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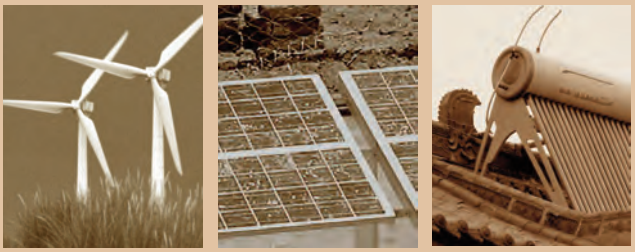

Review of AFD and French GEF Energy Efficiency and Renewable Energy Projects

Updated edition by Claude Briand and Alain Riès,
Evaluation and Capitalisation Unit, AFD

Research Department
Evaluation and Capitalisation Unit

Agence Française de Développement
5, rue Roland Barthes 75012 Paris < France
www.afd.fr

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Abstract

The energy management sector, which comprises energy efficiency projects and the development of renewable energy sources, is a major component of the efforts to combat climate change made by AFD Group (AFD and Proparco) and the French Global Environment Facility (French GEF). The sector is key to AFD Group's strategy for protecting global public goods in emerging countries.

In 2007, AFD's Evaluation and Capitalisation Unit published a general review and inventory of projects financed from 1994 to 2006[1] and undertook to update it regularly. This paper constitutes the first such update; it incorporates the data for 2007 as well as certain cancellations of aid.

Two related notes published in June 2007, "Quel usage pour les prêts bonifiés ?" ("How Should Subsidised Loans Be Used?") and "Comment mesurer l'impact climatique ?" ("How Should the Climatic Impact of a Project Be Measured?"), both in French only, are still current and relevant.

The portfolio has grown very rapidly. Total commitments of AFD, Proparco and the French GEF, which stood at about €50 million per year from 1995 to 2001, reached €205 million in 2004 and exceeded €450 million in 2006 and 2007. It should be noted, however, that commitments fell substantially in 2000, 2002 and 2003, reflecting the trend in oil prices.

Although the annual data are not very significant, the curve seems to show that, above and beyond its declared intention of long-term involvement in the sector, AFD is highly responsive to the energy context prevailing during the project preparation phase.

Very few projects have reached completion. A summary of three ex post evaluations of energy efficiency programmes in the construction sectors of China, Lebanon and Tunisia, initiated in the late 1990s and completed with financial support from the French GEF, is available on the AFD website.

Projects are unequally distributed across sectors. Most of the projects relate to the power distribution sector (27), fuels other than motor vehicle fuels (16), public transport and travel (13), wind power (10), and urban development and housing (8).

The portfolio contains more renewable energy projects than energy efficiency projects. This characteristic is more or less universal: energy efficiency projects are more difficult because they are more dispersed and are interwoven with other issues such as industrial upgrading and housing improvements. It should be emphasised, however, that this review covers only those projects in which energy efficiency or development of renewable energy sources is the main objective, and that as a result, many projects in which energy efficiency is a secondary component are not considered.

A review of the current situation of energy efficiency and renewable energy projects allows us to identify a number of enabling conditions for this type of project. For example, a suitable legislative framework, sufficient political will and appropriate local technical capacity are generally required.

Appropriate forms of financing are also required. Half of the projects in the energy management portfolio received grants (grants being the only tool available to the French GEF). One-third of all projects received subsidised loans, while 10 per cent obtained unsubsidised loans. Six per cent of projects involve lines of credit at subsidised interest rates extended by AFD to banks, which in turn lend to energy management projects (including small projects). Unsubsidised loans are used almost exclusively in the renewable energy sector.

[1] Guillaumie, K., C. Briand, et A. Ries, (2007), Cartographie du portefeuille des projets d'efficacité énergétique et d'énergies renouvelables du groupe AFD et du FFEM, ex Post, Série Evaluation et capitalisation n°3, Agence Française de Développement, Paris

Introduction

The energy management sector comprises energy efficiency (EE) projects and the development of renewable energy sources (RES) in various economic sectors. For the last ten years, AFD has been supporting projects that address two of AFD Group's main priorities: combating climate change and energy efficiency. Climate change is also a major operational focus of the French Global Environment Facility (French GEF), which consists of a steering committee[2]; a scientific and technical committee[3] and a secretariat located at AFD headquarters.

Although the fields of climate change and energy efficiency overlap, they do not entirely coincide. For example, carbon sequestration to reduce the amount of greenhouse gases (GHGs) in the atmosphere is part of the climate strategy, but not of the energy strategy; and conversely, the financing of thermal power plants to meet increased demand for electric power comes under the energy strategy and not the climate strategy.

Energy management projects form part of AFD's new mission to protect global public goods and of its "emerging countries" strategy. Two internal sector framework papers (cadres d'intervention sectoriels) on climate and energy are being drafted in order to give greater weight to these priorities. In some cases, innovative mechanisms are used in the preparation and financing of this type of project.

Energy management is an innovative, complex sector that is growing strongly at the international level. It combines several types of operation: development of renewable energy sources (wind, solar, biomass, biogas, mini-hydraulic systems, etc.), energy efficiency projects (buildings, plant and machinery, production processes and energy-efficient transport) and the establishment of appropriate legislative and regulatory frameworks (construction standards, incentive prices, suitable taxation, etc.).

In a context of skyrocketing commitments and expressions of interest by several departments, the AFD Evaluation and Capitalisation Unit undertook a review and inventory of the energy management projects, either completed or in progress, of AFD Group (AFD and Proparco) and the French GEF. This survey, which breaks down the energy management portfolio by technical sector, covers all projects for which a financing decision was taken between 1994 and 2007.

As a result of this choice of dates, the survey has to juxtapose projects that are not easily comparable because they are at different stages of advancement. Very few projects in the portfolio have been completed and are considered eligible for ex post evaluation. The present work offers an inventory of the portfolio at a given date, but updated to reflect the progress made on AFD Group and French GEF projects. It is written in very general terms because it is intended more for AFD Group as a whole, its partners and its governing bodies than for specialists.

This note is the first update of the summary paper published in September 2007.

[2] The steering committee brings together the following institutions: the Ministry of the Economy, Finance and Industry; the Ministry of Foreign Affairs; the Ministry of Ecology and Sustainable Development; the Ministry of Education, Higher Education and Research; and AFD.

[3] The scientific and technical committee is made up of ten members from the French Agency for the Environment and Energy Management (ADEME), the French Agricultural Research Centre for International Development (CIRAD), the French National Centre for Scientific Research (CNRS), the Institute of Energy Policy and Economics (IEPE), the French Development Research Institute (IRD) and the French Research Institute for Exploitation of the Sea (IFREMER).

1 Analysis of energy management projects

Projects were classified according to a nomenclature developed by AFD's technical departments (Appendix 1) and project information was entered in an Excel® database. A summary sheet was then drafted for each technical sector, describing the sector considered, listing the projects associated with it and identifying factors that facilitated or hindered these projects. These summary sheets have not been updated; they are available in the original summary document[4] ; However, the financing packages granted in 2007 are presented here in summary form, project by project (Appendix 2).

Statistics derived from the database on the energy management portfolio enable us to analyse the breakdown of projects by technical sector, by funding operator, and by type of financing, as well as to monitor progress over time.

1.1 Sector breakdown

Projects are unequally distributed across sectors:

Table 1. Number of projects per sector

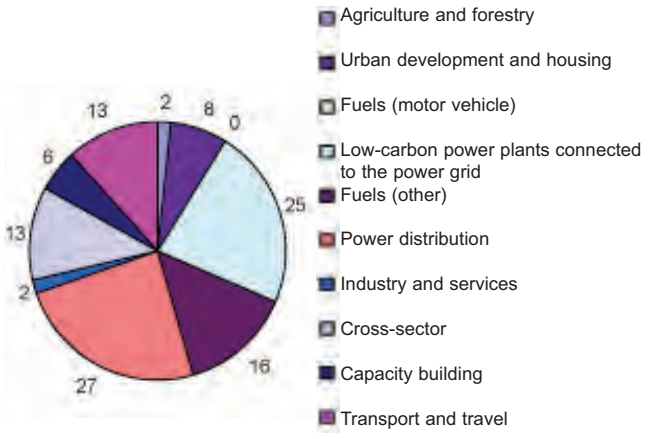
Sector	Sub-sector	Number	Total
Agriculture and forestry	Forest management plans for energy purposes and regulation of harvesting	2	**2**
Urban development and housing	Climate-friendly housing construction programmes and energy-efficient durable goods	6	**8**
	Increasing the energy component in urban planning and in urban transit plans	1	
	Composting or energy reclamation from household waste	1	
Low-carbon power plants connected to the power grid	Wind	10	**25**
	Large-scale hydraulic	7	
	Mini-hydraulic systems	4	
	Geothermal energy	4	
Fuels (motor vehicle)	Development of biofuel chains	abandoned	
Fuels (other)	Modernisation of the traditional heating and cooking fuels sectors	3	**16**
	Industrial processes to convert biomass into energy through carbonisation, gasification and multiple fuel combustion	12	
	Energy reclamation from agro-industrial waste	1	
Power distribution	Sustainable rural electrification	19	**27**
	Reduction of power losses in transmission	7	
	Demand management on the power grid	1	
Industry and services	Energy upgrading of energy-greedy industries (steel, petrochemicals, etc.)	1	**2**
	Energy management in the services sector (offices, shops, hotels, hospitals, etc.)	1	
Cross-sector	Energy efficiency fund	4	**13**
	Line of credit	7	
	Promotion of energy efficiency projects	2	
Local capacity building	Local capacity building (support for project preparation, including CDM projects, technical assistance, etc.)	6	**6**
Transport and travel	Rationalisation of energy management in transport fleets	6	**13**
	Revival of low-consuming forms of public transport	5	
	Intensification of the energy component of transport plans	2	
		112	**112**

[4] Guillaumie, Briand and Ries (2007), op. cit.

Two of the sub-sectors in the nomenclature – development of local production of energy-efficient durable goods (e.g. refrigerators) and attention to unmotorised or lightly motorised travel – are not addressed by any projects. Others, such as energy upgrading of energy-greedy industries and demand management on power grids, are targeted only by a single pilot project. However, the first financing packages in the geothermal energy sector were granted in 2007.

It should be emphasised, however, that the database compiled as part of this effort to "capitalise on lessons learned" covers only those projects in which energy efficiency or development of renewable energy sources is the main objective, and that as a result, many projects in which energy efficiency is a minor component are not considered in this study. One example is an investment project in drinking water supply in Cambodia. The project includes a component aimed at reducing leakage from the water distribution network and upgrading of pumps, which reduces the energy consumed by the network. Projects in support of local authorities also include an energy management component.

Figure 1. Sector breakdown of projects



The oldest projects in the portfolio are in the power generation and distribution sector: hydro-electric plants, decentralised rural electrification based on renewable sources, energy reclamation from agricultural and agro-industrial residues, as well as urban waste (combined heat and power [CHP] and biomass-fired power plants).

There are more RES development projects than EE projects; French GEF financing focuses more particularly on the latter.

1.2 Analysis by funding entity

AFD's energy management portfolio has changed a great deal since 1994. After having financed many decentralised rural electrification projects, partly based on renewables, and RES generation facilities (dams and wind farms), AFD is increasingly focused on the fight against climate change. More diversified projects have been mounted (biofuels, CHP) as well as many public transport infrastructure projects (construction or energy-efficiency improvements). Lastly, many lines of credit have been granted recently in the energy management sector of emerging countries to boost AFD's level of activity in several sectors.

Proparco is increasingly involved in the energy management sector. It has taken an equity stake in the investment fund FE Clean Energy Asia, which invests in projects to develop RES sources or reduce energy consumption. In addition, Proparco's project portfolio in the RES sector has grown, with a primary focus on wind energy but also projects involving hydroelectricity and combustion of biogas.

The French GEF launched its first projects in the energy management sector as from its founding in 1994, concentrating heavily on construction (China, Lebanon, Tunisia, Afghanistan). The French GEF has also set up projects in the industrial sector (Eastern Europe, Morocco), transport (a study in Vietnam), photovoltaic rural electrification and the fuelwood sector.

Table 2. Breakdown of projects by funding entity

Sector	AFD	French GEF	Proparco	Total
Agriculture and forestry		2		**2**
Urban development and housing	1	7		**8**
Fuels (motor vehicle)				
Low-carbon power plants connected to the power grid	15	2	8	**25**
Fuels (other)	8	6	2	**16**
Power distribution	21	6		**27**
Industry and services	2			**2**
Cross-sector	7	4	2	**13**
Local capacity building and support	2	4		**6**
Transport and travel	10	3		**13**
Total	**64**	**36**	**12**	**112**

1.3 Growth in commitments

The portfolio of energy management projects is growing strongly. Whereas the number of such projects initiated annually averaged about six before 2002 (Figure 2), there were 17 projects in 2006 and 22 in 2007.

Figure 2. Number of projects in the energy management portfolio of AFD Group and the French GEF, 1995-2007

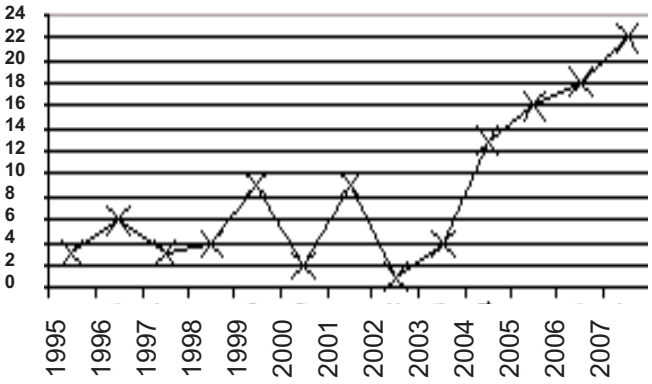
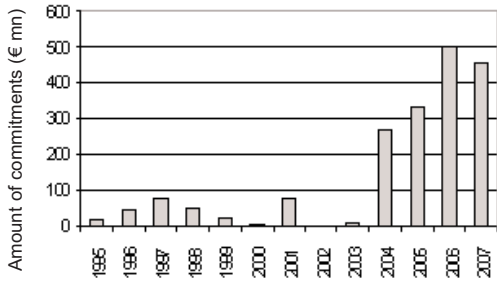
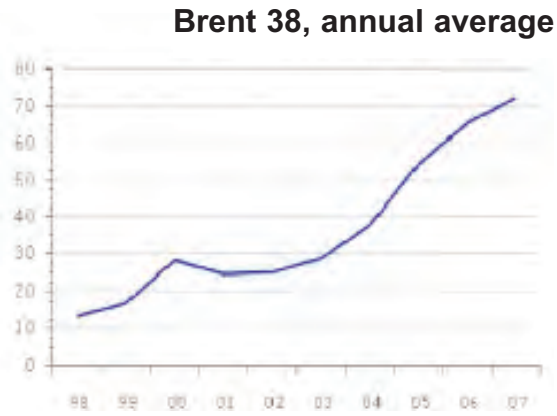


Figure 3. Growth in AFD Group's commitments



Note: AFD accounts for the bulk of these commitments. The shares of Proparco and the French GEF are much smaller.

Figure 4. Price of crude oil, 1998-2007

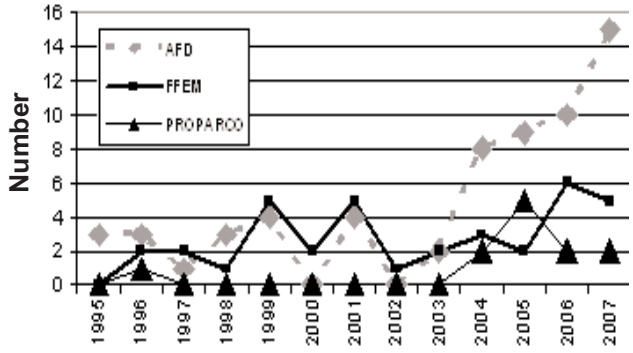


Oil and Gas Journal.(http://www.mazout.ch/doc/480846583919072006.pdf)

Over the 1995-2001 period, total commitments amounted to roughly €50 million per year. They increased strongly to over €250 million in 2004 and over €450 million in 2006 and 2007, although a sharp drop was observed in 2000, 2002 and 2003. The trend in commitments reflects that of the price of crude oil (Figure 4): low oil prices in 1998-1999 and 2001-2002 were followed a year later by a decline in the energy management commitments of AFD Group and the French GEF (Figure 3).

The number of French GEF projects related to the energy management portfolio was more or less stable over the preceding decade, whereas the number of AFD and Proparco projects concerning energy management increased sharply as from 2003.

Figure 5. Number of projects in the energy management portfolio of AFD Group and the French GEF, 1995-2007



The increased number of projects was reflected in a rise in the commitments of both AFD and Proparco. The commitments of the FFEM also increased considerably from 1995 to 2007, reaching a level of over €6 million.

Figure 6. Growth in AFD Group's commitments

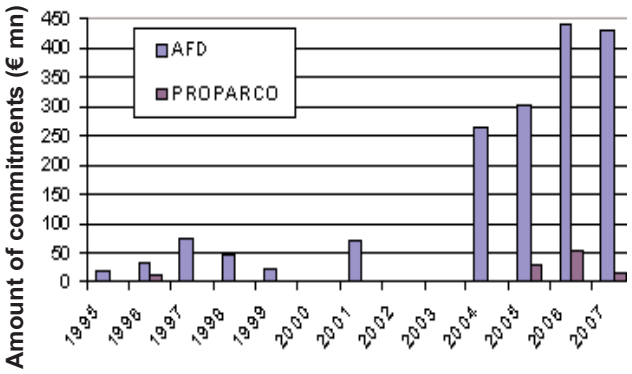
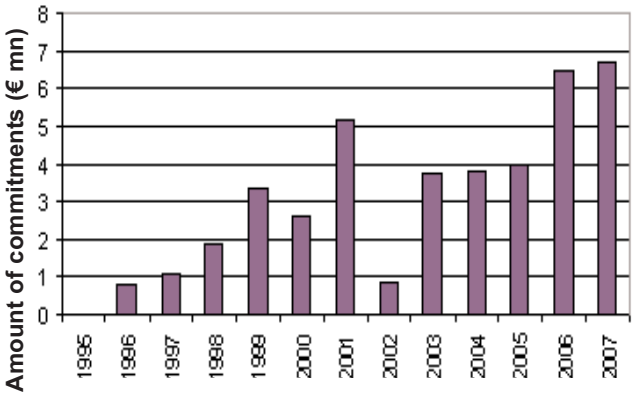


Figure 7. Growth in the French GEF's commitments



1.4 Growth in disbursements

Figure 8. Cumulative disbursements since the origin of the portfolio

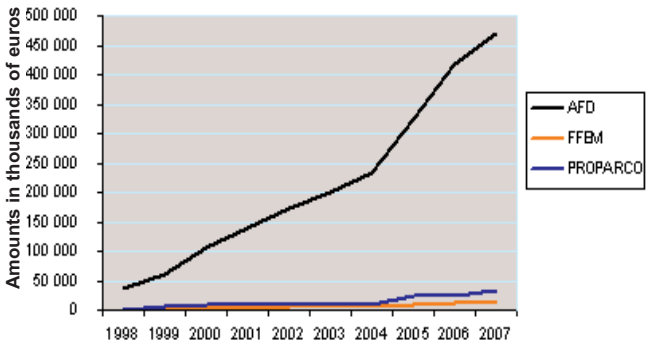
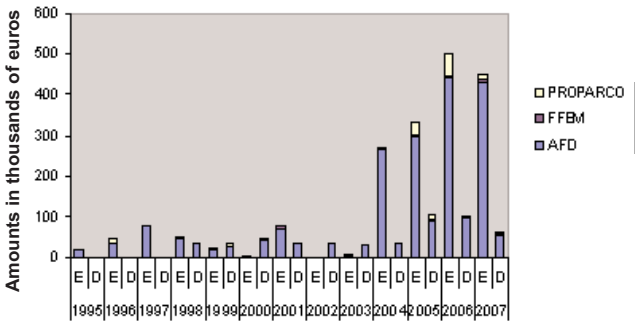


Figure 9. Commitments versus disbursements



The first disbursements were made in 1998. They were steady until 2004, at approximately €30 million per year, and then surged from 2005 to 2007, with €106.6 million disbursed in 2005 and €100.8 million in 2006. At year-end 2007, cumulative disbursements had more than doubled with respect to year-end 2004 (€520 million versus €250 million).

1.5 Analysis by type of financing

Figure 10. Type of financial tools used, by number of projects

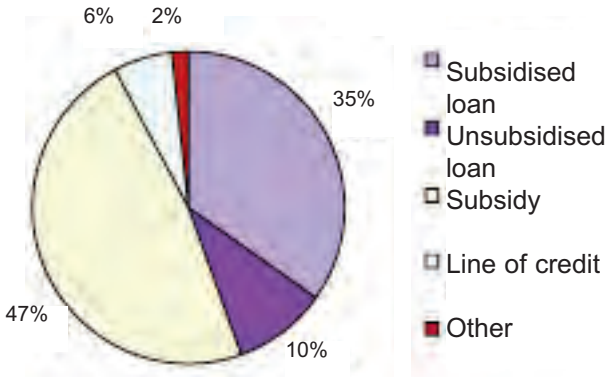
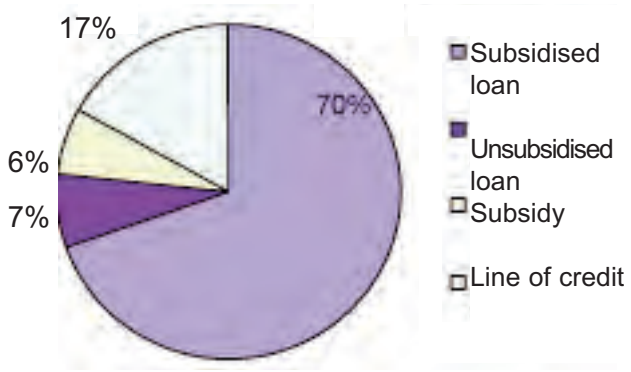


Figure 11.Type of financial tools used, by amount of commitments



Half the projects in the energy management portfolio received grants, representing 6 per cent of total commitments. One-third of projects received subsidised loans, in a total amount of €1.289 billion, and 10 per cent obtained unsubsidised loans in the amount of €131 million.

Six per cent of projects, corresponding to 17 per cent of total commitments, involve lines of credit at subsidised interest rates. These lines of credit are extended to banks, which in turn lend to energy management projects, including small ones. All companies concerned can receive such loans.

The financial tools used also depend on the operator concerned. The French GEF uses grants only, whereas Proparco's only forms of intervention are loans on market terms and stakes in investment funds and local currency loan guarantee funds.[5]

AFD can use the entire range of financial products, but not under all circumstances. For example, it cannot allocate grants in emerging countries. However, a research project on the rehabilitation of buildings in China is partly co-financed from AFD's budget.

A breakdown of financial instruments by sector (Table 3) shows that unsubsidised loans are used almost exclusively in

[5] Power generation project based on effluents from the manioc processing industry in Thailand.

the renewable energy sector. Innovative sectors such as energy efficiency in industry and local capacity building were supported almost exclusively through grants. This is also the case for the urban development and housing sector and, more generally, for all energy efficiency sectors. The reason is that energy efficiency improvements often require the establishment of appropriate legislative and regulatory frameworks, and such institution building can hardly be financed in any form other than through grants.

Table 3. Type of financial tools used, by sector

	Subsidised loan	Unsubsidised loan	Grant	Line of credit	Other	Total
Agriculture and forestry			2			**2**
Urban development and housing			8			**8**
Fuels (motor vehicle)						
Low-carbon power plants connected to the power grid	12	8	5			**25**
Fuels (other)	6	2	8			**16**
Power distribution	13		14			**27**
Industry and services			2			**2**
Cross-sector			4	7	2	**13**
Local capacity building and support			6			**6**
Transport and travel	7	1	5			**13**
Total	**38**	**11**	**54**	**7**	**2**	**112**

Note: Some projects are counted twice because two financial tools (loan + grant) are used.

AFD and Proparco therefore need to make a considerable effort to develop EE projects based on traditional loans, with or without subsidies.

1.6 Analysis by geographical region

Figure 12. Number of projects per geographical region

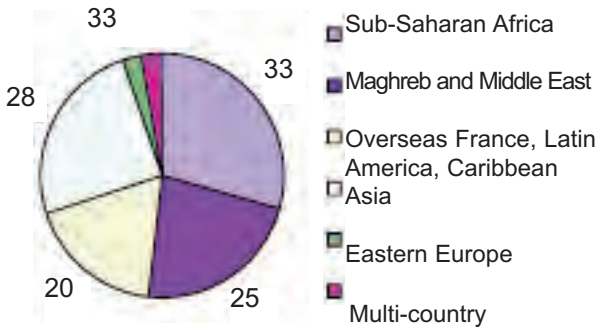
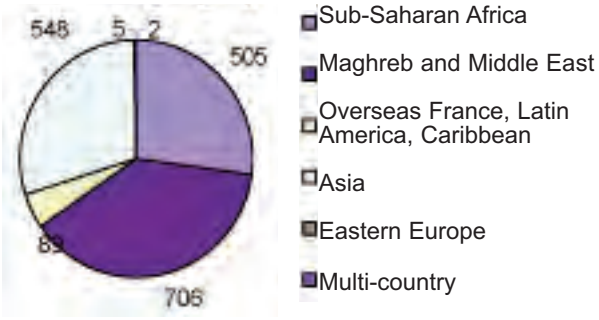


Figure 13. Amount of commitments per geographical region



In terms of the number of projects, the portfolio is well spread out over AFD's geographical areas of operation. Projects in Eastern Europe are all financed by the French GEF. Commitments in the energy management portfolio break down as follows: 38 per cent in the Maghreb and Middle East, 30 per cent in Asia, 27 per cent in sub-Saharan Africa, and 5 per cent in the French overseas departments and territories.

2 Conditions required for start-up of energy management projects

This review identifies a certain number of conditions that are conducive to the success of this type of operation.

2.1 Country context

In an increasingly globalised world, national contexts – particularly the regulations and pricing and tax measures adopted, as well as the political will backing them – are highly important to the emergence of projects.

2.2 Economic conditions

2.2.1 Regulatory standards

Coercive regulatory standards – such as the obligation to capture methane from landfill sites – constitute a favourable factor for the development of renewable energy sources and energy savings.

Regulations must take account of country-specific constraints. For example, several countries have required that a percentage of ethanol be gradually blended into petrol. These regulations had not been coordinated with the development of agro-industry, however, and it proved impossible to comply with them due to insufficient domestic production of ethanol.

There is no point in adopting a regulation unless compliance is both possible and enforced. It is therefore recommended that standard-making be accompanied by capacity building for the parties involved, particularly the future inspectors. Donor support can be effective here if it is requested by the competent national authorities and agencies.

Energy efficiency labelling of household appliances, housing and engines makes it possible to implement a regulation in a controlled fashion. Gradual prohibition of the least efficient categories gives industrial firms and other economic agents time to adapt to the future regulation. Labels also encourage "virtuous" behaviour on the part of those who wish to do more than meet the minimum standard. For such a project to succeed, labelling must be mandatory for all items targeted.

2.2.2 Pricing and tax aspects

Projects to develop renewable energy sources are favoured by:

- an obligation to purchase electric power generated from renewable sources;
- fixed purchase prices (possibly subsidised) for RES power over a period long enough to cover depreciation of plant and equipment;
- tax incentives.

The obligation to buy RES power is not in itself a sufficient condition, as solvent customers are also required. This point is particularly problematic in countries where power distribution companies are experiencing financial difficulties.

Without fixed purchase prices, it is not easy to make RES power profitable if the prices of power generated from conventional sources do not reflect the real costs involved, particularly the cost of the oil products used for generation purposes.

Similarly, the development of the biofuels sector is extremely dependent on oil prices. To ensure the sustainability of this type of industry, a State guarantee of fixed purchase prices is required.

Subsidies on power prices or subsidies for more energy-efficient power plants, transport systems and other facilities entail a cost to the State. This cost can be partly offset, however, by reducing the share of the central budget (if any) allocated to price subsidies for power generated from oil and gas.

Another form of fiscal subsidy is redistribution of taxes on energy consumption, energy-inefficient industry or energy-greedy products (automobiles, aircraft, air conditioning, etc.).

Promotion of the use of public transport also requires investment subsidies and/or subsidised user rates. The presence of national or local transport regulation authorities is a favourable condition for the development of public transport.

2.2.3 Political will

In addition to the fiscal and regulatory framework, political determination to develop renewable energy sources and improve energy efficiency increases projects' chances of success.

In Tunisia, for example, political support for these activities has been particularly marked, including at the highest level of State, since the third oil shock in 2004. It has led to the adoption of a comprehensive, coherent programme of energy savings and promotion of renewable energy sources, along with a legislative and financial mechanism supported by a well-funded public agency.

In addition, synergies can be obtained between energy saving programmes, making it possible to combine the communication campaigns targeting industrialists, consumers and government, and thus reinforcing the positive impact of each project.

2.3 Financing

Access to suitable financing is a key issue for the sponsors of EE and RES projects. Donors such as AFD must take an innovative approach to financing and facilitate use of the Clean Development Mechanism (CDM) in developing countries.

2.3.1 Suitability of financial instruments

The difficulty of obtaining finance is a major constraint on projects.

It may be due to any of several causes:

- insufficient financial capacity of the project owner;
- a perception of high project risk on the part of banks, which are not well informed about innovative RES and EE technologies (trigeneration plants, biomass-fired plants, etc.) or lack the capacity for rational risk-benefit analysis;
- unsuitable loan periods (too short-term);
- projects too small to interest a donor.

One way of dealing with the first difficulty is to increase the capital of the project owner. Specialised investment funds have been developed in the last few years, and the very stiff competition among recently developed funds favours project owners. The rates of return expected by equity investors are now considerably lower, making possible a new generation of projects.

Guarantee funds could constitute at least a partial solution to the second difficulty.

Project owners want loans with a term long enough to cover

the depreciation period of the facilities financed. Local banks often make difficulties about this type of loan, leaving a niche for international donors to undertake operations on a subsidiary basis, notably in the case of small hydroelectric dams.

Many small projects fail to attract donors because the investment required is too small. The environmental lines of credit introduced in recent years by AFD and other innovative financing tools are designed to address this obstacle, in partnership with local banks.

Lastly, project owners generally prefer to avoid borrowing to finance the studies required in the upstream phase. This obstacle can be dealt with by developing funds to allocate project launch grants.

2.3.2 CDM financing

The Clean Development Mechanism (CDM) is an additional financial resource that can favourably influence an investor's decision. As a source of income, it is unlike aid flows from donors in that the funds are obtained only after project completion and the revenue received depends on the price per tonne of CO2.

To be eligible for the CDM, a project must develop a method of accounting for GHG emissions – an elaborate process, but one that is the main assurance of the CDM's credibility. The cost of access to CDM financing is thus very high in the case of innovative projects for which no such method has been developed.

Helping developing countries to introduce CDM methods in innovative sectors is thus an activity offering considerable leverage, as similar projects around the world will later reap the benefits. AFD and the French GEF have taken some initial steps in this direction, but the support provided is being targeted not to innovative sectors that have not yet been registered for the CDM, but rather to specific geographical areas.

2.4 Technical capacity

Shortcomings in technical capacity, such as insufficient knowledge of the technologies involved and a lack of specialised private operators, constitute a considerable barrier to the emergence of projects.

2.4.1 Knowledge of technical sectors

Potential project owners, which are often small to medium-sized companies or local authorities, are not well informed about specific technical sectors and the energy savings that could be obtained. For example, the development of photovoltaic energy in developing countries is hampered by the low level of local technical know-how and a lack of private firms of the right size.

Subsidised pilot projects, and subsequent analysis and dissemination of their results, can be used to present an innovative technology or scheme and to demonstrate its technical and institutional feasibility and economic benefits. This niche is a particular focus of the French GEF, and AFD can also play a role through subsidised loans (see below).

2.4.2 Development of ESCOs

Energy saving service companies (ESCOs)[6] conduct analyses aimed at reducing the energy costs of industrial customers. An ESCO's revenue is a share of the resulting savings in the customer's operating costs. ESCOs have the advantage of managing the entire project: design, applying for financing, project preparation, construction and operation. They also have the ability to involve all players in the sector and to finance both large and small projects.

The portfolio of AFD Group and the French GEF contains fewprojects involving ESCOs.

[6] ESCO: Energy Saving Service Company.

The French GEF allocated a grant in 1999 to support the establishment of an energy efficiency fund in the Eastern European countries. This fund invested in ESCOs in order to extend its support to smaller projects or specific groups of projects. Proparco has invested in a similar fund, FE Clean Energy Group, which develops energy efficiency projects in partnership with ESCOs.

The French GEF allocated a grant also granted a subsidy for the development of an ESCO to finance small rural hydroelectric projects in Indonesia.

The small number of ESCO projects in the portfolio is due partly to the scarcity of ESCOs and partly to the small size of their projects, which makes it difficult for a donor to become involved directly.

2.5 Environmental and social factors

Negative environmental and social and environmental impacts are always an obstacle to development projects, regardless of their nature. This obviously applies to projects in the energy efficiency and renewable energy portfolio, many of which are infrastructure projects: dams, railways, CHP plants, etc.

The positive impact of a reduction in GHG emissions obviously weighs in the balance, but it should not, for example, make us forget any population displacements that may result from a project. Similarly, agro-industrial projects such as biofuel development projects raise a conflict over land use (fuel crops versus food crops) and may pollute soils and surface water. On a smaller scale, wind farms cause visual and noise pollution that limits the expansion of this form of generation.

To ensure that such projects are conducted properly, a thorough environmental and social impact assessment is needed, accompanied by an environmental and social management plan and, if necessary, a plan for relocation of the population affected.

3 Conclusion

An appropriate legislative framework and strong political support are factors that favour the development of renewable energy sources and energy efficiency. A comprehensive energy management strategy makes it possible to generate synergies between programmes and to conduct joint promotional and awareness-raising campaigns. In addition to a favourable institutional framework, EE and RES projects require the presence of local technical capacity as well as appropriate financing granted for a term long enough to cover the depreciation of the facilities financed.

Appendix 1

Nomenclature of energy management projects for evaluation/capitalisation purposes

The energy management sector comprises energy efficiency (EE) projects and development of renewable energy sources (RES) in various sectors: energy production and distribution, industry and services, transport and travel, urban development and housing, agriculture and forestry.

The financing provided may be directly related to a particular sector or may be multi-sectoral in scope (e.g. lines of credit and investment funds specialising in energy management).

Energy production and distribution

Low-carbon power plants connected to the power grid:
- Large-scale hydraulic
- Mini-hydraulic
- Wind
- Geothermal

Fuels (other than motor vehicle)

- Modernisation of the traditional (heating and cooking) fuels sectors
- Industrial processes to recover energy (heat and power) from biomass[6] by carbonisation, gasification[7] and multiple fuel combustion[8]

[6] The term "biomass" refers to the biodegradable by-products of agriculture and related forms of production, as well as municipal, industrial, hotel and restaurant waste.

[7] The biogas used in power plants is derived either from natural decomposition of municipal waste (landfill sites) and effluents (sewage treatment plants), or from fermentation of these materials in methanisers (digestion).

[8] Combined heat and power, or cogeneration, plants produce energy (electric power and/or heat) from fossil fuels (gas, LPG, diesel) and biomass or biogas. In the industrial sector, the main purpose of CHP generation is self-production of electric power and heat.

Fuels (motor vehicle)

- Development of biofuel chains (sugar/ethanol and vegetable oil/biodiesel)

Power distribution

- Demand management on the power grid (power demand management plan and incentive pricing)
- Reduction of power losses in transmission
- Sustainable rural electrification (photovoltaic or independent local grids)

Industry and services

- Energy-efficiency upgrading of energy-greedy industries (steel, petrochemicals, metallurgy, textiles, etc.)
- Development of local production of energy-efficient goods (engines, refrigerators, lightbulbs, solar panels, etc.)
- Energy management in the services sector (offices, shops, hotels, hospitals, etc.)
- Promotion of ESCOs
- Energy reclamation from agro-industrial waste

Transport and travel

- Intensification of the energy component of transport plans (people or goods)
- Rationalisation of energy management in formal and informal transport fleets (buses, minibuses, taxis, etc.)
- Revival of low-consuming forms of public transport (rail, subway, etc.)
- Attention to unmotorised or lightly motorised travel (bicycles, pedestrians)

Urban development and housing

• Intensification of the energy component in urban planning and in urban transit plans

• Managing the energy consumption of local authorities and public facilities

• Climate-friendly housing construction programmes (both new construction and renovation) and energy-efficient durable goods (household solar water heaters, energy-efficient household appliances)

• Composting or energy reclamation from household waste

Agriculture and forestry

• Forest management plans for energy purposes and regulation of harvesting

• Local and regional plans for management of and energy recovery from agricultural biomass

• Agricultural and agro-industrial production for energy purposes (sugar, vegetable oil, etc.)

• Development of irrigation methods that consume little energy (and water)

Local capacity building and support

• Building local capacity (support for project preparation, including CDM[9] projects, technical assistance, training for technical and bank managers, informing and sensitising business, studies)

• Establishment of a monitoring and evaluation system for AFD-financed projects

[9] Clean Development Mechanism.

Appendix 2

Projects approved in 2007

1 Mini-hydroelectricity

1.1 Mini-hydroelectricity programme – China (Hubei) CCN3017

This project is designed to help fight global warming by supporting China's policy of promoting renewable energy sources. It strengthens the existing partnership with the Chinese authorities in this field.

The project is located in Hubei province, which has abundant hydropower but whose population is poorly served by the system.

The aim of the programme is to participate in financing several small hydroelectric plants. The funding provided may be allocated either to the construction of new works or to the rehabilitation of existing dams and replacement of their generation facilities. Projects eligible for this financing may not exceed an installed capacity of 50 MW.

Based on the current composition of China's stock of energy production facilities, this programme will bring annual emissions savings of about 208,000 tonnes of CO2; of this total, 131,000 tonnes are attributable to the construction of new plants or capacity increases in existing plants, and the remainder corresponds to the tonnes of CO2 emissions avoided by keeping existing hydroelectric plants in operation.

The total financing package of €53.8 million consists of a subsidised loan (PS2) of €40 million from AFD, with €13.8 million being self-financed.

2 Wind

2.1. Construction of a wind farm at Zemoshan – China (Yunnan) – CCN3016

This wind farm project mounted by the provincial authorities is the first such project in southwestern China, which is less windy than the northern provinces. Apart from the GHG emissions savings expected from the project, wind power offers the advantage of complementing hydropower during the dry season and should thus make it possible to meet the expected increase in demand in the city of Dali by 2010.

The project has two main components:

- construction and operation of a 30.6 MW wind farm with thirty-six 850 KW wind turbines, along with the electrical equipment needed for connection to the grid;
- the development of eco-tourism based on sustainable energy, in partnership with the city of Dali. The concessional element of the financing package is used to facilitate the creation of an exhibition centre devoted to environmental protection and to clean energy sources in which France has special expertise.

The total cost of the project (€36.4 million) will be covered by a subsidised loan (PS2) of €30 million from AFD and €6.4 million in self-financing.

In comparison to a coal-fired thermal plant, this project will save 24,000 tonnes of coal per year and reduce emissions of various local and global gaseous pollutants: about 50,000 tonnes of CO2, 390 tonnes of SO2 and 220 tonnes of NOx per year.

2.2. Wind farm – Eskom – South Africa – CZA6012

The aim of the project is to increase the share of renewables in the South African economy in order to reduce the share of fossil fuels (of which coal accounts for 80 per cent) and reduce CO2 emissions. To this end, a partnership is to be formed with the public power company Eskom, which has already undertaken a pilot project (a wind farm in Klipeuwel) that is now well advanced, since its three-year trial period ended in 2006. The main characteristics of the project are: 100 MW capacity, located on the west coast of the Cape Town area, three-bladed wind turbines with a capacity of 1.5 to 3 MW mounted on steel towers 60 to 80 m high.

This is the largest wind farm project in sub-Saharan Africa.

The total cost of the project is €120 million, of which €102 million is financed by a non-sovereign loan (PN3) from AFD.

3 Geothermal

3.1. Financing the second phase of the Olkaria geothermal power plant – Kenya – CKE6016 and PKE1043 (Proparco)

The project consists in financing the extension of the Olkaria II 70 MW geothermal plant commissioned in 2003. It has been established that the underground steam resources exceed the initial estimate. It will thus be possible to power a third generating unit with a capacity of 35 MW from the existing wells. The project is implemented by KenGen.

The aim of the project is to improve economic efficiency, the functioning of social infrastructure and the well-being of Kenya's population by ensuring reliable, inexpensive and low-carbon supply of power to the public grid. The project should bring savings of 150,000 tonnes of CO2 per year.

The total cost of the project is estimated at €70 million, of which €20 million is financed by an AFD concessional non-sovereign loan (PN2) and the remainder by the World Bank (USD21.9 million) and the European Investment Bank (USD40.8 million).

The Olkaria 3 project, also to be financed by Proparco, is in the identification phase.

3.2. Development of the geothermal resources of Dominica combined with electrical interconnection with Guadeloupe and Martinique – CDO1024 (French GEF)

The aim of the project is the construction of a 45 to 90 MW geothermal plant in Dominica, combined with an interconnection network between Dominica and two neighbouring islands by undersea cable. The power generated by the plant will substitute for power generated from imported fossil fuels. The project leads to a reduction in GHG emissions (over 600,000 tonnes of CO2 per year for a 90 MW plant), an increase in local value added in the power generation sector, lower generation costs, a reduction in the energy dependence of the islands concerned and, for Dominica, a source of foreign exchange via the sale of surplus power.

The project is developing geothermal power generation facilities in a country where these do not exist today. Its potential for replicability is high, because the resources available are probably much greater than what the project proposes to develop for the moment. This project could set an example for Saint Lucia and Saint-Kitts-and-Nevis, which also have proven geothermal resources that are currently unused.

The French GEF's grant of €2 million (out of the estimated total project cost of €5.5 million) should make it possible to

overcome obstacles related specifically to the development of geothermal power. The fact is that this technology entails upstream risks that hold back the development of projects which are otherwise economically viable. This aid covers 25 per cent of the cost of exploratory wells and 10 per cent of the capitalisation of a hedge fund to cover risks related to drilling of production wells.

3.3. Financing of drilling campaigns and the studies required for the development of Dominica's geothermal resources – CDM3001

The project consists in determining and modelling the characteristics of the island's geothermal resources in order to attract potential private developers. This requires an exploratory drilling campaign at the Wotten-Waven site, after a few preliminary surface studies (geological, geochemical and geophysical aspects, design of the drilling plan). Additional preliminary studies will be conducted before the construction of the geothermal plant and the electrical interconnection with Guadeloupe and Martinique.

The goal is to demonstrate that the geothermal resources exist and can be harnessed, in order to arrive at a detailed evaluation of the potential power output.

The total cost of the project is estimated at €5.5 million, of which €1.5 million is financed by an AFD grant.

4 Fuels (other than motor vehicle)

4.1. Solid waste management, Addis Ababa – Ethiopia – CET6002

The purpose of the project is to process the solid waste of Addis Ababa. As the current landfill site is saturated, the project aims to start up a sanitary landfill, with the essential supporting measures in terms of institution building and a city-wide waste management policy.

In addition, AFD's financing could be accompanied by recommendations on ways of improving solid waste treatment and recycling, with attention to both environmental and economic aspects. The project will be prepared jointly with the World Bank's Carbon Fund, in line with AFD's strategy of developing partnerships with the Bank and highlighting the carbon-related aspects of our projects. The site will be designed to optimise the production and recovery of methane.

The total cost of the project is estimated at €27.76 million, of which €5.4 million is financed by an AFD grant.

4.2. Nuh Cimento energy – Turkey – CTR6006

The project involves construction by the cement manufacturer Nuh Cimento of a plant that will not only treat the city of Izmit's residential and industrial wastewater sludge but also generate energy for Nuh Cimento's cement production process.

The municipality of Izmit, which currently spreads its urban sludge in the open air or limes and dries them, will instead deliver its total output of 150 tonnes per day to Nuh Cimento's industrial complex. As its incinerator has a capacity of 250 tonnes per day, Nuh Cimento also plans to process sludge from a site at Tuzla (100 tonnes per day). The sludge treatment plant uses an incineration process, and the sludge is to be dried entirely by fumes from the cement plant's smokestacks (energy that is wasted in the current configuration of the industrial site). The treatment plant will produce bricks to be used as fuel by the cement works, reducing the latter's annual consumption of fossil fuel (the current energy source is coal) by 3.1 per cent.

Nuh Cimento's annual coal consumption is currently 550,000 tonnes. The sludge treatment process will produce enough energy to replace 30,000 tonnes of coal a year and reduce annual CO2 emissions by 46,000 tonnes.

The project is entirely financed by an AFD non-sovereign loan (PN3) of €11 million.

5 Power generation

5.1. Conversion of Kipevu's gas turbines to a combined cycle system – Kenya – CKE3011

The specific objective of the project is to increase the generation capacity of Kenya Electricity Generating Company (KenGen).

The Kipevu site, near Mombasa, comprises a 60 MW steam power plant, a 73.5 MW diesel-fired plant and two gas turbines with a combined capacity of 60 MW. The project will enable KenGen to convert these gas turbines to a combined cycle system, raising their installed capacity by 50 per cent to 90 MW. The project contributes to two aspects of KenGen's investment strategy: addressing generation shortfalls and improving the energy efficiency of existing plants.

The €40 million project is entirely financed by a non-sovereign loan (PN3) from AFD.

5.2. Engro Electric (217 MW gas/diesel combined cycle power plant) – Pakistan – PPK1001 (Proparco)

The project involves developing, building and operating a 217 MW gas-fired combined cycle power plant in the northern part of Sindh province, Pakistan. The plant will burn low-calorie gas obtained as a by-product of the purification process at the Qadirpur gas field; at present, this gas is partly burned off and partly discharged into the atmosphere.

Using this gas to produce energy will bring a significant reduction in GHG emissions, because it both avoids direct emissions of methane into the atmosphere and substitutes gas-generated power for oil-generated power, thus reducing CO2 emissions.

Over a 25-year period, the cumulative impact of the project will be a reduction of 15 to 20 million tonnes in CO2 emissions.

The loan by Proparco amounts to €18 million.

6 Power distribution

6.1 National and local centres for remote management of Yemen's power grid – CYE6000

The objective of the project is to replace the command and control system of Yemen's interconnected grid, the current system being old (1986) and obsolete.

In view of the obsolescence of the distribution network and the lack of maintenance, power losses are estimated at 28 per cent. The specific objective of the project is to minimise such losses through increased reliability of the system of power generation, transmission and distribution managed by the Public Electricity Corporation. A secondary objective is to minimise power losses in the transmission and distribution networks through more efficient use of these networks.

The project is entirely financed by a loan of €26 million from AFD on PS1 terms.

6.2 Reinforcement of the high-voltage power transport network between Mombasa and Nairobi – Kenya – CKE6012

The project consists in stringing 450 km of 330 kV double-circuit power lines between Nairobi and Mombasa. A specific secondary objective is to improve the reliability of the grid and help to reduce transmission losses to an average level of 3.5 per cent.

This investment wil remove the need to transport coal or other fossil fuels by road (there is no satisfactory rail alternative) to a thermal power plant near the capital. Given the transmission capacity of 330 MW on the high-voltage line, this means that, 300 days a year, 150 lorries will not need to travel from the coast to Nairobi. This will save energy and hence reduce CO2 emissions by some 100,000 tonnes per year on average over the term of the project. The CO2 emissions savings will increase in proportion to the increase in transmission capacity, which is eventually to reach 800 MW.

The total cost of the project is €185 million, of which €60 is financed by an AFD loan on PS1 terms.

6.3. Interconnection of the power grids of Namibia and Zambia – CNA3001

The project aims to reduce the Namibian electric company NamPower's dependence on power imports from Eskom (South Africa) and replace part of these imports with power imported from Zambia. This will lower the cost per kWh, as the Zambian power company ZESCO currently has surplus power owing to its abundant hydroelectric resources. Using Zambian hydroelectricity (renewable source) will also reduce CO2 emissions, as Eskom's power is largely generated from fossil fuels. The total cost of the project is €420 million. AFD granted a €35 million non-sovereign loan on PN3 terms.

7 Decentralised rural electrification

PASER (Tambacounda-Kedougou concession) – Senegal – CSN6032

The total cost of the project is €12 million. AFD's financing (8 million euro grant) matches the public subsidy for the Kaffrine-Tambacounda-Kedougou concession. The overall electrification rate in this area is 2.5 per cent. PASER's initial objective was to boost this rate to 30 per cent by 2015, but the government raised the target to 50 per cent by 2012. In this context, AFD's contribution will make it possible to supply 11,800 additional households, and thus to achieve at least 50 per cent of the government's new target for the Kaffrine-Tambacounda-Kedougou concession.

The local electrification plan recommends the use of light, low-voltage engineering works so as to minimise the investment required, which remains one of the primary obstacles to the development of rural electrification. For locations far from the public grid, solutions involving standalone generators and photovoltaic modules could be adopted. Individual photovoltaic systems would primarily be used for potential subscribers in villages with a population under 500 that cannot be connected to the grid or supplied via a diesel-fired power plant. The cost of the photovoltaic component is estimated at €500,000.

8 Transport and travel

8.1. Improvement of the supply of transport services in Ghana's two largest cities – CGH6018

The project's objective is to bring about a sustainable improvement in the urban structure of the country's two main cities by optimising urban transport conditions. In particular, it aims

to shift to less polluting modes of transport. The total cost of the project is €70.2 million, of which €20 is financed by a highly concessional loan from AFD.

8.2. Curitiba municipal programme for the urban environment and public transport – Brazil – CBR3005

This project, the first financed by AFD in Brazil, seeks in particular to:

- support the formulation of local public policy on environmental matters and help improve the town's management and cash flow;
- reduce commuting time for users of public transport and increase the capacity of the transport network, thus helping to reduce local and global pollution due to transport.

The "transport" component will have a positive effect on transport-related GHG emissions via an overall improvement in the quality of public transport and a consequent shift by users from automobiles to public transport. The annual reduction in CO2 emissions will be 40,000 tonnes, according to Brazilian estimates, validated by AFD.

The total cost of the project is €72.3 million, of which €36.15 is financed by an AFD loan on PS3 terms.

9 Energy efficiency

9.1. Line of credit for energy management and environmental improvements in Jordan – CJO3011 and CJO1000 (French GEF)

The project has two complementary components: a line of credit and targeted institutional and technical support including an "energy management/climate" component (€1.5 million in financing from the French GEF) and an "environmental improvement" component (€300,000 from AFD).

The non-sovereign (interbank) credit line of €36.3 million (PN2) will be used to finance projects at attractive interest rates and for appropriate loan periods. Projects will be aimed at energy savings, development of renewables and environmental improvements (the latter being obtained either in the process or through treatment of effluents). The market segments eligible for the line of credit will be as follows: in the EE sector, conversion to natural gas, combined heat and power, energy efficiency in industry and services; and in the RES sector, solar water heating systems.

The expected reduction in CO2 emissions is 142,000 tonnes.

9.2. E+CO Promotion of energy efficiency and renewable energy projects in Asia – CZZ1336 (French GEF) and PZZ1090 (Proparco)

The project concerns the following Asian countries: Cambodia, India, Indonesia, Lao PDR, Thailand, Vietnam and Nepal. It participates in the fight against greenhouse effects by contributing to the undertaking of EE and low-power RES generation projects.

Asia's hydrocarbon reserves are among the lowest in the world, and its rates of energy dependency are the highest (about 70 per cent). Moreover, considering the growth projections of Asian countries and, consequently, their growing share in global energy demand, their development will be a decisive factor on the world market for hydrocarbons and GHG emissions.

These growing energy needs have a considerable impact on the environment, both locally and globally, and are holding back the economic growth of these countries in the context of a substantial rise in oil prices. In the power generation sector,

the region thus faces two separate issues: on the one hand, increasing its installed capacity and power generation networks; on the other, limiting the environmental impact of this growing demand through greater use of more environment-friendly energy sources.

The more these countries develop their high RES potential, the more they will contribute toward the latter objective. Hydropower and biomass offer strong potential. There are also many promising sites for wind and solar power, particularly in remote areas, with a view to decentralised rural electrification.

The project aims to help small developers in Asia launch their RES and EE projects. It takes the form of participation in the financing of the Asia business plan of E+CO, a company midway between an NGO and an investment trust that seeks to disseminate these technologies in developing and emerging countries.

French GEF financing of €1.1 million is combined with a €6 million loan from Proparco to finance about ten projects. Fifteen per cent of the funds will be allocated to equity investment in new projects, and the remaining 85 per cent to loans to finance the extension or upgrading of existing projects.

The French GEF financing focuses on support activities, including 20 to 30 training and demonstration programmes for business and financial institutions. These programmes could either promote biomass gasification technologies and the use of industrial biogas, while at the same time considering whether these projects would be eligible for the CDM, or focus on facilities using renewable energy sources or on energy efficiency in rural areas.

The past activities of E+CO have saved 15.5 million tonnes of CO2 emissions over the life of the projects (nearly 2 million tonnes a year). Its Asia business plan for the four coming years estimates emissions savings over the period at 1.3 million tonnes of CO2 per year.

10 Bioenergy

Franco-Indian bioenergy research and development platform in India – CIN1005 – CIN1006 (French GEF)

The purpose of the Franco-Indian bioenergy platform, the idea for which emerged during a meeting of the Franco-Indian Forum in October 2006 in Paris, is to have companies and organisations from both countries jointly develop projects of mutual interest that are effective against greenhouse effects and create jobs in India.

The project consists of:

- agro-industrial facilities for demonstration purposes, namely a 3.5 MW containerised biomass CHP plant and a modular biodiesel production plant (4,000 tonnes per year initially, 8,000 tonnes per year after two years), and possibly power generation through gasification of shell waste or methanisation of oilcake (100 to 300 kW);
- testing equipment for analyses and tests of biomass, i.e. a laboratory for biomass analysis and a pilot boiler designed to test new types of biomass, as well as an anaerobic fermentation pilot project designed to test new types of wet biomass;
- research and development on gasification of biomass, in the form of a 100-300 kW "industrial gasification" plant and a small integrated unit (20 to 50 kW);
- scientific cooperation, research and training.

The French GEF grant of €1.5 million will be used in priority to finance support activities needed for projects (especially the most innovative ones) to succeed, technical and economic monitoring of projects, and training of field operators by The Energy Research Institute (TERI) and French or Indian bioenergy experts.

The total cost of the project is evaluated at €15 million.

11 Housing

Replacement of cooling systems in Africa (AFROC) – CZZ1317 (French GEF)

In Africa, CFC cooling units are still widely used in hospitals, private and public buildings, government buildings and shopping centres.

Most of these coolers are characterised by high rates of leakage and excessive energy consumption. Replacing them with new units whose energy efficiency is 30 to 40 per cent higher will save 565,000 tonnes of CO2 emissions a year.

The project aims to:

- initiate replacement of CFC coolers by more energy-efficient systems in six African countries in order to demonstrate the economic benefits of replacing them;
- manage the resulting flows of waste CFC;
- put together an effective financial package giving all owners of CFC coolers an incentive to replace their systems.

The French GEF contributed a €750,000 subsidy towards the total project cost of €5,334,070.

12 Capital investment fund

Aloe Environment Fund II – India/China – PZZ1091 (Proparco)

The Aloe funds invest exclusively in the environmental sector. The targeted sectors are renewable energy sources (wind, biomass, coal methane, etc.), energy efficiency, recycling and waste treatment. Projects are financed directly in India and China, or indirectly through equity stakes in European companies whose Asian development is supported by the fund.

Proparco's share of the capital amounts to €5 million.

Abbreviations and acronyms

ADEME	**French Agency for the Environment and Energy Management (Agence de l'environnement et de la maîtrise de l'énergie)**
CDM	**Clean Development Mechanism**
CIRAD	**French Agricultural Research Centre for International Development (Centre de coopération interna tional en recherche agronomique pour le développement)**
EE	**energy efficiency**
ESCO	**energy-saving service company**
French GEF	**French Global Environment facility (Fonds français pour l'environnement mondial)**
GHG	**greenhouse gas**
IEPE	**Institute of Energy Policy and Economics (Institut d'économie et de politique de l'énergie)**
IFREMER	**French Research Institute for Exploitation of the Sea (Institut français de recherche pour l'exploita tion de la mer)**
IRD	**French Development Research Institute (Institut de recherche pour le développement)**
RES	**renewable energy**

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