Country Study

Terminal Evaluation of the Country Programme of Mexico under the Global Solar Water Heating Market Transformation and Strengthening Initiative

PIMS 3611/ ID: 00063034

Final report

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Evaluation Office of UN Environment

Preamble

This evaluation report has been produced as part of the Terminal Evaluation of the GEF/UNEP/UNDP project entitled 'Global Solar Water Heating Market Transformation and Strengthening Initiative' (GEF ID 2939). The UNEP led global knowledge management component and UNDP implemented country programmes in Albania, Chile, Lebanon and Mexico were evaluated under supervision of the UNEP Evaluation Office in 2016. This report serves as an independent evaluation of the Country Programme of Mexico, but should be considered as part of the overall evaluation together with other country programme evaluations. These evaluation reports and related Terms of Reference are available at UNEP Evaluation Office webpage (unep.org/evaluation/) and UNDP Evaluation Resource Centre (erc.undp.org).

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Project Identification Table

NAME OF THE PROJECT:	The Country Program of Mexico under the Global Solar Water Heating Market Transformation and Strengthening Initiative		
GEF ID:	2939	ATLAS ID:	00063034
PIMS ID:	3611		
GEF OP #:	6	Project Type:	Full-size project
Focal Area(s):	Climate Change Mitigation	GEF Strategic Priority/Objective:	Promoting the Adoption of Renewable Energy by Removing Barriers and Reducing Implementation Costs
Expected Start Date:	June 26, 2009	Actual start date:	November 23, 2009
Planned completion date:	December 23, 2012	Actual completion date:	March 31, 2016
Planned project budget at approval:	1,750,000 USD [1] (3,570,000 USD)	Total expenditures reported as of Dec 2015 (only GEF):	1,727,780.39 USD
GEF grant (USD):	1,750,000 USD		

[1] UNDP managed total Budget (as per the project document)

Table of contents

ACRONYMS

ANES	Asociación Nacional de Energía Solar
AWPs	Annual Work Plans
CENAM	Centro Nacional de Metrología
CFE	Federal Electricity Commission
CMIC	Mexican Chamber of Construction Industry
CONAVI	National Housing Commission
Conuee	Comisión Nacional para el Uso Eficiente de Energía
CP	Country Programme
CRE	Energy Regulatory Commission
DTESTV	Dictamen Técnico de Energía Solar Térmica en Vivienda
FIDE	Electricity Savings Fund
FIRCO	Fideicomiso De Riesgo Compartido
FOTEASE	Fund for Energy Transition and Sustainable Use of Energy
GEF	Global Environmental Facility
GHG	Greenhouse Gas
GIZ	German International Cooperation agency, formerly GTZ
GSWH	Global Solar Water Heater (project)
IIDEREE	Energy Efficiency and Renewable Energy Investigation and Development Institute
INEGI	National Institute of Statistics and Geography
INFONAVIT	Instituto del Fondo Nacional para la Vivienda de los Trabajadores
ICA Procobre	International Copper Association Mexico
IER	Renewable Energy Institute
LAEFERTE	Law for the Use of Renewable Energies and Financing of the Energy Transition
LASE	Law for Sustainable Use of Energy
M&E	Monitoring and Evaluation
MTR	Mid-Term Review
NOM	Mexican Official standard
PIRs	Project Implementation Reviews
PoA	Program of Activities
PROCALSOL	National Solar Water Heater Program
ProDoc	Project Document
PTB	National Metrology Institute of Germany
R&D	Research & Development
SEDEMA	Secretaría del Medio Ambiente de la Ciudad de México
SEMARNAT	Ministry of the Environment and Natural Resources
SENER	Secretaría de Energía
SWH	Solar Water Heater
UNAM	National Autonomous University of Mexico
UNDAF	United Nations Development Assistance Framework
UNDP	United Nations Development Program
UNEP	United Nations Environment Program
USD	United States Dollar

1 INTRODUCTION

1. The subject of this evaluation report is the Mexican component (hereafter referred to as "the Country Programme" (CP) of the GEF/UNEP/UNDP project entitled 'Global Solar Water Heating Market Transformation and Strengthening Initiative' (hereafter referred to as "the GSWH initiative"). This evaluation report has been produced as part of the overall Terminal Evaluation[2] of the GSWH initiative.

2. This report presents the findings of the terminal evaluation of the Mexican Country Programme. The CP, that received a USD 1.75 million grant from the Global Environmental Facility (GEF), was implemented between July 2009 and April 2016 managed by UNDP Mexico and implemented by the National Commission of Efficient Energy Use – Conuee (La Comisión para el Uso Eficiente de la Energía). The goal of this country program of the global GEF/UNDP/UNEP Solar Water Heating Market Transformation and Strengthening Initiative has been to accelerate market development of solar water heaters in Mexico with an objective to reach total capacity of 2.5 million m^2 of installed collector area by the end of project; and expected continuing growth to reach a target of 23.5 million m^2 of total installed SWH capacity by 2020.

3. By cooperating with and supporting Mexico's National Solar Water Heater Program (PROCALSOL), the Mexican CP aimed at developing an enabling regulatory environment and helped to building up the market demand and strengthen the supply chain. The focus were on: i) enhancing awareness of the key stakeholders of the use of SWH systems; ii) supporting the establishment of an enabling regulatory environment for sustainable development of the SWH market in Mexico, including a voluntary quality control and certification of SWH systems; iii) building the capacity of the supply chain; and iv) supporting the establishment of attractive consumer financing mechanisms in co-operation with the local financing institutions.

1.1 Evaluation approach and methodology

4. The terminal evaluation was coordinated by the UNEP Evaluation Office and thus follows the UNEP evaluation policy and guidelines. The approach has been adapted and is aligned with UNDP and GEF requirements. This evaluation is guided by the Terms of Reference (TOR) developed for the overall terminal evaluation of the GSWH initiative. Each country programme under GSWH Initiative (in Albania, Chile, Lebanon and Mexico) is assessed against the evaluation criteria specified in the evaluation TOR (section 4)[3].

5. The terminal CP evaluation aims at providing a comprehensive and systematic account of the performance of the completed CP by evaluating its relevance in terms of UNDP/UN strategic programming documents, its consistency with global, regional and national environmental issues and needs as well as with the GEF climate change focal area, strategic priorities and operational programmes as well as its success in producing the programmed outputs and the extent to which its objectives and planned results were effectively achieved or are expected to be achieved and their sustainability.

6. The evaluation utilizes the Theory of Change (TOC) approach to depict the impact pathways from outputs through outcomes towards impacts. It will also assess the sustainability and the factors that influenced or could influence the replication and scaling up of the CP results and the state of

[2] Terms of Reference concerning the overall terminal evaluation of the GSWH initiative is available at UNEP evaluation office webpage

[3] Terms of Reference concerning the overall terminal evaluation of the GSWH initiative is available at UNEP evaluation office webpage

the enabling environment for a sustainable SWH market in Mexico after its completion. Efficiency through cost-effectiveness and timeliness of CP execution will also be assessed.

7. Findings from this TE will provide guidance in view of charting future directions to ensure that the market transformation of solar water heaters in Mexico is sustained as well as will be also used for accountability purpose.

8. The methodology adopted for this CP assessment includes a review, prior to the country mission, of all relevant project documentation and pertinent background information. Interviews with key project personnel and other relevant stakeholders from Government, Academia, Associations and Private sector also took place (Annex 1). A full list of documents reviewed and people interviewed will be found in Annexes 1 and 2.

9. Preliminary findings after the in-country mission were shared with the UNDP and CP team prior to the departure of the evaluator. Additional consultations, later in the CP assessment process, were done by email for the checking of the factual errors and /or omissions.

10. Project outcomes are assessed as per GEF performance ratings as follows:

- Highly Satisfactory (HS): There are no shortcomings in the achievement of the objectives.
- Satisfactory (S): There are minor shortcomings in the achievement of the objectives.
- Moderately Satisfactory (MS): There are moderate shortcomings in the achievement of the objectives.
- Moderately Unsatisfactory (MU): There are significant shortcomings in the achievement of the objectives.
- Unsatisfactory (U): there are major shortcomings in the achievement of the objectives.
- Highly Unsatisfactory (HU): There are severe shortcomings in the achievement of the objectives.

1.2 Limitations of the evaluation

11. The short duration of the in-country mission (5 days) meant that a list of questions, which does not claim to be in any way exhaustive, was prepared with a focus on main issues. For instance, the mission to Mexico of 5 days did not allow meeting all the relevant stakeholders; this is why the evaluation findings are based on the interviews conducted during the mission and some other interviews by phone hold after the mission. In addition, due to a change in the Mexican government, the majority (if not, the whole organization) of Conuee employees has changed since the beginning of the project and it was difficult to retrieve all the information for the first years of the project.

2 DESCRIPTION OF THE COUNTRY PROGRAMME

2.1 Country context

12. Mexico's average solar radiation is 1,898 kWh/m^2 year and thus, it offers good conditions for the use of SWH in the majority of the states. Demand for water heating with fossil fuels is a significant component of national energy consumption accounting for an estimated 8% of total demand; this does not even include fuel wood. In assessing the total energy demand of the building sector in Mexico, the energy consumed for hot water was estimated to be 33% in 2008. In 2009, the installed capacity of SWH in Mexico can be broken down as follows: 78% in swimming pools, 14% in industrial and commercial buildings, and 8% in the residential sector. The sales of SWH technology before the start of the program were expanding into the commercial and light industrial sectors. Mexican SWH sector was classified as an emerging market. In 2005, the penetration rate was 6.9 m^2 per 1,000 inhabitants.

13. Prior to the commencement of the national program, SWH technology was sourced mainly from small scale local factories. Conuee has supported a range of activities to promote the use of SWHs since 2001.

14. The CP reportedly builds on the following parallel programs:

- Cooperation with Conuee and GIZ to design and implement the PROCALSOL Program;
- The CONAVI pilot project to install SWH in new housing;
- Cooperation with the Municipality of Mexico DF to promote SWH through the municipal building code;
- The joint Conuee-INFONAVIT pilot program on green mortgages.

2.1.1 Procalsol and country programme cooperation

15. In 2007, the Mexican government through its energy efficiency agency, CONAE (currently known as Conuee) launched a program to promote the use of SWH in collaboration with the association of solar panel manufacturers (ANES) and the German International Cooperation Agency (GIZ, formerly GTZ). This program, called PROCALSOL, had a global objective to reach 1.8 million m^2 of installed SWH panels by 2012. This objective was set based on a potential market of more than 2 million m^2 of thermal solar panels defined taking into account the existing SWH installation in 2007, the energy consumption, the equipment replacement rate, the economy growth and the building stock.

16. The specific objectives of PROCALSOL were similar to the CP:

- Push the use of SWH in residential, commercial, industrial and agriculture sector in Mexico through the strengthening of existing mechanisms and the design and implementation of new and innovative schemes
- Guarantee that the SWH market growths with an adequate quality level of products and associated services.
- Facilitate the improvement of national industry integrating manufacturers, system designers, suppliers and installers.
- Promote the adoption of technologies developed by national R&D centers.

17. PROCALSOL had several action lines that were designed to match as much as possible with the CP:

- Regulation including the promotion of standards and regulatory tools for SWH systems and installation, training and certification program for technical and the support to implement environmental standards for SWH
- Incentives for end users including the design of new financial mechanisms for the industrial, commercial and agricultural sectors and the green mortgage for the residential sector.
- Support to the supply side including professional certifications, support for SMEs and establishment of a quality label for SWH equipment.
- Information including awareness raising for end-users, a webpage and capacity building on technical aspects of SHW to specific groups
- Management with a technical committee and a coordination unit and the creation of an evaluation and monitoring system.

18. An operation plan was defined annually for PROCALSOL. The UNDP country program design was based on the PROCALSOL activities and during the last years of operation of PROCALSOL, both programs worked in collaboration. The PROCALSOL Program terminated in December 2012 as a direct consequence of the change of the Federal Government.

2.2 Country Program start and duration

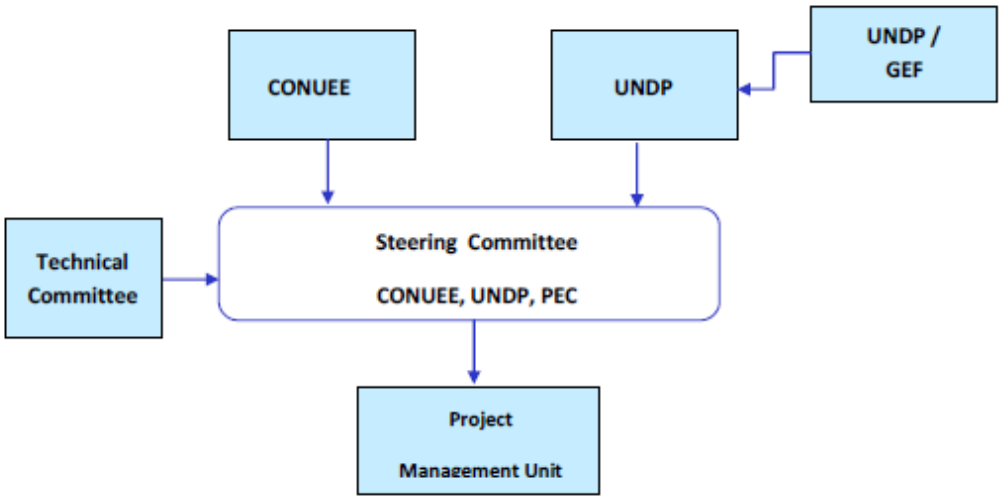
19. The CP design document (ProDoc) was signed on 15th July 2009 with formal Project operations commencing with the Inception Workshop on 10th and 11th December 2009.

20. The ProDoc indicated that the CP was a 4.5 year project with a project terminal date of 31st December 2012. The CP was extended for another 3.5 years to its current terminal date of March, 2016. The long extension was justified due to slow implementation that was followed by several factors: (1) changes within the Conuee and Project Coordination Unit in 2010 and at the end of 2012; (2) leadership changes in March 2011 and again in May 2013; and (3) between May 2013 and July 2013, the CP did not have a coordinator.

2.3 Project implementation arrangements

21. The SWH Country Program of Mexico is implemented by the UNDP Country Office in Mexico (UNDP CO) and executed by the Conuee under the National Execution Modality (or National Implementation Modality). An organigram of the CP implementation arrangements is provided in Figure 1.

Figure 1: CP Implementation Arrangements



- National Project Steering Committee: The Steering Committee is the project's supervisory and decision making body that meets at least twice a year. This committee was formed, with the participation of a representative from Conuee, SENER, the UNDP Programme Officer or representative and the project coordinator. UNEP's role in the Steering Committee was defined as an observer.
- National Project Director: Four people occupied this position during the project implementation period between 2009 and 2016.
- Project Management Unit was in charge of the management of the project, and established office within the Conuee. The National Project Coordinator, appointed on the 1st of November 2009, was responsible for the project management and to achieve the project goals on time by providing administrative and technical inputs for project activities with the support of the required professional staff. The National Project Coordinator also changed in June 2013.

2.4 Objectives of the Country Programme

22. The CP objective was to accelerate and sustain the solar water heating market in Mexico as a part of the Global SWH Market Transformation and Strengthening Initiative with an objective to reach total capacity of 2.5 million m^2 of installed collector area by the end of the project; and expected continuing growth to reach a target of 23.5 million m^2 of total installed SWH capacity by 2020. This has been estimated to correspond to an estimated cumulative GHG reduction potential of over 27 million tons of CO_2 by 2020.

23. To achieve this overall goal and objective, the CP was designed for the removal of barriers with through the implementation of the following components/outcomes (section 2 will provide details on the actual CP outputs and related activities):

- Component 1: Promote the development of a legal and regulatory framework to promote sustainable SWH market;
- Component 2: Enhanced awareness and capacity of the targeted end-users and housing developers to facilitate integration of SWH into new homes and into other promising new market segments;

- Component 3: Increased demand for SWH systems based on the availability of attractive end-user financing mechanisms;
- Component 4: A certification and quality control scheme applicable for all SWH manufactured and/or installed in Mexico and enhanced capacity of the supply chain to offer products and services promoting a sustainable SWH market;
- Component 5: The provided support institutionalized and the results, experiences and lessons learned documented and disseminated (including monitoring, learning, evaluation and other feedback for adaptive management).

2.5 Main Stakeholders

24. The main stakeholders of the Mexican CP are listed in an approximate order of ownership and involvement:

- Conuee. In August 2007, CONAE (former Conuee) launched the National Solar Water Heater Program, PROCALSOL, to continue its effort to promote SWH use in the country started in 2001. PROCALSOL intended to complement the implementation of the UNDP/UNEP Solar Water Heating Market Transformation and Strengthening Initiative. Its role is to facilitate the project design, implementation and awareness promotion by being the executing agency for the CP;
- UNDP Country Office monitored the implementation of the activities undertaken across the country project. UNDP Program Officers participated in the CP's Steering Committee as well as in PROCALSOL's coordination unit and took part in the decision-making processes;
- Secretaria de Energia (SENER) was responsible for the overall development of the energy sector, including the promotion of alternative energy technologies. SENER is the main support of the legal and regulatory framework development and facilitated the participation of other government entities in the CP;
- Instituto del Fondo Nacional para la Vivienda de los Trabajadores (INFONAVIT). INFONAVIT is the principal institution in Mexico's mortgage market. INFONAVIT is the closest to rolling the cost of SWHs into mortgages for new housing. INFONAVIT participated in the CP through its green mortgage program;
- National Housing Commission (CONAVI) is in charge of developing policies for the housing sector. CONAVI was evaluating possible sustainable design mandates for the housing sector through a program, in which SWH could be included. CONAVI promotes and facilitates SWH installation in new housing with collaboration from a number of housing developers. CONAVI participated in the CP through a pilot program to install SWH in new housings;
- Asociación Nacional de Energía Solar (ANES) represents the solar community and contributed to the CP by providing views of the academic community and of the solar industry;
- German International Cooperation agency (GIZ, formerly GTZ) assisted in the formulation and design of the PROCALSOL as well as in diverse related studies on the potential of SWH in Mexico. This institution supported and developed activities in collaboration with the CP;
- International Copper Association Mexico (ICA Procobre) supported and developed activities in collaboration with the CP;
- Centro Nacional de Metrología (CENAM) is a national reference laboratory for metrology and is responsible to establish and maintain national measurement patterns. Also, this institution offers measurement equipment calibration services. They supported the CP by maintaining a constant contact with national laboratories and with international institutions related to metrology;

- Mexican manufacturers in Renewable Energy (Famerac), established in 2010, represents the interests of Mexican manufacturers of renewable energy technologies. This institution took part in the CP as representative of companies working in SWH;
- Association of Evacuated Tubes (SOTECSOL). This institution took part of CP as representative of companies working in SWH;
- National Metrology Institute of Germany (PTB). The PTB helps the development of quality instruments thanks to a technical cooperation between the German Ministry of Economic Cooperation and Development. This institution supported the development of awareness of laboratories in the SWH metering field;
- Secretary of Environment – City of Mexico (Sedema). This organization enforced in 2006 a mandatory regulation to install SWH installations in the commercial sector. They also signed a generic agreement with Conuee and collaborated in the development of a legal framework for the SWH market under the CP;
- Universities. Several universities participated in the development of the CP activities, specifically for the capacity building (namely National Autonomous University of Mexico (UNAM) through the renewable energy institute (IER) Universidad del Caribe and Universidad Tecnológica de la Riviera Maya);
- Laboratories. The laboratories involved in the CP and able to evaluate solar panels and SWH systems were: Industrial Group Saltillo, Solar energy laboratory of the IER, Guanajuato university laboratory, energy efficiency and renewable energy investigation and development institute (IIDEREE) and Mexican solar test laboratory (Mexolab);
- Bancomext is a development bank that participated in partnership with commercial banks to provide lower interest loans for SWH system in the hotel sector via the Yucatan Peninsula Project;
- Ministry of Tourism (SECTUR). The Sustainable Tourist Development Zones Division participated in events in relation with the SWH in hotels organized in collaboration with the CP.

25. The following stakeholders played indirect roles in the energy market and in particular, in the SWH market. They did not participate actively in the CP however they were mentioned in the ProDoc:

- Federal Electricity Commission (CFE): CFE is a vertically integrated stated-owned utility;
- Energy Regulatory Commission (CRE): CRE regulates Mexico's natural gas and electricity industries;
- Ministry of the Environment and Natural Resources (SEMARNAT): SEMARNAT establishes policies on environmental protection;
- Electricity Savings Fund (FIDE): FIDE promotes actions that induce and support electricity savings and rational use of electricity;
- General Bureau of Standards housed by the Ministry of Economy (SE): SE deals with the establishment of standards and norms. SE is the authority over the implementation the SWH standards at the national level in Mexico;
- Fideicomiso De Riesgo Compartido (FIRCO) promotes SWHs in the agro-industrial sector;
- Fondo de Fomento y Garantía para el Consumo de los Trabajadores (FONACOT/INFONACOT). Identified as a possible partner to cooperate during the CP implementation in developing a financial mechanism to promote sales which was not implemented.

2.6 The Reconstructed Theory of Change

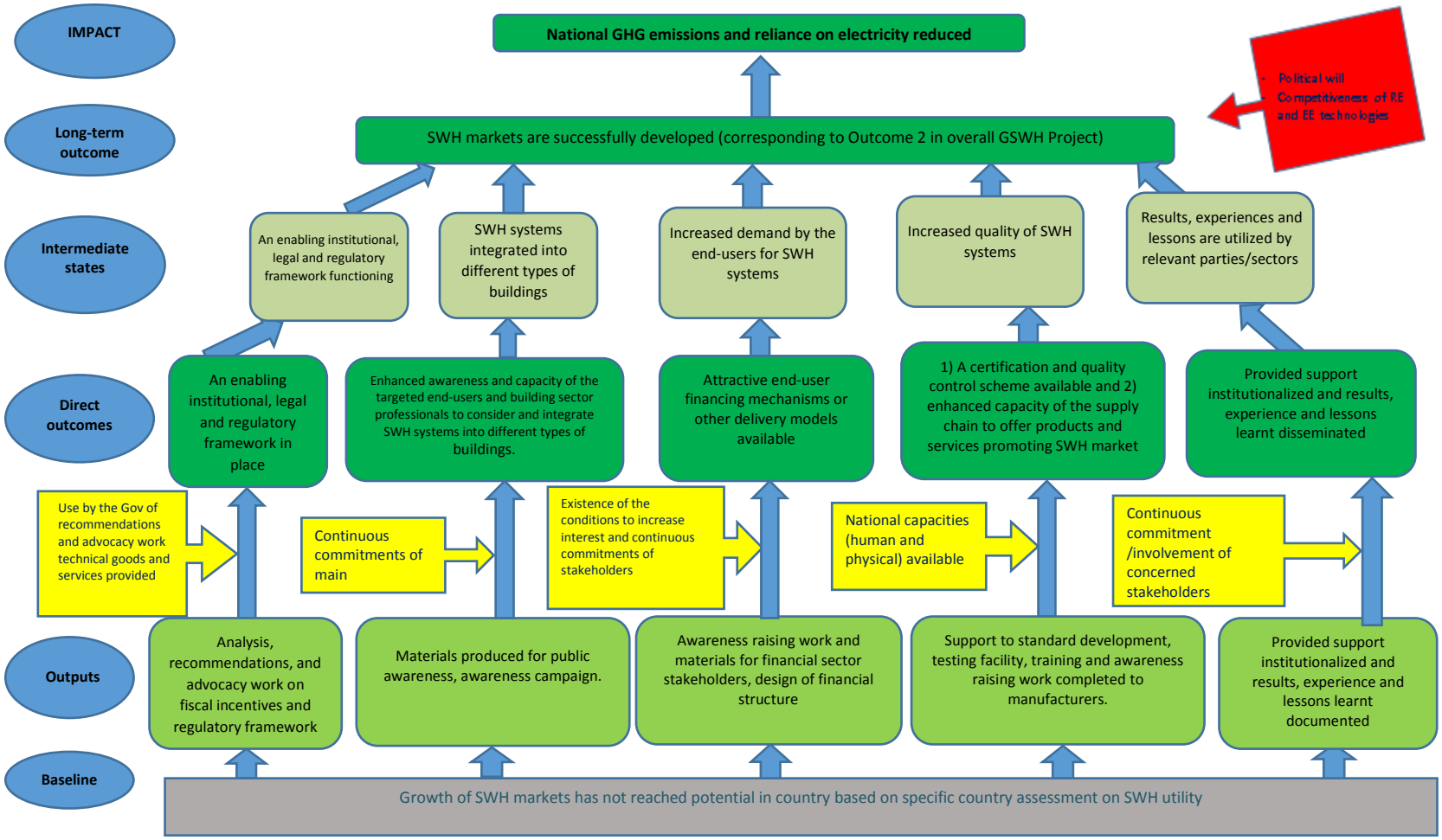
26. The theory of change (TOC) is a representation of causal linkages which allows understanding the underlying programme logic, from outputs through direct outcomes to long-term outcomes, and further towards impact(s). The CP document did not originally include a TOC, which therefore was reconstructed based on the Strategic Result Framework (SRF) in the ProDoc. The Mexican country programme was developed as part of Global Solar Water Heating Market Transformation and Strengthening Initiative thus the underlying project logic in each participating country was based on similar assumption of market transformation mechanisms.

27. The CP activities and outputs were expected to contribute to achievement of 5 direct outcomes which themselves should eventually lead, via intermediate states towards the long-term outcome and eventually towards the intended impact. The CP's intended long-term impact was reduction of GHG emissions and reduced reliance on electricity.

28. Outputs and direct outcomes are direct CP effects while intermediate states are the transitional conditions between the CP's direct outcomes and the long-term outcome. The long-term outcome of the reconstructed TOC – SWH markets are successfully developed – corresponds to the SRF objective as per the ProDoc and is measured by the a) estimated amount of installed SWH systems (as m^2), and b) growth of the annual sale of SWH systems. Direct outcomes and intermediate states of the TOC are formulated based on the outcome statements in the ProDoc

29. There are a certain number of drivers (yellow rectangles) which are external factors that are expected to contribute to the realization of the intended outcomes and impacts and can be influenced by the CP. Assumptions are also depicted (in the red rectangle) and are needed to achieve the intended impacts but they are largely beyond the control of the CP.

Figure 2. Reconstructed Theory of Change of the country programme



3 EVALUATION FINDINGS

30. This section presents the main findings of the Terminal Evaluation of the Country Programme of Mexico under the Global Solar Water Heating Market Transformation and Strengthening Initiative.

3.1 Strategic relevance

31. This criterion assesses the alignment of the project objectives with Mexican country priorities and initiatives, UNDP strategies and other programming principles.

32. **National priorities**. Climate protection features are at the very top of Mexico's political agenda. On November 28, 2007, two laws were passed as a first step to introduce renewable energy in the Mexican regulation framework: the Law for Sustainable Use of Energy (LASE) and the Law for the Use of Renewable Energies and Financing of the Energy Transition (LAEFERTE). These laws developed instruments promoting renewable energy technologies. The Mexican country program of the GSWH initiative embraced and complemented the existing program PROCALSOL to increase the results of both programs. The CP activities were aligned with the PROCALSOL's ones to take advantage of the synergies between both programs. Thereafter, the Mexican government defined the National Climate Change Strategy which is an instrument that is guiding Mexico's actions against the irresponsible exploitation of natural resources, aiming at a climate friendly path of green growth. The Strategy is part of the General Law on Climate Change, which entered into force in 2012. The National Climate Change Strategy sets out the main activity areas concerning cross-sectoral climate policy, adaptation to climate change and reduction of greenhouse gas emissions. It confirms the ambitious Mexican climate mitigation goals to reduce emissions by 30% by the year 2020 with respect to the business-as-usual scenario and by 50% by 2050, as compared with the emissions in the year 2000. The CO_2 emissions reduction obtained thanks to the CP contributed to the climate mitigation objective set in the National Climate Change Strategy.

33. **UNDP's policy and strategy.** In the action plan for the national program established for 2008-2012 period between UNDP and the Mexican government, it is stated that the program is based on the support of adoption of policies and with technical assistance to national actions and the strengthening of national capacities. The CP's outputs are clearly aligned with this action plan.

34. **UNDAF.** The United Nations Development Assistance Framework (UNDAF) for the period 2008-2012 which is aligned with the national priorities set by the national development plan and the Mexico Vision 2030 integrates five main areas of cooperation: 1) economic competitive development, sustainable, equitable and inclusive growth; 2) equitable and universal exercise of social and cultural rights; 3) exercise of the right to a healthy and productive environment; 4) strengthening of the rule of law and of public safety; 5) democracy consolidation. The country program of the GSWH promoted a sustainable and competitive development of the local SWH market. The UNDAF for 2014-2019 also includes an area of cooperation aligned with the objectives of the GSWH initiative: environment and sustainable growth.

35. **Alignment with GEF focal areas and strategic priorities.** The GEF supported activities related to Climate Change Mitigation and Climate Change Adaptation. The GEF's projects are expected to achieve several objectives related to these activities and one of these is "investment in RE technologies". The CP activities planned and developed in Mexico are evidently lined up with the GEF Climate Change strategic priorities.

36. **Gender and HRBA issues.** These issues have not been addressed during the project implementation phase because they have not been identified as such in the ProDoc.

37. The strategic relevance of the CP is evaluated as "Satisfactory" (S)

3.2 Achievement of outputs

38. This section explains the success in producing the programmed outputs and milestones as defined in the ProDoc both in quantity and in quality and their usefulness and appropriateness. The reasons behind the success or failure of the project in producing the different outputs and meeting the expected quality standards are presented in the following table. The CP includes 5 independent but inter-related outcome areas. The review of the outputs produced during the CP implementation is presented hereafter.

39. Outcome 1: An enabling institutional, legal, and regulatory framework to promote sustainable SWH market

Outputs(Project logical framework)	Actual outputs delivered:
Output 1.1: Analysis, recommendation and associated advocacy work for the introduction of adequate public financial and fiscal incentives to promote the SWH market will be finalized	Mexico provided financial incentives for SWH system installation prior the CP, including a 2004 decree that allows for depreciation of 100% of expenses of renewable energy equipment in one year. The CP has indirectly supported INFONAVIT's green mortgage Program (Hipoteca verde) by development of product quality standards and promotional activities targeting end-users and developers of housing projects. This green mortgage scheme was created in 2010 and INFONAVIT needed to establish technical requirements for the SWH systems and installation to ensure that the SWH systems would function properly. The CP helped in the development of the technical regulation that the installers must follow under the green mortgage program: Dictamen Técnico de Energía Solar Térmica en Vivienda (DTESTV). Moreover, the support provided by the CP was partly in documenting the housing sector case. The CP supported the introduction of adequate public financial scheme but did not develop a specific analysis and recommendations.
Output 1.2: Analysis, recommendation and associated advocacy work for setting-up the required regulatory framework for SWH quality control to be finalized	Conuee is working to issue an official Mexican Official standard (NOM) for solar water heating product: PROY-NOM-027-ENER, to consolidate a regulatory framework for the market for these products. The Committee is composed by representatives of public and private institutions, academia and non-profit organizations and met for the first time in April 2015. The NOM proposal did not reach an agreement in the SWH market in Mexico during the project implementation. The majority of the NOM is based on the ISO plus another pressure test. Several interviewed stakeholders pointed out that this additional pressure could create an issue. The NOM proposal was not approved during the project period (the continued work on NOM is further discussed in paragraph 48 and 73).
Output 1.3: Adoption of new regulations to consider or oblige the integration of SWH systems into the design and construction of new buildings[4]	Starting from the case of the municipal building code in Mexico City, the opportunities to replicate this model in other cities were explored. A review was made of applicable regulation in different municipalities and states. This line of action may create considerable impact, since there are few very large cities in Mexico; also the number of municipalities with more than 100,000 inhabitants is less than 100. A practical guide was elaborated defining the steps to follow to incorporate SWH regulations in building codes. ICA PROCOBRE was actively approaching municipalities. Suggested amendments to municipal building code have

[4] Numbering of outputs differ from those in the original logframe (as 1.3 was missing)

	been compiled by the CP for dissemination among municipalities. Only few municipalities have effectively implemented new building code. ICA Procobre developed this work mainly by themselves without close cooperation with other CP stakeholders, especially before 2012. Several success stories of incorporation of SWH system's obligation in municipal building codes occurred due to efforts of ICA PROCOBRE: Aguascalientes, Ags, Puebla, Pue., Villahermosa, Tab., Jalapa, Ver. And Zihuatanejo, Gro..

40. Outcome 2: Enhanced awareness and capacity of the targeted end-users and housing developers to facilitate integration of SWH into new homes and into other promising new market segments

Outputs (Project logical framework)	Actual outputs delivered:
Output 2.1: Materials for public awareness raising and marketing campaigns developed or adapted into Mexican conditions	Several tools have been developed to reach SWH market stakeholders and inform them on the latest development in the market. These tools include a newsletter disseminated through the Solar Community, with represents the market stakeholders such as manufacturers, installers, engineers, and public institutions. Anyone interested in the solar renewable energy can subscribe to the community's newsletter. Information about CP developed by Conuee is available on the Conuee's webpage. Some developed materials focus on the public awareness; however, the majority is directed to market stakeholders who are already to a certain extent knowledgeable about SWH. The work to increase awareness amongst SWH market stakeholders is spread among different counterparts and other collaborators involved in the development of the SWH market depending on their strategy. For example, ICA Procobre which has worked for many years with the municipalities used its network to promote SWH within these institutions. Moreover, the different manufacturers associations disseminated the work done by the CP and Procalsol among their affiliates. There is a Council of Solar Water Heating integrated by the main SWH Mexican stakeholders, who is in charge of follow up to the different activities. The ICP is on the continuous process of documented and disseminated of the results, experiences, and lesson learnt (including monitoring, learning, evaluation, and other feedback for adaptive management). Some of the CP knowledge products could be seen in the UNDP webpage, Twitter, Facebook and YouTube platform. Every month, the CP published a newsletter focused on Solar Water Heating news, products, etc. among the SWH community, know integrated by around 3000 people[5]. The products were spread among several sectors, such as industry, researchers, consultants, government, manufacturers, importers and distributors of SWH technology and others with interested renewable energy.
Output 2.2: Public awareness raising and marketing campaigns implemented in co-operation with relevant public entities and private SWH suppliers and manufacturers	

41. Outcome 3: Increased demand for SWH systems based on the availability of attractive end-user financing mechanisms

[5] As of April 26, 2016, the information bulletin registered 3049 users.

Outputs (Project logical framework)	Actual outputs delivered:
Output 3.1: Enhanced awareness of the key financial sector stakeholder and local suppliers on the specific characteristics and financing opportunities in the SWH market.[6]	Based on the stakeholder feedback, many financial stakeholders were contacted by the CP to establish a partnership to develop a financing mechanism for hotel SWH systems. Between 2014 and 2015 the SWH UNDP CP, along with Conuee held several meetings with representatives of many agencies, institutions and organizations related to sustainability programs, financing and technology manufacturers of SWHs (UNEP, ANES, GIZ, NAFINSA, INADEM Banamex, Bancomext) to understand their interests and experiences around the startup of the financing scheme for renewable energy. Bancomext was the only actor interested in this project. At the time of the evaluation, it was evident that the financial stakeholders did not demonstrate high interest in SWH sector in general. This situation may possibly change once the financial mechanism for tourism sector will be in operation (see output 3.2.).
Output 3.2: Design the financial structure and implementation arrangements for specific purpose financing vehicles that will address consumer needs in the SWH market	The CP supported NAFIN's Ecocredito window for Small and Medium Enterprise for SWH products and installations. The CP developed a technical and financial SWH system pilot mechanism for the Services sector (hotels), with the involvement of various national counterparts. Initially, it will be focused, to the hotel sector in a regional perspective. It will be implemented at the Yucatan Peninsula (three states Yucatan, Campeche and Quintana Roo). The CP developed a complete set of operation manuals, templates, and tools to facilitate implementation of the financial mechanisms for a hotel sector: the Operation Manual Pilot Financial Mechanism for SWH Systems, the guidelines of operation. The CP informed the technology providers on this financing mechanism with 24 technology providers interested in participating (between manufacturers, importers and technology distributors). Out of these, 4 already have requested requirement specification (technical certificates and competences) to participate. In addition, several hotels have expressed their interest to use the financing mechanism to finance a SWH system installation. Initial funding for the pilot financing mechanism in hotels was leveraged through the Ministry of Energy, FOTEASE (Fund for Energy Transition and Sustainable Use of Energy) for an amount of 21 million MXN.

42. Outcome 4: A certification and quality control scheme applicable for all SWH manufactured and/or installed in Mexico and enhanced capacity of the supply chain to offer products and services promoting a sustainable SWH market

Outputs (Project logical framework)	Actual outputs delivered:
Output 4.1: Set of SWH standards and associated certification system developed (or adapted) for Mexican conditions	Conuee developed the new reformed DIT, now DTESTV as a quality standard. Conuee is working on the update of the two voluntary standards based on a quality assurance system. In the voluntary quality control and certification scheme for SWH installation services, there are now 2 standards of competence which can certify solar thermal installers.

[6] The formulation of output 3.1 'Enhanced awareness of the …' is an outcome level result. This section is about the output level achievements.

	These standards were developed through the Management Committee for Renewable Energy and Energy Efficiency, composed of various private and public institutions, the academia, international cooperation agencies, associations and interested societies involved in these issues. The CP is part of this group. Competency standards for the installation of solar water heating are EC- 0325 (Installation of solar water heating thermosiphonic sustainable housing) and EC- 0473 (Installation of solar water heating with hot water tank forced circulation). Under the voluntary quality control and certification scheme for SWH equipment, the CP worked on strengthening the whole value chain. The quality control system equipment solar water heaters are tested by SWH testing laboratories in Mexico. The CP has been working during this time to strengthen them and at the time this report was held on diploma Metrology and Quality Management Test Laboratory Solar Water Heaters", done in the facilities of the National Metrology Center (CENAM) in Queretaro, Mexico.
Output 4.2: Availability of effective and affordable testing services to check compliance with standards	In 2013, the CP supported the installation of the new laboratory test facility in Leon Guanajuato for IIDEREE. This testing laboratory forms part of the SWH system quality assurance test labs installed capacity. Notwithstanding the good intentions, this activity created a distortion in the testing laboratory market. Conuee worked intensively after this issue to restore a good climate between the existing laboratories and the one supported by Conuee. A discussion forum has been held to exchange about the strengthening of quality infrastructure for SWH to unify opinions between the market sector and the laboratories. Conuee worked in creating a formal network of the solar testing laboratories, LabSolMx. There is no evidence on the existence of such network at the time of the evaluation.
Output 4.3: A training and recognition system in place for SWH system installers	Strengthening the scheme of certification and quality control through the creation of a diploma course "Metrology and Quality Management Test Laboratory SWH in the facilities of the CENAM in Queretaro, Mexico. This diploma course was conducted in six modules from October 2014 to February 2015, and was the culmination of several meetings for identifying training needs of testing laboratories of SWH in Mexico and meaningful collaborative actions between the CP (UNDP- Conuee), the National Metrology Center (CENAM) and its counterpart in Germany (PTB). To work with the final user, the CP made alliances with the Mexican Chamber of Construction Industry (CMIC) to improve the plumbers solar installation standards.

43. Outcome 5: The provided support institutionalized and the results, experiences and lessons learned documented and disseminated (including monitoring, learning, evaluation and other feedback for adaptive management)

Outputs (Project logical framework)	Actual outputs delivered:
Output 5.1: The reporting framework and arrangement for the SWH market monitoring established and continuing after the end of the project.	In 2011, the Ministry of Energy gave an estimate of the total SWH installations to the official statistics; however, it had insufficient human and technical resources to conduct a thorough survey on SWH installations and to conduct similar surveys in the following years. To support this work, the CP hired a consultant with expertise in survey designs and html to create and develop an automatic survey which will get data from SWH manufacturers, suppliers and distributors for 2011 and

	onwards. The online tool was available at the end of 2012. This work was finalized at the end of 2012 and showed interesting feedback on awareness about SWH and a positive vision about the public policies implemented by the government. The design of the online survey, user manuals and replication methodology were paid by the CP and donated to the Mexican Government. So far, the consultancy has created a database including up to 300 SWH suppliers and manufacturers up to 2012. The CP along with the Conuee conducted a survey between 2014 and 2015 on the lack of accurate and reliable information on installed solar water heaters in Mexico. Consequently, the CP worked in collaboration with the INEGI, the statistical institute of Mexico, to include one question about SWH in the national survey: "Does the house have a SWH?" This question was added in 2015 but does not give information on the size and the technology of the SWH. The annual SWH installation rate is monitored by ANES and this institution will continue to monitor this data after the end of the CP. The CP developed the necessary tools to monitor the SWH market after its end.
Output 5.2: Project mid-term and final evaluation	The project had its MTR on the end of 2012, which showed interesting feedback about how the project has changed due to market conditions and positive public policies implemented by the government.
Output 5.3: The project final results and lessons learned documented and disseminated	The CP's results were disseminated through Conuee - Renewable Energies website: http://www.renovables.gob.mx/ and directly in the PROCALSOL webpage http://www.procalsol.gob.mx/wb/. These webpages no longer exist. Nowadays, the Conuee web site includes information on the current Mexican program on SWH. The CP was on the continuous process of documented and disseminated of the results, experiences, and lesson learnt (including monitoring, learning, evaluation, and other feedback for adaptive management). Some of the CP knowledge products are still available in the UNDP webpage, Twitter, Facebook and YouTube platform. Every month, Conuee publishes a newsletter focused on Solar Water Heating news, products, etc. among the SWH community, know integrated by around 3,000 people[7]. A document has been issued presenting the majority of the CP's results. This document is not available on UNDP or Conuee webpages. A closing meeting was held on April 26th 2016 in the presence of Conuee and UNDP Mexico's directors.

44. As a conclusion, the CP is rated "Satisfactory" (S) in terms of the achievement of outputs. This rating is confirmed by the CP exit strategy document which acknowledges that the completion of some activities took longer than had been initially anticipated. Some tasks are still to be carried out under the Procalsol program, in order to secure and sustain the initially positive results that were achieved.

[7] As of April 26, 2016, the information bulletin registered 3049 users.

3.3 Effectiveness (attainment of direct outcomes and likelihood of impact)

45. This section presents the assessment of the effectiveness in achieving the objectives and the planned results. It is divided under three sub-sections to cover the whole program process.

3.3.1 Achievement of direct outcomes[8]

46. **Outcome 1: Promote the development of a legal and regulatory framework to promote sustainable SWH market.** The direct outcome is highly related to government willingness to enforce new regulations to promote SWH market. The Mexican government promotes the use of SWH to reach its objectives to reduce CO_2 emissions. The CP helped to promote the SWH use through municipal building codes by disseminating suggested amendments to municipal building code using Mexico City as best practice case. A few municipalities have included these amendments with CP support (as described in Output 1.3).

47. Conuee was designated by SENER to take the lead on SWH technology in Mexico leading to a clear institutional framework for SWH support in Mexico. Conuee played the role of a technical advisor for the government in the field of SWH during the CP period. Conuee has a planned budget until 2018 at least thanks to the "Programa de Calentamiento Solar de Agua 2014-2018".

48. Moreover, the CP supported policies launched by institutions like INFONAVIT through the development of technical documentations required to operate the Green Mortgage Program (as described in output 1.1.). By the end of the CP, the main contribution for this outcome is the work for the standard proposal NOM-027-ENER (as described in output 1.2). However, the standard enforcement process continued after the end of the CP. In August 2016, the standard proposal was published on the Official Journal (Diario Oficial).

49. The CP had a limited contribution to this outcome in terms of legal framework as only few municipalities adopted SWH obligation in their building code; however, its contribution at institutional and regulatory level has been important by supporting Conuee as technical advisor for the SWH technology and as developer of the NOM-027-ENER. The rating of the level of success of this outcome is therefore "Moderately Satisfactory" (MS).

50. Outcome 2: Enhanced awareness and capacity of the targeted end-users and housing developers to facilitate integration of SWH into new homes and into other promising new market segments. CP created the Solar Community which currently comprises of 3,000 individuals and the effort is aimed at establishing a dialogue between multiple actors at a federal, state and municipal level between actors of civil society, academia, the private sector, government institutions and international organizations, to optimize in a coherent and comprehensive manner, actions to promote SWH.

51. The CP had a relevant contribution to increasing awareness and building capacities in some specific market sectors: laboratories, installers, resellers and manufacturers, thanks to numerous workshops and webinars and the creation of the Solar Community newsletters. Concerning the end-users, the CP focused on one particular segment: hotels. In this segment, the CP helped to increase greatly the knowledge on SWH, especially in the Yucatan peninsula, in relation with the activities under the Outcome 3. For the other end-users segments, the CP followed the work to increase awareness developed by other institutions but did not participate actively, so the CP's contribution to enhanced awareness in the majority of the end users segments (residential, commercial, industrial, agriculture) is limited.

[8] Outcome statements are as per the project document. The analysis considers the direct outcomes as defined in the reconstructed TOC.

52. In summary, some work was completed to enhance awareness and capacity of the targeted end-users. Mainly the CP work was dedicated to create an exchange platform for professionals related to SWH.

53. It should be noted that the evaluation did not have resources to assess the actual level of awareness nor was awareness assessment/baseline established in the beginning of the CP. Thus, it is complicated to evaluate the enhancement of the awareness of the end-users as such.

54. The rating of Outcome 2 is "Moderately Satisfactory" (MS).

55. **Outcome 3: Increased demand for SWH systems based on the availability of attractive end-user financing mechanisms.** The immediate outcome (availability of the attractive end user financing mechanism) was not reached during the CP implementation period. Nevertheless, the CP launched all the activities required to develop this mechanism, and thus it is considered to contribute greatly to the development of the financial mechanism for the tourism sector (see Output 3.2). Based on the evaluation findings, it is expected that the work done under the CP in terms of development of the financing mechanisms will allow showing that the financing mechanisms are feasible in Mexico in order to promote SWH. At this stage, when the credit line hasn't been yet enforced it is impossible to assess to what extent it would contribute to the level of increased demand of SWH. However, the evaluation considers that the CP set the conditions to make this financing mechanism successful.

56. CONUEE and UNDP are still working on the implementation of the financing mechanisms. Therefore, the rating of the achievement of the outcome is "Moderately Satisfactory" (S).

57. Outcome 4: A certification and quality control scheme applicable for all SWH manufactured and/or installed in Mexico and enhanced capacity of the supply chain to offer products and services promoting a sustainable SWH market. The CP supported the development of a mandatory regulation for SWH housing products, the NOM-027-Ener (see Output 4.1.). For Hospitality and Tourism sector, the CP has created technical specifications for systems installed in this sector in relation with the financial mechanism. In collaboration with SEMANART, the voluntary Mexican standard for Sustainable Building was enforced in 2013. This standard includes a criterion for renewable energy including SWH.

58. For the four voluntary standards developed before the CP, the work done by the CP was to help the adoption of these standards and the penetration of these in the domestic market. For this purpose, the CP worked in both strengthening the network of training as well as expanding the awareness of suppliers and users in recruiting qualified staff.

59. In summary, the CP put in a lot of effort to reinforce the capacity of the whole supply chain resulting in enhanced capacity of the market stakeholders improving the quality of the SWH equipment and installation. The contribution of the CP to the outcome is significant. The progress towards the Outcome 4 is rated as "Satisfactory" (S).

60. Outcome 5: The provided support institutionalized and the results, experiences and lessons learned documented and disseminated (including monitoring, learning, evaluation and other feedback for adaptive management). The CP developed communication channels with the SWH actors. More than 3,000 people now receive information through a newsletter developed by Conuee with the support of the CP. Conuee is the public institution in charge of monitoring the SWH market and uses information from different sources to spread it over different sectors. Conuee continues to monitor and promote the SWH market after the end of the CP. Several follow-up actions regarding capacity building, market promotion and in particular, actions related to the financial mechanism for the hotel designed under the CP and operated after the completion of the CP. The evaluation findings indicate that Conuee's close involvement with CP

implementation and its role as an important player in SWH sector in Mexico strongly supports institutionalization of the results and lessons deriving from the CP implementation.

61. The achievement of the outcome 5 of the CP is evaluated as "Satisfactory" (S).

3.3.2 Likelihood of impact of the CP

62. This section explores the relation between the CP direct outcome and the intermediate states of the re-constructed TOC and to what extent these have contributed to achieving the long-term outcome ('SWH markets are successfully developed') which will eventually contribute the intended impact, reduction of GHG emissions. As also discussed in the following section, the country level target of 2.5 million m^2 of installed SWH collectors was achieved in 2013 (and 2.8 million m^2 in 2015). This is estimated to contribute to avoiding 577.818 tCO_2 on annual basis[9].

63. The CP has been united with two Mexican programs: Procalsol between 2009 and 2012 and the current program on SWH: "Programa de Calentamiento Solar de Agua 2014-2018". The joint efforts of the CP, these two national programs, the green mortgage of INFONAVIT (around 370,000 installed m^2 of solar panels between 2009 and 2015) and the GIZ and ICA Procobre's activities created momentum in the SWH market. Activities of the CP and the two national programs were entirely linked; therefore, it is difficult, even for the participating stakeholders, to assess or estimate to what extend the CP on its own supported the SWH market.

64. The CP contributed to increased quality of the future SWH systems following the activities completed under several outcomes. Several technical standards were developed under the Outcomes 1 and 4 that will increase the quality of the SWH panels and of the SWH systems. This work was supported with communication activities about these standards under Outcomes 2 and 4. Outcome 3 uses these standards in the financial mechanism for hotels to guarantee that the SWH systems installed under the financial mechanism are high quality. Consequently, the higher quality of the SWH installations, both in terms of equipment and of installation, increases the production of each installed m^2. Based on the evaluation findings, the CP's main contribution towards the intended impacts has been through the efforts towards enhanced quality of SWH systems. Conuee's support is also expected to ensure the enforcement of the mandatory standards for the SWH panels and installation in future.

65. To increase the demand of a market, in general, the following components are required:

- Good quality of the product (Outcome 4);
- Trained professionals (Outcomes 2 and 4);
- End-user interest (Outcome 2 and 5) to increase the demand;
- Support from the government (Outcome 1);
- Easy access to adapted financial mechanism (Outcome 3).

66. The main market stakeholders in SWH sector were integrated in the CP work importantly after 2012. The Mexican public institutions were involved since the beginning and collaborated greatly with the CP, like INFONAVIT, NAFIN, SECTU and even INEGI, the National Institute of Statistics and Geography. This situation allowed progress towards several direct outcomes of the CP TOC.

[9] source Techscope GHG Calculator, 2015

67. The CP was designed wisely encompassing the need for all the components for accelerating the Mexican market of SWH. The evaluation did not observe any unintended negative impacts of the project. The undesirable consequence of the CP support to IIDEREE laboratory by buying testing equipment was reduced by Conuee actions to help the other laboratories of the SWH market.

68. The likelihood of impact's effectiveness of the program is evaluated as "Likely" (L).

3.3.3 Achievement of the formal CP objective

69. The objective of the CP was to accelerate and sustain the solar water heating market in Mexico. The planned country level objectives of the CP were reached only partially. The objective of 2.5 million m^2 was reached in 2013 but the growth rate was estimated to be lower than the set target in the ProDoc. In 2014, the growth rate of solar collector area was +18.2%. Based on these growth figures, it would be unlikely to reach the target of 23.5 million m^2 by 2020 as defined in the Prodoc.

70. Based on the SWH market share in Mexico, with around 50% in housing market, and that the activities of the CP were not targeted to this sector, it seems that the CP contribution to the acceleration of the SWH market growth figures can be assessed as low. On the other side, from activities on the quality schemes and capacity building of the SWH market actors, it is expected that the CP helped to sustain the achieved level market development.

71. The achievement of the formal project objective of the program is evaluated as "Moderately Satisfactory" (MS).

3.4 Sustainability and replication

72. In assessing CP sustainability, we 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.

73. The "Programa de Calentamiento Solar de Agua 2014-2018 is continuing the work of the CP. This program is promoted by Conuee and is included in the Mexican strategy to reduce CO_2 emissions and is backed by the highest politicians in Mexico. Consequently, the financial resources to develop activities started under the CP similar to the development and enforcement the draft standard PROY-NOM-027-ENER/SCFI-2016. The financing mechanism for the tourism sector and the activities of awareness raising and capacity building are covered by Procalsol until 2018. Moreover, the draft NOM on SWH was published on August 22, 2016, in the official Gazette (DOF) for public consultation but is not yet a standard, which is the continuation of CP activities after its end[10].

74. For the residential sector, the green mortgage program of INFONAVIT should be extended to multi-family housing. Hence, the financial resources for this activity are expected to be available. At the same time GIZ, an important stakeholder for the residential sector activities, is planning to withdraw their contribution to the SWH market development in Mexico in a few years. The sustainability and replication of the program in terms of financial resources is evaluated as "Likely" (L).

75. The main risk in terms of sustainability and replication of the activities and results is a change of political environment leading to a modification of the institutional role of Conuee. In the case that

[10] See official publication here: http://dof.gob.mx/nota_detalle.php?codigo=5448823&fecha=22/08/2016

Conuee loses its role in the promotion and development of the SWH market, which could affect greatly the persistence of the CP's benefits, poses an institutional and governance related risk to the sustainability. When a new government is to be elected, it is possible that Conuee's director and collaborators will change and that SWH technology will not be any more considered by the new head of Conuee as an attractive and interesting technology to reach the Mexican objectives of CO_2 reduction and climate change mitigation.

76. In terms of the introduction of the mandatory SWH installation in building regulation, the opportunities to replicate the model developed in Mexico City is high. Many municipalities could integrate this obligation to their existing building regulation and so, maintain and even, increase the impact of the CP.

77. Role of Conuee and other partners in sustaining the SWH market and as well as the indication for financial sustainability indicate likely sustainability of the project results. The sustainability and replication of the program is evaluated in terms of institutional framework as "Moderately Likely" (ML) and in terms of socio-political risks as "Moderately Likely" (ML). The environmental sustainability of the CP is guaranteed as SWH technology has a positive influence on the reductions of CO_2 emissions. The sustainability and replication of the program in terms of environmental factors is evaluated as "Likely" (L).

78. The overall the sustainability and replication criteria of the program is evaluated as "Moderately Likely" (L).

3.5 Efficiency

79. In this section, the cost-effectiveness and the timeliness of CP execution is assessed. The delivery rate was low during the first years with less than 5% of the GEF funding until 2012. The CP activities accelerated in 2012 with more than 25% of disbursement. After 2013, the disbursement rate fluctuates between 12% and 20%. During the second half of 2013, revisions and analysis were executed to improve the CP's implementation. Through this process, working areas were reshaped and the efficiency of the CP increased greatly.

Table 1: Disbursement per year of GEF funding (in %)

Year	Actual cost (in cash USD)	Disbursement ratio (in %)
2009	13,493.50	0.8%
2010	98,942.44	5.7%
2011	103,751.18	6.0%
2012	477,092.33	27.6%
2013	222,270.60	12.9%
2014	209,135.31	12.1%
2015	352,290.73	20.4%
2016	250,804.30	14.5%

Source: Reporte 2015, Informe final 2015 and UNDP

80. It should be noted that the expenditures on project management seem somewhat higher than budgeted.

81. The cooperation between UNDP and UNEP did not improve the efficiency of the CP's activities. UNEP and UNDP collaborated in the beginning of the CP, but since 2013, the collaboration was very limited. As per project design, it was intended that UNEP collaborates in the development of the financial mechanism, which never materialized. In addition, the CP had almost no interaction with the other countries participating in the GSWH project.

82. The CP has made efficient use of its complementarities with other existing initiatives on SWH in Mexico. Several stakeholders co-financed the program as GIZ and ICA Procobre. However, based on the evaluation interviews, the CP could have further utilized the synergies between the activities developed by these stakeholders. Nevertheless, other stakeholders, as INFONAVIT or SEDEMA, indicated that the collaboration between them and Conuee to promote the SWH market has been productive.

83. The main reasons for inefficiencies before 2012 were related several administrative burdens due to governmental change which caused staff changes among key stakeholder organizations, resulting as extended time frame of the CP. Moreover, the decision to fund with a new USD 130,000 laboratory, around 7% of the program budget, created issues within the SWH laboratories stakeholders.

84. Considering the CP coverage of a country of the size of Mexico, and delivery of the majority of outputs within a 5.5 year period, the efficiency of the program is evaluated as "Satisfactory" (S).

3.6 Factors affecting performance

3.6.1 Preparation and readiness

85. The program was developed to operate in relation with Procalsol and other existing or planned programs developed by Mexican stakeholders, such as CONAVI pilot project on SWH in new housing and green mortgages of INFONAVIT. It would have been better to define more clearly the relationship and responsibility between these two programs before starting the UNDP program.

86. The CP design included the main public and private stakeholders and all the sectors in which SWH systems could be installed. CP's planned stakeholder participation plans were holistic to include all levels of stakeholders from regulators to end-users.

87. All of these stakeholders were represented during the March 2009 Inception consultation, where they shared their experiences, perceptions and opinions on the accelerated development of the sector. This design approach was excellent representing a holistic approach to stakeholder engagement from regulators to financers, suppliers and installation personnel.

88. The main barriers to SWH market development, based on international and best practice experience, were taken into account even if a market study was not implemented to define more clearly these market barriers.

89. In the ProDoc , several design weaknesses have been identified:

- There were two different baselines in the ProDoc;
- The indicators might not allow assessing the effectiveness of the CP, in particular, in terms of awareness raising for the public and of SWH systems cost's reduction;
- A survey should have been planned and budgeted (at least one at the beginning of the project: baseline, and one at the end) to evaluate the market transformation among the end users.

90. These aspects could have been addressed and fixed during the project appraisal committee. Therefore, the preparation and readiness is evaluated as "Moderately Satisfactory" (MS).

3.6.2 Project implementation and management

91. The project management unit composition changed several times during the course of the CP which led to a break in the CP for more than a year in 2012 until mid-2013 due to the change of government. When the new government was selected, a vast majority of Conuee's employees changed including the responsible of the CP's implementation and the general director. This is the main reason why the CP delivery rate was slow and the project lifetime was extended. A new coordinator was named in June 2013 and during six months, Conuee worked on the realignment of the project to create a new national program for the period 2014-2018 for SWH in Mexico: , englobing the CP. Procalsol has similar objectives and outputs than the CP and was designed to reinforce the CP's activities. Procalsol is financed by Conuee.

92. The management unit worked in closed collaboration with UNDP, at least since 2013. Based on the project progress reports and information gathered during the interview, UNEP had almost no interaction with this unit during the CP's implementation.

93. There is an enormous difference in the project implementation status before and after 2013. The context was more stable after 2013 and this stability was directly reflected as enhanced and more effective implementation and management of the project.

94. The decision to support financially the equipment purchase of one laboratory created some frustration among the other SWH laboratories in the Mexican market. The project management unit reacted rapidly to calm down the situation and at the end of the CP, it seemed that the relation between the laboratories and Conuee were good.

95. The project implementation and management is evaluated as "Moderately Satisfactory" (MS) mainly due to the interruptions. In the case the CP had been implemented and managed with the same efficiency before 2013 than after 2013, the rating would have been higher.

3.6.3 Cooperation, partnership and stakeholder participation

96. The CP was implemented in close cooperation with Mexican government financed programme, that had two phases Procalsol (2007-2012) and Programa de Calentamiento Solar de Agua (june 2013 to april 2016). For instance, the National Project Director of the CP was also in charge of the Mexican programme. As a consequence, high synergies were developed between the national SWH programmes and the CP. The second stage of the Mexican programme was designed to support the activities of the CP and to increase the impact of both programmes.

97. Due to the Procalsol and the Programa de Calentamiento Solar de Agua 2014-2018, many national stakeholders were involved in the SWH market development. Since 2013, the CP contacted the majority of the market stakeholders in the private sector (including associations, manufacturers, laboratories, installers, building developers) and the public sectors (such as development banks, ministries, universities) to extend the cooperation with these partners. The creation of the Solar Community encouraged the participation of the stakeholders in the CP's activities. Many meetings and forum have been held to gather views of all key stakeholders covering the different parts of SWH value chain.

98. GIZ and ICA Procobre, among few other partners, co-financed the CP. However, during the interviews, the lack of synergies between the activities developed by these stakeholders was raised. Nevertheless, other stakeholders, as INFONAVIT or SEDEMA, indicated that the collaboration between them and Conuee to promote the SWH market has been productive. UNEP collaborated with the CP in the beginning of the program, but since 2013, the collaboration has been very limited.

99. Despite the abovementioned limitations, the evaluation assesses that the overall design and exchange with key players in the Mexicon SWH markets supports the "Satisfactory" (S) rating for the cooperation, partnership and stakeholder participation aspects of the CP.

3.6.4 Communication and public awareness

100. The SWH market was not new in Mexico in 2009. Based on the interviews, it was assessed that the public knew this technology even if its penetration rate was not significant. The CP developed many awareness raising activities dedicated to the market stakeholders involved in the SWH industry. However, the CP did not develop any general public awareness activities at large scale even if it was an output of the CP (Output 2.2).

101. The CP focused on the communication to the SWH market stakeholders through on-site activities and virtual communication channels and increase greatly the knowledge of some specific end-users mainly in the hotel sector. However, activities to increase public awareness could have been implemented, especially for the residential end-users who cannot be reached through the green mortgage program of INFONAVIT. The communication and public awareness is evaluated as "Moderately Satisfactory" (MS).

3.6.5 Country ownership and drivenness

102. Governmental actors were closely involved in the program. Conuee, also a government agency, dedicated resources in manpower, mainly, to implement the CP. Conuee developed its Programa de Calentamiento Solar de Agua 2014-2018 to complement the CP activities and use as much as possible the synergies between the country program and the Mexican initiative. These two programmes involved many public institutions in several activities. Mexican public institutions involved in the CP gathered ministries, regional and municipal institutions, technical centers, regulatory bodies and national development banks. The country ownership and drivenness is evaluated as "Highly Satisfactory" (HS).

3.6.6 Financial planning and management

103. Table 3 presents the annual delivery rates of the GEF funds until 2015. The overall delivery rate of GEF funds of 1,750,000 USD was 99 %. At the time of the project design, confirmed co-financing (in cash) was 700,000 USD from ProCobre and 100,000 USD from GTZ (GIZ). In-kind support from Conuee was estimated to be 1,000,000 USD and 20,000 USD from ANES. The UNDP managed budget was 1,750,000 USD (covering the GEF portion). Thus, the evaluation team was not provided with additional data or reporting related to the co-financing disbursement or expenditure.

Table 2: Delivery Rates of GEF Funding for 2009-2015 (in %)

Year	Estimated cost at design (budget) (in cash USD)	Actual cost (in cash USD)	Expenditure ratio (actual/planned)
2009	-	13,493.50	N/A
2010	165,000	98,942.44	60%
2011	420,000	103,751.18	25%
2012	568,000	477,092.33	84%
2013	315,000	222,270.60	71%
2014	282,000	209,135.31	74%
2015	-	352,290.73	N/A
2016	-	250,804.30	N/A
Total	1,750,000	1,727,780.39	99%

Source: ProDoc , Reporte 2015 and Informe final 2015

104. The CP was designed for 4.5 years, and it ended finally after 7 years of operation. The financial planning and management has been adapted to the situation over the years. The remaining budget from one year was passed to the next year. The deviation between the designed budget and the real budget were well justified. All the combined delivery reports were made available to the evaluation team are clear and transparent. Audit report covering the project period until 2012 was made available for the evaluation.

105. The project's final report contained information about procurement, contracted individuals and travels. The administrative processes appeared to follow the UN and GEF rules in terms of procurement and other processes. The financial information available for the evaluation team was clear.

106. The financial planning and management is evaluated as "Moderaltely Satisfactory" (S).

3.6.7 Supervision, guidance and technical backstopping

107. The UNDP Country office is the executing agency with responsibility for supervision of the quality and timeliness of project execution. According to Conuee, UNDP was very present through regular consultations and meetings during all the implementation phase. UNDP program officers approved the annual Program of Activity and ensured its alignment with the CP's objectives. UNDP staff managed closely all CP activities and was present continuously to guide CP staff in their management activities. UNDP played a crucial role in the redeployment of CP after the managerial transition. UNDP also demonstrated ability to adapt at the time of government change in 2012, which created discontinuity in the project's activities, by modifying the directions as needed.

108. However, the evaluation found that UNDP team didn't necessarily have sufficient technical capacity dedicated to SWH technologies, which would had been useful in terms of the project oversight and supervision role. UNEP's stronger role in terms of technical backstopping could have benefitted the CP in defining activities requiring more in-depth technical understanding of the SWH systems. Nevertheless, the exchange between Mexico CP and UNEP was scarce during the whole project. During the first years, the relationship was more frequent but in general, UNEP supervision and backstopping is assessed as unsatisfactory. Based on the GSWH project design and considering the global nature of the overall programme, UNEP should have had a significantly stronger role in terms of the technical backstopping.

109. For example, in September 2012, it was requested to the UNEP the technical review of the proposal to identify areas of improvement or issues that should be considered to ensure their effectiveness. Although talks were held for this issue, they did not receive technical feedback on the proposal itself.

110. The UNDP supervision and backstopping is evaluated as "Satisfactory" (S) (UNEP's role is further discussed in the main evaluation report).

3.6.8 Monitoring and Evaluation

111. **Monitoring and Evaluation (M&E) Plan.** The M&E followed the principles defined in the ProDoc which were based on UNDP program M&E. As discussed in paragraph 89, the main weakness of the project design was related M&E aspects of the design. The indicators defined in the ProDoc do not allow assessing the effectiveness of the program; in particular, in terms of awareness rising of the public and of SWH systems costs reduction to assess the market evolution and no

additional indicators were measured to evaluate the impact of the outcomes, in particular, for the Outcome 2. The monitoring and evaluation plan is evaluated as "Moderately Satisfactory" (MS).

112. **Monitoring and Evaluation Implementation.** The required reports were produced during the CP timeframe. Other M&E requirements were also completed including an inception report, Quarterly progress reports (QPR) and Project Implementation Reviews (PIRs), Steering Committees meetings and Terminal report.

113. Concerning the baseline, the information came from ANES and this information is used in the IEA Solar Heat Worldwide reports. Conuee is not aware of the methodology used to assess the installed area of SWH in Mexico. The information regarding the specific methodology was requested from ANES but no response was received. The monitoring and evaluation implementation is evaluated as "Satisfactory" (S).

4 CONCLUSIONS, RECOMMENDATIONS AND LESSONS

4.1 Conclusions

114. The Mexican CP has been operating over 8 years under two governments in close cooperation with national SWH programmes. Despite the several administrative issues and delays in project implementation due to the government change in 2012, the CP has performed well. The country level target of installed SWH capacity measured in m^2 was achieved during the course of project implementation. The CP worked closely with national SWH initiatives, which can be seen a strength of the CP to promote sustainable SWH market development in Mexico. At the same time, it is difficult to assess to what extent the CP as an individual GEF project contributed to acceleration SWH market in Mexico.

115. Despite the SWH market growth rate not reaching the intended level (as defined in the project document), there is a likelihood of impact towards sustaining the SWH market development and reduction of GHG emissions. The CP managed in its final years of its operations to create a momentum in the SWH market gathering the market stakeholders around the national executing partner Conuee. Continued support of several national partners (mainly INFONAVIT and Conuee through PROCALSOL) to the SWH market development is expected to contribute to increase of the penetration rate of SWH in Mexico in the future.

116. As a result of the CP activities, the quality of SWH systems and installations has greatly increased and should increase even more due to the future standard on SWH panels and systems. Considering the context of Mexico the programme was considered successful and the satisfaction level was among those interviewed for the evaluation was high.

117. The CP managed to tackle the whole supply chain of the SWH market. However, further work is required to support the SWH market development in the building sector, which is strongly linked with enforcement of building codes.

118. The main achievements of the program are the following:

- Proposal of a draft of an Official Mexican Standard or NOM (mandatory) for solar water heating products: PROY-NOM-027-ENER/SCFI-2016, thermal performance, gas savings and safety requirements of SWH and SWH with a water heater that uses liquefied petroleum or natural gas as a backup;
- Creation of the Solar community with around 3,000 users receiving news about SWH market monthly;

- Development of a Diploma "Metrology and Quality Management Test Laboratory SWH" and conducting six modules to train testing laboratories technicians;
- Development of the new reformed DIT, now DTESTV as a quality standard for Green Mortgage program of INFONAVIT;
- Creation of two standards of competence to certify solar thermal installers: EC-0325: Installation of solar water heating thermosiphonic sustainable housing. EC-0473: Installation of solar water heating with hot water tank forced circulation;
- Development of a technical financial SWH system pilot mechanism initially focused on the hotel sector in the Yucatan peninsula.

Table 3: Summary of Evaluation Ratings

Criterion	Overall Rating[11]
A. Strategic relevance	**S**
B. Achievement of outputs	**S**
C. Effectiveness: Attainment of objectives and planned results	**MS**
1. Achievement of direct outcomes	MS
2. Likelihood of impact	L
3. Achievement of formal project objectives as presented in the Project Document.	MS
D. Sustainability and replication	**ML**
1. Socio-political sustainability	ML
2. Financial resources	L
3. Institutional framework	ML
4. Environmental sustainability	L
5. Catalytic role and replication	S
E. Efficiency	**S**
F. Factors affecting project performance	
1. Preparation and readiness	MS
2. Project implementation and management	MS
3. Stakeholders participation, cooperation and partnerships	S
4. Communication and public awareness	MS
5. Country ownership and driven-ness	HS
6. Financial planning and management	MS
7. Supervision, guidance and technical backstopping	S
8. Monitoring and evaluation	S
i. M&E plan	MS
ii. M&E plan implementation	S
Overall project rating	**MS**

4.2 Recommendations

119. The following recommendations have been developed based on the analysis of evaluation findings and interviews with SWH market stakeholders.

[11] Most criteria will be rated on a six-point scale as follows: Highly Satisfactory (HS); Satisfactory (S); Moderately Satisfactory (MS); Moderately Unsatisfactory (MU); Unsatisfactory (U); Highly Unsatisfactory (HU). Sustainability is rated from Highly Likely (HL) down to Highly Unlikely (HU).

Recommendation #1	There is no methodology or guidance given in the ProDoc for the Mexican CP to calculate the target indicators. The target indicators reflect the achievement of the outcomes and by calculating them each year, they help to plan the effort to put in each activity. These methodologies and parameters to calculate the indicators should be defined in the M&E plans. In this particular program of market transformation, the end-user awareness and the cost of the SWH systems were not defined as indicators whereas they allow understanding the real market evolution. The definition of adapted target indicators together with the development of clear methodology to monitor these indicators would help UNDP, UNEP and the country counterparts to understand the progress towards the project goals.
Responsibility:	UNDP and Conuee
Time-frame:	Design phase/inception of follow-on project
Recommendation #2	The ProDoc was developed several years before the implementation started and the situation might have changed in-between. Moreover, to develop a program, exact information of the situation is needed to find the specific solutions to tackle the main barriers. It is recommended a market analysis at the beginning of program involving market transformation activities, to ensure integration of all the important market stakeholders and address the country specific, real existing barriers of the market. This market study should be used as a baseline to compare the former situation with the market at the end of the program.
Responsibility:	UNDP
Time-frame:	First year of the program of follow-on project

4.3 Lessons learned

- **Program timeframe was not in all cases adapted considering the time needed to deliver planned outcome**. In the case of Mexico, the mandatory standard and the financial mechanism for hotel were designed under the CP but due to time constraints, their enforcement and implementation will be done after the program end.
- **The key persons implementing the CP influenced significantly the program progress and the achievement of the outputs.** The recruitment process of the project management unit should be carefully planned and the required expertise to implement such a program is not only technical but also, in management and planning.
- **UNDP played an important role during institutional transition**. The Mexican government changes in 2012 had significant consequences in terms of turnover of key project personnel. The program implementation was interrupted and the person in charge of the program in Conuee had to change. This situation created a discontinuity in the project's activities and the directions that were taken since the beginning were modified in the middle of the program. UNDP played a crucial role in the redeployment of CP after the managerial transition.
- **The national counterparts should be closely involved in the project design and planning to fulfill objectives defined in the ProDoc**. The country management unit, which is the unit in charge of the CP operation, might not have the experience and capacities to design a comprehensive program. Training on program design could help the management unit to define an efficient and successful program.
- **UNDP country office does not necessarily have the sufficient technical capacity to analyze in details the Program of Activity proposed by the management unit**. UNDP's role was to solely validate whether the proposed activities were aligned with the program

objectives. The activities can be aligned with the program objectives but are not necessarily appropriate considering the country context. One example reflecting the capacity gap was the funding of a laboratory which created a market distortion in term SWH testing services.

- **Establish a system for information collection and monitoring energy performance of SWH installations**. Conuee needs to capture the positive impact of the SWH market through the setup of a robust monitoring and reporting system to evaluate the capacity and the energy performance of the installed SWH systems. Currently, the area of installed SWH in m^2 is established by the ANES association, but the methodology is not transparent and Conuee is looking for other information source as the national survey made by INEGI, the statistical institute of Mexico.
- **Promote the enforcement of mandatory building codes to install SWH**. ICA Procobre worked on this issue with several municipalities. They manage to develop some successful case studies. Conuee, as a renowned governmental institution, could promote the enforcement of such regulation in municipalities with high solar radiation.
- **Extend the financial mechanisms to other sectors**. Once the pilot project in the Yucatan peninsula will be running and optimized, Conuee could open the financial mechanisms to other sectors which also meet the technical and financial requirements stated in the operation manual of the credit line.
- **Create a dedicated webpage for SWH information**. The information is currently shared through the Solar Community for the market stakeholders. But there is no easily accessible and adapted communication channel for the public. A dedicated webpage maintained and broadcasted by the government would help to spread good practices among the public.

ANNEX I. LIST OF THE PERSONS MET

#	Stakeholder	Persons Met	Position	Date	Meeting (Face-to-face/by phone)
1	Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ)	Santiago Mata	Principal consultant	April 4th 2016	Face-to-face
2	Conuee	Odón de Buen	Director	April 4th 2016	Face-to-face
3	Conuee	Sergio Segura Calderón	International Cooperation Director	April 4th 2016	Face-to-face
4	Conuee	Ybo Pulido Saldaña	General Director of Regulation in Energy Efficiency	April 4th 2016	Face-to-face
5	Conuee	Gonzalo Montemayor	General Director of Development , Diffusion and Innovation	April 4th 2016	Face-to-face
6	Conuee	Jorge A. Soriano Muñoz	Director of Innovation	April 4th 2016	Face-to-face
7	Bancomext	Arturo Sojo Quiroz Felipe Ortiz Flores	Director of financial intermediaries Assistant director of guarantee and sectorial programs	April 5th 2016	Face-to-face
8	Ministry of Tourism	Carolina Chavez Oropeza	Director of Sustainable Tourist Development Zones	April 5th 2016	Face-to-face
9	FIRCO	Miriam Macias Solis	Sustainable Development Consultant	April 5th 2016	By phone
10	Physikalisch-Technische Bundesanstalt (PTB)	Susanne Wendt	Project Coordinator	April 6th 2016	By phone
11	SENER	Alejandro Garza Ochoa	Internal Control Department	April 6th	Face-to-face

		Cesar Umberto Contreras Martinez		2016	
12	UNDP	Gisela Martinez Gerardo Arroyo	SWH country program coordinator Sustainable Director	April 7th 2016	Face-to-face
13	UNAM	Dr. Roberto Best y Brown	Researcher	April 7th 2016	By phone
14	FAMERAC	Daniel Garcia Valladares	Association President	April 7th 2016	By phone
15	ANES	Alberto Valdez	Association President	April 8th 2016	By phone
16	ICA Procobre	Fernando Sánchez Monter	Consultant	April 21st 2016	By phone
17	SEDEMA	Oscar Vazquez	Climate Change Director	April 27th 2016	By phone
18	CENAM	Dr. Salvador Echeverria	General Director of Physic Metrology	April 27th 2016	By phone
19	INFONAVIT	Manuel Carballo	Cooperation and Technical Relation, Department of Sustainable Mechanisms	April 27th 2016	By phone
Other stakeholders could have been interviewed, in particular, two universities: Universidad del Caribe and Universidad Tecnológica de la Riviera Maya, to capture better the opinions of the end users of the SWH country program. Unfortunately, after several intents to organize conference calls, it has not been possible to reach these two stakeholders.					

ANNEX II. LIST OF THE DOCUMENTS CONSULTED

- UNDP-GEF "Global Solar Water Heating Market Transformation and Strengthening Initiative: Mexico Country Program", Project Document, June 2009;
- GSWH Project AWP s from 2010 to 2015
- GSWH Project PIR from 2010 to 2015
- GSWH Project CDR from 2009 to 2015

- Project Inception Report, The Country Program of Mexico under the Global Solar Water Heating Market Transformation and Strengthening Initiative (PIMS 3611), Conuee, GEF, UNDP, December 2009
- Minute of Project Appraisal Committee (PAC), July 2009
- Mid-Term Review Country Program of Mexico (PIMS 3611), UNDP CO, Mexico, February 2013
- Plan de acción del programa nacional (PAPN) entre el gobierno de los estados unidos mexicanos y el programa de las naciones unidas para el desarrollo (PNUD) – 2008-2012
- Solar Heat Worldwide 2016, Markets and Contribution to the Energy Supply 2014, June 2016
- Solar Heat Worldwide 2015, Markets and Contribution to the Energy Supply 2013, June 2015
- Solar Heat Worldwide 2014, Markets and Contribution to the Energy Supply 2012, June 2014
- SOLAR WATER HEATING MARKET EVA LUATION, Case Study of Mexico, November 2015, Prepared for UNEP, Division of Technology, Industry and Economics, Global Solar Water Heating Initiative
- Estudio de la Legislación Mexicana Energías Renovables que impacta el CSA, Iniciativa de Transformación y Fortalecimiento del Mercado de Calentadores Solares de Agua, PNUD México, 2011
- Programa para la Promoción de Calentadores Solares de Agua en México – Procalsol, 2007 – 2012, CONAE- SENER, August 2007
- Evidencias Cierre, PNUD – Conuee
- Dictamen técnico de energía solar térmica en vivienda
- Informe de auditoría independiente 2009 – 2012, April 2013
- Programa de Calentamiento Solar de Agua México Informe 2014, Conuee, 2015
- UNDAF Mexico 2008-2012
- UNDAF Mexico 2014-2019
- Conuee web page: www.conuee.gob.mx
- Comunidad Solar web page: https://sites.google.com/a/conuee.gob.mx/boletin-comunidad-solar/