Expert Workshop on CDM Methodologies and Technical Issues Associated with Power Generation and Power Saving Project Activities

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Note: This document is meant as a broad summary of the discussions and views represented at this event. It is not a complete overview and does not necessarily represent the views of the World Bank or QualityTonnes.

Executive Summary
Many developing countries are integrating activities to increase power generation and improve energy efficiency with their sustainable development priorities as they prepare to meet a significant increase in the demand for energy related services. Many developing countries hope that the Clean Development Mechanism (CDM) will help attract investments in GHG-friendly project activities in those areas. However, for a variety of reasons, the CDM's impact in the power generation and energy efficiency areas has not been commensurate with both their importance to sustainable development and with the scope of opportunity.

Acknowledging that many factors influence the development of CDM project activities in different sectors, the World Bank organised a workshop parallel to the recent COP/MOP negotiations in Montreal focussed on the methodological issues facing potential CDM project activities in the power generation and energy efficiency areas. The main goals of the event were to identify and discuss issues and challenges relating to the development and implementation of energy supply and energy efficiency CDM methodologies and tap some of the brain-power available at the COP/MOP meeting for developing options to address them. Participants (about 40 in total), from both developed and developing countries, included experts involved in different areas of the CDM or other project-based/offset schemes, e.g. members of the Meth Panel, project developers, writers of project design documents (PDD), representatives of Designated National Authorities (DNAs), representatives of Designated Operational Entities (DOEs), and experts from governmental and non-governmental organisations, the research and business communities, as well as experts in the power generation and energy efficiency fields. The report of this workshop is made available to the broad CDM community as a contribution to the further development of good and practical methodologies for CDM project activities that will help improve the representation of both power generation and energy efficiency projects within the CDM. All presentations made at the workshop are available on the World Bank's Carbon Finance website (www.carbonfinance.org).

The workshop identified areas for further study, provided recommendations to alleviate specific bottle-necks, and offered ideas on how to grow exponentially the number of projects in the power and energy efficiency sectors. Key findings include:

- A general acknowledgement of the progress made in the development of guidance and approval of CDM methodologies in past 12 months, but also that improvements are possible and needed.
- The need for further feedback venues between project developers and the Meth Panel/Executive Board (EB), with suggestions for more of a hearing-type process to have a more open exchange of views as methodological decisions are made. This could help reduce delays currently experienced with the assessment of CDM methodologies.
- A call for the simplification of methodologies taking into account existing data constraints to facilitate the implementation of CDM project activities in areas key for the sustainable development of developing countries.

- Striving for methodological robustness and accuracy is important, but this goal should be balanced with the need to limit CDM-related costs, i.e. costs associated with methodologies' data and modelling requirements should not go beyond what can be justified by reasonable returns in terms of increased robustness and accuracy.
- The importance of greater guidance and tools (e.g. sampling, control groups, benchmarking) to reduce the risk to project developers of creating much needed methodological innovations; and
- The recommendation to engage the broader community of CDM/energy experts and institutions to contribute to the development and expansion of methodologies in the key sectors of power and, especially energy efficiency.
- Increase the threshold for energy efficiency projects to benefit from small-scale CDM procedures.
- Efforts to develop top-down methodological guidance/standardisation would be welcomed.

An overview of the key specific methodology issues facing power generation and energy efficiency project activities – and options to address them, are discussed in the respective sections in the body of the report.

1 Context-setting and Overview of the Opportunities

GHG projections show a steady growth in the CO_2 emissions from developing countries, with their share of global emissions also increasing. Much of this growth will be driven by mounting demand for electricity and fuel for transportation associated with economic growth. To date, however, the potential of CDM in these areas has not scratched the surface of the opportunity at hand. As the following chart describes (Figure 1), while the power sector has made up a large portion of the total number of projects they tend to be small and do not make up a very large share of the CER total. The contribution of energy efficiency projects to estimated Certified Emission Reductions from the overall CDM portfolio is even smaller.

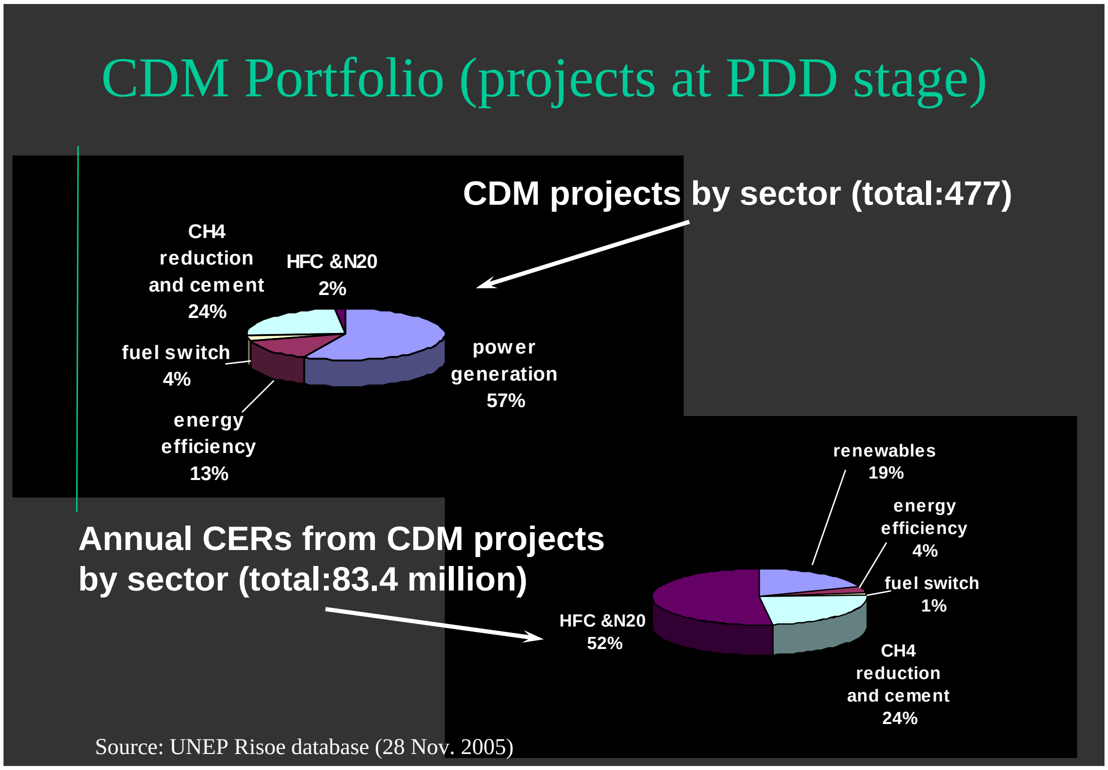

Figure 1

1.1 Power Generation Sector

Projections for power generation show that there will be a significant increase in generation requirements in developing countries to satisfy increasing demand. According to the International Energy Agency's World Energy Outlook 2004 (IEA, 2004), CO2 emissions from power generation in developing countries are expected to almost triple between now and 2030, with coal power plants in developing countries in 2030 producing more CO_2 than the entire power sector in OECD countries (Figure 2).

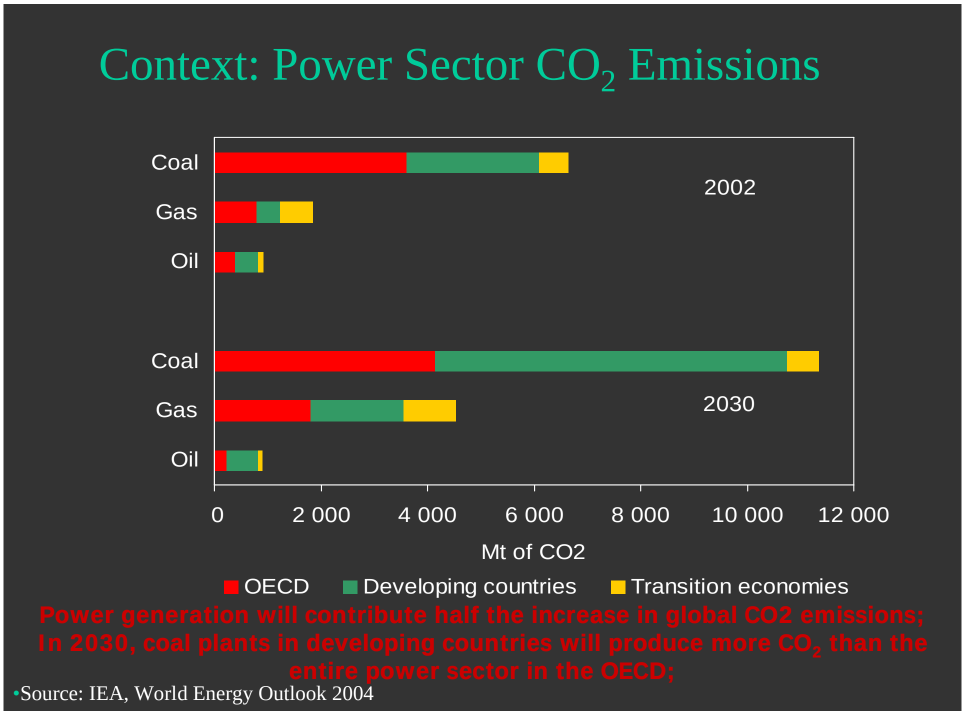

Figure 2

IEA estimates over 4800 GW of capacity will have to be added world wide to meet growing demand. The bulk of which will be added in the developing world. Given the long lifetime of power generation assets, not taking GHG considerations into account in investment decisions now could mean locking-in countries into a very GHG intensive power future or greatly increasing the costs for future emission reduction interventions in this key sector. The CDM can be a vehicle to raise finance for cleaner fuels, more efficient generation technologies and renewable energy resources which can limit the growth of CO2 emissions from this critical sector in the developing world.

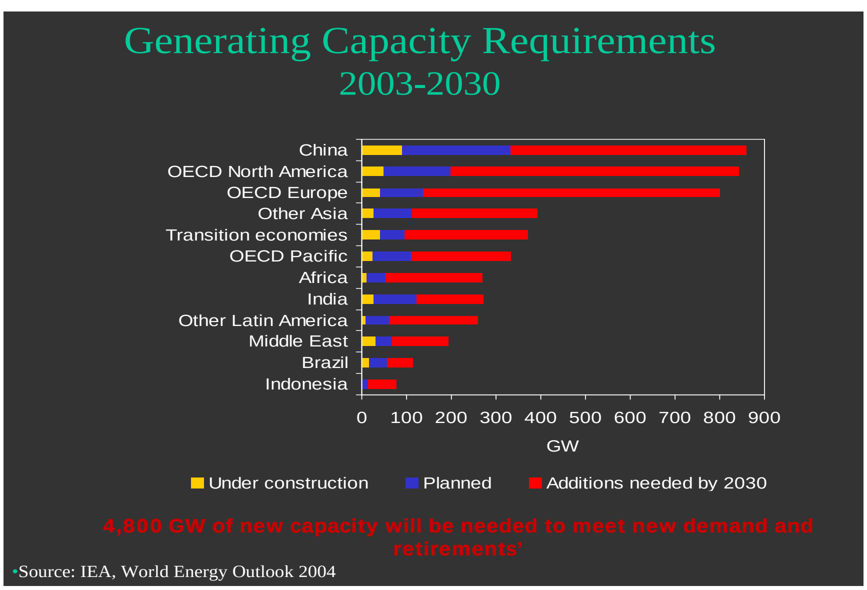

Figure 3

1.2 Energy Efficiency

There is a general consensus around the potential to significantly reduce GHG emissions cost-effectively through greater energy efficiency. Efforts towards greater energy efficiency can also contribute to other goals of economic growth and energy security.

There is empirical evidence of the impact of activities undertaken under energy efficiency measures. Studies show that the energy consumption in 1998 of the most industrialised countries (IEA-11[1]) would have been 49% higher if it were not for the energy saving measures implemented after the energy crisis in 1973. These have eliminated billions of potential tonnes of CO2 emissions and demonstrated the potential of energy efficiency to alter future energy demand and generation. An example of such an energy efficiency (EE) measure is refrigerator standards – consumption was reduced by two thirds during this same period. As can be seen in Figure 4 depicting energy consumption from refrigerators, current models are many times the size they were in 1947 but consume almost the same amount of energy, which is less than one fourth of the consumption in 1973.

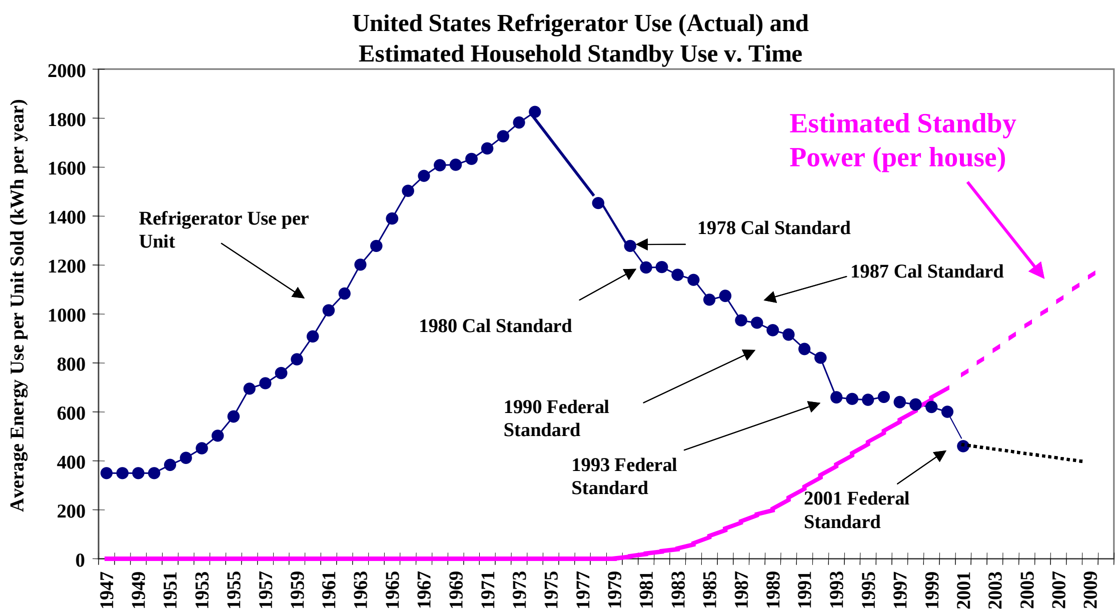

Figure 4 (Source: P. Waide, IEA)

However, many of these basic energy saving technologies and practices have yet to penetrate developing world markets. Developed countries often discard or 'dump' inefficient vehicles and appliances that do not meet their standards to developing country markets, where consumers may value the inefficient product's lower initial cost more than the life-cycle costs – which is one of the key barriers to the market penetration of more energy efficient appliances[2].

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[1] i.e., Australia, Denmark, Finland, France, Germany, Italy, Japan, Norway, Sweden, the United Kingdom, and the United States.

[2] In some cases, initial costs of efficient equipment may not even be higher than the initial cost of inefficient equipment.

Potential reasons for the under-exploitation of energy efficiency potential to reduce GHG emissions are numerous, e.g.:

- Lack of information on energy efficiency performance and lack of common metrics;
- Lack of awareness of the cost-effective savings potential;
- Energy efficiency is often a minor determinant of capital acquisition decisions;
- Split incentives (e.g. landlord-tenant issue);
- Emphasis on first investment costs, rather than life-cycle costs.

Energy efficiency driven by CDM could help developing countries take advantage of the tremendous economic benefits of energy efficiency. This can be seen in the example of a proposed CDM-based Ghanaian programme of activities to install more energy efficient air conditioners; an estimated 3% increase in the average initial cost per unit is more than offset within a year by the more than 9% savings in electricity realized over the life of the product. Inefficient air conditioners, however, continue to dominate the market in Ghana and it is argued that it is unlikely that anything would change without a labelling program including an appliance testing laboratory in Ghana which, in turn, would likely not be possible without the CDM. The market penetration of higher energy efficient air conditioners which can be realized with the program would not only save consumers $64 million annually, but it would also eliminate the need for building a power plant of similar size to a current $600 million project. The program would save Ghanaian consumers and taxpayers over $1.5 billion over the next 15 years (Figure 5). However, without the appliance testing laboratory necessary to support the labelling program, Ghanaians and the vast majority of consumers in developing countries will continue to buy and want to use inefficient air conditioners that use more electricity to provide the desired level of cooling. This will either cause power shortages which typically limit economic growth or force already cash-strapped governments to invest in unnecessary, often carbon intensive, power generation plants.

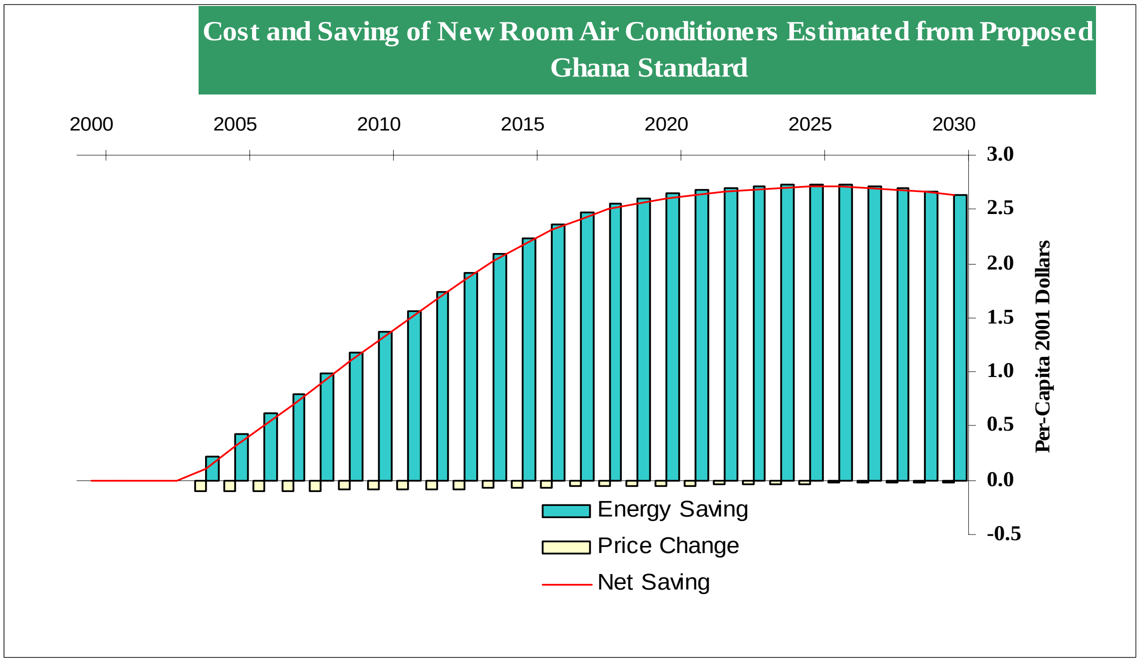

Figure 5 (Source Ghana Energy Foundation)

The opportunities for CO2 reduction through energy savings throughout the world are tremendous, as can be seen in the following IEA graphics (Figures 6 and 7) demonstrating how CO_2 emissions could be reduced by 16% from the Reference Scenario by 2030 if a variety of measures are taken. Energy efficiency has the highest impact from among the proposed measures (WEO, 2004). The IEA calculates that this "Alternative Scenario" would require $700 billion to implement, but benefits from lower energy consumption are estimated at about $1.4 trillion.

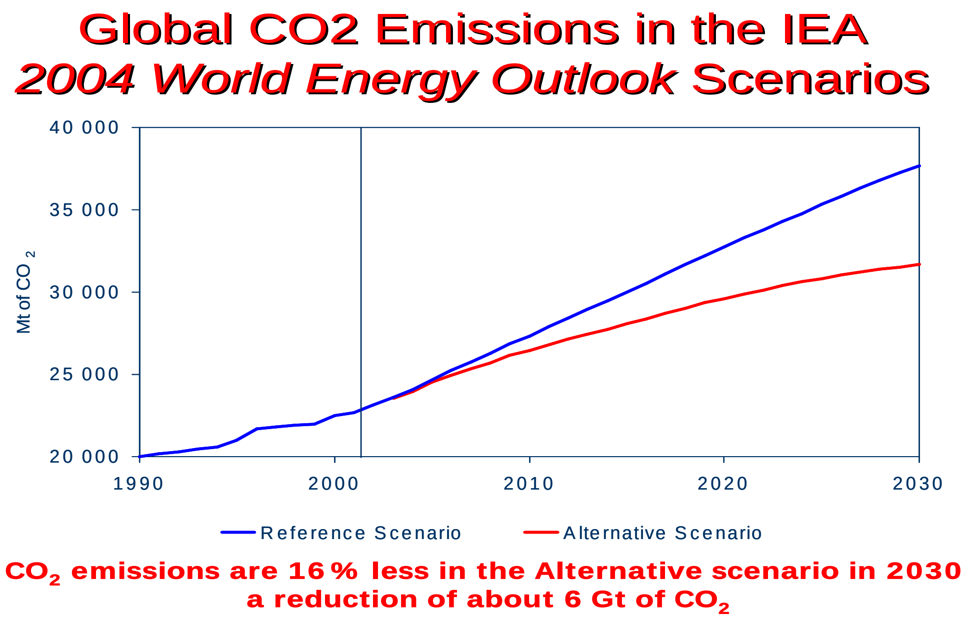

Figure 6

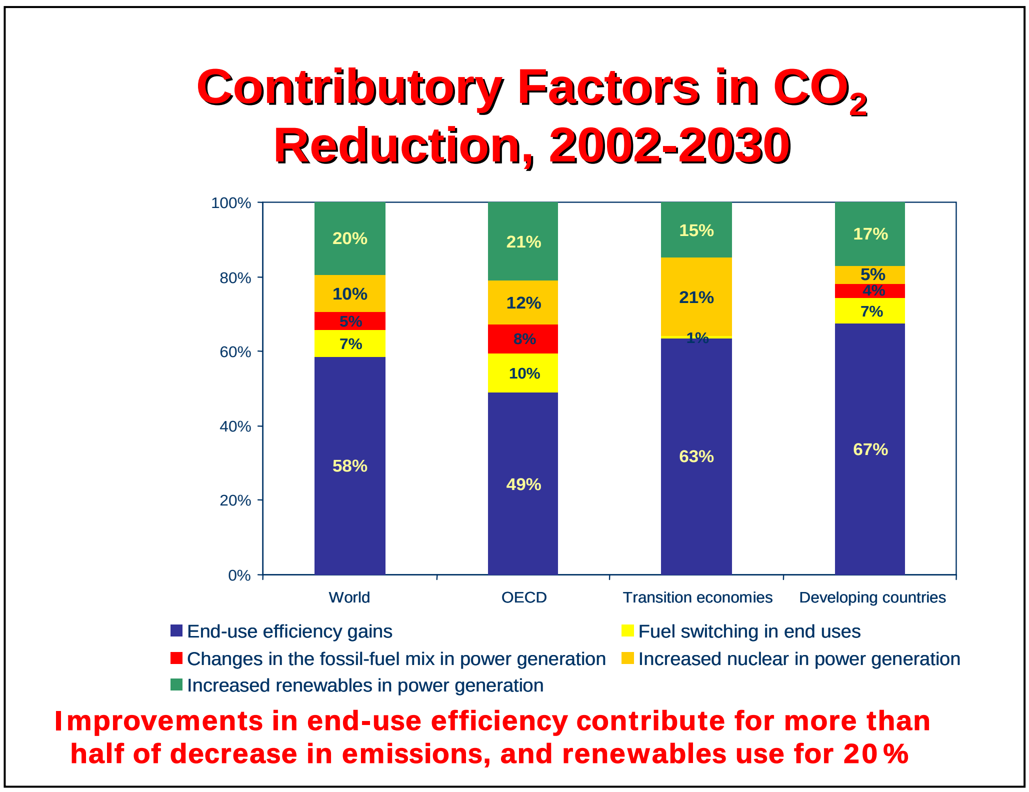

Figure 7

Transportation, which currently accounts for 1.5 billion metric tonnes of CO**2e** or approximately 21% of total emissions, also offers an important area for energy efficiency. Developing countries will contribute about 60% of the growth in total transport CO**2e** emissions worldwide under a business as usual scenario. Well designed transportation efficiency CDM projects could help reduce the level of growth and nature of technology used in the transportation sector for years to come.

2 CDM Methodology Issues Facing Project Activities in Energy Efficiency and Power Generation Sectors

2.1 Power Generation Sector

Whether directly, or indirectly through its impact on other proposed methodologies, the *Consolidated baseline methodology for grid-connected electricity generation from renewable sources* (ACM002) has been a key driver in moving forward power sector projects under the CDM. It focuses on renewable energy projects, but its derivation of the electricity grid-based emission factor and its approach to additionality has had far reaching methodological implications and repercussions.

The power generation sector has, early-on, been the focus of CDM methodological work. Six power generation-related project-specific methodologies, with limited applications, have been approved, and three consolidated methodologies, including ACM 002, have been developed. It was noted that while all the methodologies were robust, accuracy and conservatism came at the expense of flexibility.

The combined margin baseline calculation to quantifying the emissions per unit of electricity displaced by new grid-connected power generation has helped usher numerous projects through the approval process – and is the basis of many approved methodologies for project activities in the power sector. The "success" of the combined margin calculation is based in its relative simplicity, applicability in many situations, inclusion of both Build and Operating effects[3], and its reliance on verifiable data.

The calculation of the combined margin as currently structured does have its limitation, however. There are remaining ambiguities and data constraints that limit the application of the methodology – which merits further examination. Moreover, it was highlighted that numerous project developers have sacrificed significant quantities of justifiable CERs or been unable to rationalize otherwise excellent CDM projects because of the (at least perceived) inflexibility of the default 50/50 weighting of the build margin (BM) and the operating margin (OM). This is especially the case in smaller countries with few power plants or in hydro-dominated grids.

[3] The combined-margin methodology seeks to reflect the most grid-connected power generation projects on both (i) the operation of current and future power plants (i.e. the *operating margin*); and (ii) the building of new plants (i.e. the *build margin*).

The CDM Executive Board has started to address the issue and stated that "Alternative weights can be used as long as…appropriate evidence justifying the alternative weights is presented. These justifying elements are to be assessed by the Executive Board." This is cited in ACM002 itself, on Page 8. However, workshop participants were of the view that the statement does not provide adequate guidance. Information in the Report of the Executive Board's 22nd meeting (Annex 2) and summarized in Figure 9 below[4] might be more helpful to prospective project developers looking to propose alternatives to the 50/50 weighting. *– although there remained concerns about the difficulty in making a convincing case for alternatives to the 50-50 weighting.*

Factor	**Impact on OM/BM Weights**
Project size (absolute or relative)	No change in weight on basis of absolute or relative size alone
Timing of project output	Can increase OM weight for highly off-peak projects (e.g. PV in evening peak regions); increase BM for highly on-peak projects (e.g. AC efficiency).
Predictability of project output	Can increase OM for intermittent resources (e.g. wind) in some project/grid contexts. Estimate capacity value.
Suppressed demand	Can increase BM weight for the 1st crediting period where conditions likely to persist.
System management, other factors	No systematic guidance is available at present.

Figure 9

Workshop participants identified the following issues as needing additional clarifications or alternative proposals:

- Should other CDM projects be reflected in the baseline? (By definition CDM projects are not the baseline, so workshop participants were generally of the view that other CDM projects should not be included in baselines)

[4] For more information on this issue, readers can refer to the UNFCCC Secretariat-commissioned expert technical paper on "Using Electric system Operating Margins and Build Margins in Quantification of Carbon Emission Reductions Attributable to Grid Connected CDM Projects" (2005) prepared by Bruce Biewald (Synapse Energy Economics, Inc.). It is available in Annex 7 of the report of the Meth Panel's 17th meeting at: http://cdm.unfccc.int/Panels/meth/

- The treatment of generation that does not coincide with peak demand - in terms of the build margin,
- The treatment of hydropower. Several issues: (i) arbitrary capacity constrains potential good projects; (ii) calculation of the Build Margin; (iii) combined margin calculations in context of hydro-based systems.
- Recognising and dealing with data gaps (which is becoming more of an issue with deregulation in power sectors) and the definition of the build margin cohort.
- The baseline scenarios definition process and ensuring its consistency with the demonstration of additionality.
- Issues concerning the treatment of suppressed demand, especially where large segments of the population are currently not served or underserved by the grid and rely instead on wood, diesel, fuel oil, charcoal, etc.,
- Guidance as to what "the spatial extent of the power plants that can be dispatched without significant transmission constraints" really means in terms of defining the grid boundary,
- The need for guidelines on different weightings for build and operating margins in cases that merit such consideration;
- Definition of grid boundaries
- Treatment of second and third project periods using the combined margin. Would the Build Margin dominate the equation in most cases?
- Streamlining the demonstration of additionality

The juxtaposition of determining additionality and defining alternative baselines in regards to ACM002 also has created some confusion around the determination of operating margin and build margin. Greater guidance is needed on the process to define baseline scenarios and to ensure consistency with the demonstration of additionality. Some key questions to be clarified include:

- If additionality analysis identifies a specific plant as most attractive or having fewest barriers, should that plant be used for Build Margin instead of the five most recent plants?
- If it is determined that the continuation of current situation is the most likely scenario in absence of the project, is there only OM displacement?
- Should common practice, as determined by the additionality tool, also be relevant for determining the build margin?
- How can the timing of implementation be incorporated in additionality analysis? (maybe the project would not happen for five years without CDM)
- Should "common practice" in additionality analysis involve a timing component for retrofits (and other electricity projects)?

2.2 Energy Efficiency Sector

The key methodology issues affecting CDM project activities seeking to improve energy efficiency (EE) include:

- **Project Boundaries-** Energy end users can be spread over large geographic area with little linkage or across diverse operations in industrial facilities
- **Baseline**- Energy efficiency projects typically demand dynamic baselines[5] or similar alternatives to account for fluctuation in production, demand, supply, and normal efficiency improvements
- **Monitoring**- Energy efficiency projects often consist of smaller measures requiring aggregation and innovative monitoring methodologies
- **Size** – Energy efficiency projects tend to be small unless mass deployment/multiple sites strategies are used. Yet, the threshold for small-scale methodology only allows for energy efficiency projects that reduce energy consumption by 15 GWh a year. Workshop participants were unanimous in finding this threshold too low (e.g. a small-scale renewable energy projects of 15 MW capacity – which is eligible to use the small-scale methodology - can cover projects generating up to 130 GWh) and questioned why there was such an uneven playing field against small scale energy efficiency projects.
- **Dealing with suppressed demand**.

Statistical sampling is a very important tool for EE projects to estimate project baseline and project emissions. More guidance is needed on the use of statistical sampling. For example, it was suggested that such guidance could clarify the acceptance of using a 95% confidence level consistently for project emissions and project baselines. Similarly methodologies using conservative benchmarking could be a great asset in facilitating energy efficiency projects. For example, guidance could be provided by stipulating, for example, that the baseline rate of improvement is considered to be the most effective year of improvement in the last three years.

There is also some clarification needed as to the definition and overlap of rebound effects versus suppressed demand. Since CDM is promoting sustainable development, meeting suppressed demand through an energy efficiency project activity should not be penalized. For example how much of an increase in heating temperature of an apartment could be linked to suppressed demand versus rebound effect from reduced costs and increased supply? It seems that most people would not chose to over heat their house beyond a desirable temperature just because they can now afford to do so and the supply is there. Moreover, it was pointed out that the CDM Modalities and Procedures[6] paragraph 46 states 'The baseline may include a scenario where future anthropogenic emissions by sources are projected to rise above current levels, due to the specific circumstances of the host Party,' which seems to indicate that projects should not be penalised for meeting suppressed demand.

Experts participating at the workshop were generally of the view that energy efficiency methodology developers may be well served to sacrifice accuracy and rigor to obtain

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[5] A dynamic baseline is one that will naturally fluctuate over time. For example, the total electricity used for a given air conditioner in a year might fluctuate naturally based on how hot the weather turns out to be. Since the energy consumption impacted by many energy efficiency projects will normally fluctuate a methodology developer will have to somehow account for these normal fluctuations in determining what the baseline would have looked like after the project is undertaken.

[6] http://cdm.unfccc.int/Reference/Documents/cdmmp/English/mpeng.pdf

simple and conservative results. Sometimes getting a better estimate might be more costly than the value of the extra CERs generated. For example, sometimes less frequent monitoring may be more cost-effective even though the project developer might lose some potential credits. In addition, accuracy can be sacrificed in order to make calculations easier – as long as the error is on the conservative side.

In addition, many large scale energy efficiency projects such as those in the transportation sector use smaller pilot scale efforts to test assumptions and build a track record for success before implementing a large scale project. It is unclear how successful pilot projects colour the common practice test for future scale-ups.

This is the case, for example, in the Mexico City Bus Rapid Transit (BRT) Project where the initial high speed bus corridors with the fewest barriers to implementation were developed as a pilot project to help facilitate the eventual creation of 33 such corridors. The ultimate creation of 33 corridors will likely occur over a significant time span making their inclusion in one PDD impractical. As the initial corridors become successful, it is unclear how will these affect the common practice test of later corridors under the same plan that must be submitted using a separate PDD.

Guidance that would allow project ‘bundles’ to actually span the period beginning with pilot scale efforts through a large scale role-out by using standardized PDDs would be a major facilitating factor for energy efficiency projects in general and transportation efficiency projects in particular.

Participants unanimously called for more clear and appropriate guidance from the EB and Meth Panel on methodologies for energy efficiency project activities. However, workshop participants also acknowledged the poor quality of many of the energy efficiency methodologies submitted thus far to the Methodology Panel. Common problems identified in PDDs include:

- failure to provide method to select the baseline scenario,
- lack of justification for the appropriateness of benchmark period,
- failure to consider variables that could affect future emissions (i.e. autonomous energy efficiency improvements),
- inability to distinguish between discretionary retrofit and planned replacement,
- poor justification of assumptions (e.g. load factors, hours of operation),
- deficiencies in the consideration of leakage ;and
- inadequate guidance in the monitoring plan.

In order to improve methodologies for energy efficiency project activities, both bottom-up and top-down efforts will be needed. On the one hand, project participants must submit better methodologies. But it was also suggested that the development of top-down, generic approaches for each efficiency market (or key sectors) would be enormously helpful. This could be done by the Meth Panel with collaboration from institutions with recognised energy efficiency expertise.

More guidance from the EB would be desirable in areas such as establishing criteria for issues common to different types of EE projects (e.g. *use of sampling, suppressed demand, etc.*). Additional guidance on these issues would remove some of the risk and uncertainty with methodology development and encourage project developer (?) to come up with more proposed solutions.

During the very lively workshop discussion on CDM methodologies for energy efficiency projects, it was pointed out that it is necessary to accept some basic points in order to fully embrace energy efficiency within the CDM framework:

- Energy savings are almost always estimates – but there is a great deal of experience that can be used to make very reasonable estimates. The CDM methodology work should draw from that experience.
- Barriers to energy efficiency projects are often non-financial in nature, but additional financing from the CDM can nonetheless provide important additional financing.
- Rebound effects exist but there are ways of reducing them (e.g. discounting). It is also important not to penalise projects in contexts of suppressed demand
- There is a tendency to focus on limiting free-ridership on the legitimate grounds of conservatism; however, methodologies should not overlook the spill-over effects (i.e. emission reductions beyond the boundary of the project activity) which may be more important than free-ridership.
- Existing guidelines conforming to basic best practices should be accepted and used to measure emission reductions in energy efficiency project activities.
- Undertaking and assessing energy efficiency is often rather simple. There is no need to make it hard just for the sake of looking rigorous. As one participant said: “We can pretty well say how much electricity 1,000,000 light bulbs will save without monitoring each bulb.”
- In many cases, the CDM needs to be linked to policies to be really effective in lowering GHG emissions.

3 Options/ Recommendations for Methodology Improvement

In addition to the issues and clarifications of specific points mentioned above, there are several general areas for improvement that could help spurn more projects in energy efficiency and in the power sector. The following is a list of these recommendations.

- The Executive Board should create a user friendly, frequently updated compilation of clarifications on all the methodologies. This will offer more transparency and would hopefully lead to more consistency among decisions[7].

[7] This recommendation was subsequently included in the COP/MOP 1 decision on the CDM (see paragraph 11 a and b http://unfccc.int/files/meetings/cop_11/application/pdf/cmp1_24_4_further_guidance_to_the_cdm_eb_cmp_4.pdf).

- Clarification is needed regarding the use of surveys in methodologies;

- A closer interaction using multiple venues between Meth panel and project developers is required, (example: web-based organized discussions, direct methodology presentation and Q&A, etc.);

- The EB should also expand efforts to broaden existing methodologies and act on constraints (e.g. propose a way to calculate CO2 emissions from very small grids that do not clearly fit under the combined margin outlined in ACM 002). It would be good to have more option-based methodologies like ACM002 and ACM006.
    - Methodologies from existing industry or government programs that have been successful should be quickly adopted;

- Provide rules or guidance regarding sampling, benchmarking and the use of control groups;

- Increase the threshold for energy efficiency projects to benefit from small-scale CDM procedures.

- Create a specific additionality tool that takes into account the unique attributes of energy efficiency projects;

- Create an advisory group for the Meth Panel and Executive Board to receive outside feedback including members from the UNDP, IEA and the WB, who have recognised expertise in power generation and energy efficiency. This will give the Meth Panel and the Executive Board a better sense of views and suggestions on from the international community of experts.
    - In particular, these institutions should work together to provide a forum for advising on what constitute best practices and to develop methodologies for key EE projects;

- Project developers need to develop alternatives to the combined margin approach that meet the needs of projects that are not well served by the combined margin approach. This could be greatly facilitated by the EB providing clear signals as to what approaches they would consider or by offering a forum to discuss options.
- There is a need to continue the debate and help the UNFCCC better understand energy efficiency and to fully embrace its eligibility for CDM even though it is almost always highly cost-effective in traditional cost-benefit analyses. In case this approach is not enough to enhance EE, a working group or task force should be created to design how a protocol could be developed for EE project activities. It was suggested that such work also include the consideration of a harmonization of testing procedures for standards and labels.

- The CDM provides a great opportunity to use market signals to benefit both developed and developing countries in limiting global GHG emissions. However, there is concern that the CDM will not be able to deliver the CERs developed countries require to meet Kyoto Protocol emission commitments in a cost-effective way, and that it will also be seen as not contributing to the sustainable development of the bulk of developing countries. From the beginning, many hoped that the CDM would create incentives leading to more renewable energy and EE investments. While there are different factors at play, it is generally accepted that more simplified procedures and methodologies are needed for these kinds of projects to fulfil the expectation. This is important to enhance the long-term sustainable development impact of the CDM and the entire Kyoto agreement.