

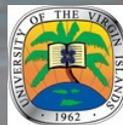


SOLAR WATER HEATING MARKET EVALUATION

CASE STUDY OF MEXICO

November 2015 | Prepared for UNEP, Division of
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UNITED NATIONS ENVIRONMENT PROGRAMME



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EXECUTIVE SUMMARY

The United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) launched a joint initiative entitled the "Global Solar Water Heating Transformation and Strengthening Initiative" (GSWH) with funding from the Global Environmental Facility (GEF) and the International Copper Association. The objective of the GSWH initiative was to develop, strengthen, and accelerate the growth of the residential solar water heating (SWH) sector.

The GSWH initiative supports Solar Water Heating (SWH) national development in five countries, including Mexico. Prior to the initiation of the GSWH initiative, Mexico's SWH market was growing annually at an average rate of 15% per year.¹ Despite this growth, the market lacked a number of important enabling mechanisms and sustained SWH market growth was constrained by the following barriers:

- ⦿ An absence of long-term financing and marketing for the purchase of SWH systems.
- ⦿ The cost of SWH systems was too high for the majority of residential home owners.
- ⦿ The financial sector, banks, and mortgage institutions lacked adequate support mechanisms.
- ⦿ A lack of SWH industry capacity to provide sufficient equipment and associated services to meet demand.
- ⦿ Statistics, metrics, and lessons learned within the industry were not documented and disseminated.

This report analyzes how the GSWH initiative addressed these barriers and strengthened Mexico's SWH market and enabling environment. Specifically, it examines the SWH market in Mexico through two different approaches. First, the report provides a qualitative analysis of the development of the solar water heating market in Mexico, studying the different stages of development that the market has experienced. The report describes the GSWH initiative's impact on the market in the following main subcomponent areas of the initiative:

- ⦿ **Legal, regulatory, and institutional framework.** In Mexico, the GSWH initiative was structured to support the existing national-level SWH program, Procasol. By supporting and leveraging national policy development and market development initiatives, the GSWH initiative contributed to the development of an enabling regulatory environment during the project period. The initiative has also strengthened policy instruments that ensure quality SWH installations, as well as efforts to assess the potential of underserved markets.
- ⦿ **Public awareness raising, marketing support, and capacity building.** The GSWH initiative worked with the federal government to develop pilot projects to demonstrate SWH technology in multiple sectors, worked with a strategic communication consultancy to develop regular updates

¹ Mexico's SWH market grew at a rate of 18% annually during the GSWH initiative. This is equivalent to offsetting 2.9 million tons CO₂eq annually according to the UNDP, www.mx.undp.org.

on SWH news in Mexico, and continuously engaged with key actors in the SWH industry through networking events and media in order to achieve initiative objectives.

- **Financing mechanism and new delivery models.** Mexico provided financial incentives for SWH system installations prior to the GSWH initiative, including a 2004 Decree that allows for depreciation of 100% of expenses of renewable energy equipment for one year. Infonavit, the quasi-public mortgage lender, introduced the Green Mortgage Fund in 2010, whereby borrowers can access additional credit by meeting energy and water efficiency requirements, including solar water heating. In 2011, the green mortgage requirements were extended to all Infonavit mortgages. More recently, two green mortgage programs began providing low interest loans and subsidies to the commercial sector.
- **Business skills barrier and product quality.** The GSWH initiative is working to develop a voluntary quality control and certification scheme for SWH equipment and installation services. In addition, the GWSH initiative sponsored the installation of the new laboratory test facility in León Guanajuato, where staff will perform tests on equipment to assess the SWH thermal performance and operational integrity security, and general quality of SWH components. The GSWH initiative also collaborated to develop or update regulations and construction codes in Mexican states and municipalities.

This report also employs a quantitative analysis using UNEP's SWH TechScope Market Readiness Assessment tool to compare Mexico's TechScope scores for the SWH enabling environment across three time periods:

- **Pre-GSWH initiative.** The first stage is considered to be the period before the start of the GSWH initiative, which began during the last quarter of 2009;
- **Mid-Term of the GSWH initiative implementation.** The second stage coincides with the evaluation of the national GSWH initiative in Mexico (2014).
- **Final GSWH initiative.** The last stage of the scoring considers the achievements and impact of the GSWH initiative prior to its estimated closure in early 2016.

Using this baseline analysis, the report evaluates the extent to which the GSWH initiative had an impact on Mexico's SWH market. This analysis considers seven areas of potential impact including SWH targets, financial incentives for system installation, SWH loan programs, building mandates, outreach campaigns, and product standards and certifications. **The results of this analysis conclude that the TechScope score for Mexico has increased from 2.42 in the Pre-GSWH phase, to 3.2 in 2013 and to 3.61 in 2015.**

The goal of the GSWH initiative in Mexico was to reach a target of 2.5 million square meters of SWH collector area – approximately 1,750 MW_{th} of capacity – as well as to achieve goals for residential sector market acceleration and to accelerate growth in total installed capacity.² Growth in Mexico's SWH market

² The GSWH set the following objectives for the implementation period: accelerate and ensure a sustainable growth rate of 25-30% (in total installed capacity) for the SWH market; reach a target of 2.5 million square meters of SWH

accelerated to 19% per year during the initiative (2009-2015). The GSWH initiative helped the SWH market in Mexico achieve its collector area target despite a sustained growth rate lower than the initiative's projected target of 25 to 30%.³ SWH market growth has been strong and consistent in Mexico, growing from 912 MW_{th} of capacity in 2009 to 1,960 MW_{th} in June 2015. This growth in the SWH market resulted in avoided greenhouse gas emissions of 577,818,870 kg CO₂ equivalent per year by 2015. According to projected growth targets for the SWH market, Mexico's estimated avoided emissions will be 1,093,728, kg CO₂ equivalent per year by 2020.

The GSWH initiative achieved a notable level of impact in Mexico, showing a medium to high level of impact for multiple Techscope Indicators: SWH targets, financial incentives, SWH loan programs, building mandates, outreach campaigns and product standards and certification. However, the GSWH initiative had little impact on installer certification.

Moving forward, it will be important for Mexico to track progress in achieving its SWH target of installing 18.2 million square meters of SWH collectors by 2027. If this goal is reached it could have major environmental impacts by avoiding an estimated 3.76 million tCO_{2e}/yr by 2020 (TechScope GHG Calculator, 2015). As the GSWH initiative support comes to a close, the initiative should continue efforts to track the progress of the SWH market. Mexico should also continue to implement holistic, clear, and reliable regulatory policies and financial incentive programs to continue growth in its SWH market.

collector area; and grow the residential sector proportionately faster to account for 14% of the total installed capacity for the SWH market.

³ The growth rate in the residential sector was estimated to account for 10% of the total installed capacity as of June 2015. The rate of growth for the SWH market (total installed capacity) was approximately 16% per year from 2009 - 2014.

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SECTION 1

BACKGROUND AND METHODOLOGY

1.1 BACKGROUND

The United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) launched a joint initiative titled the "Global Solar Water Heating Transformation and Strengthening Initiative" (GSWH) with funding from the Global Environmental Facility (GEF) and the International Copper Association. The objective of the GSWH initiative was to develop, strengthen, and accelerate the growth of the residential solar water heating (SWH) sector. The GSWH initiative began with five different project countries globally, including Mexico.

The SWH TechScope Market Readiness Assessment report and excel-based Analysis Tool ("the TechScope") were developed to support the growth of the global SWH market by providing a replicable, high-level, and publicly available methodology to evaluate the residential SWH market in various countries.⁴ The four parameters evaluated by the TechScope—SWH support framework, national conditions, financing, and business conditions—help provide an understanding of the opportunities and challenges faced by a country attempting to grow its SWH market. Policy makers can use the TechScope to benchmark current country achievements against specific objectives, compare achievements against other countries, and set future SWH market and policy goals.

The SWH TechScope Market Readiness Assessment provides a detailed explanation of the assessment methodology, and serves as the instruction manual for the excel-based Market Readiness Analysis Tool. The associated tool allows users to input the relevant data for a specific country and receive a score that reflects the state of the country's enabling environment for SWH.

This report profiles Mexico and analyzes its experience in strengthening its SWH market over the course of the GSWH initiative. This analysis assesses the progress Mexico has made in fostering a stronger enabling environment for SWH under the GSWH initiative in part by comparing Mexico's TechScope scores across three time periods: before the GSWH initiative (pre-2009), during the GSWH initiative (2014, as discussed in the original TechScope report), and the final GSWH initiative (Fall 2015). This report also discusses the

⁴ Note: This report may include examples of leadership in the commercial and industrial SWH sector, if relevant. The Report and excel-based Analysis Tools can be found at: <http://www.solarthermalworld.org/content/solar-water-heating-techscope-market-readiness-assessment-report-and-analysis-tool-2014>

impacts of the various initiatives undertaken by the Country National Program in Mexico, as part of its participation in the GSWH initiative, highlighting lessons learned.

1.2 ANALYSIS AND STRUCTURE OF THE STUDY

The purpose of this report is to analyze the SWH market in Mexico, reviewing the context before, during, and the final GSWH initiative to assess the impact of the initiative on the market. This report provides insight into the SWH market in Mexico by using a replicable case study approach that offers lessons learned and best practices to other countries.

This report addresses the SWH market in Mexico by offering two different perspectives. First, the analysis will summarize the Mexican solar water heating market from a narrative approach, providing a qualitative analysis of the different stages of development that the market has experienced and the impact of the national SWH programs. Second, this analysis will follow a quantitative approach using UNEP's SWH Techscope Market Readiness Assessment tool.

The report is structured as follows:

Section 2 of this report provides a narrative assessment of the Mexican SWH market, discussing the progress of Mexico's SWH market as it relates to the main focus areas of the GSWH initiative:

- Legal, regulatory, and institutional framework;
- Public awareness raising, marketing support, and capacity building;
- Financing mechanism and new delivery models;
- Business skills barrier and product quality.

Section 3 uses UNEP's TechScope Market Assessment Methodology and Tool to compare the relative state of Mexico's SWH enabling environment at three different stages of the GSWH initiative (Figure 1).

- **Pre-GSWH initiative.** The first stage is considered to be the period before the start of the GSWH initiative, which began during the last quarter of 2009.
- **Mid-Term of the GSWH initiative implementation.** The second stage coincides with the evaluation of the national GSWH initiative in Mexico (2014).
- **Final GSWH initiative.** The initiative in Mexico is still open and will end in early 2016. The last stage of the scoring considers the achievements and impact of the GSWH initiative prior to its official closure.

In addition, a comparison of the scores at the three stages of implementation is presented in Section 3.

Figure 1. The three stages of the GSWH initiative used for benchmarking the Mexican SWH market

Pre-GSWH Initiative Pre GSWH Initiative	Mid-Term GSWH Initiative MID Term Update	Post-GSWH Initiative Final GSWH
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Section 4 evaluates the extent to which the GSWH initiative had an impact on Mexico's SWH market. This analysis is focused on seven primary areas of impact, including:

- ⦿ SWH targets
- ⦿ Financial incentives for system installation
- ⦿ SWH loan programs
- ⦿ Building mandates
- ⦿ Outreach campaigns
- ⦿ Product standards and certifications

Finally, the CO₂ savings are estimated based on targets established at the national level.

SECTION 2

DEVELOPMENT OF THE MEXICAN SWH MARKET

This section summarizes the development of the solar water heating market in Mexico prior, during, and following the GSWH initiative implementation period. Prior to the initiation of the GSWH Initiative (National Program in Mexico) (“GSWH Mexico”) in 2009, Mexico's SWH market was growing annually at an average rate of 15% per year.⁵ Despite this growth, the market lacked a number of important enabling mechanisms and sustained SWH market growth was constrained by the following barriers:

- An absence of long-term financing and marketing for the purchase of SWH systems.
- The cost of SWH systems was too high for the majority of residential home owners.
- The financial sector, banks, and mortgage institutions lacked adequate support mechanisms.
- A lack of SWH industry capacity to provide sufficient equipment and associated services to meet demand.
- Statistics, metrics, and lessons learned within the industry were not documented and disseminated.

The national component of the GSWH initiative included a number of programs to overcome these hurdles, (e.g. financial incentives, loan programs) with the goal of creating a strong national SWH market. The ongoing GSWH initiative in Mexico was implemented in 2009 and received approximately US\$1,750,000 from the Global Environment Facility (GEF).⁶ UNDP-GEF funds were complemented by funding to support SWH financing programs and incentives from the Mexican National Energy Efficiency Commission (CONUEE), the German Agency for Technical Cooperation (GIZ), as well as the Mexican quasi-public housing agency (Infonavit) via the Green Mortgage Fund. Additional key stakeholders and partners involved in supporting the GSWH initiative in Mexico included the Asociación Nacional de Energía Solar (ANES); Labsolmex; PTB; National Center of Meteorology (CENAM); Sociedad de Tecnología Avanzada en Tubos Evacuados (SOTECNISOL); Fabricantes Mexicanos en las Energías Renovables (FABRICANTES); Mexicanos en las Energías Renovables A.C. (FAMERAC).

⁵ Mexico's SWH market grew at a rate of 18% annually during the GSWH ini

tative. This is equivalent to offsetting 2.9 million tons CO₂eq annually according to the UNDP, www.mx.undp.org.

⁶http://www.mx.undp.org/content/mexico/es/home/operations/projects/environment_and_energy/transformacion-y-fortalecimiento-del-mercado-de-calentadores-sol.html

The sections below provides a brief overview of the SWH market and then examine the market's development along the four focus areas of the GSWH initiative: legal and policy framework, public awareness raising, finance, and product quality and standards.

2.1 OVERVIEW OF THE SWH MARKET

SWH market growth has been strong and consistent in Mexico, growing from 912 MW_{th} of capacity in 2009 to 1,890 MW_{th} in 2014. By June 2015, Mexico's capacity had grown to 1,960 MW_{th}. Growth accelerated in particular during the period of the GSWH initiative. Average annual growth was 19% per year during the initiative (2009-2015) compared to 15% in the five years before the GSWH initiative was implemented.⁶

The objective of the GSWH initiative in Mexico was to accelerate and sustain the solar water heating market. More specifically, the goal of the GSWH Initiative in Mexico was to reach a target of 2.5 million square meters of SWH collector area (i.e. approximately 1,750 MW_{th} of capacity) as well as to achieve goals for residential sector market acceleration and to accelerate growth in total installed capacity.⁷

The GSWH Initiative in Mexico helped the SWH market achieve its collector area target despite a sustained growth rate lower than the initiative's projected target of 25 to 30%.⁸

Building on the GSWH initiative, Mexico also set a formal national SWH target after the project completed. The Law for the Sustainable Use of Energy of 2008 required the Mexican Federal Government to "integrate goals and strategies in the National Development Plan regarding the sustainable use of energy (Secretary General, 2012)." As part of that requirement, the Government of Mexico developed a mandatory national goal for solar water heating through its National Program for Sustainable Energy Use 2014-2018 (*Programa Nacional para el Aprovechamiento Sustentable de la Energía* or "PRONASE"). The Renewable energies Prospective (2013-2027) from SENER propounded (in the conservative scenario) a total of 18.2 million square meters of solar water heaters installed in Mexico for the year 2027 (SENER, 2014) in 2014. This target was subsequently integrated into Mexico's sector-specific plans.

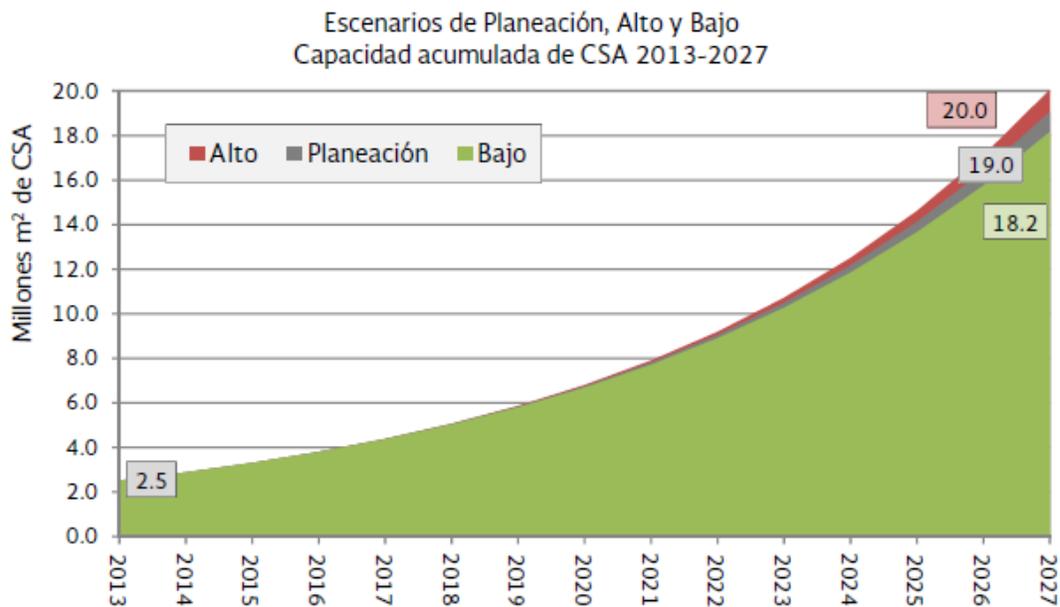
Information collection about the solar water heating market was improved during the GSWH initiative through the strengthening of information systems to evaluate programs, plans, and projects related to SWH in Mexico. This information was integrated in the National Statistics and Geography Institute

⁷ The GSWH set the following objectives for the implementation period: Accelerate and ensure a sustainable growth rate of 25-30% (in total installed capacity) for the SWH market; to reach a target of 2.5 million square meters of SWH collector area; Grow the residential sector proportionately faster to account for 14% of the total installed capacity for the SWH market.

⁸ The growth rate in the residential sector was estimated to account for 10% of the total installed capacity as of June 2015. The rate of growth for the SWH market (total installed capacity) was approximately 16% per year from 2009 - 2014.

(INEGI), so they could incorporate the use of SWH into their information tools. The 2014 National Survey of Home Income Expenses for Mexico notes the use of SWH technology. Currently around one million homes are using SWH to meet their hot water needs. The Mexican National Energy Efficiency Commission/Comisión Nacional para el Uso Eficiente de la Energía (Conuee) continues to work in this area with INEGI, developing other tools and/or surveys that develop data resources not only for SWH, but also other sustainable energy technologies (Martinez, 2015a). As can be seen in Figure 2 below, the market is projected to continue to expand steadily through 2027.

Figure 2. Estimated Accumulated SWH Capacity based on three planning scenarios (SENER, 2014)



2.2 LEGAL, REGULATORY, AND INSTITUTIONAL FRAMEWORK

The GSWH initiative was executed at the national level by CONUEE in support of Mexico’s national solar water heating program (Procasol). Procasol launched in 2007, prior to the launch of the GSWH initiative, and represents a collaboration of private and public sector stakeholders engaged on developing the SWH market. The Procasol program had a goal of reaching 1.8 million square meters of new solar thermal collectors by the end of the project. This goal was reached successfully during the course of the GSWH initiative.

To support an enabling environment for investment, the quasi-public mortgage lender (Infonavit) introduced the Green Mortgage programme (*Hipoteca Verde*), a government sponsored mortgage program to reduce barriers to investment. This program is discussed in greater detail in Section 2.4 below.

To date, Mexico has not established a national SWH building mandate. Government efforts during the period of the GSWH initiative did, however, lay the groundwork for a number of states and cities to adopt SWH mandates at the subnational level. For example, Mexico City (Distrito Federal) established a mandate for all new and refurbished swimming pools and large commercial buildings (>50 employees) to achieve 30% of their water heating energy needs through solar collectors. A number of large energy consuming states have adopted SWH mandates as well. These include Quintana Roo (i.e. Yucatán), Tabasco, and Veracruz (Itzel, 2015).

At the public level, Article 34 of Mexico's Climate Change Law (i.e. "Ley General del Cambio Climático") requires all branches and entities of the public federal administration to promote the design and implementation of mitigation policies for construction code (Secretary General, 2012).

By supporting and leveraging national policy development and market development initiatives, the GSWH initiative contributed to the development of an enabling regulatory environment during the project period. The initiative has also strengthened policy instruments that ensure quality SWH installations (see Section 2.5), as well as efforts to assess the potential of underserved markets. There have been advances in the Mexico's SWH regulatory framework over the past several years in part due to the dialogues the GSWH initiative sponsored (e.g. forums, workshops, exchanges, etc.).

2.3 RAISING PUBLIC AWARENESS

The GSWH initiative focused on raising awareness and building capacity for the SWH industry in Mexico. Three pathways in particular were pursued:

- Development of pilot projects to demonstrate SWH technology in the hotel, commercial, and multi-family (vertical) housing sectors.
- Engagement with a strategic communication consultancy to develop regular updates on SWH news in Mexico.
- Continuous engagement with key actors in the SWH industry through networking events and media in order to achieve initiative objectives.

2.3.1 PILOT PROJECTS

Since 2014, CONUEE has continued to develop strategies to accelerate and expand its capacity for meeting the needs of different end-user consumption sectors. A number of pilot projects targeting hotels, hospitals, and new housing developments aim to increase the adoption of solar water heating. The pilot program for hotels, for example, is expected to target more than 6,000 hotels (Conuee, 2015).

The tourism industry in Mexico is a large consumer of hot water and its continued growth makes it an ideal candidate for SWH. Building off of the GSWH in 2014 and 2015, Conuee supported the conceptualization and design of a loan loss reserve pilot program financing mechanism for Mexico's service sector. The program will encourage lending to finance solar hot water installations in Mexico's

large hotels within the Yucatan Peninsula (Lang, 2015). The innovation of the model is done in considering the technical and financial/economic facts in the model.

Beyond hotels, the Government of Mexico City is also planning to install solar water heaters in 19 hospitals, replicating a previous pilot project by La Villa Pediatric Hospital in Mexico City, which led to savings of up to 40% in fuel (Lara, 2015). Mexico's new high security prison was also designed with a sustainability focus in mind, incorporating solar water heaters in its construction (Fernández, 2015).

2.3.2 SWH NEWS UPDATES

Following the completion of the GSWH initiative, Mexico has increased its online presence by disseminating information through a series of online forums and communities. A new platform of courses, webinars, and events launched in October 2015, providing information for interested parties, government support opportunities (e.g. new forthcoming initiatives), and solar outreach targeting 2,000 people (Martinez, 2015b; UNDP, 2015).

In 2014, the GSWH initiative and Conuee continued their collaboration efforts to develop the Conuee Communities and Microsites proposal. The program engages the public to increase awareness and building capacity for the SWH industry in Mexico through "SWH microsites," a mobile education platform designed to familiarize the community members on the basic concepts of solar hot water (Cadena Rasa, 2015). The permanent awareness campaign clearly communicates the basic concepts of solar hot water by spreading information on the status of the technology and applications, listing certified companies, and providing evaluation tools (Infonavit, 2015).

From December 2014-2015, a number of publications featuring solar water heating technologies were circulated amongst potential end users. Conuee and Profeco, Mexico's federal consumer protection agency, produced a free special supplement for the 38th anniversary edition of Consumer Magazine. 70,000 copies of the supplement, promoting energy efficiency and responsible consumption, were circulated nationwide (Conuee, 2014). The February-March 2015 edition of CNEP, a journal aimed at middle and senior schoolteachers, featured solar water heating technologies (Figure 3).

Figure 3. Solar water heating article in Mexican Federation of Private Schools magazine (Issue no. 4 2015).

Los especialistas opinan

**El Calentamiento Solar de Agua
como alternativa para trascender de
la escuela verde a la comunidad verde**

Uno de los resultados de la reunión internacional de la Agenda 21 que tuvo lugar en la ciudad de Río de Janeiro, Brasil en 1992, son las Escuelas Verdes. En México se consolidaron desde 2007 como parte de un compromiso nacional por la década de la educación para el desarrollo sostenible. El objetivo era propiciar la participación activa de la comunidad en pro del medio ambiente.

Las escuelas verdes son aquellas que cumplen con lineamientos de acción como: 1. Educación ambiental, 2. Manejo de residuos sólidos urbanos, 3. Consumo eficiente de agua potable, 4. Eficiencia en el consumo de energía y, 5. Acciones ambientales comunitarias.

Los modelos no sostenibles de producción y consumo de energía amenazan la salud y la calidad de vida, al tiempo que afectan los ecosistemas y contribuyen al cambio climático.

Por lo tanto, la energía sostenible puede ser un motor en la reducción de la pobreza, progreso social, equidad, resiliencia, crecimiento económico y sostenibilidad medioambiental. Por ello, desde 2009 el Programa de las Naciones Unidas para el Desarrollo (PNUD) en México, gestiona acciones en pro del medio ambiente a través del proyecto "Transformación y Fortalecimiento del Mercado de Calentadores Solares de Agua en México".

Este proyecto tiene por objetivo contribuir a la disminución de las emisiones de gases de efecto invernadero



Las escuelas verdes cumplen acciones como educación ambiental, manejo de residuos sólidos urbanos, consumo eficiente de agua potable, eficacia en el consumo de energía y acciones ambientales comunitarias.

2.3.3 ENGAGEMENT WITH KEY ACTORS

Government-led or government-supported campaigns to raise awareness about SWH can be an important complement to policies and regulations. Outreach and education campaigns can be designed to target a broad range of different constituencies and utilize different tools (e.g. social media) to encourage the purchase of SWH systems. Mexico utilizes a number of resources to increase awareness to solar water heating, including:

- ANES Boletín Solar (National Solar Energy Association) (ANES, 2006)
- Microsites (SEDEMA, 2015)
- ANES forums (ANES, 2015)
- Public exhibitions
- Facebook and Twitter ("Mexico GSWH National Program Twitter," n.d., "UNDP Mexico Facebook," 2015) (see Figure 4)
- Forums and international exchanges
- Public webinars

The “Where is Solar Water headed in Mexico” Forum took place in October 2014, engaging many of key actors across the SWH industry.⁹ A series of interviews on topics related to solar water heating were published following the forum on YouTube (UNDP Mexico, 2015a). Interview participants included government agency representatives from CSA, UNDP, SNER, CENAM, Conuee, and PTB (UNDP Mexico, 2015b).

Figure 4. Solar water heating webinar announcement flyer published on CSA Twitter feed (Conuee Twitter, 2015)



2.4 FINANCING MECHANISMS

A number of organizations collaborated with the GSWH initiative to contribute investment and financial resources in support of Mexico’s SWH market. Conuee invested in-kind support and resources to the GSWH initiative, as well as coordination services in support of the development of Mexico’s SWH quality standard (DTESTV).

⁹ Organized by GSWH Country National Program in Mexico.

Mexico provided financial incentives for SWH system installations prior to the GSWH initiative, including a 2004 Decree that allows for depreciation of 100% of expenses of renewable energy equipment for one year. Infonavit, the quasi-public mortgage lender, introduced the Green Mortgage Fund (*Hipoteca Verde*) in 2010, whereby borrowers can access additional credit by meeting energy and water efficiency requirements, including solar water heating (Infonavit, 2011). The program provided low interest loans for SWH installations, which has contributed significantly to the growth of the SWH market. In 2012, for example, the Green Mortgage Fund was responsible for financing approximately 53% of the total collector area installed. The German Agency for Technical Cooperation (GIZ) contributed technical resources to develop that program, in addition to financial incentives to buy down the upfront costs of SWH systems under its 25,000 solar roofs program (Alianza Infonavit-GIZ, 2012). In 2011, the green mortgage requirements were extended to all Infonavit mortgages (El Sol del Centro, 2011; Infonavit, 2011). Partial subsidies for solar collectors were offered from 2010 to 2012 to Infonavit mortgage-holders under the 25,000 Solar Roofs program (Alianza Infonavit-GIZ, 2012).

More recently, two green mortgage programs began providing low interest loans and subsidies to the commercial sector. FONAGA Verde, financed by the National Fund for Bonds for the Agricultural, Forestry, Fishing, and Rural sectors (FIRA) provides incentives to cover the initial financial gaps for project investments (up to 90%) in SWH and energy efficiency. FONAGA Verde will provide reserves through a financial broker and credit to cover losses in the event of default (Fideicomisos Instituidos en Relación con la Agricultura, 2014). This program will provide initial funding up to \$200 million pesos (\$11.9 million USD).

In previous years, FIDE (The Fund for Electric Energy Savings), a “Business Eco-Credit Program,” provided support to micro entrepreneurs in acquiring nearly 3,000 high-efficiency technologies, primarily commercial refrigerators and air conditioners (Srinivas, 2012). In 2015, the FIDE began incorporating solar water heaters into their program as means to help micro entrepreneurs reduce their electricity bills in hotels, laundries, and dry cleaners (FIDE, 2015). The Shared Risk Trust FIRCO (Fideicomiso de Riesgo Compartido) is a parastatal entity, created to promote and advances rural areas and competitive and sustainable agribusiness. FIRCO channels public and private dollars to investors with limited access to venture capital or the credit needed to finance projects in renewable energy and agribusiness (FIRCO, 2015) (Table 1. Subsidies Offered by the Shared Risk Trust (FIRCO, 2015)).

Table 1. Subsidies Offered by the Shared Risk Trust (FIRCO, 2015)

2. FIRCO ENERGIAS RENOVABLES	
a) Sistemas Térmico Solares (calentamiento de agua)	Hasta 50% del costo del system sin rebasar (\$500,000)
b) Sistemas Fotovoltaicos Autónomos (bombeo de agua refrigeracion)	Hasta 50% del costo del system sin rebasar (\$100,000.00)
c) Sistemas Fotovoltaicos Interconectados	Hasta 50% del costo del system sin rebasar (\$1,000,000.00)

d) Sistemas de Biodigestión	Hasta 50% del costo del system sin rebasar (\$1,000,000.00)
e) Motogeneradores	Hasta 50% del costo del system sin rebasar (\$500,000)
f) Aprovechamiento de la biomasa para generacion de energiz eléctrica	Hasta 30% del costo del system sin rebasar (\$750,000) pro persona fisica o moral y hast un maximo de \$15,000,000 por proyecto
g) Otros proyectos de Energía Renovables	Hasta 30% del costo del system sin rebasar (\$750,000) pro persona fisica o moral y hast un maximo de \$15,000,000 por proyecto
h) Obras accesorias	Hasta 50% del costo del system sin rebasar (\$500,000)

Financing for a loan loss reserve fund that was developed for Mexico’s hotel industry in collaboration with the Ministry of Energy and BANCOMET is also being deployed in partnership with commercial banks to provide lower interest loans in the hotel industry via the Yucatan Peninsula Project (Lang, 2015).

2.5 BUSINESS SKILLS BARRIER AND PRODUCT QUALITY

Prior to the GSWH initiative, Mexico implemented design of formal quality standards for SWH products and installations, although additional standards were developed at a slower pace than initially planned in Mexico. Some national manufacturers have expressed concern that quality standards may adversely affect their market position. As a result, it has been challenging to reach agreement about specific technical requirements and test procedures in the established technical committee for standard development.

Nonetheless, Mexico does have a quality standard based on the Technical Report of Solar Thermal in Housing (DTESTV), which is used by Conuee as well as the Green Mortgage Program. This regulates the types of collectors used in installations and is generally credited with increasing the quality of installations across the country. In collaboration with project partners, the GSWH initiative is now working to develop a voluntary quality control and certification scheme for SWH equipment and installation services. A series of installation trainings have also been developed (Figure 5). The certification scheme will ultimately be adopted by the majority (over 80%) of SWH equipment and service providers in Mexico.

The interest rate buy down program financed by the BANCOMET is currently creating the first interest rate buy down program for hotels, scheduled to begin in January 2016. It will include equipment quality standard requirements and installer qualifications, as well as inspection of system installations and monitoring to track fuel savings (Lang, 2015).

In addition, the GWSH initiative sponsored the installation of the new laboratory test facility in León Guanajuato, where staff will perform tests on equipment to assess the SWH thermal performance and

operational integrity (pressure, impact, thermal shock, and other specifications), security, and general quality of SWH components. The testing facility will operate in accordance with the national DTESTV, the Technical Report for Solar Thermal Energy in Housing Equipment.

From October 2014 to February 2015, the GSWH initiative supported the Metrology Certification and Quality Management in SWH Test Labs Course that took place in five SWH test labs in Mexico. The course provided the opportunity to standardize SWH equipment tests with clear criteria, which provided accreditation by ISO 17025 (ISO, 2015).

Mexican standardization entities have been participating in the development of product standards and certifications, including: the National Standardization and Certification Association for the Electric Sector (ANCE) and the Society for Normalization and Certification (NORMEX). NORMEX was created in 2003 to provide standardization, certification, testing laboratories, verification, and training courses for energy performance. The first standards for domestic solar water heating thermal performance and functionality of solar collectors for water heating testing methods and labeling were established in October 2005.¹⁰ Two additional standards addressing the definitions and terminology of SWHs and the minimum installation requirements followed in the years preceding the GSWH initiative.^{11,12} Evaluation procedures for solar thermal testing methods were adopted in 2010.¹³ A total of 21 published standards and testing methodologies have been adopted by NORMEX to ensure conformity and specified standards for the evaluation of equipment for certification.

Currently, it is required to complete a certification process for SWH equipment that guarantees correct installation and operation for solar heaters. The GSWH initiative also collaborates in regulations and construction codes in Mexican states and municipalities.

¹⁰ NMX-ES-001-NORMEX-2005: Solar water heating standard for thermal performance and functionality of solar collectors for heating water-testing methods and labeling

¹¹ NMX-ES-002-NORMEX-2006: Contains the definitions and terminology of GSWH National Program in Mexico. Issued in September, 2007.

¹² NMX-ES-003-NORMEX-2008: established the minimum requirements for the installation solar thermal systems for water heating. The effective start date was September, 2008

¹³ NMX-ES-004-NORMEX-2010: The evaluation of solar thermal systems for water heating test methods. The effective start date was June 2010.

Figure 5. Training flyer for solar thermal and electric energy workshop. (UNAM, 2015)

UNAM
UNIVERSIDAD NACIONAL AUTÓNOMA DE MÉXICO

IER
Instituto de Energías Renovables

30 AÑOS
en Temixco

Curso-Taller
"Conversión Térmica y Eléctrica de la Energía Solar"
Del 24 al 27 de noviembre de 2015
Coordinador: Dr. Isaac Pilatowsky Figueroa

Objetivo: Brindar las herramientas indispensables para la implementación de proyectos de sistemas de calentamiento solar para el diseño de sistemas de baja, mediana y alta temperatura con sus diferentes aplicaciones, además de dar a conocer las experiencias de la industria nacional de energía termosolar.

Dirigido: Profesionistas, académicos, estudiantes, industriales, comercializadores y público en general interesados en el diseño e instalación de sistemas fotovoltaicos y/o térmico solares.

Duración: 32 horas

Costos:
\$9,200.00 Profesionistas
\$7,400.00 Académicos y Ex Alumnos UNAM
\$6,000.00 Estudiantes

Contacto:
Unidad de Educación Continua
e-mail: uec@ier.unam.mx
Tel. (777) 362-00-90
ext. 29824

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SECTION 3

APPLYING UNEP'S SWH TECHSCOPE ASSESSEMENT METHODOLOGY: PARAMETERS EVALUATION AND SCORE VARIATION IN 3 PHASES OF IMPLEMENTATION

3.1 INTRODUCTION AND SUMMARY OF SCORES

This section applies the TechScope SWH market readiness assessment methodology to analyze the market in Chile. The TechScope assessment methodology was designed based on in-depth research on international solar thermal markets and policy development, as well as a review of the experiences and outcomes of the five GSWH project countries.¹⁴

The methodology focuses on four interrelated parameters:

- I **SWH Support Framework (29% of score):** Government policies, regulations, and engagement programs have played an important role in scaling up many of the world's leading solar heating markets. For the purposes of developing the score, the support framework includes SWH targets, financial incentives, loan programs, building mandates, and outreach campaigns.
- II **National Conditions (30%):** The relevant national conditions include the incoming solar radiation (i.e. insolation), SWH penetration and market growth, energy demand trends, and the competitiveness of SWH compared to other heating fuels.
- III **Financing (20%):** Financing takes into account national macroeconomic conditions, as well as

¹⁴ To access the entire Solar Water Heating Techscope Market Readiness Assessment, please refer to <http://solarthermalworld.org/content/solar-water-heating-swh-techscope-market-readiness-assessment-eight-caribbean-countries>.

data on access to loans and the cost of financing.

- IV **Business Climate (21%)**: The business climate is assessed by examining the ease of doing business, the existence of SWH quality standards, and the presence of associations that support SWH.

These four parameters are composed of 18 indicators that reflect different elements of the enabling environment for SWH in a given country.

Together, these indicators and their corresponding parameters can be used to construct a “snapshot” of a particular country’s SWH market. Based on this assessment, each country is provided an overall score on a scale of 0 to 5. A higher score reflects the fact that there is significant policy, financial, and industry infrastructure in place within the country to support and enable SWH deployment. A lower score reflects the fact that some of the “building blocks” for a robust solar heating market may not be in place. It is important to note that the score is static and does not capture progress that a country has made in strengthening its enabling environment.

The SWH TechScope Market Readiness Analysis Tool assigns the following broad labels for scores:

- ◎ **Score of 0-2**: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.
- ◎ **Score of 2-3**: SWH enabling environment is “good” with the SWH market positioned for increased growth.
- ◎ **Score of 3-4**: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.
- ◎ **Score of 4-5**: SWH conditions are “very strong” – policy, market, financial, and business conditions are aligned to support SWH and market growth is likely to be rapid.

This report applies the TechScope Market Readiness Assessment for three different stages of Mexico’s participation in the GSWH Initiative. The three stages analyzed are as follows:

- ◎ **Pre-GSWH initiative (until 2009)**. The first stage is considered to be the period before the initiation of the GSWH initiative and provides a baseline for analyzing its impacts.
- ◎ **Mid-Term of GSWH initiative implementation (2014)**.¹⁵ The second stage coincides with the mid-term evaluation of the GSWH initiative in Mexico.
- ◎ **Final-GSWH initiative (2015)**. The final stage takes into account all activities completed under the GSWH initiative prior to the anticipated closure of the program in early 2016.

¹⁵ While the year used for benchmarking the mid-term of the GSWH initiative is 2013, data used for indicators for this stage varies in years due to gaps in available data.

Figure 6 below provides a breakdown of TechScope indicators that (1) cannot be impacted by policy action, (2) indicators that are indirectly impacted by policy action or would be directly impacted by policy action outside of the scope of the GSWH project, and (3) indicators that are directly affected by policy action. As suggested by the scores in Table 2, some of the improvements in Mexico’s TechScope score can be attributed to changes in indicators that would not be directly affected by policies enacted under the GSWH.

The summary of TechScope scores for each of the three stages are summarized in Table 1 below. As can be seen in Table 1, Mexico’s TechScope score has increased steadily through all three stages of the GSWH initiative. Many of the TechScope parameters are either related to conditions specific to Mexico itself (e.g. insolation) or outside of the scope of what could have been affected by the direct policy actions under the GSWH initiative (e.g. country credit rating, heating fuel subsidies). As such, in assessing Mexico’s progress under the GSWH initiative, it may be valuable to focus analysis on improvements under the indicators that can be directly impacted by policy actions from the government.

Figure 6. TechScope indicators and potential to be affected by policy action undertaken within the scope of the GSWH initiative

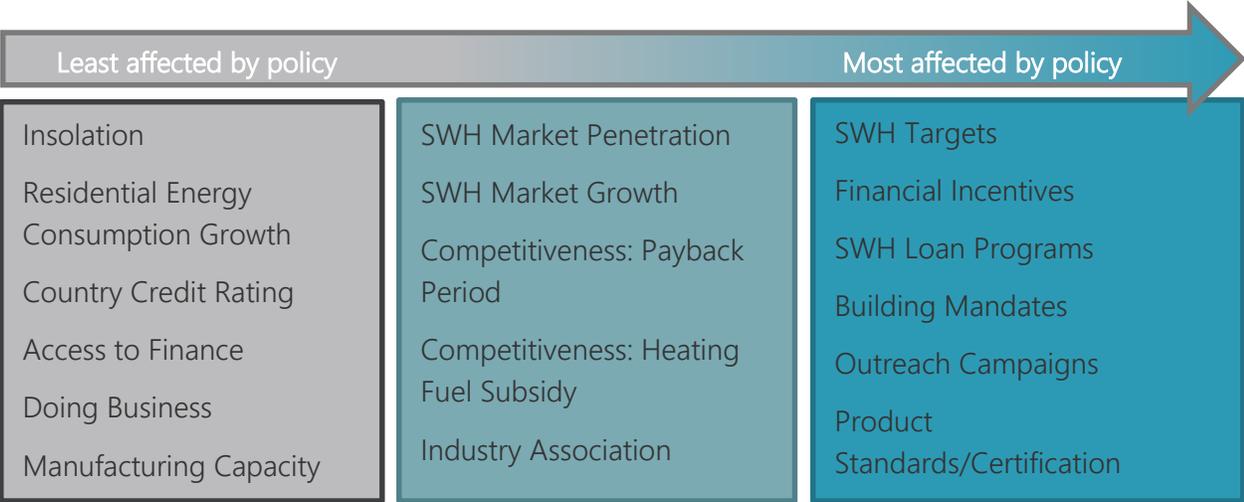


Table 2. Summary of TechScope scores for Mexico across the three stages analyzed (weighted scores)

Parameter	Score	Indicator	Pre-GSWH		Mid Term-GSWH		Final-GSWH	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
I. SWH Support Framework	29%	SWH Targets	0.0	0.00	0.0	0.00	5.0	0.25
		Financial Incentives for System Installation	5.0	0.40	5.0	0.40	5.0	0.40
		SWH Loan Programs	0.0	0.00	5.0	0.35	5.0	0.35
		Building Mandates	0.0	0.00	2.5	0.13	2.5	0.13
		Outreach Campaigns	0.0	0.00	5.0	0.20	5.0	0.20
		Subtotal		0.40		1.08		1.33
II. National Conditions	30%	Insolation	4.4	0.22	4.4	0.22	4.4	0.22
		SWH Market Penetration	0.15	0.01	0.2	0.01	0.30	0.01
		Residential Energy Consumption Growth	0.0	0.00	0.5	0.02	0.5	0.03
		SWH Market Growth	5.0	0.20	5.0	0.20	5.0	0.20
		Competitiveness: Payback Period	2.0	0.14	2.0	0.14	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	0.0	0.00	0.0	0.00	0.0	0.00
		Subtotal		0.57		0.59		0.74
III. Financing	20%	Country Credit Rating	2.0	0.10	2.0	0.10	3	0.15
		Access to Finance	3.0	0.45	3.5	0.53	3.0	0.45
		Subtotal		0.55		0.63		0.60
IV. Business Climate	21%	Doing Business	4.0	0.20	4.0	0.20	4.0	0.20
		Manufacturing Capacity	5.0	0.15	5.0	0.15	5.0	0.15
		Product Standards and Certification	3.0	0.15	3.0	0.15	4.0	0.20
		Installer Certification	5.0	0.20	5.0	0.20	5.0	0.20
		Industry Association	5.0	0.20	5.0	0.20	5.0	0.20
		Subtotal		0.90		0.90		0.95
TOTAL	100%			2.42		3.20		3.61

The following section provides analysis of the indicators under each of the four parameters and describes changes in scores evaluated. The complete scores generated by the Techscope Market Readiness Assessment Tool and GHG calculator can be found in the annex (SECTION 6).

For a full description of the TechScope methodology, parameters, and indicators, the full *Solar Water Heating TechScope Market Readiness Assessment* can be accessed online here:

<http://solarthermalworld.org/content/solar-water-heating-techscope-market-readiness-report-2014>

3.2 PARAMETER I: SOLAR WATER HEATING SUPPORT FRAMEWORK

Table 3. Summary of Solar Water Heating Support Framework scores for Mexico

Parameter	Score	Indicator	Pre-GSWH		Mid-GSWH		Final-GSWH	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
I. SWH Support Framework	29%	SWH Targets	0.0	0.00	0.0	0.00	5.0	0.25
		Financial Incentives for System Installation	5.0	0.40	5.0	0.40	5.0	0.40
		SWH Loan Programs	0.0	0.00	5.0	0.35	5.0	0.35
		Building Mandates	0.0	0.00	2.5	0.13	2.5	0.13
		Outreach Campaigns	0.0	0.20	5.0	0.20	5.0	0.20
		Subtotal		0.95		1.08		1.33

3.2.1 SWH TARGETS

Prior to 2014, Mexico did not have any established national-level SWH targets, though the country did have several noteworthy efforts. Mexico's 2008 Law for the Sustainable Use of Energy required the federal government to incorporate goals and strategies in the National Development Plan in regards to the sustainable use of energy, though specific targets for SWH were not included. Previously a national programme to promote SWH in Mexico, PROCALSOL, had launched in 2007 with the goal of installing 1.8 million m² of solar collectors by 2012 (PRONASE; Rickerson et al., 2014; Epp, 2011).

The Renewable energies Prospective (2013-2027) from SENER estimated (in the conservative scenario) a total of 18.2 million square meters of solar water heaters installed in Mexico for the year 2027 (SENER, 2014) in 2014. This target was subsequently integrated into Mexico's sector-specific plans. Mexico's score therefore improves from 0 before and during the GSWH initiative to a score of 5 for final GSWH.

Pre-GSWH Score	0	Mid-GSWH Score	0	Final-GSWH Score	5
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3.2.2 FINANCIAL INCENTIVES FOR SWH SYSTEMS INSTALLATION

Mexico provided financial incentives for SWH system installations prior to the GSWH initiative, including a 2004 decree that allows for depreciation of 100% of expenses of renewable energy equipment in one year and grants from the Trust Fund for Shared Risk (*Fideicomiso de Riesgo Compartido*), which was established in 2013.

Mexico’s score of 5 for this indicator is unchanged.

Pre-GSWH Score	5	Mid-GSWH Score	5	Final-GSWH Score	5
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3.2.3 SWH LOAN PROGRAM

Mexico introduced a green mortgage scheme (managed by *Hipoteca Verde*) in 2010, a low interest loan for financing SWH systems that was utilized for 53% of SWH collector area installed in 2012 (Epp, 2013). This program has remained in place.

Mexico’s score final-GSWH therefore remains unchanged from the score of 5 from during the GSWH initiative period.

Pre-GSWH Score	0	Mid-GSWH Score	5	Final-GSWH Score	5
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3.2.4 MANDATES

Mexico has not introduced a building mandate at the national level, though numerous subnational governments (e.g. Distrito Federal, Quitana Roo, Tabasco, and Veracruz) have adopted SWH building mandates as part of implementing the federal building code requirements. Mexico City was the first municipality to adopt a SWH building mandate in 2006 (IRENA, 2015). Mexico’s score of 2.5 is unchanged through the duration of the GSWH project.

Pre-GSWH Score	2.5	Mid-GSWH Score	2.5	Final-GSWH Score	2.5
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3.2.5 OUTREACH PROGRAMS

The GSWH initiative implemented numerous outreach and stakeholder engagement programs, including pilot projects, networking events, and media outreach. Mexico has built upon these programs, launching a new platform of courses, webinars, and events in October 2015 aiming to reach 2,000+ people. These initiatives have continued following the Mid-GSWH initiative, and therefore, Mexico's score of 5 remains unchanged.



The Solar Water Heating Support Framework parameter saw a large score increase, which drove an overall score increase for Mexico. The parameter score moved from 0.40 to 1.32 at the end of the project. This happened mainly due to the direct involvement of the government bodies and national agencies. This involvement and cooperation resulted in financing mechanisms, subsidies, adoption of building mandates, and outreach.

3.3 PARAMETER II: NATIONAL CONDITIONS

Table 4. Summary of National Condition scores for Mexico

Parameter	Score	Indicator	Pre-GSWH		Mid-GSWH		Final-GSWH	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
II. National Conditions	30%	Insolation	4.4	0.22	4.4	0.22	4.4	0.22
		SWH Market Penetration	0.15	0.01	0.22	0.01	0.30	0.01
		Residential Energy Consumption Growth	0.0	0.00	0.5	0.02	0.5	0.02
		SWH Market Growth	5.0	0.20	5.0	0.20	5.0	0.20
		Competitiveness: Payback Period	2.0	0.14	2.0	0.14	4.0	0.28
		Competitiveness: Heating Fuel Subsidy	0.0	0.00	0.0	0.00	0.0	0.00
		Subtotal		0.57		0.59		0.74

3.3.1 INSOLATION

Average daily insolation in Mexico range from levels range from 6.0 kWh/m² to 7.0 kWh/m² in Mexico, with a country average of 6.5 kWh/m² (Clean Energy Solutions Center (CESC), 2015). Insolation is not affected by policy action. Mexico's score of 4.4 is unchanged.

Pre-GSWH Score	4.4	Mid-GSWH Score	4.4	Final-GSWH Score	4.4
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3.3.2 SWH MARKET PENETRATION

Mexico's installed capacity of SWH has grown from 7.9 kW_{th} per 1000 inhabitants in 2009 to 15.45 kW_{th} per 1000 inhabitants in 2014 and then to 11.8 kW_{th} per 1000 inhabitants in 2015 (Mauthner & Weiss, 2015; Weiss & Mauthner, 2010, 2010, 2011, 2012, 2013). This results in a modest score increase in the final-GSWH initiative score for Mexico from .15 prior to .27 post-GSWH initiative.

Pre-GSWH Score	0.15	Mid-GSWH Score	0.22	Final-GSWH Score	0.27
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3.3.3 RESIDENTIAL ENERGY CONSUMPTION GROWTH

According to IEA statistics, residential energy consumption dropped slightly in Mexico during the period leading up to 2009. However, energy use has continued to increase steadily at a rate of approximately 0.2% annually since 2009, leading to a score of .5 (IEA, 2015).

Pre-GSWH Score	0	Mid-GSWH Score	0.5	Final-GSWH Score	0.5
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3.3.4 SWH MARKET GROWTH

According to IEA Solar Heat Worldwide data, the SWH market in Mexico has witnessed strong and consistent growth during the GSWH initiative, growing from 912 MW_{th} in 2009 to 1,890 MW_{th} in 2014 (Martinez, 2015a). By June 2015, Mexico's capacity had grown to 1,960 MW_{th}. Growth has accelerated under the GSWH initiative: for the five years leading up to the GSWH initiative (2004-2009), average annual growth was 15%, increasing to 17% for the period of 2006-2011 and to 19% for the period of 2009-2013 (UNDP, 2014).

Mexico receives a score of 5 for this parameter.

Pre-GSWH Score	5	Mid-GSWH Score	5	Final-GSWH Score	5
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3.3.5 COMPETITIVENESS: PAYBACK PERIOD

SWH system costs. SWH system cost estimates vary in Mexico. Costs were estimated to be \$750 USD for the purposes of the TechScope study. The average system size is approximately two square meters (Baerbel Epp, 2009).

Retail energy prices. In Mexico, liquefied petroleum gas (LPG), a bi-product of petroleum and natural gas production, is the predominant fuel used for heating in the residential sector (Martinez, 2015a). Prices vary at the subnational level, but have consistently increased year-on-year (50%) in the years following the start of the GSWH program (CEMAER, 2015; Secretary of Energy, 2015).¹⁶

After running the RETScreen analysis, the payback period for a SWH system has improved by 4.8 years as a result of the increased fuel prices. This results in a score of 4.

Pre-GSWH Score	2	Mid-GSWH Score	2	Final-GSWH Score	4
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¹⁶ Every state in the republic has a different price of Liquefied Petroleum Gas (LPG). The Secretary of Energy provides historical information on the average monthly price of LPG.

3.3.6 COMPETITIVENESS: HEAT FUEL SUBSIDY

Mexico continues to regulate many fossil fuel prices, including LPG, the primary fuel used for heating. In 2015, Mexico set a maximum consumer price for LPG at \$14.46 pesos/kg (\$0.88 USD)(Garcia, 2015).¹⁷

Because Mexico continues to subsidize the price of LPG, its score remains at 0, unchanged for this indicator.

Pre-GSWH Score	0	Mid-GSWH Score	0	Final-GSWH Score	0
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3.4 PARAMETER III: FINANCING

Table 5. Summary of financing scores for Mexico

Parameter	Score	Indicator	Pre-GSWH		Mid-GSWH		Final-GSWH	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
III. Financing	20%	Country Credit Rating	2.0	0.10	2.0	0.10	3	0.15
		Access to Finance	3.0	0.45	3.5	0.53	3.0	0.45
		Subtotal		0.55		0.63		0.60

3.4.1 COUNTRY CREDIT RATING

Pre- and Mid-GSWH. Mexico's ratings from Moody's and Standard and Poor's (S&P), were BAA1 and BBB, respectively in 2009 and 2013, resulting in a score of 2 for this indicator. Mexico's credit ratings improved to BBB+ (S&P) and A3 (Moody's) in the years following the mid term evaluation, resulting in an increased score of 3 for this indicator.

It should be noted that while Mexico's credit rating improved from during the GSWH to final-GSWH, policy actions under the GSWH had no effect on this score.

Pre-GSWH Score	2	Mid-GSWH Score	2	Final-GSWH Score	3
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¹⁷ Starting this year, the government set a maximum monthly consumer price of LPG for domestic households.

3.4.2 ACCESS TO FINANCE

Pre-GSWH. Mexico’s average domestic credit provided by the banking sector (2007-2009) was 39% and its average real interest rate was 3% (World Bank, 2015).

Mid-GSWH. Mexico’s average domestic credit provided by the banking sector (2010-2012) was 46% and its average real interest rate was 0.33%.

Final-GSWH. Mexico’s average domestic credit provided by the banking sector (2013-2015) was 51% and its average real interest rate was 0%. Mexico’s score decreased, but it does not impact the final score.

Mexico’s real interest rate (%) increased following the Mid Term evaluation. As a results Mexico’s Access to Finance score decreased from 3.5 (Mid-Term) to 3 (Final GSWH Score). As with the previous indicator, while Mexico’s access to finance has generally improved since the start of the GSWH project, this indicator is not affected by SWH policy actions.



3.5 PARAMETER IV: BUSINESS CLIMATE

Table 6. Summary of Business Climate scores for Mexico

Parameter	Score	Indicator	Pre-GSWH		Mid-GSWH		Final-GSWH	
			Raw	Weighted	Raw	Weighted	Raw	Weighted
IV. Business Climate	21%	Doing Business	4.0	0.20	4.0	0.20	4.0	0.20
		Manufacturing Capacity	5.0	0.15	5.0	0.15	5.0	0.15
		Product Standards and Certification	3.0	0.15	3.0	0.15	4.0	0.20
		Installer Certification	5.0	0.20	5.0	0.20	5.0	0.20
		Industry Association	5.0	0.20	5.0	0.20	5.0	0.20
		Subtotal		0.90		0.90		0.95

3.5.1 DOING BUSINESS

Mexico’s ranking on the World Bank’s *Doing Business* index increased from 56 out of 185 in 2009 to 48 out of 185 in 2012 and then to 39 out of 189 in 2014. Though Mexico’s score for this indicator is unchanged, its position on the *Doing Business* index is not directly related to the GSWH project, as this metric is difficult to influence with energy policy measures.

Pre-GSWH Score	4	Mid-GSWH Score	4	Final-GSWH Score	4
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3.5.2 MANUFACTURING CAPACITY

Mexico’s manufacturing capacity has remained constant at over 17% since before the GSWH project (UNIDO, 2015).

Domestic manufacturers, such as Módulo Solar, as well as foreign manufacturers are active in the Mexican SWH market. Determining a country’s Manufacturing Value Added (MVA) is useful because this indicator can be used as a barometer of how developed that country’s manufacturing sector is. Mexico’s MVA as a percentage of GDP in 2012 was approximately 18%, lower than the average for developing countries (~21%) but slightly higher than the global average (~17%). Due to Mexico’s strong MVA, it gets a score of 5 for this section.

Pre-GSWH Score	5	Mid-GSWH Score	5	Final-GSWH Score	5
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3.5.3 PRODUCT STANDARDS AND CERTIFICATIONS

Mexico has been steadily building its standards and certification infrastructure since the inception of the GSWH initiative.

- ⦿ **Standards.** Mexico’s national agency for standards and certification, NORMEX18, has published standards and testing methodologies for solar thermal systems (e.g. NMX-ES-001-NORMEX-2005) (NORMEX, 2015). The Hipoteca Verde loan program, which continues to finance a significant proportion of the SWH systems in Mexico, requires that SWH systems adhere to a specific set of standards managed by CONUEE known as DTESTV (i.e. *Dictamen Técnico de Energía Solar Térmica en Vivienda*)(SEGOB, 2010). The Yucatán Peninsula Pilot Project also requires SWH manufacturers to adhere to these standards.
- ⦿ **Testing.** Mexico has established five SWH testing facilities, which perform national certification tests based on DTESTV quality standards.

Mexico introduced a solar thermal product national certification following the Mid-GSWH. As a result of its improved standards and testing infrastructure, Mexico receives a score of 4.

Pre-GSWH Score	3	Mid-GSWH Score	3	Final-GSWH Score	4
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3.5.4 INSTALLER CERTIFICATION

Mexico’s national labor standards and certification body, CONOCER⁴² has published standards for the job skills required for solar thermal installers, which have been entered in the National Register of Competency Standards.⁴³ The federal state of Aguascalientes is piloting the certification, with support from Infonavit, the quasi-public housing agency and the German Technical Cooperation Agency (GIZ). Following the pilot, it is anticipated that the certification will become mandatory for all installers working on housing developments financed by Infonavit. An additional seven federal states are exploring the certification of another 150 installers. The existence of national solar installer standards leads to a score of 5.

Pre-GSWH Score	5	Mid-GSWH Score	5	Final-GSWH Score	5
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3.5.5 INDUSTRY ASSOCIATIONS

The organization of renewable manufacturers, FAMERAC (i.e. *Fabricantes Mexicanos en las Energías Renovables A.C.*), has represented the interest of the solar thermal industry prior to and since the GSWH initiative.

Mexico continues to receive a score of 5.

Pre-GSWH Score	5	Mid-GSWH Score	5	Final-GSWH Score	5
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SECTION 4 NATIONAL SWH PROGRAM IMPACT ANALYSIS

This section assesses the impact of the GSWH initiative on the SWH market in Mexico. This assessment is focused on seven primary areas of impact as outlined in Section 3.1:

- SWH Targets
- Financial Incentives for System Installations
- SWH Loan Program
- Building Mandates
- Outreach Campaigns
- Product Standards and Certification
- Installer Certification

The impact of the GSWH project is defined in terms of high, medium, low or no impact as outlined in Table 6. Table 7 provides a summary of the impact of the GSWH initiative in Mexico. These assignments were determined qualitatively through the review of project documents and from conversations with national stakeholders (e.g. UNDP Mexico and Conuee). The complete scores generated by the Techscope Market Readiness Assessment Tool and GHG calculator can be found in the annex (SECTION 6).

Table 7. Levels of Impact and Associated Symbol

Level of Impact	Symbol
High Impact	
Medium Impact	
Low Impact	
No Impact	

Table 8. Summary of the Impact of the GSWH initiative in Mexico

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
SWH Targets	0.00	0.00	0.25	
Financial Incentives for System Installation	0.40	0.40	0.40	
SWH Loan Programs	0.00	0.35	0.35	
Building Mandates	0.00	0.13	0.13	
Outreach Campaigns	0.00	0.20	0.20	
Product Standards and Certification	0.15	0.15	0.20	
Installer Certification	0.20	0.20	0.20	

Table 7 illustrates the improvement of Mexico’s TechScope score over the course of the GSWH initiative. According to Market Readiness Assessment methodology, Mexico’s initial score was at 2.42. Prior to the project implementation, Mexico had a “good” enabling environment with a SWH market positioned for increased growth. Upon the completion of the GSWH initiative, Mexico’s SWH market showed signs that the enabling environment was “strong” with a score of 3.61.

4.1 SWH TARGET

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
SWH Targets	0.00	0.00	0.40	

Mexico did not have solar water heating targets prior to the GSWH initiative, but has since set a target. The GSWH worked with the Government of Mexico to develop a SWH target. As a result, the GSWH initiative had a high impact on developing SWH targets.

4.2 FINANCIAL INCENTIVES

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
Financial Incentives for System Installation	0.40	0.40	.40	

Prior to the GSWH initiative, Mexico provided financial incentives that allowed for the depreciation of 100% of the cost of renewable energy equipment in one year. The GSWH initiative worked with CONUEE to establish and deploy some additional financial incentives. However, most of these financing mechanisms were geared towards the commercial sector. Since the GSWH initiative is targeting the residential sector and few additional residential financing mechanisms were developed, the GSWH initiative's direct impact is considered medium.

4.3 SWH LOAN PROGRAMS

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
SWH Loan Programs	0.00	0.35	0.35	

Mexico did not have solar water heating loan programs prior to the GSWH initiative. The GSWH initiative helped to introduce the Green Mortgage Fund (Hipoteca Verde) in 2010, whereby borrowers could access additional credit for solar water heating systems. As a result, the GSWH initiative had a high impact on providing loan programs.

4.4 BUILDING MANDATES

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
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Building Mandates	0.00	0.15	0.15	
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Mexico did not have solar water heating building mandates prior to the GSWH initiative, but a number of states adopted mandates following the inception of the GSWH initiative. The GSWH initiative provided assistance in the development of building mandates at the state level. As a result, the GSWH initiative had a medium impact on developing building mandates for the SWH market in Mexico.

4.5 OUTREACH CAMPAIGNS

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
Outreach Campaigns	0.00	0.20	0.20	

The GSWH initiative worked with CONUEE to establish outreach and stakeholder engagement programs for solar water heating. As a result of these efforts, Mexico had these programs in place during the Mid- and Final-GSWH initiative. Since the GSWH initiative worked with CONUEE to establish outreach campaigns, the GSWH initiative had a high impact on developing and deploying these campaigns for the SWH market in Mexico.

4.6 PRODUCT STANDARDS AND CERTIFICATION

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative Impact
Product Standards and Certification	4.00	4.00	5.00	

Mexico had products standards and certifications in place prior to the GSWH initiative. The GSWH initiative helped to develop additional standards throughout, resulting in the introduction of a solar thermal product national certification program (ONNCCE, 2014). As a result, the GSWH initiative had a medium impact on the products and standards certification in the SWH market of Mexico.

4.7 INSTALLER CERTIFICATION

Indicator	Pre-GSWH	Mid-GSWH	Final-GSWH	GSWH Initiative
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				Impact
Installer Certification	0.20	0.20	0.20	

Mexico had installer certifications prior to the GSWH initiative. The GSWH initiative is now working to develop a voluntary quality control and certification scheme for SWH equipment and installation services, but to date has had little impact on the market.

4.8 LESSON LEARNED AND THE PATH FORWARD

The goal of the GSWH initiative in Mexico was to reach a target of 2.5 million square meters of SWH collector area – approximately 1,750 MW_{th} of capacity – as well as to achieve goals for residential sector market acceleration and to accelerate growth in total installed capacity.¹⁹ Growth in Mexico’s SWH market accelerated to 19% per year during the initiative (2009-2015). The GSWH Initiative helped the SWH market in Mexico achieve its collector area target despite a sustained growth rate lower than the initiative’s projected target of 25 to 30%.²⁰ SWH market growth has been strong and consistent in Mexico, growing from 912 MW_{th} of capacity in 2009 to 1,890 MW_{th} in 2014. By June 2015, Mexico’s capacity had grown to 1,960 MW_{th}.

This report analyzed the extent to which the GSWH initiative had an impact on Mexico’s SWH market. This analysis considers seven areas of potential impact including SWH targets, financial incentives for system installation, SWH loan programs, building mandates, outreach campaigns, and product standards and certifications. **The results of this analysis conclude that the TechScope score for Mexico has increased from 2.42 in the Pre-GSWH phase, to 3.2 in 2013 and to 3.61 in 2014.** The GSWH initiative achieved a notable level of impact in Mexico, showing a medium – to high level of impact for six of the seven Techscope Indicators: SWH targets, financial incentives, SWH loan programs, building mandates, outreach campaigns and product standards and certification. However, the GSWH initiative had little impact on installer certification.

In evaluating the GSWH initiative and progress in developing Mexico’s SWH market, several key lessons can be drawn:

¹⁹ The GSWH set the following objectives for the implementation period: Accelerate and ensure a sustainable growth rate of 25-30% (in total installed capacity) for the SWH market; to reach a target of 2.5 million square meters of SWH collector area; Grow the residential sector proportionately faster to account for 14% of the total installed capacity for the SWH market.

²⁰ The growth rate in the residential sector was estimated to account for 10% of the total installed capacity as of June 2015. The rate of growth for the SWH market (total installed capacity) was approximately 16% per year from 2009 - 2014.

Program stability and holistic implementation. To ensure growth in the SWH industry, enabling environment programs need to remain stable. Mexico started a number of notable incentive programs for SWH, including the green mortgage program, which was recently expanded to other sectors. Steady growth in the industry will require consistent incentives and the continuation of a holistic approach to developing a SWH market focusing on multiple parameters as outlined in this report. In this regard, Mexico could also consider focusing on installer certification, the only parameter in which the GSWH initiative did not have an impact. From a business perspective, however, particularly given the impacts of the recession at the start of the GSWH initiative, Mexico has maintained and enhanced its market enabling environment.

Resource coordination. The implementation of the GSWH initiative in Mexico took place in coordination with a national program, Procasol, and also in partnership with several state-based SWH market development programs. This close partnership between different programs with similar goals was an important component for success, allowing the GSWH initiative to support and enhance existing programs and goals.

Strong standards. Mexico had a product certification program in place prior to the start of the program, having implemented design of formal quality standards for SWH products and installations. However, additional standards have developed at a slower pace than initially planned and it has been challenging to reach agreement amongst stakeholders about specific technical requirements and test procedures in the established technical committee for standard development. Mexico does have quality standards through some of its incentive programs, such as the Green Mortgage Program, and should continue its work to develop a voluntary quality control and certification scheme for SWH equipment and installation services. Ensuring quality in SWH product and installation will be critical for continued growth in the market, especially given the relatively high cost to invest in the technology.

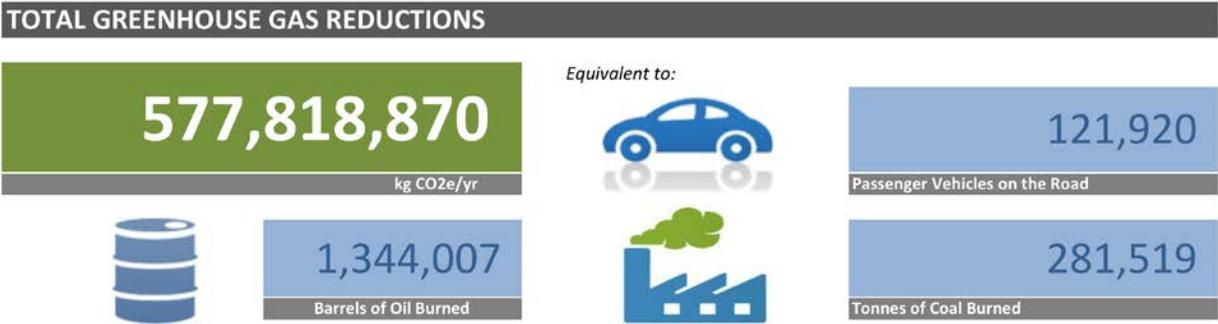
Innovative Financing Programs. Mexico provided financial incentives for SWH system installations prior to the GSWH initiative, including a 2004 decree that allows for depreciation of 100% of expenses of renewable energy equipment for one year. With assistance from the GSWH initiative, Mexico has implemented several successful green lending programs since 2009. These programs, which provide low-interest financing for home owners and the commercial sector, including the agricultural, forestry, fishing, and rural sectors, have contributed significantly to the growth of the SWH market in Mexico. Mexico should ensure continuity of its successful financial incentive programs and continue to consider other financial products and sectors the government can target for SWH installations.

Raising Awareness. Some of the success of Mexico's SWH market thus far can be attributed to GSWH initiative and CONUEE's collaboration to raise awareness about the technology. To meet its future market penetration goals, Mexico will need to continue and expand its outreach campaigns to reach target markets and increase product demand.

At the conclusion of the GSWH initiative, Mexico now has a strong enabling environment to grow its SWH market. The GSWH initiative achieved a notable level of impact in Mexico, helping to lay the foundation for SWH targets, financial incentives, SWH loan programs, building mandates, outreach

campaigns and product standards and certification. Moving forward, it will be important for Mexico to track progress in achieving its conservative SWH target of installing 18.2 million square meters of SWH collectors by 2020. By 2015, the growth of the SWH market resulted in avoided greenhouse gas emissions of 577,818,870 kg CO₂ equivalent per year. According to projected growth targets for the SWH market, Mexico’s estimated avoided emissions will be 1,093,728, kg CO₂ equivalent per year by 2020 (TechScope GHG Calculator, 2015). As the GSWH initiative support comes to a close, the initiative should continue efforts to track the progress of the SWH market in Mexico, which will be important in successful program evaluation and redesign.

Figure 7. Estimated avoided emissions for 2.8 million square meters of SWH collectors for 2015.



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SECTION 6 ANNEX: SOLAR
WATER HEATING
TECHSCOPE MARKET
READINESS ASSESSMENT
TOOL AND GHG ANALYSIS

6.1 MEXICO PRE-GSWH

Techscope Report

Solar Thermal Market Analysis

Country:

Mexico Pre GSWH

SUMMARY OF RESULTS

Parameter	Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
I. Solar Water Heating Support Framework	29%	5%	SWH Targets	0.0	0.00
		8%	Financial Incentives for System Installation	5.0	0.40
		7%	SWH Loan Programs	0.0	0.00
		5%	Building Mandates	0.0	0.00
		4%	Outreach Campaigns	0.0	0.00
II. National Conditions	30%	5%	Insolation	4.4	0.22
		4%	SWH Market Penetration	0.1	0.01
		5%	Residential Energy Consumption Growth	0.0	0.00
		4%	SWH Market Growth	5.0	0.20
		7%	SWH Competitiveness: Payback Period	2.0	0.14
		5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
III. Financing	20%	5%	Country Credit Rating	2.0	0.10
		15%	Access to Finance	3.0	0.45
IV. Business Climate	21%	5%	Doing Business Index	4.0	0.20
		3%	Manufacturing Capacity	5.0	0.15
		5%	Product Standards and Certification	3.0	0.15
		4%	Installer Certification	5.0	0.20
		4%	Industry Association	5.0	0.20

Overall Score **2.42**

Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

6.2 MEXICO MID-TERM GSWH

SUMMARY OF RESULTS

Parameter	Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
I. Solar Water Heating Support Framework	29%	5%	SWH Targets	0.0	0.00
		8%	Financial Incentives for System Installation	5.0	0.40
		7%	SWH Loan Programs	5.0	0.35
		5%	Building Mandates	2.5	0.13
		4%	Outreach Campaigns	5.0	0.20
II. National Conditions	30%	5%	Insolation	4.4	0.22
		4%	SWH Market Penetration	0.2	0.01
		5%	Residential Energy Consumption Growth	0.5	0.02
		4%	SWH Market Growth	5.0	0.20
		7%	SWH Competitiveness: Payback Period	2.0	0.14
		5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
III. Financing	20%	5%	Country Credit Rating	2.0	0.10
		15%	Access to Finance	3.5	0.53
IV. Business Climate	21%	5%	Doing Business Index	4.0	0.20
		3%	Manufacturing Capacity	5.0	0.15
		5%	Product Standards and Certification	3.0	0.15
		4%	Installer Certification	5.0	0.20
		4%	Industry Association	5.0	0.20

* The overall score lies between between 3.19 depending upon Assessment Tool rounding **Overall Score 3.19**

Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

6.3 MEXICO FINAL GSWH

Techscope Report

Solar Thermal Market Analysis

Country:

Mexico Final GSWH

SUMMARY OF RESULTS

Parameter	Parameter Weight	Indicator Weight	Indicator	Raw Score	Weighted Score
I. Solar Water Heating Support Framework	29%	5%	SWH Targets	5.0	0.25
		8%	Financial Incentives for System Installation	5.0	0.40
		7%	SWH Loan Programs	5.0	0.35
		5%	Building Mandates	2.5	0.13
		4%	Outreach Campaigns	5.0	0.20
II. National Conditions	30%	5%	Insolation	4.4	0.22
		4%	SWH Market Penetration	0.3	0.01
		5%	Residential Energy Consumption Growth	0.5	0.03
		4%	SWH Market Growth	5.0	0.20
		7%	SWH Competitiveness: Payback Period	4.0	0.28
		5%	SWH Competitiveness: Heating Fuel Subsidy	0.0	0.00
III. Financing	20%	5%	Country Credit Rating	3.0	0.15
		15%	Access to Finance	3.0	0.45
IV. Business Climate	21%	5%	Doing Business Index	4.0	0.20
		3%	Manufacturing Capacity	5.0	0.15
		5%	Product Standards and Certification	4.0	0.20
		4%	Installer Certification	5.0	0.20
		4%	Industry Association	5.0	0.20

Overall Score **3.61**

Assessment of Overall Strength of Market



Explanation of Scores

Score of 0-2: SWH enabling environment is “emerging” and could likely benefit from additional support to accelerate SWH market growth.

Score of 2-3: SWH enabling environment is “good” with a SWH market positioned for increased growth.

Score of 3-4: SWH enabling environments are considered to be “strong” and are likely ready to attract investment.

Score of 4-5: SWH conditions are “very strong” – policy, market, financial, business conditions are aligned to support SWH and market growth is likely to be rapid.

6.4 GHG CALCULATIONS BASED ON ACHIEVED RESULTS (2015)

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Mexico 2015

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	2,800,000
		0
		0

Energy Output (kWhth/yr)

1,307,672,931
1,307,672,931

TOTAL GREENHOUSE GAS REDUCTIONS

577,818,870
kg CO2e/yr

Equivalent to:



121,920
Passenger Vehicles on the Road



1,344,007
Barrels of Oil Burned

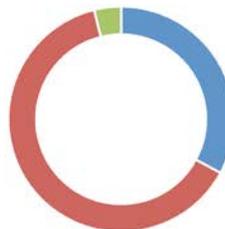


281,519
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Liquefied Petroleum Gases	190,060,093
Wood / Wood Waste	365,508,700
Natural Gas	22,250,077
	-
	-
TOTAL	577,818,870



■ Liquefied Petroleum Gases
■ Wood / Wood Waste
■ Natural Gas

6.5 GHG CALCULATIONS BASED ON ESTIMATED RESULTS (2020)

TechScope Report

Greenhouse Gas Calculator for Residential Solar Water Heating

Country:

Mexico 2020

OUTPUT OF SOLAR WATER HEATING SYSTEMS INSTALLED

Solar Hot Water Systems Installed (m2)

	TOTAL	5,300,000
		0
		5,300,000
		0

Energy Output (kWhth/yr)

2,475,238,048
2,475,238,048

TOTAL GREENHOUSE GAS REDUCTIONS

1,093,728,575
kg CO2e/yr

Equivalent to:



230,777
Passenger Vehicles on the Road



2,544,013
Barrels of Oil Burned

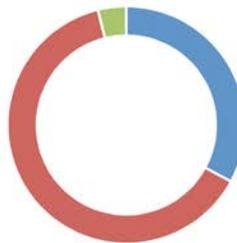


532,875
Tonnes of Coal Burned

GHG REDUCTIONS BY AVOIDED FOSSIL FUEL TYPE

AVOIDED EMISSIONS

	kg CO2e/yr
Liquefied Petroleum Gases	359,756,605
Wood / Wood Waste	691,855,753
Natural Gas	42,116,216
	-
	-
TOTAL	1,093,728,575



■ Liquefied Petroleum Gases
■ Wood / Wood Waste
■ Natural Gas

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In 2009, the United Nations Environment Programme (UNEP) and the United Nations Development Programme (UNDP) jointly launched the Global Solar Water Heating (GSWH) Market Transformation and Strengthening Initiative (“the GSWH Initiative”) with funding from the Global Environmental Facility (GEF) and co-financing from the International Copper Association (ICA). The objective of the GSWH project is to develop, strengthen and accelerate the growth of the solar water heating (SWH) sector.

The GSWH Initiative supported SWH national market development in five countries including Mexico. At the time, the SWH market in Mexico was developing quickly, but a lack of several important enabling mechanisms constrained SWH market growth. The national program implemented through the GSWH Initiative aimed to accelerate and ensure sustainable growth of the SWH market, particularly in the residential sector, and achieve a national target of 2.5 million square meters of SWH collector area.

This report evaluates SWH market development in Mexico under the GSWH-supported national program using the Solar Water Heating TechScope Market Readiness Assessment Methodology and Analysis Tool to provide high-level assessments of the Mexican SWH market before, during, and after the GSWH Initiative. This report also provides a summary of lessons learned and best practices to encourage the implementation of national SWH initiatives in countries around the world.