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**Working Paper**

## Additionality and Sustainable Development Issues Regarding CDM Projects in Energy Efficiency Sector

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Edited by the Department World Economy

# **Additionality and Sustainable Development Issues Regarding CDM Projects in Energy Efficiency Sector**

## **ABSTRACT**

The objective of this discussion paper is to assess additionality and sustainable development issues of energy efficiency CDM projects with an emphasis on the situation in India. In the second half of 2005, almost 100 energy efficiency projects have been submitted for validation and 54 of those projects were analysed with regards to additionality and sustainable development benefits based on Activity Scale (Large Scale & Small Scale), Sector (WHR, DSM, Cement Blending, Service), project start date. 60% are large scale projects and 90% had started before 2005. The results show that additionality and sustainable development are often assessed in a cursory manner and only in few projects additionality was well established. Besides resource conservation, energy efficiency projects do not create much qualitative sustainable development benefits on the whole. Technology transfer occurred rarely and indigenous technology development happened only in 2 projects.

**Key words:** Energy Efficiency Projects, Additionality, Sustainability Development, Large Scale, Small Scale Projects

**JEL-Classifications:** Q540, Q580

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## ***Chapter 1 - Introduction***

Fossil fuels, the main source of commercial energy used by humans on Earth, are exploited aggressively. Therefore it is not surprising that almost 55% of the anthropogenic greenhouse gas emissions stem from electricity generation. The IEA (2002) projects that electricity generation capacity on a global scale will have doubled by 2030, from 3500 GW today to around 7000 GW, in order to meet global electricity demand, a large part of which will be using fossil fuels and increase GHG emissions. Therefore, during climate change negotiations, a part of the debate is focused specifically on the energy saving potential (technically referred to energy efficiency), which refers to the ratio between energy output and input achieved by reducing energy consumption on the demand side and improving the electricity generation processes on the supply side. Energy efficiency improvement is a powerful tool for achieving sustainable development and will offer social benefits in the form of energy security (through reduced reliance on fossil fuels, particularly when imported) and enhanced energy services. According to IPCC (2001), the worldwide potential for emission reductions through energy efficiency improvement compared to a baseline development for the year 2010 is estimated to be 1000 - 1850 million t CO<sub>2</sub> and for 2020 it is estimated to be 2600-3300 million t CO<sub>2</sub>..

Table 1 gives an overview of the classification of energy efficiency measures under the major sectors relevant to CDM (Pembina Institute 2002, own additions).

Table 1: Energy efficiency project types in different economic sectors

|            |  |
|------------|--|
| Industrial | <ul style="list-style-type: none"><li>• Improved process efficiency (efficient process control and automation &amp; maintenance)</li><li>• High efficiency equipment and lighting</li><li>• Improved building structure</li><li>• Improved housekeeping procedures</li><li>• Retrofits (replacement of outdated plant and equipment with the modern energy-efficient equivalent)</li><li>• Recovery of embodied energy in recycled industrial post-consumer wastes</li></ul> |
|------------|--|

|                           |  |
|---------------------------|--|
| Residential and Community | <ul style="list-style-type: none"> <li>• High efficiency lighting and appliances</li> <li>• Improved building structure</li> <li>• District heating</li> </ul> |
| Transportation            | <ul style="list-style-type: none"> <li>• Improved vehicle efficiency</li> <li>• Transit expansion</li> </ul>   |
| Electricity Generation    | <ul style="list-style-type: none"> <li>• Supply Side</li> <li>• Transmission and Distribution</li> </ul>   |

Under CDM - energy efficiency projects can be classified into large scale and small scale projects. The Marrakech Accords of 2001 classified energy efficiency projects, in which annual energy savings of less than 15 GWh in the case of electricity-related projects and 45 GWh in the case of projects reducing heat / steam use as small scale projects that can benefit from the small scale CDM modalities and procedures.

To avoid fictitious emission reductions that could jeopardize the environmental integrity of the Kyoto Protocol, the additionality of CDM projects has to be checked. The rules of the CDM Executive Board and the Kyoto Protocol Meeting of the Parties shall ensure that emission reductions are real, and measurable , CDM projects should contribute to **Sustainable Development** of, one of the two main objectives of the Clean Development Mechanism. The Designated National Authorities of each CDM host country checks whether projects contribute to sustainable development.

As can be seen from past negotiations regarding the CDM, the focus is often on the additionality aspect, as environmentalists' and business peoples' interests clash here forcibly<sup>1</sup>. While the contribution to sustainable development has been generally supported verbally, its definition remains unclear in many countries and whether the approved projects really achieve sustainable development benefits remains to be seen.

The objective of this discussion paper is to assess additionality and sustainable development issues of energy efficiency CDM projects with an emphasis on the situation in India. The report

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<sup>1</sup> For an in-depth discussion see for example Greiner and Michaelowa (2003). The business standpoint is nicely captured in IETA (2005), the environmentalists' in WWF (2005).

is structured into 6 main chapters, with the 1<sup>st</sup> the chapter addressing the general aspects of the CDM and energy efficiency measures.

Chapter 2 provides an overview of energy efficiency projects and their relevance and potential under the CDM. A detailed analysis of the energy efficiency projects based on public comments under the validation stage of 31 December 2005 is also included. Separate discussions are held for the energy efficiency methodologies based on the context of additionality.

Chapter 3 addresses the general discussions of additionality, its present status and the views of various groups. A separate discussion follows on additionality determination in specific cases.

In chapter 4, additionality issues of 54 energy efficiency projects are analysed in detail, based on arguments related to the choice of analysis (Investment analysis / Barrier Test), how project developers argue for projects that started before November 2004, vintage of CER generation and significance of common practice analysis. Analyses of these parameters were based on the project activity scale and sectoral classification.

Chapter 5 & 6 discuss general sustainable development issues. An analysis of sustainable development issues follows for a selected group of 54 projects.



## ***Chapter 2 - CDM & Energy Efficiency***

### **2.1 Relevance of CDM in Energy Efficiency sector**

As per article 12 of the Kyoto Protocol (KP), any kind of voluntary emission reduction activity carried out in a Non Annex I country can be used by an Annex I country to meet its compliance with the emission targets defined under the Protocol. This gives rise to an innovative market mechanism known as the Clean Development Mechanism (CDM). All kinds of energy efficiency improvement activities will lead to onsite as well as offsite GHG emission reductions and these GHG emission reductions, and thus generally qualify for the CDM.

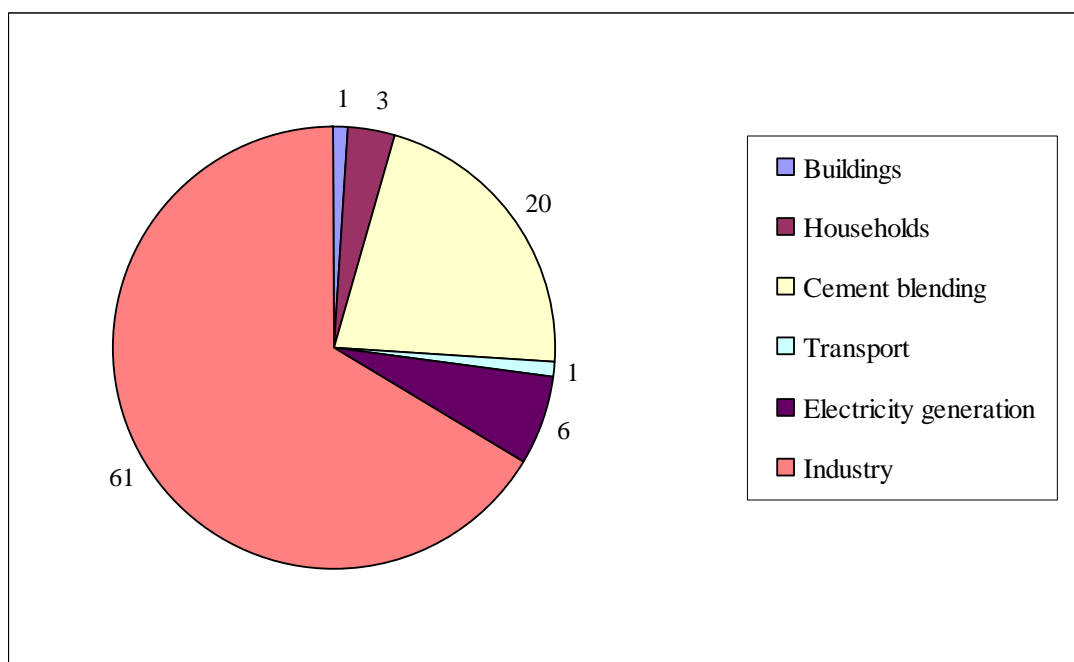
### **2.2 International Potential of CDM projects from Energy Efficiency Sector**

In the time of oil price shocks, developed countries have taken the necessary steps to reduce their energy consumption and their capital resources required to make energy efficient investments. A lack of resources, institutional barriers and other development priorities impede the investment by developing countries in energy efficiency measures. Thus hurdle can be removed through the market mechanisms of the Kyoto Protocol (Ellis and Bosi 2000). The collective global GHG emission reduction targets of Annex 1 countries under KP is estimated to be 713 million t CO<sub>2</sub> eq. from their 1990 emission levels in the first commitment period Grubb et al. (2003), assess the emission trajectories, domestic GHG emission reductions and the supply potential of Hot Air and Joint Implementation and conservatively estimate the global CDM potential to be 50 to 180 million t CO<sub>2</sub> eq per year. While cheap and easy reductions from industrial GHGs will take the lion's share of the CDM market in the short run, energy efficiency projects are likely to take up a larger share in the long term.

### **2.3 Status of CDM projects from Energy Efficiency Sector**

As of 20th January 2005, 2 projects (1 SSC & 1 large scale) in the energy efficiency sector have been registered with the EB and one small scale project has been requested for registration. 92 projects became available for public comments under the validation stage and the total CERs envisaged until 2012 from these projects is 64 million. Of these 92 projects, 51 are large scale and 41 are small scale projects.

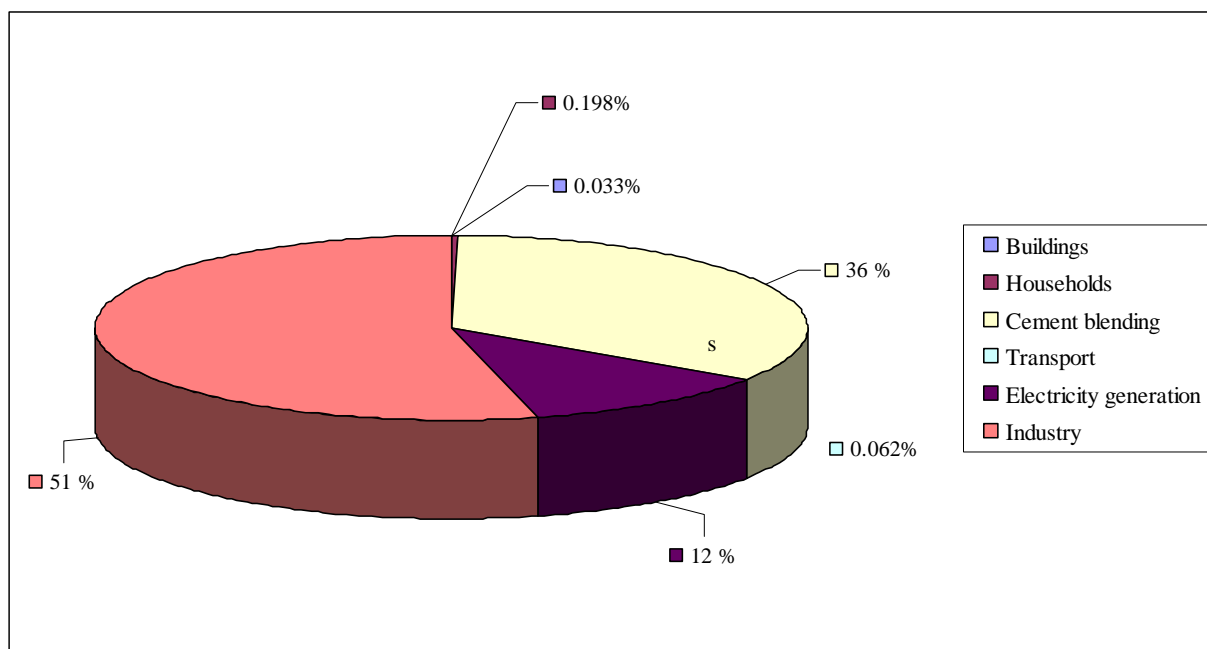
The distribution of these projects based on the sector analysis is given in figure 1. The majority of the energy efficiency project activities are carried out in major energy intensive industries like Fertilizers, Cement, Paper, Iron & Steel, Transport, Textiles, Sugar, and Petrochemical<sup>2</sup>. The next major sector of energy efficiency projects is from cement blending activity carried out by mixing additives in the cement manufacturing process. Two projects are household projects aiming at development of poor communities of which one was registered with EB under gold standard and the other has requested registration. The building sector project activity is carried out in a commercial building (hotel).



**Figure 1 Classification of Projects based on the Project type Sector**

The distribution of the CER envisaged until 2012 from these project activities is given in Figure 2. 50% of the CERs are from the industrial sector projects (30.7million), followed by cement blending projects, electricity generation projects and household and buildings projects. The share of the last two sectors is too low to be significant. However the quality of these CERs is high compared to other sector projects, since these projects have now completed a major part of the CDM cycle.

<sup>2</sup> Sequence is based on the energy intensity of the respective industry



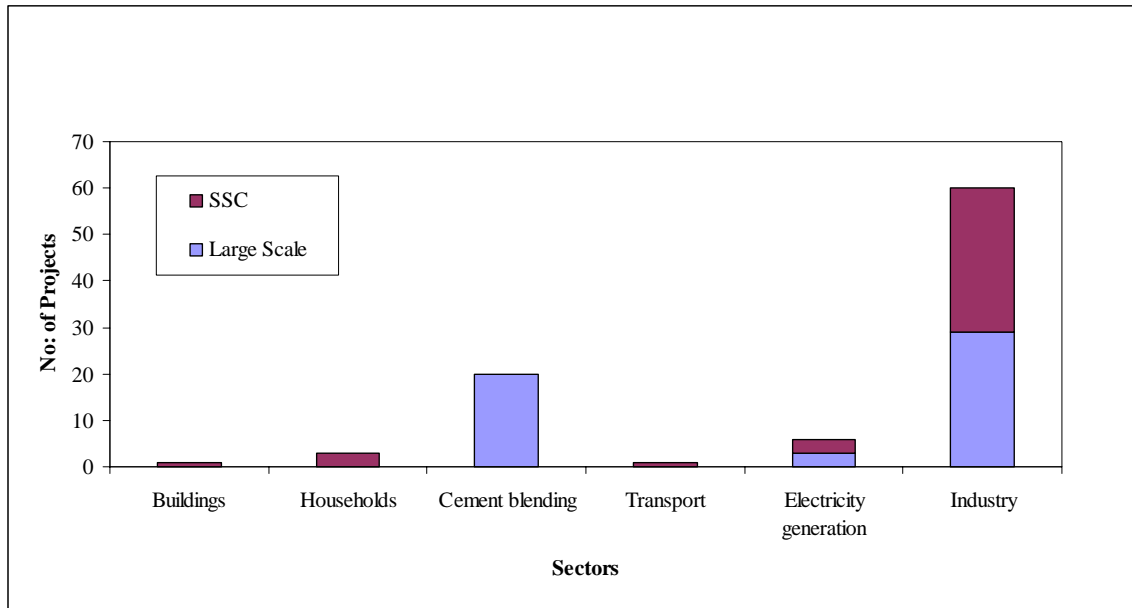
**Figure 2 CERs envisaged until 2012 based on the Project type Sector**

The distribution of the projects based on the activity scale is given in the figure 3. As can be seen, more than 50% of the projects in the industrial sector are small scale projects of which a couple of projects are demand side energy efficiency improvement projects in the industrial complex<sup>3</sup>. There are no large scale projects in the buildings, households and transport sectors though much potential is available in these sectors<sup>4</sup>.

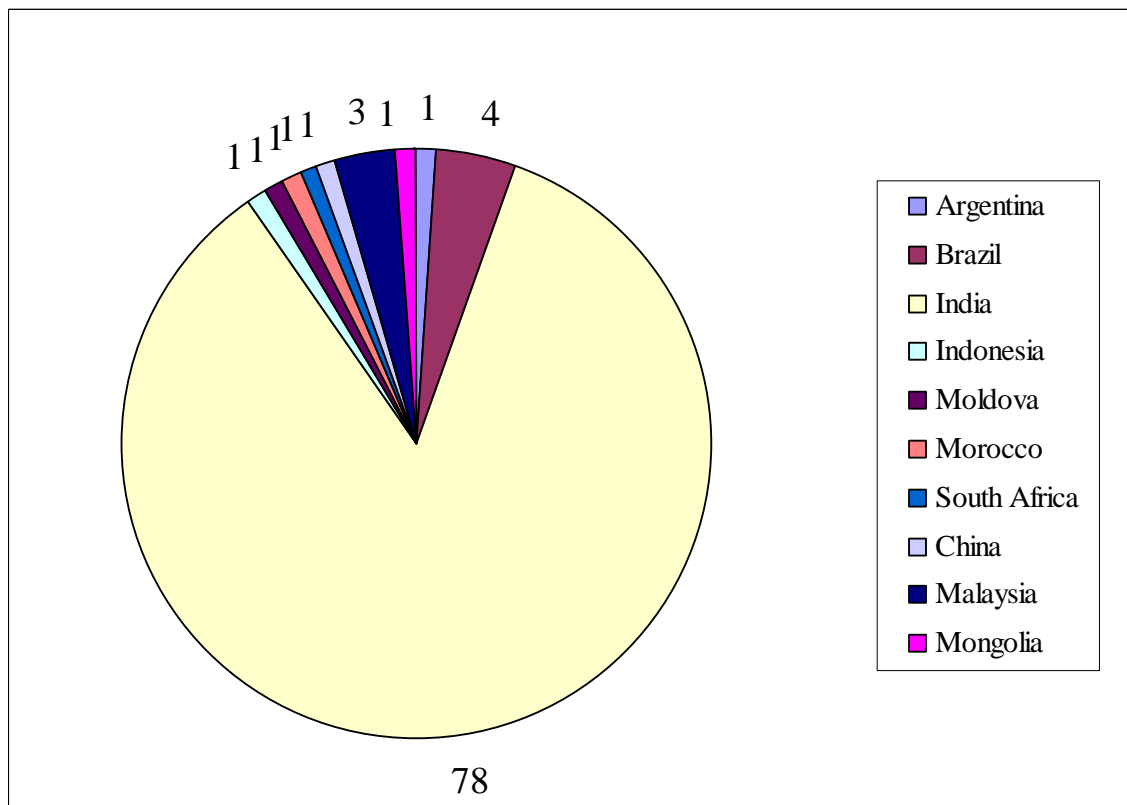
The geographical distribution of projects shows that Indian projects have the major share, accounting for 90% of the total global energy efficiency projects, of which 1 project has requested registration. Countries like Argentina, Indonesia, Moldova, Morocco and South Africa each have a project. Brazil has 3 projects from cement blending, electricity generation, and industrial energy efficiency activities.

<sup>3</sup> See Annex for the list of projects

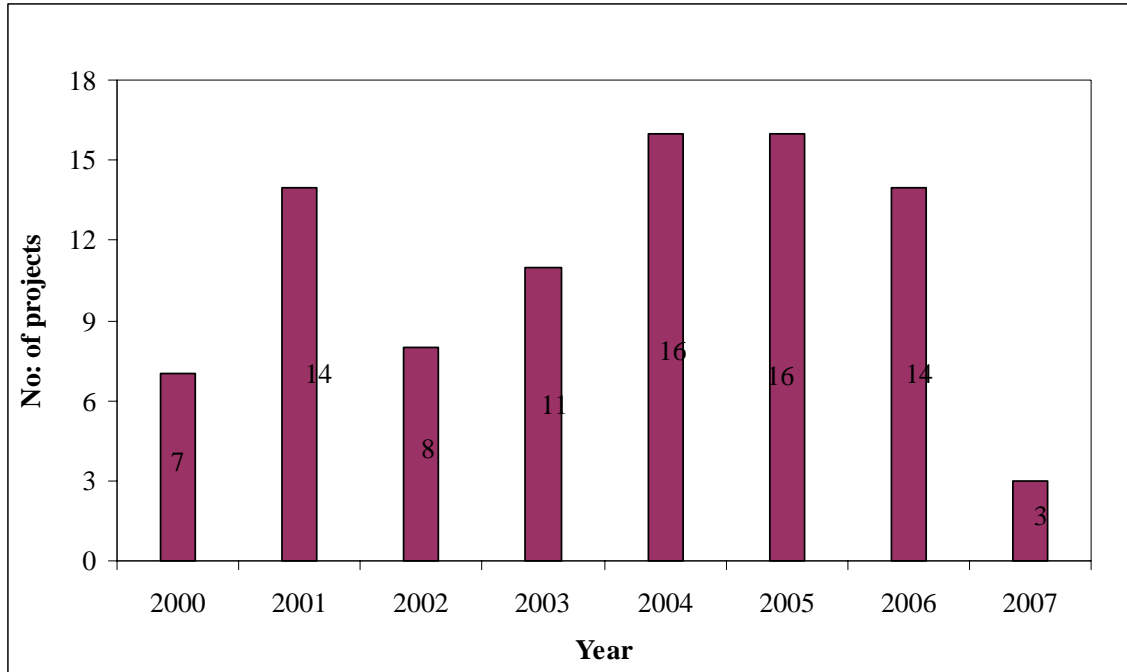
<sup>4</sup> IPCC (2001)



**Figure 3 Project Sector classification based on the Project activity scale**



**Figure 4 Projects from different host countries**



**Figure 5 Distribution of Projects based on vintage of CER generation**

Figure 5 gives the overview of projects based on the start date of the CER generation. It can be seen that about 88% of the projects are early start projects and their distribution decreases as the year's progress a fact associated with the post-2012 uncertainties. However in the year 2004, more projects are conceived, which can be attributed to the reduced uncertainty from Kyoto Protocol coming into force. Of the projects analysed, only 7 projects use a crediting period of 7+ years while the remainder goes for the 10 years crediting period. Project developers want to reap the short term benefits of the projects because of the uncertainties regarding the CDM in the post-Kyoto regime. Another reason may be that validators do not accept 7+ year crediting periods due to a life of equipment which is shorter than 21 years. Finally many developers may think that they have difficulties in passing the additionality test at the time of baseline renewal after 7 years.

Of the 92 projects we have selected 54 randomly and have analysed the additionality and sustainability issues of these projects. A brief summary of the analysed projects is given in Table 2 .

**Table 2: Energy efficiency project types analyzed**

| Project type<br>sector    | Break up    |             | Total<br>Projects | Early Start Projects |             |
|---------------------------|-------------|-------------|-------------------|----------------------|-------------|
|                           | Large Scale | Small Scale |                   | Large Scale          | Small Scale |
| Buildings                 | -           | 1           | 1                 | -                    |             |
| Cement<br>blending        | 14          | -           | 14                | 14                   | -           |
| Electricity<br>generation | 1           | 1           | 2                 | 1                    | 1           |
| Households                | -           | 2           | 2                 | -                    | 2           |
| Industry                  | 17          | 17          | 34                | 8                    | 10          |
| Transport                 | -           | 1           | 1                 | -                    | 1           |
| <b>Total</b>              | <b>32</b>   | <b>22</b>   | <b>54</b>         | <b>23</b>            | <b>14</b>   |

## ***Chapter 3 - Additionality***

### **3.1 What does Additionality mean?**

In Article 12.5, the Kyoto Protocol stipulates that emission reductions achieved through CDM project activities have to be certified on the following grounds:

- (a) Voluntary participation approved by each Party involved;*
- (b) Real, measurable, and long-term benefits related to the mitigation of climate change;*  
*and*
- (c) Reductions in emissions that are additional to any that would occur in the absence of the certified project activity.*

B and c are the technical qualifications which are related to the baseline and additionality of the proposed project. The emission reductions achieved from a project activity with a defined baseline scenario has to be proved to be additional. In the Marrakech Accords, additionality is defined as follows: “A CDM project activity is additional if anthropogenic emissions of greenhouse gases by sources are reduced below those that would have occurred in the absence of

*the registered CDM project activity*”<sup>5</sup> so essentially repeating the Kyoto Protocol wording. But a standard method to assess additionality was not prescribed due to the conflict of environmentalists and businesspeople described below. The design of the additionality determination process has to be balanced so as to maintain the environmental integrity of the KP while at the same time not unduly restricting the project developers from pursuing emission reduction projects.

### **3.2 Additionality present status & views of various groups**

The definition of additionality as described under the MA has been much debated by various groups with different perceptions. This has resulted in a big buzz in all COPs. The *business* viewpoint of additionality, is that “*in its present form, the Additionality Tool exposes every project to a highly subjective assessment of its CDM eligibility and allows for second-guessing by the EB*” (IETA 2005).

However, *researchers* consider additionality to be an imperative tool that is necessary to preserve the environmental integrity and successful implementation of the KP. They claim that “*Non-additional projects might grant greenhouse gas credits to any ordinary foreign direct investment that uses more efficient technology than the one existing in the host country and would lead to the generation of low value CERs (Michaelowa 2000)*”. According to *NGOs*, the CDM has to retain its integrity in order to remain an important mechanism that satisfies the dual purpose for which it has been designed. “*Without additionality, the CDM results in increased global emissions and thus the additionality criteria should be strict and the enforcement must be effective*” (WWF 2005).

Proving additionality depends on number of factors, especially size.

### **3.3 Additionality of Small Scale projects**

The project has to show that it overcomes one of certain barriers to investment, application of technology or the project not being common practice. EB practice shows that it is not checked whether these barriers are actually prohibitive.

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<sup>5</sup> as given in the para 43 of the decision 17/CP.7

### 3.4 Additionality of Large Scale projects

, During its 10<sup>th</sup> meeting (July 2003), the Executive Board suggested the following steps to prove a project's additionality through the baseline methodology and not the baseline scenario;

- (i) *A flow-chart or series of questions that lead to a narrowing of potential baseline options; and/or*
- (ii) *A qualitative or quantitative assessment of different potential options and an indication of why the non-project option is more likely; and/or*
- (iii) *A qualitative or quantitative assessment of one or more barriers facing the proposed project activity (such as those laid out for small-scale CDM projects); and/or*
- (iv) *An indication that the project type is not common practice (e.g. occurs in less than [ $<x\%$ ] of similar cases) in the proposed area of implementation, and not required by a Party's legislation/regulations.*

These steps resulted in ambiguous interpretations, and thus the EB, at its 16<sup>th</sup> meeting in October 2004, defined a new tool to prove project additionality (*Tool for the demonstration and assessment of additionality*), which is separate from the baseline methodologies. So even if the baseline scenario has higher emissions than the project scenario, it has to be checked whether the project passes the additionality test

The additionality tool suggested<sup>6</sup> by the EB has 5 main steps, associated with several sub-steps as follows<sup>7</sup>:

#### **Step 0. Preliminary screening based on the starting date of the project activity**

#### **Step 1. Identification of alternatives to the project activity consistent with current laws and regulations**

Sub-step 1a. Define the alternatives to the project activity

Sub-step 1b. Enforce applicable laws and regulations

#### **Step 2. Investment analysis**

Sub-step 2a. Determine appropriate analysis method

Sub-step 2b. – Option I. Apply simple cost analysis

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<sup>6</sup> It is not mandatory which has been stated several times and confirmed by COP 11 in Montreal in December 2005. But it has become de facto common practice.

<sup>7</sup> <http://cdm.unfccc.int/EB/Meetings/016/eb16repan1.pdf>



Sub-step 2b. – Option II. Apply investment comparison analysis

Sub-step 2b – Option III. Apply benchmark analysis

Sub-step 2c. Calculation and comparison of financial indicators (only applicable to options II and III)

Sub-step 2d. Sensitivity analysis (only applicable to options II and III)

**Step 3. Barrier analysis**

Sub-step 3a. Identify barriers that would prevent the implementation of proposed project activity

Sub-step 3 b. Show that the identified barriers would not prevent the implementation of at least one of the alternatives (except the proposed project activity)

**Step 4. Common practice analysis**

Sub-step 4a. Analyze other activities similar to the proposed project activity

Sub-step 4b. Discuss any similar options that may be occurring

**Step 5. Impact of CDM registration**

The projects that use this tool have to follow these steps sequentially to prove the additionality of the proposed project. The EB, in its 22<sup>nd</sup> meeting, modified this tool with respect to step 0 above - “evidence of CDM consideration while conceiving the project”<sup>8</sup>, essentially weakening it.

**3.4 Additionality issues of energy efficiency CDM projects with respect to approved baseline methodologies**

Additionality of a project is directly related to the defined baseline scenario and varies with the specific methodology applicable to the project activity. By Jan.9, 2006, 54 energy efficiency methodologies had been submitted to the EB and there were 4 approved large scale methodologies (AM 0017, AM 0018, AM 0024 (*Energy efficiency in Industry activities*) and AM 0020 (*Energy efficiency in service sector*)), three consolidated methodologies (ACM 004, ACM 005, ACM 007) and five small scale methodologies (AMS-II.A, AMS-II.B, AMS-II.C, AMS-II.D, AMS-II.E). Initially there was a general rejection of energy efficiency methodologies by the meth panel and executive board from an additionality view point but the situation improved after

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the consolidated additionality determination tool had been provided to facilitate the easy submission of methodologies by project developers. Table 3 gives a brief summary of the additionality demonstration method for energy efficiency methodologies.

Table 3: Use of the additionality tool in the approved baseline methodologies for energy efficiency projects

| <i>Sl. No.</i>   | <i>Methodology number</i> | <i>Methodology</i>  | <i>Additionality tool is required to prove additionality</i> |
|--|---------------------------|---|--|
| <b><i>Approved Large Scale</i></b>   |                           |   |  |
| <b>Energy efficiency, Industry</b>   |                           |   |  |
| 1  | AM17                      | Steam system efficiency improvement by replacing steam traps and returning condensate | No   |
| 2  | AM18                      | Baseline methodology for steam optimization systems                                   | Yes  |
| 3  | AM24                      | Waste gas recovery and utilization for power generation at cement plant               | Yes  |
| <b>Energy efficiency, Service</b>  |                           |   |  |
| 4  | AM20                      | Water pumping efficiency improvement  | Yes  |
| <b><i>Consolidated Methodology</i></b>   |                           |   |  |
| 1  | ACM4                      | Waste gas and/or heat for power generation  | Yes  |
| 2  | ACM5                      | Consolidated Methodology for Increasing the Blend in Cement Production                | Yes  |
| 3  | ACM7                      | Conversion from single cycle to combined cycle power generation                       | Yes  |
| <b><i>Small Scale Type II: Energy Efficiency Improvement Projects (&lt;15 Gwhe &amp; 45 GWhth)</i></b> |                           |   |  |
| 1  | AMS-II.A.                 | Supply side energy efficiency improvements - transmission and distribution            | No   |
| 2  | AMS-II.B.                 | Supply side energy efficiency improvements - generation                               | No   |

<sup>8</sup> [http://cdm.unfccc.int/EB/Meetings/022/eb22\\_repan8.pdf](http://cdm.unfccc.int/EB/Meetings/022/eb22_repan8.pdf)

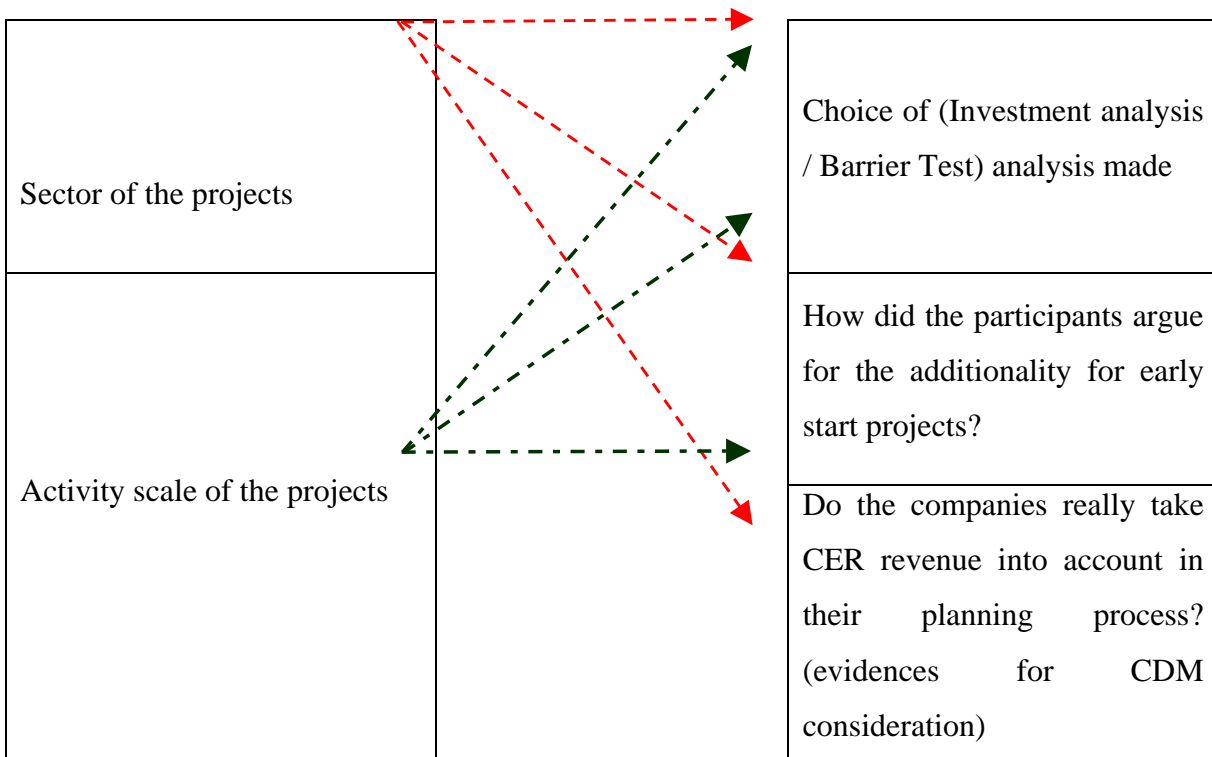
|   |           |   |    |
|---|-----------|---|----|
| 3 | AMS-II.C. | Demand-side energy efficiency programmes for specific technologies      | No |
| 4 | AMS-II.D. | Energy efficiency and fuel switching measures for industrial facilities | No |
| 5 | AMS-II.E. | Energy efficiency and fuel switching measures for buildings             | No |

Table 3 shows that all the large scale energy efficiency projects except the projects with steam system efficiency improvements follow the consolidated additionality determination tool to prove project additionality. In the case of steam system efficiency projects, additionality has to be established based on the common practice analysis. As mentioned earlier, in the case of small scale projects, it is sufficient that the projects show existence of any of the barriers to implementation described in appendix B of attachment A of the small scale modalities and procedures.

## Chapter 4 - Analysis of Additionality issues regarding Energy Efficiency Projects

As mentioned in chapter 2, 54 energy efficiency projects have been reviewed and the additionality issues addressed in these projects will be discussed in this chapter. Sustainability issues are addressed in the next chapter.

**Figure 6 Sequence of analysis**



Additionality issues of the projects were analyzed based on the questions shown in Figure 6, and a separate discussion of the following criterion for the projects used the ACM 0004 methodology.

- i. Whether the projects happen in the baseline scenario (BAU)?
- ii. Whether the projects are attractive in terms of size?

### **4.1 Sector- Specific analysis: Choice of (Investment analysis / Barrier Test) analysis made** **Industrial Sector**

The majority of analyzed projects address industrial energy efficiency and have a wide range of size and technology. Most of the large scale industrial projects are waste heat recovery projects which applied baseline methodology ACM 0004 and thus used the Consolidated Additional

determination tool. With the exception of one project from Morocco all projects in this category are done in Indian Iron & Steel industries. As there are no regulatory requirements for waste heat utilization, project participants argue that in the absence of the proposed activity the energy would be drawn from the grid. But some of the projects proposed that in the project absence, energy would be produced by conventional fossil captive power generation modes.

In most of these projects barrier analysis was chosen to prove project additionality and projects generally report technical barriers for the project implementation. Technical barriers reported are gas quality and quantity (to generate uninterrupted power). In case of retrofit measures reported barriers are the risks and problems associated with the replacement of the old technology with the new technology. Lack of local available waste heat recovery technology will directly affect the cash flows of the project. From a sustainability perspective these barriers will help for employment addition in these plants as the risky technology needs more manpower. Both investment and barrier analysis was made in the case of 4 projects, of which three projects have used the IRR as financial indicator for the investment analysis and compared with the respective benchmarks. The parameters chosen for the calculation of the financial indicators selected for the financial analysis in the project “Use of waste gas use for electricity generation at Jindal Thermal Power Company Limited (JTPCL)” the parameters chosen are doubtful and not credible to prove project additionality.

Process steam optimization projects are low in number and these projects applied the methodology AM 0018. All the selected projects are from India and the project “*Energy Efficiency through installation of modified CO<sub>2</sub> removal system in Ammonia Plant*” in M/s Indo Gulf Fertilizers Limited got registered. Additionality of these projects was proved based on the technological barriers for the project implementation. In a project, technology was imported from Germany and 1<sup>st</sup> of its kind in the country. In the case of two projects from Reliance Industries Ltd. the technology and the energy efficiency activity have been awarded for the best energy reduction technology for process optimization and in this case the technology was developed

indigenously after number of R&D trials<sup>9</sup>, showing the considerable barriers associated these projects faced.

In the case of small scale projects (*Energy efficiency and fuel switching measures for industrial facilities*) analyzed it is seen that most of the project additionality tests are based on the barrier analysis , especially on the investment barrier and technology barriers.

Box 1: Examples of the investment barrier test arguments

1. “India - Vertical Shaft Brick Kiln Cluster Project”.

Project implementation (*change from conventional brick kiln manufacture to VSBK manufacture*) needs high capital investment in the case of VSBK (18,000 €<sup>0</sup>). But usually, brick manufacture needs only 900€ In this case, project developers are reluctant to pursue the project. But the carbon benefits make the project viable. Also, this project will lead to sustainable SD benefits upon project implementation.

2. “ElDorado Energy Efficiency Project” (*Increasing the efficiency of sugar milling process by the reduction of heavy oil consumption*). The present situation of the Mexican sugar industry is not favourable to investments in new projects, as investing in a new project won’t yield much benefit. However the carbon benefits will boosts the investment in new projects and benefits will be attractive.

In the case of the Type B & C small scale energy efficiency activity (*Supply side & Demand-side energy efficiency programmes*) the argument is same as that of the above case, investments is high for these projects and are the considerable barriers for the project implementation.

**Cement (Blending)**

The additionality arguments of these projects are clearly based on the barrier analysis. This is mainly focused on market barriers associated with the utilisation of the blended cement (PPC), as

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<sup>9</sup> Energy efficiency through steam optimization projects at RIL, Hazira and Reduction in steam consumption in stripper reboilers through process modifications at RIL

there are always huge barriers and an existing reluctance for the PPC market and its utilization (based on the additive). In this sector one project is from Brazil and the remaining projects are from India. Irrespective of the geographical distribution, it becomes clear from the study that all the projects have the same additionality argument: the PPC market in the country is small as the major share of the market is taken by non-blended cement. As such, the consumption of PPC is not attractive. Moreover, technological barriers are quoted, such as lack of blending technology in the country which needs excessive R&D efforts to develop PPC with good compression strength. Institutional / Market barriers are claimed due to additional marketing efforts (compared to non-blended cement), like capacity building of the masons and builders to educate them about the PPC utilization. In Indian projects the argument is further linked with the regulatory market barriers based on the following;

- Central Public Works Department has imposed a ban on the use of blended cements in bridges and other concrete works and constructions.
- Usage of PPC cement in development construction projects is strictly restricted.
- Problems faced by the project developers in procuring fly ash from thermal plants. Some of the thermal power plants demand a share of the CERs, while in other cases the project developers are asked to construct their own ash handling facilities in power plant premises.

Most of these projects are early start projects. In India, the regulatory requirements regarding cement quality are governed by the Bureau of Indian Standards (BIS) as per the specification IS: 1489 (Part 1). According to this specification, the blended cement can be manufactured to a limit of 15 to 35%. Under the CDM aspect, the blending % which exceeds the limit of common practice in the region to the higher limit (< 35%) is claimed as additional, which shows that there exist no regulatory barriers for cement blended CDM projects.

### ***Electricity generation***

Projects under this sector are the EE activities taken in the electricity generation units – power plants. In this sector, six projects have arrived at the validation stage, of which one small and two large scale projects were analysed. The large scale projects are from Brazil & India, while the small scale project is from India. The Brazilian project is the only project that used benchmark

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<sup>10</sup> Exchange rate used: 1 € = 55 Indian Rupees.

analysis in its investment analysis. The small scale project activity uses the barrier analysis to prove project additionality and the project faced both the technological and prevailing practice barriers. The large scale Indian project additionality arguments are not credible and the project states that “*Project doesn’t generate extra revenue and compared the project scenario with coal for power generation*”. Also, the investment analysis made in the project was not clear. A more detailed discussion about this project follows in chapter 5.

### ***Transportation***

There is only one project under this sector. This project is a small scale activity undertaken in India for the *Shift to low greenhouse gas emitting vehicles for materials transport*, and centres on shifting from road to rail transport. The basis for the project activity is that rail transportation is four times more energy efficient than road transport. Additionality arguments are based on the local institutional barriers prevailing in the Indian railway sector, like freight tariff and manpower uncertainties.

### ***Buildings***

Significant headway in energy efficiency improvements has been made in the buildings sector. But unfortunately, only two projects from this sector have been submitted that both are from India. Additionality arguments are based on institutional barriers. Energy efficiency activities in hotels are considered. The hotel industry always considers guest satisfaction as its priority, and facilities are provided without considering energy utilisation and the associated energy costs. Also, the hotel management is unsure about the payback of these activities. Technology barriers are also considered in these projects, as the building energy efficiency activity is in its nascent stage in the country and the availability of the appropriate technology is limited. Therefore the technology has to be imported, which in turn increases the cost of the project.

### ***Households***

Projects in this sector are community development projects undertaken in Moldova and South Africa and additionality arguments are based on barrier analysis. Technological barrier were also taken into consideration. The projects are also the first of their kind in the respective project locations and will improve the quality of life of the people in the area. Both projects have



completed the major portion of the CDM cycle and the South African project is a Gold Standard CDM project.

**Sector Specific analysis: Investment Analysis test**

Most of the projects have selected barrier analysis for proving project additionality. Only 18 of the 54 projects have selected investment analysis; of which for 13 projects carried out a barrier test as well. Most of the projects applying investment analysis are from the industrial sector. The remaining sectors have one project each. None of the projects from Cement (blending) used investment analysis. The investment analysis was clear and credible in only a few projects. Tests of these projects were based on IRR as financial indicator and compared to with a pre-defined threshold limits of the project. On the whole, IRR specifications lie between 11 to 13 % without CDM benefits and with CDM benefits they vary from project to project. In another project, the investment analysis was based on the project payback period. “Pay back is more than 2 years” - clearly the project is additional. Investment barriers were mostly compared with institutional barriers and in one small scale project the capital investment was compared with and without the proposed CDM project, which clearly explains the barrier faced by the project for the capital investment. However most of these projects do not provide a concrete analysis. Excerpts of some of these project analyses are listed below;

*“General cost comparison of the equipment with & without the project”*

*“Project doesn’t generate extra revenue. Cost of coal and the waste gas was compared”*

*“Investment of this kind was even made in the company's poor performance for the past 6 years”*

**4.2. Sector Specifications of early start projects: how did the participants argue for the additionality?**

As per the EB Additionality Demonstration tool all prompt start projects (1<sup>st</sup> January 2000 < Project Construction Date > 18 November 2004) must have a proper evidence that CDM revenue was considered duly while conceiving the proposed project. Of the analyzed projects, 80% are prompt start projects and additionality arguments reported for these projects are described in this section.

### ***Industrial Sector***

Of the analysed 54 projects, early start project from the industrial sector amount to 8; 3 are waste heat recovery projects and 5 are steam optimisation projects. In the case of WHR projects, all 3 early projects argue that CDM revenue will directly affect the project implementation. All these were reported in PDD and the communications were conducted with financial institutions prior to project implementation. In the case of Steam Optimization projects, arguments were credible in 3 projects but in the remaining 2 they are sloppy: *“project if registered would penetrate the technology widely which will boost the economy in the respective sector and successful implementation of this technology needs CDM funds to strengthen process control and cover uncertainties”*. This argument begs the questions whether CDM was considered in the planning stages of the projects. However for the remaining 3 projects the arguments are credible and are as follows:

- *“CDM fund will provide additional coverage to the risk due to failure of project, shut down of plant and loss of production*
- *CDM funds will provide the training support to company employees in understanding operational accuracies and mitigation of risks associated*
- *The fund will stimulate R&D efforts in company to find methods of mitigating risks and enhance replication of such projects & to promote GHG abatement*
- *Encourage other industries to initiate such measures for energy conservation*
- *Publicity of the efforts taken by the project proponent towards energy efficiency and hence sustainable development”*

### ***Cement (Blending)***

Of the analysed 54 projects, 14 projects are cement blending project activities. All projects are early start projects and claim the retrofit credits. In all the projects, the impact of project registration was considered. Yet the explanations are not plausible in most of the cases. But the remaining set of explanations is same as mentioned in the section 4.1 As per SSC, CDM project activity modalities and procedures attachment A to appendix B, project participants have to provide an explanation for project additionality by providing evidences that the project activity is faced with one of the barriers, irrespective of the project start date. Hence the analysis is basic in this case and this was also not reported in the PDD.

#### **4.3. Sector Specifications of the projects: do the companies really take CER revenue into account in their planning process?**

This analysis is directly linked with the early start projects, as has been discussed in the previous section. Of the analyzed prompt start projects, the evidence for CDM consideration was given in the following forms to prove the projects have considered CDM revenue in planning process.

- Climate change activities carried out by company in partnership with the respective industry association
- Workshop participation
- Decisions made in the board meetings and discussions
- Contract made with CDM consultant
- Research activity data
- Technical equipment details
- Preliminary emission calculations, technical PIN pre-evaluation submissions
- Financial documents (budget proposal, FI communications)
- Methodology submission

In most of the projects, the evidence reported that decisions were made in the board meetings of the respective company, followed by contract agreements made with CDM consultants. Some projects have argued very broadly, for example *“all activities taken by the company are in line with the environmental, health, social assessment, consequently climate change issues are very much a part of the board decision making covering all its proposed activities”*. But only a few projects reported credible evidences in the PDD, such as *“new baseline submitted to the Meth Panel was based on the proposed project”*.

#### **4.4 Activity scale of the projects: choice of (Investment analysis / Barrier Test)**

##### ***Large Scale***

The analysis shows that most of the large scale projects used barrier analysis and subsequently common practice analysis to prove additionality. Only 10% of the projects on the whole used Investment analysis tests. The details can be found in annex 1. In the barriers analysis, technological barrier were mainly considered, which are associated with institutional barriers like the lack of manpower to operate the technology. Barriers due to the prevailing practice are

general arguments - reluctance to invest in energy efficiency projects with scepticism arising around the amount of rate of return. Much of the details regarding the individual sector and the large scale projects were discussed in the earlier section.

### ***Small Scale***

Additionality arguments in small scale projects were based on the barrier analyses. In most cases, investment barriers were used by the projects, followed by technological barriers and barriers of the prevailing practice. Investment barrier projects mainly faced capital investment sourcing problems also small scale projects have long pay back period. But only in the case of the South African project was common practice analysis used. The project is also the first of its kind in the area. On the whole, only 9 large scale projects applied investment analysis to prove project additionality since large scale projects mostly faces technical barriers as well as many institutional problems while they are attractive from a purely financial point of view.

### **4.5 Activity scale of early start projects: how did the participants argue for additionality?**

Of the 54 analysed projects, 34 were early start projects of which 23 were large scale and 14 are small scale. As mentioned earlier, the analysis was carried out based on the impact of CDM registration due to the linkage of the early start project's investment plans and the impact of CDM registration. If the companies have really taken the CDM revenue into consideration, activities will be designed to overcome barrier when the project fails to get registered.

### ***Large Scale***

In case of large scale projects, most of the important discussions have been reported in section 4.2 based on the project sectoral classification. In general, for the large scale projects, additionality arguments were very diverse. Only for some projects were the arguments credible but in the other cases they were flawed. In an early start project, the arguments quoted: *“CERs will be used by the company operations in the annex 1 area, thus emissions reductions occurs & company will get value added if the project get registered with EB”*. In another case, the argument is as follows: *“Without the CDM revenue project won't move & also there is no policy, other incentives, which prevents the investment so project will be facing problems if not registered”*. Thus only in few early start projects sound credible arguments are given.

### ***Small Scale***

In all small scale projects, the additionality test is simple and all the projects irrespective of the start date have used the barrier tests.

#### **4.6 Activity scale of the projects: do the companies really take CER revenue into account in their planning process?**

In section 4.3, we have conducted a detailed in-depth analysis regarding this issue. The same results are applied here, as we have carried out the analysis on the whole irrespective of the project activity scale and how the companies considered the CDM revenue in their planning stage.

#### **4.7 Significance of common practice analysis in additionality tests**

Of the analysed 54 projects, 32 used the common practice analysis, of which 18 were large scale and 14 were small scale. On the whole, all industrial sector projects used common practice analysis in the additionality determination process associated with the barrier analysis. In the case of waste heat recovery projects, all the projects used common practice analysis. In some of the cases the analyses are simple and not plausible.

In few projects, a detailed data inventory of the project area was made and compared to the additionality, though the analyses are not accurate. In the case of waste heat projects undertaken in two iron & steel industries within the same region, there is a discrepancy in the data (number of the similar plants in the area- one project states 17 plants and in the other it states 65 plants) used for the analysis, which is putting a doubt on the credibility of the additionality checks.

In the case of cement blending projects, the case is entirely different since baseline emission calculations are based on the percentage of blending exceeding the common practice in the region to the higher limit, and the blending across the higher common level is claimed to be additional. Thus the cement blending projects consider the similar activities (blending) that are occurring in the region for common practice analysis. The data was clearly mentioned in most of the Indian projects due to the availability of blending data collected by the Cement Manufacturers' Association.

In case of steam optimization projects, common practice analysis was clearly explained as the projects were the first of their kind, technology was either imported or indigenously developed and thus faced technical barrier for project implementation.

#### 4.8 Discussions of projects using ACM 0004

Globally, 22 projects used ACM 0004 - “Consolidated baseline methodology for waste gas and/or heat for power generation” - for the respective waste heat recovery activities carried out in the iron & steel, cement and chemical industry. It is interesting to note that all these projects were submitted for validation in the last quarter of 2005, and account for 47% of the total CER. Based on this we have selected the following issues for discussion:

i. Whether the projects happen in the baseline scenario (BAU)?

A detailed analysis of the projects with ACM 0004 methodology was discussed in the previous sections.

ii. Are the projects attractive in terms of size?

As mentioned earlier, 22 of the 92 projects are WHR projects, which show a sizable portion of CER share from WHR projects that accounts for 45% of total CERs (29,541). The attractiveness of energy-efficiency project with respect to the emission reduction volume achieved per year is given in Table 4<sup>11</sup>:

Table 4: Attractiveness of CDM projects according to CER volumes

| <b>Emission reductions (t CO<sub>2</sub>e/a)</b> | <b>Level of attractiveness</b> |
|--|--------------------------------|
| >100,000   | Very attractive                |
| >50,000 – 100,000                                | Medium attractive              |
| >20,000 – 50,000                                 | Marginally attractive          |

Comparing these figures with the actual CERs envisaged from the projects, all waste heat recovery projects are found to very attractive in terms of the annual CER generation.

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<sup>11</sup> Michaelowa et al. (2003)

## ***Chapter 5 - Sustainable Development***

Sustainable Development (SD) is at the heart of negotiations in various international environmental conferences today. The concept of sustainable development began in 1992 at the Rio Earth Conference, after which the SD concept was linked to all important development issues globally. Many definitions for the term exist, but the universally accepted ***best definition*** for sustainable development is “*development that meets the needs of the present without compromising the ability of the future generations to meet their needs*”. The CDM is also designed with SD in mind - GHG reduction projects must promote sustainable development and bring about CO<sub>2</sub> emission reductions. The COP 8 emphasised the linkage between climate change and sustainable development and highlighted the principle of the common but differentiated responsibilities of countries to address climate change.

There is a wealth of literature available on the discussions of linkages between sustainable development and CDM. All the projects undertaken with the CDM must be voluntary actions in the developing countries and have to promote sustainable development in the host country and the formal host country approval letter from all the host countries have to state this. According to the Decision 17/CP.7 for the Article 12 of the Kyoto protocol, “*it is the host Party’s prerogative to confirm whether a clean development mechanism project activity assists it in achieving sustainable development but it is the host country **prerogative** to decide the sustainable issue*”. This makes it difficult to formulate internationally accepted protocols that assess the sustainable development benefits achieved through a CDM. However it is generally accepted that CDM project activity in a host country has to improve the following:

- Social well being
- Economic well being
- Environmental well being

### *Sustainable benefits of energy efficiency projects*

In principle, energy efficiency measures will generally lead to sustainable development benefits through resource conservation (see Table 5).:

Table 5: Sustainable development criteria and indicators

| SD criteria          | Sectoral /Project level indicator | Measurement standard of indicator   |  |
|----------------------|-----------------------------------|---|--|
|                      |                                   | Quantitative  | Qualitative  |
| Economic             |                                   |   |  |
| Investments          |                                   |   |  |
| Sectoral development | Technology access Market creation | Physical measures like energy demand and supply, economic measures, energy efficiency and affordability, energy security                                  | Improvement of Nation Energy Sufficiency and enhancement of global stature |
| Technological change | Innovation Learning               | <ul style="list-style-type: none"><li>• No of technologies</li><li>• Price of technologies and maintenance</li><li>• Cost development over time</li></ul> |  |
| Growth               | Income generation                 | Net surplus   |  |
| Employment           | Employment                        | No. of man-years created or lost  |  |



| <b>Environmental</b> |  |   |  |
|----------------------|--|---|--|
| Air pollution        | Local air pollution, particulates<br>Environmental health benefits           | Emissions of SO <sub>2</sub> , NO <sub>x</sub> and particulates<br>Monetary value of environmental health benefits  |  |
| Climate change       | GHG emission   | GHG emission  |  |
| <b>Social</b>        |  |   |  |
| Equity               | Distribution of costs and benefits, income distribution, local participation | Cost and benefits in economic units related to stakeholders, income segments, gender, geographical area etc.<br>Income generation adjusted with distributional weights Gini coefficient | Mapping local stakeholders and their participation<br><br>Gender aspects |

### **5.3 Scope of Sustainable development for energy efficiency CDM projects**

In the case of energy efficiency projects, sustainable development is mainly focused on resources minimization – energy savings achieved and economic wellbeing – technology transfer, job creation and improvement of employee occupational health with a change from lower-end technologies to higher-end technologies, which will reduce worker drudgery. However there won't be sizeable socio- economic sustainable developments through energy efficiency projects like sustained job creation, local poverty elevation and local infrastructure development.

## ***Chapter 6 - Analysis of Sustainable Development issues of Energy Efficiency Projects***

We have analysed the 54 projects based on the social, economic, technical, and environmental well-being reported in the PDD. We analysed the sustainable development achieved through the projects based mainly on the activity scale with respect to the respective sector.

### **6.1 Large Scale projects**

In large scale projects, there are few socio economic benefits achieved through the energy efficiency projects. The benefits achieved are minuscule: a limited number of people will find employment indirectly and directly during the project construction and operation, employee occupational health will be improved and the workers drudgery will be reduced with advanced process systems. Moreover, the projects achieve resource conservation. In the case of waste heat recovery projects, economic benefits would be gained through reduced power consumption from the grid and the saved power can be utilized effectively in power shortage area and will reduce the fossil fuel consumption in the power plant. In some projects, power is wheeled from one company to another company using the regional grid which will increase the revenue of the regional utilities.

In the case of Cement blending projects, the benefits achieved are more doubtful. These projects lead to environmental benefits with resource conservation and reduced energy consumption. Only one project has imported technology (a steam optimisation project), but technology is not transferred through the CDM and the activity were carried by the company. In some of the projects, technology was indigenously developed and some sustainable development will be achieved once the technology has penetrated the market. The environmental benefit reported in all projects is reduced energy consumption with reduced GHG emissions from the power plants. From our understanding, the sustainable development benefits achieved through these projects were not substantial and very negligible if considered holistically. None of the large scale projects have resulted in mass employment generation that helps in alleviating poverty. There is no sustained employment through the project.

## **6.2 Small Scale projects**

Only few projects, like the South African Gold Standard project “Low-cost urban housing energy service upgrades, Kujasa, Khayelitsha”, have real sustained sustainable development benefits. The project is the first of its kind in the area. It will improve the life quality of the people and has created a market for improved electrical appliances. The other project that offers a significant sustainable benefit is the Indian “India - Vertical Shaft Brick Kiln Cluster Project”. The project employs new energy efficient technology (VSBK) in the Indian brick sector, and 14 brick companies from 3 states are selected for the project. The project has sound sustainable developmental benefits like carbon benefit sharing for community development, technology penetration into the market, capacity building in the brick sector the reduction of hard and monotonous routine work, and resource conservation. The transport sector project lead negative sustainable development benefits with the project implementation - reduced employment.

In the case of other projects, the sustainable benefits are not similar to the ones mentioned above. In all projects clearly stated that the project will reduce resource use. It is clear, that there are not many sustainable benefits envisaged from the energy efficiency projects. Nevertheless, the benefits of these projects can be defined as environmental

benefits that will improve resource conservation and the occupational health of the employee of the plant. CDM was envisaged to transfer environmental sound technology to developing countries however of the analysed 54 projects in only one project technology was transferred, but transfer was not undertaken with the CDM. Energy efficiency projects were mostly expected to transfer energy efficient technology from the developed to the developing countries, but in reality this is not the case. Most of the energy efficiency projects are in-house projects and there is not much development for the community or the project area. The major benefit to come from energy efficiency projects is resource conservation and energy savings, and the assistance provided to the host countries in planning their energy security issues.

### **6.3 Stakeholder comments on the projects**

Stakeholders comments are one of the sustainable development aspects that the CDM projects contribute to the host country. The selection of the stakeholders is relevant in most of the projects. Important stakeholders that were considered were locally elected representatives, the authorities of regulatory bodies, NGOs and the employees of the company, since most of the projects are carried out in the company itself. But in several projects, stakeholders are not identified properly. It is just stated that the project has no negative environmental effect and project developer have a good reputation and perform favourably in aspects concerning corporate social responsibility. In some of the projects, stakeholders were simply identified for namesake, like workers and casual labours. Unfortunately these are not aware of the CDM.

In most of the projects, the discussion during stakeholder consultation was based on the project's environmental and technical aspects. Only few projects conducted detailed discussions on the sustainable development envisaged from the project. In some projects, stakeholder consultation was inexistent as shown by statements that *“stakeholder consultation was part in the process of obtaining no objection certificate from the regulatory bodies for the project implementation”* (which shows that no separate stakeholder participation was solicited).

## ***Chapter 7 - Discussion & Conclusion***

In the second half of 2005, almost 100 energy efficiency projects has been submitted for validation. 60% are large scale projects and 90% had started before 2005. 54 of those projects were analysed with regards to additionality and sustainable development benefits. The results show that additionality and sustainable development are often assessed in a cursory manner. Generally, the small-scale projects only use the barrier test; they do not really check whether the barrier reported would have been prohibitive. Also most of the large projects used a barrier analysis which focused on the existence of technical barriers. Cement blending projects have also referred to market barriers due to lack of customer confidence in the blended cement. Likewise, they reported regulatory barriers that are however not credible. Investment analysis was only used by a third of the large projects and not done in a detailed manner. While common practice analysis was done by a majority of projects, it was not supported by quantitative arguments except in a small minority of cases. Only in very few projects like Shree Cements, Indo Gulf Fertilizers Limited project additionality was well established. Many early start projects could not provide sufficient evidence to prove CDM was duly considered while conceiving the project.

Besides resource conservation, energy efficiency projects do not create much qualitative sustainable development benefits on the whole. The stakeholder consultation process failed in many projects as no CDM-specific stakeholder consultation was held. Technology transfer occurred rarely. Indigenous technology development happened only in 2 projects.

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## Annex I : List of Analysed projects

| Si. No. | Name of Project   | Country | Activity Scale | Methodology | Sector                 | Start date for CER generation | Early start projects evidence | Investment test | Barrier test | Barriers  | Common practice test | Impact of CDM registration |
|---------|---|---------|----------------|-------------|------------------------|-------------------------------|-------------------------------|-----------------|--------------|-----------|----------------------|----------------------------|
| WHR 1   | Electric Power Co-Generation by LDG Recovery – CST - Brazil   | Brazil  | Large          | ACM 0004    | Electricity generation | 2004                          | C                             | -               | -            | -         | ✓                    | -                          |
| WHR 2   | Waste Heat based 7 MW Captive Power Plant   | India   | Large          | ACM 0004    | Industry               | 2002                          | B                             | -               | ✓            | T, M      | ✓                    | -                          |
| WHR 3   | TSIL - Waste Heat Recovery Based Power Plant  | India   | Large          | ACM 0004    | Industry               | 2001                          | B, C, PE                      | -               | ✓            | I, T, Ins | ✓                    | -                          |
| WHR 4   | Kalyani Steels Limited Project  | India   | Large          | ACM 0004    | Industry               | 2005                          | N                             | -               | ✓            | T, P      | ✓                    | ✓                          |
| WHR 5   | 12MW Captive Power Project based on Waste Heat  | India   | Large          | ACM 0004    | Industry               | 2006                          | -                             | -               | ✓            | T, P, In  | -                    | -                          |
| WHR 6   | Use of waste gas use for electricity generation at Jindal Thermal Power Company Limited (JTPCL)   | India   | Large          | ACM 0004    | Industry               | 2001                          | BM, C                         | ✓               | ✓            | T, P      | ✓                    | ✓                          |
| WHR 7   | 11.2 MW waste heat recovery boiler at the ISA smelt furnace of Copper smelter   | India   | Large          | ACM 0004    | Industry               | 2005                          | C, FD                         | -               | ✓            | T, M      | -                    | -                          |
| WHR 8   | VGL Waste Heat Based 4 MW Captive Power Project at Raipur   | India   | Large          | ACM 0004    | Industry               | 2005                          | N                             | -               | ✓            | R, In, T  | ✓                    | -                          |
| WHR 9   | JSBL Waste Heat Recovery Based Captive Power Project  | India   | Large          | ACM 0004    | Industry               | 2005                          | N                             | -               | ✓            | R, In, T  | -                    | -                          |
| WHR 10  | Generation of electricity through combustion of waste gases from Blast furnace and Corex units at JSW power limited (JPL) at Torangallu in Karnataka, India | India   | Large          | ACM 0004    | Industry               | 2005                          | B                             | ✓               | ✓            | T, P      | ✓                    | ✓                          |
| WHR 11  | Nakoda WHR CDM Project  | India   | Large          | ACM 0004    | Industry               | 2005                          | C, Meth                       | ✓               | ✓            | M, T      | -                    | -                          |

|        |  |         |       |          |                   |      |       |   |   |       |   |   |
|--------|--|---------|-------|----------|-------------------|------|-------|---|---|-------|---|---|
| WHR 12 | Jorf Lasfar heat recovery enhancement for power project  | Morocco | Large | ACM 0004 | Industry          | 2006 | -     | ✓ | ✓ | In, T | ✓ | - |
| CB 1   | Use of blast furnace slag in the production of blended cement at Votorantim Cimentos   | Brazil  | Large | ACM 005  | Cement (Blending) | 2001 | A     | - | ✓ | M     | ✓ | - |
| CB 2   | ACC Blended cement projects at: • New Wadi Plant • Tikaria Cement Plant • Chanda Cement Works • Kymore Cement Works • Lakheri Cement Works • Chaibasa Cement Works | India   | Large | ACM 005  | Cement (Blending) | 2004 | C, W  | - | ✓ | T,M   | - | - |
| CB 3   | GACL Blended cement projects at: Maratha Cement plant, Gujarat Unit, Himachal Unit, Ropar Unit, Bhatinda Unit, Rabriyawas Unit                                     | India   | Large | ACM 005  | Cement (Blending) | 2004 | C     | - | ✓ | T,M   | - | - |
| CB 4   | Optimum utilization of clinker by production of Pozzolana Cement at Ultra Tech Cement Ltd. (UTCL), Andhra Pradesh  | India   | Large | ACM 005  | Cement (Blending) | 2000 | M     | - | ✓ | T,I,M | ✓ | - |
| CB 5   | Optimal Utilization of Clinker in PPC manufacturing at Birla Corporation Limited, Raebareli Unit   | India   | Large | ACM 005  | Cement (Blending) | 2001 | B, PE | ✓ | ✓ | T,M   | - | - |
| CB 6   | Increasing the Additive Blend in the Portland Slag Cement Manufacturing, Indorama Cement Ltd.  | India   | Large | ACM 005  | Cement (Blending) | 2002 | N     | - | ✓ | T,M   | - | - |
| CB 7   | Blended cement with increased blend at Orient cement's Devapur and Jalgaon plants in India   | India   | Large | ACM 005  | Cement (Blending) | 2001 | B     | - | - | M     | - | - |

|       |   |       |       |         |                   |      |           |   |   |      |   |   |
|-------|---|-------|-------|---------|-------------------|------|-----------|---|---|------|---|---|
| CB 8  | Optimum utilization of clinker by PCC production at Binani Cement Limited, Rajasthan                                | India | Large | ACM 005 | Cement (Blending) | 2003 | B         | - | ✓ | T, M | ✓ | - |
| CB 9  | Optimal utilization of clinker: Substitution of Clinker by Fly ash in Portland Pozzolana Cement blend at OCL, India | India | Large | ACM 005 | Cement (Blending) | 2001 | B, TE     | - | ✓ | T, M | - | - |
| CB 10 | Optimal Utilization of Clinker in PPC manufacturing at Vasavadatta Cement   | India | Large | ACM 005 | Cement (Blending) | 2003 | B         | - | - | M    | ✓ | - |
| CB 11 | Mysore Cements Limited Portland Slag Cement project   | India | Large | ACM 005 | Cement (Blending) | 2001 | B, R      | ✓ | ✓ | T, M | ✓ | - |
| CB 12 | Optimal utilization of clinker: Substitution of Clinker by Slag in Portland Slag Cement blend at OCL, India         | India | Large | ACM 005 | Cement (Blending) | 2001 | N         | - | ✓ | T, M | - | - |
| CB 13 | ACEL Blended cement project at Sankrail grinding unit   | India | Large | ACM 005 | Cement (Blending) | 2004 | C, W, PE  | - | ✓ | T, M | - | - |
| CB 14 | Blended Cement Project with Fly Ash – Lafarge India Private Limited   | India | Large | ACM 005 | Cement (Blending) | 2001 | B         | - | ✓ | T, I | - | ✓ |
| S 1   | Energy Efficiency through installation of modified CO2 removal system in Ammonia Plant                              | India | Large | AM 0018 | Industry          | 2003 | B Mom, FD | - | ✓ | T    | - | - |
| S 2   | Optimization of steam consumption by applying retrofit measures in blow heat recovery system                        | India | Large | AM 0018 | Industry          | 2003 | B         | - | ✓ | T    | ✓ | - |
| S 3   | Optimization of steam consumption at the evaporator   | India | Large | AM 0018 | Industry          | 2002 | B         | - | ✓ | T    | ✓ | ✓ |

|       |  |              |       |                       |                        |      |      |   |   |             |   |   |
|-------|--|--------------|-------|-----------------------|------------------------|------|------|---|---|-------------|---|---|
| S 4   | Reduction in steam consumption in stripper reboilers through process modifications   | India        | Large | AM 0018               | Industry               | 2004 | B, C | - | ✓ | T           | ✓ | ✓ |
| S 5   | Energy efficiency through steam optimisation projects at RIL, Hazira   | India        | Large | AM 0018               | Industry               | 2004 | B    | - | ✓ | T           | ✓ | ✓ |
| CE 1  | Taishan Cement Works Waste Heat Recovery and Utilisation (NM79)  | China        | Large | AM 0024               | Industry               | 2006 | -    | ✓ | ✓ | T, In, PP   | ✓ | - |
| B 1   | Improvement in Energy Conservation in a Hotel  | India        | SSC   | AMS II B              | Buildings              | 2006 | -    | ✓ | ✓ | I, T, PP, I | - | - |
| EG 1  | Energy efficiency measures at a thermal power generation station of CESC Limited   | India        | SSC   | AMS II B              | Electricity generation | 2002 | -    | - | ✓ | T, PP       | ✓ | - |
| H 1   | Moldova Energy conservation and greenhouse gases emissions reduction   | Moldova      | SSC   | AMS-I.C.-II.E.-III.B. | Households             | 2004 | -    | ✓ | - | I           | - | - |
| H 2   | Low-cost urban housing energy service upgrades, Kujasa, Khayelitsha  | South Africa | SSC   | AMS-I.C.-II.C.-II.E.  | Households             | 2004 | -    | - | ✓ | -           | ✓ | - |
| S I 1 | Demand-side energy efficiency programme in the 'Humidification Towers' of Jaya Shree Textiles  | India        | SSC   | AMS II B              | Industry               | 2000 | -    | - | ✓ | PP, T       | ✓ | - |
| S I 2 | Energy efficiency projects - Steam system upgradation at the manufacturing unit of Birla Tyres   | India        | SSC   | AMS II D              | Industry               | 2006 | -    | ✓ | ✓ | I, T        | ✓ | - |
| S I 3 | Demand side energy efficiency programmes for specific technologies at ITC Bhadrachalam Pulp and paper making facility in India, in Andhra Pradesh by ITC Ltd | India        | SSC   | AMS II C              | Industry               | 2005 | -    | ✓ | - | PP,T, I     | ✓ | - |

|        |  |       |     |                    |          |      |   |   |   |           |   |   |
|--------|--|-------|-----|--------------------|----------|------|---|---|---|-----------|---|---|
| S I 4  | Efficiency improvement of Turbine Generator to reduce fossil fuel consumption in the Coal fired boiler system          | India | SSC | AMS II B           | Industry | 2002 | - | ✓ | - | I, T, Ins | - | - |
| S I 5  | Demand side energy conservation and reduction measures at ITC Tribeni Unit   | India | SSC | AMS II C           | Industry | 2006 | - | ✓ | ✓ | I, PP, I  | ✓ | - |
| S I 6  | Demand side energy conservation & reduction measures at IPCL – Gandhar Complex   | India | SSC | AMS II C, D, III B | Industry | 2005 | - | ✓ | ✓ | In, T     | - | - |
| S I 7  | Energy Efficiency Measures At Cement Production Plant  | India | SSC | AMS II D           | Industry | 2000 | - | ✓ | ✓ | T, I      | - | - |
| S I 8  | Energy Efficiency Measures at Cement Production Plant in Central India   | India | SSC | AMS II D           | Industry | 2000 | - | ✓ | ✓ | T, I      | - | - |
| S I 9  | Energy efficiency and fuel switching measures in the caustic soda and sodium cyanide plant at Vadodara complex of GACL | India | SSC | AMS II D           | Industry | 2003 | - | - | ✓ | PP        | - | - |
| S I 10 | NG Preheating through E 204 coil   | India | SSC | AMS II D           | Industry | 2005 | - | - | ✓ | T, PP     | ✓ | - |
| S I 11 | Installation of Additional Urea Trays in Urea Reactors (11/21- R01)  | India | SSC | AMS II D           | Industry | 2004 | - | - | ✓ | PP, T     | ✓ | - |
| S I 12 | Replacement of BFW pump turbine (TP 601B) by Electric Motor  | India | SSC | AMS II D           | Industry | 2004 | - | - | ✓ | PP, T     | ✓ | - |
| S I 13 | Demand side energy efficiency improvement measures at Tata Chemicals Limited, Mithapur                                 | India | SSC | AMS II C           | Industry | 2003 | - | ✓ | - | I, T, Ins | ✓ | - |
| S I 14 | Supply side energy efficiency measures at Tata Chemicals Limited, Mithapur   | India | SSC | AMS II B           | Industry | 2004 | - | ✓ | ✓ | PP, In, I | - | - |

|        |   |        |     |           |           |      |   |   |   |              |   |   |
|--------|---|--------|-----|-----------|-----------|------|---|---|---|--------------|---|---|
| S I 15 | India - Vertical Shaft Brick Kiln Cluster Project   | India  | SSC | AMS II D  | Industry  | 2004 | - | ✓ | ✓ | PP, T        | ✓ | - |
| S I 16 | ElDorado Energy Efficiency Project  | Mexico | SSC | AMS-II.D  | Industry  | 2005 | - | - | ✓ | C, PP, I     | ✓ | ✓ |
| S I 17 | Lazaro Energy Efficiency Project  | Mexico | SSC | AMS II D  | Industry  | 2005 | - | - | ✓ | C, PP, I     | ✓ | ✓ |
| T 1    | Shift to low greenhouse gas emitting vehicles for materials transport to and from Doom Dooma plant of HLL | India  | SSC | AMS-III.C | Transport | 2004 | - | - | - | In, T, PP, I | ✓ | - |

A - Activities related with the related respective Industry Association; B - Board Resolution, Meeting & Discussion; C - Contract with consultant;

PE - Preliminary emission calculations; Technical PIN Pre-evaluation submissions; R - Research Activity Data; T - Technical equipment details; N - Name sake Argument;

FI - Financial Documents like (Budget Proposal, FI Communications); W - Workshop participation; Meth - Methodology Submissio