

# A Guide to Bundling Small-scale CDM Projects

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This guidebook can be downloaded from [www.cdmpool.com](http://www.cdmpool.com)

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## GLOSSARY OF TERMS RELATED TO THE CLEAN DEVELOPMENT MECHANISM (CDM)

**Additionality:** According to the Kyoto Protocol, gas emission reductions generated by Clean Development Mechanism and Joint Implementation project activities must be additional to those that otherwise would occur. Additionality is established when there is a positive difference between the emissions that occur in the baseline scenario, and the emissions that occur in the proposed project.

**Annex I countries:** These are the 36 industrialised countries and economies in transition listed in Annex 1 of the UNFCCC. Their responsibilities under the Convention are various, and include a non-binding commitment to reducing their GHG emissions to 1990 levels by the year 2000.

**Annex B countries:** These are the 39 emissions-capped industrialised countries and economies in transition listed in Annex B of Kyoto Protocol. Legally-binding emission reduction obligations for Annex B countries range from an 8% decrease (e.g. EU) to a 10% increase (Iceland) on 1990 levels by the first commitment period of the Protocol, 2008-2012.

**Baseline:** The baseline for a CDM project activity is the scenario that reasonably represents the anthropogenic emissions by sources of greenhouse gases (GHG) that would occur in the absence of the proposed project activity. A baseline should cover emissions from all gases, sectors and source categories listed in Annex A (of the Kyoto Protocol) within the project boundary.

**Baseline methodology:** A methodology is a tool to determine the baseline for an individual project activity, reflecting aspects such as data availability, sector and region. In cases where no methodology applicable to the proposed project has been approved by the CDM Executive Board project participants have the opportunity to propose a new methodology.

**Bundling:** refers to combining or aggregating a number (more than one) of small-scale projects and/or project activities into a single emissions reduction project. Small-scale CDM project activities may be bundled at the following stages in the project cycle: the project design document, validation, registration, monitoring, verification and certification.

**Carbon offsets:** offsets are tradable emission reductions that are used to offset emissions from various sources, such as emissions related to personal or business air travel. Offset 'credits' can be generated by a number of activities, most commonly the output of carbon sequestration projects in the forestry sector, or

to refer to the output of any climate change mitigation project more generally. Such credits are then purchased by an organisation/individual that is responsible for the actual emissions ('debits') usually on a voluntary basis.

**Carbon credits:** as for carbon offsets, though with added connotations of (1) being used as 'credits' in companies' or countries emission accounts to counter 'debits' i.e. emissions, and (2) being tradable, or at least fungible with the emission permit trading system.

**Carbon Dioxide Equivalent (CO<sub>2</sub>eq):** The universal unit of measurement used to indicate the global warming potential (GWP) of each of the six greenhouse gases listed in Annex A of the Kyoto Protocol - carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>). Carbon dioxide - a naturally occurring gas that is a by-product of burning fossil fuels and biomass, land-use changes, and other industrial processes - is the reference gas against which other greenhouse gases are measured, and the global warming potential of 1 ton of CO<sub>2</sub> is set equal to 1, for example the GWP of CH<sub>4</sub> is 21 and the GWP of N<sub>2</sub>O is 310.

**CERs (certified emission reductions):** the technical term for the output of CDM projects, as defined by the Kyoto Protocol. One CER is the reduction of 1 tonne of carbon dioxide equivalent.

**Certification:** Certification is the written assurance by the designated operational entity that, during a specified time period, a project activity achieved the reductions in anthropogenic emissions by sources of greenhouse gases (GHG) as verified.

**CDM Executive Board:** The formal governance body established under Article 12 of the Kyoto Protocol to oversee the implementation and administration of the CDM, under the authority and guidance of the COP/MOP.

**Clean Development Mechanism (CDM):** The CDM was established by Article 12 of the Protocol and refers to climate change mitigation projects undertaken between Annex 1 countries and non-Annex 1 countries (see below). Project investments must contribute to the sustainable development of the non-Annex 1 host country, and must be independently certified. This latter requirement gives rise to the term 'certified emission reductions' or CERs, which describe the output of CDM projects, and which under the terms of Article 12 can be banked from the year 2000, eight years before the first commitment period (2008-2012).

**Conference of Parties (COP):** The meeting of parties to the United Nations Framework Convention on Climate Change.

**Crediting period:** The crediting period for a CDM activity is the period for which reductions against the baseline are verified and certified by a designated operational entity for the purpose of issuance of certified emission reductions (CERs). Project participants are able to choose the starting date of a crediting period to be after the date the first emission reductions are generated by the CDM project activity. A crediting period can't extend beyond the operational lifetime of the project activity. The project participants may choose between either a fixed crediting period of 10yrs or three renewable crediting periods of a maximum 7 years each (i.e. maximum 21 years).

**Debundling test:** Debundling is defined as the fragmentation of a large project into smaller parts. A small-scale project activity that is part of a large project activity is not eligible to use the simplified modalities and procedures for small-scale project activities. A debundling test would be carried out to ensure this. A proposed small-scale activity can be deemed a debundled component of a large project activity if there is a registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- With the same project participants;
- In the same project category and technology/measure; and
- Registered within the previous 2 years; and
- Whose project boundary is within 1 km of the project boundary of the proposed small-scale project.

If a proposed small-scale project activity is deemed to be a debundled component, but the total size of such an activity combined with the previous registered small-scale CDM project activity does not exceed the limits for small-scale CDM project activities (paragraph 6(c) of the decision 17/CP.7, then the project activity can use simplified modalities and procedures for small-scale CDM projects.

**Designated National Authority (DNA):** The national authority for CDM designated by the Party to the Protocol.

**Designated operational entity (DOE):** An entity designated by the COP (or MOP), based on recommendation by the Executive Board, as qualified to validate proposed CDM project activities as well as verify and certify reductions in anthropogenic emissions by sources of greenhouse gases (GHG). A designated operational entity shall perform validation or verification and certification on the same CDM project activity. Upon request, the Executive Board may how-

ever, allow a single DOE to perform all these functions within a single CDM project activity.

**Emission Reductions Purchase Agreement (ERPA):** Agreement which governs the purchase and sale of emission reductions.

**Greenhouse gases (GHGs):** These are gases released by human activity that are responsible for climate change and global warming. The six gases listed in Annex A of the Kyoto Protocol are carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), and nitrous oxide (N<sub>2</sub>O), as well as hydrofluorocarbons (HFCs), perfluorocarbons (PFCs), and sulphur hexafluoride (SF<sub>6</sub>).

**Host Country:** The country where an emission reduction project (under Joint Implementation or the Clean Development Mechanism) is physically located.

**Internal Rate of Return (IRR):** The annual return that would make the present value of future cash flows from an investment (including its residual market value) equal the current market price of the investment. In other words, the discount rate at which an investment has zero net present value.

**Kyoto Protocol:** Adopted at the Third Conference of the Parties to the United Nations Convention on Climate Change held in Kyoto, Japan in December 1997, the Kyoto Protocol commits industrialised country ratifiers to reduce their greenhouse gas (or ‘carbon’) emissions by an average of 5.2% compared with 1990 emissions, in the period 2008-2012.

**Leakage:** Leakage is defined as the net change of anthropogenic emissions by sources of greenhouse gases (GHG) which occurs outside the project boundary, and which is measurable and attributable to the CDM project activity.

**Letter of Approval:** A letter issued by the Designated National Authority (DNA) of the Host Country to a CDM Project confirming that the project, as proposed, will assist the Host Country to achieve its goals of sustainable development.

**Monitoring plan:** A set of requirements for monitoring and verification of emission reductions achieved by a project.

**Non-Annex I countries:** Countries which are not listed in Annex I of the UNFCCC (generally developing and least developed countries)

**Non-Annex B countries:** Countries which are not listed in Annex I of the Kyoto Protocol (generally developing and least developed countries).

**Party to the Kyoto Protocol:** A country that has ratified the Kyoto Protocol.

**Project Activity:** A project activity is a measure, operation or an action that aims at reducing greenhouse gases (GHG) emissions. The Kyoto Protocol and the CDM modalities and procedures use the term ‘project activity’ as opposed to ‘project’. A project activity could, therefore, be identical with or a component or aspect of a project undertaken or planned.

**Project Boundary:** The project boundary encompasses all anthropogenic emissions by sources of greenhouse gases (GHG) under the control of the project participants that are significant and reasonably attributable to the CDM project activity.

**Project Design Document (PDD):** A project specific document required under the CDM rules which will enable the Operational Entity to determine whether the project (i) has been approved by the parties involved in a project, (ii) would result in reductions of greenhouse gas emissions that are additional, (iii) has an appropriate baseline and monitoring plan.

**Project Idea Note (PIN):** A note prepared by a project proponent regarding a project proposed for a potential CER buyer, such as the World Bank or SENTER. The PIN is often set out in a given format as with the World Bank which has a PIN that is generic across all World Bank managed funds.

**Registration:** Registration is the formal acceptance by the Executive Board of a validated project activity as a CDM project activity. Registration is the prerequisite for the verification, certification and issuance of CERs related to that project activity.

**Small-scale CDM project activities:** Includes project activities that remain under the limits set out in paragraph 6 (c) of the CDM modalities and procedures, every year during the crediting period. These are:

- Renewable energy project activities with a maximum installed capacity of 15MW;
- Energy efficiency improvement activities up to 15 gigawatthours per year;
- Other project activities that both reduce emissions directly less than 15,000 tonnes of carbon dioxide equivalent per year.

Projects falling within these limits are eligible for the modalities and procedures for small-scale projects.

**Sustainable Development:** The original definition by the Brundtland Commission report (WCED, 198) states that development is sustainable when it ‘meets the needs of the present generation without compromising the ability of future

generations to meet their own needs. Sustainable development is a requirement of CDM projects and it is the responsibility of the host country to confirm whether a CDM project activity assists in achieving sustainable development.

**United Nations Framework Convention on Climate Change (UNFCCC):**

The international legal framework adopted in June 1992 at the Rio Earth Summit to address climate change. It commits the Parties to the UNFCCC to stabilise human induced greenhouse gas emissions at levels that would prevent dangerous manmade interference with the climate system.

**Validation:** The assessment of a project's Project Design Document, which describes its design including its baseline and monitoring plan, by a Designated Operational Entity, before the implementation of the project against the requirements of the CDM.

**Verification:** Verification is the periodic independent review and ex post determination by a designated operational entity against the requirements of the CDM.

**Verification report:** A report prepared by an Operational Entity, or by another independent third party, pursuant to a Verification, which reports the findings of the Verification process, including the amount of reductions in emission of greenhouse gases that have been found to have been generated.

# 1. INTRODUCTION

## 1.1 Background and Context

In 1997, almost 200 countries signed the Kyoto Protocol to the United Nations Framework Convention on Climate Change (UNFCCC). The most important component of the agreement was the establishment of quantitative targets for greenhouse gas (GHG) emissions in industrialised (Annex B) countries. Industrialised countries may meet their targets through a combination of domestic climate change mitigation activities and the use of the Kyoto Mechanisms. One of these mechanisms, the Clean Development Mechanism (CDM), allows developed countries to achieve part of their Kyoto target in a more cost-effective way by implementing projects that reduce GHG emissions in developing (non-Annex I) countries, assisting the latter in achieving sustainable development.

Small-scale energy projects that fit the development needs of developing countries can be supported via investments made through the CDM. Additional financial flows from certified emission reductions (CERs) could become important in many developing, and particularly least developed countries, where they can help to provide much-needed modern energy services and improve living conditions for millions of people in rural communities.

Despite the low prices for CERs and high transaction costs for the development of such projects that have characterised the market to-date, the current pipeline of CDM projects shows that a number of small-scale projects, such as small hydro, are beginning to come on stream with some of the transaction costs reduced through the use of the relevant procedures and modalities<sup>1</sup> developed specifically to ‘fast-track’ projects of this size.

However, the majority of CDM investments are flowing into larger scale projects, whilst projects at the lower end of the small-scale definition, producing very few CERs, are being overlooked for carbon finance.

While these projects are generally of a higher quality in terms of their contribution to sustainable development than larger scale projects, and despite some initial indications from buyers, only small in-roads are being made to increase the value of CERs from small-scale projects. The World Bank’s Community Development Carbon Fund<sup>2</sup>, the non-Kyoto compliance market (for example offsetting of emissions associated with business travel), and the development of the Gold Standard<sup>3</sup> are attempting to lead the way in this field.

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<sup>1</sup> Adopted at the Conference of Parties (COP8) in New Delhi in October 2002.

<sup>2</sup> See the CDCF website for further details: <http://carbonfinance.org/cdcf/home.cfm>.

<sup>3</sup> See the Gold Standard website for further details: <http://www.goldstandard.org>.

One approach to reducing CDM transaction costs is to bundle a number of small-scale projects into a portfolio that can be developed as one larger CDM project as shown in Figure 1. As long as the portfolio is under the limits defined for small-scale projects (see below), they can benefit from reduced transaction costs associated with fast tracking procedures and the spreading of costs across several projects.

It would also mean that every small-scale project developer would not necessarily need to accustom themselves to the complex modalities of the CDM.

This approach has been advocated by a number of commentators; however, in practice there have been few examples of successful implementation in developing countries. There are clearly a number of challenges ahead before bundling can become fully operational. This report will give some guidance on how to bundle successfully, and where appropriate suggest ways of improving existing rules to overcome the high transaction costs for small-scale projects.

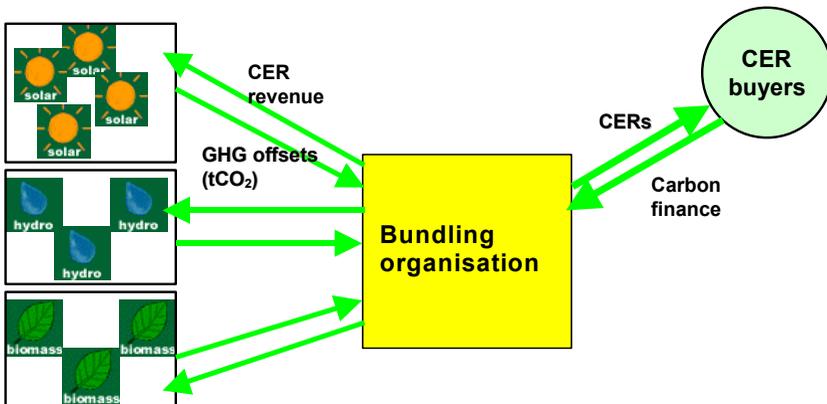


Figure 1 *Bundling Small-scale projects*

## 1.2 Simplified Modalities and Procedures

The importance of small-scale projects in terms of sustainable development and cumulatively for emission reductions has been recognised by governments, and to assist these projects in overcoming the anticipated high transaction costs, the simplified modalities and procedures were developed for small-scale projects defined as:

- **Type (i)** Renewable energy projects with a maximum output capacity of 15 MW;

- **Type (ii)** Energy efficiency improvement which reduce energy consumption, on the supply and/or the demand side, by up to the equivalent of 15 GWh per year; and
- **Type (iii)** Other project activities that reduce anthropogenic emissions by sources, and directly emit less than 15/ktCO<sub>2</sub>eq annually.

Table 1 *Project categories for small-scale CDM projects*

| <b>Project Type*</b> | <b>Project Category</b>   |
|----------------------|---|
| Type (i)             | A. Electricity generation by the user   |
|                      | B. Mechanical energy for the user/enterprise  |
|                      | C. Thermal energy for the user  |
|                      | D. Renewable electricity generation for a grid  |
| Type (ii)            | A. Supply side energy efficiency improvements-transmission and distribution activities    |
|                      | B. Supply side energy efficiency improvements - generation                                |
|                      | C. Demand-side energy efficiency programmes for specific technologies                     |
|                      | D. Energy efficiency and fuel switching measures for industrial facilities                |
|                      | E. Energy efficiency and fuel switching measures for buildings                            |
|                      | F. Energy efficiency and fuel switching measures for agricultural facilities & activities |
| Type (iii)           | A. Agriculture  |
|                      | B. Switching fossil fuel  |
|                      | C. Emissions reduction by low greenhouse emission vehicles                                |
|                      | D. Methane recovery   |
|                      | E. Avoidance of methane production from biomass decay through controlled combustion       |
| Types (i)-(iii)      | Other small-scale projects**  |

\* *In accordance with paragraph 60c) of decision 17/CP.7.*

\*\* *Paragraph 8-10 of the simplified modalities & procedures for small-scale CDM project activities allow project participants to submit a new small-scale project activity category or revisions to a methodology to the Executive Board for consideration and amendment of Appendix B by the Executive Board, as appropriate.*

Each project type is further divided into a number of project categories shown in Table 1 for which simplified baseline and monitoring procedures have been developed.

Compared to large-scale CDM projects the main differences for small-scale CDM projects after applying the small-scale procedures and modalities are:

- **Project Design Document (PDD):** requirements and time taken to complete reduced through simplified PDD particularly in the baseline methodologies, monitoring methodology and plan, additionality checklist and environmental impact requirements discussed below;
- **Baseline methodologies:** simplified standardised baseline methodologies provided for 15 project activities to reduce the cost of developing a project baseline, these methodologies simplify the baseline calculations for example, the use of default emission factors for certain project activities;
- **Monitoring methodology and plan:** simplified monitoring requirements are specified per project category, including a less frequent and reduced monitoring plan, such as the metering of a sample of renewable energy systems;
- **Additionality requirements:** project developers can determine additionality using a simple barrier analysis showing the existence of investment barriers, a technological barriers, barriers due to prevailing practice, or other barriers such as institutional barriers or information requirements that affect the project;
- **Environmental impacts:** documentation of environmental impacts must be provided only if required by host country;
- **Leakage:** no calculation is required if the technology is installed for the first time<sup>4</sup>;
- **Validation/Verification and Certification:** the same designated operational entity (DOE) may undertake validation, and verification and certification;
- **Registration:** a shorter review period for registration is required, and registration costs are lower for small-scale projects (e.g. US\$ 5,000 for emission reductions of 15 ktCO<sub>2</sub>/year and US\$ 10,000 for 15-50 ktCO<sub>2</sub>/year compared to a maximum of \$ 30,000 for larger projects with emissions of more than 200 ktCO<sub>2</sub>/year).

In addition to cost reductions in the project cycle through the above simplifications, the CDM Executive Board has also proposed that several small-scale project activities may be bundled with opportunities for cost reductions possible at the project design, validation, registration, and monitoring/verification/issuance stages.

For example a single PDD could be used for a project bundle and monitoring requirements may be reduced, for example to a sample basis.

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<sup>4</sup> See glossary for definition.

### 1.3 Bundling Experience to Date

Despite the provision by the CDM Executive Board for bundling small-scale projects, there has been little experience to date, as many developers have focused on projects that are more easily developed and particularly those with the highest returns. However, in the growing pipeline of small-scale projects there are a small number of project bundles now being developed. Those at the most advanced stage (post-validation) include a bundle of 9 biomass gasifier plants in Karnataka and Tamil Nadu, India, and a urban housing energy services upgrade project in Kuyasa, Khayelitsha, Cape Town, South Africa<sup>5</sup>, the latter a Gold Standard CDM project. In addition, IT Power is developing a number of projects, some as part of the EU Synergy CDM Pool project and described in Section 4, these include micro hydro, solar, fuel switch/energy efficiency and biogas. Desk studies have shown that bundling can make CDM projects more attractive by increasing internal rates of return by around 1-3%<sup>6</sup>, this is particularly the case for metered small-scale project bundles, as the monitoring costs can be particularly high, even though monitoring of only a sample of individual systems may be required<sup>7</sup>. Experience from the development of ‘real’ projects will be crucial for achieving cost reductions using this approach. Relevant results and information will be available via the CDM Pool website: [www.cdmpool.com](http://www.cdmpool.com).

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<sup>5</sup> See <http://cdm.unfccc.int/Projects/Validation/?archive=yes> for more details.

<sup>6</sup> IT Power and KITE (2002) *Bundling Small-scale CDM Projects*. Report for the UK Foreign and Commonwealth.

<sup>7</sup> ECN, IT Power & IT Power India (2004) *Realising the Potential of Small-scale CDM Projects in India* ([www.cdmpool.com](http://www.cdmpool.com)) ECN, Netherlands, November 2004.

## 2. CHECKLIST REQUIREMENTS FOR BUNDLING

### 2.1 Introduction

The simplified procedures and modalities for small-scale CDM projects adopted by the CDM Executive Board can significantly reduce the transaction costs compared to regular CDM projects. For example, analysis shown in Table 2 for an average-sized small-scale project over a 10-year crediting period can be reduced by nearly 70% compared to an average large-scale project.<sup>8</sup>

Table 2 *Transaction costs of normal and small-scale CDM projects*

|                         |   | Large-scale<br>(average) | Small-scale<br>(average) | Cost reduction<br>[%] |
|-------------------------|---|--------------------------|--------------------------|-----------------------|
| Upfront                 | 1. Project preparation and review             | 71,000                   | 28,400                   | -60                   |
|                         | 2. Project Design Document                    | 9,000                    | 4,800                    | -47                   |
|                         | 3. Validation                                 | 24,000                   | 10,800                   | -55                   |
|                         | 4. Appraisal phase                            | 12,000                   | 6,000                    | -50                   |
|                         | 5. Initial verification (start-up)            | 20,000                   | 3,800                    | -81                   |
| Operation               |   | 6,000                    | 3,000                    | -50                   |
|                         | 6. Periodic monitoring                        | 132,000                  | 30,000                   | -77                   |
|                         | 7. Verification and certification<br>(yearly) | 72,000                   | 12,000                   | -83                   |
|                         |   | 60,000                   | 18,000                   | -70                   |
| Total transaction costs |   | 203,000                  | 58,400                   | -71                   |

*Note: Projects with a crediting period of 10 years are assumed. The small-scale project achieves a yearly reduction of 10-30 ktCO<sub>2</sub>eq. The last column indicates the reduction of the transaction costs for small-scale projects compared to large-scale projects.*

These transaction costs can, in some cases, be even further reduced by bundling of several individual small projects into a single CDM project. Recent bundling proposals by the CDM Executive Board's small-scale working group are summarised in Table 3 with shaded cells showing opportunities for further cost reductions.

<sup>8</sup> ECN, IT Power & IT Power India (2004) Realising the Potential of Small-scale CDM Projects in India ([www.cdmpool.com](http://www.cdmpool.com)) ECN, Netherlands, November 2004.

Table 3 Summary of proposal on bundling for each of the steps in the project cycle (Shaded cells correspond to potential reductions in transaction costs)

| Categories                                 | Design  | Validation  | Registration   | Monitoring  | Verification  | Issuance   |
|--|---|---|--|---|---|--|
| Same category and same measure/technology  | <ul style="list-style-type: none"> <li>- Same PDD</li> <li>- Same baseline (under conditions: same category)</li> </ul> | <ul style="list-style-type: none"> <li>- One DOE - Public comments (common)</li> </ul>                      | <ul style="list-style-type: none"> <li>- One fee</li> <li>- Review for registration on one case affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- Monitoring plan common: same technology/Measure</li> <li>- One monitoring report</li> <li>- Same period</li> </ul> | <ul style="list-style-type: none"> <li>- Same periods</li> <li>- One verification report</li> </ul>                             | <ul style="list-style-type: none"> <li>- Issuance for all at the same time for same period</li> <li>- One serial number</li> <li>- CDM registry</li> </ul> |
| Same category with ≠ measures/technologies | <ul style="list-style-type: none"> <li>- ≠ PDDs</li> <li>- Same baseline (under conditions - same category)</li> </ul>  | <ul style="list-style-type: none"> <li>- One DOE - Public comments on all PDDs affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- One fee</li> <li>- Review for registration on one case affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- Separate monitoring reports</li> <li>- ≠ Periods or same period</li> </ul>   | <ul style="list-style-type: none"> <li>- ≠ Periods or same period</li> <li>- One verification report if same periods</li> </ul> | <ul style="list-style-type: none"> <li>- ≠ Issuances</li> <li>- ≠ Periods or same period</li> <li>- ≠ Serial numbers</li> </ul>                            |
| ≠ Categories and ≠ Measures/technologies   | <ul style="list-style-type: none"> <li>- ≠ PDDs</li> <li>- Different baselines</li> </ul>                               | <ul style="list-style-type: none"> <li>- One DOE - Public comments on all PDDs affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- One fee</li> <li>- Review for registration on one case affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- Separate monitoring reports</li> <li>- ≠ Periods or same period</li> </ul>   | <ul style="list-style-type: none"> <li>- ≠ Periods or same period</li> <li>- One verification report if same periods</li> </ul> | <ul style="list-style-type: none"> <li>- ≠ Issuances</li> <li>- ≠ Periods or same period</li> <li>- ≠ Serial numbers</li> </ul>                            |
| ≠ Types                                    | <ul style="list-style-type: none"> <li>- ≠ PDDs</li> <li>- Different baselines</li> </ul>                               | <ul style="list-style-type: none"> <li>- One DOE - Public comments on all PDDs affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- One fee</li> <li>- Review for registration on one case affect the bundle</li> </ul> | <ul style="list-style-type: none"> <li>- Separate monitoring reports</li> <li>- ≠ Periods or same period</li> </ul>   | <ul style="list-style-type: none"> <li>- ≠ Periods or same period</li> <li>- One verification report if same periods</li> </ul> | <ul style="list-style-type: none"> <li>- ≠ Issuances</li> <li>- ≠ Periods or same period</li> <li>- ≠ Serial numbers</li> </ul>                            |

≠ denotes 'not the same' for example, PDD.

Note: Annex 1 of the Report of the Second Meeting of the Small-scale Working Group, 16-17 May, 2005, Bonn, Germany see [http://cdm.unfccc.int/Panels/ssc\\_wg\\_for\\_further\\_details](http://cdm.unfccc.int/Panels/ssc_wg_for_further_details)

## 2.2 Eligibility Requirements

Eligibility requirements consist of two types of requirements: firstly, the (bundled) project has to fall under one of the three project categories defined by the CDM Executive Board; and, secondly, the (bundled) project must be additional. Although Table 3, shows that it may be possible to still reduce some transaction costs, such as for registration, for projects with different baseline methodologies, it is highly recommended to avoid these types of project bundles as very few cases will result in reduced transaction costs, particularly when additional PDDs, separate monitoring plans and reports etc are required. The eligibility requirements are schematically presented in Figure 2 and a simple tool based on this flow chart to determine whether or not potential projects are eligible for the CDM can be found at [www.CDMpool.com](http://www.CDMpool.com).

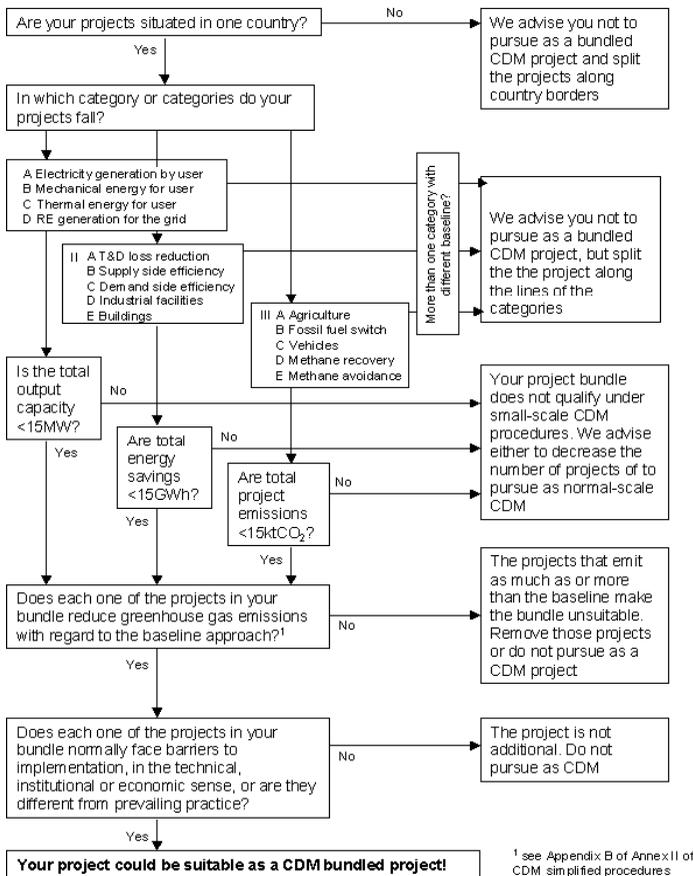


Figure 2 Flow chart to check CDM eligibility for potential bundled projects

### 2.3 Sustainable Development Requirements

Sustainable development requirements have to be met to gain the necessary approval by the host country. These requirements are related to social, environmental, economic and technological aspects and are set by the host country. These aspects will probably vary from country to country and therefore sustainable development criteria will be different in different countries. In India, the Ministry of Environment and Forests (MOEF) has formulated interim sustainable development criteria but these criteria are not very clearly defined and the associated indicators to enable an objective evaluation of the criteria have not yet been developed. In anticipation of more concrete guidelines, Table 4 presents an example set of indicators that can be used for evaluating the sustainable development requirements. This is by no means an exhaustive list, and the level of relevance of each indicator will depend on the host country in question.

Table 4 Sustainable Development Indicators<sup>9</sup>

|               | Dimension evaluation                  | Indicator for evaluation   | Unit             | Rationale  |
|---------------|---------------------------------------|--|------------------|--|
| Social        | Poverty alleviation                   | Net employment generation  | Person-year/year | Employment provides people with a regular income which helps them to improve their personal economic situation.  |
|               | Equal distribution                    | Ratio of income for poor compared to total income generated by the project or alternatively proportion of total job creation for vulnerable sections of society (e.g. rural women) | %                | Equal distribution is a crucial point for sustainable development.   |
|               | Local area development                | Proportion of total capital/operating costs investment that flows into local economy (through sourcing of goods and services)  | %                | The proportion of investment that stays in the local area is extremely important for local development.  |
|               | Capacity building                     | Number of local people acquiring new skills  | No. of people    | Training and other capacity building impacts of the project can have significant social benefits.  |
| Economic      | Micro economic efficiency             | Economic Internal Rate of Return (EIRR)  | %                | The EIRR measures the microeconomic efficiency of projects. It shows to what extent the flows on the project level produce revenues on the investment. |
|               | Contribution to balance of payments   | Net foreign currency required/MW installed capacity  | USD/MW           | This indicator aims at the macro-level. If less foreign capital is needed to implement a particular project the national balance of payment improves.  |
| Environmental | Saving of resources                   | Fossil fuel, water, soil, biodiversity, etc  | T/year           | The most important resource has been chosen and its saving can be evaluated.   |
|               | Pressure release on local environment | SPM/ SO <sub>2</sub> /NO <sub>x</sub> emissions  | Tonnes           | The most important local can be chosen and its reduction can be evaluated.   |

## 2.4 Financial requirements

Financial requirements related to the CDM part of bundled projects are determined by the transaction costs incurred by CDM, any costs related to bundling itself. Other necessary project finance aspects related to the non-CDM part, such as principal capital for the physical assets, remain relevant but are not considered here. The transaction costs for bundled projects basically consists of two items:

- Upfront costs related to the CDM project cycle and organisational aspects of the bundle;
- Yearly running costs related to verification and certification of CERs generated.

<sup>9</sup> Adapted from Factor Consulting + Management AG and Dasag Energy Engineering Ltd. 2001.

The effect on transaction costs of bundling individual projects into a single CDM project on is presented in Table 5. In the first column, transaction costs are given for an individual project in the low-end range of small-scale (less than 10,000 ton CO<sub>2</sub> per year). The second column presents the transaction costs for a bundle consisting of projects that are metered (connected to the grid) and, finally, the third column presents the same information for a bundle consisting of projects that are not metered (off-grid projects).

The distinction between metered and non-metered projects is relevant because the verification costs for metered projects are substantially lower than for a project without a meter, that is assuming the cost of the meters is not excessive and particularly if the meters would have been implemented normally in the absence of CDM. If the bundled project is metered, verification can be done simply by reading the meter. If, however, the bundle consists of technologies without a meter, the CDM Executive Board guidelines stipulate that verification must be done by means of an annual check of the operational status of a representative sample of the systems included in the bundle. This, however, involves much more effort than simply reading the meter and verification costs are, therefore substantially higher.

Table 5 *Estimated transaction costs*

|   | Single small low-end project | Bundle of metered projects | Bundle of projects without a meter           |
|---|------------------------------|----------------------------|--|
| <i>Establishment of bundling organisation</i>             |                              |                            |  |
| Development of registry                                   |                              | 4,500                      | 4,500  |
| Building of capacity                                      |                              | 9,000                      | 9,000  |
| General costs   |                              | 3,000                      | 3,000  |
| <i>CDM Project Cycle</i>                                  |                              |                            |  |
| Project preparation                                       | 4,800                        | 5,400                      | 5,400  |
| Project Design Document                                   | 10,800                       | 12,000                     | 12,000                                       |
| Validation  | 6,000                        | 7,200                      | 7,200  |
| Appraisal phase   | 8,000                        | 13,000                     | 13,000                                       |
| Initial verification                                      | 3,000                        | 3,600                      | 3,600  |
| <i>Operation</i>  |                              |                            |  |
| Verification  | 1,200                        | 1,800                      | 78,000                                       |
| Certification   | 3,000                        | 3,000                      | 3,000  |
| Present Value (PV) Transaction costs as % of CER revenues | 21.0%                        | 9.9%                       | 69.1% (price US\$ 4)<br>39.5% (price US\$ 7) |

Notes:

- 1) It is assumed that the emission reduction of the bundled project (both metered and non metered) is 30,000 CO<sub>2</sub>eq per year.
- 2) The bundle consisting of non-metered technologies includes 120,000 very small systems (average emission reduction per system is 250 kg CO<sub>2</sub> per year).
- 3) Discount rate applied is 8% and the present value calculations are based on a crediting period of 10 years.

Clearly, taking into account only transaction costs and CER revenues, a project would only be financially viable if the bundle generates at least 10,000 tonnes of CO<sub>2</sub> per year and consists of projects that are metered. However, when considering the viability of a project, one would need to consider the return on investment from both the carbon revenues and the often higher non-carbon revenues, such as electricity sales. Therefore, more relevant experience on the actual scope for increasing the viability of small-scale CDM projects through bundling can be obtained from the development of ‘real’ case studies, such as those discussed in Section 4.

## 2.5 Legal requirements and risks

There are number of legal requirements and agreements that will have to be fulfilled or negotiated when developing a CDM project. Project bundling can actually increase these requirements as the project may well include a greater number of project participants than with a normal CDM project. Any contracts and agreements will have to be integrated into the overall project structure to ensure the successful implementation and operation of the CDM project and share risks (e.g. for non-delivery of CERs), responsibilities (e.g. for carrying out monitoring of individual projects) and benefits (e.g. for sharing of CERs) to the appropriate parties. The costs and time required to put in place and negotiate these CDM related agreements, such as the carbon contract, will be part of the CDM transaction costs and should be accounted for accordingly. The exact types of agreement or contracts required will vary from project-to-project, however some template documents for the sale of CERs have been made available by IETA<sup>10</sup> and UNEP<sup>11</sup> as a starting point for both project developers and buyers.

Figure 3 shows the kind of agreements that might need to be secured for a project bundle and how these might fit within an overall project structure. In addition to the CDM related legal requirements will be a host of project related agreements for such things as loan agreements, technology supply contracts, construction agreements, operation & maintenance contracts, power purchase agreements, environmental permits, land lease agreements, power generation licenses, right of way etc.

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<sup>10</sup> IETA (2004) CDM Emission Reduction Purchase Agreement. International Emissions Trading Association (IETA), Toronto, Canada, Geneva, Switzerland.  
<http://www.ieta.org/ieta/www/pages/download.php?docID=311>.

<sup>11</sup> Draft Contract for Direct Sale of CERs & Draft Contract where CER Buyer has an underlying interest in the project. See *Legal Issues Guidebook to the CDM*. Prepared by Baker & McKenzie, London for UNEP Riso Centre on Energy, Climate & Sustainable Development: Roskilde, Denmark  
<http://www.cd4cdm.org/Publications/CDM%20Legal%20Issues%20Guidebook.pdf>.

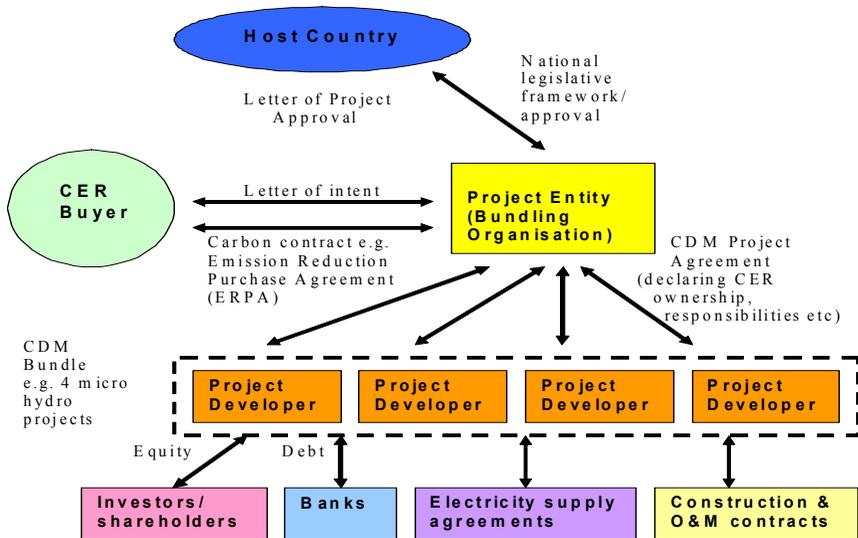


Figure 3 *Legal Agreements for CDM Projects*

In addition to legal requirements, there are also several risk factors that have to be taken into account by the bundling organisation before the decision is made to develop a bundled small-scale CDM project. Two specific types of risks can be distinguished, CDM related risks and normal project risks. The CDM specific risk include for example:

- **CDM Licensing/Regulatory:** These risks are associated with the CDM project cycle itself as at all stages - appraisal (PDD), monitoring, verification, certification, registration - there is risk of delays, for example if application of the baseline methodology needs revising, or non-approval, for example for registration. The largest risk will be that the project does not make it to registration with some transaction costs already paid out and an agreement for sale of CERs already in place. There are also risks associated with the crediting period itself, with no concrete system in place post-2012 and for projects with a crediting period of 21 (3x7) years there could be risks, after 7 and 14 years, for example: reductions in the crediting of emission reductions when the project baseline is reviewed;
- **Political Risk:** These are risks associated with those factors under the control of the Government in the country of implementation. These include the risk of failure to gain host country approval, particularly as many countries are still in the process of setting up a fully functioning Designated National Authorities (DNAs) or criteria for approval such as sustainable development criteria are still to be fully developed. Other risk factors include regulatory

change which could affect the viability of a project and in some cases the baseline (particularly in projects to be renewed after 7 years), and changes in tax which could affect the CER revenue, for example if a country introduced a tax on CERs;

- *Carbon Market/Financial*: As the carbon market is still immature and illiquid, there is still great uncertainty about the prices. This means that the sale of CERs bears the risk of market prices for CERs rising above the price set in the contract. However, it is expected that trading activity will increase with the increasing number of registered CDM projects and the introduction of the European Union Emissions Trading Scheme (EU ETS) in January 2005 including a link for CERs, the uncertainty about the price of carbon credits will decrease as the market becomes more liquid. Furthermore, some buyers are offering more flexible and dynamic emission reduction purchase agreement (ERPA) terms with prices indexed to market prices allowing the buyer and seller to share this risk. Other financial risk relates to the currency used for sale of CERs, however, in some cases having revenue from CERs in a hard currency (e.g. US dollars, Euros etc.) can offset some of the main project risk related to the currency of the host country which is likely to be more open to large fluctuations in relative value.

Furthermore, the project developer runs the normal project risks, which include:

- *Cost/Delay*: These risks relate to long delays or extra costs due to licensing and *permitting* barriers with different probabilities at different stages of the project, such as the development, construction, start-up and operation phases;
- *Technology*: Less than expected performance of the project as a result of, for *example*, poor technology performance, could result in less GHG reductions and therefore fewer revenues from the CDM project, and in some cases cost penalties for non-delivery.

Contractual arrangements, if properly structured, can be used to minimise risk or allocate those risks to an entity that is best able to control. For example where a project bundle includes a large number of small installations, such as solar systems, operation and maintenance contracts to installers or standard seller warranties and indemnities to technology providers may be included to minimise project performance risk as well as ensure regular monitoring. The price of CERs agreed with a carbon buyer will usually reflect risk sharing in the contracts.

The risks discussed above are generally found in any normal CDM project, and it is important to realise that the nature of bundling itself results in additional risks, mainly due to the increased number of parties, locations, often technolo-

gies and whole host of uncertainties that are increased with a project bundle compared to a single CDM project. These are particularly important considering the recent recommendations by the CDM Executive Board's small-scale working group.<sup>12</sup> For example, when submitting a project bundle for registration, a request for review of an individual component of the project would lead to the whole project bundle being affected. Similarly, the failure of individual projects can threaten the viability of the whole bundle, and risk mitigation techniques will be important to minimise the risk of shortfalls in expected yearly CER generation.

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<sup>12</sup> See [http://cdm.unfccc.int/Panels/ssc\\_wg](http://cdm.unfccc.int/Panels/ssc_wg).

### 3. BUNDLING ORGANISATION

#### 3.1 Introduction

To achieve the successful implementation, registration and operation of a bundled CDM project, the task of bundling needs to be carried out by a competent organisation with sufficient skills and capacity to undertake what is often a more complex task than the development of a normal, single CDM project. This section will focus on the establishment and role of a bundling organisation.

#### 3.2 Required Skills and Capacity

A bundling organisation will require a wide range of skills to develop successful project bundles, and this capacity relates directly to the role that the organisation carries out. Figure 4 shows the role of the bundling organisation in the CDM project cycle which includes project identification, feasibility, development, implementation and finally verification/certification/issuance of CERs. It will quite obviously not be efficient for the intermediary to carry out all these functions, and to cut costs, they need to be carried out by, or outsourced to, specialist organisations. For example, installing monitoring equipment may be carried out by the other entities, such as individual project developers, however, the bundling organisation will be responsible for making sure this is carried out via contractual agreements.

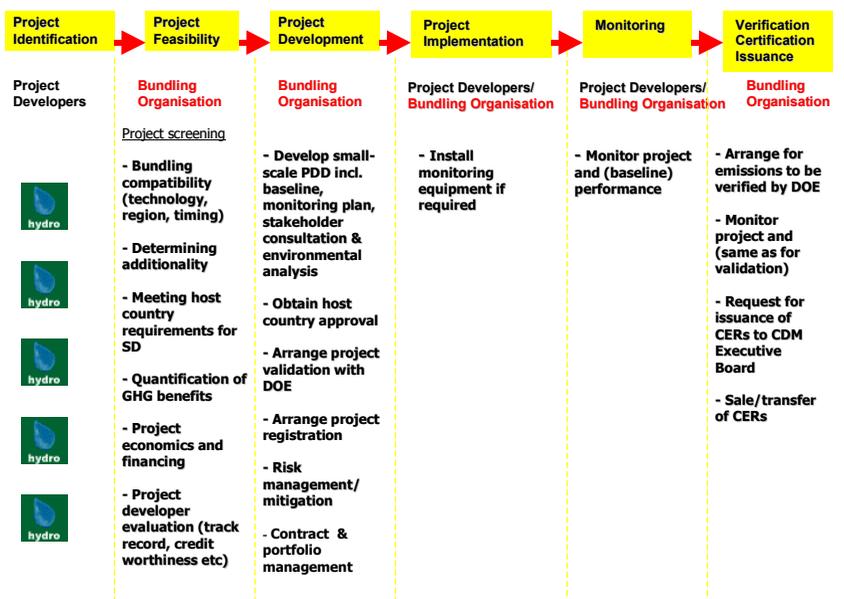


Figure 4 *The Role of the Bundling Organisation - CDM Project Cycle*

The skills required to take on this role include:

- Knowledge and expertise of CDM including development and application of appropriate baseline methodologies and monitoring and verification plans;
- Capacity to screen for and select suitable projects for CDM project bundles that have enough similarities to reduce transaction costs for individual projects;
- Contract and portfolio management to manage a complex arrangement of contracts and relationships with a multitude of project developers, financiers, sub-contractors, validators, carbon credit buyers, etc.;
- Risk/financial management, including use of risk management tools, risk allocation, insurance, joint ventures, etc.;
- Ability to market CERs to buyers to maximise carbon asset value and returns;
- Ability to market CDM bundling services to project developers to ensure a pipeline of suitable projects. This may mean promotional activities for offering bundling services through existing project developer networks, such as trade associations, workshops, advertisements etc;

- Credibility (reputation) and stability (financially), for raising finance, gaining trust and credit worthiness<sup>13</sup>, to assure project developers that they are able to secure carbon finance and to provide confidence to carbon buyers that they will be able to deliver the CERs.

As most organisations are unlikely to have all of the required skills, capacity building activities may be required, including training courses, hiring of relevant and experienced staff, development or purchase of appropriate tools, and contracting out or strategic partnerships with other organisations.

### 3.3 Type of Organisations

In essence, any type of organisation can become a bundling organisation, but not all of these organisations will be able to carry out the activities efficiently to ensure sufficient cost reductions and the development of successful bundles. The key requirements discussed above show that it is necessary for the bundling organisation to be able to organise the development of a CDM project through the whole of the CDM project cycle and set up and manage a series of contracts and relationships with other entities, in a way that allocates risks, costs and rewards in a manner that satisfies all parties. Suitable candidates will need to view bundling in-line with their main business objectives. Therefore potential bundling organisations could include:

- Private companies, such as energy service companies (ESCOs) or financial institutions (such as those that already invest in project activities which reduce emissions) that may wish to be involved if the business case is strong enough;
- Governmental or non-governmental organisations (NGOs), for reasons associated with rural/sustainable development, poverty alleviation and the provision of essential services;
- Trade or industrial associations to enhance the business of their members;
- Equipment manufacturers or distributors, to increase the sales of a technology;
- Turn-key contractors or small project engineering contractors (including O&M companies), to enhance the viability and revenues of their projects.

Figure 5 gives an example of a candidate organisation from India that is currently exploring this role in addition to the services it already provides. This organisation was selected from a number of organisations, including a Trade Association, an ESCO, and a number of finance institutions, who expressed interest in participating in the CDM Pool project.<sup>14</sup>

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<sup>13</sup> A key determinant when assessing project risk from a CER buyers perspective.

<sup>14</sup> Details of the selection procedure can be found at [www.cdmpool.com](http://www.cdmpool.com).

### ***IREDA - Indian Renewable Energy Development Agency***

IREDA is a Public Limited Government Company, established in India in 1987 under the administrative control of the Ministry of Non-Conventional Energy Sources (MNES), to promote, develop and extend financial assistance for renewable energy and energy efficiency/conservation projects for sustainable development in India.

IREDA is in a good position to take advantage of the opportunities afforded by carbon finance for meeting IREDA's objectives which are to:

- operate a revolving fund for new & renewable sources of energy;
- assist in the rapid commercialisation of new & renewable sources of energy;
- assist in the upgrading of new & renewable sources of energy technologies;
- promote energy efficiency & conservation.

Apart from the CDM's role in enabling some of the large-scale projects within IREDA's remit to go ahead, the majority of projects being targeted by IREDA are small-scale, and taking on the role of a bundling organisation could help:

- reduce CDM transaction costs to allow access to carbon finance for small-scale renewable energy and energy efficiency/conservation projects;
- add carbon finance to help overcome barriers to new and renewable sources of energy;
- maximise carbon revenues by acting as a single contact for carbon buyers.

IREDA is well-positioned to act as a bundling organisation as it has 18 years of experience in project identification and appraisal, investment/financial analysis, financial/portfolio management and marketing its opportunities and programs particularly to small-scale project developers. It has other useful attributes such as credibility, financial standing and importantly access to finance. Project appraisal and CDM project development skills have been noticeably absent; however, this is being addressed through training activities supported by the EU Synergy project and other ongoing national capacity building programs, as well as an internal commitment to develop such skills.

Figure 5 *An example of a candidate bundling organisation in India*

### **3.4 Business Plan for a CDM Bundling Organisation**

The business plan developed in this handbook is based on the situation in India and is focused on creating a strategic business unit that is either independent or attached to an existing organisation. However, the same approach could be used by any organisation as a basis for their own business plan, taking account of specific local conditions.

The text in Annex 2 can be used as part of a business plan by any organisation wishing to develop a bundling organisation.

## 4. REPRESENTATIVE PROJECT BUNDLE EXAMPLES

### 4.1 Introduction

To gain a better understanding of the key issues when developing CDM bundles, three case studies from India were selected and compared. These projects were selected from project concept notes (PCNs) submitted by various project developers for consideration under the CDM Pool project, using screening criteria designed through stakeholder consultation in a series of workshops in India. The first stage of this selection was to check eligibility for CDM bundling using the flow chart set out in section 2, and a number of projects were ‘screened out’ at this stage. The selected projects were:

1. Biomass gasification power plant bundled project;
2. Energy efficiency in water heating using LPG based water heaters bundled project;
3. Solar home systems and solar lanterns bundled project.

The projects bundles selected were either similar technologies in similar geographical area or similar technology in different geographical area, as projects can be developed using the same baseline methodology for all technologies within the bundle. Very different technologies, would require different baselines for each technology which would not necessarily reduce transaction costs (the purpose of bundling), similarly different geographical areas could also require different baselines in some cases, for example where. This latter issue was one that was explored further using the case studies.

The selected projects were at different stages of planning and implementation. This helped in analysing issues on additionality. Both the energy efficiency and the solar bundled projects were implemented before registration as CDM projects, requiring documentation determining additionality and proving that the incentives and benefits created by CDM was seriously considered at the planning stage of the project. Issues such as baseline, monitoring, additionality, sharing/ownership of CERs, ownership and risk sharing are presented in the table below. An example project concept note (PCN) is given in Annex 3, and PCNs for the other two projects can be downloaded from [www.cdmpool.com](http://www.cdmpool.com).

|                             |  |   |  |
|-----------------------------|--|---|--|
| <b>Project Name</b>         | <b>Biomass Gasification Bundled project</b>  | <b>LPG water heater Bundled project</b>                                     | <b>Solar Home Systems and Solar Lanterns Bundled project</b>         |
| <b>Location</b>             | <b>Ramanthapuram, Tamil Nadu</b>   | <b>India (country-wide)</b>   | <b>West Bengal, India</b>  |
| <b>Developer</b>            | <b>Southern Green Power Pvt. Ltd</b>   | <b>Shri Shakti Alternative Energy Ltd.</b>                                  | <b>Market Dynamics Pvt. Ltd.</b>                                     |
| <b>Description</b>          | Development of five individual 1 MW biomass gasification power stations feeding electricity to the state grid. The biomass feedstock to be used is the locally available <i>Prosopis Juliflora</i> . | Replace existing storage type electrical water heaters by gas water heater. | Provide home lighting solution to communities in the off-grid areas. |
| <b>Scale</b>                | Small-scale (<15 MW), the scale of this project is $5 \times 1 \text{ MW} = 5 \text{ MW}$ .  | Small-scale -aggregate energy savings does not exceed 15 GWh per year.      | Small-scale (<15 MW)   |
| <b>Type</b>                 | Type I.D   | Type I.I.C  | Type I.A   |
| <b>Name of the category</b> | Renewable electricity generation for a grid  | Demand-Side Energy Efficiency Programmes for specific technologies          | Electricity generation by the user                                   |
| <b>GHG abated</b>           | Carbon dioxide   | Carbon dioxide  | Carbon dioxide   |
| <b>Crediting period</b>     | 2006-2015 (10 years)   | 2004 to 2013 (10 years)   | 2001 to 2010 (10 years)  |

| Project Name   | Biomass Gasification Bundled project  | LPG water heater Bundled project   | Solar Home Systems and Solar Lanterns Bundled project   |
|--|---|--|---|
| <b>Baseline methodology</b>                              | <p>Standardised baseline for small-scale renewable electricity generation for grid.</p> <p>Refer to Annex I -Modalities and Procedure for small-scale CDM projects Type I.D projects.</p>                               | <p>Standardised small-scale methodology for this type of project. The methodology uses sales projections of the devices and emission coefficient of the grid in the area.</p> <p>Refer to Annex I -Modalities and Procedure for small-scale CDM projects Type II.C projects.</p> | <p>Standardised small-scale methodology for this type of project. The methodology uses sales projections of the devices. The emission reductions are assumed to correspond to the number of units sold multiplied by an IPCC emission factor for diesel gensets and integrated over the number of years relevant for crediting.</p> <p>Refer to Annex I -Modalities and Procedure for small-scale CDM projects Type I.A projects.</p> |
| <b>Outline of baseline</b>                               | <p>The baseline is the kWh produced by the renewable generating unit multiplied by an emission coefficient (in kgCO<sub>2</sub>/kWh) corresponding to the weighted average emissions of the current generation mix.</p> | <p>The energy baseline is multiplied by an emission coefficient for the electricity displaced. This coefficient will correspond to the weighted average emissions of the current generation mix (in kgCO<sub>2</sub>/kWh).</p>   | <p>The energy baseline is the fuel consumption of the technology that would have been used in the absence of the project activity. The measured service level in the project case is used to determine the emission reductions.</p>   |
| <b>Total reductions for projects in CO<sub>2</sub>eq</b> | <p>Approx. 250,000 tCO<sub>2</sub>eq/over 10 years crediting period.</p>  | <p>1.72 million tCO<sub>2</sub>eq over 10 years crediting period.</p>  | <p>Approx. 21,000 tCO<sub>2</sub>eq over a 10 year crediting period.</p>  |

| <b>Project Name</b>  | <b>Biomass Gasification Bundled project</b>  | <b>LPG water heater Bundled project</b>   | <b>Solar Home Systems and Solar Lanterns Bundled project</b>   |
|--|--|---|--|
| <b>Determination of additionality</b>  | CER revenues increase the IRR of the project from 12.9% to 15.6% making it comparable to alternate options. In absence of CERs the project is least attractive among other available options i.e. investment barrier.  | Investment barrier and market barriers addressing investment cost, competitive use of LPG, and uncertainties in prices & government policies. | Investment barriers and market barrier analysis to address the investment requirement for such projects and market uncertainties to promote such projects even where limited government support is available.  |
| <b>Main risks involved in this project</b>   | One project implemented and monitored for performance. Based on the performance evaluation the other four projects implemented in phases.<br><br>Performance risks associated with new technology.<br><br>Very few installations globally.   | Lower sales than expected.<br><br>Monitoring difficulties.  | The market for solar is currently supported by the Government, both at the national & state level. The removal of state support to solar in the future might affect the project viability. Limited financial means by the end-user. Its ability to pay is uncertain. |
| <b>Contribution to sustainable development (environmental &amp; socio-economic impacts, technology transfer effects)</b> | Avoided GHG emission from conventional power plants.<br><br>Avoid the emission of other pollutants emitted if the biomass is burned in an uncontrolled manner or dumped.<br><br>Positive impact on poverty reduction due employment creation for biomass collection and transport. | Avoided GHG emission from conventional power plants.<br><br>Transfer of technology by the import of the units.                                | Avoided GHG and indoor air emissions from fossil fuels.<br><br>The availability of light gives access to more activities in education and small-scale economic activities fundamental to meet basic needs of the concerned population.                               |
| <b>Project cost estimate</b>   | \$ 5.72 million  | \$ 12.39 million  | \$ 10 million  |

| <b>Project Name</b>                     | <b>Biomass Gasification Bundled project</b>   | <b>LPG water heater Bundled project</b>   | <b>Solar Home Systems and Solar Lanterns Bundled project</b>            |
|---|---|---|---|
| <b>Source of Carbon finance</b>         | Loan from State Bank of India   | Applied for Loan from IFC   | Applied for Loan from IREDA<br>Subsidy from MNES, No ODA                |
| <b>Indicative ER price</b>              | 5.5 \$US/tCO <sub>2</sub> eq  | 5 \$US/tCO <sub>2</sub> eq  | 5 \$US/tCO <sub>2</sub> eq  |
| <b>Forecast Internal rate of return</b> | IRR - 13% without CDM<br>IRR - 15.6 % with CDM  | IRR - 18.2 % without CDM<br>IRR - 20.2 % with CDM   | IRR - Standalone - 29.35 %<br>IRR - Carbon Inclusive - 30.27%           |
| <b>CER ownership</b>                    | CERs will be owned by the project developer.  | CERs will be transferred from the final user to the bundling organisation. The latter will provide full maintenance service.  | CERs passed on to the end user in the form of maintenance services.     |
| <b>Outline of monitoring plan</b>       | Using a meter on each gasifier plant to monitor annual electricity delivered to grid. | If the devices replace existing devices, the number and power of the replaced devices shall be recorded and monitored.<br><br>The power & operating hours OR the energy use of the devices will be monitored (methods are given in the modalities & procedures for this type of project).<br><br>The monitoring shall include annual checks of a sample of non-metered systems. | Annual check of the system performance of a sample of lanterns and SHS. |

## 4.2 Lessons learnt

Some of the key lessons learnt from comparison of the above three projects indicate that

- The highest transaction cost is estimated for the energy efficiency bundle followed by the solar and biomass gasification bundle, with estimates for the upfront transaction costs in the USD90,000-120,000 range. The differences are mainly because of the extra complexities in developing the baseline and monitoring plan, and contractual arrangements with more entities particularly in the energy efficiency bundle where individual technologies will be implemented by a number of different distributors to a wide range of end users;
- The transaction cost of the project increases with increase in the complexity of baseline (geographical spread). The biomass bundle is restricted to one state, solar project in one region and energy efficiency project is at country level. The monitoring and verification cost is the major cost associated with energy efficiency and solar project as they are non-metered and spread very widely;
- The biomass gasification and energy efficiency project bundle are viable project bundles and the solar project is least attractive as CDM projects. The solar project bundle with 23,500 solar home systems and 12,500 solar lanterns will account for only 2100 ton of CO<sub>2</sub>eq per year and generating approx US\$ 10,000 per year. One option for this project could be to sell CERs in the retail market where carbon offsetting prices may be higher than the compliance market. The solar bundle will only be attractive at prices nearer US\$ 20 per ton of CO<sub>2</sub>eq, and may be better served by focusing on the retail market where potential buyers may be looking for low numbers of credits from a project with very high sustainable development benefits;
- Baselines for bundles using the same technology for a project in similar geographical locations has the advantage of using the same baselines for all projects e.g. in the solar bundle, solar home systems and solar lanterns were bundled together in areas where there is no grid and kerosene lamps are presently used for lighting. In this case a default value for diesel genset emissions can be used by applying the relevant standardised baseline;
- Projects implemented before registration under by the CDM Executive Board should be applying for registration before December 31, 2005. In addition, for determining additionality it will be necessary to provide documentation proving that CDM was seriously considered at the planning stage of the project. The energy efficiency and solar bundle projects were projects that have already started implementation, whilst the biomass project is in the process of implementation. In all three bundles CDM revenues were included in the business plan submitted to financial institutions. In addition correspondence regarding carbon finance between the project developers,

government institutions (including the national focal point and designated national authority) and financial institutions are available for each project;

- Bundles that involve projects developed by a single project developer may be far simpler in contractual terms with related legal and organisational costs minimised. For example the case of the Biomass gasification bundled project is shown in Figure 6;
- Where five 1MW project bundles are developed by a single project developer who negotiates finance and all the agreements related to both the project and carbon components;
- Bundling small-scale projects where there is either a large number of project developers involved, for example technology manufacturers, dealers and distributors will be far more complex contractually as each will depend on their own project financing and will require a separate CER sharing agreements, which may include not only the sharing of CDM revenues but also possibly transaction costs, monitoring responsibilities and risks. For projects, such as the solar and energy efficiency bundle this is complicated further by the fact that end-users are making the emission reductions. In the case of the end users efforts were made to overcome some of these complexities and costs by lowering the cost of technology or providing free maintenance contracts in exchange for rights to the emission reductions and permission to retrieve monitoring data for verification purposes.

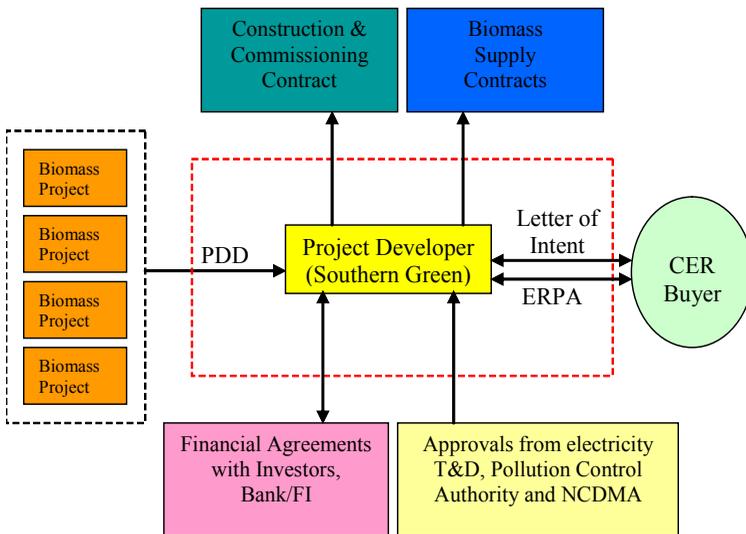


Figure 6 Contractual agreements in bundling with single project developer in a bundle

Further lessons will be learnt as projects are developed further and implemented, particularly in the case of the energy efficiency and biomass gasification projects for which PDDs are being prepared. The development of the solar bundle may still be inhibited by high transaction costs and low CER prices, and as discussed earlier it is envisaged that this solar project could possibly be developed as a carbon offsetting project for the retail market.

## 5. CONCLUSIONS AND RECOMMENDATIONS

The addition of revenues from carbon finance has the potential to enable a wide variety of small-scale energy projects, many of which are the most appropriate option for sustainable development in many less developed and developing countries which have a high demand for modern energy services but often limited access to large quantities of project finance. Although for many small-projects, given current market prices and transaction costs, the CDM may not enhance viability, bundling projects within the small-scale limits and following the guidelines set out in this handbook, can widen access to carbon markets and enable more of this small-scale potential.

In order to develop and successfully implement small-scale CDM project bundles, the following are recommended to project developers:

- *Bundling*: projects can be bundled at various stages of the project cycle to reduce costs, such as the project design document, validation, registration, monitoring, verification and certification. However, the greatest transaction cost reductions can be achieved if projects are bundled at the earliest opportunity i.e. at the project design stage;
- *Screening*: an initial screen should be carried out to assess the eligibility of projects for both CDM in the country to be implemented and for bundling (including a debundling test) using the bundling eligibility tool illustrated in Figure 2, Section 2;
- *Project assessment and evaluation*: individual small-scale projects should be assessed individually to identify project finance commitments, sources or requirements, timing of implementation, and all project related risks. A full analysis of all CDM and bundling related costs/revenues and risks should be evaluated before proceeding with development. Projects with low returns from CERs, particularly compared to transaction costs, and uncertain CER generation should not be developed further for CDM unless revenues can be increased due to high sustainable development benefits particularly in the retail market;
- *Baseline and monitoring plans*: project bundles should be limited to include individual projects that can apply common baselines and monitoring plans, except in cases where a very simple second baseline can be applied in line with CDM rules without resulting in excessive costs or lowering the financial viability of the portfolio;
- *Monitoring techniques*: low cost and innovative monitoring techniques should be used and combined with the normal operation of projects, for example as part of the operation and maintenance service (O&M) or through electricity meters; *Bundle size*: project bundles should be as large as possible whilst keeping within the small-scale size limits. Optimisation of the bundle size will entail an evaluation of the transaction costs and revenues;

- *Development stage/timing of the projects*: individual projects should be in a similar development stage to synchronise the CDM project cycle for the overall portfolio;
- *Bundling organisation*: bundling should be carried out by a competent organisation with the necessary skills to successfully organise, develop and facilitate project portfolios and to act as a single contact point for the carbon buyer. Attributes of the bundling organisation should include: in-depth knowledge of the CDM project development process; credit worthiness, project, financial and risk management;
- *Marketing*: the bundling organisation should develop a cost effective marketing plan to increase the project options for potential portfolios and to maximise carbon revenues. This includes:
  - Awareness raising activities, which could be carried out within a national or regional program, targeting small industries/project developers;
  - Developing, accessing and enhancing small-scale project networks including trade associations, and other national, regional and local forums;
  - Developing and packaging project portfolios in a way that can best suit the needs of carbon buyers in terms of sustainable development benefits and risks. This could include the use of the CDM Gold Standard and the pooling of project bundles.
- *Risk management/minimisation*: methods should be applied to reduce or share risks where possible, through the use of innovative organisational arrangements including monitoring and verification, phased implementation, risk management and mitigation tools, including the use of contractual mechanisms to deal with project risks and CER shortfalls.

In addition to these recommendations focused towards the project developer there are a number of factors outside the realm of the bundling organisation or project developer that can enhance their ability to develop successful portfolios of small-scale projects. These include:

- *Designated National Authorities*: the formation and implementation of adequately resourced designated national authorities (DNA's) that can carry out their function in an effective and efficient manner. Support from Annex-1 countries may be required in many cases;
- *Governance*: good governance that minimizes host country political and sovereign risks to CDM projects;
- *Capacity building*: support for the strengthening of financial intermediaries and bundling organizations through capacity building and knowledge transfer, both North-South and South-South;

- *Good quality CERs*: recognition by international carbon buyers of the dual benefits of small-scale projects, in terms of both emission reductions and sustainable development, including the development of special procurement funds targeting such projects and the support for ‘quality’ project indicators, such as the CDM Gold Standard;
- *Small-scale limits*: removal of the small-scale limits for project bundles to encompass far higher volumes of small-scale projects in line with larger programs such as rural electrification plans, whilst ensuring a project bundle meets the ‘debundling’ test requirements;
- *Further simplification and bundling tools*: the development of further simplification methods and support tools for bundling small-scale projects by the CDM Executive Boards small-scale working group with inputs and experience from the international community. For example, provision for multiple baselines in a single PDD.

## Annex 1 FURTHER INFORMATION

### UNFCCC Website

A key resource for any developer considering small-scale CDM should be the UNFCCC website for small-scale project activities at:

[http://cdm.unfccc.int/Projects/pac/pac\\_ssc.html](http://cdm.unfccc.int/Projects/pac/pac_ssc.html)

From this webpage the following can be downloaded:

- Simplified modalities and procedures for small-scale CDM project activities (Annex II to Decision 21/CP.8) - <http://cdm.unfccc.int/Reference/Documents/AnnexII/English/annexII.pdf>
- Appendix A (SSC-PDD) - Simplified Project Design Document: [http://cdm.unfccc.int/Reference/Documents/SSC\\_PDD/English/SCCPDD\\_en.pdf](http://cdm.unfccc.int/Reference/Documents/SSC_PDD/English/SCCPDD_en.pdf)
- Appendix B - Simplified methodologies for baseline determination and monitoring plans: <http://cdm.unfccc.int/Projects/pac/ssclistmeth.pdf>
- Appendix C: Determining the Occurrence of Debundling

In addition to useful information on these pages the Small-scale Working Group (SSC WG) meets intermittently to discuss issues concerning small-scale CDM projects. Meeting minutes for the SSC WG can be found at: [http://cdm.unfccc.int/Panels/ssc\\_wg](http://cdm.unfccc.int/Panels/ssc_wg) and these include issues concerning bundling, new simplified methodologies and amendments to the simplified modalities and procedures.

### CDM Pool website

The EU Synergy Project website at <http://www.cdm-pool.com> holds all information regarding the project including:

- An introduction to the project and project team;
- Workshop summaries;
- Bundling organisation and pilot project selection;
- All project reports including:
  - Project Inception Report (Introduction to the project, background and situation in India, summary/presentations of 3 stakeholder workshops);
  - A report on 'Realising the Potential of Small-scale CDM Projects in India';
  - A Guide to Bundling SSC-CDM Projects.

Furthermore the website includes other publications by IT Power, ECN and others on small-scale CDM projects and bundling and also relevant links to key resources.

The site will be kept up to date by IT Power, and disseminate worldwide experience in developing small-scale projects. If you have relevant websites, publications etc. please contact: [jason.mariyappan@itpower.co.uk](mailto:jason.mariyappan@itpower.co.uk).

## Annex 2 TEMPLATE TEXT FOR A CDM BUNDLING ORGANISATION BUSINESS PLAN

### Business Description

The proposed business, **CDM POOL**, will develop a portfolio of CDM projects by bundling small-scale renewable energy and energy efficiency projects. This will be achieved in a way that maximises the carbon asset value of each project bundle, minimises the transaction costs and risks, and packages the projects to obtain carbon prices at the high end of the market range. **CDM POOL** will succeed for the following reasons:

- There is a large market in [*Country Name*] for small-scale renewable energy and energy efficiency projects for which the organisation has strong links and an already successful track-record in realizing some of this potential;
- The organisation is committed to making the business succeed, as the aims and objectives complement the mission of the parent organisation that is to ‘to be a pioneering, participant-friendly and competitive institution for financing and promoting self-sustaining investment in energy generation from renewable sources, energy efficiency and environmental technologies for sustainable development’;
- The recent developments in information technology make even distributed offgrid generation and distribution systems feasible;
- The organisation will also acquire and bank CERs from project developers with registered projects (i.e. projects that may or may not have been bundled) to diversify its portfolio of CERs. This will help mitigate delivery risk, and by acting as a ‘one stop shop’ for carbon buyers and minimising transaction costs per CER, this will enhance the average realisation per CER transacted through **CDM POOL**;
- The organisation has an excellent track record of financing, developing and facilitating the implementation of small-scale energy projects and has identified and put in place the necessary skills, relationships and resources to carry out this new role successfully.

*The overall mission of **CDM Pool** is to become a key facilitator of small-scale renewable energy and energy efficiency projects, by maximising the value of carbon finance.*

## Market Analysis and Demand

### Business location

**CDM Pool** will operate nationwide in India, from its headquarters in New Delhi, and through its branch offices in Chennai and Hyderabad.

### Customers

Project developers ranging from energy service companies, turnkey contractors, product/technology distributors and manufacturers, rural entrepreneurs, farmers and householders etc., will be the main customers for **CDM Pool**. Carbon credits will mostly be sold to organisations outside of India, therefore international carbon buyers including industrialised (Annex 1) country governments, multi-lateral carbon funds and private entities, such as energy intensive companies, brokers, private carbon funds etc., will also be key customers.

### *Target market*

Within in India, specific target customers have been identified through IREDA's existing network of customers and during the EU Synergy CDM Pool project, which has initiated a first pipeline of potential projects and customers. Carbon buyers who are particularly looking to purchase 'good quality' credits have been targeted, including CDM Gold Standard<sup>15</sup>, special carbon funds for small-scale projects credits and the retail market (for carbon offsets). These organisations are likely to purchase at the high end of market prices or allow terms that may minimise some of the risks to the bundling organisation.

### *Competition*

Although there are a few bundled projects being developed in India, and the developers of these can be seen as the main competition at present. However, there are no organisations currently offering the complete 'bundling' service. It is expected that as capacity is built and the CDM market develops, a number of different organisations may offer this service, however, **CDM Pool** can build up a dominant and reputable position in the market during this time. There may be opportunities to partner with other organisations (including building capacity) to secure further project portfolios.

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<sup>15</sup> See <http://cdmgoldstandard.org/> for further details.

## *Demand*

The demand for services provided by **CDM Pool** falls into to two categories:

- Demand for carbon finance to facilitate the development of small-scale projects in India;
- Demand for CERs from registered small-scale CDM projects.

### *1. Small-scale projects*

India, like many developing countries, has considerable potential for small-scale CDM energy projects in a number of sectors where emission reductions can be significant and non-carbon benefits, such as poverty alleviation, can be particularly high. This potential is partly due to the lack of adequate energy services in many rural areas, for example more than 80,000 villages are still to be electrified and around 13,500 of these are remote and difficult to reach. In addition, energy efficiency is low within many industries, such as foundries and hotels, whilst the vast under utilisation of available waste products and renewable energy sources offer further opportunities.

In many cases, due to available resources (both financial and energy), local demand, and low operational efficiency of the power systems, small-scale energy projects may well be more appropriate for many applications. Although, many of the first pipeline of CDM projects developed in India have tended to be large-scale projects (as these are low cost emission reduction opportunities which can easily cover high transaction costs), in terms of numbers there is far more potential for small-scale CDM projects. The total long term greenhouse gas emission reduction potential for all CDM projects in India has been estimated at 865-1080 MtCO<sub>2</sub>eq.<sup>16</sup> An assessment of the different project types for small-scale projects has been carried out by IT Power, IT Power India and ECN<sup>17</sup>, and shows considerable potential for emission reductions in Types I (e.g. biomass and hydro systems), II (e.g. energy efficiency measures in buildings and industries) and III (e.g. methane recovery and utilization from waste) projects. A conservative estimate for annual emission reductions from small-scale projects, using the current market situation<sup>18</sup>, is around 5 MtCO<sub>2</sub>, which could generate annual financial inflows to India of at least US\$ 25m.

Overall the demand for small-scale projects is high, and unlikely to result in constraints to a pipeline of suitable project bundles for **CDM Pool**.

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<sup>16</sup> ADB, GEF and UNDP (1998) *Asia Least-cost Greenhouse gas Abatement Strategy (ALGAS)*, India. Asian Development Bank (ADB), Manila, Philippines.

<sup>17</sup> Bhardwaj, N., Parthan, B., de Coninck, H., Roos, C., van der Linden, N., Green, J., Mariyappan, J. (2004) *Realising the Potential of Small-scale CDM Projects in India*. IT Power, IT Power India and ECN, ECN-C-04-084 November 2004, The Netherlands. <http://www.cdmpool.com/reports/C04084.pdf>

<sup>18</sup> Based on a conservative CER (Certified Emission Reduction) market price of US\$5.

## 2. Carbon credits

The demand for CERs is unlikely to be a constraint on the success of **CDM Pool** in the short-to-medium term. A number of countries including Austria, Canada, Denmark, France, Finland, Italy, Japan, the Netherlands and Spain are preparing or have already started to procure CERs for meeting their Kyoto obligations during the first commitment period (2008-2012). In addition, some of these countries have allocated some of this burden to energy intensive industries, and thus a large number of private companies are looking to purchase CERs for compliance with their obligations. For example, the EU Emissions Trading Scheme (ETS) started in January 2005, and the linking directive allows CERs to be used within this scheme.

Depending on EU allowance prices and domestic action by industrialised countries to meet their Kyoto targets, the demand for CERs has been estimated to be at least 1,000 million tCO<sub>2</sub>eq by 2012.<sup>19</sup> Although the bulk of this demand will be for credits at the low end of the market prices (e.g. for CERs from large-scale projects with low implantation costs), a significant amount will undoubtedly come from small-scale projects. Indeed, a significant number of schemes, such as the World Bank's Community Development Carbon Fund, Finland's Pilot CDM Scheme and Austria's Small-scale Project Facility, are targeting CERs from small-scale projects.

Demand for CERs from small-scale projects will also come from the so-called retail market, which is created by companies or individuals who are unlikely to be regulated under domestic regimes due to their low level of emissions, but by becoming climate-neutral or offsetting some of their emissions they can demonstrate their commitment to tackling climate change. Although these emission reductions are not used for compliance, they may still be generated in line with CDM procedures. For this growing market CERs are being procured by brokers/retailers and small tranches of CERs are retired for their customers, with prices often exceeding the average market price.

Overall, the demand for CERs is unlikely to be a constraint on income to **CDM Pool**, with market prices upwards of US\$ 5-7.5/tCO<sub>2</sub>eq for such credits; however, prices will be secured on a project-by-project basis in negotiation with buyers with the best efforts to secure prices at the top-end of the market. To meet this aim, carbon credits from project bundles of significant size and quality may be sold via a tendering process.

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<sup>19</sup> *Carbon Market Analyst*, March 2004, Point Carbon, Oslo, Norway.

## Service Description and Strategy

**CDM Pool** will supply an integrated project bundling development service that helps create and monetise carbon assets from small-scale projects. The level of service will depend on that required for each individual case, but will include:

- Identifying, quantifying and optimising the value of carbon assets by bundling suitable projects at either the project design document (PDD), validation, registration or monitoring, verification and certification stages;
- Realisation and sale of carbon assets through packaging of CERs, matching projects with appropriate buyers, negotiating and structuring contracts, and liability and risk management.

These services can be offered in a range of packages:

1. A direct fee basis for which **CDM Pool** takes no risk in the project itself and will be paid on delivery/completion of each service;
2. A combined fee/share of CER basis in which **CDM Pool** takes responsibility for a small proportion of the CDM project risk;
3. The full ‘bundling’ service will be offered by **CDM Pool** to suitable projects/project developers for which the role and involvement of **CDM Pool** would be to become the main project ‘participant’<sup>20</sup> taking on a larger share of the CDM project risks/transaction costs and receiving a significant share of CERs.

The actual details will be dependent on an evaluation of each project bundle and in negotiation with project developers; however, the main strategy of **CDM Pool** will be geared towards offering a full service to project developers as shown in option 3, which has been identified as the major gap in the market.

## Organisational Structure and Operating Plan

### Organisational structure

The business will be owned by the parent organisation as a strategic business unit. The advantage of this is that time and effort, for example from technical and administrative staff, can be allocated to **CDM Pool** from the core business, alongside **CDM Pool’s** permanent staff. The association with the parent organisation can also help with issues such as credit worthiness for emission reduction purchase agreement (ERPA) purposes, raising finance and having a credible reputation and track record.

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<sup>20</sup> As a main project participant, CDM Pool will be responsible for distribution of the CERs (certified emission reductions).

**CDM Pool** will be overseen by a director, who will work on developing the business and who will meet every three months with a board of non-executive directors made up of experienced individuals from the parent organisation, a private financial institution, an NGO and other members who have been identified as providing a balanced input to the development of the bundling organisation. In the first year consultants may be contracted where required, for example for the development of a new baseline methodology, in which case the consultants will work alongside **CDM Pool** technical staff to ensure knowledge transfer and the development of in-house expertise. As the organisation grows further more staff will be recruited.

## Operating Plan

The organisation will develop one project bundle in the first year, rising to the development of two project bundles in the second year, and four project bundles per year from then on. After developing the first project bundle options, if demand is seen to be high then the option to develop a greater number of projects will be considered, which will require additional resources.

## Financial Analysis and Plan

**CDM Pool's** financial plan is based on conservative estimates and assumptions.

### Main Assumptions

The financial plan was developed based on local costs and expenses in Indian Rupees (INR) using a conversion rate of 46.00 INR to 1 US\$ in Year 1 rising by 2% per year. Revenues from the sale of CERs is conservatively assumed to be start US\$ 7/tCO<sub>2</sub> in Year 1 and each bundle is considered to be at least 30,000 tCO<sub>2</sub> per year.

### *Business cash flow*

Start-up costs are estimated to be around US\$ 50,000, this includes approximately US\$ 37,000 to register the organisation, acquire office space and equipment and the remainder to cover overheads and expenses (see expenses below) in Year 1 and again in Year 2. An initial investment in the business will be required to cover these costs as revenues from the sale of CERs will not be received until Year 3. Bundling fee rates of US\$ 19,500 plus 10% of the CERs from the project has been assumed for each project bundle, which would be shared between project developers. This fee would be negotiable depending on the complexity of the project and the option package. The fee indicated here would include PDD development and facilitation of the sale of the CERs, but does not include validation costs.

Operating costs shown in Table 6 include the costs of:

- Personnel;
- Overheads (office, computers, stationary, etc.);
- Marketing material;
- Travel (to visit project developers, stakeholder consultations, buyers);
- Contracting/legal services;
- Insurance/risk management.

As shown in Table 8, in the first year of operation **CDM Pool** is forecast to make a loss of US\$ 12,775, whilst a profit<sup>21</sup> of US\$ 18,124 is expected in Year 3. Detailed planned profit and loss statements are given in below. Taking into account the assumption of a bundling fee for year one and 10% of CERs (at US\$ 7/tCO<sub>2</sub>), the company will break-even if it sells 31,525 CERs per year, as shown in Figure 7.

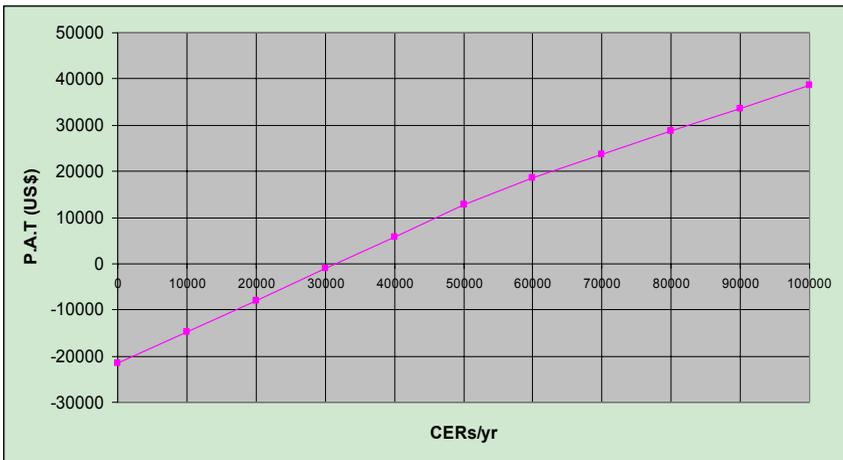


Figure 7 *Break-even analysis*

<sup>21</sup> Profit after tax (P.A.T).

Table 6 *Expenses (Yearly) includes start-up costs (USD)*

| <b>Particulars</b>                   | <b>Year 1</b> | <b>Year 2</b> | <b>Year 3</b> | <b>Year 4</b> | <b>Year 5</b> | <b>Year 6</b> |
|--------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>Monthly compensation</b>          |               |               |               |               |               |               |
| Director                             | 1,229         | 1,325         | 1,429         | 1,541         | 1,662         | 1,792         |
| Technical Staff                      | 877           | 946           | 1,020         | 1,100         | 1,187         | 1,280         |
| Support                              | 458           | 494           | 533           | 575           | 620           | 669           |
| <b>Manday rate</b>                   |               |               |               |               |               |               |
| Director                             | 56            | 60            | 65            | 70            | 76            | 81            |
| Technical Staff                      | 40            | 43            | 46            | 50            | 54            | 58            |
| Support                              | 21            | 22            | 24            | 26            | 28            | 30            |
| <b>Level of effort in mandays</b>    |               |               |               |               |               |               |
| <i>Identification - Projects</i>     |               |               |               |               |               |               |
| Director                             | 5             | 10            | 20            | 20            | 20            | 20            |
| Technical Staff                      | 20            | 40            | 80            | 80            | 80            | 80            |
| Support                              | 5             | 10            | 20            | 20            | 20            | 20            |
| <i>Bundling</i>                      |               |               |               |               |               |               |
| Director                             | 3             | 6             | 12            | 12            | 12            | 12            |
| Technical Staff                      | 12            | 24            | 48            | 48            | 48            | 48            |
| Support                              | 6             | 6             | 12            | 12            | 12            | 12            |
| <b>Total - Mandays (Bundling)</b>    |               |               |               |               |               |               |
| Director                             | 8             | 16            | 32            | 32            | 32            | 32            |
| Technical Staff                      | 32            | 64            | 128           | 128           | 128           | 128           |
| Support                              | 11            | 16            | 32            | 32            | 32            | 32            |
| <i>Marketing</i>                     |               |               |               |               |               |               |
| Director                             | 5             | 5             | 5             | 5             | 5             | 5             |
| Technical Staff                      | 15            | 15            | 15            | 15            | 15            | 15            |
| Support                              | 4             | 4             | 4             | 4             | 4             | 4             |
| <i>Identification - OE</i>           |               |               |               |               |               |               |
| Director                             | 1             | 2             | 4             | 4             | 4             | 4             |
| Technical Staff                      | 7             | 14            | 28            | 28            | 28            | 28            |
| Support                              | 2             | 4             | 8             | 8             | 8             | 8             |
| <i>Facilitation and Registration</i> |               |               |               |               |               |               |
| Director                             | 1             | 2             | 4             | 4             | 4             | 4             |
| Technical Staff                      | 12            | 12            | 24            | 24            | 24            | 24            |
| Support                              | 4             | 4             | 8             | 8             | 8             | 8             |
| <b>Total - Mandays (CERs)</b>        |               |               |               |               |               |               |
| Director                             | 15            | 25            | 45            | 45            | 45            | 45            |
| Technical Staff                      | 66            | 105           | 195           | 195           | 195           | 195           |
| Support                              | 21            | 28            | 52            | 52            | 52            | 52            |
| <b>Total - Cost (Bundling)</b>       |               |               |               |               |               |               |
| Director                             | 447           | 964           | 2,078         | 2,241         | 2,417         | 2,607         |
| Technical Staff                      | 1,276         | 2,753         | 5,937         | 6,403         | 6,905         | 7,447         |
| Support                              | 229           | 360           | 775           | 836           | 902           | 973           |
| Total cost                           | 1,952         | 4,076         | 8,791         | 9,481         | 10,224        | 11,026        |
| <b>Total - Cost (CERs)</b>           |               |               |               |               |               |               |
| Director                             | 838           | 1,506         | 2,923         | 3,152         | 3,399         | 3,666         |
| Technical Staff                      | 2,632         | 4,516         | 9,045         | 9,754         | 10,519        | 11,345        |
| Support                              | 438           | 629           | 1,260         | 1,359         | 1,466         | 1,580         |
| Total cost                           | 3,908         | 6,651         | 13,228        | 14,265        | 15,384        | 16,591        |

| <b>Particulars</b>            | <b>Year 1</b> | <b>Year 2</b> | <b>Year 3</b> | <b>Year 4</b> | <b>Year 5</b> | <b>Year 6</b> |
|-------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <b>Consultants</b>            |               |               |               |               |               |               |
| <i>Fees per day INR</i>       |               |               |               |               |               |               |
| Overseas                      | 435           | 469           | 506           | 545           | 588           | 634           |
| Resident                      | 201           | 217           | 234           | 252           | 272           | 293           |
| <i>No. of days (Bundling)</i> |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 4             | 4             | 8             | 8             | 8             | 8             |
| <i>Cost (Bundling)</i>        |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 804           | 867           | 1,871         | 2,018         | 2,176         | 2,347         |
| Total                         | 804           | 867           | 1,871         | 2,018         | 2,176         | 2,347         |
| <i>No. of days (CERs)</i>     |               |               |               |               |               |               |
| Overseas                      | 2             | 2             | 4             | 4             | 4             | 4             |
| Resident                      | 8             | 8             | 16            | 16            | 16            | 16            |
| <i>Cost (CERs)</i>            |               |               |               |               |               |               |
| Overseas                      | 870           | 938           | 2,023         | 2,181         | 2,352         | 2,537         |
| Resident                      | 1,609         | 1,735         | 3,742         | 4,035         | 4,352         | 4,693         |
| Total                         | 2,478         | 2,673         | 5,765         | 6,217         | 6,704         | 7,230         |
| <b>Travel - International</b> |               |               |               |               |               |               |
| Cost per trip                 | 1,304         | 1,407         | 1,517         | 1,636         | 1,764         | 1,903         |
| <i>No. of trips</i>           |               |               |               |               |               |               |
| Director                      | 1             | 2             | 4             | 4             | 4             | 4             |
| Technical Staff               | 0             | 0             | 0             | 0             | 0             | 0             |
| Support                       | 0             | 0             | 0             | 0             | 0             | 0             |
| Consultants                   |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 0             | 0             | 0             | 0             | 0             | 0             |
| <i>Cost</i>                   |               |               |               |               |               |               |
| Director                      | 1,304         | 2,813         | 6,068         | 6,544         | 7,057         | 7,611         |
| Technical Staff               | 0             | 0             | 0             | 0             | 0             | 0             |
| Support                       | 0             | 0             | 0             | 0             | 0             | 0             |
| Consultants                   |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Total - A                     | 1,304         | 2,813         | 6,068         | 6,544         | 7,057         | 7,611         |
| <b>Travel - Domestic</b>      |               |               |               |               |               |               |
| Cost per trip                 | 435           | 469           | 506           | 545           | 588           | 634           |
| <i>No. of trips</i>           |               |               |               |               |               |               |
| Director                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Technical Staff               | 1             | 2             | 4             | 4             | 4             | 4             |
| Support                       | 0             | 0             | 0             | 0             | 0             | 0             |
| Consultants                   |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 1             | 2             | 4             | 4             | 4             | 4             |
| <i>Cost</i>                   |               |               |               |               |               |               |
| Director                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Technical Staff               | 435           | 938           | 2,023         | 2,181         | 2,352         | 2,537         |
| Support                       | 0             | 0             | 0             | 0             | 0             | 0             |
| Consultants                   |               |               |               |               |               |               |
| Overseas                      | 0             | 0             | 0             | 0             | 0             | 0             |
| Resident                      | 435           | 938           | 2,023         | 2,181         | 2,352         | 2,537         |
| Total - B                     | 870           | 1,876         | 4,045         | 4,363         | 4,705         | 5,074         |

| <b>Particulars</b>                        | <b>Year 1</b> | <b>Year 2</b> | <b>Year 3</b> | <b>Year 4</b> | <b>Year 5</b> | <b>Year 6</b> |
|---|---------------|---------------|---------------|---------------|---------------|---------------|
| Total - A + B                             | 2,174         | 4,689         | 10,113        | 10,906        | 11,762        | 12,684        |
| <b>Workshops</b>                          |               |               |               |               |               |               |
| Cost per Workshop                         | 435           | 469           | 506           | 545           | 588           | 634           |
| No. of Workshops                          | 1             | 2             | 4             | 4             | 4             | 4             |
| Total Cost                                | 435           | 938           | 2,023         | 2,181         | 2,352         | 2,537         |
| <b>Legal Fees/Insurance</b>               | 10,870        | 21,313        | 41,790        | 40,971        | 40,167        | 39,380        |
| <b>Start-up costs</b>                     | 36,196        | 12,525        | 1,026         | 0             | 0             | 0             |
| <b>Overheads</b><br>(% of Manpower costs) | 30%           | 30%           | 30%           | 30%           | 30%           | 30%           |
| Total Overheads                           | 1,172         | 1,995         | 3,968         | 4,280         | 4,615         | 4,977         |
| <b>Depreciation</b>                       | 435           | 426           | 418           | 410           | 402           | 394           |
| <b>Interest</b>                           | 0             | 0             | 0             | 0             | 0             | 0             |
| <b>Income Tax %</b>                       | 35%           | 35%           | 35%           | 35%           | 35%           | 35%           |

Table 7 *Bundling Organisation revenue (USD)*

| <b>Particulars</b>               | <b>Year 1</b> | <b>Year 2</b> | <b>Year 3</b> | <b>Year 4</b> | <b>Year 5</b> | <b>Year 6</b> |
|----------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| Bundling Fee - A                 | 39,130        | 76,726        | 75,222        | 73,747        | 72,301        | 70,883        |
| CO <sub>2</sub> abated (in tons) | 0             | 30,000        | 60,000        | 120,000       | 120,000       | 120,000       |
| Price per ton (in USD)           | 7.00          | 7.55          | 8.14          | 8.78          | 9.47          | 10.21         |
| Total consideration              | 210,000       | 452,941       | 976,932       | 1053,554      | 1136,186      | 1225,298      |
| % of Commission<br>on CER        | 10%           | 10%           | 10%           | 10%           | 10%           | 10%           |
| Revenue per year                 | 21,000        | 45,294        | 97,693        | 105,355       | 113,619       | 122,530       |
| Year 1 Bundle                    | 21,000        | 20,588        | 20,185        | 19,789        | 19,401        | 19,020        |
| Year 2 Bundle                    | 0             | 45,294        | 44,406        | 43,535        | 42,682        | 41,845        |
| Year 3 Bundle                    | 0             | 0             | 97,693        | 95,778        | 93,900        | 92,058        |
| Year 4 Bundle                    | 0             | 0             | 0             | 105,355       | 103,290       | 101,264       |
| Year 5 Bundle                    | 0             | 0             | 0             | 0             | 113,619       | 111,391       |
| Year 6 Bundle                    | 0             | 0             | 0             | 0             | 0             | 122,530       |
| Revenue from CER - B             | 21,000        | 65,882        | 162,284       | 264,457       | 372,890       | 488,109       |
| Total revenue - A + B            | 60,130        | 142,609       | 237,506       | 338,204       | 445,191       | 558,992       |

Table 8 *Profit and loss account for Bundling Organisation - with CER revenues (USD)*

| <b>Particulars</b>  | <b>Year 1</b> | <b>Year 2</b> | <b>Year 3</b> | <b>Year 4</b> | <b>Year 5</b> | <b>Year 6</b> |         |
|---|---------------|---------------|---------------|---------------|---------------|---------------|---------|
| Revenues from Bundling  | 19,565        | 38,363        | 75,222        | 73,747        | 72,301        | 70,883        |         |
| Revenue from CER Commission   | 0             | 20,588        | 64,591        | 159,102       | 259,272       | 365,579       |         |
| Total Revenues  | 19,565        | 58,951        | 139,812       | 232,849       | 331,573       | 436,462       |         |
| Manpower  | 3,908         | 6,651         | 13,228        | 14,265        | 15,384        | 16,591        |         |
| Consultancy   | 2,478         | 2,673         | 5,765         | 6,217         | 6,704         | 7,230         |         |
| Gross Margin  | 13,179        | 49,628        | 120,820       | 212,367       | 309,484       | 412,641       |         |
| Overheads   | 1,172         | 1,995         | 3,968         | 4,280         | 4,615         | 4,977         |         |
| Travel  | 2,174         | 4,689         | 10,113        | 10,906        | 11,762        | 12,684        |         |
| Workshops   | 435           | 938           | 2,023         | 2,181         | 2,352         | 2,537         |         |
| Legal Fees/Insurance  | 21,739        | 42,626        | 83,580        | 81,941        | 80,334        | 78,759        |         |
| Earnings Before Interest, Taxes, Depreciation & Amortisation (EBITDA) | -12,341       | -620          | 21,136        | 113,058       | 210,420       | 313,684       |         |
| Depreciation  | 435           | 426           | 418           | 410           | 402           | 394           |         |
| Earnings Before Interest & Taxes (EBIT)                               | -12,775       | -1,046        | 20,718        | 112,649       | 210,019       | 313,290       |         |
| Interest  | 0             | 0             | 0             | 0             | 0             | 0             |         |
| Profit Before Tax (PBT)   | -12,775       | -1,046        | 20,718        | 112,649       | 210,019       | 313,290       |         |
| Cumulative PBT  | -12,775       | -13,571       | 7,413         | 119,916       | 327,584       | 634,450       |         |
| Provision for Tax   | 0             | 0             | 2,595         | 39,427        | 73,507        | 109,651       |         |
| <b>Profit After Tax (PAT)</b>   | -12,775       | -1,046        | 18,124        | 73,222        | 136,512       | 203,638       |         |
| <b>Net Margin</b>   | -65%          | -2%           | 13%           | 31%           | 41%           | 47%           |         |
| Initial Investment - Startup costs                                    | 36,196        | 12,775        | 1,046         | 0             | 0             | 0             |         |
| Cash flows  | 36,196        | -12,775       | -1,046        | 18,124        | 73,222        | 136,512       | 203,638 |

## Annex 3 AN EXAMPLE PROJECT CONCEPT NOTE FOR A BUNDLED PROJECT

1. *Name of Project:*  
Biomass Gasification Cluster (1MW x 5 Plants).
2. *Location of Project (Village/ District/ State):*  
Ramanthapuram, Virudhunagar & Tuticorin districts of TamilNadu, India.
3. *Name of Project Sponsor(s) & Contact details:*  
Southern Green Power Private Limited  
#33, 59th Cross, V Block, Rajajinagar, Bangalore - 560 010  
Tel: +91 98450 91641/+ 91 80 23350009
4. *Name of Project (Developer/ Consultant) & Contact details:*  
Southern Green Power Private Limited  
#33, 59th Cross, V Block, Rajajinagar, Bangalore - 560 010  
Tel: +91 98450 91641/+ 91 80 23350009
5. *Ownership details of Project Sponsor(s) Company:*  
Southern Green Power Private Limited is a new company formed for the purpose of this project. It is promoted by persons with several years of experience in renewable energy project development and implementation.
6. *CER sharing arrangements amongst Project Sponsors:*  
Not yet arrived at.
7. *Project description:*  
The project involves the development of five 1 MW power stations generating 5 MW electricity round-the-clock and feeding the power to the state grid. Each plant will be about 25 - 50 km away from the other nearest plant. The technology to be used is Biomass Gasification. The biomass feedstock to be used is the locally available Prosopis Juliflora.  
  
The project involves the construction of five similar systems, each comprising a 1200 kg/hr gasification reactor along with the cooling systems and other auxiliaries, and 1 MW producer gas engines to be energized by the gas generated from the gasifier.

The reason for five decentralised systems is to ensure that each plant can source the biomass from the 10-15 km radius of the plant, thus ensuring that the environment is not stressed, the biomass is procured from sustainable sources, there are no leakages, transport costs are low, and project is sustainable on a long term basis.

The main problem that this project addresses is rural employment generation and rural infrastructure development. In addition, the project generates renewable energy that is environment friendly along-with improvement of grid transmission efficiency.

8. *Technology to be employed:*

The power plants will be based on open top gasifier from Indian Institute of Science, Bangalore and 100% producer gas engines. Gasification involves the sub-stoichiometric combustion through thermo-chemical reactions of biomass to generate carbon-monoxide and hydrogen. The gas generated from gasification is known as producer gas, which is further combusted in IC Gas Engines. The engine/alternator system generates electricity which is evacuated to the state grid through the nearest grid sub-station.

9. *Technology innovation, (if any):*

The technology is the result of years of development efforts by IISc. Bangalore and has recently been implemented in two projects (using 100% Gas Engines) recently in India.

10. *Transfer of Technology (methodology):*

Not applicable.

11. *Project start date: Jan 2005*

1st Project: February 2005

2nd Project: June 2005

3rd Project: August 2005

4th Project: October 2005

5th Project: December 2005

12. *Project completion date:*

1st Project: July 2005

2nd Project: November 2005

3rd Project: January 2006

4th Project: March 2006

5th Project: May 2006

*Prospective Dates on which the projects will be operational are:*

1st Project: September 2005

2nd Project: January 2006

3rd Project: March 2006

4th Project: May 2006

5th Project: July 2006

13. *Project Life time:*

15 years.

14. *Status of Project Clearances:*

| Activity                              | Status   |
|---------------------------------------|--|
| 1. Feasibility study                  | Completed  |
| 2. Biomass study                      | Completed  |
| 3. Wasteland identification           | Completed; Soil testing and analysis completed, and negotiations with local landowners for contract/land lease in progress                       |
| 4. Land acquisition for project sites | 4 of 5 sites completed, 1 more in progress   |
| 5. Power purchase agreement           | 1 completed, 4 in process  |
| 6. Local community                    | Discussions in progress  |
| 7. Local clearances                   | Obtained for 2 sites   |
| 8. Pollution control clearance        | Site clearance for 1 <sup>st</sup> project obtained  |
| 9. Negotiations with vendors          | In progress  |
| 10. Financial closure                 | 30% Equity commitment obtained; Soft commitment from financial institution - State Bank of India for 100% loan sanction at 2:1 debt equity ratio |

15. *Financing details of the Project:*

Equity: Group of Individuals have committed Euro 0.44 million, (\$ 0.54 million, Rs 24.2 million) to date. Balance equity to be tied up.

Debt - Long-term and Short-term debt:

State Bank of India, Foreign Currency Branch, Bangalore. Project has been appraised, similar projects sites implemented have been visited by Bank Officials, and Biomass Survey and Availability has been studied. Based on this, loan sanction has been agreed to.

Terms of debt:

- Long-term debt = 2.94 million Euros (\$ 3.59 million)
- Loan amount is based on 2:1 debt equity
- Short term debt including bank guarantee and working capital support = 0.45 million Euros (\$ 0.55 million)
- Rate of interest = 10% pa
- Repayment over 7 years repayment + 1 year moratorium.

Formal clearance/sanction will be given when the following milestones are achieved:

- Detailed list of equipment vendors along with details of equipment supply after price negotiations and terms of conditions of supply are completed;
- Power Purchase Agreements for the other projects are signed;
- Pollution Control Clearance.

16. *Indicative CER price:*

\$ 5.5/ton of CO<sub>2</sub>eq (Linked to market prices at the time of signing the ERPA).

17. *Name & Address of buyer of CER's:*

Not identified.

18. *IRR and DSCR without CER Revenue:*

Refer Table 9.

19. *IRR and DSCR with CER Revenue:*

Refer Table 9.

20. *Whether any ODA is flowing to the Project:*

No ODA involvement.

21. *Subsidy element if any in the project & source:*

MNES subsidy on equipment duty exemption.

22. *Total cost of the Project:*

| Project cost (1 Euro = Rs 55, 1 \$ = Rs 45) | Euros | Dollars<br>(million) | Rs    |
|---|-------|----------------------|-------|
| Land  | 0.045 | 0.056                | 2.5   |
| Gasifier                                    | 1.545 | 1.889                | 85.0  |
| Engine with electrical accessories          | 2.064 | 2.522                | 113.5 |
| Building                                    | 0.300 | 0.367                | 16.5  |
| Office equipment                            | 0.018 | 0.022                | 1.0   |
| Furniture & fixture                         | 0.004 | 0.004                | 0.2   |
| Interest during construction period         | 0.113 | 0.138                | 6.2   |
| Preliminary & preoperative expenses         | 0.167 | 0.204                | 9.2   |
| Working capital margin                      | 0.144 | 0.176                | 7.9   |
| Total                                       | 4.4   | 5.4                  | 242   |

23. *Break up of Foreign currency (if any):*  
Not Applicable.

24. *Transaction Cost:*  
Five percent of the expected CDM Revenue.

25. *Whether Project appraised by any Financial Institution:*  
Yes, Project has been appraised by State Bank of India, Foreign Currency Branch, Bangalore. Similar projects sites implemented have been visited by Bank Officials, and Biomass Survey and Availability has been studied.

26. *Financial Closure:*  
Financial Closure: 30% Equity commitment obtained; Soft commitment from financial institution - State Bank of India for 100% loan sanction based on 2:1 Debt: Equity ratio.

27. *Expected date of first CER delivery & CER flow year wise:*  
2006.

28. *Crediting period:*  
10 years.

29. *Estimate of GHG abatement in tCO<sub>2</sub>eq (Year wise):*

| <b>Project Details</b>             |       |    |
|------------------------------------|-------|----|
| Each plant capacity                | 1.135 | MW |
| Project capacity                   | 5.675 | MW |
| Auxiliary consumption              | 12%   |    |
| Net power exported                 | 5.0   | MW |
| Plant load factor (year 1)         | 75%   |    |
| Plant load factor (year 2 onwards) | 80%   |    |

| Commercial operations   | Start Date | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 |
|-------------------------|------------|------|------|------|------|------|------|------|
| <i>(days/annum)</i>     |            |      |      |      |      |      |      |      |
| Project 1               | 15-Sep-05  | 365  | 365  | 365  | 365  | 365  | 365  | 365  |
| Project 2               | 15-Jan-06  | 350  | 365  | 365  | 365  | 365  | 365  | 365  |
| Project 3               | 15-Mar-06  | 291  | 365  | 365  | 365  | 365  | 365  | 365  |
| Project 4               | 15-May-06  | 230  | 365  | 365  | 365  | 365  | 365  | 365  |
| Project 5               | 15-Jul-06  | 169  | 365  | 365  | 365  | 365  | 365  | 365  |
| <i>(1000 MWh/annum)</i> |            |      |      |      |      |      |      |      |
| Project 1               | 15-Sep-05  | 6.6  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  |
| Project 2               | 15-Jan-06  | 6.3  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  |
| Project 3               | 15-Mar-06  | 5.2  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  |
| Project 4               | 15-May-06  | 4.1  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  |
| Project 5               | 15-Jul-06  | 3.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  | 7.0  |
| Total power exported    |            | 25.3 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 | 35.0 |

| Years  | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|--|---------|---------|---------|---------|---------|---------|
| Grid Emission Factor - With Thermal* (tCO <sub>2</sub> /MWh) | 0.978   | 0.967   | 0.968   | 0.968   | 0.968   | 0.966   |
| Power Exported (1000 MW/annum)                               | 25.3    | 35.0    | 35.0    | 35.0    | 35.0    | 35.0    |
| CERs tCO <sub>2</sub> eq/ annum                              | 24,743  | 33,845  | 33,880  | 33,880  | 33,880  | 33,810  |

| Years   | 2006-07 | 2007-08 | 2008-09 | 2009-10 | 2010-11 | 2011-12 |
|---|---------|---------|---------|---------|---------|---------|
| Grid Emission Factor - All (tCO <sub>2</sub> /MWh)* | 0.758   | 0.78    | 0.767   | 0.751   | 0.736   | 0.736   |
| Power Exported (1000 MW/annum)                      | 25.3    | 35.0    | 35.0    | 35.0    | 35.0    | 35.0    |
| CERs tCO <sub>2</sub> eq/ annum                     | 19,177  | 27,300  | 26,845  | 26,285  | 25,760  | 25,760  |

\* Source: MNES, GOI <http://mnes.nic.in/baselinepdfs/chapter2.pdf>

In addition, further green house gas reduction accrues in the following manner:

- Charcoal - About 4% of the input biomass by weight (about 50 gm/kWh) is extracted out of the system as charcoal on a continuous basis. This represents the biomass that is not completely converted to Carbon Monoxide. This charcoal is typically converted to energy bricks for use as fuel by industry. The calorific value of 50 gm of charcoal is about 1260 kJ. The industrial consumption of the charcoal produced as by-product will result in consequent reduced consumption of fossil fuel.
- The development of wasteland with fast growing biomass species will result in increased tree growth and regions that were hitherto devoid of dense tree growth will contribute to reduced carbon dioxide in the atmosphere.

However, contribution to GHG reduction due to these components has not been considered for the sake of being conservative.

30. *Baseline Methodology (Approved or New):*

Approved, as prescribed by the CDM Small Scale Methodologies.

31. *Whether EIA conducted for the project:*

Not Required.

32. *Sustainable Development Criteria:*

Eligible under the Sustainable Development Criteria of Government of India.

33. *Specific global & local environmental benefits:*

The overall impacts of using sustainably produced biomass as fuel for generation of electricity and its impact on the local economy, environment, and rural development are tremendous, with significant local benefits can that provide important linkage to sustainable development viz.

- Promotion of renewable energy
- Cleaner environment
- Rural Infrastructure development
- Increased employment: The projects will result in the creation of direct new employment opportunities of about 100 jobs per 1 MW project
- Increased economic activities on account of purchase of biomass which was hitherto wasted Wasteland development

- Reduces import of crude/petroleum products that would have been used for generating the electricity
- Spill over effect, encouraging the usage of the more efficient technology
- GHG emissions reduction has a global effect.

34. *Socio-economic aspects:*

- Increased Employment Generation (about 100 jobs per 1 MW plant)
- Local area economic development
- Capital investment
- Energy plantation - significant employment opportunity
- GHG emissions reduction has a global effect.

35. *Local stake holders comment:*

Not yet conducted.

36. *Environment Management Programme:*

Not Required.

37. *Project risks (Economic, Legal, Political, Social & Environmental):*

**Market Environment**

The renewable energy industry has developed significantly in India with the Government of India beginning to encourage clean and decentralised power generation systems. The state electricity boards offer a preferential price to producers of renewable power. As against the usual price of Rs 2.25 - 2.5/kWh paid by Tamil Nadu State Electricity Board (TNEB) to an Independent Power Producer (IPP) generating electricity from thermal/conventional sources, they pay IPPs of renewable power a tariff of Rs 3.15 (escalating at 5% pa).

**Commercial Risk**

The State Electricity Boards (SEBs) in India are under severe pressure to subsidise agriculture, and this is done by charging higher industrial tariffs to cross-subsidise electricity to the farming sector. This has created tremendous market distortions and, along with inefficiencies in transmission/distribution, has resulted in the SEBs having to deal with heavy debt burdened balance sheets and huge operating losses. For us, this could imply that the payments due to us from the SEBs could come under pressure.

Therefore, the company strategy is to start with the SEB as the customer, but quickly find industrial customers in the vicinity who can off-take a portion of the power produced. This will help us in two ways immediately - reducing the payment risk of the SEB and improving our bottom-line. Strategically, it will position us in a place of strength going ahead, because the Government of India is pushing ahead with the Electricity Reforms, and in a few years we expect to take over local distribution in the regions where we operate.

### **Biomass Risk**

In addition, the other possible risk is raw material availability. We are mitigating this risk in the following manner:

- Our plants will be situated in areas where biomass availability is very high.
- At 1 MW scale, although our capital costs and operating costs will be higher vis-à-vis the large scale plants, we shall benefit because our biomass will be available in the 10 - 15 km radius of the plant. This means that we can procure directly from the farmer (and get rid of the middlemen) and our fuel transport costs will also be correspondingly lower.
- We shall enter into agreements with local land-owners (of uncultivated land) and develop the wastelands for production of fast-growing biomass species to serve us with a captive source of bio-energy.

### **Management, Operations, and Logistics**

Distributed operations that need to run 24 hours over 3 shifts have to be managed effectively. Each plant will be managed by an engineer and will be assisted by trained supervisors. In addition, a slew of practices will be deployed to ensure smooth operations and preventive maintenance:

- a. **Biomass Management:** Each plant requires about 25 tons biomass everyday. Biomass shall be procured through a multi-pronged strategy - (i) managing captive plantations, (ii) procuring harvesting rights of biomass in village tanks from local panchayat bodies, (iii) purchasing from local supply contractors, and (iv) offering a minimum support price for any local supplier. We shall hire locally available trucks on long-term basis, so that transport costs are lowered. Our fuel-manager shall co-ordinate the supply of fuel to our plants to ensure that sufficient stock is maintained at all times. The biomass processing shall be automated such that manual labour is only required to stack the biomass as it enters the cutting machine. After cutting, the biomass shall be fed into a drier room before being moved on to the gasifier. All biomass supply and processing shall be completed during the daytime hours.

- b. Central Maintenance Team: Each plant will be managed by the plant engineer and will be assisted by 4 supervisors (1 for each shift plus 1 reserve). The power plants shall be supported by the Central Maintenance Team that shall comprise a Chief Engineer, an Assistant Engineer, a Foreman, a Store-keeper, a Mechanic, and an Electrical Supervisor. Strict preventive maintenance schedules shall be followed as prescribed, with maintenance charts updated and scrutinized every week. The store-keeper shall maintain updates on availability of consumables at each location, and shall manage the consumables and spare-parts inventory.
- c. Good Logistics. The Power Plants are all to be located near Madurai - within 1-2 hours drive on reasonably good roads. All of the Power Plants are therefore within an overnight train ride from Bangalore and within easy access to management and technical expertise from the central office. All Power Plants are also located right next to existing sub-stations for grid-paralleling.
- d. Online data monitoring: Key parameters (flow rate, temperature, pressure, gas quality etc.) at various points in the process flow and the performance of critical equipment will be digitally logged on a continuous basis. It will then be possible for our central office to monitor the performance of all the Power Plants on a real-time basis.
- e. Video surveillance. Video surveillance cameras shall be installed in all Power Plants to capture and transmit images of sensitive areas. These still images will be transmitted every few seconds, but they will allow the central office to monitor the work floor staff at all times.
- f. Communications. All plants will be accessible by telephone (landline and cellular). Communicating back with the plant manager, supervisor and staff to change something at the plant, coupled with the video and data capture will allow us manage a large number of plants from a central location.
- g. Hiring and Training. Training programs shall be administered on a periodic basis to train new recruits and to provide additional skills to better performers so they can earn more and grow within the organization.
- h. Technical Advisory Panel. A technical panel shall be assembled to advise us on various technical issues with respect to the operations of a plant. The Indian Institute of Science has agreed to be represented in strength on this panel.
- i. Onsite Residential Quarters. Onsite residential facilities will be provided for supervisory staff.
- j. Company Sponsored Courses. We expect to develop a training module - theory and hands-on that can be delivered in neighbouring ITI schools (Institutes of Technical and Industrial Vocational Training) in rural TN. This will provide us with a continuous stream of qualified personnel.
- k. Hands-on management. In the initial years, the founding team will be hands-on and on-site and not depend on multiple layers of managers. Project promoter credentials.

Table 9 *Project cash flow and IRR with and without CDM*

|                                       |           | Y1    | Y2    | Y3    | Y4    | Y5    | Y6    | Y7    |
|---------------------------------------|-----------|-------|-------|-------|-------|-------|-------|-------|
| Plant capacity                        | [MW]      | 5.675 | 5.675 | 5.675 | 5.675 | 5.675 | 5.675 | 5.675 |
| Plant load factor                     | [%]       | 75    | 80    | 80    | 80    | 80    | 80    | 80    |
| Units produced                        | [Mln kWh] | 37    | 40    | 40    | 40    | 40    | 40    | 40    |
| Auxiliary consumption + Tie-in charge | [%]       | 12    | 12    | 12    | 12    | 12    | 12    | 12    |
| Units available for sale              | [Mln kWh] | 33    | 35    | 35    | 35    | 35    | 35    | 35    |
| <b>Cost of power</b>                  |           |       |       |       |       |       |       |       |
| <i>Revenue</i>                        |           |       |       |       |       |       |       |       |
| Sale revenue from electricity         | [Rs/kWh]  | 3.15  | 3.31  | 3.47  | 3.65  | 3.83  | 4.02  | 4.22  |
| Sale revenue from carbon credits      | [Rs/kWh]  | 0.16  | 0.16  | 0.16  | 0.16  | 0.16  | 0.16  | 0.16  |
| Total sales revenue                   | [Rs/kWh]  | 3.31  | 3.47  | 3.63  | 3.8   | 3.99  | 4.18  | 4.38  |
| <i>Costs</i>                          |           |       |       |       |       |       |       |       |
| Cost of fuel                          | [Rs/kWh]  | 1.03  | 1.09  | 1.14  | 1.2   | 1.26  | 1.32  | 1.39  |
| Direct wages                          | [Rs/kWh]  | 0.24  | 0.24  | 0.25  | 0.26  | 0.28  | 0.29  | 0.3   |
| Plant maintenance                     | [Rs/kWh]  | 0.41  | 0.42  | 0.44  | 0.46  | 0.48  | 0.5   | 0.53  |
| Administration cost                   | [Rs/kWh]  | 0.26  | 0.26  | 0.27  | 0.28  | 0.3   | 0.31  | 0.33  |
| Total operating cost                  | [Rs/kWh]  | 1.94  | 2.01  | 2.10  | 2.20  | 2.32  | 2.42  | 2.55  |
| Finance cost                          | [Rs/kWh]  | 0.58  | 0.40  | 0.35  | 0.29  | 0.22  | 0.14  | 0.06  |
| Capital repayment                     | [Rs/kWh]  | 0.40  | 0.54  | 0.60  | 0.66  | 0.73  | 0.81  | 0.91  |
| Taxes                                 | [Rs/kWh]  | 0.02  | 0.04  | 0.05  | 0.06  | 0.07  | 0.09  | 0.10  |
| Total cost including finance cost     | [Rs/kWh]  | 2.94  | 2.99  | 3.10  | 3.21  | 3.34  | 3.46  | 3.62  |

|   |       | Y1   | Y2   | Y3   | Y4   | Y5   | Y6   | Y7   |
|---|-------|------|------|------|------|------|------|------|
| <b>Project free cash flows (million Rs)</b>   |       |      |      |      |      |      |      |      |
| Cash flows with CDM                           | -242  | 44   | 50   | 52   | 54   | 56   | 58   | 141  |
| Cash flows without CDM                        | -242  | 39   | 44   | 46   | 48   | 50   | 53   | 136  |
| DSCR with CDM                                 | 1.61  | 1.38 | 1.51 | 1.56 | 1.62 | 1.68 | 1.76 | 1.78 |
| DSCR without CDM                              | 1.45  | 1.21 | 1.34 | 1.39 | 1.46 | 1.52 | 1.59 | 1.62 |
| 7 Year project IRR with CDM*                  | 15.6% |      |      |      |      |      |      |      |
| 7 Year project IRR without CDM*               | 12.9% |      |      |      |      |      |      |      |
| <b>Project free cash flows (million \$)</b>   |       |      |      |      |      |      |      |      |
| Cash flows with CDM                           |       | 0.98 | 1.10 | 1.15 | 1.20 | 1.24 | 1.30 | 3.14 |
| Cash Flows without CDM                        |       | 0.87 | 0.98 | 1.03 | 1.07 | 1.12 | 1.17 | 3.01 |
| <b>Project free cash flows (million Euro)</b> |       |      |      |      |      |      |      |      |
| Cash flows with CDM                           |       | 0.81 | 0.90 | 0.94 | 0.98 | 1.02 | 1.06 | 2.57 |
| Cash flows without CDM                        |       | 0.71 | 0.80 | 0.84 | 0.88 | 0.92 | 0.96 | 2.47 |

\* Assuming 33% salvage at end of 7th year.

1 \$ = Rs 45

1 Euro = Rs 55