Energy Sector Management Assistance Program

PROJECT CONCEPT NOTE

MEXICO RENEWABLE ENERGY ASSISTANCE PROGRAM

1. The current energy matrix in Mexico is over-reliant on hydrocarbons. Ninety percent of its total energy consumption is based on hydrocarbons and power generation relies heavily on thermal sources (oil and gas), with more than 70 percent of installed generation capacity being fossil fuel-based. Taking into account that energy diversification through renewable energy generation has a great potential in the country, the Government of Mexico (GOM) has recently introduced several regulatory reforms aimed to promote funding for renewable energy development. One of such reforms is the Renewable Energy Development and Financing for Energy Transition Law (November, 2008), which defines different rules, mechanisms and instruments to develop and expand renewable power generation (wind power, solar power, geothermal, and hydropower).

2. While the new Law provides the basic framework to scale-up renewable energy in Mexico, substantial secondary legislation is required to define the modalities and mechanisms needed for the implementation of the Law.

3. In this context, the GOM, in particular the Secretary of Energy (SENER) and the Energy Regulatory Commission (CRE), require assistance to (i) define a specific target regarding the renewable capacity and energy which might displace fossil-based generation in the near and long term, and (ii) establish a new set of regulations to implement the Law.

I. ENERGY SECTOR BACKGROUND

4. Currently, Mexico has approximately 59,008 MW of installed power capacity. About 76 percent of Mexico's installed generation capacity is fired by fossil fuels – fuel oil, natural gas, coal, and small amounts of diesel. The remaining capacity consists of hydropower (22 percent), nuclear (2.7 percent), geothermal (2.2 percent), and a small fraction of wind. The most notable change in the generation mix over the last decade has been the large increase in natural gas-fired capacity, which has replaced fuel oil plants.

5. Coal-fired plants entered the mix in the early 1980s and have gradually increased to 5.2 percent of installed capacity. As for hydropower, its installed capacity has increased by 50 percent in absolute terms over the last two decades but its share in total capacity has decreased from 30 to 19 percent. The large share of gas-fired generation and sizable portion of hydropower contributed to the relatively low carbon intensity of electricity in Mexico, compared with most "G8 plus 5" countries.

6. The demand for electric power in Mexico has been growing faster than GDP over the past several decades and this trend is likely to continue for the foreseeable future as electricity use continues to grow in all sectors. Specifically, electricity consumption has grown at a continuous pace of 4.1 percent in the last 10 years, reaching 209.7 TWh in 2007. The residential sector accounts for about 18 percent of total end-use energy in Mexico. The commercial and public sector in Mexico are also important electricity consumers, accounting for over 11 percent of total use. Lighting, air-conditioning, and home appliances are expected to

represent the main growth areas of residential electricity demand. According to the Government's estimates, electricity demand was expected to grow at 3.1 percent per year from 2008 to 2017. However, the GOM growth estimates are now closer to 2 percent as a result of the international financial crisis and the related economic slowdown. To meet demand growth, Mexico will need to install roughly 14,000 MW of new power plants by 2017.

7. According to the estimates in Mexico's Low Carbon Study, to meet the increasing demand for power under a business-as-usual scenario (BAU), total CO2e emissions from power generation would increase by 230 percent between 2008 and 2030 – from 138 to 312 Mt CO2e. Based on their economic costs of production – excluding climate change and local externalities – both coal and gas-fired power generation would increase under the BAU, with coal accounting for 37 percent of new installed capacity, and natural gas 25 percent.

8. There are two key state-owned enterprises (SOEs) which exercise monopoly control over the electricity sector: (i) *Comisión Federal de Electricidad* (CFE), and (ii) *Luz y Fuerza del Centro* (LFC). CFE and LFC are both electric power companies that control generation, transmission and distribution and operate as monopolies in their respective service areas. There are various independent power producers (IPPs) that generate and sell power to the utilities[1], as well as some small auto-suppliers (less than 20 MW). CFE services most of the country (about 95% of the territory) with the exception of the Federal District and part of the metropolitan area where service is provided by LFC.

9. The *Secretaría de Energía* (SENER, Secretariat of Energy) is responsible for planning and formulating energy policy, as well as for approving exploration activities related to natural resources. The *Comisión Reguladora de Energía* (CRE or Energy Regulatory Commission) is responsible for the regulation and oversight of private power generation and gas transmission and distribution. The *Secretaría de Hacienda* (SHCP) sets the electricity tariffs proposed by CFE for retail distribution.

II. RENEWABLE ENERGY CONTEXT

Mexico's commitment to climate change mitigation

10. The GOM has strong interest in promoting the international agenda on climate change, to which its energy sector reform can contribute. Although the Kyoto Protocol does not require Mexico to reduce its GHG emissions, the country has committed to reduce its emissions voluntarily. According to Mexico's Third National Communication to the UNFCCC, the country emitted 643 million tons of carbon dioxide equivalent (Mt CO_2e) in 2002, of which almost 400 Mt CO_2e resulted from the combustion of fossil fuels (over 60 percent of total emissions). The sources of Mexico's GHG emissions are energy generation (24 percent), transport (18 percent), forests and land-use change (14 percent), waste management (10 percent), manufacturing and construction (8 percent), industrial processes (8 percent), agriculture (7 percent), fugitive emissions (6 percent), and other uses (5 percent).

11. In May 2007, President Calderón announced the National Climate Change Strategy (*Estrategia Nacional de Cambio Climático* – ENACC) which focuses on climate

[1] IPPs represent around 23 percent of total installed capacity in Mexico and generate 31 percent of total electricity

change as a central part of Mexico's national development policy. The ENACC sets the long-term climate change agenda for the country, together with medium to long-term goals for adaptation and mitigation. In December 2008, Mexico announced that it would reduce its GHG emissions by 50% below 2002 levels by 2050.

12. Moreover, in July 2009, the Government of Mexico formally committed itself to a detailed long-term plan for emission reductions embedded in the Special Climate Change Progra (*Programa Especial para Cambio Climático*, or PECC) that provides an accounting of emissions by sector, creates a framework for monitoring improvements and establishes a legally binding blueprint for emission reduction initiatives, sector by sector. The PECC sets out a four pillar program that includes (i) a long-term vision for government action; (ii) sectoral plans for GHG mitigation; (iii) plans for adaptation; and (iv) cross-cutting policy initiatives.

13. The World Bank has supported these efforts to mainstream climate change and environmental considerations into public policy through a Climate Change Development Policy Loan. Support has been specifically focused in the following three areas: (i) improved analytical basis for policy responses through the submission of a Third National Communication to the UN Framework Convention on Climate Change; (ii) the approval of the National Climate Change Strategy by the government's Inter-Secretarial Commission on Climate Change and its announcement by the President; and (iii) the integration of climate change considerations in sector programs.

Benefits of low carbon growth

14. There are at least four reasons why moving to a low-carbon economy could benefit Mexico: (i) Mexico is likely to suffer disproportionately from the impacts of climate change (e.g. drought, sea level rise, increased severity of tropical storms); (ii) there are numerous "no-regrets" low-carbon interventions that can contribute substantially to the economic development of the country; (iii) many low-carbon interventions have important co-benefits for Mexico including energy security associated with energy efficiency (both supply- and demand-side) and renewable energy projects, human health benefits from transport and other inventions that reduce local air pollutants, and environmental protection benefits through forestry and natural resource management, waste reduction programs or reduced emissions of local pollutants from energy facilities; and (iv) there are likely to be strategic and competitive advantages to countries that pursue low-carbon development, including the transfer of financial resources through the carbon market and new public programs that support climate change mitigation[2].

Barriers to low-carbon interventions

[2] One such program is the establishment of the Climate Investment Funds (CIF) by the Multilateral Development Banks (MDBs), together with developed and developing countries and other stakeholders, which provides support to developing countries for both mitigation and adaptation activities.

15. There are a number of regulatory, institutional, and market development barriers that inhibit low-carbon interventions (e.g. renewables) from being undertaken on a larger scale today. Two of the biggest challenges that Mexico will face in moving to a low-carbon economy are: (1) financing the generally higher upfront costs of low-carbon investments, and (2) putting in place supportive policies and programs to overcome the regulatory, institutional, and market development barriers.

16. Several policy and regulatory changes are needed to expand the share of renewable energy in the power sector in Mexico. For example, while the costs of wind generation in Mexico are among the lowest in the world – due to the high-quality wind resources in the Isthmus of Tehuantepec – a number of factors have inhibited the successful development of the country's enormous wind resources. Among the barriers for wind and other renewables are the excessively low planning prices that CFE assumes for new fossil fuel-based power generation, the lack of recognition for the portfolio effect in power planning that would increase the share of renewable energy interventions based on their lower fuel-risk, and the inability to adjust procurement procedures to the particularities of renewable energy projects. For cogeneration and other small-scale projects, new contracting procedures are needed to reduce the risks and transactions costs of small power producers. (see Annex 1 for a full list of barriers)

Renewable Energy Law

17. To reach the aggressive objectives of GOM on climate change, one important step was the Renewable Energy Development and Financing for Energy Transition Law, which entered into force on November 28, 2008. The main objective of the Law is to regulate the use of renewable energy resources and clean technology, as well as to establish a national strategy and financing instruments to allow Mexico to scale-up electricity generation based on renewable energy sources. The Secretary of Energy (SENER) and the Energy Regulatory Commission (CRE) are responsible for defining these mechanisms and establishing legal instruments to allow Mexico to increase renewable power generation.

18. The following functions are the responsibility of SENER, among others: (a) defining a national program for ensuring a sustainable energy development both in the short and the longer term, (b) creating and coordinating the necessary instruments to enforce the law, (c) preparing a national renewable energy inventory, (d) establishing a methodology to determine the extent to which renewable energies may contribute to total electricity generation (such a contribution must be expressed in terms of minimum percentages of installed capacity and minimum percentages of electricity, and should take into account different kinds of renewables and regional available sources), (e) defining transmission expansion plans to connect power generation from renewable energy to the national grid, and (f) promoting the development of renewable energy projects to increase access in rural areas.

19. The CRE is responsible for developing rules and norms regarding the implementation of the Renewable Energy Law, including provisions for promotion, production, purchase and exchange of electricity from renewable sources. CRE, in coordination with the Secretary of Finance (SCHP) and SENER, will determine the price that suppliers will pay to the renewable energy generators. Payments will be based on technology and geographic location. In addition,

CRE will set rules for contracting between energy generators and suppliers, obliging the latter to establish long-term contracts from renewable sources.

III. RATIONALE FOR BANK INVOLVEMENT

20. The GOM has requested support from the World Bank to define an action plan to implement a national strategy to increase the use of energy from renewable sources to generate electricity. This support would happen in the context of the Memorandum of Understanding (MOU) with SENER, which supports the policy dialogue with the GOM and further strengthen Mexico's capacity to implement its Energy Strategy. The rationale for Bank involvement is four-fold:

i. The proposed Assistance Program is fully consistent with Mexico's Country Partnership Strategy (CPS) for FY08-FY13, submitted to the Board in April 2008. In order to align more closely the World Bank Group's support with the GOM's 2007-2012 National Development Plan (NDP), the CPS is composed of the same pillars as the NDP. The Plan focuses on five strategic pillars including competitiveness, security and the rule of law, effective democracy, equality of opportunity and environmental sustainability. The proposed program would meet two interrelated objectives consistent with the CPS, namely competitiveness and environmental sustainability.

ii. The Bank has a well-established and solid relationship with the GOM through the ongoing Climate Change Development Policy Loan jointly with the new Country Partnership Strategy (CPS). The request underlines the GOM's interest in a continued, strong engagement with the Bank. Furthermore, the GOM and the Bank have a mutual interest in promoting projects that help achieve the principles set forth in the Renewables Law, which aims to establish a national strategy and financing instruments for scaling-up renewable power generation.

iii. In the context of its broader support to Mexico on Climate Change, the Bank Energy Sector dialogue with Mexico is strongly focused on the promotion of renewable energy sources and energy efficiency. This includes sector dialogue on renewable energy policy, studies on renewable resources such as mini-hydroelectric plants and on the social and environmental standards to be applied in the development of wind farms. In addition, the Bank is supporting investments in the development of two wind farms and their operation, the installation of off-grid renewable energy sources for the poor in the four Southern-most provinces of Mexico, and the building of a combined cycle solar-thermal hybrid generation plant. Building on this rich set of sector interventions and a deep knowledge of low-carbon options studied in the context of the Mexico Low Carbon Study (MEDEC), the agenda under discussion between Mexico and the Bank now focuses on locking in the sector reforms that will most significantly reduce the country's carbon footprint. Also, two large operations are currently under preparation: (i) a project aimed at improving energy efficiency by replacing incandescent lighting and appliances with more energy efficient technologies for public and private consumers, and (ii) a DPL focused on key

reforms in the legal and regulatory frameworks for Renewable Energy and Energy Efficiency reforms in the Energy and Urban Transport Sectors (the new Framework for Green Growth Development Policy Loan).. (See annex 2 for a complete description of World Bank ongoing activities in the energy sector in Mexico)

iv. The development of renewables in Mexico has some key advantages. Specifically, alternatives to oil, coal and gas are necessary in order to offset a country's vulnerability to price shocks in those commodities. The urgency to decrease Mexico's vulnerability to price shocks is even more pressing barring the unpredictable fluctuations in oil prices that were seen in 2008. Renewable sources of energy, such as wind power, geothermal, solar power, and hydroelectric power are particularly attractive sources of alternative energy because of the additional environmental benefits they offer in addition to the energy security benefits.

The proposed Mexico Renewable Energy Assistance Program aims to provide the GOM authorities with technical assistance, just-in time advice, and the support of high level experts, as well as enable knowledge exchanges with countries that have successfully introduced renewables in their generation mix, to implement an effective Renewable Energy Strategy. Annex 3 contains the Working Paper on the elements to elaborate a Renewable Energy Strategy elaborated by Bank staff and shared with the GOM as a first step towards the definition of a Renewable Energy Action Plan.

IV. PROPOSED ASSISTANCE PROGRAM

21. **Objective.** To support the GOM to operationalize the Renewable Energy Law.

22. **Outputs.** The assistance provided by the Bank under ESMAP funding will have the following outputs:

i. The provision of just-in-time advice, high level expertise on legal, regulatory and technical issues related to renewable energy policy.
ii. The carrying out of studies as needed.
iii. The facilitation and dissemination of international best-practice with regard to renewable energy.
iv. The identification of further areas for dialogue on renewable energy

23. The complete program that the GOM should carry out to scale-up renewable energy includes a broad range of activities, some of which have already been initiated by the GOM, both independently and with the support of other donors (e.g. IDB, GTZ).. Annex 4 contains a detailed list of activities in which the different partners have been identified. The World Bank has defined, together with SENER and CRE, the activities to be supported through this assistance program financed by ESMAP during FY10. The activities identified for FY11 are still to be agreed and could vary based on the results of the activities carried out during the first period. A summary of the activities to be supported by the Bank is presented below (see annex 4 for further detail):

- **Resource Analysis:** Studies to identify potential sites for renewable projects including technical characteristics, costs and transmission requirements; produce a database available to potential developers and define the work needed to prepare a comprehensive national inventory.

- **Economic and Financial Analysis**: Definition of renewable energy targets (national and regional); definition of pricing, contracting mechanisms, and financial incentives.

- **Policy and Regulatory Analysis**: Definition of standard contracts and study on the penetration of intermittent renewable energy resources in the National Electricity System.
- **International experience** workshop on lessons learned from renewable energy policies (e.g. Germany, USA, Australia, Brazil, India, and China).

- **Environmental regulation:** Study to identify regulatory arrangements to include social and environmental issues and to promote the use of renewable energy.

- **Renewable Energy Strategy/Plan** including consultation and dissemination workshops.

V. TIMETABLE, BUDGET, TASK TEAM, AND PEER REVIEWERS

24. Timetable

Activity	Timeline
1. Concept Note distributed (virtual review)	July 22, 2009
2. Concept Note approval	August 10, 2009
3. Identifying and hiring consultants	August-September, 2009
4. International Experience Workshop in Mexico	November, 2009
5. Resource Analysis • Initial data base • Data base available to potential developers • Definition of work to prepare national inventory	 May, 2010 March, 2011 March, 2011
6. Economic and Financial Analysis • Economic Analysis • Financial analysis	September, 2010 May 2010 March 2011
7. Policy and Regulatory Analysis • Study on penetration of intermittent RE resources in the grid • Standard contract for ER purchase	 April 2010 November 2010
8. Social and environmental regulatory arrangements	February 2010
9. Definition of pricing and contracting mechanisms	March, 2011
10. Renewable Energy Strategy/Plan • Consultation • Dissemination	 April-June, 2010 April-June, 2011
11. Activity Completion Summary	December 15, 2011

25. Budget

	FY10 (estimate)	**FY11** (estimate)

Expected commitments (total funding requirement)	500,000	850,000
Expected disbursements of ESMAP funds	500,000	850,000

26. **Funding Sources**

	Amount
ESMAP	1,350,000

27. **Task Team Members.** Leopoldo Montanez (TTL, Senior Energy Specialist, LCSEG), Susan V. Bogach (Senior Energy Economist, LCSEG), Michelle C. Keane (Senior Country Manager, LCSEG), Ariel Yepez-García (Senior Energy Specialist, LCSEG), and Almudena Mateos (ETC, LCSEG).

Peer Reviewers for the PCN are Anil Cabraal (Lead Energy Specialist, ETWEN), Marcelino Madrigal (Senior Energy Specialist, ETWEN), and Migara Jayawardena (Senior Infrastructure Specialist, EASIN).

Annex 1

Barriers to low-carbon development in the Mexican power sector

Barriers	Corrective actions
Large scale projects	
Power sector planning is based on low fuel price scenarios	Use higher fuel price scenarios for electricity planning (not necessarily the same scenarios used for oil sector planning)
Power sector planning seeks least cost technology and does not consider portfolio approach	Modify the planning procedures to assess and consider, in addition to the costs, the volatility risks associated with the different technologies, and to minimize the overall risk and cost of the portfolio in the long-term
Power sector planning does not consider ex-plant infrastructure costs and co-benefits	Include other benefits such as local environmental externalities, all infrastructure costs (e.g., ports, pipelines, transmission lines), and possible carbon mitigation revenues
Only large-scale projects can participate in bidding processes	Allow small-scale renewable energy and cogeneration projects to offer partial capacity in bidding processes
Social conflicts for large hydro projects	Put in place better negotiation mechanisms for the planning, construction and operation of hydropower plants, such as those proposed by the World Commission on Dams.[3]
Small-scale projects	
No predefined contracting procedures to allow renewable energy and cogeneration projects to sell electricity to the grid	Develop small power purchase agreements
Renewable energy generators are only paid short-term marginal costs and capacity	Develop payment systems that reward all benefits, including capacity, risk reduction, and externalities (including carbon payments)
No capacity payments for cogeneration projects	
Difficulties in obtaining local and federal licenses	Put in place streamlined licensing procedures
Transmission bottlenecks	Expand transmission capacity in areas with large renewable energy potential

Source: MEDEC: Mexico Low Carbon Study (Final draft, not for further distribution)

[3] Dams and Development. A New Framework for Decision-making. The Report of the World Commission on Dams. Available from www.dams.org.

Annex 2

World Bank Ongoing Activities in Mexico

Several World Bank ongoing and proposed activities can contribute to the proposed renewable energy framework that Mexico wishes to develop.

Policy activities

- *Climate Change Development Policy Loan (P110849)*: This IBRD operation, approved on April 2008, was designed to support the Government of Mexico's efforts to mainstream climate change and environmental considerations into public policy, specifically, in the following three areas: (i) improved analytical basis for policy responses through the submission of a Third National Communication to the UN Framework Convention on Climate Change; (ii) the approval of the National Climate Change Strategy by the government's Inter-Secretarial Commission on Climate Change and its announcement by the President; and (iii) the integration of climate change considerations in sector programs.

- *Framework for Green Growth Development Policy Loan (P115608)*: This IBRD operation under preparation builds on the existing climate change mitigation policy agenda and a nascent set of sector-levels interventions that address Mexico's GHG emissions. This DPL would support the Government of Mexico in its long-term commitment to fighting Climate Change as laid out in the PECC through green sectoral policies, incentives and regulations—particularly as they relate to the reduction of Greenhouse Gas emissions. For the energy sector, the Green Growth DPL supports efforts to transition the country from its predominantly hydrocarbon-based energy matrix towards a cleaner, more diversified mix including renewable energy sources, while developing the appropriate regulatory framework for renewable energy and energy efficiency

Analysis and technical activities

- *Mexico Low Carbon Study (MEDEC) (P108304)*: The MEDEC study builds upon the low-carbon development work program outlined in Mexico's Third National Communication. It will help frame the strategic and competitive advantages of low-carbon development for Mexico in an international context, including the opportunities created by developing the market for energy efficiency and renewable energy, and through greater access to the carbon market and other resources available to Mexico for climate change mitigation. Through the MEDED, the World Bank assisted the Mexican Government in assessing the country's potential for low carbon growth and the macroeconomic and fiscal implications of a low carbon development plan. The study highlights Mexico's potential for reducing carbon emissions from a range of sectors, including

transport, power generation, end-use energy efficiency, and land-use. Based on a common economic cost-benefit analysis, the study estimates the net costs, emissions reductions, and upfront investment that would be needed to maintain carbon emissions relatively constant over the next two decades while meeting existing economic and social development objectives.

- *Memorandum of Understanding (MOU) with SEMARNAT (P112959).* The purpose of this MOU is to bolster the policy dialogue and further strengthen Mexico's capacity to mainstream environmental consideration into productive sectors and to implement its National Climate Change Strategy and Special Climate Change Program (PECC). The MOU includes the following activities: (i) design and implementation of environmental regulations; (ii) mainstreaming environmental considerations in the housing sector; (iii) mainstreaming environmental considerations in the energy sector; (iv) design of a Cap and Trade System for Mexico; (v) preparation of Sub-national climate change action plans; and (vi) Adaptation on the Gulf Coast.

- *Memorandum of Understanding (MOU) with SENER (P114892).* The MOU supports the policy dialogue with the Government of Mexico and further strengthen Mexico's capacity to implement its Energy Strategy. This MOU includes the following areas of cooperation: (i) Support for integrating the policy to promote the use of renewables in power generation, (ii) analysis of options for modifying the regulatory framework for energy efficiency, (iii) best practices for reducing gas flaring, (iv) support in the design of programs to promote the use of efficient lighting and appliances, and (v) support to the development of a National Energy Strategy.

- *Guidelines for Scaling-up Wind Energy Development (P109850).* This study identifies good practices in managing the key environmental and social issues in wind power development and provides practical advice on how best to address these issues in wind project siting, design, operation, and monitoring.

- *Examining the Feasibility of Mini-hydro Projects in Mexico***:** The World Bank is conducting a study that (i) leverages existing knowledge of identified mini-hydro sites through *Comisión Federal de Electricidad* (CFE) and the *Instituto Mexicano de Tecnología del Agua* (IMTA), and (ii) funds pre-feasibility studies and environmental assessments of selected mini-hydro project sites with relevant hydrological potential in Mexico (these pre-feasibility studies will be available to developers, both public and private). The overarching objective is to spur mini-hydro development in Mexico. This activity fulfills one of the obligations of SENER under the Renewables Law.

- *Workshop on Mini-hydro Development in Mexico*: The World Bank recently organized a workshop on Mini-hydro that was attended by members of Mexico's Ministry of Energy, the Energy Regulatory Commission, CFE, the Environment and National Resources Ministry, and the National water Commission. The

workshop included (i) a discussion of the basic engineering, hydrometrics, and cost-benefit analysis of mini-hydro projects, (ii) a discussion of the environmental impacts of hydropower, (iii) a case study of the Peru experience on mini-hydro development, and (iv) a discussion about strategies to accelerate the development of mini-hydro, particularly by attracting private investment. This activity addresses some of the regulatory barriers within the overall renewable strategy.

Investment and financing activities

- *Clean Technology Fund (CTF) Investment Plan***:** The CTF Investment Plan is a "business plan" agreed between the Government of Mexico IBRD, the IDB and the IFC to provide support the low-carbon objectives contained in Mexico's 2007-2012 PND, its ENAAC and PECC (Special Climate Change Program). This multi-year business plan identifies programs to be co-financed by the CTF and IBRD, IDB and IFC in the Urban Transport and Energy Sectors. In the Renewable Energy (RE) and Energy Efficiency (EE) sub-sectors, the CTF Investment Plan for Mexico proposes to finance the Government's efforts towards implementing a comprehensive national Renewable Energy program and Energy Efficiency agenda. For the RE subsector, the IP specifically emphasizing the following activities: (i) design of policy and regulatory incentives for scaling-up renewable energy investments and commercialization of these technologies in the medium-term; (ii) establishment of a financing facility in NAFIN (Nacional Financiera) to leverage and complement the proposed Energy Transition Fund, and support investments for accelerating public and private investment in RE; (iii) provision of financing instruments and capacity-building for developers and local financial intermediaries to develop projects and/or programs for scaling-up private sector investments in renewable electricity, heat and transport fuels; (iv) technical and financial assistance to lower the costs of interconnection associated with increased installed capacity of RE power within the power system; (v) support to local RE research centers for demonstration of technologies designed to optimize local conditions;
- The *Hybrid Solar Thermal* (P066426) project (GEF funded) aims to demonstrate and encourage replication of the Integrated Solar Combined Cycle Systems (ISCCS) power generation technology in Mexico and elsewhere, thereby contributing to the reduction of global GHG emissions. The project was approved on October 5, 2006 and expected to close by December 2012 (an extension will be processed shortly).
- The *Integrated Energy Services* (P095038) project supports the relative provide clean energy through the use of renewable energy in rural areas for the provision of electricity. The legal agreements for the project were signed on December 05, 2008 and the project was declared effective in July 2009.

- The *Large-Scale Renewable Energy Development GEF Project* (P077717)[4] is being financed through GEF and CF funds, and aims to assist Mexico in developing initial experience in commercially-based grid-connected renewable energy applications by supporting construction of an approximately 101 MW IPP wind farm, while building institutional capacity to value, acquire, and manage such resources on a replicable basis. The project was approved on June 29, 2006 and declared effective May 18, 2007. The contract with the IPP developer was signed by CFE in June 2009. It is expected to close by December 2016.
- *Wind Umbrella*, or *La Venta II* (P080104), a carbon finance operation, aims to reduce GHG emissions from power generation by 4 million tons CO2e over a 20-year operation period, promote investment in wind energy, and contribute to further development of the international carbon market in Mexico. The Emissions Reductions Purchase Agreement (ERPA) was signed on December 12, 2006, and the closing date for the project is December 31, 2019.
- The Mexico *Biomass Residues Based Co-generation Project* (P109794) is a Carbon Finance project of the amount of US$7 million, fully funded by the Bank's administered carbon funds. The ERPA is expected to be signed on Q4 FY2010. The *Grupo Modelo* Biomass Residues Based Co-generation Project consists of the replacement of fossil fuel used for heat and electricity generation at the brewery, specifically replacement of heavy fuel oil by biomass. The Bank has requested a revision of the methodology to include the use of waste bagasse to generate electricity, which is expected by mid July this year.

[4] The World Bank. (2006). *Mexico - Large-Scale Renewable Energy Development GEF Project*. Project Appraisal Document. May 19.

Energy Sector Management Assistance Program

Annex 3

Working Paper

Elements for a Viable Strategy and Action Plan to Develop Mexico's Renewable Energy Strategy

A. Elements for a Viable Strategy

1. International experience in China, Croatia, Serbia and South Africa among others shows that a viable strategy to scale-up renewable energy in any country should include at least the following elements, which are mentioned in Mexico's Renewables Law.

2. **The national strategy must establish a legal obligation and a regulatory framework.** Undoubtedly, the new Law is an important step towards the development of a national renewable energy strategy. Even though the Law requires SENER to establish a target for renewable electricity generation, it will also be necessary to define clear mechanisms and legal instruments to meet such target.

3. **The national strategy must establish a renewable generation target which can be a quantified objectively (TWh, MW, or a percentage of generation or consumption in a given year) or a price guarantee for electricity generated from renewable sources (as in so-called feed-law systems)**. In the case of Mexico, the new law (Articles 10 and 11) requires SENER to (a) define a specific target in terms of renewable capacity and energy which might displace fossil-based generation in the near and long term, and (b) determine the methodology for evaluating the externalities related to fossil fuel use. As mentioned above, procedures and requirements to meet the specific renewable target should be established.

4. **The national strategy must include financial incentives to attract investors in renewable energy.** The Law requires CRE to (a) establish a comprehensive regulatory framework to eliminate entry barriers for renewable energy, (b) expedite the implementation of rules and norms regarding the generation and exchange of electricity derived from renewable sources, and (c) define the payments that suppliers might pay to generators of renewable energy sources. Therefore, the secondary legislation, which should be expedited by the GOM, must include the creation of adequate financial incentives to invest in renewable power generation derived from renewable sources.

5. **The national strategy must have a contractual bidding framework.** The Law also requires the definition of rules for renewable energy contracting. A clear and simple contractual framework, including standard long-term contracts, will be necessary to ensure competition and participation of different investors.

6. **The national strategy requires institutional support.** The development of renewable energy generation will depend on the capacity of the institutional agencies (Ministries, environmental and regulatory bodies, etc.).

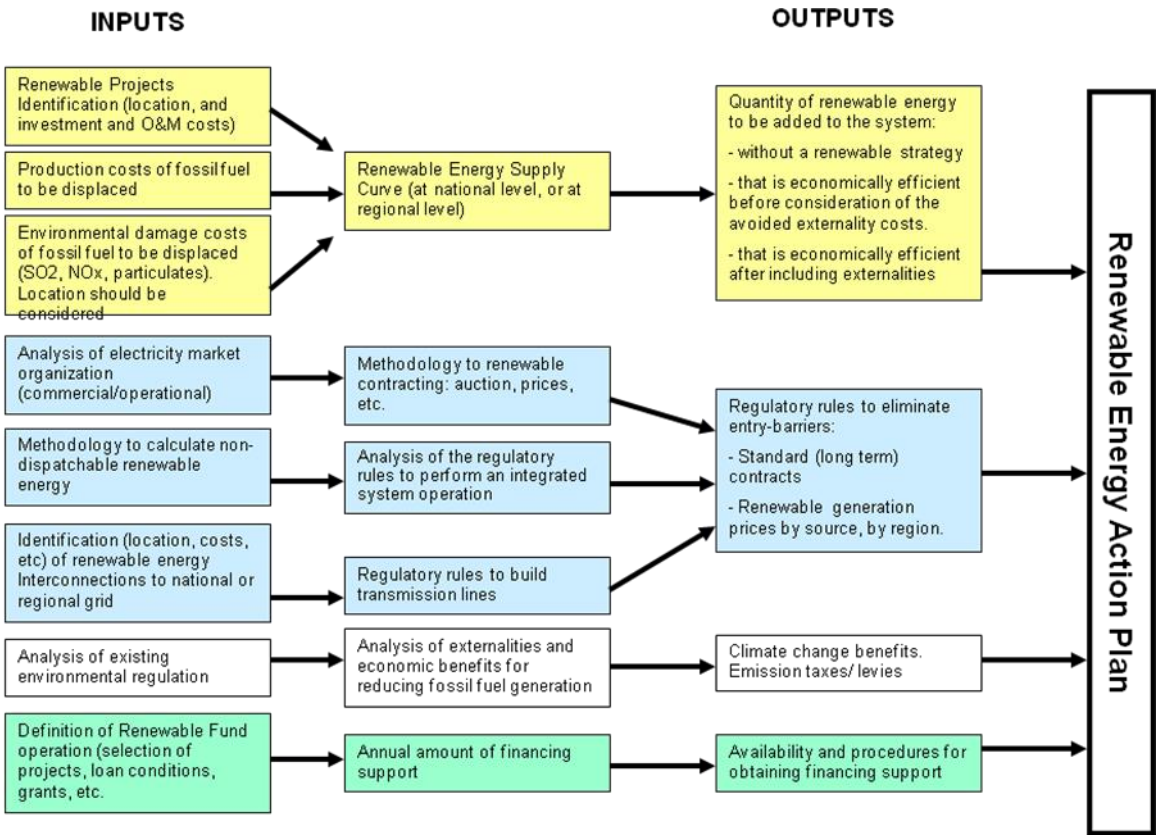
B. Action Plan to develop Mexico's renewable energy strategy

7. While the new Law provides the basic framework to scale-up renewable energy in Mexico, much secondary legislation will be required to sort out the details. The definition of a renewable energy strategy for Mexico will therefore require an action plan with many different components.

8. Such a plan would include steps to (a) calculate the target for renewable energy generation (in MW and MWh) that the country's power sector should consider into the energy matrix; (b) establish the necessary regulatory and environmental policies, including the elimination of entry barriers, and renewable pricing and contracting rules; and (c) identify financing sources for the development of renewable energy projects.

9. The following chart summarizes the action plan which should be carried out by the GOM to develop and expand renewable electricity generation. It is divided into four main activities:

(1) Activities needed to define the volume of renewable generation to be added to the system;
(2) Activities needed to set up regulatory rules for grid-connection, renewable energy purchases, and systems operation;
(3) Activities to set up environmental regulations to reduce pollutant emissions from fossil fuel-based generation; and
(4) Activities to provide financing using the new Renewable Energy Fund (also called *Fondo para la Transición Energética y el Aprovechamiento Sustentable de la Energía*).



(a) Activity 1: Renewable generation target.

10. The plausible renewable target will depend on how much renewable energy generation is justified with and without the consideration of externalities. This analysis will take into account potential renewable energy sources, the power expansion plan, demand projections, existing power alternatives, and investment and fuel costs, among other parameters.

11. In addition, it will be necessary to gather information and data on renewable power projects, including their location and costs (investment and O&M). This information will be needed to estimate the renewable costs curve and to establish the need for grid connections. An estimation of production costs and of the costs of the environmental damage caused by fossil fuels to be displaced by renewable sources will also be required to calculate possible externalities. Box 1 describes the methodology to calculate the renewable generation target.

Box 1.

Summary of the methodology to define renewable energy target in Mexico:

- Calculate the supply curve of different renewable projects, based on the levelized costs of generation, and adjusted by capacity penalties related to the lack of firm-energy.
- Define the fossil fuel(s) which will be displaced, and estimate the production cost of fossil generation.
- Estimate the environmental damage costs of the fossil-fueled alternative.
- Estimate the quantity of renewable energy, whose adjusted production costs are lower than the social cost of fossil generation (i.e. greater than the sum of production cost and their corresponding local environmental externalities).
- Estimate the quantity of renewable energy that would be additionally justified by the avoidance of CO_2 emissions.

Additional key assumptions:

- The discount rate
- The economic price of coal
- The firm-energy value of renewable energy (specially for mini-hydro, wind and solar)
- The monetary value of environmental damage costs

(b) Activity 2: Regulatory framework.

12. In order to establish a specific regulatory framework to scale-up renewable generation, it will be necessary to analyze Mexico's electricity market, in particular its commercial and operational organization. This analysis will allow the formulation of clear procedures to bring non-firm energy into the power system, to calculate penalties that renewable generation would have to pay (if any) for non-delivery the firm energy required, and to propose standard long-term contracts for the purchase of energy generated from renewable sources.

13. The regulatory framework for renewables should include a set of rules to connect renewable generation to the national or regional grid, specifying who is responsible for the connection, its costs, and payments. For that reason, renewable projects will need to be identified

(see Activity 1) in order to determine project location and technical characteristics of associated transmission (or sub-transmission) lines.

(c) Activity 3. Environmental regulation.

14. The Law (Article 10) requires that the Secretary of Energy (SENER) develop a methodology to determine the costs of externalities associated with electricity generation based on renewable energy. Considering such externalities, the SE should establish environmental policy mechanisms and an environmental regulation to promote the use of renewable energy. This activity (in combination with Activity 1) will determine the costs of such externalities, the benefits of reducing fossil fuel generation, and possible emission taxation.

(d) Activity 4. Financing support.

15. According to the Law (Article 27), financing support will be available for projects aimed at developing renewable energy from a new Fund (the Renewable Energy Fund) financed from Mexico's annual budget. This activity will determine the parameters of operation of this Fund, setting clear procedures to select projects and defining loan or grant conditions. It will also project the cash flow for the Fund.

Annex 4
Indicative Plan of Activities

STUDIES & ACTIVITIES	FY10 Q1/10	FY10 Q2/10	FY10 Q3/10	FY10 Q4/10	FY11 Q1/11	FY11 Q2/11	FY11 Q3/11	FY11 Q4/11	COSTS (US$) FY10	COSTS (US$) FY 11	COSTS (US$) Total	OUTPUTS	AGENCY	SUPPORT
ACTIVITY 1: Renewable Generation Target														
1. 1. Resource Analysis									170,000			1.1.1. Potential sites for projects, including technical characteristics & costs, and transmission requirements (1)	SENER	WB
										220,000		1.1.2. Database available to potential developers; definition of work to prepare national inventory	SENER	WB
Consultation / Dessimination									10,000	10,000	**410,000**	1.1..3. Workshop	SENER	WB
1.2. Economic and Financial Analysis									100,000			1.2.1. Methodology to determine the extent to which RE may contribute to total electricity generation, prepare cost curves by tecchnology, estimation of appropriate target based on avoided cost plus externality value, estimation of regional impact of RE development at target level.	SENER	WB (w/ GTZ)
												1.2.2. Development of methodology to determine the cost of externalities associated with electricity generation based on renewable energy (2)	SENER	IDB
										180,000		1.2.3. Analysis of financial viability of projects with and without carbon benefits, estimation of financial cost curves by techology, impact of different financial mechanisms for meeting targets, effectiveness of alternative financial incentive mechanisms, sharing of costs, impacts of proposed pricing/regulatory arrangements with respect to tariff received by project development.	SENER	WB
Consultation / Dessimination										10,000	**290,000**	1.2.4. Workshop	SENER	WB
ACTIVITY 2: Regulatory Framework														
2.1. Policy & Regulatory Analysis												2.1.1. Identify regulatory arrangements and develop policy approach (e.g. feed-in laws, portfolio standards, auctions, financial incentives, etc) to meet RE targets	SENER/ CRE	CRE
										30,000		2.1.2. Develop a standard contract for RE purchase	CRE	WB
												2.1.3. Develop a standardized price or approach to pricing, to third parties or to nearest utility, based on avoided costs or other principles, by region, season, time of the day.	CRE	IDB/GTZ
												2.1.4. Develop arrangements of RE dispatch and calculation of firm energy, for transmission access and costs and for wheeling and	CRE	IDB/GTZ
									30,000			2.1.5. Study on the penetration of intermitent RE sources in the National Electricity System (3)	CRE	WB
Consultation / Dessimination										30,000	**90,000**	2.1.6. Workshop	CRE	WB
2.2. International Experience Dissemination									55,000		**55,000**	2.2.1. Workshop: Preparation and Presentation of Renewable polices and lessons learned (Germany, USA, Australia, Brazil, India, China)	SENER	WB
ACTIVITY 3: Environmental Regulation														
3.1. Regulatory arrangements										40,000	**40,000**	Identify regulatory arrangements to include social and environmental issues and to promote the use of renewable energy.	SENER	WB
3.2. Cogeneration efficiency											**0**	Definition of efficiency criteria por cogeneration projects	CRE	GTZ
ACTIVITY 4: Financing Support														
4.1. Development of Renewable Energy Fund											**0**	4.1.1. Determine the parameters of operation of the Renewable Fund, setting clear procedures to select projects and defininf loan or gran agreements; project cash-flow (4)	SENER	SENER
Final Output: Renewable Energy Strategy														
5. Development of Renewable Energy Strategy/Plan												5.1. Working paper preparation. Workshop: Overall objectives, description of methodology	SENER	WB (delivered)
										60,000		5.2. Preliminary report (targets, policies, social&environmental issues, regional impacts).Workshop: consultation preliminary renewable strategy	SENER	WB
										70,000	**130,000**	5.3. Final Report and Workshop: dissemination of Mexico's renewable strategy	SENER	WB
6. General Coordinator									60,000	90,000	**150,000**	Coordination of overall study, reports preparation, travel, etc	SENER	WB
7. WB Supervision									75,000	110,000	**185,000**	Staff time and travel	WB	
TOTAL									**500,000**	**850,000**	**1,350,000**			

(1) A study to calculate geothermal potential is being financed by REEEP and a study to estimate small hydro potential is being financed by ESMAP

(2) The Bank will provide support to revise this methodology (3) GTZ/PERGE are supporting definition of procedures to predict wind conditions

(4) Bank could offer support, but SENER has taken the lead