



Policy Paper

Document Stage: Working Paper
January 2009

Energy Policy

ABBREVIATIONS

ADB	– Asian Development Bank
CO ₂	– carbon dioxide
DMC	– developing member country
EBRD	– European Bank for Reconstruction and Development
EU	– European Union
GDP	– gross domestic product
IEA	– International Energy Agency
LNG	– liquefied natural gas
LPG	– liquefied petroleum gas
MDB	– multilateral development bank
MDG	– Millennium Development Goal
OECD	– Organisation for Economic Co-operation and Development
OED	– Operations Evaluation Department
PRC	– People's Republic of China
RSDD	– Regional and Sustainable Development Department

WEIGHTS AND MEASURES

btoe	– billion tons of oil equivalent
mb/d	– million barrels per day
Mtoe	– million tons of oil equivalent
Tcm	– trillion cubic meters

NOTE

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

Vice President	U. Schäfer-Preuss, Knowledge Management and Sustainable Development
Director General	X. Yao, Regional and Sustainable Development Department (RSDD)
Director	W. Um, Sustainable Infrastructure Division, RSDD
Energy Committee	S. Chander (chair), A. Terway (co-chair), A. Jude, A. Guha, T. Jung, T. Kimura, R. Stroem, M. Tsuji, S. Tumiwa
Team leader	J.I. Kim, Principal Energy Specialist, RSDD
Team member	P. Calcetas, Senior Sector Officer, RSDD

TABLE OF CONTENTS

	Page
I. INTRODUCTION	1
II. SUMMARY OF THE REVIEW	2
III. THE UPDATED POLICY	3
IV. POLICY IMPLEMENTATION	4
A. Promoting Energy Efficiency and Renewable Energy	5
B. Maximizing Access to Energy for All	6
C. Promoting Energy Sector Reforms, Capacity Building, and Governance	8
D. Implementation Arrangements	9
V. RECOMMENDATION	10
APPENDIXES	
1. Policy Analysis	11
2. Results Framework for ADB's Energy Policy Implementation	35

I. INTRODUCTION

1. Rapid economic growth in developing Asia has been generating high levels of demand for energy. While the ongoing global financial crisis is impacting on its short term economic performance, primary energy demand in the developing Asia, according to the International Energy Agency (IEA), is projected to almost double between 2006 to 2030. Addressing energy efficiency and climate change is a fundamental challenge to achieve sustainable development. Scientists have documented a rise in atmospheric temperature and other significant climate changes, some of which have serious consequences for the Asia and Pacific region.

2. Meanwhile, with recent record high oil price and subsequent sharp drop in oil prices as a result of credit crisis, energy market volatility and uncertainties have encouraged developing countries to focus on energy security, reduction of oil consumption, and development of indigenous energy sources. The success of these measures depends on a comprehensive and coordinated approach. Another critical issue is meeting energy demand and providing access to modern forms of energy to all—at present, about 1 billion people in the region lack this.

3. The Asian Development Bank (ADB) has been providing assistance to its developing member countries (DMCs) in the energy sector for the last 40 years, focusing on electricity sector expansion programs, interventions in the oil and gas sectors, institutional capacity building, and power sector reforms, governance, and efficiency improvement. ADB adopted its first energy policy in 1981,¹ which focused on overcoming the crisis caused by the oil price shocks, and placed considerable emphasis on (i) developing energy infrastructure and indigenous energy sources, (ii) promoting efficiency, and (iii) creating markets conducive to foreign investment in DMCs.

4. The second energy policy paper released in 1995,² noted that, with increased investments, the power sectors of the DMCs were becoming unmanageable and inefficient, mainly due to the dual role of the government as both policy maker and monopoly owner. This second policy paper recognized the changing needs of the sector and recommended balanced infrastructure investment and development of financially robust and efficient operations. Other recommendations included enhanced focus on demand-side management, environmental protection, rural electrification, and renewable energy development.

5. The 2000 Energy Policy review³ confirmed that the existing framework was appropriate and sound. However, taking into consideration ADB's revised operational priorities and the changing needs of the DMCs, the review recommended the development of independently regulated and privatized energy markets which would lead to more efficient uses of energy, lower costs, and increased private investments. The 2000 review recommended the next review to be undertaken in 2005 to ensure that ADB's energy operations are properly aligned to the needs of its DMCs.

6. In 2008, ADB completed the second review of 1995 ADB's Energy Policy. This paper has been prepared to seek Board approval on the proposed updates to ADB's Energy Policy in light of the review's findings, regional and global economic developments, and ADB's adoption of the

¹ Asian Development Bank (ADB). 1981. *Role of the Bank in the Energy Sector in the Region, Working Paper No. 2*. Manila.

² ADB. 1995. *Bank Policy for the Energy Sector*. Manila.

³ ADB. 2000. *Energy 2000: Review of Energy Policy*. Manila.

Long-Term Strategic Framework (2008–2020), Strategy 2020.⁴ It also outlines implementation of ADB's Energy Policy.

II. SUMMARY OF THE REVIEW

7. The Review of the Energy Policy started in 2006. It has been prepared by the Regional and Sustainable Development Department in consultations with energy experts in the operations departments. The ADB's Energy Community of Practice has also been actively involved in preparing the paper. In addition to the internal consultations, Management commissioned a 60-day external consultation process which yielded a wide range of views from governments, civil society organizations, industry, academe, and other stakeholders. The draft paper has been finalized incorporating views received from both internal and external stakeholders.

8. The scale at which energy is being used in the Asia and Pacific region now, and in the foreseeable future, is expected to have far-reaching consequences. In developing Asia,⁵ the projected primary energy demand is expected to grow from 3,227 mtoe in 2006 to 6,325 mtoe by 2030, with the People's Republic of China (PRC) and India accounting for a major share. Much of the increase in energy demand will be due to projected high economic and population growth. Industrialization, urbanization, and the replacement of noncommercial biomass fuels by commercial fuels will also contribute to the increase in demand. Other factors will be increased economic activities, improved living standards, and increased consumption by households. Higher demand for energy from developing Asia has prompted concerns of energy security. There is a need to explore long-term cooperative options at the international level to ensure production and use of energy within reasonable costs and in a sustainable manner.

9. Higher demand for energy must also be met in a socially, economically, and environmentally sustainable manner. There is now general recognition that the threat of climate change is real and increasing. The continuing and accelerating emissions of greenhouse gases, and their close link to average global temperature, are likely to result in significant changes in mean climate and its seasonal and annual variability, both globally and in Asia. Climate change models predict that, unless drastic measures are taken now, land regions of Asia will experience an annual mean warming of about 3° Celsius (C) in the decade of the 2050s and up to 5°C in the decade of the 2080s as a result of future increases in greenhouse gas concentrations.⁶

10. The impacts of rapid climate change are expected to be profound in the Asia and Pacific region. From the Himalayan highlands to the rich tropical forests of Southeast Asia, and in the Pacific islands, many natural ecosystems are vulnerable to climate change and some will probably be irreversibly damaged. The poorest people within the large populations of both sub-Saharan Africa and South Asia are most vulnerable to the effects of climate change.⁷ Scientists have observed abnormal weather patterns and impacts recently, including (i) more intense tropical storms, (ii) more severe and more frequent droughts and floods, (iii) accelerated melting of glaciers and rises in sea level, (iv) higher frequency of forest fires, (v) shortages of fresh water,

⁴ ADB. 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008-2020*. Manila.

⁵ Developing Asia, as defined by the IEA, includes Afghanistan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; the People's Republic of China; Fiji Islands; French Polynesia; India; Indonesia; Kiribati; Democratic People's Republic of Korea; the Lao People's Democratic Republic; Malaysia; Maldives; Mongolia; Myanmar; Nepal; New Caledonia; Pakistan; Papua New Guinea; the Philippines; Samoa; Singapore; Solomon Islands; Sri Lanka; Thailand; Tonga; Taipei, China; Viet Nam; and Vanuatu.

⁶ Intergovernmental Panel on Climate Change (IPCC). 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group I Report—the Physical Science Basis*. UK: Cambridge University Press.

⁷ Stern, Nicholas. 2006. *Stern Review: The Economics of Climate Change*. London: Treasury Office of the Government of the United Kingdom and Northern Ireland.

(vi) threatened crop production and aquaculture, (vii) higher incidence of heat-related and infectious diseases, and (viii) greater risk of loss of life and property.

11. Access to modern and reliable energy services remains essential for sustainable human development, economic growth, improved quality of life, and better delivery of education and health services. Though access to energy was not identified as a Millennium Development Goal (MDG), studies⁸ have shown that MDG targets cannot be met without modern energy services. It is clear that access to energy is a critical element in reducing poverty. In the absence of energy services, the rural poor must resort to the use of traditional biomass sources—such as wood, charcoal, dung, and waste materials—for cooking and heating. According to the IEA,⁹ about 2.5 billion people in 2004 in developing countries continue to rely on traditional biomass to meet their energy needs; PRC (with 700 million people) and India (with 565 million people) account for a large percentage of this figure.

12. A review of current constraints, future outlook, and emerging issues of the energy sector in the Asia and Pacific region found that the 1995 Energy Policy continues to provide a sound and basic framework for addressing the needs of the DMCs, with key policy elements on energy efficiency, energy and environment, rural energy development, structural reform, and regional cooperation remaining especially relevant. A detailed assessment of key policy issues was conducted, taking into account the 1995 energy policy, its 2000 review, the findings of this review, and priorities established in Strategy 2020 (Appendix 1).

III. THE UPDATED POLICY

13. In response to these challenges and to better reflect the new review findings, the lessons learned, policy analysis, and the strategic directions of Strategy 2020, it is proposed that the 1995 Energy Policy be updated to align ADB's energy operation for meeting energy security, facilitating a transition to a low-carbon economy, and for achieving ADB's vision of a region free of poverty, through the following principles and objectives:

- (i) **Objective:** ADB will aim to help DMCs to provide reliable, adequate, and affordable energy supplies for inclusive growth in a socially, economically, and environmentally sustainable way. It will emphasize promoting energy efficiency and renewable energy, maximizing access to energy for all, and promoting energy sector reforms, capacity building, and governance.
- (ii) **Principles of policy implementation:** ADB will prioritize and broaden efforts to support energy efficiency improvements and promote clean energy projects in as many sectors and in as many ways possible, thereby helping limit energy demand and provide energy supply while also addressing the challenges of environmentally sustainable growth and global warming. ADB regards energy efficiency as essential to (a) ease growth in fossil fuel demand and upward pressure on energy prices, (b) improve energy security, and (c) reduce emissions of greenhouse gases.
- (iii) ADB will place special focus on wide-ranging efforts to provide energy for communities and groups that lack access to its economic and social benefits, including remote rural areas.

⁸ Modi, V., S. McDade, D. Lallement, and J. Saghir. 2006. *Energy Services for the Millennium Development Goals*. New York: Emergency Sector Management Assistance Programme, United Nations Development Programme, UN Millennium Project, and World Bank.

⁹ International Energy Agency. 2006. *World Energy Outlook 2006*. Paris.

- (iv) ADB will continue to play a pivotal role in promoting effective regional cooperation in the energy sector to ensure energy security in a sustainable manner in the region.
- (v) ADB will emphasize promotion of energy sector reforms, capacity building, and governance as crucial areas of its assistance essential for promoting energy efficiency, renewable energy, and maximizing access to energy for all. Private sector participation and public–private partnerships, in particular, will be encouraged as an optional tool to enhance energy sector efficiency as a result of introducing competition and increased investable resources, but not as the end objective of reform activities.
- (vi) ADB will maintain its current position on non-involvement in the financing of nuclear power generation, coal mine development (except for substantial use by thermal power plants), and oilfield development (except marginal fields).
- (vii) ADB will strengthen knowledge management and dissemination of good practices and lessons learned in its role as a regional knowledge bank.
- (viii) To help achieve its energy sector goals, ADB will continue to collaborate with a range of development partners, including international development agencies, multilateral and bilateral institutions, the private sector, nongovernment organizations, community-based organizations, and foundations.

14. The updated Energy Policy will be guided by Strategy 2020 as well as all other ADB policies and strategies. In particular, all ADB investments in the energy sector will comply with ADB safeguards policies regarding the environment, involuntary resettlement, and indigenous peoples, ensuring that affected persons are safeguarded from impoverishment risks, and development programs for these persons are incorporated and implemented.

15. In implementing its updated Energy Policy, care will be taken to identify the specific given situation in each DMC and plan the interventions accordingly. ADB's policy implementation will be realigned to achieve the objectives of the updated Energy Policy based on three pillars: (i) promoting energy efficiency and renewable energy, (ii) maximizing access to energy for all, and (iii) promoting energy sector reforms, capacity building, and governance. The policy implementation will be monitored by a results framework (para. 47).

IV. POLICY IMPLEMENTATION

16. In line with the objectives of the updated Energy Policy, the policy implementation has taken into account emerging issues and options, lessons learned from past operations, the experiences of other development partners including the World Bank. It has also been supported by examination of issues related to fossil fuels, power generation and district heating, power sector reforms and restructuring, regional cooperation, and the special needs of the Pacific DMCs. This policy implementation is also a coherent expression of important elements of Strategy 2020 that prioritize energy-related objectives and identify the institutional capabilities needed for the future within a changing regional, global, and technological context.

17. For more efficient implementation, ADB will seek further collaboration with a wider range of development partners. To mobilize necessary funds and modalities for new initiatives for the energy sector, such as the Energy Efficiency and the Carbon Market Initiatives, a financing partnership facility and trust funds have been set up. In addition, funds have been mobilized to cofinance specific projects and initiatives. ADB will also collaborate closely with global climate

change initiatives such as the Climate Investment Funds¹⁰ in helping its DMCs move toward a low carbon economy. ADB will (i) continue to seek commitments for cofinancing models, (ii) share knowledge and experience, and (iii) coordinate efforts with a range of development partners. Also, given the huge investment requirements for the energy sector in the region and the need to maximize economic efficiency, ADB will strengthen the role of private sector participation, and enhance the synergy of ADB's public and private sector operations.

18. The policy implementation is guided by three pillars emphasized in the updated energy policy: (i) promoting energy efficiency and renewable energy; (ii) maximizing access to energy for all; and (iii) promoting energy sector reform, capacity building, and governance.

A. Promoting Energy Efficiency and Renewable Energy

19. Harnessing energy efficiency is one of the most effective ways of meeting energy demand while addressing global warming challenges. Increasing the efficiency of energy use and supply will yield more service value from each primary energy unit consumed, as well as having large environmental and economic benefits. Energy efficiency is essential to (i) ease growth in fossil fuel demand and upward pressure on energy prices, (ii) improve energy security, and (iii) reduce emissions of greenhouse gases.

20. Improving energy efficiency by examining both demand side and supply side alternatives is a priority of ADB. Additional efforts will be made under the policy to decrease the demand through energy efficiency initiatives—including the 3Rs of reduce, reuse, and recycle—and increases in system efficiencies. While there are many opportunities to improve energy efficiency, the increasing demand for power in the region will require significant investment in new generation capacity. Thus, while energy efficiency initiatives and renewable energy should have a priority, this should not be at the expense of "turning off the lights."

21. ADB will expand its operations in the industry sector by collaborating with industry associations, domestic banks, and specialized energy efficiency agencies and energy service companies. ADB will provide assistance in identifying energy efficiency options and preparing financial assistance and guarantees. To address commercial and residential energy needs, which account for 30% of total energy demand, ADB will assist DMCs in framing enabling legislation and efficiency standards requiring the manufacture and use of energy efficient equipment and goods, especially consumer goods. This may also include establishment of labeling authorities.

22. With the increased viability of new and renewable sources of energy due to technical advances and the option for off-grid community-based electricity supply, ADB will actively seek out and target renewable energy projects for financing. In order to increase the utilization of clean energy in DMCs, ADB will facilitate wider deployment of clean energy technologies via awareness raising, promotion of policy and regulatory incentives to encourage their use, and promotion of financing packages that share risks and lower costs. Considering the global interest in biofuels, ADB will support further studies to assess the costs and benefits of sustainable biofuels development, particularly food security, the net energy balance of crops, and environmental impacts, and, where the benefits indicate it is appropriate, will support their development.

23. Financial sustainability of energy efficiency and renewable energy projects improves with additional revenue from the Clean Development Mechanism (CDM), i.e., the sale of Certified

¹⁰ The Climate Investment Funds was initiated by the governments of Japan, the United Kingdom, and the United States to help DMCs transform toward low carbon and climate resilient economies.

Emission Reductions. The ADB Carbon Market Initiative provides up-front financing and continuous technical support to developers and sponsors of projects with greenhouse gas mitigation benefits that can qualify as eligible CDM projects under the Kyoto Protocol. ADB will continue to provide assistance to DMCs in designing projects which are eligible for Certified Emission Reductions.

24. ADB will promote the expansion of suitable policies that encourage the development of renewable energy. The objective is to create a framework that makes investing in renewable energy a commercially viable proposition. In addition, ADB will assume greater—but thoroughly assessed—risks and act as a catalyst for investments that the private sector might not otherwise be willing to make. ADB will help facilitate direct private sector investments that support inclusive growth and improve the environment.

25. Given the enormity of the challenges of energy security and climate change, ADB has strengthened its institutional commitment and launched a strategic approach with the Clean Energy and Environment Program. This program includes several initiatives to help DMCs increase their utilization of renewable energy and energy efficiency technologies. As the region's partner in development, ADB can play a catalytic role in advancing the clean energy agenda in the region. ADB's target for increase of its clean energy program to \$1 billion a year starting from 2008 has been achieved in 2008 and has established a platform for an increase of the target to \$2 billion per year from 2013. While this is only a fraction of the region's needs, this contribution will catalyze significant additional resources from other sources.

B. Maximizing Access to Energy for All

26. In accordance with the proposed policy update and Strategy 2020's inclusive growth development agenda, the policy implementation will actively engage with DMCs and other bilateral and multilateral development partners in addressing the lack of access to energy. ADB will support DMCs' sustainable rural electrification efforts designed to provide electricity to the rural population.

27. ADB will place special focus on remote communities that are less likely to be connected to the electricity grid in the near future. ADB will develop small-scale demonstration projects which can be replicated in other locations, such as remote mountain villages or island communities. Such projects will be packaged into larger bankable-size projects, and if feasible, will be added to main energy sector projects as a special energy access component.

28. Regional cooperation can play a critical role in ensuring energy security in a sustainable manner. Subregional power trade can help meet energy demand while maximizing scarce natural resources. By utilizing different peak times of neighboring countries, regional power trade can reduce the need for building new power generation plants in each country. As demonstrated in the Greater Mekong Subregion, ADB can play a pivotal role in promoting effective regional cooperation in the energy sector.

29. ADB will continue to identify and implement regional projects and programs that promote regional energy trade with economic and environmental benefits for the entire region. ADB will promote an enabling policy framework for regional trade of electricity and gas, as well as infrastructure to enhance regional cooperation and trade in the energy sector. ADB will also focus on removing barriers to increased cooperation and trade in the energy sector, seeking ways to address regulatory, currency, and trading risks, as well as political uncertainty.

30. ADB will engage with DMCs to address their electricity demand needs in a sustainable and planned manner. ADB will encourage the utilities to incorporate into their energy planning process the key elements of integrated resource planning.¹¹ When sectorwide interventions are planned for DMCs, ADB will help develop energy sector road maps which have substantial electricity sector investments and which accordingly identify project pipelines with adequate flexibility.

31. ADB will also selectively support large hydroelectric power plants requiring seasonal storage reservoirs with multipurpose benefits. However, such financing will be based on enhanced economic benefits and in compliance with ADB's social and environmental safeguards requirements. Such projects may be for domestic or regional benefits.

32. To meet the electricity needs of the region, large capacity additions will be required for which coal-based generation will grow. ADB will encourage DMCs to adopt available cleaner technologies, such as fluidized bed combustion, supercritical and ultra-supercritical boilers, and flue gas desulfurization. As new technologies—like integrated gasification combined cycle and carbon capture and storage (or sequestration)—are shown to be technically feasible and economically viable, ADB will support the deployment of such technologies in DMCs in order to increase their financial viability. ADB will also assist DMCs in collaborating with developed countries on long-term technology transfer agreements for new and better technologies under development. It will selectively support coal-based power projects if cleaner technologies are adopted and adequate mitigation equipment and measures are incorporated into the project design. Some DMCs with smaller size grids that are dependent on oil-based power supply or imports from neighboring countries may need to install coal-based power plants using subcritical boiler technology. Such diversification will improve power system reliability and energy security, and may even be the least-cost option. In the interest of economical and developmental needs, such base-load power plants, if found justified after due diligence, will be supported. Assistance will also be extended to retrofitting existing power plants needing efficiency improvements.

33. ADB will continue to support financing of natural gas-based power plants because of their environmental benefit.

34. Although ADB will encourage adoption of renewable energy sources for power generation, oil-based power plants will continue to be a major component of the electricity grids in some island economies. Hence, ADB will continue to finance modern, small, oil-based power plants for island economies where other options are not feasible.

35. Huge capacity addition in power generation will require substantial investments in transmission and distribution facilities. ADB will continue to support installation of modern transmission and distribution systems to efficiently transmit electricity from generation facilities to consumers, including upgrading of existing systems to reduce technical losses and enable competition when open access is permitted by law.

36. Many DMCs need to extend their heating systems, in addition to retrofitting existing obsolete systems. ADB will assist DMCs to identify and install modern and energy efficient technologies such as combined heat and power systems. Where viable, the use of renewable

¹¹ Integrated resource planning is a least-cost planning process which (i) treats supply addition options and demand-side management options on the same footing, and (ii) incorporates and internalizes environmental costs and benefits more fully than in conventional least-cost analyses.

energy (e.g., solar and geothermal heat pump) will be encouraged to complement existing district heating systems.

37. As oil and gas are internationally traded commodities with established private sector interest in their development, ADB will continue its policy not to finance exploratory projects. However, ADB will continue to provide assistance in oil and gas field development, refining, transportation, and distribution of petroleum products. Distribution projects will include setting up compressed natural gas networks for transportation, and gas for domestic use such as cooking and heating. ADB will promote a policy environment that encourages private sector participation, greater competition, and independent and transparent regulation. ADB will also assist DMCs in preparation and management of databases on hydrocarbon resources; skills enhancement; and financial management.

38. Since coal is a major source of energy for electricity and heat, several DMCs will aggressively pursue coal mine development. Again, as coal is an internationally traded commodity, ADB will maintain its current policy not to directly finance coal mine development except for substantial use by thermal power plants. However, ADB will actively support (i) safety in coal mines, (ii) environmentally and socially sound mining practices and efficient use of coal for power generation, (iii) carbon capture and storage (or sequestration) once technologically viable, (iv) coalbed methane extraction and use, (v) coal gasification, (vi) coal scrubber, (vii) waste coal utilization, and (viii) efficient coal transportation over land and sea. ADB will also support safety and efficiency improvements in oil and LNG transportation, including oil and LNG terminals, storage facilities, pipelines, and marine transportation.

C. Promoting Energy Sector Reforms, Capacity Building, and Governance

39. ADB will align its energy operation on reforms, capacity building, and governance by continuing to assist DMCs in the restructuring and reform of the energy sector through technical assistance and project support for regulating natural monopolies and introducing competition where feasible. It will build on the lessons of past sector reform experience. Reforms take a long time, and ADB's continued association is needed to ensure that all sections of society, especially consumers, are benefited. Private sector participation will be encouraged, and in particular, public-private partnerships. However, privatization will not be the target or the end objective of ADB's sector reform activities; instead, it will be one of the options available to enhance energy sector efficiency and increase investable resources. Sector reforms, including either privatization or corporatization, will be designed and sequenced carefully on a country by country basis in a transparent manner.

40. In addition to adopting reforms and restructuring, ADB will assist DMCs that are establishing competitive electricity markets for the benefit of consumers. These markets need a certain level of sector maturity before they can be successfully launched. ADB will provide support for research, legislation, technology development, and regulatory frameworks.

41. ADB will encourage DMCs to adopt tariff structures that promote energy conservation and penalize peak hour and peak season consumption, and consumption with poor power factor and load factor. Cross-subsidies from one class of consumers to another should be minimized; life-line rates to consumers with very low monthly consumption could be an acceptable compromise. Subsidies, if any, should be made transparent, quantifiable, targeted, and capable of being phased out in the medium term. ADB will similarly assist in the establishment of independent regulatory mechanisms to address transparency in the management of the heating sector, including tariff setting and targeted or direct subsidies.

42. Capacity development is an important element of effectively promoting sector reforms and governance. Human resource development is a long-term investment in the effectiveness of the energy sector. In this context, ADB will provide technical assistance support to not only regulators but also utilities in bringing into operation the regulatory authority, tariff and subsidy analysis, licensing procedures, demand analysis, and all other activities needed for regulators to perform effectively. In addition, ADB will provide technical assistance on capacity development relevant to whole areas of energy operations, such as energy planning, demand forecast, financial management, operations and maintenance of assets, and economic assessment.

43. As part of the Clean Energy and Environment Program, ADB is promoting wider knowledge production and sharing through regional knowledge hubs. These hubs are positioned to become a strong support to strengthen the Asia and Pacific region's capacity to generate innovative concepts, and science, technology, and management development related to clean energy.

44. ADB will assist DMCs to prepare and implement energy projects with due emphasis on accountability, participation, predictability, and transparency—the basic elements of good governance. ADB will promote greater transparency in procurement and improved corporate and financial management. ADB will support the appropriate division of regulatory responsibilities amongst policy, regulatory, and operational roles within the particular national context, and across different levels of government. Wherever possible, ADB will promote regulatory cooperation and skills development. ADB will prioritize regulation of natural monopolies segments and increasing competition in other segments of the energy sector. ADB will support reforms that improve the governance and efficiency of public enterprises operating in the energy sector, and where appropriate within the national context, increase competition and efficiency. If requested by a DMC, ADB will support privatization of public sector enterprises and assist in the transparent transition of such enterprises from government to private sector ownership.

D. Implementation Arrangements

45. The Regional and Sustainable Development Department (RSDD) will support ADB's operations departments in policy implementation, and the Energy Committee will play a technical oversight role with RSDD's secretariat support.

46. ADB will assist DMC governments in developing an implementation plan for its energy sector and regional cooperation strategy based on policy dialogue. This may be in conjunction with the development of the country partnership strategy and regional cooperation strategy and program, or in a separate planning process, whichever is most appropriate to the individual country context and subregional context.

47. A monitoring framework that includes a set of simple and implementable indicators for ADB to monitor the progress of the policy implementation is included in Appendix 2. The framework identifies broad outcomes to be achieved and the proposed contribution of ADB to the realization of those outcomes. However, since each country will decide its strategy and policy options in a given country context, it is very difficult to develop indicators for the overall ADB policy implementation in the energy sector. The indicators for each pillar in the framework will be monitored during preparation of biennial energy sector reports and continuously fine-tuned in consultation with concerned departments.

48. The policy implementation requires adequate human and financial resources to support its implementation. Proper skills mix and technical capacity must be further enhanced in areas of

energy efficiency and renewable energy development in close consultation with the Energy Community of Practice and the Budget, Personnel, and Management Systems Department. Further, when the number of energy projects rise, an increase in staff positions with energy sector specialization will be required. Financial resources will be required to implement the policy, including preparation of country energy sector road maps. These requirements would be met by reprioritization of available budget funds, trust funds under the Energy Efficiency Initiative, the Clean Energy Financing Partnership Facility, and technical assistance sources.

V. REQUEST FOR BOARD GUIDANCE

49. The Board's guidance is sought on the review and update of the 1995 Energy Policy, as described in paras. 13–15 above.

POLICY ANALYSIS

1. The proposed changes to ADB's 1995 Energy Policy and the decision to realign the policy implementation are based on an overview of the changes affecting Asia and the Pacific, with a focus on energy-related developments and strategic concerns. They are supported by reviews of ADB's past experience in the energy sector and the relevant experience of other multilateral development banks (MDBs). A detailed assessment of key policy issues was also conducted, taking into account the 1995 energy policy, its 2000 review, the findings of this review, and priorities established in Strategy 2020.¹

A. The Energy Sector: An Overview

2. The demand for energy in the Asia and Pacific region is increasing rapidly due to unprecedented economic growth. According to the International Energy Agency (IEA), primary energy demand in developing Asia is expected to grow from 3.2 billion tons of oil equivalent (btoe) in 2006 to 6.3 btoe in 2030. This growth is not sustainable if most of this energy has to be met by fossil fuels. Increased fossil fuel consumption will significantly increase greenhouse gas emissions.

3. It is widely known that global warming is caused by increased greenhouse gas emissions largely from the excessive use of fossil fuels. Significant changes in climate are being observed, some of which have serious consequences worldwide. With better understanding of this phenomenon, many economies have adopted policies to reduce the projected energy demand. However, much more needs to be done to reverse the current trend of increasing greenhouse gas emissions.

4. The volatility of international oil prices places an extra and disproportionate burden on developing countries. Oil supply and price instability have led to increased focus on energy security, reduced oil consumption and subsidies, and greater use of indigenous sources of energy. For these measures to be successful, a comprehensive and coordinated approach is necessary. This encompasses policy decisions, legal and regulatory frameworks, energy conservation and efficiency, optimum use of fossil fuels, increase in the use of renewable energy, and market orientation towards sustainable development.

5. For the Asia and Pacific region there are other compelling issues that also merit attention: increasing energy demand, and the challenge of providing access to modern forms of energy to all. At present, about 1 billion people in the region do not have such access.

6. The Asian Development Bank (ADB) has been involved in the energy sector of its developing member countries (DMCs) since 1969. ADB's first energy policy,² issued in 1981, focused on overcoming the crisis caused by the oil price shocks, and placed considerable emphasis on (i) developing energy infrastructure and indigenous energy sources, (ii) promoting efficiency, and (iii) creating markets conducive to foreign investment in DMCs.

7. The second energy policy paper,³ released in 1995, noted that, with increased investments, the power sectors of the DMCs were becoming unmanageable and inefficient,

¹ Asian Development Bank (ADB). 2008. *Strategy 2020: The Long-Term Strategic Framework of the Asian Development Bank 2008–2020*. Manila.

² ADB. 1981. *Role of the Bank in the Energy Sector in the Region, Working Paper No. 2*. Manila.

³ ADB. 1995. *Bank Policy for the Energy Sector*. Manila.

mainly due to the dual role of the government as both policy maker and monopoly owner. This second policy paper recognized the changing needs of the sector and recommended balanced infrastructure investment and development of financially robust and efficient operations. It suggested full recovery of costs, reduction of subsidies, establishment of independent regulatory mechanisms, and tariff fixation based on transparent tariff principles. The paper further recommended corporatization and commercialization of government-owned utilities, private sector participation, development of regional trade in energy. Other recommendations included enhanced focus on demand-side management, environmental protection, rural electrification, and renewable energy development.

8. The energy policy was reviewed in 2000.⁴ This review confirmed that the existing framework was appropriate and sound. However, taking into consideration ADB's revised operational priorities and the changing needs of the DMCs, the review recommended the development of independently regulated and corporatized energy markets which would lead to more efficient uses of energy, lower costs, and increased private investments. The recommendations encouraged more emphasis on (i) reducing poverty by creating energy infrastructure for sustainable economic growth and increasing access to energy for the poor, particularly in rural areas; (ii) increasing private involvement by restructuring the energy sector and creating an enabling environment for private investors; (iii) addressing regional and global environmental impacts, especially acid-rain problems, supporting clean energy and the Kyoto Protocol⁵ mechanisms for greenhouse gas abatement, and financing renewable energy projects; and (iv) promoting regional cooperation. Within the framework of these basic principles, the 2000 review supported a wide range of initiatives such as power sector restructuring, private sector participation, social development, subsidy rationalization, sector governance, information technology, environmental protection, energy efficiency, and capacity building. The 2000 review further called for a reassessment after 5 years.

9. ADB's energy sector operations have also been evaluated by the Operations Evaluation Department (OED) as appropriate, timely, and generally successful (paras. 29 and 30). The results of the evaluation suggested that ADB's support for the energy sector should be driven by two key policy considerations (i) energy efficiency; and (ii) good governance.

B. Energy Demand Outlook

10. The world's primary energy demand⁶ is projected to increase by 45% from 2006 to 2030, an annual average growth of about 1.6%. In 2030, the total energy demand will be 17.0 btoe, based on a scenario that assumes no further government policies are introduced beyond those adopted by mid-2008. This scenario, prepared by the IEA and referred to as the reference scenario, suggests that about 87% of the increase in world energy use will come from non-OECD countries, where economic and population growth rates will continue to be significant. Fossil fuels will account for more than 79% of the projected increase in primary energy demand, with oil remaining the major component of the primary energy mix. While natural gas demand

⁴ ADB. 2000. *Energy 2000: Review of Energy Policy*. Manila.

⁵ The United Nations Framework Convention on Climate Change (UNFCCC) established in the Conference of Parties (COP) as its supreme body with the responsibility to oversee the progress toward the aim of the Convention. At the first session of the COP in Berlin, Germany, it was decided that post-2000 commitments would only be set for annex I parties. During the third COP in Kyoto, Japan, a legally binding set of obligations for 38 industrialized countries and 11 countries in Central and Eastern Europe was created to return their emission of greenhouse gases to an average of approximately 5.2% below their 1990 levels over the commitment period 2008–2012. This is called the Kyoto Protocol to the Convention.

⁶ International Energy Agency (IEA). 2008. *World Energy Outlook 2008*. Paris.

will grow (mainly due to increased preference for gas-based electricity generation), coal will continue to be the predominant fuel source for electricity generation. The share of nuclear power (5.3%) and hydropower (2.4%) will remain generally constant. The share of biomass-based energy consumption is expected to actually reduce due to increased use of modern fuels in rural regions of developing countries. The share of other renewable sources, excluding large hydropower and biomass, will be about 2.1% of the global primary energy demand (Table 1).

Table 1: World Primary Energy Demand in the Reference Scenario
(million tons of oil equivalent)

Item	1980	2000	2006	2015	2030	2030 share (%)	2006–2030 (%) ^a
Coal	1,788	2,295	3,053	4,023	4,908	28.8	2.0
Oil	3,107	3,649	4,029	4,525	5,109	30.0	1.0
Gas	1,235	2,088	2,407	2,903	3,670	21.6	1.8
Nuclear	186	675	728	817	901	5.3	0.9
Hydropower	148	226	261	321	414	2.4	1.9
Biomass and waste	748	1,045	1,186	1,375	1,662	9.8	1.4
Other renewables	12	55	66	158	350	2.1	7.2
Total	7,223	10,034	11,730	14,121	17,014	100	1.6

^a Average annual growth rate.

Source: International Energy Agency. 2008. *World Energy Outlook 2008*. Paris.

11. The world's energy resources are adequate to meet the projected growth in energy demand as indicated in the reference scenario, but these sources are not evenly distributed geographically. To meet growing energy demand, investments of over \$26.3 trillion (in 2007 dollars) will be required worldwide, and greenhouse gas emissions are projected to increase.⁷ Clearly, these demand projections have unsustainable environmental implications. To assess the implications for the energy sector of efforts to put the world onto a different greenhouse gases trajectory in the atmosphere, the IEA developed two stabilization output of greenhouse gases scenarios of 550 or 450 ppm CO₂-eq in 2030, namely the 550 policy scenario and 450 policy scenario.

12. In the 550 policy scenario, global energy-related CO₂ emissions peak in 2025 and then decline slightly to 33 gigatonnes in 2030 and this is 19% lower in 2030 than in the reference scenario. The total energy demand in 2030 is 9% lower than in the reference scenario. The role of renewable energy, mainly wind, rises, while demand for coal falls 27% and that of both gas and oil declines by 8%. In the 450 policy scenario, emissions fall sharply after 2020, as a result of much stronger and broader policy action. The total energy demand in 2030 is 16% lower in 2030 than in the reference scenario. Hydropower, biomass and other renewables see faster deployment in power generation, accounting for 40% of total electricity generation worldwide in 2030. Global energy related CO₂ emissions peak in 2020 at 32.5 gigatonnes and then decline to 25.7 gigatonnes in 2030.(Table 2). While the 550 policy scenario could be achieved through the widespread deployment of existing carbon-efficient technologies, further technological progress will greatly facilitate, and lower the costs of, meeting it. The 450 policy scenario can only be achieved through stepped-up research, development and subsequent demonstration and deployment technologies. The 550 policy scenario requires additional investment of \$1.2 trillion on power plants and \$3 trillion in energy efficiency relative to the reference scenario. The

⁷ Energy-related carbon dioxide (CO₂) emissions are estimated to be 45% higher in 2030 than in 2006.

450 policy scenario requires further power plant investments of \$2.4 trillion in addition to those in the 550 policy scenario.

Table 2: World Primary Energy Demand in 2030 Under Different Climate Policy Scenarios
(million tons of oil equivalent)

Item	Reference Scenario	550 Policy Scenario	450 Policy Scenario
Coal	4,908	3,575	2,381
Oil	5,109	4,689	4,308
Gas	3,670	3,383	2,950
Nuclear	901	1,086	1,364
Hydropower	414	456	555
Biomass and waste	1,662	1,826	2,119
Other renewables	350	468	683
Total	17,014	15,483	14,361

Source: International Energy Agency. 2008. *World Energy Outlook 2008*. Paris.

13. In developing Asia,⁸ the projected primary energy demand is expected to grow from 3,227 mtoe in 2006 to 6,325 mtoe by 2030, with the PRC and India accounting for a major share. Much of the increase in energy demand will be due to projected high economic and population growth. Industrialization, urbanization, and the replacement of noncommercial biomass fuels by commercial fuels will also contribute to the increase in demand. Other factors will be increased economic activities, improved living standards, and increased consumption by households. A review of the demand trends in developing Asia according to fuel types shows that coal will continue to dominate, with a share of 51% in 2030 (compared with 49% in 2006), followed by oil at 24% (23% in 2006), biomass and waste at 10% (17% in 2006), and natural gas at 9% (7% in 2006). Oil demand is dominated by the PRC, where the demand will rise to 16.6 million barrels per day (mb/d) in 2030 compared to the total Asian oil demand of about 30.8 mb/d in 2030. Electricity demand is expected to grow the fastest in India (5.7% per year) during the period 2006–2030, followed by the PRC (4.6% per year). Hydropower output is projected to increase in developing Asia, as most of the potential is yet to be exploited. Of the \$26.3 trillion investments required worldwide for the energy sector, developing Asia will account for more than \$7.4 trillion; the PRC alone will need about \$4.2 trillion in investments.

C. Energy Security

14. Recent volatility in the energy market, especially the oil market, has encouraged oil importing countries to address the need for a comprehensive approach to energy security concerns, including short-term risks to economic growth. Many economies in the Asia and Pacific region are experiencing high economic growth, which results in increased energy consumption. Oil supply is heavily dependent on the politically volatile Middle East. Since energy independence is not likely, there is a need to explore long-term cooperative options at the international level to ensure production and use of energy within reasonable costs and in a sustainable manner. Extensive use of fossil fuels generates large volumes of greenhouse gases.

⁸ Developing Asia, as defined by the IEA, includes Afghanistan; Bangladesh; Bhutan; Brunei Darussalam; Cambodia; the People's Republic of China; Fiji Islands; French Polynesia; India; Indonesia; Kiribati; Democratic People's Republic of Korea; the Lao People's Democratic Republic; Malaysia; Maldives; Mongolia; Myanmar; Nepal; New Caledonia; Pakistan; Papua New Guinea; the Philippines; Samoa; Singapore; Solomon Islands; Sri Lanka; Thailand; Tonga; Taipei, China; Viet Nam; and Vanuatu.

Recent studies⁹ suggest that to address energy security, energy consumption is reduced by aggressively pursuing efficient energy use. This can be achieved to varying degrees by (i) improved vehicle efficiency, (ii) better urban planning, (iii) increased use of new and renewable energy sources, (iv) use of alternate fuels, and (v) greater emphasis on demand-side management. Another approach is diversifying the energy portfolio and enhancing regional cooperation, including facilitating international trade, and cross-border investments. Managing market volatility is a challenge; maintaining reserve stock is an option but it is useful for only a limited duration. The issues in addressing energy security are numerous, and hence there is a need for an appropriate macroeconomic policy framework that focuses on comprehensive plans to mitigate energy supply risks. Nuclear power is also set to stage a comeback, especially in the Organisation for Economic Co-operation and Development (OECD) countries and ADB's larger DMCs.

D. Climate Change

15. There is now general recognition that the threat of climate change is real and increasing. The continuing and accelerating emissions of greenhouse gases, and their close link to average global temperature, are likely to result in significant changes in mean climate and its seasonal and annual variability, both globally and in Asia. Greenhouse gas emissions are, for the most part, the product of human activities, primarily from the burning of fossil fuels and, to a relatively smaller extent, from the changes in land use (especially deforestation). The equilibrium that existed for several centuries between various sources of greenhouse gas emissions and CO₂ sinks has been considerably disturbed because of industrialization, urbanization, and the fourfold increase in world population in the 20th century. Climate change models predict that land regions of Asia will experience an annual mean warming of about 3° Celsius (C) in the decade of the 2050s and up to 5°C in the decade of the 2080s as a result of future increases in greenhouse gas concentrations.¹⁰

16. The impacts of rapid climate change are expected to be profound in the Asia and Pacific region. From the Himalayan highlands to the rich tropical forests of Southeast Asia, and in the Pacific islands, many natural ecosystems are vulnerable to climate change and some will probably be irreversibly damaged. The poorest people within the large populations of both sub-Saharan Africa and South Asia are most vulnerable to the effects of climate change.¹¹ Scientists have observed abnormal weather patterns and impacts recently, including (i) more intense tropical storms, (ii) more severe and more frequent droughts and floods, (iii) accelerated melting of glaciers and rises in sea level, (iv) higher frequency of forest fires, (v) shortages of fresh water, (vi) threatened crop production and aquaculture, (vii) higher incidence of heat-related and infectious diseases, and (viii) greater risk of loss of life and property. Global economic damage from the negative impacts of climate change is projected by the insurance industry to be hundreds of billions of dollars each year. The Intergovernmental Panel on Climate Change estimates that if atmospheric CO₂ concentrations were to double from pre-industrial levels, the average global warming is likely to increase in the range of 2–4.5°C; “while the developing countries are expected to experience larger percentage losses, global mean losses could be 1–5% of the gross domestic product (GDP) for 4°C of warming.”¹² These changes would severely

⁹ World Bank. 2005. *Energy Security Issues*. Washington, D.C.

¹⁰ Intergovernmental Panel on Climate Change (IPCC). 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group I Report—the Physical Science Basis*. UK: Cambridge University Press.

¹¹ Stern, Nicholas. 2006. *Stern Review: The Economics of Climate Change*. London: Treasury Office of the Government of the United Kingdom and Northern Ireland.

¹² Intergovernmental Panel on Climate Change (IPCC). 2007. *IPCC Fourth Assessment Report: Summary for Policymakers of Working Group II Report—Impacts, Adaptation, and Vulnerability*. UK: Cambridge University Press.

hinder long-term global and regional efforts to create a more healthy, prosperous, and sustainable world.

17. The international community has been calling for drastic measures to significantly reduce and stabilize the concentration of greenhouse gas levels in the atmosphere. Some of the options identified are to (i) take global measures to transform the way energy is used, (ii) promote research and development, (iii) finance the transition to cleaner energy, (iv) manage the impact of climate change, and (v) tackle illegal logging. The present predicament is not due to recent developments but to the continuous unsustainable use of energy over many decades. With significant economic growth of the emerging economies, energy use will continue to increase briskly unless significant mitigation measures are taken. There is a need for collective global action.

18. The first step towards stabilizing atmospheric GHG concentration is to promote energy conservation and efficiency; options are numerous. In 2005, oil accounted for about 39% of global carbon emissions, coal accounted for 41%, and natural gas accounted for the remaining 20% (footnote 6). Most of the oil consumption was for transportation; hence, efficiency in transportation is clearly a priority area. Manufacture and use of more efficient vehicles, sustainable biofuel development, and improved urban planning can mitigate the production of greenhouse gases to a large extent. Improved efficiency in coal-fired electricity generation and opting for cleaner fuel sources will reduce carbon emissions significantly. Residential and commercial buildings account for a significant component of electricity demand today. Efficient lighting, heating and cooling equipment, and other appliances will address energy efficiency and conservation to a large extent. Industrial energy use also needs to be made more efficient. Other options for stabilizing carbon levels include improving the efficiency of power systems (both on the supply and demand sides), using alternate sources of clean energy, developing nuclear power, and exploring long-term options like CO₂ capture and storage.

19. Many countries have announced policies to address climate change issues. Implementing these will be a challenge and substantial efforts will be needed from both the developed and developing world. All countries need to focus first on energy conservation and improving energy efficiency. There are many technologies for reducing carbon emissions, and research is continuing. These technologies have to be transferred to developing countries and be integrated with the markets for carbon emission reduction credits through energy efficiency and renewable energy projects. Developing economies, in their drive to meet increasing energy needs, need to avoid excess consumption, wastage, and unsustainable energy use. While planning capacity addition, due consideration needs to be given to energy efficient options. These activities will require supporting policy decisions, enabling legislation, and finance. Financing requirements, which are substantial, will have to come from internal sources, transfers through emissions trading, multilateral sources, and the private sector. Suitable transparent regulatory frameworks will attract more private investment in energy to supplement government efforts.

20. Mitigation measures, however, cannot prevent the climate changes that will occur in this century because of today's atmospheric concentration of greenhouse gases; adaptation is needed to reduce vulnerability to climate change. High population density and relatively low income levels will result in low adaptive capacity and high vulnerability. The less-developed countries and the poorest sections of society are likely to suffer the most from climate change. Early action is needed to develop adaptive capacity, starting with disseminating information, assessing adaptation needs, identifying priority investments, mainstreaming adaptation, organizing resources, and promoting regional partnerships.

E. Energy Access

21. Access to modern and reliable energy services is essential for sustainable human development, economic growth, improved quality of life, and better delivery of education and health services. Though access to energy was not identified as a Millennium Development Goal (MDG), studies¹³ have shown that MDG targets cannot be met without modern energy services. It is clear that access to energy is a critical element in reducing poverty. In the absence of energy services, the rural poor must resort to the use of traditional biomass sources—such as wood, charcoal, dung, and waste material—for cooking and heating. According to the IEA,¹⁴ about 2.5 billion people in 2004 in developing countries continue to rely on traditional biomass to meet their energy needs; the PRC (with 700 million people) and India (with 565 million people) account for a large percentage of this figure. Although efforts are being made to improve energy access, as these ongoing efforts will be offset by population growth it is estimated that the number of people without access to modern forms of energy will increase to 2.7 billion in 2030.

22. Extensive use of traditional biomass, especially in improperly ventilated rooms, can result in higher incidence of health-related problems, such as bronchial diseases, and reduced productivity. According to a World Health Organization study,¹⁵ every year almost 1.6 million people—the majority of whom are women and children—die due to the effects of such pollution. Further, the time and energy spent in collecting, storing, and using traditional fuels is a considerable drain on human productivity which could otherwise be spent on more economical or intellectual tasks. Access to modern fuels and electricity is essential for economic production and social development. Poor rural people most commonly graduate from biomass to coal and kerosene, but the use of these fuels is either unsustainable or unsafe. Modern fuel sources such as liquefied petroleum gas (LPG), natural gas, and electricity are better options. LPG is a preferred option, but inadequate distribution systems and high costs hinder its widespread use, especially in remote rural areas. Improved modern cooking stoves can be used efficiently with a variety of biomass sources, making them a viable option for rural areas. The other preferred option is electricity, which is indispensable for lighting, refrigeration, and running of motorized household appliances. Table 3 shows electricity access in various countries in Asia.¹⁶

¹³ Modi, V., S. McDade, D. Lallement, and J. Saghir. 2006. *Energy Services for the Millennium Development Goals*. New York: Emergency Sector Management Assistance Programme, United Nations Development Programme, UN Millennium Project, and World Bank.

¹⁴ IEA. 2006. *World Energy Outlook 2006*. Paris.

¹⁵ World Health Organization. 2006. *Fuel for Life: Household Energy and Health*. Geneva.

¹⁶ For Pacific DMCs, the electrification rate is assumed to be around 50%–60% and varies significantly among countries (e.g., Samoa 95%, Fiji Islands 60%, and Papua New Guinea 10%). In Central Asian economies, the electrification rate assumed is more than 95%.

Table 3: Electricity Access in Asia in 2005

Country	Electrification Access (%)	Population without Electricity (million)	Population with Electricity (million)
Afghanistan	7.0	27.0	2.0
Bangladesh	32.0	96.2	45.3
Bhutan	36.0	0.5	0.3
Brunei Darussalam	99.2	0.0	0.4
Cambodia	20.1	10.9	2.7
China, People's Republic of	99.4	8.5	1,302.1
India	55.5	487.2	607.6
Indonesia	54.0	101.2	111.8
Lao People's Democratic Republic	45.0	3.1	2.6
Malaysia	97.8	0.6	24.7
Maldives	100.0	0.0	0.3
Mongolia	64.1	1.0	1.8
Myanmar	11.3	45.1	5.7
Nepal	33.0	18.1	8.9
Pakistan	54.0	71.1	83.5
Philippines	80.5	16.2	66.8
Singapore	100.0	0.0	4.3
Sri Lanka	75.0	5.0	14.7
Taipei, China	99.2	0.2	22.9
Thailand	99.0	0.6	64.1
Viet Nam	84.2	13.2	70.3
Total	73.0	905.7	2,442.8

Note: Data for Bhutan, the Lao People's Democratic Republic, and Maldives are based on staff estimates.

Source: International Energy Agency. *World Energy Outlook 2006*. Paris.

23. Many DMCs have launched schemes to provide modern and sustainable energy services, including electricity, to all. Bangladesh, the PRC, India, the Philippines, and Sri Lanka are among the DMCs that have accelerated rates of new connections.¹⁷ Several technical options are available, such as grid extensions, mini grids, and off-grid systems based on renewable energy sources. It should be noted that electricity connections without quality supply, especially during peak periods, will not provide the desired benefits. Hence, such initiatives should be implemented in a comprehensive manner to ensure that the target population actually benefits from such schemes. The World Summit on Sustainable Development in the Johannesburg Plan of Implementation called for the international community to "take joint actions and improve efforts to work together at all levels to improve access to reliable and affordable energy services for sustainable development sufficient to facilitate the achievement of the MDGs."¹⁸ Multilateral institutions, bilateral agencies, financial institutions (especially those

¹⁷ World Bank. 2006. *An Investment Framework for Clean Energy and Development: A Progress Report*. Washington, D.C.

¹⁸ United Nations. 4 September 2002. *Plan of Implementation of the World Summit on Sustainable Development*. Johannesburg.

dealing with microfinance), and the private sector will have to provide substantial support to government efforts in this area.

F. Investment Outlook

24. According to IEA estimates (footnote 6), the global energy market will grow by 45% by 2030 (1.6% annual growth). This translates to a total investment of over \$26.3 trillion (in 2007 dollars) for energy supply infrastructure during the period 2007–2030, of which the power sector will account for \$13.6 trillion (52%) of total investment, the oil sector will account for \$6.3 trillion, the gas sector \$5.5 trillion, and the coal sector \$728 billion. With the rapid increase in energy demand, non-OECD countries will absorb over 65% of the global investment estimates; the PRC alone will need to invest \$4.2 trillion to meet its energy demand. The IEA estimated that, while the world's energy sources are sufficient to meet projected demand, mobilizing investment resources will be a challenge.

25. At a global level, financial resources are sufficient to finance this projected energy investment—energy investment needs are estimated at only 1% of the projected global gross GDP, while domestic savings is about 23% of global GDP.¹⁹ This ratio, however, varies among regions; the PRC, with a share of domestic savings of around 40%, will require an average annual energy investment of about 2.4% of GDP, while India, with domestic savings of 20%, will require annual average energy investments of about 2.2%. Even where domestic savings are larger than energy investment forecasts, the energy sector will have to compete with other priority sectors for financial resources, particularly in many developing countries where the domestic investment exceeds domestic savings as a percentage of GDP.

26. The shortfall between investment requirements and domestic savings allocated to the energy sector will need to be met by foreign investment. Foreign debt may be available on better terms, but overdependence on foreign capital without a commensurate increase in foreign earnings can have other macroeconomic impacts. Countries with a large external debt burden will have difficulty in sourcing additional financing. Further, foreign investment is influenced by the state of the host countries' financial markets and banking sectors; better developed, transparent, and regulated financial markets generally attract more investments. Innovative financing vehicles will need to be developed by multilateral and bilateral funding agencies to help meet the financing gap. Carbon funds and clean energy funds are some options available and these need to be pursued, especially for support of clean energy development. The Global Environmental Facility and other innovative funds support environmental and clean energy initiatives; these need to be increased with more grants from developed countries. Procedures should be streamlined to improve access to such funds.

G. ADB Experience

1. ADB's Energy Sector Operations

27. ADB's energy sector operations began in 1969 and generally reflected the development and needs of the power sector of the DMCs. Funding peaked in the early 1990s²⁰ but declined thereafter for a number of years (Table 4). Technical assistance support has continued to increase steadily over the past 15 years. From 1998, the focus was realigned to address power sector reforms and restructuring, and increased support for transmission systems enhancement.

¹⁹ IEA. 2003. *World Energy Investment Outlook*. Paris.

²⁰ A total of \$1,658 million, the highest amount for public sector loans for the energy sector, was approved in 1993.

One factor that contributed to this shift was the worsening financial situation of the power utilities, most of which were vertically integrated with government playing the dual role of policy maker and monopoly owner. Further, due to the economic slowdown, demand for new capacity had declined. Meanwhile, DMCs were increasingly able to implement new generation capacity through the private and public sectors, and this has provided an opportunity for ADB to increase its focus on (i) sector reforms, (ii) restructuring, (iii) independent regulatory mechanisms with licensing and tariff-fixing authority, (iv) commercialization, (v) creation of enabling energy markets for the private sector and systems improvement, and (vi) loss reduction. These reform-related operations needed a thorough analysis of the existing situation and extensive stakeholder consultations, along with studies to provide guidance to ADB and DMCs on better options for energy sector development. Power sector reforms increased the private sector's interest, and the ADB Private Sector Operations Department successfully supported a number of generation projects.

Table 4: ADB Lending to the Power Sector (1990–2006)
(\$ million)

Sector	1990–1995	1996–2000	2001–2006
Public Sector	8,484	4,084	4,249
Generation	2,279	152	73
Sector development	2,450	1,496	2,134
Hydropower	896	512	48
Renewable energy	100	158	161
Transmission and distribution	2,758	1,766	1,833
Private Sector	179	123	809

Source: Asian Development Bank database.

28. ADB's oil and gas sector involvements started in the early 1990s with significant support for operations in the public sector. Thereafter, operations were sporadic with limited interventions due to increased focus on the power sector and its move towards market-oriented operations. However, since 2002, ADB has increased operations in the private power sector, especially in gas, by financing pipelines, storage facilities, and distribution systems. Nevertheless, the share of the oil and gas sectors in ADB operations remains low (Table 5). Recently, interest in these sectors has increased in some DMCs due to the rise in international prices and the need to explore indigenous sources. It is expected that ADB interventions will increase, especially in the gas sector.

Table 5: ADB Lending to the Oil and Gas Sectors (1990–2006)
(\$ million)

Sector	1990–1995	1996–2000	2001–2006
Public sector	1,617	150	78
Gas pipelines	1,617	50	5
Transport	–	–	73
Private sector			862
Gas pipelines	–	–	352
Liquefied natural gas	–	–	510

Source: Asian Development Bank database.

H. Evaluation of ADB Energy Operations

29. In its evaluation of the energy policy, the ADB Operations Evaluation Department (OED)²¹ observed that ADB has followed a dynamic path in developing its energy policies and operations, keeping pace with the development and needs of the sector in the changing economic and political environment. To a large extent, ADB's energy projects have addressed poverty reduction indirectly through increased economic opportunities and better facilities. ADB's focus on governance, sector reform, regional cooperation, private sector involvement, corporatization, and systems improvement were evaluated as relevant. ADB's projects and technical assistance designs were appropriate. Of the projects that were evaluated by OED, 98% were rated partly or fully satisfactory. Project design took into consideration the project management and technical skills of the executing agencies. Consultative approaches, analysis of baseline studies, comprehensive policy dialogue, establishment of clear plans, and tranche-based assistance resulted in effective implementation and overall sector improvement.

30. Overall the Energy Policy 2000 Review is rated "successful" based on OED's assessment of: relevant (bordering on highly relevant); effective; efficient; and highly likely to be sustainable. The study concluded that the energy policy was highly relevant and responsive to the changing needs in the energy sector of most DMCs. However, OED also found that analysis of alternatives in project identification and selection has been further improved.

31. ADB's energy policy has clearly influenced a number of major sector reforms, including those in Bangladesh, India, Indonesia, Pakistan, the Philippines, Sri Lanka, and Viet Nam. There has been a two-way flow of knowledge. ADB's inputs into policy reform determined the programs, and the ensuing discussions with member countries and other development partners—particularly the World Bank—led to an evolving consensus on power sector restructuring, which in turn contributed to ADB bringing its energy policy into the mainstream. The energy sector reforms have enjoyed varying degrees of success; the key variable in each country has been the level of internal support for the reform program. One common lesson that emerges from power sector reforms is that they take many years—in many cases, far longer than originally expected. Progress is sometimes slow and punctuated by setbacks.

32. Although some DMCs have graduated and do not need further ADB public sector support for energy projects, most DMCs will require continued ADB assistance. The OED report pointed out that sustainability of lending will depend on demonstrated positive impacts, capacity to meet clients' emerging needs, and development of relevant skills of ADB staff. Competition and a smaller lending base mean ADB must (i) develop client-driven products, (ii) take a more tailored approach to covenants and safeguards, (iii) adopt a long-term approach to developing appropriate responses to client needs, and (iv) assure staffing skills are appropriate to meet these needs.

33. In its conclusion, OED recommended that an updated energy strategy be designed to achieve the following outcomes: (i) efficiencies are enhanced across the energy chain to minimize investment in new generating capacity to meet the growing demand for energy; (ii) environmental externalities are reflected in decision making in the energy sector; (iii) pricing and resource allocation decisions take place under market forces with effective and credible regulatory oversight; (iv) energy subsidies are transparent and targeted; (v) policies rely on market-based incentives to promote efficiency and environmentally responsible behavior; and

²¹ ADB. 2007. *Energy Policy 2000 Review: Energy Efficiency for a Better Future*. Manila.

(vi) sector governance is improved to increase efficiency, create opportunities for private sector participation, and reduce opportunities for corruption.

34. OED also suggested that an implementation plan be developed that (i) reconciles the policy and strategic aspirations with organizational, budget, and human resources implications; and (ii) includes a results framework with monitorable key indicators (for inputs, outputs, and short- and long-term outcomes and results) so that implementation progress can be monitored and, if necessary, midterm corrections can be made.

I. Experience of Other Multilateral Development Banks

1. World Bank

35. Starting with its first loan in 1949, the World Bank's energy operations accounted for more than 20% of the World Bank Group's²² annual commitments. Its assistance includes instruments such as loans, credits, guarantees, technical assistance, advisory work, equity participation, syndication of commercial bank financing, investment funds, and political risk coverage. In addition, programs tailored for the energy sector delivered technical assistance supplementary to traditional instruments. These include the Energy Sector Management Assistance Program, the Global Environment Facility, the Asia Alternative Energy Group, the Clean Coal Initiative, the Regional Program on Traditional Energy Sector, and the Solar Development Corporation. Most of these programs had multilateral support and contributions. In the early 1990s, the World Bank reviewed its energy operations and developed its energy policy,²³ which set out guiding principles for the power sector that also apply to oil, gas, and coal operations: (i) client countries must take explicit steps to reform and restructure, (ii) regulatory process must be established, (iii) energy efficiency and private sector participation must be encouraged, (iv) highly polluting or poorly performing clients should be avoided, and (v) transfer of clean energy technologies should be encouraged. In addition, the World Bank focused on rural energy, sustainable transport, clean energy, and the environment.

36. The World Bank's analysis found that results have been mixed.²⁴ Regulatory agenda implementation, including tariff rationalization and phasing out of subsidies, has been slow. The slow pace of privatization also contributed to underachievement; however, projects focusing on curbing pollution showed better results. During the latter part of the 1990s, the World Bank's focus on renewable energy increased. Its attempts to stimulate private sector participation have yielded expected results through reforms, and development of clean technologies have contributed to improved environmental mitigation.

37. In 2006, the World Bank adopted a clean energy and development strategy²⁵ which outlined a two-track approach: developing an investment framework which complements ongoing activities, and developing and applying technologies to address climate change. The specific focus is on (i) energy for development and access for the poor with special attention to sub-Saharan Africa, (ii) transition to a low-carbon economy, and (iii) adaptation. Over the longer term, the World Bank proposes to undertake a climate risk-management approach.

²² The World Bank Group includes the International Bank for Reconstruction and Development and the International Development Association, and the affiliates International Finance Corporation, Multilateral Investment Guarantee Agency, and International Centre for Settlement of Investment Disputes.

²³ World Bank. 1993. *The World Bank's Role in the Electric Power Sector*. Washington, D.C.

²⁴ World Bank. 2000. *Fuel for Thought. An Environmental Strategy for the Energy Sector*. Washington, D.C.

²⁵ World Bank. 2006. *Clean Energy and Development: Towards an Investment Framework*. Washington, D.C.

2. European Bank for Reconstruction and Development

38. During the 2000–2005 period, the European Bank for Reconstruction and Development (EBRD) committed more than €4 billion to the energy sector.²⁶ Electric power generation (21%), oil and gas extraction (20%), and electric power transmission (17%) comprised a major portion of EBRD's lending. The EBRD also increased its financing for energy efficiency projects, while continuing to engage in policy dialogue to promote its strategic objectives—economic transition and environmentally sound and sustainable development. In general, reforms have advanced smoothly due to the establishment of the clean energy and transport regulatory framework. Similarly, private sector participation has increased. Accession to the European Union (EU) and the need to comply with requirements has facilitated reforms. Again, EBRD's results have been mixed, but progress is being made. There have been considerable gains in energy efficiency (a major focus of the EBRD) but much greater effort is needed to meet EU energy efficiency standards.

39. Countries outside the EU have progressed slowly. EBRD's reform implementation process in the Commonwealth of Independent States countries continues to be a challenge; regulatory independence is low and tariffs are not based on costs. Privatization within the Commonwealth of Independent States region has been extensive. Taking into consideration the development in the energy sector in Europe, the EU developed a revised strategy—the Energy Operations Policy 2006—to address (i) competitiveness and efficiency, (ii) increased investment, (iii) energy security, (iv) climate change, and (v) natural resource development. In line with the EU energy strategy, the EBRD has set a number of priorities: to promote energy efficiency, advance the reform agenda, promote renewable energy and carbon trading, exploit energy reserves in a sustainable way, promote energy trade, and enhance nuclear safety.

J. Issues and Options

40. The recommended update of the 1995 Energy Policy not only responds to the rapidly changing conditions affecting the sector but also reflects ADB's new policy directions, as laid out in Strategy 2020 (footnote 1). Strategy 2020 identifies energy as a key component of the infrastructure core area of operations, and this drives its three complementary strategic agendas of inclusive growth, environmentally sustainable growth, and regional integration. Accordingly, ADB needs to clearly delineate a policy to assisting DMCs to increase their focus on promoting clean energy and sustainable development. The Asia and Pacific region, like the rest of the world, is experiencing considerable environmental stress and needs to emphasize not just growth but environmentally sustainable growth. Strategy 2020 identifies the environment, including climate change, as one of the five core specializations to support ADB's development agenda. Accordingly, the energy policy update addresses environmental sustainability and the fact that Asia's current approach of increasing the supply of energy based on fossil fuels is unsustainable in its present format. Strategy 2020 emphasizes that ADB will focus on promoting energy efficiency and development of clean energy. Energy access is an essential input into meeting the MDGs and significant efforts are needed to address this. Strategy 2020 also focuses on addressing governance issues—a key component of energy sector development.

1. Energy Efficiency

41. The decision to prioritize and broaden efforts to support energy efficiency initiatives rests on a simple but important fact: harnessing energy efficiency is the most effective way of

²⁶ European Bank for Reconstruction and Development. 2006. *Energy Operations Policy*. London.

reducing growing energy demand, improving supply-side efficiency, and reducing carbon emissions and reliance on expensive hydrocarbon imports. Studies have shown that adoption of proper and effective energy efficiency measures can reduce energy demand by 20%.²⁷ Energy efficiency can be achieved in many ways, such as (i) energy discipline (switching off appliances when not required), (ii) manufacture and use of energy efficient equipment, (iii) reduction of systems losses, (iv) proper energy planning and management, (v) efficient transport planning, (vi) use of alternative and renewable fuels, and (vii) cogeneration. The scope is immense and requires both public and private sector support. With increasing oil prices and CO₂ emissions, and threats to the climate and energy security, energy efficiency assumes a larger role and should have a higher priority than other activities. Benefits from energy efficiency are long term, and can be exploited faster and at a lower cost. Energy efficiency contributes to reduced fossil fuel consumption, improves public health, and induces commercial savings.

42. Potential obstacles and constraints were also considered. To achieve these benefits, energy efficiency interventions must be developed in a comprehensive manner. Energy efficiency can be challenging because it involves a shift in consumers' attitudes and habits, requiring awareness building, policy support, and a combination of both compulsory and incentive measures. Energy efficient technologies may also be more expensive, raising affordability issues for DMCs. Any project's technical soundness and applicability of technologies to the specific countries and locations in which it is to be employed need to be carefully evaluated to ensure cost-effectiveness and maximum benefits.²⁸ Barriers to energy efficiency projects include (i) high up-front costs, (ii) high transaction and project preparation costs due to small project size, (iii) lack of appropriate financial instruments, (iv) continued regimes of low tariffs and subsidies, and (v) inadequate institutional capacities. Institutional barriers faced by MDBs such as ADB include lending products that are not conducive to small clean energy projects, long processing times for loans, and high transaction cost.

43. The fact that ADB has demonstrated initial success in the efficiency and clean energy field also supported the policy proposal. ADB has made significant progress in implementing the Clean Energy and Environment Program to assist DMCs in building energy efficient and low-carbon economies. A key Clean Energy and Environment Program component is the Energy Efficiency Initiative launched in 2005 to expand ADB's operations in clean energy to at least \$1 billion annually by 2008. In this regard, establishment of the Clean Energy Financing Partnership Facility was approved in April 2007 to (i) help deploy new cleaner technology in DMCs, (ii) provide a credit enhancement mechanism to finance a large number of clean energy and energy efficiency projects, and (iii) provide technical assistance to DMCs in the areas of clean energy and energy efficiency. Through effective implementation of the clean energy and environment program, ADB provided \$1.6 billion for clean energy projects in 2008, far exceeding the target of \$1 billion. To maintain ADB's commitment on promotion of clean energy projects, the new target was proposed to be at least \$2 billion annually by 2013. The Asia Pacific Carbon Fund, launched in November 2006, is another innovative financing facility under the Carbon Market Initiative. It provides up-front cofinancing, technical assistance, and carbon credit marketing support for projects with carbon emission reduction potential.

44. To address energy efficiency issues in the transport sector, ADB launched the Sustainable Transport Initiative in 2006. The initiative provides advice and financing for public transport innovations and cleaner technologies to reduce greenhouse gas emissions and other vehicular pollution. In terms of power, heat, and gas, greater attention to energy efficiency

²⁷ ADB. 2006. *Report of the Energy Efficiency Initiative*. Manila.

²⁸ ADB. 2006. *Clean Energy Applications in Asia and the Pacific*. Manila.

activities is needed. In addition to support for energy efficiency projects, labeling procedures for appliances and equipment are needed, along with development of minimum energy performance standards, facilitation of financing for energy efficiency projects through innovative and dedicated funds, and awareness raising. Support should be targeted and measurable to clearly assess the benefits achieved.

2. Renewable Energy

45. In 2004, renewable sources of energy accounted for 13% of the global total primary energy demand,²⁹ with combustible renewable sources³⁰ comprising a major share (10.4%). The renewable energy sources include biomass (combustible renewable and waste), hydropower, solar, wind, ocean, and geothermal energy (including geothermal heat pump systems). Biomass is currently the largest renewable energy source due to its extensive noncommercial use (mainly for cooking and heating) in developing countries. Biomass accounts for about 80% of the total renewable sources; it is followed by large hydropower, which comprises 17%. The share of other forms of renewable sources is minimal. In this paper, renewable sources of energy will include solar, wind, geothermal, hydropower, ocean sources, waste-to-energy, and biomass (other than the present noncommercial use).

46. Most DMCs import oil to meet energy needs. Due to increased oil prices, the foreign currency expenditure on energy imports has, in some cases, been at the expense of other essential imports. Since the bulk of oil production is concentrated in the conflict-prone Middle East, many countries need to enhance their energy security. This requires a number of measures, including efficient energy use and diversification of energy sources. Renewable energy can help diversify the sources of supply for energy demand, while providing energy that is clean, sustainable, and generates no or little greenhouse gases. In addition, renewable energy is an appropriate option for decentralized energy systems.

47. Development of renewable energy sources in rural areas can contribute to improved agricultural productivity, health, education, communications, small-business enterprise, and quality of life. The lack of access of about 1 billion people in the Asia and Pacific region to modern forms of energy may be addressed largely through cost-effective renewable sources, such as modern cooking systems using biomass and small electricity grids. Operational costs of renewable energy are low and, unlike those of fossil fuels, are not subject to fluctuating prices. Furthermore, grid extension is not required, which saves transmission costs. Thus, there is a need to frame suitable policies that encourage development of renewable energy, for which long-term support is needed. Some DMCs already have aggressive policies in place requiring a certain minimum share of renewable energy in the electricity grid within a fixed time frame. Implementation of these policies needs support.

48. Biofuels are attracting increasing interest worldwide for their potential in addressing energy security and climate change by substituting gasoline and diesel in the transport sector. DMCs also see biofuels as a way to stimulate rural development, create jobs, and save foreign exchange. However, there are issues related to development of biofuels. Due to rising demand for biofuels, farmers have an increased economic incentive to grow crops for biofuel production instead of for food production. This could lead to food security issues—reduced food production and increased food prices. Production of biofuels from raw materials requires energy input (for

²⁹ IEA. 2006. *Renewables Information*. Paris.

³⁰ Combustible renewables and waste include solid biomass and animal products, gas and liquid from biomass, and industrial and municipal waste.

farming, transport, and conversion to the final product, as well as the production of fertilizers, pesticides, and herbicides). The net energy balance between energy used to produce biofuels and energy outcome from biofuels for different types of crops is crucial. The net impact on greenhouse gas emissions of replacing conventional fuels with biofuels depends on various factors: (i) the type of crop, (ii) the amount and type of energy embedded in the fertilizer and other inputs used to grow the crop, (iii) the energy used in gathering and transporting the crop (iv) alternative land uses (especially the conversion of forests to biofuel production), and (v) the energy intensity of the conversion process. Also, major changes in the use of farm land could profoundly affect local and regional ecosystems, with both positive and negative implications for flora and fauna.

49. Renewable energy development has been hindered by its relatively high initial cost. However, with larger markets and economies of scale, renewable energy equipment prices have fallen recently and are almost cost competitive with fossil fuel technologies, especially when life cycle and environmental advantages and income from carbon credits are considered. In fact, many renewable energy technologies are, or in the near future likely to be, economical compared to some fossil fuels. If global concerns regarding CO₂ emissions trigger imposition of carbon taxes, then renewable energy will be more competitive.

50. While sources of renewable energy—such as wind, water, and sunlight—are abundant, there are technical and economic constraints to renewable energy, including the intermittent nature of power from renewable energy sources. Hydropower depends on water availability, and wind and solar power depend on climatic conditions. Renewable energy lacks the reliability needed for grid operations unless energy storage devices, such as fuel cells, are commercially available. Renewable sources from sun, wind, tide, and waves are currently not suitable to directly provide either base-load or peak-load power when needed. Energy storage is also a problem that discourages renewable energy use in stand-alone systems. Weather uncertainties require a backup redundancy; some believe 100% backup is necessary, but renewable energy proponents disagree. Solar power is suitable for heating purposes but its potential for electricity generation is limited due to interruptions associated with unfavorable weather and night time, resulting in a low capacity factor. Solar photovoltaic cells are more suitable provided battery storage facilities are built in. Wind turbine operation is restricted within a limited range of wind velocity, and requires alternate backup provisions to ensure power supply at times of unfavorable weather.

51. Research is under way to develop systems that can be adopted within the grid system without any additional redundancy so that the contribution of solar and wind power can be significantly increased. The involvement of the private sector is critical in the development of renewable energy because of the need for innovation and more efficient use of resources. In some DMCs, the private sector is already engaged in promoting renewable energy. Promotion of an enabling policy framework is needed to encourage private sector participation in renewable energy development.

3. Fossil Fuels

a. Oil

52. Oil consumption trends closely follow the growth of GDP. The IEA forecasts that primary oil demand will grow from 85 million barrels per day (mb/d) in 2007 to 106 mb/d in 2030, an annual average increase of 1.0%. Oil demand will continue to grow more quickly in non-OECD countries, with an annual average increase of 2.2%. The PRC's oil use is expected to rise by

3.5% per year from 2007 to 2030. The transport sector will account for more than half of the primary oil consumption, mainly due to increased demand for road transport fuels. Experts speculate that high oil prices since 2006 may be not sustainable in the long run and market fundamentals could drive prices down. However, oil prices tend to be volatile and certain factors (lower than required investments in supply infrastructure, strong demand pressures, production shortages, and geopolitical factors) could provide pressure to maintain high oil prices.

53. According to the IEA (footnote 14), a sustained high oil price will encourage consumers to reduce consumption, switch to other fuels, reduce waste, use fewer energy services, and use more energy efficient technologies. Since oil imports have a significant effect on the fiscal balance, it is critical to address this issue over a longer time frame. Some available options include the following: (i) conserve or reduce energy consumption, (ii) explore and invest in alternate and renewable fuel sources (including biofuels) and energy efficient technologies, (iii) promote effective transport planning, (iv) introduce fuel efficient engines for transport vehicles, and (v) possibly implement larger-vehicle taxes. Though most of the world's oil is concentrated in the Middle East, a number of DMCs have discovered oil within their geographical boundaries, which will help stem the foreign exchange outflow to some extent. A few DMCs with high demand growth are also aggressively exploring joint ventures outside the region for oil exploration.

54. Currently, ADB does not support any oil field exploration projects due to associated risks. As oil is an internationally traded commodity with established private sector involvement, ADB should not, in general, fund oil field development projects. If necessary, ADB may consider selective assistance to develop marginal and already proven oil fields subject to economic soundness. Recently, due to oil price fluctuations, a number of DMCs are actively exploring and developing domestic oil fields, with some success. Though the government and private sector are actively involved in oil prospecting, support for policy assistance is needed in management of oil resources, oil field development, refining, transportation, distribution, and support in developing tariff policy and accountability. There is also a need for active support for regional trade.

b. Natural Gas

55. Natural gas is the fossil fuel with the least emissions. Its consumption is expected to increase globally by 1.8% annually from 2006 to 2030, from 2.9 trillion cubic meters (tcm) to 4.4 tcm (footnote 6). Proven gas reserves in 2007 were 179 tcm, sufficient to meet the projected demand for around 60 years at current production. Investment requirements worldwide will be about \$5.5 trillion. While North America and Europe will be the largest market, the demand rate in developing Asia will be higher than the global average. The power sector will account for more than half the increase in global primary gas demand. Emerging technologies such as gas-to-liquid plants are expected to be a significant market for gas. Regional gas trade continues to operate with pipeline transportation as the most favored option. Nevertheless, trade in liquefied natural gas (LNG) is expected to increase, which may spur Asian economies to lease bulk carriers, set up LNG terminals, and develop associated facilities. The gas market outlook is also favorable because compressed natural gas may replace gasoline in motor vehicles and for heating purposes in order to mitigate environmental impacts. However, gas-based power plants may not be competitive if the current upward trend in gas prices continues. Significant funding will be needed for natural gas development, extraction, processing, storage, transportation and distribution networks, and regional trade. ADB will support safety and efficiency improvements in oil and gas transportation, and LNG terminals and carriers.

c. Coal

56. Coal will continue to be a major primary source of energy, with a share of about 29% in 2030 (footnote 6). Coal demand will increase primarily due to the increased energy needs of developing Asia, particularly the PRC and India, both of which have abundant reserves; power generation will account for about 80% of the world coal demand. Energy security concerns have led to an increased interest in coal due to its availability. Unlike oil and gas, proven reserves of coal are enormous and widely dispersed. It is also easy to transport and store and is not affected by weather changes. However, coal and its use have a number of serious environmental implications, including the highest CO₂ emission rates among fuels used to generate electricity. Though emission standards for other pollutants (such as sulfur dioxide, nitrogen dioxide, and particulates) are in place, inconsistency in application and enforcement are issues that require considerable capacity building. Coal mine safety will require greater attention with the need for increase in deep coal mining; investments in the extraction and use of coalbed methane and other combustible gases will make mines safer and reduce the emissions of highly potent greenhouse gases.

57. ADB is currently not directly financing coal mine development, except where it is for substantial use by thermal power plants and economically superior to other coal supply options. ADB support is currently restricted to promoting environmentally sound mining practices and clean scrubbers, policy assistance to enable restructuring of the coal mine industry. Measures to reduce pollutants (including waste coal utilization that has a low heat content), coal mine safety, coalbed methane extraction, and environmental safeguards in coal extraction have been pursued. As coal is abundantly available in Asia, coal mining will increase in DMCs due to energy security and cost. However, much larger associated environmental and social issues in coal mine development must be carefully addressed. Coal mining is associated with many negative impacts such as dust pollution, deforestation, and land degradation.³¹ Social impacts on the local population include involuntary resettlement, inappropriate disposal of excavated soil, and improper backfilling after mining activities are completed. ADB support could serve as a catalyst for encouraging and developing good practices, especially in terms of enforcing required environmental and social standards and adopting efficient technology.

4. Power Generation and District Heating

58. Large parts of the Asia and Pacific region suffer from electricity shortages. To meet the projected increase in electricity demand, DMCs are considering various options such as coal, natural gas, nuclear power, hydropower (large, small, and micro), and energy from renewable sources.

a. Coal-Based Power Plants

59. Many existing coal-based power plants have been operating for a number of years. They need retrofitting to improve efficiency, reliability, and operating life, and to become compliant with current higher environmental standards. Such retrofit projects will be cost-effective and will reduce emission of pollutants and improve efficiency.

60. Due to energy security concerns and availability of indigenous coal, coal-based power plants have been the option preferred by some DMCs. These power plants are a major source

³¹ Other negative impacts include gas emission, groundwater contamination, industrial and waste water, waste management, coal burning, noise, and other construction-related negative impacts.

of pollutants (e.g., oxides of nitrogen, sulfur, and carbon; heavy metals; and particulate matter). Therefore, capacity addition needs to include cleaner technologies that reduce emissions, such as fluidized bed combustion, supercritical and ultra-supercritical technologies, and flue gas desulfurization.

61. As and when new technologies—like pressurized fluidized bed combustion, integrated gasification combined cycle, and carbon capture and storage (or sequestration)—are commercially viable, power companies will readily adopt such technologies. Meanwhile, there is a need for ADB to proactively support the dissemination and deployment of new technologies in DMCs. To achieve this, developed and developing countries need to collaborate on long-term technology transfer agreements, if necessary with the active support of bilateral and multilateral donors.

b. Oil and Gas-Based Power Plants

62. Oil is a major source of power generation in most Pacific DMCs, some mainland DMCs like Cambodia and Sri Lanka, and for captive use by the industry sector. In these countries, oil imports form a large component of import expenditures, leaving the countries vulnerable to price fluctuations in the oil market. For example, Sri Lanka has the highest cost of electricity generation in all of South and Southeast Asia. Oil-based power generation continues to be a feasible solution for providing electricity in remote areas, island communities, and sparsely populated areas. Pacific DMCs need to reduce their dependence on imported oil by developing renewable sources of energy and other conventional base-load options, which will partly mitigate price considerations and pollution aspects. Industrial use of diesel sets for captive generation is mainly to secure energy supply, which can be addressed only when generation capacity is available to meet the demands of industry or through appropriate captive power policies.

63. The power sector will account for more than half the increase in the global primary gas demand. Gas-based power generation is expected to remain a preferred option in the long term due to its comparative benefits such as domestic availability of gas, easier transportation through pipelines from extraction sources (both within and outside the countries' boundaries), favorable installation costs, faster installation time, quick start facilities, multifuel operability, and its more environmentally friendly profile compared with coal-based power plants. Many DMCs plan to install gas-fired power plants for either their base load or peak load. However, as gas prices are also rising, it is expected that gas-fired power plants will face competition from coal-based power plants. Use of LNG for gas-fired power plants is an option for countries that do not have indigenous gas resources or in coastal regions, but insufficient infrastructure facilities will cause a bottleneck. ADB will continue to support financing of natural gas-based power plants because of their environmental benefit.

c. Hydropower Plants

64. Although world primary energy demand is projected to grow by more than 45% from 2006 to 2030, the share of hydropower in global electricity generation is predicted to drop from 16% to 14%. However, total hydropower output will still grow by 1.9% annually (from 3,035 terawatt-hours to 4,809 terawatt-hours). Only 31% of the economic potential of hydropower worldwide had been exploited by 2004. Since the best sites in OECD countries have been exploited, and with further increase constrained by environmental concerns, most of the increase in hydropower development will be in developing countries where there is substantial untapped hydroelectric potential. Within Asia, large hydropower development is

planned in India, the Lao People's Democratic Republic, Nepal, Pakistan, the PRC, Viet Nam, and some Central Asian DMCs, including the Kyrgyz Republic and Tajikistan.

65. Hydropower development has a number of benefits. It is renewable³² (although there are opinions that large hydropower should not be included in renewable initiatives³³), highly efficient, clean, substantially reliable, and flexible. It is an essential component for grid management and extremely useful for meeting peak-load demands. Hydropower saves consumption of scarce fossil fuels and dams can prevent floods and provide water for irrigation purposes. It comes in a variety of sizes—large, small, mini, and micro³⁴—and each has its own niche.

66. Large hydropower projects, especially those based on reservoirs as opposed to run-of-river, are complex and environmentally and socially sensitive. They have many impacts on the surrounding ecosystem,³⁵ and, according to scientific studies,³⁶ some large reservoirs produce significant amounts of greenhouse gases—like CO₂ and methane—due to the submergence of vegetation and forest land. This largely depends on the extent of plantation that is flooded due to the reservoirs and the size of the reservoirs. The projects' environmental impacts are interrelated with social impacts³⁷ and their combined effects can result in considerable attrition. Since inappropriate management of these issues can further exacerbate their impacts, implementation of large hydropower projects require (i) robust mitigation strategies, (ii) adequate disclosure and consultation with the affected people, (iii) enforcement of environmental safeguards including policy dialogue, and (iv) proper resettlement and economic rehabilitation of the affected people. The applicable environmental and social safeguards must be implemented and monitored in a sustainable manner. ADB has safeguard policies that govern all its projects, including hydropower projects. ADB's current policies and guidelines respect guidelines from the World Commission on Dams.³⁸

67. Hydropower projects are often located in the relatively higher reaches of watersheds to take advantage of the head difference within short distances. In such cases, high-head run-of-river hydropower plants are the preferred option, as these do not involve huge storage reservoirs. Ecological aspects need to be carefully addressed in these projects. Pumped storage plants are another variety of hydropower that have gained acceptance; these plants help to economically meet the high grid demand during peak periods.

d. Nuclear Power Plants

68. Due to the uncertainties linked with nuclear power development, future demand assessments vary. According to the IEA, the share of nuclear power in electricity will decline from 15% in 2006 to 10% by 2030 as nuclear power capacity does not increase as rapidly as demand for electricity. However, recent trends indicate that nuclear power will play an

³² IEA. January 2007. *Renewables in Global Energy Supply*. Paris.

³³ International Rivers Network. 2003. *Twelve Reasons to Exclude Large Hydro from Renewable Initiatives*. Berkeley.

³⁴ Small hydropower, for this paper, is defined as those with a generating capacity below 10 megawatts, mini hydro's capacity is below 1 megawatt, and micro hydro's capacity is below 100 kilowatts.

³⁵ Ecosystem impacts include fish migration blockage, terrestrial ecosystem loss, biodiversity loss (e.g., rare and endangered species), changes in downstream aquatic and riparian ecosystems, increased downstream estuary and shoreline erosion, decreased flood-dependent fisheries, reduced sediment inflow, and public health threats.

³⁶ World Commission on Dams. 2000. *Dams and Development: A New Framework for Decision Making*. Geneva.

³⁷ Social impacts include involuntary displacement, loss of livelihood and support systems, loss of traditional way of life, increase in health risks, low economic returns to the affected communities, displacement or loss of physical and cultural assets, reduced farm and domestic water supply, influx of migrants and population growth, and straining of local institutions and service providers.

³⁸ ADB. 2002. *ADB's Planned Responses to the World Commission on Dams*. Manila.

increasing role in the total energy mix in Asia. Several large countries in the region, including PRC and India have announced policies to accelerate nuclear power development for electricity generation. Nuclear power does not generate significant greenhouse gas emissions, and hence can contribute to reducing global warming. Nuclear power generation is suitable for large-scale base-load power plants which are the core of electricity grids. Since 1990, significant development has taken place in nuclear fission technology. Advanced designs seek improvements in three principal areas: cost reductions, safety enhancements (use of passive safety features), and proliferation resistance.³⁹ With the unstable oil and gas market and the global warming effects of fossil fuels, nuclear power is increasingly becoming an option gathering support in the OECD countries and some DMCs.

69. Significant technological advances, international supervision, and improved safety standards and waste management have resulted in increased interest in exploring nuclear power generation. Some countries aggressively pursued nuclear power as a measure of energy security, while many others opted to phase out existing facilities. Global warming concerns have renewed interest in nuclear power, as it is a low-carbon source of electricity. Some countries which had phasing-out policies are now reviewing the options. The factors that may influence a policy change are energy security, fuel supply security, stability of fuel prices, and climate change benefits. A few DMCs—such as India, Pakistan, the PRC, Thailand, and Viet Nam—are actively pursuing nuclear power.⁴⁰ Many member countries in the region—such as Japan, the Republic of Korea, and Taipei,China—have nuclear power development policies in place. Although the proportion of nuclear power worldwide is projected to decrease, nuclear power development in Asia is expected to grow.

70. Nevertheless, in spite of its sustainable and operational benefits, nuclear power development faces a number of barriers, such as public concerns related to nuclear proliferation, waste management, safety issues, high investment costs, long lead times, and commercial acceptability of new technologies. Overcoming these barriers is difficult and open public debate will be required to convince the public about the benefits of nuclear power. MDBs have traditionally avoided financing nuclear power plants. In the context of the former Soviet Union states, the EBRD's current energy policy (footnote 26) includes financing safety measures of nuclear plants, decommissioning and environmental rehabilitation, and promoting an efficient nuclear regulatory framework. In view of concerns related to nuclear technology, procurement limitations, proliferation risks, fuel availability, and environmental and safety concerns, ADB will maintain its current policy of non-involvement in the financing of nuclear power generation.

e. District Heating

71. DMCs in Central Asia, Mongolia, and the northern provinces of the PRC have high demand for space heating and hot water. Heating is needed by residential and institutional buildings, and this can be provided either through stand-alone systems or a centralized district heating system. District heating systems are potentially energy efficient and hence are a cost-effective way to meet the demand. Currently, large district heating systems that were installed 30–40 years ago continue to operate on obsolete and inefficient technologies. In some cases, more than 40% of the heat in the fuel is lost during generation, transmission, and end use.⁴¹ Exacerbating these inefficiencies is a lack of adequate policies and regulation. Since district

³⁹ IEA. 2006. *Nuclear Power and Sustainable Development*. Vienna.

⁴⁰ Armenia also has an operating nuclear power plant that supplies over 35% of the power demand.

⁴¹ World Energy Council. 2003. *Towards Local Energy Systems: Revitalizing District Heating and Co-generation in Central and Eastern Europe*. London.

heating is important for the wellbeing of the population in regions with long and harsh winters, an enabling legislative framework is needed to establish independent regulatory mechanisms that will encourage (i) private sector participation and financing, (ii) decentralization, and (iii) transparent tariff and subsidy mechanisms.

72. Space heating (largely fossil fuel-based) is a major source of greenhouse gases, and requires cost-effective and sustainable solutions. For centralized district heating systems, fuel sources include coal, oil, gas, industrial waste heat, and municipal wastes. Combined heat and power plants use the waste heat from steam turbines, significantly increasing overall thermal efficiency and reducing greenhouse gas emissions per unit of energy delivered. Renewable energy options, such as solar panels for water heating and geothermal heat pump systems that use shallow ground heat, can reduce fossil fuel use. Consumer patterns differ between residential, commercial, industrial, and educational uses, as well as between urban and rural uses, so proper cost-effective systems are needed to ensure adequate heating is supplied in a sustainable way. For example, multifuel boilers can be designed to achieve higher efficiencies. In all cases, heating requirements may be reduced through improved building designs and insulation systems. Where feasible, renewable energy sources can be used to augment the system and reduce fuel consumption.

5. Regional Cooperation

73. Regional cooperation in energy enables integration of markets for higher economic development, and is an effective way to address energy security as well as promote energy efficiency. Each country has individual energy needs and resources; integrated regional planning allows for identification of the most cost-effective and environmentally sustainable regional projects. Many DMCs have abundant natural resources which can be effectively traded in large energy markets in neighboring countries, thus benefiting all parties. It is in each country's interest to promote clean air and environmental protection; by collaborating at a regional level, countries may maximize these regional public goods.⁴² Barriers to regional cooperation in the energy sector include technical compatibility (e.g., compatible specifications of transmission lines) and policy framework compatibility. An enabling policy framework for regional trade of power and gas is needed, along with the regional infrastructure to encourage regional cooperation and trade in the energy sector.

74. In recent years, ADB has promoted and assisted regional cooperation efforts, including export of natural gas from Indonesia to Singapore, and hydropower projects in the Lao PDR which produce energy that is sold to Thailand. ADB has been instrumental in effectively forging subregional collaboration and networks. Electricity can be supplied from Nepal and Bhutan to India, from the Kyrgyz Republic and Tajikistan to Afghanistan and Pakistan, from Kazakhstan and Mongolia to the PRC, from the Lao PDR and Cambodia to Thailand, between India and Sri Lanka, and between the Greater Mekong Subregion countries (including southern PRC). There is great potential for more regional cooperation and integration in the energy sector. For example, in South Asia, the size and scattered nature of the region's hydropower and natural gas resources—and the different sizes of its national economies and associated energy demand levels and rates of growth—suggest immense potential for mutually beneficial integration and trade in energy and energy resources (footnote 4). Building consensus and negotiations for bankable projects remains a challenge. ADB is well positioned to play a catalytic role in fostering regional trade in energy.

⁴² ADB. 2006. *Regional Cooperation and Integration Strategy*. Manila.

6. Power Sector Reform and Restructuring

75. In the 1980s, a trend began worldwide to restructure the power sector and establish independent regulators. Developed countries restructured to improve efficiency through competition; developing countries restructured to augment scarce public resources with more private sector financing. MDBs, including ADB, actively supported restructuring and regulatory reform efforts in DMCs seeking private sector participation in the power sector. This included unbundling the power sector, creating an independent regulatory mechanism, introducing competition in power generation, and in some cases, privatizing through the sale of assets. These reforms encouraged private sector participation and access to commercial financing. Independent regulation separated short-term political objectives from tariff setting and enabled the power sector to operate on a more competitive basis.

76. Progress has, however, been slow due to delays in legislation, insufficient consultation with stakeholders, apprehensions regarding tariff increases, and lack of clearly defined plans. The power sector reform involved separating government responsibilities for power sector policy from the regulation of the industry in order to ensure a fair balance between the interests of investors and consumers. It also involved splitting vertically integrated power companies into generation, transmission, and distribution companies. Many DMCs have pursued reform policies with varying degrees of success. The PRC has separated most of the power generation into five large national companies and established a regulatory commission. Some countries in Central Asia (Kazakhstan and the Kyrgyz Republic) and Mongolia have also established separate regulatory bodies. A number of provinces in India have unbundled the sector, but more needs to be done to make them fully commercial. In Pakistan, the regulator is performing independently and transparently and is helping to create a better commercial structure for private sector investments. Progress in the Philippines has been mixed. The legal, regulatory, and institutional framework was largely established; the wholesale electricity spot market became operational in mid-2006; and the transmission and distribution tariffs are being regulated. However, the objectives of making the sector financially viable and privatizing assets of the National Power Company were not achieved.

77. Restructuring and competition have shown mixed results internationally. Unbundling the sector and corporatization is one approach. Transformation from a government-run organization to a completely private sector operation is a difficult transition and not always the most efficient path. Reform initiatives need careful assessment, political will, tariff rationalization, enabling legislation, improved corporate and financial management, and independent regulatory mechanisms, which are often difficult to ensure. Further, concerns about new investment in capacity addition have weakened resolve for a fully competitive wholesale and retail electricity market. Very few countries have fully deregulated the electricity business, and others are moving cautiously. Privatization is not the end objective of reform activities, but is one of the options available to improve sector efficiency and increase the availability of investment capital. Sector reforms, including privatization, should be designed and sequenced carefully on a country by country basis in a transparent manner.

78. In the short term, tariff setting through independent and transparent regulation is needed. In the hydrocarbon subsector, a more rapid movement towards the normative market framework and market-based pricing is imperative. In the medium term, governments should be encouraged to divest themselves of all commercial functions and retain only those classified as public or merit goods. ADB will encourage private sector participation through the development of a supportive policy and regulatory environment within DMCs.

79. Capacity building is also important in the context of power sector reform and restructuring. Those who lead and run power sector institutions need management skills, technical knowledge about new technologies, and good governance capacity (including financial management). Human resource development is an important long-term investment in the future effectiveness of the energy sector.

7. Pacific Developing Member Countries

80. Many Pacific DMCs deploy diesel sets for power generation; oil accounts for a significant portion of import bills, and these countries are more susceptible to oil price fluctuations than most others. Some Pacific DMCs have alternate power sources that use renewable technology—such as mini- and micro-hydropower, wind, and solar—but this is not significant. To address energy security, reduce oil imports, and (on an extremely small scale) reduce greenhouse gas emissions, Pacific DMCs could adopt new and renewable sources of electricity on a large scale by (i) addressing the main barriers of community and land issues, and (ii) introducing the policy and regulatory environment to attract necessary financing and ensure sustainability. The existing oil-based power plants would ensure reliability, while renewable energy sources can provide energy when available and reduce oil consumption. Use of biomass for electricity generation is also an option, particularly for islands with a palm tree-based industry. In addition to capacity addition, energy efficiency policies (including buildings with low energy requirements) are needed to rationalize demand. As appropriate, management structures and tariff guidelines could be developed. Capacity building is needed, possibly through regional cooperation. Each Pacific DMC needs a comprehensive package for power sector support, including systems improvement. Promotion of rural electrification and appropriate institutional and implementation arrangements are vital when the rural population lives on isolated islands.

81. Pacific DMCs—like other island economies such as the Maldives, archipelagoes, and low-lying areas of many DMCs—will be seriously affected by climate change and global warming. A rise in sea levels, as predicted by scientific studies, will submerge portions of the land mass. Therefore, in addition to mitigation measures for global warming, Pacific DMCs need to adapt to likely future changes. To ensure attention to these issues, a comprehensive energy sector package should address adaptation, particularly for Pacific DMCs.

RESULTS FRAMEWORK FOR ADB'S ENERGY POLICY IMPLEMENTATION

<p>Impact:</p> <p>To help developing member countries in providing reliable, adequate, and affordable energy for inclusive growth in a socially, economically, and environmentally sustainable manner</p> <p>Primary Responsibility: Regional Departments, Private Sector Operations Department, and Regional and Sustainable Development Department</p>

Outcome	Indicators	Key Activities and Initiatives Contributing to Outcome	Assumptions and Risks
Energy efficiency and renewable energy are promoted in developing member countries (DMCs)	<p>Asian Development Bank (ADB) investment in clean energy at least \$2 billion per year by 2013</p> <p>Numbers and lending volume of up-front financing under Carbon Market initiative</p> <p>Numbers and lending volume for renewable energy (five projects and \$356 million for 2001–2007)</p>	<p>Clean Energy and Environment Program (2006 onwards)</p> <p>Carbon Market Initiative (2007 onwards)</p> <p>Sustainable Transport Initiative (2007 onwards)</p> <p>Facilitation of private sector investment in energy efficiency and renewable energy projects</p> <p>Cooperation with other multilateral development banks on investment framework for clean energy</p> <p>Clean Energy Forum (2006 onwards)</p>	<p>Adequate resources will be available</p> <p>Stable economic growth in the region</p> <p>Close coordination with other development partners</p> <p>Strong commitment and willingness of DMC governments</p>
Access to energy for all in DMCs is maximized	Electrification access in the Asia and Pacific region: 80% in 2013 (baseline of 73% in 2005)	<p>Energy for All project:</p> <p>(i) Support rural electrification projects</p> <p>(ii) Investments in small off-grid</p>	<p>Adequate resources will be available</p> <p>Strong commitment and willingness of DMC governments</p>

Outcome	Indicators	Key Activities and Initiatives Contributing to Outcome	Assumptions and Risks
	Numbers and lending volume for regional and subregional projects (six projects and \$210 million for 2001–2007)	<p>demonstration projects</p> <p>Promoting cleaner technologies in power generation</p> <p>Support regional and subregional power and gas projects and programs</p>	
Energy sector reform, capacity building, and governance are improved in DMCs	<p>Numbers and lending volume for public and private projects</p> <p>Numbers and lending volume for independent power producer projects</p>	<p>Assistance and policy dialogue to reform and restructure the power sector to improve system efficiency</p> <p>Support to strengthen regulators</p> <p>Promotion of enabling environment to encourage private sector participation</p> <p>Support to capacity building and institutional strengthening</p> <p>Support of studies and knowledge sharing and dissemination for good practice</p>	<p>Strong commitment and willingness of DMC governments</p> <p>Availability of skills to establish effective regulation</p> <p>Close coordination with other development partners</p>