



**CLEAN DEVELOPMENT MECHANISM
PROPOSED NEW METHODOLOGY: MONITORING (CDM-NMM)
Version 01 - in effect as of: 1 July 2004**

CONTENTS

- A. Identification of methodology
- B. Proposed new monitoring methodology



SECTION A. Identification of methodology

A.1. Title of the proposed methodology:

>> Monitoring methodology for district heating rehabilitation, possibly reducing use of in house devices

A.2. List of category(ies) of project activity to which the methodology may apply:

>>

1. Energy industries (renewable - / non-renewable sources)
2. Energy distribution

A new category might be introduced: “Energy efficiency, district heating system reconstruction”

A.3. Conditions under which the methodology is applicable to CDM project activities:

>>

The proposed methodology can be used if the following conditions apply:

- The project rehabilitates an existing district heating system (DHS), which may be deteriorating and therefore be reducing heating services to DHS customers, while DHS customers may replace or supplement reduced DHS heating services with one or several alternative means of providing heat and hot water. The rehabilitation of the DHS may lead to the reduced use of in house devices, such as individual electric heaters fuelled by gas, oil or electricity.
- No capacity increase: The capacity (according to name plate, in MW) of the boilerhouse(s) to be installed with the project activity and from which CERs are claimed is not higher than the sum of the capacities (according to name plates, in MW) of the boilerhouse(s) and other heating devices (if applicable) that form the baseline situation. A project with expanded capacity cannot claim CERs under this methodology for the capacity that exceeds the old capacity.
- Sufficient information is available about local conditions that impact the operation, use and development of the DHS and about technical and investment alternatives to the existing DHS.
- The decision on the future of the DHS system is made on the basis of financial considerations taking into account barriers to investment and operation of the current and any future system configuration.
- The methodology is not applicable for new (greenfield) DHS.



- The project does not result in any significant leakage of CO₂ emissions or an increase of non-CO₂ emissions. Project proponents claim only reductions of CO₂ emissions. If leakage is present or a reduction of other than CO₂ emissions is claimed, the methodology must be supplemented with additional elements.
- The project does not claim emission reductions from demand side measures.

A.4. What are the potential strengths and weaknesses of this proposed new methodology?

>>

Strengths: The methodology can deal with cases of limited data availability which are quiet common for district heating rehabilitation projects in countries in transition to a market based system.

Weaknesses: The methodology may have to rely on a number of estimates for the considered parameters.

SECTION B. Proposed new monitoring methodology

B.1. Brief description of the new methodology:

>>

The emissions from a specified mix of technologies in the baseline (in tCO₂ per GJ of heat delivered to customers by old DHS and IHDs) are calculated based on measured or estimated fuel consumption, heating system efficiencies, net calorific values, oxidation factors and supplied heat for district heating system and for individual fossil fuelled heaters. Emissions from power consumption in DHS and for electric individual heaters are calculated from measurements or estimates of electricity consumptions and a grid carbon emission factor (ACM0002 or small scale grid methodology).

The emissions from a specified project technology (in tCO₂ per GJ of heat delivered to customers by rehabilitated DHS) are calculated based on monitored fuel use, efficiencies and emission factors.

Emission reductions are the difference of specific baseline and project emission factors (in tCO₂/GJ) multiplied by the annuel amount of heat delivered to "baseline customers". Baseline customers are those that are physically connected to a rehabilitated (part) of the DHS and were physically connected to the old district heating system before the start of the project activity.

**B.2. Option 1: Monitoring of the emissions in the project scenario and the baseline scenario:**

>>

B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
1.	$F_{i,DHS}$	Operator: fossil fuel(s) i consumption in new DHS (sum of all boilers) ¹	t (for coal or liquid fuels); Nm ³ (for NG)	m	Monthly	100%	Electronic	Recorded from main fuel meters and documented by fuel purchasing records
2.	NCV_i	Fuel supplier: fossil fuel(s) i net calorific value	GJ/t (for coal or liquid fuels); MJ/Nm ³ (for NG)	m	Annually	100%	Electronic	More frequent if change of supplier or origin. If no local data available, IPCC values can be used as default.
3.	$EF_{CO_2,i}$	Fuel supplier: fossil fuel(s) i CO ₂ emission factor	tCO ₂ /GJ	m	Annually	100%	Electronic	More frequent if change of supplier or origin. If no local data available, IPCC values can be used as default.
4.	$OXID_i$	Operator: fossil fuel(s) i oxidation factor	-	m	Annually	100%	Electronic	If no local data available, IPCC values can be used as default.
5.	$ELEC_{DHS_PA,y}$	Operator: electricity consumption new DHS	MWh	m	Monthly	100%	Electronic	Recorded from main electricity meters and documented by electricity purchasing records

¹) If more than one fossil fuel is used, then $i = HFO, LFO, COAL, NG, \dots$ and lines 1 to 4 are repeated accordingly.

**B.2.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:**

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
6.	$HEAT_{Boiler}$	Operator: boiler heat output to network	GJ	m	Monthly	100%	Electronic	As measured by the difference in temperature between water entering and exiting the boilers and by the amount of water; data used for cross-checking only.
7.	$HEAT_{PA_BLS-HH,y}$	Operator: heat delivered in year y to consumers that are connected to the new DHS and that have been connected to the old DHS before the start of the project activity.	GJ	m	Monthly	100%	Electronic	As measured by the difference between water entering and exiting the Apartments and the temperature and amount of hot tap water supplied.

**B.2.2. Description of formulae used to estimate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):**

>>

Formula are provided in steps 3, 4, and 5 in Section D.1. of the related new baseline methodology. They are repeated here for convenience:

Determination of emission factors for project activity heat source

$$(1) \quad EF_{heat,DHS,LFO,y} = \frac{1}{\eta_{DHS,LFO}} \cdot EF_{CO2,LFO} \cdot OXID_{LFO}$$

$$(2) \quad EF_{heat,DHS,NG,y} = \frac{1}{\eta_{DHS,NG,y}} \cdot EF_{CO2,NG} \cdot OXID_{NG}$$

These factors will be determined *ex-post* based on monitoring.

The emission factor for the project's technology is the weighted average of the emission factors of the fuels used in the rehabilitated/new DHS, including DHS electricity consumption:

$$(3) \quad EF_{PA,y} = \frac{\left[\sum_i HEAT_{DHS,i,y} \cdot EF_{heat,DHS,i,y} \right] + ELEC_{DHS_PA,y} \cdot EF_{el}}{\left[\sum_i HEAT_{DHS,i,y} \right]}$$

where

Σ sums up the contributions of the heat sources and fuels composing the project technology

$HEAT_{DHS,i,y}$ is the heat (GJ) delivered in year y to the rooms by the rehabilitated DHS consuming fuel(s) i (e.g. $HEAT_{DHS,HFO,2007}$, $HEAT_{DHS,NG,2007}$),

$EF_{heat,DHS,i,y}$ is the emission factor for heat provided in year y by rehabilitated DHS consuming fuel i , calculated following equations (1) and (2).

$ELEC_{DHS_PA,y}$ is the amount of electricity (in MWh) consumed by the rehabilitated/new district heating system in year y for its operation (for pumps, control system, lighting, etc.).



B.2.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
8.	$F_{i,DHS}$ or $F_{i,IHD}$	Operator: fossil fuel(s) i consumption ² in old DHS (sum of all boilers) or individual heaters (IHD) ³	t (for coal or liquid fuels); Nm ³ (for NG)	m/e	Monthly in period before project activity start	100%	Electronic	DHS: Recorded from main fuel meters and documented by fuel purchasing records IHD: Recorded from main fuel (gas) meters and documented by fuel purchasing records; or documented estimate
9.	NCV_i	Fuel supplier: fossil fuel(s) i net calorific value	GJ/t (for coal or liquid fuels); MJ/Nm ³ (for NG)	m	Annually in period before project activity start	100%	Electronic	More frequent if change of supplier or origin (each time supplier/origin is changed). If no local data available, IPCC values can be used as default.
10.	$EF_{CO_2,i}$	Fuel supplier: fossil fuel(s) i CO ₂ emission factor	tCO ₂ /GJ	m	Annually in period before project activity start	100%	Electronic	More frequent if change of supplier or origin (each time supplier/origin is changed). If no local data available, IPCC values can be used as default.

²⁾ If more than one fossil fuel is used, then $i = HFO, LFO, COAL, NG, \dots$ and lines 8 to 11 are repeated accordingly.

³⁾ Only IHD that compensate insufficient DHS services are counted. Fuel consumption of IHDs that are not affected by the rehabilitation of the DHS (e.g. that are in rooms that will receive no heat services from the rehabilitated DHS) are not included.



B.2.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of greenhouse gases (GHG) within the <u>project boundary</u> and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
11.	$OXID_i$	Operator: fossil fuel(s) i oxidation factor	-	m	Annually in period before project activity start	100%	Electronic	If no local data available, IPCC values can be used as default.
12.	$ELEC_{DHS_BLS}$	Operator: electricity consumption old DHS	MWh	m	Monthly in period before project activity start	100%	Electronic	Recorded from main electricity meters and documented by electricity purchasing records
13.	$HEAT_{DHS}$	Operator: annual heat delivered to all consumers that are connected to the old DHS	GJ	m	Monthly in period before project activity start	100% or representative samples	Electronic	As measured by the difference between water entering and exiting the Apartments and the temperature and amount of hot tap water supplied
14.	$\eta_{i,IHD}$	Operator, technical data sheets, expert estimate based on site visit: Specific efficiency of individual heater using fuel i (IHD)	-	m/e	Once before project activity start	Sample	Electronic	See definition in Step 3 in Section D.1. in related NMB.



B.2.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment
15.	$HEAT_{el}$	Public utility, operator, expert estimate: estimate of amount of heat produced by individual electric heaters (IHD) that compensate for insufficient DHS heating services ⁴	MWh	m/e	Monthly or annually, in period before project activity start	Sample	Electronic	Estimated based on electricity consumption pattern (summer vs. winter), random surveys in consumer's apartments, sales data of individual electric heaters etc.
16.	EF_{el}	Option (a): see ACM0002 Option (b): published studies on grid emission factors, grid operator	tCO ₂ /MWh	c	At the beginning of each crediting period	Option (a): see ACM0002 Option (b): all power plants, including renewables, nuclear, etc.	electronic	Option (a): see Baseline Emissions Parameters in monitoring methodology ACM0002

⁴) Only IHD that compensate insufficient DHS services are counted. Heat produced by electric IHDs that are not affected by the rehabilitation of the DHS (e.g. that are in rooms that will receive no heat services from the rehabilitated DHS) are not included.



B.2.3. Relevant data necessary for determining the <u>baseline</u> of anthropogenic emissions by sources of greenhouse gases (GHG) within the project boundary and how such data will be collected and archived:								
ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
17.	$COST_{i,y}$	Fuel supplier: cost of fossil fuel(s) i^5 ; average market price in year y	USD per unit of fuel or electricity	m	At the beginning of each crediting period	samples	electronic	Fuel costs are only to be monitored if they play a crucial role in the determination of the baseline scenario. Market price as documented by official price list of supplier or other official statistics. All fuels used in DHS and IHD as well as electricity for heating have to be considered.
18.	Indicators on barriers ⁶	Official and documented sources.		m	At the beginning of each crediting period	samples	electronic	

The specific emission factor of the baseline technology is determined before the start of the project activity on the basis of fuel use / efficiency / performance data of heating systems over two or more heating season or through the use of IPCC default data and estimates as indicated in Table 2.3. The recording frequency is also indicated in Table B.2.3. Data may be adjusted for climatic variations using heating degree days or an equivalent measure.

In addition to the parameters listed here, the relevant Baseline Emissions Parameters listed in the monitoring methodology ACM0002 have to be monitored, collected and archived as well if option (a) in Step 4 in Section D.1. of the related new baseline methodology is chosen. If option (b) is chosen, the relevant Baseline Emissions Parameters must be monitored that are listed for category I.D small scale projects.

⁵⁾ If more than one fossil fuel is used, then $i = HFO, LFO, COAL, NG, \dots$ and line 17 is repeated accordingly.

⁶ these indicators are monitored at the beginning of each crediting period to determine, if the barrier analysis that may have been carried out in the baseline selection is still valid. Indicators may be qualitative and quantitative, including availability of commercial loans, data on prevailing practice, technical barriers etc.

Option

If measurements of $HEAT_{DHS}$ for calculating the efficiency of DHS (as defined in Step 3 in Section D.1. of the NMB) are not available, DHS efficiencies $\eta_{i,DHS}$ may be conservatively estimated based on available data and measurements, i.e. estimates should tend to overestimate efficiencies in the baseline case (and therefore underestimate baseline emissions). This extends the applicability of the methodology to geographical areas with less developed institutions/infrastructure and lower data availability.

ID number	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/ paper)	Comment
19.	$\eta_{i,DHS}$	Operator, , expert estimate based on site visit: estimate of overall DHS specific system efficiency	-	m/e	Before project activity start	Representative samples of network	Electronic	Overall DHS specific system efficiency of old system can be conservatively estimated based on available data and measurements on efficiencies of boiler, network insulation, network leakage etc.

In case that data on the use of IHD can not be measured, the methodology recommends to estimate the overall heat demand of a typical consumer's apartment. Based on room temperature, outside temperature, building insulation properties etc. the total heat demand can be estimated. The total demand should be in line with the sum of the contribution of the old district heating system and individual heaters.

B.2.4. Description of formulae used to estimate <u>baseline emissions</u> (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):
--

>>

Formula are provided in steps steps 3, 4, and 5 in Section D.1. in the related new baseline methodology. They are repeated here for convenience:

Determination of emission factors for baseline district heating system

The emission factor for heat provided by a relevant heat source j consuming fuel i is:

$$(4) \quad EF_{heat,i,j} = \frac{1}{\eta_{i,j}} \cdot EF_{CO_2,i} \cdot OXID_i$$

with the specific system efficiency of heat source j consuming fuel i defined as:



$$(5) \quad \eta_{i,j} = \frac{HEAT_{i,j}}{F_{i,j} \cdot NCV_i}$$

where

j refers to the heat source(s) delivering heat to the consumers (e.g. DHS, individual heaters),

$HEAT_{i,j}$ is the heat (GJ) delivered annually to the consumers (at the consumer's room/location) by source j consuming fuel i (e.g. $HEAT_{DHS,HFO}$, $HEAT_{DHS,NG}$, $HEAT_{IHD,NG}$, etc.); heat delivered by IHDs that are not affected by the rehabilitation of the DHS (e.g. that are in rooms that will receive no heat services from the rehabilitated DHS) are not included in $HEAT$,

$F_{i,j}$ is the amount of fuel i (in a mass or volume unit) consumed annually by the relevant heat source(s) j ,

NCV_i is the net calorific value (energy content in GJ) per mass or volume unit of fuel i ,

$OXID_i$ is the oxidation factor of the fuel i (see page 1.29 in the 1996 Revised IPCC Guidelines for default values),

$EF_{CO_2,i}$ is the CO₂ emission factor per unit of energy of the fuel i (in tCO₂/GJ),

For the baseline technology the emission factor (in tCO₂/GJ) is the weighted average of the emission factors of the different heat sources used by the technology, possibly including the old/alternative district heating system (including DHS electricity consumption) and possible individual fossil fuelled heaters:

$$(6) \quad EF_{BLS} = \frac{\left[\sum_{DHS, IHD} HEAT_{i,j} \cdot EF_{heat,i,j} \right] + ELEC_{DHS_BLS} \cdot EF_{el} + HEAT_{el} \cdot EF_{el}}{\left[\sum_{DSM, IHD} HEAT_{i,j} \right] + HEAT_{el} \cdot 3.6}$$

where

Σ sums up the contributions of the heat sources and fuels composing the baseline technology: the old/alternative DHS and the fossil fuelled in house devices.

$ELEC_{DHS_BLS}$ is the amount of electricity (in MWh) consumed by the old/alternative district heating system annually for its operation (for pumps, control system, water treatment, lighting, etc.).

$HEAT_{el}$ is the amount of heat produced by individual electric heaters (in MWh) annually

3.6 is a conversion factor (1 MWh = 3.6 GJ)

This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.

**B.3. Option 2: Direct monitoring of emission reductions from the project activity:**

>>

B.3.1. Data to be collected or used in order to monitor emissions from the project activity, and how this data will be archived:

ID number (Please use numbers to ease cross-referencing to table B.7)	Data variable	Source of data	Data unit	Measured (m), calculated (c), estimated (e),	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

This option is not used.

B.3.2. Description of formulae used to calculate project emissions (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

>>

B.4. Treatment of leakage in the monitoring plan:

>>

Leakage is assumed to be negligible (see Section D.8. in related new baseline methodology).

**B.4.1. If applicable, please describe the data and information that will be collected in order to monitor leakage effects of the project activity:**

ID number (Please use numbers to ease cross-referencing to table B.7)	Data variable	Source of data	Data unit	Measured (m), calculated (c) or estimated (e)	Recording frequency	Proportion of data to be monitored	How will the data be archived? (electronic/paper)	Comment

B.4.2. Description of formulae used to estimate leakage (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

>>

Leakage is assumed to be negligible (see Section D.8. in related new baseline methodology).

B.5. Description of formulae used to estimate emission reductions for the project activity (for each gas, source, formulae/algorithm, emissions units of CO₂ equ.):

>>

Formula is provided in step 6 in Section D.1. of the related new baseline methodology. It is repeated here for convenience:

The emission reduction ER_y (in tCO₂) by the project activity during a given year y is the difference in the specific overall emission factor of the baseline EF_{BLS} and of the project activity EF_{PA} , multiplied by the actual energy $HEAT_{PA_BLS-HH,y}$ delivered to the baseline households by the CDM project⁷ in year y . The latter part is to ensure that an increase in coverage (compared with the baseline) by the improved DHS is not included in ER calculations.

$$(7) \quad ER_y = (EF_{BLS} - EF_{PA,y}) \cdot HEAT_{PA_BLS-HH,y}$$

where

$HEAT_{PA_BLS-HH,y}$ is the amount of heat (in GJ) delivered in year y to consumers that

(a) are physically connected to a rehabilitated (part) of the DHS in the year y , and

⁷ This calculation of emission reductions (ER) follows Meth Panel recommendation to the Executive Board on NM0046 (p. 3, Section A.I.c. "Others").



(b) were physically connected to the old district heating system before the start of the project activity.
(Only heat delivered to consumers fulfilling both conditions (a) and (b) is considered in $HEAT_{PA_BLS-HH,y}$.)

B.6. Assumptions used in elaborating the new methodology:

>>

As the data availability for the situation before the rehabilitation of the district heating system (DHS) may be rather weak, the determination of the baseline emission factors for the district heating system (DHS) and for possible in house devices (IHD; individual electric or fossil fuelled heaters) may have to rely partly on expert estimates and assumptions regarding use and efficiency of the district and individual heating systems. The assumptions and estimates made have to be completely and transparently documented in the PDD.

B.7. Please indicate whether quality control (QC) and quality assurance (QA) procedures are being undertaken for the items monitored:

Data (Indicate table and ID number e.g. 3.-1.; 3.2.)	Uncertainty level of data (High/Medium/Low)	Explain QA/QC procedures planned for these data, or why such procedures are not necessary.
B.2.1.-1.	Low	Flow meters should be subject to a regular maintenance and testing regime to ensure accuracy.
B.2.1.-2. to -4.	Low	Data should be documented. No QC/QA if IPCC default values are used.
B.2.1.-5. to -7.	Low	Meters should be subject to a regular maintenance and testing regime to ensure accuracy.
B.2.3.-8.	Low to Medium	Meters should be subject to a regular maintenance and testing regime to ensure accuracy.
B.2.3.-9. to -11.	Low to Medium	Data should be documented. No QC/QA if IPCC default values are used.
B.2.3.-12. to -13.	Medium to High	Data should be documented. No QC/QA if IPCC default values are used.
B.2.3.-14.	Medium	Data/estimates should be documented.
B.2.3.-15.	Medium to High	Data/assumptions/estimates should be documented.
B.2.3.-16.	Low to Medium	Option (a): see monitoring methodology ACM0002; Option (b) document data/assumptions/estimates/sources
B.2.3.-17.	Low to Medium	Cross check prices of several fuel suppliers
B.2.3.-18.	Medium	Data/assumptions/estimates should be documented.

B.8. Has the methodology been applied successfully elsewhere and, if so, in which circumstances?

>>No.
