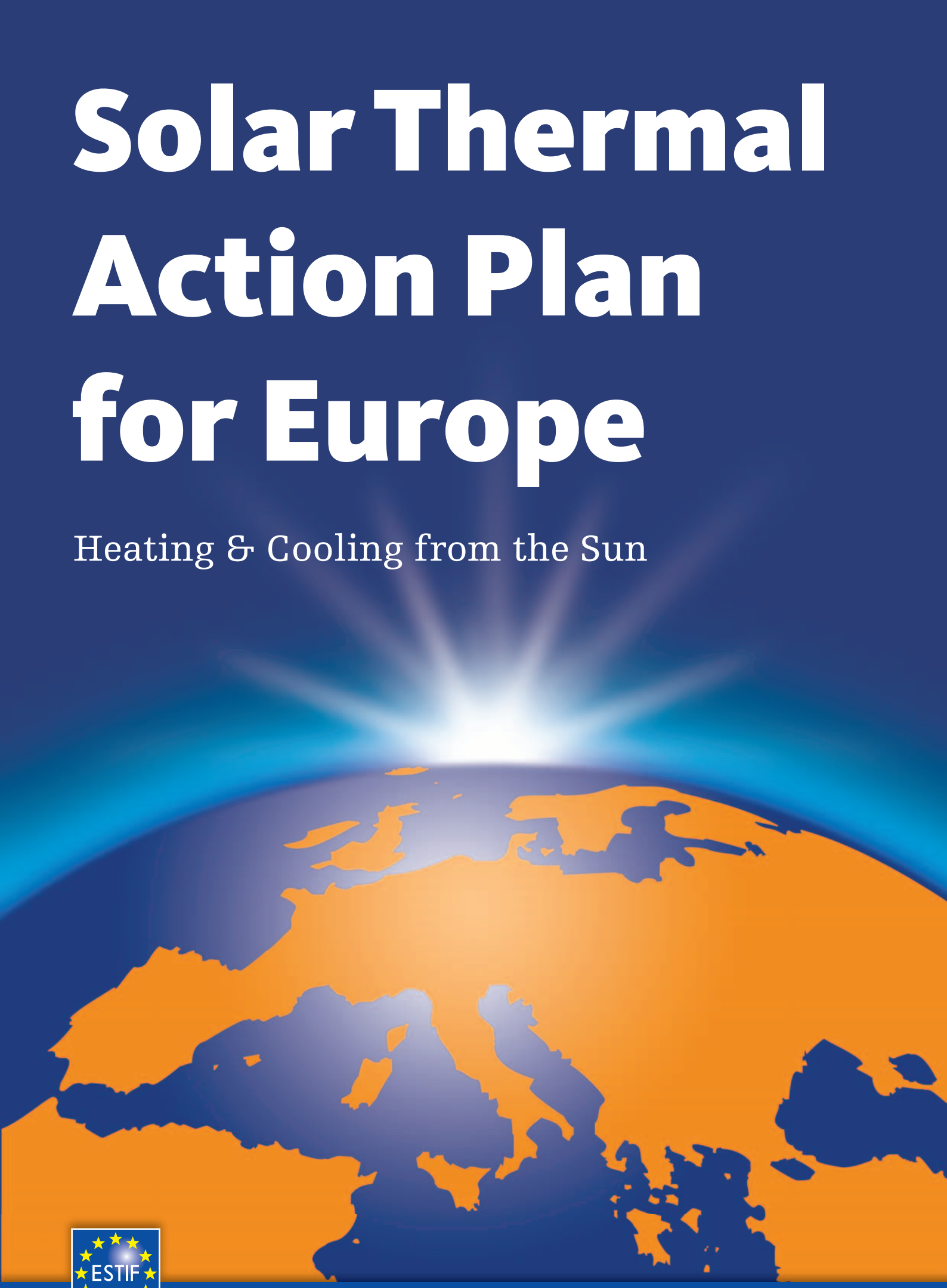
Solar Thermal Action Plan for Europe

Heating & Cooling from the Sun



ESTIF

European Solar Thermal Industry Federation

Solar Thermal Action Plan for Europe

- Solar Thermal Today & Tomorrow
- Market Growth Strategy
- Guidelines for Effective Policies

January 2007

ESTIF

European Solar Thermal Industry Federation

Coherent strategy to promote solar thermal

Introduction

Ten years ago, the European Commission published its *White Paper* on Renewables, proposing a Community Strategy and Action Plan. Since then, European Directives to promote renewables in the electricity sector and in the transport sector have been successful in kicking off substantial growth in these two sectors.

However, the renewable heating and cooling (RES-H) sector has been neglected at EU level and in most Member States. Thus, the fragmented solar thermal development is not surprising. If all EU countries used solar thermal as enthusiastically as the Austrians, the EU's installed capacity would already be 91 GW_{th} (130 million m^2) today, far beyond the target of 100 million m^2 by 2010, set by the *White Paper* in 1997. However, this target will be missed by a wide margin, due to the numerous countries that are still in the starting blocks.

We warmly welcome the *Renewable Energy Roadmap* presented by the European Commission on 10 January 2007, as it definitively corrects this misperception and fully integrates RES-H into the European strategy. Regrettably, the *Roadmap* does not measure up to its own message, as it fails to follow the European Parliament's resolution of February 2006, which called for an EU Directive to promote RES-H, including targets at EU and national level. This call is widely supported by a broad coalition of industry, environmental organisations, research and citizens.

While the political debate at EU level develops, all Member States are urged to act as soon as possible to promote solar thermal in their own country.

This *Action Plan* helps policy makers to identify successful support strategies. The analyses carried out in the course of the *Key Issues for Renewable Heat In Europe* project clearly show: Public support policies have had a strong impact on the successful development in countries as diverse as Greece, Austria, Germany and recently also France and Spain.

The most successful countries have supported solar thermal over longer periods – thus avoiding a destructive stop-&-go of the market – and have implemented a coherent mix of measures, which address not one but several barriers to growth.

Most of these barriers are directly related to the small size of the market. As soon as a critical mass is reached, these barriers vanish:

- People know about solar thermal and find it natural to use it
- Standard training of craftsmen includes solar thermal
- Architects foresee solar thermal as a standard feature in buildings
- Every installer offers solar thermal systems
- Industry invests heavily into market development, R&D
- Mass production and marketing drive down costs

Ten years after the *White Paper*, the solar thermal sector is in a better position than ever before: Today, an established industry produces highly reliable solutions for sustainable heating and cooling. Solar domestic hot water systems are mature technologies. Combi Systems, which additionally cover parts of the space heating demand, are now widely used in several countries. Promising applications such as solar cooling and process heat, expected to play an important role in tomorrow's energy supply, are slowly finding their way into the markets.

At the same time, the need for a heating and cooling supply based on renewables has become more and more apparent. In a few decades, oil and gas will be too precious to be wasted for low temperature applications, which could be easily supplied by solar thermal. The clear and unmistakeable signs of global warming highlight the urgency to reduce greenhouse gas emissions.

Therefore, a new and ambitious goal for solar thermal in Europe is needed. As a minimum, by 2020 we should aim at reaching the same solar thermal penetration on average as Austria has today. This Central European country has shown that it can be done. With more ambitious policies, a bigger goal can be reached: $1m^2$ of collector area for every European – 320 GW_{th} of installed capacity in 2020.

To be effective, European targets must be followed by targets and measures in each Member State. National targets are essential to make sure that support measures are conceived with a long term perspective and they continue for sufficient time.

We hope this document will help policy makers at European, national and local levels to design successful policies leading each European country to a full exploitation of its potential for clean, safe, cheap and endless solar energy for heating and cooling purposes.

Ole Pilgaard, President, ESTIF
11 January 2007

Can Euro

not to use the heat of the sun?

In 2005, solar thermal systems in the EU produced an amount of energy equivalent to more than 686.000 tons of oil. It would take 34.000 large lorries to carry this amount of oil, and if lined up in a row the lorries would cover the distance from Lisbon to Madrid.

Solar thermal energy production per year equals the energy carried by ...

1990

7.000
heating oil lorries

2005

34.000
heating oil lorries

2020
minimal target

278.000
heating oil lorries

pe afford

ESTIF's minimum target for 2020 is to produce solar thermal heat to the equivalent of 5.600.000 tons of oil. To carry this amount of oil, 278.000 lorries would be needed to transport this amount of oil, which would form a row from Lisbon to Moscow.

A more ambitious – but feasible – target for 2020 lengthens that row from Lisbon to Sydney. And the long term potential of solar thermal in the EU is even bigger: over 73 millions tons of oil per year – a lorry row spanning 1,5 times around the globe!

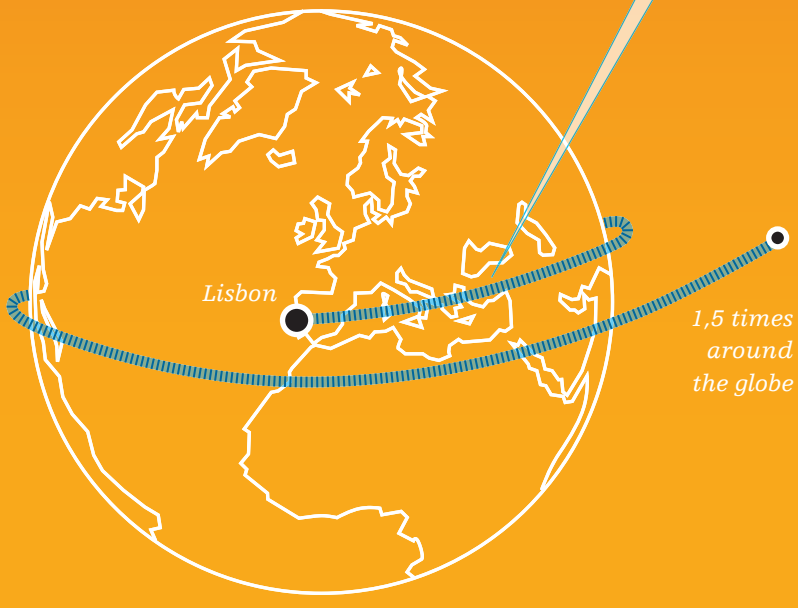
2020
ambitious target

982.000
heating oil lorries

long term
potential

3.655.000
heating oil lorries

For an explanation of the targets, potential and energy values, see page 9.
The assumptions used for this comparison are:
a lorry has a 20.000 litre capacity, and a length of 16,5 metres plus 1,5 metres of distance between each lorry in the row.



Solar Thermal

"15 % of detached houses in Austria already use solar thermal"

Today & Tomorrow

Solutions for sustainable heating & cooling

The lion's share of solar energy worldwide

With solar energy we can produce heating and cooling (solar thermal) and electricity (photovoltaic and concentrating solar power).

Solar thermal makes up more than 90% of the solar energy capacity installed worldwide. It is one of the most cost effective forms of renewable energy and has an immense potential for growth, within Europe and beyond.

Solar thermal systems are based on a simple principle known for centuries: the sun heats up water contained in a dark vessel. Solar thermal technologies on the market now are efficient and highly reliable, providing solar energy solutions for a wide range of areas of use and potential users.

Areas of use

Domestic hot water and space heating

Most of the energy consumption of households is linked to two basic needs: hot water, and warm rooms in winter. To meet them we need low temperatures in the range of 40–60°C, that can be easily supplied from the sun, avoiding an unnecessary waste of oil, gas or electricity.

Even the simplest solar thermal systems can provide a large part of the domestic hot water needs. With some more initial investment, nearly 100% of the hot water demand and a substantial share of the space heating can be covered with solar energy. Natural flow systems work without any need for pumps or control stations. They are widely used in Southern Europe. Forced circulation systems are more complex, and can also cover space heating. These so called Solar Combi systems are more common in Central and Northern Europe.

Solar assisted cooling

A growing number of demonstration projects shows the huge potential for solar assisted cooling. Solar chillers use thermal energy to produce cold and/or dehumidified air. When backed up by biomass boilers, 100% renewable cooling systems are possible. Solar cooling is on the edge of wide market introduction and substantial cost reductions are expected in the next few years, through technological development and economies of scale.

A typical solar cooling system also provides space heating and hot water – which is why they are often called Solar Combi+ systems. For hot water, the demand is relatively stable throughout the year and can be covered completely by solar energy. The demand for space heating is higher in winter when solar energy is less available. Ordinary solar thermal systems cover only a part of the space heating demand, with the remainder covered by a back-up system.

Cooling demand in summer typically correlates with high solar irradiation. Then, solar energy can easily provide more than half of the energy required for cooling, the remainder being provided by the same back-up system used in winter for heating.

This will be a key answer to the problems created by the growth of cooling demand in many European countries.

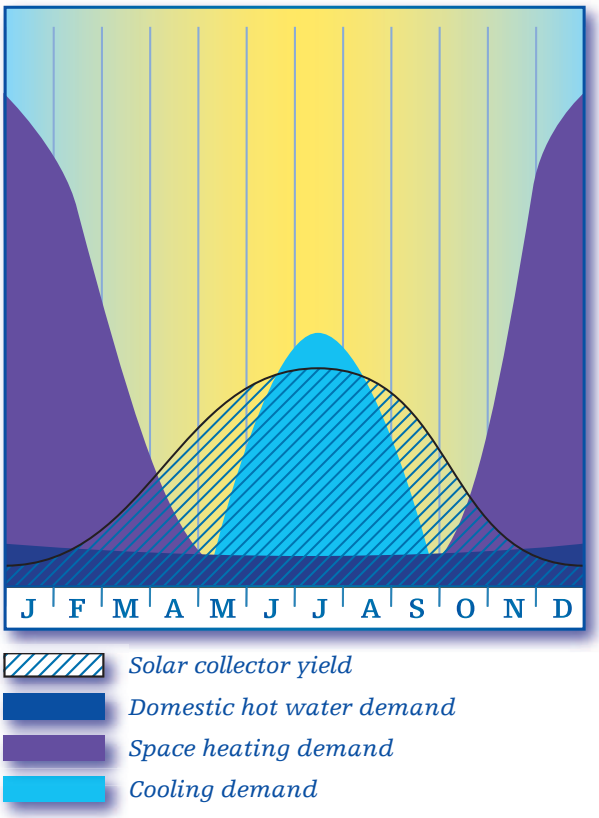
Industrial process heat

Solar thermal can also provide the heat needed in many industrial processes. Ordinary solar collectors typically provide temperatures around 60–100°C, that are suitable for many applications like food processing, water desalination, industrial washing processes etc. These

Natural flow system
Domestic hot water

Forced ciculation system
Solar Combi – Hot water and space heating

Solar cooling & heating system: demand & supply



Solar thermal can cover a substantial part of the heating and cooling demand in a typical Central European building.

uses cause a significant share of the industrial heat demand. Medium temperature collectors for higher temperatures have been demonstrated but further research and development is needed to standardise them and to reduce their costs. Process heat applications are still very rare, but there is a large potential for growth in this area, as solar thermal becomes more cost competitive and awareness of decision makers increases in this area as well.

Swimming pools

Inexpensive unglazed collectors are an ideal solution to achieve a longer bathing season without energy consumption. With glazed collectors, high solar fractions can also be achieved beyond the summer, and solar energy can be used for both space heating and clean, hot water.

Market segments in the building sector

Small residential

Roughly 90% of the solar thermal market volume in the EU has so far been in the small residential sector.

In Austria, 15% of detached houses are already equipped with a solar system. The market share of Solar Combi systems, providing both domestic hot water and space heating, has recently grown to almost 40%.

In this segment solar thermal has meanwhile become a standard product, installed millions of times in Europe, but most of them in three countries only (see pages 8 & 9).

Large residential, tertiary and industrial buildings

Solar thermal can be particularly convenient for larger central heating systems, and especially where there is a relatively constant heat demand. This is often the case in large residential buildings, hotels, elderly or student houses, hospitals, sport centres, shopping centres etc. These kinds of buildings usually offer optimal conditions for the use of solar thermal energy, including cooling.

There is already a broad technical experience with these larger systems, and in Spain they are the dominant system type. In many other countries, however, the level of market penetration is still very low, mainly due to social, legal and economic factors.

For more information and a good practice database, visit: www.solarge.org

Key benefits of solar thermal

- Inexhaustible
- Reduces the dependency on imported fuels
- Saves CO_2 emissions at low costs
- Curbs urban air pollution
- Creates local jobs and stimulates the local economy
- Is a proven and reliable renewable energy source
- Is immediately available – all over Europe

Solar thermal tomorrow

Today, mature products exist to provide domestic hot water and space heating with solar energy. But in most countries they are not yet the standard option in buildings. The European Solar Thermal Technology Platform (www.esttp.org) has developed a vision for solar thermal in 2030, which shows that by then up to 50% of the low and medium temperature heat can be covered by solar thermal. Integration into buildings will be significantly improved, costs will go down and the almost untapped potential in the non-residential applications will be more and more exploited through newly developed technology. Public support for market introduction and for research and development will help to reach this critical mass of the sector, from which it will be able to grow in a self-sustained way.

Market growth, targets & potential

A growing market

The European solar thermal market is booming. A growth rate of well over 30 % is expected for 2006.

Based on provisional figures, the market volume in the EU-25 has been very close to 2 GW_{th} newly installed capacity in 2006, compared with 0,6 GW_{th} 10 years before.

The total solar thermal capacity in operation was 5 GW_{th} in 1997, 10 GW_{th} in 2004 and will reach 15 GW_{th} in 2007.

Around 2 million European families already directly benefit from solar thermal energy, as do other frequent users such as hotels, sport centres, office buildings etc.

Beyond policy support, which is discussed in other parts of this document, the main drivers of these high growth rates are:

- Growing awareness for solar energy, at least in some countries
- Increasing prices of conventional energies
- Growing concern over the security of supply with imported fuels
- The unmistakable and visible signs of climate change

At the same time, the solar thermal industry has improved its products and services and is widening its distribution networks.

A positive development is the growing market share of Solar Combi systems, which support space heating as well as producing domestic hot water, thus leading to higher energy savings. In Austria, Solar Combi systems already have a market share of almost 40 %.

Most countries are still in the starting blocks

However, this growth is still only driven by a few leading countries, whereas most EU countries have yet to begin substantial market development.

For many years, over 70 % of the solar thermal sales have only been concentrated in three countries: Germany, Austria, Greece.

France and Spain have had very good growth rates in the last few years, but they still have much smaller markets than Austria or Greece, which only have a fraction of their population.

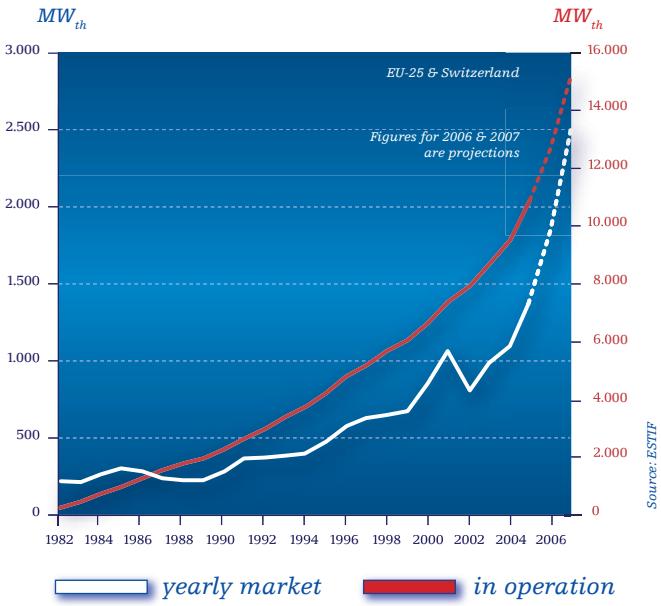
At the end of 2005, the capacity in operation per capita ranged from 479 kW_{th} / 1000 capita in Cyprus and 199 in Austria to less than 10 in high potential countries such as Italy, France and the UK.

In comparing the capacity in operation per capita of regions with similar climatic and economic conditions:

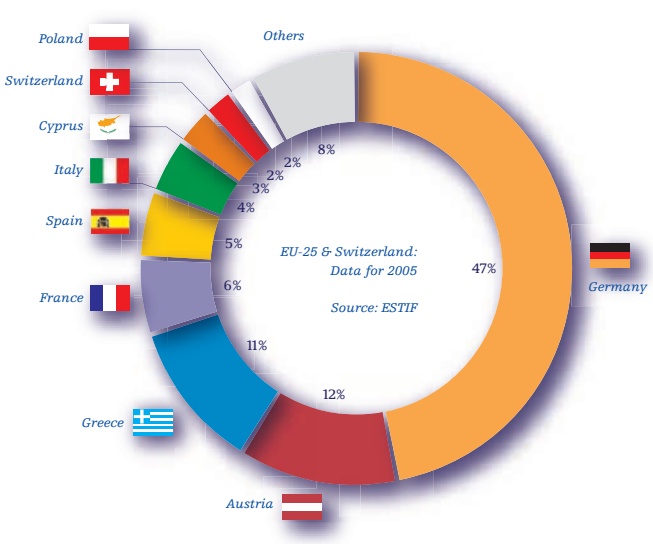
- Greece beats Southern Italy nearly 50 to 1
- Austria beats Northern Italy by more than 20 to 1

Similar ratios can also be observed when comparing neighbouring regions of France and Germany, or Denmark with the UK.

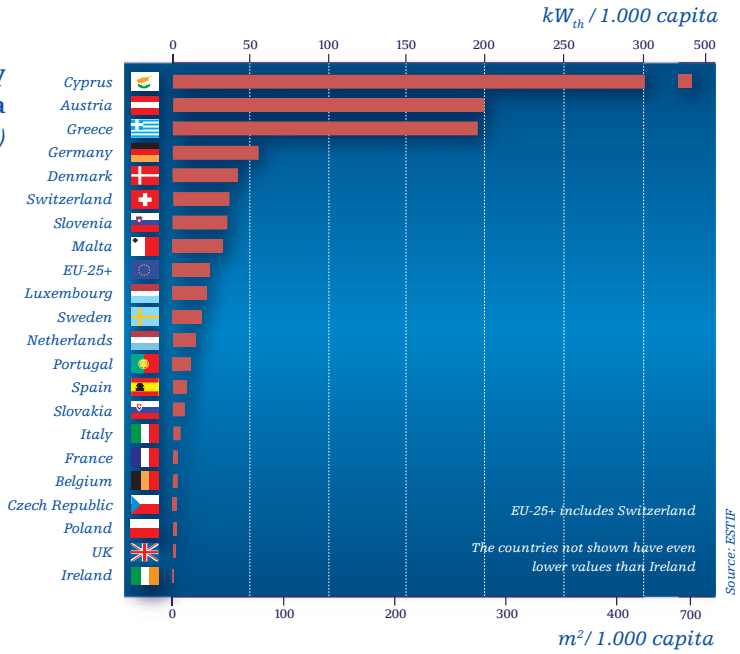
Growth of solar thermal in Europe
(Yearly market and capacity in operation)



Share of solar thermal market
(Newly installed capacity)



Solar thermal capacity in operation per capita
(End of 2005)



These huge differences are a problem and an opportunity simultaneously:

Problem: because the low market development in most EU countries tends to be a self-perpetuating cycle of imbalance (see pages 14 & 15). Economies of scales are missed as long as only a few countries have substantial market volumes.

Opportunity: because the leading countries demonstrate in practice the huge potential which is easily achievable at EU level.

Targets for 2020

15% of detached houses in Austria already use solar thermal. In some villages, solar collectors can be seen on most roofs and people are proud of them. This shows the way ahead for the rest of Europe.

Even in Austria, 85% of detached houses still have no solar heating, of which only a tiny fraction are not suitable for technical reasons. Thus, the potential for growth is immense, particularly considering other market sectors such as multi-family houses, industrial and office buildings, which have been less developed sectors to date.

The ESTIF 2020 minimal & ambitious targets are based on a mix of technical, economic and political considerations.

Technical: market phase-in of new applications, considerable advancement in heat storage and solar cooling which will impact on the market around 2015–2025.
Economic: further cost reduction of solar thermal, and the continuing cost increase of fossil fuels.

Political: In the case of the minimal target: business as usual, i.e. fragmented support. In the case of the ambitious target: strong support EU-wide.

	Capacity in operation (GW$_{th}$)	*kW$_{th}$ per 1.000 capita*	*Energy produced (tons of oil equivalent)*
1990	2,2	5	137.897
2005	11,2	24	686.493
Minimal target 2020	91	199	5.600.000
Ambitious target 2020	320	700	19.650.000
Long term potential	1.200	2.600	73.100.000

The above table shows the energy produced by solar thermal systems in the EU in the past and in the future, according to the scenarios discussed.

2020 minimal target (Austria scenario)

The minimum goal for the EU in 2020 should be to reach the solar thermal usage of 199 kW$_{th}$ per 1.000 capita of Austria in 2005, equivalent to a total capacity in operation of 91 GW$_{th}$ in the EU.

This central European country needed 20 years to reach this level, but meanwhile new and improved products have been developed and now there is an established European-wide industry. The market growth rate needed to reach this minimal target is 16% per year, well below the EU average of 2002–2006. However, to reach this target a better political framework is needed throughout the EU, to make sure that the growth is shared in all countries.

2020 ambitious target (1m² per capita)

With a suitable support framework it will be possible to reach 1 m² of collector area (0,7 kW$_{th}$) for every European in 2020, equivalent to a total capacity in operation of 320 GW$_{th}$ in the EU.

In the residential sector alone about 2 million EU families have already installed this amount of solar capacity.

To reach this target, solar will be widely used for both cooling and process heat, though the majority of this capacity will still supply domestic hot water and space heating.

The average yearly growth rate of the EU market necessary to reach this target is 31% – less than the rate achieved in 2006 and only 7% above the 2002–2006 average.

Long term potential

The long term potential of 1.200 GW$_{th}$ assumes that solar thermal is used wherever technically reasonable. This long term solar thermal potential for EU-15 was estimated in Sun in Action II (ESTIF, 2003) and extrapolated for EU-25.
In the long term, this will be a foregone conclusion. In a few decades, wasting gas, oil or electricity for low temperature uses such as space heating will no longer be an option. There will be strong competition for limited biomass resources. For heating and cooling, solar will be the main outstanding alternative, combined with geothermal where available.

Replacing imported fuels with local jobs

Building up a dynamic industry

What started in the 1970s as garage businesses is now an established international industry. Some of the pioneers are still amongst the market leaders. A number of major players from "neighbouring" sectors entered the market. At the same time, several solar thermal companies are diversifying into other renewable energies such as biomass heating or solar photovoltaics.

The large majority of the systems sold in Europe are manufactured within the EU or its Mediterranean neighbours. Imports from Asia are limited mainly to components such as evacuated glass tubes. For European manufacturers, exports outside the EU are becoming a growing market. The main selling point is their high quality and reliability.

The industry is in a phase of dynamic growth. Production lines are constantly being expanded. Employment in the European solar thermal sector already exceeds 20.000 full time jobs. As in all industrial sectors, manufacturing will be more exposed to global competition as the market develops. However, for solar thermal, nearly half of the jobs are in retail, installation and maintenance. This work is necessarily local, and creates jobs mainly in small and medium sized enterprises, directly in the regions where the solar thermal market is developing.

For the time being, solar thermal is used together with a source of back-up heating. Therefore, solar thermal does not replace another industry's products, but really adds new demand and jobs. This higher initial investment pays off for the investor by reducing the conventional fuel bill over the lifetime of the system. For society it is even better: Solar thermal replaces imported oil and gas with local labour!

With solar thermal going into the mainstream, employment in the sector at EU level will reach half a million full time jobs within the next few decades.

Training & education

Training and education are key to achieving a wider adoption of solar thermal energy.

Of course, it is necessary to increase the awareness of end consumers of solar thermal. However, a decisive role in the market is played by professional groups such as architects, planners and installers, who are the interface between end consumers and industry. These professionals often determine, or have a strong influence on, the end consumers' choice about heating systems.

Usually, the standard education and training of these professionals does not include solar thermal technologies. Unfortunately, this is still the case for the current training patterns in many countries.

For this reason, many of these professionals do not feel comfortable recommending solar thermal to their customers, or even discourage them to avoid dealing with a technology still unknown to them. At the same time, lack of training can lead to poor planning and installation, thus creating quality problems and decreasing the acceptance of solar heating.

Solar thermal is not rocket science, but it should be included in normal training of relevant professionals – all over Europe. This would immediately tear down one of the main barriers to growth today.

European industrial leadership

The European industry is the worldwide technological leader in solar thermal.

High efficiency collectors use highly selective absorber coating, which absorb more solar irradiation and emit less infrared radiation. This increases the overall solar thermal energy production. These coatings are available mainly from a small number of European manufacturers who export their coated material to collector manufacturers worldwide. Europe is also leading in research and manufacturing of high quality heat tanks.

In solar cooling, European researchers and companies have a clear technological lead. Beyond system design and high quality collectors, the key challenge for wide market introduction of solar cooling lies in the development of smaller and more cost effective thermally driven cooling machines. More recently, products have been developed that can also be used in small residential buildings, opening new market segments for solar cooling. Most of these new machines have been developed in Europe, and various new companies have been founded here to bring them into the market.

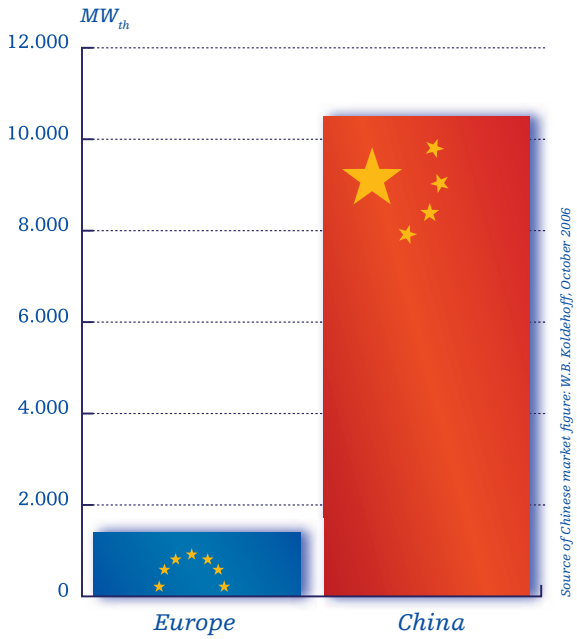
Preparing for global competition

A glance at the growing competition for scarce resources on the global energy markets is enough to understand that solar thermal will be used almost everywhere possible during the 21st century.

Europe is in a good position and has the chance to be the main beneficiary of this new global business field.

In most renewables, Europe is leading both in technology and in the market volumes. However, the latter is not the case for solar thermal, where the Chinese market alone is seven times bigger than the EU market.

Solar thermal market 2005

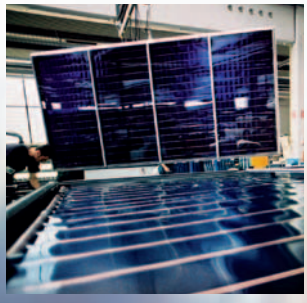


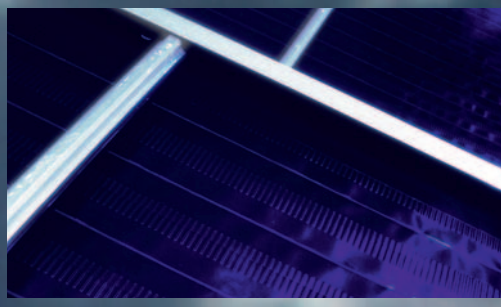
Given the price levels, European manufacturers cannot easily compete in markets like China, India and Turkey. If the EU does not catch up soon with a substantial growth in the domestic market, the European industry will face a hard task in maintaining its technological leadership.

Beyond market growth, maintaining the technological lead requires a joint effort to define and implement the research strategy to answer the energy needs of tomorrow's world. Industry and research, private investors and public authorities co-operate in the European Solar Thermal Technology Platform (ESTTP) to pave the way for solar energy to be the sole source of domestic hot water, space heating and cooling, and a major contributor to low temperature industrial heating in the next decades: The goal is to identify the research issues and lay the foundations to solve them.

Solar Thermal

"Once the market has reached a critical mass, people will find it natural to use solar thermal"





Market Growth Strategy

Kicking off growth towards critical mass

Overcoming the chicken & egg dilemma

For two decades, a constant feature of the European solar thermal market has been the strong imbalance between a few leading countries with developed markets, and a large majority of countries with very slow market development (see page 8).

This imbalance is self-perpetuating. When a country has reached a minimal market volume, growth tends to become self-sustained, even with very low political support, as is the case in Greece. On the other hand, in countries where there is low demand, a vicious circle tends to inhibit growth and the market stagnates.

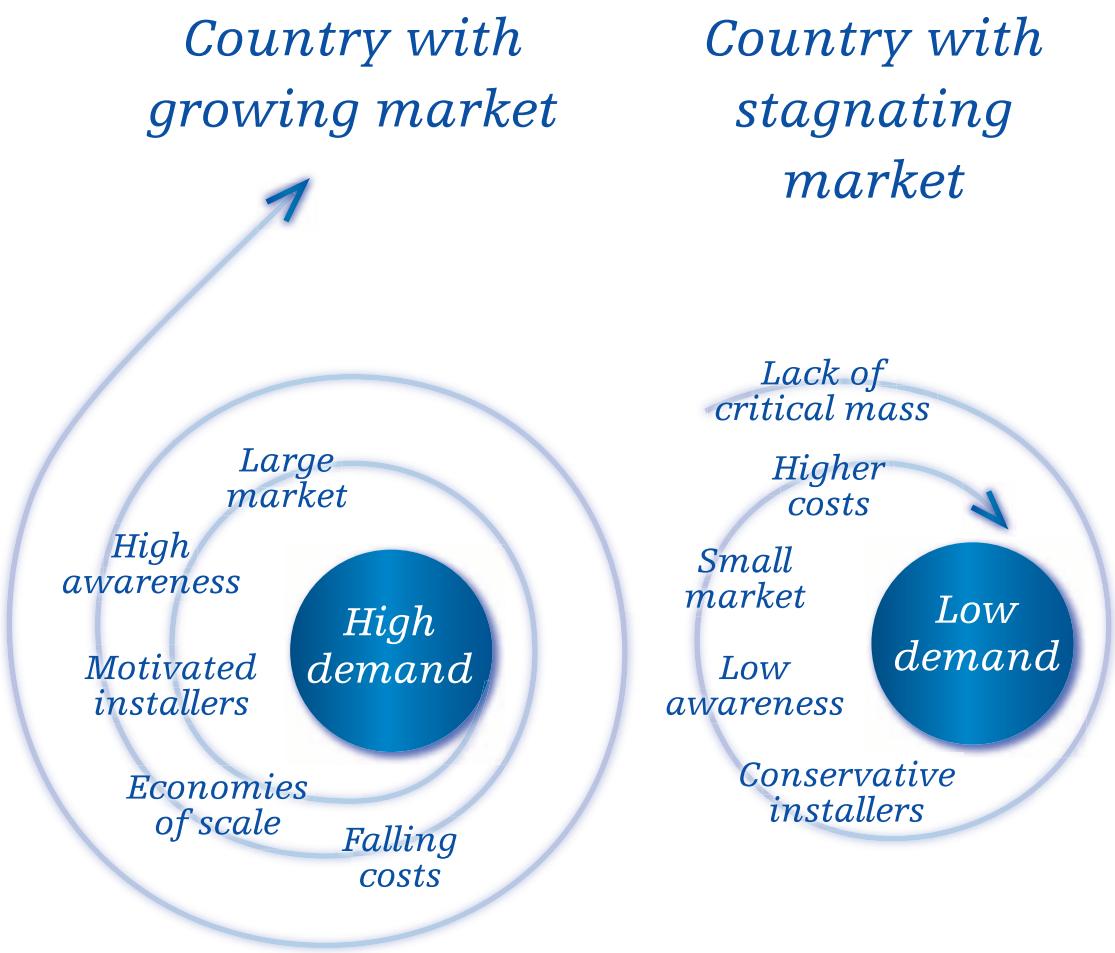
Political support can help break out of this vicious circle by kicking off, and maintaining, market growth until the critical mass of the market is reached.

Critical market mass

Practical experience shows that most of the barriers to growth for solar thermal are linked to the lack of critical market mass. Where solar thermal has reached a sufficient level of market penetration, these barriers vanish:

- People know about solar thermal and find it natural to use it
- Standard education and training of professionals includes sections on solar thermal
- Architects foresee solar thermal as a standard feature in buildings
- Every installer offers solar thermal systems
- Industry invests heavily into market development, R&D
- Mass production and marketing drives down costs

Self-perpetuating cycle of imbalance



Other barriers to growth

A few challenges will remain, independent of the size of the solar thermal market.

Tenant-owner dilemma

In rented buildings, any measure to improve the energy performance is faced with an important challenge: The owner, who has to invest in a solar thermal heating system for example, typically does not benefit from it directly. The investment reduces the fuel costs for heating, but they are usually borne by the tenant. The tenant himself cannot choose his favourite heating system but has to live with what the owner offers.

Higher investment costs

The great advantage of solar thermal is its potential to save energy used for heating and cooling purposes. This advantage is realised over the full lifetime of the solar thermal system – typically 20 years or more – but comes at higher investment costs. For individuals, who only have a certain amount of money to invest, or for businesses, that plan with payback times of just a few years, this higher investment cost can be an important barrier.

Private investment & political framework

While governments can greatly support the fast market penetration of solar thermal, it is the industry itself, which develops the market and makes the necessary investments. Governments at all levels – local, regional and national – should aim at creating a good investment climate in order to activate private capital and resources. By setting long term targets for solar thermal and by providing a positive and stable framework, public authorities can strengthen the confidence of manufacturers, suppliers and implementers, who will then invest the resources necessary for the further growth of solar thermal.

The regional dimension

Heating and cooling are almost exclusively decentralised and even where district heating networks exist, they only supply local demand. This has direct implications for the development of solar thermal markets: They often start locally before they grow to neighbouring regions. On the demand side, consumers become aware of solar thermal and purchase their next heating system with solar thermal. On the supply side, planners and installers are selling more and more solar thermal systems, which encourages them to invest in training and further marketing of these products.

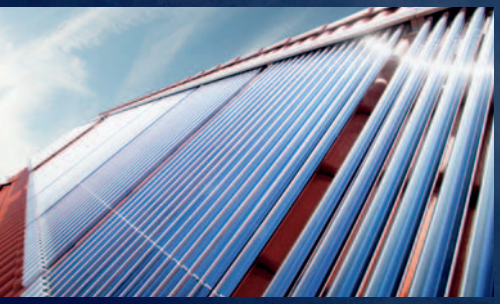
Therefore, public support for solar thermal can be very effectively applied at local and regional level. A more sustainable energy supply, less air pollution and more local jobs are the direct benefits for the region.

The European dimension

With the strong growth of several national markets in the 1980s and 1990s, exports to other countries increased significantly. The development of European Standards and later the Solar Keymark helped overcome barriers to trade stemming from differing local requirements in support programmes (see page 25). The national markets are beginning to merge into one European market and further support for the development or updating of the EN Standards can further this process. This helps develop a strong European industry and increases healthy competition throughout the EU.

While the industry has developed many new products and improved existing components, most solar thermal manufacturers are still small and medium sized companies lacking the necessary R&D budgets for research into new technologies for the coming decades. Today, public R&D funds are necessary to speed up the development of solar cooling solutions, solar industrial process heat plants or advanced heat storage. With growing markets, private companies will invest more and more of their own resources into R&D.

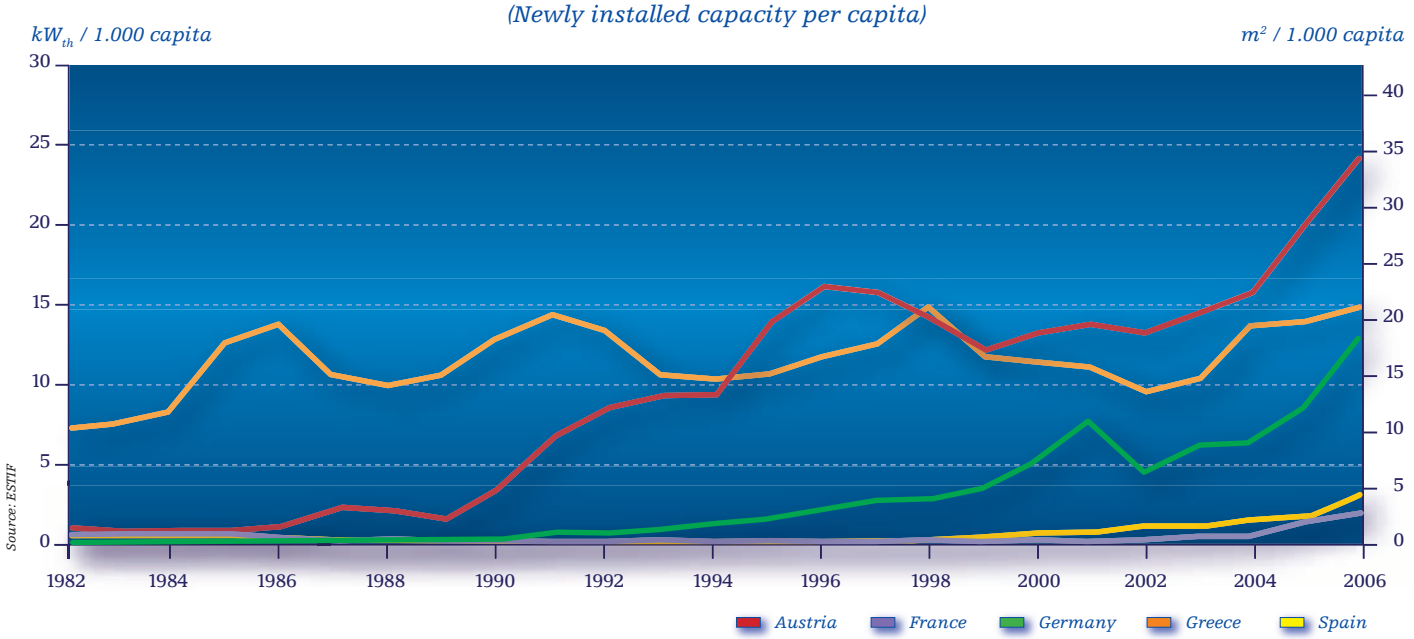
Solar Thermal



"It is this continuity and long term commitment, which creates a good investment climate"

Guidelines for Effective Policies

Key national markets
(Newly installed capacity per capita)



Policy matters!

Experience shows that support policies play a major role in kicking off the growth of national solar thermal markets. Once a critical mass of the market is reached, the intensity of political support can be gradually reduced until the market is fully self-sustained.

The leading countries

As seen above, three countries make up most of the European market. In all of them, public policies have been decisive, particularly in the starting phase of the market.

Greece

In the 1980–1990s, the Greek Government offered financial incentives, combined with awareness raising activities. Their success made the market reach a critical mass. Several years after the termination of the main support programmes, the market is still flourishing: per capita, it is 16 times bigger than in Italy.

Austria

Per capita, Austria is leading continental Europe in solar thermal. The success is largely based on stable, long term public support schemes in several federal states, which include: awareness raising, financial incentives and training of professionals, R&D funds and demonstration projects. Propelled by the domestic market, the Austrian solar industry has become the number one exporter in the EU.

Germany

The largest market in Europe has been built up with the help of suitable policies. The financial incentive scheme "MAP" now enters its 8th year. Awareness raising campaigns at federal and local level have been implemented. With less sunny conditions than Greece, demand is gradually becoming independent from public support: 2006 was a record year, despite the interruptions and substantial reductions of the financial incentive scheme.

The upcoming markets

Except for Cyprus and Greece, the Mediterranean countries have so far been lagging far behind, despite their enormous potential for quick and extensive growth. Recently, two of them have shown strong growth. In France, the market has tripled in only three years. In Spain, demand has increased considerably stronger than in the past. In both countries support policies are strongly supporting this uptake.

France

In 1999, France launched the "Plan Soleil", a comprehensive set of measures to stimulate solar thermal markets. Awareness raising, qualification of installers, financial incentives, demonstration projects and scientific support have shown good results. A tax rebate on solar thermal systems was introduced in 2005 and upgraded to 50 % in 2006. This resulted in very high growth rates, though France is still far behind the leading countries.

Spain

After years of very modest growth, the "Solar Ordinances" in many Spanish municipalities have shown a very positive impact on the Spanish market. These regulations require the installation of solar thermal systems in new buildings. In 2006 this obligation was introduced nationwide through the new technical building code. A much more pervasive growth is expected now, leading to a greatly improved investment climate, with many companies increasing their investments in the development of the Spanish market.

Continuity & coherence needed

As discussed overleaf, public support polices can be a decisive factor for growth, particularly if they are long term oriented, well designed and implemented.

A coherent strategy for strong and sustained growth must take into account the local situation. It should be based on clear targets and include a comprehensive set of measures.

The importance of clear targets

A solar thermal strategy should set and pursue clear growth targets. This helps overcome one of the most common shortcomings of public support policies: the lack of continuity. Policies oriented towards a longer term target are less likely to be frequently interrupted.

Stop-&-go support does not create the necessary confidence of market actors. Both on the supply and on the demand side, decision makers tend to postpone investment decisions, as they take on a wait-&-see attitude. This can even damage the market, if for instance installers experience that their investment in solar training does not pay off, due to the abrupt end of a financial incentive scheme.

Stable and positive framework conditions must be created over several years to pave the way for investments in production capacities, training, marketing and distribution, and to mobilise resources for research and development.

At European level, the renewable electricity Directive set national and EU-wide targets for this sector. It is widely accepted that these targets and the policies they induced were vital for the huge investments and successes in electricity generation from renewables. A similar approach must now also be taken for renewable heating and cooling, at national and EU level.

A comprehensive set of measures is needed

Effective support strategies address not only one, but several barriers to growth. For example: The lack of public awareness can be overcome with an awareness raising campaign. But the higher initial investment costs might be addressed with a financial incentive scheme. The limited availability of informed and motivated professionals can only be tackled by specific training and education programmes.

The best support strategies consist of a coherent mix of complementing measures. These measures should be well-targeted and not contradictive: a financial incentive scheme targeted at private households should not come with technical requirements typical for large systems.

Even the most powerful support measure, solar regulations ("Barcelona model"), should be accompanied by flanking measures. Information campaigns targeted at raising quality awareness amongst consumers and installers ensure that the installed systems are used most effectively. And public authorities can support the fast introduction of the next generation of solar thermal applications by providing funds for R&D work.

Coherent strategy to promote solar thermal

Solar regulations

The long term begins today

Future new buildings will last into the second half of the 21st century and longer.

By then, fossil fuels will be very scarce and expensive. They will probably still be irreplaceable in sectors like air transport and chemicals. One more reason to accelerate the necessary transition: in the long term, 100% of the energy needs of buildings has to be covered by renewables.

Adapting the building stock will be a steady process. At least new buildings, and those undergoing major renovation, should be equipped for future conditions.

At EU and national level, legislation has been adopted to improve the energy performance of buildings. However, in most EU countries, this legislation is mainly promoting energy efficiency. Higher efficiency is necessary and urgent, but alone will not be enough to keep houses and people warm.

No new buildings without solar!

ESTIF calls for a wide introduction of solar obligations. New buildings, and those undergoing major renovation, must cover a share of their heat demand with solar or other renewables.

Solar thermal obligations have the following benefits:

- The building stock can be gradually prepared for the post-oil and gas era
- Solar thermal is cheaper and more cost effective if installed at the construction stage
- If solar is not included, the window of opportunity will be closed for a long time
- An obligation solves the tenant-owner dilemma: the fuel costs are not paid by the same person who pays for the investment to save fuels
- Implementation requires little administration effort over usual building permits and controls
- Minimal impact on public budgets
- Avoids stop-&-go market dynamics and thus creates a positive investment climate for the solar thermal industry

Positive experience with solar obligations

The City of Barcelona enacted in 1999 its first "Solar Ordinance", later replicated by many Spanish local councils of different political backgrounds. This paved the way for the solar obligation to be included in the new Spanish national building code, approved in 2006. In the same year, Barcelona upgraded its solar obligation, thereby increasing the number of buildings subject to the obligation.

In Israel, a solar obligation has been in force since 1980. As a result, Israel is the world leader in solar thermal usage. Solar has become a mainstream product. Today, 90% of the market is in voluntary segments: in retrofitting and replacements of old systems.

Solar obligations have positive effects beyond their direct scope, by promoting the voluntary use of solar beyond required levels, and by encouraging private investment of the solar thermal industry.

Guidelines for implementation

Several countries and regions are considering introducing similar solar obligations. This is welcome and necessary.

In this process, it is necessary to make sure that the regulations are optimally designed and adapted to the local situation. ESTIF has developed guidelines, focusing on the following principles:

- Technical and design requirements should not be overly detailed, to avoid hampering technological development and causing excessive costs
- Any product requirement should be based on European Standards and certification, to avoid creating barriers to trade
- Quality assurance clauses should be introduced and randomly checked, to avoid unmotivated owners installing the cheapest low quality products

Detailed analyses and recommendations, including case studies about Barcelona and Madrid, the city of Vellmar (Germany) and Italy are available at www.estif.org/STAP

Financial incentive schemes

Direct grants played an important role in the development of Europe's leading solar thermal markets: Germany, Austria and Greece. The fastest growing market, currently France, is benefiting from a reduction in income tax.
However, the case studies of the K4RES-H study also show examples of Financial Incentive Schemes (FIS) that have not produced the expected result.

FIS for solar thermal can come in various types:

- Direct grants (e.g. German Market Stimulation Programme)
- Tax reductions (e.g. income tax break in France)
- Loans at reduced rates
- Green heat or energy efficiency certificates

So far, most of the FIS were among the first two types. The main finding of the K4RES-H case studies, however, is that the success of a FIS does not mainly depend on the type, but on the continuity and on the quality of design and implementation, including the flanking measures.

A detailed analysis, including case studies is available at www.estif.org/STAP

Success through continuity

The key success factor of FIS for solar thermal has been continuity. Only a long term approach gives the right incentive to the decisive market actors (installers, designers, architects, construction sector, solar thermal industry) to invest, thus creating the conditions for self-sustained growth. On the contrary, stop-&-go financial incentives discourage long term investment and disrupt market development.

Guidelines for best practice

- FIS should be part of a comprehensive approach, including coherent flanking measures, such as awareness raising, training and demonstration projects
- FIS should last for several years under stable conditions. This maximises the impact on investments and creates conditions for self-sustained growth
- No early announcement of improved financial conditions, to avoid consumers postponing purchase
- Funds must be available to guarantee the continuity of the FIS over some years – if the public budget cannot do it, the "Polluter Pays Principle" should be applied
- Easy and lean procedures increase the effectiveness of the FIS
- Product requirements should be fully compatible with the European Standards and certification procedures, to guarantee high quality without creating barriers to trade
- Quality criteria on the installation should be set, in line with the specific situation of the country/region, to avoid low quality installations without creating artificial hurdles
- The amounts offered should be high enough to provide a real incentive

Role of financial incentives & regulations

FIS should be used in cases where binding regulations are not appropriate: retrofitting of existing heating systems and upcoming solar thermal applications, like cooling or process heat.
Where a binding regulation exists, FIS can also provide an incentive for investments beyond the minimal level required by law, thus saving more conventional energy.

Policies for solar cooling
& other emerging applications

New potential beyond today's applications

Domestic hot water and space heating are the dominant solar thermal applications today. And they will continue to lead the market and provide clean solar energy for millions of citizens.

Other applications are still in their infancy but have a huge potential to curb conventional energy use. As these technologies are still emerging, most existing support policies do not yet cover them.

Specific support is needed to address the concrete barriers to growth of each application and market segment.

Current barriers to quick market adoption

Some of the new applications with the highest potential are solar thermal for cooling, for industrial processes and for seawater desalination. All three of them have been demonstrated successfully but optimisation has just begun and broad market penetration has not yet started.

Selected barriers specific to emerging new solar thermal technologies:

- Very low awareness amongst decision makers and professionals
- Typically high initial costs
- Shorter track record of the new technologies
- Packaged (standardised) products are not available
- Planning is more complex and practical guidelines and software tools often do not exist
- New materials or components need to be developed and tested for the different uses, e.g. higher temperatures

Specific support for the next generation of solar thermal applications

If public support policies ignore the specific barriers to growth faced by emerging and new applications, they will most likely fail to help them into the market. Therefore, the typical support schemes focusing on domestic hot water and space heating should be accompanied by specific measures targeted at new applications.

These are our main recommendations:

- Specific awareness raising campaigns targeted at potential customers of emerging applications
- Large number of demonstration projects in every region – where relevant also in public buildings or companies
- Dedicated financial incentives
- Basic research in new materials and the development of new components
- Applied research and development to optimise the emerging applications and their integration with existing technology
- Funding for the development of planning guidelines and tools
- Inclusion in relevant legislation, e.g. solar cooling should be covered by the Energy Performance in Buildings Directive (EPBD)

In Cyprus, a solar thermal system belongs to the house just as a chimney belongs to a house in the UK – every child in the relative country "knows" this.

Awareness raising & training

Knowledge is key to solar thermal acceptance

In regions where solar thermal is already widely used, awareness is very high: Neighbours and friends use solar thermal and everyone knows that hot water is available even during cloudy periods. Lack of knowledge or doubts about solar thermal is the primary reason for not choosing solar energy for heating in regions where solar is still a niche product.

An uninformed end-consumer will not buy or even enquire about a solar thermal system!

An uninformed architect, planner or installer is an even bigger problem: If professionals do not know about solar thermal or if they feel insecure about it they will not recommend it to their customers. One uneducated or untrained professional means many lost opportunities in the market.

Spreading the word: Public awareness raising campaigns

Nearly every successful support scheme in Europe has included public awareness raising in their policy mix. The concrete measures range from a fully-fledged campaign like "Solar – na klar!" in Germany to specific information portals on the web or the funding of impartial advice to consumers by local energy agencies.

Consumers must be aware of solar thermal products when they need it. And often they need a new heating system urgently – when their old one breaks down and needs to be replaced. In these situations the buyers do not shop around to look for the best overall offer, but choose the technology they are already used to.

Educated consumers will choose solar thermal – ever more often. Public awareness raising can help educate consumers and create market pull.

In the more and more mature markets, marketing by solar thermal suppliers will supersede the need for public campaigns. In those regions, targeted public information campaigns may focus on the next generation of solar thermal applications to help them pave the way into the market.

More training & quality assurance of professionals

Professionals in the construction sector, including heating, ventilation and air-conditioning (HVAC) installers have an important role in the market: More often than not, they are the gatekeepers to the final decision makers. In effect, they are the ones who decide whether or not a new building is equipped with a solar thermal system and whether the new heating system is based on renewable energies.

Where the market is well developed, professionals will learn about solar thermal or will invest their own resources in training. But where solar thermal is still a niche market, installers do not see the benefit in specialised training.

In many countries, public bodies have supported the development and implementation of training courses targeted at professionals crucial for the success of solar thermal. Training plays a vital role in motivating installers to recommend and actually sell solar thermal products.

At the same time, they help sustain a high quality level in a growing market. By having attended basic training in solar thermal, planners and installers learn to avoid simple mistakes, thus improving the high quality experience with solar thermal technology.

Setting & monitoring national targets

Targets – for better focused policies

Solar thermal support policies aim at increasing the share of solar energy used in heating and cooling. To evaluate the overall success of a support policy, it is important to compare the induced market growth with a previously set target.

Targets are a widely used tool in business management. The more specific a target is, the more likely it is to be achieved. This principle has been successfully applied in policy making. The European Directives to promote renewable electricity and biofuels have been successful largely because of clear sectoral targets, broken down by countries. Such targets are now needed also for renewable heating and cooling – serving as a guideline also for the development of solar thermal markets.

Setting & monitoring national solar thermal targets

Led by ESTIF, experts from the solar thermal sector have agreed on the following recommendations for how to set (sub-)targets for solar thermal:

What to consider for the target?

The thermal energy gained through active conversion of solar radiation. This excludes energetic gains through "passive solar" (e.g. south-facing windows, orientation of buildings etc.). Not because the use of passive solar was not useful but because it is in effect an energy efficiency measure and would be hard to take into account in target setting and monitoring. A detailed recommendation on how to assess the solar thermal energy for statistical purposes can be found at www.estif.org/STAP

How to assess the potential for growth in the short to medium term?

In the long term, the limited availability of oil and gas will necessarily lead to the full exploitation of the solar thermal potential. For policy making, shorter time periods need to be considered, e.g. a target for 2020. Until then, the solar thermal potential will be far from being realised. In the next two decades, the development of solar thermal will be determined by other factors, such as awareness, costs, availability of trained and motivated professionals.

At European level, an ambitious target should be set. Both a minimum and a more ambitious target have been proposed by the solar thermal sector (see page 9).

The national targets should be compatible with the overall EU target. To determine the specific targets for each country, the following factors should be considered:

- Current level of solar thermal use (implying also a certain level of market infrastructure)
- Overall solar thermal potential (local heating/cooling demand, solar irradiation etc.)
- Current energy supply mix
- Use of other renewables for heating and cooling today
- Purchasing power
- Other urgent priorities in the heating/cooling sector (e.g. refurbishment of district heating systems)

Quantifying energy delivery

Often, it is desirable to link support policies to the actual solar thermal energy production. Most financial incentive schemes follow this principle to some extent, e.g. by offering a grant per m² of collector area.

But a closer link is possible. For systems, where energy production is typically measured, financial incentives can be based on the actual heat produced. This gives additional benefits to well designed and maintained systems.

In smaller systems the costs of accurate measurement would outweigh any benefit. Their energy production can be calculated upfront, using a calculation method which is more accurate than only the collector surface, but based on a few simple parameters.

Within the K4RES-H project, solar thermal experts have developed recommendations on energy measurement and on alternative calculation methods. Policy makers are invited to use these recommendations in their solar thermal support programmes.

Detailed methods and recommendations can be found at www.estif.org/STAP

Avoiding barriers to trade

Support programmes sometimes create artificial barriers to trade

Sometimes governments have set requirements within their support programmes, which inadvertently hampered the market entry for certain companies or products. In particular this applies for companies operating at EU level, which have to adhere to various different national, regional or local requirements.

Overcoming fragmentation by using European Standards

Since the 1990s, European Standards (EN) have existed for collectors (EN 12975), factory-made systems (EN 12976) and custom-built systems (ENV 12977). For the energy performance in buildings, CEN (European Committee for Standardisation) has developed a pre-standard to assess the positive contribution of solar thermal in the heating systems of buildings.

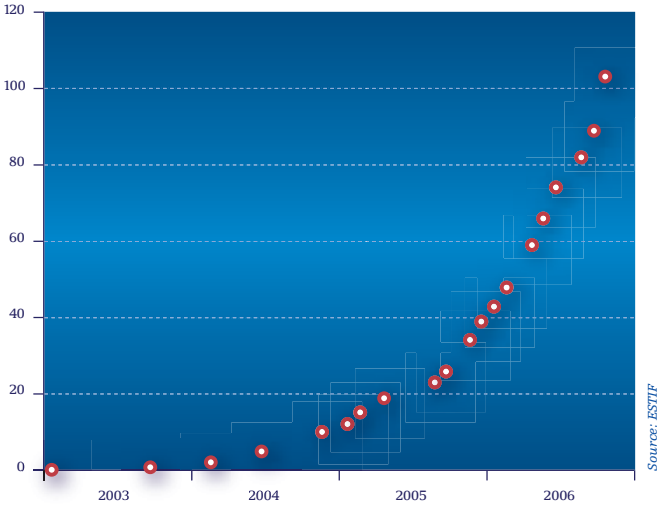
European Standards are vital for the creation of a European market. Governments should refer to them wherever possible in financial incentives schemes, solar regulations, or in building codes – instead of adding new, differing local requirements.

Solar Keymark – the one European certification scheme for solar thermal products

Even after the introduction of EN Standards, certification requirements still differed among countries. Some countries would not recognise in their financial incentive schemes products tested in other countries. The Solar Keymark, developed by ESTIF in co-operation with CEN and with support from the European Commission, was introduced in 2003 to overcome this last hurdle. Today, almost all countries accept Solar Keymark'ed products in their support schemes. Further effort is needed to tear down the last remaining barriers to trade.

For further information, please see www.solarkeymark.org

Accumulated number of Solar Keymark licences
(Status October 2006)



Key Issues for Renewable Heat in Europe (K4RES-H)

This Solar Thermal Action Plan has been developed by ESTIF as part of the project "Key Issues for Renewable Heat in Europe (K4RES-H)", which aims at stimulating growth of renewable heating and cooling (RES-H).

Since January 2005, nine organisations – most of them European renewable industry associations and energy agencies – have analysed public policies supporting renewable heating and cooling in order to develop concrete guidelines applicable at local, regional, national and European level.

The European Communities support this project through their Intelligent Energy – Europe programme and the European Commission is also actively involved through their Joint Research Centre.

The project has a cross-sectoral nature as it analyses a number of key issues, first looking in parallel at the different RES-H technologies: solar thermal, biomass and geothermal, and then integrating the results for policy guidelines applicable to RES-H in general.

Key Issues for K4RES-H Renewable Heat in Europe

Specific approach:

Helping to improve public policies by focusing on five Key Issues for which concrete guidelines are developed:

- Verifiable targets for RES-H
- Quantifying the energy delivery of individual RES-H installations
- Regulations
- Financial Incentives
- Innovative RES-H applications

Main Results:

An integrated Renewable Heating Action Plan for Europe, and separate action plans for solar thermal, bioheat and geothermal.

Project Coordinator:

ESTIF – European Solar Thermal Industry Federation

Partners:

AEBIOM – European Biomass Association, Agencia d'Energia de Barcelona, EC-JRC – European Commission, Joint Research Centre, EGEC – European Geothermal Energy Council, Energie 2000 – Energieagentur im Landkreis Kassel, EREC – European Renewable Energy Council, IDAE – Instituto para la Diversificacion y Ahorro de la Energia, WIP.

Further information:

A wide range of detailed analysis and guidelines is available:

- on the solar thermal results: www.estif.org/STAP
- on K4RES-H in general: http://www.erec-renewables.org/projects/proj_K4_RES-H_homepage.htm

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