

PROMOTING RENEWABLE ENERGIES AND ENERGY EFFICIENCY THROUGH THE CDM FUNDING OPTIONS

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The promotion of Renewable Energy Sources (RES) and Energy Efficiency (EE) is a central aim of the world energy policy in order to contribute in reducing greenhouse emissions. Moreover, Clean Development Mechanism (CDM) allows Annex I countries to achieve their emission targets. Financial assistance to developing countries is needed in order to avoid high increase of their greenhouse emissions associated with their development. Today, a large number of Annex I countries are also setting up programmes to fund RES and EE investment through CDM. These include Denmark, Great Britain, Italy, Japan, Norway, Canada and Austria. These programmes are being applied by international organisations and numerous non-governmental organisations and they facilitate projects throughout the developing world. Initial experiences have also been gained from the “World Bank Prototype Carbon Fund – PCF” and the “Dutch CDM tender-programme - CERUPT”. The most important result of these initial experiences is the creation of appropriate organisational structures and the use of qualified personnel by both the host and investor countries and the respective participants in the project, thus, building the capacity to facilitate the CDM. This paper describes the main role of CDM funding programmes and their potential role in promoting RES and EE projects.

1. Introduction

Energy is essential for economic and social development. About ninety per cent of the world energy supplies are provided by fossil fuels, with the associated emissions causing local, regional and global environmental problems. Most energy projections show that current and expected future global energy demand patterns are not sustainable. Even when assuming massive improvements in energy intensity, long term projections indicate that world energy demand may increase dramatically, with most of this increase, taking place in developing countries. These trends indicate that, in order to comply with the necessary conditions for the three dimensions of sustainability (economic, environmental and social) with respect to energy production and consumption, a decoupling of economic activity from fossil primary energy consumption should be achieved.

Increasing the share of Renewable Energy Sources (RES) in the energy balance enhances sustainability and helps to improve the security of energy supply by reducing dependence on imported energy sources. In addition, the development of Energy Efficiency (EE) is a central aim of the world energy policy in order to contribute in reducing greenhouse emissions [1].

The interest in RES and EE increased when the oil crises of the 1970's made everyone aware of the fact that fossil resources would run out one day - but since there is some uncertainty about when that will actually happen the efforts made in this area remained rather tentative.

Nowadays, growing environmental concerns and limitations in the exploitation of conventional energy resources have given new impulse in modern RES technologies. Beyond 2020, new technologies, such as hydrogen-based fuel cells and carbon sequestration, hold out promising prospects of plentiful, clean energy supplies for the world. So, RES projects and EE will need to play a greater role in the future energy mix in order to achieve low-carbon intensive energy systems [2].

Despite the fact that RES and EE provide a series of benefits in national and private scale, the development and dissemination process of such technologies has been slower than expected. The state cannot always place sufficient amounts for the modernisation of the energy sector through the promotion and penetration of these technologies. In addition, the users of energy often face the implementation of RES and EE projects hesitantly. A pool of inhibits that justify this attitude, includes [2]:

- The high initial cost of RES and EE projects in relation with the long time period of depreciation of the investment;
- The lack of available funds of the enterprises for the implementation of these projects. In most cases the enterprises cannot allocate sufficient amounts of their budget in such projects, since they have to overcome more demanding priorities, such as the improvement of their competitiveness and the identification of new markets;
- The financial, technological and performance risks of these projects are often high for an enterprise related to the expected results;
- The lack of awareness regarding the performance of modern and innovative renewable technologies.

Besides the barriers mentioned above, a project investment in GHG abatement technologies might encounter several other barriers, especially when the investment takes place in developing countries. For instance, one barrier may be the flow credit worthiness that often developing countries have. The Kyoto Protocol through the Clean Development Mechanism (CDM) can exert a leverage effect to increase the attractiveness of new and renewable technologies [3].

The purpose of the CDM, as defined in Article 12 of the Kyoto Protocol, is to assist Parties not included in Annex I in achieving sustainable development and to assist Parties included in Annex I in achieving compliance with their quantified emission limitation and reduction commitments [4-6].

The additional funding channeled through the CDM could assist countries in reaching some of their environmental and sustainable development objectives, such as CO₂ emission reductions, cleaner air and water and reduced dependence on imported fossil fuels. CDM projects are comprised of two parallel income flows [7-9].

- The first flow refers to the base project and is typical of any traditional investment in an energy project;
- The second flow is the “carbon flow”. The products of this flow are tonnes of carbon dioxide avoided or reduced in the case of energy projects. Through the CDM project cycle, these reductions are converted into certified emission reductions (CERs).

These CERs can be purchased by greenhouse gas emitting sources, such as thermal power generation companies in industrialized countries, to meet domestic emissions reductions requirements. The market price of CERs will fall in between the cost of production (including all transaction costs incurred in the CDM project cycle) and the maximum purchaser price. This price is not anticipated to exceed the cost of domestic reduction measures in industrialized countries. The sale of CERs can significantly increase the internal rate of return (IRR) of an entire project. In the case of projects with a healthy IRR on the traditional flow, the CER is an incentive to implement a more greenhouse gas efficient project. In the case of projects that are not quite commercially viable, the added input of financing for the resulting CERs could make them viable.

In this context, the objective of this paper is to present the main role of CDM funding programmes and their potential role in promoting RES and EE projects. The paper is structured along 3 parts, as follows:

- The first part is the introduction of the paper;
- The second part is devoted to the review of the objectives and the procedures of the main CDM - funding programmes (PCF, CERUPT, CDM Programme of Canada, Rabobank and Finland Programme) presenting the progress so far. This part is devoted to the interpretation of the results of CDM funding programmes and concerns actions and measures to be undertaken for maximum RES and EE penetration;
- The last part presents the conclusions of this study.

2. CDM - Funding Options

Governments and private companies from Annex I parties are the main end-users of CERs. Funds to implement CDM project in a developing country can flow from three different trading models:

- Multi-lateral model – financial resources from Annex I investors flow through a centralized investment fund and channeled toward project activities in host developing countries;
- Bilateral model – this involves collaboration among investors from Annex I countries, project developers, and host country governments. These parties agree on project selection, funding and credit sharing arrangements;
- Unilateral model – the host country invests in a project, and sells or banks CERs.

The carbon funds of the World Bank (Prototype Carbon Fund, Community Development Fund, BioCarbon Fund) are examples of multi-lateral funds using the World Bank as fund manager. The Dutch Government adopts several means of producing emission reduction credits, through multi-lateral organizations such as World Bank and European Bank for Reconstruction and Development (EBRD), through banks (e.g. Rabobank) or through bilateral contracts and via its own tender (CERUPT). Similarly, the Government of Japan uses the Japanese Bank of Industrial Development to manage its CDM funds. More recently, the Canadian and Netherlands governments have initiated

bilateral transactions with several Latin American countries while the Danish government has recently come to bilateral agreements with Malaysia and China [10].

The World Bank's PCF and the Dutch Government's CERUPT tender are the current main buyers of CERs through direct purchase transactions. As of 2002, the PCF Fund Management Committee and the Participants Committee approved a total of 16 CDM projects with emission reduction purchase agreement of almost 24 Mtn CO₂. The CERUPT tender, on the other hand, approved 18 projects in 2003, to generate emissions reductions of 16, 7 Mtn CO₂. A number of PCF projects have been commissioned in 2002. Most of the PCF and CERUPT's projects would be commissioned between 2003-2007. Furthermore, the Finnish and Swedish government launched CDM tenders in 2002 while the Austrian government is currently in the process of preparing CDM/ JI tenders.

Today, CDM funds and investment approaches are growing and expanding. The Prototype Carbon Fund (180 million \$), the Community Development Carbon Fund (100 million \$) and the World Bank Bio-Carbon Fund (100 million \$) are the main multilateral funds. The main government funds are categorized as follows [10]:

- Own Tender:
 - ✓ Dutch Government C-ERUPT Program;
 - ✓ Finnish CDM/JI Pilot Program (20 million \$);
 - ✓ Sweden International Climate Investment Program – CDM;
 - ✓ Austria JI/CDM Procurement Program;
- Commercial/Development Banks:
 - ✓ RaboBank (Dutch Government);
 - ✓ Japanese Bank of Industrial Cooperation (Japan CDM Fund - 4 billion yen);
 - ✓ Development Bank of Japan (Japan CDM Fund - 3 billion yen);
- Multilateral Institutions:
 - ✓ World Bank (The Netherlands Clean Development Facility - € 70 million);
 - ✓ IFC (IFC-Netherlands Carbon Facility - € 44 million);
- Bilateral Transactions:
 - ✓ Canadian Government with Colombia and Chile;
 - ✓ Dutch Government with Bolivia, Colombia, Uruguay and Ecuador;
 - ✓ Danish CDM Portfolio -bilateral agreements with Malaysia and China.

In the above framework, the most known CDM funding schemes are analysed as follows:

2.1. Prototype Carbon Fund (PCF)

2.1.1. Objective

Recognizing that climate change will have a significant impact on the world, on July 20th, 1999, the Executive Directors of the World Bank approved the establishment of the Prototype Carbon Fund (PCF). The PCF, with the operational objective of combating climate change, aspires to promote the Bank's tenet of sustainable development,

demonstrate the possibilities of public/ private partnerships, and offer a “learning-by-doing” opportunity to its stakeholders [11].

The PCF has three primary strategic objectives [12]:

- Show how project-based greenhouse gas emission reduction (ER) investment can contribute to sustainable development;
- Provide the Parties of the UNFCCC, the private sector, and other interested parties with an opportunity to “learn by doing” in the development of policies, rules, and business processes for the achievement of emission reductions under JI and the CDM.

2.1.2. Progress so far

PCF has prepared and successfully negotiated an Emission Reduction Purchase Agreement with 12 Host Governments. The Prototype Carbon Fund signed emission reductions purchase agreements for most of its projects in 2005. More specifically, the following RES developing projects have been selected [12]:

- Brazil: Plantar Sequestration and Biomass Use;
- Bulgaria: 2 projects:
 - ✓ 13,4 MW biomass-based boiler to utilize wood waste produced at the Svilosa pulp and cellulose plant to replace coal;
 - ✓ District heating system upgrades for the city of Sofia;
- Chile: Mid size run-of river hydropower plant with capacity of 25 MW and 175 GWh displacing the dispatch of coal thermal power generation;
- Colombia: Wind farm in the northern part of Colombia to displace a mix of coal-and gas-based power generation;
- Costa Rica: 2 projects:
 - ✓ Wind farm to displace thermal power capacity addition;
 - ✓ Small hydro to replace thermal power generation;
- Czech Republic: EE measures and RES through the Czech Energy Agency (CEA);
- Guatemala: Peaking run-of-river hydro-electric plant in the west coast of Guatemala to displace thermal power plants;
- Hungary: Conversion of Pecs Power plant’s existing coal-fired boilers to biomass, with annual generation 162 TJ heat and 334,3 GWh electricity;
- Indonesia: Implement energy efficiency measures including reducing clinker contents in the produced cement, burning alternative fuels for clinker formation, utilizing heat power generation;
- Latvia: Methane capture from waste management and carbon dioxide reduction from power generation;
- Moldova: Soil conservation afforestation of 14,394 hectares of degraded and eroded state-owned and communal agricultural lands throughout Moldova;
- Romania: Afforestation of 6,852 hectares of public land;
- South Africa: Durban Municipal Solid Waste 10 MW landfill gas-fired generator to produce electricity from landfill-collected methane;

- Uganda: Off-grid hydropower development in the West Nile region of Uganda.
In addition several projects are under negotiations as of September 30, 2004, such as:
- Brazil: 3 projects:
 - ✓ Alta Mogiana Bagasse Cogeneration;
 - ✓ Guarani Cruz Alta Bagasse Cogeneration;
 - ✓ Lages Wood Waste Cogeneration Facility;
- China: 2 projects:
 - ✓ Jincheng Coal Mine Methane Recovery;
 - ✓ Xiaogushan Run-of-River Hydropower;
- Costa Rica: 2 projects:
 - ✓ Rio General;
 - ✓ Vara Blanca Wind Farm;
- India: 2 projects:
 - ✓ Municipal Solid Wastes (ABIL);
 - ✓ Nitrous Oxide Removal Project;
- Mexico: 2 projects:
 - ✓ INELEC Hydros;
 - ✓ Umbrella Waste Management;
- Philippines: North Wind Bangui Bay Wind Farm;
- Poland: Stargard Geothermal Heating;
- Vietnam: Grontmij Landfill in Ho Chi Minh City.

A broad balance has been achieved in the number of projects undertaken in economies in transition and in developing countries. Furthermore, major emphasis has been laid on the development of projects in the area of RES technology such as, but not limited to, geothermal, wind, solar and small-scale hydro energy projects.

2.2. Certified Emission Reduction Unit Procurement Tender (CERUPT)

2.2.1. Objective

Through CERUPT (Certified Emission Reduction Unit Procurement Tender), the Netherlands is aiming at attracting CDM projects by providing funds for the acquisition of CERs. The responsibility for CDM in the Netherlands is with the Minister of Housing, Spatial Planning and the Environment (VROM). The Minister has appointed Senter International as tendering authority for CERUPT [13].

The main objective of CERUPT is to buy CERs at a low price and acceptable risk. Senter International, the organisation that manages the CERUPT for the Netherlands' Government, therefore assesses primarily price and project risk and does not have a preference for specific project types, which means that the submitted project proposals most likely reflect the actual supply on the market. CERs are generated and delivered as follows:

- CERs are generated in CDM projects. To generate CERs a CDM project has to realise a GHG emissions reduction compared to the baseline scenario. The CDM

project's feasibility should be proven at the moment of submission to Senter. The CDM project should be operational in the contract period. To ensure that all these requirements have been met, a business plan for the project must be included in the proposal. CDM projects have to be part of one of the following project categories:

- ✓ RES (e.g. solar, wind, biomass, hydro);
- ✓ EE (e.g. CHP, lighting, insulation, process optimisation);
- ✓ The replacement of CO₂ – intensive fuels (e.g. oil to gas, coal to gas);
- ✓ Waste processing (e.g. land fill gas extraction, waste incineration);
- CDM projects have to assist host countries in achieving sustainable development goals. The host country will have to judge impacts on the environment of the CDM project. This may require an Environmental Impact Assessment on request of the host country;
- Public participation is essential in CDM projects. Local stakeholders are to be invited to comment the draft project design. The final project design should take these comments into account.

Further general requirements are that:

- Greenhouse gas (GHG) emission reductions should be additional to any that would occur in the absence of the CDM project. This must be demonstrated through in a baseline study;
- CDM projects are validated by Designated Operational Entities (DOE) and registered by the Executive Board (EB);
- Emission reductions are verified and certified by DOEs, CERs are issued by the EB;
- CDM projects are subject to levies by the EB. The EB will withhold part of the CERs (2%) to cover administrative expenses and to assist least developed countries in meeting costs of adaptation to the adverse effects of climate. CDM projects in one of the least developed countries are exempt from the adaptation levy [14].

Furthermore, the EB will charge an administration fee on each registered CDM project. The volume of this fee has not been specified yet.

2.2.2. Progress so far

The program has been launched on 1 November 2001 and resulted in 78 expressions of interests covering all relevant regions and technologies. Among these proposals, 26 qualified for the awarding stage and 18 proposals have been already awarded (13 March 2003) [14]:

- 11 projects from Central and Latin America:
 - ✓ Total emission reductions achieved: 7,7 Mton;
 - ✓ Type of projects: Biomass, geothermal, hydro, landfill, wind and EE projects;
- 7 projects from South-East Asia:
 - ✓ Total emission reductions achieved: 8,8 Mton;
 - ✓ Type of projects: Biomass, geothermal and wind projects.

It is unclear what the future of CERUPT will be. There has only been one tender period which officially closed on January 31, 2002 and is therefore no longer open for

submission of projects. Since CDM projects can often take a long time to process, it is likely that the Dutch Government is hoping to see first if the CDM Executive Board approves the 18 projects under CERUPT and then evaluate. As of yet none of the 18 projects have passed through the CDM approval process, though the Wigton Wind Farm project in Jamaica which CDM Watch describes as 'business as usual' has been approved by the CDM Executive Board 'subject to required changes'.

2.3. CDM Programme of Canada's CDM and JI Office

2.3.1. Objective

Canada's Clean Development Mechanism and Joint Implementation (CDM & JI) Office was established within the Climate Change and Energy Division of the Department of Foreign Affairs and International Trade (DFAIT) in 1998. The Office is the federal government's focal point for CDM and JI activities. It was created to enhance Canada's capacity to take advantage of the opportunities offered by the CDM and JI and is guided by an Interdepartmental Steering Committee comprised of representatives from Industry Canada, Natural Resources Canada, Agriculture Canada, Environment Canada, the Canadian International Development Agency and Canada's Climate Change Secretariat.

Under Action Plan 2000, the CDM & JI Office received funds for the period 2001-2005 in order to pursue the following three objectives:

- To strengthen Canada's capacity to take maximum advantage of the Kyoto Mechanisms. These include the Clean Development Mechanism, Joint Implementation and Emission Trades backed up by emission reduction projects;
- To encourage and facilitate Canadian participation in the Kyoto Mechanisms by building awareness, promoting cost-effective opportunities and lowering transactions costs, while also engaging developing countries and countries-in-transition in such activities;
- To assist Canadian entities in obtaining emissions reductions credits from CDM and JI type projects, this can assist Canada in meeting its Kyoto target, according to international rules and guidelines.

With the elaboration of international rules and guidelines at Marrakech in November 2001, the Office is primarily focused on project facilitation including:

- Guiding companies on the technical requirements for CDM activities and issues related to ownership of emission reduction credits;
- Providing financial support for market identification studies, feasibility assessments, baselines and monitoring plans, risk assessments and environmental impact studies;
- Preparing memoranda of understanding and project-specific agreements with host country governments.

Project proposals submitted to Canada's CDM & JI Office will be assessed in reference to the following key criteria:

- Promotion of the objectives of the UNFCCC. The UNFCCC seeks to stabilize GHG concentrations in the atmosphere at a level that does not create dangerous anthropogenic interference with the climate system;
- Contribution to the objectives of Canada's CDM & JI Office;
- Consistency with Canada's International Strategy on Climate Change Proposals must respond to at least one of the Strategy's objectives:
 - ✓ Maximise Canada's ability to meet its UNFCCC commitments and Kyoto Protocol targets at the lowest cost;
 - ✓ Contribute to the achievement of global climate change objectives;
 - ✓ Maximize business opportunities for Canadian business interests in international projects and initiatives on climate change [15-16].

2.3.2. Progress so far

Indicative recent events of the Canada's CDM & JI Office in order to strengthen Canada's capacity for CDM are the following:

- Introductory Workshops on the Kyoto Mechanisms, SPRING 2006;
- Trade Team Canada Environment (TTCE) Mission to China, February 27 to March 10, 2006;
- CDM Seminars in India, March 1-11, 2006;
- Canada's CDM & JI Office. DNA and Focal Point Workshop, March 27th-28th, 2006, Vancouver, BC;
- Carbon Expo, Cologne, Germany, (May 10-12, 2006);
- Trade Mission to Carbon Expo 2005. May 11-13. Cologne, Germany;
- Business Development Mission to India Partnering Together. February 2005;
- AMERICANA 2005, Pan-American Environmental. Technology Trade Show and Conference;
- COP-10, Buenos Aires, Argentina, (December 6th-17th, 2004);
- Green Power Conference. Metro Toronto Convention Centre, (November 24 & 25, 2004);
- DNA and Focal Point Conference Ottawa, (September 30th- October 1st, 2004);
- Canada's CDM & JI Office at the Emissions Marketing Association (EMA), Fall Meeting. Toronto, (September 2004);
- Canada's CDM & JI Office at Globe 2004. Vancouver, British Columbia, (March 31-April 2);
- Globe 2004 Conference Program;
- CDM & JI Workshop at Globe 2004 (March 29, 2004);
- Salon des technologies environnementales du Québec 2004 (March 17-19, 2004) ;
- CDM & JI National Technical Workshop Ottawa (March 16-17, 2004);
- Canada-Cuba Seminar on Clean Development Mechanism - Havana, (February 23-24, 2004).

In addition, 65 CDM and JI proposals have been awarded from the following regions:

- Africa and Middle East (14 projects);
- Latin and South America (19 projects);
- Central Eastern and Europe (15 projects);
- Asia (17 projects).

2.4. Rabobank Fund

2.4.1. Objective

In January 2003, Rabobank International has established the Carbon Procurement Department for the sale and purchase of project-related emission reductions from projects in developing countries. More specifically, the Rabobank International concluded a contract with the Ministry of Housing, Spatial Planning and the Environment for the Dutch government to purchase ten million tons of certified greenhouse gas reductions from projects in developing countries in Asia, Latin America and Africa. These projects should have a sustainable character. In these projects, Rabobank may participate as financier via its international network.

2.4.2. Progress so far

During the next eighteen months Rabobank will conclude contracts for the purchase of emission reductions with the owners of CDM projects. These will involve bilateral contracts and project-related reductions such as:

- A wind farm and a hydroelectric power station in China;
- A hydroelectric power station in Chile;
- A wind farm and a biomass project in India;
- A manure management project in Brazil.

In some cases the extra proceeds generated by the sale of emission reductions will enable projects to be carried out. Otherwise, these projects would be difficult to be financed. In addition to reducing harmful emissions, these projects often also serve to strengthen the local economy, in part by improving the infrastructure and creating employment [17].

2.5. Finland Programme

2.5.1. Objective

Finland has a commitment of 8% reduction of greenhouse gases according to the burden sharing agreement under the EU as a result of the Kyoto Protocol. The Ministry of Foreign Affairs (Development Cooperation) is currently exploring the possibilities of

purchasing certified emission reductions via small-scale CDM projects. The guidelines for small-scale projects are simplified, reducing transaction costs, and small-scale projects are in general more beneficial for sustainable development than large-scale CDM projects. The government of Finland has published an invitation to submit project proposals [15-16].

2.5.2. Progress so far

Currently, the Pilot Programme has seven on-going CDM and five on-going JI projects. The CDM projects are located in Viet Nam, Honduras, El Salvador, Costa Rica, India and Zambia. The JI projects include four projects in Estonia (Tamsalu, Kadrina, Paide and Pakri). The projects are at different stages. Some are already validated or determined and some are only in their early stages. Most of them are RES projects and include among others

- Hydro Power;
- Biogas;
- Landfill;
- Gas Recovery;
- Wind Power.

3. Conclusions

RES and EE constitute really important factors to sustainable development. However, the development and dissemination process of such technologies has been slower than expected because the use and promotion of RES and EE is inhibited by a number of factors. The most important factors are the high initial costs, the financial, technological and performance risks, the scarcity of investment capital and the investing priorities of private companies.

The new climate change regime also offers an opportunity for RES and EE as they meet the two basic conditions to be eligible for assistance under the UNFCCC implementing mechanisms:

- They contribute to global sustainability through GHG mitigation;
- They conform to national priorities by leading to the development of local capacities and infrastructure.

The application of CDM funding programmes could facilitate the development of RES and EE projects both in national and private level. RES, as indigenous sources can enable local development since they can secure the environmental integrity through the minimisation of CO₂ emissions. In addition, RES projects can contribute to the technology transfer through the CDM of the Kyoto Protocol [18-19].

CDM projects require upfront investments that are normally obtained from different sources such as loans, equity and grants. As in conventional projects, the funding of CDM projects can be arranged either through corporate or project funding. Additional project revenues (i.e. CERs) could leverage debt financing.

In addition, the net financial gain derived from the sale of CERs is the difference between the project CER value and the transaction costs. There are three elements that influence the net impact of CERs on project profitability [20]:

- Value of CERs (low CER value implies low net benefits);
- Overall transaction costs (high transaction costs yield low net benefits);
- Up-front transaction costs (high upfront payments could also result in low benefits).

Project developers generally expect up-front transaction costs within the range of 5 to 7% of the net present value of the revenue or total transaction costs around 10 to 12% of the net present value of revenue. A positive net financial gain means that CER revenues improve the financial viability of the project [10].

Nowadays, the decisions adopted at the COP 9 and the recent adaptation of the directive linking the EU Emissions Trading Scheme to RES and EE projects, made clear that CDM will play a significant role as an effective mechanism for achieving the binding targets of the Kyoto Protocol. Within this framework it is expected that the EU Governments as well as the developing countries will make further use of the CDM funding programmes, which will play a more and more important role in funding RES and EE projects [21, 22].

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