CDM, AN OPPORTUNITY TO ENHANCE SHP IN DEVELOPING COUNTRIES

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Abstract

The burning of ever-greater quantities of oil, gasoline, and coal, that have increased the amount of "greenhouse gases" in the atmosphere, especially carbon dioxide, methane, and nitrous oxide, are pushing the temperature of the earth's surface, that is expected to increase by 1.4 to 5.8 degrees C by the year 2100. Although such gases are critical for the life on earth - without them the world would be a cold and barren place - augmented in increased quantities are altering the climate, and human beings are likely to face mounting difficulties.

*In 1992, most countries joined the **United Nations Framework Convention on Climate Change** (**UNFCCC**) with the objective of stabilize the GHG concentrations in the atmosphere, and In 1997 a number of nations approved an addition to the treaty, called the **Kyoto Protocol**, legally binding GHG reductions on industrialised countries´*

One of the mechanisms devised to assist industrialised countries to achieve those GHG reductions was the Clean development Mechanism (CDM) that at the same time encourage sustainable projects in developing countries. The presentation intend to explain how this mechanism can be used to co finance the development of small hydropower plants in those countries.

I. UNITED NATIONS FRAMEWORK CONVENTION ON CLIMATE CHANGE

The burning of ever-greater quantities of oil, gasoline, and coal have increased the amount of "greenhouse gases" (GHGs) in the atmosphere, especially carbon dioxide, methane, and nitrous oxide. Those GHGs are pushing the temperature of the earth's surface, that is expected to increase by 1.4 to 5.8 degrees C by the year 2100. Although such gases are critical for the life on earth - without them the world would be a cold and barren place - augmented in unbridle quantities are altering the climate, and human beings are likely to face mounting difficulties.

At the "Earth Summit" in Rio de Janeiro in 1992, over 180 countries adopted the **UNFCCC** to start the process of stabilizing Green House Gas (GHGs) in the atmosphere. Five years later, in 1997, 111 countries attended the 3rd Conference of Parts (COP3), and 84 of them approved a protocol, known as the **Kyoto Protoco**l, legally binding GHG reductions on industrialised countries. **The Kyoto protocol came into force** on 16th February 2005 with its ratification by Russia in Montreal, when 157 countries, whose emissions represented 61.6% of the Annex I countries 1990's emissions levels, ratified, approved, accepted or acceded to it.

To assist industrialised countries to achieve those GHG reductions, The Protocol, established three mechanisms:

- Emissions Trading System.
- Joint Implementation (JI) projects between industrialised countries.
- Clean development Mechanism (CDM) to encourage projects in developing countries

I.1 Emission Trading System

Emissions trading provides for Annex I Parties to acquire units from other Annex I Parties and use them towards meeting their emissions targets under the Kyoto Protocol. Only Annex I Parties to the Kyoto Protocol with emissions limitation and reduction commitments inscribed in Annex B to the Protocol may participate in such trading.

Although emissions trading have been in use in the United States since the mid-1970s and the UK emissions trading scheme began in March 2002, the European Union **Emission Trading Scheme (EU-ETS)** is the largest greenhouse gas emissions trading scheme in the world, with an estimated total, in 2005, of 362 Mt CO2e, at an estimated financial value of €7.2 billion. According to it, each company receives an emission quota, and a respective number of emission allowances each equalling one ton of CO2. At the end of each year the covered company has to return a number of allowances equal to it's total CO2 emissions. If it emitted less than its quota it can sell those allowances; if it emitted more, according to the Kyoto Protocol, has to buy them.

I.2 Joint Implementation projects

Under the Joint Implementation, the company that need to buy emission allowances can implement projects that reduce emissions, in other Annex 1 country and receive in return, emission reduction units (ERUs). The ERUs generated by JI projects can be used by Annex I Parties towards meeting their emissions targets under the Kyoto Protocol. However, ERUs may only be issued in relation to periods from 2008 onwards. It is expected that most of the JI projects will take place in Annex 1 countries, with economies in transition

I.3 Clean Development Mechanism

The CDM is a project-based mechanism. which has three global criteria:

- help mitigate climate change;
- help Annex I countries attain their emission reduction commitments;
- help non-Annex I countries achieve sustainable development.

The principal and direct actors in CDM projects are the investors and the hosts.

- *Investors* are entities from Annex I Parties that have ratified the Kyoto Protocol.
- *Hosts* are non-Annex I countries which are recipients of a CDM project**.**

The project must:

- meet the sustainable development goals defined by the host country;
- have the host country's approval;
- reduce GHG emissions above and beyond "business as usual";
- not contribute to environmental decline.

All kinds of hydro projects are, initially, admitted under the CDM. There are no problems with run-of-river projects, hydro projects in existing dams and reservoirs and small hydropower schemes (up to 15 MW installed capacity). The large scale projects using new dams need to incorporate the methane emissions from the reservoir in the baseline methodology, and up to date there are not accepted methodology to account for those emissions. The larger run-of-river project – the 155 MW La Higuera diversion project, in Chile – was validated in December 2005 and registered as a CDM project in March 2006.

II. CDM MECHANISM'S MANAGEMENT

The rather complex CDM mechanism is supervised by the CDM Executive Board (EB) under the authority and guidance of the Conference of the Parties (COP).

The EB is responsible for the:

- registration of CDM projects;
- approval of methodologies for the calculation of emission reductions (baseline methodologies) as well as for the monitoring of project emissions;
- issuance of CERs

The link between the project developer and the EB is the **Designated Operational Entity (DOE).** The DOE can be a domestic legal entity or an international organization but must be formally accredited by the CDM EB, and has two key functions:

- validate and subsequently request registration of a proposed CDM project activity
- verify emission reduction of a registered CDM project activity, certify it as appropriate and request the BE to issue Certified Emission Reductions accordingly

As the CDM projects have to be implemented in the host countries, those countries should designate a national authority (DNA) that approves the project and confirms that it assists the country in achieving sustainable development The list of Designated National Authorities can be found in http://cdm.unfccc.int/Projects/pac/howto/.

III.MODALITIES AND PROCEDURES

Project participants shall:

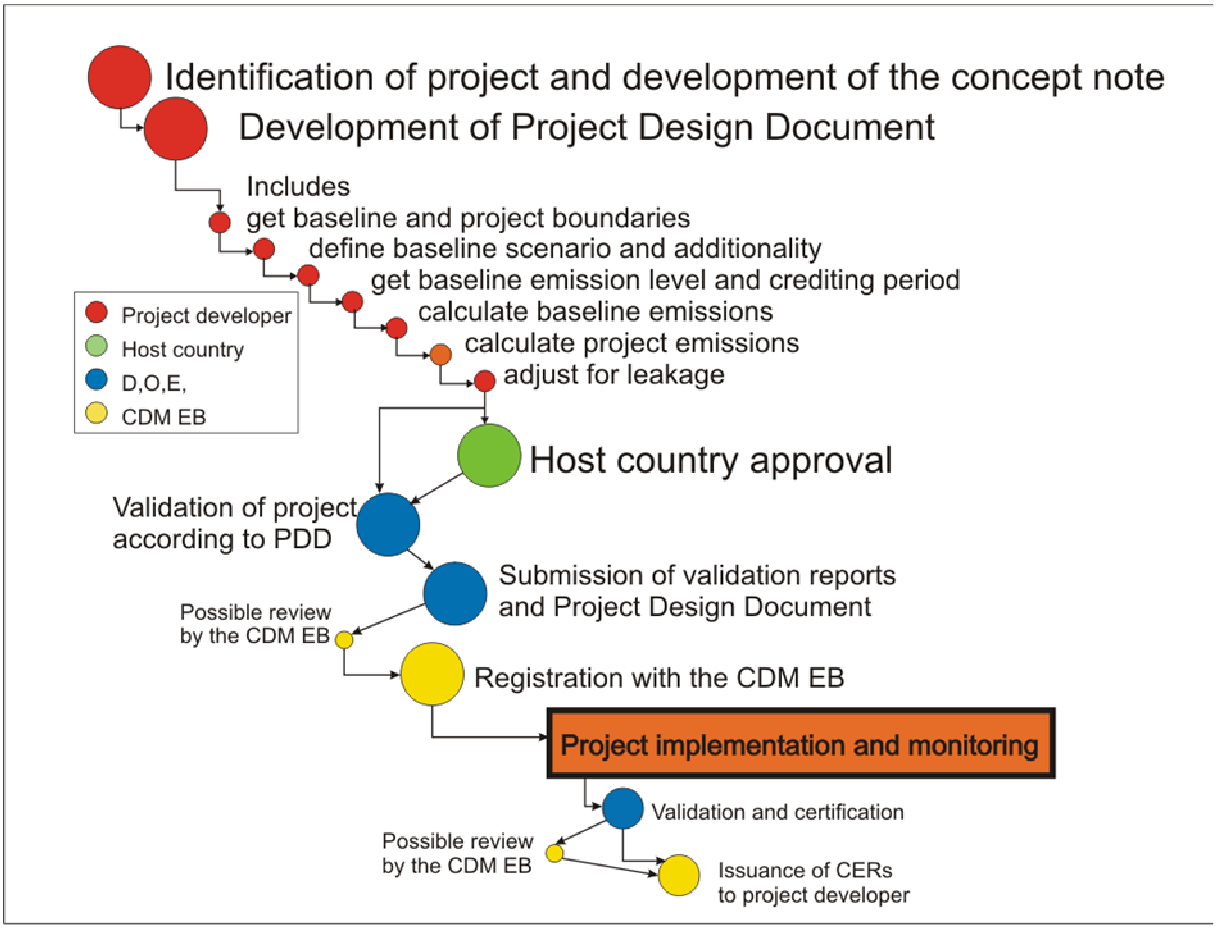
- Propose a baseline and/or monitoring methodology
- Use the emission baseline and/or monitoring methodology
- Validate the CDM project activity
- Register the CDM project activity
- Certify/Verify the emission reductions of a CDM project activity
- Request issuance of CERs related to a CDM project activity

The key eligibility requirement for a project to be considered under CDM is the "**additionality**". For that, the project participants shall provide an explanation to show that the project activity would not have occurred anyway due to at least one of the following barriers:

- An investment barrier: a financially more viable alternative to the project activity would have led to higher emissions.
- A technological barrier: a less technologically advanced alternative to the project activity involves lower risks due to the performance uncertainty or low market share of the new technology adopted for the project activity and so would have led to higher emissions.

According to the simplified M&P for small-scale project activities in category 1D, the monitoring methodology used is that of direct measurement of the electricity generated by the power plant. Since this is a "zero emission" project, the key item to be monitored will in all cases be the electricity exported to the grid expressed in GWh/year.

The scheme below shows the modalities of a CDM project cycle, with the entities involved, and underline the complexity of the procedure, with its implied costs.



IV. SMALL SCALE CDM PROJECTS

The COP decided that the share of proceeds to cover administrative expenses of he CDM shall be:

- USD 0.10 per certified emission reduction issued for the first 15,000 tonnes of CO2 equivalent for which issuance is requested in a given calendar year;
- USD 0.20 per certified emission reduction issued for any amount in excess of 15,000 tonnes of CO2 equivalent for which issuance is requested in a given calendar year.

The maximum registration fee payable based on this calculation shall be USD 350,000. No registration fee has to be paid for CDM project activities with expected average annual emission reduction over the crediting period below 15,000 t CO2 equivalent. If an activity is not registered, any registration fee above USD 30,000 shall be reimbursed.

CDM transaction costs are therefore considerably high relative to the total project costs. To cope with it, the COP8 in New Delhi (2002), decided to simplify the M&P required for small-scale CDM projects, **limiting the SS CDM to three types of projects**:

- renewable projects with a maximum of 15 MW
- energy efficiency projects with reductions up to 15 GWh/yr
- other projects that emit less than 15 ktonnes CO2/yr

and providing pre-approved methodologies to elaborate the PDD, defining the baseline and the monitoring of the project, allowing that the same DOE could undertake the validation, verification, and certification, and allowing the bundling of projects.

From the three pre-approved projects, the EB takes into consideration four type of renewable projects

- 1A. Electricity generation by the user household
- 1B. Mechanical energy for the user enterprise
- 1C. Thermal energy for the user
- 1D. Electricity generation for a grid

. Under the type 1D category can be developed the next three types of project activities:

- Project activities developing a new site
  - The projects nominal capacity does not exceed the limit of 15 MW set by the UNFCCC.
  - All the electricity generated by the plant is exported to the electricity distribution system
- Project activities adding renewable energy capacity should consider the following cases:
  - Adding new units;
  - Replacing old units for more efficient units.

The aggregate installed capacity after adding the new units or of the more efficient units should be lower than 15 MW.

According to the above, a SHP project, implemented in a non-Annex 1 country can get the benefits of a SSCDM projects, and obtain the corresponding CERs, that can be traded in the carbon market. Being "small", the baseline methodology is very simple: the number of kWh generated multiplied by an emission coefficient, measured in Kg of CO2e, calculated as an average of the "approximate operating margin" and the "build margin". The project shall have as crediting period, either a maximum 7 years which may be renewed at most 2 times, or Fixed crediting period: a maximum of 10 years with no option of renewal

V CARBON MARKET

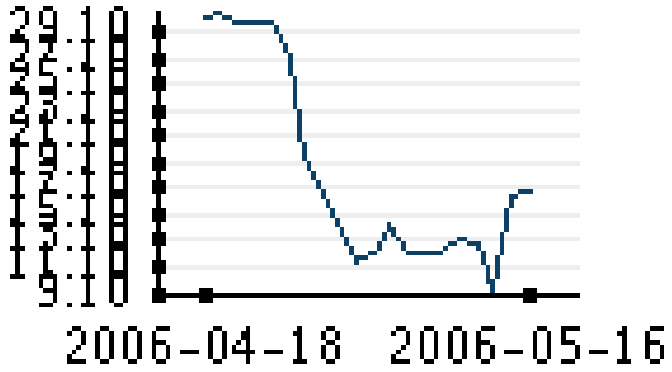
The global warming impact of the green house gases on the atmosphere is equal irrespective of where they are emitted. This indifference from an environmental perspective to where the greenhouse gas is emitted — or reduced — is the key insight that lends itself well to a global management system. By allowing that the emissions reductions achieved in one country could be bought by other countries to meet their own targets, the three mentioned flexible mechanisms have created a rather big global market, where the carbon is the commodity, In 2005, these global carbon market transactions did 787 Mt CO2e worth €9.4 billions:

- The EU ETS did 362 Mt CO2e, at a financial value of €7.2 billion.
- In the project-based market
  - 93.4% of the volumes came through CDM: 397 Mt CO2e, worth €1.9 billion
  - 6.6% of the volumes came through JI: 28 MtCO2e, worth €95 million

From the above figures it can be seen that the EUA had an average price along 2005,close to €20, whereas the CER averaged less than €4,8. This difference in prices are mainly due to the risks involved in the CER issuance. A CER does not legally exist until it is issued; its volume depends on project performance, verification, and actual issuance. Contracting project-based emission reductions involves higher transaction costs and more risk than purchasing allowances. Projects, after all, have to be planned, financed and executed according to schedule and operated as planned for the credits to materialize when and where required. Along all the above steps there exist a certain risk, that has an influence in its price.

In fact all along the first quarter of 2006 the price of the EUA oscillated around €29. Suddenly, at the end of April, price plummeted to €12.3. The apparent reason: verified

emissions data released by the Netherlands, Czech Republic, France and Spain have shown that power plants and factories in those countries emitted less carbon dioxide than expected.. Later on the prices were pushing up. The graphic below, taken from Point Carbon, shows the trend in the last thirty days.



VI. CDM SMALL HYDROPOWER SCHEMES

On 20 October 2005 the Executive Board of the CDM issued the first ever CERs under the Kyoto Protocol. These credits were issued for two hydroelectric projects in Honduras:

- 'La Esperanza Hydroelectric Project' is expected to generate annually 37,000 CERs and is registered in partnership with Italy,
- 'Rio Blanco Small Hydroelectric Project', in which Finland has a stake, produces 17,800 CERs per year.

Since then, more than 25 SHP projects have been registered by the CDM EB. Hereunder some of the most remarkable:

- "Los algarrobos" in the Chiriquí Province, Panama. Total capacity 9.73 MW. Estimated annual output: 48.25 GWh.
- Yukaizou in Hunan Province of the People's Republic of China. Total capacity 15 MW. Estimated annual output: 57.35 GWh.
- Maujhi in Himachal Pradesh, India. Total capacity 4.5 MW. Estimated annual output: 20 GWh.
- Cayumel in Republic of Honduras. Total capacity 7.8 MW. Estimated annual output: 33.7 GWh
- Upgrading Poechos in Perú. Total added capacity 14.5 MW
- Refurbishment and upgrading Dolega SHP in Panama. Total added capacity 3.12 MW.
- A 6 MW grid-connected SHP in Karnataka, India, using the hydro potential available in an irrigation canal and exporting the generated electricity to the state owned power utility company Karnataka Power Transmission Corporation Ltd
- A bundle of 3 small run-of-river hydropower plants located in Lima-Peru in the Santa Rosa Irrigation1 in the Sayán District. The project's installed capacity and the projected yearly average generation are 4.1 MW and 30.1 GWh respectively.
- The Magal Ganga SHPt will have a capacity of 9.9 MW and is expected to generate an average of 40.23 GWh/yr. The electricity will be sold to the monopoly government-owned utility in Sri Lanka, the Ceylon Electricity Board (CEB),

- Two small hydropower plants, (Badulu and Alupola) with an installed capacity of 2.4 MW and 5.8 MW, have an estimated combined output of 37 GWh/yr. The electricity will be sold to the monopoly government-owned utility in Sri Lanka, the Ceylon Electricity Board (CEB),
- Four run-of-river hydropower plants in Sri Lanka. The four hydropower plants, which range in size from 2.4 MW to 4.8 MW, will have a global capacity of 13.15 MW and an estimated combined output of 56.7 GWh/yr. The electricity will be sold to the monopoly government-owned utility in Sri Lanka, the Ceylon Electricity Board CEB),
- A 4.5 MW SHP in Maujhi, Himachal Predesh The installed capacity is 4.5 MW.
- Two small hydro projects in Vajra and in Chaskaman in India. One is a run-of-the-river project, and the other is a dam toe SHP set up on an existing dam.
- A run-of-the-river SHP in the district of Chamba, Himachal Pradesh (India), with an installed capacity of 5 MW.
- The Santa Ana Hydroelectric Plant is a small run–of-river type hydroelectric plant, introduced into the municipal potable water supply system of Bogotá Colombia, located on the outskirts of the city with an installed capacity of 13.43 MW and an estimated annual output of 47 GWh.
- A run-of-river SHP located in Honduras, with an installed capacity of 12.2 MW and an estimated annual output of 48.19 GWh, using for daily regulation an existing dam on the Cuyamaya river

VII CONCLUSIONS

- Carbon Credits will not turn a bad project into a good one, but a project only marginally viable, can become economically worthwhile with this additional revenue.
- Assuming an emission factor of 0.8 MtCO2/MWh (a reasonable average figure, that depends of the host country generator mix), and 5,000 hours of operation, a SHP of 1 MW installed power, will generate annually 4,000 CER. At €8/CER, it represents €32,000 which discounted at an interest rate of 8%, in the 21 year of crediting period, amounts to €320,540.
- In developing countries the investment cost of such a plant is in the order of 1.000/Kw. The sell of CER represents therefore 32% of the investment. Using those data on a Typical Spanish SHP project permit estimate an increase of 2.5 points in the IRR, substantially improving the profitability of the project.