

Good practices for solar water heating in multifamily housing

Global Solar Water Heating Market Transformation and Strengthening Initiative



IMPORTANCE OF A GOOD DESIGN

This document is the synthesis of a manual realized in 2011 to compile the best practice in the design of Solar Water Heating (SWH) systems in the context of multifamily housing. It is part of the Country Program of Mexico "Global SWH Market Transformation and Strengthening Initiative".

Objective and methodology

Study objective

To analyze technological barriers that appear when trying to include solar water heating for domestic use in vertical or horizontal housing groups.

Methodology

1. Analysis of technological and social barriers against the use of SWH systems, through the analysis and compilation of examples of studies existing on the Mexican territory.
2. Identification of best practice to select and take decisions on the design of a SWH system.

To analyze existing examples in Mexico, the careful assessment of numerous experiences, accumulated in the country over the last 30 years, was performed

In Mexico, SWH systems for domestic use have been known for more than 100 years. However, their formal and professional offer started in Mexico in 1975, with the "Módulo Solar" company based in Cuernavaca and with other manufacturers and distributors in the country, supported by the growing National Association for Solar Energy (ANES in its Spanish acronym).

A. Analysis of technological and social barriers associated to the use of SWH systems

In multifamily housing, five groups of general considerations should be taken into account for SWH:

1. Hydraulic installations
2. Entitlement to sunshine
3. Current regulation
4. Community collaboration
5. New businesses

1. Hydraulic installations

A SWH system is composed of three main parts:

► The solar collectors

They convert solar energy into hot water that circulates in them.

► The thermal tank

It stores hot water during the day to conserve it so during all night. Sometimes it is equipped with an additional warming system to compensate during cloudy periods or when users wish to use more hot water than usually.

► The piping, equipment and control system

It enables the system to operate appropriately and supplies the service expected by the user.

SWH systems belong to one of these two categories:

1. Passive SWH systems
2. Active SWH systems (forced-circulation)

► Passive SWH systems

Passive SWH systems are more attractive as they do not require to be powered or automatically controlled. In addition, a huge experience in their use has been acquired during the last 30 years.

A large variety of passive SWH systems exists. Nonetheless, all of them share the same foundation: water heated by the sun rises due to its minor density and settles in the superior part of the thermal tank. Meanwhile, colder water takes its place at the bottom of the tank.

► Active SWH systems

Active SWH systems, equipped with modern and efficient electronic control systems, enable to obtain more heat and more hot water by unit of surface area. As a consequence, these systems can result more attractive than passive ones due to economies of scale. On the other hand, they offer a major control on productive capacities and operating limits. They also allow placing the thermal tank on the rooftop or in any other place, optimizing thus the use of rooftop space and leaving a large freedom to the designer.

2. Entitlement to sunshine

The entitlement to sunshine has been very scarcely legislated and in a very schematic manner. Solar energy is practically unlimited. However its use is limited by:

- The limitation of sunshine times.
- The diverse intensities of sunshine.
- The reducer effect of the atmospheric layer.

Besides, there is no guarantee that a SWH system user who installs it in any location would receive the sunlight required to operate it satisfactorily in the future. However, given the huge benefits of using solar radiation, the culture and value of sunshine entitlement in Mexico is growing year by year.

The distributed application, which means the supply of hot water from a SWH system to a group of independent dwellings, is a challenge. Indeed, technical considerations need to be taken into account so that each household, independently on its location in the housing group, receives hot water at a convenient pressure and temperature.

Hydraulic installations of a building, with or without a SWH system, should be entrusted to well-known and accredited professionals only.

80%

Proportion of gas amount required for gas water heating only in a dwelling, compared to the total dwelling gas requirements.

In a few cities and states, a process of legislation in this regard has started to make the access to sun radiation compulsory.

Fortunately, architects and building developers display a more and more informed sensitivity on the topic.

In more progressive countries, legislation elements exist to protect solar energy for the user, and it is to expect that Mexico will make good progress in this regard and in a consistent manner as time goes by.

3. Current regulation

The regulation relevant for the installation of SWH systems in housing belongs to two categories:

- ▶ **The technical one**, relevant to building schemes and practice.
- ▶ **The administrative one**, important in the management of spaces, since SWH systems are almost systematically installed in common areas in multifamily housing.

This regulation expresses essential points that have to be met when installing a SWH system in a multifamily housing, to avoid that SWH systems do not provide the expected service.

A summary on key regulation for the installation of SWH system in multifamily housing units is presented within the green box at the bottom of this page.

4. Community collaboration

A fundamental characteristic of the new era is that urban decisions should be taken for the benefit of the public good.

There is no better way to implement measures that encourage common good than developing the concept of community. However the respect of community is not characteristic of our culture, since Mexicans have got a certain proclivity to satisfy their individual desires or the ones of their relatives even at the cost of community interests.

As a consequence, the protection of the appropriate use of common spaces that are encountered on the rooftop will be a condition for the successful use of SWH systems in these buildings. For this reason, a few modern developers have been concerned to promote the idea of community, by encouraging the sharing of actions and decisions that affect the use of building common spaces and services.

In the case of Mexico, it is expected for the SWH systems to receive direct sunrays during most of the day and this during most of the year. This is the reason why it is preferable to plant trees and to construct high buildings to the north of the housing group.

Technical regulations are useful to preserve the high efficiency of solar systems and reduce accident risks.

As the technology gets improved, it is likely that important changes in the assignation and regulation of communal space uses will have to be introduced in the administration of multifamily housing.

Key regulation for the installation of SWH systems in multifamily housing

- All regulations applicable to vertical housing should be respected.
- All previsions related to hydraulic installations should be covered (e.g.: thermal insulation).
- It should be taken into account that SWH systems may occasionally reach very high temperatures, and that some collectors are not conceived to resist this, when systems remain without water supply for example.
- It is necessary to take decisions collegially, involving neighbors and/or condominium owners meeting.

However, proclivity to change does not characterize citizen groups who live in economic housing, as demonstrated in diverse studies.

Thus, the adoption of SWH systems has to be considered in its global socio-economic dimension.

A few housing developers were successful with SWH in economic housing, but this was made possible almost systematically by individualizing this service to each household.

5. New businesses

In parallel to the emergence of the new sustainable community vision, it is expected that new businesses should appear, such as:

- ▶ Integral service SWH systems businesses

They "acquire", to the extent possible due to legal obstacles mentioned above, the solar installations and are responsible for maintaining them in good conditions, taking benefit from the scale effect to get a numerous number of customers. Just as it is cheaper to provide any municipal service, such as cleaning and caring for green areas, it is also cheaper to operate SWH systems in a communal manner.

- ▶ Remote management businesses

They measure from the distance the

hot water supply to each household, and bill periodically in the previously agreed manner. In some vertical housing groups, this modality is successful and highlights user satisfaction.

- ▶ Horticultural businesses

According to various studies, SWH system users would care more for their gardens and plant pots. In this way, the opportunity for new businesses such as the production of organic culinary herbs appears thanks to the solar energy.

Vertical housing builders should always remember that new sociological concepts of great significance and associated with the market of SWH do exist.

B. Identification of best practice

Below comes the description of particular recommendations relative to the installation of a SWH system, taking into account five aspects:

1. Concept selection
2. Equipment selection
3. Control systems
4. Operation and maintenance
5. General considerations

1. Concept selection

The process of concept selection is represented in Figure 1.

The current regulation allows a determined number of neighbors to decide whether SWH systems should be preserved.

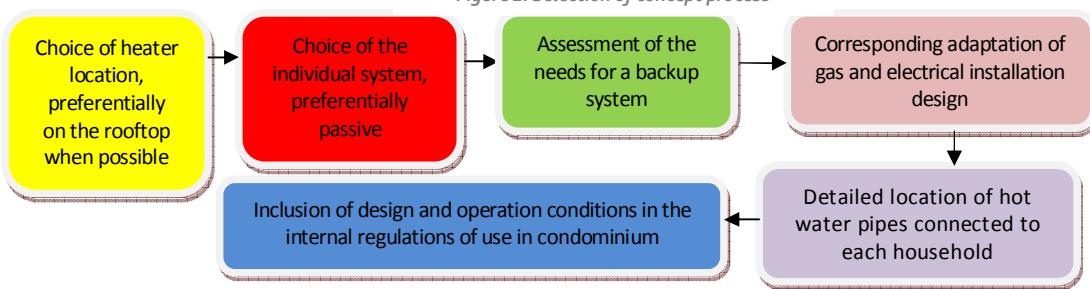
The best use of SWH systems, such as the best use of common areas, will not be possible without the aware community collaboration.

3%
Of the total housing value can be saved by a SWH system user in the mid-term operation of the SWH system.

SWH system users have a major curiosity towards climate, their surroundings and nature.

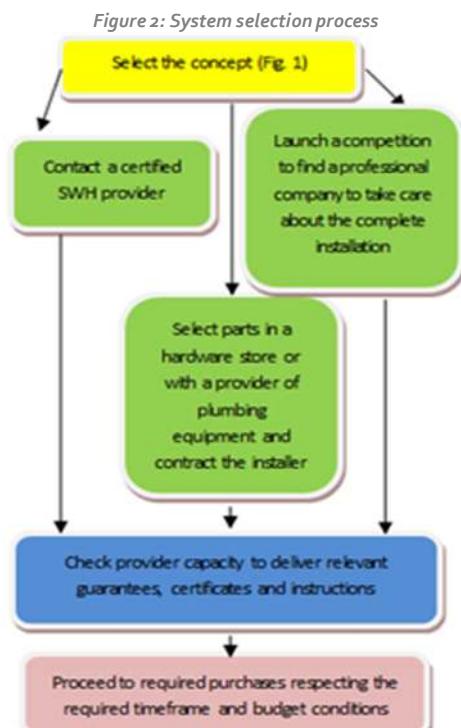
Equipping a building with SWH implies a step towards sustainability, economically, socially and energetically speaking.

Figure 1: Selection of concept process



2. System selection

The system selection process is represented below (Fig. 2).



Throughout this process, it is important to consider the topic of information management and particularly to:

- ▶ Have access to referred information from the early stage of the Project.
- ▶ Keep handy all information required to:
 - Face operation, maintenance and service requirements.
 - Share it with the board of tenants assembly.
- ▶ Ensure that the list of materials and other instructions that would result necessary is part of the package that describe the SWH system and is available for the interested parts.

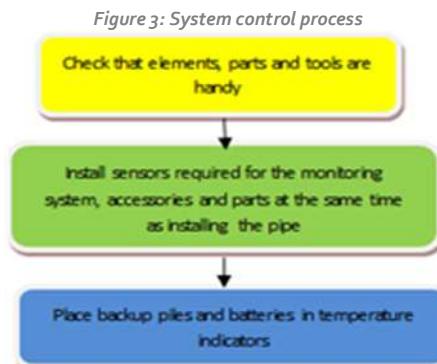
3. Control systems

They are the parts and pieces of equipment which use the solar collector capacity to heat water and take it efficiently to the thermal tank.

For each element, the following points have to be very well-understood:

- ▶ Its function
- ▶ Its precautions for use
- ▶ Its irregular use conditions

This process is represented in Figure 3.



In addition further recommendations should be observed to ensure an efficient use of the system:

- ▶ It is better to have manual cold water purge valves than electric ones, due to the lower failure risk of manual valves.
- ▶ When a backup warming system is present, the appropriate operation of automatic mixing valves interconnected between the SWH and the backup systems should be checked periodically.

4. Operation and maintenance

The designer has to deliver the SWH system to the user with a clear operation and maintenance manual. There is little to do after system installation, verification and transmission of key information to the user or tenant for the operation.

In Mexico, the loss of SWH system efficiency due to collector dirtiness is very low.

It is convenient for the seller that the operation and maintenance manual be clear and available to ensure a smooth and satisfactory operation which will contribute to the recognition of the brand.

Whether passive or active, modern SWH systems have a reliable operation along the years.

In the event of failure, active SWH systems usually have failure indicators to indicate the origin of the problem, and recommend how to tackle it. Neither is it necessary to wash collectors. As a consequence, there are practically no maintenance needs on SWH systems.

5. General considerations

As a summary, technological difficulties of SWH systems in vertical housing are very limited, simple, and should not represent an obstacle to limit the growing popularity of solar systems, for which benefits are:

- ▶ The economic savings corresponding to hot water use are noticeable.
- ▶ The SWH system investment gets recovered quickly and represents a long-term investment.
- ▶ These systems give autonomy to their users.
- ▶ They associate the user to the world society aware of climate change and respectful of nonrenewable natural resources.

On the other hand, a few technical precautions should be respected, for example:

- ▶ A SWH system should never be left without anti-freezing protection.
- ▶ Safety requirements should be met.

Nonetheless, it remains crystal clear that barriers to the use of SWH systems in Mexico are not financial nor economic but social.

We have to learn how to live together as a community and not to fight for public or common spaces such as rooftops.

Besides, it is expected that the communal use of SWH systems will encourage us to consolidate our community values, which are explicit and protected within the law.

ADDITIONAL INFORMATION (IN SPANISH)

- [National Commission for the Efficient Use of Energy \(CONUEE\)](#)
- [Manual of SWH installations \(2008\)](#)
- [Installation, operation and maintenance manual, Caleffi Solar\(in English\)](#)
- [¿Why is it convenient to get a SWH system installed in your house?, CONUEE](#)
- [Solar heaters: Renewable energy in your household, Greenpeace México](#)
- [PROCALSOL 2007 2012](#)
- [Mexico City environmental standard NADF-008-AMBT-2005](#)
- [Mexico City law for condominium property](#)
- [Condominium regulation for the State of Mexico \(2003\)](#)
- [Condominium regulation of article 947 of the Civil Code of the State of Mexico](#)
- [General condominium regulation for the municipality of Tlalnepantla de Baz, México](#)
- [General condominium regulation for the municipality of Tultitlán, Estado de México](#)