



Technical Assistance Report

Project Number: 42525
Policy and Advisory Technical Assistance (PATA)
March 2009

India: Study on Cross-Sectoral Implications of Biofuel Production and Use

CURRENCY EQUIVALENTS

(as of 27 February 2009)

Currency Unit	–	Indian rupee/s (Re/Rs)
Re1.00	=	\$0.0198196405
\$1.00	=	Rs50.455002

ABBREVIATIONS

ADB	–	Asian Development Bank
CDM	–	Clean Development Mechanism
DEA	–	Department of Economic Affairs
TA	–	technical assistance

TECHNICAL ASSISTANCE CLASSIFICATION

Type	–	Policy and advisory technical assistance (PATA)
Targeting Classification	–	General intervention
Sector	–	Energy
Subsector	–	Renewable energy
Themes	–	Economic growth, environmental sustainability, social development
Subthemes	–	Promoting macroeconomic stability, global and regional transboundary environmental concerns and issues, human development

NOTE

In this report, "\$" refers to US dollars.

Vice-President	X. Zhao, Operations 1
Director General	K. Senga, South Asia Department (SARD)
Director	T. Kandiah, Energy Division, SARD
Team leader	P. Wijayatunga, Energy Specialist, SARD
Team member	N. Sakai, Energy Specialist, SARD

I. INTRODUCTION

1. Following a request of the Government of India (the Government) during the Country Programming Mission in July 2008, the Asian Development Bank (ADB) included policy and advisory technical assistance (TA) for the Study on Cross-Sectoral Implications of Biofuel Production and Use in the country operations business plan¹ for 2009. ADB fielded a fact-finding mission during 14–18 July 2008. In a letter dated 21 January 2009, the Department of Economic Affairs (DEA) provided government confirmation to the aide-mémoire containing the impact, outcome, outputs, implementation arrangements, cost, financing arrangements, terms of reference of consultants, and design and monitoring framework (Appendix 1).²

II. ISSUES

2. India has many years of experience using renewable energy sources to fulfill the energy needs of its population. This includes exploitation of both traditional sources (such as biomass) and nontraditional sources (such as wind power). India has been the region's research hub on the use of biomass for electricity generation as well as development of biofuels, mainly to replace fossil fuels used in the transport sector. Up to now, the production of biofuels in India has concentrated on ethanol and the use of non-edible sources such as *Jatropha*³. It is expected that the focus will remain on non-edible sources in the foreseeable future. These biofuel interventions are well placed within India's Integrated Energy Policy of 2006⁴ and the National Action Plan of Climate Change of 2008.⁵

3. India has an estimated 64 million hectares (ha) of wasteland, out of which about 17 million ha are likely to be suitable for biofuel crops. Under the current biodiesel strategy, about 400,000 ha of marginal land are to be brought under biodiesel crop cultivation. It is expected that India will achieve a target of 20% blending of biodiesel by 2012. In 2005, India introduced a biodiesel purchase policy⁶ that allowed public sector oil marketing companies to purchase biodiesel at 20 identified centers in different states.

4. A variety of issues involving the production and use of biofuels need to be understood before interventions in this sector. These include issues involving usage of land, water, and labor; replacement of food crop cultivation with biofuel crop cultivation; and adverse environmental and social impacts. These issues require careful attention and need to be addressed in an integrated manner. Taking them in isolation could lead to conflicting conclusions and recommendations leading to suboptimal solutions in the context of overall economic development. Therefore, a balanced view on biofuel production and use is required considering these interactions among different sectors.

5. An in-depth study on the production and use of biofuels would allow the Government to have appropriate and balanced interventions in this sector. This would optimize the contribution of biofuels in replacing high carbon-emitting fuels.

¹ ADB. 2008. *Country Operations Business Plan (2009): India*. Manila

² The TA first appeared in the business opportunities section of ADB's website on 9 February 2009.

³ *Jatropha* is a plant native to Central America and has become naturalized in many tropical and subtropical areas, including India, Africa, and North America. Originating in the Caribbean, *Jatropha* was spread as a valuable hedge plant to Africa and Asia. *Jatropha* produces seeds containing up to 40% oil. When the seeds are crushed and processed, the resulting oil can be used in a standard diesel engine.

⁴ Planning Commission, Government of India. 2006. *Integrated Energy Policy*. New Delhi.

⁵ Prime Minister's Council on Climate Change, Government of India. 2008. *National Action Plan on Climate Change*. New Delhi,

⁶ Ministry of Petroleum and Natural Gas, Government of India. 2005. *Biodiesel Purchase Policy*. New Delhi.

III. THE TECHNICAL ASSISTANCE

A. Impact and Outcome

6. The impact of the policy and advisory TA will be improved energy security and low carbon energy sector development through appropriate bioenergy interventions. The indicators will be reduction in projected oil imports and greenhouse gas emissions.

7. The outcome of the TA will be well-informed interventions in the biofuels sector with due consideration given to the cross-sectoral interactions and multifaceted nature of the impacts of biofuel production and use. The indicator will be Government acceptance of a national policy and strategies on biofuel production and use accepted by the Government.

B. Methodology and Key Activities

8. The methodology for successful implementation of the TA is the following:

- (i) Literature survey on the worldwide production and use of biofuels, with specific emphasis on activities in South Asia. This will include a review of the extent of the contribution of the biofuels sector to the sustainable development of these countries and regions.
- (ii) Study on the impact of biofuel production on agriculture and food security, land and water use, human resource utilization, rural employment generation, and poverty reduction in relation to the traditional biofuel crops used in India.⁷
- (iii) Extend study (ii) to include second-generation biofuels.⁸
- (iv) Study on possible biofuel penetration scenarios in the energy sector and their impact on the overall socioeconomic environment.
- (v) Economic and financial analyses of biofuel production, considering the opportunity costs of factors such as land, water, and human resources; and the benefit of replacing imported fossil fuels. Incentives and subsidies will be included during the financial analysis; an output of this will be the cost recovery price of biofuels.
- (vi) Estimation of possible greenhouse gas and other emission reductions under different scenarios of biofuel production and use.
- (vii) Reviewing the eligibility criteria for Clean Development Mechanism financing in biofuel development.
- (viii) Examining the investment opportunities in different subsectors, including potential for projects under the Clean Development Mechanism.
- (ix) Suggestions for government interventions with an integrated approach, including those in the legal and regulatory environment, to maximize the overall benefits from expansion of the biofuels sector.
- (x) Dissemination of the findings among all the stakeholders such as relevant government line agencies, research institutions, academia, and different pressure groups active in the areas of biofuels, energy, and environment.

9. The key output of the TA is a report containing the output of activities (i) to (v). This report, along with the proposed outreach program for stakeholders on the findings of the study,

⁷ Based on secondary data from other studies and relevant publications.

⁸ Global experience adopted and extended to India for the analysis.

will assist the Government in deciding and implementing required government interventions in the biofuels sector.

C. Cost and Financing

10. The total cost of the TA is estimated to be \$625,000. Of this, \$500,000 will be financed on a grant basis by ADB's TA funding program (Technical Assistance Special Fund-other sources). The Government will finance \$125,000 equivalent of local currency costs through in-kind contributions, including office accommodation and related facilities and counterpart staff. The detailed cost estimates and a financing plan are in Appendix 2.

D. Implementation Arrangements

11. DEA will be the Executing Agency of the TA. It will provide necessary office accommodation for the consultants and provide counterpart staff. It will assist the consultants to liaise with the relevant ministries and other government agencies and to establish a working relationship with these agencies. The TA is expected to start by April 2009 and close by December 2009. DEA has assured the availability of counterpart services, facilities, and funds by the start of the TA.

12. The TA will require the services of 3 international consultants for a total period of 16 person-months and one national consultant for a period of 6 person-months. The consulting team will include an international biofuels specialist, an international energy economist, an international environmental and social specialist, and a national biofuel specialist. ADB will recruit the consultants in accordance with its *Guidelines on the Use of Consultants* (2007, as amended from time to time). All four consultants will be recruited as individual consultants. Disbursements under the TA will be made in accordance with ADB's *Technical Assistance Disbursement Handbook*.⁹

13. The findings of the study will be disseminated through a stakeholder seminar to be held after completion of the study report, and through internal as well as external seminars and conferences. The report and the outcome evaluation will be made available on the ADB website.

IV. THE PRESIDENT'S DECISION

14. The President, acting under the authority delegated by the Board, has approved the provision of technical assistance not exceeding the equivalent of \$500,000 on a grant basis to the Government of India for the Study on Cross-Sectoral Implications of Biofuel Production and Use, and hereby reports this action to the Board.

⁹ ADB. 2008. *Technical Assistance Disbursement Handbook*. Manila.

DESIGN AND MONITORING FRAMEWORK

Design Summary	Performance Targets and/or Indicators	Data Sources and/or Reporting Mechanisms	Assumptions and Risks
<p>Impact Improved energy security and low carbon energy sector development</p>	<p>Deceleration in the growth of oil imports and greenhouse gas emissions</p>	<p>Data on oil imports</p> <p>Estimates of greenhouse gas emissions published by Ministry of Environment and Forests</p> <p>ADB review mission</p>	<p>Assumption Rapid implementation of a biofuels program</p>
<p>Outcome Well-informed interventions in the biofuels sector</p>	<p>Government acceptance of national policy and strategies on biofuel production and use, incorporating the findings of the study</p>	<p>National policy document on biofuels</p>	<p>Assumption The Government gives high priority to biofuels policy recommendations</p> <p>Risk Non-convergent views among different interest groups</p>
<p>Outputs</p> <p>1. Report encompassing (i) review of the work on biofuels already carried out for South Asia, compilation of international experience in production and use of biofuels; (ii) critical analysis of biofuels environment in India in relation to international experience, considering cross-sectoral implications; and (iii) conclusions of the analysis in relation to India and suggestions for possible interventions in the sector.</p> <p>2. Outreach program targeting all stakeholders in the biofuels sector</p>	<p>Timely submission of the TA reports acceptable to ADB and the Government</p> <p>Effective consultation workshop involving stakeholders</p> <p>Successful implementation of the outreach program</p>	<p>TA reports</p> <p>ADB TA review missions</p> <p>Number of attendees and representation of stakeholder institutions in the consultation workshop and the dissemination seminar</p>	<p>Assumptions Timely and free access to all the past work on biofuels, both in the South Asia region and outside</p> <p>Effective and timely stakeholder consultation</p>

Activities with Milestones	Inputs
<ol style="list-style-type: none"> 1. Submit inception report (1 month after assignment) <ol style="list-style-type: none"> 1.1 Review the overall TA scope and requirements 1.2 Propose work plan to carry out activities in the TA 2. Submit midterm report (3 months after assignment) <ol style="list-style-type: none"> 2.1 Review South Asia experience 2.2 Review international experience 2.3 Perform detailed analysis of the findings in 2.1 and 2.2 2.4 Review eligibility criteria of biofuels for Clean Development Mechanism financing 3. Submit draft final report (5 months after assignment) <ol style="list-style-type: none"> 3.1 Provide in-depth analysis of biofuels in India 3.2 Provide relevant conclusions based on the analysis 3.3 Suggest any interventions required in developing a coordinated and integrated approach to biofuel production and use 4. Submit final report (6 months after assignment) <ol style="list-style-type: none"> 4.1 Incorporate comments from DEA and ADB into the draft final report 5. Conduct dissemination seminar for the stakeholders <ol style="list-style-type: none"> 5.1 Conduct seminar 5.2 Submit a summary of the seminar proceedings 	<p>ADB: \$500,000</p> <p>Government: \$125,000 equivalent of cash and in-kind contribution</p>

ADB = Asian Development Bank, DEA = Department of Economic Affairs, TA = technical assistance.

COST ESTIMATES AND FINANCING PLAN
(\$'000)

Item	Total Cost
A. Asian Development Bank Financing	
1. Consultants	
a. Remuneration and Per Diem	
i. International Consultants	328.0
ii. National Consultants	36.0
b. International and Local Travel	36.0
c. Reports and Communications	10.0
2. Training, Seminars, and Conferences	20.0
3. Surveys	10.0
4. Miscellaneous Administration and Support Costs	10.0
5. Contingencies	50.0
Subtotal (A)	500.0
B. Government Financing	
1. Office Accommodation	70.0
2. Remuneration and Per Diem of Counterpart Staff	35.0
3. Others	20.0
Subtotal (B)	125.0
Total	625.0

^a Financed by the Asian Development Bank's technical assistance funding program (Technical Assistance Special Fund-other sources).
Source: Asian Development Bank estimates.

OUTLINE TERMS OF REFERENCE FOR CONSULTANTS

A. Introduction

1. The consultants for the Asian Development Bank (ADB)-financed Study on Cross-Sectoral Implications of Biofuel Production and Use based on policy and advisory technical assistance (TA) will provide a comprehensive analysis of issues involving biofuel production and use. Since biofuel production and use concern many sectors—such as energy, transport, agriculture, social development, and the environment—it is essential that the final outcome of the project is balanced from the point of view of all these sectors. Further, given this cross-sectoral nature, it is important that the TA is executed and implemented by a nodal agency responsible for the highest levels of decision making in the overall economy. The Executing Agency of the TA will be the Department of Economic Affairs (DEA).

2. The consultants will (i) review work on biofuels already carried out for South Asia, (ii) compile international experience in the production and use of biofuels, (iii) critically analyze the future of biofuels in India vis-à-vis international experience, (iv) consult all the stakeholders, (v) derive conclusions from the analysis and suggest interventions required in the biofuels sector, and (vi) conduct an outreach program. The data source needs to be clarified in all the documents. Where necessary to meet ADB standards and requirements, the consultants will also conduct primary data collection and analysis.

3. The TA will require the services of 3 international consultants for a total period of 16 person-months and 1 national consultant for a period of 6 person-months. The consulting team will include an international biofuels specialist, an international energy economist, an international environmental and social specialist, and a national biofuel specialist. ADB will recruit the consultants in accordance with its *Guidelines on the Use of Consultants* (2007, as amended from time to time). All four consultants will be recruited as individual consultants.

4. The international biofuel specialist will act as team leader to coordinate the overall work program with all the consultants and facilitate communication with ADB, DEA, and other consultants. In particular, the team leader will be responsible for consolidating and compiling the inception report, interim report, draft final report, and final report.

B. Scope of Work

5. The duration of the policy and advisory TA is 9 months from the start of services. However, the work should be concentrated within the first 6 months. All the consultants are expected to participate in ADB's missions and contribute to preparing the aide-mémoire as mission members. The professional positions, person-months, and activities for the required positions are as follows:

1. **Biofuel Specialist** (international, team leader, 6 person-months)

6. In addition to attending the responsibilities associated with the position of team leader, the consultant is expected to have the capacity to address all issues related to the biofuels sector with the assistance of other members of the team. These include biofuel and energy sector specific issues in particular. The activities of this position include but are not limited to the following:

- (i) As the team leader, coordinate TA implementation and ensure timely delivery of all tasks by team members.
- (ii) Conduct a comprehensive review of the current work on biofuels, in the contexts of policy, financing, technological, environmental, social, and economic impacts carried out for India and South Asia.
- (iii) Conduct a comprehensive review of up-to-date international scenario on the production and use of biofuels in the contexts of policy, financing, technological, environmental, social, and economic impacts.
- (iv) Review international experience with renewable energy laws and regulations (with and without subsidies or financial incentives) in relation to biofuels, and assess whether they have contributed to the sustainable development of indigenous production of biofuels.
- (v) Provide a critical analysis of the findings in (ii), (iii), and (iv), particularly considering the cross-sectoral implications of biofuels production and use.
- (vi) Extend the analysis encompassing all critical and relevant sectors in the context of India, giving appropriate consideration to the cross-sectoral nature of the implications of biofuels production and use.
- (vii) Separately examine the traditional (palm oil, sugarcane, etc.) versus cellulosic feedstock; and determine the net energy balance required for production of each different feedstock in India.
- (viii) Provide a list and brief analysis of possible investment opportunities in the biofuel sector.
- (ix) Review the eligibility criteria for Clean Development Mechanism (CDM) financing in biofuel development.
- (x) Provide an estimate of the potential of biofuels in mitigating greenhouse gas and other emissions in India and the overall benefits under the CDM.
- (xi) Present the findings in a consultation workshop, with the participation of all stakeholders—such as relevant government line agencies, research institutions, academia, and different pressure groups active in the areas of biofuels, energy, and the environment.
- (xii) Derive conclusions and suggest interventions for an integrated approach to the biofuels sector to maximize its benefits in national development efforts and make suggestions on any legislative or regulatory changes that the Government could consider.
- (xiii) Deliver inception, interim, draft, and draft final reports in a timely manner to the satisfaction of DEA and ADB, and ensure that their comments are incorporated in the final report
- (xiv) Conduct a dissemination seminar for policy makers and other stakeholders on the findings of the study, and prepare a summary of the seminar proceedings.

2. **Energy Economist** (international, 4 person-months)

7. The consultant is expected to have the capacity to address the interaction of the energy sector with the biofuel sector and to deal with economic analysis in all relevant areas of the project. The activities of this position include but are not limited to the following:

- (i) Assist the team leader in TA implementation and ensure the timely delivery of the tasks assigned.
- (ii) Assist the team leader to conduct the review of the current work on biofuels, in the context of policy, financing, technological, environmental, social, and economic impacts carried out for India and South Asia, with emphasis on those in the areas of integrated energy planning, economic, and financial aspects.
- (iii) Assist the team leader in conducting the review of international scenario on the production and use of biofuels in the context of policy, regulatory, financing, technological, environmental, social, and economic impacts, giving emphasis to integrated energy planning, economic, and financial aspects.
- (iv) Provide critical analysis on the findings in (ii) and (iii) in the context of economic and energy sector development impacts, with attention given to cross-sectoral implications.
- (v) Conduct economic and financial analyses of biofuel production considering the opportunity costs of factors such as land, water, and human resources and the benefit of replacing imported fossil fuels. Incentives and subsidies should be included during the financial analysis; an output of this will be the cost recovery price of biofuels.
- (vi) Extend the analysis in relation to economic and energy sector development, encompassing all critical and relevant sectors in the context of India—considering the cross-sectoral nature of the implications of biofuels production and use, greenhouse gas emission mitigation potential, and CDM benefits.
- (vii) Provide the team leader with inputs on the economic and financial analyses of possible investment opportunities in the sector.
- (viii) Assist the team leader in presenting the findings in a stakeholder consultation workshop.
- (ix) Provide relevant inputs to derive conclusions and suggest interventions for an integrated approach to maximize the benefits of a national biofuels program.
- (x) Provide inputs to the team leader in the areas of economic and financial analyses in the preparation of the inception, interim, draft, and draft final reports.
- (xi) Assist the team leader in conducting the dissemination seminar for policy makers and other stakeholders on the findings of the study, and summarizing the proceedings.

3. Biofuel Specialist (national, 6 person-months)

8. The activities of this position include but are not limited to the following:

- (i) Assist the team leader by ensuring timely delivery of the tasks assigned.
- (ii) Assist the team leader in conducting a comprehensive review of the current work on biofuels, in the context of policy, financing, technological, environmental, social, and economic impacts carried out for India and South Asia.
- (iii) Assist the team leader in reviewing the Indian experience with the renewable energy laws and regulation (with and without subsidies or financial incentives) and assess whether they have contributed to the sustainable development of indigenous production of biofuels.
- (iv) Assist the team leader in the analysis of the findings in (ii) and (iii).

- (v) Assist the team leader in extending the analysis encompassing all critical and relevant sectors in the context of India, considering the cross-sectoral nature of implications of a biofuels production and use. Expand assistance to examine the traditional (palm oil, sugarcane, etc.) versus cellulosic feedstock and determine the net energy balance required for production of each different feedstock in India.
- (vi) Assist the team leader in determining possible investment opportunities in the biofuels sector and analysis of the same.
- (vii) Assist the team leader in presenting the findings in a consultation workshop, with the participation of all stakeholders—such as relevant government line agencies, research institutions, academia, and different pressure groups active in the areas of biofuels, energy, and the environment.
- (viii) Provide inputs to derive conclusions and suggest interventions for an integrated approach to the biofuels sector to maximize its benefits in national development efforts, and to make suggestions on any relevant legislative or regulatory changes that the Government could consider.
- (ix) Assist the team leader in the timely delivery of inception, interim, draft, and draft final reports to the satisfaction of DEA and ADB and ensure that their comments are incorporated in the final report
- (x) Assist the team leader in conducting a dissemination seminar for policy makers and other stakeholders on the findings of the study and summarizing the proceedings.
- (xi) Facilitate the communication and interaction of other international team members with local agencies.

4. Environment and Social Specialist (international, 6 person-months)

9. The consultant is expected to have the capacity to address issues relating to (i) environmental, (ii) agricultural, and (iii) social impacts of biofuel production and use. The consultant needs to have a strong background in areas (i) and (ii). The activities of this position include but are not limited to the following:

- (i) Assist the team leader by ensuring timely delivery of the tasks assigned.
- (ii) Assist the team leader in conducting a comprehensive review of current work on biofuels, in the context of agricultural, environmental, and social impacts, particularly work relating to the energy sector in India and South Asia. Special attention needs to be given to examining labor, land and water use (availability and competing uses in India), farming methods for different types of feedstock, and the environmental impacts of the transportation of end products (or feedback) to blenders or consumers.
- (iii) Assist the team leader in analysis of the findings in (ii) in the context of agricultural, social, and environmental impacts.
- (iv) Assist the team leader in extending the analysis—from the point of view of agricultural, social, and environmental aspects—encompassing all critical and relevant sectors in the context of India, while considering the cross-sectoral nature of the implications of biofuels production and use.
- (v) Assist the team leader in determining possible investment opportunities in the sector and their analysis in the context of environmental, agricultural, and social aspects.

- (vi) Assist the team leader in presenting the findings in a consultation workshop with the participation of all stakeholders such as relevant government line agencies, research institutions, academia, and different pressure groups active in the areas of biofuels, energy, and environment.
- (vii) Provide inputs on agricultural, social, and environmental aspects in relation to deriving conclusions and suggesting interventions for an integrated approach to the biofuels sector to maximize its benefits in national development efforts.
- (viii) Develop standard terms of reference for a comprehensive environmental impact assessment for a biofuels project, with emphasis on South Asia.
- (ix) Assist the team leader in timely delivery of inception, interim, draft, and draft final reports to the satisfaction of DEA and ADB and ensure that their comments are incorporated in the final report.
- (x) Assist the team leader in conducting a dissemination seminar for policy makers and other stakeholders on the findings of the study and summarizing the proceedings.

C. Reporting Requirements

10. The consultants will submit the following reports:

- (i) Inception report, within 1 month after the start of services.
- (ii) Midterm report, within 3 months after the start of services. The midterm report will include the outputs relating to tasks (ii) through (vii) of the team leader's terms of reference.
- (iii) Draft final report, within 5 months after the start of services. The draft final report will include the updated outputs relating to tasks (ii) through (xii) of the team leader's terms of reference.
- (iv) Final report within 1 month after receipt of all comments from DEA and ADB.
- (v) A report within 1 week after conducting the dissemination seminar, summarizing its proceedings.

11. ADB requires 5 copies of each report, and the DEA requires 20 copies of each report in English.

OUTLINE OF THE FINAL REPORT

1. The report shall include, but not be limited to, where appropriate, the following sections:
 - (i) Executive Summary
 - (ii) List of Figures and Tables
 - (iii) Abbreviations
 - (iv) Chapter 1: Introduction - Importance of the study, terms of reference, and organization of the report.
 - (v) Chapter 2: Review and critical analysis of current work on biofuels—covering policy, financing, technological, environmental, social, and economic impacts— carried out both internationally and in India and South Asia.
 - (vi) Chapter 3: Review international experience with renewable energy policies, laws, and regulations (with and without subsidies or financial incentives) and assess whether they have contributed to the sustainable development of indigenous production of biofuels.
 - (vii) Chapter 4: Detailed analysis and discussion of the types of cross-sectoral implications of biofuel production and use in India, encompassing all critical and relevant sectors.
 - (viii) Chapter 5: Examination of the traditional (palm oil, sugarcane, etc.) versus cellulosic feedstock, and determination of the net energy balance required for production of each different feedstock in India.
 - (ix) Chapter 6: Analysis of possible investment opportunities in the biofuels sector.
 - (x) Chapter 7: Review of eligibility criteria for Clean Development Mechanism financing in biofuel development, and estimate of the greenhouse gas emission mitigation potential of biofuels in India and the overall benefits under the Clean Development Mechanism.
 - (xi) Chapter 8: Conclusions and suggestions for interventions required for an integrated approach to the biofuels sector to maximize its benefits in the national development efforts, and suggestions for any legislative or regulatory changes that the Government could consider.
 - (xii) References
 - (xiii) Appendixes: Summary of proceedings of the stakeholder consultation workshop and dissemination seminar and any other relevant information.