CDM INVESTMENT NEWSLETTER

Nr. 2/2005   A joint initiative of BEA International and the Climate Business Network

Energy Efficiency

Table of contents

Editorial

WHY AREN'T WE SEEING MORE ENERGY EFFICIENCY PROJECTS IN THE CDM YET? This is the question we have asked ourselves in this issue of the Newsletter[1] as: many decisions of the UNFCCC recognize the importance of energy efficiency; several Kyoto signatories have recently highlighted this as a key area for action; and the Marrakech Accords requested simplified approval procedures for small-scale CDM projects that included projects in energy efficiency that reduce up to the equivalent of 15 GWh per year.

Also, recent assessments estimate the potential savings from energy efficiency measures in developing countries alone to be between 30-45%[2]; in energy-intensive industrial sub-sectors to be about 40% (building materials) and 25-30% (chemicals, aluminium & food) with a market potential of $50 billion and a payback less than 3 years[3]. Also, *"low-cost opportunities lie predominantly in the hundreds of technologies and practices … in buildings, transportation and manufacturing"*[4] Nevertheless, there are still comparatively few energy efficiency projects in the CDM 'pipeline'.

Given the recent entry into force of the Kyoto Protocol (16th February 2005), the start of the European Emissions Trading Scheme (EU ETS) one and a half months earlier with its Linking Directive and associated National Allocation Plans (NAPs), *"it is clear that the pressure on industry and business to reduce their emissions, and the emissions profile of their investments, will only increase in the future"*[5] and that this will, to a large extent, need to happen through energy efficiency measures, at least in the near term.

A REVIEW OF THE CDM PIPELINE OF METHODOLOGIES AND PROJECTS AS PRESENTED ON THE UNFCCC CDM WEB SITE[6] shows:

- A large number of renewable energy proposals in both the small- (at the validation stage) and large-scale (approved & consolidated methodologies as well as projects at validation and registration stages) categories—most of which are for grid-connected power generation;
- A large number of landfill projects similarly across different stages of the CDM approval cycle;
- Several fuel switch projects (we do not consider this as an energy efficiency measure);
- Several energy efficiency and/or cogeneration (including use of renewable energy sources) projects mostly in high energy-intensive industries (cement, metals, chemicals, food) or in power generation.

The methodologies already approved for energy efficiency and cogeneration are:

- Natural gas-based package cogeneration (AM0014 from the Metrogas package cogeneration project);

- Steam system efficiency improvements by replacing steam traps and returning condensate (AM0017 from the Steam System Efficiency Improvements in Refineries in Fushun project);
- Steam optimization systems (AM0018 from the Energy efficiency project by modification of CO2 removal system of Ammonia Plant to reduce steam consumption project).

However, there are more under consideration, but nearly all deal with large-scale industries that are high-energy consumers in the first place and the energy efficiency measures are also relatively large-scale. So far, only one project in the large-scale and one in the small-scale category have reached a DOE for validation (Vale do Rosário Bagasse Cogeneration using AM0015 & Shree Renuka Sugars Bagasse Cogeneration using AMS-I.D respectively).

SO WHERE ARE THE SMALL-SCALE, DEMAND-SIDE CDM ENERGY EFFICIENCY PROJECTS given that such opportunities are reportedly plentiful and that measures do not require large capital outlays on major equipment and are demonstrably cost effective?[7] There are a number of market failures and other barriers that can constrain adoption of efficiency measures, for instance: industrial users may not seek to optimize the efficiency with which they use energy; managers may have other concerns that have higher priority; energy costs (except for energy intensive industries) are usually only a small fraction of total production costs; there could be complex techniques and procedures for identifying and quantifying potential energy savings.

In addition, identifying and quantifying energy use and savings and subsequent preparation of the required CDM documentation are likely to incur high transaction costs. Therefore, business and industry managers and other investors will probably think twice before moving into such a project under the CDM as the extra income to be gained through earning CERs may not offset the additional transaction costs. However, high transaction costs for small-scale CDM energy efficiency projects can be addressed in several ways, two of which were described in earlier issues of this Newsletter[8].

1) One approach is to 'bundle' or prepare a portfolio of smaller projects. This can reduce the risks associated with energy efficiency projects, but a few things should be kept in mind:

- Bundle the same type so that the CDM documentation and analyses can be readily prepared, i.e. it is easier to bundle motor efficiency projects in different companies than to bundle a motor with steam efficiency one;
- Bundle in the same geographic area / country;
- Bundle projects in a similar development stage (e.g. project idea, feasibility study, detailed planning) as the carbon project cycle has to be integrated into the conventional project cycle;
- A single institution best undertakes bundling.

2) Energy Service Companies (ESCOs) can be one type of that 'single institution' that can help in developing and bundling industrial energy efficiency projects (in fact some are already doing this and acting as a project aggregator). But, ESCOs can, and some do, deliver other services such as:

- Coordinating the preparation and submission of CDM documents (ESCOs are used to investigate business-as-usual scenarios and reductions in energy consumption that is similar to doing baseline studies for a CDM project);
- Setting up contracts (ESCOs are used to working with performance contracts so should be able to assist with ERPAs);
- Providing financing;
- Monitoring reductions in energy consumption and emissions (methodologies already in use by ESCOs can be used as the basis);
- Acting as the main contact point for a carbon purchaser and a guarantor for implementation of the different projects and their delivery of CERs;
- Implementing the project(s).

However, there is still limited experience in linking energy efficiency projects to greenhouse gas emission reductions.

3) Should project promoters find appropriate ways to reduce transaction costs, what is now commonly being called 'Carbon Financing' would be a useful tool to promote measures that lead to improvements in industrial energy efficiency as the extra financial flows can provide the added incentive to accelerate industries' acceptance of required investments.

However, while the total potential energy savings and emissions reductions from small-scale efficiency improvements are considerable, an individual project is only likely to generate credits in the range 20,000 - 100,000 tCO_2. Nevertheless, such projects have the potential for *'quality'* emission reductions with considerable sustainable development impact, *viz*: helping to catalyze / transform the market for energy efficiency; disseminating best-practice technologies and techniques; strengthening local delivery and institutional capacities; and providing extension services and training. These 'additional' benefits may encourage facility managers and CDM project intermediaries to bring more small-scale energy efficiency projects into the CDM and could well encourage investors and intermediaries to look further at these opportunities.

THE ARTICLES IN THIS ISSUE OF THE NEWSLETTER WILL PROVIDE SOME ADDITIONAL IDEAS for you to think about as well as some experience from practitioners of energy efficiency in the context of the CDM. We start with an interesting overview of the benefits and issues confronting a would-be implementer of energy efficiency measures as well as suggestions for overcoming some of the problems, written by the Chairman of the IEA DSM-Programme (page 4). This is followed by a review of the 'Monitoring, Evaluation, Reporting, Verification and Certification' (MERVC) aspects of energy efficiency projects from the Lawrence Berkeley National Laboratory (NL), Berkeley, USA (page 10). The subsequent articles move from theory to practice in potential CDM host countries: an article from Econergy, Brazil, provides some insights into energy efficiency concerns in that country and presents a recently-completed model / tool that could assist ESCOs to encourage more CDM projects in this sector (page 13); efforts to promote demand-side management (DSM) by introducing the "efficiency power plant" (EPP) concept in China are detailed in the article from A+B International and the Natural Resources Defense Council (page 16); and finally an article from the David Noble Group shows that there are ample opportunities for energy efficiency in Mexico and proposes an institutional 'architecture' to take advantage of them (page 20).

1 The focus will be upon the manufacturing and energy demand sectors (i.e. sectoral scopes 3 & 4)

2 Pieter Van Geel, State Secretary for Housing, Spatial Planning and the Environment, Netherlands in 'A Law of Energy', article in OurPlanet v.15/No. 3

3 Application of Carbon Financing to improve the Efficiency of Industrial Energy Systems in Transition Economy Countries, issue paper presented to the Expert Group Meeting on Industrial Energy Efficiency and Carbon Financing, Vienna, Austria, 30-31 October 2003

4 Down to Business on Climate Change: An Overview of Corporate Strategies, by Seth Dunn, Worldwatch Institute, in The Business of Climate Change

5 Baker & McKenzie Newsflash – Kyoto Protocol enters into force

6 http://cdm.unfccc.int/

7 The following sections draw upon material presented in three issue papers presented to the Expert Group Meeting on Industrial Energy Efficiency and Carbon Financing, Vienna, Austria, 30-31 October 2003: 'Application of Carbon Financing to Improve the Efficiency of Industrial Energy Systems in Transition Economy Countries'; 'ESCOs and Other Service Providers as Possible Delivery Mechanisms for CDM/JI Projects in Industrial Energy Efficiency'; and 'Bundling Small-scale Energy Efficiency Projects'.

8 'Making Small-scale CDM Projects Competitive on the Greenhouse Gas Market--focus Africa' by Tippmann, & Medina-Gómez, in CDM Investment Newsletter, Issue No. 1 & 'Can a Portfolio Approach Work? Enabling Small-Scale CDM Projects in Asia' by Mariyappan & Bhardwaj in CDM Investment Newsletter, Issue No. 3

Why are there so few energy efficiency projects in the CDM registers? by Hans Nilsson, Chairman, IEA DSM-Programme

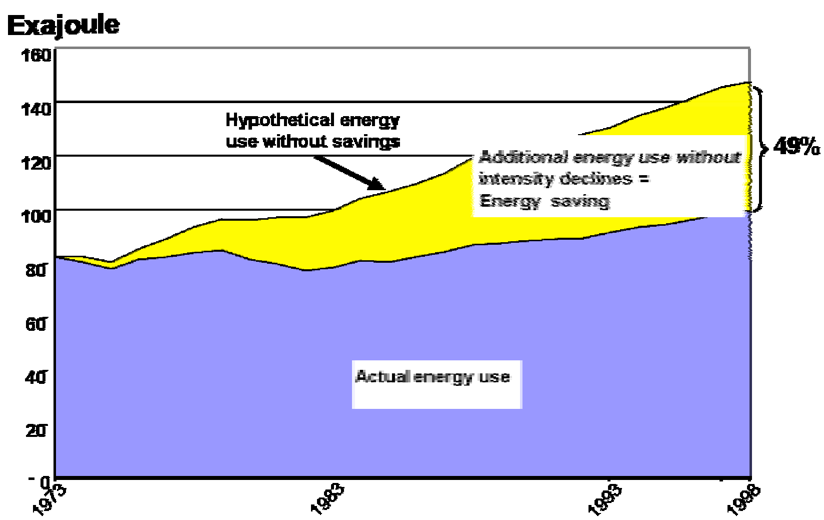
THE LONG LISTS OF PROJECTS FOR CDM SHOW THAT THERE IS A ROLE LOOKING FOR AN AUTHOR. The energy efficiency projects that could have an impact in the life of ordinary people and change the markets are simply not there. Even the few that are classified in the category "energy demand and manufacturing industries" are often related to single industries and their specific technologies and would be difficult to replicate for wider dissemination. We certainly should feel bad about this and try to do something to correct the situation, but are we really astonished? Is this not just a natural consequence of the way the CDM-machine is constructed and even worse, a consequence of the way we generally handle energy efficiency in our energy systems?

I will argue that there is an urgent need to develop institutions, in the broad sense of the word, such as frameworks, standards, routines, habits, etc., to enable energy efficiency to be recognised and treated in a systemic manner that it is not generally utilized today. This need for systemic development of institutions is universal but even more urgent in dealing with developing countries under the CDM because of the speed of development and the severe consequences of taking the wrong route early in development.

ENERGY EFFICIENCY IMPROVEMENTS ARE THE ORIGIN TO GROWTH OF WELFARE, but are so common that we do not even think about them. They are, however, the very reason for our present standard of living (or welfare) and are all around us, like air. We breathe but we do not think about it.

An IEA report[1] shows that developments to our present standard of living, since the first oil-crisis in the early 70's, mostly depended on energy efficiency improvements. Without the more effective use of energy we would have to use 50% more energy than we actually do. Energy use in 11 OECD countries[2] has grown by some 25% but is exceeded by a factor 2 by efficiency improvements, see figure 1. The report, however, also shows that the efficiency improvements have slowed down since the first decade. This slow down is however not correlated to a depletion of the efficiency potential. On the contrary, the potential is growing but it seems as if we have become lax in our attitude to reap its benefits or that we have lost the grip of management, or both?

Figure 1 Growth of energy use and use of energy services in 11 IEA-countries 1973-1998



So if energy efficiency is all around, develops silently without much fuss, but is slowing down since we do not pay attention any more, why should we be concerned that energy efficiency does not step out from the shadows and claim its right and importance in relation to the CDM?

THERE ARE (AT LEAST) SIX BENEFITS OF ENERGY EFFICIENCY:

- **Development:** We should be concerned first and foremost within the context of development. A visit to a shop selling household equipment in a developing country is enough to understand that. Fast growing economies produce wealth for people that, of course, want to spend some of it on “modern living” including washing machines, air conditioning, refrigerators and vacuum cleaners. If you want to equip your new home fast within a limited budget the risk is high that quite a few of the things you buy are not from the top line in terms of energy efficiency, but rather are cheap and wasteful. So the first argument is that fast growing economies need energy efficient equipment much more than others if they don’t want to be loaded with an inflated need for energy supply later;
- **Paves the way for renewable fuels**: Secondly the utilization of renewable fuels will be much easier when energy use is kept low but still delivers the services needed. In many urban African households solar cell-powered batteries are ‘unpowered’ by a less than good TV-set and by incandescent lamps that rapidly ‘drain’ the stored energy. With energy efficient equipment and CFL-, or even LED-, lighting, the battery could serve more and longer. So the second issue is the need to balance power supply and demand to make room for the renewable fuels and supply options;
- **Costs:** Thirdly, efficient energy use is mostly the cheapest way to get more capacity in power as is well known from the days when Integrated Resource Planning was still used. Less wasteful use makes room for more valuable use, e.g. less waste in household gives more power resources to be used for industry. The individual does not normally have the information, the skill or even the incentive to make these educated choices so the systems are, as a rule, over-investing in supply;
- **Reliability of systems:** Fourth argument is that peaks are built up in summer by air-conditioning and in winter by heating, depending on the part of the globe in which you reside; peaks that are expensive and also create risk for reliable functioning of the energy systems. A lower, and controllable, energy use by e.g. so called Demand Response actions, make energy cheaper and the systems more reliable;
- **Sustainable environment:** Fifthly energy efficiency reduces supply for whatever fuel you use and thus has a positive impact on the environment *per se*. Energy efficiency is therefore a cornerstone for a sustainable energy system since, in the longer run, it can also host fuels other than those harmful to the environment and climate;
- **Industry and jobs:** A sixth reason is that energy efficiency requires both technology and skills advances and is a forceful driver for new and sustainable technologies which will also have an impact on employment, both in scale and diversification.

BUT WHEN IT IS SO GOOD, WHY DOES IT NOT SELL?!

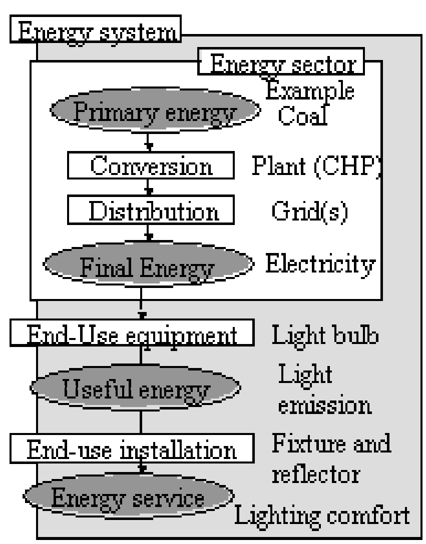
Have you heard it before, the argument that the market, if not immediately so at least eventually, will pick up and commercialise energy efficiency? Our belief in this automatic adjustment may be the very reason why energy efficiency has slowed down in the OECD and does not even make it on the agenda for CDM!

Following this way of approaching the problem we have a long tradition of naming “barriers” to energy efficiency and kilometres of publications based on the metaphorical thinking that barriers once removed, or at least lowered, will yield an economically optimal situation. Good in theory and certainly good advice to follow, but rather a necessary but not sufficient condition!

The market is both fragmented (with many people who makes a lot of decisions every minute that affect energy systems) and uneven in terms of roles (see figure 2[3]) as:

- Decisions on energy supply are made by professionals in

Figure 2 The Energy flow in a system



companies, based on economic rationale using a lot of specialised skills to investigate before making decisions;

- Individuals mostly make decisions on energy use, most of them being laymen (or even ignorant on technical issues) based the idea of services and comfort. They act on intuition and routine and with little skill to calculate the consequences of their decisions.

More energy efficiency is not a natural choice for the individual and that for two reasons. The first is that energy efficiency is not a product but a characteristic in products that are made for other purposes, like lamps for light, motors for power, cars for transport, and refrigerators for cooling and so on. This simple truth seems always to get lost in policy decisions when the call for “a level playing field” makes the decision-makers believe that people really make energy calculations in every move they make. The second is that a shift towards energy efficiency often requires that you change a habit or change the way you look at the things you buy and use. Such re-considerations are often difficult to make for the individual and especially at short notice as they make biased decisions even with perfect information and even with the capability to make “correct” calculations.[4] So even the level playing field is not as level as it looks!

In short, one could say that incentives can be recognised and technological solutions be outlined, but relying on the market in its present framework is not enough. The institutions are missing that could make energy efficiency an equal opportunity. And, if we do not have these institutions in place in the developed economies, we cannot expect them to be any other place either and hence there is no ‘demand pull’ for energy efficiency from the CDM alone.

To be fair some of these institutions are developing but too slow it seems. Focusing on them and speeding them seems necessary.

Table 1: Consciousness about energy depends on who the consumer is[5]

Decision Characteristics				**Corresponding Characteristics for technology**	
Frequency of Change	**Basis for choice of replacement**	**Energy and savings as objective**	**Decision strategy**	**Unit size**	**End-Use Activity Type**
Often	Habit	Never	Mainly along heuristic rules (if not purely by habit and tradition)	Very small (20-100 W)	Household lamps
Regular	Routine	Occurs		Small (100-1000 W)	Small appliances
Normal	Planned	Important		Small (1-10 kW)	Commercial maintenance, (e.g. motors)
Not often	Calculated	Important	Rational within delegated responsibilities	Big by unit size or aggregation (10-5000 kW)	Industrial & Commercial. Retrofit (e.g. lighting)
Seldom	Investment	Depends	Rational in context of purpose	Huge (> 2 MW)	Production and process technology (e.g. casting)

THE FOLLOWING ‘MISSING INSTITUTIONS’ SHOULD ATTRACT MORE ATTENTION TO ENERGY EFFICIENCY AND AGGREGATE ACTIONS FOR THE BENEFIT OF THE CDM PIPELINE. The assumption that financial incentives will do the job may not be enough when it comes to the individual; even where it might be attractive, the hassle to gain the few Euros may be overwhelming. Energy efficiency will have to be turned into a product characteristic that can be recognised and desired. Those who turn energy efficiency into an IKEA-like concept will win the game but, while waiting for the genius, we can try the following to improve the conditions for energy efficiency within the CDM. Some of the following can be undertaken as projects in their own right while others would need some sort of support, such as capacity building, to establish conditions suitable for energy efficiency to take root. There could be other ideas that work but, without attention to the institutions and their development, energy efficiency in the context of climate mitigation activities may just remain a dream.

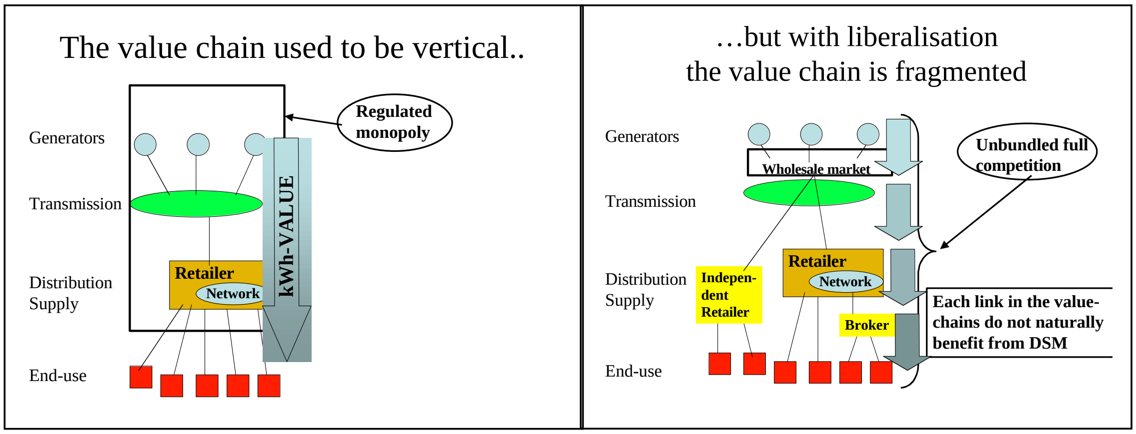
1) Energy Service Companies (ESCOs)

These have been around for some time and have developed several interesting modes of operation, but ESCOs have only achieved a tiny proportion of their potential. A market estimate made in the IEA work mentioned above shows a huge potential if the basic problems can be overcome.[6]

Table 2

Region	Market 2001 (MUSD)	Total potential (BUSD)	Market penetration (%)
Europe	135	63	0.2
Japan	64-196	19	1
USA	1800-2000	63	3

Figure 3: Value chains for energy supply



Part of their problem is that customers do not know what the ESCOs can deliver; the product is not specific enough. Many buyers in industry make a rational choice to buy 'Energy Services' to reduce costs but still many others do not perceive that they have a problem with costs.

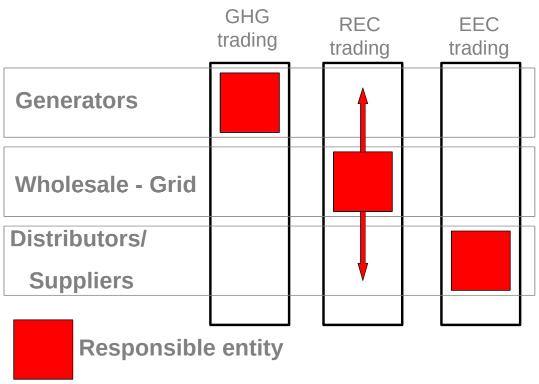
The IEA DSM-Programme Annex X (Roman 10) has a list of "problems" which probably could be read differently in different countries depending on their respective cultural, economic and political context. The following issues have to be addressed:

- Credibility and trust: Who delivers and with what competence? What capacity has the ESCO and the customer? Who takes the risks?
- Process and Procurement: Legal framework and specification skill;
- Contracts: Standard;
- Financing: Institutions, guarantees, insurances;
- Measurement and Verification: Protocols and procedures;
- Market: Experience and cases.

2) Energy efficiency Certificates:

In a regulated monopoly there could be (a theoretical) direct benefit for the energy generator from a reduced demand from the customer. But even where this could be proven, the utility culture (and the interests of the stakeholders) would still favour growth in supply over reduction in demand. The liberalisation of energy markets has further complicated matters since the

Figure 4: Trading new obligations

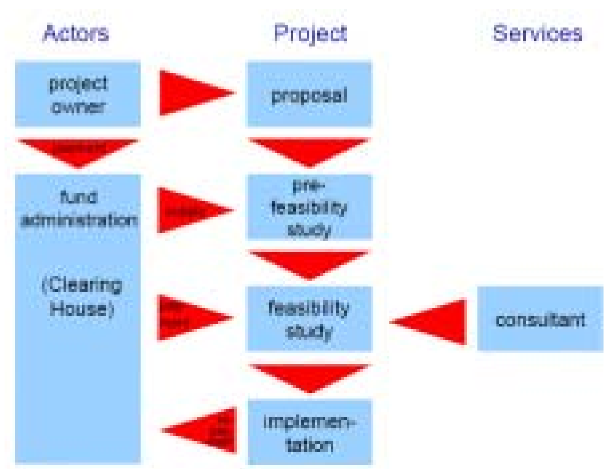


vertical value-chain has been fragmented and thus cannot transmit the “steering” signal from customer efficiency improvements that would show up as a benefit in reduced generation emissions with the generating company.

The IEA DSM-Programme Annex XIV is developing ideas around application of ‘Energy Efficiency Certificates’ (also called “White Certificates”) as a means to make energy distribution and supply companies partners in dissemination of energy efficiency, thus restoring the incentive.

There are several issues when designing a certificate system. A first consideration is how white certificates relate to other systems with similar intentions, like GHG-emissions trading (black certificates), Renewable Energy Commitments/REC (Green certificates), and energy efficiency certificates/EEC (White certificates), see figure 4 (source R. Baron, IEA).[7]

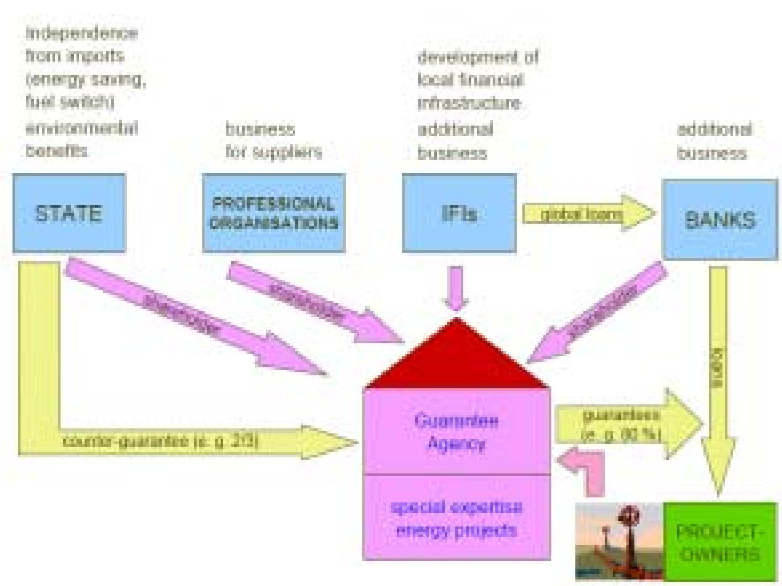
Figure 5 Project Preparation Fund



Institutionalising such aggregations of energy efficiency and appointment of a responsible party to deliver certainly fills a gap in the system as it works today.

Delivery of the services on the market is another issue. One of the ideas with the certificates is that they should promote cost-efficient solutions and could be developed and delivered by specialists. It seems likely that there could be a bigger role for Energy Services and companies to deliver such certificates. Tradability of the certificates is also an issue. Should they just be an object to clear the obligations between mandated parties or should they have a further value and thus challenge parties to develop not only technological but also financial creativity? Will there be room for a marketplace and maybe even for transfer of obligations between periods (banking) or use of brokers?

Figure 6 Guarantee Agency



3) Bundling and project preparation

Energy efficiency is a big thing but is unfortunately delivered in small packages. Bundling of these small packages is often suggested as a solution and was investigated in the “Baltic Chain Project”. Bundling is often treated as a technology issue but it also has strong legal and financial implications. The Baltic Chain therefore suggested the use of a clearinghouse that could have several functions using both technological and financial experience in a bundling process. They suggested establishment of a project preparation fund and a state guarantee agency to handle risks and leverage financing, see figures 5 and 6.[8]

This configuration would then cover both the aspect of development of a project from the first (idea) stage to its implementation and this could still be done from a business perspective rather than a grant or subsidy scheme. Money that is available to buy CERs could probably, when used in guarantees, leverage much larger sums from clearinghouse partners who have found the necessary support to develop sound projects.

1 "30 Years of Energy Use in IEA Countries" (2004)
2 These 11 countries count for 80% of the entire energy use within the OECD, which makes the figures and result significant.
3 From the World Energy Assessement, WEA
4 These issues are studied and described in great detail by Daniel Kahneman, Nobel-prize winner in economy. In DSM-literature the macro-representation of this is known as the phenomenon "(high) implicit discount rate"
5 Nilsson, H. and Wene, C.-O. (2002) 'Best Practices in Technology Deployment Policies', Proceedings of ACEEE Summer Study on Energy Efficiency in Buildings, Asilomar, California, 18-23 August, 2002, p. 9.267
6 Summary report appendix 2 from EA DSM-Programme Annex X.
7 See http:// dsm.iea.org/ for proceedings from "Energy Efficiency Certificate Trading" In Milan, Italy, on 17 April 2002 at CESI.
8 'Building Structures to enhance the Financing of small and medium sized Energy Projects'. Final Report. Kiel 22 January 2001.

The Monitoring, Evaluation, Reporting, Verification and Certification of Energy-Efficiency Projects for Climate Change Mitigation, by Edward L. Vine, Lawrence Berkeley National Laboratory, Berkeley, CA 94720 USA

THE KYOTO PROTOCOL WENT INTO FORCE IN FEBRUARY 2005 and requires developed countries to reduce their aggregate greenhouse gas (GHG) emissions by at least 5.2% below 1990 levels by the 2008-2012 time period. The Protocol includes two project-based mechanisms for activities across countries: Article 6 of the Protocol allows for Joint Implementation (JI) projects between developed (Annex I) countries; and Article 12 provides for a Clean Development Mechanism (CDM) that allows legal entities in the developed world to enter into cooperative projects to reduce emissions in the developing world for the benefit of both parties. In addition, as part of the Protocol, Emissions Trading will allow organizations to trade and bank carbon credits from projects, with a linkage to JI and CDM projects. Monitoring, evaluation, reporting, verification, and certification (MERVC) activities are needed for Joint Implementation and CDM projects in order to accurately determine their impact on GHG emissions and other areas. MERVC is also intended to: (1) increase the reliability of data for estimating GHG impacts; (2) provide real-time data so programmes and plans can be revised mid-course; and (3) enhance the credibility of the projects with stakeholders.

THIS PAPER BRIEFLY DESCRIBES SOME OF THE KEY MERVC ISSUES THAT ENERGY-EFFICIENCY PROJECT DEVELOPERS AND EVALUATORS NEED TO ADDRESS. These issues will need to be addressed in four key areas in the CDM process: preparation of the project design document, validation of the project design, the monitoring of the project, and the verification of the project.

1. Establishing the monitoring domain

The domain that needs to be monitored (i.e., the monitoring domain) is typically viewed as larger than the geographic and temporal boundaries of the project. In order to compare GHG reductions across projects, a monitoring domain needs to be defined. Consideration of the domain needs to address the following issues: (1) the temporal and geographic extent of a project's direct impacts; and (2) coverage of positive project spillover and market transformation. The first issue concerns the appropriate geographic boundary for evaluating and reporting impacts. For example, an energy project might have local (project-specific) impacts that are directly related to the project in question, or the project might have more widespread (e.g., regional) impacts. Also, energy projects may impact energy supply and demand at the point of production, transmission, or end use.

2. Monitoring and evaluation methods

For energy-efficiency projects, the first step in measuring emission reductions is the measurement of gross energy savings: comparing the observed energy use of project participants with pre-project energy consumption. Several data collection and analysis methods are available which vary in cost, precision, and uncertainty. The data collection methods include engineering calculations, surveys, modeling, end-use metering, on-site audits and inspections, and collection of utility bill data. Most monitoring and evaluation activities focus on the collection of measured data; if measured data are not collected, then one may rely on engineering calculations and "stipulated" (or default) savings. Data analysis approaches include engineering methods, basic statistical models, multivariate statistical models (including multiple regression models and conditional demand models), and integrative methods.

There is no one approach that is "best" in all circumstances (either for all project types, evaluation issues, or all stages of a particular project). The costs of alternative approaches will vary and the selection of evaluation methods should take into account project characteristics and the kind of load and schedule for the load before the retrofit. The load can be constant, variable, or variable but predictable, and the schedule can either be known (timed on/off schedule) or unknown/variable. The monitoring approach can be selected according to the type of load and schedule.

In addition to project characteristics, the appropriate approach depends on the type of information sought, the value of information, the cost of the approach, and the stage and circumstances of project implementation. The applications of these methods are not mutually exclusive; each approach has different advantages and disadvantages. Using more than one method can be informative. Employing multiple approaches, perhaps even conducting different analyses in parallel, and integrating the results, will lead to a robust evaluation. Such an approach builds upon the strengths and overcomes the weaknesses of individual approaches. Also, each approach may be best used at different stages of the project life cycle and for different measures or projects. An evaluation plan should specify the use of various analytical methods throughout the life of the project and account for the financial constraints, staffing needs, and availability of data sources.

3. Baseline estimation and additionality

For JI and CDM projects, the emissions reductions from each project activity must be "additional to any that would otherwise occur," also referred to as "additionality criteria." Determining additionality requires a baseline for the calculation of energy saved, i.e., a description of what would have happened to energy use had the project not been implemented. Additionality and baselines are inextricably linked and are a major source of debate. Determining additionality is inherently problematic because it requires resolving a counter-factual question: What would have happened in the absence of the specific project?

Because investors and hosts of energy-efficiency projects have the same interest (i.e., they want to get maximum energy savings from the project), they are likely to overstate and over-report the amount of energy saved by the project (e.g., by overstating business-as-usual energy use). This tendency may be widespread if there is no strong monitoring and verification of the projects. Even if projects are well monitored, it is still possible that the real amount of energy saved is less than estimated values. Hence, there is a critical need for the establishment of realistic, credible and conservative baselines.

Future changes in energy use may differ from past levels, even in the absence of the project, due to growth, technological changes, input and product prices, policy or regulatory shifts, social and population pressure, market barriers, and other exogenous factors. Consequently, the calculation of the baseline needs to account for likely changes in relevant regulations and laws, and changes in key variables (e.g., population growth or decline, and economic growth or decline).

The baseline will be re-estimated based on monitoring and evaluation data collected during project implementation. The re-estimated baseline should describe the existing technology or practices at the facility or site. Finally, in order to be credible, project-specific baselines need to account for free riders. The CDM Executive Board is reviewing some baseline and monitoring methodologies for energy efficiency projects and has recently approved a tool for assessing additionality.

4. Free riders

In energy-efficiency projects, it is possible that the reductions in energy use are undertaken by participants who would have installed the same measures if there had been no project. These participants are called "free riders." The savings associated with free riders are not truly "additional" to what would occur otherwise. Although free riders may be regarded as an unintended consequence of an energy-efficiency project, free ridership should still be reviewed, if possible, during the estimation of the baseline, and then later evaluated, after the project has been implemented.

5. Calculation of net GHG emissions

Once the net energy savings have been calculated (i.e., measured energy use minus re-estimated baseline energy use), net GHG emissions reductions can be calculated in one of two ways: (1) if emissions reductions are based on fuel-use or electricity-use data, then default emissions factors can be used, based on utility or non-utility estimates; or (2) emissions factors can be based on generation data specific to the situation of the project (e.g., linking a particular project on an hourly or daily basis to the marginal unit it is affecting). In both methods, emissions factors translate consumption of energy into GHG emission levels (e.g., tons of a particular GHG per kWh saved).

6. Environmental and Socio-economic Impacts

Energy-efficiency projects have widespread and diverse environmental impacts that go beyond GHG impacts. The environmental benefits associated with energy-efficiency projects can be just as important as the global warming benefits. Direct and indirect project impacts need to be examined, as well as "avoided negative environmental impacts" (e.g., the deferral of the construction of a new power plant). Both gross and net impacts need to be evaluated.

The Kyoto Protocol exhorts developed countries, in fulfilling their obligations, to minimize negative social, environmental and economic impacts, particularly on developing countries (Articles 2.3 and 3.14). Furthermore, one of the primary goals of the CDM is sustainable development. The persistence of GHG reductions and the sustainability of energy-efficiency projects depend on individuals and local organizations that help support a project during its lifetime. Both direct and indirect project benefits will influence the motivation and commitment of project participants. Hence, focusing only on GHG impacts would present a misleading picture of what is needed in making a project successful or making its GHG benefits sustainable. In addition, a diverse group of stakeholders (e.g., government officials, project managers, non-profit organizations, community groups, project participants, and international policymakers) are interested in, or involved in, energy-efficiency projects and are concerned about their multiple impacts.

7. Reporting

Reporting refers to measured GHG and non-GHG impacts of a project. Reporting occurs throughout the MERVC process (e.g., periodic reporting of monitored results and a final report once the project has ended).

8. Verification and Certification

Verifying the amount of carbon reduced or fixed by JI and CDM projects is important, and is a critical component of any emissions trading system. To resolve any potential problems with conflict of interest, there is a need for an external, objective, third party to conduct the verification. Certification will be issued by the UNFCC-designated entity (Designated Operational Entity).

9. Costs

Monitoring and evaluation costs will depend on what information is needed, what information and resources are already available, the size of the project area, the monitoring methods to be used, and the frequency of monitoring. Furthermore, some methods require high initial costs. Based on the experience of U.S. utilities and energy service companies, monitoring and evaluation activities can easily account for 5-10% of an energy-efficiency project's budget.

Depending upon the availability of funding, some project developers and evaluators may not be able to conduct the most data intensive methods; however, each project is expected to undergo some evaluation and verification in order to receive carbon credits. In the end, the cost of monitoring and evaluation will be partially determined by its value in reducing the uncertainty of carbon credits: e.g., will one be able to receive carbon credits with a value greater than the 10% of project costs that are spent on monitoring and evaluation?

TO LEARN MORE ABOUT THESE ISSUES and how they can be evaluated, read the following report: Vine, E. and J. Sathaye. 1999. Guidelines for the Monitoring, Evaluation, Reporting, Verification, and Certification of Energy-Efficiency Projects for Climate Change Mitigation. LBNL-41543. Berkeley, CA: Lawrence Berkeley National Laboratory. The report is available at the following web site: http://eetd.lbl.gov/EA/EA_Pubs.html. Furthermore, the author is presenting a one-day workshop on the evaluation of these issues on August 16, 2005, at the International Energy Program Evaluation Conference. Workshop and conference registration information can be found at www.iepec.org.

A Tool for CDM / ESCO Industry: a success story in Brazil, by Marcelo Schunn Diniz Junqueira, Vice-President of Brokerage & Luís Eduardo Lima, Investment Manager, Econergy International Corporation

DESPITE THE CURRENT LARGE SURPLUS OF GENERATING CAPACITY IN BRAZIL, there are frequent questions regarding capacity for supply in the medium term. Investment has been paralyzed for almost three years, mostly due to uncertainty about the new institutional model for the energy sector that has been under construction since the beginning of President Lula´s government.

A balanced future supply will depend upon the projects already authorized by the National Energy Agency (ANEEL), mostly frozen since the last energy crisis in 2001, commencing operation. Even more critical shall be the impact of the economy: on the assumption that GDP growth reaches the planned target (4% p.a.), electricity demand growth could easily reach 6% p.a., as the elasticity between electricity demand and economic growth is 1.5. Therefore, supply could become constrained leading to another energy shortage in mid-2007.

ENERGY USE IN BRAZIL IS VERY INEFFICIENT, largely a result of many years of subsidies during period of military government (1964 - 1985). Eletrobrás (the state owned energy company) estimates that the losses are equivalent to 11,000 MW of installed capacity, which is almost equivalent to the Itaipu hydropower plant, the biggest such facility in the world on the border of Brazil and Paraguay. Given the facts that a new generation facility would have an environmental impact while energy efficiency would not and, when comparing the financial benefits of energy efficiency projects to the equivalent of a new facility, one wonders why energy efficiency is not a key issue on the policy-makers' agenda.

Eletrobás' PROCEL programme is the only well-known energy efficiency programme in Brazil. . This is, in fact, a certification scheme for household appliances that guarantees their specific electricity consumption for consumers. The success of this programme is based on energy use and related financial information, instead of including the Energy Service Company (ESCO) concept to provide financial schemes grounded on performance contracts. Therefore, the actual ESCO concept is still to be experienced in Brazil.

THE ESCO INDUSTRY IS STILL SMALL IN COMPARISON TO THE POTENTIAL FOR ENERGY EFFICIENCY IN BRAZIL. It is estimated that the market for energy services in 1996 was about US$ 12 million in terms of new projects. By early 2001, on the eve of the electricity supply crisis, ABESCO (Brazilian Association for ESCO's) estimated new project flow to be about US$ 27 million. Currently the project flow is estimated to be about $ 33 million. While a typical project is relatively small (<US$ 150,000) with short, simple payback times (one year or less), the potential market for energy efficiency services with high rates of return is much larger; ABESCO estimates it will reach roughly US$ 400 million per year within a few years.

The entry into force of the Kyoto Protocol has added a new variable that could stimulate the ESCO market for energy efficiency projects, namely the generation of carbon credits. Now, by reducing energy consumption and diminishing the use of fossil fuels and thereby avoiding the emission of green house gases Certified Emission Reductions (CER) can be added to the revenue stream of an energy efficiency project and increases its returns.

The GERBI project (Greenhouse Gas Emission Reduction in Brazilian Industry) was sponsored by the CCCDF[1] to stimulate emission reductions through energy efficiency projects, starting in 2002 for a 30-month period. Econergy, due to its early involvement with the carbon/emission reduction market, was contracted to develop a model as part of this project that would evaluate the benefits of integrating revenues from carbon assets under the CDM framework into energy efficiency projects in Brazil. The model has two main applications: (i) to support energy efficiency-based CDM rules in the industrial sector, thereby generating the metrics needed for submission of a successful PDD; and (ii) to assess the financial returns from carbon credit/CER revenues and effectively integrate this value into the developer's projected revenue stream.

THE MODEL IS A SPREADSHEET TOOL DESIGNED TO FACILITATE THE ASSESSMENT OF ENVIRONMENTAL AND FINANCIAL ASPECTS OF ESCO PROJECTS. The model can assess renewable energy projects that generate electricity and/or produce non-electric energy as well as energy efficiency projects that save electricity and/or fossil fuels. These projects may involve a single large installation (such as a power plant) or many units of small equipment. Several of the model inputs will come from the ESCO/project developer as a direct output of their analyses.

Apart from the GHG emission reductions that are calculated for the combustion of fossil fuels or other processes that would be avoided through implementation of the project being assessed, the model also calculates the: Net Present Value (NPV); Internal Rate of Return (IRR); Debt Service Coverage Ratio (DSCR); Annual Cash Flow of a project from the perspective of the investor; and an initial project feasibility assessment. The model can conduct either a Basic or an Advanced Financial Analysis (respectively calculating returns to the project sponsors collectively or the specific returns to a local sponsor and a foreign investor under alternative financial structures, the latter option being suitable for a project in which a foreign investor has an equity stake). On the other hand, the model was not designed to support engineering or energy calculations for a given technology or expected savings from energy efficiency technologies (in order to keep the structure of the model relatively simple) so these need to be performed with a separate tool.

There are five financial perspectives that the model can address:

- Energy management service provider showing value of the credits;
- Industrial customer showing total value stream (credits plus energy savings);
- Bank showing the financials for both the project and the incremental value of the CERs;
- CDM project broker;
- CER buyer.

A carbon value stemming from a project will consist of a number of important factors beyond the project including: CDM transaction costs; the CDM adaptation fee; tax treatment; and market conditions/prices in CDM and energy markets. A thorough accounting of these carbon value factors is required to ensure that the tool adequately captures the main drivers on project value. The PDD/CDM rules and requirements are also made explicit in the model, permitting the:

- Identification of PDD and CDM needs to ensure that the model outputs seamlessly fit with requirements (e.g. model outputs as inputs to the PDD process);
- Users to follow the specifics of the CDM and PDD processes and to review pertinent information such as the creation of CERs or when small-scale project status (and lower transaction costs) are triggered.

Other features of the tool are:

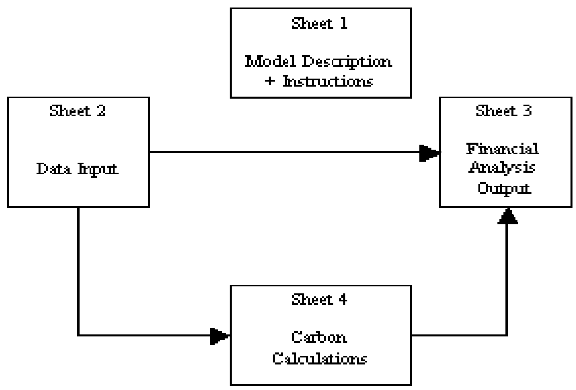
- Accounting for risk. This is an important item related to the financial viability of the project/CERs so the model includes parameter uncertainty (where ranges of values for important variables such as discount rate or carbon price need to be recognized as important sensitivities) and cumulative uncertainty (where uncertainty across a number of variables impacts the overall risk to the financial value of the carbon);
- The project developer must gather specific data for each type of project for example grid-connected energy efficiency (electricity efficiency and demand reduction), direct combustion energy efficiency (e.g., more efficient boiler), fuel switch project (generating emission

reductions by switching to a cleaner fuel) that will be used to calculate the ERs that the project can generate during the crediting period;

- The investment variables, such as total investment, equity share (%), debt share (%), grace period of the debt (years), term of the debt (years), lender interest rate (%), performance insurance premium (if applicable), O&M costs, energy savings payment to ESCO (% of the energy savings).
- The fiscal structure, taxes and the accounting rules; and
- The CDM components of carbon price (US$/tCO2e), exchange rate (local currency/US$), PDD development, Operational Entity contracting for validation (US$), Operational Entity contracting for verification (US$ repeatable), carbon brokerage success fee (%), CDM registration fee and CDM certification fee (2% of value).

A financial analysis will be carried out utilizing the input data presented above to determine the 'CDM impact' for the customer.

Figure 1: Flow chart of spreadsheet



The figure provides a view of the model structure showing what is being captured. The individual worksheets guide the user through the process and eventually provide the financial analysis. The use of this model by the ESCO industry should provide new opportunities for energy efficiency projects that will lead to a better optimization of energy usage thereby improving the supply of energy that will be needed by Brazil.

IN SUMMARY, the opportunity for developing ESCO-type projects in Brazil is huge and the benefits, in terms of reducing emissions of greenhouse gases, are clear. Because of the complexity of CDM regulations, some project developers and ESCOs have not considered CERs as a revenue stream useful for energy efficiency projects. By introducing user-friendly tools, such as the GERBI model described above, the ESCO industry will now have an incentive for promoting and developing CDM opportunities as originally envisaged by its creators.

[1] Canada Climate Change Development Fund, a Canadian initiative designed to assist developing countries to tackle the challenge of climate change. The CCCDF, a five-year, $100 million initiative administered by CIDA (Canadian International Development Agency), aims to combine technology transfer with a capacity building approach to help reduce GHGs and contribute to sustainable development.

Building an Efficiency Power Plant under the Clean Development Mechanism in China

by Anne Arquit Niederberger, A + B International (Sustainable Energy Advisors) & Barbara Finamore, Senior Attorney, Natural Resources Defense Council

CHINA IS CURRENTLY FACED WITH A SHORTAGE OF ELECTRIC POWER IN KEY REGIONS / CITIES, coupled with double-digit growth in demand while manufacturing plant closures and the external costs of emissions from coal-fired power plants have a negative impact on the economy. One immediate and cost-effective way to address these issues is to tap the vast potential for efficienct use of electricity by enterprises and households. This paper describes one major effort in China to promote demand-side management (DSM) by introducing the "efficiency power plant"[1] (EPP) concept, as a substitute for new generation capacity and to leverage international financial resources for energy saving measures under the Clean Development Mechanism (CDM).

China's government recognizes that it needs to make fundamental changes to meet its rapidly growing power demand in a sustainable way. In addition to full-scale efforts to diversify its energy portfolio – including plans to boost the share of renewable energy (based on the Renewable Energy Law adopted in February 2005) –energy efficiency has been elevated to a national policy, with plans to adopt strong measures to save an estimated 800 million tons of coal equivalent by 2020.[2] This aggressive policy has created a rare opportunity for synergy, as it offers a solution to an economic problem that also will have a significant, positive effect on the regional and global environment.

ENERGY EFFICIENCY IS A KEY OPPORTUNITY FOR CHINA, because it still uses much more energy, and emits much more pollution, per unit of GDP than the least intensive member countries in the Organization for Economic Co-operation and Development (Regulatory Assistance Project & State Power Economic Research Center, 2004). Despite a dramatic improvement in energy efficiency (and a corresponding reduction in the CO_2 intensity of the economy) in recent years[3], even new equipment has a carbon emissions intensity more than double that of new equipment in the United States (Bate & Montgomery, 2004). This suggests that there is significant potential for reducing greenhouse gas (and other pollutant) emissions by overcoming market barriers and increasing the rate of investment in efficient technologies.

According to an analysis by Princeton University, introducing advanced versions of current technologies could cumulatively reduce carbon emissions by 33% by 2050 (Larson *et al*., 2003).

One of the most effective ways to remove market barriers to investment in energy efficient technologies is through utility-sponsored demand-side management (DSM) programmes that use ratepayer funds to help customers take advantage of energy saving opportunities (e.g. high-efficiency commercial lighting, industrial motors, commercial and residential air conditioners), which reduces the need for new power plants, lowers customers' electric bills and improves the environment. The cost of reducing electricity demand through DSM is typically half (or less) than that of building new power generation capacity.

Chinese experts estimate that DSM programmes could eliminate the need to construct 100,000 megawatts of new power plant capacity by 2020—more than five times the installed capacity of the Three Gorges Dam—saving as much as US $125 billion (Hu, 2004) while avoiding emitting air pollutants and hundreds of millions of metric tons of CO_2annually.

THE NATURAL RESOURCES DEFENSE COUNCIL (NRDC) HAS BEEN WORKING IN CHINA for nearly a decade to promote energy-efficiency policies, strategies and technologies and has taken the lead in helping to launch a large-scale DSM programme in Jiangsu Province. NRDC signed a long-term cooperation agreement with the Jiangsu Provincial Economic & Trade Commission in July 2004 and, after six months of cooperative research and analysis with Chinese energy experts and institutions, presented a 10-year DSM strategic plan (Optimal Energy & State Grid Corporation DSM Instruction Center, 2005) to the Jiangsu government. Implementing the entire plan could reduce China's total coal consumption by an estimated 21.2 million metric tons by 2014, eliminating 854 million metric tons of CO_2 emissions, 12 million metric tons of sulfur oxides and 406 thousand tons of nitric oxides in the process. Similar work is underway in collaboration with the municipality of Shanghai.

HOWEVER, THERE ARE A NUMBER OF CHALLENGING BARRIERS TO OVERCOME, including a lack of institutions and supportive tariff structures that would enable utilities to profitably meet customer demand with energy savings on an equal footing with traditional supply expansion. To demonstrate the benefits of utility-funded DSM, "efficiency power plant" (EPP) pilot projects have been proposed in Jiangsu Province and Shanghai. An EPP is a bundled set of energy efficiency programmes designed to deliver reductions in energy demand that represent the energy and capacity equivalent of a large conventional power plant (CPP). The following table summarizes the common features that efficiency and conventional thermal power plants share, as well as the unique advantages of EPPs:

Unique Advantages of Efficiency Power Plants	Common Features EPPs & CPPs
o can be built faster o begin delivering energy services as soon as construction begins o are much cheaper o are much cleaner o are climate-friendly	o can meet customer needs o can be financed conventionally o can be bought and paid for by utilities o can be part of new power markets

The proposed EPPs could be built in only two years, but would continue to reduce demand over the lifetime of the technologies used, which is estimated to average 13 years. The specific measures proposed as part of the EPPs are promotion of efficient:

- Electric motor systems in industry;
- Cooling/heating and lighting systems in industrial and commercial buildings; and
- Residential lighting and electrical appliances.

Preliminary analysis of the Jiangsu EPP (Asian Development Bank, 2005a) indicates that two years of such DSM investments can lead to a peak demand reduction equivalent to a 464 MW power plant. This EPP has high peak load coincidence, high reliability and a lifetime delivered cost of about US$ 0.01 (or about 8 fen) per kWh saved. The EPP can be installed for a utility cost of US$ 197 million and, if the costs are assigned equally to capacity and energy, the EPP can be built for approximately $200 per kW installed, and less than ½ cent per kWh produced. The preliminary cost data for a 179 MW EPP in Shanghai are similar (Asian Development Bank, 2005b).

INVESTMENTS IN ENERGY SAVING PROGRAMMES UNDER EPPS STILL REQUIRE UP-FRONT CAPITAL despite the fact that they can provide energy services at a quarter of the cost of constructing new power plants. And, in contrast to the well-established practice of financing conventional power plants, lenders lack experience with such diversified programmes and are reluctant to provide loans. In addition, tariff structures currently do not allow utilities to charge customers for energy services provided as a result of investments in increased efficiency. To overcome some of these barriers, the NRDC team has proposed developing these two EPPs under the CDM.

THE CHINESE GOVERNMENT HAS ADOPTED A PROACTIVE CDM STRATEGY and has established the necessary institutional prerequisites for CDM project approval. The Designated National Authority (National Development and Reform Commission) has already approved several CDM projects, and the Government is eager to see more demonstration projects, particularly in energy efficiency.

The Jiangsu and Shanghai EPP projects could demonstrate how China can actively leverage CDM funding to support its energy priorities and, in so doing, can draw on world-class Chinese CDM expertise (e.g., members of international CDM Executive Board and Meth Panel).

OUR PRELIMINARY CALCULATIONS OF THE VALUE OF CO_2 EMISSIONS REDUCTIONS ACHIEVED BY THE EPPS assume a market clearing price of RMB 40 per ton (ca. US$ 4.8/t CO_2)[4]. The following figures show the EPP capital investment cost in 2005-06 and the estimated value of the corresponding volume of CERs, for the Jiangsu Province (464 MW) and Shanghai EPPs (179 MW), respectively[5].

Figure 1. Jiangsu Province EPP Utility Cost & CER Value, discounted (464 MW)

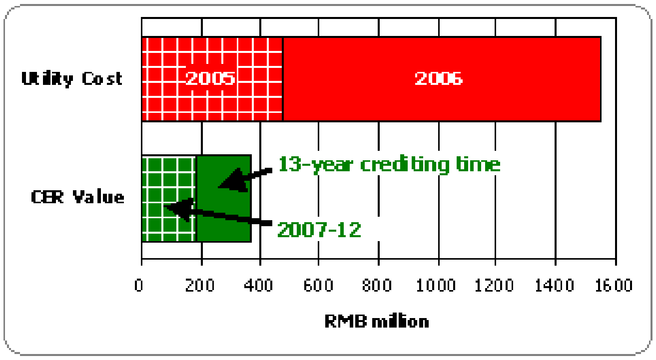
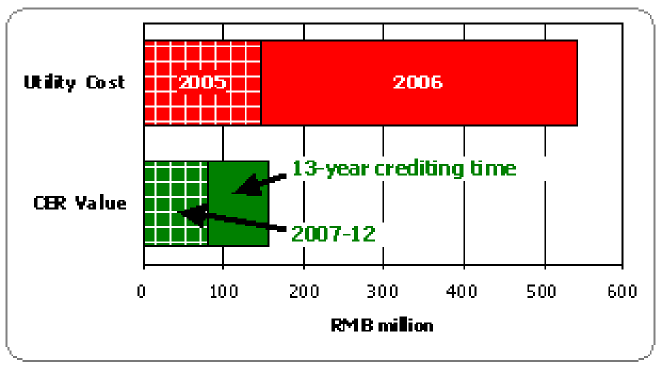


Figure 2. Shanghai EPP Utility Cost & CER Value, discounted (179 MW)



At this stage of project development, these estimates are still rough, as they are based on preliminary designs of DSM programmes and the resulting rough estimates of abatement costs, energy savings and GHG emission reductions.

With respect to the emission factor, a conservative approach was taken, relying mainly on data from case study analysis of a potential CDM project in Shanghai (World Bank, 2004). As the CO_2 intensity of electricity supply on the Shanghai Grid is already decreasing (shifting away from coal-fired generation to cleaner fuels & more efficient power plants), we assumed that the fuel rate of supply will continue falling at a rate of 1 gce / kWh annually. The result is an average baseline emission factor (built margin) for the period 2006-12 of 910 g CO_2/kWh for Shanghai[6]. For simplicity, we applied the same value to the Jiangsu EPP analysis, which gives conservative results.

These values resulted in cumulative GHG emission reductions for the 2007-12 period of 6.28 million tons of CO_2 for the Jiangsu EPP and 2.64 Mt CO_2 for the Shanghai EPP, whereas total emission reductions for the two years of investment are much larger (15.5 Mt CO_2 and 6.52 Mt CO_2, respectively), as they continue over the average 13-year lifetime of the energy saving equipment installed. Figures 3 and 4 therefore show the present value of CERs generated through 2012 (assuming revenues of RMB 40 / ton CO_2, as indicated above), as well as for the entire crediting period (assumed to be 13 years, for reductions implemented in 2006 and 2007).

Leveraging additional CDM financial resources from foreign sources is fully compatible with the EPP model (utility funding of demand-side management), and would have a number of advantages, including:

- Providing a significant additional source of revenues from CER sales (or investment in CDM projects);

- Contributing a secure hard currency revenue stream for debt servicing purposes (beginning with the second year of CER transactions, annual CER sales will amount to nearly RMB 48 million for the Jiangsu EPP and over RMB 20 million for the Shanghai EPP, which could easily cover loan repayment needs);
- Reducing or eliminating possible rate impacts from utility-funded DSM measures;
- Improving access to the most advanced technologies available;
- Ensuring full value for the Chinese contribution to global climate protection.

IN CONCLUSION, given the substantial hurdles to the implementation of large-scale utility demand-side management programmes and the effort required to devise credible, yet cost-effective baseline and monitoring methodologies for such complex projects, we believe the additionality of the two projects can be convincingly demonstrated. The projects are of strategic significance in demonstrating the feasibility and advantages of integrated resource planning, and could be replicated many times over in Jiangsu and Shanghai, at the national level and internationally. Jiangsu and Shanghai are now considering various options for the funding and administration of these projects.

[1] The concept of an "efficiency power plant" was developed by the Regulatory Assistance Project (RAP), which has played a leading role in the development of the proposed EPP project described in this paper.
[2] See Draft National Energy Plan, 2004-2020, http://www.efchina.org/resources
[3] According to the IEA (2002), for example, "China has made significant progress in reducing the CO_2 intensity of its economy. The CO_2/GDP ratio declined 50.8% between 1990 and 2002, to 0.62 kg CO_2/$US, equivalent to the Annex I North America (Canada and USA) average."
[4] It is virtually impossible to predict future prices, but this is below the current price of EU allowances (from €7-9 / RMB 75-95 per ton over the past year) and UK allowances (currently trading at about RMB 50/ton) and is within the range of average prices reported for compliance-ready project-based reductions, which is between $4-5/ton (see, for example, Natsource, 2004). A team of Chinese and international experts have modeled an equilibrium price of $5.2-6.5/ton (World Bank, 2004)
[5] Values are given in 2005 present value, discounted at a rate of 6.4%.
[6] For details, refer to World Bank (2004), in particular, Annex I, Case Study 4, included in the CD-ROM that accompanies the study.

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Towards an institutional architecture for promoting energy efficiency projects – an example from northern Mexico by David Noble, David Noble Group

THERE IS A TREMENDOUS OPPORTUNITY FOR CDM ENERGY EFFICIENCY ACTIVITIES IN NORTHERN MEXICO. This article identifies elements of an institutional framework for facilitating project development.

Energy conservation is critical to sustainable development in northern Mexico as energy demand and use is growing rapidly, new electric generating capacity is anticipated to meet demand only through the next three years, and there are concerns over the continued availability and cost of electricity in the region.

In 2004, the Western Governors' Association (WGA) investigated the potential energy savings from energy efficiency (EE) measures in key customer sub-sectors (manufacturing; hospitality, commerce & trade; and hospitals, government & education) in three major cities[1]. It estimated a market potential for cost-effective energy savings of approximately 773.8 GWh/year, mostly from small projects (i.e. less than 500,000 kWh).

In northern Mexico, as elsewhere, numerous barriers impede EE project development. Relevant barriers and recommendations for addressing these barriers are summarized in the first two columns of Figure 1. As a result, efficiency gains go unrealized, and opportunities remain.

MEXICO IS AN ATTRACTIVE POTENTIAL SUPPLIER OF CERS. The north is particularly attractive, since:

- Power generation is carbon intensive - Five of the six Border States rely predominantly on fuel oil or natural gas (50%) and coal (41%);
- Energy demand is growing rapidly – Electricity demand growth is projected at roughly 6% annually over the coming decade. At this rate, energy consumption will double in 12 years;
- Energy savings opportunities are relatively homogeneous and replicable;
- There is strong institutional development – Mexico has strong bi- and trilateral cooperation with US and Canada on energy and environmental issues, particularly in the northern region. There are several environmental technology organizations in the US-Mexico border region. Mexico is also the only developing country in the world with free trade agreements with Canada, US, European Union and Japan.

Mexico could develop high-quality CERs, in respect to EE projects as:

- The simplified modalities for small-scale CDM would apply to most projects, so transaction costs would be reduced;
- The project design document, baseline and monitoring requirements are simplified;
- A lower share of proceeds from the project will be lost to registration fees and administrative expenses;
- Since there is a high degree of replicability, baseline calculations could be further simplified;
- Many EE project types would require minimal leakage considerations (e.g. installations of ceiling fans and occupancy sensors);
- Barriers to EE are well documented, so projects are easily shown to be additional.

As a result, Mexico could achieve an efficient scheme to maximize its project flow and minimize transaction costs.

In north-western and north-central Mexico, the hot, dry climate makes EE particularly attractive. The region's relatively strong institutions and political and economic stability (vis-à-vis many other developing countries) afford it a further advantage – it can access technology and technical assistance, minimize transaction costs of technology transfer, and minimize CDM investment risks. These are all important advantages for CDM project development.

TO DATE HOWEVER, MEXICO HAS BEEN SLOW TO ENGAGE IN THE CDM. It established its DNA in 2004 and is only now developing the capacity to participate effectively. In the north, a strategic focus on GHG emission reductions is lacking. This is partly due to Mexico's close cooperation with US institutions on border environmental management. Since Washington is not engaged in the Kyoto mechanisms, US institutions active in the region are unable or reluctant to focus on GHG emission reductions.

NUMEROUS ORGANIZATIONS ARE CURRENTLY INVOLVED IN EE ACTIVITIES IN NORTHERN MEXICO, AND THEIR INTERESTS ARE CLEARLY CONVERGENT:

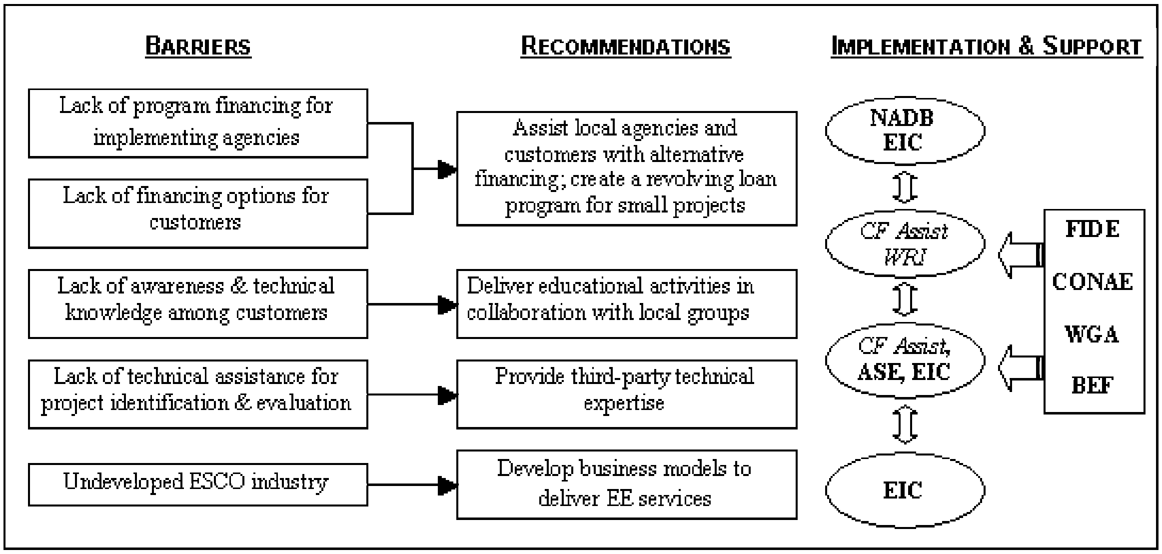
- **BEF** (Border Energy Forum) encourages and fosters energy-related alliances between public and private sector groups throughout the region. BEF is working with Mexican partners to identify and promote pilot EE projects. **WGA** (Western Governors' Association) has agreed to finance audit(s) for candidate facilities that commit to a serious effort to implement pilot project opportunities;
- **ASE** (Alliance to Save Energy) is implementing the Watergy program in two municipalities in northern Mexico. The programme facilitates EE implementation in municipal water utilities by delivering training and energy audits, and developing case studies to promote replication;
- **EIC** (Econergy International Corporation) is an energy services company (ESCO) that provides technical and investment advisory services, and also manages a private equity investment fund dedicated to clean energy projects in Latin America, with a focus on Mexico;
- **WB** (World Bank) is delivering technical assistance and capacity-building in Mexico in 2005 through its CF Assist programme;
- **WRI** (World Resources Institute) and **SEMARNAT** (Mexico's Secretariat for Environment and Natural Resources) are implementing the GHG Pilot Program. From 2005-2007, the focus is on recruiting participants, developing partnerships and capacity-building aimed at facilitating project identification and participation in future GHG emission reduction initiatives;
- The **BECC** (Border Environment Cooperation Commission) and the **NADB** (North American Development Bank) are sister institutions that work together to finance environmental infrastructure, including EE, in the US-Mexico border region. NADB has recently developed a bundling mechanism for EE projects and is now arranging its first bundled project financing with several US and Mexican ESCOs;
- **CONAE** (a section of Mexico's Ministry of Energy) that promotes clean and efficient energy;
- **FIDE** (a non-profit, private trust) supports EE activities through audits, demonstration projects and training;
- **CRS** (Center for Resource Solutions) is developing an accounting system for renewable energy certificate trading in North America. The system could be adapted for energy efficiency to support verification and certification;
- In the past, Annex-I countries have contributed resources aimed at developing high-quality CER prospects[2]. It is reasonable to expect that similar contributions, also for Mexico, are possible into 2006.

With the exception of WB, EIC and WRI, the organizations working in the region have focused almost exclusively on energy efficiency and air quality aspects in their activities. There have been some collaborative efforts to promote EE in the region, but these have generally failed to produce significant impacts beyond the immediate project results, due in large part to the barriers identified in Figure 1. The CDM could be the catalyst for more collaborative and successful EE project development in the region, with, for example: CER revenues helping to finance an EE programme and/or enhance project economics sufficiently to attract customers and ESCOs; and high-quality CER opportunities inducing technical assistance (as it already has) and technology transfer.

Here, as elsewhere, high transaction costs and a low CER revenue stream are barriers to project development. The notional solution is to advance a portfolio of projects and bundle the CERs through an intermediary[3]. In practice, this approach has proven difficult. To work, it will require, at a minimum: 1) multiple participants, with all of the required resources and expertise, and convergent and well-represented interests; and 2) a framework for collaborative action that ensures an efficient scheme for developing projects and CERs. These conditions may seem intuitively obvious, but they should not be taken for granted. Multi-organizational initiatives are rarely easy. They require careful design and plenty of attention.

The challenge is to craft and mobilize an appropriate framework for institutional collaboration. With the first Kyoto commitment period beginning in less than three years and the uncertain value of post-2012 CERs, it is critical to act quickly. With US participation, it is possible to act quickly and develop northern Mexico's advantage. Any initiative should thus be advanced under the rubric of energy efficiency and air quality to make US participation more palatable. However, there needs to be a strategic focus on developing and capitalizing on the carbon asset.

Figure 1



AS A CRITICAL FIRST STEP, PARTICIPANTS MUST NEGOTIATE A FRAMEWORK FOR COLLABORATIVE ACTION. This begins as an exploratory process, and if successful, converges to a commitment. The aim is to identify synergies, align activities and mobilize the resources required to initiate and sustain a programme for CDM EE activities. Participants might consider the "Facility" model described by Tippman and Medina-Gomez[3]. The Facility could be delivered via a public-private clearinghouse model, with seed capital and technical assistance from the public sector, and equity, bundling and fee-for-service work by the private sector for example:

- **WB**, **WGA** and **NADB** (and EIC, if required) contribute seed capital and an Annex-I country government might also be invited to participate here[2], depending on the Facility's final design;
- **BEF** and **ASE** continue to identify pilot projects, and support ongoing project identification and PDD development;
- **WRI** and **SEMARNAT** align GHG Pilot Program activities with the Facility;
- **WB** align CF Assist activities with key opportunities and ongoing initiatives in the region, develop baseline methodologies and deliver capacity-building and technical assistance;
- **CONAE** and **FIDE** engage Mexican industry associations and workgroups, professional associations and participants of existing programmes, and support Facility activities with technical assistance, outreach and government relations;
- **EIC** provides energy services (e.g. audit, design and implementation), GHG measurement (validation, verification, certification), equity investment, bundling and brokerage services.

EIC's role is critical. It is both equity investor and ESCO with technical and management expertise. It is experienced in carbon finance and brokerage services, and it has a Mexican office and operations. It could serve as equity investor and bundling organization, and could work with NADB and other organizations (e.g. commercial banks, leasing companies) to structure EE financial packages. With the prospect of involvement across all of these areas and a large number of projects, EIC has a strong business case for committing and contributing to a major initiative.

Participants should target highly replicable project types (e.g. lighting) in targeted sub-sectors (e.g. manufacturing) and regions (e.g. north-central Mexico). The Facility could easily adapt and disseminate a decision-support tool, such as RETScreen, the International Clean Energy Project Analysis Software, to support low-cost project screening. Participants should seek pre-approval from the Mexican DNA for all projects funded through the Facility. These measures will help minimize Facility administration costs and project transaction costs.

IN CONCLUSION, THERE IS A CONVERGENCE OF INTERESTS, EXPERTISE AND OPPORTUNITIES NORTHERN MEXICO, that enhances the viability of EE activities under the

CDM. Energy efficiency (and its associated air quality benefits) offers a point of entry for all of the key actors, and many are already active in the region. Because of the concentration and homogeneity of small-scale EE opportunities, transaction costs can be streamlined and distributed across a large number of projects. Mexico offers a large potential supply of high-quality CERs and buyers have already taken note.

These attributes, by themselves, are not sufficient to result in large scale EE project development and CERs. But collectively, and in synergy, they can redress many of the challenges to small-scale CDM and to EE projects more generally, and hopefully catalyze a wide-scale implementation of projects. Nor are these attributes unique to northern Mexico. No doubt, other regions boast similar opportunities for collaborative action. Again, the challenge is to craft and mobilize an appropriate framework for institutional collaboration.

[1] *'Energy Efficiency in the Border Region: A market approach', by Western Governors Association, April 2004.*

[2] *For example, Canada partially funded a PDD Development Facility for India to stimulate CDM project activities. Any resultant CERs must be offered for sale in Canada for 90 days before sold outside of Canada.*

[3] *'Making Small-scale CDM Project's Competitive on the Greenhouse Gas Market - focus Africa', by Tippeman & Medina-Gomez, in CDM Investment Newsletter, Issue No. 1 & 'Can a Portfolio Approach Work? Enabling Small-scale CDM Project in Asia' by Mariyappan & Bhardwaj, in CDM Investment Newsletter, Issue No. 3.*

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