CLEAN DEVELOPMENT MECHANISM
PROJECT DESIGN DOCUMENT FORM (CDM-SSC-PDD)
Version 03 - in effect as of: 22 December 2006

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Revision history of this document

Version Number	Date	Description and reason of revision
01	21 January 2003	Initial adoption
02	8 July 2005	• The Board agreed to revise the CDM SSC PDD to reflect guidance and clarifications provided by the Board since version 01 of this document. • As a consequence, the guidelines for completing CDM SSC PDD have been revised accordingly to version 2. The latest version can be found at <http://cdm.unfccc.int/Reference/Documents>.
03	22 December 2006	• The Board agreed to revise the CDM project design document for small-scale activities (CDM-SSC-PDD), taking into account CDM-PDD and CDM-NM.

SECTION A. General description of small-scale project activity

A.1 Title of the small-scale project activity:

Visakhapatnam (India) OSRAM CFL distribution CDM Project
Version Number: 05
Date: 24.07.2008

A.2. Description of the small-scale project activity:

The "Visakhapatnam (India) OSRAM CFL distribution CDM Project" involves the distribution of around 630,000 OSRAM Long life Compact Fluorescent Lamps (CFLs) in the district of Visakhapatnam, which numbers about 700,000 households.[1] For this project, CFL components will be imported from Germany/Italy to India. The assembly of the components will be undertaken in Sonepat factory in the state of Haryana, and assembly technology and know-how will be transferred from Germany to India. The project activity covers the complete district of Visakhapatnam[2]. The CFLs will be distributed for free or for a minimal fee. The target group of the project comprises households that are registered customers of the Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL) and have an electricity grid connection. Households can substitute up to 2 incandescent light bulbs (GLS bulbs) in their home by CFL lamps provided through the project. Households can freely decide whether to participate in the project. Only GLS bulbs with wattages equal to or higher than 60W will be replaced. The project CFL will be put only in places where GLS bulbs have been used before and where the lighting behaviour is appropriate.[3]
Table 1 shows which type of CFL (in terms of wattage) the households receive depending on which type of GLS bulb (in terms of wattage) the household substitutes.

Table 1: Substitution schedule for incandescent (GLS) lamps[4]

GLS bulb (Watt)	60	100
CFL (Watt)	15	20

At the time of the distribution of the CFLs, the substituted GLS bulbs will be collected and later destroyed under supervision of an independent body to make sure that they will not be used again.

The district of Visakhapatnam is divided into sections by the APEPDCL and consists of 43 smaller administrative units, so-called mandals[5]. The sections and mandals correlate directly in most cases. The distribution of CFLs will be conducted and coordinated by dividing the district into mandals and/or sections. The allocation of CFLs will be organized per section/mandal by OSRAM India. The

[1] All electricity grid connected households in the district of Visakhapatnam. Source: Utility data of APEPDCL.

[2] All information of the total Visakhapatnam household database used in the project has been submitted to the DOE.

[3] GLS bulbs will not be replaced by a CFL in spots where the (daily) utilization hours can be expected to be very low, for example in toilets, bathrooms or storage rooms. In addition no replacement is done for GLS used for security lighting outside in case of danger of theft.

[4] For justification of the CFL-types chosen for substitution (regarding Lumen) see PDD Enclosure "Technical datasheet project CFL".

[5] Mandals are the third-level administrative areas of India, below states and districts.

actual distribution will be carried out by pre-trained distribution teams.[6] These teams will visit the project households "door-to-door". Initially, members of the distribution team will inform the households about the project at their home. If the household wants to participate in the project, the distribution team will install CFLs with the applicable wattage (see above) at up to two lighting spots where either 60 W or 100 W GLS bulbs are used. Only under these pre-conditions the replacement and usage of the CFL will lead to considerable savings for the household and it can be assured that the project CFL will be used most effectively (see footnote 3 above).
Subsequently, the distribution team will collect the substituted GLS bulbs, which will be destroyed under supervision of an independent body, so that they are not used somewhere else.[7] The project will be accompanied by an awareness raising campaign.

The CFL-type to be used in the project activity is the OSRAM DULUX EL LONGLIFE with B22d base for direct replacement of incandescent lamps. It has the following specifications:

- Extra Long average life of 15.000 hours
- More than 500.000 switching cycles to meet the highest demands in terms of frequent switching and durability in the professional /commercial sector and for high-quality domestic applications
- Up to 80% lower energy consumption compared to similar conventional light bulbs

For more detailed specifications see the PDD Enclosure "Technical datasheet project CFL".

The project will lead to considerable electricity consumption savings in the households that participate in the project. The project will therefore lead to reduced consumption of fossil fuel-based generated electricity in the Southern Grid and thus reduce GHG emissions.

The project contributes to the sustainable development of the host country because it:

- reduces CO_2 emissions
- reduces local pollutants such as NO_x and SO_2 caused by power generation in the Southern Grid which is predominantly coal-based
- contributes to poverty alleviation by significantly reducing household expenditure on electricity bills
- increases energy services in a country which faces considerable power outages
- reduces the mercury content in CFLs used in India. The project CFL OSRAM uses in the project will have a mercury content of only 2.5 mg.
- creates employment in local CFL manufacturing at ISO9001- and ISO14001-certified OSRAM manufacturing sites as well as in project monitoring
- has a high replicability potential and can therefore promote technological self reliance in India.

[6] For further information regarding the distribution see also PDD section B. 7.2.

[7] In case of unexpected early technical failures of the project CFLs after installation, the households will have the opportunity to claim the failed project CFL and receive a new project CFL within 12 months after distribution. (For this, the failed project CFL and the copy of the distribution form showing the household ID need to be handed over). Thus, the households are given a guarantee regarding the functionality of the project CFL which is similar to the guarantee given by OSRAM for CFLs in the Indian market. This is also considered to be important as the participating households will hand over a functioning GLS bulb at the time of first installation which could have been working for on average up to 1000 h (depending on the actual utilization hours per household approx. up to 12 months).

The project implementation time schedule is as follows:

- Production of CFLs: October – December 2007
- Shipping of CFLs: Nov. 2007 – Feb. 2008
- Assembly of CFLs: Feb. 2008 – May 2008
- Training of distribution team, metering installation team: Apr 2008
- Installation of metering devices: Apr./May 2008
- Start of baseline-group monitoring: Apr./May 2008
- Distribution of CFLs (door-to-door): Apr. – June 2008
- Start of spot-check-group monitoring: May 2008
- Training of cross-check teams: August 2008

A.3. Project participants:

Name of Party involved ((host) indicates a host Party)	**Private and/or public entity(ies) project participants**	**Kindly indicate if the Party involved wishes to be considered as a project participant (Yes/No)**
India (host)	▪ Private entity: Osram India Pvt. Ltd.	No
Germany	▪ Private entity: Osram GmbH	No
Germany	▪ Private entity: RWE Power AG	No

A.4. Technical description of the small-scale project activity:

A.4.1. Location of the small-scale project activity:

A.4.1.1. Host Party(ies):

India

A.4.1.2. Region/State/Province etc.:

State: Andhra Pradesh
District: Visakhapatnam

A.4.1.3. City/Town/Community etc:

City of Visakhapatnam and rural areas of Visakhapatnam district (whole district of Visakhapatnam)

A.4.1.4. Details of physical location, including information allowing the unique identification of this small-scale project activity :

Figure 1: Map of India and location of Visakhapatnam district

Figure 2: Map of the district of Visakhapatnam (City of Visakhapatnam and rural areas)

Figure 3: Mandals of Visakhapatnam

Mandal Code	Mandal Name	Mandal Code	Mandal Name	Mandal Code	Mandal Name
1	Munchingiputtu	16	Nathavaram	31	Pedagantyada
2	Pedabayalu	17	Narsipatnam	32	Paravada
3	Hukumpeta	18	Rolugunta	33	Anakapalli
4	Dumbriguda	19	Ravikamatham	34	Munagapaka
5	Arakuvalley	20	Butchayyapeta	35	Kasimkota
6	Ananthagiri	21	Chodavaram	36	Makavarapalem
7	Devarapalle	22	K Kotapadu	37	Kotauratla
8	Cheedikada	23	Sabbavaram	38	Payakaraopeta
9	Madugula	24	Pendurthi	39	Nakkapalli
10	Paderu	25	Anandapuram	40	S. Rayavaram
11	Gangaraju Madugula	26	Padmanabham	41	Yelamanchili
12	Chintapalle	27	Bheemunipatnam	42	Rambilli
13	Gudemkothaveedhi	28	Visakhapatnam	43	Atchutapuram
14	Koyyuru	29	Visakhapatnam (U)		
15	Golugonda	30	Gajuwaka		

A.4.2. Type and category(ies) and technology/measure of the small-scale project activity:

Type (ii): Energy efficiency improvement projects
Category: C. Demand-side energy efficiency programmes for specific technologies

The project leads to diffusion of highly energy efficient lighting technology with a high lifetime from Germany to India.

A.4.3 Estimated amount of emission reductions over the chosen crediting period:

Years	Annual estimation of emission reductions in tonnes of CO_2 e
05/2008-04/2009	39.816
05/2009-04/2010	44.515
05/2010-04/2011	43.708
05/2011-04/2012	42.807
05/2012-04/2013	41.672
05/2013-04/2014	40.162
05/2014-04/2015	37.664
05/2015-04/2016	34.807
05/2016-04/2017	31.223
05/2017-04/2018	26.968
Total estimated reductions (tonnes of CO_2 e)	**383.342**

Total number of crediting years	**10**
Annual average over the crediting period of estimated reductions (tonnes of CO_2 e)	**38.334**

A.4.4. Public funding of the small-scale project activity:

The project activity does not involve any public funding.

A.4.5. Confirmation that the small-scale project activity is not a debundled component of a large scale project activity:

The project participants are currently undertaking similar project activities in the district of Yamunanagar & Sonepat in the State Haryana.
The project activity is not a debundled component of a large project activity as there is no registered small-scale CDM project activity or an application to register another small-scale CDM project activity:

- with the same project participants;
- in the same project category and technology/measure; and
- registered within the previous 2 years; and
- whose project boundary is within 1 km of the project boundary of the proposed small-scale activity at the closest point.

SECTION B. Application of a baseline and monitoring methodology

B.1. Title and reference of the approved baseline and monitoring methodology applied to the small-scale project activity:

AMS-II.C. "Demand-side energy efficiency programmes for specific technologies"/Version 9

B.2 Justification of the choice of the project category:

The project activity is a Type (ii) project activity ("Energy efficiency improvement projects") because it increases the efficiency of electric lighting in households.
The project activity belongs to the Category C ("Demand-side energy efficiency programmes for specific technologies") because it increases the efficiency of lighting use in households (demand-side) and the project activity consists of a large quantity of CFLs (specific technology) to be replaced over a long period of time (programme).

The project will cover the whole district of Visakhapatnam, as the total number of domestic electricity connections received from the Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL) will be used for the project. As there is no official data regarding existing lamp appliances available for the Indian domestic market, and especially for the project area, OSRAM India Pvt. Ltd. has conducted a pre-study of 200 households in the project area to enable a more accurate estimation of the amount of GLS bulbs that can be replaced and the number of households eligible to participate in the project. In the following the relevant results from the pre-study are described.

All selected households were visited, however some households either were absent during conducting the pre-study or did not want to participate. Of all 200 visited households 177 participated in the pre-study, which is a rate of 89 %. The following tables the lamp types found in the participating households are depicted. Most relevant for the project, is the rate of replaceable GLS-types (60 W and 100 W) found in the pre-study.

Lamp types found in the households participating in pre-study:

Total lamps	698
GLS	435
CFL	48

Rate of GLS-types (replaceable):

GLS replaceable	
60 W	89%
100 W	11%

Regarding GLS bulbs eligible to be replaced (60 W and 100 W) and taking into account, that at maximum 2 GLS bulbs per household are replaceable, the pre-study came to the result, that theoretically 1.27 GLS per household can be replaced. Hence the pre-study results include all GLS bulbs found used for outside lighting (around 30 % of all GLS bulbs), it is assumed that only one third of the GLS bulbs used outside the building are eligible to be replaced, due to danger of theft of CFL in certain areas (mainly in urban areas). For further calculations an average GLS bulbs exchange rate of 1.0 GLS per household is assumed.

The pre-study results alongside with empirical data regarding the average daily operating hours [8] of GLS bulbs and CFL in India were taken into account for calculating/estimating the total number of households and CFLs needed for the project, without exceeding the threshold, given by the Small Scale Methodology rules of an annual energy saving of 60 GWh. The following preconditions were set for the ex-ante emission reduction calculation:

- on average 1,0 GLS bulbs /household are eligible to be replaceable by CFL
- from the replaceable GLS types (60 W and 100 W), 89 % are 60 W and 11 % are 100 W
- The average operating hours of domestic light appliances (GLS bulbs and CFL) in India is 5 hours/day[9]
- 10 % of the households are assumed to not participate in the project[10]

[8] The Energy & Resource Institute (2007): Handbook for franchise development in the rural electricity distribution sector (page 25), TERI Press, New Delhi, India, 2007, ISBN 81-7993-113-7

[9] The Energy & Resource Institute (2007): Handbook for franchise development in the rural electricity distribution sector (page 25), TERI Press, New Delhi, India, 2007, ISBN 81-7993-113-7

[10] This includes households that do not want to participate or because of absence of the housekeeper/family during distribution phase. The assumption of 10 % is based on the experience gained during the pre-study.

By using the described pre-study results, the utilisation hours and the data of household connections for the whole district of Visakhapatnam, the annual energy savings were calculated. The annual energy savings will not exceed 60 GWh in any year of the crediting period.

B.3. Description of the project boundary:

The project boundary is the physical, geographical location of each CFL installed for which a GLS bulb has been collected and destroyed. The project boundary also includes all power plants connected physically to the electricity system that each CFL distributed in the project activity will be connected to.

Data of all power grid connections for households in the complete district of Visakhapatnam were received by the utility APEPDCL. It has been confirmed by APEPDCL that these data cover the whole district of Visakhapatnam. The project boundary is therefore the official border of the Visakhapatnam district (see maps in section 4.1.4 of PDD)[11].

B.4. Description of baseline and its development:

The baseline for this project means that the lamp type used before the replacement (GLS bulb) would have been used instead of the distributed CFL used in the project activity.
A separately conducted baseline study inside the project boundary is applied. For the baseline study a randomly selected baseline sample group of about 200 households will be selected out of the project database including all grid connected households in the district. These households will get meter equipment installed in places where they use GLS bulbs and which would be eligible for substitution by a CFL during the project. The meter equipment will monitor the daily operating hours of each GLS bulb. The metering of the baseline will take at least two month.

With all GLS bulbs taking part in the baseline study (wattage per GLS bulb) and the daily operating hours during the baseline period, the overall power consumption of those GLS bulbs during the baseline period will be calculated (Baseline energy consumption).

The baseline is continuation of current practice of household lighting behaviour as shown by the extremely low penetration of CFLs in the households found in the pre-study. In the randomly selected pre-study of 200 households in the district we found that out of 698 lamps only 6.9 % were CFLs.

CFLs have been introduced in India already in the early 90s. Even 15 years after introduction, the penetration rate is still very low especially for lamps used in residential homes. In the pre-study conducted in the project area, only less than 7 % of all lamps found were CFLs. The penetration rate has increased to this level as costs for CFLs have decreased over the years. Recently, the price for CFLs in India range between Rs 40 for no branded Chinese lamps to Rs 100 for branded quality lamps.

The very low price level however is commonly combined with a very low quality level where the early failure rate of lamps is so high that disappointed customers are returning to purchase GLS bulbs.

[11] All information of the total Visakhapatnam household database used in the project has been submitted to the DOE.

The prices for CFLs have reached such a low price level that no further major reduction of costs can be expected in the near future as costs for material (metals, etc.), energy and labour are recently increasing. As price and good reputation of the product is the key factor for the usage of CFLs in residential homes, therefore a significant increase in CFL penetration over the crediting period is not to expect.

Table 2: Parameters to be monitored for calculation of baseline emissions:

ID	Data variable
$Date_{START,BL}$	Start date of the baseline study. The data when all baseline meters r are installed.
$Date_{END,BL}$	End date of the baseline study.
$o_{r,d,q}$	Operating hours per day of the GLS i as measured by the meter r in the baseline households during the baseline period BL.
p_i	Power rating of the GLS bulbs i used before replacement.
$n_{r,d}$	Number of meters *r* that provide a valid value for day *d* during the baseline study.
$EF_{CO2,ELEC}$	CO_2 grid emission factor of the project electricity system. The ex-ante grid emission factor value will be used. The factor used is the Combined Margin (incl. Imports) published by the Central Electricity Authority (CEA).

The baseline emission factor will be established based on ACM0002.

B.5. Description of how the anthropogenic emissions of GHG by sources are reduced below those that would have occurred in the absence of the registered small-scale CDM project activity:

The additionality of the project activity is demonstrated in the following by demonstrating barriers to investment.

The project participant aims to distribute around 625,500 CFLs for free or for a minimal fee.[12] In case a fee is charged, it will not be higher than 15 Indian Rupien (INR) which is comparable to the price of a GLS bulb (e.g. 15 INR is around 0.26 €)[13] and therefore much lower than the costs for a CFL lamp production of a CFL, depending on the quality of CFL. To be most conservative, for the calculation it is assumed that the project may generate a revenue stream, hence an investment comparison analysis (NPV and IRR calculation) is applied in the following.

The fully absorbed costs per CFL to be distributed in the project activity is 3.00 € to 5.00 € per CFL (including duties, taxes and assembly). Other project costs including costs for OSRAM India overhead plus freight and distribution of the CFLs in the project area will amount to range between 0.30 € 0.80 € per CFL. Regarding the costs all the following calculations have been performed in a

[12] The exact number of CFLs will only be known after the distribution, when the number of participating households and replaced CFLs is counted and known.

[13] The main reason for charging the minimal fee is that it will increase the feeling of ownership of the households that receive the CFLs and that the households are more likely to handle them with appropriate care.

conservative manner using the lowest numbers in the band widths. In addition a sensitivity analysis has been done. In one case by assuming 10 % lower costs than initially calculated and one time by assuming 10 % higher revenues from CFL sales (16,5 INR instead of 15 INR).

The following table shows the net present value (NPV) of the project activity. To be most conservative a discount rate of 0 % is used for the calculation. In the table below it can be seen that the resulting NPV of the project without income from CERs is -1.902 million €.

Table 3: Costs and revenues of the project activity in 1,000 € without CER revenues

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
CFL costs	1,877	0	0	0	0	0	0	0	0	0	**1,877**
Other project costs	188	0	0	0	0	0	0	0	0	0	**188**
Total costs	2,064	0	0	0	0	0	0	0	0	0	**2,064**
CFL sales	162										
Revenue	**-1,902**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**-1,902**

Table 4: Amount of CERs generated by the project activity

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
CER volumes	39,816	44,515	43,708	42,807	41,672	40,162	37,664	34,807	31,223	26,968	**383,342**

Assuming a CER price of 10 €/CER, the NPV increases to 1.931 million € as shown in the table below. The corresponding internal rate of return (IRR) is 22.84 %.[14]

Table 5: Costs and revenues of the project activity in 1,000 € at a CER price of **10** €

Year	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	**Total**
CFL costs	1,877	0	0	0	0	0	0	0	0	0	**1,877**
Other project costs	188	0	0	0	0	0	0	0	0	0	**188**
Total costs	2,064	0	0	0	0	0	0	0	0	0	**2,064**
CFL sales	162	0	0	0	0	0	0	0	0	0	162
CER revenue	398	445	437	428	417	402	377	348	312	270	3.833
Total Revenues	560	445	437	428	417	402	377	348	312	270	3.995
Revenue (discounted)	**-1.504**	445	437	428	417	402	377	348	312	270	1.931

It can be seen that the CDM provides the only financial incentive to implement the project activity. Net present value without CER revenues is negative. It could be demonstrated that only with CER revenues of 10 €/CER, the project becomes financially attractive.

[14] Even under most conservative conditions, with a maximum fee of 15 INR charged the additionality of the project is outlined clearly.

This can be outlined further by doing a sensitivity analysis. When lowering the total costs by 10 % (EUR 1,858,000 instead of 2,064,000) and keeping all other figures equal, the IRR increases to 28.39 %. When rising the revenues from the CFL sales by 10 % (178,000 instead of EUR 162,000) and keeping all other figures equal, the IRR results to 23.22 %.

In addition:
Currently, in India there does not exist any national policy or regulation that requires using CFLs in households or bans GLS bulbs.

B.6. Emission reductions:

B.6.1. Explanation of methodological choices:

AMS-II.C. only provides a very generic formula and very generic guidelines for calculation of emission reductions. In the following we explain in detail how we apply and substantiate the procedures in AMS-II.C. in order to arrive at a transparent estimate for emission reductions to be expected by the project activity.

The project activity reduces electricity consumption by households. In this case (energy displaced is electricity), AMS-II.C. requires that baseline emissions are calculated by multiplying the energy baseline (EB) with an emission coefficient (measured in kg CO_2e/kWh) in accordance with provisions under category I.D.[15]

Step 1: Energy use in baseline:

AMS-II.C. requires the application of the following formula for calculation of the energy baseline (EB) if the energy displaced is electricity:

$EB = \Sigma_i(n_i \cdot p_i \cdot o_i)$

Where:
- EB is the annual energy baseline in kWh per year.
- Σ_i is the sum over the group of “i” devices replaced for which the replacement is operating during the year, implemented as part of the project.
- n_i is the number of devices of the group of “i” devices replaced for which the replacement is operating during the year
- p_i is the power of the devices of the group of “i” replaced. In the case of a retrofit programme, “power” is the weighted average of the devices replaced.
- o_i is the average annual operating hours of the devices of the group of “i” devices replaced

For reasons of precision we substantiate the above formula (while maintaining it conceptually) and use the following formula for calculation of the energy baseline (E_{BL}):

[15] We use a slightly different approach (which is conceptually the same). We first establish the energy baseline and the energy project. Afterwards we subtract the energy project from the energy baseline. Emission reductions are then [(energy baseline – energy project) * the emission coefficient] (see below for details).

$$E_{BL,v} = CF_v * \sum_{i=1}^{n} \left[p_i * \mu_{BL} * d_{k,v} \right] \tag{1}$$

Where:

$E_{BL,v}$	Energy baseline (electricity) in MWh per monitoring interval *v*
CF_v	Correction factor for distributed CFLs which are not functional during the cross-check. CF_v represents the share of CFLs that are still operating.
p_i	Power rating of the replaced GLS bulbs *i* used before replacement
μ_{BL}	Average baseline operating hours per day
$d_{k,v}$	Days of operation of each distributed CFL *k* in monitoring interval *v* derived from $Date_{START,v}$, $Date_{END,v}$ (and $Date_{i,k}$ in first monitoring interval)

The formula required for calculation of CF_v is:

$$CF_v = 1 - \left(\hat{p}_{CC,v} + z * \sqrt{\frac{\hat{p}_{CC,v} * \left(1 - \hat{p}_{CC,v}\right)}{n_{all,v}}} \right) \tag{2}$$

Where:

CF_v	Correction factor for distributed CFL which are not operating during the cross-check in the monitoring interval *v*
$\hat{p}_{CC,v}$	Share of CFLs not found operating during cross check in monitoring interval *v*
$N_{all,v}$	Number of checked CFLs during cross check in monitoring interval v
z	Standard normal for a confidence level of 95% (z = 1.96)

$\hat{p}_{CC,v}$ is calculated as follows:

$$\hat{p}_{CC,v} = \frac{n_{all,v} - n_{ok,v}}{n_{all,v}} \tag{3}$$

Where:

$\hat{p}_{CC,v}$	Share of CFLs not found operating during cross check in monitoring interval *v*
$n_{ok,v}$	Number of distributed CFLs distributed to cross-check households which are functional
$n_{all,v}$	Number of distributed CFLs distributed to cross-check households

The formula required for calculation of μ_{BL} is:

$$\mu_{BL} = \frac{\sum_{d=1}^{n} \mu_{BL,d,adjust}}{dur_{BL}} \tag{4}$$

Where:

μ_{BL} Average baseline operating hours per day

$\mu_{BL,d,adjust}$ Mean of the operating hours for day *d* during the baseline study interval adjusted by confidence interval

dur_{BL} Duration of the total baseline study interval in days derived from $Date_{START,BL}$, $Date_{END,BL}$

The formula required for calculation of $\mu_{BL,d,adjust}$ is:

$$\mu_{BL,d,adjust} = \mu_{BL,d} - z * \frac{\sigma_{BL,d}}{\sqrt{n_{r,d}}} \tag{5}$$

Where:

$\mu_{BLd,adjust}$ Mean of the operating hours for day *d* during the baseline study interval adjusted by confidence interval

$\mu_{BL,d}$ Mean of the operating hours for day *d* during the baseline study interval

z Standard normal for a confidence level of 95% (z = 1.96)

$\sigma_{BL,d}$ Standard deviation of operating hours for day *d* during baseline study interval

$n_{r,d}$ Number of meters *r* that provide a valid value for day *d* during the baseline study

The formula required for calculation of $\mu_{BL,d}$ is:

$$\mu_{BL,d} = \frac{\sum_{r=1}^{n} \frac{o_{r,d,q}}{\alpha_{daylight,q}}}{n_{r,d}} \tag{6}$$

Where:

$\mu_{BL,d}$ Mean of the operating hours for day *d* in the baseline interval adjusted by $\alpha_{daylight,q}$

$n_{r,d}$ Number of meters *r* that provide a valid value for day *d* during the baseline study

$o_{r,d,q}$ Operating hours from meter *r* for day *d* for which complete data is available

$\alpha_{daylight,q}$ Adjustment factor for the mean operating hours measured during the baseline period in month *q* compared to the weighted annual average of daylight hours (see Table 6 for overview of $\alpha_{daylight,q}$) derived from the daylight hours in month *q* compared to the weighted annual average.

Table 6: Factors for adjustment of operating hours measured during the baseline

	Jan	Feb	Mrch	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
$\alpha_{daylight,q}$	0,937	0,921	0,901	0,896	0,871	1,026	1,133	1,153	1,167	1,072	0,983	0,940

The formula required for calculation of $\sigma_{BL,d}$ is:

$$\sigma_{BL,d} = \sqrt{\frac{\sum_{r=1}^{n} \left(\frac{o_{r,d,q}}{\alpha_{daylight,q}} - \mu_{BL,d} \right)^2}{n_{r,d} - 1}} \tag{7}$$

Where:

$\sigma_{BL,d}$	Standard deviation of operating hours for day *d* during baseline study interval
$o_{r,d,q}$	Operating hours from meter *r* for day *d* for which complete data is available
$\mu_{BL,d}$	Mean of the operating hours for day *d* in the baseline interval adjusted by $\alpha_{daylight,q}$
$n_{r,d}$	Number of meters *r* that provide a valid value for day *d* during the baseline study

<u>Step 2: Energy use in project:</u>

In analogy to the baseline case the energy use in the project is calculated.

The formula required for calculation of $E_{PJ,v}$ is

$$E_{PJ,v} = CF_v * \sum_{k=1}^{n} \left[p_k * \mu_{PJ,v} * d_{k,v} \right] \tag{8}$$

Where:

$E_{PJ,v}$	Energy use in the project (electricity) in MWh per monitoring interval *v*
CF_v	Correction factor for distributed CFL which are not operating during the cross-check in the monitoring interval *v*. CF_v represents the share of CFLs that are still operating.
p_k	Power rating of the distributed CFL *k*
$\mu_{PJ,v}$	Average operating hours per day in monitoring period *v*
$d_{k,v}$	Days of operation of each distributed CFL *k* in monitoring interval *v* derived from $Date_{START,v}$, $Date_{END,v}$ (and $Date_{i,k}$ in first monitoring interval)

The formula required for calculation of $\mu_{PJ,v}$ is:

$$\mu_{PJ,v} = \frac{\sum_{d=1}^{n} \mu_{PJ,v,d,adjust}}{dur_{PJ,v}} \tag{9}$$

Where:

$\mu_{PJ,v}$	Average project operating hours per day in the monitoring interval *v*
$\mu_{PJ,v,d,adjust}$	Mean of the operating hours for day *d* during the monitoring interval *v* adjusted by confidence interval
$dur_{PJ,v}$	Duration of the monitoring interval *v* in days derived from $Date_{START,v}$, $Date_{END,v}$

The formula required for calculation of $\mu_{PJ,v,d,adjust}$ is:

$$\mu_{PJ,v,d,adjust} = \mu_{PJ,v,d} + z * \frac{\sigma_{PJ,v,d}}{\sqrt{n_{m,v,d}}} \quad (10)$$

Where:

$\mu_{PJ,v,d,adjust}$	Mean of the operating hours for day *d* during the monitoring interval *v* adjusted by confidence interval
$\mu_{PJ,v,d}$	Mean of the operating hours for day *d* during the monitoring interval *v*
z	Standard normal for a confidence level of 95% (z = 1.96)
$\sigma_{PJ,v,d}$	Standard deviation of operating hours for day *d* during monitoring interval *v*
$n_{m,v,d}$	Number of meter instruments *m* that provide a valid value for day *d* during monitoring interval *v*

The formula required for calculation of $\mu_{PJ,v,d}$ is:

$$\mu_{PJ,v,d} = \frac{\sum_{m=1}^{n} o_{m,v,d}}{n_{m,v,d}} \quad (11)$$

Where:

$\mu_{PJ,v,d}$	Mean of the operating hours for day *d* during the monitoring interval *v*
$o_{m,d,v}$	Operating hours from measuring instrument *m* for day *d* for which complete data is available
$n_{m,d,v}$	Number of meter instruments *m* that provide a valid value for day *d* during the monitoring interval *v*

The formula required for calculation of $\sigma_{PJ,v,d}$ is:

$$\sigma_{PJ,v,d} = \sqrt{\frac{\sum_{m=1}^{n} \left(o_{m,v,d} - \mu_{PJ,v,d}\right)^2}{n_{m,v,d} - 1}} \quad (12)$$

Where:

$\sigma_{PJ,v,d}$	Standard deviation of operating hours for day *d* during monitoring interval *v*
$o_{m,v,d}$	Operating hours from measuring instrument *m* for day *d* for which complete data is available
$n_{m,d,v}$	Number of meter instruments *m* that provide a valid value for day *d* during the monitoring interval *v*
$\mu_{PJ,d,v}$	Mean of the operating hours for day *d* during the monitoring interval *v*

<u>Step 3: Leakage:</u>

Leakage results from the potential usage of GLS that have been replaced but not scrapped in the project activity.

Leakage is calculated as follows:

IF $\mu_{BL} * \sum_{v=1}^{n} dur_v \leq 1000h$ THEN

$$LE_v = (n_{i,k} - n_{SCRAP}) * \mu_{BL} * dur_v * (60W * Sh_{60W} + 100W * Sh_{100W}) * EF_{CO2,ELEC} \quad (13)$$

IF $\mu_{BL} * \sum_{v=1}^{n} dur_v > 1000h$ THEN

$$LE_v = (n_{i,k} - n_{SCRAP}) * \left[\mu_{BL} * \left(dur_v - \sum_{v=1}^{n} dur_v \right) + 1000h \right] * (60W * Sh_{60W} + 100W * Sh_{100W}) * EF_{CO2,ELEC}$$

(14)

IF $\left[\mu_{BL} * \left(dur_v - \sum_{v=1}^{n} dur_v \right) + 1000h \right] \leq 0$ THEN $LE_v = 0$

Where:

μ_{BL}	Average baseline operating hours per day
dur_v	Duration of the monitoring interval v in days derived from $Date_{START,v}$ and $Date_{END,v}$
LE_v	Leakage emissions in monitoring interval v
$n_{i,k}$	Number of replaced GLS bulbs i derived from p_i
$n_{SCRAP,i}$	Number of scrapped GLS bulbs handed in by households until the end of the first monitoring interval v
Sh_{60W}	Percentage share of 60W GLS replaced in the project activity derived from p_i
Sh_{100W}	Percentage share of 100W GLS replaced in the project activity derived from p_i
$EF_{CO2,ELEC}$	CO_2 emission factor for displacement of electricity in the grid serving the household consumers that participate in the project (fixed for the entire crediting period)

<u>Step 4: Emission reductions: Emission reductions per monitoring interval *v* are calculated using the following formula:</u>

$$ER_v = (E_{BL,v} - E_{PJ,v}) * EF_{CO2,ELEC} - LE_v \quad (15)$$

Where:

ER_v	Emission reductions during monitoring interval v
$E_{BL,v}$	Energy baseline (electricity)
$E_{PJ,v}$	Energy project (electricity)
$EF_{CO2,ELEC}$	CO_2 emission factor for displacement of electricity in the grid serving the household consumers that participate in the project (fixed for the entire crediting period)
LE_v	Leakage emissions in monitoring interval v

All applied formulae and parameters are incorporated in a project database for the monitoring process. Only the monitored parameters during the baseline study and the project activity have to be separately inserted into the database.

The project activity will use ex-ante grid emission factor. Hence the grid emission factor is fixed over the crediting period. The factor used is the Combined Margin (incl. Imports) published by the Central Electricity Authority (CEA).

B.6.2. Data and parameters that are available at validation:

Data / Parameter:	$EF_{CO2,ELEC}$
Data unit:	$kgCO_2/kWh$
Description:	CO_2 grid emission factor of the project electricity system
Source of data to be used:	Central Electricity Authority of India (CEA): CO_2 baseline data
Value of data	0,850 $kgCO_2e/kWh$
Description of measurement methods and procedures to be applied:	The project coordinator will download the latest grid emission factor from the CEA website.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper and electronic
Any comment:	The project activity will use an ex-ante grid emission factor. Hence the grid emission factor is fixed over the crediting period. The factor used is the Combined Margin (incl. Imports) published by the Central Electricity Authority (CEA).

B.6.3 Ex-ante calculation of emission reductions:

Applying the formulae given in PDD section B 6.1 (formula No. 15), the ex-ante calculation of emission reductions is shown.

$$ER_v = \left(E_{BL,v} - E_{PJ,v}\right) * EF_{CO2,ELEC} - LE_v$$

Where:

ER_v Emission reductions during monitoring interval *v*

$E_{BL,v}$ Energy baseline (electricity)

$E_{PJ,v}$ Energy project (electricity)

$EF_{CO2,ELEC}$ CO_2 emission factor for displacement of electricity in the grid serving the household consumers that participate in the project (fixed for the entire crediting period)

LE_v Leakage emissions in monitoring interval *v*

For calculating the baseline emissions as well as the project emissions, the total number of lamps operating during the monitoring interval is needed. The exact number of lamps during the project will be monitored by recording all replaced lamps and by monitoring the amount of lamps during each monitoring interval (Cross-Check). For the ex-ante calculation, the number of lamps operating during

each monitoring period are estimated by applying for each CFL type a specific life-time curve and in addition to assume a annual failure rate of 1 % due to household behavior.
From the total number of households in the district of Visakhapatnam (695,000 households), it is derived from the result of the pre-study that 10 % might not participate because of unwillingness or due to absence while distribution is going on. Hence 625,500 households are generally eligible to participate.
The rate of replaceable GLS bulbs (power rating of 60 W and 100 W) is derived from the conducted pre study[16] of 200 randomly selected households in the project area. It was found, that from the found GLS types eligible to be replaced 89 % are 60 W and 11 % are 100 W. With this rate between the replaceable GLS, an average wattage for GLS (baseline) can be calculated. By knowing the wattage of the CFL eligible for replacement, the average wattage for the CFLs can also be calculated.
The rates of failure of both types of project CFLs during the whole crediting period is taken into account by applying specific life-time curves for each CFL-type used in the project separately.

Taking into account that in households with more than 1 replaceable GLS, at maximum 2 GLS will be replaced as defined in the project (see PDD section A.2) an average lamp exchange rate of 1.27 GLS per household is the result from the pre-study. Due to the fact, that the pre-study counted beside indoor lighting also all GLS used outside, the results from the pre-study is assumed to be too optimistic. Experience form native people in India as well as gained experience during the pre-study showed, that some households in certain areas, do not use CFL for outside security lighting, because of the danger of theft. From all found 60 W and 100 W GLS during the pre-study, around 30 % were used outside. For the project it is assumed, that only about a third of the outside GLS can be safely replaced by project CFLs. Therefore, the project will calculate with an average lamp exchange rate of 1 GLS per household, instead of 1.27.

Taking into account the number of lamps at the start, the correction factor of operating lamps per monitoring period (CFL life-time curve + failure through household behaviour), the average wattage of the lamps (rate between 60W/100W GLS and 15W/20W CFL respectively) and the operating hours during each monitoring period, the energy saving per monitoring period or per year respectively can be estimated. By applying the emission factor given in PDD section B 6.2, the annual amount of emission reductions can be calculated.

Sample calculation for the first monitoring period:

Number of lamps in operation:

GLS 60 W / CFL 15 W	GLS 100 W / CFL 20 W	Total
278,341	34,373	312,714

It has to be considered, that in the first monitoring period the distribution is ongoing, so that only half of all lamps are assumed to count.

The average wattage of lamps:

Baseline: (278,341 * 60 W + 34,373 * 100 W) / 312,714 = 64.397 W

[16] For the pre-study results see also PDD section B.2.

Project: (278,341 * 15 W + 34,373 *20 W) / 312,714 = 15.550 W

It is assumed, that on average the lamps will operate for 5 h per day. For a conservative approach, the baseline and project operating hours are statistically corrected as described in detail in PDD section B 6.1. By applying the statistical correction, the baseline operating hours are lowered and the operating hours for the project are presumed higher.

Average operating hours per day:

Baseline	Project
4.94 h/d	5.06 h/d

The following monitoring intervals are assumed for the project:

1 and 2 year	3 months
3 and 4 year	6 months
5 and 6 year	6 months
7 and 8 year	12 months
9 and 10 year	12 months

Assuming for the first monitoring interval 0.25 * 365 days, the monitoring interval has 91.25 days.

Total operating hours in the first monitoring period:

Baseline: 91.25 days * 4.94 h/d = 450.8 h

Project: 91.25 days * 5.06 h/d = 461.7 h

With the data above, the baseline and project energy for the first monitoring interval can be calculated:

Baseline: 312,714 lamps * 64.397 W * 450.8 h = 9,078,139,831 Wh = 9.078 GWh

Project: 312,714 lamps * 15.550 W * 461.7 h = 2,244,965,457 Wh = 2.245 GWh

The energy savings amount to:

9.078 GWh – 2,245 GWh = 6,833 GWh

For a more conservative approach regarding the annual 60 GWh threshold, leakage has been assumed to be zero. The CERs for the first monitoring period are calculated as follows:

6,833 GWh * (0,850 kgCO2/kWh * 1000) = **5,808 tCO2e**

With the same procedure the emission reductions of all monitoring intervals are estimated (see the table given in PDD section B. 6.4 below).

B.6.4 Summary of the ex-ante estimation of emission reductions:

The CERs per year are already adjusted by the fee of 2 % for Small Scale Methodologies (SSC). See Table 7 below for the summary of ex-ante estimation of emission reductions.

Table 7: Summary of ex-ante estimation of emission reductions

Year	Estimation of project activity emissions (tCO2 e)	Estimation of baseline emissions (tCO2 e)	Estimation of leakage (tCO2 e)	Estimation of overall emission reductions (tCO2 e)	Estimation of overall emission reductions with the reduction of 2 % for SSC (tCO2 e)
May 08 - Apr 09	13.352	53.980	-	40.629	39.816
May 09 - Apr 10	14.929	60.352	-	45.423	44.515
May 10 - Apr 11	14.663	59.263	-	44.600	43.708
May 11 - Apr 12	14.366	58.047	-	43.681	42.807
May 12 - Apr 13	13.990	56.512	-	42.522	41.672
May 13 - Apr 14	13.484	54.466	-	40.982	40.162
May 14 - Apr 15	12.640	51.073	-	38.433	37.664
May 15 - Apr 16	11.667	47.184	-	35.518	34.807
May 16 - Apr 17	10.440	42.301	-	31.861	31.223
May 17 - Apr 18	8.979	36.498	-	27.519	26.968
Total (tonnes of CO2 e)	**128.510**	**519.676**	**-**	**391.166**	**383.342**

B.7 Application of a monitoring methodology and description of the monitoring plan:

B.7.1 Data and parameters monitored:

(Copy this table for each data and parameter)

Data / Parameter:	$Date_{START,v}$
Data unit:	Date (day/month/year)
Description:	Date of the start of the monitoring interval *v*
Source of data to be used:	Project coordinator sets the date
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	The date of the start will be fixed by the project coordinator
QA/QC procedures to	Date will be fixed and stored in the project database

be applied:	
Any comment:	Start date of the monitoring interval will be recorded for each monitoring interval separately

Data / Parameter:	$Date_{END,v}$
Data unit:	Date
Description:	Date of the end of the monitoring interval *v*
Source of data to be used:	Project coordinator sets the date
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	The date of the start will be fixed by the project coordinator
QA/QC procedures to be applied:	Date will be fixed and stored in the project database
Any comment:	End date of the monitoring interval will be recorded for each monitoring interval separately

Data / Parameter:	$Date_{START,BL}$
Data unit:	Date
Description:	Date of the start of the baseline study *BL* interval
Source of data to be used:	Project coordinator sets the date
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Date will be fixed and stored in the project database
Any comment:	Once at start date of the baseline study interval

Data / Parameter:	$Date_{END,BL}$
Data unit:	Date
Description:	Date of the end of the baseline study *BL* interval
Source of data to be used:	Project coordinator sets the date
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	
QA/QC procedures to be applied:	Date will be fixed and stored in the project database
Any comment:	Once at end date of the baseline study interval

Data / Parameter:	$o_{r,\ d,\ q}$
Data unit:	hours
Description:	Operating hours of GLS bulb *i* on day *d* as given by valid meter *r* in month *q* during the baseline study in the baseline households
Source of data to be used:	Readings of meters
Value of data	Daily operating hours
Description of measurement methods and procedures to be applied:	Meter per lamp appliance (GLS) is installed. For further information regarding the metering procedure, see PDD Annex 4 – meter information.
QA/QC procedures to be applied:	Automatic and continuously applied plausibility check of the data. Data review through project coordinator and automatic recognition of wrong data formats by the database; data storage electronic. Validity of meters evaluated according to procedure described for parameter $n_{r,d}$
Any comment:	

Data / Parameter:	$n_{SCRAP,i}$
Data unit:	No.
Description:	Number of scrapped GLS bulbs handed in by households until the end of the first monitoring interval *v*
Source of data to be used:	Distribution team/GLS scrap protocol
Value of data	No.
Description of measurement methods and procedures to be applied:	Each GLS displaced will be recorded on the distribution form and later be fed into the project database. The GLS replaced will be taken back to the section office of APEPDCL by the distribution team. Each distribution team will record the total number of replaced GLS on a separate protocol.
QA/QC procedures to be applied:	All GLS bulbs which will be replaced by CFL need to be collected, counted & destroyed. New packaging concept for CFLs is being developed. Packaging has increased size (diameter) which allows the replaced GLS bulb to be stored inside the original CFL packaging. By this measurement, transportation & counting of returned GLS will be simplified. To assure that the GLS lamps will not be reused, the lamps will be destroyed in presence and under supervision of an independent body. Automatic and continuously applied plausibility check of the data. Data review through project coordinator and automatic recognition of wrong data formats by the database; data storage paper (until first verification) and electronic.
Any comment:	

Data / Parameter:	$n_{r,d}$
Data unit:	No.
Description:	Number of meters *r* that provide a valid value for day *d* during the baseline study
Source of data to be used:	Server/Project Database
Value of data	Initially determined by number, willingness to participate and number of GLS of

	households in the baseline study (target volume 200)
Description of measurement methods and procedures to be applied:	All installed meters for the baseline study are registered in the project database. Only meters delivering valid daily data records or daily operating hours are counted. The data will have a daily monitoring frequency.
QA/QC procedures to be applied:	Data will be checked either manually and/or by automated procedures in the database
Any comment:	

Data / Parameter:	$Date_{i,k}$
Data unit:	Date
Description:	Date of the replacement of GLS bulb *i* by CFL *k*
Source of data to be used:	Distribution team/Distribution form
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	The date of replacement will be recorded on the distribution form while the replacement of GLS by CFL is physically taking place. Date for GLS replacement will be recorded for each replacement separately The information from the distribution form is afterwards entered into the project database.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper (until first verification) and electronic
Any comment:	

Data / Parameter:	p_i
Data unit:	W
Description:	p_i is the power of the GLS bulb *i* used before replacement.
Source of data to be used:	Lamp marking data of GLS
Value of data	60 W or 100 W
Description of measurement methods and procedures to be applied:	Read by the distribution team from the lamp while replacement is taking place and recorded on the distribution form. Afterwards distribution data is entered into the project database
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper (until first verification) and electronic
Any comment:	Data for power rating will be recorded for each replacement separately

Data / Parameter:	p_k
Data unit:	W
Description:	Power rating of the CFL *k* used to replace GLS bulb *i*
Source of data to be used:	Lamp marking data of CFL
Value of data	15 W or 20 W
Description of measurement methods	Read by the distribution team from the lamp while replacement is taking place and recorded on the distribution form. Afterwards distribution data is fed into the

and procedures to be applied:	project database
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper (until first verification) and electronic
Any comment:	Data for power rating will be recorded for each replacement separately

Data / Parameter:	BN_k
Data unit:	No.
Description:	Batch number (production number) of each CFL *k*
Source of data to be used:	Lamp marking data; Distribution team/Distribution form
Value of data	Format of the type t_c828
Description of measurement methods and procedures to be applied:	The Batch number will be recorded on the distribution form while the replacement of GLS by CFL is physically taking place. The batch number will be recorded for each replacement separately. The information from the distribution form is afterwards entered into the project database.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper (until first verification) and electronic
Any comment:	

Data / Parameter:	$o_{m,d,v}$
Data unit:	hours
Description:	Operating hours of the distributed CFL *k* on day *d* as given by valid meter *m* at the spot-check households
Source of data to be used:	Readings of measuring instruments
Value of data	Daily operating hours
Description of measurement methods and procedures to be applied:	Meter per lamp appliance (CFL) is installed. For further information regarding the metering procedure, see PDD Annex 4 – meter information.
QA/QC procedures to be applied:	Automatic and continuously applied plausibility check of the data. Data review through project coordinator and automatic recognition of wrong data formats by the database; data storage electronic. Validity of meters evaluated according to procedure described for parameter $n_{m,d,,v}$
Any comment:	

Data / Parameter:	$n_{m,d,v}$
Data unit:	No.
Description:	Number of meters *m* that provide a valid value for day *d* during the monitoring interval *v*
Source of data to be used:	Server/Project Database

Value of data	Initially determined by number, willingness to participate and number of GLS of households in the baseline study (target volume 200)
Description of measurement methods and procedures to be applied:	All installed meters in the spot-check households (during the monitoring interval) are registered in the project database. Only meters delivering valid daily data records or daily operating hours are counted. The data will have a daily monitoring frequency.
QA/QC procedures to be applied:	Data will be checked either manually and/or by automated procedures in the database
Any comment:	

Data / Parameter:	$Date_{c,v}$
Data unit:	Date
Description:	Date of cross-check in cross-check household *c* for monitoring period *v*
Source of data to be used:	Cross-check team/Cross-Check form
Value of data	Format dd.mm.yyyy
Description of measurement methods and procedures to be applied:	The date of the cross-check will be recorded on the cross-check form while the cross-check (checking whether the project CFL is still functioning) is physically taking place. Date of the cross-check will be recorded for each cross-check household separately. The information from the cross-check form is afterwards entered into the project database.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper and electronic
Any comment:	Cross-check has to be done per each monitoring interval separately

Data / Parameter:	$n_{sample,CC,v}$
Data unit:	No.
Description:	Number of checked CFLs during cross check *CC* in monitoring interval *v*
Source of data to be used:	Cross-check team/Cross-Check form
Value of data	At least 200
Description of measurement methods and procedures to be applied:	The data of each checked CFL will be recorded on the cross-check form while the cross-check (checking whether the project CFL is still functioning) is physically taking place. This is done by the cross-check team. The data of the cross-check will be recorded for each cross-check household separately. The information from the cross-check form is afterwards entered into the project database. The project database sums up all CFL that were checked during the cross-check in monitoring interval *v*.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper and electronic
Any comment:	Cross-check has to be done per each monitoring interval separately

Data / Parameter:	$n_{ok,v}$
Data unit:	No.
Description:	Number of distributed CFLs to cross-check households which are functional during cross-check of monitoring interval *v*
Source of data to be	Cross-check team/Cross-Check form

used:	
Value of data	$n_{sample,CC,v}$ minus CFL found not functioning in monitoring interval *v*
Description of measurement methods and procedures to be applied:	The data of each checked CFL will be recorded on the cross-check form while the cross-check (checking whether the project CFL is still functioning) is physically taking place. This is done by the cross-check team. The data of the cross-check will be recorded for each cross-check household separately. The information from the cross-check form is afterwards fed into the project database. The project database sums up all CFL that were found not functioning during the cross-check in monitoring interval v.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper and electronic
Any comment:	Cross-check has to be done per each monitoring interval separately

Data / Parameter:	$EF_{CO2,ELEC}$
Data unit:	$kgCO_2/kWh$
Description:	CO_2 grid emission factor of the project electricity system
Source of data to be used:	Central Electricity Authority of India (CEA): CO_2 baseline data
Value of data	0,850 $kgCO_2e/kWh$
Description of measurement methods and procedures to be applied:	The project coordinator will download the latest grid emission factor from the CEA website.
QA/QC procedures to be applied:	Application of standardized data forms and compliance protocols; data review through project coordinator; data storage paper and electronic
Any comment:	The project activity will use ex-ante grid emission factor. Hence the grid emission factor is fixed over the crediting period.

B.7.2 Description of the monitoring plan:

This Monitoring Plan (MP) describes management systems and procedures to be implemented by the project coordinator upon project implementation in order to ensure consistent project procedure as well as monitoring, processing and reporting of data required for the calculation of emission reductions (ERs).
In addition to the MP a project database is established. All data collected is entered into the database. All required calculations specified in this MP will be performed in the project database.
The project is designed in such a way that the first monitoring period starts with the start of distribution.

1. Preparations
A project coordinator is appointed to organise all requirements according to this MP and to supervise all involved bodies. The project coordinator has to determine the start date as well as the end date of each monitoring interval. All relevant involved bodies will be trained in advance, so that a most accurate monitoring can be assured (See Table 8 below for further information).

Table 8: Project implementation plan Visakhapatnam

Processes	Involved body, responsibility	Supervising
1. Pre-Study	OSRAM India	OSRAM Germany
2. Transport Overseas		
2.1 Transportation of CFL from Europe to India, Osram factory	OSRAM Germany	OSRAM India, Purchase
- see overseas transport document for details	OSRAM Germany	OSRAM India, Logistics
3. Assembling		
3.1 Assembling of CFL in factory, Sonepat	OSRAM India Sonepat factory	OSRAM India, Manufacturing
4. Transport Local		
4.1 Transport of CFL to project area (Vizak)	OSRAM, India / Logistic company / APEPDCL	OSRAM India, Logistics Dept.
5. Distribution		
5.1 Training of distribution team	APEPDCL & OSRAM India	OSRAM India, CDM Team
5.2 Distribution of CFL		
- allocation of CFL + forms to distribution teams	APEPDCL Vizak	OSRAM India, CDM Team
- visiting houses for physical distribution of CFLi, replacement of CFLi and filling in distribution forms	APEPDCL & Distribution Team	OSRAM India, CDM Team
5.3 Collection of distribution forms, protocols, GLS…		
- the set of documents, replaced GLS-lamps and not-utilised CFL will be collected per distribution area	APEPDCL & Distribution Team	OSRAM India, CDM Team
- all material within the section area will be brought back to the section office of EPDCL	APEPDCL & Distribution Team	OSRAM India, CDM Team
5.4 Destruction of GLS and waste management		
- destruction of GLS lamps section wise under supervision of an independent body	APEPDCL under supervision of independent body	APEPDCL + Municipal Corp Visak
5.5 Data assembling from forms and data-entry	APEPDCL Vizak; Osram India, CDM Team	OSRAM India, CDM Team
5.6 Storage of forms and protocols	OSRAM India	OSRAM India, CDM Team
6. Metering		
6.1 Training for meter installation team	OSRAM India; Meter Company	OSRAM India, CDM Team
6.2 Installation of meter equipment for Baseline (BL)	OSRAM India; Meter Company	OSRAM India, CDM Team
6.3 Installation of meter equipment for Spot-Check (SC)	OSRAM India; Meter Company	OSRAM India, CDM Team
6.4 Collection of forms & protocols (regarding metering)	Meter company, OSRAM India	OSRAM India, CDM Team
- after installations all BL and SC forms are submitted to OSRAM	Meter company, OSRAM India	OSRAM India, CDM Team
6.5 Data assembling, data entering (regarding metering)	Meter company, OSRAM India	OSRAM India, CDM Team
6.6 Storage of forms & protocols (for metering)	Meter company, OSRAM India	OSRAM India, CDM Team
7. Cross-Check (CS)		
7.1 Training for cross-check group	OSRAM India	APEPDCL + OSRAM India
7.2 Conducting the cross-check (CC) per monitoring period		
- allocation of forms to the cross-check groups	EPDCL	OSRAM India, CDM Team
- visiting the households and checking CFL plus filling in forms	EPDCL	OSRAM India, CDM Team
7.3 Collection of forms & protocols		
- all filled in forms and a summary sheet will be send back to OSRAM India	APEPDCL	OSRAM India, CDM Team
7.4 Data assembling, data entering	OSRAM India, CDM Team	OSRAM India, CDM Team
7.5 Storage of forms & protocols	OSRAM India, CDM Team	OSRAM India, CDM Team

The operating hours are determined by monitoring (measurement) of the GLS during the baseline study (see step 2 below) and of the CFL during the project period (Spot-Check – see step 4 below). The selection of those households will be done in a representative manner out of the total list of households eligible to participate in the project. The whole data of all domestic electricity grid connections are provided in the project database.
For each, the baseline study (operating hours of the GLS used before the replacement by CFL through the project) and the spot-check (operating hours of the project CFL after replacement) a sample group of at least 200 households will be randomly selected.

2. Baseline-Study

For the baseline study only GLS are eligible to be metered that will later be suitable for replacement (GLS with 60 W and 100 W) with project CFL. For the baseline study all selected households will be visited and meter equipment will be installed.[17] The baseline operating hours will be metered for at least 2 months. The results of the daily operating hours will be adjusted by seasonal adjustment factors that take seasonal differences of daylight hours into account. With these adjustments the metered baseline measurement of daily operating hours can be later applied as an annual daily average.
In case in the selected households less than 170 meters could be installed, because the other households are not accessible at all or cannot participate because of not using eligible GLS, a certain number of households might be additionally selected under the same procedure as before, so that the target number 200 meters can initially be installed.[18]

3. Distribution

All electricity grid connected households in the district of Visakhapatnam are eligible to participate in the project. The distribution of the CFLs will be done by distribution teams door-to-door. The teams will physical visit each household, inform about the project idea, will check the current lighting installation and will actually exchange the eligible GLS bulbs by CFL lamps.
This distribution system will make sure of the following:

- the CFL lamps will be installed immediately at the date of distribution and there is no risk that CFL lamps will be kept in storage or not being used at all
- the CFL lamps will actually replace the GLS bulbs that have the longest usage hours and will not be installed in areas where usage hours are very low (bathroom, storage room, etc.)
- the CFL lamps will replace only the eligible GLS bulbs (60W & 100W)
- the GLS bulbs replaced will be collected immediately and will not be used anymore from date of exchange

The allocation of CFLs per region, section and village will be organized by OSRAM India and allocated through the section offices of the Eastern Power Distribution Company of Andhra Pradesh Limited (APEPDCL). The sortation of households regarding the different distribution areas

[17] Meter equipment will only be installed in households that have GLS that are eligible to be replaced by project CFLs as described under section A.2 and only when they agree to participate in the baseline study. For further details regarding the meter equipment see PDD Annex 4 (sub-section A “Metering Information”).

[18] This needs to be done to ensure an amount of lamps/meters that is high enough to deliver appropriate and representative meter data for the baseline.

(sections/mandals) will be done automatically in the project database by certain criteria. During the distribution phase pre-trained distribution teams will take the allocated CFLs plus the assigned distribution forms[19] (one for each household) along to the households that the team is going to visit. The forms will be filled out immediately while replacement of lamps is taking place. The forms will be designed in such a way that filling in of the forms can be done very easily to avoid mistakes.
The date of replacement, the power rating of the replaced inefficient light bulb (GLS) and the power rating of the efficient light bulb (CFL) as well as the batch number[20] of the CFL has to be recorded during distribution. The power rating of the replaced GLS is derived from the lamp marking. In the case GLS are found where the power rating is unreadable, it is recorded as 60 W. The power rating of the efficient distributed light bulbs (CFL) is derived from the lamp marking and manufacturer's information. All information from the distribution forms will be entered 1 to 1 into the database. Consequently, the database will have per participating household the number of replaced CFL with date of replacement, wattage of replaced GLS and wattage of project CFL.
The GLS replaced will be taken back to the section office of APEPDCL by the distribution team. Each distribution team will record the total number of replaced GLS on a separate protocol. All GLS bulbs which will be replaced by CFL need to be collected, counted & destroyed. New packaging concept for CFLs is being developed. Packaging has increased size (diameter) which allows the replaced GLS bulb to be stored inside the original CFL packaging. By this measurement, transportation & counting of returned GLS will be simplified. To assure that the GLS lamps will not be reused, the lamps will be destroyed in presence and under supervision of an independent body. The destruction will be done as specified by the appropriate local authority. It will be assured that the destruction will be done in an appropriate manner with due care and safety. The waste of the destroyed GLS will be handled in an appropriate and environmental friendly way with due care and safety and without causing any hazard in close coordination with APEPDCL, as specified by local authority.
In case the number of destroyed (scrapped) GLS is lower than the number of GLS replaced according to the distribution forms (this will be checked manually/automatically by the project database, leakage will be taken into account according to PDD section B 6.1 – Step 3: Leakage.

4. Spot-Check
To be able to claim CERs during distribution, the spot-check households will be the first participating households in the project where GLS are replaced by project CFLs. This approach needs to be done to be able to get daily data regarding the operating hours of CFL right from the start of distribution. By having these data and recording the daily operating hours for each day separately throughout the distribution phase, the first monitoring interval can start before completing the whole distribution. However, to be representative, the emission reduction can only be correctly calculated from the date when the meter installation for the spot-check households is completed. With this approach the energy savings achieved during distribution can be taken into account for the first monitoring period.

[19] The distribution forms have household specific data like family name, address, customer ID already pre-printed, so that the distribution teams are able to find and identify each household.

[20] The batch number is a production number that enables one to check when and where this lamp was produced. To avoid re-sale of the CFL, the label on the project CFL will be clearly marked accordingly. See also PDD Annex 4 (sub-section B "Sample labelling project CFLs") for further information.

5. Metering equipment

The metering equipment for both the baseline and the spot-check will be installed by a meter company. The meter ID together with the name, address and consumer ID will be recorded on pre-printed baseline forms/spot-check forms. After the installation, a functionality check will be done to assure the correct operation of the meter. Each meter will send the data of lamp operating hours via SMS to a server. On this server the data of all operating meters will be stored as daily data per meter. The daily operating hours per meter will be frequently sent to the project database.[21]

6. Cross-Check

The cross-check will be done for every monitoring period and evaluates to what extent the distributed CFLs in the project area are still functioning. After the distribution is completed, all participating households (households that received at least one CFL during the distribution) will be marked in the database accordingly. Out of these participating households a group of at least 200 households[22] will be randomly selected. This needs to be done for each monitoring period newly and separately.
The project coordinator will send pre-printed cross-check forms to the cross-check teams that will conduct the actual cross-check and visit the households. In each household it will be checked whether the CFL distributed before is still functioning. The date of cross-check and the results will be recorded on the cross-check forms.
If a household is not at home or a house is inaccessible (e.g. household has moved or is on holiday), this information will also be recorded on the form. The cross-check team proceeds until all households selected for the cross-check have been visited.
The information from the cross-check forms will be entered into the project database, where they will be stored.

With the result of the cross-check, the database will calculate the following:

- the total number of project CFLs checked during the cross-check (the number of project CFLs in households that were inaccessible does not count)
- the total number of project CFLs not functioning during the cross-check
- the percentage of project CFL not functioning (CFL not functioning in the cross-check sample group divided by total number of CFL checked in the cross check sample group) For example: 250 CFL were checked; 10 found not functioning -> 10/250 = 0.04 = 4 %.

For reasons of conservativeness, this percentage resulting from the cross-check group then has to be statistically corrected according to the monitoring plan. Only with this correction, it is possible to apply the results from the cross-check group to the whole project group.
After the statistical correction, the database will use the result of project CFLs not functioning, to reduce the energy savings for the specific monitoring period accordingly. For the example given above, it would mean that the energy savings in this specific monitoring period would be reduced by

[21] For further information regarding the meter equipment see PDD Annex 4 (sub-section A "Metering information").
[22] The number of households selected for the cross-check might vary. However it needs to be assured, that a minimum number of samples is checked to be able to use the statistical methods described in the PDD. OSRAM will always try to have a fairly high number of samples (at least 200) to become more accurate and representative results.

the factor (1 - 0.04) resulting in the factor 0.96. As a result, the energy savings achieved would be multiplied by the factor of 0.96.

7. CO_2-Grid Emission factor

The CO_2 grid emission factor of the project electricity system of which the participating household of the project activity is connected to, shall be determined using ACM0002. The emission factor used is an ex-ante grid emission factor value. The factor used is the Combined Margin (incl. Imports) published by the Central Electricity Authority (CEA).

8. Project Database

All formulae given in Section B.6.1 are incorporated in the project database. The project database consists of the following main steps:

- Setting up the database: Import of raw data and certain parameters
- Selection for CFL distribution
- Selection for installing the meter equipment (Baseline/Spot-Check)
- Baseline study results (operating hours of GLS)
- Spot Check results (operating hours of project CFLs)
- Spot-Check: Intervals for meter calibration
- CFL distribution: Data recording
- Cross-Check (functionality-check of CFL)
- Calculation of emission reductions
- Generating the Monitoring Plan

The database is web-based and contains all households connected to the power grid in the district of Visakhapatnam. All parameters that are needed for calculating emission reductions will be entered into the database. At the same time the database serves as a data storage device. All data in the database is stored until 2 years after the end of the crediting period.

To ensure reliable and transparent data collection, the project coordinator has to set up a project implementation handbook before the start of the crediting period including detailed procedure instructions, data forms that are used to document all procedures undertaken and required for project implementation and data collection as well as protocols which are applied to ensure a good level of quality assurance.

B.8 Date of completion of the application of the baseline and monitoring methodology and the name of the responsible person(s)/entity(ies)

12.12.2007
OSRAM GmbH, Munich, Germany; Hellabrunner Str. 1; 81443 Munich; Germany
Mr. Boris Bronger; b.bronger@osram.de; Tel.: +49 89 6213 4115

Perspectives Climate Change GmbH, Im Tobelacker 23; 8044 Gockhausen; Zürich, Switzerland
(not a project participant)
Mr. Matthias Krey; krey@perspectives.cc; Tel.: +41 44 820 42 10
Mr. Marc André Marr; marr@perspectives.cc; Tel.: +41 44 820 42 11

Mr. Sven Feige; feige@perspectives.cc; Tel.: +49 2204 506 392

SECTION C. Duration of the project activity / crediting period

C.1 Duration of the project activity:

C.1.1. Starting date of the project activity:

08.05.2007

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

10 years and 0 months

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

C.2.1. Renewable crediting period

C.2.1.1. Starting date of the first crediting period:

Not applicable.

C.2.1.2. Length of the first crediting period:

Not applicable.

C.2.2. Fixed crediting period:

C.2.2.1. Starting date:

11.05.2008

C.2.2.2. Length:

10 years

SECTION D. Environmental impacts

D.1. If required by the host Party, documentation on the analysis of the environmental impacts of the project activity:

The Government of India does not require any documentation of the environmental impacts of the project activity. The project type/category is not included in the "List of projects or activities requiring prior environmental clearance" included in the Environmental Impact Assessment (EIA) notification of the Ministry of Environment and Forest (MOEF), Government of India, 2006[23].

[23] See MOEF [Ministry of Environment and Forests] (2006): S.O.1533(E),[14/09/06] - Environmental Impact Assessment Notification. Source: http://envfor.nic.in/legis/eia/so1533.pdf

D.2. If environmental impacts are considered significant by the project participants or the host Party, please provide conclusions and all references to support documentation of an environmental impact assessment undertaken in accordance with the procedures as required by the host Party:

Currently all fluorescent lamps used in India – especially the tubular shaped lamps being used in commercial as well as in residential applications – are not being recycled but disposed with the regular waste in landfills. Every tubular lamp and CFL contains small quantities of mercury and therefore may eventually add to contamination of soils and groundwater resources in India[24]. OSRAM India is aware of this fact and therefore wants to address this issue proactively. Although MOEF does not mandate an EIA or any precautionary measures for CFL use, OSRAM India will implement a mitigation plan that will contribute to the prevention of mercury pollution from the project activity, containing the following elements:

- OSRAM GmbH has continuously reduced the amount of mercury inside its CFLs lamps. While most other manufacturers use a liquid dose system where the amount of mercury included into each lamp cannot be measured accurately, OSRAM GmbH has developed a mercury pill which allows to reduce mercury to the exact amount that is necessary to operate the lamp. The lamps being used for these projects will contain only ≤ 2.5 mg of mercury. These lamps are produced in Germany and the assembly takes place in India. This is done because OSRAM India has so far no production line for producing CFL with a life-time of 15,000 h. OSRAM India is currently building a new production plant at Kundli, that will mainly produce energy-saving T5 fluorescent lamps and compact fluorescent lamps including a manufacturing line which can produce 15,000-hour high-quality long-life CFLs.. OSRAM India will cut down the mercury content in its new production line from 4.5 to 2.5 mg/CFL.
- The CFLs used in the project activity have a long lifetime of 15,000 utilization hours. This means that the average amount of mercury used for 1,000 utilization hours is only ≤ 0.25 mg of mercury.
- The long lifetime of 15,000 utilization hours also reduces the amount of other waste (glass, plastic, PCB-board, etc.) and energy required to produce and distribute lamps. It is therefore not intended to replace the lamps during the project period[8]. The high quality of the lamps is therefore eminent to make this a sustainable project.
- The burners of the CFLs (which contain the mercury) will be produced in Germany by OSRAM GmbH and shipped to India. The CFLs will be assembled in the OSRAM India factory in Sonepat, Haryana. No mercury will be released in India during lamp reassembly in India.
- All households that take part in the project activity will be informed in detail how to use and handle the CFLs properly.
- All fused CFLs will be collected and will be disposed off, especially its mercury content, in accordance with the approved guidelines of the Ministry, applicable at that time.
- Until the Government of India has set-up a recycling system for CFls, OSRAM will inform all households about how and where the fused lamps can be disposed of in an environmental friendly manner
- The CFLs used in the project activity have a long lifetime of 15,000 utilization hours. It is therefore expected that he majority of the CFLs will only fuse after a recycling system has already been set up by the Indian Government.

[24] See Srivastava, R.C. (2003): Guidance and Awareness Raising Materials under new UNEP Mercury Programs (Indian Scenario).Source: http://www.chem.unep.ch/MERCURY/2003-gov-sub/India-submission.pdf

- The waste of the collected and destroyed GLS will be handled in an appropriate and environmental friendly way with due care and safety without causing any hazard in close coordination with AEPDCL, as specified by local authority.

SECTION E. Stakeholders' comments

E.1. Brief description how comments by local stakeholders have been invited and compiled:

On the 17.05.07 public announcements were made in the (local) newspapers Eanadu (in Telugu) and Deccan Chronicle (in English) that informed about the project and invited the general public to participate in a stakeholder consultation meeting. No comments were received before the conduction of the stakeholder consultation.
The stakeholder consultation meeting was carried out on 25.05. 2007 at 6:00 pm in Darsini Hall, Daspalla Hotel, Suryabagh, Visakhapatnam. In total 132 stakeholders participated in the consultation. A large part of the stakeholders that participated in the consultation came from the local community in Visakhapatnam. A list of participants is available on request.

The stakeholder consultation was conducted in English and Telugu.

The agenda of the consultation meeting was as follows:

- 18:45h – 19:00h: Opening remarks (Mr. Praveen Prakash, Eastern Power Distribution Company of A.P. Limited)
- 19:00h – 19:30h: Presentation of the company OSRAM GmbH (Mr. Gagan Mehra, OSRAM India Pvt. Ltd.)
- 19:30h – 20:15h: Presentation of the planned CDM project (Mr. Boris Bronger, OSRAM GmbH)
- 20:15h – 20:20h: Overview on energy efficiency (Mr. Pradeep Kumar, The Energy and Resources Institute)
- 20:20h – 20:50h: Question & answer session

E.2. Summary of the comments received:

Generally, the project was very welcomed by the stakeholders. The outstanding benefits for the individual households and the country as a whole due to the expected electricity savings and the long life-time of the CFL lamps were acknowledged. Specifically, the following questions were raised to which answers/clarifications were provided as follows:

1) **Question:** What is a CFL and how does it work? **Answer:** A CFL consists of magnetic or electronic ballast and a tube filled with gas. When electricity from the ballast flows through the gas, it causes the gas to emit ultraviolet light. The light excites a white phosphor coating on the inside of the tube which then emits light.
2) **Question:** Why is a CFL so costly and why is it not so good looking and which power factor does it have? **Answer:** The CFL is more costly because it is more expensive to produce it. A CFL looks the way it looks due to the technological requirements. The power factor of CFLs is normally between 0.5 and 0.6.
3) **Question:** How are the CFLs disposed? **Answer:** Currently there is no recycling regulation by the Indian Government but OSRAM will investigate how this issue can be solved.

4) **Question:** Instead of targeting only households why not concentrate on street lighting and other applications? **Answer:** CDM requires a very rigid monitoring system and as street lighting is very scattered monitoring costs would be very high. However, OSRAM offers a number of other energy-efficient lighting appliances such as street lighting.

E.3. Report on how due account was taken of any comments received:

As can be seen above, no concerns were raised during the stakeholder consultation and positive feedback was given to the project participant.

Annex 1

CONTACT INFORMATION ON PARTICIPANTS IN THE PROJECT ACTIVITY

Organization:	OSRAM India Pvt. Ltd.
Street/P.O.Box:	South City 1
Building:	11th Floor, Signature towers, Wing B
City:	Gurgaon
State/Region:	Haryana
Postfix/ZIP:	122001
Country:	India
Telephone:	+91 (0) 124 4081581
FAX:	+91 (0) 124 4081577
E-Mail:	info@osram.co.in
URL:	http://www.osramindia.com/index.html
Represented by:	Mr. Chandan Bhattacharjee
Title:	Divisional Manager
Salutation:	Mr.
Last Name:	Bhattacharjee
Middle Name:	-
First Name:	Chandan
Department:	Sales
Mobile:	+91 (0) 987 1885511
Direct FAX:	+91 (0) 124 4081578
Direct tel:	+91 (0) 124 4150119
Personal E-Mail:	c.bhattacharjee@osram.co.in

Organization:	OSRAM GmbH
Street/P.O.Box:	Hellabrunner Straße 1
Building:	
City:	Munich
State/Region:	
Postfix/ZIP:	81543
Country:	Germany
Telephone:	+49 (0) 89 6213 0
FAX:	+49 (0) 89 6213 2020
E-Mail:	webmaster@osram.info
URL:	http://www.osram.com
Represented by:	Mr. Boris Bronger
Title:	Senior Director Climate Change & Sustainability Projects
Salutation:	Mr.
Last Name:	Bronger
Middle Name:	-
First Name:	Boris
Department:	Sales Overseas
Mobile:	

Direct FAX:	+49 (0) 89 6213 2071
Direct tel:	+49 (0) 89 6213 4115
Personal E-Mail:	b.bronger@osram.de

Organization:	RWE Power AG
Street/P.O.Box:	Rellinghauser Straβe 37
Building:	/
City:	Essen
State/Region:	
Postfix/ZIP:	45128
Country:	Germany
Telephone:	+49 201 12-20226
FAX:	+49 201 12-24132
E-Mail:	michael.fuebi@rwe.com
URL:	www.rwe.com
Represented by:	Michael Fübi
Title:	Vice President Climate Protection
Salutation:	Dr.
Last Name:	Fübi
Middle Name:	/
First Name:	Michael
Department:	/
Mobile:	/
Direct FAX:	+49 201 12-24132
Direct tel:	+49 201 12-20226
Personal E-Mail:	michael.fuebi@rwe.com

Annex 2

INFORMATION REGARDING PUBLIC FUNDING

Not applicable

Annex 3

BASELINE INFORMATION

NOT APPLICABLE

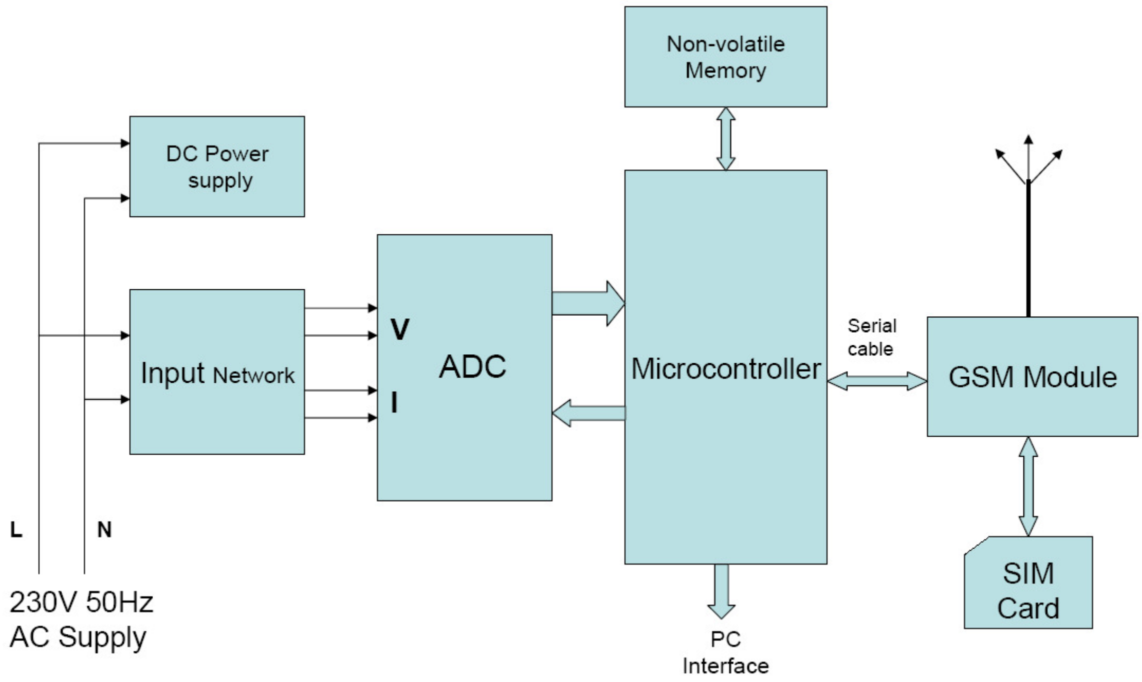
Annex 4

MONITORING INFORMATION

A. Metering information

Data-Sheet for CDM Meter

Schematic diagram:



Specifications

A.1 General

The meter is designed to measure electrical parameters of a CFL Lamp. The measured data is stored and relayed to Central Server wirelessly. It is possible to down load data on a computer using an interface cable.

Supply Voltage:	150 – 270 V AC
Enclosure:	ABS White/Beige colour
Mounting:	Suitable for mounting on a Bulb Holder

	Holder for plugging bulb is mounted on meter
Dimensions:	Not above Ø 85 mm, thickness 45 mm excluding Adaptor and Lamp Holder

A.2 Measurement

Time (Cumulative)

Resolution:	15 Sec

Memory

Capacity:	>= 16 kB, Nonvolatile

A.3 Data Transmission

GSM module:	Dual/Tri band 900/1800 MHz
Transmission Mode:	Wireless – By SMS/GPRS/Data call Wired – By downloading to computer using USB Dongle

A.4 Calibration interval	Within 3 years to take care of effect of component ageing

A.5 Features

1. Construction

As meter is required to measure electrical parameters of a CFL Lamp, it is fitted with bulb adapter on one side and a holder on another side. This facilitates plugging of the meter in the bulb holder and the CFL lamp can be plugged in to the holder fitted on the other side.

2. Electrical

- Operates over wide supply range.
- Measures and Records
  - Burning hours of CFL lamp
- GSM Modem built-in.
- Detailed records stored in Non Volatile memory – No battery back up required.

- Detailed records transmitted to central server over GSM network after pre-programmed interval.
- Retries automatically after failure in sending data over GSM.

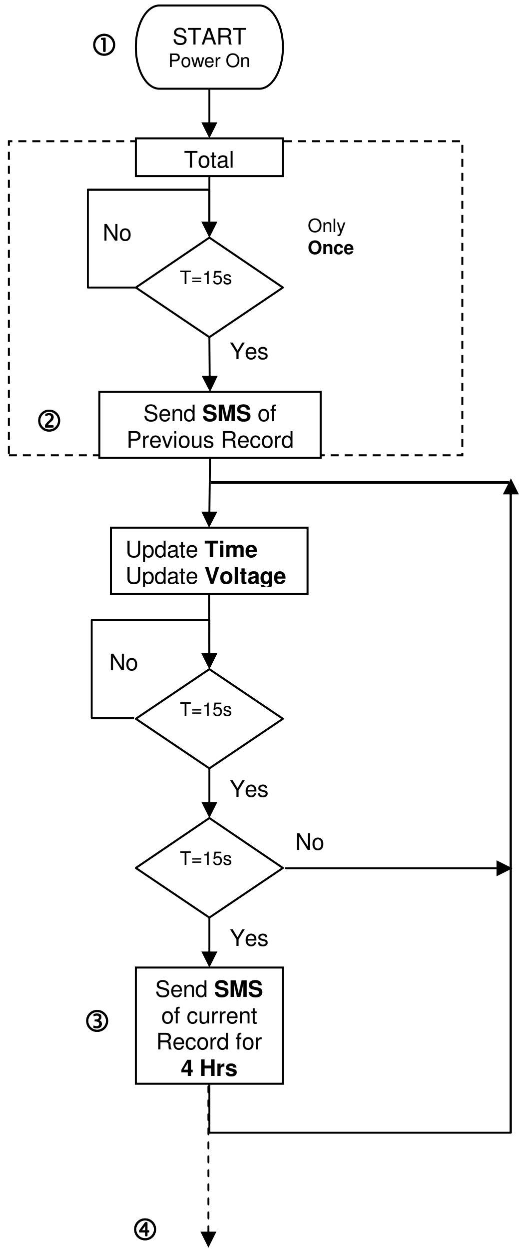
A.6 Measurement & Data Transmission Process & Diagram

1. Light is switched on:
   a) Meter is starting to record;
   (every 15s measured data will be saved in flash memory of meter)

2. After light is on for 15sec continuously, SMS will be send to server incl. memory information of first data recoding

3. If light is on continuously:
   after 4h have been accumulated in flash memory, SMS will be sent

4. All SMS will sent to a central server where all information are entered into a database which will then summarize the usage hours per day and meter



B. Sample labelling project CFLs

The OSRAM CFLs used for the CDM-projects in India will have a specific labelling on the lamp base (see picture below).

1. Technical data about the CFL
2. Batch number
3. IS-No.
4. Label – "CDM Project – NOT FOR RESALE"