United Nations Development Programme

Government of India

Terminal Evaluation of UNDP/GEF Project: Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India (India CSH)

(GEF Project ID: 4134; UNDP PIMS ID: 4284)

Terminal Evaluation Report

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SYNOPSIS

Title of UNDP supported GEF financed project: Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India (India CSH Project)

UNDP Project ID: PIMS 4284

GEF Project ID: 4134

Evaluation time frame: March 2012 to September 2017

CEO endorsement date: 22 December 2011

Project implementation start date: 28 March 2012

Project end date: 30 September 2017

Date of evaluation report: 26 January 2018

Region and Countries included in the project: India

GEF Focal Area Objective: SP3 (for GEF-4): Promoting market approaches for renewable energy

Implementing partner and other strategic partners: Implementing partner: Ministry of New and Renewable Energy (MNRE)

Evaluation team members: Mr. Roland Wong, International Consultant
Dr. Sanjay Mande, National Consultant

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EXECUTIVE SUMMARY

This report summarizes the findings of the Terminal Evaluation Mission conducted during the 25 October to 3 November 2017 period for the UNDP-GEF Project entitled: "*Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India*" (hereby referred to as the India CSH Project, CSH Project or the Project), that received a US$ 4.40 million grant from the Global Environmental Facility (GEF) in May 2012.

Project Summary Table

Project Title:	*Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India (CSH Project)*			
GEF Project ID:	4134		*at endorsement (Million US$)*	*at completion (Million US$)*
UNDP Project ID:	4284	GEF financing:	4.400	5.200
Country:	India	IA/EA own:	0	0.0
Region:	Asia and the Pacific	Government:	7.350	0.0
Focal Area:	Climate Change	Other:	12.000	0.0
FA Objectives, (OP/SP):	SP3 for GEF 4: Promoting market appraches for renewable energy	Total co-financing:	19.350	0.0
Executing Agency:	Ministry of New and Renewable Energy (MNRE)	Total Project Cost:	23.750	0.0
Other Partners involved:		ProDoc Signature (date project began):		28 March 2012
		(Operational) Closing Date:	Proposed: July 2016	Actual: 30 September 2017

Project Description

At the commencement of the India CSH Project in 2012, the industrial sector was deemed to be the second largest energy consuming sector in India after the residential sector. The industrial sector consumed 169 Mtoe of energy in 2012, growing to 195 Mtoe in 2015, comprising 33% of total energy consumption in India, and an annual growth rate of 5% in industrial energy demand between 2012 and 2015. In 2015, the energy demand in the industrial sector was met through electricity (20%) and conventional fuels (64%); less than 16% of this energy demand is met with renewable energy sources.

India has sought to develop its full potential to utilize indigenous renewable resources as a secure and affordable energy supply that will fuel its growing economy. To support the expansion of renewable energy, India released its first National Action Plan on Climate Change (NAPCC) in 2008 that identified 8 core "National Missions" running through to 2017 that includes the Jawaharlal Nehru National Solar Mission (JNNSM) that is most relevant to the CSH Project.

Much of India's land mass receives an average 5-7 kWh/m^2/day of solar energy. Since the late 1990s, MNRE has provided a range of support to initiate a concentrated solar heating (CSH) program in India with a range of Indian organizations from the academia to private sector firms for CSH technology development

and market promotion for solar concentrators for process heat applications. This work led to the commercial emergence of 2 concentrated solar technologies (CSTs) for India, namely the fixed focus parabolic dish (also known as the Scheffler dish) and the moving focus parabolic dish (also known as the ARUN dish). The more recent promotion of CSH in India commencing in 2010 is part of the off-grid solar applications programme of JNNSM. At the commencement of the CSH Project in 2012, MNRE was managing a subsidy and support programme for CSH systems to support the objective of the JNNSM.

Barriers identified to wider use of CSH technologies included technology barriers (the lack of availability of a full-range of CSH technology application packages in India, and the absence of performance measurement standards for measuring CSH system performance and testing facilities for CSH technologies), awareness and capacity barriers, and financial barriers. The Project goal was "to reduce GHG emissions from use of CSH systems for low and medium temperature process heat". The objective of the CSH Project was to "increased use and promote CSH systems for low and medium temperature process heat applications".

Project Results

The Project goal and objective and overall outcomes of the CSH Project are summarized on Table A against intended outcomes in the CSH Project Results Framework (PRF).

Table A: Comparison of Intended Project Outcomes from PRF of 2011 to Actual Outcomes

Intended outcomes in LFA of 2011	Actual Outcomes as of December 2017
Project Goal: 32,900 tonnes of CO_2 emissions reduced during Project duration from use of CSH systems for low and medium temperature process heat	**Actual achievement of Project goal**: Only 22,432 tonnes of cumulative emission reductions were generated during the Project (up to 31 December 2017) from the use of CSH systems for low and medium temperature process heat. The primary reason for this was the expectation of GHG emission reductions during Year 1 in the Project design which was unrealistic considering the Project was mobilizing stakeholders for investments in Year 1. Regardless, this was still a good outcome despite being short of the target.
Project Objective: Increased use and promotion of CSH systems for low and medium temperature process heat applications that would include a cumulative installed area of CSH systems for process heat applications of over 80,000 m^2 and 161 companies that have installed CSH systems by the EOP.	**Actual achievement of Project objective:** The Project has promoted and achieved increased use of CSH systems for low and medium temperature process heat applications by meeting its target of 80,000 m^2 of installed CSH systems and over 161 companies involved with CSH installations.
Outcome 1.1: Enhanced understanding of CSH technologies, applications and markets.	**Actual Outcome 1.1**: There is an enhanced understanding of CSH technologies, applications and markets ranging from stakeholders in Government, academia, and manufacturers of CSH equipment, to end-users of CSH technology
Outcome 1.2: Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance.	**Actual Outcome 1.2:** Standards and specifications have been adopted by the Bureau of Indian standards on CSH quality, safety and performance. This includes adoption of technical specifications and testing standards for 5 CSTs of which 3 have now been published by Bureau of Indian Standards with the remaining two to be published in early 2018.

Intended outcomes in LFA of 2011	Actual Outcomes as of December 2017
Outcome 1.3: Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions	**Actual Outcome 1.3:** There are 2 capable and operational testing laboratories for the verification of CSH manufacturer claims and to provide guidance for CSH users to enable informed decisions. However, improvements of their capacities are still required to allow these CSH testing laboratories to comply with best international practices.
Outcome 2.1: Strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/institutional process heat applications	**Actual Outcome 2.1**: The technical capacity and awareness of industrial professionals as well as end-users and O&M personnel has been strengthened.
Outcome 2.2: CSH Project deliverables facilitated and/or influenced widespread replication of CSH technology applications in India	**Actual Outcome 2.2:** CSH Project deliverables have raised awareness of CSH technology applications in India, but not to the extent where there has been widespread replication of CSH technology throughout India.
Outcome 3.1: Increased number of commercial and near commercial CSH technologies for diversity of applications.	**Actual Outcome 3.1**: There has been an increased number of CSH technologies demonstrated that can be applied for a diversity of applications ranging from cooking fuel to chilling.
Outcome 3.2: Improved technical and economic performance of commercial and near commercial CSH technologies in an increased diversity of applications.	**Actual Outcome 3.2:** Due to CSH Project support and the availability of capital subsidies from JNNSM, the technical and economic performance of CSH technologies supplied from India has improved, notwithstanding that further improvements can be achieved through adoption of best international practices.
Outcome 4.1: Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks	**Actual Outcome 4.1:** There is an enhanced understanding of the financial viability of CSH technologies and measures, sufficient to assess how CSH investments risks can be mitigated which includes promotion of the ESCO model as a future modality for scaled up installations of CSH technologies.
Outcome 4.2: Promulgation of favourable financial policies that promote increased use and promotion of CSH for low and medium temperature process heat applications	**Actual Outcome 4.2:** Favourable financial and performance-based policies are being considered to increase the use and promotion of CSH technologies. This also includes financial support for investments into improved manufacturing processes; however, these policies have yet to be promulgated.

Summary of Conclusions, Recommendations and Lessons

The CSH Project has been pivotal in bringing increased enhanced awareness through several knowledge products, awareness-training workshops and demonstrations of CSH technologies in its applicability for medium process heat applications in India. This general conclusion has been made possible through a well-designed project that was well researched and supported by numerous stakeholder consultations during the design process, and through strong MNRE management in line with management arrangements provided in the CSH ProDoc.

These are outstanding results of the CSH project; however, less than 1% of CSH potential has been realized through this Project. In addition, much of the installed CSH capacity has been subsidized, and that without the 30% capital subsidy, there are doubts as to whether or not all potential CSH beneficiaries would embrace a CSH investment without the subsidy (which would increase the payback periods to unacceptable levels to some proponents). Notwithstanding, there is not much doubt that further support is required to transform and scale-up the market for low and medium temperature process heat applications using CSH systems to exploit vast untapped potential. The Indian CSH industry has performed

well but needs international inputs to evolve into an industry capable of producing durable high efficiency CSH systems at lower costs, improved quality, precision, durability. This would include adoption of best international practices by the industry, investments in upgrading the manufacturing and commissioning facilities, and continual improvements into the adopted BIS standards for CSH equipment and testing laboratories. A likely outcome of adoption of best international practices by the Indian CSH industry is improved CSH equipment efficiencies sufficient to eliminate the need for subsidies.

With the end of this UNDP-GEF project and the mid-point of the UNIDO-GEF project, donor support for the momentum built by the UNDP-GEF CSH Project could be sustained with the 2-year remaining period of the UNIDO-GEF project. However, efforts are required over the next 2 years to prepare and obtain approval for a project funded with donor resources that will involve international inputs to transform India's CSH industry of low and medium temperature process heat applications towards production of higher efficiency equipment that meets best international practices.

Corrective actions for the design, implementation, monitoring and evaluation of the project:

Action 1 (to MNRE and UNDP): To improve design of these projects, project preparations should include realistic targets for GHG emission reduction estimates. See Para 88 for additional details.

Actions to follow up or reinforce initial benefits from the project*:*

Action 2 (to MNRE). Seek required resources to continue supporting the various public platforms that disseminate information and technical assistance on CSH technologies. See Para 89 for additional details.

Action 3 (to MNRE). Provide further support from either MNRE or donors for additional testing equipment at the two CSH testing laboratories in Pune and Gurgaon. See para 90 for further details.

Action 4 (to MNRE). Issue performance-based subsidies on the basis of performance monitoring data and benchmarking of existing systems with National Institute of Solar Energy (NISE). See Para 91 for further details.

Action 5 (to MNRE). Follow-up on the development of over 800 potential CSH projects that were identified by this Project. See Para 92 for further details.

Proposals for future directions underlining main objectives of CSH Project:

Action 6 (to Government of India, specifically MNRE): Capitalize on the outputs of CSH Project to sustain CSH market transformation and develop India as a global leader in CSH technologies. There should be a vision of the Indian CSH industry transforming itself to manufacture reliable and durable and high-quality CSH equipment. The impact of such an effort will likely reduce production costs and make Indian CSH equipment financially viable for its users, notably the industrial sector. Activities to be undertaken are elaborated in detail on Para 93.

Action 7 (to UNIDO-GEF): Leverage CSH Project outputs for the remaining 2 years of the UNIDO project to assist the CSH industry in India to become a global leader. With more details on Para 94, some areas of focus for the UNIDO project can include:

- modernization of CSH manufacturing lines;

- manufacturing in India of key components that are imported (e.g. reflectors);
- support for financial products (e.g. soft loans for modernization of manufacturing facilities);
- improving workmanship of CSH products through Skill India or Surya Mitra mission;
- developing and implementing labels for the branding of CSH systems to increase confidence in reliability and durability.

Action 8 (to Government of India, specifically MNRE): Based on the recommendations in Action 6, the following activities should be undertaken to ensure continued long-term support for the evolution of India's CSH industry:

- Commence preparation of a DPR in early 2018 to support the CSH industry modernization, a project that would commence in 2020. The rationale for this recommended activity is that CSH industry modernization in India may take longer than 2.5 years, after which the UNIDO-GEF Project will have exhausted its resources;
- Make available direct normal irradiance (DNI) charts for various locations in different climatic zone. The rationale for this recommended activity is to help investors and end-users make informed decision for technology selection to suit their needs.

Best and worst practices in addressing issues relating to relevance, performance and success:

Best practice: The CSH Project was managed by a highly qualified professional specializing in concentrated solar technologies who also possessed excellent managerial and interpersonal skills.

Best practice: The CSH Project is an excellent example of a well prepared and designed project that possessed essential activities for achieving its objectives. See Para 97 for further details.

Best practice: The Project demonstrated excellent skills at forming effective partnership arrangements with a wide range of stakeholder to successfully demonstrate CSH viability in India for industrial and social applications. See Para 98 for further details.

Poor practice: Project designers should be cognizant of the number of outcomes and indicators within a Project Planning Matrix to ensure that Project Management personnel will be able to provide effective monitoring efforts. See Para 99 for further details.

Evaluation Ratings[1]

1. Monitoring and Evaluation	*Rating*	2. IA & EA Execution	*Rating*
M&E design at entry	5	Quality of Implementation Agency - UNDP	6
M&E Plan Implementation	5	Quality of Execution - Executing Entity (MNRE)	6
Overall quality of M&E	5	Overall quality of Implementation / Execution	6
3. Assessment of Outcomes	**Rating**	**4. Sustainability[2]**	**Rating**
Relevance[3]	2	Financial resources	3
Effectiveness	6	Socio-political	3
Efficiency	5	Institutional framework and governance	3
Overall Project Outcome Rating	6	Environmental	3
		Overall likelihood of sustainability	3

[1] Evaluation rating indices (except sustainability – see Footnote 2, and relevance – see Footnote 3): 6=*Highly Satisfactory (HS)*: The project has no shortcomings in the achievement of its objectives; 5=*Satisfactory (S)*: The project has minor shortcomings in the achievement of its objectives; 4=*Moderately Satisfactory (MS)*: The project has moderate shortcomings in the achievement of its objectives; 3=*Moderately Unsatisfactory (MU):* The project has significant shortcomings in the achievement of its objectives; 2=*Unsatisfactory (U)* The project has major shortcomings in the achievement of its objectives; 1=*Highly Unsatisfactory (HU):* The project has severe shortcomings in the achievement of its objectives.

[2] Sustainability Dimension Indices: *4 = Likely (L):* negligible risks to sustainability; *3 = Moderately Likely (ML):* moderate risks to sustainability; *2 = Moderately Unlikely (MU):* significant risks to sustainability; and *1 = Unlikely (U):* severe risks to sustainability. *Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions.*

[3] Relevance is evaluated as follows: 2 = Relevant (R); 1 = Not relevant (NR)

ABBREVIATIONS

Acronym	Meaning
APR-PIR	Annual Project Report - Project Implementation Report
AWP	Annual Work Plan
BAU	Business-as-usual
BEE	Bureau of Energy Efficiency
BIS	Bureau of Indian Standards
CBO	Community-based organization
CLFR	Compact linear Fresnel reflector
CO	UNDP Country Office
CO_2	Carbon Dioxide
COE	Centre of Excellence
CP	Country Programme
CPAP	Country Programme Action Plan
CPD	Country Programme Document
CSH	Concentrated Solar Heating
CST	Concentrated solar technologies
DNES	Department of New and Renewable Energy Sources
DNI	Direct normal irradiance
DPR	Detailed project report
EC	Energy Conservation
ECN	Energy Research Centre
EE	Energy Efficiency
EIA	Environmental Impact Assessment
EOI	Expression of Interest
EOP	End-of-Project
ESCerts	Energy Savings Certificates
ESCO	Energy Service Company
FY	Fiscal Year
FYP	Five-Year Plan
GDP	Gross Domestic Product
GEF	Global Environment Facility
GoI	Government of India
GHG	Green House gas
IEP	Integrated Energy Policy of 2006
INR	Indian Rupee
IREDA	Indian Renewable Energy Development Agency
ISA	International Solar Alliance
JNNSM	Jawaharlal Nehru National Solar Mission
kWh	kilowatt hour
M&E	Monitoring and evaluation
MoEF	Ministry of Environment and Forests
MNRE	Ministry of New and Renewable Energy (formerly Ministry of Non-Conventional Sources or MNES)
Mtoe	Million tonnes of oil equivalent
MTR	Midterm Review
MW	Megawatt
NAPCC	National Action Plan on Climate Change
NABARD	National Bank For Agriculture And Rural Development

Acronym	Meaning
NABL	National Accreditation Board for Testing and Calibration Laboratories
NEX	National Execution Modality
NGO	Non-government organization
NIC	Non Imaging Concentrator
NISE	National Institute of Solar Energy
NPD	National Project Director
NPM	National Project Manager
O&M	Operation and Maintenance
OP	Operational Programme of GEF
PAC	Project Advisory Committee
PAT	Perform, Achieve and Trade
PEC	Project Executive Committee
PIMS	UNDP/GEF Project Information Management System
PIR	Project Implementation Report
PMU	Project Management Unit
PRF	Project Results Framework
PSC	Project Steering Committee
PTC	Parabolic Trough Concentrator
PV	Photovoltaic
R&D	Research and Development
REC	Renewable energy certificate
RPO	Renewable energy purchase obligations
SEC	Solar Energy Center (now known as NISE)
SMART	Specific, Measurable, Attainable, Relevant and Time-bound
SNA	State Nodal Agency
SOP	Standard Operating Procedures
STFI	Solar Thermal Federation of India
tCO2	Tonne of Carbon Dioxide
TE	Terminal Evaluation
ToR	Terms of Reference
UN	United Nations
UNDAF	UN Development Assistance Framework
UNFCCC	UN Framework Convention on Climate Change
UNDP	UN Development Programme
UNIDO	United Nations Industrial Development Organization
UoP	University of Pune
USD	United States dollar (= 66 Indian Rupee)

1. INTRODUCTION

1. This report summarizes the findings of the Terminal Evaluation Mission conducted during the October – November 2017 periods for the UNDP-supported GEF-financed Project entitled: "Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India" (hereby referred to as the India CSH Project, CSH Project or the Project), that received a US$ 4.40 million grant from the Global Environmental Facility (GEF).

2. The goal of the India CSH Project was to "reduce GHG emissions from use of CSH systems for low and medium temperature process heat", and the objective was to "increase use and promote CSH systems for low and medium temperature process heat applications".

1.1 Purpose of the Evaluation

3. In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP supported GEF-financed projects are required to undergo a Terminal Evaluation (TE) upon completion of implementation of a project to *provide a comprehensive and systematic account of the performance of the completed project by evaluating its design, process of implementation and achievements vis-à-vis GEF project objectives and any agreed changes during project implementation.* As such, the TE for the India CSH Project serves to:

- promote accountability and transparency, and to assess and disclose levels of accomplishments of the Project in the context of providing technical assistance in the setup of CSH demonstrations designed to inform the CSH industry of the feasibility and benefits of CSH technologies for industrial and social uses;
- synthesize lessons that may help improve the selection, design and implementation of future GEF activities;
- provide feedback on issues that are recurrent across the renewable energy portfolio that require attention, and on improvements regarding possible follow-up efforts to scale-up CSH investments; and
- contribute to the GEF Evaluation Office databases for aggregation, analysis and reporting on effectiveness of GEF operations in achieving global environmental benefits and on the quality of monitoring and evaluation across the GEF system.

4. This TE was prepared to:

- be undertaken independent of Project management to ensure independent quality assurance;
- apply UNDP-GEF norms and standards for evaluations;
- assess achievements of outputs and outcomes, likelihood of the sustainability of outcomes, and if the Project met the minimum M&E requirements; and
- report basic data of the evaluation and the Project, as well as provide lessons from the Project on broader applicability. This would include an outlook and guidance in charting future directions by UNDP, the Government of India, on continued support for the increased use of CSH technologies and reducing GHG emissions from the use of fossil fuels for heating and cooling purposes in several sectors throughout India.

1.2 Scope and Methodology

5. The scope of the TE for the CSH Project was to include all activities funded by GEF and activities from parallel-financing. The Terms of Reference (ToRs) for the TE are contained in Appendix A. Key issues addressed on this TE include:

- Design of the CSH Project and its effectiveness in achieving its stated objective of "increasing use of and promoting CSH systems for low and medium temperature process heat applications" and its goal of "reducing GHG emissions from use of CSH systems for low and medium temperature process heat";
- Assessment of key financial aspects of the Project, including the extent of co-financing planned and realized;
- The effectiveness of the CSH Project in the piloting of the installation of various CSH technologies for specific industrial applications;
- Strengths and weaknesses of CSH Project implementation, monitoring and adaptive management and sustainability of Project outcomes including the Project exit strategy;
- Results and impacts of the implemented Project activities including views from CSH Project focal points (and other relevant stakeholders) on the impacts of the CSH Project activities implemented and their recommendations on the scale up of the Project after completion of the Project; and
- Recommendations, lessons learned, best practices from implementing this Project that could be used on other similar GEF projects.

6. The methodology adopted for this evaluation includes:

- Review of project documentation (i.e. APR/PIRs, meeting minutes of Project Steering Committee or multipartite meetings) and pertinent background information;
- Interviews with key project personnel including the current and former Project Managers, technical advisors, and Project developers;
- Interviews with relevant stakeholders including other government agencies and institutes; and
- Field visits to selected 6 sites that were supported by the Project complete with interviews with beneficiaries.

A detailed itinerary of the TE Mission is provided in Appendix B. A full list of people interviewed and documents reviewed are given in Appendix C and Appendix D respectively. The TE Mission Team for the UNDP-GEF project was comprised of one international expert, and one national expert.

7. The Project was evaluated for overall results in the context of:

- *Relevance* - The extent to which the outcome is suited to local and national development priorities and organizational policies, including changes over time;
- *Effectiveness* - The extent to which an objective was achieved or how likely it is to be achieved;
- *Efficiency* - The extent to which results were delivered with the least costly resources possible; and
- *Sustainability* - The likely ability of an intervention to continue to deliver benefits for an extended period of time after completion.

8. All possible efforts were made to minimize the limitations of this independent evaluation. Notwithstanding that more than 10 days were spent in Pune, Hyderabad, Chennai, Salem and New Delhi by the evaluation team to collect and triangulate as much information as possible, follow-up interviews and Skype conversations by the evaluation team were necessary after the October-November mission. As a result, the only limitation of this TE would be the limited time to view CSH installations supported by the Project; with a total of 5 days in the field, only 6 CSH installations were visited by the TE team out of more than 110 CSH installations supported by the Project[4]. As such, the CSH installations visited are assumed to be a representative sample of the overall quality of CSH installations supported by this Project. The TE team has made every effort to understand the Project and present a fair and a well-balanced assessment of the Project. Any gross misrepresentation of the Project has been resolved through discussions with the Project team.

1.3 Structure of the Evaluation Report

9. This TE report is presented as follows:

- An overview of Project activities from commencement of operations in March 2012 to the 2017 activities;
- An assessment of Project results based on Project objectives and outcomes through relevance, effectiveness and efficiency criteria;
- Assessment of sustainability of Project outcomes;
- Assessment of monitoring and evaluation systems;
- Assessment of progress that affected Project outcomes and sustainability; and
- Lessons learned and recommendations.

10. This evaluation report is designed to meet GEF's "Guidelines for GEF Agencies in Conducting Terminal Evaluations, Evaluation Document No. 3" of 2008: http://www.thegef.org/gef/sites/thegef.org/files/documents/Policies-TEguidelines7-31.pdf

11. The Evaluation also meets conditions set by:

- the UNDP Document entitled "UNDP GEF – Terminal Evaluation Guideline": http://web.undp.org/evaluation/documents/guidance/GEF/UNDP-GEF-TE-Guide.pdf;
- the UNDP Document entitled "Handbook on Planning, Monitoring and Evaluating for Development Results", 2009: http://www.undp.org/evaluation/handbook/documents/english/pme-handbook.pdf; and
- the "Addendum June 2011 Evaluation": http://www.undp.org/evaluation/documents/HandBook/addendum/Evaluation-Addendum-June-2011.pdf

[4] The Project reported 110 installations (as shown on Table 4) during the Evaluation mission, but have also reported an additional 17 installations that were to be completed by December 2017 bringing the total number of installations supported by the Project to 127.

2. PROJECT DESCRIPTION AND DEVELOPMENT CONTEXT

12. At the commencement of the India CSH Project in 2012, the industrial sector was deemed to be the second largest energy consuming sector in India after the residential sector. The industrial sector consumed 169 Mtoe of energy in 2012, growing to 195 Mtoe in 2015, comprising 33% of total energy consumption in India, and an annual growth rate of 5% in industrial energy demand between 2012 and 2015. In 2015, the energy demand in the industrial sector was met through electricity (20%) and conventional fuels[5] (64%); less than 16% of this energy demand was met with renewable energy sources[6].

13. India has sought to develop its full potential to utilize indigenous renewable resources as a secure and affordable energy supply that will fuel its growing economy. As such, the Government of India (GoI) recognized that this can only be achieved through aggressive development of these renewable energy resources that are economically viable and beneficial for its environment. To this end, the Ministry of New and Renewable Energy (MNRE) serves as the nodal ministry of the GoI for all matters related to new and renewable energy. MNRE evolved from the Commission of Additional Sources of Energy that was established in 1981 which was later converted into the Department of New and Renewable Energy Sources (DNES) in 1984 followed by its conversion into its current name, MNRE, in 1994. MNRE works in close collaboration with state level renewable energy development agencies (referred to as state nodal agencies or SNAs), and has been instrumental in setting up and supporting a wide range of institutions to develop and promote renewable energy technologies and applications in India. This includes public financial institutions such as the Indian Renewable Energy Development Agency (IREDA) and research institutes such as the National Institute of Solar Energy (NISE) and Sardar Swaran Singh National Institute of Renewable Energy.

14. To support the expansion of renewable energy, India released its first National Action Plan on Climate Change (NAPCC) in 2008 containing existing and future policies and programs to address climate mitigation and adaptation. The objective of creating this supportive policy and regulatory environment was to provide a predictable and effective incentive structure that enables rapid and large-scale capital investment in solar energy applications and encourage strong technical innovation and the lowering of costs. NAPCC identified 8 core "National Missions" running through to 2017 that included the Jawaharlal Nehru National Solar Mission (JNNSM) that is most relevant to the CSH Project. Targets of the JNNSM are provided in Table 1.

Table 1: Targets under JNNSM

Application Segment	Target for Phase I (2010-13)	Target for Phase II (2013-17)	Target for Phase III (2017-22)
Solar collectors[7]	7 million m^2	15 million m^2	20 million m^2
Off grid solar applications	200 MW	1,000 MW	2,000 MW
Utility grid power, including roof top	1,000-2,000 MW	4,000-10,000 MW	20,000 MW

[5] Coal, oil products and natural gas

[6] http://www.iea.org/statistics/statisticssearch/report/?country=INDIA&product=balances&year=2015

[7] There are no specific targets for CSH. Tentative targets are 25,000 m^2, 50,000 m^2 and 75,000 m^2 in each phase respectively. As of 2007, the installed capacity of CSH was 5,000 m^2.

15. Much of India's land mass receives an average 5-7 kWh/m^2/day of solar energy. Since the late 1990s, MNRE has provided a range of support to initiate a CSH program in India with a range of Indian organizations from academia to private sector firms for CSH technology development and market promotion for solar concentrators for process heat applications. This work led to the commercial emergence of 2 CSH technologies for India in the 1990s, namely the fixed focus parabolic dish (also known as the Scheffler dish) and the moving focus parabolic dish (also known as the ARUN dish).

16. The more recent promotion of CSH in India commencing in 2010 is part of the off-grid solar applications programme of JNNSM. At the commencement of the CSH Project in 2012, MNRE was managing a subsidy and support programme for CSH systems to support the objective of the JNNSM. The capital subsidy consisted of INR 5,400/m^2 (US$ 116) and INR 6,000/m^2 (US$ 129) for CSH systems with single-axis and double-axis tracking respectively[8]. MNRE was also offering a soft loan at a concessional interest rate of 5%.

2.1 Project Start and Duration

17. The project identification form (PIF) for the CSH Project was approved on 4 May 2010 and endorsed to the GEF CEO by 22 December 2011. The Government of India (GoI) signed the Project document (ProDoc) on 28 March 2012, marking the official start date of the India CSH Project. The Project duration for the CSH Project originally was planned for 5 years ending in 27 March 2017.

18. During the period over which the CSH Project was implemented, India as well as the world had experienced phenomenal economic growth that facilitated significant changes and major reforms in the energy sector with more focus in India on solar-related technologies for energy generation. During the CSH Project, India also experienced falling global prices of solar PV equipment around 2015 and 2016. This in turn, only intensified GoI interest in CSH technologies, notably for industrial applications.

2.2 Problems that the India CSH Project Sought to Address

19. The CSH ProDoc was prepared based on the barriers identified in 2010. In building upon the GoI-backed promotion of CSH described in Paras 14 and 15, the CSH Project sought to remove barriers to the widespread deployment of concentrated solar heating technologies and applications. Barriers encountered in 2010 included:

- *Technology barriers*: This included the full set of developed concentrated solar technologies available worldwide for process heat applications that were yet to be demonstrated in India. In addition, there was a lack of availability of a full-range of CSH technology application packages in India, and the absence of performance measurement standards for measuring CSH system performance and testing facilities for CSH technologies;
- *Awareness and capacity barriers:* This included the lack of awareness amongst industry and policymakers on the benefits of CSH applications in reducing energy costs for process heat, lack of knowledge of CSH technologies amongst technical consultants to industries and other sectors, limited capacity of CSH supply chain, limited availability of skilled and semi-skilled CSH technicians, limited interaction between the Indian CSH industry, academia and international

[8] This capital subsidy per unit area of collector was based on the assessment of MNRE's benchmark cost of collectors.

CSH experts, and the lack of a public platform for documenting and disseminating existing CSH applications;

- *Financial barriers:* This includes high costs and low rates of return on CSH investments and a lack of fiscal incentives to procure best performing CSH technologies.

By removing these barriers within the design 5-year period of the CSH Project, investments into CSH applications were to be catalysed and poised for scale-up by the End of Project (EOP).

2.3 Goal and Objective of the India CSH Project

20. The Project goal as taken from the 2011 ProDoc and its revised PRF from 2011 was to "reduce GHG emissions from use of CSH systems for low and medium temperature process heat". The objective of the CSH Project was to "increased use and promote CSH systems for low and medium temperature process heat applications". The CSH Project PRF from 2011 is contained in Appendix F.

2.4 Baseline Indicators Established

21. The baseline indicators and their values for the CSH Project can be found in the PRF contained in Appendix F.

2.5 Main Stakeholders

22. The main stakeholders of the CSH Project are the Ministry of New and Renewable Energy (MNRE). While there were several stakeholders associated with the India CSH Project, Project funds involving these stakeholders were primarily channeled through MNRE. An elaboration of stakeholders who have participated or received support from the CSH Project is provided in Section 3.2.2 (Paras 45-48).

2.6 Expected Results

23. To achieve the specific objective of "increased use and promote CSH systems for low and medium temperature process heat applications", the CSH Project (as of 2011) was designed for the removal of barriers with the following expected Project outcomes:

- Outcome 1.1: Enhanced understanding of CSH technologies, applications and markets;
- Outcome 1.2: Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety and performance;
- Outcome 1.3: Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions;
- Outcome 2.1: Strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/institutional process heat applications;
- Outcome 2.2: CSH Project deliverables facilitated and/or influenced the widespread replication of CSH technology applications in India;
- Outcome 3.1: Increased number of commercial and near commercial CSH technologies for diversity of applications;
- Outcome 3.2: Improved technical and economic performance of commercial and near commercial CSH technologies in an increased diversity of applications;

- Outcome 4.1: Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks;
- Outcome 4.2: Promulgation of favourable financial policies that promote increased use and promotion of CSH for low and medium temperature process heat applications.

These outcomes are also listed in Appendix F in the PRF of the India CSH Project.

3. FINDINGS

3.1 Project Design and Formulation

24. The overall design of the India CSH Project is strong. The design process of the CSH Project was benefited by the presence of key personnel from the National Institute of Solar Energy (NISE)[9] in New Delhi, and an international consultant with a strong background in renewable energy development. NISE has been involved in research and development of solar energy in India for almost 30 years.

25. The CSH ProDoc provides detailed information on the rationale and the incremental value of GEF assistance to this industrial subsector. This well-written ProDoc includes an overview of the national programs to support renewable energy to demonstrate country drivenness, a history and baseline scenario of CSH technologies in India, an overview of prevailing CSH technologies used in India prior to 2012, a baseline analysis as well as a business-as-usual (BAU) projection without GEF support, a summary of international CSH applications that would be applicable to India, a summary of an alternate scenario that includes GEF support, detailed stakeholder analysis, and detailed project activities complete with costing along with M&E and administrative support.

3.1.1 Analysis of Project Planning Matrix

26. The Evaluation Team has the following comments on the original PRF that was prepared in 2011 on its quality in comparison to best practices for preparing PRFs:

- The PRF has 9 outcomes for which 9 separate budgets were setup in the ProDoc. Common practice of most GEF projects is to have 4 to 5 outcomes for budgeting and monitoring purposes (see Para 51). Many of the CSH Project outcomes can be combined to reduce efforts for budgeting and monitoring by project management units;
- While the layout of the matrix is clear with the wording of most indicators meeting SMART criteria with clear targets, there are too many indicators in this PRF. This PRF currently has 3 objective/goal level indicators, 32 outcome indicators and 67 output indicators. With too many indicators, there is a likelihood that some of these indicators have a lack of relevance towards the intended outcome, and could be dropped to reduce the monitoring work load of project implementing teams (it also appears some indicators were simply ignored). Notwithstanding, the CSH Project Management Unit (PMU) still managed to track most of the indicators provided in the PRF, an indicator of the commitment of the PMU to ensuring the Project leveraged maximum benefit to the GoI and stakeholders of the Project. Specific comments on some of the SMART qualities of the indicators can be found on Tables 5 to 9 in Section 3.3;
- The PRF does not need any outcome indicators. Delivery of the outputs should logically lead to the intended outcome.

27. The calculation of GHG emission reduction targets proposed on the CSH Project in the ProDoc assumed the generation of 1,050 tonnes CO_2 during Year 1 of the Project[10]. Considering the baseline scenario where there was a low level of awareness of CSH technologies and the lack of industrial entities willing to invest in CSH due to perceived technology risks, there was a high likelihood that no

[9] Prior to 2013, NISE was known as the Solar Energy Center supported by MNRE
[10] Pg 113 of the CSH ProDoc

GHG emission reductions would have been generated during Year 1 of the project. As such, meeting this cumulative emission reduction target would have been challenging (also see Para 50).

28. Overall, the quality of the project planning matrices for the CSH Project can be rated as **moderately satisfactory**.

3.1.2 Risks and Assumptions

29. In the CSH ProDoc, critical assumptions were provided in the PRF which in general provided reasonable assumptions for PMU personnel to monitor during implementation of the Project. Examples of key critical assumptions included:

- Timely execution of planned activities with adequate resource mobilization to meet goal-level GHG emission reduction targets;
- Selected and users for demos and replications have sufficient equity and have good financial positions to meet objective-level targets for cumulative installed area of solar concentrator technologies;
- Cooperation is received from manufacturers of all 5 CSH technologies being demonstrated as well as users of CSH technology as an assumption to meet targets of the number of companies adopting and producing CSH equipment compliant with new standards;
- Manufacturers submit their products for testing to meet targets for improving testing and certification of CSH equipment;
- There is cooperation amongst manufacturers, vendors, users and other stakeholders in identifying training needs to meet training targets; and
- Chosen demonstration and replication projects comply with agreement that includes making data available and permission to publish the data to meet targets for documentation of project demonstrations and financial viability of CSH technologies.

30. The Project risk log in the CSH ProDoc includes 20 risks (on Annex C on Pg 79 of the ProDoc). These risks are quite strongly linked to the critical assumptions of the PRF; however, similar to the large number of indicators in the PRF, there are too many risks that would need monitoring by the PMU personnel. Current practices in preparing ProDocs recommend that no more than 6 risks be entered into a risk log for closer monitoring during implementation.

3.1.3 Lessons from Other Relevant Projects Incorporated into CSH Project Design

31. The ProDoc of the CSH Project does list government supported renewable energy support and demonstration programs into its design, including efforts under the JNNSM and implemented by the SEC (or NISE) with the support of MNRE. These were explained in detail under the baseline situation of the CSH Project. There was no listing for any related donor supported projects in CSH promotion or demonstration. With a lack of commercially available CSH applications in India and globally in 2011, India has managed to initiate a market for CSH application for process heat industries, possibly due to the fact that CSH has been embedded in Government of India's policy for promoting solar and specifically with focus on solar thermal technologies in National Solar Mission of NAPCC. India also had an edge over other countries due to the close working relationships amongst a diverse range of stakeholders from government, CSH suppliers, beneficiary industries and institutions, academia involved with the development of different CSH technologies, and a few foreign experts visiting India

on technologies and systems for a variety of medium temperature range thermal process heat applications.

3.1.4 Planned Stakeholder Participation

32. The CSH Project identified a wide range of stakeholders from government, industry, research and academic institutions (both national and international) and financial institutions that would be required to work together seamlessly to create the enabling environment for CSH demonstration investments. A full list of CSH stakeholders is provided in the ProDoc on Table 12 on Page 23. Interactions between stakeholders were planned through series of awareness creation workshops, pilot demonstration programmes, capacity building workshops, national and international conferences, state level meetings with state nodal agencies (SNAs), international knowledge sharing tours, participation in bi-monthly planned project executive committee (PEC) meeting and bi-annually planned project advisory committee (PAC) meeting.

3.1.5 Replication Approach

33. As a Project objective, the ProDoc has targeted 32,900 tCO_2 emissions reductions by the EOP not only through GEF support of CSH demonstration projects but also through supporting replication projects cumulating to 45,000 m^2 of collector area. The ProDoc has also kept a provision to support (in addition to the MNRE support) up to 60 replication projects (apart from 30 demonstration projects), additional support for projects operating in ESCO mode, and support systems requiring repair and rehabilitation (later added during project implementation).

34. The Project replication approach is based on showcasing the various CSH technologies and system application through pilot demonstration projects and facilitating replication of CSH projects by promoting those CSH technologies that have not been commonly applied yet in India. With only a few CSH applications in the world, however, the Project is unique with few lessons learned from abroad to be incorporated into the CSH Project. To enhance replication potential, the Project was designed to support a favourable investment environment for CSH installation proponents; this would include JNNSM subsidy support for CSH demonstrations, improved capacity to test and certify CSH installations, improve access for sharing information on CSH demonstrations, and formulation of standards to optimize the performance of CSH equipment manufactured in India. The impact of this favourable investment environment would boost the confidence of industrial establishments and other entities on the benefits of investing in CSH installations, which would facilitate further CSH investments.

3.1.6 UNDP Comparative Advantage

35. As is usually the case with several other UNDP projects, the CSH Project had a distinct advantage compared to projects funded by other donor agencies in terms of its focus on policy-based and cross-sectoral approaches as well as creating local capacities through effective collaboration with a wide range of local stakeholders, encompassing public and private sectors in addition to technical experts, civil society and grassroots level organizations. These approaches were strongly applicable to promoting CSH projects on the CSH Project. Given UNDP's long track record on a wide variety of projects within the energy sector, UNDP was the appropriate agency championing this Project.

3.1.7 Linkages between CSH Project and Other Interventions within the Sector

36. Though not acknowledged in the ProDoc, UNDP and MNRE were implementing a GEF-supported program (The Country Programme of India under the Global Solar Water Heating Market Transformation and Strengthening Initiative GEF ID: 2939) with a focus on flat plate collector for sub 80°C applications primarily for residential applications but also with some successful industrial applications; this project was implemented between March 2009 to April 2013. With high demand for solar water heating for process heating for various industries (up to 250-300°C), this UNDP-GEF supported project for promoting CSH applications was a logical step forward in assisting the GoI to meet its JNNSM objectives.

37. Another GEF project linked with the CSH Project was the UNIDO-GEF project on "Promoting business models for increasing penetration and scaling up of solar energy" that was launched in around the midpoint of implementation of the CSH India Project. This UNIDO-GEF Project was planned for a duration of 5 years with an objective to facilitate the installation of 45,000 m^2 of installed concentrated solar collector area through 15 to 25 demonstration projects and 60 replication projects. This project is focusing on solar-based technology for industry, focusing on processes in the temperature range of 150-400°C in various industries, such as pulp and paper, food processing, fertilizer, pharmaceutical industries, textiles, desalination and tobacco industry. Its 4 components are similar to the CSH India Project, (a) strengthening, policy and institutional framework; (b) technology investment and application (including 15-25 pilot, demonstrations), (c) scaling up (business models and financing; supply of quality components), and (d) awareness raising and capacity building. To avoid overlapping, it was decided that UNIDO project will cover "co-generation and tri-generation projects, new projects on space cooling, replacement of electrical driven VCR systems with VAR systems and on industrial refrigeration, stand-alone hybrid systems for process heat application with automatic operations and storage facility to take care of intermittent clouds". To minimize overlaps with the UNIDO-GEF project, the focus of the UNDP-GEF CSH Project was shifted to community cooking in institutional establishments. Normal projects for process heat applications in industrial and commercial sectors or retrofitted space cooling projects would be covered under both the projects.

3.1.8 Management Arrangements

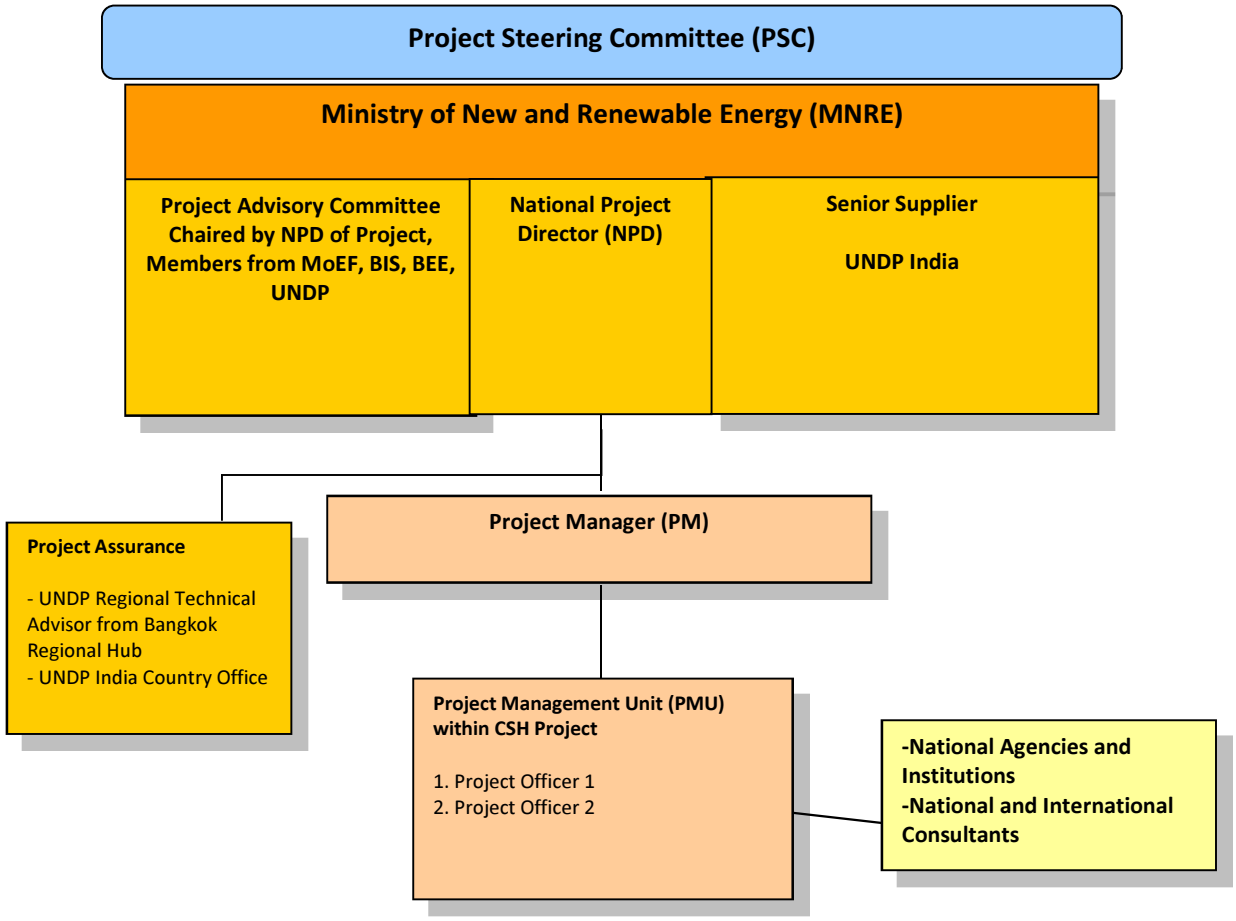
38. The implementing partner of the CSH Project was the Ministry of New and Renewable Energy (MNRE) in accordance with UNDPs National Implementation Modality (now referred to as National Execution or NEX modality). NEX modality tasks MNRE with responsibility for certifying work plans and approved budgets, reporting on procurement, coordinating and tracking co-financing, terms of reference for contractors and tender documentation, and chairing the Project Steering Committee (PSC). The Chair of the PSC was to be the National Project Director (NPD) from MNRE, a senior official responsible for overall guidance to project management, including adherence to the Annual Work Plan (AWP) and achievement of planned results as outlined in the ProDoc, ensuring the use of UNDP funds through effective management and well established project review and oversight mechanisms, ensuring coordination with various ministries and agencies, providing guidance to Project teams to coordinate with UNDP, and reviewing reports and administrative arrangements as required by GoI and UNDP. An organogram of CSH Project implementation arrangements is provided on Figure 1.

39. A Project Management Unit (PMU) was to be established to implement the Project, headed by a full-time National Project Manager (NPM) responsible for implementing day-to-day activities in

coordination with the National Project Director (NPD). The NPM was to be supported by two Project Officers, and technical experts as required from different disciplines and project management consultants with expertise in project, finance, and legal matters.

40. The CSH Project was also to have a PAC comprised of representatives from MNRE, MoEF, Ministry of Small and Micro Enterprises, BIS, BEE, and UNDP. Other members (e.g. Director General of Boiler Control, IREDA, NABARD, research institutes, industry associations, etc.) were to be invited by the decision of the PAC on an as needed basis, however, taking care that the PAC remains small enough to be effective.

Figure 1: Current Management Arrangements for the UNDP-GEF Project "India CSH Project"



3.2 Project Implementation

41. The following is a compilation of key events and issues of CSH Project implementation in chronological order:

- The CSH Project was signed by the Government of India on 28 March 2012;

- An inception workshop for the CSH Project was conducted on 18 May 2012, almost 2 months after the signing of the ProDoc. Outcome of the workshop was no major deviations on the PRF or timeline of Project execution;
- In 2013, 3-day training sessions were conducted in 12 states for creating a pool of skilled technicians for O&M of CSH systems;
- In 2013, a CSH systems manufacturing association for India was formed;
- In December 2013, a "Compendium on concentrator solar heating projects for community cooking process heat and cooling applications" was published using information from 96 field studies on existing CSH installations for community cooking, process heat and cooling applications;
- In December 2013, on-line performance monitoring was setup for CSH installations for 15 sites. Data seen on-line included solar radiation, inlet and outlet temperatures, pressure, and fluid flow. This was coupled with the launching of the Project website (www.cshindia.in) where much of this data could be observed on-line;
- In 2014, a number of public outreach efforts were initiated including:
  - the monthly e-newsletter "Insolthermtimes" that provided updates on project activities and current events on developing CSH sites;
  - the setup of a toll-free helpline number being operated from Pune by the Solar Thermal Federation of India (STFI) offering support to a wide range of stakeholders in technical, financial and policy related matters of CSH;
  - the first issue of the quarterly magazine SUNFOCUS;
- In 2014, reports were issued by EcoAxis Systems Pvt Ltd describing the technical performance of 6 concentrator solar technologies (CSTs) prevailing in India including the fixed focus elliptical dish (Scheffler dish), parabolic-through collector, Fresnel reflector-based dish (ARUN dish), paraboloid dish, linear Fresnel reflector concentrator, and the non-imaging concentrator;
- In 2014, a series of Project reports were issued including a technical performance evaluation of various CSTs for cooking, process heat and cooling applications; assessment of facilities of CST manufacturing; assessment of CST for off-grid applications; report on the development of performance measuring standards for CSTs, test procedures & test protocols for CSTs, and O&M training manuals for 6 CSTs (that was translated into both Hindi and English);
- In September 2014, an international visit was made to Germany for selected officials from MNRE, the CSH industry and UNDP to improve knowledge of best CSH international practices;
- In late 2014, a Midterm review (MTR) for the CSH Project was conducted with the MTR report issued in March 2015. The MTR expressed satisfaction over Project progress but expressed concern over progress on activities related to financing of CSH projects;
- In 2015, two CST test centers were established at National Institute of Solar Energy (NISE) in Gurgaon and at the University of Pune (UoP) in Pune;
- In 2015, a report was issued entitled "Preliminary reports on possible installation of CSH systems in 800 establishments in 20 States";
- During 2015 and 2016, over 35 videos were developed on various CSH sites and uploaded on the www.cshindia.in website;
- In 2017, 4 ESCO projects were supported under the CSH Project comprising 80% investment by ESCO and 20% by beneficiary with contract time spread over 7 years;
- In 2017, 3 BIS standards were adopted and published with another 2 standards in final stages of publication;
- In 2016, the Project received approval for a no-cost extension from scheduled date of 31 March 2017 to 30 September 2017 with financial closure date of 31 December 2017.

3.2.1 Adaptive Management

42. Adaptive management is discussed in GEF terminal evaluations to gauge Project performance and the ability of a project to adapt to changing regulatory and environmental conditions, common occurrences that afflict the majority of GEF projects. Without adaptive management, GEF investments would not be effective in achieving their intended outcomes, outputs and targets.

43. During the critical commencement period, an inception workshop for the CSH Project was held 2 months after the signing of the ProDoc. The outcome of this Workshop did not result in any significant changes to the Project. The high quality of the ProDoc and design of the CSH Project resulted in minimal adaptive management of the CSH Project. Minimal adaptive management was also reflected in the MTR findings from late 2014 which rated progress as highly satisfactory with the most significant concern being the lack of progress in the financing of CSH installations.

44. In conclusion, UNDP's efforts to adaptively manage this project were ***highly satisfactory*** in consideration that the Project did catalyze CSH project investments in India, and that minimal adaptive management was required due to the overall high quality of the Project design document.

3.2.2 Partnership Arrangements

45. Partnership arrangements were made by the CSH Project to deliver the numerous outputs to achieve the Project objective of "increasing use and promotion of CSH systems for low and medium temperature process heat applications". In consideration of the wide range of skill sets required to achieve this objective, it was necessary for the Project to engage in effective partnerships with CSH manufacturers, energy professionals and consultants, professional associations, ESCOs, NGOs and CSOs. These partnerships were fostered and strengthened through regular contact at various forums such as workshops, PSC meetings, and conferences.

46. One important aspect of this Project's partnership arrangements was to disseminate CSH knowledge over a wide range of stakeholders. To this end, the Project fostered a number of effective partnerships with consulting organizations with skill sets that would help in advance the general knowledge of CSH systems in India[11]. This also included collaborations with academic institutions such as UoP (Center for Energy Studies) and research institutes such as NISE who established regional test centers, and have taken on post graduate and doctorate research students to undertake CSH-related research and development activities such as test methods for performance evaluation.

47. Another interesting partnership has been with STFI which has been highly effective in developing public outreach platforms to advance the public's general knowledge of solar thermal technologies including those of CSH and solar water heating for the residential sector. STFI was also responsible for developing and publishing the e-magazine "Insolthermtimes" as well as other magazines to create widespread awareness through the general public as well as targeted stakeholders. The dedicated toll-free helpline operated by STFI was also successful in creating awareness, as well as clarifying and responding to queries about emerging technology and helped create interest for its adoption.

[11] Skill sets for preparing material specifications manuals, preparing field performance survey and developing case studies, developing and implementing online monitoring, developing information packages, preparing training manuals and organizing large number of awareness generation workshops.

48. In summary, overall efforts by the CSH Project on its ability to facilitate effective partnership arrangements with key stakeholders was **highly satisfactory**.

3.2.3 Feedback from M&E Activities Used for Adaptive Management

49. Feedback for M&E activities was provided primarily through PIRs. The evaluation had the opportunity to review PIRs from 2013 to 2017 that contained progress reports of the CSH Project work against clearly defined and quantifiable output indicators. Despite this evaluation's previous concern over the high number of indicators to be monitored (see Para 26), the PIR is provided descriptors of progress against more than 90% of the 63 indicators. With the satisfactory quality of the feedback, the PIRs served as a primary sounding board, mostly positive, in providing feedback to the PMC. The timely and high quality feedback in these PIRs enabled the PSC to undertake necessary adaptive management measures that would serve to catalyze CSH projects. This aspect of the CSH Project has in part been responsible for timely completion of high quality outputs. As such, feedback from M&E activities for adaptive management are rated as **highly satisfactory**.

3.2.4 Project Finance

50. The CSH India Project had a GEF budget of US$ 4.40 million that was to be disbursed over a 5-year duration. Implementation of Project activities started after organization of the inception workshop in May 2012 and was completed in December 2017, with only 9 months added to the original Project duration of 60 months. Table 2 provides the known expenditures against the components, and depicts a slower start to the Project than anticipated in the Project design. The planned AWP expenditures provides a better reflection of the adaptive management of the budget. The 2012 AWP planned expenditure of US$42,580 was a reflection of the PMU's need to focus on stakeholder engagement and capacity building prior to implementing the demonstration CSH installations planned under Component 3. This backs the statement on Para 27 that the generation of 1,050 tonnes CO_{2eq} of emission reductions in Year 1 was not realistic, adding another risk to the Project of not reaching the cumulative target of 32,900 tonnes CO_{2eq} by the EOP. Notwithstanding, the satisfactory results of the Project (as reviewed in Section 3.3) are an indication that the Project was cost-effective in its utilization of GEF grant funds (see Section 3.3.7 and Para 77).

51. As mentioned in Para 26, the budget for the CSH Project was presented in the ProDoc as 10 separate budgets (representing 9 outcomes plus Project Management). To reduce Project management efforts to a practical level, the CSH PMU only reported on component expenditures from 5 separate budgets (4 components plus Project Management). A lesson to be learned from this PMU action is that project designers should setup a PRF and its budgets in a manner that is practical for project management teams to setup and monitor.

52. Co-financing details can be found on Table 3. Project co-financing was estimated to be US$ 18 million, US$1.35 million below the ProDoc estimate. Moreover, co-financing from financial institutions in the form of working capital for CSH manufacturers was only up to December 31, 2016, with the possibility that this figure is higher. Considering the overall outcome of raised awareness and catalysed interest in CSH by the industrial sector, and the number of companies involved as beneficiaries and suppliers of CSH equipment, this co-financing shortfall can be considered minor.

Table 2: GEF Project Budget and Expenditures for India CSH Project (in USD as of December 31, 2017)

CSH Outcomes	Budget (from ProDoc)	2012[24]	2013	2014	2015	2016	2017[25]	Total disbursed	Total remaining
Outcome 1.1: Enhanced understanding of CSH technologies, applications and markets	311,150	35,578	607,844	509,833	74,258	62,211	54,548	1,344,272	-512,747
Outcome 1.2: Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance	226,250								
Outcome 1.3: Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions	294,125								
Outcome 2.1: Strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/ institutional process heat applications	860,200	55,951	241,294	168,304	273,108	179,703	48,903	967,623	280,917
Outcome 2.2: CSH project deliverables facilitated and/or influenced the widespread replication of CSH technology applications in India	387,980								
Outcome 3.1: Increased number of commercial and near-commercial CSH technologies for diversity of applications	1,461,805	0	3,095	146,189	96,460	527,110	668,216	1,441,070	527,175
Outcome 3.2: Improved technical and economic performance of commercial and near-commercial CSH technologies in an increased diversity of applications	506,440								
Outcome 4.1: Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks	58,700	0	0	14,016	10,218	18,075	124,256	166,565	62,465
Outcome 4.2: Promulgation of favourable financial policies that promote increased use and promotion of CSH technologies for low and medium temperature process heat applications	45,400								
Project Management	247,950	33,093	74,951	164,910	114,657	67,972	43,551	499,134	251,184
Total (Actual)	4,400,000	124,622	927,184	1,003,252	568,701	855,070	939,474	4,418,303	-18,303[26]
Total (Cumulative Actual)	4,400,000	124,622	1,051,806	2,055,058	2,623,759	3,478,829	4,418,303		
Planned expenditure as per AWPs	4,400,000	42,580	1,003,447	996,093	553,660	864,746	939,474		
Annual Planned Disbursement (from ProDoc)[27]	4,400,000	321,378	1,355,977	1,126,252	953,170	643,223	939,474		
% Expended of Planned Disbursement (from ProDoc)		**39%**	**68%**	**89%**	**60%**	**133%**	**100%**		

[24] From March 28, 2012
[25] To December 31, 2017
[26] Includes direct UNDP expenditure of US$18,303 which was spent for Project Management
[27] Original Project duration was 60 months

Table 3: Co-Financing for India CSH Project (as of December 31, 2017)

Co-financing (type/source)	UNDP own financing (million USD)		Government (million USD)		Partner Agency (million USD)		Private Sector (million USD)		Total (million USD)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants			7.350	4.850			12.000	11.500[28]	19.350	16.350
Loans/Concessions									0.000	0
• In-kind support				1.650					0.000	1.650
• Other									0.000	0
Totals	0.000	0.000	7.350	6.500	0.000	0.000	12.000	11.500	19.350	18.000

[28] Estimated US$7.0 million from beneficiaries' equity and US$4.5 million from financial institutions up to December 31, 2016 for working capital to CSH manufacturers.

53. Overall, the cost effectiveness of the CSH Project has been **satisfactory** in consideration of the positive results of the Project and its impact of catalysing interest in CSH investments in the industrial sector.

3.2.5 M&E Design at Entry and Implementation

54. The M&E design of the CSH Project is contained in Section 14 of the ProDoc. The M&E design of the CSH Project is comprehensive as well as standard to other similar GEF projects within UNDP. The design included the inception workshop and report, measurement of means of verification for project results and progress, PIRs, midterm evaluations, final evaluations, audits, and visits to field sites. *The M&E design is rated as **satisfactory***.

55. Implementation of M&E activities were conducted according to the aforementioned design. The quality of the PIRs provides an indication of M&E activities implemented during the CSH Project. Another indication are the details provided for the 110 CSH installations supported by GEF funds, most of which can be found in Appendix H. As such, *M&E plan implementation is rated as **satisfactory***. Ratings according to the GEF Monitoring and Evaluation system[29] are as follows:

- *M&E design at entry - 5;*
- *M&E plan implementation - 5;*
- *Overall quality of M&E - 5.*

3.2.6 Performance of Implementing and Executing Entities

56. The performance of the implementing partner of the CSH Project, MNRE, can be characterized as follows:

- MNRE were able to recruit a well-qualified NPM who possessed postgraduate degrees specializing in concentrated solar technologies combined with excellent skills in management and interpersonal relations. This person served as the NPM for the entire 5.75 year duration of the CSH Project;
- MNRE had effectively integrated its own CSH promotional programs (under JNNSM) with the CSH Project to boost stakeholder confidence in the enabling environment being created to encourage and accelerate deployment of CSH technologies in India;
- MNRE reports on fiscal and physical progress of the CSH Project has provided a clear picture of the Project's accomplishments;
- Overall performance of MNRE on the CSH Project is assessed as being **highly satisfactory**.

57. The performance of UNDP (the Implementing Agency) can be characterized as follows:

[29] 6 = HS or Highly Satisfactory: There were no shortcomings;
5 = S or Satisfactory: There were minor shortcomings,
4 = MS or Moderately Satisfactory: There were moderate shortcomings;
3 = MU or Moderately Unsatisfactory: There were significant shortcomings;
2 = U or Unsatisfactory: There were major shortcomings;
1 = HU or Highly Unsatisfactory
U/A = Unable to assess
N/A = Not applicable.

- UNDP was able to effectively communicate and collaborate with MNRE to execute the CSH Project according to the regulations of both Government of India as well as UNDP;
- UNDP provided support to MNRE on the preparation of AWPs as well as PIRs. This effective collaboration on project progress and work plans provided the Project with satisfactory documentation of progress and reasonable and accurate requests for Project funds;
- Overall performance of UNDP on the CSH Project can be assessed as being **highly satisfactory**.

58. A summary of ratings of the implementing and executing entities of the CSH Project are as follows:
    - *Implementing Partner (MNRE)* – 6;
    - *Implementing Entity (UNDP)* – 6;
    - *Overall quality of implementation/execution (UNDP/MNRE)* – 6.

3.3 Project Results

59. This section provides an overview of the overall project results and assessment of the relevance, effectiveness and efficiency, country ownership, mainstreaming, sustainability, and impact of the CSH Project. In addition, evaluation ratings for overall results, effectiveness, efficiency and sustainability are also provided against the revised March 2012 Project PRF (as provided in Appendix F)[30]. For Tables 5 to 9, the "status of target achieved" is color-coded according to the following scheme:

Green: Completed, indicator shows successful achievements	Yellow: Indicator shows expected completion by the EOP	Red: Indicator shows poor achievement – unlikely to be completed by project closure

3.3.1 Overall Results

60. Goal-level targets of the CSH Project was to reach cumulative emission reductions of 32,900 tonnes CO_2 by the EOP. Objective level targets of the CSH Project included a cumulative CSH systems installation of 85,000 m^2 for process heat applications by the EOP, and 175 companies installing CSH systems in India by the EOP.

61. Cumulative emission reductions from CSH installations on this Project only reached 20,018 tonnes CO_{2eq} from over 110 installations. These installations are summarized on Table 4 by technology type with additional details provided in Appendix H. MNRE reported that another 17 CSH installations were being completed in December 2017; these are not listed in Appendix H since they will not generate GHG emission reductions during the implementation period of the CSH Project.

62. The Project did not meet its key GHG emission reduction target of 32,900 tonnes CO_2 by the EOP. A primary reason may have been the unrealistic expectation that Project activities could generate more than 1,050 tonnes CO_2 emissions reductions during Year 1 (as shown on pg 113 of the ProDoc). This evaluation doubts the feasibility of this scenario given the fact that during Year 1, the Project was mobilizing all stakeholders including potential industrial clients wishing to take advantage of the MNRE subsidy for CSH installations, companies who could be selected for the supply of CSH equipment, and educational institutes who could have been selected to demonstrate CST applications for social cooking (in reference to Para 27).

[30] Evaluation ratings are on a scale of 1 to 6 as defined in Footnote 29.

63. As of 30 October 2017, a total of 71,778 m^2 of CSH systems was installed through the influence of this Project (against the EOP target of 80,000 m^2). This Project influenced the installation of 162 projects with 46,778 m^2 out of which 127 projects with 36,096 m^2 were implemented with GEF support. MNRE reports that with the current CSH installations to be completed by 31 December 2017, the total installed CSH systems will be in the order of 80,000 m^2. A summary of the achievements of CSH Project at the goal and objective level with evaluation ratings are provided on Table 5.

64. Based on the number of CSH installations completed during the Project, and the interest generated in CSH technologies in India (as indicated through reaching the targets for CSH installed capacity and exceeding the number of companies involved in CSH installations), the achievement of CSH Project-Level targets are rated as **satisfactory.** Details of the GHG emission reductions from the CSH Project are summarized on the GEF Tracking Tool as provided in Appendix E.

3.3.2 Component 1: Technical capacity development

65. Under this Component, there were 3 expected outcomes:

- Activities under Outcome 1.1 were intended to result in "the enhanced understanding of CSH technologies, applications and markets". Project resources were to be used to generate an output of "developed technology application information packages and characterized technologies, applications, and markets";
- Activities under Outcome 1.2 were intended to result in "adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance". Project resources were to be used to generate an output of "developed CSH performance standards and technology specifications";
- Activities under Outcome 1.3 were intended to result in "adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions". Project resources were to be used to generate an output of "developed CSH system components and equipment testing facilities".

66. For the reporting of Outcome 1.1 indicators, only two out of the 4 indicators were reported on in PIRs, namely "the number of technology package suppliers that are available to market CSH technologies in India by EOP", and "the number of companies that used the information packages in purchasing and installing CSH process heat systems by EOP".

67. Over 161 companies have used information packages available on websites or the information provided in workshops or suppliers for the purposes of making informed CSH investment decisions. The number of companies using these information packages since inception of the Project is around 161 as reported by MNRE.

68. In conclusion, the results of Component 1 can be rated as **satisfactory** based on the numerous outputs delivered as summarized on Table 6. One of the crowning achievements in this Component as well as the Project has been the adoption of 5 technical specifications for 5 different CSTs, 3 of which have already been published by BIS in November 2017 with the remaining 2 technical specifications to be published early in 2018.

Table 4: List of Demonstration Concentrated Solar Heating Projects supported by CSH Project

CST technology type	No of installations	Installed Capacity (m^2)	UNDP Sanctioned amount (in Rs Lakhs)	UNDP Support Released (in Rs Lakhs)	GHG emission reduction (till October 2017)
ARUN	8	1,295	29.57	28.07	1,187
CPC	6	1,239	30.18	16.23	207
NIC	7	3,372	65.19	53.19	3,578
Paraboloid	17	5,370	183.29	97.49	2,684
PTC	18	4,069	111.41	63.10	4,786
Scheffler	51	8,853	226.68	155.48	7,339
Scheffler Dish	2	192	6.90	3.45	54
Single Axis	1	1,333	56.70	28.35	132
Total	**110**	**25,724**	**710**	**445**	**20,018**[31]
					22,432[32]

Table 5: Project-level achievements against CSH Project targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [33]
Project Goal: *Reduced GHG emissions from use of CSH systems for low and medium temperature process heat*	Cumulative CO2 emission reduced from start of project to End-of-Project (EOP), (tCO_{2e})	0	32,900	*22,432 tonnes of CO_2 cumulatively reduced.*	See Para 59, Appendix E (pg 67)	5
Project Objective: *Increased use and promotion of CSH systems for low and medium temperature process heat applications*	Cumulative installed area of CSH systems for process heat applications (m^2) by EOP	20,000	80,000	*80,000 m^2 will have been installed by EOP.*	See Para 60	5
	No. of companies that have installed CSH systems by EOP	71	161	*Over 300 companies have been involved with the installation of CSH systems as reported by MNRE.*	-	5
Overall Rating – Project-Level Targets						**5**

[31] Up to 30 October 2017
[32] Prorated to 31 December 2017. See Appendix E (pg 67) detailed calculation.
[33] Ibid 29

Table 6: Outcome 1 achievements against targets

Intended Outcome/Output	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [34]
Outcome 1.1: Enhanced understanding of CSH technologies, applications and markets	No. of technology package suppliers that are available to market CSH technologies in India by EOP	18	30	*33*	-	5
	No. of companies that are interested in the installation of CSH systems by EOP	0	60	*161*	*See Para 65*	6
	No. of companies that are potential users of CSH process heat systems by EOP	71	131	*Not reported*	*A report was issued by the Project in 2015 listing over 800 potential sites for CSH process heating systems (in reference to Para 41)*	5
	No. of companies that used the information packages in purchasing and installing CSH process heat systems by EOP	0	90	*Not reported*	*Several companies have used information packages of the Project for installing CSH systems. The rating for this, notwithstanding the lack of monitoring, should be satisfactory.*	5
Output 1.1.1: Developed technology application	Number of performance assessment reports of existing installations by year 2	0	15	*40*	*Target met as of 2016 PIR when on-line monitoring was established for 21 projects. Another 19 projects with online performance reports was made available during the period of late 2016 to early 2017*	6
	Number of technology assessment reports of CSH technologies by EOP	0	2	*2*	*One global and one for India were already completed by Eco-axis in 2015 and are uploaded on CSH website link: http://cshindia.in/images/List%20of%20Reports/Executive%20summary%20Nov15%20.pdf*	6
	Number of market assessment reports for CSH process heat applications by EOP	0	2	*2*	*These are for Northern and Southern regions entitled "Preliminary reports on possible installation of CSH systems in 800 establishments of 20 States in country". The reports are uploaded at: http://cshindia.in/images/List%20of%20Reports/UNDP GEF_TERI_Rep.pdf for southern region and http://cshindia.in/images/List%20of%20Reports/UNDP GEF_MPEN_Report.pdf for northern region*	6

[34] Ibid 29

Intended Outcome/Output	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [34]
	Number of CSH technology application information packages developed by EOP	0	10	*10*	*This includes information packages for 4 industries developed in 2015: textile, automotive, food processing & chemicals. These are uploaded on www.cshindia.in*	6
Outcome 1.2: Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance	No. of Indian CSH system components & equipment manufacturers that comply with the BIS standards and specifications by EOP	0	30	*33*	*Target met. 33 CSH manufacturers follow technical specifications laid down by MNRE. BIS standards are under publication. The project developed "Component and material specifications booklets on CSTs" to help developing the standards.*	6
	No. of Indian CSH system component & equipment manufacturers that comply with ISO standards and specifications for CSH systems by EOP	0	10	*Not reported*		1
	No. of Indian CSH system component & equipment manufacturers that entered into the internal CSH business (export of CSH components & equipment) by EOP	0	7	*4*	*This would include the following manufacturers and suppliers: ARS glass, Thermax, Megawatt Solutions & Forbes Solar all of whom are reporting doing business abroad.*	4
Output 1.2.1: Developed CSH performance standards and technology specifications	Document of performance measurement standard developed by year 2	0	1	*1*	*Document on "Detailed project report on Development of performance measuring standards, test procedures and test protocols for concentrating solar technologies to be used for process heat applications" completed in 2014.*	6
	Number of test protocols developed – technology specific by year 3	0	5	*5*	*This includes developed test procedures for CSTs, 3 of which have been published by BIS. This includes Dish Technology, Scheffler Technology, Parabolic Trough Concentrator, and Non Imaging Concentrator.*	6
	No. of minimum performance norms developed by year 2	0	1	*1*	*The norms were developed in 2014 and posted on: http://mnre.gov.in/file-manager/UserFiles/Anticipated-Heat-Delivery-from-CSTs-in-different-regions.pdf. These are being constantly changed based on actual performance data collected from various CSHs test installations established at NISE, Gurgaon and University of Pune.*	6
	A document of field performance monitoring guidelines developed	0	1	*1*	*Field performance norms for CSTs for different regions were completed in 20154 and 2015 by an Expert Group*	6

Intended Outcome/Output	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [34]
	by year 2				*and are uploaded on: http://mnre.gov.in/filemanager/UserFiles/specifications_steam_generating_systems.pdf*	
	No. of technology specifications developed by EOP	0	5	*6*	*6 booklets on material and component specifications of various CSTs were prepared and uploaded on www.cshindia.in in 2016*	6
	No. of performance standards and specifications taken up for consideration and adoption as draft national standards by BIS by year 4	0	1	*5*	*The following standards are in place before the EOP:* *Part 1: Dish Technology- Requirements and Specification* *Part 2 : Scheffler Technology- Requirements and Specification* *Part 3 : Parabolic Trough Concentrator (PTC) - Requirements and Specification* *Part 4 : Non Imaging Concentrator (NIC) - Requirements and Specification* *Part 5 : CSTs-Test Methods* *Parts 1, 2 and 3 have been published by BIS, with Parts 4 and 5 to be published early in 2018.*	6
	No. of performance standards and specifications submitted to ISO as draft international standards by year 4	0	1	*0*	*This should be taken up by MNRE/NISE after BIS standards are in place.*	1
Outcome 1.3: Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions	No. of accredited testing facilities for CSH components and equipment in India by year 3	0	2	*2*	*Target met & reported in PIR 2014. 2 Nos of test set ups have already been established at NISE in Gurgaon & UoP in Pune*	5
	No. of Indian CSH system component & equipment manufacturers that approached testing laboratories for certification by EOP	0	28	*17*	*17 systems have been tested so far. During the reporting period 5 CST systems were tested. Target will be met by EoP*	4
	No. of international CSH system component & equipment manufacturers that approached Indian testing laboratories for certification to enable their systems sale in Indian market by EOP	0	5	*0*	*None have approached from abroad for testing of CST component and systems as the CSH technologies for decentralized applications are mostly popular in India alone*	1

Intended Outcome/Output	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [34]
Output 1.3.1: Developed CSH system components and equipment testing facilities	Number of reports on proof-of-concept testing carried out at SEC for at least three technologies by year 4	0	3	*5*	*All the 6 technologies namely, CLFR, Scheffler, paraboloid dish, Arun, NIC and PTC have been tested at NISE by 2015*	6
	Number of mobile test setups developed	0	2	*2*	*Completed in 2014*	5
	Established national testing facility by year 2	0	1	*1*	*Established at National Institute of Solar Energy, Gurgaon, Haryana*	5
	Established a regional test facility by year 3	0	1	*1*	*Established at School of Energy Studies, University of Pune, Pune, Maharashtra.*	5
Overall Rating – Outcome 1						**5**

3.3.3 Component 2: Awareness enhancement and capacity building

69. Under this Component, there were 2 expected outcomes:

- Activities under Outcome 2.1 were intended to result in "strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/ institutional process heat applications". Project resources were to be used to generate several outputs including:
  - Output 2.1.1: Trained manufacturers/vendors, installers and CSH users;
  - Output 2.1.2: More trained technical consultants that provide technical services to both CSH system components & equipment manufacturers and users;
  - Output 2.1.3: Established and supported industry academic partnership through research programmes to build future capacities;
  - Output 2.1.4: Trained staff at SEC and staff at regional testing center;
  - Output 2.1.5: Completed awareness enhancement programmes for policy makers, academicians, industries, financial institutions, etc. to facilitate replications;
  - Output 2.1.6: Completed Promotional campaign for CSH;
  - Output 2.1.7: Established Concentrating Solar Heat Technology Platform and is operational;

- Activities under Outcome 2.2 were intended to result in "CSH Project deliverables facilitated and/ or influenced the widespread replication of CSH technology applications in India". Project resources were to be used to generate an output of "documentations on the Project outputs, case studies, best practices and lessons learnt disseminated to ensure larger replication".

70. Based on the information presented in Table 7, the results of Outcome to can be rated as **satisfactory.** A rationale for this rating is the result of a high number of CSH replication projects, a high participation rate in workshops and conferences, high usage of the project website and its publications, and the agreement of 5 banks to provide concessional rate financing for CST installations. This Outcome, however, did not facilitate any significant involvement of international expertise which would have provided some guidance to the Indian CSH industry on adopting best international practices with the goal of improving the efficiencies of CSH equipment manufactured in India.

3.3.4 Component 3: Pilot demonstration of CSH technologies for various applications

71. Under this Component, there were 2 expected outcomes:

- Activities under Outcome 3.1 were intended to result in "increased number of commercial and near commercial CSH technologies for diversity of applications". Project resources were to be used to generate several outputs including:
  - Output 3.1.1: Completed feasibility studies for demonstration and replication projects of various CSH technology applications;
  - Output 3.1.2: Completed Detailed Project Reports (DPRs) for demonstration Projects;
  - Output 3.1.3: Developed and commissioned demonstration projects in at least 5 sectors;
  - Output 3.1.4: Results of the performance monitoring, analysis, and evaluation of demonstration projects;

Table 7: Outcome 2 achievements against targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [35]
Outcome 2.1: Strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/ institutional process heat applications	No. of technology package suppliers that are available to market CSH technologies in India by EOP	18	30	*Not reported*		n/a
	No. of CSH replication projects by EOP	0	60	72	*This includes 39 projects during 2016-17 [some of which were repaired or renovated*	6
	No. of trained participants of test facilities that are actively involved in the development of the CSH technology development by EOP	0	10	10	*Includes the 10 officials that were trained on testing of CSTs and O&M of CSH systems at Pune and Gurgaon*	5
	No. of CSH technologies available in India by EOP due to increased awareness and capacity	2	5	5	*Includes 10 designs for 5 technologies available in India*	6
	No. of banks/financial institutions that agreed to finance CSH projects and CSH system component & equipment manufacturing as a result of the awareness enhancement programs by EOP	1	3	5	*This includes IREDA (who have included CSH for lending finance and provide loans on solar thermal systems and CSHs at normal interest rates), Syndicate Bank, State Bank of Patiala, United Bank of India, and State Bank of Bikaner & Jaipur (for CSH loans at concessional lending rates at 5%).*	5
	No. of papers presented in conference that were used by policy makers in decision making on technology applications, in general, and CSH technology applications, in particular, by year 4	0	15	31	*At national and international conferences*	6
	% of conference participants expressed satisfaction about the conference by EOP	0	70	*Not reported*	*Indicator not specific on which conference.*	n/a
Output 2.1.1: Increased information available with project promoters and all stakeholders in the focused states and their enhanced knowledge base	Training needs assessment completed by year 2	0	1	*1*	Training needs assessment was conducted by M/s Anthropower followed up with a training programme for technicians at NISE. Another programme was designed as a residential training at Mount Abu for State Government Officials. Awareness cum training center has been established at Mount Abu for organizing	6

[35] Ibid 29

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [35]
					the training programme entrepreneurs, employees of manufacturers.	
	No. of training modules (including all the training material) on CSH technologies developed by year	0	3	*6*	*Modules were developed by AnthroPower and cover 6 different CSH technologies in Hindi and English. These are uploaded at: http://www.cshindia.in/ListofReports.html*	6
	Number of training courses on CSH technologies organized and conducted under the project by EOP	0	15	*18*	-	6
	Number of personnel trained in the training courses by EOP	0	300	*550*	-	6
	No. of personnel that were received training on specific aspects of CSH technologies from study tour conducted under the project by year 2	0	10	*15*	*15 persons received training from 5 study tours in country and abroad (including Germany)*	6
Output 2.1.2: More trained technical consultants that provide technical services to both CSH system components & equipment manufacturers and users	No. of training modules (including all the training material) on CSH technologies developed by year 2	0	1	*Not reported.*		n/a
	Number of training courses on CSH technologies organized and conducted under the project by EOP	0	4	*18*	-	6
	Number of trained technical consultants by EOP	0	100	*97*	*This includes 27 consultants involved with the project on various assignments and over 70 officials from State Governments/Nodal Agencies (who were trained at Awareness and m Training Center at Mount Abu)*	5
Output 2.1.3: Established and supported industry academic partnership through research programmes to build future capacities	Number of Ph.D. fellowships supported by year 3	0	4	*16*	-	6
	Number of M.Tech. fellowships supported by year 3	0	6	*7*	-	6
	Number of fellows completing Ph.D. by EOP	0	2	*Not reported*		n/a
	Number of fellows completing M.Tech. by EOP	0	6	*Not reported*		n/a
	Number of institutions where fellowships on CSH technologies are supported by year 3	0	5	*Not reported*		n/a
	No. of universities/ technical schools	0	1	*1*	*At NISE in Gurgaon*	6

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [35]
	with Masters level course (at least as elective) available on CSH by year 3					
Output 2.1.4: Trained staff at SEC and staff at regional testing center	Number of personnel trained in international training programmes organized and conducted by year 2	0	5	*0*	*This was never done by the Project.*	1
	Number of national training programmes organized and conducted by year 2	0	1	*1*	*Completed in 2014-15*	6
	Number of personnel trained in national training programmes by year 2	0	10	*10*	*Completed in 2014-15*	6
Output 2.1.5: Completed awareness enhancement programmes for policy makers, academicians, industries, financial institutions, etc. to facilitate replications	Number of participants in conferences by year 4	0	200	*1,000*	-	6
	Number of international participants in the completed conferences by year 4	0	20	*100*	-	6
	Number of papers presented in conferences by year 4	0	20	*31*	-	6
	Number of CSH system exhibitors in expos organized and held by year 4	0	20	*0*	*Manufacturers attend these expos with their own resources*	5
	Number of awareness programmes organized and conducted by EOP	0	20	*70*	*These programmes were aimed not only at creating awareness but also generating expression of interest in installing CSH systems*	6
	Number of participants in organized and conducted awareness programmes by EOP	0	1,600	*2,000*	*A total of over 2,000 people have participated in 60 programmes*	6
Output 2.1.6: Completed Promotional campaign for CSH	Number of advertisements about CSH placed on print media under the project by year 3	0	5	*13*	*Disseminated through national newspapers and magazines*	6
	Number of industrial clusters in which hoardings are displayed by year 3	0	10	*0*	*Activity dropped by Project*	1
	Number of industrial exhibitions and trade fairs participated to promote CSH systems and CSH technology applications by EOP	0	5	*Not reported*	-	n/a
Output 2.1.7: Established Concentrating Solar Heat	An officially established CSH Technology Platform by year 1	0	1 (Jan 12)	*1*	-	6

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [35]
Technology Platform and is operational	Number of meetings conducted by the CSH Technology Platform by EOP	0	8	*6*	*Organized for various stakeholders including manufacturers*	5
	No. of CSH system users that make use of the platform in addressing issues/problems concerning energy performance and improvements of CSH systems by EOP	0	100	*95*	-	5
	No. of CSH system manufacturers/ suppliers/ distributors that make use of the platform in addressing issues/ problems concerning the market of CSH products by EOP	0	15	*15*	*Over 15 manufacturers are making use of the platform on routine basis to address issues related to CSTs*	6
Outcome 2.2: CSH Project deliverables facilitated and/ or influenced the Widespread replication of CSH technology applications in India	Cumulative number of newsletter issues prepared and disseminated by EOP	0	48 (four years 12x4)	48	These are e-newsletters 'Insolthermal Times' – a monthly newsletter that can be accessed at http://www.insolthermtimes.in	6
	Cumulative number of quarterly magazines produced by EOP	0	18	15	Includes the quarterly magazines '"Sunfocus" that is now being compiled into a compendium	5
	No. of copies of each newsletter issue circulated to CSH stakeholders (CSH system manufacturers, suppliers, importers, installers, maintenance service providers and users)starting year 1	0	200	3,000	Includes hard copies for 1,000 and 3,000 through UN Solution exchange. It is also uploaded on UNDP project webpage, www.mnre.gov.in and on the project website: www.cshindia.in	6
	~~No. of CSH replication projects by EOP~~	~~0~~	~~60~~		*Replaced by indicators above*	
	~~% of newsletter recipients expressed it is useful by EOP~~	~~0~~	~~80~~		*Replaced by indicators above*	
	~~% of users of the audio-visual capsule that are satisfied with it, and find it useful by EOP~~	~~0~~	~~70~~		*Replaced by indicators above*	
	~~% of users satisfied with compendium and find it useful by EOP~~	~~0~~	~~70~~		*Replaced by indicators above*	
Output 2.2.1: Documentations on the Project outputs, case	Cumulative number of newsletter issues prepared and disseminated by EOP	0	18	48	These are e-newsletters 'Insolthermal Times' – a monthly newsletter that can be accessed at http://www.insolthermtimes.in	6

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating [35]
studies, best practices and lessons learnt disseminated to ensure larger replication	No. of copies of each newsletter issue circulated to CSH stakeholders (CSH system manufacturers, suppliers, importers, installers, maintenance service providers and users) starting year 1	0	200	3,000	Includes hard copies for 1,000 and 3,000 through UN Solution exchange. It is also uploaded on UNDP project webpage, www.mnre.gov.in and on the project website: www.cshindia.in	6
	Audio-visual capsule uploaded and accessible from project website by year 3	0	1 (Jan 14)	*35*	*These are uploaded on UNDP project webpage, UN solution exchange, MNRE website (www.mnre.gov.in), and the project website www.cshindia.in. The 35 video capsules have been developed on various CSH sites including 4 video films on different applications*	6
	No. of users of the audio-visual capsule by the EOP	0	1,000	*3,000*	-	6
	Project website established and operational by year 1	0	1 (Jan 12)	*1*	*Project website www.cshindia.in already established in 2014 by Solar Thermal Federation of India who are also operating and maintaining the website for the project*	6
	No. of CSH stakeholders that use the project website for information each year starting year 1	0	2,000	*20,000*	-	6
	No. of brochures on CSH technology applications produced and disseminated by EOP	0	90	*69*	-	5
	No. of copies of printed and disseminated	0	1,000	*1,600*	-	6
Overall Rating – Component 2						**6**

- Activities under Outcome 3.2 were intended to result in "Improved technical and economic performance of commercial and near commercial CSH technologies in an increased diversity of applications". Project resources were to be used to generate several outputs including:
  - Output 3.2.1: Documentation of results of demonstration and replication projects; and
  - Output 3.2.2: Completed Performance monitoring, analysis and overall evaluation for demo and replication projects.

A summary of the actual achievements of Outcome 3 with evaluation ratings are provided on Table 8.

72. Based on the information presented in Table 8, the rating of the results of Outcome 3 is assessed as **satisfactory**. This is in consideration of the Project exceeding its targets for completed and operational CSH installations, most of which were documented for their energy and financial performance. The availability of information of successful CSH installations, in fact served the CSH industry very well with respect to sustaining the rates of investment into new CSH projects. In conclusion, the results of Outcome 3 can be assessed as **satisfactory.**

3.3.5 Component 4: Sustainable financial approach in the adoption of CSH technologies and applications in India

73. Under this Component, there were 2 expected outcomes:

- Activities under Outcome 4.1 were intended to result in "enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks". Project resources were to be used to generate an output of "documented financial viability of CSH technologies, applications, and mitigation approaches of investment risks";
- Activities under Outcome 2.2 were intended to result in "Promulgation of favourable financial policies that promote increased use and promotion of CSH for low and medium temperature process heat applications". Project resources were to be used to generate an output of "formulated recommendations for financial and promotional policies and strategies for adoption by Government of India".

74. Based on the information presented in Table 9, the rating of the results of Outcome 4 is assessed as **highly satisfactory**. The rationale for this rating can be traced to the outcome of the willingness of 5 banks to provide concessional loan finance for prospective users of CSH systems, and the initiation of the use of ESCOs as an alternative for financing CSH systems installations. The willingness of financing, however, is conditional on the subsidy support from a government source.

Table 8: Outcome 3 achievements against targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating[36]
Outcome 3.1: Increased number of commercial and near commercial CSH technologies for diversity of applications	No. of replication CSH technology application projects based on the demonstrations that are planned and implemented by EOP	0	6$	72	-	6
	Number of technology application information packages applied in demonstration and replication projects by EOP	0	70	9	*70 was the target in the ProDoc which does not appear to be realistic or achievable. The evaluation believes this target should have been 7.* *In addition, the evaluation believes this indicator is not too dissimilar to Output 1.1.1. With too many indicators for this Project, consolidation of this indicator as well as others would have been beneficial for the PMU.*	5
Output 3.1.1: Completed feasibility studies for demonstration and replication projects of various CSH technology applications	Number of completed feasibility studies that were supported by the project by year 4.	0	90	*131*	-	6
Output 3.1.2: Completed Detailed Project Reports (DPRs) for demonstration projects	Number of completed DPRs for demonstrations that were funded and implemented under the project by year 4	0	30	*38*	*This includes 5 which were supported in 2016-17*	6
Output 3.1.3: Developed and commissioned demonstration projects in at least 5 sectors	Number of CSH technology application demonstration projects implemented and commissioned by EOP	0	30	*24*	*17 commissioned between 2013 and 2014 with an addition 7 demonstration projects in 2016-17.*	4

[36] Ibid 29

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating[36]
	No. of CSH technology application demo projects that were operational by EOP	0	30	*Not reported*	*The progress is likely 24, similar to the previous indicator. The evaluation notes that this indicator is superfluous and should have been combined with the previous indicator since implementation, commissioning and operational are roughly the same stages of progress.*	4
Output 3.1.4: Results of the performance monitoring, analysis, and evaluation of demonstration projects	Cumulative number of performance monitoring reports of the demonstration projects prepared by EOP	0	30	*24*	*14 on-line performance and 10 manual reports have been received of all commissioned demonstration projects. Again, the evaluation notes that this indicator could have been combined with indicators of Output 3.1.3.*	4
	No. of implemented CSH technology application demo projects whose operational and energy performances are at least the same or better than as per design by EOP	0	15	*14*	*For all the commissioned projects, UNDP support has been released after ensuring that their thermal performance is almost same or more as per the designed performance. Accounts for 14 such demonstration projects have been settled as of June 30, 2017*	5
	No. of implemented CSH technology application demo projects whose financial and economic performances are at least the same or better than as per design by EOP	0	15	*Not reported*	*See previous indicator. Progress is likely 14. The evaluation again notes that this indicator is superfluous and should have been combined with the previous indicator since viable operational and energy performances would also be reflective of viable financial and economic performances.*	4
Outcome 3.2: Improved technical and economic performance of commercial and near commercial CSH technologies in an increased diversity of applications	No. of replication CSH technology application projects planned and implemented by EOP	0	60	*103*	*72 of these replication projects were commissioned as of mid-2017.*	6
	No. of demonstrated CSH technologies replicated by EOP	0	5	*5*	*All the 5 technologies have been used in replication projects.*	5
	No. of companies where CSH technologies are successfully applied by EOP	0	90	*Not reported*	*Appendix H lists 110 CSH installations where 109 were reporting GHG emission reductions that can be assumed to be a successful application of CSH technologies.*	6

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating[36]
	No. of implemented demo and replication projects whose performance data is as per feasibility study by EOP	0	90	*90*	*This would include all commissioned projects where UNDP support has been released after ensuring that their thermal performance is almost same or more as per the designed performance. Accounts for 109 such completed projects have been settled accordingly.*	6
Output 3.2.1: Documentation of results of demonstration and replication projects	No. of CSH technology projects included in the project database by EOP	0	90	*131*	*A data base system in Excel has been created in PMU which is provided in Appendix H that only shows 110 projects. MNRE is reporting 131 CSH systems sanctioned with support from UNDP-GEF project with updates required in this database*	6
	Number of demonstration project profiles prepared by EOP	0	30	*38*	*Profiles for all 38 demonstration projects has been prepared in tabular form by the PMU*	6
Output 3.2.2: Completed Performance monitoring, analysis and overall evaluation for demo and replication projects	No. of performance monitoring reports of demo and replication projects completed by EOP	0	90	*96*	-	6
	Overall evaluations of demonstration and replication projects completed by EOP	0	2	*0*	*Evaluation under progress with 2 reports, one on brief status of commissioned projects and other on their performance as regards to GHG emission abated are expected by EoP. Work being conducted by APITCO Ltd, Hyderabad*	5
	No. of projects developed in ESCO mode	0	5	*4*	*These were sanctioned during 2015 reporting period*	5
Overall Rating – Component 3						**5**

Table 9: Outcome 4 achievements against targets

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating[37]
Outcome 4.1: Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks	No. of potential and feasible financial options for the application of CSH technologies identified and promoted by EOP	0	2	3	*Three financial options identified were ESCO, regular channel of financing with financial incentive offered to beneficiary, and financing with banks at concessional lending rates with loan amount reduced by MNRE subsidy and UNDP support after commissioning of the CSH systems.*	6
	No. of replication projects that use financial options by EOP	0	30	Not reported		
	No. of banks/ financial institutions that agreed to finance CSH projects by EOP	1	3	5	*This includes IREDA (who have included CSH for lending finance and provide loans on solar thermal systems and CSTs at normal interest rates), Syndicate Bank, State Bank of Patiala, United Bank of India, and State Bank of Bikaner & Jaipur (for CST loans at 5% concessional lending rate).* *This is the same indicator in Outcome 2.1 and is not necessary as an indicator for this Outcome*	6
Output 4.1.1: Documented financial viability of CSH technologies, applications, and mitigation approaches of investment risks	No. of completed financial viability analyses of CSH technologies and applications by year 3	0	1	1	*Software for assessing the economics of CST based systems has been developed in 2015*	6
	Analysis of alternative financial options by year 3	0	1	1	*ESCO option was analysed as the alternative financial option and implemented as a part of Output 3.2.2. This is another case where this indicator could have been combined with the indicator in Output 3.2.2 concerning ESCOs.*	5
Outcome 4.2: Promulgation of favourable financial policies that promote increased use and promotion of CSH for	No. of implemented CSH projects that benefitted from the enforced policy and regulatory regimes on CSH technology applications by EOP	0	28	0	*There is no policy environment for enforcing CSH projects. However, PMU has proposed to MNRE to consider solar thermal systems including CSH to be part of Renewable Energy purchase obligations (RPO) of states. A draft National policy on CSTs was prepared during 2016 through STFI, Pune and passed over to MNRE for consideration.*	4

[37] Ibid 29

Intended Outcome	Performance Indicator	Baseline	Target	Status of Target Achieved	Evaluation Comments	Rating[37]
low and medium temperature process heat applications	No. of banks/ financial institutions that agreed to finance CSH projects by EOP	1	3	5	*This is the same indicator in Outcomes 2.1 and 4.1 and is not necessary as an indicator for this Outcome*	6
Output 4.2.1 Formulated recommendations for financial and promotional policies and strategies for adoption by Government of India	No. of policy studies completed for inputs in the formulation of policies supportive of CSH system and application projects by year 3	0	1	1	*This study completed in 2012 included all CSTs for formulation of policies on solar thermal programmes. The study was done by M/S CITRAN Consulting Organization, Bhubaneswar*	6
Overall Rating – Outcome 4						**6**

3.3.6 Relevance

75. The CSH Project is **relevant** to the development priorities of India, notably the Integrated Energy Policy (IEP) of 2006 and the National Action Plan on Climate Change (NAPCC).

76. The CSH Project was funded under GEF 5 under OP 6 which was designed to promote the adoption of renewable energy through assistance in removing barriers and reducing implementation costs. The CSH Project is still relevant with the objective of OP 6.

3.3.7 Effectiveness and Efficiency

77. The effectiveness of the CSH Project has been **highly satisfactory** due to:

- Project assistance resulting in the adoption of 5 technical specifications and testing procedures by BIS for 5 CSTs demonstrated;
- The Project exceeding its targets for CSH installations for demonstration;
- The generation of interest amongst a wide spectrum of stakeholders that resulted in co-financing levels reaching US$18.0 million, an indication of the strong level of interest generated by this Project;
- 5 financial institutions agreeing to participate in a concessional loan finance scheme for CSH installations.

78. The efficiency of the CSH Project has been **satisfactory** for a range of reasons:

- the Project was completed within 69 months, 9 months over the design period of 60 months;
- the Project achieved nearly all of its targets (in some cases exceeding these targets) through the use of a GEF grant of US$4.4 million.

3.3.8 Country Ownership and Drivenness

79. One of the primary reasons for the success of the CSH Project has been the strong level of ownership and drivenness of MNRE and the Government of India. A review of the PSC meeting minutes of the CSH Project provides strong indications of the level of participation of MNRE and its government partners in managing the progress of the CSH Project. As such, the TE team can conclude that country ownership and drivenness of the CSH Project can be rated as **highly satisfactory**.

3.3.9 Mainstreaming

80. The intended objective and outcomes of the CSH Project were successfully mainstreamed with:

- the UNDAF for India 2008 to 2012[38], specifically UNDAF CP Outcome 4.2: Communities are aware of their vulnerabilities and adequately prepared to manage and reduce disaster and environmental related risks, Output 4.3.2: Capacities built and pro poor initiatives supported at national and local levels to directly address environmental issues. One of the targets for this

[38] http://www.in.undp.org/content/dam/india/docs/country_programme_action_plan.pdf - see pg 51

output is to "increase access to clean energy with focus on renewable energy technologies for remote areas";

- UNDAF for India for 2013 to 2017[39], specifically UNDAF/CPD Outcome 6: Government, industry and other relevant stakeholders actively promote environmental sustainability and enhanced resilience of communities in the face of challenges of climate change, disaster risk and natural resource depletion", with CP Joint Output 6.1 of "SMEs and underserved communities have enhanced access and capacities to deploy clean technologies and practices for reducing GHG emission intensity".

3.3.10 Sustainability of Project Outcomes

81. In assessing sustainability of the CSH Project, the evaluators asked "how likely will the Project outcomes be sustained beyond Project termination?" Sustainability of these objectives was evaluated in the dimensions of financial resources, socio-political risks, institutional framework and governance, and environmental factors, using a simple ranking scheme:

- *4 = Likely (L):* negligible risks to sustainability;
- *3 = Moderately Likely (ML):* moderate risks to sustainability;
- *2 = Moderately Unlikely (MU):* significant risks to sustainability; and
- *1 = Unlikely (U):* severe risks to sustainability; and
- *U/A = unable to assess*.

Overall rating is equivalent to the lowest sustainability ranking score of the 4 dimensions. Details of sustainability ratings for the CSH Project are provided on Table 10.

82. *The overall CSH Project sustainability rating is moderately unlikely (MU).* This is primarily due to:

- The CSH Project being very successful in raising awareness and demonstrating the financial viability of CSH installations in educational institutes and industries *with subsidies*;
- The possibility that the number of willing CSH investors is reduced with the absence of the 30% subsidy (which would result in payback periods that may not be acceptable to the investor);
- No official position yet from MNRE on increasing foreign partnerships to improve the technical performance of CSH equipment manufactured in India with best practices, and possibly eliminate the need for subsidies.

3.3.11 Impacts

83. The primary impact of the CSH Project has been raising awareness of the technical viability of CSH installations on reducing the use of fossil fuels for social cooking and various industrial applications. To some extent, it has also demonstrated the financial viability, especially to those users who can accept a longer payback period of a CSH investment. The Project has generated considerable interest amongst a wide range of stakeholders from government to CSH manufacturers and suppliers in India to end users such as educational institutes and several industrial and commercial entities.

[39] http://in.one.un.org/wp-content/uploads/2016/09/India_UNDAF202013-17_9Jul2012-1.pdf - see pgs 115 and 119

Table 10: Assessment of Sustainability of Outcomes

Actual Outcomes (as of October 2017) against the CSH PRF of 2012	Assessment of Sustainability	Dimensions of Sustainability
Actual Outcome 1.1: There is an enhanced understanding of CSH technologies, applications and markets by Government, academia, manufacturers of CSH equipment, and end-users of CSH technology.	• *Financial Resources:* Financial resources for the upkeep and maintenance of CSH related websites (by STFI) was not confirmed during the evaluation, despite strong interest expressed by MNRE and stakeholders in the CSH industry; • *Socio-Political Risks*: Stakeholder interest in the continuation of information related to the CSH industry remains strong; • *Institutional Framework and Governance:* GoI support through JNNSM for CSH information dissemination is strong; • *Environmental Factors:* No risks identified. ***Overall Rating***	3 4 4 4 **3**
Actual Outcome 1.2: Standards and specifications have been adopted by the Bureau of Indian standards on CSH quality, safety and performance. This includes adoption of technical specifications and testing standards for 5 CSTs of which 3 have now been published by Bureau of Indian Standards with the remaining two to be published in early 2018.	• *Financial Resources:* No risk here since BIS will undertake further efforts to change standards if necessary; • *Socio-Political Risks:* It is unknown what reaction domestic CSH manufacturers may have to further changes to standards brought on by the adoption of international best practices for the CSH industry in India; • *Institutional Framework and Governance:* BIS is regarded as a strong institution in the development of standards and specifications. Enforcement of these standards and specifications through the testing laboratories has been developed, but not for the testing of best international standards; • *Environmental Factors:* Best international standards for the design and manufacture of CSH need to be adopted to improve efficiencies of CSH equipment and further reduce GHG emissions. ***Overall Rating***	4 3 3 3 **3**
Actual Outcome 1.3: There are 2 capable and operational testing laboratories for the verification of CSH manufacturer claims and to provide guidance for CSH users to enable informed decisions. However, improvements of their capacities are still required to allow these CSH testing laboratories to comply with best international practices.	• *Financial Resources:* Funds for additional testing equipment are not yet available despite the interest of the GoI to develop these into regional testing centers; • *Socio-Political Risks:* Personnel from testing laboratories and manufacturers would appreciate further improvements to the testing labs; • *Institutional Framework and Governance:* Further improvements to these testing laboratories would be supported institutionally through MNRE; • *Environmental Factors:* Capacity of these testing laboratories to adopt best international practices for testing CSH equipment still needs to be adopted to improve efficiencies of CSH equipment and further reduce GHG emissions. ***Overall Rating***	3 4 4 3 **3**
Actual Outcome 2.1: The technical capacity and awareness of industrial professionals as well as end-users and O&M personnel has been	• *Financial Resources:* Financial resources for continued training of CSH O&M personnel and professionals has not been confirmed despite strong MNRE interest to continue training through NISE; • *Socio-Political Risks:* There is a critical mass of CSH stakeholders who wish to see a continuance of CSH-related training;	3 4

Table 10: Assessment of Sustainability of Outcomes

Actual Outcomes (as of October 2017) against the CSH PRF of 2012	Assessment of Sustainability	Dimensions of Sustainability
strengthened.	• *Institutional Framework and Governance:* NISE with University of Pune are in place to continue CSH training; • *Environmental Factors:* Industry professionals, end-users and O&M personnel have not yet adopted best international practices to achieve optimal efficiencies of CSH equipment and maximize GHG emission reductions. However, some have initiated contacts with international CSH practitioners to strengthen their capacities towards best international practices ***Overall Rating***	4 3 **3**
Actual Outcome 2.2: CSH Project deliverables have raised awareness of CSH technology applications in India, but not to the extent where there has been widespread replication of CSH technology throughout India	• *Financial Resources:* Financial resources for the continued involvement of STFI (in Pune), maintenance of the Project website and dissemination of other CSH related journals for the continuation of CSH awareness raising has not yet been confirmed despite strong interest by MNRE for its continuance; • *Socio-Political Risks:* There is a critical mass of CSH stakeholders who wish to see a continuance of CSH information dissemination; • *Institutional Framework and Governance:* Project website was to be taken over by MNRE with STFI to assist in its upkeep. This arrangement has not yet been finalized as of December 2017; • *Environmental Factors:* No risks identified. ***Overall Rating***	3 4 3 4 **3**
Actual Outcome 3.1: There has been an increased number of CSH technologies demonstrated that can be applied for a diversity of applications ranging from cooking fuel to chilling.	• *Financial Resources:* It is unclear if financial resources are available under JNNSM for technical support similar to what UNDP provided during implementation of the CSH Project, despite raised interest amongst entities in the industrial sector and educational institutes; • *Socio-Political Risks:* There is willingness of industrial entities to adopt CSH installations provided they are financially viable. As such, the 30% JNNSM subsidy may still be needed unless there are substantial improvements made to the quality of CSH equipment manufactured in India; • *Institutional Framework and Governance:* JNNSM subsidy is in place until 2020. Without a guarantee of subsidy after this date, there is a need for MNRE to adopt best international practices for the CSH industry that will possibly eliminate the need for the capital subsidy of 30% (if more efficient CSH equipment can improve heat generation by more than 30%); • *Environmental Factors:* Best international practices have not yet been adopted to reach optimal efficiencies of CSH equipment and maximize GHG emission reductions that will sustain the growth in the number of commercial CSH technology applications. ***Overall Rating***	3 3 3 3 **3**
Actual Outcome 3.2: Due to CSH Project support and the availability of capital subsidies from JNNSM, the technical and economic performance	• *Financial Resources:* It is unclear if financial resources are available under JNNSM for technical support similar to what UNDP provided during implementation of the CSH Project. NISE is continuing its technical support notwithstanding;	3

Table 10: Assessment of Sustainability of Outcomes

Actual Outcomes (as of October 2017) against the CSH PRF of 2012	Assessment of Sustainability	Dimensions of Sustainability
of CSH technologies supplied from India has improved, although further improvements can still be made.	• *Socio-Political Risks:* There is willingness of industrial entities to adopt CSH installations provided they are financially viable. As such, the 30% JNNSM subsidy is needed unless there are substantial improvements made to the technical quality of CSH equipment manufactured in India; • *Institutional Framework and Governance:* JNNSM subsidy is in place until 2020. Without a guarantee of subsidy after this date, there is a need for an improvement in CSH standards to best international practices that will possibly eliminate the need for the capital subsidy of 30% (if more efficient CSH equipment can generate more than 30% solar heating); • *Environmental Factors:* Best international practices have not yet been adopted to reach optimal efficiencies of CSH equipment and maximize GHG emission reductions. ***Overall Rating***	3 3 3 **3**
Actual Outcome 4.1: There is an enhanced understanding of the financial viability of CSH technologies and measures, sufficient to assess how CSH investments risks can be mitigated which includes promotion of the ESCO model as a future modality for scaled up installations of CSH technologies.	• *Financial Resources:* Subsidies still are necessary for the long-term transformation of the market for low process heating from fossil fuels to CSTs. These may not be in place after 2020. This would force the industry to adopt best international practices to improve the technical performance of CSTs manufactured in India; • *Socio-Political Risks:* Sufficient awareness of the financial viability of CSH installations has been built by the Project, creating willingness of potential users to invest, provided there are subsides involved; • *Institutional Framework and Governance:* MNRE must institutionally address the need for improving the performance of the CSH equipment to best international standards which could eliminate the need of capital subsidies; • *Environmental Factors:* Best international practices have not yet been adopted to reach optimal efficiencies of CSH equipment and maximize GHG emission reductions. ***Overall Rating***	3 3 3 3 **3**
Actual Outcome 4.2: Favourable financial policies are being considered to increase the use and promotion of CSH technologies; however, these policies have yet to be promulgated.	• *Financial Resources:* Favorable financial policies are now under consideration by GoI although they are not yet in place to address the need for developing CSH standards that are in line with best international practices; • *Socio-Political Risks:* A lessor number of potential CSH investors may not accept CSH installations without subsidies due to longer payback periods of investment; • *Institutional Framework and Governance:* MNRE are considering financial policies but may not promulgate them unless there are measures undertaken to adopt improved efficiencies of CSH equipment manufactured in India, and reduce the risks of financial loans for some CSH installations; • *Environmental Factors:* Best international practices have not yet been adopted to reach optimal efficiencies of CSH equipment and maximize GHG emission reductions. ***Overall Rating***	3 3 3 3 3
	Overall Rating of Project Sustainability:	**3**

4. CONCLUSIONS, RECOMMENDATIONS AND LESSONS

84. The CSH Project has been pivotal in bringing increased enhanced awareness through several knowledge products, awareness-training workshops and demonstrations of CSH technologies and its applicability for medium process heat applications in India. This general conclusion has been made possible through a well-designed project that was well researched and supported by numerous stakeholder consultations during the design process, and there is strong management by MNRE according to details provided in the CSH ProDoc.

85. These are outstanding results from the CSH Project; however, less than 1% of CSH potential has been realized through this Project. In addition, much of the installed CSH capacity has been subsidized, and that without the 30% capital subsidy, there are doubts as to whether or not all potential CSH beneficiaries would embrace a CSH investment without the subsidy (which would increase the payback periods to unacceptable levels to some proponents). Notwithstanding, there is not much doubt that further support is required to transform and scale-up the market for low and medium temperature process heat applications using CSH systems to exploit vast untapped potential.

86. The Indian CSH industry has performed well to evolve into an industry capable of producing CSH installations for industrial applications. However, the industry needs international inputs to be able to produce higher efficiency CSH systems at lower costs, through improvements in manufacturing quality, precision, and durability. This would include adoption of best international practices by the industry, investments in upgrading the manufacturing processes and commissioning facilities, and continual improvements into the adopted BIS standards for CSH equipment and testing laboratories. Through the adoption of best international practices by the Indian CSH industry, there is a strong likelihood of improving CSH equipment efficiencies sufficient to eliminate the need for subsidies.

87. With this evaluation coinciding with the end of this UNDP-GEF project and the mid-point of the UNIDO-GEF project, donor support for the momentum built by the UNDP-GEF CSH Project could be sustained with the 2-year remaining period of the UNIDO-GEF project. However, efforts are required over the next 2 years to prepare and obtain approval for a project funded with donor resources that will need to involve international inputs to transform the market for low and medium temperature process heat applications using CSH systems.

4.1 Corrective actions for the design, implementation, monitoring and evaluation of the project

88. *Action 1 (to MNRE and UNDP): To improve design of these projects, project preparations should include realistic targets for GHG emission reduction estimates that reflect:*

- few if any emission reductions in the early years to account for raising awareness amongst potential investors, identification of interested investors, and arranging the financing and implementation of pilot or demonstration projects; and
- increasing levels of GHG emission reductions towards the latter part of the project when awareness and knowledge levels and capacity of stakeholders has been strengthened, investments into GHG emission reduction technologies are realized, and GHG emission reductions are actually generated.

4.2 Actions to follow up or reinforce initial benefits from the project

89. *Action 2 (to MNRE). Seek required resources to continue supporting the various public platforms that disseminate information and technical assistance on CSH technologies.* Financial resources are required for the continuation of the STFI helpline, operation and maintenance of the website on CSH technologies with its e-newsletters and magazine. Disruptions in the operations of the STFI helpline and website would only blunt momentum of the Project in building confidence in prospective investors into solar concentrating technologies.

90. *Action 3 (to MNRE). Provide further support from either MNRE or donors for additional testing equipment at the 2 CSH testing laboratories in Pune and Gurgaon.* The current inventory of equipment at these testing laboratories will need to be upgraded to ensure these laboratories can support the testing of CSH equipment according to best international practices.

91. *Action 4 (to MNRE). Issue performance-based subsidies on the basis of performance monitoring data and benchmarking of existing systems with NISE.* The present subsidy norms are only based on the square meter area of solar concentrating collectors installed. The outcome of this criteria has been the promotion of systems with shorter payback periods where higher subsidies are received for larger installations, irrespective of its performance efficiency. This results in financial assistance to inefficient systems. With the Project having supported online and off-line monitoring systems for different CSH technologies for a wide range of applications, operational field performance data is now available to evolve performance-based benchmarks for different CSH technologies that can be used to remove this subsidy distortion. The evaluation has been informed that MNRE has developed a discussion paper around this issue. The evaluation wants to mention the importance of addressing this issue of performance-based financial assistance which can be easily resolved from the analysis of performance monitoring data available with NISE. In addition, performance-based financial assistance for CSH systems will incentivize local CSH manufacturers to improve the performance of their manufactured equipment creating demand for international inputs into the Indian CSH industry (see Actions 6 and 7);

92. *Action 5 (to MNRE). Follow-up on the development of over 800 potential CSH projects that were identified by this Project*. Follow-up should include energy audits of these potential projects, and identification of potential and appropriate CSH technologies that may be available in India over the next 5 years (see Action 6 regarding the need for foreign technical assistance to improve the efficiencies of CSH equipment currently available in India). This would include CSH technologies that have significantly higher efficiencies resulting from expected foreign partnerships between domestic and foreign CSH equipment manufacturers.

4.3 Proposals for future directions underlining main objectives

93. *Action 6 (to Government of India, specifically MNRE): Capitalize on the outputs of CSH Project to sustain CSH market transformation and develop India as a global leader in CSH technologies*. There should be a vision developed of the Indian CSH industry transforming itself to manufacture reliable and durable and high-quality CSH equipment. The impact of such an effort will likely reduce production costs and make Indian CSH equipment financially viable for its users, notably the industrial sector. Activities to be undertaken would include:

- Promoting CSH as an industry through:
  - focusing on developing Indian CSH manufacturing towards being a global hub to cater other developing countries (who are members of the International Solar Alliance or ISA) to help them harness solar process heat potential;

  - helping CSH manufacturers to explore global market through ISA Secretariat and promoting CSH products made in India;
  - encouraging foreign partnerships with local CSH companies;
  - developing professionals to serve as owner's engineer to provide potential users with impartial advice (and serving as a systems integrator) on the best CSH equipment to deploy at a particular location or application for optimal energy performance;
- Financing the evolution of the CSH industry through:
  - creating a favourable business environment for energy performance contracting, the impact of which will force CSH businesses to self-improve. Creation of this favourable business environment would include partial performance guarantee funds to encourage ESCOs that some of their risks would be covered with government funds;
  - providing soft financial support to CSH manufacturers to finance the upgrading of enhanced CSH production lines that meet international standards;
  - inclusion of process heat with mandatory targets set for solar through renewable energy purchase obligations or RPOs for issue of certificates such as REC or ESCerts (in PAT) for quantum of process heat generated through CSH;
  - continuing financial support to support CSH industry's transition towards improved efficiency of CSH equipment produced in India by:
    - transitioning current support into performance-based subsidies or loans as a follow-up to Action 4 (e.g. actual rating of CSH system, penalty for non-performance as per rating, use of high efficiency materials such as glass mirrors);
    - providing soft loan support for the purchase of higher efficiency CST manufacturing equipment;
    - targeting subsidy for other key items such as storage and innovative components instead of subsidy for reflectors alone;
- Continuing the strengthening of operational support for testing centres for CSH equipment through:
  - NABL-accrediting of all test centers;
  - provision of mobile testing facilities for periodic post-commissioning performance;
  - provision of component testing equipment;
  - provision of equipment for long-term durability testing;
  - enabling the periodic testing of suppliers to monitor performance consistency of rated system;
  - training of test center personnel;
- Technician training on higher precision manufacturing methods for CSH equipment. This can be achieved through stronger linkages with Skill India or Surya Mitra mission;
- Vendor and technology neutral tendering. Without neutral tendering, users may not be able to source the most cost-effective CSH solutions for their businesses;
- Introduce system efficiency rating system for various CSH systems in addition to benchmarking;
- Develop Standard Operating Procedures (SOP) for owners and operators of CSH systems for the purposes of proper CSH testing, performance monitoring, system installation and commissioning.

94. *Action 7 (to UNIDO-GEF): Leverage CSH Project outputs[28] for the remaining 2 years of the UNIDO project to assist the CSH industry in India to become a global leader*. Some areas of focus for the UNIDO project can include:

[28] This would include: a) awareness raising products (website, magazine, newsletters, videos and helpline); b) 4 BIS standards for CSH technologies (2 near completion and 2 in pipeline); c) 33 CSH manufacturers out of which 15 are Channel partners; d) 250 installed CSH systems (consisting of 6 technologies, various industrial applications and on-line performance monitoring

- modernization of CSH manufacturing lines;
- manufacturing in India of key components that are imported (e.g. reflectors);
- support for financial products (e.g. soft loans for modernization of manufacturing facilities);
- improving workmanship of CSH products through Skill India or Surya Mitra mission;
- developing and implementing labels for the branding of CSH systems to increase confidence in reliability and durability.

95. *Action 8 (to Government of India, specifically MNRE): Based on the recommendations in Action 6, the following activities should be undertaken to ensure continued long-term support for the evolution of India's CSH industry:*

- Commence preparation of a DPR in early 2018 to support the CSH industry modernization, a project that would commence in 2020. The rationale for this recommended activity is that CSH industry modernization in India may take longer than 2.5 years, after which the UNIDO-GEF Project will have exhausted its resources;
- Make available DNI charts for various locations in different climatic zone. The rationale for this recommended activity is to help investors and end-users make informed decision for technology selection to suit their needs.

4.4 Best and worst practices in addressing issues relating to relevance, performance and success

96. *Best practice: The CSH Project was managed by a highly qualified professional specializing in concentrated solar technologies who also possessed excellent managerial and interpersonal skills*. The CSH Project was truly fortunate to have had the services of this Project manager throughout the entire duration of the Project.

97. *Best practice: A well prepared and designed project is essential to achieve its objectives.* In the case of the CSH Project, a clear and concise project document with clear activities and targets allowed the PMU to efficiently implement a successful project that demonstrated the viability of CSH technologies for industrial and social cooking activities. Furthermore, the successful completion of other soft activities (such as training with specialized solar institutes in India, and workshops amongst government, manufacturers and end-users ideas on improving the CSH industry in India, and exploring innovative financial mechanisms for further CSH deployment) was key to providing continued interest in CSH technologies for various applications in India.

98. *Best practice: The Project demonstrated excellent skills at forming effective partnership arrangements with a wide range of stakeholder to successfully demonstrate CSH viability in India for industrial and social applications.* The Project effectively engaged other government agencies (such as BIS), research institutes (NISE), consulting firms, academia (University of Pune), CSH manufacturers and suppliers in India, and several CSH users from over 127 industrial entities and educational institutes throughout India. The volume of stakeholders engaged on this Project is impressive, with the appropriate personalities of the PMU being able to facilitate these partnerships.

data); e) National and regional CSH testing centers; f) Trained technicians; g) 4 ESCO projects; h) 5 financial institutions ready for financing CST investments; and i) Inventory of 800 potential CSH investments.

99. *Poor practice: Project designers should be cognizant of the number of outcomes and indicators within a Project Planning Matrix to ensure that Project Management personnel will be able to provide effective monitoring efforts.* While this Project's PRF did provide a number of SMART indicators for monitoring, the CSH Project simply had too many indicators which created extra work for PMU personnel. The PRF could have reduced the number of indicators through:

- Eliminating outcome-level indicators;
- Eliminating indicators that have marginal relevance towards achievement of intended outcomes;
- Eliminating indicators that have similarities with other indicators in the PRF; and
- A request from the PMU to a Regional Technical Advisor to formally reduce the number of Component-level indicators.

APPENDIX A – MISSION TERMS OF REFERENCE FOR CSH PROJECT TERMINAL EVALUATION

INTRODUCTION

In accordance with UNDP and GEF M&E policies and procedures, all full and medium-sized UNDP support GEF financed projects are required to undergo a terminal evaluation upon completion of implementation. These terms of reference (TOR) sets out the expectations for a Terminal Evaluation (TE) of the *Market development and Promotion of Solar Concentrator based Process Heat Applications in India – CSH India (Concentrating Solar Heat Applications*) (PIMS 4284)

The essentials of the project to be evaluated are as follows:

- **PROJECT SUMMARY TABLE**

Project Title:	**CSH India (Concentrating Solar Heat Applications)**			
GEF Project ID:	77828 (GEF PMIS ID)		at endorsement (million US$)	at completion (million US$)
UNDP Project ID:	4284 (UNDP PIMS ID) 61446 (Atlas ID)	GEF financing:	4.400	
Country:	India	IA/EA own:		
Region:	Asia Pacific	Government (Grand subsidy) (MNRE in kind):	6.000 1.350	
Focal Area:	Climate Change GEF-4	Other: Industries in cash Financial Institutions	6.000 6.000	
FA Objectives, (OP/SP):	SP-3 GEF-4	Total co- financing:	19.350	
Executing Agency:	Ministry of New and Renewable Energy Resources (MNRE)	Total Project Cost:	23.750	
Other Partners involved:		ProDoc Signature (date project began): actual		August 2011 (28 March 2012)
		(Operational) Closing Date:	Proposed: July 2016	Actual: September 2017

Objective and Scope

The overall goal of this GEF-UNDP-MNRE project is the reduction of GHG emissions from low and medium temperature process heat applications in India through the use of CSH systems. The project objective is increased use and promotion of CSH systems for low and medium temperature process heat applications, which was envisaged to be achieved by the integrated removal of the key barriers that prevent the wider adoption of CSH technologies in India. The project was designed so as to complement the ongoing effort of MNRE to promote the use of Solar Concentrators for process heat applications by overcoming various identified existing barriers (in technology, awareness, capacity, market and financial) so as to enable it to position the Indian CSH industry for further on-going sustained growth after the end of this project. The main objective was to increase the use and promotion of CSH systems for low and medium temperature process heat applications. The overall project objective was to reduce the GHG emission reduction of the order of

32,900 tCO2 equivalent through technical support for setting up demonstration and replication projects cumulating to 45,000 m2 collector area. This was envisaged to be achieved by tripling the annual sales to 15,000 m2 per year during the project period of five years i.e. by 2017 across India.

The four key envisaged outcomes form the project were

(i) Technical capacity development,
(ii) Awareness enhancement and capacity building,
(iii) Pilot demonstration of CSH technologies for various applications and
(iv) Sustainable financial approach in the adoption of CSH technologies and applications.

The major components along with planned work activities and expected outcomes of the project are described in brief in the following section.

- **Component 1: Technical capacity development**

The activities under this component focused on developing the needed understanding and technology capacity about CSH technologies, systems and its various applications for low temperature process needs in small scale industries in India so as to enable the envisaged growth of deployment of CSH systems across the country. Outcome of the component this addresses the need to develop a better understanding of the five main solar concentrator technologies, the performance of existing installations, markets for CSH in India; and development of technology application information packages.

Various outcomes and sub activities to achieve the same under this component are as follows:

- Enhanced understanding of CSH technologies, applications and markets
  - Performance assessment of existing installations
  - Technology assessment of CSH technologies
  - Market assessment for solar process heat applications
- Development of technology application information Packages
  - Performance assessment of existing installations
  - Technology assessment of CSH technologies
  - Market assessment for solar process heat applications
  - Development of technology application information packages
- Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance through development of CSH performance standards and technology specifications
  - Development of performance measurement standards, test protocols, and minimum performance norms for CSH applications
  - Development of field performance monitoring guidelines for CSH end-use applications
  - Development of specifications for materials/ components/systems for CSH applications
  - Completion of the process for consideration and adoption as draft national standards by BIS
  - Completion of the process for standards and specifications adoption as international standards by ISO
- Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions for developing CSH system components and establishing equipment testing facilities
  - "Proof-of-concept" testing of new technologies at SEC
  - Establishment of a national testing facility for CSH technologies and applications at SEC
  - Strengthening of one regional testing facility for CSH technologies and applications

- **Component 2: Awareness enhancement and capacity building**

This component mainly deals with the awareness creation and capacity building of key CSH stakeholders for the promotion of CSH technologies for process heat applications in India. The objective is to overcome the identified barrier of lack of awareness amongst potential user segments, limited technical ability at the end user level to properly operate and maintain CSH systems, and a shortage of trained technical and scientific manpower to serve the CSH industry.

Various outcomes and sub activities to achieve the same under this component are as follows:

- Trained manufacturers/vendors, installers and CSH users
  - Training needs assessment
  - Development of training programmes and materials for different stakeholders
  - Organization and conduct of training programmes
  - Organization and conduct of an international study tour
- More trained technical consultants that provide technical services to both CSH system components & equipment manufacturers and user
  - Development of training programme and material
  - Organization and conduct of 4 training programmes
- Established and supported industry academic partnership through research programmes to build future technical capacities
  - Design and implementation of an academic program involving courses and applied research of CSH technologies.
- Trained staff at SEC and staff at regional testing center
  - Organization and conduct of international training programme on testing
  - Organization and conduct of national training programmes on testing
- Completed awareness enhancement programmes for policy makers, academicians, industries, financial institutions, etc. to facilitate replications
  - Organization and conduct of International CSH conference and exhibition in year 2 and 4.
  - Organization and conduct of awareness programmes (20 numbers)
- Completed promotional campaign for CSH
  - Design and publication of advertisements in industrial magazines, design and display of hoardings in industrial clusters, participation in industrial exhibitions and trade fairs
- Established Concentrating Solar Heat Technology Platform and is operational
  - CSH Technology Platform formation and facilitation
- Documentations on the project outputs, case studies, best practices and lessons learnt disseminated to ensure larger replication
  - Design, launching and operation of project website
  - Publication of quarterly project newsletter
  - Production and publication of brochures, case study reports, and a compendium that includes process documentation and project results

- **Component 3: Pilot demonstration of CSH technologies for various applications**
  - Increased number of commercial and near-commercial CSH technologies for diversity of applications
  - Completed feasibility studies for demonstration and replication projects of various CSH technology applications
    - Conduct of the feasibility studies and approval of applications for support for completed feasibility studies
  - Completed Detailed Project Reports (DPRs) for demonstration projects
    - Preparation of DPRs and approval of applications for support for completed DPR
  - Developed and commissioned demonstration projects in at least 5 sectors
    - Installation and commissioning of demonstration projects
    - Conduct of continuous performance monitoring of commissioned and operational demonstration projects for at least one month
  - Results of the performance monitoring, analysis, and evaluation for demonstration projects
    - Performance monitoring and analysis of demonstration projects
    - Evaluation of demonstration projects
  - Improved technical and economic performance of commercial and near-commercial CSH technologies in an increased diversity of applications
    - Documentation of results of demonstration and replication projects
      - Development and maintenance of CSH projects database
      - Preparation of case studies
    - Completed performance monitoring, analysis and overall evaluation for demonstration and replication projects
      - Set the criteria for selection and approval of applications for support of replication projects

- Installation and commissioning of replication projects
- Performance monitoring and analysis of replication projects
- Conduct of the overall evaluation of demo and replication projects

- **Component 4: Sustainable financial approach in the adoption of CSH technologies and applications in India**
  - Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks
    - Documented financial viability of CSH technologies, applications, and mitigation approaches of investment risks
      - Analysis of financial viability of CSH technologies and applications, and comparative evaluation with alternative or competing solutions such as biomass energy or energyefficiency
      - Assessment of alternative financial options for mitigation of investment risks
  - Promulgation of favourable financial policies that promote increased use and promotion of CSH technologies for low and medium temperature process heat applications
    - Formulated recommendations for financial and promotional policies and strategies for adoption by Government of India
      - Assessment and recommendations for policies on financial incentives, schemes and mechanisms

The TE will be conducted according to the guidance, rules and procedures established by UNDP and GEF as reflected in the UNDP Evaluation Guidance for GEF Financed Projects.

The objectives of the evaluation are to assess the achievement of project results, and to draw lessons that can both improve the sustainability of benefits from this project, and aid in the overall enhancement of UNDP programming.

- **EVALUATION APPROACH AND METHOD**

An overall approach and method[29] for conducting project terminal evaluations of UNDP supported GEF financed projects have developed over time. The evaluation should include a mixed methodology of document review, interviews, and observations from project site visits, at minimum, and the evaluators should make an effort to triangulate information. The evaluator is expected to frame the evaluation effort using the criteria of **relevance, effectiveness, efficiency, sustainability, and impact,** as defined and explained in the UNDP Guidance for Conducting Terminal Evaluations of UNDP-supported, GEF-financed Projects. The international consultant will be the team leader and coordinate the evaluation process to ensure quality of the report and its timely submission. The national consultant will provide supportive roles both in terms of professional back up, translation etc. The evaluation team is expected to become well versed as to the project objectives, historical developments, institutional and management mechanisms, activities and status of accomplishments. Information will be gathered through document review, group and individual interviews and site visits.

A set of questions covering each of these criteria have been drafted and are included in Appendix G. The evaluator is expected to amend, complete and submit this matrix as part of an evaluation inception report, and shall include it as an annex to the final report.

The evaluation must provide evidence-based information that is credible, reliable and useful. The evaluator is expected to follow a participatory and consultative approach ensuring close engagement with government counterparts, in particular the GEF operational focal point, UNDP Country Office, project team, UNDP GEF Technical Adviser based in the region and key stakeholders. The evaluator is expected to conduct a field mission to various project stakeholder locations including the following project field sites viz. New Delhi, Gurgaon, Pune, Chennai and Bangalore etc. Interviews will be held with the following organizations and individuals at a minimum but not limited to:

- Relevant personnel at UNDP Country Office in New Delhi, India and Program Officer in-charge of the Project

[29] For additional information on methods, see the Handbook on Planning, Monitoring and Evaluating for Development Results, Chapter 7, pg. 163

- National Project Director (NPD)
- National Project Coordinator (NPC)
- Project Management Unit (PMU)
- Relevant project stakeholders like RTA – UNDP BKK, NISE, BIS, STEFI, BEE, MoEFCC, SNAs, UNIDO, former NPD, consultants like PwC, IT Power, APITCO, etc.

The evaluator will review all relevant sources of information, such as the project document, mid-term review (MTR) report, project reports – including Annual APR/PIR, project budget revisions, midterm review, progress reports, GEF focal area tracking tools, project files, national strategic and legal documents, and any other materials that the evaluator considers useful for this evidence-based assessment. A list of documents that the project team will provide to the evaluator for review is included in Appendix D.

• EVALUATION CRITERIA & RATINGS

An assessment of project performance will be carried out, based against expectations set out in the Project Logical Framework/Results Framework (see Appendix F), which provides performance and impact indicators for project implementation along with their corresponding means of verification. The evaluation will at a minimum cover the criteria of: **relevance, effectiveness, efficiency, sustainability and impact.** Ratings must be provided on the following performance criteria. The completed table must be included in the evaluation executive summary.

Evaluation Ratings:			
1. Monitoring and Evaluation	***rating***	**2. IA& EA Execution**	***rating***
M&E design at entry		Quality of UNDP Implementation (IA)	
M&E Plan Implementation		Quality of Execution - Executing Agency (EA)	
Overall quality of M&E		Overall quality of Implementation / Execution	
3. Assessment of Outcomes	**rating**	**4. Sustainability**	**rating**
Relevance		Financial resources:	
Effectiveness		Socio-political:	
Efficiency		Institutional framework and governance:	
Overall Project Outcome Rating		Environmental:	
		Overall likelihood of sustainability:	

• PROJECT FINANCE / COFINANCE

The Evaluation will assess the key financial aspects of the project, including the extent of co-financing planned and realized. Project cost and funding data will be required, including annual expenditures. Variances between planned and actual expenditures will need to be assessed and explained. Results from recent financial audits, as available, should be taken into consideration. The evaluator(s) will receive assistance from the Country Office (CO) and Project Team to obtain financial data in order to complete the co-financing table below, which will be included in the terminal evaluation report.

Co-financing (type/source)	UNDP own financing (mill. US$)		Government (mill. US$)		Partner Agency (mill. US$)		Total (mill. US$)	
	Planned	Actual	Planned	Actual	Planned	Actual	Planned	Actual
Grants								
Loans/Concessions								
• In-kind support								
• Other								
Totals								

• MAINSTREAMING

UNDP supported GEF financed projects are key components in UNDP country programming, as well as regional and global programmes. The evaluation will assess the extent to which the project was successfully mainstreamed with other UNDP priorities, including poverty alleviation, improved governance, the prevention and recovery from natural disasters, and gender. The evaluation will examine this project's contribution to the United Nations Development Assistance Framework (UNDAF).

- **IMPACT**

The evaluator will assess the extent to which the project is achieving impacts or progressing towards the achievement of impacts. Key findings that should be brought out in the evaluations include whether the project has demonstrated: a) verifiable improvements in ecological status, b) verifiable reductions in stress on ecological systems, and/or c) demonstrated progress towards these impact achievements[30].

- **CONCLUSIONS, RECOMMENDATIONS & LESSONS**

The evaluation report must include a chapter providing a set of **conclusions**, **recommendations** and **lessons**. Conclusions should build on findings and be based in evidence. Recommendations should be prioritized, specific, relevant, and targeted, with suggested implementers of the recommendations. Lessons should have wider applicability to other initiatives across the region, the area of intervention, and for the future.

- **IMPLEMENTATION ARRANGEMENTS**

The principal responsibility for managing this evaluation resides with the UNDP CO in (New Delhi). The UNDP CO will contract the evaluators and ensure the timely provision of per diems and travel arrangements within the country for the evaluation team. The Project Team will be responsible for liaising with the Evaluators team to set up stakeholder interviews, arrange field visits, coordinate with the Government etc.

Throughout the period of evaluation, the evaluation team will liaise closely with the Programme Officer/ Adviser/Project Manager, the concerned agencies of the Government, any members of the international team of experts under the project and the counterpart staff assigned to the project. The team can raise or discuss any issue or topic it deems necessary to fulfill its task, the team, however, is not authorized to make any commitments to any part on behalf of UNDP/GEF or the Government.

Logistics

The evaluation team will conduct a mission visit to New Delhi and selected project sites, to meet with relevant project stakeholders. This visit will also include meetings with the officials of UNDP, the Implementing Partner, stakeholders from other institutions and ministries related to the project.

After the initial briefing by UNDP CO, the review team will meet with the National Project Director (NPD), National Project Coordinator (NPC) and the GEF Operational Focal Point as required.

- **EVALUATION TIMEFRAME**

The total duration of the evaluation will be 30 working days according to the following plan:

Activity	Timing	Completion Date
Preparation	3 days	1 September 2017
Evaluation Mission	10 days	11- 20 September 2017
Draft Evaluation Report	12 days	5 October 2017
Final Report	5 days	25 October 2017

- **EVALUATION DELIVERABLES**

The evaluation team is expected to deliver the following:

Deliverable	Content	Timing	Responsibilities
Inception Report	Evaluator provides clarifications on timing and method	No later than 2 weeks before the evaluation mission.	Evaluator submits to UNDP CO
Presentation	Initial Findings	End of evaluation mission	To project management, UNDP CO
Draft Final Report	Full report, (per annexed template) with annexes	Within 2 weeks of the evaluation mission	Sent to CO, reviewed by RTA, PCU, GEF OFPs
Final Report	Revised report	Within 1 week of receiving UNDP comments on draft	Sent to CO for uploading to UNDP ERC.

[30] A useful tool for gauging progress to impact is the Review of Outcomes to Impacts (ROtI) method developed by the GEF Evaluation Office: ROTI Handbook 2009

When submitting the final evaluation report, the evaluator is required also to provide an 'audit trail', detailing how all received comments have (and have not) been addressed in the final evaluation report. See Annex I for an audit trail template.

• TEAM COMPOSITION

The evaluation team will be composed of 2 consultants *(1 international /1 national evaluators).* The international consultant will be designated as the Team Leader and will be responsible for finalizing the report. The consultants shall have prior experience in evaluating similar projects. Experience with GEF financed projects is an advantage. The evaluators selected should not have participated in the project preparation and/or implementation and should not have conflict of interest with project related activities.

The International Consultant (Team Leader) must present the following qualifications and professional background:

Years of experience

• Professional background in project evaluations of renewable energy, solar energy and climate change mitigation projects is essential. Experience in evaluating projects on renewable energy, solar energy, specifically in the concentrating solar and solar thermal sector is desirable. A minimum of 15 years of relevant experience in monitoring and evaluating donor driven projects (preferably GEF, World Bank, or UN);

Competencies*:*

- Highly knowledgeable of participatory monitoring, review and evaluation processes, and experience in review and evaluation of technical assistance projects with major donor agencies;
- Familiar with solar energy policies, solar concentrator and solar thermal technologies and projects through management and / or implementation or through consultancies in review and evaluation of donor funded projects;
- Understanding of CO2 emission reduction calculations (including IPCC, GEF procedure and implementation of its recommendations that contribute to global benefits;
- Familiar with GEF rules, regulations and project reviews and evaluations;
- Demonstrated ability to assess complex situations, succinctly, distil critical issues, and draw forward-looking conclusions and recommendations;
- Ability and experience to lead multi-disciplinary and national teams, and deliver quality reports within the given time;
- Writing and communication will be in English, and he/she must have excellent communication skills in English. The consultant must bring his/her own computer/ laptop and related equipment.

The evaluation team shall conduct debriefing for the UNDP Country Office, NPD, NPC, Project Management Unit and UNDP BRH, in India towards the end of the evaluation mission. The international consultant shall lead presentation of the draft review findings, creating the recommendations, and shall lead the drafting and finalization of the terminal evaluation.

Note: Candidates meeting minimum qualification and experience as stated above will get 70% marks, additional marks will be awarded for additional expertise.

• EVALUATOR ETHICS

Evaluation consultants will be held to the highest ethical standards and are required to sign a Code of Conduct (Annex E) upon acceptance of the assignment. UNDP evaluations are conducted in accordance with the principles outlined in the UNEG 'Ethical Guidelines for Evaluations'

PAYMENT MODALITIES AND SPECIFICATIONS

%	Milestone
10%	Following submission and approval of the TE inception report
30%	Following submission and approval of the 1ST draft terminal evaluation report
60%	Following submission and approval (UNDP-CO and UNDP RTA) of the final terminal evaluation report

APPLICATION PROCESS

Applicants are requested to apply online only. Individual consultants are invited to submit applications together with their CV for these positions. The application should contain a current and complete C.V. in English with indication of the e-mail and phone contact. Shortlisted candidates will be requested to submit a price offer indicating the total cost of the assignment (including daily fee, per diem and travel costs).

UNDP applies a fair and transparent selection process that will take into account the competencies/skills of the applicants as well as their financial proposals. Qualified women and members of social minorities are encouraged to apply.

- ## EVALUATION CRITERIA

Cumulative analysis

The award of the contract shall be made to the individual consultant whose offer has been evaluated and determined as:

- Responsive.

Having received the highest score out of a pre-determined set of weighted technical and financial criteria specific to the solicitation.

Only candidates obtaining a minimum of 49 points (70% of the total technical points) would be considered for the Financial Evaluation.

- Technical Criteria weight - 70%;
- Financial Criteria weight - 30%.

Evaluation Criteria:

- Qualification of the Consultant: 20 Marks;
- Relevant work Experience: 30 Marks;
- Proposed Work Plan for undertaking the task: 15 Marks;
- Time Line for completion of the Task: 5 Marks.

- **Annexes to the TOR**
  - Annex 1: Offeror's Letter to UNDP Confirming Interest and Availability for the Individual Contractor Assignment
  - Annex 2: General Terms and Conditions for ICs (in separate document)
  - Annex 3: P-11 form for ICs (in separate document)

Above documents can be found 'Forms and Documentation for Individual Contractor' column in career section. Please find link below:
http://www.in.undp.org/content/india/en/home/operations/careers/

- **Documents to be submitted by Consultants**
  - Offeror's Letter to UNDP Confirming Interest and Availability for the Individual Contractor Assignment
  - Updated and signed P-11 form for ICs
  - Proposed work methodology with timeline
  - Updated CV with contact details of three references.

Please note following components have to be covered while giving financial proposal:

- Per day consultancy fee;
- Rates for one flight ticket for Home station-New Delhi-Home station, please note it has to be economy class only.

Notes:

- Any kind of miscellaneous charges i.e. internet, phone etc. would not be reimbursed;
- Individuals working with institutions may also apply, contract would be issued in the name of institution for the specific services of individual;
- Please note proposals without financial proposal will not be considered;
- CV, Financial proposal and proposed work plan can be clubbed in one file for uploading;
- The consultants must bring his/her own computing equipment

APPENDIX B – MISSION ITINERARY (FOR OCTOBER AND NOVEMBER 2017)

#	Activity	Stakeholder involved	Place
October 25, 2017 (Wednesday)			
	Arrival of Roland Wong in New Delhi		
October 26, 2017 (Thursday)			
1	Evaluation kick-off meeting with Dr. S.N. Srinivas	UNDP India	New Delhi
2	Meeting with Dr A.K. Singhal, NPM of CSH Project	MNRE	New Delhi
3	Meeting with Mr. Shirish Garu	TERI	New Delhi
	Travel by air to Pune		
October 27, 2017 (Friday)			
4	Visit to Regional CSH Testing Facility at Center for Energy Studies, Pune University	Pune University	Pune
5	Meeting with Mr Jaideep Malaviya	STFI	Pune
	Travel by air to Hyderabad		
October 28, 2017 (Saturday)			
6	Visit to CSH installation for steam production	Unique Biotech	Hyderabad
7	Visit to CSH installation for building air conditioning	Honeywell	Hyderabad
	Travel by air to Chennai		
October 29, 2017 (Sunday)			
8	Visit to CSH installation for institutional cooking with storage and 24/7 operation	R K Mission	Chennai
	Travel by road to Salem		
October 30, 2017 (Monday)			
9	Visit to CSH installation for dairy process heat application	Hatsun Agro	Salem
	Travel to Chennai by road and back to Delhi by air		
October 31, 2017 (Tuesday)			
10	Visit to CSH Installation Dairy process heat application with online monitoring	Mother Dairy	New Delhi
11	Telephone call with Mr. S. Malik	Megawatt Solutions	New Delhi

#	Activity	Stakeholder involved	Place
12	Telephone call with Mr. Abhishek	Arun Solar	New Delhi
13	Meeting with Dr Anil Mishra, NPM-CSH UNIDO program	UNIDO India	New Delhi
November 1, 2017 (Wednesday)			
14	Visit to National CSH testing facility	NISE	Gurugram
15	Visit to CSH installation for building air conditioning	Padmini VNT Mechtronics	Gurugram
November 2, 2017 (Thursday)			
16	Meeting with Dr. A. K. Singhal, NPM	MNRE	New Delhi
17	Meeting with Mr. Vibhash Garg at UNDP	PWC, Gurugram	New Delhi
18	Meeting with Dr. Preeti Soni	UNDP India	New Delhi
19	Skype call with Dr Akansha Chaurey	IT Power India	New Delhi
November 3, 2017 (Friday)			
20	Meeting with Dr Usha Rao, RTA, UNDP Bangkok	UNDP India	New Delhi
21	Presentation on mission findings in PEC meeting at MNRE	MNRE	New Delhi
November 4, 2017 (Saturday)			
	Departure of Mr. Roland Wong from mission		

Total number of meetings conducted: 21

APPENDIX C – LIST OF PERSONS INTERVIEWED

This is a listing of persons contacted in New Delhi, Maharashtra, Telangana, Haryana, and Tamil Nadu (unless otherwise noted) during the Terminal Evaluation Period only. The Evaluation Team regrets any omissions to this list.

1. Sh. J. N. Swain, Joint Secretary, MNRE & NPD – CSH India;
2. Sh. S. K. Singh, Adviser, MNRE, NISE and his support team;
3. Dr. R. P. Goswami, Director (CST), MNRE;
4. Sh. I. P. Singh, Director (ST), MNRE;
5. Sh. K. G. Suresh Kumar, US (F), MNRE;
6. Dr A. K. Singhal, NPM, CSH Project, MNRE;
7. Sh. Som Pal, General Manager, IREDA;
8. Dr. Usha Rao, Regional Technical Advisor, UNDP Bangkok;
9. Dr. Preeti Soni, Energy and Environment Cluster Lead, UNDP India;
10. Dr. S. N. Srinivas, Programme Officer, UNDP India;
11. Mr. Shirish Garud, Director, TERI;
12. Prof. S. R. Jadkar, Head, Center of Energy Studies, Pune University;
13. Dr. (Mrs) Anagha Pathak, Center of Energy Studies, Pune University;
14. Mr. Jaideep Malviya, General Secretary, STFI, Pune;
15. Mr. Jawahar Babu, Director, Unique Biotech, Hyderabad;
16. Mr. Arvind Mamidi, Manger, Honeywell, Hyderabad;
17. Mr. Chandrasekaran, R K Mission, Chennai;
18. Dr. C. Palaniappan, Sunbest, Theni;
19. Mr. Muthusami and operational personnel from Hatsun Agro, Salem;
20. Mr. Tapomay Saha, GM, Mother Dairy, New Delhi;
21. Dr Akanksha Chaurey, CEO & Director, IT Power India, New Delhi;

22. Mr Vibhash Garg, Director, PWC, Gurugram;
23. Mr. S. K. Pandey, Padmini VNA Mechtronics (P) Ltd, Gurugram;
24. Mr. S. Malik, Megawatt Solutions, Noida;
25. Mr. Abhishek, Arun Solar (Clique Solar), Bangalore.

APPENDIX D – LIST OF DOCUMENTS REVIEWED

1. UNDP Project Document for the "Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India (India CSH), April 2006;

2. UNDP-GEF Mid-Term Review Report for the CSH India Project, March 2015;

3. UNDP-GEF PIRs for CSH India Project from 2013 to 2017;

4. UNDP-GEF AWPs for CSH India Project from 2012 to 2017;

5. CSH India Project Inception Workshop report (May 2012);

6. Report "Development of Performance Measuring Standards, Test Procedures and Test Protocols for Concentrating Solar Technologies (CSTs) to be Used for Process Heat Applications" (University of Pune; GK Energy Marketers Ltd; Thermax India Ltd; Aksons Solar Equip. Ltd; Oct 2013);

7. Report "Independent Technology Assessment and Performance Evaluation of Concentrating Solar Technologies (CSTs) based Systems for Community Cooking, Process Heat, and Cooling Applications by EcoAxis Systems Pvt. Ltd., Oct 2014);

8. Report "Development of Skilled Manpower for Operation, Maintenance & troubleshooting of CST Based System for various Process Heat applications" (Anthropower, Nov 2014);

9. Reports on Material and Component Specifications of CST Technologies by IT Power India
   - Fresnel Reflector Based Dish with Moving Focus (Arun);
   - Fixed Focus Automatically Tracked Elliptical Dish (Scheffler);
   - Dual Axis Tracked Paraboloid Dish;
   - Single Axis Tracked Parabolic Trough;
   - Non-Imaging Concentrator;
   - Linear Fresnel Reflector.

10. Preliminary Reports on Possible Installation of CST based Projects in selected States of the country for Central - Southern Region by TERI (January 2016);

11. Preliminary Reports on Possible CST Installation North Western Region by MPEN (January 2016);

12. Training Manuals in English and Hindi by Anthro Power:
    - ARUN Dish Operations & Maintenance Manual
    - Linear Fresnel Reflector Operations & Maintenance Manual
    - Paraboloid Dish based Solar System Operations & Maintenance Manual
    - Non-Imaging Concentrator Operations & Maintenance Manual
    - Parabolic Trough Operations & Maintenance Manual
    - Scheffler Dish Operations & Maintenance Manual

13. "Compendium on CSH Project for Community Cooking, Process Heat and Cooling Applications" (APITCO, Ltd);

14. "Market development of CSTs for Community Cooking / Cooling Applications in Institutional and Religious Sectors" (Ajay Chandak; Suman Foundation);

15. "Pre-feasibility Report, Siddarth Surgicals, Valsad, Gujarat" (PwC, Nov 2013);

16. "Process Mapping of Chemical Sector for CST Intervention" (PwC, Nov 2014);

17. "Report on Assessment of CST in India" (EcoAxis Systems Pvt Ltd; Oct 2014);

18. "Report on the Status of 20 CST Installations" (EcoAxis Systems Pvt Ltd; May 2014);

19. "Report on the Status of Instrumentation at 15 CST Installations" (EcoAxis Systems Pvt Ltd; May 2014);

20. "Report on Assessment of Facilities of CST Manufacturers" (EcoAxis Systems Pvt Ltd; May 2014);

21. "Utility of Performance Monitoring of CST Systems to Various Stakeholders" (EcoAxis Systems Pvt Ltd; Oct 2014);

22. Information packages and info available at CSH India website for various Concentrating Solar Technologies for Medium and High Temperature Application (prepared by ExoAxis for MNRE under UNDP-GEF Project):
    - Fixed Focus Elleptical Solar Dish (Scheffler)
    - Fresnel Reflector Based Dish
    - Linear Fresnel Concentrator
    - Non-Imaging Concentrator
    - Parabolic Through Concentrator
    - Paraboloid dish

23. Various case studies developed under the CSH India project:
    - Cooking applications:
        - A Case Study on Shirdi Solar Steam Cooking System by WISE
        - Use of ARUN 100 Solar Concentrator for Community Cooking at Akshardham Temple Delhi by Prince, Suman Foundation
        - Use of Scheffler Solar Concentrators for Community Cooking at JNV, Leh by Prince, Suman Foundation
        - Use of Scheffler Solar Concentrators for Community Cooking at SRM University Chennai by Prince, Suman Foundation
        - Using Scheffler Solar Concentrators for community cooking at S.V. School Vankuva, MuniSeva Ashram, Goraj by Prince, Suman Foundation
    - Process heat applications:
        - Using parabolic trough for phosphating process (SKF Technologies, Mysore) by PWC
        - Using non-imaging concentrator for boiler feed water heating (ITC factory, Bangalore) by PWC
        - A Case Study on Solar Concentrators Installed at Hotel ITC Maurya, New Delhi by WISE
        - Using ARUN dish for washing application (Mahindra Vehicle Manufacturers, Chakan, Pune) by PWC
        - A Case Study on Gajraj Drycleaners, Ahmednagar, for Solar Laundry by WISE
        - Using Scheffler dish for steam pressing (Purple Creations, Baramati, Pune) by PWC

- Cooling applications:
  - Using Scheffler dish for cooking and LPG vaporisation application (Mahindra, Chakan, Pune) by PWC
  - A Case Study on Solar Concentrators Installed at CSM Hospital, Thane by WISE.

APPENDIX E – COMPLETED TRACKING TOOL

Tracking Tool for Climate Change Mitigation Projects (For Terminal Evaluation)

Special Notes: reporting on lifetime emissions avoided

Lifetime direct GHG emissions avoided: Lifetime direct GHG emissions avoided are the emissions reductions attributable to the investments made **during the project's supervised implementation period**, totaled over the respective lifetime of the investments.
Lifetime direct post-project emissions avoided: Lifetime direct post-project emissions avoided are the emissions reductions attributable to the investments made outside the project's supervised implementation period, but supported by financial facilities put in place by the GEF project, totaled over the respective lifetime of the investments. These financial facilities will still be operational after the project ends, such as partial credit guarantee facilities, risk mitigation facilities, or revolving funds.
Lifetime indirect GHG emissions avoided (top-down and bottom-up): indirect emissions reductions are those attributable to the long-term outcomes of the GEF activities that remove barriers, such as capacity building, innovation, catalytic action for replication.
Please refer to the Manual for Calculating GHG Benefits of GEF Projects.

Manual for Energy Efficiency and Renewable Energy Projects
Manual for Transportation Projects

For LULUCF projects, the definitions of "lifetime direct and indirect" apply. Lifetime length is defined to be 20 years, unless a different number of years is deemed appropriate. For emission or removal factors (tonnes of CO2eq per hectare per year), use IPCC defaults or country specific factors.

General Data	Results at Terminal Evaluation	Notes
Project Title	Market Development & Promotion of Solar Concentrator-based Process Heat Applications in India	
GEF ID	4134	
Agency Project ID	4284	
Country	India	
Region	SAR	
GEF Agency	UNDP	
Date of Council/CEO Approval	December 22, 2011	**Month DD, YYYY (e.g., May 12, 2010)**
GEF Grant (US$)	4,400,000	
Date of submission of the tracking tool	January 20, 2018	**Month DD, YYYY (e.g., May 12, 2010)**
Is the project consistent with the priorities identified in National Communications, Technology Needs Assessment, or other Enabling Activities under the UNFCCC?	1	**Yes = 1, No = 0**
Is the project linked to carbon finance?	0	**Yes = 1, No = 0**
Cumulative cofinancing realized (US$)	18,000,000	
Cumulative additional resources mobilized (US$)		**additional resources means beyond the cofinancing committed at CEO endorsement**

Objective 3: Renewable Energy		
Please specify if the project includes any of the following areas		
Heat/thermal energy production	1	Yes = 1, No = 0
On-grid electricity production	0	Yes = 1, No = 0
Off-grid electricity production	0	Yes = 1, No = 0
Policy and regulatory framework	4	0: not an objective/component 1: no policy/regulation/strategy in place 2: policy/regulation/strategy discussed and proposed 3: policy/regulation/strategy proposed but not adopted 4: policy/regulation/strategy adopted but not enforced 5: policy/regulation/strategy enforced
Establishment of financial facilities (e.g., credit lines, risk guarantees, revolving funds)	5	0: not an objective/component 1: no facility in place 2: facilities discussed and proposed 3: facilities proposed but not operationalized/funded 4: facilities operationalized/funded but have no demand 5: facilities operationalized/funded and have sufficient demand
Capacity building	4	0: not an objective/component 1: no capacity built 2: information disseminated/awareness raised 3: training delivered 4: institutional/human capacity strengthened 5: institutional/human capacity utilized and sustained
Installed capacity per technology directly resulting from the project		
Wind		MW
Biomass		MW el (for electricity production)
Biomass		MW th (for thermal energy production)
Geothermal		MW el (for electricity production)
Geothermal		MW th (for thermal energy production)
Hydro		MW
Photovoltaic (solar lighting included)		MW
Solar thermal heat (heating, water, cooling, process)	50.40	MW th (for thermal energy production, 1m² = 0.7kW)
Solar thermal power		MW el (for electricity production)
Marine power (wave, tidal, marine current, osmotic, ocean thermal)		MW
Lifetime energy production per technology directly resulting from the project (IEA unit converter: http://www.iea.org/stats/unit.asp)		
Wind		MWh
Biomass		MWh el (for electricity production)
Biomass		MWh th (for thermal energy production)
Geothermal		MWh el (for electricity production)
Geothermal		MWh th (for thermal energy production)
Hydro		MWh
Photovoltaic (solar lighting included)		MWh
Solar thermal heat (heating, water, cooling, process)		MWh th (for thermal energy production)
Solar thermal power		MWh el (for electricity production)
Marine energy (wave, tidal, marine current, osmotic, ocean thermal)		MWh
Lifetime direct GHG emissions avoided	483,916	tonnes CO2eq (see Special Notes above)
Lifetime direct post-project GHG emissions avoided	-	tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (bottom-up)	44,863	tonnes CO2eq (see Special Notes above)
Lifetime indirect GHG emissions avoided (top-down)	288,107	tonnes CO2eq (see Special Notes above)

Market potential for CSH technologies in India is based on the Jan 2015 report "Capturing Sun for Heat" by Greentech Knowledge Solutions (Pvt) with support from Shakti Sustainable Energy Foundation available on:
http://www.gkspl.in/reports/renewable_reports/Solar%20Thermal%20Roadmap%20for%20India%20(2015-2030).Pdf

On Table 4.6 from the Greentech report, growth under a BAU scenario is provided:

Table 4.6 Cumulative installations of solar technologies in 2032 under BAU scenario

		Installed capacity		Energy delivered
Sector	Solar thermal technology	Collector area/no.	GW	(GWh/year) th
Residential	Solar water heaters	50 million m^2	34.800	22,080
	Solar cookers	0.72 million	0.151	36
Commercial and institutional	Solar water heaters	6.5 million m^2	4.600	3,691
	Solar concentrators	114,300 m^2	0.080	82
Industrial	Solar water heater	2.2 million m^2	1.500	1,217
	Solar concentrators	285,000 m^2	0.200	266
	Solar air heater	85,000 m^2	0.060	73
Agriculture	Solar dryer	19,000 m^2	0.013	16
Total			**41.404**	**27,461 (2.36 Mtoe)**

On Table 4.7 from the Greentech report, growth under an aggressive scenario is provided:

Table 4.7 Cumulative installations of solar technologies in 2032 under aggressive effort scenario

		Installed capacity		Energy delivered
Sector	Solar thermal technology	Collector area/no.	GW	(GWh/year) th
Residential	Solar water heaters	133 million m^2	92.800	58,908
	Solar cookers	1.36 million	0.286	68
Commercial and institutional	Solar water heaters	9.6 million m^2	6.700	5,415
	Solar concentrators	336,100 m^2	0.235	242
Industrial	Solar water heater	7.4 million m^2	5.200	4,202
	Solar concentrators	689,000 m^2	0.483	642
	Solar air heater	196,000 m^2	0.137	168
Agriculture	Solar dryer	43,000 m^2	0.030	37
Total			**105.872**	**69,683 (5.99 Mtoe)**

Assuming only 70,000 m2 of CSH installed in 2017, the BAU and aggressive growth rates are **11.3% (BAU)** and **18.4% (aggressive**). Assuming a causal factor of 0.4 (assuming some positive influence of this Project over growth of CSH), the assumed growth rate could be as much as 14.1%

Indirect top down calculation is based on 10-yr GHG emission reduction potential times a causality factor													
Detail	**Unit**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**
Potential collector area	m2	70,000	79,870	91,132	103,981	118,643	135,371	154,459	176,237	201,087	229,440	261,791	298,703
Annual GHG reduction	tonnes CO2	26,250	29,951	34,174	38,993	44,491	50,764	57,922	66,089	75,407	86,040	98,172	112,014
Cumulative GHG emission reduction	tonnes CO2	26,250	56,201	90,376	129,369	173,860	224,624	282,546	348,635	424,042	510,082	608,254	720,267
Assumed growth factor	14.1%	40% between 11.3% and 18.3% growth rates in Jan 2015 report "Capturing Sun for Heat" by Greentech Knowledge Solutions (P											
		with support from Shakti Sustainable Energy Foundation available on:											
		http://www.gkspl.in/reports/renewable_reports/Solar%20Thermal%20Roadmap%20for%20India%20(2015-2030).Pdf											
Tonnes CO2 abated per 1 m2 of installed CSH	0.375	over a 280-day period annually											
Causality factor	0.4	Based on interest by industrial and institutional entities but dampened by the need for subsidies											
Indirect top-down emission reduction	**288,107**	**tonnes CO2 over a 10-yr period**											
Indirect bottom-up calculation is based on the direct project GHG emission times a replication factor													
Direct GHG emission reduction	20,018	tonnes CO2 (up to 30 October 2017)											
Total number of days up to 30 Oct 2017	60,513	days											
Factor for reduction for non-sunshine days	0.9	on the basis of "total non-sunshine days" and "total number of days up to 30.10.17" from "Updated Mainsheet"											
Total number of days up to 31 Dec 2017	66,545	days											
Actual number of days up to 31 Dec 2017	59,818	days											
Direct GHG emission reduction adjusted to 31 Dec 2017	22,432	tonnes CO2											
Replication factor	2												
Indirect bottom-up emission reduction	**44,863**	**tonnes CO2**											
Calculation of CSH installed capacity	71,778	m2 (from Para 63)											
	1425	m2/MW (thermal) based on conversion rates from Tables 4.6 and 4.7 from the Greentech report											
Installed capacity of solar thermal heat from Project	**50.4**	**MW (thermal)**											
Lifetime direct GHG emissions avoided	**483,916**	**tonnes CO2 (based on 0.375 tonnes/m2 CSH installed, 0.9 factor for non-sunny days, and 20-year service life)**											

APPENDIX F – PROJECT PLANNING MATRIX FOR CSH PROJECT (FROM 2011)

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
Goal: Reduced GHG emissions from use of CSH systems for low and medium temperature process heat	Cumulative CO2 emission reduced from start of project to End-Of-Project (EOP), (tCO2e)	0	32,900	M&E reports of the demonstration/ replication projects	Timely execution of planned activities with adequate resource mobilization. Field performance is monitored and recorded as per available guidelines.
Objectives: Increased use and promotion of CSH systems for low and medium temperature process heat applications	Cumulative installed area of CSH systems for process heat applications (m2) by EOP No. of companies that have installed CSH systems by EOP	20,000 71	80,000 161	Annual reports of MNRE	Timely implementation of demo and replication projects. Selected end users for demos and replications have sufficient equity and financial position is good.
Component 1: Technical capacity development					
Outcome 1.1: Enhanced understanding of CSH technologies, applications and markets	No. of technology package suppliers that are available to market CSH technologies in India by EOP No. of companies that are interested in the installation of CSH systems by EOP No. of companies that are potential users of CSH process heat systems by EOP No. of companies that used the information packages in purchasing and installing CSH process heat systems by EOP	18 0 71 0	30 60 131 90	Technology and market assessment reports available at the EOP Project impact assessment report Annual reports of MNRE	Available information on existing capacities data/ information to establish standards and benchmarks.
Output 1.1.1: Developed technology application information packages and characterized technologies, applications, and markets	Number of performance assessment reports of existing installations by year 2	0	15	Reports available on Performance assessment of existing installations	
	Number of technology assessment reports of CSH technologies by EOP	0	2	Reports available on technology assessment of CSH technologies	
	Number of market assessment reports for CSH process heat applications by EOP	0	2	Availability of report	

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
				on market assessment for solar process heat	
	Number of CSH technology application information packages developed by EOP	0	10	Project impact assessment report Annual reports of MNRE	
Outcome 1.2: Adoption of standards and specifications for guidance of manufacturers and users for assurance of CSH quality, safety, and performance	No. of Indian CSH system components & equipment manufacturers that comply with the BIS standards and specifications by EOP	0	30	Technology and market assessment reports available at the EOP	Cooperation (sharing of information, accessibility for discussions) is received from manufacturers of all 5 CSH technologies
	No. of Indian CSH system component & equipment manufacturers that comply with ISO standards and specifications for CSH systems by EOP	0	10	Project impact assessment report Annual reports of MNRE	Cooperation is received from users and other stakeholders MNRE takes the lead in coordinating the activity with BIS
	No. of Indian CSH system component & equipment manufacturers that entered into the internal CSH business (export of CSH components & equipment) by EOP	0	7		BIS takes a lead in pursuing the issue of ISO standards for CSH with ISO
Output 1.2.1: Developed CSH performance standards and technology specifications	A document of performance measurement standard developed by year 2	0	1	A report on performance measurement standard available	
	Number of test protocols developed – technology specific by year 3	0	5	A report on number of test protocols available	
	No. of minimum performance norms developed by year 2	0	1	A report on performance norms available	
	A document of field performance monitoring guidelines developed by year 2	0	1	A report on field performance monitoring guidelines available	
	No. of technology specifications developed by EOP	0	5	A report on number of technology specifications available	
	No. of performance standards and specifications taken up for consideration and adoption as draft national standards by BIS by year 4	0	1	Confirmation from BIS regarding submission Standards issued as BIS standards	

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
	No. of performance standards and specifications submitted to ISO as draft international standards by year 4	0	1	Confirmation from ISO regarding submission Standards issued as ISO standards	
Outcome 1.3: Adequately capable and operational testing laboratories for verification of manufacturer claims and guidance of CSH users to enable informed decisions	No. of accredited testing facilities for CSH components and equipment in India by year 3 No. of Indian CSH system component & equipment manufacturers that approached testing laboratories for certification by EOP No. of international CSH system component & equipment manufacturers that approached Indian testing laboratories for certification to enable their systems sale in Indian market by EOP	0 0 0	2 28 5	Certification by a certifying/ accrediting agency Project impact assessment report Test reports produced by testing facilities	Manufacturers submit their products for testing No turnover of the personnel involved in the proof-of-concept and testing laboratories Decisions are taken as scheduled for the establishment of test facilities.
Output 1.3.1: Developed CSH system components and equipment testing facilities	Number of reports on proof-of-concept testing carried out at SEC for at least three technologies by year 4	0	3	Number of reports available on proof-of-concept testing carried out at SEC	
	Established national testing facility by year 2	0	1	A policy decision by respective ministry/SEC Number of test reports by national testing facility	
	Established a regional test facility by year 3	0	1	A policy decision by respective ministry/SEC Number of test reports by regional testing facility	
Component 2: Awareness enhancement and capacity building					
Outcome 2.1: Strengthened technical capacity and awareness of stakeholders of CSH systems for industrial/	No. of technology package suppliers that are available to market CSH technologies in India by EOP No. of CSH replication projects by EOP	18 0	30 60		

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
institutional process heat applications	No. of trained participants of test facilities that are actively involved in the development of the CSH technology development by EOP	0	10		
	No. of CSH technologies available in India by EOP due to increased awareness and capacity	2	5		
	No. of banks/financial institutions that agreed to finance CSH projects and CSH system component & equipment manufacturing as a result of the awareness enhancement programs by EOP	1	3		
	No. of papers presented in conference that were used by policy makers in decision making on technology applications, in general, and CSH technology applications, in particular, by year 4	0	15		
	% of conference participants expressed satisfaction about the conference by EOP	0	70		
Output 2.1.1: Trained manufacturers/ vendors, installers and CSH user***s***	Training needs assessment completed by year 2	0	1	Report on Training needs assessment available	Cooperation (sharing of information, accessibility for discussions) is received from manufacturers, vendors, users and other stakeholders in identifying training needs Targeted stakeholders, including energy efficiency / renewable energy consultants and other stakeholders, show willingness for training and trigger positive response from training programmes
	No. of training modules (including all the training material) on CSH technologies developed by year 2	0	3	Three types of training modules are produced one each for manufacturers/ vendors, installers and CSH users	
	Number of training courses on CSH technologies organized and conducted under the project by EOP	0	15	Completion/ post-training reports of training programmes	
	Number of personnel trained in the training courses by EOP	0	300	After-training evaluations completed by participants	
	No. of personnel that were received training on specific aspects of CSH	0	10	Completion/post-training report of study tour	

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
	technologies from study tour conducted under the project by year 2			After-training evaluation completed by participants	Industry will grow; hence there will be a demand for training
Output 2.1.2: More trained technical consultants that provide technical services to both CSH system components & equipment manufacturers and users	No. of training modules (including all the training material) on CSH technologies developed by year 2	0	1	Training programme calendar and structure Training modules are completed and available	Arrangements are successfully made with international organisations and installations for visits and discussions Senior officials directly working in CSH area are nominated and accepted for the study tour Targeted stakeholders show willingness to participate in study tour and part fund their costs
	Number of training courses on CSH technologies organized and conducted under the project by EOP	0	4	Completion reports for training programmes	
	Number of trained technical consultants by EOP	0	100	After-training evaluations completed by participants	
Output 2.1.3: Established and supported industry academic partnership through research programmes to build future capacities	Number of Ph.D. fellowships supported by year 3	0	4	Project impact assessment report Annual reports of MNRE Reports published by respective institutions of (a) no. of fellowships awarded (b) no. of fellows receiving degrees (c) no. of fellows sponsored by CSH industry, (d) no. of fellows absorbed in CSH industry	Suitable candidates will be interested in research fellowships. Faculty will be interested in research in CSH area Sufficient research areas/topics are identified by CSH industry.
	Number of M.Tech. fellowships supported by year 3	0	6		
	Number of fellows completing Ph.D. by EOP	0	2		
	Number of fellows completing M.Tech. by EOP	0	6		
	Number of institutions where fellowships on CSH technologies are supported by year 3	0	5		
	No. of universities/ technical schools with Masters level course (at least as elective) available on CSH by year 3	0	1		
Output 2.1.4: Trained staff at SEC and staff at regional testing centre	Number of personnel trained in international training programmes organized and conducted by year 2	0	5	Completion report of training programme After-training evaluations completed by participants	Trained and qualified personnel are retained in the test centres. Suitable international organisation(s) to conduct and host such training are available and willing to participate.
	Number of national training programmes organized and conducted by year 2	0	1		
	Number of personnel trained in national training programmes by year 2	0	10		

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
					Testing facilities at SEC are installed and operational to conduct and host such training.
Output 2.1.5: Completed awareness enhancement programmes for policy makers, academicians, industries, financial institutions, etc. to facilitate replications	Number of conferences organized and held by year 4	0	2	Conference brochures, agendas, completion reports	CSH manufacturers, users, researchers, policy makers and other
	Number of participants in conferences by year 4	0	200	Number of registered participants	
	Number of international participants in the completed conferences by year 4	0	20	Number of registered International participants	
	Number of papers presented in conferences by year 4	0	20		
	Number of CSH system exhibitors in expos organized and held by year 4	0	20	Number of abstracts, conference presentations, conference papers and posters submitted presented Number of registered exhibitors	
	Number of awareness programmes organized and conducted by EOP	0	20	Completion reports for awareness programmes	Targeted stakeholders show willingness to examine and consider CSH options.
	Number of participants in organized and conducted awareness programmes by EOP	0	1,600	Post-programme evaluations completed by participants	
Output 2.1.6: Completed promotional campaign for CSH	Number of advertisements about CSH placed on print media under the project by year 3	0	5	Advertising agency records	
	Number of industrial clusters in which hoardings are displayed by year 3	0	10	Project impact assessment report Annual reports of MNRE	
	Number of industrial exhibitions and trade fairs participated to promote CSH systems and CSH technology applications by EOP	0	5	Visit reports shared by manufacturers /suppliers	
Output 2.1.7: Established Concentrating Solar Heat Technology Platform and is operational	An officially established CSH Technology Platform by year 1	0	01 Jan 12	Platform charter Document	Provided equitable role for different stakeholder irrespective of their scale and area of operation.
	Number of meetings conducted by the CSH Technology Platform by EOP	0	8	Number of members and their distribution (by type of stakeholder, region etc.)	Stakeholders will come together to form CSH Platform to further development and growth of CSH industry
	No. of CSH system users that make use of the	0	100	Number of meetings held	

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
	platform in addressing issues/problems concerning energy performance and improvements of CSH systems by EOP				
	No. of CSH system manufacturers/ suppliers/distributors that make use of the platform in addressing issues/problems concerning the market of CSH products by EOP	0	15		
Outcome 2.2: CSH Project deliverables facilitated and/or influenced the widespread replication of CSH technology applications in India	No. of CSH replication projects by EOP	0	60	Project impact assessment report	Captured all the information, updated knowledge and documented the results
	% of newsletter recipients expressed it is useful by EOP	0	80	Annual reports of MNRE	
	% of users of the audio-visual capsule that are satisfied with it, and find it useful by EOP	0	70	Web based feedback for audiovisual capsule	The web portal is created and operational
	% of users satisfied with compendium and find it useful by EOP	0	70	Survey of recipients of the published compendium	
Output 2.2.1: Documentations on the Project outputs, case studies, best practices and lessons learnt disseminated to ensure larger replication	Cumulative number of newsletter issues prepared and disseminated by EOP	0	18	Number of people visiting website (click count)	
	No. of copies of each newsletter issue circulated to CSH stakeholders (CSH system manufacturers, suppliers, importers, installers, maintenance service providers and users) starting year 1	0	200	All the information including audio visual capsule of project is available on the web and downloadable	
	Audio-visual capsule uploaded and accessible from project website by year 3	0	01 Jan 14	Hard and soft copy of the brochure booklet available	
	No. of users of the audio-visual capsule by the EOP	0	1,000	Project impact assessment report	
	Project website established and operational by year 1	0	01 Jan 12		

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
	No. of CSH stakeholders that use the project website for information each year starting year	0	2,000		
	No. of brochures on CSH technology applications produced and disseminated by EOP	0	90		
	No. of copies of printed and disseminated compendium by EOP	0	1,000		
Component 3: Pilot demonstration of CSH technologies for various applications					
Outcome 3.1: Increased number of commercial and near commercial CSH technologies for diversity of applications	No. of replication CSH technology application projects based on the demonstrations that are planned and implemented by EOP	0	60	Feasibility study reports of projects Project impact assessment report Annual reports of MNRE	
	Number of technology application information packages applied in demonstration and replication projects by EOP	0	7		
Output 3.1.1: Completed feasibility studies for demonstration and replication projects of various CSH technology applications	Number of completed feasibility studies that were supported by the project by year 4	0	90	Feasibility study reports for supported projects	Potential users having interest in examining CSH viability in their applications respond and eliminated users with only marginal or passing interest All the feasibility studies get converted into serious prospective projects.
Output 3.1.2: Completed Detailed Project Reports (DPRs) for demonstration projects	Number of completed DPRs for demonstrations that were funded and implemented under the project by year 4	0	30	Detailed project reports for supported projects	
Output 3.1.3: Developed and commissioned demonstration projects in at least 5 sectors	Number of CSH technology application demonstration projects implemented and commissioned by EOP	0	30	Project commissioning reports and all other required documents for demonstration projects	After the project is commissioned, demonstration project participant comply fully with the stipulated terms and conditions
	No. of CSH technology application demo projects that were operational by EOP	0	30		

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
Output 3.1.4: Results of the performance monitoring, analysis, and evaluation of demonstration projects	Cumulative number of performance monitoring reports of the demonstration projects prepared by EOP	0	30	Performance evaluation report is available	Users will be attracted by the support to be provided for demonstration projects
	No. of implemented CSH technology application demo projects whose operational and energy performances are at least the same or better than as per design by EOP	0	15		
	No. of implemented CSH technology application demo projects whose financial and economic performances are at least the same or better than as per design by EOP	0	15		
Outcome 3.2: Improved technical and economic performance of commercial and near commercial CSH technologies in an increased diversity of applications	No. of replication CSH technology application projects planned and implemented by EOP	0	60	Feasibility study reports of projects Project impact assessment report	
	No. of demonstrated CSH technologies replicated by EOP	0	5	Annual reports of MNRE	
	No. of companies where CSH technologies are successfully applied by EOP	0	90		
	No. of implemented demo and replication projects whose performance data is as per feasibility study by EOP	0	90		
Output 3.2.1: Documentation of results of demonstration and replication projects	No. of CSH technology projects included in the project database by EOP	0	90	Number of project's information included in database	The demonstration and replication projects are implemented as scheduled and operational The chosen units, both demo and replication projects, comply with agreement that includes making data available and permission to publish the data
	Number of demonstration project profiles prepared by EOP	0	30	Number of case study reports available	
Output 3.2.2: Completed performance monitoring, analysis and overall evaluation for demo and replication projects	No. of performance monitoring reports of demo and replication projects completed by EOP	0	90	Annual reports on performance monitoring of replication projects available	
	Overall evaluations of demonstration and replication projects completed by EOP	0	2	Overall evaluation reports on demonstration and	

Strategy	Objectively Verifiable Indicators			Means of Gauging Success	Critical Assumptions
	Indicator	Baseline	Target		
				replication projects available	Demonstration and replication project participants allow access for onsite monitoring and evaluation.
Component 4: Sustainable financial approach in the adoption of CSH technologies and applications in India					
Outcome 4.1: Enhanced understanding of the financial viability of CSH technologies and measures to mitigate investment risks	No. of potential and feasible financial options for the application of CSH technologies identified and promoted by EOP No. of replication projects that use financial options by EOP No. of banks/financial institutions that agreed to finance CSH projects by EOP	0 0 1	2 30 3	Project impact assessment report Annual reports of MNRE A report on analysis of financial viability of CSH available A report on assessment of alternative finance models available	
Output 4.1.1: Documented financial viability of CSH technologies, applications, and mitigation approaches of investment risks	No. of completed financial viability analyses of CSH technologies and applications by year 3 Analysis of alternative financial options by year 3	0	1	A report on assessment and recommendations for policies available	Cooperation (sharing of information, accessibility for discussions) is received from users Transparency in information on existing installations is provided by users, manufacturers, MNRE
Outcome 4.2: Promulgation of favourable financial policies that promote increased use and promotion of CSH for low and medium temperature process heat applications	No. of implemented CSH projects that benefitted from the enforced policy and regulatory regimes on CSH technology applications by EOP No. of banks/financial institutions that agreed to finance CSH projects by EOP	0 1	28 3		
Output 4.2.1: Formulated recommendations for financial and promotional policies and strategies for adoption by Government of India	No. of policy studies completed for inputs in the formulation of policies supportive of CSH system and application projects by year 3	0	1		Cooperation (sharing of information, accessibility for discussions) is received from stakeholders.

APPENDIX G - EVALUATION CRITERIA QUESTIONS

Evaluation Criteria	Questions	Indicators	Sources	Methodology
Relevance: How does the Project relate to the main objectives of the GEF focal area, and to the environment and development priorities at the local, regional and national levels?				
Is the project relevant to national priorities and commitments under international conventions?	Is the project country driven?	Existence of national legislation related to sustainable development, climate change and renewable energy power generation development (specifically for CSH) development	National and regional strategy and policy documents	Desk review, interviews with Indian government representatives (GEF operational focal point, MNRE NPD)
	Does the project adequately taken into account the national realities, both in terms of institutional and policy framework and its implementation?	Existence of national legislation related to sustainable development, climate change and renewable energy generation for CSH	National and regional strategy and policy documents	Desk review, interviews with Indian government representatives (GEF operational focal point, MNRE NPD)
	How effective is the project in terms of supporting and facilitating energy sector?	Number of CSH projects developed by local governments and private developers	PIRs and information from stakeholders including PMU	Desk review of PIRs and interviews with PMU and stakeholders
	What was the level of stakeholder participation in project design and ownership and project implementation?	Number of stakeholders participating in PPG Number of stakeholders participating in project sponsored training sessions and meetings	PPG stakeholder meeting minutes Project designers PIRs	Desk review of PIRs and interviews with project designers, PMU, stakeholders
Is the project internally coherent in its design?	Are there logical linkages between expected results of the project (log frame) and the project design (in terms of project components, choice of partners, structure, delivery mechanism, scope, budget, use of resources)?	Quality of outcomes and indicators on log frame	Project document	Desk review

Evaluation Criteria	Questions	Indicators	Sources	Methodology
	Even after several extensions, does the project achieve its expected outcomes?	Log frame outcome and output targets	PIRs Report on log-frame review	Desk review, interviews with PMU and stakeholders
	Did the project make satisfactory accomplishments in achieving project outputs vis-à-vis the targets and related delivery of inputs and activities?	Log frame output targets	PIRs Report on log-frame review	Desk review, interviews with PMU and stakeholders
Does the project provide relevant lessons and experiences for other similar projects in the future?	Has the experience of the project provided relevant lessons for other future projects targeted at similar objectives?	Effectiveness and efficiency ratings of the project by the evaluation	PIRs Stakeholders (investors and government personnel)	Desk review, interviews with PMU and stakeholders
Effectiveness: The extent to which an objective has been achieved or how likely it is to be achieved?				
Has the project been effective in achieving the expected outcomes and objectives?	Whether the performance measurement indicators and targets used in the Project monitoring system are accomplished and able to achieve desired project outcomes by the 31 December 2016?	Effectiveness ratings of the project by the evaluation	PIRs	Desk review, interviews with PMU and stakeholders
How is risk and risk mitigation being managed?	How well are risks, assumptions and impact drivers being managed?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
	What was the quality of risk mitigation strategies developed? Were these sufficient?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
	Are there clear strategies for risk mitigation related with long-term sustainability of the project?	Content of risk management in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders
Consideration of recommendations and reporting of information	Did the project consider midterm review and recommendations conducted on time and reflected in subsequent project activities?	Content of management responses to MTR	PIRs and information from PMU personnel	Desk review, interviews with PMU and stakeholders

Evaluation Criteria	Questions	Indicators	Sources	Methodology
	Reporting of the petroleum fuels and the power reduction in each of the model units from implementing eco- tech options and the corresponding carbon emission reductions.			Desk review, interviews with PMU and stakeholders
What lessons can be drawn regarding effectiveness for other similar projects in the future?	What lessons have been learned from the project regarding achievement of outcomes?	Evaluation assessment of Project effectiveness and efficiency	PIRs	Desk review, interviews with PMU and training participants
	What changes could have been made (if any) to the project design to improve the achievement of the project's expected results?	Evaluation assessment of Project effectiveness and efficiency	PIRs and information from PMU and training participants	Desk review, interviews with PMU and training participants
Efficiency: was the project implemented efficiently, in-line with international and national norms and standards and delivered results with the least costly resources possible?				
Was project support provided in an efficient way?	How does the project management systems, including progress reporting, administrative and financial systems in monitoring and evaluation systems were operating as effective management tools, aid in effective implementation and provide sufficient basis for evaluating performance and decision-making?	Evaluation assessment of M&E design and implementation, and quality of feedback from M&E activities	PIRs and information from PMU personnel	Desk review, interviews with PMU
	How effective was adaptive management practised under the Project and lessons learned?	Adaptive management reporting in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU
	Did the project logical framework and work plans and any changes made to them used as management tools during implementation?	Adaptive management reporting in PIRs	PIRs and information from PMU personnel	Desk review, interviews with PMU
	Utilization of resources (including human and financial) towards producing the outputs and adjustments made to the project strategies and scope	Annual financial disbursements against each component	PIRs, CDRs and information from PMU personnel	Desk review, interviews with PMU

Evaluation Criteria	Questions	Indicators	Sources	Methodology
	Details of co-funding provided (industry of urban development, GEO I and financing units) and its impact on the activities	Cofinancing of each stakeholder	PIRs, CDRs and information from PMU personnel	Desk review, interviews with PMU
	How does the APR/PIR process help in monitoring and evaluating the project implementation and achievement of results?	APR/PIR qualitative assessments	PIRs and information from PMU personnel	Desk review, interviews with PMU
How efficient is our partnership arrangements for the project?	Appropriateness of the institutional arrangement and whether there was adequate commitment to the project	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
	Was there an effective collaboration between institutions responsible for implementing the Project?	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
	Is technical assistance and support received from project partners and stakeholders appropriate, adequate and timely specifically for the project PMU?	Institutional arrangements of the project	PIRs and information from PMU and MNRE personnel	Desk review, interviews with PMU and MNRE personnel
Sustainability: To what extent are there financial, institutional, social-economic, and/or environmental risks to sustaining long-term project results?				
Will the Project be sustainable on its conclusion and stimulate replications and its potential?	How effective is the project in terms of strengthening the capacity of CSH professionals?	Opinions of training participants	Survey of feedback of training sessions, and testimonial evidence from investors and stakeholders	Desk review, interviews with investors and stakeholders
	Was an exit strategy prepared and implemented by the project? What the "Expected situation at the end of the Project" is as envisioned at the time of terminal evaluation?	Existence of exit strategy prepared by the project	Report on exit strategy, and information from PMU and MNRE personnel	Desk review, interviews with investors and stakeholders
	Appropriateness of the institutional arrangement and whether there was adequate commitment to the project	Number of institutions and local government agencies that have streamlined CSH investments	Progress reports, PIRs, and information from PMU and MNRE personnel	Desk review, interviews with investors and stakeholders

Evaluation Criteria	Questions	Indicators	Sources	Methodology
Impact: Are there indications that the project has contributed to, or enabled progress toward maximizing environmental benefits?				
What was the project impact under different components?	To what extent has the project contributed to the following: • institutional arrangements strengthened • effective information dissemination program developed • stakeholder capacity enhanced	Indicator targets of MNRE strengthening Indicator targets of state-level strengthening Number of CSH project plans prepared by state governments	Progress reports, PIRs, and information from PMU and MNRE personnel	Desk review, interviews with with PMU and MNRE personnel
What are the indirect benefits that can be attributed to the project?	Were there spinoffs created by the project, if any, as a result of the various workshops held nationwide, toolkits, case studies developed?	Number of knowledge products created by Project Number of hits on project website	Survey of feedback of training sessions, and testimonial evidence from training participants	Desk review, interviews with training participants
Impacts due to information dissemination under the Project	To what extent did the dissemination activities facilitate progress towards project impacts?	Number of knowledge products created by Project Number of CSH plans prepared by state governments	Survey of feedback of training sessions, testimonial evidence from training participants, and information from PMU and MNRE personnel	Desk review, interviews with training participants, PMU and MNRE personnel

APPENDIX H – LIST OF CSH INSTALLATIONS SUPPORTED BY PROJECT THAT CONTRIBUTED TO CUMULATIVE GHG EMISSION REDUCTIONS[43]

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
Manufacturer / Supplier: A.T.E., Pune									
1	Tamilnadu Agricultural University, Coimbatore, Tamilnadu	Paraboloid	250	Cooking	Jan-17	299	0	299	100
2	Truetzschler India Pvt. Ltd., Ahmedabad, Gujrat	Paraboloid	25	Cooking	20-Dec-16	310	0	310	10
3	Rainbow Dry-cleaning Industries, Aurangabad, Maharashtra	Paraboloid	25	Process Heat	19-Oct-15	731	60	671	22
4	Punarutthan Samarasata Gurukulam, Pune, Maharashtra	Paraboloid	25	Cooking	12-Aug-16	438	19	419	14
5	Seminary of Our Lady, Goa	Paraboloid	25	Cooking	25-Apr-17	185	0	185	6
6	Frontier Knitters Pvt. Ltd., Tirpur, Tamil Nadu	CPC	44	Process Heat Application (Textile industry)	30-Dec-16	300	0	300	18
Manufacturer / Supplier : Clique Development									
7	Salem District Cooperative Milk Producers Union Ltd., Salem, Tamilnadu	ARUN	338	Process Heat	13-Jul-15	827	108	719	325

[43] List submitted by PMU at MNRE

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
8	Bajaj Auto Ltd. , Waluj, Aurangbad Maharashtra	ARUN	169	Process Heat	1-Jul-15	839	120	719	163
9	The Tamilnadu District Cooperative Milk Producer's Federation Ltd., Aavin, Chennai, T.N.	ARUN	338	Process Heat	1-Jun-16	509	60	449	203
10	SEE-Tech Solutions Pvt. Ltd.,Nagpur, Maharashtra	ARUN	34	Cooking	26-Oct-15	724	60	664	30
11	Ram Krishna Mission, Students' Chennai, TamilNadu	ARUN	104	Cooking	1-Oct-14	1109	120	989	138
12	Christian Medical College, Vellore, Tamilnadu	ARUN	104	Process heat	14-Mar-15	946	120	826	115
13	Anandwan Maharog Seva Samiti, Warora, Maharashtra	ARUN	104	Cooking	23-Mar-15	937	120	817	114
14	Hero MotoCorp Limited, Neemrana, Rajasthan	ARUN	104	Process Heat	10-Jul-15	830	120	710	99
Manufacturer / Supplier: Greenera									
15	Danavarshini Exports (p) ltd., Tripur, Tamilnadu	PTC	50	Process Heat	1-Mar-16	599	60	539	36
16	Noble Clothing Company,Tripur, Tamilnadu	PTC	50	Process heat	30-May-16	510	60	450	30

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
17	ICAR-Indian Institute of Species Research, Calicut, Kerala	PTC	32	Process heat	22-Dec-15	668	60	608	26
18	PSG Hospitals, Coimbatore (PSNA Engineering & Technology + PSG Hospital)	PTC	100	Cooking	28-Dec-15	662	60	602	81
19	G.Kuppuswamy Naidu Memorial Hospital, Coimbtore, Tamilnadu	PTC	50	Cooking	6-Nov-16	354	0	354	24
20	Tube products of India, Chenai, Tamilnadu	PTC	112	Process heating	1-Mar-16	599	60	539	81
21	PSG College of Arts & Science, Coimbatore, Tamil Nadu	PTC	150	Cooking	1-Jun-17	149	0	149	30
22	PSG Institute of Technology and Applied Research, Tamil Nadu	PTC	100	Steam Cooking	31-Jan-17	270	0	270	36
Manufacturer / Supplier : LeverageNet (Energy Guru)									
23	Siddarth Surgicals,Valsad, Gujrat	PTC	263	Process Heat	28-Jul-14	1172	153	1019	359
Manufacturer / Supplier : Megawatt Solution									
24	Synthokem Labs Pvt. Ltd., Hyderabad, A.P.	Paraboloid	450	Process Heat	Oct-14	1109	120	989	596
25	Unique Biotech Ltd. Hyderabad, A.P.	Paraboloid	540	Process Heat	Mar-15	959	120	839	607
26	Ultramarinine Pigments, Vellore Tamilnadu	Paraboloid	570	Process Heat	Jul-16	479	60	419	320

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
27	Muni Seva Ashram, Vadodra, Gujrat	Paraboloid	55	Cooking	Aug-14	0	0	0	0
28	Gnanodaya high School, Chittoor, Tamilnadu	Paraboloid	55	Cooking	Jul-14	1199	180	1019	75
29	Mother Dairy, Pathparganj	Paraboloid	1520	Process heat	Dec-16	329	0	329	670
Manufacturer / Supplier: Forbes Marshall									
30	M/s Abbott Health Care Pvt. Ltd., Solan, Himachal Pradesh	Paraboloid	186	Food process	Mar-16	599	60	539	134
Manufacturer / Supplier: K Energy									
31	M/s Navkar Textiles, Jodhpur, Rajasthan	Scheffler	192	Process heat	Mar-16	599	60	539	139
Manufacturer / Supplier: Oorja Energy									
32	Devnar School for the Blind, Hyderabad, Telangana	PTC	36	Cooking	16-Apr-16	554	60	494	24
33	Almond house, Hyderabad, Andhra Pradesh	PTC	255	Process Heat	12-Mar-15	948	120	828	283
Manufacturer / Supplier: Solar Alternatives									
34	Tripolia Social Service Hospital, Patna, Bihar	Scheffler	32	Sterilization of medical equipment	Oct-16	389	0	389	17
Manufacturer / Supplier: SUNBEST									
35	Goodricke Group Ltd., Jalpaiguri West Bengal	NIC	695	Process Heat	7-Oct-15	743	60	683	636
36	Hatsun Agro Product Ltd., Salem, Tamilnadu	NIC	722	Process Heat, Boiler feed water	2-Sep-16	418	0	418	404

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
37	TTK Prestige Ltd., Uttarakhand	NIC	196.8	Process heat	14-Nov-15	706	60	646	170
38	TTK Prestige Ltd., Uttarakhand	NIC	262.4	Process heat	1-Jan-17	299	0	299	105
Manufacturer / Supplier : Thermax									
39	NPCIL, Rajasthan Atomic Power Project, Kota, Rajasthan	PTC	641	Cooling	Nov-13	1439	180	1259	1081
40	Honeywell Technology Solutions Lab. Pvt. Ltd., Hyderabad, Andhra Pradesh	PTC	821	Cooling	25-May-13	1595	240	1355	1490
41	SKF Technologies (India) Pvt. Ltd. Mysore, Karnataka	PTC	256	Process Heat	21-Jan-13	1719	240	1479	507
42	Mahindra and Mahindra, Nagpur, Maharashtra	NIC	442	Process Heat	16-Apr-13	1634	240	1394	825
43	ITC Ltd., Ranjangaon, Pune	NIC	442	Process Heat	Mar-14	1319	180	1139	674
44	M/s Neel Metals Product Ltd. Gurgaon, Hyryana	NIC	612	Process Heat	29-Nov-14	1051	120	931	763
45	Mother Dairy, A unit of GC MMF ltd, Ahmedabad, Gandhinagar, Gujrat	PTC	615.36	Process Heat	May-16	539	60	479	395
46	PSNA College of Engineering & Technology, Dindigul, Tamilnadu	Scheffler	80	Cooking	Nov-14	1079	60	1019	109

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
47	Mahindra Holidays and Resorts, Club Mahindra Ooty, Tamil Nadu	PTC	82	Process heat	Mar-16	599	60	539	59
Manufacturer / Supplier: Taylormade									
48	Cairen India Ltd., Barmer, Rajasthan	Scheffler	256	Process Heat	May-15	899	60	839	288
49	The Kalgidhar Trust Sirmore, Himachal Pradesh	Scheffler	896	Cooking	30-Mar-17	210	0	210	252
50	Gurudwara Shri Maan Dhan Dhan Baba Deep Singh Ji Shaheed, Ropar, Punjab (Through HIMURJA)	Scheffler	320	Cooking	Oct-13	1469	180	1289	552
51	Ecole Globale International Girls School, Horrawala, Dehraun, Uttarakhand	Scheffler	256	Cooking/Process Heat	Jun-16	509	0	509	175
52	Shree Vijayadurga Seva Samiti, Keri-Ponda-Goa	Scheffler	32	Cooking	10-Dec-15	680	60	620	27
53	Haryana Police Housing Corporation, Karnal, Haryana	Scheffler	96	cooking	Oct-14	1109	120	989	127
54	Vardhman Fabrics, Sehore, Madhya Pradesh	Scheffler	128	cooking	Apr-14	1289	60	1229	211
55	M/s Radha Krishn Reality Pvt. Limited, Ambawadi, Ahmedabad (Gujarat)	Scheffler	128	cooking	May-15	899	120	779	134

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
56	Gurudwara Karamsar Rara Sahib Trust, Ludhiana, Punjab	Scheffler	224	cooking.	Feb-16	629	60	569	171
57	Vardhman Yarns, Satlapur, Dist. Raisen, Madhya Pradesh	Scheffler	64	cooking.	Nov-14	1079	60	1019	87
58	Anant Spinning Mills, Mandideep, M.P.	Scheffler	64	Cooking	Oct-15	749	60	689	59
59	Boys Hostel, Shoolini University, Bajhol, Himachal Pradesh	Scheffler	96	Cooking	Dec-15	689	60	629	81
60	Darshan Singh Bawa, All India Pingalwara Charitable Society , Amritsar	Scheffler	224	Cooking	Jan-15	1019	120	899	270
61	KGMC, Lucknow	Scheffler	480	Cooking	10-Jun-17	140	0	140	90
62	Director General of Police , Hyderabad	Scheffler	112	Cooking	Oct-15	749	60	689	103
Manufacturer / Supplier: Ultraconserve									
63	Milk Center, Lingnoor, Kolhapur	CPC	225	Process heat	13-Jun-17	137	0	137	41
64	Milk Center, Gogave, Kolhapur	CPC	225	Process heat	21-May-17	159	0	159	48
65	Milk Center, Chandgarh, Kolhapur	CPC	225	Process heat	15-Apr-17	195	0	195	59
66	Milk Center, Bidri	CPC	225	Process heat	17-Jul-17	103	30	73	22
67	Zytex, Mumbai	PTC	136	Process Heat	Nov-15	719	60	659	120
68	Reeling Unit, Dehradun	CPC	295	Process heat	30-Apr-17	180	0	180	71
69	Unique Pharmaceutical Laboratories, Gujrat	PTC	320	Process Hat (Pharma Industry)	9-Jan-17	291	0	291	125

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
Manufacturer / Supplier: Unisun									
70	Indo US Mim Tec Pvt.Ltd., Bangalore	Scheffler	80	Cooking	Mar-16	599	60	539	58
71	SBI local head office staff canteen, Bangalore	Scheffler	32	Cooking	25-Oct-15	725	60	665	29
72	AGE(I)AF, Coimbatore	Scheffler	96	Cooking	Apr-16	569	60	509	65
73	Shri Jagadguru Tontadaswamy Samsthanmath, Gadag , Karnataka	Scheffler	96	Cooking	Mar-16	599	60	539	69
74	Horticulture Biocentre, Bangalore	Scheffler	32	Cooking	25-Oct-15	725	60	665	29
Manufacturer / Supplier: Quadsun									
75	Padmini VNA Mechtronics, Gurugram	Paraboloid	264	Space cooling	15-May-17	165	0	165	58
Manufacturer / Supplier: Soft tech, Ludhiana									
76	Asian Bikes, Ludhiana	Scheffler	256	Process heat	2-Feb-17	268	0	268	92
77	Gurudwara Pota Sahib, H.P	Scheffler	96	Cooking	Mar-17	239	0	239	31
Repair and Renovation									
78	Kailash Cancer Hospital, Muni Seva Ashram, Goraj, Wagohodia, Gujarat	Scheffler	1250	Cooking	Mar-14	1319	180	1139	1907
79	Anusuchit Jati Kanya Ashram, Singharbhat, CREDA	Scheffler	64	Cooking	May-14	1259	180	1079	92
80	Ramkrishna Mission Ashtram Narayanpur CREDA	Scheffler	300	Cooking	May-14	1259	180	1079	434
81	Vivekanada Vidya Peth , Raipur CREDA	Scheffler	72	Cooking	May-14	1259	180	1079	104

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
82	Adarsh higher secondary school, Pharasgaon CREDA	Scheffler	80	Cooking	May-14	1259	180	1079	116
83	Aastha Gurukul, Dantewara CREDA	Scheffler	64	Cooking	May-14	1259	180	1079	92
84	Sathyabhama University, Tamilnadu	Scheffler	1100	Cooking	01-Feb-16	629	180	449	661
85	Sri Ved Mata Gayatri Trust, Shanti Kunj, Uttarkhand	Scheffler	160	Cooking	Oct-15	749	60	689	148
86	DEI Girls Hostel , Dayalbagh, UP	Scheffler	80	Cooking	May-16	539	60	479	51
87	DEI Junior Boys Hostel, Dayalbagh, UP	Scheffler	80	Cooking	May-16	539	60	479	51
88	DEI Senior Boys Hostel, Dayalbagh, UP	Scheffler	80	Cooking	Jun-16	509	60	449	48
89	Sainik School, Karnataka	Scheffler	160	Cooking	19-Dec-16	311	0	311	67
90	KEDI School, Vlsad, Gujarat	Scheffler	96	Cooking	1-Jun-17	149	0	149	19
91	Tapi food, Surat	Scheffler	100	Process heat	May-17	154	0	154	21
92	Devalaya, Valsad	Scheffler	95	Cooking					
93	Manthan Apang Kanya Seva Sankul , Gujarat	Scheffler	64	Cooking	31-Dec-15	660	60	600	51
Leh									
94	Druk Padma Karpo Residential School	Scheffler	64	Cooking	5-Sep-16	415	0	415	36
95	Jamyang School	Scheffler	64	Cooking	Nov-16	359	0	359	31
96	Central Institute of Buddhist Studies	Scheffler	64	Cooking	5-Oct-16	385	0	385	33
97	Lamdon Boys School, Shrey	Scheffler	64	Cooking	5-Aug-16	445	0	445	38

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
98	Govt. Residential School, Tharuk	Scheffler	64	Cooking	Aug-16	449	0	449	38
99	Lamdon Girls School, Shrey	Scheffler	64	Cooking	Jun-17	133	0	133	11
100	Mahabodhi International School, Leh	Scheffler	64	Cooking	Sep-17	46	0	46	4
101	Central Institute of Buddhist Studies	Scheffler	64	Cooking	Sep-17	59	0	59	5
102	Govt. Centralized Residential School	Scheffler	64	Cooking	Sep-17	59	0	59	5
Kargil									
103	JNV, Khumbuthung	Scheffler	64	Cooking	Jun-17	149	0	149	13
Manufacturer / Supplier: Greenlife									
104	Shree krishna yan desi gorakshak evam gaulok dham seva samiti, Haridwar, Uttarakhand	Paraboloid	700	Process Heat	Oct-17	10	0	10	9
105	Indian Ordnance Factories, Ministry of Defence, Nagpur, Maharshtra	Paraboloid	180	Cooking	Jun-17	149	60	89	21
106	Velammal College of Engineering, & Technology, Madurai, Tamilnadu	Paraboloid	250	Cooking	Sep-17	59	0	59	20
107	Perumal Manimekalai College of Engineering, Hosur, Tamilnadu	Paraboloid	250	Cooking	Sep-17	59	0	59	20
State Nodal Agency- GEDA, Gujarat									

S.No.	Beneficiary	Technology	Collector Area (m^2)	Application	Commissioning date	No. of days operating to 30 Oct 2017	No of non-sunshine days	Actual Days	Estimated CO_2 emission reduction to 30 Oct 2017 (tonnes)
108	Admin. Office of Gujarat State Electricity Corporation, Gandhinagar	Single Axis	1333.28	Space cooling with new VAM	Aug-17	89	15	74	132
State Nodal Agency- CREDA, Chhattisgarh									
109	Pota Cabin Avasiya Vidyalay, Devgaon, Narayanpur, Chhatisgarh	Scheffler dish	96	Steam cooking	Mar-17	239	60	179	23
110	Pt. Ravi Shankar Shukla University, Amanaka, GE Road, Raipur, Chhatisgarh	Scheffler dish	96	Steam cooking	Jan-17	299	60	239	31
Totals:			**25,724 m^2**			**67,318 days**	**6,805 days**	**60,513 days**	**20,018 tonnes CO_2**

APPENDIX I – RESPONSES TO COMMENTS RECEIVED ON DRAFT TE REPORT

To the comments received on January 14, 2018 for the Terminal Evaluation of UNDP-GEF PIMS 4284: *Market Development and Promotion of Solar Concentrator-based Process Heat Applications in India* (India CSH Project)

The following comments were provided in track changes to the draft Terminal Evaluation report; they are referenced by institution ("Author" column) and track change comment number ("#" column):

Author	#	Para #/ Comment location	Comment/Feedback on draft TE report	TE response and actions taken
Dr. S.N. Srinivas, UNDP India	*1*	*Table A, pg v*	*If you add Dec month, the cumulative emissions will slightly increase. I understand from Dr Singhal they added another 1,000 m2 of collector area*	*The TE appreciates this comment and has re-estimated direct GHG emission reductions of the Project to 31 December 2017. Edits can be found on pgs 66-67 in Appendix E.*
Dr. S.N. Srinivas, UNDP India	*2*	"Relevance" on the Evaluation Ratings Table on pg ix	*I think this also deserves higher rating*	*"2" is the highest rating according to GEF "relevance" evaluation criteria found on Footnote 3. No changes have been to the document on this comment.*
Dr. S.N. Srinivas, UNDP India	*3*	"Overall Project Outcome Rating" on the Evaluation Ratings Table on pg ix	*As all the targets are met, it may be considered for 6*	*The TE team agrees with this re-assessment especially considering the outcomes have provided a plethora of information on CSH performance that will sufficiently inform MNRE of appropriate policies to be formulated to continue market transformation of the CSH industry. The TE team has also raised the scoring for "effectiveness" to a 6.*
Dr. S.N. Srinivas, UNDP India	*4*	"Overall likelihood of sustainability" on the Evaluation Ratings Table on pg ix	*I think this can be 3*	*The TE team agrees with a re-assessment towards a "3". There is willingness of all stakeholders to continue and JNNSM subsidies are available until 2020.*

APPENDIX J - EVALUATION CONSULTANT AGREEMENT FORM

Evaluator 1:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[44]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Roland Wong

Name of Consultancy Organization (where relevant)**:** _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at *Surrey, BC, Canada* on *January 26, 2018*

[44] www.unevaluation.org/unegcodeofconduct

Evaluator 2:

1. Must present information that is complete and fair in its assessment of strengths and weaknesses so that decisions or actions taken are well founded.
2. Must disclose the full set of evaluation findings along with information on their limitations and have this accessible to all affected by the evaluation with expressed legal rights to receive results.
3. Should protect the anonymity and confidentiality of individual informants. They should provide maximum notice, minimize demands on time, and respect people's right not to engage. Evaluators must respect people's right to provide information in confidence, and must ensure that sensitive information cannot be traced to its source. Evaluators are not expected to evaluate individuals, and must balance an evaluation of management functions with this general principle.
4. Sometimes uncover evidence of wrongdoing while conducting evaluations. Such cases must be reported discreetly to the appropriate investigative body. Evaluators should consult with other relevant oversight entities when there is any doubt about if and how issues should be reported.
5. Should be sensitive to beliefs, manners and customs and act with integrity and honesty in their relations with all stakeholders. In line with the UN Universal Declaration of Human Rights, evaluators must be sensitive to and address issues of discrimination and gender equality. They should avoid offending the dignity and self-respect of those persons with whom they come in contact in the course of the evaluation. Knowing that evaluation might negatively affect the interests of some stakeholders, evaluators should conduct the evaluation and communicate its purpose and results in a way that clearly respects the stakeholders' dignity and self-worth.
6. Are responsible for their performance and their product(s). They are responsible for the clear, accurate and fair written and/or oral presentation of study imitations, findings and recommendations.
7. Should reflect sound accounting procedures and be prudent in using the resources of the evaluation.

Evaluation Consultant Agreement Form[45]

Agreement to abide by the Code of Conduct for Evaluation in the UN System

Name of Consultant: Dr. Sanjay Mande

Name of Consultancy Organization (where relevant)**:** _____

I confirm that I have received and understood and will abide by the United Nations Code of Conduct for Evaluation.

Signed at *New Delhi, India* on *January 26, 2018*

[45] www.unevaluation.org/unegcodeofconduct