GLOBAL SOLAR WATER HEATING MARKET TRANSFORMATION AND STRENGTHENING INITIATIVE

Guidelines for policy and framework conditions

Acknowledgement

This publication is the result of a joint effort from the following contributors: The European Solar Thermal Industry Federation (ESTIF), the United Nations Environment Program (UNEP) through its Division of Technology, Industry and Economics (DTIE) and the Global Environment Fund (GEF).

This publication is part of the "Global Solar Water Heating Market Transformation and Strengthening Initiative" (Global Solar Water Heating: GSWH project).

More information on the "Global Solar Water Heating Market Transformation and Strengthening Initiative" (Global Solar Water Heating: GSWH project) at www.solarthermalworld.org/node/330.

Foreword

The European Solar Thermal Industry Federation (ESTIF) and the United Nations Environment Program (UNEP) through its Division of Technology, Industry and Economics (DTIE) have committed to work together on the "Global Solar Water Heating Market Transformation and Strengthening Initiative" (Global Solar Water Heating: *GSWH project*).

Funded by the Global Environment Fund (GEF), this project's goal is to accelerate the global commercialization and sustainable market transformation of Solar Water Heating (SWH), thereby reducing the current use of electricity and fossil fuels for hot water preparation. It will build on the encouraging market development rates already achieved in some GEF program countries and seek to further expand the market in other GEF program countries, where the potential and necessary prerequisites for market uptake seem to exist.

The GSWH project consists of two components as follows:

- Component 1 - Global Knowledge Management (KM) and Networking: Effective initiation and co-ordination of the country specific support needs and improved access of national experts to state of the art information, technical backstopping, training and international experiences and lessons learned.
- Component 2 - UNDP Country Programs: Work in the country programs is articulated around addressing the most common barriers to solar water heating development: policy and regulations, finance, business skills, information, and technology.

ESTIF, as one of the project's regional partners, is committed to the development of knowledge, products and services. To this effect, ESTIF has been entrusted with the task of elaborating three practical handbooks to include recommendations and best practices in the following areas which have been identified as key for strengthening the solar water heating market:

- Policy and regulatory framework
- Awareness raising campaigns
- Standardization and quality

However, ESTIF is very much aware that practices cannot simply be transposed and must be adapted to local market realities; we must consider best practices and lessons learned in all geographies and markets.

Good reading and sunny regards

The GSWH Team

Structure and Methodology

The content of the following publication is based on the experience acquired by the ESTIF extended team (secretariat staff and experts) in its role of industry association representing the solar thermal industry at European level.

In particular three major projects/initiatives can be mentioned because of their relevance:

- As an accredited representative body of the solar thermal industry ESTIF is consulted directly by legislators (European AND National) to give input concerning incentive schemes for solar thermal (financial and non financial) and also input for the legislative framework for the promotion of solar heating and energy savings in buildings
- ESTIF has been involved in several projects financed by the European Commission whose objective was to study and promote one or more of the concepts relevant for these guidelines. In particular the Intelligent Energy Europe projects KEY4Res-H (how to remove barriers to the development of the market for renewable heat in Europe) and PROSTO (promotion of solar obligations at local level)
- ESTIF is also involved in experts groups relevant at global level such as the working group elaborating the International Energy Agency Solar Heating and Cooling Roadmap
- For all the publications an extensive use is made of the web based knowledge management tool www.solarthermalworld.org; examples and case analysis can be found concerning all the relevant topics using the right hand side menu FILTER/KEY PILLARS

The guides are meant to be accessible to a “beginner” and do not take for granted basic knowledge relating to solar thermal, communication, policy and standardisation. This is why some basic concepts are repeated and defined in different contexts e.g. the different type of solar thermal systems. An effort is made to define the concepts used and to avoid jargon.

The structure is progressive and the subject is approached from the initial assessment to the implementation phase in the three areas. The guide begins with a reminder of the benefits of solar water heating and an overview of the different systems and applications. Then we propose an assessment of the barriers to the market development and of the potential of solar thermal. Finally we review the different types of policy and framework.

A summary of the key recommendations opens the publication.

Contents

1 Key recommendations

I. The commitment of public authorities is necessary to ensure the market development of solar thermal

II. An efficient market strengthening programme must be designed as a coherent set of measures including the three pillars:
   a. Awareness raising
   b. Standardisation & quality
   c. Incentives

III. A growing market for solar thermal generates immediate benefits for the local economy

IV. Communicate, communicate, communicate

V. Standardisation and quality must be developed and implemented for the solar thermal systems AND for the installation from the earliest stage of the market development

VI. Everything is economic-related but financial incentives are not enough

2 Benefits from SWH for your country, region

It seems a very logical step to begin a guide, containing recommendations and guidelines for the implementation of a solar water heating strengthening programme, by stating clearly the reasons why this technology deserves to be promoted and supported. This step is less trivial than one might think because a good understanding of the solar thermal benefits will lay the groundwork for a long-term strong commitment from countries and communities, which is the first, and, probably, the most important recommendation for a successful policy.

2.1 Typology of benefits/advantages

We will here deliberately mix benefits and advantages. Solar thermal shares with other renewable energy sources the fact that it does not contribute to CO_2 emissions; it has the unique advantage to rely on an unlimited, free resource.

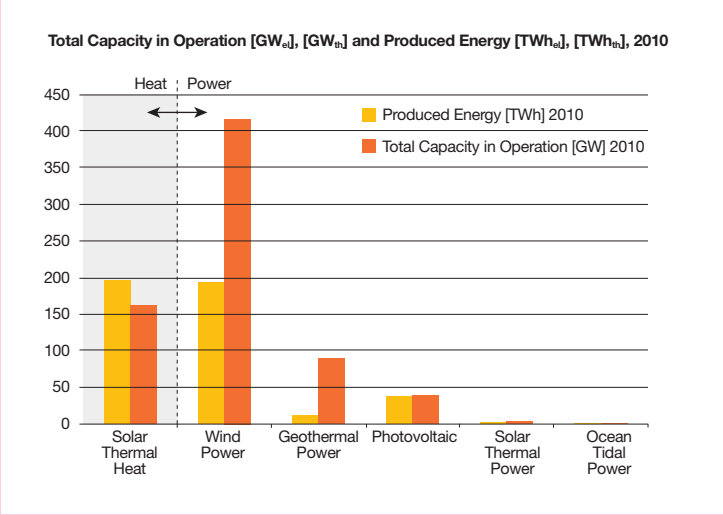
The benefits of solar thermal are usually classified as follows

- **Environmental benefits**
  Solar thermal is the renewable energy source "par excellence" and does not produce any kind of emissions. Solar energy cannot become scarce and the production of energy does not affect its environment.

  The manufacture and production of solar thermal systems does not involve dealing with hazardous or toxic substances and the systems are easy to recycle.

  In the particular context of the international efforts for the reduction of CO_2 emissions solar thermal can be considered, at global level, as part of the solution.

  Compared with other forms of renewable energy, solar heating's contribution in meeting global energy demand is, besides the traditional renewable energies like biomass and hydropower, second only to wind power, and makes a much larger contribution than photovoltaic. This fact is still underestimated in energy policies.



Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

- **Economic benefits**
  - **Macroeconomic**
    Solar thermal, as other renewable energy sources, contributes to the reduction of fossil fuels consumption, in countries or regions that cannot rely on domestic production; the costs and volatility of imported fossil fuels can represent a real economic issue. While, on the other hand, the solar thermal value chain is to a large extent national or local. Even in countries that do not have a manufacturing industry, the local economy will benefit from the market development of solar thermal. Moreover, because of the low technical complexity of manufacturing solar thermal systems such as thermosiphon systems, it can be seen as encouraging the creation of local manufacturing facilities.
  - **Microeconomic**
    One or many households using solar thermal will benefit from a long-term cheap energy and will no longer depend on fluctuating energy prices.

- **Social benefits**
  Because of its decentralised nature and its simplicity, solar thermal is a renewable energy which individual citizens can grasp. Solar thermal allows a bottom up approach to energy and environmental issues.

- **Benefits in comparative terms with other renewable energy sources (advantages)**
  In the context of market strengthening and promotion of renewable energy sources, solar heat has distinctive advantages.
  - Solar thermal is a heating technology and heating accounts for a significant part of the final energy demand alongside electricity production and transport. Solar hot water can, for example, help resolve the issues of peak load electricity for domestic hot water in certain geographies.

Managing electricity demand with SWH

In 2007 the Namibian government launched a programme to reduce its peak electricity demand by almost 20 MW. A set of measures were introduced aimed at imposing SWH in all new public buildings, on existing public buildings without water heaters and in existing public buildings with electric geysers.
The Namibian Renewable Energy Programme (NAMREP) that includes awareness raising, promotion and training of skilled workers accompanied this law.

Source www.solarthermalworld.org/node/494

  - Solar thermal thermosiphon systems are cheap and easy to use, and are accessible to the majority of end consumers in developing countries. It is an affordable accessible renewable energy sources.
  - Solar thermal is a mature, market-ready technology in all its core applications for individual and collective hot water and space heating production, and does not require further investment in research & development.

These benefits and advantages need to be adapted to local conditions and climate. Identifying the most relevant benefits and advantages according to your own situation is extremely useful.

3 Solar water heating technologies overview

The concept of solar heat goes beyond hot water. To be in a position to devise, design and implement the right framework and policy measures for solar thermal technology, it is important to have a basic understanding of the technology and its applications.

As mentioned in the previous section, solar thermal produces heat and therefore it must be clearly distinguished from two other renewable energy sources, which use the sun directly – Photovoltaic and Concentrated solar - both producing electricity.

In terms of heat generation solar covers a wide range of applications and temperatures, using different basic technologies.

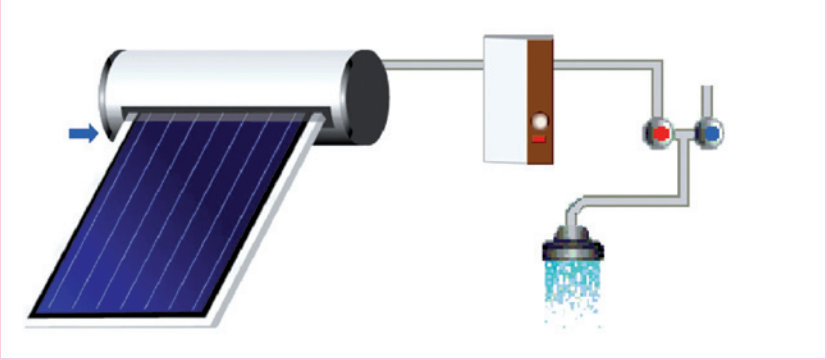
3.1 Type of solar thermal systems and types of collectors

The different types of solar systems and collectors described below are represented in different market and geographies, they have specific advantages and weaknesses which will in turn influence what kind of policy and framework conditions are required to encourage their market development.

3.1.1 Thermosiphon and forced circulation (pumped system)

Thermosiphon

Systems based on a method of passive heat exchange using on natural convection, which circulates liquid without the necessity of a mechanical pump.

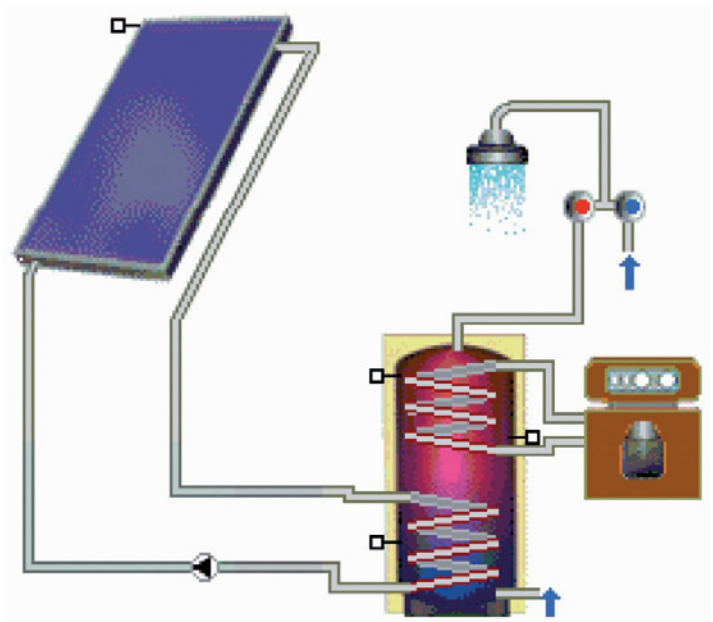


Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

This technology is extremely simple in terms of design, manufacturing and installation; this explains probably why it is by far the most commonly sold system worldwide.

Forced (pumped) circulation

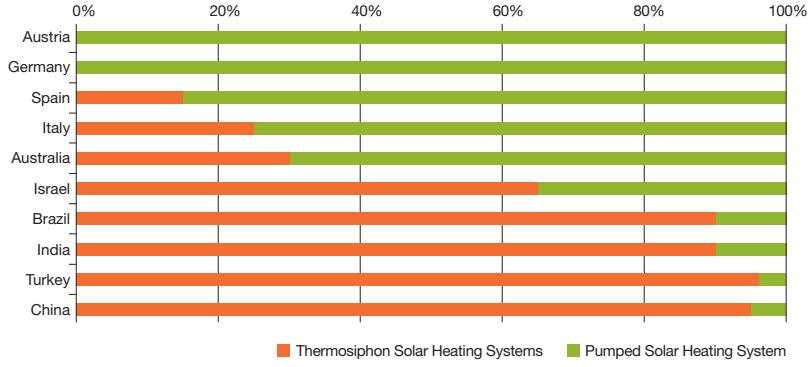
Those systems use one or more pumps to circulate water and/or heating fluid in the system.



Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

Widely used in European markets, these systems offer a variety of options in terms of application. They provide both hot water and space heating and are also known as combi systems. The collective and district heating systems are exclusively forced circulation systems. In general pumped circulation achieves better control, performance and efficiency.

Weighted share between thermosiphon and pumped systems by economic region for newly installed glazed water collectors in 2009



Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

Which framework conditions and policy measures for which technology?

Type	Application	Strengths	Weaknesses
Thermosiphon	Individual hot water	• Extreme ease of use • No or limited installation • Easy manufacturing • Low cost and payback time	• Hot climates only • Only hot water • No scalability • Quality and performance • Aesthetic
Pumped circulation	Individual hot water	• Ease of use • Simple installation • Adapted to all climates • Scalability • Medium term payback time	• Necessity of qualified installer • Requires roof and storage surfaces
	Combie	• High solar fraction • Adapted to all climates • Scalability	• Necessity of qualified installer • Investment costs • Requires roof and storage surfaces
	Collective housing	• Economies of scale • Scalability • Market ready technology	• Necessity of qualified planning and engineering • Performance measurement • High investment costs

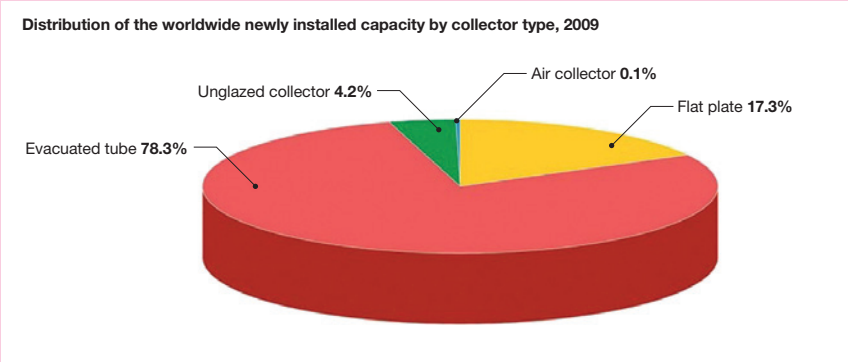
3.1.2 Flat plate, evacuated tubes and unglazed collectors

Vacuum tube collectors use heat pipes for their core instead of passing liquid directly through them. Evacuated heat pipe tubes consist of multiple evacuated glass tubes each containing an absorber plate fused to a heat pipe.

Flat plate collectors consist of a dark flat-plate absorber of solar energy, a transparent cover that allows solar energy to pass through but reduces heat losses, a heat-transport fluid (air, antifreeze or water) to remove heat from the absorber, and a heat insulating backing.

Unglazed collectors, which are the simplest and least expensive of all collectors, are used almost universally for heating outdoor pools and spas.

These three types of collector account for 99% of the market, beyond the technicalities and comparison of efficiency it is interesting to notice that they have a very strong regional base.
The Chinese market uses only exclusively vacuum tubes; flat plates dominate Europe and the US associate solar heat with swimming pools.



Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

There are two additional types of collectors, which are not relevant for this publication.

Solar air collectors heat air directly, almost always for space heating. They are also used for pre-heating make-up air in commercial and industrial HVAC systems.

Solar concentrators (parabolic trough or dishes), this type of collector is generally used for high or very high temperature applications. A trough-shaped parabolic reflector is used to concentrate sunlight on an insulated tube or heat pipe, placed at the focal point, containing a medium which collects the heat. This family of collectors because of its type of application is not of relevance for this publication.

3.2 Different applications

3.2.1 Solar heat for domestic use

The core application of solar heat is the production of domestic hot water and space heating in dwellings. The whole range of buildings is covered: Individual, collective, and even district heating. The IEA Solar Heating and Cooling programme makes further distinctions between types of applications:

- Single family houses
- Multiple family houses
- Public sector (hospitals, schools, homes for elderly..)
- Tourism sector (hotels, accommodations)
- District heating
- Pool heating

It should also be pointed out that the use of solar for pool heating remains important, especially in its traditional markets such as the United States.

3.2.2 Solar cooling and air conditioning

Worldwide, the energy consumption required for cold and air conditioning is rapidly increasing, and electrically driven compressor chillers have maximum energy consumption in peak-load periods during the summer; as in Southern Europe over the past few years, for example. On the other hand, solar cooling uses thermally driven “adsorbers” and absorbers and no electricity. This emerging technology has a great potential because the peak period of solar heat production coincides with peak time use. Solar heating and cooling production can be combined in one system.

3.2.3 Solar heat used in industrial processes and water treatment

A wide range of industrial processes (steam, agro food processing, drying) as well as the treatment of water (desalination) can be achieved by using solar thermal. As for solar cooling, despite its obvious potential, solar process heat is still an emerging technology requiring high level engineering and planning.

3.3 Different temperatures

Solar heat can be produced over a wide range of temperatures. However, the highest are required for electricity production (CSP) and do not come within the scope of this manual.

Low temperature applications

Applications that require thermal (heat) energy and operate at less than 90°C are grouped under this category. For low temperature applications the standard products are based on flat plate solar, evacuated tube and unglazed collectors. Domestic applications fall under this category.

Medium temperature applications

Applications that require thermal (heat) energy and operate in a temperature range from 90°C to 150°C are grouped under this category. The standard products that can be used are solar box cookers, Evacuated Tube collectors, solar parabolic cookers and solar thermal Concentrators.

Some of the Solar Thermal Medium temperature applications are

- Steam Generation up to 150°C in industries for process heat applications.
- Steam Generation up to 150°C in hotels and industries for steam cooking.
- Steam Generation up to 150°C in industries for drying produce.
- Solar Effluent Evaporation in industries using steam.
- Solar Cooking in houses, hotels, institutions and community cooking using solar cookers.

High Temperature applications

Applications that require thermal (heat) energy and operate in a temperature range from 150°C to 300°C. The standard products that can be used are solar thermal concentrators.

The applications are steam generation up to 350°C and pressure up to 25 bar in Industries for process heat applications including

- Cooling using Vapour Absorption Refrigeration (VAR) systems and air conditioning systems
- Electricity production which is out of the scope of solar heat

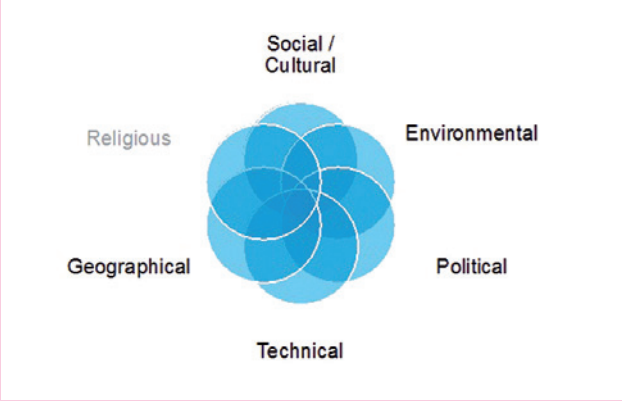
4 Definition of barriers and solutions to overcome them

Despite its obvious benefits and advantages, the solar thermal technology is far from being a standard solution in every country and geography. The mere existence of a programme such as the GSWH demonstrates that it is commonly believed that there is a need for active policies and initiatives to develop the use of solar energy.

This section will provide an overview of the main factors potentially impeding its development while indicating the generic solutions to overcome them.

4.1 Non-economic barriers

It is, of course, possible to identify non-economical factors which have a very strong influence on the adoption of a product by consumers.



Source "Non-Economic Barriers & Policy Framework" by Daniel Rowe IEA Solar Heating & Cooling Roadmap Workshop, April 2011

Typology of non-economic barriers:

Sphere	Encompassing
Social/Cultural	Understanding/use
Geographical	Supply/servicing
Technical	Functionality/performance
Political	Incentives/market access
Environmental	Resource supply/waste creation
Religious	

How these factors constitute a real barrier in one given market will **vary** considerably, e.g. accessing the market to supply and install solar thermal products does not constitute a barrier in the United States where on the contrary incentives are inexistent or very low.

Although it can be argued that all these barriers can be removed by economic incentives, it is necessary to tackle them through framework conditions and policy that do not focus solely on these economic incentives.

Barriers	Solutions
Understanding/use	Information/education
Supply/servicing	Industrial policy
Functionality/performance	Standard and certification/R&D
Absence of Incentives/ no market access	Building obligations/ free market access to imported products
Resource supply/waste creation	Resource & waste management

4.2 Economic barriers

Economic barriers relate to prices, costs and competitiveness of solar thermal on the market.

- What is the price of a solar system installed?
- What is the price of the heat produced over the life cycle of the system?
- How do those prices compare with fossil fuels or renewable alternative solutions on the market?

In order to fully understand how economic barriers can occur, it is important to distinguish between the initial investment costs (the solar system and its installation) and the cost of each unit of heat it produces over its life cycle. Solar heat will, anyway, pay for itself because the sun is free; but depending on the initial costs, and the costs of other options, the “pay-back” will vary considerably. Sensitivity to the “pay-back” time and the capacity for end consumers to invest must be understood and analysed to understand to which extent they will or not constitute a barrier.

In China, Greece and Israel solar thermal is not only extremely competitive compared with other options but also, in absolute terms, the initial investment costs are low. This probably explains, to a large extent, the success of solar thermal in these countries.

Financial/economic incentives will usually address directly the issue of price by either trying to compensate the difference with other options or create an economic advantage.

Finally, it is important to take into account that the market development of solar thermal in itself is a factor which will contribute to a reduction in prices and improve competitiveness through increased competition in systems and installation costs, economies of scales in manufacturing etc…

5 Importance of policies and definition of framework conditions

In this publication, we use the concept of public policies and framework conditions. What do they mean and why are they so important?

Public policies

Public policy or government action is generally the principal guide to action taken by government departments with regard to a category of issues. The policy action occurs through legislations, regulations, financing, and communication. Government can act directly or via local authorities, agencies or other public bodies. The government can substitute or complement private initiatives - a marketing campaign, a financial incentive can result from private initiatives – however public bodies have the monopoly of imposing obligations and/or taxes.

A market-strengthening programme will require the implementation of targeted policy measures contributing to the creation of the right framework conditions for the development of the solar water heater market.

The Programa Solar in Chile: addressing the 4 pillars

The initiative seeks to promote the integration of solar thermal technologies into the housing sector. The Programa Solar is a project supported by the Chilean national institutions and is based on four main pillars: standards, regulations, ordinances and system certification, market awareness, skill-enabling programmes for engineers and technicians and financial incentives.

A financial incentive developed in this framework is particularly interesting and innovative because it addresses the construction sector in the form of a corporate tax deduction for solar thermal investments. Integration of ST in new buildings is less expensive and increases the value of a building.

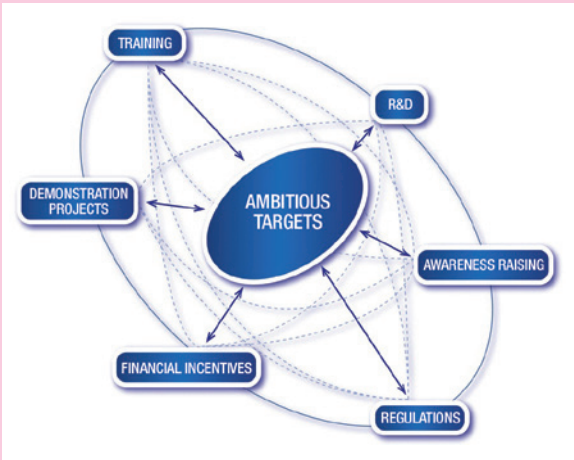
Source solarthermalworld.org

Framework conditions

The concept of framework conditions is broader than that of policies. It covers the hot water market *stricto sensu*, the solar and heating industry development, public acceptance and awareness of solar thermal, the national, local energy mix, the research and testing capacity, the qualification and training and, finally, the regulatory framework. Both policies and private initiatives can contribute to shape and influence the framework conditions but, as already demonstrated, the influence of the public sector is crucial to be able to put in place a coherent set of measures.

A Solar Thermal Action Plan

In 2007 ESTIF published the "Solar Thermal Action Plan for Europe", this document aimed at proposing a series of recommendations to reach the ambitious target of 1 square meter of solar collector for every European by 2020. This work contains several studies and projects on solar thermal and, at least, one conclusion in evidence: "The market strengthening of solar thermal in order to be successful requires to address all framework conditions, the incentives especially the financial ones are only one part of the plan and the public authorities can play an even more important role in fields of such as standardisation, quality, training, R&D, information and promotion, where public and private initiative can be combined."



Source:
Solar Thermal Action Plan, ESTIF 2007

6 Methodology for a basic assessment of the state of development and potential of solar water heating

The potential and conditions necessary for the development of the solar water heating market can vary considerably, the obstacles to overcome, the advantages and benefits on which one should build will determine not only the content of the "action plan" but also the priorities.

The potential of solar thermal energy technologies in a sustainable energy future

This study is a deliverable of the IEA Solar Heating & Cooling Programme. Based on the previous studies and results from international R&D cooperation, the declared goal is to present the opportunities linked to solar thermal technologies given their positioning as the fourth largest renewable source of energy.

The paper starts by outlining the massive energy potential at stake, an employed simulation tool outlining the differences between the yearly potential of solar energy and the combined potential of all other resources. The next part offers a description of existing technologies and their application for heating and cooling purposes – water heating, space heating and cooling, industrial process heating, etc. – and mentions the recent technological developments such as the Solar Combi Systems. Subsequently, it gives a broad overview of the global solar thermal capacity in operation and an assessment of the main producers and markets.

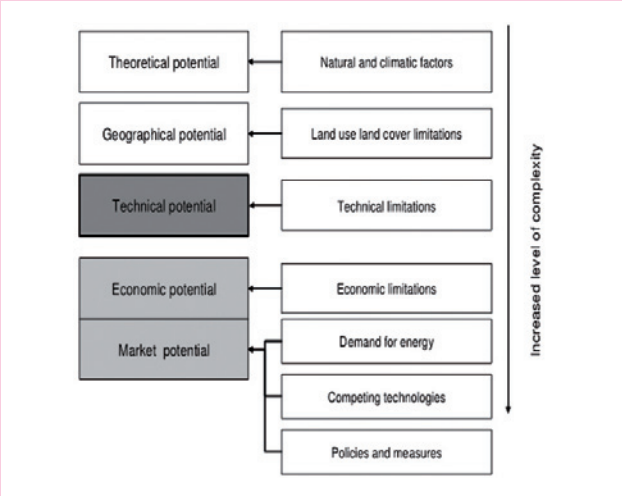
Last but not least, the study develops a sectorial analysis of solar thermal technologies and a scenario for the market deployment of solar thermal collectors, thus pinpointing the significant role that this sector could play in achieving sustainable energy consumption.

Source IEA solar Heating and Cooling Programme

6.1.1 The potential of solar thermal

Five types of potentials can be identified.

- Theoretical potential: The highest level of potential is the theoretical potential. This potential only takes into account restrictions with respect to natural and climatic parameters.
- Geographical potential: Most renewable energy sources have geographical restrictions, e.g. land use, land cover, reducing the theoretical potential. The geographical potential is the theoretical potential limited by the resources at geographical locations that are suitable.
- Technical potential is the total amount of energy (final or primary) that can be produced taking into account the primary resources, the socio-geographical constraints and the technical losses in the conversion process.
- Economic potential is the technical potential at cost levels considered competitive.
- Market potential is the volume that solar thermal can reach taking into account the demand for energy, the competing technologies, the costs and subsidies of renewable energy sources, and the barriers. As opportunities are also included, the market potential may in theory be larger than the economic potential, but usually the market potential is lower because of all kind of barriers.

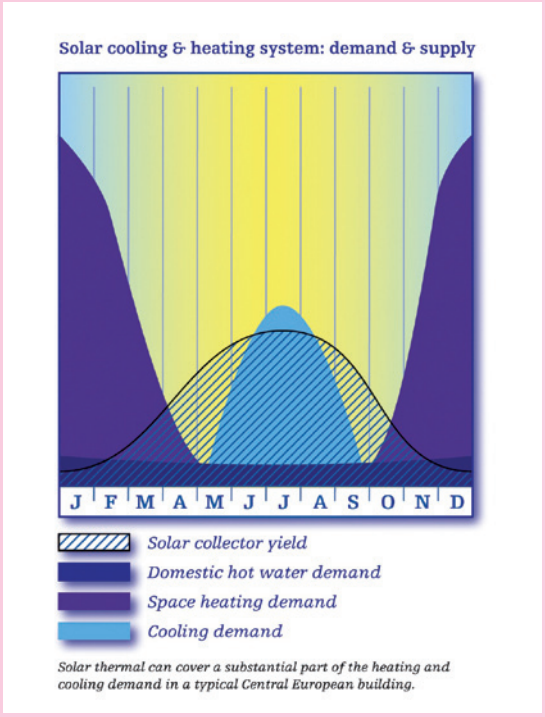


Source "Global Potential of renewable energy sources: a literature assessment" Monique Hoogwijk and Wina Graus by order of: REN21 - Renewable Energy Policy Network for the 21st Century

The measures and initiatives discussed in this publication only cover the economic and market potential; however, it should be pointed out that they, of course, include previous ones. One major non-market related factor affecting greatly the potential of solar thermal must be mentioned: The solar radiation.

There is an obvious limitation to the capacity of solar thermal at night and in winter. However, this limitation does not affect the potential of solar thermal as much as one might think.

- Solar thermal systems include energy storage to provide heat during night time or in the early morning
- In temperate and cold climates solar thermal is combined with an auxiliary heat generator, which is active when solar thermal cannot provide heat. Even when it cannot satisfy the total heat demand solar thermal brings several benefits:
    - Free solar energy covers a significant part of the heat demand
    - The auxiliary (fossil fuel) heat generator can be used at its highest level of efficiency thanks to pre heated water and switched off in summer when it would work at a sub optimum load profile
    - When integrated in the building design and combined with highly energy efficient building envelope, solar thermal can cover the whole heat demand even in northern and temperate climates



Source Solar Thermal Action Plan, ESTIF 2007

In Europe, countries such as Austria, Germany, Denmark and Poland have dynamic markets and include solar thermal in their national energy mix. It is very important to challenge the vision of solar thermal as a solution limited to warm climates held by the population but also by decision makers.

6.2 Methodology for assessment of the market development and framework conditions

6.2.1 Total volume and volume per capita

Total market volume and installed capacity
The actual solar thermal market and its development should first be in terms of absolute volume. The different units, which can be used, will serve different purposes and target group.

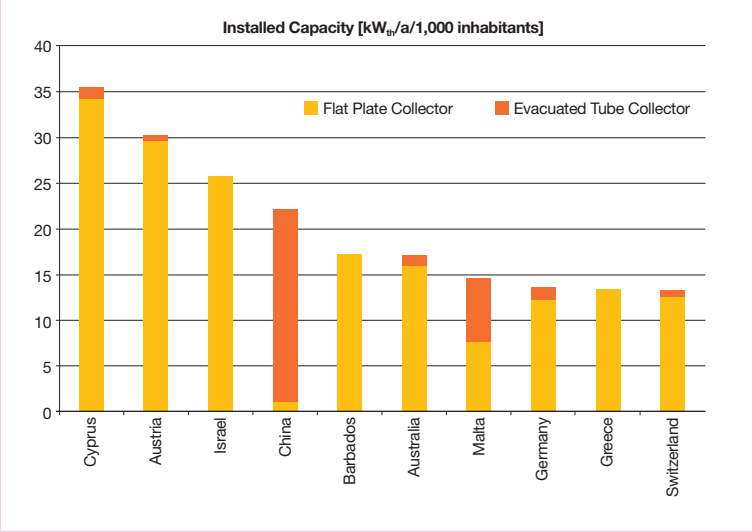
- **Square meters** are usually the reference unit for the industry. Surface sales can also be combined with the sales of storage tanks to work out the number of systems brought to the market. This very rough value does not indicate the final use/application. It is very important to understand the market structure: dedicated water heaters (thermosiphon, forced circulation), combi systems, collective housing, other domestic applications, and process heat. The right strategy can only be developed with a detailed view of the market.
- **The collector yield (in Watt thermal)** is important in terms of energy policy and energy mix. This is necessary to understand the contribution of solar thermal in macroeconomic terms
- **Million tons oil equivalent (MToe) and CO_2 emission savings** are necessary to understand the contribution from solar thermal as a renewable energy source and within the framework of policies against global warming

The International energy agency offers a tool with agreed conversion factors in the field of energy on the following website www.iea.org/stats/unit.asp.

The International Energy Agency Solar Heating and Cooling Programme in its reference publication details the specific conversion factor which can be used regarding solar thermal ("Solar Heat worldwide 2011", Annex 7 p 40 IEA SHC)

Volume per capita
The total volume gives a partial indication of the level of development in a market. The volume per inhabitant (capita) gives a very strong indication of the actual level of acceptance of solar thermal penetration. Italy, with an installed capacity of nearly 2.6 million square meters, is the 4th largest market in Europe (second in terms of newly installed capacity) but is below the European average per capita.

For 2009 the "Top 10" solar thermal countries per capita is shown in the graph below.



Source: Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011

6.2.2 Market potential

As explained at 6.1 there is a simple formula from which the market potential can be deduced. This formula can also serve as a basis to understand what actions and initiatives are required to realise this potential and strengthen the market for solar thermal.

$$\textbf{Market Potential} = \frac{\textbf{Economic potential}}{\textbf{Framework conditions}}$$

6.2.3 Typologies of the market

Mass market, emerging markets, "Niche" markets

In its 2007 action plan ESTIF has set an objective of 1 square meter of solar collector per inhabitant in Europe by 2020. This can definitely be considered as a mass-market level. However, in 2010 no country had reached this level worldwide, even Cyprus. To assess the maturity of a market, it seems more reasonable to consider a combination of the total volume and the volume per capita. Mass, emerging and niche markets will obviously present very different framework conditions. In a mass market, a market strengthening initiative will hardly be required, except if it appears to tackle a negative trend in the market. The framework conditions are obviously in place; however, if stagnation or decrease is observed some corrective measures should be implemented.

China: Market development initiatives in a mass market

Despite the fact that the largest market worldwide is still growing the Chinese government is still active in promoting solar thermal technology. The Solar thermal Roadmaps 2015, 2020, 2030 propose corrective measures to address the decreasing market in large urban areas and to increase the share of solar thermal applications in space heating and collective housing.

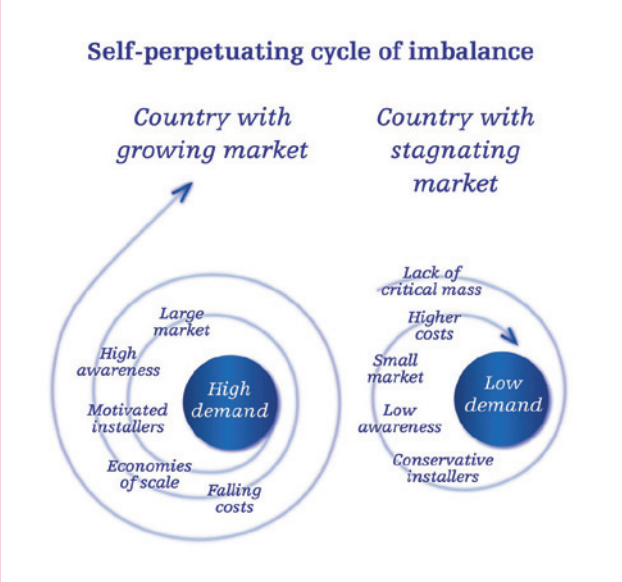
In urban areas thermosiphon systems on the roofs are more and more perceived as an issue in aesthetic terms and the Chinese authorities are promoting forced circulation systems, which offer more building integration. In general the chines authorities wish to orientate the market towards higher end solutions.

Source: "Chinese solar thermal development and perspectives" by Hu Runqing, Energy Research Institute, China IEA Solar Heating & Cooling Roadmap Workshop, April 2011

The "emerging" market still has a low volume of sales and installed capacity but the market trend is positive. The basic framework conditions are there but the market must be monitored and the conditions for a sustainable growth must be implemented.

A "niche" market is a market where solar thermal technology is limited to a very small community of interested users and where there is no increase in sales volume. The framework conditions must be built up from scratch.

In general, the growth in a market has positive effects in terms of market conditions as is illustrated in the graph below:



Source Solar Thermal Action Plan, ESTIF 2007

Types of systems on the market

Different application and solar thermal technology require different framework conditions.

- A market dominated by thermosiphon or unglazed collector systems will require less investment and efforts in the qualification and training of installers. On the contrary, if the market strengthening initiative aims at developing forced circulation and collective systems, it will be necessary to develop a specific strategy to influence the market orientation.
- In a market where combi or collective systems are required, it will be essential to overcome the complexity and focus on the information to be provided to end users, the question of the initial investment costs will also need to be addressed.
- The solar thermal solution promoted must be adapted to the local conditions, climate and heat demand

Economic development and heating market

In certain cases, competition in the heating market will in itself be a major obstacle. Countries that have a domestic production of fossil fuels, or where classical utilities dominate the market, tend to be very challenging for solar thermal. The level of economic development and the capacity for individuals to afford solar thermal systems are of course crucial elements.

7 Awareness raising: the importance of communication

Guidelines and recommendations for the promotion of solar thermal, as well the organisation of campaigns, is the object of a guide also published by ESTIF within the framework of the GSWH programme. In this publication, we will limit ourselves to explaining which role should be played by communication as part of a strategy for market strengthening.

With regard to market strengthening and improvement of market conditions, communication will serve mainly three purposes

7.1 Basic awareness: solar what?

In emerging and niche markets it is often necessary to raise awareness on the existence and availability on the market of solar thermal systems. This basic situation of awareness is well illustrated by the questions: “Solar… what or solar… why?”

Campaigns with this kind of messages are necessary at early stages of market development, although it has been demonstrated in previous sections that the vast majority of markets worldwide are still at phases where basic awareness raising is needed.

The support of government and local authorities for solar thermal has in itself a huge added value in terms of communication. The commitment of public authorities instils consumer confidence and provides stability to the industry.

7.2 Information and education

A more advanced type of communication consists of targeted information or education campaign.

Information on the technology when interest has been awakened: is there a technical solution adapted to my needs, where can I obtain a quote or buy a system?

When incentives, especially financial, are adopted it is always necessary to promote their existence and inform about the administrative process and requirements.

Campaigns can have educational purposes. Customers can be encouraged to purchase certain products with a quality mark, to request qualified installers or dealers, to monitor the performance of their systems, to testify about their experience.

7.3 Marketing and advertising

We have already stressed the importance of cooperation between public and private sectors for the success of the market strengthening initiatives. In the field of communication, it is crucial that efforts in the public sector are known or replaced by private initiatives. The industry, which will benefit from the market development, should co-finance the communication efforts and acquire visibility for their brands at a later stage, products advertisements will contribute to the promotion of the technology and increase in sales.

8 Non financial incentives for solar thermal

Non Financial Incentives include all public policies that support the creation of public good, even when providing an indirect financial advantage to the solar thermal market. For instance: an awareness raising campaign financed from public money or a programme to subsidise craftsmen training or R&D, etc. Obviously, all these instruments create an indirect financial advantage for companies involved in the market and this benefit is then passed on to the users.

8.1 Solar thermal obligations

- **What is a Solar Thermal Obligation (STO)?**
  STO are legal provisions making mandatory the installation of solar thermal systems in buildings. The obligation mainly applies to new buildings and those undergoing major refurbishment. The owner must then install a solar thermal system meeting legal requirements. Most of the existing STOs are connected to national or regional energy laws and implemented through the municipal building codes. A growing number of European municipalities, regions and countries have adopted solar thermal obligations. Already today, more than 150 million people live in regions covered by a STO.

- **Benefits**
  A major benefit of solar thermal ordinances is their effectiveness combined with low costs and limited administrative overheads for public authorities. As part of the building permit process, the inspection with regard to the renewable energy requirement is simple and thus does not strain public finances.

  The introduction of a solar thermal ordinance prevents market fluctuation caused by inconsistent incentive programmes. It provides a stable planning environment for market actors and investors, encouraging local economic growth and creating new jobs in this sector.

- **Unwanted effects and flanking measures**
  Solar obligations have a profound effect on the solar thermal market's structure. Therefore, to maximise their benefits, they require flanking measures.

  In a market where solar thermal becomes mandatory, promoters and customers will tend to question the solar systems' operation and react more negatively than in a voluntary market.

  Ends users and the construction sector will often go for the cheapest possible solution, while building owners will try to circumvent the obligation through exemptions. The real impact of any regulation strongly depends on its technical parameters and control procedures.

  It is vital, therefore, that the regulations adopted ensure state-of-the-art quality assurance, products, planning, installation and maintenance of the system, guaranteeing the same high level of customer satisfaction as in the current voluntary market. Poor performance of "mandatory" systems would not only undermine public acceptance of the obligation, but also, possibly, of the solar thermal technology in general.

Israel, 30 years of experience with solar thermal ordinances

Thirty years ago, Israel was the first country to pass legislation on solar thermal installations. With the second oil crisis at the end of the 1970s, members of parliament examined ways to make their country less dependent on imported energy. The result was a law, which made solar water heaters mandatory in new buildings such as residential housing, hotels, guest houses and old people's homes up to 27 metres high. The legislation entered into force in 1980.

Nowadays over 80% of Israel's households get their domestic hot water from solar rooftop heaters. A typical domestic unit consists of a 150 litre insulated storage tank and a 2 m2 collector. These hot water heaters save the country the need to import about 4% of its energy needs, and replace about 9% of the electricity production.

The law has now become redundant. More than 90% of the solar systems are installed on a voluntary basis, i.e. they are installed in existing buildings, or the systems are larger than required by the obligation.

Source: PROSTO project

8.2 Quality, standards and certification policy

The need and methods to ensure quality in the market are so important for solar thermal, that a complete guide is dedicated to this topic in the framework of the GSWH project.

Why do we need standards?

The objective of standardisation and quality assurance is to guarantee product safety and quality, as well as lower prices. At every stage of market development, the capacity of solar thermal systems to deliver the expected level of performance is a key factor. In the early stage of the market, quality issues have had long lasting devastating effects. The existence of standards is the cornerstone of quality assurance.

The actors of standards and certification

Standardisation and quality for solar thermal should be the result of a joint effort from public authorities (market regulation), the industry, the technical community and, when they are adequately organised, the end users.

- Public authorities have a key role to play in imposing stringent quality requirements and in initiating, facilitating and controlling the standardisation process.
- The industry must provide product and technical expertise. It must understand the benefits of ensuring standardised level of quality. Public authorities should guarantee that the standards are neutral and do not favour certain products or companies.
- It is essential to be able to rely on independent testing facilities and certification bodies. If the private initiative is not adequate, then public authorities should actively support the creation of such structures.
- Consumer organisations can bring a useful contribution to the process.

Quality installation for quality products

Solar thermal products usually need to be installed. This operation can be simple to the extent that it might not require the intervention of a specialist, e.g. some termosiphons systems, but on average it should be undertaken by a professional. To guarantee performance, the quality of the installation is as important as the quality of the system. Minimum requirements in terms of training and qualification of installers should be implemented in parallel with product requirements. Public authorities should regulate in the absence of initiatives from trade and industry.

Performance and quality for a sustainable market

Performance and quality measures do not constitute flanking or accompanying measures. Framework and regulations should be developed, and relevant bodies involved from the beginning, even if this has to be imposed to the market to some extent.

The market tends to be shortsighted; industry will naturally prefer to avoid costs and regulations. The benefits of high quality regulations and market surveillance will emerge eventually and guarantee a sustainable market. Public authorities should ensure that incentives and promotion endorse quality.

8.3 Research and development, demonstration projects (definition, importance, recommendations, examples)

Solar thermal is a simple and mature technology; however, research and development are necessary to guarantee that performance will continue to improve and costs to decrease. Research and development can also contribute to adapt the technical features of products to local needs, e.g. improve water tightness in tropical areas, resistance to frost in mountainous regions. Research and development cannot proceed only from public initiative but, through public universities and public research centres, public authorities have a leading role to play.

Building up centres of technical excellence

Applied research, engineering education, development, product innovation, standardisation, testing are closely linked and there are a lot of synergies between those fields. Most of the time, the same persons will be likely to teach, test and lead research projects. A sustainable market will always require relying on a high level engineering community. Public authorities should encourage the creation of multi disciplinary technical facilities for solar thermal engineering and encourage or even impose on the industry to participate in this effort.

Importance of demonstration projects

For both promotion and technical (experimental) reasons demonstrations projects are extremely useful. Projects implementing technologies that are not market ready, but which have an important potential, will allow testing and improving the solution, gather data, monitor functioning and finally demonstrate the feasibility to the general public and the industry in order to prepare the introduction on the market.

9 Financial incentives (direct, indirect, tax incentives, low interest loans): definition, importance, recommendations, examples

Financial Incentives include any public policy giving a financial advantage to those who install a solar thermal system or that use solar thermal energy.

9.1 Solar thermal economics

- **Value and costs**
  The direct economic value of a solar thermal system for its owner consists of:
  - The economic value of the energy it saves
  - The independence from conventional energy supply

  The costs of a solar thermal system include:
  - The investment to buy and install the system
  - The costs of maintenance and decommissioning

  Life cycle assessments of solar thermal systems have shown very low environmental impacts and thus external costs, almost all of them in connection with the manufacture of the product or its raw materials. But nearly all materials can be recycled.

  Over the lifetime of a system, the largest part of the cost (usually well over 90%) occurs at the time of investment, since the maintenance and decommissioning costs are very low. The economic benefit, however, is spread over the lifetime of the system, which is usually over 20 years. Alternatively, in the case of conventional heating and cooling systems, the operational (mainly fuel) and maintenance costs are much higher than the investment costs.

- **Barrier of the initial investment**
  This high share of upfront investment costs is a major barrier for increased use of solar thermal and other renewable as well as energy efficiency measures.

  For many private individuals, the absolute amount of upfront investment costs is the key barrier. And, future lower heating costs tend to be undervalued against the initial investment costs.

  For many commercial decision makers, it is the payback time, which is seen as crucial. Even in the case of high returns on investments (over the lifetime of the system), many companies avoid solar thermal because the payback time is higher than 5-7 years. Furthermore, the calculation of a payback time depends largely on the assumption made for the price of conventional fuels when replaced by solar. In the absence of reliable price forecasts, many investors calculate with stable prices of conventional fuels, which may lead to lower estimations of the future energy costs savings through solar thermal systems.

  Even in countries where the solar thermal market has reached a certain market size, the decision to purchase and install a system can still be more complicated than installing a conventional heating system. Only in mass markets has solar thermal become a mainstream technology.

9.2 Benefits of financial incentives

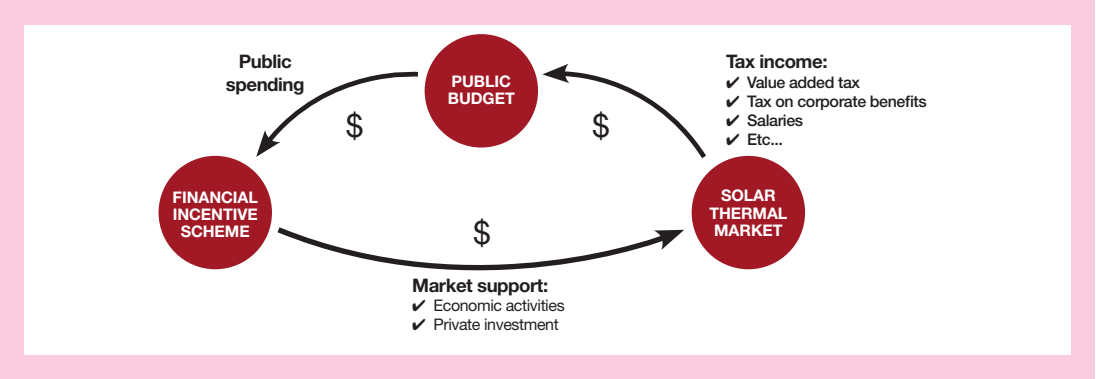
- **External utility of private investment**
  Private investment creates external utility: society benefits from the reduction of emissions and other external costs linked to the use of oil, gas or electricity for heating or cooling purposes. The financial incentive rewards private investors for these positive externalities.

- **Security of energy supply**
  By decreasing the dependency on imported energy sources, every solar thermal system reduces the need to take public measures such as strategic energy reserves, investment on infrastructure for transport of energy sources, diplomatic and military costs. By increasing national energy supply, in the long term, a financial incentive for solar thermal can be cheaper than alternative measures.

- **Removing the barrier of upfront investment costs**
  For the different reasons mentioned above, private investors can be discouraged by the high rate of upfront investment costs, compared with a conventional heating or cooling system. By reducing this financial and psychological burden, investments in solar thermal are encouraged. Thereby, a number of economically sound investments (with payback time shorter than the lifetime of the system and a substantial benefit in terms of energy saving) are encouraged.

- **Solar thermal replaces imported fuels with local jobs**
  Regardless of where the solar thermal hardware has been produced a substantial part of the turnover linked to a system remains local: marketing and distribution, design, installation, training etc.

  By stimulating investments, financial incentives create benefits for the local and national economy.



- **A positive signal from the public authority**
  The fact that a public authority gives a financial incentive shows a positive signal to citizens, concretely demonstrating public support for this kind of investment. This builds market confidence in both the technology and the installers supported by the FIS.

- **Financial incentive as a marketing tool**
  The existence of financial incentive schemes can be one of several methods for marketing solar thermal products. Their introduction should always be accompanied by a public awareness raising campaign. At the same time, private market actors will communicate with their customers. The level of incentives can be low but their existence still motivates the general public to purchase solar because of the “should not be missed” feeling in a similar manner to a discount campaign.

- **Creating economies of scale**
  Since there are very few mass markets for solar thermal, the potential for economies of scale are substantial. This is true not only for manufacturing, which is driven more and more by competition, but also for the subsequent stages of the value chain, e.g. in areas like marketing and distribution, system design, installation, customer care, etc. In some cases, these service costs represent over 50% of the final consumer cost e.g. pumped circulation. This means that, in countries with a low level of market penetration, there is a significant potential for economies of scales and reinforced competition in local and regional servicing. Financial incentives help to create economies of scale at all levels and thus reduce the price of solar energy in the short and long term.

9.3 Main forms of financial incentives

This overview is not extensive, and other forms of financial incentives might be developed:

- Direct grants
- Solar heat tariff
- Tax reductions
- Loans at reduced rates
- Green heat or energy efficiency certificates

Prosol in Tunisia an effective combination of incentives

The ambitious subsidy programme Prosol started in 2005.The incentives combine a direct grant of 20 % of the investment costs for a solar water heater with the payment of remaining investment costs done through the electricity bill on a monthly bases over five years.

The level of the monthly rates is fixed according to the money the household have spent so far on LPG gas bottles or on electricity for hot water.

The system is very successful and increased the market from 7000 m² in 2005 to 80,000 m² in recent years.

Source: www.solarthermalworld.org/node/266

- **Grants**
  Grants are a direct support to reduce the initial investment (upfront cost). This is probably the most common form of incentive and it is definitely the case in Europe.

  Such a grant scheme always implies an administrative structure for processing the applications as well as a budget to cover the costs. If the budget is limited, the number of acceptable applications must be limited, either on a first-come-first served basis or on other criteria.

- **Solar tariff**
  In 2011, the United Kingdom introduced a system of incentives, which, to our knowledge, is unique. The Renewable Heat incentive is a tariff paid to the end users for each unit of renewable heat they produce. Solar thermal is only one of the technologies covered by this scheme together with geothermal, biomass and heat pumps.

  The UK government has established a tariff for each energy source, which is supposed to increase the return on investment. This concept is largely inspired by the feed-in tariff introduced in many European countries for electricity.

  For budgetary reasons the introduction has been partially delayed and it is too soon to draw any conclusions on the effect such measures will have on the market.

- **Tax reductions (direct and indirect taxes)**
  The first part of this section looks at reductions in income or corporate tax and the second section looks at VAT reductions.

  - **Direct taxes**
    Part, or all, of the investment in a solar thermal system can be made deductible from income tax or corporate tax.

    In monetary terms, tax breaks can give the same incentive as direct grants. However, because they work differently, it has been argued that their impact could be lower than direct grants.

    Firstly, a reduction in the income or corporate tax leads to a benefit only one or two years later (when the income is declared and the tax returned). But typically a benefit at some point in the future is valued less by people than an immediate payment (which could be accomplished with a grant). The longer the interval between the expenditure (purchase of a solar thermal system)

and the incentive (tax reduction or return) the longer the person has to finance the whole investment. Some positive effects of a tax reduction can outweigh any disadvantage: The tax reduction removes the need to apply for a grant before purchasing a solar thermal system. This drastically reduces the procedure and the waiting period.

It should be noted that a real tax reduction can have socially unjust implications: As low-income households typically pay no or very low taxes, the absolute tax reduction may be lower than for the medium to higher income earners.

For the government, an income or corporate tax reduction has the advantage that it does not require significant additional administration.

For the solar thermal industry, a tax reduction has the benefit of not being tied to a limited budget: As long as the scheme is applied, there can be no limit on the number of accepted applications. This contributes to creating a more positive framework for the industry to invest in market development, particularly if there is confidence that the tax break will last for several years.

- **Indirect taxes**
  In principle, a reduction, or abolition, of the indirect taxes applied on solar thermal products and services needed to install and maintain a solar thermal system can be a very effective financial incentive for private individuals: Like a grant it immediately lowers the overall investment costs to the end consumer. And it does not involve the processing of any grants or additional items in a tax declaration and is thus very simple to apply.

- **Loans at reduced rates**
  The investment in solar thermal systems can be supported by loans offered at a lower-than market interest rate. So far, such loan schemes alone have not had a significant impact on the development of the solar thermal market in any European country.

  Due to the rather small size of the typical solar thermal investments (often in the range of between 1 000 to 5 000 Euro), a loan for a solar thermal system alone does not seem very attractive to many consumers, as the overhead costs for both the bank/government and the end-consumer are quite high. However, they can be an interesting complement to other support measures.

  In principle, a privileged loan is an appropriate answer to one of the main barriers to growth for solar thermal, i.e. the high rate of upfront investment cost. The loan allows to spread the investment costs so that the energy cost savings of the solar thermal system can be used to pay off the loan.

  Under present conditions, low interest loan programmes could be very useful if targeted at large solar thermal systems purchased by commercial users; such as HVAC systems used in large residential buildings and hotels, solar process heating systems and solar cooling systems. In these cases, the investment volume is higher and so the propensity to take loans increases.

  Apart from public loans, some companies offer agreements, in which the solar thermal company builds, owns and operates the (large) solar thermal system and the customer only pays for its usage, just like he would pay for oil or gas. Such offers, where the solar thermal company effectively operates as an Energy Service Company (ESCO) have become known as “Guaranteed Solar Results” contracts. Their market share is still very limited but with a growing solar thermal market it can be expected that their impact will rise. By providing low interest loans, governments can support the development of viable markets for solar thermal ESCOs.

- **Tradable certificate schemes**
  In a Tradable Certificate Scheme (TCS), those investing in a solar thermal system obtain certificates representing the energy saved through the system. The certificates can then be sold on a certificates market, which is typically driven by a requirement on certain stakeholders (e.g. energy suppliers) to cover a share of their energy trading with certificates.

  In the electricity sector, TCS usually awards certificates for each produced and measured unit of energy. As the price of the certificates varies according to supply and demand, the income from certificates is

not known in advance. This, critics of TCS have often maintained, would not create the market stability needed for the young and growing RES-electricity sector.

- **Private sector initiatives**
  Regarding financial incentives it can prove extremely useful to encourage initiatives coming from the private sector utilities, system manufacturers or others. In that case the financial burden can be shared or even transferred to the private sector that conducts the initiative as a marketing and profit-making programme.

  These initiatives can be triggered or encouraged by public authorities via TCS (see above) or simply support to awareness and marketing.

Utilities promote solar heat in the US

Lakeland Electric in Florida and the California-based renewable energy service company Regenesis Power offer solar heat to consumers on a contracting basis since October 2010. Both utilities offer homeowners the possibility to purchase the energy a system generates for a monthly fee, which is comparable to the monthly electricity, costs for a family of four. The contract runs over 20 years with a fixed, monthly energy fee. In addition to a fixed price plan, the customer receives other benefits, such as no up-front investments costs, additional hot water storage, zero maintenance costs, a reliable supply and the option to purchase the system.

Source: www.solarthermalworld.org/node/1580

9.4 Key success factors for financial incentives

When a financial incentive scheme for solar thermal is developed a certain number of generic key factors will influence its success:

- **Continuity**
  This factor is very important. Short term or sporadic support is the single most important factor leading to the failure of a FIS. In some cases, sporadic availability leads to a stop-&-go market dynamic that seriously disrupts the development of healthy market structures. This sometimes outweighs the benefits of the financial incentive scheme.

  The most obvious effect of erratic support is that people postpone their purchase until the support is available. In numerous cases, this tends to slow down considerably market development. By discussing, or even announcing, a support scheme in the future, the market actually decreased rather than increased.

  Another problem with short term measures is the lack of incentives for the supply side to invest in the development of healthy market structures, e.g. by building up a sales network, by training installers and other professionals etc. On the contrary, such a stop-&-go dynamic encourages the emergence in the market of “gold diggers”, short term companies only aiming at making a quick buck. As these “cowboy” companies install low quality systems with low or non-existent after-sales customer care, the reputation of the whole solar thermal industry can be seriously damaged.

- **Clear target**
  When targeted at a very specific application or market segments (e.g. only at individual domestic hot water systems, or at large collective combi systems, at swimming pool heating or at solar thermal heat for industrial processes) the incentives can be much more effective. This is especially the case for new and emerging applications.

- **Quality criteria**
  The support allocation should always be linked to minimum quality requirements to prevent bad quality systems from receiving public money.

- **Monitoring and evaluation**
  While not strictly necessary for its smooth operating, it is very important that a scheme is continuously monitored and the results evaluated. It allows governments to fine-tune the scheme operation and prevents major problems in the future. Evaluation should be done in close cooperation with market experts

- **Financial resources**
  The scheme models are different in terms of how they set incentives, but also where the financial resources come from.

  The most typical FIS, a governmental grant scheme, is usually financed through public funds, i.e. through taxes. This means that all taxpayers contribute to the financial incentives granted for solar thermal. It also means that the budget is limited – as approved by parliament – and this creates uncertainty if the required amount has not been assessed properly or if the scheme proves more successful than expected. The negative consequences of stops and uncertainties regarding financial incentives are often more damaging for the markets than the absence of such schemes.

  Therefore, it is of utmost importance for any government to plan on a long-term basis in order to have budgets approved, which allow potential market growth. Several experts have suggested the use a grant-like scheme, but to finance it not from public funds but through the sales of conventional fuels.

  Such a model would have several benefits compared with annual or pluri annual budgeting:
  - It reduces dependence on public finances (both in terms of total amount available, and approval procedures)
  - It applies the Polluter-Pays-Principle by putting a financial burden on the user of conventional energy.
  - It minimises the administrative tasks for the government

  Such a funding, outside public budget, is more likely to be stable long term.

Financial incentives independent from Public budget

The California Solar Initiative (CSI) – Solar thermal Programme is a pure "rate-payer" financed programme. That means that the budget over 8 years of US$ 250 million for replacing gas heating systems is collected from the gas ratepayers and the US$ 101 million for replacing electric systems are collected from the electric ratepayers.
The CSI has some more innovative features that are worth mentioning: the tariffs are performance-based and decrease over time.

www.solarthermalworld.org/node/1453

- **Basis of the financial incentives: Collector area or energy yield**
  The basis chosen for the allocation and calculation of the amount of incentive given is typically related to the size or capacity of the supported system: Larger systems receive higher incentives than smaller ones. Traditionally the incentive has been based on square meters of collector area, sometimes differentiating according to certain size brackets, applications or technologies. This method is not very refined but extremely simple in terms of implementation and understanding.

  Alternatively, it would be possible to base the financial incentive on the expected or real solar energy yield of the system. This would add complexity, and thus costs. Any such calculation of incentives based on the energy production should therefore be carefully weighed against the additional costs of such a procedure.

  In order to measure the energy yield of a solar thermal system, two different approaches are available: Actual measuring of the solar energy production and (ex-ante) calculation of the annual energy yield of the solar thermal system. Standards methods and metering are available for this purpose. Methods based on the solar yield can contribute to raise the awareness on systems' quality and performance.

- **Amount of incentive**
  Experience shows that the absolute amount of a financial incentive given is not the most important factor. The correlation between the amount and the market growth does not seem to be high. There is no "right" amount.

  If the overall market framework conditions for solar thermal are good, then the amount can be lower and still present a good enough incentive. On the other hand, the decrease of financial support can have very disruptive effects on the market, if it comes at the wrong time.

- **Simplicity of the application and payment procedures**
  Not surprisingly, simplicity of the application and payment procedure is recommended. The more complicated it is for the consumer to benefit from a FIS, the less incentive the FIS provides to install a solar thermal system. At the same time, governments also benefit from lean procedures as it avoids unnecessary bureaucratic overheads.

  In order to avoid misuse of financial incentives, governments should check at least randomly, if the systems, for which financial incentives were claimed, were actually installed.

- **Flanking measures**
  The importance of flanking measures cannot be underestimated – an incentive alone almost never has a significant impact on the uptake of solar thermal. The most successful support policies for solar thermal target the different barriers to growth for solar thermal and provide a package of measures. The upfront investment costs are only one issue, yet an important one. The "potential "flanking measures" are constituted by all the items described in the previous section.

10 References

1. UNEP Guide on standardisation and quality insurance for solar thermal
2. UNEP guide on awareness raising campaigns for solar thermal
3. Weiss, W. and Mauthner F.: Solar Heat Worldwide, IEA SHC 2011
4. International Energy Agency Solar heating and Cooling Programme, www.iea-shc.org/
5. Renewables 2011 Global Status Report, REN21
6. Solar Ordinances, PROSTO project financed by the Intelligent Energy Europe programme of the Executive Agency for Competitiveness & Innovation (EACI), www.solarordinances.eu/
7. Key4RES-H project financed by the Intelligent Energy Europe programme of the Executive Agency for Competitiveness & Innovation (EACI), www.erec.org/index.php?id=50&type=0
8. Green Chiller the association for renewable cooling, www.greenchiller.eu
9. Global Solar Thermal Energy Council (GSTEC), www.solarthermalworld.org/

Cover pictures courtesy of: GREENoneTEC, Wagner & Co, Austria Solar