

SMALL-SCALE CDM PROGRAMME ACTIVITY DESIGN DOCUMENT FORM
(CDM-SSC-CPA-DD) - Version 01



NAME /TITLE OF THE PoA:



Punjab State Electricity Board: High Voltage Distribution System for Agricultural consumers in the Rural Areas of the Punjab.

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CLEAN DEVELOPMENT MECHANISM
SMALL-SCALE PROGRAM **ACTIVITY DESIGN** DOCUMENT FORM (CDM-SSC-CPA-DD)
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Annexes

- Annex 1: Contact information on entity/individual responsible for the CPA
- Annex 2: Information regarding public funding
- Annex 3: Baseline information
- Annex 4: Monitoring plan

NOTE:

- (i) This form is for submission of CPAs that apply a small scale approved methodology using the provision of the proposed small scale CDM PoA.

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(ii) The coordinating/managing entity shall ~~prepare~~ [prepare a](#) CDM Small Scale Programme Activity Design Document (CDM-SSC-CPA-DD)^{1,2} that is specified to the proposed PoA by using the provisions stated in the SSC PoA DD. At the time of requesting registration the SSC PoA DD must be accompanied by a CDM-SSC CPA-DD form that has been specified for the proposed SSC PoA, as well as by one completed CDM-SSC CPA-DD (using a real case). After the first CPA, every CPA that is added over time to the SSC PoA must submit a completed CDM-SSC CPA-DD.

¹ The latest version of the template form CDM-CPA-DD is available on the UNFCCC CDM web site in the reference/document section.

² At the time of requesting validation/registration, the coordinating managing entity is required to submit a completed CDM-POA-DD, the PoA specific CDM-CPA-DD, as well as one of such CDM-CPA-DD completed (using a real case). This template shall not be altered. It shall be completed without modifying/adding headings or logo, format or font.

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SECTION A. General description of small scale CDM programme activity (CPA)

A.1. Title of the small-scale CPA:

Punjab State Electricity Board: High Voltage Distribution System for Agricultural consumers in the Rural Areas of the Dhuri, Punjab

A.2. Description of the small-scale CPA:

The present CPA is being implemented by Punjab State Electricity Board (PSEB) as an initiative to reduce the technical losses by replacing the existing 3-phase, 400V Low Voltage Distribution System (LVDS) feeding Agricultural Pumps (AP), with an 11-kV High Voltage Distribution System (HVDS) within Dhuri ~~D~~istribution ~~circle~~-Division (scheme).

Dhuri scheme is uniquely identified in the POA by the PSEB / Rural Electrification Corporation (REC) code number 161358. It consists of 53 feeders with agriculture pump set connections numbering around 12118. The total energy sent out is about 21.21 Gwh.

For the Dhuri CPA, financing has been secured from REC. The financing is sanctioned based on DPR (Detailed Project Report) prepared specifically for the CPA at Dhuri. REC is providing a loan of 90% of the total investment. The remaining 10% ~~is being brought in~~shall be provided by PSEB ~~in form of equity~~.

A.3. Entity/individual responsible for the small-scale CPA:

PSEB is the project implementer for the POA as well as all the CPAs under the POA.

Dhuri CPA implementer would report to the PSEB POA coordinating manager based at the headquarters level, Patiala, Punjab.

Chief Engineer/~~RE&APDRP~~, PSEB, ~~F-2 Shakti Vihar -Patiala~~~~Er. V K Singh~~, is the designated POA coordinating Manager, ~~Addl.SE~~/Senior Executive Engineer, PSEB ~~at Dhuri~~at Dhuri, ~~Er. S S Bhattal~~, is the designated Dhuri CPA implementer.

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A.4. Technical description of the small-scale CPA:

The Dhuri CPA consists of voltage ~~upgradation~~up gradation in the distribution lines from 400 V to 11,000 V. The AP consumers will be fed through HVDS (11,000 Volts), using existing poles, conductor and by installing small capacity dedicated Distribution Transformers (DT) at the delivery point to the AP consumers. Only the hardware and insulators suitable for 11 KV shall be replaced to withstand voltage stress and maintain clearances in compliance with the Indian Electricity Rules.

Moreover, PSEB will decommission existing high capacity transformers (25 to 200 KVA) and will install new 6.3 kVA, 10 kVA, 16 kVA and 25 kVA transformers based on the load requirements to feed individual AP consumers in Dhuri rural areas.

The resultant energy savings can be equated to reduction in the need for electricity generation at the grid level. The State of Punjab is fed by the Northern Grid. As per the Central Electricity Authority (CEA), Ministry of Power, Government of India, as on September ~~2008~~2008, per MWh of electricity saved in the Northern Grid about 0.80 tons of carbon dioxide emissions are saved to the atmosphere.

The saving in electricity through loss reduction and leading to lesser emissions to the environment will have a positive effect in the region in terms of socio-economic development and environmental gains in the northern region of India.

The revenue from the carbon credits that would accrue to PSEB under the Clean Development Mechanism of the Kyoto Protocol, will lead to reduction of the interest burden of the REC loan taken by PSEB to implement the project, thus making it financially attractive to implement it on a full scale.

The present CDM Program activity targets only ‘Technical’ loss reduction in the feeders at Dhuri.

A.4.1. ~~Identification.~~ Identification of the small-scale CPA:

The CPA will be implemented in the Dhuri ~~district~~Division, in the State of Punjab. Punjab is located at 31⁰’ North and 76⁰’ East.

A.4.1.1. Host Party:

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A.4.1.2. Geographic reference ~~or other~~ or other means of identification allowing the unique identification of the small-scale CPA (maximum one page):

Figure 1 : Geographical location of the project

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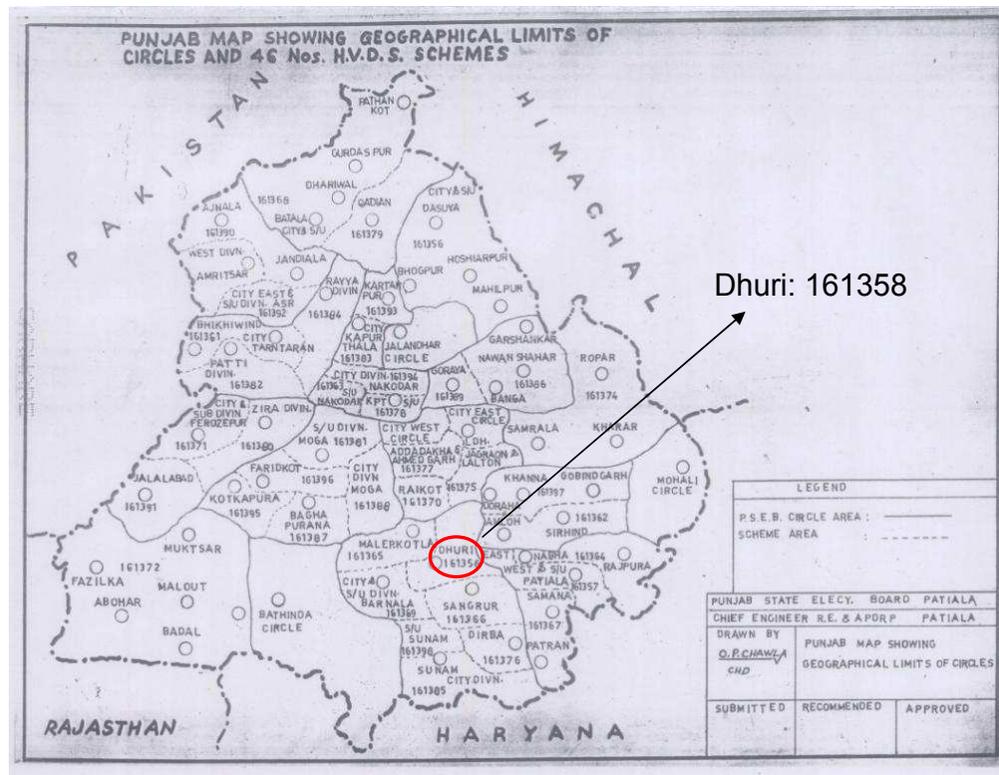
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Figure 2: Geographical boundary of 46 CPA with identification code

The unique PSEB/REC identification code for Dhuri CPA is : 161358.

A.4.2. Duration of the small-scale CPA:

A.4.2.1. Starting date of the small-scale CPA:

November 2007

Comment [MR1]: Is this the starting date of implementation?

A.4.2.2. Expected operational lifetime of the small-scale CPA:

50 years

Comment [world1232]: PSEB confirmed .

A.4.3. Choice of the crediting period and related information:

Fixed Crediting period

A.4.3.1. Starting date of the crediting period:

March 2009 or the date of registration, whichever is later

A.4.3.2. Length of the crediting period, first crediting period if the choice is renewable CP

10 years

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A.4.4. Estimated amount of emission reductions over the chosen crediting period:

Name of Scheme	REC Code	Energy Sent out (KWH)/yr	Energy Saved (KWH)/yr	ERs (tco2)/yr	Gwh
Dhuri	161358	212137549	16971003.92	13746.51	16.97
Estimated emission reductions over crediting period (10 yrs)				137465.10	

A.4.5. Public funding of the CPA:

There is no public funding available for the project activity.

A.4.6. Information to confirm that the proposed small-scale CPA is not a de-bundled component

In the HVDS program case, PSEB is the only organization mandated to carry out transmission and distribution projects in Punjab. Power generation is liberalized, but transmission and distribution is mandated for PSEB only. No other project or PoA has been developed /implemented in the same sectoral scope in the state of Punjab.

There is: (i) no registered small-scale CPA of a PoA, (ii) no application to register another small-scale CPA of a PoA or (iii) no other registered CDM project activity in Punjab using HVDS to supply AP consumers in rural areas.

A.4.7. Confirmation that small-scale CPA is neither registered as an individual CDM project activity or is part of another Registered PoA:

Dhuri CPA is not registered as an individual CDM project activity or is part of another registered POA.

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SECTION B. Eligibility of small-scale CPA and Estimation of emissions reductions

B.1. Title and reference of the Registered PoA to which small-scale CPA is added:

Title of the POA : Punjab State Electricity Board: High Voltage Distribution System for Agricultural consumers in the Rural Areas of the Punjab.

Status of POA : Submitted for validation and registration

B.2. Justification of the why the small-scale CPA is eligible to be included in the Registered PoA :

As per the eligibility criteria for a CPA to be included in a POA

Eligibility Criteria	Met by CPA?
The CPA should be located in the State of Punjab in an area not covered by any other CPAs enrolled in this PoA or any PoA targeting LVDS to HVDS.	Yes
The CPA is listed in table 1, Annexure 4 of POA and has a REC assigned code	Yes
The CPA involves conversion of LVDS to HVDS by upgrading the voltage from 400 V to 11,000 V.	Yes
New 6.3 <u>KkVA</u> , 10 <u>KkVA</u> , 16 <u>KkVA</u> and 25 <u>KkVA</u> rating transformers will be installed for each AP consumer and existing 25-200 KVA rating transformers will be dismantled and handled in an environmentally sound manner.	Yes
The cumulated energy savings resulting from the CPA should be equal or lower than 60 GWh per year.	Yes

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B.3. Assessment and demonstration of additionality of the small-scale CPA , as per eligibility criteria listed in the Registered PoA:

Step 1: Identification of alternatives to the project activity consistent with current laws and regulations

The baseline scenario as identified ~~in section~~ in section E.4 of the POA PDD is relevant for Dhuri CPA .

The alternatives to the CPA includes

- a) carry on with the business as usual scenario i.e the LVDS in the Dhuri division/schemes of PSEB and continue incurring the technical losses
- b) conversion of the LVDS to HVDS in the Dhuri division/scheme, so as to achieve reduction in the technical losses and thus saving energy and corresponding lesser generation of fossil based power at the grid levels leading to reduction of carbon dioxide emissions (a GHG)

Both the alternatives are consistent with the current laws and regulations.

“Proceed to Step 2 (Investment analysis) or Step 3 (Barrier analysis).

Step 3: Barrier Analysis

Financing Barrier

The electricity tariff for the agricultural sector is Rs 2.440/KWh, received by PSEB as tariff compensation from Punjab Government (as per Punjab Government notification power in agriculture sector is free to farmers and utilities are partially compensated for free power supply) whereas the average cost of power delivery by PSEB in the State of Punjab is approximately Rs 3.40/KWh. Thus there is a revenue gap between the power delivery cost of PSEB and the compensation it receives from Punjab government. In order that PSEB remains a solvent company, the fore mentioned revenue gap is cross subsidized by the electricity tariff PSEB charges to its customers in non-agriculture sector as industrial, commercial etc.

Further, the revenue loss of PSEB in the agriculture sector gets ~~increased by~~ increased by the ‘technical losses’ in the distribution system (LVDS). Thus, overall LVDS and the supply to agricultural consumers is a loss-making proposition for PSEB.

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The Dhuri CPA , conversion of LVDS to HVDS leading to reduction of ‘technical losses’ and earning of carbon revenues is an attempt to partially reduce the ‘cross subsidy’ power supply gap between agriculture and non-agriculture sector being fed by PSEB in Punjab. Thus CDM revenue will be used to bridge the revenue loss gap.

In absence of Dhuri CPA business-as-usual investments in PSEB will continue to be prioritized on maintaining the LVDS systems in rural areas and not on conversion of LVDS to HVDS. More likely, technical losses and corresponding GHG emissions would increase as the existing systems are degrading and the demand keeps on increasing. Typical O&M practices will maintain distribution systems and equipment as they are, and replace them with similar equipment when required. Thus the distribution performance will remain at the same level or worsen in future without the present project activity.

Without Dhuri ~~CPA~~, more coal or other fuel input would be required to deliver any incremental increase in service and to fulfill the increasing demand for electricity.

CDM brings additional revenues stream that motivates PSEB to undertake the Dhuri CPA and move away from ~~the~~ maintaining the LVDS system.

Further, the Dhuri CPA (replacement of LVDS with HVDS) needs additional investments that PSEB is getting financed from the loans from Rural Electricity Corporation (REC). The CDM revenues will reduce interest burden on loans taken by PSEB from REC to implement the Dhuri CPA and also reduce risks of insufficient cash flow to be generated by the project for loans reimbursement. Without CDM, the implementation of Dhuri CPA would face financial barrier in terms of full interest rates charged by REC on the investments and POA may not get implemented.

The Dhuri CPA / POA is a ‘first of its kind’ activity being carried out in Punjab by the project proponent PSEB , which has the mandate to supply electricity in Punjab. Hence, the conversion of LVDS to HVDS is a not a common practice.

Considering step1-4, the Dhuri CPA is ‘Additional’.

B.4. Description of the sources and gases included in the project boundary and proof that the small-scale CPA ~~is~~ CPA is located within the geographical boundary of the registered PoA.

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The carbon dioxide (a GHG) emission reduction is correlated to the energy saving resulting from the reduction in technical losses due to conversion from LVDS to HVDS in place of LVDS in the CPA. The project is supplied by the Integrated NEWNE Grid through fossil based power generation.

B.5. Emission reductions:

B.5.1. Data and parameters that are available at validation:	
Data / Parameter:	Number of feeders
Data unit:	Nos. <u>53 Nos Feeders</u>
Description:	Feeders from which agricultural pumps are supplied
Source of data used:	Detailed Project Reports (DPRs) for each CPA from PSEB
Value applied:	The exact number is known for each CPA (details available in DPRs)
Justification of the choice of data or description of measurement methods and procedures actually applied :	Low voltage lines are fed from group-feeders.
Any comment:	

Data / Parameter:	Number of transformers dismantled
Data unit:	Nos. <u>2398 Nos(25 KVA= 862 nos,63 KVA =949 nos. 100 KVA =587 nos.)</u>
Description:	Existing transformers to be removed during CPA implementation
Source of data used:	Detailed Project Reports (DPRs) for each CPA available with PSEB
Value applied:	The number and the rating are available in the DPR for each CPA
Justification of the choice of data or description of measurement methods	The number of transformers removed would be recorded. The existing installed capacity could be derived. The actual number will be recorded after project implementation.

Comment [MR3]: Specify number

Comment [world1234]: Can be provided as per DPR

Comment [MR5]: Specify number

Comment [world1236]: PSEB to provide data

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and procedures actually applied :	
Any comment:	

Data / Parameter:	Number of new transformers
Data unit:	Nos. <u>12118Nos(6.3 KVA=1677nos.,10KVA=8235nos.,16KVA=2075nos.,25 KVA=131nos.)</u>
Description:	New or existing small capacity rating transformers to be installed in each CPA
Source of data used:	Detailed Project Reports (DPRs) for each CPA available with PSEB
Value applied:	The number and rating are available in the DPR for each CPA
Justification of the choice of data or description of measurement methods and procedures actually applied :	A pump load matching capacity transformer (6.3 to 25 kVA) is installed to supply electricity to each AP consumer. <u>The consumer.</u> The installed capacity could be derived. The actual number would be recorded during project implementation.
Any comment:	<u>The actual no. may vary due to introduction of VDS(Voluntary Disclosure Scheme) by PSEB.The exact no willbe possible after completion of work.</u>

Data / Parameter:	Length of distribution network (LVDS/HVDS) in each CPA
Data unit:	<u>Km -1630.98 KM</u>
Description:	The total length of the distribution lines from feeders to dedicated transformers serving agricultural consumers
Source of data used:	Detailed Project Reports (DPRs) for each CPA available with PSEB
Value applied:	The length is known for each feeder
Justification of the choice of data or description of measurement methods	The lines length is used to calculated losses using REC's guidelines

- Comment [MR7]:** Specify number
- Comment [world1238]:** PSEB to provide data

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and procedures actually applied :	
Any comment:	The calculations would be used to arrive at the averaged Technical losses as the percentage of the energy sent from Feeder in each CPA

Data / Parameter:	Energy sent out from each feeder
Data unit:	kWh (212137549 KWH(Total Energy Sent of all 53 nos of Feeders))
Description:	Annual input energy sent-out v/z energy recorded at the sub-station in the project within the CPA boundary for each year and each feeder
Source of data used:	PSEB metered data
Value applied:	Value varies for each feeder in the CPA.
Justification of the choice of data or description of measurement methods and procedures actually applied :	The average annual energy sent out will be calculated over the last three years for each CPA for the baseline.
Any comment:	The calculations would be used to arrive at the baseline energy sent out and to calculate the averaged technical losses as the percentage the percentage of the energy sent from Feeder in Feeder in each CPA. <u>The details of energy sent from each feeder will be provided.</u>

Comment [MR9]: Specify baseline number

Comment [world12310]: PSEB to provide data

Data / Parameter:	Voltage available at each feeder
Data unit:	kV
Description:	Voltage recorded at the feeder within the CPA boundary for each year and each feeder
Source of data used:	PSEB metered data
Value applied:	Value varies for each feeder in the CPA.
Justification of the	The average annual energy sent out will be calculated over the last three years

Comment [MR11]: Specify baseline number

Comment [world12312]: PSEB will prto provide data
PSEB Comments: Data shall be provided

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choice of data or description of measurement methods and procedures actually applied :	for each CPA for the baseline.
Any comment:	The calculations would be used to arrive at the baseline energy sent out , current and to calculate the averaged technical losses as the percentage of the energy sent from Feeder in each CPA

Data / Parameter:	Resistance of conductor in the distribution network (LVDS/HVDS) in each CPA
Data unit:	Ohms/Km
Description:	The average resistance of the conductor per unit length ,length, in the distribution lines from feeders to transformers .
Source of data used:	Detailed Project Reports (DPRs) for each CPA available with PSEB
Value applied:	The amount is known for each feeder
Justification of the choice of data or description of measurement methods and procedures actually applied :	The resistance per unit length is used to calculate ‘technical losses’ using REC’s guidelines
Any comment:	The calculations would be used to arrive at the averaged Technical losses as the percentage of the energy sent from Feeder in each CPA. Data shall be provided by PSEBfor selected feeder.

Data / Parameter:	Emission Factor for the NEWNE Grid
Data unit:	tCO2/MWh

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Description:	Grid Emission Factor for NEWNE grid
Source of data used:	CEA data
Value applied:	0.80
Justification of the choice of data or description of measurement methods and procedures actually applied :	Central Electricity Authority (India) is a government body and data published is in line with the ACM0002/ Version07. http://www.cea.nic.in/planning/c%20and%20e/user_guide_ver4.pdf
Any comment:	

B.5.2. Ex-ante calculation of emission reductions:

Name of Scheme	REC Code	Energy Sent out (KWH)/yr	Energy Saved (KWH)/yr	Avg. ERs (tco2)/yr	Gwh
Dhuri	161358	212137549	16971003.92	13403.3	16.97
Estimated emission reductions over crediting period (10 yrs)				1340330	

Emissions are estimated based on the formulas provided in section E.6 of the POA PDD

B.5.3. Summary of the ex-ante estimation of emission reductions:

Year	Estimation of project activity emissions (tonnes of CO ₂ e)	Estimation of baseline emissions (tonnes of CO ₂ e)	Estimation of leakage (tonnes of CO ₂ e)	Estimation of overall emission reductions (tonnes of CO ₂ e)
2009*	118563	128873	0	10310

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2010	158084	171831	0	13747
2011	158084	171831	0	13747
2012	158084	171831	0	13747
2013	158084	171831	0	13747
2014	158084	171831	0	13747
2015	158084	171831	0	13747
2016	158084	171831	0	13747
2017	158084	171831	0	13747
2018	158084	171831	0	13747
Total (tonnes of CO ₂ e)	1541319	1675352	0	134033

B.6.1. Description of the monitoring plan:

In line with AMS II A , the project activity proposes to reduce the ‘Technical Losses’ through conversion of LVDS to HVDS. The ‘Technical Losses’ have been analytically calculated using the standard formulas derived by REC. Details provided in the POA-. The loss calculations have further been verified in CPA ~~Dhuri through~~ Dhuri through actual measurements.

The ‘verified Data’ would be made available to the DOE so as to assess the correctness & conservativeness of the calculated technical losses in terms of the percentage of energy sent out at each feeder for Dhuri CPA, both for the baseline as well as the project activity case.

For Dhuri ~~CPA the~~ CPA the energy sent out per feeder would be measured ‘on actual basis’, recorded and archived. The ‘Technical loss’ reduction by conversion of the LVDS to HVDS and the corresponding ER reductions calculated using the REC derived formulas detailed provided in sections E.6.1 & E.6.2 of the POA.

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The monitoring plan is based on the following records:

- The precise identification of the Dhuri CPA through PSEB/ REC identification code, name of scheme and substation
- The name of the person responsible for the CPA, i.e., PSEB official at the Dhuri ~~substation~~ Division and his reporting relationship with PSEB official managing the POA at the headquarter level.
- Technical characterization of the Dhuri CPA in terms of the number of feeders, number and capacity of pumps connected to each feeder, length of distribution lines before and after the implementation of the CPA
- Metering records of energy sent out on each feeder. The metered electricity will be registered in the operation book and captured electronically on daily basis.
- Calibration records of the ‘Meters’ installed at the feeders in Dhuri CPA.
- Other parameters like daily supply time, power cut, transformers failure and delay for repair will record on a feeder-basis. These data will serve to verify any inconsistency in the claimed energy savings.

Dhuri CPA implementation in charge would report to the PSEB POA coordinating manager at the headquarters level. The calibration of the meters and the archiving of all the records would be done as per the PSEB standard policy.

Dhuri CPA is located in rural areas of Punjab and the conversion of LVDS to HVDS in Dhuri has been codified, so that there is no double counting of the emission reductions with any other CPA.

C.1. Please indicate the level at which environmental analysis as per requirements of the CDM modalities and procedures is undertaken. Justify the choice of level at which the environmental analysis is undertaken:

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Information is provided at the PoA level. In this case sections C.2. and C.3. need not be completed in this form.

C.2. Documentation on the analysis of the environmental impacts, including transboundary impacts:

C.3. Please state whether an environmental impact assessment is required for a typical CPA, included in the programme of activities (PoA), in accordance with the host Party laws/regulations:

SECTION D. Stakeholders' comments

D.1. Please indicate the level at which local stakeholder comments are invited. Justify the choice:

This information is provided at the PoA level. In this case sections D.2. to D.4. need not be completed in this form.

This section has NOT been completed at POA level. If it is not possible for this information to be provided at POA-DD level for the entire state of Punjab, it may be preferable to suggest that stakeholder comments will be invited at CPA-DD level and provide Dhuri level information.

Comment [world12313]:

PSEB Comments: Local Stakeholder comments shall be provided at CPA level.

D.2. Brief description how comments by local stakeholders have been invited and compiled:

>>

D.3. Summary of the comments received:

>>

D.4. Report on how due account was taken of any comments received:

>>

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Annex 1

CONTACT INFORMATION ON ENTITY/INDIVIDUAL RESPONSIBLE FOR THE SMALL-SCALE CPA

Organization:	Punjab State Electricity Board
Street/P.O.Box:	
Building:	Operations Operation Division PSEB
City:	Dhuri, Distt. Sangrur
State/Region:	Punjab
Postfix/ZIP:	
Country:	India
Telephone:	0987251002209646110022
FAX:	
E-Mail:	Bhattal63@hotmail.com
URL:	
Represented by:	
Title:	Addl.SE/ Senior Executive Engineer,
Salutation:	
Last Name:	Bhattal
Middle Name:	
First Name:	Sukhwinder Singh (SS)
Department:	PSEB
Mobile:	09646110022
Direct FAX:	
Direct tel:	
Personal E-Mail:	

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Annex 2

INFORMATION REGARDING PUBLIC FUNDING

There is no Public funding available for Dhuri CPA.

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Annex 3

BASELINE INFORMATION

Please provide excerpt from the DPR, preferably a summary of all 53 feeders. The following information should be referred to the POA and need not be repeated. This section should provide step-by-step calculation of Annual Energy Loss in the LVDS baseline (average of past 3 years), specify the Energy Loss in the HVDS project (set to 0).

Comment [world12314]: PSEB to provide the information

Baseline energy due to technical losses

The baseline energy is the technical loss of energy within the project boundary calculated as per AMS II.A provisions. The energy supply to agricultural pumps is metered at every 11 kV feeder level across the Punjab State.

Connected load and other relevant details of the feeders are also available with PSEB and have been used for calculations of Baselines

The Detailed Project Reports (DPRs) for the CPAs/schemes contain the feeder-wise theoretical calculations for computing the ‘Technical losses’ with existing LVDS, as well as with proposed HVDS systems.

The guidelines followed for the calculation of Technical Losses are issued by REC (Government of India).

The baseline energy is therefore calculated as follows:

Equation 1: $E_{B,j} = E_{AP,j} * l_B$

$E_{B,j}$ Annual energy baseline in kWh for year “j”. It represents the energy that would be lost in the absence of the proposed CPA.

$E_{AP,j}$ Annual input energy sent-out viz energy recorded at the sub-station in the project within the CPA boundary for year “j”.

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l_B Technical losses in percentage for each specific CPA in the baseline (LVDS). These are the average technical losses within the CPA boundary over the three last years.

Standard for Technical losses of energy calculation

The procedures for technical losses calculation are provided by REC. Technical losses are determined after HVDS project implementation. As per REC guidelines, the Power loss (kW_{loss}) is given by:

$$\text{Equation 2: } kW_{loss} = 8.264 * 10^{-6} * P_{max}^2 * R * L / (Df)^2$$

P_{max} Maximum demand in KVA

R Line resistance in Ohms/km. The value of resistance of various sizes of conductor at 60 °C is taken as per REC standards.

L Line length in km

Df Diversity factor which is the sum of individual maximum demand divided by the total max and demand of the sub station. The diversity factor is taken as 1.2 based on actual system parameters as per REC guidelines.

The annual energy loss (E_{loss}) is derived from power loss calculated above:

$$\text{Equation 3: } E_{loss} = kW_{loss} * LLf * 8760 * 10^{-5}$$

Where, $LLf = PF * LF^2 + 0.2 * LF$

LLf Loss load factor.

PF Power factor (0.8 as per REC guidelines).

LF Load factor which the ratio between the average load and the maximum load. REC guidelines recommends to LF equal to 0.3 based on actual system parameters.

The energy input is the metered consumption at feeders' level. Therefore, the technical losses coefficient can be calculated by dividing the annual energy loss by the annual energy sent out on each feeder.

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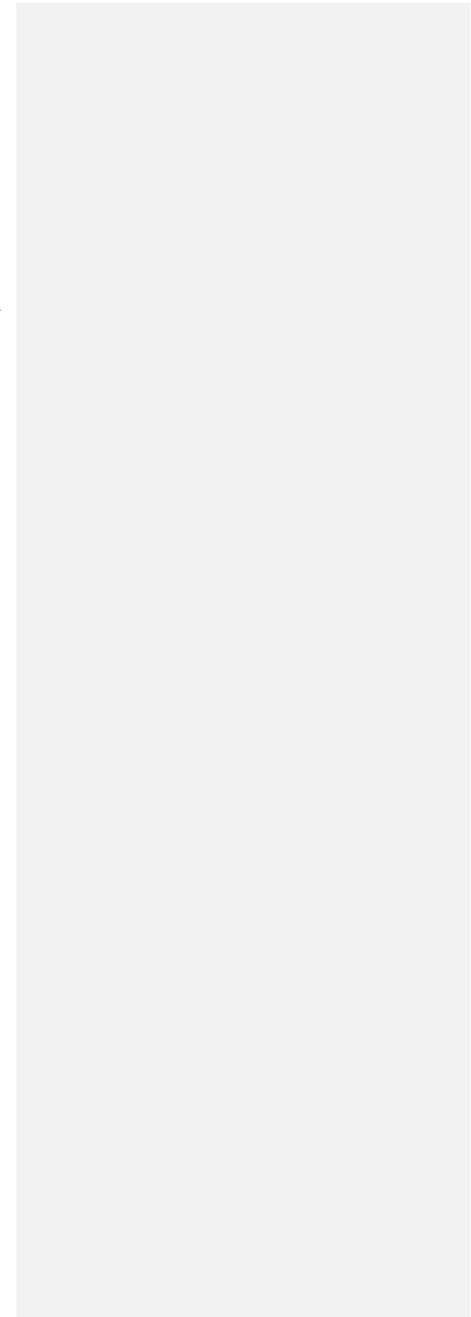
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Annex 4

MONITORING INFORMATION

Provide sample of the monitoring table provided by the sub-station to circle office and then to the POA coordinating entity.

Comment [world12315]: PSEB to provide information

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<u>Name of Feeder</u>	<u>Length of Line Conversion to HVDS</u>	<u>Connected Load (KW)</u>		<u>Max Demand (Amp)</u>		<u>Energy Sent As per Grid Meter(Lus)</u>		<u>Consumption as per AP sample Meters (Lus)</u>		<u>Energy Losses</u>		<u>% Losses</u>	
		<u>11/2007</u>	<u>11/2008</u>	<u>11/2007</u>	<u>11/2008</u>	<u>11/2007</u>	<u>11/2008</u>	<u>11/2007</u>	<u>11/2008</u>	<u>11/2007</u>	<u>11/2008</u>	<u>11/2007</u>	<u>11/2008</u>

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