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ETS market fundamentals and recession

Prices in the EU ETS market have been quite volatile, to say the least. Not only dropped allowances prices from € 30 to below € 1 during the first ETS period, also during the second phase of the EU ETS prices have shown volatility. Price developments were initially favourable (*i.e.* prices between € 25 and 30 per allowance). However, since October 2008, when the size and impact of the credit crunch became increasingly clear, EU allowances prices have dropped to around € 12 per allowance in January 2009. These prices are for spot market trading of allowances with expiration in December 2009; on forward market allowances are traded at prices up to € 15.

Long-term market price

It may not be fair to judge the price development of the ETS during the first trading period and during a period of credit crunch and economic recession. After all, if a trading period has a clear end point without the possibility to bank allowances for use during a future period (as during the first ETS phase) prices have the tendency to move to either € 0 (if market players realize that the market is long) or to the *fine* level per tonne CO_2 not covered by an emission allowance (when the market is short on aggregate so that a number of installations cannot buy allowances anymore and have to pay the fine or carry out emission reduction efforts that are more expensive than the fine level). Consequently, the lack of banking between the first and second phase was an important reason for the price drop during 2006-2007.

During the second ETS period banking of surplus allowances to the third ETS phase of 2012-2020 has become possible. Effectively, this implies that installations and other market players can now estimate their allowance needs for a 12-year period and decide to bank allowance now for future use. In order to calculate a long-term market price for ETS allowances, Deutsche Bank (Lewis and Curien, 2008) estimate on a regular basis the required allowances for installations to comply with their ETS commitments up until 2020. Given that during the second and third phase of the ETS annual allowances are derived from the verified CO_2 emissions of installations in 2005 – each subsequent year the overall allowances in the EU are further reduced by a predetermined amount – and assuming an emissions path in case no extra emission reduction measures were taken by installations, the ETS was expected (as per Deutsche Bank's estimate in October 2008) to be short, on average, for 80 million tonnes CO_2 per year between 2008 and 2020.

With this shortage amount in mind, one could estimate at which point on the marginal cost curve for CO_2 emission reduction technologies within the EU the ETS market would be in equilibrium. In Lewis and Curien (2008), the marginal technology would be Combined Cycle Gas Turbines, which marginal cost figure could be estimated at around € 50 per EU allowance in 2020 (which would have corresponded with around € 30 per EU allowance in 2008; assuming a 4% annual discount rate).

Deviation from market fundamentals

However, during 2008, even before the credit crunch, the ETS market never really seemed to be following these market fundamentals. On the contrary, markets strictly followed the oil markets with CO_2 prices moving up during the first half of 2008 alongside the sharp increase in oil prices, and a downward movement of ETS prices when the oil price started to decline. In October 2008, the ETS market price was around € 22 per allowance for a December 2008 contract, which was almost 30% below the prices that one would expect according to market fundamentals.

The criticism one could raise in this respect is that the ETS market players still insufficiently look at fundamental values and, instead, follow short-term energy price developments. One of the problems that may explain this behaviour is that there has been uncertainty about the future climate policy

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regime which will succeed the Kyoto Protocol in 2012, about the future installation-level allocation procedure of the European Commission during the third ETS phase (central allocation instead of national allocation), and about the amount of allowances that will be auctioned or grandfathered. Lack of true clarity about the scarcity per individual installation has caused market players to remain cautious to take forward-looking positions. This has had a downward effect on the ETS prices thus far.

Remaining uncertainty

Possibly, the *EU Climate and Energy Package* adopted by the Council of Ministers and by the European Parliament in December of last year, could be an important step in the direction of providing certainty to market players. Also, the recent communication by the European Commission (see below on this page) with a recommendation to extend the ETS to all OECD countries by 2015 shows the EU's determination to make the ETS the cornerstone for the future EU and global climate policies.

However, for the time being, the impact of the economic ression (*i.e.* lower CO_2 emissions due to lower economic activity, but higher emissions since investments in low-carbon technologies might be postponed) and the uncertainty about the outcome of the Copenhagen negotiations are two important obstacles for market players to judge market fundamentals, let alone that they can be expected to base their decisions on these.

Wytze van der Gaaast, JIQ Editor

European Commission Presents Views on Road towards Copenhagen Agreement

On 28 January of this year, the European Commission published a communication to, among others, the European Parliament and the European Council of Ministers: "Towards a Comprehensive Climate Change Agreement in Copenhagen". The document contains thoughts and recommendations on international climate policy targets, the role of industrialised and developing countries in terms of mitigation and adaptation actions, financing, and the role of carbon emissions trading.

In the document, the European Commission repeats the CO_2-eq. emission reduction targets which have been adopted by the European Council and the European Parliament in the EU *Energy and Climate Package* of December of last year:

- an autonomous 20% reduction of the EU emissions by 2020 below 1990, which will be increased to -30% with an ambitious Copenhagen Agreement.
- an 80 to 95% reduction of emissions by 2050 in developed countries,
- which would have to lead to a global 50% emission reduction by 2050.

The assumption is that these reductions are needed to avoid a global average temperature increase of more than 2^0C aboven pre-industrial times levels

With respect to the position of developing countries, the European Commission proposes that "under the Copenhagen Agreement, all developing countries, except least-developed countries (...), should commit to adopting low-carbon development strategies by the end of 2011." These strategies would not necessarily contain quantified commitments, but "a credible pathway to limit the country's emissions through nationally appropriate mitigation actions that cover all key emitting sectors." The formulation of strategies would be supported by a new *Facilitative Mechanism for Mitigation Support*.

The Commission foresees that the experience with the EU ETS can be expanded to the entire group of OECD countries. It is proposed that by 2015 a robust OECD-wide carbon market is created. The Commission expects that it can particularly engage on this topic with the new US legislation. In addition, developing countries interested in the ETS would be helped by the EU to gain experience with the system. It is important to note that the Commission, in the communication, proposes that this ETS enlargement will proceed in parallel to the UN climate negotiations.

Finally, the European Commission suggests that "the CDM should be reformed, crediting only those projects that deliver real additional reductions and go beyond low-cost options." In addition, it is suggested that the CDM is phased out in favour of moving to a sectoral carbon market crediting systems in advanced developing countries. The underlying thought is that this would "pave the way for the development of cap and trade systems" in these countries.

See also **http://ec.europa.eu/environment/climat/pdf/future_action/communication.pdf**

JIAG: Binding and Detailed Provisions for Determination and Verification not Necessarily Suitable for JI

Position Paper by the Joint Implementation Action Group

The Joint Implementation Supervisory Board (JISC) has launched a call for public inputs on the exact nature and purpose of a Determination and Verification Manual (DVM). The Joint Implementation Action Group (JIAG) has prepared a position paper in which it urges independent entities and project developers to jointly develop a guidance document for determination and verification of JI project PDDs and GHG emission reductions for application on a voluntargy basis, instead of a binding set of provisions under the JISC. The JIAG is a consortium of JI practitioners which are currently developing JI projects representing more than 100 millions of tonnes of GHG emission reductions. The views expressed in this paper are based on the unique JI experience of the JIAG members.

Background

JI is a project-based mechanism for emission trading set out in the Kyoto Protocol. In that sense it is similar to the Clean Development Mechanism (CDM). The CDM Executive Board has adopted a detailed Validation and Verification Manual (VVM) launched in November 2008. The CDM VMM contains a set of binding provisions and requirements for Designated Operational Entities guiding the processes of validation of CDM projects and the verification of emission reductions. However, when looking at the key differences between JI and CDM it becomes clear that binding and detailed provisions for verification are not necessarily suitable for JI.

a) Capped environment

JI is different from the CDM. Other than Certified Emission Reductions (CERs) which are created by the CDM Executive Board, Emission Reduction Units (ERUs) that originate from JI projects are converted Assigned Amount Units (AAUs). CERs can be used to offset emissions in Annex I countries and thus stretch their emission caps and increase the overall number of AAUs of Annex I countries taken together. With the conversion of JI projects' GHG emission reductions into ERUs, the original AAUs are cancelled from the account of the project's host country, thus preserving the total carbon credit balance in the GHG capped system. This means that all emissions reductions transacted under JI are underwritten by a legally binding sovereign obligation attached to the assigned amount of each Kyoto party. This is not the case for the CDM.

b) The case for flexibility and testing

Because of the stronger country responsibility and inherent environmental integrity, JI is more case law oriented than the CDM[1]. Project Design Documents for CDM projects should be based on a methodology approved by the CDM Executive Board. The JISC, on the other hand, does not approve JI methodologies. This implies that there are no limitations with respect to the JI project types and every new JI project has the potential to bring forward new ways to calculate and monitor emission reductions.

Under these conditions, it will be difficult to develop a JI Determination and Verification Manual (DVM), even when using the CDM VVM as a basis. In addition, JI is a relatively young mechanism. The CDM VVM was launched when the CDM had been in operation for four years after its first project was registered in November 2004 and the list of registered projects currently exceeds 1500. The first final determination of a JI project, on the other hand, was in March 2007 and the number of projects that have passed the final determination under the JI Track 2 procedure is limited to six.

In the long run, also the case law system of JI may develop into a set of standardised practices that can be summarised and defined in a DVM, but that time has still to come. Currently, the flexibility and ability to test new approaches and methodologies are beneficial to the overall functioning of JI. The Kyoto

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[1] The CDM Validation and Verification Manual confirms in paragraph 29 that the "CDM is a rules-based mechanism". JI on the other hand does not have separate procedures for the approval of methodologies, but rather approves projects including applied methodologies on a case-by-case basis. By approving projects only, the JISC adopted a "bottom-up" approach based on case law principles.

Protocol flexibility mechanisms have the ability to use market forces to identify and develop low-cost emissions reduction options. This is particularly true for JI. Since JI projects are not bound to a set of previously approved methodologies, it can pioneer new areas of emission reductions in a fast and effective way.

A binding DVM may diminish JI's ability to be on the forefront of developing new emission reduction options. A flexible and non-binding DVM has the advantage that it is more likely to be widely adopted under Track 1 as well as Track 2. A very prescriptive DVM will likely turn host countries away from adopting it, as it will not allow them to adapt the manual to national circumstances and their Track 1 procedures. A DVM that is only applicable to Track 2 projects is of less use than a Manual that is broadly supported under Track 1 as well.

The JIAG also sees an important role for the recently launched JISC clarification procedure. The procedure opens the door for applicant or accredited Independent Entities (IEs) to direct requests for clarification to the JISC on "issues of general relevance for the Track 2 procedure". All requests and the corresponding answers shall be published on the UNFCCC website. This procedure[2] supports the development of case law. The clarification procedure can function as a resolution mechanism if also project participants are entitled to direct requests for clarification to the JISC.

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The JIAG is a consortium of JI practitioners which are currently developing JI projects representing more than 100 millions of tonnes of GHG emission reductions.

Recommendations

The JIAG welcomes the initiative to harmonise determination and verification procedures among IEs to facilitate the development of an industry standard. However, the JIAG has strong doubts whether such guidance should be a binding set of provisions and requirements under the JISC. The JIAG therefore urges the IEs and project developers to jointly develop such a guidance document based on previous experiences and keep compliance with its provisions on a voluntary basis.

To that respect, the JIAG is willing to support the IEs with the development of such a document. At the same time we suggest the JISC to allow Project Participants to submit requests to the recently adopted clarification procedure.

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[2] See 13th JISC meeting, Annex 11: Procedures for requests for clarification under the verification procedure under the Joint Implementation Supervisory Committee.

Enhancing the Role of the CDM in Accelerating Low-Carbon Technology Transfers

Wytze van der Gaast and Katherine Begg*

According to the Kyoto Protocol, next to the objective of reducing emissions of greenhouse gases (GHG), CDM projects shall also aim at supporting sustainable development in developing countries. The idea was straightforward: a CDM project enables the transfer of a low-carbon technology to a developing country which would be in accordance with that country's development needs and priorities.

'Red thread'

The present size of the pipeline and the acceleration of projects since 2005 indicate that the CDM in terms of numbers (projects and GHG emission reductions) has been successful. However, analysing to what extent the CDM has contributed to host countries' sustainable development is less straightforward. For instance, a study carried out by the Ministry of Foreign Affairs of the Netherlands shows a mixed picture of the expected contribution to sustainable development by CDM projects with Dutch government involvement.[1]

It also shows that there is a difference between developing countries in terms of how they apply sustainable development criteria when approving CDM projects. Some countries have detailed lists with criteria, whereas others issue Letters of Approval provided that the projects will not have 'disbenefits'.

What seems to be lacking in many countries though is a 'red thread' from countries' sustainable development strategies to the eventual technology selection for the CDM project. As a result, several CDM projects are only loosely embedded in host countries' sustainable energy strategies and mainly selected for their GHG abatement potential.

Energy Service Needs assessments

The EU funded study "Promoting Sustainable Energy Technology Transfers through the CDM: Converting from a Theoretical Concept to Practical Action" (ENTTRANS) took this 'red thread' as a key study objective.[2] The study team selected five case study countries – Chile, China, Israel, Kenya and Thailand – and organised bilateral interviews with country stakeholders (energy and environmental policy and decision makers) in order to learn from them which energy services (*e.g.* electricity availability, heating, cooling, waste management, transport) they considered most important with respect to their development needs and priorities. Subsequently, stakeholders identified suitable low-carbon energy technologies to meet those needs, which was followed by an analysis of the implementation chain in the countries for those technologies. The latter resulted in an overview of blockages and incentives for low-carbon technology implementation in the countries.

Finally, ENTTRANS analysed the role of the CDM in this process of exploring development needs and priorities, identifying suitable low-carbon technologies to meet these needs, and streamlining implementation chains for these technologies. The study also analysed whether this role would require changes in the present functioning of the CDM.

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An extended version of this article has been submitted for publication in CCLR, later this year.

[1] Netherlands Ministry of Foreign Affairs. Clean and sustainable? An evaluation of the contribution of the Clean Development Mechanism to sustainable development in host countries, IOB Evaluations, no. 307 (2007), the Hague, the Netherlands.

[2] ENTTRANS, Promoting Sustainable Energy Technology Transfers through the CDM: Converting from a Theoretical Concept to Practical Action, European Union Sixth Framework Programme, Specific Support Action, contract number: 022673, duration: January 2006 - December 2007.

The first results from ENTTRANS (*i.e.* an overview of energy service needs) have been presented in earlier issues of *JIQ* (see http://www.jiqweb.org/dljiq.htm); this article addresses the role of the CDM in supporting the transfer and implementation of low-carbon technologies to developing countries.

To a large extent the difference between how host countries deal with determining the sustainable development contribution requirements can be explained by limitations in terms of knowledge and training of staff of CDM Designated National Authorities (DNA) and in several countries a clear sustainable development strategy simply does not exist. Such situations could easily lead to selection and approval of projects that result in the largest GHG emission reduction and, hence, monetary revenue for the host country.

Technology transfer supporting systems

This tendency has been enhanced by the fact that the CDM has thus far not really fostered the supporting systems needed to enhance adoption of a new technology in a host country, and it therefore has only addressed part of the process related to the early stages of demonstration and pre-commercialisation of technologies in the developing country market.

At the stakeholder workshops held in the five ENTTRANS case study countries, the question was addressed how the CDM could be improved to ensure that CDM projects are in line with energy services needs instead of *ad-hoc* CDM projects, and improve the efficiency of CDM host country operation to fast track projects?

In all five countries (Chile, China, Israel, Kenya and Thailand) recommended actions were developed by exploring the positive and negative aspects of the performance of the CDM on technology transfer. Stakeholders also recommended actions needed to improve this performance. The country recommendations have been summarised below under three main headings: technology transfer enhancement, host country facilitation of the CDM, and CDM procedural change at the international level.

Host country systemss for technology transfer

The following issues have come out of the workshops with respect to the host country organisation of technology transfer through CDM projects and possible combinations with existing policy programmes (*e.g.* ODA):

1. Promotion/marketing of DNAs as one-stop-shops for CDM activities. This involves streamlining the process for foreign investors, as well as initiatives to build capacity within DNA and within sectors for project participants for all aspects of the CDM, including bundling of CDM projects and programmatic CDM. It is suggested that DNAs are assisted in achieving these tasks and build capacity by Government agencies specialised in development co-operation (*e.g.* DGIS in the Netherlands, DANIDA in Denmark, GTZ in Gemany, *etc.*). It is also important that DNAs do not operate in isolation from other policies and minisries and that there are integration structures in place.
2. Support is also needed for the formulation of low-carbon CDM strategies by the host country based on national energy service needs and priorities and suitable technologies for which technology implementation chains have been clearly mapped and streamlined along the lines explained in the ENTTRANS study. It is recommended that these strategies are based on participatory processes. The low-carbon CDM strategies thus formulated should lead to a domestic CDM project pipeline in line with energy service needs and priorities identified.
3. The CDM in its programmatic form could also support programmes of demonstration projects covering a range of sizes, sectors, locations, implementation models and scales of country conditions to prove and adapt the technologies using a participatory process. As mentioned above, one-off projects can be useful, but a portfolio or programme approach to projects should be preferred where possible.
4. Although formulating CDM strategies is a country-specific exercise depending on the country contexts, it is also recommended that countries collaborate through regional co-operation in order to share experience and to establish South-South dialogues.
5. Although CDM projects should not use ODA funds for the acquisition of CERs, the expertise in development co-operation projects would be a valuable input for identifying CDM project opportunities, since such deliberate links between CER acquisition and development assistance experts would ensure maximisation of local development benefits under the CDM. This would imply a strict dividing line between ODA budgets and CER acquisition budgets, while ensuring that projects are in accordance with host countries' sustainable energy strategies.

CDM at the international level

At the governance level of the CDM EB, the following steps are recommended to streamline CDM procedures and to make the mechanism more accessible for investments in, *e.g.*, small-scale projects or energy efficiency activities across a range of installations in an industrial sector:

1. Since for some developing countries there are no other projects which would be undertaken in the absence of the CDM project and since it is important that country circumstances are recognised when assessing additionality of emission reductions, it would be better to have a more positive approach to additionality. This could give a stimulus to CDM project development in countries that are presently underrepresented in the CDM project pipeline.
2. In order to make the CDM fit for technology transfer and for sustainable development it is recommended to use it mainly in the programmatic mode as it is very suitable for energy efficiency improvement projects in households (*e.g.* cooking, lighting) and industry (*e.g.* one technology applied within an industrial sector at different locations but under similar circumstances).
3. Devise alternative schemes to minimise the up-front loading of PDD costs, for example by using CERs to pay the costs, either by paying later, or by borrowing, or by using an increase in the levy to assist in offsetting the costs as well as by support for increased accreditation of local entities.

Differentiation

These findings are in accordance with the present discussion within the CDM EB context about differentiation in the treatment of CDM projects. This discussion has arisen due to the concern about the unequal geographical distribution of CDM projects across developing countries and through a differentiation policy it could be tried to facilitate more projects also in other developing countries, especially those in sub-Sahara Africa and least developed countries in Latin America and Southeast Asia (which are presently largely underrepresented in the CDM pipeline).

Differentiation could take many forms, such as imposing quota on the number of projects that a developing country could host at maximum or multiplying CO_2-eq. emission reduction from CDM projects in least developed countries so that these projects can generate more CERs and the countries become relatively attractive CDM host country partners.

The above-mentioned positive approach towards additionality is another example of how one could differentiate between the supply of CDM projects. The CDM EB could, for instance, agree on a positive additionality approach for all projects from least developed countries, or projects from certain categories that are considered to contribute strongly to sustainable development, or consider a project additional if it has been derived from an energy service needs assessment followed by a selection of suitable low-carbon technologies to meet those needs. This overview of differentiation options is not exhaustive and, recently, the Netherlands Government has commissioned a study on differentiation under the CDM.[3]

Conclusions

This paper has argued that in the current CDM practice there is a trade-off between fostering sustainable development objectives and seeking relatively cheap GHG abatement opportunities for CDM projects. The recommendations made in this paper are aimed at providing input to CDM Executive Board to make this trade-off less pronounced and increase the attractiveness of projects that have been clearly derived from energy service needs assessments and therefore clearly embedded in host countries' sustainable development strategies.

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[3] Stefan Bakker, Harro van Asselt, Joyeeta Gupta, Constanze Haug, Raouf Saïdi, Differentiation in the CDM: options and impacts, ECN, IVM, the Netherlands, *forthcoming*.

Incorporating Co-generation Plants in Baselines for Grid-Connected Electricity Joint Implementation Projects

By Wytze van der Gaast*

CDM projects which deliver electricity to the power grid that would otherwise have been generated by operation of grid-connected power plants and by the addition of new generation sources can apply the "Consolidated baseline methodology for grid-connected electricity generation from renewable sources" (ACM0002 methodology). Basically, this methodology could also be applied for JI greenfield power sector projects. However, some specific power sector characteristics in Central and Eastern Europe complicate the application of ACM0002. One of these characteristics is the large scale operation of CHP plants.

Determining a marginal plant

The ACM002 methodology enables project participants to determine a CO_2 emission factor for the grid to which CDM or JI project will deliver its electricity output. It is generally very complex to accurately identify beforehand what grid-connected power capacity will be replaced by the additional capacity of a greenfield (*i.e.* project on a site where there was power generation capacity before) CDM or JI project. After all, the capacity replaced will depend on such factors as grid capacity usage, load factor, weather conditions throughout the year, *etc*.

The baseline methodology will have to enable a reasonable estimate of the electricity production capacity that will appear at the margin of being disconnected when new electricity production capacity becomes online. The ACM0002 methodology allows for both calculating a weighted average of CO_2-eq. emissions of existing and operational plants, and estimating the CO_2-eq. emissions of plants that are planned and/or expected to be built and connected to the grid. The resulting emission factor is a so-called combined margin factor.

The JI Supervisory Committee has decided that for similar JI greenfield power generation projects, the same methodology could be used. This decision can be justified in many ways. Usually, a country's power production capacity is as big as the highest annual peak in electricity demand, so that throughout the year there is excess capacity. Power plants are operated in different modes with nuclear energy and run-of-river hydropower plants normally being operational as many hours as possible because of their relatively low operational costs. Fossil fuel based plants, instead, are usually modulated depending on electricity demand developments while securing electricity supply. For the latter plants, it could generally be assumed that the higher the fuel costs and the lower the energy efficiency, the higher will be their variable costs and, therefore, it will be more attractive to reduce their operation when new capacity becomes available.

It is therefore reasonable to assume that grid-connected hydropower and nuclear power plant capacity will not become marginal technologies. Consequently, these technologies are generally not included in the baseline for a JI and CDM project.

However, as stated by the "Tool to calculate the emission factor for an electricity system" (adopted by the CDM EB at its 35th Session), if 'coal' is obviously used as must-run, it should also be included in the list of must-run technology plants.[1] In some Central and Eastern European countries (*e.g.* Romania), it is not common practice to reduce the output of some large-scale coal plants when new capacity becomes online. Therefore, these coal plants must be left outside the baselines. This requires a case-by-case assessment of the country situation within the context of ACM002.

CHP connected to the electricity grid

Next to 'must-run coal', there is another important aspect of Central and Eastern European electricity generation that needs to be considered for JI project baseline determination. Contrary to most developing countries, countries in Central and Eastern Europe

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[1] CDM EB, "Tool to calculate the emission factor for an electricity system", Annex 12 of EB 35 report, footnote 3, p.4.

produce a large part of their electricity through Combined Heat and Power (CHP or co-generation) plants.

Taking Romania as an example, most CHP plants are used for district heating. Until 2002, heat was mainly produced by district heating and CHP plants owned by Termoelectrica and municipality-owned district heating plants. As part of the liberalisation of the Romanian energy market, several Termoelectrica district heating and CHP plants have become independent, with in many cases municipalities as single shareholder.[2] Nowadays, around 5.5 million inhabitants connected to residential district heating systems (including CHP).

CHP plants produce electricity and heat in a combined manner, which is much more efficient than producing heat and power in separate processes. CHPs could reach an efficiency level of over 90%, thereby increasing efficiency by 15-40% compared to separate processes. According to the OECD database,[3] about a quarter of Romania's electricity output in 2005 was produced by CHP plants. CHP plants in Romania generally run on burning coal or natural gas.

The complexity with CHP plants is that when, irrespective of the reason (for instance, due to a JI project), a plant delivers less electricity to the grid, there is still a heat demand that needs to be met. A typical CHP plant produces heat for baseload heat demand (*e.g.* hot water during the summer) so that additional heat-only boilers are needed for meeting peak-load heat demand. Should a CHP plant's delivery of electricity to the grid be reduced and, in combination with that, the heat production reduced, then extra heat needs to be produced elsewhere in order to be able to meet the municipality's baseload heat demand, which would still cause emissions of CO_2.[4] Therefore, calculating CO_2 emissions in terms of kWh of electricity produced and including this emission factor in the baseline would not be a conservative approach as it would overlook the heat demand that would still need to be met (and its consequent CO_2 emissions).

In this respect, there would, in principle, not be a large difference between CHP plants that are driven by heat demand with electricity as a 'residual' product and CHP plants driven by electricity demand with residual heat production. In both cases, the heat demand will have to be met with an alternative technology. Generally, it is considered inefficient to disconnect CHP-based electricity from the grid as this would reduce the efficiency of CHPs and it is therefore reasonable to give these plants a preferential treatment in the dispatch procedure.

CO_2 emissions per unit of energy

With a view to the above, and in order to follow a conservative approach, CHP plants could be treated as follows: when CHP plants have, by law, a preferential status in the dispatch order (*e.g.* guaranteed access to the grid), then these plants would be left out of the baseline as they are unlikely to become marginal plants due to a JI project.

All other CHPs which deliver electricity to the grid, but which are not serving district heating purposes and/or have no guaranteed access to the electricity grid (but, instead, *e.g.*, CHPs delivering industrial heat/steam), are proposed to be treated as follows. For these plants, the total energy output would be taken (heat and power) and expressed in GWh (by converting heat output from PetaJoule to GWh by a conversion rate of 1000/3.6). Subsequently, a CHP plant's annual CO_2 energy output would be divided by its total annual energy output (instead of electricity alone). Therefore, for these plants the CO_2 emission factor to be included in the overall electricity grid baseline factor would become lower.

Case specific context

The above discussion has shown that in some JI grid-connected electricity generation projects the application of methodology ACM002 may overstate the baseline CO_2 emission factor since including CHP plants in the baseline as marginal plants overlooks the CO_2 emissions related to the heat demand that would need to be met when the CHP would be disconnected due to the JI project. In addition, we have seen that in some countries, such as Romania, CHPs have a guaranteed access to the grid, so that they are unlikely to be disconnected from the grid in case of a JI project. However, since guaranteed access to the grid does not guarantee that the CHP will actually deliver power to the grid, the baseline determination requires a country context specific analysis which goes further than just applying ACM002.

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[2] COGEN Romania: http://www.cogen.ro/

[3] http://oecd-stats.ingenta.com/OECD/TableViewer/tableView.aspx

[4] Although the efficiency of heat production in a heat-only boiler is generally higher, around 80%, then in a CHP, around 55%, so that CO2 per kWh heat produced would become lower, see WADE, 2003, *Guide to Decentralised Energy Technologies*, December 2003.

CDM Technology Focus

Energy Towers

The EU-funded research activity ENTTRANS describes energy technologies that could contribute to GHG emission reduction. JIQ briefly describes these technologies in a series of articles. The background description for this article has been prepared by ENTTRANS partner Tel Aviv University (ICTAF, China).

General description of the technology

An energy tower is a vertical, hollow tower constructed in dry, desert regions with heights of 400 m or more and diameters of more than 100 m. The optimal dimensions can reach over 1000 m in height and four to five hundred meters in diameter. Water (usually sea water or brackish water) is sprayed in the tower through the top opening. The sprayed water cools the air within the tower from its dry bulb temperature to close to its 'wet bulb' temperature.

As a result, the cooled air mass becomes denser, compared with the surrounding air mass (for instance, air cooled by 120° C is approximately 4% heavier than the ambient air), and will sink downwards thereby producing a downflow effect in the hollow tower-chimney. When properly designed, the air will flow strongly through openings near the tower's bottom, so that it can drive large wind turbines connected to electricity generators. The system can operate day and night, although the produced energy might be reduced at night due to changes in ambient air temperatures and humidity. Figure 1 shows the working of the technology.

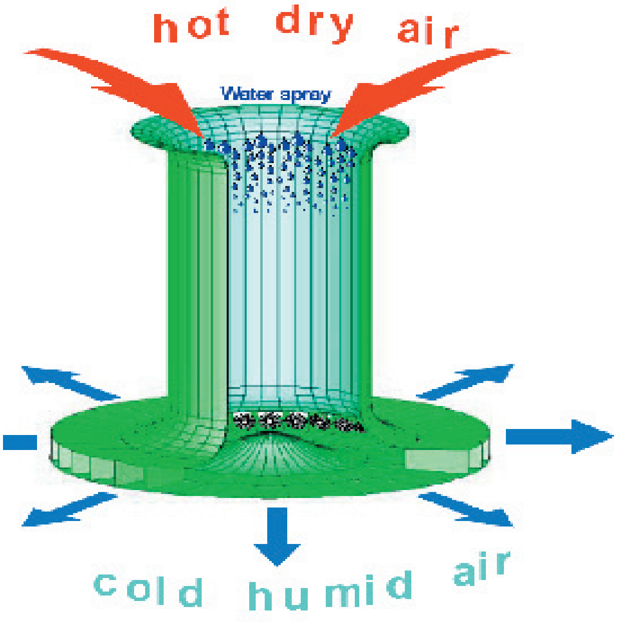

Figure 1. Energy towers

The technology could be applied in regions with hot, dry climates (deserts and arid places) which are relatively close to the sea or to oceans, so as to enable pumping of sea or brackish water to the top of the chimney. Appropriate locations may be: Africa, India, Australia, Chile, South-west of the USA, Mexico, Southern Israel, *etc*. Table 1 (next page) provides a rough estimate of global potential for applying this technology.

meeting sustainable development objectives

The importance of energy towers can be categorised as follows:

- **Possibility to store water during off-peak hours:** It is possible to fill an elevated reservoir in the tower with water during hours of relatively low electricity demand, so that during peak hours no power is needed for pumping the sprayed water. As a result, the electricity delivery rate can come close to the maximum value needed for meeting electricity demand. This is an important advantage over several other forms of renewable energy sources that have difficulties with matching electricity supply and demand at any moment of the day.
- **Contribution to GHG emission reduction:** The electricity produced through energy towers causes much less GHG emissions as it replaces electricity otherwise produced with fossil fuels.
- **Desalination of Seawater:** The largest irrigation projects in the world are in the process of gradual destruction due to salinisation. Examples are the Colorado River, the Murray-Darling River in Australia, the Orange River in South Africa, the Indira Gandhi Canal in Rajasthan, India, Nile valley Egypt, *etc*. The problems are caused by the evaporation of most of the irrigation water and the return of the drainage water to the aquifer-source with all the disolved salts in it. Sometimes more salt is added from saline layers that are leached by the drainage water. The water is re-circulated several times through the soils, so that salt concentrations gradually build up.

In order to prevent salinisation, drainage water must be intercepted so that it cannot return to the river or aquifer involved. However, this technique

Table 1. **Worldwide potential of energy towers** (Israel - India Steering Committee, 2001)

Region	200-600 MW average net output		200-600 MW average net output		6,000 kWh/ year per capita*	10,000 kWh/ year per capita*
	Annual energy	Number of towers	Annual energy	Number of towers		
	10^9 kWh/year	[-]	10^9 kWh/year	[-]	10^6	10^6
North Africa	46,412	18,140	14,251	4,018	2,375	-
South Africa	17,256	6,850	5,932	1,685	989	-
India	16,086	6,487	4,407	1,548	734	-
Saudi Arabia	8,780	2,580	6,072	1,089	1,012	-
Persian Gulf	6,884	1,715	6,440	1,543	1,073	-
California & Mexico	27,182	10,956	4,748	1,442	-	474
Chile & Peru	23,653	8,385	9,542	2,730	1,590	-
Australia	111,783	5,004	907	289	151	-

is rather expensive (in particular the water transport which costs USDcent 0.1-0.15/m³/km). In dry desert climates, the solution can be to spray available brackish water inside the Energy Towers. The desalination capacity can be installed gradually in small modules without the need for a large initial investment. The ability to reduce desalination costs may solve one of the most crucial environmental, economic and political problems in arid lands. The saving is on the water intake, conduit of sea water and return of end brine, as well as efficient water pre-treatment. The desalination capacity can be installed gradually in small modules without the need for a large initial investment. The ability to reduce desalination costs is a technological breakthrough that may solve one of the most crucial environmental, economic and political problems in arid lands:

- **Reducing fuel imports:** The coal equivalent of producing the energy of a 388 MW net average power tower is 1.27 million tonnes per year. Producing electricity through energy towers reduces the dependency on fossil fuel imports and the vulnerability to fuel price fluctuations. It also reduces the need to maintain large strategic fuel reserves for fossil-fuel energy power plants.

Status of the technology

The energy tower technology has reached a demonstration phase. Some experts, *e.g.*, a Steering Committee composed of Indian and Israeli Experts (Israel - India Steering Committee, 2001) have suggested building a small but commercially viable power station. Possible demonstration plants could be in a range of 6.5 MW and 10 MW of electricity production capacity. For Israel, a demo plant is envisaged to cover at least the running expenses by electricity sale. This demonstration programme envisages the following activities:

- Planning of the demonstration plant,
- Full scale planning and quotations from suppliers,
- Undertaking the necessary statutory process,
- Legal and patent activities, and
- Site data collection.

In addition, and not directly related to the planning of a specific site, the following has been performed:

- World climate survey and search for suitable sites.
- A scientific efforts to refine different design points and considerations.

Contacts have been established with European companies (*e.g.* Alstom) as well as with Indian authorities (Tifac) with respect to participating in the construction of the first Energy Tower in Israel (Israel - India Steering Committee, 2001), which will be 1000 to 1200 m tall.

Financial requirements for energy towers

A substantial investment is required for energy towers, even for the planning of a demonstration unit such as the one mentioned above, which requires an estimated investment of about USD 20 million. The size of the demonstration unit not only determines its cost but is also related to the question whether it can be operated as a semi-commercial unit. According to the Israeli company involved, a pilot plant with a capacity of one MWe will not be economically acceptable, whereas a demonstration unit with a capacity of 6-10 MWe might be able to produce electricity at prices similar to other units without, however, recovering the capital expenditure.

The estimated investment for the erection of a demonstration unit with a capacity of 50 MW would be about USD 135 million. Other ancillary costs involved are estimated at several tens of millions of dollars, depending upon site conditions. Depending on electricity prices at the chosen location, such a unit might be able to recover the initial investment. The erection cost of a full-size commercial unit with an average net output of about 370 MW was estimated at USD 850 million.

The minimum time required for the planning of a demonstration plant is a year and a half to two years. The erection of such a demonstration plant will take at least an additional two years. The economics of commercial units differ greatly from one location to another depending on climatic and topographic conditions. Another factor to be taken into consideration is whether further income can be obtained from additional activities, *e.g.* desalination.

For India, the potential for installing energy towers was assessed, including a review of comparable technologies and assessment of the impact of energy towers. A set of evaluation tools was devised to assess the potential of an energy tower to supply environmentally clean and economically profitable electric energy. The assessment integrated site-specific topographic parameters and time dependent air properties into a model producing time sequence maps of energy tower's power outputs. Implementation of the model resulted in the mapping of both power production and electricity costs for the entire continent of Australia (Altman *et al*, 2005[1]).

Analysis of the model outputs showed specific regions of interest and provided overall ranking of sites in terms of net power production and energy cost. The results depicted regions in Australia where arid conditions imply high gross power from energy towers. However, some of these areas are characterised also by a large distance from water sources and thus will entail high pumping power, which in turn will result in relatively low net power. Regions where the environmental conditions may support profitable energy towers are characterised by favourable meteorological and topographic conditions in which a single energy tower would supply constantly high net power (≈370 ± 160 MW), serving the electricity needs of around 0.5 million people, at economically competitive costs (USD 0.047/KWh). In another region characterised by less favourable environmental conditions (lower temperatures and higher humidity), net power would be lower (≈230 ± 140 MW). Yet, its proximity to populated areas and to water source makes of this region compatible to that of the first-mentioned region (USD 0.07.3/KWh).

The construction of energy towers will entail efforts of many local and international design and construction groups with respect to: local conditions related to water supply and drainage, supply of heavy construction machinery and specialised equipment, control systems for the tower as well as some other equipment and piping as may be determined by the parties involved when addressing the real project, and a design office in the country where the tower is erected and local design groups may participate in the design and project implementation.The estimated cost of the various sub systems of an energy tower is provided in Table 2.

Future market potential and developments

The potential for building energy towers in EU countries is relatively low. However, the potential in several developing countries is very high as demonstrated in Table 1. The construction of energy towers in northern African countries and connecting these with the electricity grids of Europe and North Africa could create a new source of income for the north African countries, as well a source of clean renewable energy for parts of Europe.

Table 2. Cost estimations per energy tower subsystem

Subsystem	**Unit description**	**Evaluated cost per unit [USD/unit]**	**Number of units for construction**
Tower construction	Evaluated cost for the steel space frame construction (incl. chimney, diffuser and systems support)	2,000 [$/tonne]	191,300 [tonne]
	Framework cover	13 [**USD** /m²]	3.355e+6 [m²]
	Concrete foundation	165 [**USD** /m³]	140,500 [m³]
Water supply	Operational reservoir (1,000,000[m³] and water uptake structure	21.8 [million $]	1 [per ET]
	Water conduit: 20% pipes (Φ2,600mm) & 80% concrete open canal (wall slope 1:4 and 4 m width)	0.2*5,500+0.8*1,000 [**USD** 100 /km]	D [km]
	Water Pumping from water source up to the ET top	400[$/kW]	$PP_{installed}$ [kW]
Water spray system	Including: 1,000,000 Sprayers. 20,000 m of water pipes (Φ200- Φ2,000 mm), support beams and controllers.	38[million **USD**]	1 [per ET]
Power pack	An array of 100 Wind Turbine	124 [**USD** /kW]	$GP_{installed}$ [kW]
	Generators	182 [**USD** /kW]	$GP_{installed}$ [kW]
	Transmissions	10 [**USD** /kW]	$GP_{installed}$ [kW]
Brine disposal system	Brine reservoir (500,000[m³]) Ground sealing and drainage of the ET surroundings	109 [million **USD**]	1 [per ET]
	Brine disposal conduit (half the price of the Water conduit).	950 [1000 USD/km]	D [km]
Infrastructure	Land, roads, fence, buildings, *etc.*	30 [million **USD**]	1 [per ET]

Source: Altman *et al.*, 2005[1].

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1 Altman, T., D. Zaslavsky, R. Guetta and G. Czisch, 2005. Evaluation of the potential of electricity and desalinated water supply by using technology of "Energy Towers" for Australia and America, Interim Report June 2005,. Faculty of Civil and Environmental Engineering, Technion-Israel Institute of Technology, Haifa, Israel, Institute for Electrical Engineering-Efficient Energy Conversion,University of Kassel, Germany

Reports

Cheng, C., Pouffary, S., Svenningsen, N., Callaway, M., The Kyoto Protocol, The Clean Development Mechanism and the Building and Construction Sector – A Report for the UNEP Sustainable Buildings and Construction Initiative, United Nations Environment Programme, Paris, France , 2008.

Buildings are responsible for more than one third of total energy use and associated greenhouse gas emissions in society, both in developed and developing countries. Energy is mainly consumed during the use stage of buildings, for heating, cooling, ventilation, lighting, appliances, *etc*. A smaller percentage, normally 10-20%, of the energy consumed is used for materials manufacturing, construction and demolition.

The potential for drastic reductions of the energy consumption in buildings is significant. With proven and commercially available technologies, the energy consumption in both new and old buildings can be cut by an estimated 30-50 percent without significantly increasing investment costs. Energy savings can be achieved through a range of measures including smart design, improved insulation, low-energy appliances, highefficiency ventilation and heating/cooling systems, and incentives to building users to conserve energy.

This report analyzes the project development environment in the building sector and explores why building sector projects have been under-represented in the CDM's project portfolio. Among other things, the report finds that difficulties stem from the design of the CDM, as well as from issues inherent in the building sector environment that can hinder the promotion of energy efficiency projects.

Internet:
http://uneprisoe.org/CDMbuildings/CDMbuildings.pdf

SVK-CDM Technologies Private Limited, 2008. A Viable CDM Model for Solar Water Heaters, prepared for UNEP Risö Centre.

Solar water heaters replace fossil fuels and are generally not considered business as usual. These characteristics make this technology suitable under the CDM. However, a single solar water heater is a very small unit to be able to generate sufficient certified emission reductions (CERs) to pursue it as a CDM project. Even if the project is considered at the level of local venders or at the level of a company engaged in manufacturing solar water heaters, the amont of CERs remains very small.

This study examines the size of solar water heating systems from the perspective of its viability as a CDM project. It also explores other related issue such as additionality requirements, selection of methodology, baseline calculations, approach for stakeholders' comments, potential bundlers, monitoring and verification, and required interventions.

Internet:
http://uneprisoe.org/SWH_CDM/CDMmodelSolarWaterHeaters.pdf

IETA, 2008. "State of the CDM 2008: Facilitating a Smooth Transition into a Mature Environmental Financing Mechanism", International Emissions Trading Association.

The report explains the necessity for the CDM because of the strong growth of projects. The primary and secondary CDM market in 2007 was worth nearly US$13 billion, a US$7 billion increase from 2006. In addition, over 15 new countries have now entered the project pipeline for the first time, many of them in Sub Saharan Africa and Central Asia. The share of clean energy projects is also on the rise, increasing to 64% of traded CER volume in 2007 compared with 33% in 2006 and 14% in 2005.

According to the report, such a successful mechanism can no longer function on the basis of a 'learning-by-doing' approach to governance, however. The report provides recommendations on how to increase the efficiency of the CDM, and on how to follow international regulatory best practice. For instance, the report claims that "it seems unlikely that any other regulatory agency charged with such responsibility and working on a global scale employs such a small workforce, works on such an irregular schedule, and has a board involved in case-by-case decision-making."

Internet:
http://www.ieta.org/ieta/www/pages/getfile.php?docID=3111

The **Joint Implementation Quarterly** is an independent magazine established to exchange the latest information on the Kyoto mechanisms and emissions trading. *JIQ* is of special interest to policy makers, representatives from business, science and NGOs, and staff of international organisations involved in the operationalisation of the Kyoto mechanisms, including emissions trading.

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Abbreviations

AAU	Assigned Amount Unit
AIJ	Activities Implemented Jointly under the pilot phase
Annex A	Kyoto Protocol Annex listing GHGs and sector/source categories
Annex B	Annex to the Kyoto Protocol listing the quantified emission limitation or reduction commitment per Party
Annex I Parties	Industrialised countries (OECD, Central and Eastern European Countries, listed in Annex I to the UNFCCC)
Annex II Parties	OECD countries (listed in Annex II to the UNFCCC)
non-Annex I Parties	Developing countries
CCS	Carbon Dioxide Capture and Storage
CDM	Clean Development Mechanism
CDM EB	CDM Executive Board
CER	Certified Emission Reduction (Article 12 Kyoto Protocol)
COP	Conference of the Parties to the UNFCCC
DOE	Designated Operational Entity
DNA	Designated National Authority
ERs	Emission Reductions
ERPA	Emission Reduction Purchase Agreement
ERU	Emission Reduction Unit (Article 6 Kyoto Protocol)
EU ETS	European Union Emissions Trading Scheme
EUA	European Union Allowance (under the EU ETS)
GHG	Greenhouse Gas
IET	International Emissions Trading
ITL	International Transaction Log
JI	Joint Implementation
JISC	Joint Implementation Supervisory Committee
KP	Kyoto Protocol
LULUCF	Land Use, Land-Use Change and Forestry
MethPanel	Methodology Panel to the CDM Executive Board
MOP	Meeting of the Parties to the Kyoto Protocol
PIN	Project Information Note
PDD	Project Design Document
SBSTA	UNFCCC Subsidiary Body for Scientific and Technological Advice
SBI	UNFCCC Subsidiary Body for Implementation
UNFCCC	UN Framework Convention on Climate Change

JIQ Meeting Planner

10-12 March 2009, Climate Change: Equity between Nations and Regions, Copenhagen, Denmark
Organised as a session for the upcoming Copenhagen Science Congress on Climate Change: global risks, challenges, and decisions (10-12 March 2009).
Contact: J. Timmons Roberts and Coleen Vogel at jitrobe @wm.edu or http://climatecongress.ku.dk/

16-17 March 2009, International Standards to Promote Energy Efficiency and Reduce Carbon Emissions, Paris, France (OECD Conference Centre, Paris)
Joint workshop of the International Energy Agency, International Organization for Standardization and International Electrotechnical Commission
Contact: charlotte.forbes@iea.org

17-19 March 2009, Carbon Market Insights 2009, Copenhagen, Denmark
6th annual conference organised by Point Carbon
Contact: conference@pointcarbon.com, telephone: + 47 22 40 53 47

29 March to 8 April 2009, United Nations Climate Change Talks, Bonn, Germany
- Seventh session of the Ad Hoc Working Group on Further Commitments for Annex I Parties under the Kyoto Protocol (AWG-KP 7);
- Fifth session of the Ad Hoc Working Group on Long-term Cooperative Action under the Convention (AWG-LCA 5).

Contact: unfccc.int

7-8 April 2009, Carbon TradeEX America, Washington, D.C., USA
Contact: http://www.koelnmessenafta.com/

27 - 28 April 2009, 2nd Renewable Energy Finance Forum Latin America (REFF - LatAm), Rio de Janeiro, Brazil
Contact: mediapartners - Maria Ferreiro at mferreiro@euromoneyplc.com, tel. +44 (0) 20 7779 8084; for speaking at REFF-Latin America 2009, please contact: webmaster@euromoneyenergy.com