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Policy measures to support solar water heating: information, incentives and regulations

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1. Policy measures to support solar water heating: information, incentives and regulations[1]

1.1. Introduction

Solar Water Heating (SWH) is now considered to be a standard technology and, in a few pioneering countries (Israel, Cyprus, Greece and Austria), is competing directly with conventional water heating systems. However, in most countries of the world the use of SWH remains limited.

The first programmes to promote SWH systems were introduced for reasons of energy security and to save on oil costs. Even though these reasons are still valid today, they now take second place behind other concerns: serving areas with insufficient energy supplies, reducing peak power loads, harnessing a country's own resources and protecting the environment. For these different reasons, policies have been in place for many years to develop SWH systems, both in the industrialized world and in developing countries.

In this chapter, we shall describe the **different instruments** used to promote the diffusion of solar panels for heating water. These measures can be divided into three groups:

- economic incentives to lighten the investment barrier and improve cost effectiveness (direct subsidies, low-interest loans, tax exemptions, third-party financing, etc).
- regulations requiring new or renovated apartment buildings to be equipped with solar energy systems
- strategies to improve the quality of equipment and installations through the use of technical standards and quality labels.

We shall focus particularly on combinations of measures that have often been implemented to support solar energy and that are aimed at creating **synergy** between instruments. Important aspects of such measures are

- the complementarity between direct subsidies and access to loans to improve cost-effectiveness while limiting investment constraints
- making access to economic incentives contingent upon the use of products with quality labels to encourage the diffusion of high-performance installations
- the creation of special financing schemes or labels to complement regulations in order to limit impacts on the price of housing and prevent cost constraints from leading to a drop in housing quality.

This chapter is based on an analysis of the literature and on **case studies** that can be found in the appendix to this report. The case studies were chosen so as to represent a cross-section of programmes set up in industrialised and developing countries.

Austria and Spain provide examples of policies adopted in EU countries. **Austria**, the European leader in terms of installed surface area per inhabitant, is an example of a country with a sustained and successful policy to promote solar energy based on different types of measures, in particular economic incentives. The case study for **Spain** completes that of Austria and illustrates the impact of a regulatory approach. In Barcelona, the city's Solar Ordinance makes it compulsory for builders to install solar energy in new buildings.

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China and India illustrate the situation in very large developing countries where there is considerable potential for expansion of the SWH market. The dynamics for growth are very strong in both countries although considerably greater in **China**, which is by far the largest market in the world. In China, the diffusion of solar water heating systems is taking place in a spontaneous manner, governed by market forces and free competition. The state's main role is to build consumer confidence by ensuring that quality is maintained and improved in this sector, which it does through the use of standards and quality labels. The situation is much the same in **India**, where SWH systems are fast becoming competitive with conventional water heating systems. The main constraint in this country remains financing, a problem which can only be alleviated by making micro-credits available at low cost.

Tunisia provides the example of a "small" country that has been attempting to develop a market for SWH for many years. It seems to be achieving success by combining a variety of measures to provide direct subsidies and loans in order to address the problem of financing.

On the other hand, **Mexico** has had little success in developing SWH. The market for solar collectors for residential applications is still very small, due in particular to energy taxation that provides little incentive to use renewable energies and the lack of any consistent coordinated policies to promote SWH.

1.2. State of the market and barriers to diffusion

1.2.1. Solar collectors worldwide

According to a recent report by the International Energy Agency (Solar Heating and Cooling Programme), the total area of collectors installed throughout the world in 2004 was in excess of 140 million m² (IEA, 2006). The corresponding total energy production, estimated according to a method devised by a group of IEA experts, was several 100 GWth, equivalent to around 200 000 TJ or 10 Mtoe, with 25 MtCO² of emissions avoided[2].

Paradoxically, given that we are looking at renewable energy technology, it is in an emerging country, China, that most of the installed capacity of SWH is found (Table 1).

Table 1: SWHs in operation (in MWth)

	2006	2005	2004	2003	2002	2001
China	*nd*	*nd*	43 400	33 950	25 970	19 250
Japan	*nd*	*nd*	5 408	5 232	5 036	4 801
Turkey	*nd*	*nd*	5 096	4 256	3 696	3 346
Germany	5 428	4 588	3 923	3 398	2 894	2 516
Israel	*nd*	*nd*	3 353	3 304	3 024	2 744
Greece	2 298	2 133	1 979	1 828	1 715	1 609
Brazil	*nd*	*nd*	1 586	1 563	1 540	1 506
USA	*nd*	*nd*	1 502	1 469	1 432	1 397
Austria	1 819	1 623	1 460	1 332	1 215	1 108
Australia	*nd*	*nd*	1 117	1 011	917	839

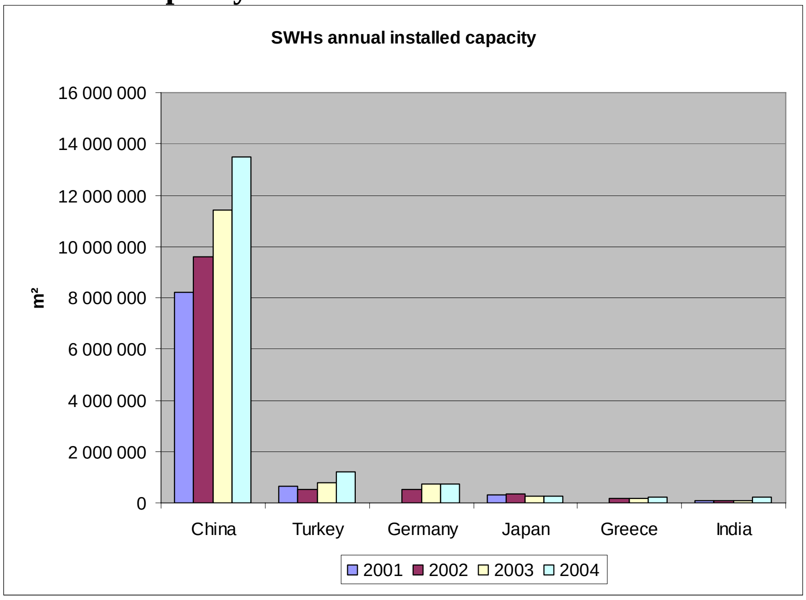
Source : IEA, 2006 and ESTIF, 2006 for European countries

Annual sales figures for solar collectors confirm this high concentration as well as the dynamism of the Chinese market (Fig.1). In 2004, China accounted for close to 80% of annual sales of collectors for SWH or for heating buildings, ahead of Turkey and Germany. Sales in China are increasing by close to 20% a year, representing an additional collector area of 1.5 to 2.0 million m² every year, which is more than total annual sales in Turkey.

[2] 75% from glazed collectors for SWH and 25% from unglazed collectors for heating swimming pools.

In the southern hemisphere, a few countries such as Brazil, India, South Africa and Mexico already have significant cumulative collector area: respectively 2,300,000 and 1,000,000 m² for the first two, and between 250,000 and 260,000 m² for the other two (figures for the year 2004). Elsewhere, installed capacity is much lower but numerous markets seem to be emerging in the developing world in response to the growing demand for SWH (Martinot et al. 2002).

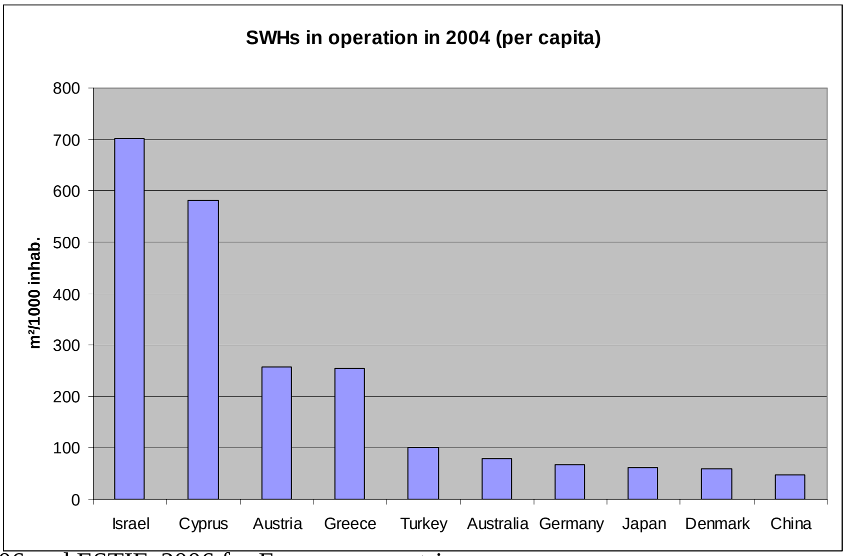
Fig. 1 : Annual installed capacity of SWHs



Source : IEA, 2006 and ESTIF, 2006 for European countries

Apart from a few exceptions, the per capita installed area of collectors is still very low in the developing world. In the leading countries (Israel, Cyprus, Greece and Austria), installed area varies between 250 and 700 m²/inhabitant but the market is progressing very slowly. In Germany and Turkey, the installed area of solar collectors is well below these levels but the market is rapidly expanding, with installed areas increasing from 44 m²/inhab. and 70 m²/inhab. respectively in 2001 to 68 m²/inhab.and 101 m²/inhab. in 2004. China, is still only in tenth position with an equipment rate of 48 m²/inhab (2004) but this figure is increasing rapidly (the equipment rate was expected to reach 80 m²/inhab. in 2006 ; a 4-fold increase between 2000 and 2006).

Fig. 2 : Cumulated installed capacity of SWHs per capita

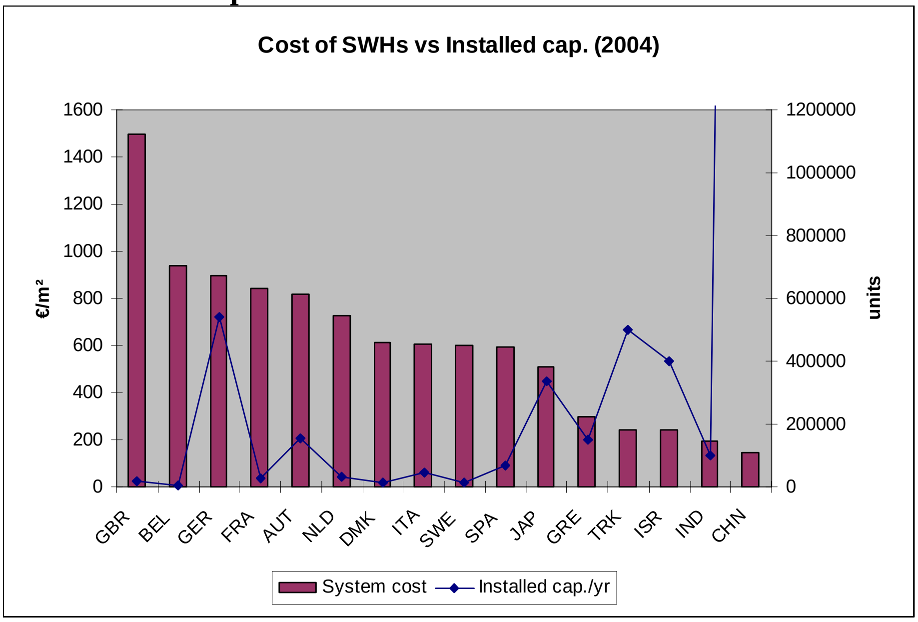


Source : IEA, 2006 and ESTIF, 2006 for European countries

1.2.2. Principal barriers to diffusion and cost considerations

The cost of a SWH system varies considerably. It can be as low as 300 – 400 € in China and India and as high as 5,000 – 7,000 € in the countries of northern Europe. The differences in cost can be explained by the differences in installed surface area (from 2m² to 6 m² per installation), which will depend on hot water needs and hours of sunshine. But there are also significant differences in the cost per unit of area (Fig.3). In Europe, a SWH system costs on average between 600 and 900 €/m² compared with 200 – 300 €/m² in India, China, Greece Turkey and Israel (Fig.3). Generally speaking, systems cost less in southern countries which have more sunshine and where it is therefore possible to use simpler technologies to produce comparable amounts of hot water.

Fig. 3 : Total cost of SWHs per m²



Source : from ESTIF, 2003

In Europe, SWH systems are not, at present-day prices, generally competitive with conventional water heating technologies (gas or electricity). In countries in the central and northern areas of Europe, average payback periods can exceed 10 years, even when available subsidies are taken into account (Ecofys, 2003). The situation is better in Mediterranean countries, where the climate is more favourable and where less sophisticated technologies can therefore be used.

Individual thermosiphon systems can be a viable alternative to conventional water heaters in the developing world. In Barbados, for example, the payback time for an SWH installation is 2 years for a household equipped with an electric water heater with an annual consumption of 4000 kWh (Headley, 2000). In Mexico, the relatively low fossil energy prices do not provide any incentive for consumers to acquire solar systems and they lead to payback times of between 3.5 and 6 years. But it is the initial investment, rather than the economic return, that is the biggest constraint for consumers: the cost of a solar installation is 3 times that of a standard water heater (1,700 $ vs 500 $) and is equivalent to three times the average annual amount spent by a household on LPG for heating water (Castro, 2005).

In the vast majority of countries, a variety of economic factors have a determining influence on decisions whether or not to invest in SWH: installation costs, maintenance costs, costs of conventional water heaters, current and projected prices of fossil energy, financing methods, availability of loans at reasonable rates, etc. However, two of the leading European markets (Germany and Austria) are in central Europe where the climatic conditions and consequently the payback time are not particularly favourable. This suggests that the return on investment and more generally the economic criteria are not the main factors taken into account by consumers, and that a very sunny climate is not a necessary condition for growth of the flat plate collector market. Other factors also affect decisions, in particular, high visibility of the technology, quality and perceived reliability or conversely the associated risks, problems of access to information, availability of the technology, the existence of networks of skilled installation contractors, architectural and regulatory constraints, etc.

1.3. Measures and packages of measures

In most countries, SWH is a mature technology but its diffusion is still severely limited by economic constraints. The main economic barriers are the excessively high initial outlay and excessively long payback periods for investors (residential or tertiary) who expect a return on their investment after no more than a few years. For this reason, measures to support the development of SWH technology are based principally on economic instruments (subsidies, low interest loans, tax relief). Regulatory approaches have also started to make their appearance in recent years. Regulations make the use of solar energy compulsory in situations where economic incentives have not been sufficient to overcome existing barriers. In addition, other measures to provide information and enhance awareness, and to improve quality in general, are used to help overcome the non-economic barriers and identify other factors that influence consumer motivation.

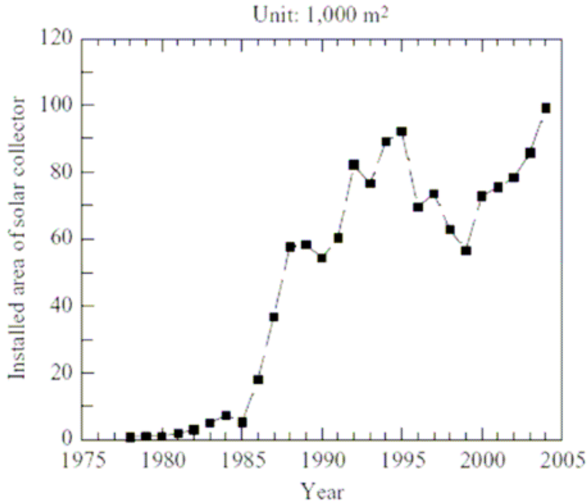
1.3.1. Economic instruments

Subsidies
Numerous examples of policies to support the development of flat plate collectors show that subsidies are an effective way of boosting sales.

In Taiwan for example, the two successive government campaigns conducted in 1986-91 and then 2000-04 to promote solar collectors for heating water had a clearly visible impact on sales of equipment (cf Fig. 4). Similarly, in Europe, financial incentives are seen as a key factor for developing the market for SWH systems (ESTIF, 2003).[3]

The experience of Tunisia among others countries shows that if subsidies are discontinued prematurely it is quite possible for sales to plummet in a market that is not sufficiently mature (ANER, 2003). However, once the critical mass has been reached economic incentives can be reduced and even stopped without slowing down the diffusion dynamics (see for instance the case study for Greece).

Fig. 4 : Impact des incitations économiques (Taïwan)



Source : Chang et al.., 2006

Subsidies are intended to reduce the capital cost at the time of purchase and shorten the payback time, which are the principle barriers to growth of this market. They can also be used to promote quality if they are granted on condition that the equipment or the contractors comply with certain quality criteria. Finally, subsidies provide the public authorities with the opportunity to show their interest in solar technologies. Combined with a clear and ambitious policy to develop solar technologies, this can help mobilise professionals in the sector and build consumer confidence in the reliability of SWH equipment.

But direct subsidies are not without a certain number of drawbacks, the main one being the cost in public funds if the financial incentives concern a large volume of equipment over a long period of time. Furthermore, direct subsidies can involve very high transaction costs, in particular when they are granted for individual systems. Finally, as discussed above, subsidies may also have negative impacts on markets for a number of reasons:

- negative impact on demand, on networks of contractors and on manufacturers and importers if subsidies are withdrawn too rapidly in markets that are not sufficiently prepared (cf supra);
- effects of the market anticipating the withdrawal or introduction of subsidies, leading respectively to a rush to buy or a waiting game;
- the cost of equipment might increase if manufacturers or contractors raise their prices in anticipation of the rebates that purchasers will be granted.

[3] All the member states, apart from Greece, Denmark and Finland, provide financial incentives for the installation of SWH systems

While a great many countries use direct financial incentives to support the development of SWH systems, countries such as Israel, Greece, Japan and China have succeeded in making SWH a standard technology that now competes with conventional water heating systems sufficiently well for such incentives to be no longer needed.

Tax credits / tax incentives

There are various types of tax incentive: tax reductions (lower VAT for example) applicable to equipment or installation costs, reduced tax rates on imported equipment where applicable, tax credits, shorter write-off periods, etc.

Several European countries have lowered their VAT rates on solar equipment but only Spain and Austria (in 2003) have made solar equipment fully exempt from VAT (ESTIF, 2003). Tunisia has also introduced a reduced VAT rate in its incentive programme financed by the GEF (1997-2004). In France, since the start of 2006, solar water heaters have benefited from a tax rebate of 50%, which means that households can deduct half of the purchase cost of SWH equipment from their income tax.

The aim of tax incentives is much the same as that of direct subsidies: they reduce the investment cost and therefore improve the return on this investment. For the tax authorities, they have the advantage of representing a loss in tax revenue rather than an additional expenditure. However, unlike subsidies, tax credits do not lower the barrier of the initial upfront payment, and therefore do not help low-income households.

Low-interest loans / third-party financing

Providing access to credit is another way of lowering the initial cost barrier as long as the interest rates are lower than those generally applicable to consumer loans. Loan facilities are often set up as a complement to direct subsidies to help cover the remaining cost that has to be paid by the investor.

In Spain, the possibility of obtaining low interest loans (6-8 % instead of 14-18%) has greatly facilitated implementation of legislation on solar installations (cf case study for Spain). India has also adopted a strategy based on low-interest loans to help consumers to invest in SWH systems. When direct subsidies were withdrawn in the early 90s, the Ministry of Non-conventional Energy Sources (MNES) set up a special loans programme through the Renewable Energy Development Agency (IREDA) and the country's banks. Through this cooperation between the SWH sector and the banking network, the Indian government made it much easier for households to obtain loans at reduced interest rates.

It is possible to go even further by adjusting loan repayments according to the energy savings produced by the SWH system. This is the principle of third-party financing where the party paying for the equipment, usually an ESCO (energy services company), is reimbursed from the savings made. This arrangement can be accompanied by a guarantee of results offered by the contractor that protects against the risk of technical failure. This type of arrangement has been used to finance solar installations in the hotel sector in Spain (ESTIF, 2003). However, this method of financing is still not very widespread. Tunisia's experience is perhaps worth mentioning here. At the beginning of the 1980s and then again in 2005 programmes were set up to finance SWH systems through credit sales and monthly repayments through consumers' electricity bills (PROSOL programme). The amount paid back through the electricity bill is calculated in such a way that it remains lower than the savings on electricity made by using SWH. Since the operation was started in April 2005 a total of 7200 SWH systems have been installed, which is the equivalent of 23 000 m² per year. This is a significant increase when compared with previous years when the maximum reached was 14,000 m²/yr (2001 was the best year) (Usher et al., 2006).

1.3.2. Regulations

Even in fairly mature markets, SWH systems are not used in all situations where they would be justifiable from a financial point of view. The reasons are numerous and are no secret: lack of trust in new technologies, long payback times and preference for immediate savings, insufficient visibility and information, lack of motivation and awareness on the part of decision-makers, high transaction costs, problems with owners / tenants, and so on. In such circumstances, regulations making the use of renewable energy sources mandatory provide a way of expanding diffusion and benefiting from increasing returns to adoption.

In 1999 the Barcelona City Council drew up municipal regulations which were extended in to the rest of the country in March 2006 when the new Technical Building Code was introduced. The purpose of the Code is to promote the use of SWH systems in all new or renovated buildings. It stipulates that in such buildings 60% of hot water demand must be met by SWH.

The introduction of this regulation gave rise to numerous debates and protests. In particular, it was necessary to win over the various actors in the construction sector (architects, builders, investors, etc.). The most difficult group were the investors, who were not entirely convinced of the wisdom of such a choice, nor of the reliability of the technology. They were also concerned about the possible impact of the extra cost of solar installations on the construction market, and especially any extra time that might be needed to obtain equipment that was not readily available. Finally a moratorium of several months was allowed before the regulation was enforced to give everyone time to adjust to the new requirements. This is an example of a regulatory decision applicable across the board and which was drawn up with the general agreement of all the stakeholders.

The results achieved by Barcelona demonstrate the effectiveness of this approach, since the average surface area of collectors installed each year increased from 1,650 m² (i.e. 1.1 m²/inhab.) before the Ordinance to 19,600 m² (i.e. 13 m²/hab.) in 2004 (Pujol T., 2004). The additional investment cost was finally kept to within 0.5 and 1% of total construction costs and was covered by no-interest loans offered by the Instituto de Crédito Oficial (Stirzaker, 2004).

Regulatory measures result in a much larger market for the technology and can thereby help improve performance (reliability/cost) and enhance the visibility of the technology, as well as setting in motion a virtuous spiral that will lead to greater diffusion. Nevertheless, minimum quality levels must be imposed to prevent the solar energy obligation from encouraging the use of inexpensive but inefficient equipment. Standards and quality labels can ensure that such minimum requirements are met.

1.3.3. Improving quality: standards and labels

The aim of standards is to guarantee or improve quality. Technical standards are drawn up with reference to a given set of specifications and guarantee a specific level of quality. In addition to product standards, there are standards relating to the installation of equipment. While the technical standards are restrictive, labels designed to achieve the same ends are in theory not so. In practice, they may become restrictive if consumer access to subsidies or loans is conditional on certification of the product or contractor.

In 2003, European manufacturers developed the Keymark voluntary certification scheme with the support of the association ESTIF. This label is recognised in most European countries and facilitates the movement of products between EU member states by making it easier to gain direct access to financial incentives (subsidies, loans) without the need for compliance with national standards.

The Keymark label is one of the basic references used by the Chinese government to develop its own national technical standards for solar thermal equipment. China's aim is to gain easier access to the European market for its solar products and to develop technical standards in China in order limit the presence of poor quality equipment on a highly competitive market where the selling price is a determining factor in the decision to buy (Wallace, 2006).

In addition to standards, special contractual approaches have also been developed aimed at guaranteeing or improving the quality of SWH systems. For example, the Guarantee of Solar Results project has been implemented on an experimental basis in certain countries such as France and Spain. Applicable to large installations, its aim is to check that the real performance of a system corresponds to the advertised performance, and to compensate users if this is not the case. The risk related to poor performance is no longer borne by the user but by manufacturers and installation contractors, who are thus strongly encouraged to supply high quality equipment.

1.3.4. Complementarity of instruments

In the above paragraphs we have presented the policy instruments used to support the development of SWH one by one. But it is important to note that in reality they are often used to complement one another.

Subsidies at time of purchase / access to credit

Direct subsidies help address the problem of capital outlay but are not sufficient in themselves to help the lowest income families to purchase SWH equipment. Similarly, tax credits and tax rebates help improve the return on investment in SWH but do help families with very limited financial means to purchase SWH systems. In this case, it is essential to provide complementary measures to facilitate access to credit, such as low-interest loans or schemes involving third-party financing (see case study for Tunisia, where loan repayments are made through electricity bills).

Energy and environmental taxes are other factors that determine the economic competitiveness of SWH systems. A number of European countries have introduced environmental taxes or adopted energy taxation systems that make fossil energy sources more expensive and improve the return on investment for solar installations. But existing energy taxation is not always compatible with the objective of promoting renewable energy sources. In a great many countries, fossil fuel subsidies that are intended to facilitate access to energy for the poorest families have an antagonistic effect on sectoral policies aimed at promoting SWH.

Most of the time, direct subsidies must therefore be combined with systems providing access to credit (in particular low-interest loans), especially in developing countries where the cost barrier is felt the most strongly But it is important not to lose sight of the potential synergy with environmental or energy taxation.

Subsidies and quality labels

As discussed above in the paragraph concerning economic incentives, subsidies, low-interest loans, tax credits, and so on are almost always conditional upon certification as a way of promoting the use of high quality equipment. In practical terms, this means that economic incentives are granted only for equipment that has an approved quality label, in other words that meets stringent quality requirements. Economic incentives thus enhance the effectiveness of labels which themselves are designed to promote better quality equipment.

In France for instance, the government has set up a system of tax credits that are applicable to SWH equipment provided the solar collectors concerned have been awarded CSTBat or Solar Keymark certification. Similarly, in India, only solar collectors certified by the Bureau of Indian Standards are eligible for low-interest loans (ESTIF, 2003).

Subsidies can be granted to encourage the use not only of high quality products but also of qualified installation contractors and high-performance installations if they are awarded on the basis of minimum performance levels. For instance, in the Netherlands, the amount of the subsidy is determined by the performance of the installation (ESTIF, 2003). On the other hand, experience in Tunisia has shown that it is not enough to set up schemes to finance investment in SWH; they must be accompanied by measures to improve quality. In fact the market collapsed when subsidies were withdrawn because of insufficient quality control and a negative perception of the quality of solar equipment among consumers.

More generally, there should of course be complementarity between financial incentive packages and public information and awareness campaigns. Such campaigns are intended to stimulate public interest in SWH but consumers must still be given the possibility to acquire SWH installations. By the same token, any economic incentive schemes must be promoted through public awareness campaigns if they are to be truly effective. Public information and awareness campaigns are thus a vital complement to economic incentive programmes.

Regulations / financial aid / quality labels

Where regulations have been introduced, additional economic incentives may be necessary to ensure that the initial extra costs involved (at least during the early stages) do not give rise to increased construction costs and make home ownership more difficult for lower-income families. At the same time, regulatory measures must be accompanied by equipment certification schemes to ensure that pressure on building costs does not lead to poorer quality installations and ultimately a decline in consumer confidence.

A regulatory approach, more than any other type of instrument, must be part of an overall strategy based on a wide variety of incentives. For reasons discussed above, financial incentives must be made available (subsidies and/or low-interest loans), and quality improvement measures should be introduced, such as product labels and special certification for installation contractors. Generally, when regulations are introduced making solar systems mandatory, additional support measures are necessary: information and awareness programmes, schemes to maintain or improve quality (standards / labels), training and certification schemes for installation contractors, special support measures on the supply side (R&D programmes, opportunities to achieve economies of scale), urban planning regulations that take into account SWH, and so on. More generally still, the motivation and involvement of all the players in the sector is needed to find the best solution for promoting the integration of SWH in buildings.

1.4. Conclusion

- The case studies and the literature consulted show that direct subsidies are an effective way of stimulating the growth of the SWH sector
- Subsidies may also have negative impacts on emerging markets if they are applied without real continuity: stop and go effects, depression of market if subsidies are withdrawn suddenly, impact on selling prices, etc.

- Direct subsidies alone cannot lower the cost barrier; the availability of low interest loans is also essential, especially for low-income households.
- In certain market configurations (e.g. northern Europe), environmental considerations seem to be sufficiently motivating in themselves, making subsidies less necessary.
- When the extra cost of SWH systems becomes less onerous or when it can be reduced through economies of scale, regulatory measures can be used to boost diffusion and set in motion a virtuous spiral.
- SWH can be competitive in certain countries thanks to less sophisticated technologies, very low production costs and abundant sunshine
- Measures other than direct subsidies are still necessary when SWH is approaching competitive levels: suitable financing mechanisms to help overcome the investment barrier, quality labels or technical standards to ensure high performance levels of installations.
- Generally speaking, packages of measures that combine several instruments are more effective: direct subsidies plus financing methods, economic incentives plus quality labels, regulations plus subsidies or financing mechanisms and quality labels, and so on.
- The regulatory approach exemplified by the Solar Ordinance is the perfect example of a package of measures where the complementarity of the instruments is vital. For regulations to work, they must be accompanied by information and awareness programmes, measures to maintain or improve quality (standards / labels), training and certification of installation contractors, special supply-side support measures (R&D programmes, opportunities to achieve economies of scale), urban planning regulations that take into account solar energy, etc., and more generally the motivation and involvement of all the stakeholders in the sector.
- In addition to complementary instruments, policies to support the SWH sector must be designed on the basis of the maturity of the target markets. Although subsidies are generally effective, they could become counterproductive if they are introduced too late. When the market reaches a certain size, new building regulations or technical standards can gradually take over from economic incentives, at least those in the form of direct subsidies.

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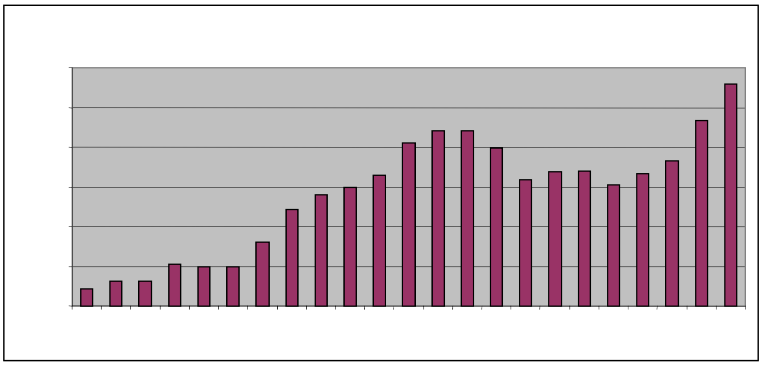
Context

Despite unfavourable climatic conditions, the market for solar water heating systems is very large in Austria and still increasing very fast after a short period of depletion between 1999 and 2002: the installed area of solar collectors per capita (approximately 300 m² per 1000 inhabitant) is one of the most important in the world behind Israel and Cyprus.

As in most mature markets, financial subsidies have clearly played (and still play) a role in the growth of the market. But, high energy prices and environmental awareness among the general public, on the one hand, widespread self-building activity and competition among manufacturers, on the other hand, have also created favourable conditions for the development of solar applications in the domestic sector and to a lesser extent in the tertiary sector (hotels, swimming pools, etc.).

Market development

At the beginning of the 80's the yearly installed area of solar collectors in Austria was below 20 000 m². It reached 200 000 m² for the first time in 1995 and exceeded 250 000 m² in 2005 as a result of a sustained growth since 2002. The cumulated installed surface of solar collectors is approx. 2 600 000 m², the third European market in volume but the first in terms of installed area per inhabitant : it is estimated that one out of height single (or two) family houses in Austria is equipped with a solar heating system.
A majority of systems are used for hot water in individual (or two family) houses (75% of total installed collector area) but combined systems providing both hot water and part of heating needs receive increased interest among the general public (20 % of collectors area). Large collective solar systems also exist in residential buildings, sport centres, tourism facilities, hospitals, etc. but are less developed with an installed surface below 5% of total. It is worth noting that large solar plants also provide hot water to multi-family houses through district heating networks but these systems still represent less than 1% of the total installed collector area.



Source : Soltherm Europe,
One important feature of the Austrian solar collectors market is the existence of a well developed distribution network. Ten years ago, the producers of SWH systems was selling directly their products to end-users or installers; with the growing interest of the conventional heating branch in solar products, some companies decided to establish wholesale structures which proved to be a very effective strategy. Today, it is no more necessary to rely on specialised installers for solar products; almost all the heating installers also offer solar systems that are considered as mature if not yet fully conventional technological option.

The inclusion of professional groups from the construction sector (roofing companies for ex.) in the distribution of solar systems has also contributed to a large extent to a better integration in buildings and a rapid deployment of the technology.

Today, Austria has a functional solar market based on innovative high quality solar products available at favourable prices (cf infra) and considered as integral part of the business by the heating installers. As an evidence of the market reaching maturity, is the emphasis that is now shifting from hot water supply in new individual houses to multi family buildings and combined systems for both hot water and heating purpose.

Prices

In Austria, a typical individual solar system for water supply has a collector area of 6 m² and a storage capacity of 300 l providing 60-65% of solar contribution. The average cost of such a system is 4200 – 4900 € (installation and VAT included), similar to the cost of a comparable system in Germany but much higher than the costs of the systems installed in the Southern European countries like Italy, Spain or Greece (respectively 2200 €, 1400 €, and 700 €). At these prices, solar systems are only economically viable in specific locations depending in particular on the financial subsidies that are provided to final users.

The Austrian situation shows that except cost effectiveness, numerous purchase criteria are taken into account by final customers and that SWHs may become a (almost) standard solution when existing framework provides stable incentives.

Drivers / measures

Austrian authorities have promoted solar thermal applications since the mid 90's as a way to reach the national objectives agreed in the Kyoto protocol toward greenhouse gas emission reduction.

Subsidies of different kind (direct grants, soft loans, etc.) are central in the framework of the support programmes at the federal, regional or local level. In 2003, direct grants were allocated for solar plants in single family home in all the provinces (Soltherm Europe, 2003). The grant has represented between 6 and 36% (25% on average) of the total investment cost (4650 € for a typical solar system of 8 m²) depending on the province considered but a large number of municipalities also offered additional support (between 10 and 50% of State subsidies). Some kind of exemption for taxpayers has also been provided but mostly focused on solar heating devices.

Apart from direct subsidies, classical financing tools used in the building sector have also been utilised to promote the deployment of solar systems. The general housing subsidy which amounted to 3 billion €/year in 2002 is an important control instrument of the building quality in Austria. The instructions from the Federal government to the provinces were to restructure the funds available for housing grants (new constructions and renovation projects) in accordance with the national climate goals (Soltherm, 2002). It has been used to control the selection of heating systems and stimulate an increase of energy efficiency and the dissemination of solar systems (different regulatory and incentive frameworks exist in the provinces). Depending on the States, the influential instrument has been either direct subsidies or general housing subsidies.

Fiscal policy is consistent with the objectives of the climate policy and favours renewable energy schemes. An energy tax has been introduced in 1996 on domestic and industrial gas and electricity consumers which improves the cost effectiveness of carbon free energy sources. Part of this tax is recycled to support environmental-friendly initiatives among which renewable energy.

The existence of do-it yourself groups may also have contributed to the deployment of the Austrian SWH's market. The first groups were formed after the decline experienced in the beginning of the 80's; at the end they contributed to disseminate and to recreate confidence among the large public in the solar thermal technology: in 1997, about 42.000 solar systems, with a total collector area of approx. 400.000 m² have been installed by use of this strategy. The other positive impact of this approach is the price decrease of solar systems: the existence of a competition with self build groups has forced the manufacturers and installers to limit their financial rents and to invest in order to stimulate price decreases. Over the years the gap between manufactured and self build systems has decreased so that most of these groups have disappeared but their influence has been very important in facilitating the emergence of the hot water solar applications.

Despite the large dissemination of solar systems in Austria, the lack of information is still considered to be an important barrier for further market penetration. Numerous activities are carried out in order to raise awareness about these technologies, including (ex. of Upper Austria):

- free answers to questions about renewable energy and energy efficiency (energy hotline)
- free advice and auditing for private households, public institutions and companies.
- distribution of publications and information tools (videos, interactive CD-ROMs, etc.)

Perspectives / impacts / problems

Today, the large number of installed and properly functioning systems has led to the recognition of solar energy as a standard technical option for supplying hot water in individual houses. Solar systems are easily accessible as an option for new constructions as:

- the conventional heating sector provides high quality (Autrian producers give guarantees between 5 and 10 years for flat plate collectors) and reasonably priced SWHs.
- it is easy for final customers to get independent and reliable information of costs and performance of solar systems
- some kind of financial subsidies are available for the installation of solar systems (may ease the investment even if it is not the most important decision factor for individual houses)

The main problem of Austrian authorities today is to enlarge the solar market toward new applications, namely, space heating in individual houses and multi storeys buildings, tertiary uses (sports centres, hotels, hospitals etc.), district heating networks and in the segment of solar process heat (low temperature heat in industrial companies).

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CHINA

Context

The market for solar water heaters (SWH) has grown very fast in the last 10 years in China along with the economic development and associated increasing demand of Chinese households for hot water supply. The Government of China is supporting the SWH industry through technology standards, testing facilities or R&D activity, but interestingly this huge development has occurred without explicit policies for promoting solar hot water installation (grants or rebates) as it is common in other countries. It is expected that the present growth of the Chinese market will be reinforced by the new Renewable Energy Law published in 2005 that will encourage the use of solar energy in buildings.

Market development

Market development has started in the late 80s but the period of rapid development occurred at the end of the 90s and to the present time.

China's SWH market is the biggest in the world today (80% of the global additions in 2004). The annual production has increased from 0.5 million m² in 1991 to 13 million m² in 2004 with an average annual growth rate of 29 %. At the end of 2004, the cumulative number of installations was over 60 million m² (Fig.1), which was 5 times that of 1997 and also more than 70% of the total world market (Refocus, 2005).

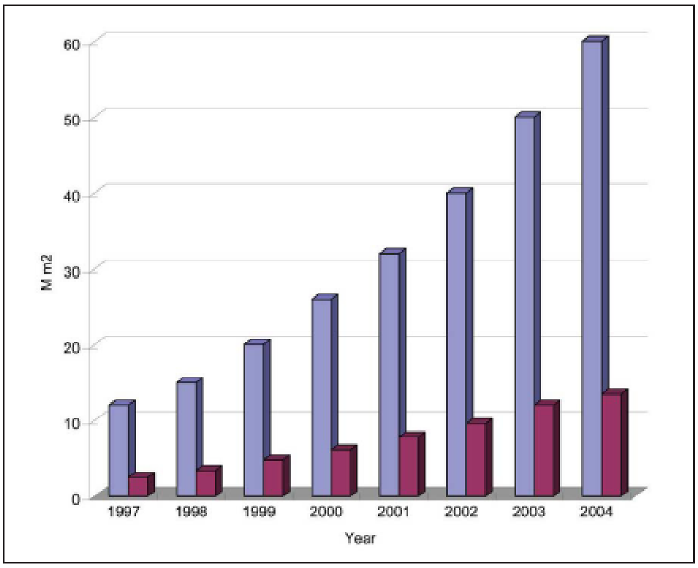

Figure 1: Annual production and cumulative installed capacity (in millions of square meters) of solar water heating systems in China by year.

www.re-focus.net

There are three types of SWH in China (flat plate, combined storage and vacuum tube collectors) but evacuated tube collectors are by far the most common : 88% market share in 2004 (Ib.). SWHs are mostly used as a hot water source for showers (90%) but there is increasing use of large and middle sized collective systems to providing hot water to hotels, schools, factories, etc.

In urban areas, SWH is competing with electric and natural gas heaters to provide hot water, occupying nearly 12% of market share and providing hot water for more than 35 million families (Table 1).

Table 1 : Rate of ownership of domestic water heaters installation in urban areas

	Market share	*Annual growth rate*
Electric heaters	31.3	*+ 36%*
Gas heaters	57.4	*+ 7%*
SWHs	11.2	*+ 29%*

Source : Bosselar et al., 2004

Prices

The market initially focused on low income rural families has developed toward high value market segment , ie, larger collector area and water storage capacity as requested by higher income urban families. In 2002, 70% of SWH were sold at a price lower than 150 € (1€ = 10 RMB – exchange rate 07/2006). Today in the upper range of the market, the price for installing dual loop forced circulation system with 4-6 m² of solar collector and electric auxiliary water heater is about 1000-1500 €. On average, a SWH based on vacuum tube type technology with 1.5-6 m² of collector area, 300 l of water storage and a forced circulation system costs between 350 and 550 € (Bosselar L. et al., 2004).

Supply side (industry / prod. Capacity)

Over one thousand SWH manufacturers currently operate in China but about 100 are considered as competitive (Wallace, 2006). With a production capacity over 16 million m², China is the world's largest manufacturer of SWH equipment. Exports are increasing due to quality improvement of vacuum tube collectors but they still remain very low (1% of sales in value). Following R&D activities in the 80s, Chinese manufacturers have realised a breakthrough in the all glass vacuum tube technology. China is now developing its own technology for the industrialisation of SWHs.

Drivers / measures

China is one of the few countries with a commercial SWH market in the world. The government does not offer subsidies or low interest loans to manufacturers, installers or end-users of SWH systems. Most SWH manufacturers are privately-owned enterprises and competition is increasing on the market.

The main drivers for rapid development of SWH in China are :

- increasing demand for hot water supply along with economic development and increased income
- unmet demand for hot water in some regions because of unavailable or insufficient supply of electricity or gas
- availability, reliability and reasonable price of SWHs that compete with electric and gas water heaters.
- rise in public awareness for environmental protection

Although there are no explicit policies for promoting solar hot water in buildings, building design and construction by developers has begun to incorporate solar hot water, and there are new government programs for technology standards, building codes, and testing and certification centers. The new Renewable Energy Law will encourage the use of solar systems and request that administration implements appropriate policies for the integration of solar systems in buildings

Perspectives / impacts /

Further development of SWH use in Chinese buildings is constrained by two difficulties:

problems

- despite the creation of national standards (testing and evaluation, product, industry standards) there are still some problems of product quality related to lack of enforcement.
- the current technology is not appropriate for adequate integration in new buildings and as a consequence solar systems are often disapproved by local authorities because of aesthetic problems.

This issue of system design and building codes for the integration of solar systems in new buildings might be the key for an increased development of SWH in China.

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INDIA

Context	Potential deployment of solar thermal technologies is important in India but the equipment rate is still limited. Penetration of solar systems for water heating is higher in the southern region due to relatively lower temperatures but lower in the north where the need for hot water is limited to a few months. Up to now the market has been dominated by large commercial and industrial applications with a limited initial deployment of domestic systems. With the increase of energy prices and improvement in the costs of SWH systems, the share of domestic applications is increasing. Initial direct subsidies have been gradually reduced and finally removed in 1993-94. Nowadays the main incentives to the deployment of SWH systems are in the form of soft loans available for domestic and professional applications.
Market development	According to the IEA, the installed area of glazed collectors in India was 200 000 m² in 2004, and the cumulated installed capacity would be close to 1 000 000 m². The Indian market of solar collectors is divided in two distinct parts, domestic applications, on the one hand, and industrial and commercial applications on the other. Historically the focus has been on large thermal solar systems producing process heat in industry or hot water in hotels, hospitals, etc. These applications in commercial and industrial sectors still represent 80% of the newly installed collector area but the domestic market is slowly increasing in the recent years.
Prices	The typical solar domestic hot water system in India has a storage capacity of 100 litres with a collector area of 2 m² (thermosiphon principle). The total cost of such a domestic system is close to 400 € (ESTIF, 2003), i.e. 200 €/m². The cost breakdown of an average system is as follows : - Production (materials and labour) : 74% - Installation : 17% - Marketing / distribution : 9% Ministry of Non-Conventional Energy Sources (MNES, 2005) has estimated that an average domestic system (100 l) saves approximately 1500 kWh of electricity per year which represents a payback time of 2-3 years (if electricity is displaced and 6-7 years if it is coal).
Supply side (industry / prod. Capacity)	Domestic industry is already well developed although comprising mostly small and medium enterprises. There are around 60 manufacturers of SWH systems in India employing approximately 800 persons. The manufacturers produce the SWHs' systems components but they also provide for installation and maintenance, distribution, sales and marketing.

Perspectives / impacts / problems

According to the medium term goals of the renewable energy policy, a 10% share of renewables in the new power capacity to be installed in 2012 and the deployment of solar water heating systems in 1 million houses.

As typical solar systems were initially devoted to large scale industrial or commercial applications, SWHs were in India designed on request so as to fit specific situations / needs ; marketing, installation, after sales services was carried out by the manufacturers themselves mostly on a centralised basis (local / regional networks for commercial, installation and after sales services was very limited).

With the rapid development of applications in the domestic sector, networks of installers are emerging and some manufacturers have begun to rely on dealers for commercial / installation / after sales activities, but 90% of sales and installation are still done directly by the manufacturers. As a consequence, the market development toward domestic applications is hampered by the lack of adequate level of sales and maintenance infrastructure and the perceived reliability of the suppliers in terms of after sales services and maintenance is considered as a major barrier to development of the market.

Another key issue to the development of the solar market is the access to micro credits for the households. The Government has implemented a soft loan programme through the Indian Renewable Energy Development Agency (IREDA) and a few designated banks but credit availability is still limited given the vast potential market. As a corrective measure, the decision has been made to widen the access to low interest loans by increasing the number of banks and financial institutions providing financing throughout the country.

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MEXICO

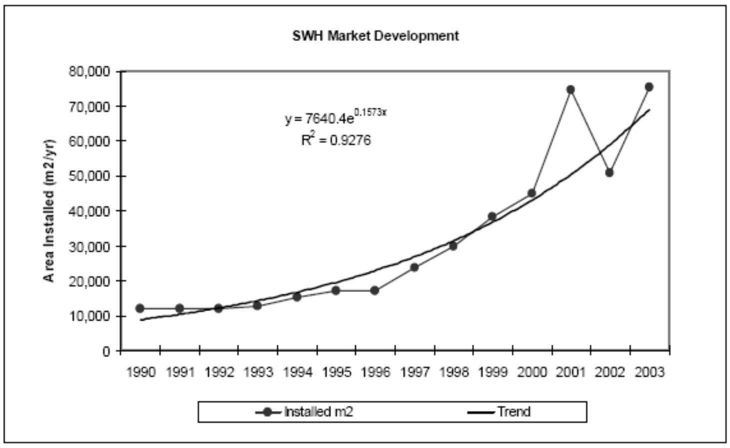
Context

In Mexico no specific policies have been implemented in order to support the development of SWH in residential use. As a consequence, the market has mostly developed toward the application of SWH for swimming pools and residential use remains a niche market. Nevertheless, development perspectives are important for domestic applications of SWH given the trend of energy price increase if appropriate policies are implemented to lower the main constraints to adoption.

Market development

The market for SWHs has developed fastly since the beginning of the 90s. The sales remained almost stable from 1990 to 1995, around 10- 15 000 m², and then grew steadiliy to reach 75 000 m² in 2001. The resulting installed surface of SWHs that was approximately 150,000m2 reached almost 574,000m2 in 2003.

Figure 1 : Development of SWH in Mexico



Source : Negrete from Martinez, 2005

Nevertheless it is important to notice that SWH technologies are employed for water heating applications in different sectors (unglazed collectors for pool heating applications, to glazed collectors for residential, commercial and industrial uses). By far the most developed market is water heating for swimming pools with 78% of sales, followed by industrial and commercial applications (14% of sales). The residential applications do not represent more than 10 % of the installed surface of solar collectors each year in Mexico and approximately 1% of all SWH installations (Davila 2003) .

Prices

The installation price of a typical SWH system for residential use is 1500 – 2000 $ (Quintanilla 2000 – Davila, 2003 cited by Milton & Kaufman, 2005), a price that is much higher than prices for similar systems in other emerging countries such as China or India. According to Castro (2005), the investment cost (equipment and installation costs) for SWH systems is 3.0 – 3.5 times higher than the cost for convention water heating systems (LPG water heater with or without backup system).

Supply side (Industry / production capacity)

In 2000, there were 48 national manufactures and 19 retailers of SWH systems in Mexico, sixteen of them national and three importers.

Drivers / measures

Natural gas or LPG fired devices are widely available in Mexico for water heating applications. The main driver for the development of SWH systems is cost effectiveness. Despite still low conventional energy prices (LPG and NG are subsidised for household uses), the installation of a thermal solar system for hot water heating is cost effective in Mexico, in pools applications and increasingly in residential applications due to rising energy prices: the payback time for a solar system dedicated to residential water heating is 5 to 6 years (Castro, 2005) with a LPG backup.

High upfront capital costs are still an important economic barrier for low or average income households which cannot afford to spend so much money in a water heating device even if it could paid back in 5 or 6 years. As other countries' experience has shown, this economic barrier could be removed if adequate financial instruments were developed.

Other classical barriers to the development of SWH market in Mexico are:
- low quality of equipment and installations and lack of adequate maintenance
- lack of awareness among the public about the existence, the performance, the economic benefits of SWH technology
- limited availability of qualified installers

No significant financial measure (direct capital grants or soft loans) in favour of SWH systems has been implemented yet at the national level. The most significant measures that are worth noting are the following:
- The Solar Energy National Association (ANES) is a tentative to structure the solar energy sector in Mexico ; different actions have been initiated by ANES such as solar thermal equipment standards, organisation of technical workshops for installers, promotion of solar energy among the general public, etc., with the goal to increase the market for solar thermal technology.
- The CONAE Pilot Programme is aimed at providing information on the performance of existing SWH systems and the clients satisfaction ; the ultimate goal is to help defining an adequate national policy for SWH technology in the future
- At the local level, the government of Mexico City is also promoting solar technology with a program to install SWH systems in 50,000 homes over a five years period as a part of the city's strategy to improve air quality (pilot project to install 5 000 systems).

The government of Mexico City has also established tax rebates for low pollutant technologies: labour and land fiscal taxes can be reduced for SWH owners including households, commercial and industrial buildings.

Perspectives / impacts

Given the absence of a structured solar thermal sector, the limited awareness and present bad perception of the technology by the public, the potential market of SWHs in Mexico appears to be limited in the short term.

Nevertheless, the Mexican market is increasing in the absence of major incentive policy since several years, so it may be inferred that development potential is very significant if adequate measures such as capital subsidies or soft loans are implemented.

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SPAIN

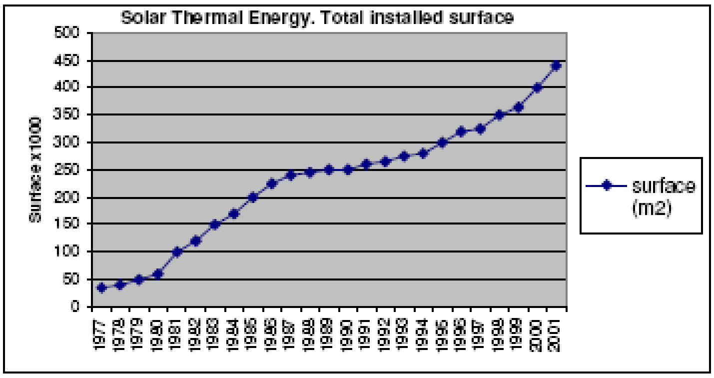
Context

There is no a specific law in Spain to stimulate the development of HWS systems
in buildings. The market growth is sustained since the beginning of the 90s but the installed capacity per inhabitant was still below the European average in the year 2005, albeit the important solar potential. Nevertheless, the expansion of the solar collectors market is expected to speed up with the launch of new regulations by several authorities that make mandatory the use of solar energy for hot water in new buildings. These local policies have been implemented following the success of the Barcelona experiment.

Market development

At the end of 2005, the cumulated surface of glazed solar collectors installed in Spain was 500,000 m2 (ESTIFa, 2006). The market has grown from 60 000 m² / year in the beginning of the years 2000 to around 180.000 m2 as estimated in 2006 which sets the Spanish market in the 5th position at the European level.

Nevertheless, Spain is still below the European average both in terms of installed area or operating capacity per capita.



Source : Ecofys, 2003

Prices

Total installed cost for a typical solar system is estimated to be between 625 – 1380 € according to the size, with a collector area of 1.5-2 m² and a hot water storage capacity of 200 liters (ESTIF, 2003).

Drivers / measures

The Barcelona Solar Ordinance went into force in August 2000 (ESTIF):

- Aim: to promote and regulate through local legislation the installation of low-temperature systems for collecting and using active solar energy for the production of hot water for buildings.
- According to this bylaw all new buildings and buildings undergoing major refurbishment are obligated to use solar energy to supply 60% of their running hot water requirements. Swimming pool heating must be 100% from solar.
- Area of application: City of Barcelona

Historically, Israel was the first country in 1980 to introduce a regulation about the use of solar energy in new buildings for reasons of energy security. This legislation has had a great success and made SWHs a mainstream technology.

The Barcelona Ordinance has a long history. It was first debated in 1995 and finally approved by the city council in 1999. It came into force in August

2000 after a one-year moratorium to allow builders time to adjust.

The Barcelona Solar Ordinance requires new buildings and rehabilitated buildings to use solar energy systems for hot water supply. The regulation applies to buildings intended for residential, health-care, sports, commercial and industrial use. Different exemptions are being considered in cases where it is technically impossible to cover 60% of hot water requirements with a solar system but a technical study should justify such an exemption.

In practice, the conformity to the ordinance is verified at the time a construction permit is approved. Inspectors are then responsible for ensuring that the building actually provides the 60% hot water demand from solar energy. The projects that do not follow the Municipal Ordinance are liable to sanctions with fines that may reach 3 million euros (Stirzaker P., 2004).

The extra investment incurred by the Ordinance is estimated to be 0.5%-1% in building work and materials (Stirzaker P., 2004). This extra-investment may be financed by interest-free credit arrangements available from IDAE and the public credit institute, Instituto de Crédito Oficial (ICO). The credit backs up to 70% of total investment (Ibid.)

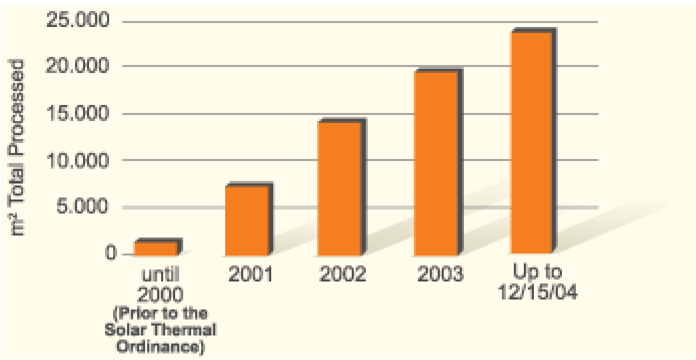
Even with such financing arrangements, reaching a consensus with all the stakeholders involved in the construction sector was essential to the success of the ordinance. Property developers, construction companies, architecture colleges and installation contractors have all been closely associated to the construction and implementation of the regulation. Nevertheless, a 18-month moratorium has been introduced for all the sectors to prepare for the new regulation and for installers to gain statutory certification.

In parallel, the standard certification of solar systems and installation has been developed in order to prevent the installation of low quality equipment as a result of the ordinance. The City of Barcelona has also implemented a broad communication program and organised periodic round tables in order to promote and facilitate the acceptance of the Ordinance.

Perspectives / impacts /

In the year 2005, the cumulated installed surface of solar panels has reached 30 000 m² compared to less than 2000 m² before the ordinance was in place. As the building stock is added, this indicator should rise substantially in Barcelona, as 41% of all new buildings now include SHW. The city's objective is 96,000 m2 of SHW by 2010.

Figure 1 : Evolution of the installed surface of solar panels in Barcelona



Source : http://www.barcelonaenergia.com

The introduction of the Barcelona Ordinance in 2000 and the success of this experiment have led to its extension to several Spanish municipalities (villages and large cities such as Pamplona, Sevilla and Madrid). The

"Barcelona model" has also been adopted in other countries ; in some Austrian regions, for example, the subsidy for private citizens building new residential houses for their own use is being linked to an obligation to install solar thermal heating.

But the most striking evidence of the success of this experience is the introduction of a similar obligation to cover a signification part of the domestic hot water demand in new buildings with solar thermal energy in the new national thermal regulation: the Spanish government has indeed approved the 17th March 2006 the new Technical Buildings Code (CTE, Codigo Tecnico de la Edificacion), which includes an obligation to cover 30-70% of the Domestic Hot Water (DHW) demand with solar thermal energy (ESTIFb, 2006).

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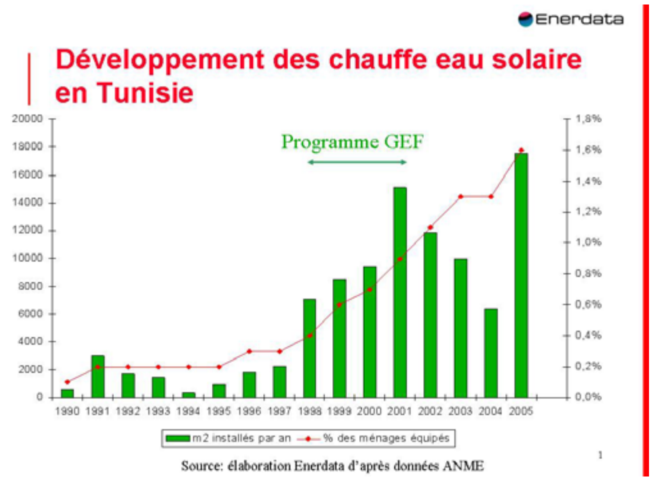
TUNISIA

Context

First development of the Tunisian SWH market goes back to the early 80s. Since then several phases have been observed with successive periods of growth and decline. A real uptake of the SWH market in Tunisia has seemed to occur in 1995 following the implementation of the GEF program. The end of subsidies provided within the GEF program caused a new period of fall down from 2002 to 2004 but the new program implemented in 2005 has allowed recovering the initial dynamic.

Market development

Figure 1 : Deployment of solar water heaters in Tunisia



The development of SWHs' applications in Tunisia can be split in 4 phases:

- Period 1980-1993:

The Tunisian government attempted to create a national industrial capacity for the production of SWH systems. The national company (SEN) has beneficiated from public investments and trade barriers to limit competition with foreign firms. The deployment strategy also relied on an innovative financing mechanism based on credit sale and loans payments recovery through electricity bills. Despite this apparently favourable framework, the dissemination of SWHs remained limited because of uncertain quality, inefficient maintenance services and high purchase prices. The national company went to bankrupt in 1994.

- Period 1994-1996

The middle of the 90's is a transition period with a new deployment strategy relying on the private sector and increased competition. Market opening has been limited as some trade barriers remained but even if the results were not as expected, the sales stopped decreasing.

- Period 1997-2004

This period corresponds to the implementation of an ambitious stimulation program implemented by the Tunisian government and the GEF (Global Environmental Fund). This project was based on the following main features:

- a direct subsidy (35% of the purchase price)
- accompanying measures aiming at developing the global product quality (product, installation, after-sales service, etc.).

- fiscal measures : removal of trade barriers and VAT on SWHs

The program created a clear dynamic of dissemination from 2000 m² of solar collectors sold in 1996 to more than 17 000 m² sold in 2001. This dynamic interrupted in 2002 because the funds provided by the GEF were exhausted and the attribution of subsidies was not possible anymore.

- Period 2005 - …

In 2005 a new incentive program (PROSOL) has been implemented that has reversed the decreasing tendency observed since 2001 and restored a new dynamic.

Prices

A large majority of the SWHs sold in the residential sector are of the thermosiphon technology with the possibility to add an electric back up. The average size of solar collectors is 2 or 4 m² with a storage capacity of 200 l / 300 l respectively. The average cost for locally produced SWHs is 250 €/m².

Drivers / measures

Different incentive measures have been implemented in Tunisia since the beginning of the 80's to stimulate de deployment of solar collectors. The successive programs have all to a certain extent relied on financial incentives: direct grants, soft loans or tax rebates. The evolution of the sales as expressed in the Figure 1 has clearly been greatly influenced by the introduction and removal of these incentives. The Tunisian experience also teaches that financial incentives are alone not effective enough to create a viable market on a long term basis.

The innovative financing mechanism introduced in the 80's (cf supra) has certainly contributed to the first takeoff of the solar collectors' market in Tunisia (30 000 m² installed between 1982 and 1993). But this favourable financial framework has not been sufficient to stabilize the sales when problems of product quality have emerged. New sales and even loan recovery have become difficult or impossible when the good operation of existing equipment has been questioned. The decreasing perceived quality of the solar collectors has contributed to the collapse of the market.

The GEF program (1997-2004) has succeeded in modifying this perception and stimulating new sales. It basically relied on direct financial incentives (35% of investment cost for the customer) plus tax exemption (no custom duties no VAT) for suppliers with some accompanying measures in order to stimulate purchase (information) and preserve products / system quality (training of installers, technical standards). One key issue compared with the previous programme is the willingness of the authorities to maintain / improve the quality of the installations through the implementation of quality standards that were mandatory in order to obtain the financial incentives. This program has proved to be very effective in the first phase (1997 - 2001): the sales have grown from less than 2000 m² in 1996 to 17 000 m² in 2001. Unfortunately, the exhaustion of the budget allocated to the project has caused the removal of the subsidies with immediate consequences on the rhythm of the sales.

Sales of solar collectors have been promoted by the introduction of new incentives in the framework of the GEF project but the subsidies have been removed (2002-03) before the market reached a commercial maturity. The risk was the disappearance of existing firms (manufacturers, importers, installers, etc.) with associated skills and know how, and the loss of confidence in this technology for several years.

The new program Prosol (partnership between UNEP, the STEG and Ademe) which has began in 2005 for a five years period is the continuation of the GEF program. Two financial mechanisms have been introduced: a classical subsidy of 20% of the investment cost with a maximum of 70 € and an innovative financing mechanism similar to the one used in the 80's (soft loan over 5 years with a reimbursement of the loan to the electric utility through the bill).

The main objectives of the programme are twofold:

- to provide the end user a capital subsidy so that the SWH is competitive with LPG (loan is repaid over 5 years),
- to create a credit facility which lowers the interest rate (the interest rate charged for SWH financing is lowered by 7 to 8 points) and provides monthly payments that are equal or very near conventional energy expenditure.

In 2005, the area of collectors installed has been 29 000 m², equivalent to 8,800 households ; by 2011, 222 000 m² of solar collectors should have been installed (Kappen, 2006). According to these preliminary results, it can be assumed that this package of measures is effective in addressing the high up front investment barrier and stimulating market deployment.

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