



UNITED NATIONS
INDUSTRIAL DEVELOPMENT ORGANIZATION

UNIDO Templates for DPR

**“Promoting Business Models for
Increasing Penetration and Scaling Up
of Solar Energy”**

April 2017

INTRODUCTION

The United Nations Industrial Development Organization (UNIDO) in association with the Ministry of New and Renewable Energy (MNRE), Government of India (GoI) has started the implementation of the project titled “Promoting Business Models for Increasing Penetration and Scaling up of Solar Energy” in India.

To support commercialization of solar technologies, the project plans to facilitate the installation of 45,000 m² of installed CS collector area through demonstration and replication projects. The demonstration projects will be enabled through the following steps.

- ▶ Selection of demonstration projects
- ▶ Finalization of the evaluation criterion
- ▶ Generation of Expression of Interest (Eoi) from potential bidder
- ▶ Selection of bidders for preparation of detailed project reports.
- ▶ Evaluation of Detailed Project Reports (DPRs) and selection of bidder for demonstration projects.
- ▶ Separate application to be used for loan under a special UNIDO/IREDA scheme.

This project report elaborates on the templates of Eoi and DPR that may be used by industrial enterprises for submission of their concentrating solar thermal (CST) project applications to the Ministry of New and Renewable Energy, India. The report contains two subsequent sections: the first section details out the template Expression of Interest (Eoi) template and the other elucidates the template of a Detailed Project Report (DPR). The information provided in the Eoi and DPR will play a critical role in selection of the industries for the demonstration projects.

DETAILED PROJECT REPORT TEMPLATE

The industries shortlisted from the Expression of Interest stage (Eoi) stage will have to prepare and submit a Detailed Project Report (DPR). The DPR will comprise of the following sections.

1. Introduction
2. Energy Demand
3. Concentrated Solar Thermal Technology Solution
4. Detailed Technical and Financial feasibility of the application
5. Plant Operation and Maintenance
6. Project scheduling and implementation
7. Supply chain options
8. Construction requirement
9. Risks and benefits

The information furnished in the above section will facilitate our reviewers to finalize and shortlist industries that will be responsible for carrying out the demonstration projects. Funds will be allocated to the respective industries based on the above assessment. A sample of the detailed project report is illustrated in this section.

1. Introduction

This section will help the reviewer in accessing all the relevant details that will be required to assess the necessary background details, current financial position of the company, market penetrability of the company's products, type of operations and how suitable these operations are to concentrated solar heating/thermal technology.

This section will include the following sub-headings:

GENERAL INFORMATION ABOUT THE COMPANY	
1.1. Name of Company	
1.2. Sector of the Company	
1.3. Address of Registered Office	
1.4. Contact Details	Website: Telephone: Email: Fax:
1.5. Contact Details of Chief Executive	Name: Designation: Telephone: Email: Fax:
1.6. Company Profile	<i>Provide a brief overview of company's history and existing operations (within 500 words)</i>
1.7. List of Products	

FINANCIAL INFORMATION ABOUT THE COMPANY			
1.8. Financial Performance of the Company over the last three years			
	Year 1	Year 2	Year 3
a) Equity			
b) Reserve and Surplus			
c) Net Worth			
d) Sales Turnover			
e) PBDT			
f) Net Profit			
g) Loan (Term Loan)			
h) Fixed Asset			
i) Dividend (%)			
j) Debt-Equity Ratio			
k) Capital Employed			
<i>Credit rating from CRISIL/ CARE, if any</i>			

Separate application to be used for loan under a special UNIDO/IREDA scheme.

2. Energy Demand

This section will give a detailed overview of the energy demand and generation of the industry. Our reviewers on reviewing this section will have a clear portrayal of the complete energy profile of the industry. This section will comprise of the month wise steam and heat generation profile, hourly heat/steam generation profile and cost of steam and heat generation. On reviewing the above parameters, the reviewers can assess the impact that concentrated solar heat/thermal installations can generate in that particular industry.

2.1. Thermal/ Electrical Energy Demand

This section will include an introduction of the energy requirement of various processes and the subsections will show case the following seasonal and daily variation of thermal and electrical energy requirements of the plant and the cost of generating the same.

This section will help the reviewer to understand the overall energy requirement and heat requirement of the industry

2.1.1. Month wise steam/heat generation profile

This section will include the month wise steam and heat generation profile of the operations. The below table illustrates the month wise steam/heat generation profile. A graphical representation of the same can also be provided.

Figure 1: Month wise steam/heat generation profile

Months:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Heat/steam generation profile (kCal/ day)												

This section will portray a monthly and yearly overview of the typical energy profile of the industry

2.1.2. Hourly steam/heat generation profile of a typical day

The below table illustrates the hourly steam/heat generation profile. A graphical representation of the same can also be provided.

Figure 2: Hourly steam/heat generation profile of a typical day

Time of the Day (hour)												
Heat/steam generation profile(kCal/ hr)	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx	xxx

This subsection will help the reviewer to assess the energy requirement of the industry on a typical day.

2.1.3. Month wise electrical energy requirement from conventional sources

On reviewing this section, our reviewer will get an overview of the industry's monthly electricity consumption generated from conventional sources by the processes

2.1.4. Boiler

Type	Capacity	Temperature range	Pressure range	Operating pressure	Fuel	Operational hour	No of operating days in a year

In addition to above, Industry may provide boiler output graph.

2.1.5. Cost of steam/heat generation

This section will include an estimate of the heat/steam generation cost for existing facility are calculated on actual. This section will help our reviewer to understand the current cost that the industry is bearing behind conventional sources of fuel like coal, diesel, LPG

3. Concentrated Solar Thermal (CST)Technology Solution

This section will include site assessment, identification and listing of appropriate concentrated solar heating/thermal technologies options and a detailed technical and financial feasibility report.

On reviewing this section our reviewers will be in a position to assess the feasibility and the of the demonstration project.

3.1. Site Assessment

This section will include a detailed assessment of the industrial site where the demonstration projects are proposed to launch. This section will include the following sections.

On assessment of this section, our reviewers will have a clear insight about the spatial and climatic conditions/variations of the concerned industrial zone. This section will also enlist the concentrated solar technology options that the industry will propose.

3.1.1 Area available for Solar System:

Selection of area for installation of solar applications is presented here in discussion with the plant management. The criteria for selection of the site are

- ▶ *Free of shadow area*
- ▶ *No future expansion plans in that area*
- ▶ *Minimal distance from the usage point*
- ▶ *Ability to sustain structural load*
- ▶ *Convenience to the management.*

Area calculation should be provided here. If possible photographs and images should be provided out here.

The area available will help the reviewers to assess the scale and the amount of heat that can be generated through Concentrated Solar Heating/Thermal applications

Project location and Site description

- ▶ *Brief description of project area/region, type of project lands*
- ▶ *Placement of solar power plant*
- ▶ *Site Parameters*
- ▶ *Obstacles/Shadow*
- ▶ *Approach road to site/ connectivity by road*
- ▶ *Air (Pollution/corrosion)*
- ▶ *Levelling degree*
- ▶ *Soil test report*
- ▶ *Availability of water*
- ▶ *Quality of water*

3.1.2 Solar Resource Assessment

Ambient temperature profile: The ambient temperature profile can be taken from meteorological websites and other similar sources. The below table illustrates the month wise maximum and minimum ambient temperature profile of the region. A graphical representation of the same can also be provided.

Figure 3: month wise maximum and minimum ambient temperature profile

Months:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Temperature (Av. Min.) °C												
Temperature (Av. max.) °C												

Solar Radiation Profile: Data of monthly avg. solar radiation is taken from solar maps and reported here as per sample format below. The below tables illustrates the monthly average DNI and GHI of the region. A graphical representation of the same can also be provided.

Figure 4: Monthly average DNI and GHI of the region

Months:	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Monthly Av. DNI (Direct Normal Irradiance) kWh/m ²												
Global Horizontal Irradiation (GHI) kWh/m ²												

The data furnished in this section will project the climatic profile of the region where the industry is located. Based on the climatic profile the reviewers will be able to assess the implementation and operational barriers that the demonstration project might face.

3.1.3 Identification of feasible CST technologies intervention

In this section the industry will identify the Concentrated Solar heating/thermal application that is desired to meet the energy demand discussed in section 2

3.1.4 Concentrated Solar Heating/thermal technology selection flowchart

Detailed process integration with P&I diagram methodologies for selection of Concentrated Solar Heating technology will be presented here.

This section will portray a clear picture of the mode and criterion for selection of the concentrated solar heating/thermal technology options.

3.1.5 List of Identified Applications

This section will include all the identified application.

- ▶ Option A
- ▶ Option B
- ▶ Option C

4. Detailed Technical and financial feasibility study of the applications

This section will give a detailed project scenario where both the technical and financial parameters can be assessed. Based on this section the reviewers will be in a position to select the industries where the demonstration projects will be carried out. Similarly, this study will form a basis to determine the amount of grant that will be allocated to the selected industry.

This section will include a detailed technical and financial feasibility study of all the concentrated solar heating/thermal options identified in the above sub section.

A format of the technical and financial feasibility study is illustrated below.

4.2.1. Option A

I. About the technology

This section will include a general introduction about the technology. Reasons for its selections can be highlighted in this section.

This section will help the reviewers understand the reason for selection of that particular technology.

II. Salient features

III. Technical Specification

The table below illustrates a sample technical feasibility report.

Figure 5: sample technical feasibility report.

Types of Technology	
---------------------	--

Aperture Area	
Collector Area	
Receiver	
Reflector	
Tracking	
Clear (shadow free) area required for installation	
Heat/steam generation	
IBR certification	
Dead load	
Wind speed	

The above illustrative will give our reviewers a detailed overview of the suggested technology. The reviewers will also be able to assess the suitability of the selected technologies.

III. Proposed System

- *System sizing calculation is provided here*
- *System Integration with existing system is to be provided here with PI diagram*

On reviewing the above information the reviewers will be able to understand the technical adequacy of the process. The **system sizing calculation** and the **technical suitability** for **system integration** will play a vital role in assessing the feasibility of the demonstration project.

IV. System Performance

System performance will be highlighted here based on detailed analysis & simulation of the proposed system

► *Performance (Basis of simulation and output determination)*

Incidence angle modifier

Effective length

Solar field net/effective area

Efficiency's

Solar-weighted specular reflectivity (clean reflector)

HCE envelope transmittance

HCE tube absorbance

Bellows shading

Cleanliness factor

Optical efficiency

Thermal losses (receiver tube, piping, shadow, steam generator)

► *Power Potential studies & Simulation results*

Determined Energy generation and its basis of calculations

Description of performance prediction tool

Weather data used in Simulation

▶ *Technical input data performance Tool*

Mode of Performance measurement (energy meters, Thermal oil side, Steam side)

CST plant design and System Integration

Design of the solar field

Foundation layout

▶ *Definition of position and angles (stow east, stow west, stow survival, mirror exchange and cleaning)*

▶ *Schematic diagram and brief description of each component*

▶ *Boiler specification and description (Arrangement, power Distribution, Scope of the steam side)*

Schematic P&ID Drawing

Quality and Safety

V. Financial Analysis

Financial Analysis will include the following

- Summary of financial parameters for the project option
- Sensitivity Analysis with respect to system performance of the project option

Summary of financial parameters for the project option

The summary of financial parameters will elaborate on the key estimated financial performance metrics for the project option. The following illustrates some of the indicative parameters:

- a) Project Internal Rate of Return (IRR):
- b) Average debt service coverage ratio (DSCR):
- c) Payback period:
- d) Break-even point:

Sensitivity Analysis with respect to system performance

The below table illustrates a sample sensitivity analysis report.

Figure 6: sample sensitivity analysis report.

Change in expected system performances	Pay back Period (year)
5% less	As per calculation
10% less	As per calculation
15% less	As per calculation
20% less	As per calculation

The financial analysis will help the reviewer to understand the financial feasibility of the project. Selection of industries for allocation of grants will be based on the assessment of the financial feasibility report.

4.2.2 Option B

I. About the technology

Same as above

II. Technical Specification

Same as above

III. Proposed System

Same as above

IV. System Performance

Same as above

V. Financial Analysis

Same as above

4.3.3 Option C

I. About the technology

Same as above

II. Technical Specification

Same as above

III. Proposed System

Same as above

IV. System Performance

Same as above

V. Financial Analysis

Same as above

5. Plant Operation & Maintenance

The following subsections will be included in this section

5.1 Plant operation philosophy

This section will include mission, vision and guiding principles which are followed in the plant. In this section the reviewer will gain a keen insight on the plant operation philosophy.

5.2 Basic structure of O&M team

Operational and Maintenance structure will be included in this section.

The reviewer will gain an insight on the basic structure of the O&M of the industry. This section will also include plant operation philosophy or guiding principles. This section will help the reviewer to assess the efficiency of the Operation and maintenance structure of the industry.

6. Project Scheduling and Implementation

The project scheduling and implementation section will have a detailed representation of the following subsections

5.1. *Project Schedule*

5.2. *Project Development Phases*

5.3. *Activity chart*

This section will help the reviewer to assess the structure of the project schedule, the development phases, time allocation for redressal of any constraints and the detailed time bound activity chart.

7. Supply Chain options

This section will include the list of possible suppliers of main components – Indian & Foreign. Company profile and contact details of the suppliers will be provided in this section

The reviewer will assess the reliability of the suppliers selected by the industry.

8. Construction Requirement

This section will include the Infrastructure facility requirements.

The reviewer will assess the infrastructural facility required for the installation of the project. This assessment will help the reviewer to understand the amount of funds and time the industry requires to launch the demonstration project.

9. Risks and Benefits

This section will conclude the DPR by highlighting the potential benefits and perceived risks from installation of the CST technology at the company. The following templates will be used to furnish the requisite information.

Benefits	Value
In terms of end-products	
Foreign Exchange Savings	
Import Substitution	
Direct Revenue in terms of excise duty & sales tax to National Exchequer	
Indirect revenue	



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