

# Toward a Low-Carbon Economy: Renewable Energy and Energy Efficiency Portfolio Review

A number of factors are influencing the trend in World Bank Group support for renewable energy and energy efficiency. The steadily rising support for such energy options are due to the WBG's increased commitment towards such energy options coupled with external factors such as high oil prices, commercial maturation of the technologies, greater awareness, and climate change concerns.

## Financial Commitments

Renewable energy and energy efficiency projects continue to perform strongly in the WBG energy portfolio and are increasingly being mainstreamed in the WBG's energy lending. In fiscal 2007 a total of US\$1,433 million supported 63 renewable energy and energy efficiency projects in 32 countries. This represents a 67 percent scale-up in commitments from fiscal 2006. The WBG's support can be broken down into US\$421

million for new renewable energy, US\$751 million for hydropower greater than 10 MW, and US\$262 million for energy efficiency (Table 5).

Thus, with combined commitments of US\$683 for new renewable energy and energy efficiency, **the WBG outperformed its Bonn Commitment by a wide margin, as in previous years.** Cumulatively, between fiscal 2005 and fiscal 2007, the WBG has exceeded its Bonn Commitment target by almost 100 percent—committing US\$1,812 million against the cumulative target of US\$913 million over the same timeframe (Table 6).

Since 1990, the WBG has committed about US\$11.4 billion toward renewable energy and energy efficiency (see Figure 8). Details are provided in Annexes 1, 2, and 3. Of this amount, US\$3.1 billion each were for new renewable energy and energy efficiency. Another US\$5.2 billion went

**Table 5: World Bank Group Commitments for Renewable Energy and Energy Efficiency, FY07**  
(millions of U.S. dollars)

<i>Source of funds</i>	<i>New renewable energy</i>	<i>Hydro greater than 10 MW</i>	<i>Energy efficiency</i>	<i>Total</i>
World Bank (IBRD/IDA)	70	430	49	549
GEF (World Bank)	121	0	7	128
World Bank (Carbon Finance)	68	66	10	144
IFC (own funds)	154	140	156	450
IFC (Carbon Finance)	7	0	0	7
MIGA	0	115	40	155
Total	421	751	262	1,433

Note: Some columns may not add up exactly because of rounding.

Source: WBG databases, 2007.

**Table 6: Measuring Progress in New Renewable Energy and Energy Efficiency Lending against the Bonn Commitment**  
(millions of U.S. dollars)

New RE and EE commitments	FY02	FY03	FY04	FY02–04 average	FY05	FY06	FY07	Total FY05–07
Actual	204	178	245	<b>209*</b>	461	668	683	1,812
Bonn commitment target	n.a.	n.a.	n.a.	n.a.	251	301	361	913

n.a. Not applicable.

\* The baseline of US\$209 million was set as the average annual lending commitment for new renewable energy (RE) and energy efficiency (EE) made by the IBRD and IDA, the World Bank's Carbon Finance Business (CFB-IBRD), and the GEF (IBRD and IDA) in fiscal 2002, 2003, and 2004. The baseline comprises exclusively of new RE and EE.

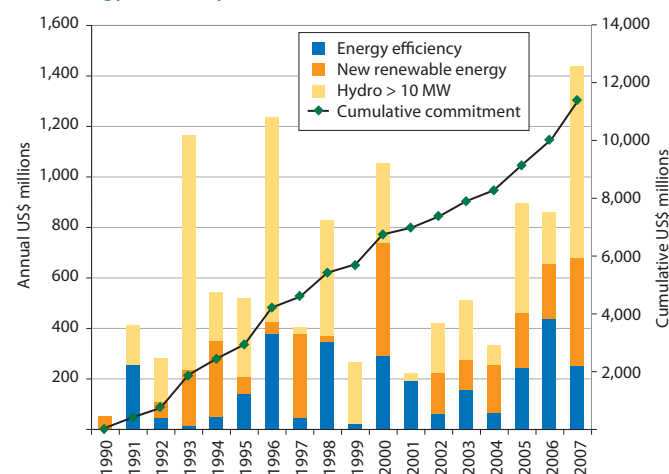
Note: This includes the additional US\$168 million in IFC fiscal 2005 commitments that were not reported in the fiscal 2005 RE and EE progress report (*World Bank Group Progress on Renewable Energy and Energy Efficiency: Fiscal Year 2005*, December 2005). Commitment amounts for two IFC projects included in last year's RE and EE progress report have also been revised (Dominican Republic Basic Energy was US\$12 million and is now US\$6.34 million, and India Allain Duhangan Hydropower was US\$49 million and is now US\$47 million). The additional IFC fiscal 05 commitments were principally EE and RE investment components of IFC projects in agriculture, industry, transport, and other nonenergy sectors.

to hydropower projects with capacities greater than 10 MW per facility. During the same period, the share of total WBG energy lending devoted to renewable energy and energy efficiency has been steadily increasing. **The average share of renewable energy and energy efficiency of total energy commitments has doubled since 1990–94 to 25 percent in 2005–07 and reached 40 percent in fiscal 2007** (Figure 9).<sup>16</sup>

<sup>16</sup> IBRD-IDA energy sector investments include oil, gas, and coal (including coal mine closing or rehabilitation; transmission and distribution of oil, gas, and electricity; power generation and associated environmental controls and plant rehabilitation; district heating and plant rehabilitation; renewable energy; and energy efficiency and conservation). IFC investments in the energy sector include investments from the IFC's own account; MIGA investments refer to gross liability exposure. IFC and MIGA investments in energy sector consist of investments in the power sector, oil, gas, and coal mining, as well as electricity and gas services. Previous IFC assessments referenced only "stand-alone" projects whose sole focus was energy efficiency or renewable energy, thus missing the full scope of investment in sustainable energy undertaken as a component of larger investments in various sectors. Subsequently, the IFC has identified additional renewable energy and energy efficiency investments in commitments IFC had made in other sectors, such as agriculture, water supply, industry and in corporate loans to financial intermediaries. For more details, see *Choices Matter: 2005 Sustainability Report* at [www.ifc.org/SustainabilityReport](http://www.ifc.org/SustainabilityReport).

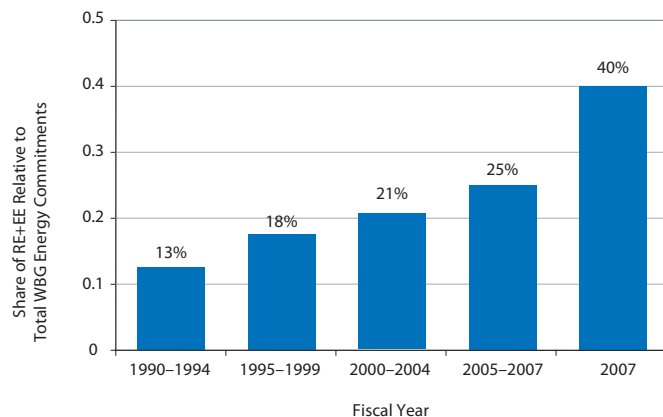
Commitments for large hydropower projects increased substantially over previous years, most prominently in Sub-Saharan Africa. The continent's vast underexploited hydropower resources offer large potential for further expansions as a low-carbon solution to increasing energy access. The WBG has renewed its efforts to support countries' benefit from this resource while at the same time continuing to maintain and refine its stringent and comprehensive envi-

**Figure 8: World Bank Group Commitments for Renewable Energy and Energy Efficiency, FY90–07**



Source: WBG databases.

**Figure 9: Share of World Bank Group Commitments for Renewable Energy and Energy Efficiency Relative to Total Energy Commitments, FY90–07**



Source: WBG databases.

ronmental and social safeguard policies. The Bugajali Hydropower Project in Uganda (see Case Five) and the Regional and Domestic Power Markets Development Project in the Democratic Republic of Congo accounted for the majority of large hydropower commitments last year.

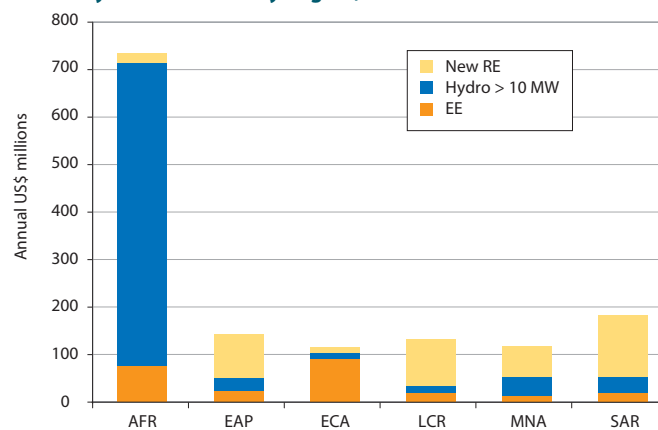
With US\$549 million of combined commitments, the IBRD and IDA provided the largest funding for renewable energy and energy efficiency of all the WBG institutions. These commitments focused predominantly on large hydropower projects, which received US\$430 million in funding, followed by US\$70 million for new renewable energy and US\$49 million for energy efficiency. In addition, the GEF has been an important partner by contributing US\$128 million in co-financing for World Bank projects. IFC committed a total of US\$450 million, with US\$154 million going to new renewable energy, US\$156 million to energy efficiency, and US\$140 million to large hydropower projects. World Bank Carbon Finance activities contributed an additional US\$144 million and MIGA contributed US\$155 million.

Sub-Saharan Africa received US\$735 million in renewable energy and energy efficiency commitments for 12 projects, which accounted for 51 percent of total renewable energy and energy

efficiency commitments (Figure 10). The majority of these commitments were devoted to large hydropower projects, followed by investments in energy efficiency improvements. Eleven projects were developed in South Asia, which accounted for US\$183 million in funding devoted mostly to new renewable energy. Also in East Asia and Pacific, Latin America and Caribbean, and Middle East North Africa regions, WBG activities were focused mainly on new renewable energy. In contrast, activities in Europe and Central Asia were focused predominantly on energy efficiency improvements, which attracted US\$97 million in commitments.

A total of 32 projects with new renewable energy projects or components of projects were approved in fiscal 2007. For example, solar thermal power generation received two large commitments from GEF in Mexico and Morocco, with a combined value of US\$93.6 million. Geothermal power generation received about US\$72 million in commitments with projects in Kenya, Philippines, and Europe and Central Asia. Wind power was supported with almost US\$70 million (see Box 8)—mostly through Carbon Finance and the IFC—and biomass energy received US\$51 million in commitments. In addition, several projects supported a portfolio of different new

**Figure 10: World Bank Group Renewable Energy and Energy Efficiency Commitments by Region, FY07**



Source: WBG databases.

renewable energy technologies. Such projects include a US\$40 million IDA commitment to Sri Lanka supporting small hydropower, solar home systems, and bioenergy, and a US\$9.5 million GEF project in the Pacific Islands supporting solar PV, picohydro, and biodiesel technologies.

See Table 7 and Figure 11 for breakdown of the number of projects by region and sector. Figure 12 shows the funds committed for new renewable energy, energy efficiency, and hydropower greater than 10 MW, by region.

Energy efficiency improvements were supported in 21 projects worldwide. On the electricity supply side, for example, these include a US\$39.6 million MIGA guarantee on investments into improving energy efficiency in power transmission and distribution in Uganda. Similarly, a US\$9 million carbon finance project in the Nigerian city of Aba focused on improving efficiency through the development of a gas-fired cogeneration plant and reduction of transmission and distribution losses through upgraded transmission lines. On the demand side, examples include a US\$27 million IBRD commitment to a residential energy efficiency project in Serbia (see Box 9).

## Technical Assistance and Sector Studies

In addition to operational activities, the WBG engages in a variety of economic sector work and technical assistance focused on renewable energy and energy efficiency. This work is an integral part of the WBG activities, which is valued as an important source of information and advice for policy makers and other stakeholders. In addition, these activities are an important component in the preparation of future lending activities. As shown in Figure 13, Analytical and Advisory Activities in renewable energy and energy efficiency have sharply risen in fiscal 2007, with 21 activities completed. Activities performed in the past year include studies, reports, and policy notes on renewable energy policy in Colombia and Morocco, energy security in Uruguay and rural electrification in Mexico, Peru, and Timor-Leste. Energy efficiency also received considerable attention, for example, building energy efficiency in China and energy efficiency policy formulation in Morocco. These figures show increasing interest in activities related to renewable energy and energy efficiency on the part of client countries and pave the way for strong operational and lending activities in the coming years.

**Table 7: Number of Projects by Region, FY07**

<i>Region</i>	<i>Energy efficiency</i>	<i>Hydro &gt; 10 MW</i>	<i>New renewable energy</i>	<i>Total</i>
AFR	5	3	4	12
EAP	3	3	8	14
ECA	5.5	1	2.5	9
LCR	4	1	9	14
MNA	0.5	1	1.5	3
SAR	3	1	7	11
Grand total	21	10	32	63

*Note:* Projects that contain both a new RE and an EE component have been divided and counted as 0.5 to avoid double counting. These projects include LCR's Bertin Ltd., FYR Macedonia Sustainable Energy, Peru BBVA Banco Continental, and Morocco's Energy Sector Development Policy Loan.

*Source:* WBG databases.

## Energy Sector Management Assistance Program

**ESMAP** The Energy Sector Management Assistance Program (ESMAP), is a multidonor trust-funded global technical assistance program that has reached its 25th anniversary. This program provides policy advice on sustainable energy development to governments of developing countries and economies in transition. ESMAP promotes the role of energy in poverty reduction and economic growth in an environmentally responsible manner to achieve the Millennium Development Goals.

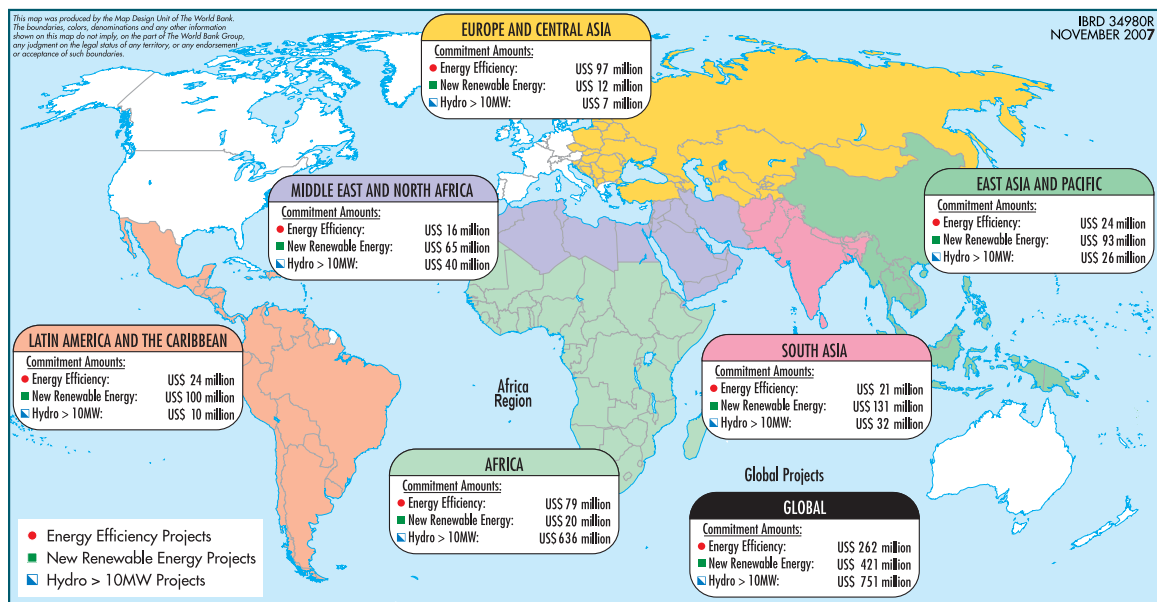
ESMAP helps build consensus on energy policies, develops innovative energy solutions, and facilitates the leveraging of incremental financing among both public and private development partners. ESMAP offers support to the WBG in four thematic areas, Energy Security and Energy Efficiency, Renewable Energy, Energy Poverty, and Market Efficiency and Governance. It sup-

ports both regional activities that provide better service to individual developing countries, and cutting-edge research and global projects.

### Box 8: Wind Umbrella Project, Mexico

This Carbon Finance project aims at promoting investments in wind energy to reduce greenhouse gas emissions, to contribute to the further development of the international carbon market in Mexico through the supply of Emissions Reductions under the Clean Development Mechanism and to improve energy security. The project is the first large-scale investment in wind energy in the country and is expected to reduce about 4 million tCO<sub>2</sub>e over a 20-year operating period and produce an equivalent amount of emissions reductions for sale. At the same time, the project is expected to facilitate the development of other wind projects in Mexico through its demonstration effect and by building capacity, knowledge, and experience in the development, operation, and maintenance of wind energy generation facilities.

**Figure 11: World Map with Distribution of Renewable Energy and Energy Efficiency Projects**





### **Box 9: Improving Residential Energy Efficiency in Serbia**

The principal aim of the project is to provide additional financing to expand an existing demand-side energy efficiency project in the Republic of Serbia that aims at reducing the rate of electricity use in buildings. Especially for heating, electricity consumption in the Serbian residential sector is very large, which leads to high heating costs, unsustainable electricity demand, and avoidable greenhouse gas emissions. To alleviate these problems, the project aims at improving energy efficiency in three social care buildings, eight schools, and six hospitals that were left out of the original project because of a cost overrun. Moreover, it expands the scope of the original project to include the rehabilitation of the heat supply system of the Nis Clinical Center, other demand-side efficiency improvements at the University of Kragujevac, 20 schools, 7 social care buildings (such as orphanages), and 11 hospitals across Serbia.

ESMAP supports collaboration across the energy sector and shares ideas, good practices, and project experiences across regions. ESMAP has established an Energy Efficiency Thematic Group (EETG) and a Renewable Energy Thematic Group (RETG) within the World Bank. In July 2007, the EETG sponsored a joint roundtable in Tokyo with the World Bank and the Government of Japan on market opportunities and best practices in the area of energy efficiency policies and investments. The RETG held its first meeting in June 2007, focusing discussions on “deep green” RE scenarios and the global wind power outlook.

In 2006, ESMAP’s energy efficiency portfolio comprised 23 projects for a total commitment of US\$3.8 million while renewable energy comprised 15 projects and US\$2.2 million of commitments.

In fiscal 2007, ESMAP supported a variety of studies, including *Shanghai: Developing a Green Electricity Scheme* (see Box 10), a survey and

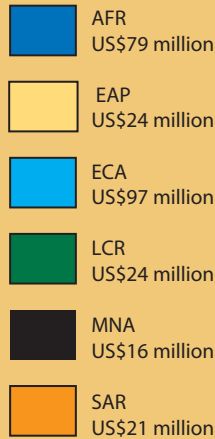
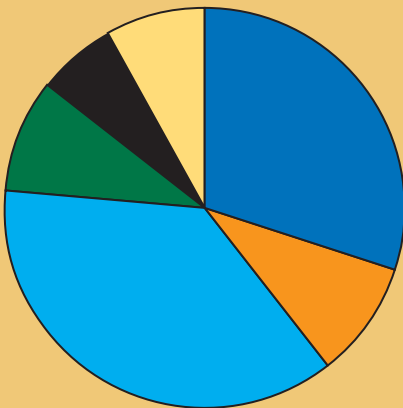
analysis of different existing green electricity schemes worldwide, and *Considering Trade Policies for Liquid Biofuels*, an international analysis of the interaction between national biofuels policies, agricultural policies, and trade policies and their effect on international markets of biofuels and other agricultural products. Moreover, *Risk Assessment Methods for Power Utility Planning* analyzes the methods currently used for planning power generation technology portfolios. It concludes that most current planning methods are inadequate for comparing fuel-intensive thermal generation technologies with free-fuel capital intensive renewables, such as hydro, wind, and geothermal because of difficulties in handling fuel price risk systematically. ESMAP and the World Bank are now working on incorporating these lessons into new activities and developing more appropriate planning methods.

### **Box 10: Shanghai: Developing a Green Electricity Scheme**

Upon the request of the City of Shanghai, China, in 2003, the World Bank—supported by grants from ESMAP and ASTAE—launched a project to help the city in designing and introducing a practical green electricity scheme. The scheme allows consumers to purchase, on a voluntary basis, part or all of their electricity from renewable energy resources, such as wind and solar, thereby contributing to making the city’s electricity portfolio more sustainable and reducing local air pollution. At its launch in 2005, the project enlisted 14 large electricity-consuming companies to commit to buying a total of 6.54 GWh of renewable electricity branded as “Jade Electricity” annually. With this critical mass of demand ensured, the scheme was subsequently able to attract additional customers, including businesses of varying sizes and households. It is believed that the success of this project can be replicated in other cities in developing countries. A more detailed description of the scheme and the lessons derived from it can be found in the report *Shanghai: Developing a Green Electricity Scheme* (ESMAP technical paper 105/06).

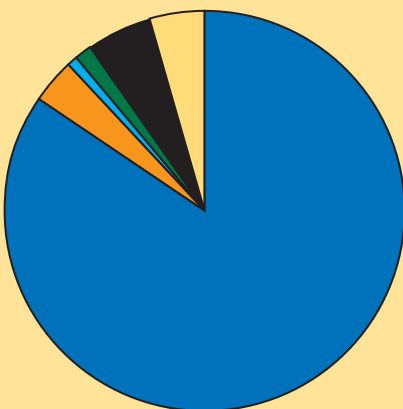
**Figure 12: Sectoral Commitments by Region, FY07**

Energy Efficiency: US\$262 Million



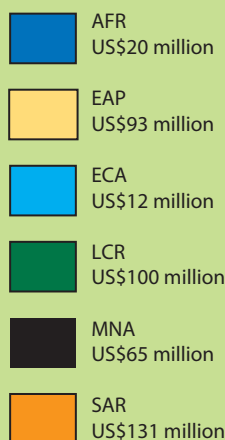
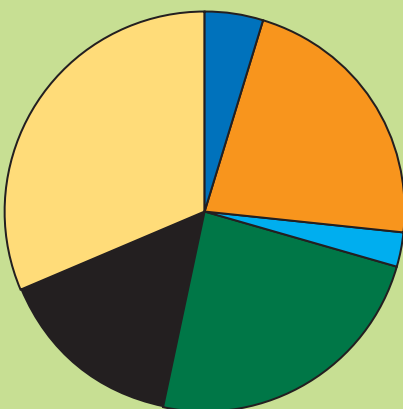
As in FY06, the ECA region continued to receive the highest energy efficiency commitments in FY07—US\$97 million. AFR performed similarly well with US\$79 million. The majority of projects improved energy efficiency in the power transmission and distribution sector, followed by industry and demand-side approaches in the residential and commercial sectors.

Renewable Energy—Hydropower > 10 MW: 751 Million



Large hydropower projects were supported with US\$751 million in FY07. The majority of these projects, valued at US\$636 million, were in AFR. Both IBRD/IDA and IFC only classify projects as large hydropower if the installed capacity at a single facility exceeds 10 MW. Pumped storage, run-of-river hydropower, and hydropower projects with dams are included here as well, as long as the capacity exceeds 10 MW. Hydropower rehabilitation projects, which do not result in a greater increase of capacity installed (that is, MW), are classified as energy efficiency projects.

Renewable Energy—New Renewables: US\$421 Million



SAR made the largest contribution to the new renewable energy portfolio, accounting for US\$131 in commitments. LCR and EAP followed with commitments of US\$100 million and US\$93 million, respectively. Solar thermal, geothermal, wind, and biomass power projects received the bulk of these commitments.

## Asia Alternative Energy Program



The Asia Alternative Energy Program (ASTAE) grew out of the Financing Energy Services for Small-Scale Energy Users (FINESSE) project initiated by ESMAP and bilateral donors in 1989. Following a joint request

from Asian borrowers and donor partners, the Bank acted to implement the FINESSE recommendations by creating ASTAE in January 1992. The original objective of ASTAE – to mainstream energy efficiency and renewable energy in World Bank operations – was achieved. The initial target of a 10 percent share of renewable energy and energy efficiency lending in the Asia energy sector was surpassed during FY97–00. With the support of ASTAE, more than US\$1 billion of renewable energy and energy efficiency projects or project components were developed, including about US\$500 million in World Bank loans and GEF grants. The projects supported by ASTAE and approved between FY93 and FY02 provided access to 660,000 households, installed 570 MW of renewable electricity-generating capacity, and avoided 720 MW of conventional electricity-generating capacity as a result of efficiency improvements.

Since then, ASTAE has embarked on a more ambitious strategy to scale up renewable energy and energy efficiency to make a direct and immediate impact on the World Bank's overall mission of poverty alleviation and growing emphasis on environmental protection in the two regions – South Asia, and East Asia and Pacific. ASTAE's work plan focuses on the following key components:

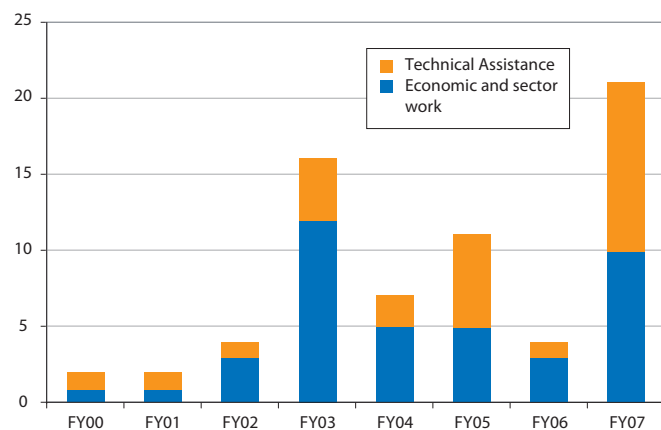
- *Support successful implementation.* ASTAE will continue to provide support for the projects currently under implementation. In the past, ASTAE assistance has been extremely valuable in helping to redesign projects to adapt to shifting conditions.

- *Scale up impact of renewable energy and energy efficiency through programmatic approaches.* To make a measurable impact on reducing greenhouse gas emissions and providing increased access to modern energy, more and larger projects are required. This will require a shift from working on stand-alone projects to working strategically on multiple projects on a programmatic basis. The projects will not be ends in themselves, as in the past, but will be seen as vehicles to build capacity and provide the momentum for policy and institutional change and the creation of an enabling environment for scale-up.
- *Strengthen the enabling environment.* Large-scale renewable energy and energy efficiency development requires that countries establish an institutional, policy, financial and regulatory framework that helps attract capital from international financial institutions, export credit agencies and, most importantly, the domestic and international private sector. ASTAE will use its cross-country experiences to share best practices.
- *Develop project pipeline.* ASTAE will continue to support new project development using the programmatic approach. The new projects will include both grid-connected and off-grid renewable energy applications, as well as market-based energy efficiency projects. ASTAE will continue its work in meeting energy needs in the agriculture, health, rural, and urban sectors.

The ASTAE work is supported by the World Bank, Government of the Netherlands, Canadian International Development Agency, United Nations Development Programme, and U.K. Department for International Development. Other sponsors have included the U.S. Department of Energy, U.S. Agency for International Development, Government of Finland, Government of the Swiss Confederation, European Community, U.S. Export Council for Renewable Energy (US/ECRE), German Federal Ministry for Economic



**Figure 13: Number of AAA Products with Renewable Energy and Energy Efficiency Focus, FY00–07**



Source: WBG databases.

Cooperation, and the Royal Danish Ministry of Foreign Affairs.

### The Way Forward

Broad consensus is now emerging that the world needs to address the dual challenges of increasing energy supply and services that are critical for economic growth for all developing countries and moderating and managing climate change. The World Bank Group launched the CEIF in 2006 to address these challenges. The growing recognition of the enormous challenge

of climate change has led to calls from governments, the private sector, and the public for the WBG to adopt a more comprehensive approach beyond the CEIF. This approach would address climate change not only as a risk to development, but also as an opportunity for Bank clients to accelerate their economic transformation and take advantage of new technologies. The WBG would expand its role in supporting meaningful, country-specific, and country-driven climate actions, focusing on the highest development and climate impacts. Broadening the WBG strategy would mean including the following elements: (a) a comprehensive approach to climate change, extending beyond clean energy and addressing sectors such as transport, agriculture, forests, and urban development; (b) a stepped-up program in policy research and knowledge sharing; (c) an enhanced role in the acceleration of new technology; and (d) an increased engagement in climate risk management.<sup>17</sup> Renewable energy and energy efficiency will contribute significantly to this enhanced strategy.

<sup>17</sup> World Bank Sustainable Development Network, “Clean Energy for Development Investment Framework: Progress Report on the World Bank Group Action Plan.” Report to the Development Committee, World Bank, Washington, D.C., September 27, 2007, p. 5.

## CASE SIX

# CREATING A FRAMEWORK FOR RENEWABLE ENERGY AND ENERGY EFFICIENCY IN MOROCCO

Morocco is 95 percent dependent on imported fossil fuels. This has focused the attention of the government on the need to ensure energy supply security and absorb energy price shocks. Morocco is well endowed with renewable energy resources, and has a substantial potential for energy efficiency improvements. Since 2005 the government has been actively engaged in an energy sector dialogue with the World Bank in order to prepare an energy sector development policy loan. ESMAP, the trust-funded World Bank Energy Sector Management Assistance Program, provided support to this dialogue. ESMAP is now catalyzing activities for energy efficiency and renewable energy in Morocco by giving assistance to formulate policies and regulations. The projects have provided a legal framework for energy efficiency and renewable energy in Morocco, including special financing mechanisms. They have also created a new energy management agency focused on the following:

- Increasing the role of renewable energy in Morocco with the objective of generating 20 percent of electricity from domestic renewable energy sources by 2015.
- Promoting more efficient utilization of energy in industry and public buildings and for residential use.
- Reducing greenhouse gas emissions by 10 percent by 2015.

In 2006, ESMAP-supported projects focused on building consensus among stakeholders on goals and measures that will promote wind electricity and energy efficiency. These projects supported working groups within the government that were able to draw on lessons learned from previous efforts in Morocco and best practices from elsewhere.

This process helped the government prepare a comprehensive legal framework for energy management. The framework eventually took the form of a single law on energy efficiency and renewable energy that will be used to prepare additional necessary regulations to promote investments. The law sets up goals, such as 1,000 MW of additional wind-electricity generation capacity by 2012, mandatory energy efficiency audits, and the preparation of improved sectoral energy efficiency standards. The law also establishes an energy management agency. The agency will be charged with promoting energy efficiency and supporting small renewable energy technologies for households and businesses.

The law also launches two special funds. One fund will pool donor financing to support private sector investment in large wind and power generation capacity. Another fund will support energy efficiency investments. In 2007 ESMAP supports additional work to prepare the business plans and to design the organization of the new energy management agency and the funds.

