

CLEAN DEVELOPMENT MECHANISMS (CDM)

**Methodology for baseline
and additionality analysis
for multiple project categories:
*Guideline Document***



UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
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The project was carried out in parallel with the work undertaken in the context of the GHG Protocol Initiative, which is a process jointly led by the World Business Council for Sustainable Development and the World Resources Institute. Efforts have been made to ensure consistency with concepts used in the GHG Protocol Initiative. The Initiative comprises of (1) the GHG Protocol Corporate Accounting and Reporting Standard, and (2) the GHG Protocol Project Quantification Standard. The latter quantifies GHG emission reductions achieved by means of specific reduction projects. At the time of publishing this report, it is in its roadtest draft stage.

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Introduction

These guidelines have been prepared for project developers seeking to develop CDM or JI projects in the industry, energy, and possibly other sectors, where projects aiming at reducing GHG emissions can take place. The guidelines are intended to be applied in the planning stages of an emission reduction project to support the work involved in preparation of the project design documentation for registration.

The guidelines assist project developers to:

- Determine proper system boundaries within which emissions can be calculated;
- Identify and describe a baseline for the proposed project;
- Account for expected changes in GHG emissions;
- Document and justify the baseline selection process.

The guidelines are intended to be used with an electronic software tool that provides standard, ready-to-use formats for baseline documents that are sufficiently adaptable to account for variations between individual projects. These guidelines propose a systematic procedure for the development of baselines in compliance with the requirements of the CDM and JI.

In 2001, the World Business Council for Sustainable Development (WBCSD) and the World Resources Institute (WRI) started a project on the accounting for project-based emission reductions (GHG Protocol

Project Quantification Standard, roadtest draft).¹ While efforts were made to ensure consistency between the UNIDO and the WBCSD efforts and to avoid the emergence of different “dialects” for the accounting of emission reductions, minor differences still exist as the GHG Protocol continues to evolve due to its underlying development process. It is being roadtested in late 2003 and further differences may emerge after the roadtest phase.

This document seeks, where possible, to build on commonalities and draw attention to the differences between the two work efforts. The GHG Protocol Project Quantification Standard (roadtest draft) will be supplemented with “GHG Protocol Project Typology: Defining Reduction Projects”. This contains a classification of project types and categories, and additional specific issues and guidance on each project type.

This version of the UNIDO guidelines do not cover issues related to the monitoring of emissions or emission reductions. However, they do address issues related to the monitoring of parameters that can cause shifting to a different baseline.

¹ The objective of the GHG Protocol Initiative is to develop internationally accepted standards and guidance on accounting and reporting of GHG emissions and reductions. Convened and led by the World Business Council for Sustainable Development and the World Resources Institute, it is a process, involving NGOs, business, government, academia, and others. It comprises two modules: (1) GHG Protocol: Corporate Accounting and Reporting Standard, and (2) GHG Protocol Project Quantification Standard. The latter is currently in its roadtest draft. Its development was primarily informed by small groups of experts or “taskforces” to address specific issues relating to project quantification.

1

The accounting of emission changes

These guidelines propose a procedure for the accounting of emission changes that is consistent with the GHG Protocol Corporate Accounting and Reporting Standards which differentiates between the accounting direct and indirect emissions in three scopes.²

- Scope 1: direct emissions
- Scope 2: indirect emissions from import/export of electricity and heat
- Scope 3: other indirect emissions

Correspondingly, the guidelines account for direct and indirect emission reductions. However, no differentiation is made between energy and non-energy related indirect emissions (scopes 2 and 3).

Differentiating between direct and indirect emission reductions is relevant due to potential ownership conflicts surrounding indirect emission reductions.

Defining system boundaries³

The guidelines differentiate boundaries for two systems:

- (a) The sources and sinks of GHG emissions within the control of the project operator that create a change of direct emissions per unit of output as a result of

a project intervention (referred to as a “scope 1 system”);

- (b) The sources and sinks of GHG emissions outside the control of the project operator that experience a change of activity level due to changing imports and exports of secondary energy carriers and materials as a result of a project intervention in a scope 1 system boundary (referred to as a “scope 2 system”).

Another way of defining these systems is that the scope 1 system defines boundaries for direct project emissions and scope 2 defines boundaries that incorporate indirect emissions.⁴

If a project creates more than one primary GHG emission impact, the project developer will need to prepare separate system boundaries for every primary impact.

Scope 1 system boundaries

Emission changes within a scope 1 system boundary result in changes of direct emissions per unit of output that can be measured within the scope 1 system boundaries (“emission rate”). A scope 1 system boundary can be displayed as a flow chart that shows all material and energy flows between the relevant sources (or sinks).

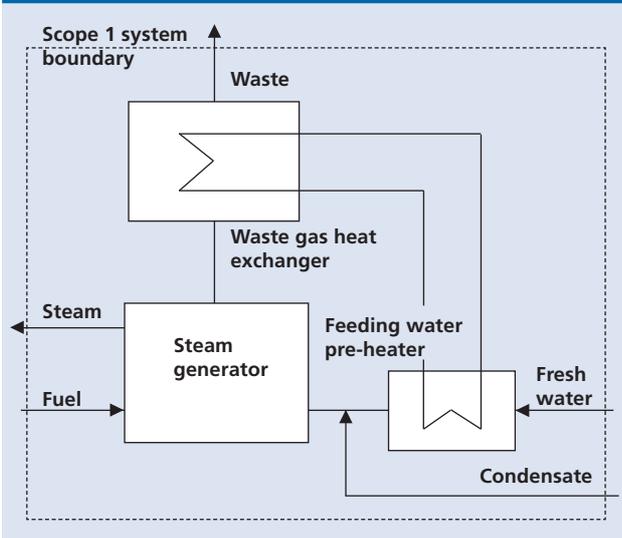
An example for an intervention in a scope 1 system boundary is a waste heat utilization project in an industrial boiler thus reducing primary energy use for a given level of heat production.

² The GHG Protocol Corporate Accounting and Reporting Standard is a tool for accounting of GHG emissions. For additional information, see www.ghgprotocol.org.

³ For more information on the concept of scopes please see GHG Protocol Corporate Standards, published in 2001. The concept of direct and indirect project GHG effects is also included in the road-test draft of the project module.

⁴ Here, “scope” identifies the location of occurrence of the direct emission reduction caused by a project intervention.

Figure I. Flow chart of a scope 1 system boundary^a



^aSee Hesse-Tender emission reduction purchase tender documentation, 2002.

Scope 2 system boundaries

Within a scope 2 system boundary, emission changes are caused by changed activity levels resulting from a project intervention in a scope 1 system that changes the demand for the output produced by the scope 2 system.

An example for an intervention in a scope 2 system boundary is a waste heat utilization project within an industrial facility that reduces the import of heat supplied by a heating plant located elsewhere.

A scope 2 system boundary can be displayed in a flow-chart that shows all material and energy flows between the scope 1 system boundary as well as all sources (or sinks) within the scope 2 system boundary.

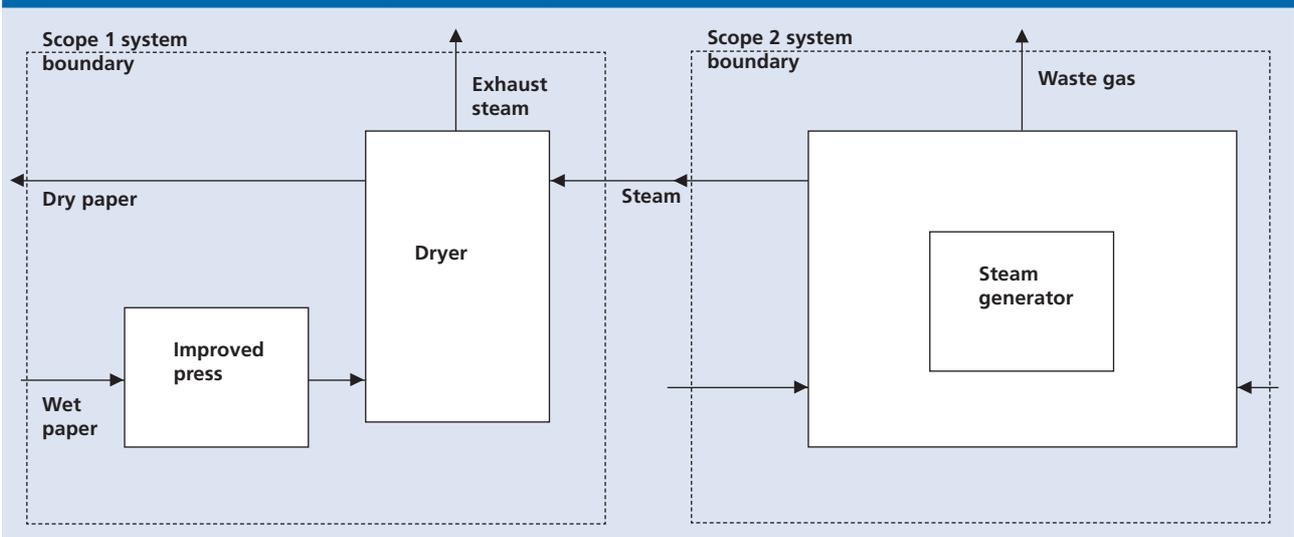
Defining activity level

In addition to identifying the sources and sinks within the system boundaries, a project developer also needs to estimate the activity level occurring within the system boundary. A project developer should estimate the activity level for the scope 1 system boundary as well as the projected activity level change within the scope 2 system boundary to calculate any emission change (to be replaced with actual activity level to determine the actual quantities of changed emissions).

Explaining the occurrence of emission changes

The relationship between quantification of GHG emissions and the quantification of alterations in emissions

Figure II. Flow chart of a scope 2 system boundary^a



^aSee Hesse-Tender emission reduction purchase tender documentation, 2002.

is comparable to standard financial accounting methods, i.e. the *accounting of emissions* is comparable to an annual balance-sheet (for a given entity) and the *accounting of emission changes* explains the year-to-year changes of an emissions inventory (for a given system boundary), which is comparable to a profit and loss statement that explains year-to-year changes of a balance-sheet.

This means that annual changes in GHG emissions (direct and indirect) within a given system boundary can always be explained by one or more of the following events:

- Event 1: a change of a direct or indirect emission rate within a system boundary as a result of an intervention, e.g. improving fuel efficiency (direct emissions rate) or improving the efficiency of imported heat/electricity use (indirect emissions rate).
- Event 2: a change of a direct fuel-specific emissions factor within a system boundary as a result of an intervention, e.g. fuel-switching.
- Event 3: a change of activity levels within a system boundary due to market forces, e.g. an economic downturn.
- Event 4: a change of activity levels within a (scope 2) system boundary due to a project-based intervention within a (scope 1) system boundary, thus changing the demand for the scope 2 system's output. e.g. the increased power production from renewable energy sources within an existing electricity grid, thus reducing activity levels within a fossil-fuel powered facility.

Thus, the accounting for emission reductions provides an explanation for annual variations in GHG emissions.

Framework to account for project-based emission changes

The guidelines provide formulas for the calculation of emission changes within a system boundary on the basis of emission rate and/or activity level changes that are different from those predicted in the baseline calculations.

One formula accounts for output-based "emission rate" changes within a scope 1 project system boundary, i.e.

it accounts for direct emission rate changes, and defines the emission rate as specific emissions per unit of output, e.g. t CO₂/kWh.

The second formula is used to account for activity level changes within a scope 2 system boundary, i.e. to account for indirect emissions.

Accounting for direct emission rate changes

Using the GHG Protocol Corporate Accounting Standard for GHG emissions, the quantification of direct emissions is as follows:

$$e = p_1 \times ef_1$$

Whereby:

- e: emission rate (emissions per unit of output)
- p_1 : average primary energy use (fuels) per unit of output (in either a production or energy conversion facility) and net carbon sequestration per area (for sinks) whereby p can be dynamic over time
- ef_1 : emission factor of primary energy use including oxidation efficiency

For example, the co-firing of biomass in a coal-fired power generation boiler could create a Δe of 150 kg CO₂/MWh by changing e from 900 kg CO₂/MWh to 750 kg CO₂/MWh after project implementation due to a change of ef_1 from 353 kg CO₂/MWh of fuel input to 294 kg CO₂/MWh of fuel input (with p_1 being constant).

Alternatively, the refurbishment of that boiler could create a Δe of 50 kg CO₂/MWh by changing e from 900 kg CO₂/MWh to 850 kg CO₂/MWh due to a change of p_1 from 39.2 per cent to 41.5 per cent (with ef_1 being constant).

Accounting for indirect emission rate changes

According to GHG Protocol standards, indirect emissions can be quantified using the following equation:

$$e = s_1 \times (p_2 \times ef_2)$$

Whereby:

- e: emission rate (emissions per unit of output)
- s_1 : average specific delivered secondary energy use (electricity or heat) per unit of output (includes

delivery losses) OR average land-use impact on area outside the project area induced by the project

(p_2): average primary energy use (fuels) per unit of secondary energy carrier production (cannot be the target of an intervention) OR net carbon sequestration per impacted area whereby p can be dynamic over time

(ef_2): emission factor of primary energy including oxidation efficiency (cannot be the target of an intervention)

Note that "Output" refers to the output of the facility, emissions source or sink within the scope 1 system boundary (the system that experiences the intervention).

For example, the production of electricity using biomass could create a Δe of 963 kg CO₂/MWh by changing s_1 from 1.07 MWh delivered secondary energy (from the above coal-fired power generator plus 7 per cent T&D losses) to 0 MWh due to the full substitution with electricity from a new, zero net emissions generator.

Accounting of absolute emission changes

This means that for a given system boundary an emissions inventory for a period 01 can be calculated as:

$$E_{01} = Q_{01} \times ((p_{11} \times ef_{11}) + s_{11} \times (p_2 \times ef_2))$$

and for a period 02 as:

$$E_{02} = Q_{02} \times ((p_{12} \times ef_{12}) + s_{12} \times (p_2 \times ef_2))$$

Consequently, a change in emissions can be expressed as:

$$\Delta e = (p_{12} \times ef_{12} - p_{11} \times ef_{11}) + (s_{12} - s_{11}) \times (p_2 \times ef_2)$$

whereby $(p_{12} \times ef_{12} - p_{11} \times ef_{11})$ and Δs_1 are the factor differences before and after the project intervention.

Factors subject to project interventions

It is to be noted that a project developer can only cause impacts leading to changes of the p_1 , ef_1 or s_1 factors. A project developer cannot change the p_2 and ef_2 factors but needs to have knowledge about them in order to calculate indirect emission changes.

Some examples of triggering a change of p_1 and ef_1 are listed below:

- Change of direct energy use per unit of output (i.e. fuel-efficiency improvement),
- Change of the emissions factor of primary energy (i.e. fuel-switching),
- Change of process emissions per unit of output (i.e. clinker substitution in cement production),
- Change in methane emission intensity by methane capture and destruction (i.e. landfill-gas capturing, collection and combustion),
- Changes of net sequestration per land area (within the scope 1 project boundary).

Changes of s_1 are related to project interventions that create activity-level changes in an upstream, same-stream or down-stream indirect boundary 2 system. Such changes could include:

- Change of secondary energy use per unit of output within the scope 1 system boundary thus reducing demand in an upstream scope 2 system (i.e. an electricity-related energy efficiency project),
- Substitution of inputs within the scope 1 system boundary thus reducing demand in an upstream scope 2 system (i.e. substituting the use of cement with ashes within the scope 1 system, thus reducing demand for cement within the scope 2 system boundary),
- Increased production within the scope 1 system boundary, thus substituting production within a same-stream scope 2 system boundary (i.e. producing electricity from renewable energy, substituting the production of electricity from other facilities or producing bio-fuels that substitute the use of fuels from other sources),
- Increased production of outputs in the scope 1 system boundary thus reducing demand in a down-stream scope 2 system (i.e. producing energy effi-

cient building materials, thus reducing demand for building heating), and

- Land-use changes within the scope 1 system that changes average net carbon sequestration of land outside the scope 1 project area (leakage).

Again, it is to be noted that the specific primary energy use (p_2) and emission factors (ef_2) of scope 2 emission sources do not change as a result of alterations to the project.

Summary accounting framework

Table 1 gives an overview of the relationship between emission reductions, emission types and system boundaries.

On the basis of this framework it is the task of the project developer to determine a baseline value for the p_1 , ef_1 and/or s_1 factor(s) that is/are changed as result of the project-based intervention using a project-based approach.

Table 1. Scopes 1 and 2 in emission reduction accounting

	Scope 1	Scope 2
Emission type	Direct emissions	Indirect emissions
Emission change by	Emission rate change	Activity level change
System boundaries in which direct emission change occurs	The proposed project and the baseline cover the same sources and sinks within scope 1 system boundaries.	Proposed project experiences a change of indirect emissions within the scope 1 system that creates an activity level change on corresponding direct emission changes within scope 2 system boundaries.
Factor change	p_1 (average primary energy use per unit of output, or net sink capacity) ef_1 (emission factor of primary energy)	s_1 (average specific delivered secondary energy use per unit of output, or land-use impact)

2

Primary emission impacts by project type

As indicated above, project-based interventions create emission changes related to one or more of the factors described above. Tables 2 to 7 classify project types according to emission factors.⁵ These tables focus on CO₂ and CH₄. Future versions of these guidelines will also provide emission factors for other GHG emissions.

This classification provides guidance to project developers with respect to the selection of baselines as well as the calculation of emission changes as a result of project interventions.

Project developers may use the tables to identify the type of project that they are proposing and to identify the corresponding emissions from the project. [Future versions of these guidelines might also recommend typical baseline options for different project types, thus further simplifying the work of project developers related to the selection of baselines.]

⁵ The table uses a project type classification that was promoted in an early draft of the GHG Protocol Project Typology for illustrative purposes and the calculation of primary emission impacts was added by the authors to make the point that all project types can be expressed as one or more primary emission impact.

Table 2. Classification of project types (energy and power)

Energy and power		Primary emissions impact		
Type of project		Emission rate $e = p_1 \times ef_1$		Activity level elsewhere $e = s_1 \times (p_2 \times ef_2)$
A. Energy and power	Example	p_1	ef_1	s_1
A 1 Energy generation, supply, transmission and distribution				
A 1.1 Renewable energy	Generation of electricity from renewable sources for own use or sale Biomass co-firing		Substitution of fuel with higher emissions factor	Substitution of production of secondary energy output at grid feeding plant(s)
A 1.2 Generator efficiency	Process controls to improve combustion efficiency	Reduced primary energy use		Reduced production of secondary energy generation at grid feeding plant(s) ^a
A 1.3 Grid management	Improved insulation of district heating conducts			Reduction of secondary energy output at the grid feeding plant
A 1.4 CHP	Replacement of a heating plant by a CHP plant	[Changed primary energy use] ^b		Substitution of production of secondary energy output at grid feeding plant(s)
	Heat supply network extension			Substitution of secondary energy generation at newly connected heat user

Table 2. Classification of project types (energy and power) (continued)

<i>Energy and power</i>		<i>Primary emissions impact</i>		
<i>Type of project</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>A. Energy and power</i>	<i>Example</i>	p_1	ef_1	s_1
A 2 End use energy efficiency				
A 2.1 Industrial and building efficiency	Reduced heat losses from	Reduced primary energy use		Reduction of secondary energy output at the grid feeding plant
	Secondary energy use improvement, i.e. use of efficient motors			Reduction of secondary energy output at the grid feeding plant
	Substitution of secondary energy use with primary energy use	Increased primary energy use		Reduction of secondary energy output at the grid feeding plant
	Substitution of electricity with imported steam			Reduced electricity generation from grid AND increased production of steam at grid feeding plant
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
A 3 Fuel switch				
A 3.1 Boiler fuel switch	Fuel switch in the direction coal > oil > gas > biofuels	Substitution of fuel with higher emissions factor		
A 3.2 Switch to other less carbon-intensive fuel technologies	Biomass or waste co-firing	Substitution of fuel with higher emissions factor		Reduction of biodegradable material left to decompose and release methane

^aIf intervention causes an increase of output.

^bDepends on how primary fuel use is allocated between heat and power generation.

Table 3. Classification of project types (transport)

<i>Transport</i>		<i>Primary emissions impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>B Transportation</i>	<i>Example</i>	p_1	ef_1	s_1
B 1.1 Fuel switch	Substitution of diesel with LNG in municipal buses	Substitution of fuel with higher emissions factor		
B 1.2 Energy efficiency	Replacement of old freight vehicles by modern, low fuel consumption trucks	Reduced primary energy use		
B 1.3 Haulage efficiency	Improvement of transportation logistics of a freight service company, cutting total transportation distances	Reduced primary energy use		

Table 4. Classification of project types (industrial)

<i>Industrial projects</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>C. Industry</i>	<i>Example</i>	p_1	ef_1	s_1
Production				
C.1.1 Cement	Improving process energy efficiency	Reduced primary energy use		Reduced use of electricity
	Decreasing the clinker factor			Reduced clinker use

Table 4. Classification of project types (industrial) (continued)

<i>Industrial projects</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>C. Industry</i>	<i>Example</i>	p_1	ef_1	s_1
Production				
C.1.1 Cement (continued)	Substituting waste for fossil fuels		Substitution of primary energy carrier with lower ef	
C.1.2 Iron and steel	Improving process energy efficiency	Corresponds to energy and power project typology		
	Substituting materials for reduction of iron	Substituting coke with biomass		
C.1.3 Aluminium and non ferrous	Improving process energy efficiency	Corresponds to energy and power project typology		
C.1.6 Pulp and paper	Improving process energy efficiency	Corresponds to energy and power project typology		
	Waste management	Corresponds to fugitive emissions capture and recycling		
Recycling and reuse				
C.2.1 Recycling and reuse	Recovery and reuse of materials, half-products, heat			Substituting use of materials, half-products, heat

Table 5. Classification of project types (fugitive emissions capture)

<i>Fugitive Emission Capture</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>D Fugitive emission capture</i>	<i>Example</i>	p_1	ef_1	s_1
D 1 Extraction				
D.1.1 Coal industry	CH ₄ emission capture and destruction in coal mines		Conversion of CH ₄ to CO ₂	
	CH ₄ emission capture and combustion for electricity generation	Corresponds to energy and power typology: renewable energy		
D.1.2 Oil industry	Associated gas capture and combustion		Conversion of CH ₄ to CO ₂	
	CH ₄ emission capture, liquefaction and sale to generate electricity	Corresponds to energy and power typology: renewable energy		
D.1.3 Transmission distribution of methane and oil	Sealing of gas leakages	Reduced CH ₄ emissions per unit of gas/oil transported		
D 2 Waste management				
D.2.1 Landfill/biomass capture	Collection of landfill gas and combustion in a CHP-plant		Reduction of biodegradable material left to decompose and release methane per unit of deposited waste plus CO ₂ -emissions from methane combustion	Reduction of secondary energy output at the grid feeding plants

Table 5. Classification of project types (fugitive emissions capture) (continued)

<i>Fugitive Emission Capture</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>D Fugitive emission capture</i>	<i>Example</i>	p_1	ef_1	s_1
D 2.2 Waste prevention and recovery	Collection and incineration of straw, other agricultural residuals or food industry residuals for energy generation purposes		Reduction of biodegradable material left to decompose and release methane Direct CO ₂ emissions from burnt methane	Reduction of secondary energy output at the grid feeding plant
D 2.3 Wastewater treatment projects				

Table 6. Classification of project types (agricultural)

<i>Agricultural projects</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>E Agricultural projects</i>	<i>Example</i>	p_1	ef_1	s_1
E 1.1 Reduced methane from rice cultivation	Process changes		Reduced CH ₄ emissions per unit of rice harvest	
E 1.2 Improved livestock production efficiency	Cattle feed additives that reduce CH ₄ production in digestion		Reduced CH ₄ emissions per unit of cattle	
E 1.3 Animal waste management	Capture of biogas from sewage		Reduced CH ₄ emissions per unit of disposed sewage	

Table 7. Classification of project types (sequestration)

<i>Carbon sequestration</i>		<i>Primary emission impact</i>		
<i>Type of intervention</i>		<i>Emission rate</i> $e = p_1 \times ef_1$		<i>Activity level elsewhere</i> $e = s_1 \times (p_2 \times ef_2)$
<i>F Carbon sequestration</i>	<i>Example</i>	p_1	ef_1	s_1
<i>F 1 LULUCF sequestration</i>				
F 1.1 Afforestation and reforestation	Replanting of native tree species, planting of shade trees		Increased carbon sequestration per area	
F 1.2 Avoided deforestation/preservation	Declaration and protection of a natural reserve, accompanied by awareness building and teaching of local residents		Increased carbon sequestration per area	
F 1.3 Cropland management	Soil enrichment		Increased carbon sequestration per area	
F 1.4 Forest management	Switch to sustainable forest management with selective logging		Increased carbon sequestration per area	
<i>F 2 Geological sequestration</i>				
F 2.1 Deep injection	CO ₂ capture at exhaust stacks and re-injection into oil fields		Increased carbon sequestration per area	

3 *Selecting a baseline*⁶

The objective of baseline selection is to determine the most qualified baseline and a baseline crediting period for a project. These guidelines describe how to select a baseline using a project-specific approach, determine a crediting period for this baseline and how to identify parameters that could trigger a baseline switch within this crediting period.⁷

As outlined above, a project is categorized by the impact it has on GHG emissions.

Step-wise approach for the selection of project-specific baselines

A project developer seeking to claim credit for reducing emissions, needs to manage limited resources to select the most credible baseline from a potentially large pool of baseline options.

This guidance is aimed at providing a consistent approach to facilitating a project developer's efforts in identifying a credible baseline and reducing the cost of selecting this baseline by:

- Reducing the number of possible baseline options on the basis of criteria that provide a reasonable basis for elimination early in this process, and

⁶ The original step-wise approach has been developed in an earlier draft of this document and was refined by a GHG Protocol task-force working on Project Specific Baseline Selection. That work has since been revised and modified in the process to reflect feedback from the stakeholders.

⁷ These guidelines focus exclusively on project-specific baselines. For information on using benchmark-derived baselines:
<http://www.ghgprotocol.org>
<http://www.northsea.nl/jiq/probase/>.

- Conducting formal tests in a sequential order to rank remaining baseline options according to the likelihood of their occurrence under business-as-usual conditions.

The following guidance is written from the perspective of a project developer in the early phases of the project development process and is interested in determining whether the project under consideration is likely to earn credit for its GHG reductions.

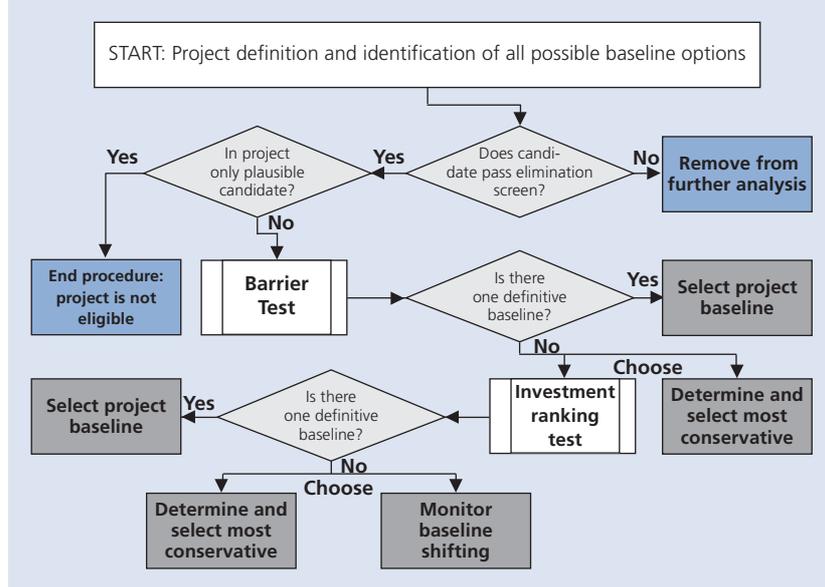
The guidance can also be used to prepare documentation that may be required to obtain regulatory approval for the registration of such projects under voluntary or mandatory regulatory programmes at later stages in the development process.

Figure 3 outlines the steps involved in selecting a project-specific baseline. The steps are listed below and explained in more detail in the following sections:⁸

1. Identify possible baseline options for every primary GHG impact of the project;
2. Eliminate non-plausible baseline options using the candidate elimination screens;
3. End the baseline selection procedure if the proposed project is the only plausible baseline: the project is non-additional;

⁸ The definition of these steps is the result of an evolutionary process involving a number of earlier efforts including an earlier draft of this document, the guidelines for the Dutch ERUPT programme as well as an earlier draft on project-specific baselines written for the GHG Protocol Project Quantification Standard (roadtest draft).

Figure III. Step-wise approach for the selection of project-specific baselines



4. Perform the Barrier Test if there is more than one plausible baseline option *including the project*; End the customized baseline selection procedure if the Barrier Test provides one definitive baseline for all variations of test assumptions;
5. Use the Investment Ranking Test on all competing baselines if the Barrier Test does not provide one definitive baseline but competing baselines;
6. End the customized baseline selection procedure if the Investment Ranking Test provides one definitive baseline;
7. If the Investment Ranking Test does not provide a definitive baseline, the project developer has the following options:
 - (a) To quantify the emissions/removal rate for all competing baselines and choose the most conservative competing baseline (lowest emissions or highest removals over the life-time of the project), or
 - (b) To specify the set of assumptions (e.g. price differentials between competing input factors, local availability of input factors) that would result in switching from one baseline to another competing baseline. In the context of the monitoring plan, establish the necessary protocols to observe any changes in the assumptions that would cause a shifting of a component baseline to a competing baseline.

These steps need to be implemented separately for every GHG primary impact that is created by a project intervention. If a proposed project has two or more primary impacts, this process is to be repeated for every primary impact. For example, a landfill gas project may (a) capture the waste methane and (b) use the methane to generate electricity for the facility so it no longer needs to purchase grid electricity. In this case, a project developer would need to select a baseline for the “capture” impact as well as for the “offsetting of grid electricity” impact.

Application of the project-specific baseline selection procedure

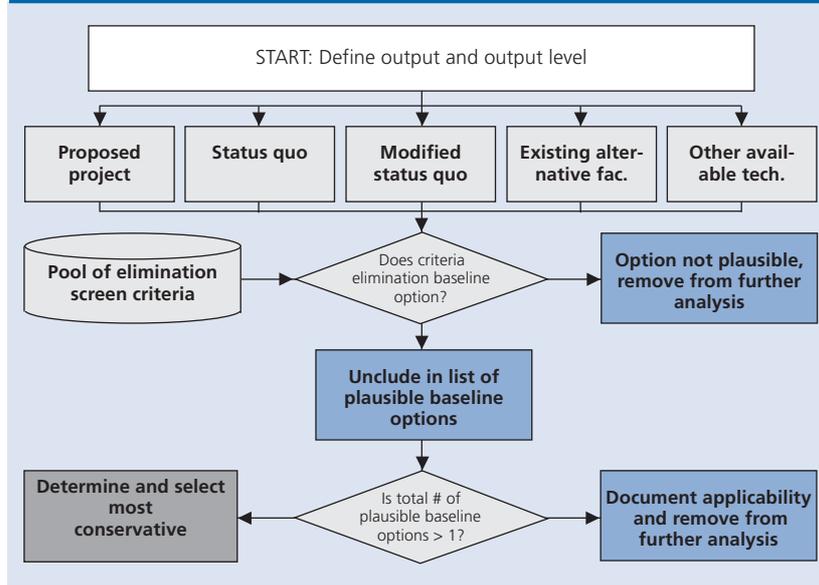
Identify possible baseline options

The possible baseline options for the project's primary impacts should include all possible courses of action, e.g. existing and new alternative delivery systems for producing the project system's output.

The purpose of this step is to create a list of possible baseline options that can be used as the basis for selecting the baseline (figure 4). The list should include:

- The proposed project;
- If appropriate, the status quo of the existing facility or site;

Figure IV. Generating possible and plausible reference scenario candidates



- A modified status quo, defined as the current status quo plus future projects necessary to achieve compliance with existing mandatory regulations and planned regulations that will become mandatory within the crediting period;
- In the event of a shutdown of operations, the technology that would be used to produce the same outputs as the project elsewhere (e.g. purchase of grid electricity instead of own generation, displacement of non-competitive production facilities (e.g. a cement plant driven out of production due to high operating costs)) or land-use changes on other sites; and
- Other locally available and currently used alternative production systems.

In addition, the developer should list all other possible candidates that represent possible courses of action that may be outside of those listed above.

Option elimination criteria

The purpose of screening possible baseline options is to reduce the number of baseline options that a project developer needs to assess in more detail using the Barrier and Investment Ranking Tests, thus reducing time and cost of selecting a baseline without compromising the integrity of this process.

Option elimination is based on a list of criteria that, if not met, eliminate a possible baseline option from further consideration on the basis of the following rationale:

- The possible baseline option does not meet an applicable national, state or local regulation or legal requirement that is customarily enforced within the region/area of the project's location, or
- The possible baseline option encounters a barrier related to the local availability or cost of a key resource or technology at the scale it is to be deployed that cannot be overcome by project design or would obviously be uneconomic.

An example of how these criteria may be applied is illustrated for an industrial boiler project. For the proposed project which upgrades the boiler to a more efficient coal-fired boiler, there are two possible baseline options: (a) fuel-switching to gas and (b) maintaining the current status quo. The first option, the fuel switch to gas, could be eliminated on the basis of a resource availability criterion if it could be demonstrated that natural gas is not locally available (i.e. access to the closest gas pipeline is non-economic, due to distance or geographical features). Similarly, the second possible baseline, the status quo, could be eliminated using the regulatory criterion, if the current status quo of that facility did not comply with locally enforced air pollution regulations. If in fact, both criteria were applicable, the proposed project would represent the only permissible course of action, and could not generate any additional GHG reductions.

Applicability of option elimination criteria

The application of option elimination criteria should use criteria that are well documented and have unquestionable reasoning. The project developer must be able to attest that:

- The applicability of regulations and other legal requirements as well as their enforcement is not subject to interpretation or argument;
- The data used to argue for the elimination of a possible baseline option is reliable and verifiable.

Project developers should use their best efforts to identify all relevant criteria and related data that might lead to the elimination of a possible baseline option from further consideration. This is to protect them from subsequent suggestions by a third party, such as a regulator, verifier or stakeholder, that a component baseline should have been eliminated.

Availability of data for the option elimination criteria

The application of option elimination criteria requires access to reliable and verifiable data that informs a project developer whether a possible baseline option meets or fails those criteria. Box 1 lists typical data sources for these criteria.

Implementing option elimination criteria

The application of option elimination criteria is a three-step process.

Step 1: Apply elimination screen criteria to possible baseline options and the proposed project

The project developer screens all possible baseline options to determine whether during the baseline validity period the following would occur:

- A baseline option does not comply with any locally applicable and customarily enforced regulations or other legal requirements;
- A baseline option encounters barriers that make the implementation of a possible baseline option impossible and cannot be overcome by project design adjustments. This could be related to the availability of key resources, such as fuels, materials, staff, technology or knowledge, climatic, geographical or other circumstances (list to be extended) that could not be overcome through project design or would make its implementation highly/obviously non-economic.

Step 2: Document the elimination of any baseline options or the project

Project developers are required to provide supporting documentation and argument if they suggest eliminat-

Box 1: Data sources and information for the application of candidate elimination screens

Relevant data/information

- List of applicable national/regional/local mandatory laws
- List of applicable mandatory regulatory standards, permitting requirements
- If appropriate, information on levels of enforcement of law or regulation in question
- Other evidence (e.g. policy positions) that project contributes to GHG legislation
- Locally available fuels, materials, know-how, technology and other resources
- Geographical and climatic conditions

Data/information sources:

- Legal texts
- Local lawyers and legal opinions
- Local regulators/enforcement agency
- Environmental NGOs
- Case law, e.g. publicly available baseline studies from other verified projects
- Official planning data
- Resource maps
- Technology inventory lists

ing a possible baseline option from further consideration, i.e. by documenting:

- Which mandatory requirements, i.e. related to local emissions, technology, performance standard, process, emissions, or land-use management that are customary within the local sector are not met by the possible baseline option;
- Which key resource is not locally available and cannot be made economically available through project design; or
- Which climatic, geographical or other circumstances exists that cannot be overcome through project design.

Step 3: End customized baseline selection procedure if the proposed project is the only plausible baseline or if the proposed project is eliminated

If the candidate elimination screens eliminate all baseline options from further consideration, the proposed project resembles the baseline and can therefore not generate emission reductions.

This baseline selection process also ends if the application of the option elimination criteria also leads to the elimination of the proposed project, as this implies that the proposed project does not meet a mandated regulatory requirement.

After project developers have applied all elimination criteria, they will have a list of plausible baseline options.

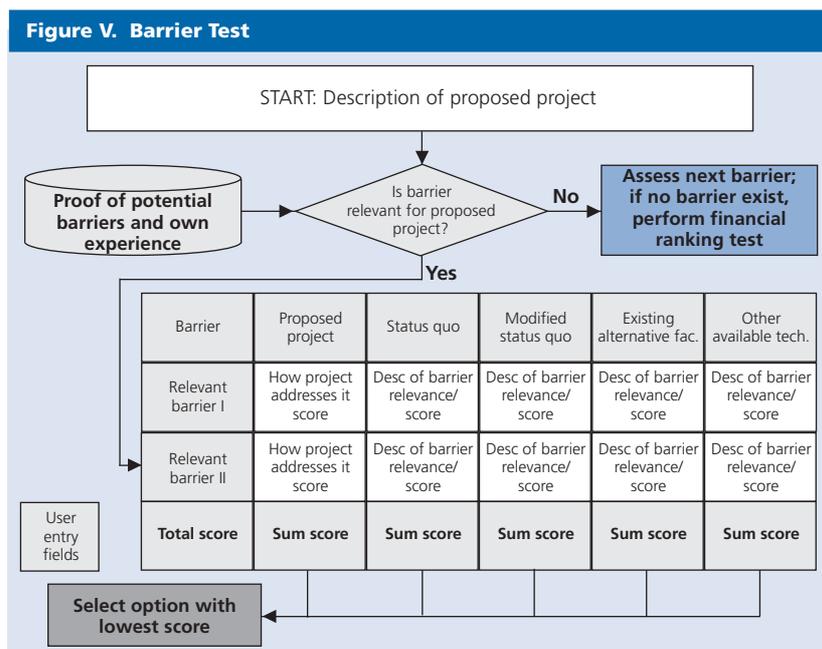
The Barrier Test

The purpose of the Barrier Test is to identify barriers facing a project (that may be overcome through project design) and to rank all plausible baseline options and the proposed project in terms of their ability to overcome the barrier(s). The baseline selected will be the one that is least affected by the barrier(s) (which may also be the project case). An example for the application of the Barrier Test is included in box 3 below.

Ideally, the Barrier Test delivers one definitive baseline irrespective of changing assumptions. However, if changing assumptions do create competing baselines then subsequent procedures need to be performed to eliminate the competing baselines.

Applicability of the Barrier Test

The Barrier Test is particularly relevant for projects that are implemented in environments with imperfect market conditions, institutional shortcomings as well as other factors that require special project design specific interventions to remove such barriers and ensure successful implementation.



Some possible project design elements that can be used to overcome barriers include:

- Project partnership/network arrangements;
- Supporting capacity-building measures and information dissemination related to technology, operational and maintenance know-how, product use, etc.;
- Innovative financing arrangements;
- Availability of carbon revenue;
- Others.

If the project developer finds that the Barrier Test is not applicable for his proposed project because no barriers can be identified, he can skip this test and implement the Investment Ranking Test. Table 8 illustrates some barriers that may affect projects.

Some examples of how barriers may affect a project include:

- Energy-efficient technology that would create substantial operational cost reductions: Investment in this type of project may not occur because of concerns that operating experience is insufficient, or there is a lack of local manufacturing capacity and/or a regulatory bias against imported equipment. These points can be listed as legal, technology operation and supply-chain related barriers.
- Energy efficiency project to improve building insulation in a hospital: The investment might have a pre-

dictable cash-flow from energy cost savings (determined by an energy audit) that meets an investor's hurdle rate, but financing could be contingent upon the availability of the hospital's own co-financing for energy efficiency investments. This investment decision takes into consideration the other investment priorities that are facing the hospital. This reflects a financial/budgetary barrier.

- A project that captures and combusts landfill gas from an existing municipal waste landfill. The underlying technology is well tested; no relevant barriers exist in the country to the use of this technology. In this case the Barrier Test is not applicable.

Availability of data for the Barrier Test

Before using this test, a project developer should assess whether the data that is required to perform this test is available (see box 2). This data is used to document that (a) a barrier does exist within the local context, (b) a barrier is relevant for the proposed project and, (c) how a barrier impacts plausible baseline options. In some cases, data might exist but can't be used because of confidentiality requirement or it lacks verifiability.

If a project developer does not have sufficient data to perform the Barrier Test, he should proceed with the Investment Ranking Test.

Table 8. Illustrative barrier categories

<i>Barrier category</i>	<i>Description</i>
Financial/ budgetary	Access to capital for project finance Hurdle rates of third-party investors Mismatch between investment costs and energy savings High initial capital costs and lacking access to credit Lack of access to foreign capital
Legal	Regulatory biases or absence of regulation Unclear ownership rights
Technology, operation and maintenance	Higher perceived risks of new technology Lack of trained personnel or technical or managerial expertise Need to make changes to existing infrastructure to integrate technology
Supply-chain	Lack of adequate supply infrastructure for spare parts, fuels, etc. Lack of transport infrastructure (may overlap with above category — maintenance)
Market structure	Below long-run marginal cost pricing and other price distortions High transaction costs
Informational	Lack of awareness about available technologies, products, financial support
Other	

Box 2. Data sources and information required for the Barrier Test

Relevant data/information

- Financial or budgetary information, e.g. availability of financing, credit, foreign capital, etc.
- Societal, skill and informational data, e.g. social traditions, training programmes, information dissemination mechanisms, etc.
- Market information, e.g. product prices, tariffs, import rules, distribution systems, etc.
- Other themes that have a direct impact on the feasibility and/or design of the project.

Sources of data/information

- Documents prepared by the project developer, contractors or project partners in the context of the proposed project or similar previous project implementations
- Corporate documents
- Expertise from local advisors/experts that are familiar with the local conditions where the project will be implemented
- Public Reports or studies, i.e. baseline studies for other projects
- Government sources (e.g. the climate change coordination office of the project host country)
- Industry studies
- Sector-level reports of bi-/multilateral organizations (e.g. JI/CDM National Strategies Studies which now exist for a large number of developing and transitional countries)

Implementing the Barrier Test

The Barrier Test is implemented as a six-step process:

1. Identify perceived barriers to the implementation of the proposed project and reference documents referred to as evidence of barriers
2. Describe how project design overcomes the barriers
3. Describe barrier relevance to all plausible baseline options
4. Rank plausible candidates and proposed project in order of increasing barrier relevance and assign increasing scores
5. Aggregate scores over all barriers for each candidate and the project (only applies if more than one barrier is identified)
6. Select baseline: candidate with the lowest aggregate score

Step 1. Identify perceived barriers to the implementation of the proposed project

Identify all perceived barriers that will impact project feasibility and/or design⁹ that the project developer is facing or expecting to face with the implementation of the proposed project. See example in box 3.

⁹ We suggest including “expected” barriers, considering that this analysis is prepared at an early stage of project development and conclusive analysis, i.e. the relevance of individual factors might not be available.

Step 2. Describe how project design overcomes barriers

The project developer needs to describe how the barriers identified in step 1 are overcome by project design. By so doing, the project developer documents the relevance of the barrier for the proposed project. For instance, a project developer could describe how a specific project arrangement, e.g. project partnerships, use of advanced financing instruments, know-how transfer, process/technology innovation as well as the additional value generated by GHG reductions could be used to overcome a barrier. See example in box 3.

Step 3. Describe barrier relevance to all plausible baseline options

The project developer needs to describe how these barriers apply to all plausible baseline options. This description is used to establish the relevance of a barrier to any plausible baseline option. See example in box 3.

Step 4. Rank plausible candidates and proposed project in order of increasing barrier relevance and assign increasing scores

The project developer needs to rank all plausible baseline options and the proposed project in order of increasing barrier relevance. The candidate which is least affected by the barrier is given the lowest score. This ranking is used to identify the baseline from the set of plausible candidates whereby candidates where the barrier has the least relevance are the “more likely courses of action”. See example in box 3.

Box 3. Applying the Barrier Test: Energy efficiency project to improve building insulation in a hospital

Step 1: Identify perceived barriers to the implementation of the proposed project

The main barrier identified is the lack of owner/operator financing to fund up-front investment costs for the project. This is despite the project meeting the investors (ESCO) hurdle rate. The project developer in consultation with an international energy efficiency expert (name and company should be included) and the project operator identified the barrier.

Step 2. Describe how the project design overcomes the barriers

The identified barrier could be removed by supporting the project operator's co-financing through a loan that is secured by the additional cash-flow expected from the sale of emission reduction credits.

Step 3. Describe barrier relevance to all plausible baseline options

The project developer identified two plausible baseline options:

- 1) the proposed project, and
- 2) the current status quo.

The barrier identified in step 1 (lack of co-financing) is highly relevant for the first (as described in step 1 of the Barrier Test) baseline option. However, the barrier is not relevant for the second option because this baseline does not require an investment and therefore the lack of owner co-financing is irrelevant.

Step 4. Rank plausible candidates and proposed project in order of increasing barrier relevance and assign increasing scores

The developer would rank the two candidates as follows:

- 2. current status quo (score = 1, i.e. barrier is not relevant)
- 1. proposed project (score = 2, i.e. barrier is more relevant)

Step 5: Aggregate scores over the barriers for each candidate and the project

This step would not apply in this example as only one barrier was identified. This means that the step 4 ranking is also the final ranking.

Step 6: Select baseline

The baseline would be the current status quo for this project.

Step 5. Aggregate scores over the barriers for each candidate and the project

This step is only relevant where there was more than one barrier identified for the proposed project. If this is the case, the project developer needs to repeat step 4 for all barriers identified. All scores are then added for each candidate (see tables 9 to 11). Considering that all bar-

Table 9. Test result: generates one definitive baseline (candidate 3)^a

Cells show ranks	Project scenario		
	Baseline 1	as baseline	Baseline 2
Barrier 1	2	3	1
Barrier 2	3	2	1
Cumulative	5	5	2
Total rank	2	2	1

^aThe GHG Protocol Initiative Project Quantification Standard roadtest draft uses an adapted evaluation method on the basis of feedback received from stakeholders. It suggests a binary system for the evaluation of barriers and proposes to use this tool on an optional basis.

Table 10. Test result: two competing baselines (candidates 2 and 3)

Cells show ranks	Project scenario		
	Baseline 1	as baseline	Baseline 2
Barrier 1	3	2	1
Barrier 2	3	1	2
Cumulative	6	3	3
Total rank	3	1	1

Table 11. Test result: three competing baselines

Cells show ranks	Project scenario		
	Baseline 1	as baseline	Baseline 2
Barrier 1	2	3	1
Barrier 2	2	1	3
Cumulative	4	4	4
Total rank	1	1	1

riers are deemed similarly relevant (they all require special project design to overcome them), they are weighted equally.

Step 6. Select baseline

The plausible baseline option with the lowest score becomes the baseline. Should there be more than one candidate with the lowest score, the project developer needs to:

- Perform the Investment Ranking test to try to identify a definitive baseline, or
- If the Investment Ranking Test is not applicable quantify the GHG emissions or removals for all competing project baseline options and choose the candidate with the lowest emissions (or greatest removals).

If only one baseline is identified the project developer can end the customized baseline selection process.

Investment Ranking Test

The purpose of the Investment Ranking Test is to use an appropriate financial indicator to rank all plausible baseline options and the proposed project in terms of their performance vis-à-vis that indicator. The baseline option that shows the best performance under business-as-usual conditions is selected as the project baseline.

Ideally, the Investment Ranking Test delivers one definitive baseline irrespective of changing assumptions. However, if changing assumptions do create competing baselines then subsequent procedures need to be performed to eliminate the competing baselines.

Applicability of Investment Ranking Test

The Investment Ranking Test is used when:

- The Barrier Test was not applicable to or used for the proposed project, or
- The Barrier Test generated one or more competing baselines.

For example, in the case of a landfill-gas capture project, there were no barriers to the project identified, so the Barrier Test was not applicable. An Investment Ranking Test — using an economic rate of return indicator and a financial rate of return indicator — could then be used to select a baseline from a set of plausible baseline options.

Availability of Investment Ranking Test data

A project developer should check whether the necessary data to conduct the Investment Ranking Test (including sensitivity analyses) is available and accessible for *all* plausible baseline options including the proposed project (see box 4).

Box 4. Data sources and information for Investment Ranking Test

Relevant data/information

- Financial analysis information, e.g. construction costs, financing costs, prices of outputs, discount rates, risk, market development plans, etc.
- Operating financial information, e.g. operating and maintenance costs, input costs (such as fuels, materials, etc.)

Sources of data/information

- Project developer experience
- Local advisors/experts familiar with the local conditions for certain project types
- Reports/studies by other developers, i.e. public baseline studies for other projects
- Industry studies, market/sector development plans

Reasons for unavailability of data include confidentiality or inability to verify the information.

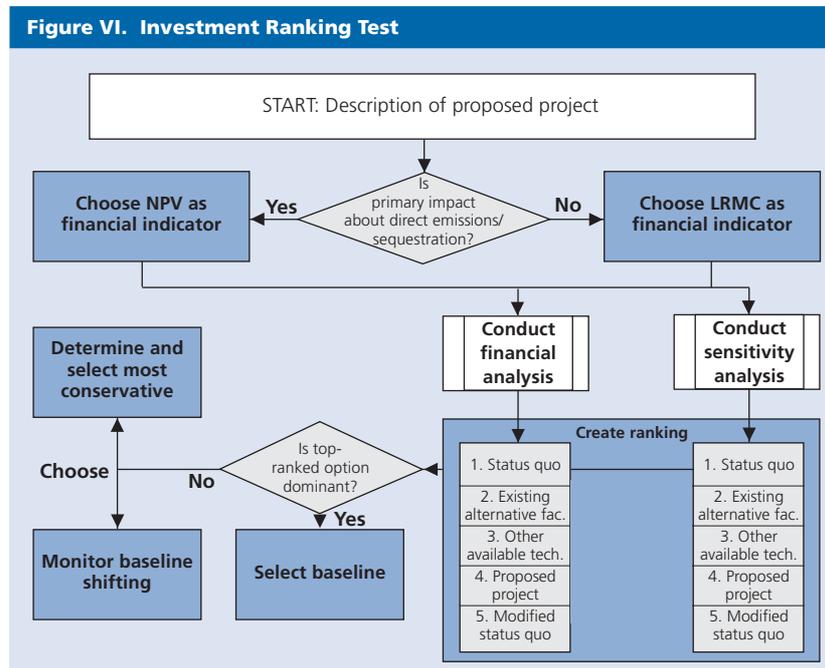
If there is insufficient data to implement the Investment Ranking Test after all reasonable efforts to obtain such data have been taken, the project developer is asked to estimate the GHG emissions/removals of all competing baseline options and select the baseline that yields the lowest GHG emissions or highest removals.

Implementing the Investment Ranking Test

The Investment Ranking Test has three steps (see figure 6).

- Selection of financial indicator
- Financial analysis
- Sensitivity analysis

Figure VI. Investment Ranking Test



Selection of financial indicator

A project developer can choose from a number of financial indicators to perform this test. The actual choice depends on (a) the project type, and (b) identity of the project developer (e.g. public vs. private).

Possible financial indicators

1. *Internal return rate on equity (IRR), or alternatively the net present value (NPV) express the profitability of given investment choices:* this indicator is appropriate to compare two investment options with each other. Sequestration projects as well as direct energy impact projects would most likely use this financial indicator to compare between baseline options.
2. *Long run marginal unit production costs (LRMC) express the costs of supplying one additional unit of output within a given system:* this indicator is appropriate to use when plausible baseline options include more than one facility, because a direct comparison of investment options is not possible. Most projects with indirect impacts (e.g. renewable energy) would most likely use this financial indicator to compare between baseline options. LRM are further differentiated in built LRM and operating LRM, whereby built LRM refers to costs including additional capital costs to construct new production facilities that are required to meet demand within a

system and operating LRM refers to costs that do not include additional capital costs.

Built vs. operating LRM

1. Project developers should use the *built LRM* when comparing a proposed project with new production capacities in a supply-constrained market (e.g. an electricity market that experiences black-outs or brown-outs). The built LRM is appropriate under these conditions, since the proposed project competes against other new projects to reduce the supply constraint.
2. Project operators should use the *operating LRM* when comparing the proposed project with existing production capacities in a demand-constrained market (e.g. a market characterized by excess reserve margins, over-capacity, or global competition). The operating LRM is appropriate under these conditions, since the proposed project is most likely replacing production from an existing facility.
3. In some cases, a proposed project will compete with both existing and new capacities (i.e. during capacity constrained peak load hours it would compete against other new supply options and during non supply constrained base load hours against existing facilities). In such a case, the project developer needs to assess the relative relevance of these circumstances or use both indicators on a proportional basis.

Financial analysis

The financial analysis for the proposed project and for plausible baseline options should be conducted on the basis of a consistent financial analysis tool, such as UNIDO's COMFAR.¹⁰

The tool should be used to calculate the chosen financial indicator for all baseline options using the same assumptions that are used in the project's feasibility study. Do not assign any value to the projected GHG reductions.

The baseline option with the best performing financial indicator becomes the project baseline of choice.

Sensitivity analysis¹¹

Considering that the financial analysis is based on a number of assumptions (e.g. input costs, output prices, discount rates) the project developer needs to perform a sensitivity analysis to verify the robustness of the selected project baseline. Usually, any financial analysis tool will support such sensitivity analysis with minimal additional effort for the project developer.

The project developer is asked to define realistic deviations from the chosen assumptions and determine via sensitivity analysis whether such deviations generate a different baseline.

Competing project baseline options will exist if the baseline changes when assumptions change.

If this procedure delivers one baseline and no competing project baselines, the project developer can end the selection procedure.

Choose conservative baseline or define baseline shifting parameters

If competing project baseline options still do exist, the project developer has three options:

- Choose a long-term crediting period, document the deviation of the chosen assumption that would trigger a baseline change within the crediting period and include provisions in the project's monitoring plan that would observe any changes in the assumptions,
- Choose a conservative crediting period that would provide regulatory assurance of the baseline irrespective of the occurrence of changing assumptions and reassess the validity of the baseline for a second crediting period, or
- Estimate the GHG emissions or removals for all competing baseline options and choose the candidate with the lowest GHG emissions or highest GHG removals.

For example, the baseline for a proposed project could be an industrial boiler with multi-fuel capabilities (coal or gas). The sensitivity analysis determines that as long as the price of coal is 0.2 cents below the price of gas (per kJ of energy) in the long-term contract market, the boiler would have been fired with coal.¹² However, as soon as the price of coal is less than 0.2 cents below the price of gas, the boiler would have been fired with gas. The project developer could:

- Make provisions in the monitoring plan that would track the price differential between coal and gas for long-term contracts and adjust the baseline automatically if that price differential were observed for the duration of that observation;
- Limit the crediting time to a period that would provide regulatory assurance and reassess the baseline at the end of that crediting period; or
- Choose a gas-fired baseline.

Baseline eligibility period and baseline switching parameters

Determining the initial baseline validity period

The determination of the initial baseline validity period should be based on the minimum duration for which

¹⁰ A licence for this tool can be obtained directly from UNIDO.

¹¹ In comparison, the GHG Protocol Project Quantification Standard (roadtest draft) suggests focusing on indicators that are outside the project developer's control, such as import tariffs or fuel prices.

¹² In this example, price changes on the spot market would not matter, considering that adjusting the burner carries a US\$ 100,000 cost per fuel-switching means that switching would only occur if the switching costs can be recovered in the context of a long-term contract.

key assumptions related to the performance with respect to criteria that were relevant in the baseline option ranking process are valid. At the end of this period, these assumptions have to be reviewed to observe baseline shifting and issue a baseline extension. This process may result in the renewal of the initial project baseline, the establishment of a new baseline, or a finding that the project is no longer additional (i.e. the project activity itself is the baseline). Forthcoming regulations from the Kyoto Protocol process are to be followed in this procedure.

- The review should be limited to the criteria that were relevant in the initial determination of the baseline.
- The consequences of different criteria performance on baseline adjustment should be laid out in the initial baseline determination document.
- The re-validation should also occur in accordance with criteria that have been laid out in the initial baseline determination document.

Rules for baseline extension

The purpose of a baseline validity period is not to limit the period for which the project can generate ERUs/CERs but to limit the period for which one set of baseline assumptions is valid. At the end of this period, baseline assumptions need to be reviewed and adjusted as necessary. The rules governing review and adjustment should be predetermined to improve process transparency, so that investors have confidence that they will be able to earn ERUs/CERs beyond the initial validity period. This is important considering the positive contribution of ERU/CER generation to net present value when using longer-term time horizons. While the discussion of such rules has not yet started in international negotiations, the following guiding rules can be identified:

Protocol for monitoring key criteria that could cause baseline shifting

When the baseline is re-assessed at the end of the initial validity period, it will be necessary to update the specific emission reduction calculation factors p_1 , ef_1 and/or s_1 . For scopes 2 and 3 emissions this is especially true for the external factors p_2 and ef_2 because project interventions do not impact these factors.

Because these factors will require constant updating, monitoring and verification protocols should be defined that clearly specify the needed measurement of these factors, how measurement should be conducted and verified. These protocols will be specific to the kind of energy or material/product under observation.

Box 5. Calculation of specific (output-based) emission reductions

After the baseline has been chosen, specific emission reductions (per unit of output) can be determined as described on page 6 (Accounting of absolute emission changes) with

$$\Delta e = (p_{11} \times ef_{11} + p_{12} \times ef_{12}) + (s_{12} - s_{11}) \times (p_2 \times ef_2)$$

By specifying the projected activity level Q_t for each period t in the lifetime T of the project, absolute emission reductions can be calculated with

$$E = \sum_{t=1}^T (Q_t \times \Delta e).$$

Note that the activity level Q is equal to the output of the project system.

Annex I. Workbook

The design of the workbook for these guidelines corresponds with the sections A to C of the UNFCCC CDM Project Design Document (PDD) format that are supported by these guidelines. Future versions of these guidelines might address additional sections in the future.

Some generic inputs that are common due to the use of this methodology have already been made and are indicated in **bold**.

A. General description of project activity

A.1. Title of the project activity: _____

Instruction: Please enter a short project title that characterizes the project type and sector

A.2. Description of the project activity:

Instruction: Please include in the description the purpose of the project activity and the views of the project participants on the contribution of the project activity to sustainable development (max. one page)

Description:

A.3. Project participants:

Instruction: Please list party(ies) and private and/or public entities involved in the project activity and provide contact information; indicate at least one of the above as the contact for the CDM project activity.

A. 3.1. Participant 1

Name: _____

Address: _____

Contact information: _____

CDM project contact: Yes No

A. 3.2. Participant 2

Name: _____

Address: _____

Contact information: _____

CDM project contact: Yes No

A. 3.3. Participant 3

Name: _____

Address: _____

Contact information: _____

CDM project contact: Yes No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

Instruction: Please enter all information to allow unique identification of this project activity

Host country party(ies): _____

Region/State/Province etc.: _____

City/Town/Community etc.: _____

Detail on physical location: _____

A.4.2. Category(ies) of project activity

Instruction: Please check the appropriate boxes. Note that multiple entries are possible.

Project category

Project type

Energy generation, supply, transmission and distribution

Renewable energy

Generation of electricity from renewable sources for own use or sale

Biomass co-firing

Other: _____

Generator efficiency

Process controls to improve combustion efficiency

Other: _____

Grid management

Improved insulation of district heating conduits

Other: _____

CHP

Replacement of a heating plant by a CHP plant

Heat supply network extension

Other: _____

End use energy efficiency

Industrial and building efficiency

Reduced heat losses from exhaust gas

Secondary energy use improvement, i.e. use of efficient motors

Substitution of secondary energy use with primary energy use

Substitution of electricity with imported steam

Other: _____

Fuel switch

Boiler fuel switch

Fuel switch in the direction coal > oil > gas > biofuels

Switch to other less carbon-intensive fuel technologies

Biomass or waste co-firing

Transportation

Fuel switch

Substitution of diesel with LNG in municipal buses

Other: _____

Energy efficiency

Replacement of old freight vehicles by modern, low fuel consumption trucks

Other: _____

Haulage efficiency

Improvement of transportation logistics of a freight service company, cutting total transportation distances

Other: _____

Project category

Industry

Production

Cement

Iron and steel

Aluminium and non ferrous

Pulp and paper

Recycling and reuse

Recycling and reuse

Fugitive emission capture

Extraction

Coal industry

Oil industry

Transmission and distribution of methane and oil

Waste management

Landfill/biomass capture

Waste prevention and recovery

Wastewater treatment projects

Project type

Improving process energy efficiency

Decreasing the clinker factor

Substituting waste for fossil fuels

Other: _____

Improving process energy efficiency

Substituting materials for reduction of iron

Other: _____

Improving process energy efficiency

Other: _____

Improving process energy efficiency

Waste management

Other: _____

Recovery and reuse of materials, half-products, heat

Other: _____

CH₄ emission capture and destruction in coal mines

CH₄ emission capture and combustion for electricity generation

Other: _____

Associated gas capture and combustion.

CH₄ emission capture, liquefaction and sale to generate electricity

Other: _____

Sealing of gas leakages

Other: _____

Collection of landfill gas and combustion in a CHP-plant

Other: _____

Collection and incineration of straw, other agricultural residuals or food industry residuals for energy generation purposes

Other: _____

Other: _____

Project category

Agricultural projects

- Reduced methane from rice cultivation
- Improved livestock production efficiency
- Animal waste management

Carbon sequestration

LULUCF sequestration

- Afforestation and reforestation
- Avoided deforestation/preservation
- Cropland management
- Forest management

Geological sequestration

- Deep injection
- Other: _____
- Other: _____

Project type

- Process changes
- Other: _____
- Cattle feed additives that reduce CH₄ production in digestion
- Other: _____
- Capture of biogas from sewage
- Other: _____

- Replanting of native tree species, planting of shade trees
- Other: _____
- Declaration and protection of a natural reserve, accompanied by awareness building and teaching of local residents
- Other: _____
- Soil enrichment
- Other: _____
- Switch to sustainable forest management with selective logging
- Other: _____

- CO₂ capture at exhaust stacks and re-injection into oil fields
- Other: _____
- Other: _____

A.4.3. Technology to be employed by the project activity:

Instruction: This section should include a description on how environmentally safe and sound the proposed technology is and if the technology is new to the project developer, whether know-how will be transferred by the sellers of the proposed technology.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gases (GHGs) are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

Instruction: Please describe system boundaries in terms of the scope in which the emission impact occurs (see page 3, Defining system boundaries) and the nature of the emission impact in terms of the emission relevant factor(s) that will change as a result of the proposed project (see pages 4 and 5, Explaining the occurrence of emission changes, and Framework to account for project-based emission changes).

The proposed project will lead to a change of:

- average primary energy use per unit of output, or net sink capacity of a land area unit, methane emission per unit of output,
- emission factor of primary energy use,
- activity level at an upstream, same-stream or down-stream facility, or land-use outside the system boundary (area) of a sequestration project.

In detail, the project will:

Instruction: Please explain briefly how anthropogenic greenhouse gas (GHG) emission reductions are to be achieved (detail to be provided in section B.) and provide the total estimate of anticipated reductions in tonnes of CO₂ equivalent as determined in section E of the CDM PDD

The baseline for this proposed project has been determined on the basis of a new baseline methodology that takes into account emission impacts that would not occur in the absence of the proposed project activity, that takes into account national and/or sectoral policies and circumstances in the baseline selection process. According to this methodology, the baseline has been identified as follows:

Instruction: Provide a description of the baseline including a description of the emission relevant factors that will be used to calculate the projected emission impact of the proposed project.

A.4.5. Public funding of the project activity:

Instruction: In case public funding from parties included in annex I is involved, please provide in annex 2 information on sources of public funding for the project activity, including an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those parties.

B. Baseline methodology

B.1. Title and reference of the methodology applied to the project activity:

Instruction: Please refer to the UNFCCC CDM web site for the title and reference list as well as the details of approved methodologies.

The baseline was developed on the basis of a new methodology with the working title: "General baseline methodology for baseline and additionality analysis for multiple project categories". Detailed documentation re the use of this methodology is available at <https://www.unido.org/doc/4224>.

B.2. Justification of the choice of the methodology and why it is applicable to the project activity

As documented in annex 3 for this new methodology, this methodology applies to the project categories listed in A.4.2. The project activity falls into one (or more) of these categories.

B.3. Description of how the methodology is applied in the context of the project activity:

The methodology is based on a systematic, step-wise approach that is applied as follows:

1. Identification of possible baseline options for every primary GHG impact of the proposed project;
2. Elimination of non-plausible baseline options using elimination screen criteria;
3. Performance of a barrier test to rank remaining plausible baseline options;
4. Performance of an investment ranking test on all competing likely baselines if the barrier test does not provide one definitive baseline;
5. Selection of one baseline if the investment ranking test provides one definitive most likely baseline;
6. Otherwise, selection of (a) the most conservative competing baseline (lowest emissions or highest removals over the life-time of the project), or (b) definition of a monitoring protocol that allows observing a set of assumptions (e.g. price differentials between competing input factors, local availability of input factors) that would result in switching from one competing baseline to another competing baseline.

B.4. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (i.e. explanation of how and why this project is additional and therefore not the baseline scenario)

Instruction: Please complete section B.4. for every primary emission impact of the proposed project.

Step 1: The following possible baseline options were identified:

Instruction: Use guidance from page 14, Identify possible baseline options, to identify possible baseline options

Ref. #	Name of possible baseline option	Brief description
001	Proposed project	
002	Status quo	
etc	

Step 2: The following possible baseline options were eliminated on the basis of the following elimination screen criteria:

Instruction: Use guidance from page 15, Option elimination criteria, to eliminate possible baseline options from further analysis

Ref. #	Name of possible baseline option to be eliminated from further analysis	Document applicability of a barrier screen

Instruction: If all possible baseline options but the proposed project are eliminated, the procedure ends here and the proposed project is not eligible for the CDM.

Step 3: A barrier test was applied to all plausible baseline options and a ranking of barrier relevance was created as follows:

Instruction: Use guidance from page 14, The Barrier Test, to complete this step: 0. check test applicability, 1. identify all relevant barriers to the proposed project, 2. describe how the design of the proposed project addresses these barriers, 3. describe relevance of these barriers to all plausible baseline options, 4. rank all options in decreasing order of barrier relevance for all barriers. 5. aggregate scores.

Barrier	Proposed project	Plausible baseline option #		
		Ref. No.	Ref No.	Ref. No.
Brief description of barrier 1	Describe how project design overcomes barrier	Describe relevance of barrier for this baseline option and assign comparative rank		
Barrier 2				

Instruction: Select baseline with lowest score. If the barrier test yields more than one baseline with lowest score, (a) perform step 4 or step 6.

Step 4: An investment ranking test was applied to all remaining competing plausible baseline options

Instruction: Use guidance from page 21, Investment Ranking Test, to complete this step: 0. check applicability of this test, 1. select financial indicator, 2. perform financial analysis and rank results in decreasing order of performance, 3. perform sensitivity analysis and rank results in decreasing order of financial performance.

The following financial indicator was selected and the following financial analysis model was used:

<i>Ranking of competing plausible baseline options in order of decreasing performance</i>			
<i>Financial analysis</i>		<i>Sensitivity analysis</i>	
<i>Ref. No. of competing baseline option</i>	<i>Financial indicator performance</i>	<i>Ref. No. of competing baseline option</i>	<i>Financial indicator performance</i>

Instruction: If the investment ranking test does not yield a dominant outcome (which means that both for the financial and sensitivity analysis the same baseline option is ranked first), perform step 5; otherwise, select baseline.

Step 5: Considering that after the financial ranking test no conclusive baseline could be identified, the project sponsor chooses to proceed as follows:

Instruction: Use guidance from page 23, Choose conservative baseline or define baseline shifting parameters, to complete this step.

- choosing a long-term crediting period, documenting the deviation of the chosen assumption that would trigger a shifting of baseline within the crediting period between the competing options and including provisions in the project’s monitoring plan that will observe any changes in assumptions triggering such shifting (details are provided in the monitoring plan);
- choosing a conservative crediting period that eliminates the incidence of changing assumptions triggering baseline shifting and commits to reassessing baseline validity at the end of the current crediting period;
- estimating the GHG emissions or removals for all competing baseline options and choosing the candidate with the lowest GHG emissions or highest GHG removals.

B.5. Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The baseline methodology differentiates two project boundary scopes and three kinds of GHG impacts that can occur within these scopes. These definitions are applied consistently to all project activities that are qualified to use this methodology. Relevant system boundaries and all cross-boundary material and energy flows are identified in the flow chart below.

Instruction: Use guidance on page 3, Defining system boundaries, to complete the flow chart.

System boundary and material energy flow chart.

B.6. Details of baseline development

B.6.1 Date of completing the final draft of this baseline section (DD/MM/YYYY):

B.6.2 Name of person/entity determining the baseline: _____

Instruction: Please provide contact information and indicate if the person/entity is also a project participant.

C. Duration of the project activity/Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity: _____

Instruction: For a definition by the Executive Board of the term "starting date", please refer to UNFCCC CDM web site. Any such guidance shall be incorporated in subsequent versions of the CDM PDD. Pending guidance, please indicate how the "starting date" has been defined and applied in the context of this project activity.

C.1.2. Expected operational lifetime of the project activity: _____

Instruction: In years and months, e.g. two years and four months would be shown as: 2y-4m

C.2 Choice of the crediting period and related information:

Instruction: Please check the appropriate option and fill accordingly. Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases, the starting date of the crediting period can be prior to the date of registration of the project activity.

C.2.1 Renewable crediting period (at most seven (7) years per period)

Starting date of the first crediting period (DD/MM/YYYY): _____

Length of the first crediting period: _____

C.2.2 Fixed crediting period (at most ten (10) years):

Starting date (DD/MM/YYYY): _____

Length (max. 10 years): _____

Annex II. Sample case study

The following case study is based on an existing project design document (PDD) that was submitted to the CDM Executive Board for approval. It has been adopted for illustrative purposes only. No statement made within the context of this case study shall be construed as meaning to represent an actual description of the project submitted to the CDM Executive Board.

A. General description of project activity

A.1 Title of the project activity: **A.T. Biopower Rice Husk Power Project, Thailand**

Instruction: Please enter a short project title that characterizes the project type and sector

A.2. Description of the project activity:

Instruction: Please include in the description the purpose of the project activity and the views of the project participants on the contribution of the project activity to sustainable development (max. one page).

Description: **The project involves construction and operation of five new combined heat and power facilities that will supply electricity to the grid and steam to industrial and agricultural users. It contributes to sustainable development by meeting Thailand's growing energy needs using renewable energy sources.**

A.3. Project participants:

Instruction: Please list party(ies) and private and/or public entities involved in the project activity and provide contact information; indicate at least one of the above as the contact for the CDM project activity.

A. 3.1. Participant 1

Name: **AT Biopower**

Address: _____

Contact information: _____

CDM project contact: Yes No

A. 3.2. Participant 2

Name: **Mitsubishi Securities**

Address: _____

Contact information: _____

CDM project contact: Yes No

A. 3.3. Participant 3

Name: **Rolls Royce Power Ventures**

Address: _____

Contact information: _____

CDM project contact: Yes No

A.4. Technical description of the project activity:

A.4.1. Location of the project activity:

Instruction: Please enter all information to allow unique identification of this project activity.

Host country party(ies): **Kingdom of Thailand**

Region/State/Province etc.: **5 locations in Thailand**

City/Town/Community etc.: _____

Detail on physical location: _____

A.4.2. Category(ies) of project activity

Instruction: Please check the appropriate boxes. Note that multiple entries are possible.

Project category

Project type

Energy and power

Energy generation, supply, transmission and distribution

Renewable energy

Generation of electricity from renewable sources for own use or sale

Biomass co-firing

Generator efficiency

Other: _____

Process controls to improve combustion efficiency

Grid management

Other: _____

Improved insulation of district heating conducts

CHP

Replacement of a heating plant by a CHP plant

Heat supply network extension

Other: _____

End use energy efficiency

Industrial and building efficiency

Reduced heat losses from exhaust gas

Secondary energy use improvement, i.e. use of efficient motors

Substitution of secondary energy use with primary energy use

Substitution of electricity with imported steam

Other: _____

Fuel switch

Boiler fuel switch

Switch to other less carbon-intensive fuel technologies

Fuel switch in the direction coal > oil > gas > biofuels

Biomass or waste co-firing

Transportation

Fuel switch

Substitution of diesel with LNG in municipal buses

Other: _____

Energy efficiency

Replacement of old freight vehicles by modern, low fuel consumption trucks

Other: _____

Haulage efficiency

Improvement of transportation logistics of a freight service company, cutting total transportation distances

Other: _____

Project category

Industry

Production

Cement

Iron and steel

Aluminium and non ferrous

Pulp and paper

Recycling and reuse

Recycling and reuse

Fugitive emission capture

Extraction

Coal industry

Oil industry

Transmission and distribution of methane and oil

Waste management

Landfill/biomass capture

Waste prevention and recovery

Wastewater treatment projects

Project type

Improving process energy efficiency

Decreasing the clinker factor

Substituting waste for fossil fuels

Other: **Reducing cement use in concrete production**

Improving process energy efficiency

Substituting materials for reduction of iron

Other: _____

Improving process energy efficiency

Other: _____

Improving process energy efficiency

Waste management

Other: _____

Recovery and reuse of materials, half-products, heat

Other: _____

CH₄ emissions capture and destruction in coal mines

CH₄ emissions capture and combustion for electricity generation

Other: _____

Associated gas capture and combustion

CH₄ emissions capture, liquefaction and sale to generate electricity

Other: _____

Sealing of gas leakages

Other: _____

Collection of landfill gas and combustion in a CHP plant

Other: _____

Collection and incineration of straw, other agricultural residuals or food industry residuals for energy generation purposes

Other: _____

Other: _____

Project category

Agricultural projects

Reduced methane from rice cultivation

Improved livestock production efficiency

Animal waste management

Carbon sequestration

LULUCF sequestration

Afforestation and reforestation

Avoided deforestation/preservation

Cropland management

Forest management

Geological sequestration

Deep injection

Other: _____

Project type

Process changes

Other: reduce methane emissions from rice husk land-filling

Cattle feed additives that reduce CH₄ production in digestion

Other: _____

Capture of biogas from sewage

Other: _____

Replanting of native tree species, planting of shade trees

Other: _____

Declaration and protection of a natural reserve, accompanied by awareness building and teaching of local residents

Other: _____

Soil enrichment

Other: _____

Switch to sustainable forest management with selective logging

Other: _____

CO₂ capture at exhaust stacks and re-injection into oil fields

Other: _____

Other: _____

A.4.3. Technology to be employed by the project activity:

Instruction: This section should include a description on how environmentally safe and sound technology and know-how to be used is transferred to the host party, if any.

The project will use suspension-fired boilers that produce high quality ash as a by-product. This project will bring this technology to Thailand for the first time. The project operator will provide capacity building for O and M through training.

A.4.4. Brief explanation of how the anthropogenic emissions of anthropogenic greenhouse gases (GHGs) are to be reduced by the proposed CDM project activity, including why the emission reductions would not occur in the absence of the proposed project activity, taking into account national and/or sectoral policies and circumstances:

Instruction: Please describe system boundaries in terms of the scope in which the emission impact occurs (see page 3, Defining system boundaries) and the nature of the emission impact in terms of the emission relevant factor(s) that will change as a result of the proposed project (see pages 4 and 5, Explaining the occurrence of emission changes, and Framework to account for project-based emission changes).

The proposed project will lead to a change of:

average primary energy use per unit of output, or net sink capacity of a land area unit, methane emission per unit of output,

emission factor of primary energy use,

activity level at an upstream, same-stream or down-stream facility, or land-use outside the system boundary (area) of a sequestration project.

In detail, the project will replace the generation of electricity, heat and cement at other facilities (scope 2 effect) and will lead to a reduction of methane emissions associated with land-filling rice husk.

Instruction: Please explain briefly how anthropogenic greenhouse gases (GHG) emission reductions are to be achieved (detail to be provided in section B.) and provide the total estimate of anticipated reductions in tonnes of CO₂ equivalent as determined in section E of the CDM PDD.

The baseline for this proposed project has been determined on the basis of a new baseline methodology that takes into account why emission impacts would not occur in the absence of the proposed project activity, and taking into account national and/or sectoral policies and circumstances in the baseline selection process. According to this methodology, the baseline has been identified as follows:

Instruction: Provide a description of the baseline including a description of the emission relevant factors that will be used to calculate the projected emission impact of the proposed project.

- 1. Electricity generation: Average CO₂ intensity of the Thai grid**
- 2. Heat generation: currently used bunker oil combustion (90 per cent efficiency)**
- 3. Rise husk land-filling: uncontrolled combustion**
- 4. Rice husk ash utilization: Avoided calcination and avoided fossil-fuel emissions from kiln firing from avoided clinker production**

Primary GHG impact	p_1	ef_1	s_1	$p_2 * ef_2$
Before				
Electricity generation			1 MWh delivered/ MWh produced ^a	504 kg CO ₂ /MWh ^b
Heat generation			1 t steam delivered/t steam produced ^c	236 kg CO ₂ /t steam @ 6 bar
Rice husk uncontrolled combustion	0.052 tCO ₂ e/t rice husk			
Ash utilization			1 t ash/t clinker	1000 kg/t clinker
After				
Electricity generation			0 MWh delivered/ MWh produced ^d	504 kg CO ₂ /MWh ^e
Heat generation			0 t steam delivered/t steam produced ^f	236 kg CO ₂ /t steam @ 6 bar
Rice husk uncontrolled combustion	0 tCO ₂ e/t rice husk			
Ash utilization			0 t ash/t clinker	1000 kg/t clinker

^aNo delivery losses included.

^bDetermined on an ex post basis, dynamic over time.

^cNo delivery losses included.

^dNo delivery losses included.

^eDetermined on an ex post basis, dynamic over time.

^fNo delivery losses included.

The table only displays those factors that experience a change due to project intervention. All other factors remain constant. On the basis of this data, emission reductions can be calculated as follows:

Primary GHG impact	Δe	Output	Expected emission reduction
Emission reduction			
Electricity generation	504 kg CO ₂ /MWh	660 GWh/a	332,640 tCO ₂
Heat generation	236 kg CO ₂ /t steam @ 6 bar	83 kt steam/a	19,588 tCO ₂
Rice husk uncontrolled combustion	52 kg CO ₂ e/t rice husk	715 kt rice husk/a	37,180 tCO ₂ e
Ash utilization	1000 kg/t clinker	30 kt rice husk ash/a	30,000 tCO ₂
Total (p.a.)			419,408 tCO₂e

A.4.5. Public funding of the project activity:

Instruction: In case public funding from parties included in annex I is involved, please provide in annex 2 information on sources of public funding for the project activity, including an affirmation that such funding does not result in a diversion of official development assistance and is separate from and is not counted towards the financial obligations of those parties.

N.a.

B. Baseline methodology

B.1. Title and reference of the methodology applied to the project activity:

Instruction: Please refer to the UNFCCC CDM web site for the title and reference list as well as the details of approved methodologies.

The baseline was developed on the basis of a new methodology with the working title: “General baseline methodology for baseline and additionality analysis for multiple project categories”. Detailed documentation re the use of this methodology is available at <https://www.unido.org/doc/4224>.

B.2. Justification of the choice of the methodology and why it is applicable to the project activity

As documented in annex 3 for this new methodology, this methodology applies to the project categories listed in A.4.2. The project activity falls into one (or more) of these categories.

B.3. Description of how the methodology is applied in the context of the project activity:

The methodology is based on a systematic, step-wise approach that is applied as follows:

- 1. Identification of possible baseline options for every primary GHG impact of the proposed project;**
- 2. Elimination of non-plausible baseline options using elimination screen criteria;**
- 3. Performance of a barrier test to rank remaining plausible baseline options;**
- 4. Performance of an investment ranking test on all competing likely baselines if the barrier test does not provide one definitive baseline;**
- 5. Selection of one baseline if the investment ranking test provides one definitive most likely baseline;**
- 6. Otherwise, selection of (a) the most conservative competing baseline (lowest emissions or highest removals over the life-time of the project), or (b) definition of a monitoring protocol that allows observing a set of assumptions (e.g. price differentials between competing input factors, local availability of input factors) that would result in switching from one competing baseline to another competing baseline.**

B.4. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered CDM project activity (i.e. explanation of how and why this project is additional and therefore not the baseline scenario)

Instruction: Please complete section B.4. for every primary emission impact of the proposed project.

Step 1: The following possible baseline options were identified:

Instruction: Use guidance from page 14, Identify possible baseline options, to identify possible baseline options.

1. For electricity generated

<i>Ref. #</i>	<i>Name of possible baseline option</i>	<i>Brief description</i>
001	Proposed project	Climate neutral supply of electricity
002	Power development plan and oil-fueled displacement caused by project	Grid average on the basis of national planning process NOT including the planned phasing out of oil-fired generation
003	Power development plan and oil-fueled displacement NOT caused by project	Grid average on the basis of national planning process including the planned phasing out of oil-fired generation

2. For steam generated

<i>Ref. #</i>	<i>Name of possible baseline option</i>	<i>Brief description</i>
004	Proposed project	Climate neutral supply of steam
005	Status quo	Continued use of bunker oil for steam production

3. For rice husk land-filling

<i>Ref. #</i>	<i>Name of possible baseline option</i>	<i>Brief description</i>
006	Proposed project	Controlled combustion of rice husk
007	Status quo	Rice husk land-filling and decay to methane
008	Modified status quo	Land-filling and uncontrolled combustion

4. For the utilization of high quality rice husk ash

<i>Ref. #</i>	<i>Name of possible baseline option</i>	<i>Brief description</i>
009	Proposed project	Rice husk ash use as cement replacing additive in concrete production
010	Status quo	Continued calcinations and fossil-fuel use for kiln firing for clinker production

Step 2: The following possible baseline options were eliminated on the basis of the following elimination screen criteria:

Instruction: Use guidance from page 15, Option elimination criteria, to eliminate possible baseline options from further analysis.

No options were eliminated. Additional analysis is required to select a project baseline.

<i>Ref. #</i>	<i>Name of possible baseline option to be eliminated from further analysis</i>	<i>Document applicability of a barrier screen</i>
---------------	--------------------------------------------------------------------------------	---------------------------------------------------

Instruction: If all possible baseline options but the proposed project are eliminated, the procedure ends here and the proposed project is not eligible for the CDM.

Step 3: A barrier test was applied to all plausible baseline options and a ranking of barrier relevance was created as follows:

Instruction: Use guidance from page 17, The Barrier Test, to complete this step: 0. check test applicability, 1. identify all relevant barriers to the proposed project, 2. describe how the design of the proposed project addresses these barriers, 3. describe relevance of these barriers to all plausible baseline options, 4. rank all options in decreasing order of barrier relevance for all barriers. 5. aggregate scores.

Barrier	Proposed project (Ref. No. 001, 004, 006, 009)	Plausible baseline option # Ref. No. 002, 003, 005, 007, 008
O and M related capacity	The technology provider will implement a training package for operators. Rank: 2	Barrier is not relevant as no new technology is transferred. Rank (for all options): 1
Access to capital	An equity share of 25% of total investment costs was raised on the basis of the expected sale of emission reduction credits. Financial closure could not have been achieved without this added incentive which increased return on equity by 5%. Rank: 2	Barrier is not relevant as no investment is required. Rank (for all options): 1

Instruction: Select baseline with lowest score. If the barrier test yields more than one baseline with lowest score, (a) perform step 4 or step 6.

Additional analysis is required for primary effects 1 and 3 whereas a clear baseline was determined for primary effects 2 and 4.

Step 4: An investment ranking test was applied to all remaining competing plausible baseline options

Instruction: Use guidance from page 21, Investment Ranking Test, to complete this step: 0. check applicability of this test, 1. select financial indicator, 2. perform financial analysis and rank results in decreasing order of performance, 3. perform sensitivity analysis and rank results in decreasing order of financial performance.

The investment ranking is not likely to generate additional insight into the selection of a baseline for primary effects 1 and 3. Instead, the project developer chooses to determine and select the more conservative options.

Ranking of competing plausible baseline options in order of decreasing performance			
Financial analysis		Sensitivity analysis	
Ref. No. of competing baseline option	Financial indicator performance	Ref. No. of competing baseline option	Financial indicator performance

Instruction: If the investment ranking test does not yield a dominant outcome (which means that both for the financial and sensitivity analysis the same baseline option is ranked first), perform step 5; otherwise, select baseline.

[Step 5: Considering that after the financial ranking test no conclusive baseline could be identified, the project sponsor chooses to proceed as follows:] not applicable

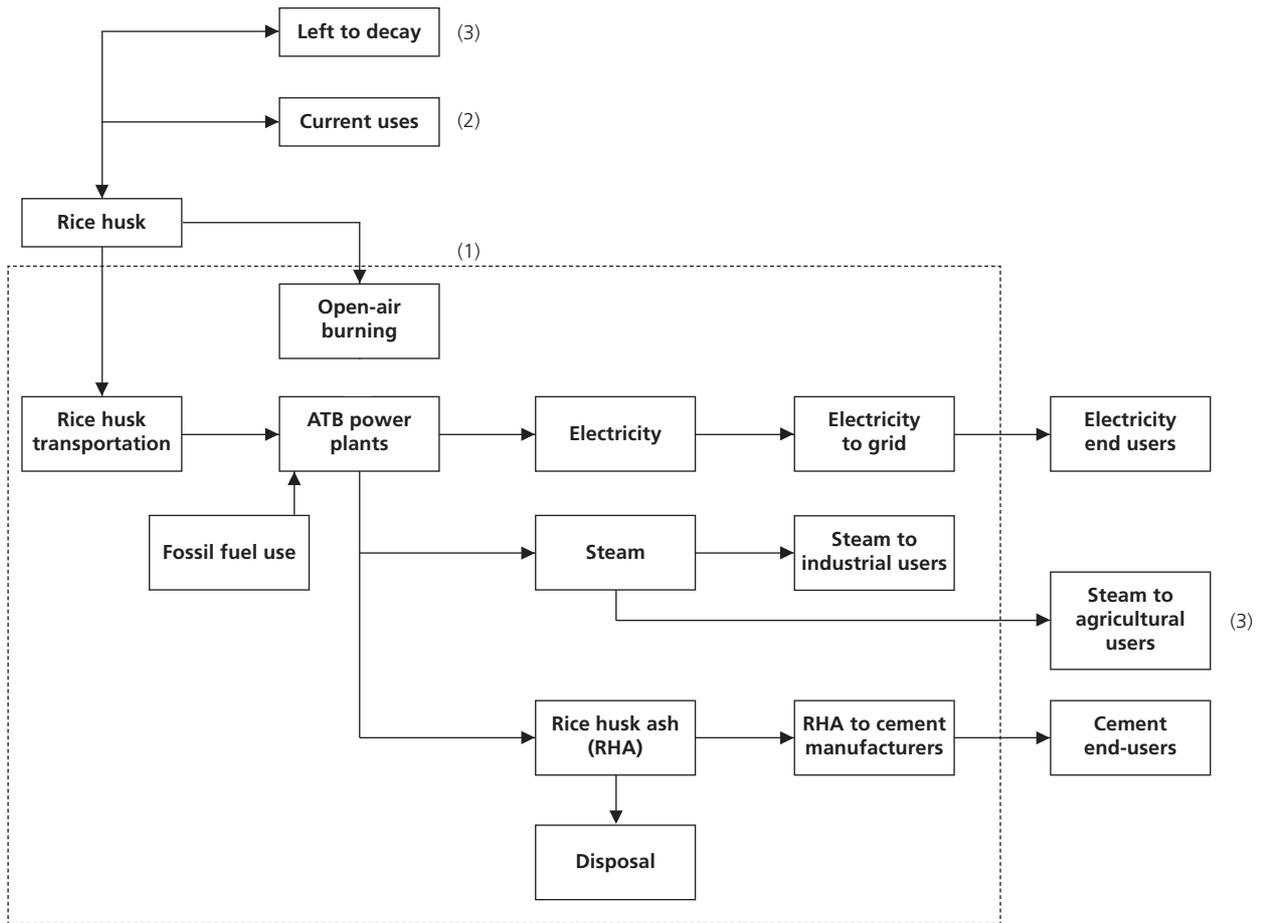
Instruction: Use guidance from page 23, Choose conservative baseline or define baseline shifting parameters, to complete this step.

- choosing a long-term crediting period, documenting the deviation of the chosen assumption that would trigger a shifting of baseline within the crediting period between the competing options and including provisions in the project’s monitoring plan that will observe any changes in assumptions triggering such shifting (details are provided in the monitoring plan);**
- choosing a conservative crediting period that eliminates the incidence of changing assumptions triggering baseline shifting and commits to reassessing baseline validity at the end of the current crediting period;**
- estimating the GHG emissions or removals for all competing baseline options and choosing the candidate with the lowest GHG emissions or highest GHG removals.**

B.5. Description of how the definition of the project boundary related to the baseline methodology is applied to the project activity:

The baseline methodology differentiates two project boundary scopes and three kinds of GHG impacts that can occur within these scopes. These definitions are applied consistently to all project activities that are qualified to use this methodology. Relevant system boundaries and all cross-boundary material and energy flows are identified in the flow chart below.

Instruction: Use guidance on page 3, Defining system boundaries, to complete the flow chart.



Notes:

- (1) The dotted lines indicate the Project's boundaries.
- (2) For the reasons mentioned in section E.2, this item is viewed as outside the project boundaries.
- (3) For conservatism, these reduction possibilities are not included in the calculation of the project's CERs.

B.6. Details of baseline development

B.6.1 Date of completing the final draft of this baseline section: **15/04/03**

B.6.2 Name of person/entity determining the baseline: **Mitsubishi Securities, not a project participant**

Instruction: Please provide contact information and indicate if the person/entity is also a project participant.

C. Duration of the project activity/Crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity: **01/01/2006**

Instruction: For a definition by the Executive Board of the term "starting date", please refer to UNFCCC CDM web site. any such guidance shall be incorporated in subsequent versions of the CDM PDD. Pending guidance, please indicate how the "starting date" has been defined and applied in the context of this project activity.

C.1.2. Expected operational lifetime of the project activity: **minimum 25 years**

Instruction: In years and months, e.g. two years and four months would be shown as: 2y-4m.

C.2 Choice of the crediting period and related information:

Instruction: Please check the appropriate option and fill accordingly. Note that the crediting period may only start after the date of registration of the proposed activity as a CDM project activity. In exceptional cases, the starting date of the crediting period can be prior to the date of registration of the project activity.

C.2.1 **Renewable crediting period (at most seven (7) years per period)**

Starting date of the first crediting period **01/01/2006** _____

Length of the first crediting period: **7 years**

C.2.2 Fixed crediting period (at most ten (10) years):

Starting date (DD/MM/YYYY): _____

Length (max. 10 years): _____

Glossary

TERMS SPECIFIC TO THESE GUIDELINES

Barrier Test: Procedure to select a baseline from a set of plausible baseline options by taking into account barriers.

Competing baseline: An additional project baseline that — under certain assumptions or criteria — may be the project baseline as well. A competing baseline could be the outcome of scenario and sensitivity analysis within the Barrier or Investment Ranking Tests.

Investment Ranking Test: Procedure to select a baseline from a set of plausible baseline options (after taking into account barriers) that uses a specific financial indicator to determine the economically “most likely course of action”.

Long-run marginal unit production costs (LRMC) (operating and built): operating LRMCM are the marginal unit supply costs, assuming that demand is met by operating production facilities; built LRMCM are the marginal unit supply costs, assuming that demand is met by new production facilities that need to be built.

Option elimination criteria: A list of criteria that, when applicable, justify the elimination of a possible baseline option from further consideration.

Output/activity level: A quantity and quality of a product, service or secondary energy carrier that is provided by either the scope 1 or scope 2 system. It is used to define the relevant system boundaries and to account emission changes on a rate basis (specific emission changes per unit of output) as well as on an absolute basis.

Plausible baseline option: All possible baseline options that pass the option elimination criteria.

Possible baseline option: A baseline option that could be a viable project baseline on first impression.

Primary GHG emission impact: The effect as a result of a project intervention that leads to a change of either direct or indirect emissions. A primary GHG emission impact is created by one of the following three effects: (a) a change of primary energy carrier with a different emission factor, (b) process changes leading to a different direct GHG emission rate per unit of output OR net carbon sequestration changes, or (c) process changes or substitution of secondary energy carriers or materials leading to different activity levels and therefore direct GHG emissions elsewhere.

Project component baseline: Projects with more than one primary emissions impact need to define a baseline for every primary GHG impact (i.e. destruction of methane and power generation using a renewable fuel source in the context of a land-fill management project).

Scope 1 system boundary: The sources and sinks of GHG emissions within the control of the project operator that create a change of direct emissions per unit of output as a result of a project intervention.

Scope 2 system boundary: The sources and sinks of GHG emissions outside the control of the project operator that experience a change of activity level due to changing imports and exports of secondary energy carriers and materials as a result of a project intervention in a scope 1 system boundary. A scope 2 system boundary could include sources that are located down-stream (a steam generator experiencing reduced production due to a waste heat recovery project), same-stream (a power generating facility experiencing reduced production due to a renewable energy project) or upstream (a land-fill experiencing lower methane emissions due to waste separation prior to land-filling).

System boundary: The sources and sinks of GHG emissions as well as imports and exports of secondary energy carriers and materials within the control of the project operator that create a GHG emission-related impact due to the project intervention.

TERMS SPECIFIC TO THE FLEXIBLE MECHANISMS

Additionality: The reduction in emissions by sources or enhancement of removals by sinks that is additional to any that would occur in the absence of a JI or CDM project activity. The Marrakech Accord states that a project activity is additional if anthropogenic emissions of greenhouse gases are reduced below those that would have occurred without the JI or CDM project activity and that a baseline can reasonably represent what existed without the project. Before Marrakech, there were several distinct interpretations of additionality:

- Financial additionality: a JI or CDM project shall not use ODA (Official Development Assistance) or GEF funds. This interpretation reflected concerns that ODA might be diverted to support CDM or JI projects
- Economic/investment additionality: If the project had a high Internal Rate of Return, it was considered likely to occur regardless of whether it was made a CDM or JI project since it presented a good investment opportunity. However, in some cases it was accepted that even with a high IRR a project might not go ahead as a result of risks and non-monetary barriers. Thus in some cases it would be possible to justify that a project was additional despite attractive IRRs. There were differing views on how to determine economic/investment additionality in quantitative terms.
- Environmental additionality: the project reduces emissions.

Annex B parties: List of annex I parties to the Kyoto Protocol that is setting out each party's emission limitation or reduction target for the first Commitment Period, relative to the base year.

Annex I parties: The industrialized countries listed in this annex to the UNFCCC trying to return their greenhouse gas emissions to 1990 levels by the year 2000 as per article 4.2(a) and (b). They have also accepted emission targets for the period 2008 to 2012 as per article 3 and annex B of the Kyoto Protocol. They include the 24 original OECD members, the European Union, and 14 countries with economies in transition (Croatia, Liechtenstein, Monaco and Slovenia joined at COP-3, and the Czech Republic and Slovakia replaced Czechoslovakia).

Assigned amount: The Kyoto Protocol's term for the total tonnage of greenhouse gas, measured in terms of carbon dioxide equivalent, which each industrialized (annex I) country can emit over a commitment period. Assigned amounts are calculated on the basis of the Quantified Emission Limitation and Reduction Commitments laid down in annex B of the Protocol.

Banking: Saving of emissions permits or CER for future use in anticipation that these will accrue value over time.

Baseline document: Formal document included within the project design document that quantifies projects emission reductions and clearly outlines the method used to calculate the baseline.

Baseline: A projected level of future emissions against which to measure the success of emissions-reduction projects.

Carbon credit OR emission offset: A generic term for a verified, real 1 tonne GHG emission reduction. If the project is a CDM project a carbon credit is referred to as a Certified Emission Reduction (CER), if generated from a JI project it is referred to as an Emission Reduction Unit (ERU).

CDM adaptation fee: 2 per cent in-kind levy on the CERs created by CDM projects to finance adaptation measures in non-annex I countries.

Certified Emission Reduction (CER): Carbon credits generated from CDM projects.

Clean Development Mechanism: One of the three Kyoto mechanisms, the CDM aims to promote sustainable development in developing countries as well as to help annex I parties achieve compliance with their cap. It allows annex I countries to invest in emission-saving projects in developing countries and gain credit for the savings achieved through the generation of CERs that they can use to contribute to compliance with part of their cap. The CERs will be added to annex I parties' assigned amounts.

Crediting period: The period during which a project baseline is valid and carbon credits are generated. In the context of the CDM, this period is either 7 years, which can be renewed twice after review of the baseline or 10 years without renewal. For JI, the term, crediting period, has not been formerly defined.

Emission Reduction Unit (ERU): Carbon credits generated from JI projects. The annex I country purchasing the ERUs can add them to their assigned amounts whilst the seller must deduct the ERUs from their assigned amounts.

Joint Implementation: (JI) One of three Kyoto mechanisms. JI allows annex I parties to invest in emission-reducing/sequestering projects in other annex I countries and generate carbon credits, in the form of ERUs, for each tonne of GHG reduced. The host country must deduct the ERUs from its own assigned amount of emissions. Like Emissions Trading, JI must be supplemental to domestic actions.

Leakage: "Measurable and attributable" net change of emissions outside the project boundary of an emission-reduction/sequestration project.

Monitoring and Verification Protocol: (MVP) Formal document that is part of a project design document establishing the procedures that are required to monitor the occurrence of emission reductions and verify this occurrence by a third party (operational entity).

Operational entity: Independent and accredited certification body that is authorized to perform validations and verifications of emission-reduction projects.

Validation: Assessment by a certifier of a project design document, containing its baseline and monitoring plan before the project can be registered by the Executive Board.

Verification: The periodic auditing of monitoring data as well as other parameters during the operation of an emission-reduction project to establish whether project operators have followed the terms and conditions formulated in the project design document and to confirm an actual quantity of reduced/sequestered emission reductions. It involves physical, on-site inspection, or where useful, deployment of techniques such as remote sensing, interviewing, sampling.

Additional terms at: <http://www.co2e.com/common/glossary.asp>

Bibliography

Project design documents

PCF: PDD, MVP and Baseline study for the Plantar Project in Brazil.

PCF: PDD, Baseline Study and Monitoring Plan for Thomayer Energy Efficiency in Public Buildings Project in the Czech Republic.

PCF: PAD, MVP and Baseline Study for the Liepaja Regional Solid Waste Management Project in Latvia.

UNFCCC documents

UNFCCC: Clean Development Mechanism Project Design Document, (CDM PDD), 2002.

FCCC/CP/2001/13/Add.2: CDM Modalities and Procedures (Extract of Decision 17/CP.7), 2002.

Studies, reports

Bosi, M.; Ellis, J.: Implications of multi-project emission baselines for CDM projects - Examples from the electricity generation sectors in Brazil and India. OECD.

Bosi, M.: An initial view on methodologies for emission baselines: Electricity generation case study IEA. Energy and Environment Division, International Energy Agency, 9, rue de la Fédération, 75015 Paris, France.

Deshun, L.; Jingfei, G.; Nielsen, P. Chris; Rogers P. Peter: Baseline Determination for Greenhouse Gas Abatement by the Clean Development Mechanism and Joint Implementation under the Kyoto Protocol. In: Working paper, pp. 1-43 . Director of Global Climate Change Institute (GCCII), Tsinghua University, Beijing, China.

Ellis, J.; Bosi, M.: Options for project emission baselines, IEA and OECD. Jane Ellis, Pollution Prevention and Control Division, OECD, 2 rue André Pascal, 75775 Paris Cedex 16, France.

Energetics Pty Ltd: Workbook for calculating greenhouse gas reductions from industrial energy efficiency projects, pp. 1-79, International Greenhouse Partnerships Office, C/- Department of Industry, Science and Resources, GPO Box 9839, Canberra City, Australia.

Energetics Pty Ltd: Workbook for calculating greenhouse gas reductions from commercial energy efficiency projects, pp. 1-77, International Greenhouse Partnerships Office, C/- Department of Industry, Science and Resources, GPO Box 9839, Canberra City, Australia.

Energy Strategies; George Wilkenfeld & Associates: Workbook for calculating greenhouse gas reductions from projects using electricity and heat generation from fossil fuels, International Greenhouse Partnerships Office, C/- Department of Industry, Science and Resources, GPO Box 9839, Canberra City, Australia.

Hargrave, T.; Helme, N.: Options for simplifying baseline setting for Joint Implementation and Clean Development Mechanism projects, pp. 89-99, New Energy and Industrial Technology Development

Organization (NEDO) and Global Industrial and Social Progress Research Institute (GISPRI). Center for Clean Air Policy.

Harrison, D. Jr.; Schatzki, S. T.; Haites, E.; Wilson, T. F.: Setting baselines for greenhouse gas credit trading programs: Lessons from experience with environmental and non-environmental programs, pp. 1-113. Electric Power Research Institute. National Economic Research Associates, Inc. Magaree Consultants, Inc.

Heister, J.: Determining a reference project for a JI investment, Vol. 3. Dr. Johannes Heister, Global Environment Division, World Bank, 1818 H Street, N.W., Washington, D.C. 20433, USA.

Lashof, D. A.: Additionality under the Clean Development Mechanism. Natural Resources Defence Council.

Meyers, S.: Additionality of emission reductions from Clean Development Mechanism projects: Issues and options for project-level assessment, Ernest Orlando Lawrence Berkeley National Laboratory. Energy Analysis Department, Environmental Energy Technologies Division, Ernest Orlando Lawrence Berkeley National Laboratory, Berkeley, CA, USA.

Mullins, F.; Morlot, J. C.; Ellis, J.; Varangu, K.; Hou, J.: Status of research on project baselines under the UNFCCC and the Kyoto Protocol, Vol. ENV/EPOC(99)19/FINAL OECD.

Probases briefing note #3: Baselines in the Marrakech Text; Foundation Joint Implementation Network; Centre for Environmental Strategies, University of Surrey (Peterswolde, Guildford, March 2002).

Probases briefing note #8: Additionality.

Puhl, I.: Options for simplifying baseline setting for Clean Development Mechanism projects . Center for Clean Air Policy.

Swisher, J. N.: Project baselines and additionality in the Clean Development Mechanism. Econenergy International Corp., Boulder CO, USA.

Telnes, E.; Ybema, R.: Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation projects; Vol. 3b: Procedural Guidelines for Validation and Verification, version 1.0.

Telnes, E.; Ybema, R.: Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation projects; Vol. 3a: Organisational Requirements for Validation and Verification, version 1.0.

Telnes, E.; Ybema, R.: Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation projects; Vol. 2a: Baseline Studies, Monitoring and reporting, version 1.0.

Telnes, E.; Ybema, R.: Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation projects; Vol 2b: Baseline studies for specific project categories; A guide for project developers, version 1.

Telnes, E.; Ybema, R.: Operational Guidelines for Baseline Studies, Validation, Monitoring and Verification of Joint Implementation projects; Vol. 1: Introduction; A guide for project developers and validation/verification bodies. Version 1.0.

UNIDO: COMFAR III English Manual, Vienna, Austria.

World Business Council for Sustainable Development and the World Resources Institute (2001). The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard.