

Biomass electricity has increased from a yearly growth of 7 percent in previous years to 13 percent in 2003 and 23 percent in 2005. Biomass in 2005 contributed 70 TWh.[214]

1.2 Objectives and Drivers

A variety of policy goals have motivated the EU to promote the production and use of bioenergy and biofuels.

Mitigation of CO_2 emissions, reduction of its dependence on imported fossil fuels and therefore improvement of security of energy supply security, are the main drivers.

However bioenergy policies are also directed toward creating new opportunities for sustainable rural development in the EU Member States.

1.2.1 Bioenergy Policy by Sub-sector

The main EU strategy for Renewable Energy Sources (RES) development was set in the European Commission's White Paper for a Community Strategy (1997) that identified a strategy to increase the overall share of renewable energies in gross domestic energy consumption to 12 percent by 2010. The Commission's most recent initiative, the *Renewable Energy Road Map*, proposed new, legally binding targets for renewables in the EU's energy mix (20 percent by 2020) and for biofuels in transport ("minimum target" of 10 percent by 2020). Those targets subsequently endorsed by the EU Council at the 8-9 March 2007 Summit. The Commission, however, refused to set any other sector-specific targets, arguing that Member States need flexibility in promoting renewables according to their potential and priorities. *Biomass Action Plan*[215] and the 2006 *Strategy for Biofuels*[216] , complete the strategy framework aimed to improve both the supply and demand for bioenergy and biofuels.

The *EU Biomass Action Plan* sets a target of doubling the current 4 percent biomass share in total energy consumption by 2010 encouraging Member States to establish national biomass action plans (nBAPs) aimed at removing the main national bottlenecks to market deployment of bioenergy in all sectors.

[214] Renewable Energy Road Map Renewable energies in the 21st century: building a more sustainable futureBrussels, 10.1.2007
COM(2006) 848 final
[215] 8COM(2005) 628 final, Brussels, 7.12.2005.
[216] 9COM(2006) 34 fi nal. Communication from the Commission: An EU Strategy for Biofuels, Brussels, 8.2.2006.

The *Strategy for Biofuels* provides an overall strategy for a sustainable production and use of biofuels.

Agriculture policies

Bioenergy support has also been introduced in the Common Agriculture Policy, a system of agricultural subsidies and programmes representing about 44 percent of the EU's budget, especially following its reform in 2003. By cutting the link between payments made to farmers and the particular crops they produce, the reform allowed them to take advantage of new market opportunities such as those offered by biofuels.

A special aid of €45 per hectare is available for energy crops grown on non set-aside (traditional food crop areas land). In addition, while farmers cannot cultivate food crops on set-aside land[217], they can use this land for non food crops including biofuels and are eligible to receive compensatory payments per hectare (since 2005 these payments are included in the single farm payment).[218]

The change in subsidies is intended to be accomplished by 2011, but individual governments are free to choose the modality through which the new scheme will be introduced.

Support to bioenergy comes also from the new EU rural development policy which includes measures to support renewable energies, as grants and capital costs for setting up biomass production eligible for support from local and regional administration within EU rural development policy.

Power Generation

The EU legislative framework for electricity production from RES is set by Directive 2001/77/CE[219], also known as the RES-E Directive. It sets an EU-wide reference target of 22 percent of RES share in electricity production by 2010 and obliges Member States to a) establish national targets for future consumption of RES-E b) assure guaranteed access for RES-E; c) issue guarantees of origin of RES-E and d) assure that the calculation of costs for connecting new producers of RES-E should be transparent and non- discriminatory.

Concerning the support systems for RES-E, the Directive abstains from proposing a harmonised Community-wide support system.

Three main types of public support have been used by Member States to support the achievement of the above targets:

[217] Under the Common Agricultural Policy (CAP), EU farmers are required to set aside 10 percent of their land to qualify for arable aid payments. The intention is to promote biodiversity by ensuring sections of land are not used for crop growth

[218] Under the SPS the farmer is no longer paid different amounts according to the crop he produces, but a set amount per hectare of agricultural land maintained in 'Good Agricultural Condition' or in return for specific rural development activities (such as diversification or setting up producer groups) or for carrying out particular land management activities that benefit the environment. See EU. Policies Restricting Current and Potential Biofuels Exports from Developing Countries (from EU and U.S. Policies on Biofuels: Potential Impacts on Developing Countries GMF public)

[219] Directive 2001/77/CE on the promotion of the electricity produced from renewable energy source in the internal electricity market

1) feed-in tariffs, a fixed price on electricity by which producers can sell renewable power into the electric power network[220];

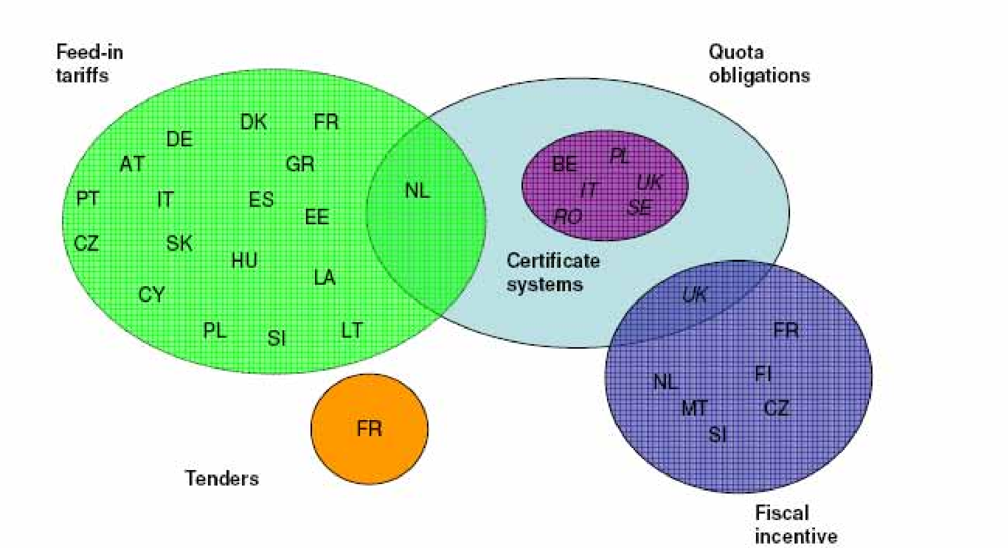
2) quota obligations and tradable renewable energy certificate mechanism;

3) fiscal incentives (as VAT reduction or subsidized interests on investment, or other tax credits) and capital subsidies/grants; and

4) other schemes such as the RECS *(Renewable Energy Certificate System)*, based on RECS-certificate that can be issued on the voluntary market for every MWh of renewable energy.

All Member States have now published their national RES electricity targets, independently of the support system or scheme in force. Overall progress in the Member States is well advanced. However, some have introduced support systems for renewable power, while others have introduced "green certificate" schemes. Most Member States are maintaining their "feed in" systems as it is shown in Figure 1.1.

Figure 1.1 - Supporting schemes for RES-E in EU-27 countries



Source EC, from "State of Play at EU-Level, current initiatives and legislative measures" presented at the Europen Photovoltaic Industry Association Roundtable Brussels 14/05/2007

Heat (Residential/Commercial)

Although the heating and cooling sector represent the 50 percent share of the final energy and present a huge potential for the use of renewables, its growth has been rather slow compared to the growth rates achieved in the renewable electricity and transport sectors[221].

This is due mainly to the existing EU legislative vacuum in the heating from renewable sources sector.

[220] Some Member Countries have provided a fixed tariff while others provided a fixed premium to market- or cost- related tariffs. Some provide both

[221] Estimates of heat production are not reliable as for the electricity and transport sector. In fact a significant part of the heat that is produced escapes detection in national statistics due to both less regular accounting practices and because of the significant share of on-site internal consumption in waste treatment process and in industrial processes.

Although the European Parliament called for a dedicated Directive, the European Commisssion announced in January 2007 to instead put forward a Framework Directive on renewable energy covering heating and cooling together with the electricity and transport sectors. Such Framework Directive is foreseen to be issued at the end of 2007.

The policy framework for the promotion and development of high efficiency cogeneration of heat and power (CHP) is set by the EU Directive 2004/8/EC[222].

Cogeneration aimed at energy saving is considered an important measure to help EU Member States to comply with Kyoto obligation.

Transport

EU biofuel legislation consists of three main Directives. The first pillar is Directive 2003/30/EC[223] for promotion of biofuels market in the European Union. In order to encourage biofuel use competing against less costly fossil fuels the Directive sets a voluntary "reference target" of 2 percent biofuel consumption (on the basis of energy content) in 2005 and 5.75 percent by 31 December 2010. It obliges Member State to set national indicative targets for the share of bio-fuels, in line with reference percentages of the Directive, although leaving them free to choose a strategy to achieve these targets. Member States must also report to the European Commission before 1 July of each year on the measure taken to promote the use of biofuels and, if needed, the reasons why the targets have not been met.

The second pillar is Directive 2003/96/EC[224] which allows application of favourable tax deduction on biofuels. These tax exemptions are considered as environmental state aid, therefore their implementation from Member Countries require authorization from the Commission in order to avoid undue distortions of competition. However, being tax policy not part of the sphere of action of the European Community, each EU Member State decides on the level of taxation for fossil and biofuels.

The third pillar of the EU biofuel legislation relates to environmental specifications for fuels indicated in Directive 2003/17/EC amended in 2003[225]. It set limits on biodiesel blending to no more than a 5 percent share by volume for technical reasons, posing an obstacle to achieving the targets set in the Biofuels Directive. As indicated in the Biofuel Strategy the Fuel Quality Directive will be revised to help reaching the 5.75 percent target by 2010.

1.3 Results and Future Challenges

Results achieved reflect differences in the regimes for electricity, biofuels and heating and cooling established at EU level: clear growth in electricity; the recent start of solid growth in biofuels; and slow growth rates for heating and cooling.

[222] EU Directive 2004/8/EC on promotion of cogeneration based on a useful heat demand in the internal energy market
[223] Directive 2003/30/EC on the promotion of the use of biofuels or other renewable fuels for transport
[224] Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (also known as Energy Taxation Directive)
[225] Directive 2003/17/EC (known as EU fuel quality directive) amending directive 98/70/EC relating to the quality of petrol and diesel fuels

Electricity: substantial progress has been made in the electricity sector, on the basis of the Directive on renewable electricity adopted in 2001, and the targets set will almost be met. Biomass electricity has gone from a yearly growth rate of 7 percent in previous years to 13 percent in 2003 and 23 percent in 2005.

Heating and cooling: renewable energy in heating has grown slowly. Biomass use dominates renewable heating consumption and the bulk of this is in domestic wood heating. Little growth has occurred in the use of efficient wood-burning stoves and boilers, or biomass CHP (for industrial use), despite their potential for reducing emissions.

Biofuels for transportation: a good rate of progress- a doubling in two years- has occurred in biofuels sector. As Table 1.1 shows, by 2005 biofuels were in use in almost all 21 Member States. Their market share reached an estimated 1 percent[226].

Table 1.1 - Progress in the use of biofuels in the Member States, 2003-2005

Member State	Biofuel share 2003 (%)	Biofuel share 2004 (%)	Biofuel share 2005 (%)	National indicative target 2005 (%)
Austria	0.06	0.06	0.93	2.50
Belgium	0.00	0.00	0.00	2.00
Cyprus	0.00	0.00	0.00	1.00
Czech Republic	1.09	1.00	0.05	3.70 [24]
Denmark	0.00	0.00	no data	0.10
Estonia	0.00	0.00	0.00	2.00
Finland	0.11	0.11	no data	0.10
France	0.67	0.67	0.97	2.00
Germany	1.21	1.72	3.75	2.00
Greece	0.00	0.11	no data	0.70
Hungary	0.00	0.00	0.07	0.60
Ireland	0.00	0.00	0.05	0.06
Italy	0.50	0.50	0.51	1.00
Latvia	0.22	0.07	0.33	2.00
Lithuania	0.00	0.02	0.72	2.00
Luxembourg	0.00	0.02	0.02	0.00
Malta	0.02	0.10	0.52	0.30
The Netherlands	0.03	0.01	0.02	2.00[25]
Poland	0.49	0.30	0.48	0.50
Portugal	0.00	0.00	0.00	2.00
Slovakia	0.14	0.15	no data	2.00

[226] Biodiesel accounted for about 80 percent of this, bioethanol 20 percent (about 15 percent in the form of the additive ETBE). From “Biofuels Progress Report on the progress made in the use of biofuels and other renewable fuels in the Member States of the European Union”(COM(2006) 845 final)

Slovenia	0.00	0.06	0.35	0.65
Spain	0.35	0.38	0.44	2.00
Sweden	1.32	2.28	2.23	3.00
UK	0.026[26]	0.04	0.18	0.19[27]
EU25	**0.5 %**	**0.7%**	**1.0 %(est.)**	**1.4 %**

Source: national reports under the biofuels directive. From Biofuels Progress Report on the progress made in the use of biofuels and other renewable fuels in the Member States of the European Union(COM(2006) 845 final)

Thanks to a favourable EU biofuels legislation, the EU has become the world leader in the production and consumption of biodiesel, although biodiesel use varies from country to country, with Germany, France and Italy being the largest biodiesel producers and users. To win the acceptance and confidence of consumers and vehicle manufactures, much attention has been paid to quality control, particularly in Germany.

The reason for the large share of biodiesel is that the majority of the cars in the EU are diesel cars, and as such there is a diesel deficit and a gasoline/diesel demand that pose a challenge for ethanol in the coming years.

This demand imbalance and the cheap imports of bioethanol from external countries impeded EU bioethanol industry to develop as the biodiesel, although increase of EU ethanol production is expected in the coming years.

Currently, locally produced biofuels are not cost-competitive in the EU. Production costs are still high, mainly due to high-priced internal feedstocks while biodiesel is already competitive with oil (though not necessarily with imported biodiesel), bioethanol is still far from it. Ethanol in Europe is produced from sugar beets and wheat, both of which are much more expansive than sugarcane derived ethanol.

Consequently, the competitiveness of EU-produced biofuels will depend on subsidies, and in the case of bioethanol on import tariffs as well. Possible diminishing production costs may, however, change the situation in the years to come. This is why the European Commission has included biofuels second generation technologies and improved production methods as a priority area in its VII Framework Programme on Research.

Two main types of subsidies are provided from the EU to support the biofuels industry and foster consumption in Member States: tax exemptions on biofuels and subsidies to agricultural producers given within the Common Agriculture Policy framework.

Tax exemption policies have been implemented in many countries. These policies have enabled indirect subsidies for biofuel compared to fossil fuels[227] considering the high fuel taxes currently in force in most Member Countries.

Due to budget concern about cost of maintaining fiscal incentives, several Member States started introducing mandates that require a given percentage of transport fuels to be substituted

[227] Since tax policy is not part of the sphere of action of the European Community, each EU member state decides on the level of taxation it considers appropriate for fossil and biofuels

with biofuels as a complementary form of support to tax exemptions, or as an alternative measure.

The Commission encourages their use with the expectation that in the long run, biofuel obligations will bring down the cost of promoting biofuels – in part because they ensure large scale deployment - and will prove the most effective approach.

As it is showed in Table 1.1, from a regional perspective the EU as a whole has not met its 2 percent (by energy content) consumption target by 2005, reaching a share of only 1.4 percent. The European Commission called for additional measures (among which a consideration whether targets for Member States should be made mandatory) to be taken if the higher target of 5.75 percent market share is to be reached by 2010.

Future steps and challenges with the aim of helping reaching the above percent target have been outlined in several documents as in the *Biofuel Strategy* and the *Report for the implementation of the Biofuels Directive* brought forward by the Commission in 2006, and based on the Member Countries progress reports. Following this *Progress Report* the EC has undertaken a review of Bio-fuels Directive[228], currently ongoing. Some future challenges and way forwards contained in these documents are illustrated below:

- Set minimum biofuel targets for 2015 and 2020 in order to provide a long term enabling framework for investment in more efficient biofuel technologies;
- Amend the directive and set national target for the market share of biofuels and introduce biofuels obligations;
- Encourage the environmentally benign production of biofuels thorough a system of incentives/support or a certification system aimed to further increasing the GHG benefits of biofuel policy and minimize environmental and biodiversity risks (for example allowing only biofuels whose production in the EU and third countries complies with minimum sustainability standards – verified along the full production chain – to count towards the indicative targets set in the Directive);
- Promote a product mix that includes domestically produced biofuels as well as imports from a variety of regions. Consequently designing a policy so that both European producers and third countries benefit from the growing market for biofuels;
- Support the research into second-generation biofuels and bring them onto the market, so that an even wider range of feedstocks, and improved production methods can be used (including bio-refineries) and their cost competitiveness improved;
- Promote large-scale use of biofuels by improving their cost-competitiveness;
- Revise the European standard for blending of bioethanol and diesel (maximum level of 5 percent by volume) therefore removing the existing constraints on increasing the use of biofuels.

The debate surrounding EU bioenergy policies remains intense.

[228] available at http://ec.europa.eu/agriculture/biomass/biofuel/index_en.htm

As the European Union moves forward to achieving its renewable energy and biofuels targets for 2020, and consumption of biomass thus increases, a policy framework that promotes the sustainable development of the bioenergy sector will become increasingly challenging.

1.4 Country Policy Table – European Union

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
EC	Directive 2001/77/CE on the promotion of the electricity produced from renewable energy source in the internal electricity market (known as 'RES-E" Directive')	Legislation-targets	Yes	Electricity suppliers	It obliges Member States to establish national targets for future consumption of RES; it sets an EU-wide reference target of 22 percent of renewables share in electricity production by 2010.	
EC	Biomass Action Plan_COM(2005) 628 final	Activity-strategy	No	Industry-bioenergy producers	It sets out a coordinated programme for Community action, including measures to promote biomass use in heating, electricity and transport, followed by cross-cutting measures affecting biomass supply, financing and research. Main objectives of the Action plan is to double the 4 percent share of energy needs met by biomass by 2010. Measures will have to help the attainment of the targets indicated in the Directives 2001/77/CE and 2003/30/CE	
EC	Green Paper: towards a European Strategy for the security of energy supply	Activity-strategy	No	Industry-bioenergy producers-electricity supplier	It promotes all usage of biomass (electricity, heat and biofuel for transportation). It proposes a target of 20 percent share of diesel and petrol in the road transportation by 2020 suggesting for a proper framework of incentives to be set	
EC	Directive 2004/8/EC on the promotion of cogeneration	Policy (legislation)-incentives	Yes	Industry and domestic users	It aims to increase energy efficiency and improve security of supply by creating a framework for promotion and development of high efficiency cogeneration of heat and power (CHP) based on useful heat demand and primary energy savings in the internal energy market, taking into account the specific national circumstances especially concerning climatic and economic conditions.	
EC	Communication on renewal of district heating COM(2003) 397	Policy-incentives	Pending		Proposal to extend to district heating the reduced rate of VAT already applied to natural gas or electricity	
EC	Directive 2003/30/EC on the promotion of the use of biofuels and other renewable fuels for transport	Policy- targets		Producers/ Suppliers (Transport) in EU MS	Sets a no mandatory target of 2 percent market share for biofuels in 2005 and 5.75 percent share in 2010. Some Member states have turned these targets into obligations requiring fuel supply companies to incorporate a given percentage of biofuels in the fuel they place on the market	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Increased use of renewables from biomass in the generation of electricity		The Directive abstains from proposing a harmonized Community-wide support system. All member states have now published their national RES electricity targets, independently of the support system or scheme in force. The Directive obliges member states to: a) assure guaranteed access for RES-E; b) issue guarantees of origin of RES-E and c) assure that the calculation of costs for connecting new producers of RES-E should be transparent and non-discriminatory.
		Impact on bioenergy market development		The main objective of the Biomass Action Plan is to double the 4 percent share of EU energy needs met from biomass by 2010. The plan would reduce oil imports by 8 percent, prevent greenhouse gas emissions worth 209 million tons CO2-equivalent per year and create up to 300,000 new jobs in the agricultural and forestry sector. It encourages Member States to establish national biomass action plans (nBAPs).
		Promotes development of biomass use		
	It supports electricity and heat production by biomass, through high efficiency micro, small scale and diffused cogeneration units	It supports the creation of a market for small/micro scale CHP individual boilers running on biomass		
		It promotes “the use of biofuels to replace diesel or petrol for transport purposes in each Member State, with a view to contributing to objectives such as meeting climate change commitments, environmentally friendly security of supply and promoting renewable energy sources”. It puts blending targets on the end-use product		Although the targets are not mandatory EU members are required to annually submit reports describing the way they implement the objectives of the directive or how they plan to do so. A review of the Directive is on going. The Directive also focuses on the need to develop appropriate European Standards so that biofuels can be traded freely within the EU. A Biofuels progress report COM(2006) 845 has been elaborated underlying that the 2010 target is not likely to be achieved urging for more efficiency in biofuel policy and the need for setting out appropriate target of 10 percent in 2020 and promoting legally binding targets.

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
EC	Directive 2003/96/EC restructuring the Community framework for the taxation of energy products and electricity (also known as Energy Taxation Directive)	Policy (legislation)-incentives	Yes	Producers/ Suppliers (Transport) in EU MS	Facilitates member states to reach the targets indicated in the Directive 2003/30/EC allowing them to apply fuel tax exemptions (environmental state aids)	
EC	Proposal for a Directive on the support of clean vehicles by public procurement COM(2005)634	Policy (Legislation)-incentives	Pending	Industry		(Environment/transportation) Aimed to encourage public procurement of clean vehicles, which could include those using high biofuel blends
EC	COM(2006) 302 on a Forest Action Plan	Activity-incentives	No	Forest industry		Aimed to enhance sustainable forestry management and improve the competitiveness of the European forestry industry. It also proposes actions aimed at increasing the use of forest resources for energy production.
EC	Directive 2003/17/EC (known as EU fuel quality directive) amending directive 98/70/EC relating to the quality of petrol and diesel fuels	Legislation-target	Yes	Biofuels producers	It amends EU's environmental specifications for market fuels to establish specifications for petrol and diesel. The EC for standardization (CEN) sets limits on biofuel blending to no more than a 5 percent share by volume (or 4,6 percent in energy terms) for technical reasons	
	Reg. (CE) 1782/2003 (CAP reform)	Policy-incentives	Yes	Farmers		It allows energy crops to be produced on set-aside land. Incentives of 45euro/hectare can be granted for energy crops grown in traditional food crop areas (non set aside land)
EC	Renewable Energy Road map COM(2006)848	Activity-targets	No	Bioenergy and biofuels producers	Proposes a legally binding target to have 20 percent of the EU's overall energy consumption coming from renewables by 2020, and as part of the overall target, a binding minimum target for each member state to achieve at least 10 percent of their transport fuel consumption from biofuels. However, the binding character of this target is "subject to production being sustainable" and to "second-generation biofuels becoming commercially available". Includes a set of policies aimed to create incentives and support to the development and increased use of renewable energy technologies as well as eliminate any unnecessary legislative or regulatory barriers within the EU and its Member States.	

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		Promotes the use of biofuels		The Commission authorization to the implementation of the state aids has the aim of avoiding undue distortions of competition and is based on the Community guidelines on state aid for environmental protection. To minimize the tax revenue loss for MS the final tax on biofuels intended for transport use may not be less than 50 percent of the normal excise duty.
		It would create a market for low emitting vehicles and therefore promoting the market introduction of biofuels		
It helps the development of markets for pellets and chips through information to forest owners about the opportunities of energy feedstock production and the facilitation of investigation and dissemination actions				
	It establishes limits on biofuels blending representing an obstacle to achieving the targets set in the Biofuels Directive. It is expected, therefore, that the Fuel Quality Directive will be revised.			
It can foster the availability of feedstock dedicated to biofuels production				Eligible area is limited to 1.5 (or 2?) million hectares, meaning that the expenditures under the energy crop scheme cannot be higher than €90 million. However agricultural raw material used for biofuel production also benefits from the support granted to traditional food crops (as compensatory payments given to oilseeds producers), the support is now given to the farmers in the form of market price support (single farm payment)
		Increased use of renewables from biomass in the overall energy consumptions and increased contribution of biofuels to the transport fuels consumption		Endorsed by the EU Summit of March 2007. Sector-specific targets are not set, so giving MS flexibility in promoting renewables according to their potential and priorities. Member States will be required to present National Action Plans and these should contain sectoral targets. A proposal on heating and cooling is lacking in this Roadmap

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
Council of the European Union	EU strategic guidelines for rural development Council Decision for the period 2007-2013 (2006/144/EC)	Activity-incentives	No	Farmer and forest industry		Rural development- It allows support from EU for investment in bioenergy on or near farms (including capital costs for setting up biomass production)
EC	EU sugar reform (20/02/2006)	Policy-incentives	Yes	Farmers	It foresees a 36 percent cut in the internal sugar support price, the elimination of the intervention system of sugar purchase and partial sugar production quota buyback. Moreover it allows sugar beet production to qualify for both set-aside payments when grown as a non-food crop and for the energy crop aid of 45 €/ha on non-set aside area. Lastly sugar used for the production of bioethanol will be excluded from sugar production quotas.	
EC	VII Framework Programme	Activity-R&D	No	Industry, research centres in MS.	It co-ordinates, finances and organizes European research and development as well as facilitation of good practices.	
	Structural and cohesion Funds	Activity-Incentives	No	Farmers and producers in qualifying regions		Employment and Development. They can be used to support economic growth and employment creation or stabilization through bioenergy development. These funds can support the retraining of farmers, the provision of equipment for biomass producers, investments in facilities to produce biofuels and other materials, and fuel switching to biomass by electricity and district heat producers

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
See conversion	It foresees a Community farm investment aid to develop local infrastructure and human capital in rural areas aimed to support developing new outlets for agricultural and forestry products with a higher value added. It helps to modernize agricultural holdings including the introduction of new technologies for non-food sectors and energy crops and to enhance market opportunities in the renewable energy sector			
It could impact biofuel feedstock availability since the reforms substantially reduce internal sugar beet production incentives.				For Member States which cut the quota more than 50 percent the EU provides further traditional coupled aids with the aim of giving to the farmers who continue the beet cultivation the time of improving their competitiveness.
	It encourages the market to find and develop new technologies, including the use of by-products and potential feedstocks now classified as waste. It includes several actions with a biomass component: biomass for fuels, electricity heating and cooling, smart energy network including integration of biomass installations into electricity grids and feeding biogas into the natural gas grid. Among the areas supported by the Programme: the development of an industry-led biofuel technology platform, the bio-refinery concept, research into second-generation biofuels. Through the Intelligent Energy for Europe Programme the EC supports the dissemination of techniques that have been proven through research.			
	Provides funding for the development of bioenergy facilities in qualifying regions. Most Structural Fund assistance is granted in the form of non-repayable grants or "direct aid", and to a lesser degree refundable aid, interest-rate subsidies, guarantees, equity participation, and participation in venture capital.The contribution from the funds depends on eligibility under the Objectives and the economic and geographical situation of the various regions.			

Implementing Agency	Policy/Activity Name	Legal and Regulatory Instruments			Impact on Bioenergy	
		Policy/Activity Type	Existing Legislation	Policy/ Activity Target Area	Direct	Indirect
	Directive 2003/87/EC establishing a scheme for greenhouse gas emission allowance trading within the Community.	Policy-targets	Yes	Industries in the EU MS		Climate change/Environment- It enables companies exceeding individual CO2 emissions targets to buy allowances from 'greener' ones and help reach the EU targets under the Kyoto Protocol. The EU Directive provides penalties for emissions in excess of surrendered allowances of €40/ton CO2 in the first period, and €100/ton CO2 in the second period.
	Kyoto Protocol to the UNFCCC (1998)	Policy-target	Yes	Member States		Climate Change - For the Protocol signatory countries, the abatement targets require a total cut in greenhouse-gas emissions of at least 5 percent from 1990 levels in the commitment period 2008-12. Through a new Communication ("Limiting Global Climate Change to 2 degrees Celsius. The way ahead for 2020 and beyond"- COM(2007) 2 final) the Commission proposed to reduce GHG emissions unilaterally by 20 percent by 2020
	European Technology Platform for Biofuels	Activity- R&D	No	Biofuels industry-research communities	The main objective of this activity is to overcome both the technical and non-technical barriers to biofuel use, both in the European Union and worldwide. providing guidance on and promotion of relevant Research, Development and Demonstration (RD&D).	
EC	Proposal for a Directive on the promotion of clean road transport vehicles COM(2005) 634	Policy	No	Vehicles producers		(Transportation/Environment) It proposes that public bodies (State, regional or local authorities, bodies governed by public law, public undertakings and operators contracted by public bodies to supply transport services) will be obliged to allocate a minimum quota of 25 percent of their annual procurement (purchasing or leasing) of heavy-duty vehicles (with a weight greater than 3.5 tonnes) to “enhanced environmentally friendly vehicles” as defined in the European Performance Standard (EEV), as defined in Directive 2005/55/EC.
	EU Strategy for Biofuels- COM(2006) 34 final	Activity- incentives	No		It includes seven policy axes: Stimulating demand for biofuels; Capturing environmental benefits; Developing the production and distribution of biofuels; Expanding feedstock supplies; Enhancing trade opportunities; Supporting developing countries; Supporting research and development. It proposes biofuels obligations as a promising way of overcoming difficulties with tax exemptions	

For the purposes of this table:
“Policy” is considered to be law created through interpretation and regulatory guidelines put forth by the implementing agency(ies). "Policy Type" is considered to identify the type of law and the goals of the mandate. "Activity Type" is defined in two categories: International (binding or non-binding - bilateral or multilateral) agreements and collaborations, or non-binding/voluntary recommendations/programmes that advance the implementation of bioenergy, biofuels, and renewable energy into the energy stream. "Legislation" is defined as national or state (sub-national political boundaries) legislative mandates. "Target Area" is defined as the sector on which the policy's/activity's goals and objectives are focused - the area of most direct impact and engagement. (e.g industry, bioenergy producers. bioenergy suppliers, farmers, educational institutions).

Impact on Production Stream			Funding Mechanism	Comments
Production	Conversion	Use		
		It establishes a credit market trading system promoting an increase in the use of biomass and energy crops in the generation of electricity		
		It promotes bioenergy projects reducing GHGs also through the use of CDM mechanism		
	Contributes to the development of cost-competitive world-class biofuels technologies	Accelerates the deployment of biofuels in the European Union		
		It can contribute towards the creation of a market for "clean" vehicles, by providing manufacturers the assurances they need in order to develop these vehicles for a wider market		The Commission will examine whether, in a second stage, the quota obligation should be extended to include other vehicle categories.
It provides an overall strategy for a sustainable production and use of biofuels, exploring opportunities for developing countries, recommending a regulated market-based approach for biofuels deployment.	See impact on production	See impact on production		The EU Strategy for Biofuels states that the EU will pursue a "balanced approach in ongoing and future trade negotiations" and will "respect the interests of both domestic producers and EU trading partners". It also gives a commitment that "market access conditions" for imported bioethanol will be "no less favourable" than under current trade agreements.The Strategy insists that biofuels production in the developing world must be done in a way which is positive for the environment and which supports sustainable development for both feedstock and biofuels. One of the issues which the European Commission will consider in its review of the Biofuels Directive is whether only biofuels meeting minimum carbon emissions should qualify for the indicative targets.

provision); electricity generation from biomass (including market penetration targets, target flexibility, enforcement provision, and heat generation from biomass including targets, target flexibility, enforcement provision). "Indirect" is defined as policies or activities that impact the energy sector by influencing activities in other sectors - affecting bioenergy deployment both directly and indirectly. Policies and activities from the following sectors should be considered: agriculture/land use, environment, trade/industry, forestry, waste management, poverty reduction, rural development, and employment.

2 NAFTA[229]

NAFTA is the North American Free Trade Agreement between the United States, Canada and Mexico. It came into effect on January 1, 1994. The purpose of NAFTA is to encourage trade by eliminating tariffs on most goods originating in and traded between these countries over a fifteen-year period.

Under NAFTA, all non-tariff barriers to agricultural trade between the United States and Mexico were eliminated. In addition, many tariffs were eliminated immediately with others being phased out over 5 to 15 years. All agricultural provisions will be implemented by the year 2008. For import-sensitive industries, long transition periods and special safeguards were created to allow for an orderly adjustment to free trade.

The agricultural provisions of the United States-Canada Free Trade Agreement (FTA), in effect since 1989, were incorporated into the NAFTA. Under these provisions, all tariffs affecting agricultural trade between the United States and Canada, with a few exceptions for items covered by tariff-rate quotas (TRQ's[230]), were removed before January 1, 1998.

Mexico and Canada reached a separate bilateral NAFTA agreement on market access for agricultural products. The Mexican-Canadian agreement eliminated most tariffs either immediately or over 5, 10, or 15 years. Tariffs between the two countries affecting trade in dairy, poultry, eggs, and sugar are maintained.

[229] Available at http://www.fas.usda.gov/info/factsheets/NAFTA.asp --> Factsheet; http://www.ers.usda.gov/Briefing/NAFTA/ → Recent developments, data products

[230] A tariff-rate quota (TRQ) is a two-level tariff where a limited volume of imports are allowed at the lower tariff and all subsequent imports are charged the higher tariff

3 APEC[231]

The Asia-Pacific Economic Cooperation (APEC) member economies include more than one third of the world's population (2.6 billion people), almost 60 percent of the global GDP and 47 percent of the world trade volume and account for 70 percent of global economic growth. The APEC member countries are Australia, Brunei, Canada, Chile, China, Hong Kong, Indonesia, Japan, Malaysia, Mexico, New Zealand, Papua New Guinea, Peru, Philippines, Russia, Singapore, South Korea, Taiwan, Thailand, United States and Vietnam.

APEC was conceptualized informally in 1989, among ministers of 12 participating states at a meeting in Canberra, Australia. APEC leaders met formally for the first time in 1993 to outline APEC's vision of trade stability, security and regional economic development.

The key objectives that drive APEC concern trade liberalization among member nations and regional economic growth. APEC is also involved in discussing solutions to reducing business transaction costs. Recently, however, APEC has also begun to address security-related issues such as controlling avian flu and other pandemics and exploring regional counter-terrorism initiatives to combat arms trade.

Although APEC has not yet adopted any definitive measures toward promoting bioenergy usage in the region, the organization is currently directing numerous project-based efforts to study, understand, and take advantage of regional potentials for sustainable transport sector biofuel usage, in particular toward the goal of energy security. A few of their relevant activities are outlined below.

3.1 Instructions from APEC Energy Ministers

As one of eleven implementing APEC divisions, the Energy Working Group (EWG) directs the "Task Force on Biofuels," which aims to enhance members' understanding of the potential for biofuels to replace oil in the transport sector. The Task Force reported recent findings at the 8th APEC Energy Ministers Meeting in May 2007. Subsequent instructions then appeared in the 27 May 2007 "Darwin Declaration On: Achieving Energy Security and Sustainable Development through Efficiency, Conservation and Diversity."[232] In a section treating energy security and transport efficiency, the Ministers state that "biofuels production should be advanced in line with sustainable development objectives" and encourage technological advancements toward the use of "non-food feedstocks". Without mention of bioenergy specifically, the Ministers encourage APEC members to "diversify the fuel mix" with cleaner fuels in order to manage oil dependency. A directive was given for the EWG to "develop best practice principles for energy efficient transport" and in addition encouragement was given of joint-EWG work with other international organizations engaged in alternative fuel policy, such as the IEA and GBEP.

[231] Available at http://www.apec.org/ → History, recent news, official website.
[232] Available at www.industry.gov.au/assets/documents/itrinternet/EMM8_Declaration_Final20070529183150.pdf

3.2 EWG Projects

There are several EWG sponsored programs currently in progress. A survey and report entitled "*Biomass Resource Assessments and Assessment Capabilities in APEC Economies*" will focus efforts in particular on understanding the potential for wastes and agricultural products to contribute to transport biofuel use in APEC economies in order to limit oil dependency. The project is expected to be completed by 31 December 2007.

3.3 Expert Group on New and Renewable Technologies Projects

Five Expert Groups assist the EWG, including the "Expert Group on New and Renewable Energy Technologies" (EGNRET), which was created to promote and facilitate the use of "new and renewable energy" where cost effective. EGNRET efforts are administered through the "APEC 21st Century Renewable Energy Development Initiative" and include two current projects which are intended to establish guidelines related to biofuels.

Of special interest is a project aimed toward the "*Establishment of the Guidelines for the Development of Biodiesel Standards in the APEC Region*" proposed by Thailand and co-sponsored by four other member economies. The motivating assumption underlying this report is that existing European and American biodiesel standards are incompatible with the feedstocks used in the APEC region. To bridge this gap, the project is made up of several components, including an examination of the biodiesel lifecycle from automotive and emissions perspectives, as well as a review of existing biodiesel standards and current feedstocks. The report will also incorporate feedback resulting from discussions with stakeholders, in particular from automobile manufacturers, on barriers and opportunities related to biodiesel, and also from APEC energy sector representatives on desired parameters for biodiesel specification. The Biodiesel Standards project is expected to finish on 31 October 2008.

Another ENGRET project, entitled "*Alternative Transport Fuels-Implementation Guidelines*" will produce database resources and an analytical report, and also host a workshop in order to help governments implement successful and regionally coherent alternative transport fuels programs. This project will be completed by 31 December 2008.

4 ASEAN

The Association of Southeast Asian Nations or ASEAN was created in August 1967 by representatives of Indonesia, Malaysia, Philippines, Singapore and Thailand. Over the next three decades these five original members were joined by Brunei Darussalam, Vietnam, Laos, Myanmar and Cambodia. These nations have a combined population of about half a billion, total area of 4.5 million square kilometers, a total GDP of close to US$ 700 billion, and the total value of ASEAN trade amounts to US$800 billion making it the third largest trading block in the world.

ASEAN was created to enhance regional economic growth, social progress and cultural development. Additionally, the aim was to promote peace and stability in the region by fostering a cooperative adherence to the principles of the UN Charter.

ASEAN leaders adopted the ASEAN Vision 2020 on the organization's 30th anniversary. The goal was to agree on a shared, cooperative development among South-East Asian nations that promotes regional peace, stability and prosperity. Building from Vision 2020, the ASEAN leaders resolved in 2003 to establish three ASEAN Communities focused on regional security, economic development and socio-cultural enhancement.

In January of 2007, ASEAN and its six regional partners, including China and India signed the Cebu Declaration on East Asian Energy Security. The declaration is "meant to demonstrate their determination to curb GHG emissions and boost energy safety and efficiency in the Asia-Pacific region" as well as reduce dependence on imported oil. Among other things, the agreement acknowledges "the need to strengthen renewable energy development such as in biofuels, and to promote open trade, facilitation and cooperation in the sector and related industries"[233] and calls for the creation of "a common standard for the use of biofuels in engines and motor vehicles".[234]

[233] Cebu Declaration on East Asian Energy Security. Cebu, Philippines, 15 January 2007 (available at http://www.aseansec.org/19319.htm. Accessed in October 2007)
[234] Wang Yu "Southeast Asian nations reach energy agreement", Science and Development Network. 16 January 2007

5 MERCOSUR

The Southern Common Market (MERCOSUR) was formed in March 1991 by Argentina, Brazil, Paraguay and Uruguay upon signing the Treaty of Asuncion. Formed as a trade bloc, the purpose of MERCOSUR is to allow for free trade between member countries with the eventual goal being the economic integration of all of South America. The total population of MERCOSUR nations is more than 250 million people with the members contributing to a collective output of $1.1 trillion. Among them, Brazil has by far the largest economy with a GDP of nearly $800 billion. MERCOSUR is presently the world's fourth largest trading bloc, after the EU, NAFTA and ASEAN.

Current full members of MERCOSUR include Argentina, Brazil, Paraguay, Uruguay and Venezuela. Associate members include Chile, Bolivia, Colombia, Ecuador and Peru who do not enjoy full voting rights or full access to the markets of the full members. The objectives of MERCOSUR as outlined by the International Labour Organization (ILO) are:[235]

- Free transit of production goods, services and factors between the member states with inter alia, the elimination of customs rights and lifting of nontariff restrictions on the transit of goods or any other measures with similar effects;
- Fixing of a common external tariff (TEC) and adopting of a common trade policy with regard to nonmember states or groups of states, and the coordination of positions in regional and international commercial and economic meetings;
- Coordination of macroeconomic and sectorial policies of member states relating to foreign trade, agriculture, industry, taxes, monetary system, exchange and capital, services, customs, transport and communications, and any others they may agree on, in order to ensure free competition between member states; and

In 2006 MERCOSUR signed a Memorandum of Understanding which created a special working group on biofuels was created to:

- Stimulate the production and consumption of biofuels, in particular ethanol and biodiesel;
- Conduct a comparative assessement of the regulatory frameworks for biofuels within MERCOSUR;
- Stimulate the structuring of integrated biofuels production chains in MERCOSUR;
- Stimulate technical cooperation regarding biofuels, especially ethanol and biodiesel, among public and private entities within MERCOSUR;
- Stimulate research programs regarding the production and use of biofuels within MERCOSUR taking existing programs into consideration;
- Facilitate the interchange of information with respect to technical aspects and technologies related to the production and use of biofuels; and

[235] available at http://www.itcilo.it/actrav/actrav-english/telearn/global/ilo/blokit/mercosur.htm

- Promote capacity building for the sustainable production of biofuels, including the evaluation of the environmental impact, land use, use of residuals, elimination and recycling of residues, distribution infrastructure, logistics, among other aspects.[236]

[236] "Memorandum de entendimiento para establecer un grupo de trabajo especial sobre biocombustibles." Mercosur/ lxvi gmc/p. Dec. Nº 32/06

6 CBI – Caribbean Basin Initiative

Not an explicit trade agreement, the Caribbean Basin Initiative (CBI) is a comprehensive program aimed at promoting economic development through private investments in Central American and Caribbean Countries. A main objective of the CBI is to increase the investment by both foreign and domestic financiers, in non-traditional sectors of trade in CBI countries thereby diversifying their economies and enhancing their exports. The CBI is collectively formed by the Caribbean Basin Economic Recovery Act of 1983 (CBERA) which was amended in 1983, and the Caribbean Basin Trade Partnership Act of 2000 (CBTPA). Jointly, these facilitate the duty-free export of a range of products from CBI countries to the United States. A recent refinement of CBI legislation known as the CBTPA, is set to provide CBI countries specific trade allowances with the United States, akin to the arrangement with Mexico under the North American Free Trade Agreement (NAFTA).

The CBI beneficiaries include the Central American nations of Belize, Costa Rica, El Salvador, Guatemala, Guyana, Honduras, Nicaragua and Panama and the Caribbean nations of Antigua, Aruba, the Bahamas, Barbados, British Virgin Islands, Dominica, Dominican Republic, Grenada, Haiti, Jamaica, Montserrat, Netherlands Antilles, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, and Trinidad and Tobago.

There are bioethanol provisions in the CBI permit up to 7 percent of the United States bioethanol production to be derived duty-free from a foreign feedstock if it is produced in any of the CBI nations. Additional to the 7 percent import allowance, CAFTA allows for 35 million gallons 132.5 million litres) of bioethanol to be imported duty-free into the United States provided that at least 30 percent of that bioethanol is derived from a local or Caribbean region. Above the 35 million gallons, imports are duty-free if at least 50 percent of the bioethanol is extracted from feedstocks of the Caribbean Basin.

7 CAFTA

Certain countries of the CBI were also involved in the creation of the Central American Free Trade Agreement (CAFTA) in early 2004. This trade agreement formed between the United States and the nations of Costa Rica, El Salvador, Guatemala, Honduras and Nicaragua came to be known as CAFTA-DR upon the inclusion of the Dominican Republic in August 2004. CAFTA-DR is the second largest free-trade zone in Latin America for United States exports that eliminated 80 percent of tariffs with the remaining tariffs being scheduled to be phased out over the next 10 years. With the formation of CAFTA, the CBI, and its bioenergy-related provisions, becomes a permanent part of regional trade policy.

7.1 Generalized System of Preferences (GSP)

The GSP is a system of preferential tariffs that favor developing countries. Until December 2005, the European Union GSP that was in effect, categorized bioethanol (code 22 07) as a sensitive product, all imports of which qualified for a 15 percent cut of the duty as per the Most Favored Nation (MFN) agreement of the WTO. The most recent EU GSP, known as the GSP+, has put in place a special incentive scheme that supports sustainable development and sound governance by granting unlimited, duty free access to bioethanol imports from Bolivia, Colombia, Costa Rica, Ecuador, Panama, Peru, El Salvador, Venezuela, Georgia, Sri Lanka and Mongolia. Pakistan, which used to qualify for reduced tariffs under the original GSP, is no longer a beneficiary since total EU imports of Pakistani bioethanol are over 1 percent and thereby, subject to full MFN imports.

This provides an interesting example of the impact these provisions can have on nations' industries. Resulting from the revocation from the GSP status, two of the seven operating distilleries in Pakistan shut down while, due to uncertain markets, another five new distilleries are likely to cancel their plans to start operation.

ANNEX III – Bioenergy Information: Data Sources, Terms and Conversion Factors

The production and consumption of biofuels are either deeply rooted, and (largely) informal, or of very recent development due to the powerful momentum created by policies and markets in recent years. In addition, unlike other fuels and energy forms that are firmly and traditionally placed within the energy sector, biofuels are at the crossing of energy, forestry and agricultural sectors and, most relevant for the quality and quantity of information available, until recently biomass fuels were regarded as marginal products in all sectors (FAO 2005).

These factors strongly affect the availability of complete and up-to-date information. Hence no source of information can be considered as fully authoritative and the reader should look at the statistics presented as best approximations rather than true representations.

The sources of information of the country tables and graphs presented below are the International Energy Agency (IEA), which maintains the most complete and consistent information system on energy matters, and the FAO, which maintains the most complete database of forest products (including woodfuels) and agriculture (including potential biomass feedstocks).

Several other data sources were consulted and compared to the main IEA reference. It was not always possible to determine the reliability of individual sources due to the widespread habit of non- reporting original data sources and assessment methods. Hence these alternative sources were simply compared to IEA data. Without implying any judgment on these sources, mention is made below only of sources that differ significantly from IEA data and that may provide more complete and up-to-date information.

Terms and definitions are extremely important when compiling and comparing data from different sources. Unfortunately, in this “new” thematic context, terms are often used inconsistently, sometimes using data from other sources and changing the definitions, which generates confusion and misunderstanding.

In this Annex the terms applied are those of the data sources and their definitions are provided at the end of the Annex. For all other terms, reference is made to the Unified Bioenergy Terminology (FAO, 2003), an abstract of which is also presented in form of glossary for the most relevant terms.

1 Data sources and estimation processes

1.1 IEA-based statistics

The values presented in Section 2.6 and in Annex I are extracted from the following IEA databases:

- World, renewables balance (Ktoe)
- World, renewables supply and consumption (various units)

The biofuels categories covered are listed in the Table 2.1, along with IEA definitions and some comments.

All values were converted in Petajoules [PJ] and the applied conversion factors are reported in Table 2.6.

1.2 FAO-based statistics

Original FAO data on forest products (FaoSTAT) was used to estimate/update woodfuel statistics (fuelwood, charcoal, black liquor), following the estimation procedure applied in i-WESTAT (FAO 2005).

Considering formal IEA and FAO definitions, woodfuels represent a portion of the IEA Primary Solid Biomass, which includes all woodfuels as well as agricultural and livestock residues used as fuel. In most countries woodfuels represent the quasi-totality of Primary Solid Biomass. A direct comparison with IEA Solid Biomass data, which includes also crop/livestock residues used as fuel, cannot be made. In addition, it's important to highlight that the two databases have different sources, energy agencies for IEA and forestry agencies for FAO, which explain in part the discrepancies between the two.

In the country tables and graphs the FAO-based woodfuel values and IEA Primary Solid Biomass values are combined for easy comparison. Where the match is reasonable, woodfuel data provide an additional insight on aggregated solid biomass statistics. In several cases, however, the datasets are obviously inconsistent: where woodfuels values are higher than solid biomass (Italy, Japan, Russia), or where they are far lower (France, Germany, United Kingdom), highlighting the need to harmonize data collection and estimation procedures between forestry and energy sectors.

1.3 Other sources

EuObserv'ER data reported in the issues of Barometer

The term "wood energy" as used in the Wood energy Barometer 2005 report also includes crop harvest residues, therefore corresponding to IEA primary solid biomass. Both values are very close. (The inconsistent definition was acknowledged in the next issue of Barometer).

Solid biomass Barometer, December 2006 gave statistics for 2004 and 2005. Production values reported were close to IEA data, for France and Germany but significantly less for Italy (quite unjustified since IEA is most likely underestimating woodfuels consumption), and slightly higher for United Kingdom. The report provides information for France and United Kingdom on the breakdown of solid biomass into main wood and agricultural residue components. Data on bioenergy electricity production are similar to IEA's for CHP plants but differ for electricity only plants (possibly including some electricity produced with gas originating from biomass). No information provided on estimation sources/methods.

Liquid biofuels Barometer 2007. Consumption in 2005 and 2006 are sometimes similar to the IEA's but differ at other times.

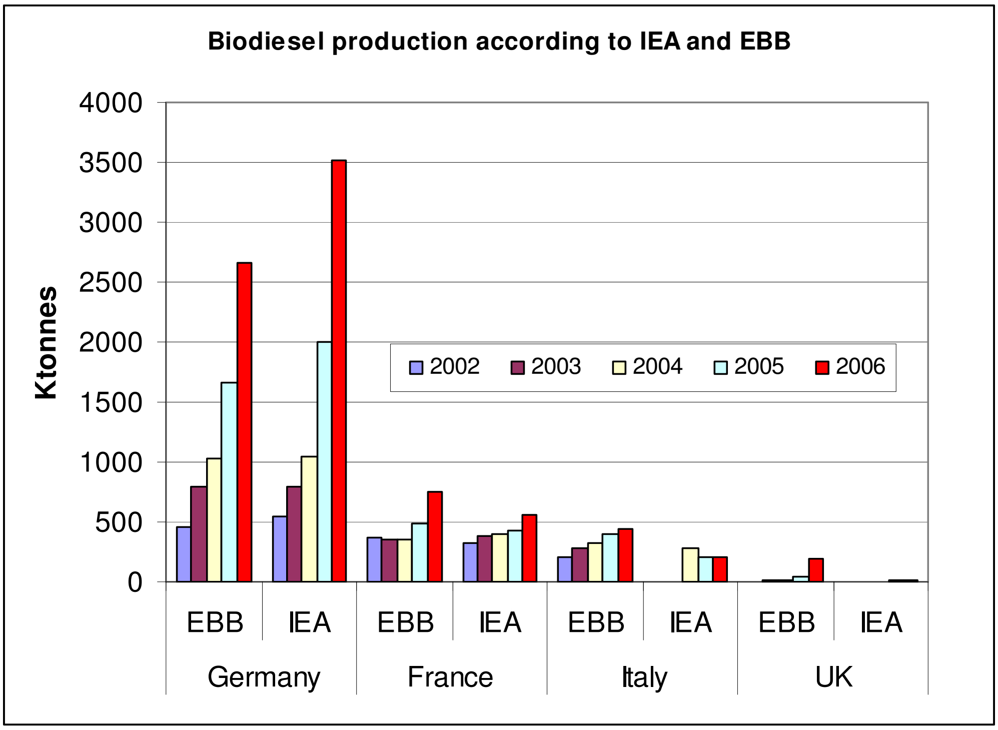
It is recommended to look more closely to the sources and estimation processes used by EurObserv'ER (and by Enerdata, a partner of IEA, providing a main source of energy data). However, the differences between datasets does not justify replacing IEA values with EurObserv'ER values. Moreover, IEA data are more consistently defined and cover all countries over several years rather than just European countries for 2004-2006.

It is difficult to judge on the reliability of data since no information is usually provided on estimation sources/methods.

European Biodiesel Board (EBB)

The European Biodiesel Board (EBB) publishes biodiesel production (and capacities) for European countries. Estimates for Italy and United Kingdom that are significantly different from IEA's. The source and estimation methods are not described.

Figure 1.1

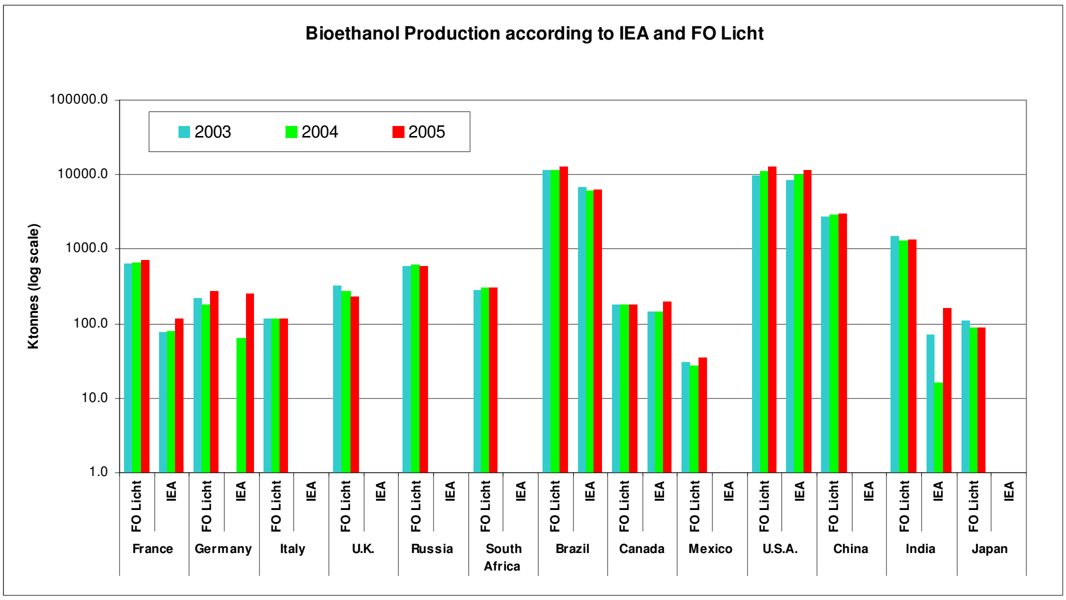


Renewable Fuels Association (RFA)

RFA uses FO Licht data for bioethanol and a comparison with IEA data shows there is a reasonable match for big producers (USA and Brazil) but a very strong IEA under-estimation for most other countries. For several countries IEA reports no production at all whereas FO Licht indicates sizeable production levels, as shown in Figure 1.2.

Although the FO Licht assessment method is not described it seems that its data are more reliable and complete than IEA's.

Figure 1.2 - Bioethanol production in G8 +5 Countries according to IEA and FO Licht



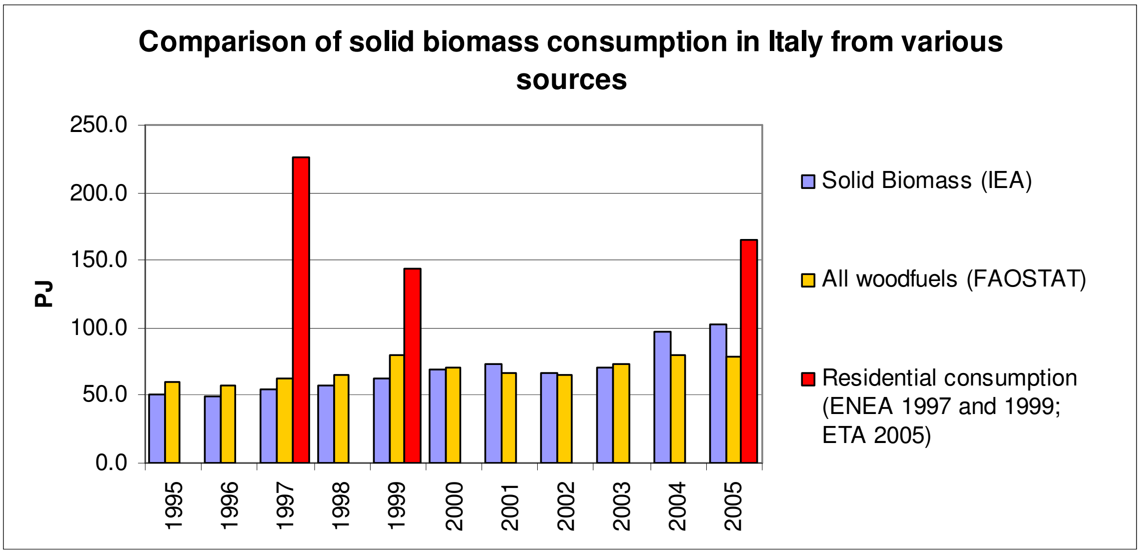
Other national sources

Given the limitations of international statistics described in the introduction, original national sources can be very important and indeed revealing. Italy, in this respect represents a clear case.

The estimated consumption of solid biomass in the Italian residential sector reported by ENEA for 1997 and 1999 (Gerardi et al. 1998; Gerardi and Perella, 2001) and by ETA are far higher than from IEA energy statistics (based on energy sector data) and from FAO Forestry statistics (based on forestry sector data). This is due to the absence of systematic data collection specifically dedicated to biomass in both sectors, which leads to a significant underestimation of actual consumption (and production) levels. It appears that the likely consumption of solid biomass (mainly fuelwood) in the residential sector alone is between 2 to 3 times higher than that reported by IEA or that may be deducted from FAO Forestry statistics for all sectors (Figure 1.3).

It is not easy to convert isolated point-data into coherent time series and to insert them in the energy database but they are very useful in revealing possible biases of international statistics and thus recalling us that no source should be given total confidence. Most important, these discrepancies highlight and emphasize the need for better focused and comprehensive data collection efforts if a realistic vision of the bioenergy sector is sought.

Figure 1.3 - Solid biomass consumption in Italy according to various national and international sources.



2 Glossary: terms and conversion factors

2.1 Key definitions

Primary energy: Primary energy is energy contained in raw fuels and any other forms of energy received by a system as input to the system. The concept is used especially in energy statistics in the course of compilation of energy balances[237].

Conversion to secondary energy: Primary energies are transformed in energy conversion processes to more convenient forms of energy, such as electrical energy and cleaner fuels. In energy statistics these forms are called secondary energy[238].

[237] Source Wikipedia – www.wikipedia.org
[238] Ibid.

2.2 IEA terms and definitions used in renewable energy statistics[239]

Table 2.1 - IEA biofuel categories and definitions

IEA Product	IEA Product definition	Comments
Primary Biofuels	Primary biofuel is defined as any organic matter used directly as fuel. This covers a multitude of woody materials generated by industrial process or provided directly by forestry and agriculture (firewood, wood chips, bark, sawdust, shavings, chips, sulphite lyes also known as black liquor, animal materials/wastes and other solid biomass). Charcoal is included here.	The flow of these biofuels is still mostly informal and poorly estimated. In many countries they are probably underestimated. Woodfuels are included here along with agro/livestock residues. For comparison and complement, country data present also FAO-based woodfuel estimates.
Biogas	Biogas is a secondary biofuel. It is derived principally from the anaerobic fermentation of biomass and solid wastes and combusted to produce heat and/or power. Included in this category are landfill gas, sludge gas and other biogas such as biogas produced from the anaerobic fermentation of animal slurries and of wastes in abattoirs, breweries and other agro-food industries.	Relatively recent and technologically specific, the statistics are probably of good standard.
Biogasoline	Biogasoline is a secondary biofuels. It includes bioethanol (ethanol produced from biomass and/or the biodegradable fraction of waste), biomethanol (methanol produced from biomass and/or the biodegradable fraction of waste), bioETBE (ethyl-tertio-butyl-ether produced on the basis of bioethanol; the percentage by volume of bioETBE that is calculated as biofuel is 47%) and bioMTBE (methyl-tertio-butyl-ether produced on the basis of biomethanol: the percentage by volume of bioMTBE that is calculated as biofuel is 36%). Biogasoline includes the amounts that are blended into the gasoline - it does not include the total volume of gasoline into which the biogasoline is blended.	IEA values show a reasonable match with other sources (i.e. FO Licht) for big producers (USA and Brazil) but a strong underestimation for most other countries. For several countries IEA reports no production at all while FO Licht indicates sizeable production levels.
Biodiesels	Biodiesels is a secondary biofuels. It includes biodiesel (a methyl-ester produced from vegetable or animal oil, of diesel quality), biodimethylether (dimethylether produced from biomass), Fischer Tropsh (Fischer Tropsh produced from biomass), cold pressed bio-oil (oil produced from oil seed through mechanical processing only) and all other liquid biofuels which are added to, blended with or used straight as transport diesel. Biodiesels includes the amounts that are blended into the diesel - it does not include the total volume of diesel into which the biodiesel is blended.	IEA values show a reasonable match with other sources (i.e. European Biodiesel Board) for big producers (Germany, France) but a certain underestimation for other countries. This also is a biofuel category in rapid development for which data collection procedures must be enhanced.

[239] List limited to the items relevant to the present report and tables

IEA Product	IEA Product definition	Comments
Other Biofuels	Other biofuels includes liquid and gaseous biofuels used directly as fuel other than biogas, biogasoline or biodiesels, such as pyrolitic oils.	This IEA category needs a more complete definition. (IEA's conversion factors for this biofuels is close to Biogasoline).

Table 2.2 - Supply

Flow	Definition
Production	Production is the energy contained in primary biofuels. Production is calculated after removal of impurities (e.g. sulphur from natural gas).
Imports	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place.
Exports	Comprise amounts having crossed the national territorial boundaries of the country whether or not customs clearance has taken place.
Total Primary Energy Supply	Total primary energy supply (TPES) is made up of production + imports – exports – international marine bunkers ± stock changes.
Transfers	Comprises interproduct transfers, products transferred and recycled products.
Statistical Differences	Includes the sum of the unexplained statistical differences for individual fuels, as they appear in the basic energy statistics. It also includes the statistical differences that arise because of the variety of conversion factors in the coal and oil columns.

Table 2.3 - Transformation Sector

Flow	Definition
Transformation Sector	The transformation sector comprises the conversion of primary forms of energy to secondary and further transformation (e.g. coking coal to coke, crude oil to petroleum products, and heavy fuel oil to electricity). Inputs to transformation processes are shown as negative numbers and output from the process is shown as a positive number. Transformation losses will appear in the “total” column as negative numbers.
Main Activity Producer Electricity Plants	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs can not be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Main activity producers (formerly referred to as public supply undertakings) generate electricity for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer Electricity Plants	Refers to plants which are designed to produce electricity only. If one or more units of the plant is a CHP unit (and the inputs and outputs can not be distinguished on a unit basis) then the whole plant is designated as a CHP plant. Autoproducer undertakings generate electricity wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Main Activity Producer CHP Plants	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the convention for

	defining a CHP plant noted above should be adopted. Main activity producers (formerly referred to as public supply undertakings) generate electricity and/or heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer CHP Plants	Refers to plants which are designed to produce both heat and electricity (sometimes referred to as co-generation power stations). If possible, fuel inputs and electricity/heat outputs are on a unit basis rather than on a plant basis. However, if data are not available on a unit basis, the convention for defining a CHP plant noted above should be adopted. Note that for autoproducer CHP plants, all fuel inputs to electricity production are taken into account, while only the part of fuel inputs to heat sold is shown. Fuel inputs for the production of heat consumed within the autoproducer's establishment are not included here but are included with figures for the final consumption of fuels in the appropriate consuming sector. Autoproducer undertakings generate electricity and/or heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Main Activity Producer Heat Plants	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Main activity producers (formerly referred to as public supply undertakings) generate heat for sale to third parties, as their primary activity. They may be privately or publicly owned. Note that the sale need not take place through the public grid.
Autoproducer Heat Plants	Refers to plants (including heat pumps and electric boilers) designed to produce heat only and who sell heat to a third party (e.g. residential, commercial or industrial consumers) under the provisions of a contract. Autoproducer undertakings generate heat, wholly or partly for their own use as an activity which supports their primary activity. They may be privately or publicly owned.
Heat Pumps	Includes heat produced by heat pumps in the transformation sector. Heat pumps that are operated within the residential sector where the heat is not sold are not considered a transformation process and are not included here – the electricity consumption would appear as residential use.

Table 2.4 - Final Consumption

Flow	Definition
Total Final Consumption	Equal to the sum of the consumption in the end-use sectors. Energy used for transformation and for own use of the energy producing industries is excluded. Final consumption reflects for the most part deliveries to consumers (see note on stock changes).
Industry Sector	Consumption of the industry sector is specified in the following sub-sectors (energy used for transport by industry is not included here but is reported under transport).
Transport Sector	Consumption in the transport sector covers all transport activity (in mobile engines) regardless of the economic sector to which it is contributing [ISIC Divisions 60, 61 and 62], and is divided into the following sub-sectors.
Other Sectors	Includes residential, commercial/public services, agriculture/ forestry, fishing and non-specified (other).
Residential	Includes consumption by households, excluding fuels used for transport. Includes households with employed persons [ISIC Division 95] which is a small part of total residential consumption.

2.3 Selection of most relevant terms from the Unified Bioenergy Terminology (FAO, 2005)

Table 2.5 FAO Terminology

Bioenergy	Energy from biofuels
Biofuel	Fuel produced directly or indirectly from biomass
Biomass	Material of biological origin excluding material embedded in geological formations and transformed to fossil
Black liquor	Alkaline spent liquor obtained from digesters in the production of sulphate or soda pulp during the process of paper production, in which the energy content is mainly originating from the content of lignin removed from the wood in the pulping process
Densified biofuel, compressed biofuel	Solid biofuel made by mechanically compressing biomass to increase its density and to mould the fuel into a specific size and shape such as cubes, pressed logs, biofuel pellets or biofuel briquettes
Energy crops, fuel crops	Woody or herbaceous crops grown specifically for their fuel value
Fuel	Energy carrier intended for energy conversion
Fuelwood	Woodfuel where the original composition of the wood is preserved
Gross calorific value (qgr)	Absolute value of the specific energy of combustion, in joules, for unit mass of a solid fuel burned in oxygen in calorimetric bomb under the conditions specified. The result of combustion are assumed to consist of gaseous, oxygen, nitrogen, carbon dioxide and sulphur dioxide, of liquid water (in equilibrium with its vapour) saturated with carbon dioxide under conditions of the bomb reaction, and of solid ash, all at the reference temperature and at constant volume. Old term is higher heating value.
Net calorific value (qnet)	Under such conditions that all the water of the reaction products remains as water vapour (at 0.1 MPa), the other products being as for the gross calorific value, all at the reference temperature. The net calorific value can be determined at constant pressure or at constant volume. Old term is lower heating value. Net calorific value as received (qnet,ar) is calculated by the net calorific value from dry matter (qnet,d) and the total moisture as received.
Renewable energy	Consists of energy produced and/or derived from sources infinitely renovated (hydro, solar, wind) or generated by combustible renewables (sustainably produced biomass); usually expressed in energy units and, in the case of fuels, based on net calorific values.
Wood energy, forest energy	Energy derived from woodfuels corresponding to the net calorific value of the fuel
Wood energy systems	All the (steps and/or) unit processes and operations involved for the production, preparation, transportation, marketing, trade and conversion of woodfuels into energy
Woodfuels, wood based fuels, wood-derived biofuels	All types of biofuels originating directly or indirectly from woody biomass

2.4 Conversion factors

Table 2.6 - Energy conversion factors

To:	TJ	Gcal	Mtoe	MBtu	GWh
From:	multiply by:				
TJ	1	238.8	2.388 x 10-5	947.8	0.2778
Gcal	4.1868 x 10-3	1	10-7	3.968	1.163 x 10-3
Mtoe	4.1868 x 104	107	1	3.968 x 107	11630
MBtu	1.0551 x 10-3	0.252	2.52 x 10-8	1	2.931 x 10-4
GWh	3.6	860	8.6 x 10-5	3412	1

Table 2.7 - Mass-to-energy conversion factors

Factors applied for IEA country statistics						
	Biogasoline		Biodiesel		Other Liquid Biofuels	
Country	Ktoe/Kton	TJ/Kton	Ktoe/Kton	TJ/Kton	Ktoe/Kton	TJ/Ktonn
Canada	0.6400	26.79552				
France	0.8567	35.86835	0.904401	37.86546		
Germany	0.6401	26.79971	0.8895	37.24159	0.8981	37.60165
Italy			0.88	36.84384		
Japan						
Russia						
United Kingdom	0.6400	26.79552	0.88	36.84384		
United States	0.6388	26.74528	0.9777	40.93433	0.515501	21.58299
Brazil	0.6500	27.2142			0.65	27.2142
People's Republic of China						
India	0.6400	26.79552				
Mexico						
South Africa						
OECD Total	0.6422	26.88833	0.899059	37.64179	0.68569	28.70848
World	0.6448	26.99577	0.899009	37.63971	0.656342	27.47974

Table 2.8 - Basic Woodfuels parameters and conversion factors (FAO)

LHV wood	13.8	MJ/ kg	
LHV charcoal	30.8	MJ/ kg	
Charcoal/fuelwood	165	kg charcoal/ CUM	
Wood density	725	kg/ CUM	air dry average
Black liquor availability	2.27	CUM/ ton chemical pulp	

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