Financial Incentives for Solar Thermal

Guidelines on best practice and avoidable problems

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Intelligent Energy Europe

Executive Summary

Financial Incentive Schemes (FIS) in the form of direct grants have played an important role in the development of the leading solar thermal markets in Europe (Germany, Austria and Greece). And in the fastest growing solar thermal market (France), a reduction of the income tax has significantly accelerated the existing market growth since 2005.

The analysis of case studies from different EU Member States has clearly shown that it is not so much the type of incentive but the concrete design and implementation – including flanking measures such as awareness raising, training of professionals – that makes a FIS succeed or fail.

The single most important success factor for the long-term stimulation of a solar thermal market through a FIS has been continuity: With short-term programmes or insufficient budgets, FIS have failed to create healthy market structures, which are the basis for continuous growth.

From experience, the following lessons have been drawn:

Avoidable weaknesses of FIS for solar thermal

- Announcements of new or higher financial incentives in the future have a destructive effect on the market in the near-term, as consumers wait for the FIS to be enacted.
- Lack of continuity leads to stop-&-go dynamics, which discourage the industry from investing into solar thermal long-term (e.g. into new production facility, marketing, training of professionals). Under such circumstances a healthy market cannot develop.
- Without suitable and targeted flanking measures, FIS typically fail to produce significant growth in the market.
- Complicated and slow administration procedures do not work if the consumer needs a new heating/cooling system soon (e.g. because the existing conventional heating system broke down).
- Lack of (sensible) quality criteria leads to many low-quality systems being installed, which may undermine the long-term European renewable energy targets.

Positive lessons learned (“best practice”)

- A long-term support strategy, consisting of a financial incentive scheme and suitable flanking measures (especially awareness raising, training of professionals) has shown to have the highest impact on market growth.
- Specific financial incentives must be high enough to really have an effect on the market.

- To guarantee continuity of the FIS, sufficient funds must be available at all times – if this cannot be guaranteed from the public budget, other sources should be tapped.
- Easy and lean application and payment procedures (where necessary) are necessary for broad acceptance of the FIS.
- Quality requirements which are fully compatible with the relevant European Norms (EN standards) strengthen the consumers' confidence in solar thermal technology and contribute to further market growth.

Introduction

The present study has been developed as a tool to support the design of effective Financial Incentive Schemes (FIS) for solar thermal heating and cooling (ST). It analyses the existing experience with FIS for ST, mainly in European countries. It looks both at best practice FIS that have reached their goals and at schemes or elements of schemes, which have either partially, or completely, failed. The study defines elements of best practice for this type of instrument that can play a decisive role in increasing the use of solar thermal, and thus reducing our dependency on gas, oil and electricity for heating and cooling purposes.

This study is targeted at legislators, public administration officials, energy agencies, NGOs, solar thermal associations, market actors and any person or institution involved in the design and implementation of policies to promote renewable energy and energy efficiency associated with solar thermal issues.

FIS for ST have so far been implemented at local, regional and national level. However the issues reviewed in this study also have a European dimension, as the discussion about a future EU Directive to promote renewable heating and cooling is progressing through the European Parliament and the European Commission. We also believe that the guidelines developed here might be helpful for discussion in countries outside the European Union, since the dynamic of ST market development is often similar in many other countries.

This study is produced within the framework of the project *Key Issues for Renewable Heat in Europe (K4RES-H)*, co-financed by the Intelligent Energy - Europe Programme of the European Commission. Within this project, guidelines for best practice policies on different issues relevant for the promotion of renewable heating and cooling are developed. FIS is one of the issues under review in K4RES-H. In this study, FIS for ST are considered. In parallel studies, FIS for bioheat and geothermal are considered. General conclusions about financial incentive schemes for renewable heating in general are presented in a different chapter[1].

Many contributors have provided their knowledge and experience in the compilation of this study: the members of ESTIF and particularly the national solar thermal associations from nearly 15 European countries and also many other experts from energy agencies, public administrations, NGOs and others. We warmly thank each of them even though we do not have enough space to mention them all.

However, ESTIF remains solely responsible for the contents and any possible mistake should be attributed to our error or omission.

[1] This chapter will be produced at a later time.

Aim and structure of this study

The key question to be answered is how financial incentives schemes should be designed to best promote the uptake of solar thermal.

In the last decade, solar thermal has been promoted by many different kinds of FIS in a number of countries, regions and local communities. In many cases, the FIS worked well and produced a significant effect on market development and so provided energy savings. In other cases, the FIS was not as effective and at worst, sometimes had counter-productive effects. In the present study, the key lessons to be drawn from the existing experience with FIS for ST are analysed.

Whilst there is a very broad range of academic literature available about the effectiveness, advantages and disadvantages of different support schemes for renewable electricity, there is hardly any literature available to date about support schemes available for renewable heating, and specifically for ST.

Some case studies are attached at the end of the main text, showing in detail how FIS for ST work. They have been selected with the aim of presenting different kinds of FIS that, for various reasons, are particularly significant. The case studies presented are:

- Germany, Market Stimulation Programme (MSP)
- Italy, White Certificate Scheme
- Italy, Support from Ministry of Environment for local authorities
- Italy, Comparison of two regional support schemes
- Austria, Regional support scheme in Upper Austria

Moreover, this analysis is based on the broad knowledge about the functioning of the solar thermal markets gathered by and within ESTIF, through direct contacts with national associations and market experts from many countries in Europe and beyond, notably at the estec (European Solar Thermal Energy Conference), organised by ESTIF in 2003 and 2005.

Definition of Financial Incentive Schemes

Within the K4RES-H project, the following definition of FIS was agreed with the project partners.

Financial Incentive Schemes (FIS) include any public policy giving a financial advantage to those who install a solar thermal system or that use solar thermal energy. For example:

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

Financial Incentive Schemes (FIS) do not include public policies that support the creation of public goods, giving an indirect financial advantage to the solar thermal market. For instance: an awareness raising campaign financed by public money or a program to subsidise training of craftsmen or R&D funds, etc. Obviously, all these instruments create an indirect financial advantage for the companies involved in the market and this advantage is then transferred to the users. However, such instruments are not considered as FIS within the K4RES-H project, because they focus on public goods and therefore the financial incentive cannot be easily quantified.

Definition of solar thermal heating and cooling

The present study deals only with solar thermal heating and cooling. Electricity-producing solar thermal power plants are not included as they should be covered in renewable electricity support schemes.

Justification and limits of Financial Incentive Schemes (FIS)

Some principle of solar thermal economics

The direct economic utility of a solar thermal system for its owner are:

- The economic value of the energy it saves
- A certain degree of independence from conventional energy supply

The first bullet point depends on the size of the system, its operation by the consumer, the solar radiation levels and most significantly the cost of the conventional energy displaced. The second bullet point can also be important. Depending on the above parameters, nearly all ST systems installed in Europe can cover the full hot water demand for a period varying between 3 to 9 months. Larger solar systems (combisystems) can cover also a significant part of the space heating and cooling load. Solar houses, covering their full heating and cooling demand with passive and active solar energy have been successfully demonstrated, but are not yet a common market option.

Other private utility of a solar thermal system is of psychological nature, such as the positive feeling that comes from caring for the environment. In some countries, a ST system is becoming a positive status symbol. Such benefits are not quantifiable by their nature.

A solar thermal system creates also external utility, i.e. benefits to other people and for the larger community for which the system owner does not gain any financial reward. In other words, an external utility is the opposite of external costs. The main external utility created by a ST system is:

- Savings of CO_2 emissions
- Savings of other emissions causing local air pollution
- Reduction in dependency on energy imports
- Reduction in further external costs linked to the use of fossil fuels or nuclear power
- When a ST system displaces electrical heating: reduction of peak demand on the national grid

These private benefits and external utility have to be balanced with the private and external costs of a solar thermal system.

The private costs of a ST system consist of:

- the investment to buy and install the system
- the costs of maintenance and decommissioning

- the additional transaction costs linked with a buying decision that in most cases is still unconventional compared with a traditional fossil or electric heating system

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

Under certain conditions, some have expressed concern about the aesthetical impact of ST systems. But the visual impact of solar collectors is not very different from standard building elements such as satellite dishes or roof windows. Therefore this aspect should not be overestimated and taken into account only in cases of historical buildings and similar structures.

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

This high share of upfront investment costs is a major barrier to the growth of the use of solar thermal and other renewable and energy efficiency measures.

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

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

As important as the economic factors are often the information and “transaction costs”. In large parts of Europe, ST systems are still uncommon. In those regions, many people prefer to stay on the traditional path, using what their friends and neighbours use. And many have never even heard of, or been offered, a ST system. Even for those who want to invest in ST, they often find it difficult to locate a high quality experienced installer.

However, even in the areas where the ST market has reached a certain market size, the decision to purchase and install a ST system is often more complicated than installing a conventional heating system. Solar thermal adds some extra components to a fossil fuel heating circuit. The buying decision is often made more challenging

because solar is not, at this moment in time, a standard solution. Most architects, heating engineers, designers and installers know less about ST than about conventional heating. If they are not trained and motivated about solar, they tend to discourage their customers from making a ST investment.

Only in very advanced markets, such as Greece, has solar thermal become a mainstream technology. There, almost every installer offers solar thermal systems and knows how to install them. People are used to solar thermal because their neighbours or relatives use it. New buildings are "automatically" equipped with solar thermal.

Justifications for Financial Incentive Schemes for solar thermal

Based on the analysis above, some justifications for the implementation of FIS for ST are described here.

External utility of private investment

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

Security of energy supply

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

Support to meet the burden of upfront investment costs

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

Solar thermal replaces imported fuels with local jobs

Regardless where the solar thermal hardware has been produced (in any case, mainly in Europe), a substantial part of the turnover linked to a ST system is inherently local: marketing and distribution, design, installation, training etc. By stimulating investments, a FIS for ST creates benefits for the local and national economy. In some cases, the average amount of the subsidy is lower than the VAT obtained by the government thanks to the ST investment: this applies, among others,

for the German market stimulation programme (MSP, see case study below), the financial incentive scheme with the greatest turnover at European level.

Psychological effect: positive signal from the public authority

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

FIS as a marketing tool

The existence of a financial incentive scheme can be one of several methods for marketing solar thermal products. FIS should always be accompanied by a public awareness raising campaign. At the same time, private market actors will communicate the FIS to their customers. In some cases, the financial incentive is not very high, but its existence still motivates the general public to purchase solar because of the "should not be missed" feeling in a similar manner to a discount campaign.

Creating economies of scale

If the whole EU was at the same level of sales per capita as Austria today, the European ST market would be five times bigger. Therefore, the potential for economies of scale are substantial. This is true not only for the manufacture of the hardware, which is driven more and more by competition at both a European and global level, but also for subsequent steps of the value chain, e.g. in areas like marketing and distribution, system design, installation, customer care, etc. In the majority of cases, these service costs represent well over 50% of the final consumer cost, and they are delivered at a local and regional level. This means that, in the countries with a low level of market penetration, there is a significant potential for economies of scales not only for manufacturing of hardware, but also for the local and regional services. Financial incentive schemes help to create economies of scale at all three levels and so reduce the price of solar energy in the short and long term.

Benefits of Financial Incentive Schemes

There is a wide consensus that financial incentive schemes have played a crucial role in developing the ST market in different countries.

Germany, Austria and Greece represent three quarters of the current European ST market, both in terms of current sales and capacity in operation. France still has a rather small market but the highest growth rates in the period 2000-2005. In these four markets, financial incentive schemes contribute, or have significantly contributed, to market development.

Greece is an excellent example, because it was the first EU country to reach a significant ST sales volume. In the 1980s, market development was boosted by public support in the form of strong awareness raising campaigns, including television advertisements and through financial incentives. The latter was gradually phased out. Since 2003 there have been no financial incentive schemes in Greece

except for very small ones targeted at special market niches. In spite of the withdrawal of financial incentives, in 2004 Greece had a level of sales per capita around 30 times higher than Portugal and Southern Italy, and yet all three of these countries have similar climatic and economic conditions. The Greek example shows the true result of a long term, well implemented FIS for ST: once a certain critical mass is reached, the market continues to grow without further public support. Nevertheless, the potential for solar thermal energy in Greece is a long way from being fully exploited. Within a positive framework of support for the full exploitation of solar potential, the Greek market should grow by a factor of 5 to 10 times over the next two decades.

However, financial incentive schemes do not always work as effectively as the cases discussed above. In some countries or regions, FIS have not produced the same long term positive effects. Sometimes the available budget was not fully allocated. In other cases, some opinions have indicated that a specific financial incentive scheme disrupted market development by creating a stop-&-go dynamic that discouraged buyers as well as installers. The most common problems linked to financial incentive schemes are analysed below.

It should be noted that, as in the case of any other socio-economic analysis, it is impossible to isolate the effects of a single measure from all other developments affecting the final outcome. Among the other factors affecting the result in terms of ST capacity installed (and thus energy savings realised), there are other policy measures (regulations, awareness raising campaigns, training, R&D etc), the costs associated with conventional heating supply, general economic conditions and last but not least in the construction sector, the development of a widespread presence of the ST industry and its distribution channels.

Inherent limits of financial incentives

Financial incentives have shown to be a very effective tool to stimulate growth in solar thermal markets. But they are not the solution to everything and in particular they are typically not very effective if applied without suitable flanking measures. This section analyses the limitations of FIS. In the section below, avoidable problems linked to the specific design and implementation issues of FIS are analysed.

The financial aspect is not the only barrier to growth for ST

The financial burden on the investor is not the only barrier to growth. In countries that have a low level penetration of ST, other barriers to growth can be significantly more relevant. Some of these barriers are: lack of awareness from potential purchasers, lengthy or difficult planning procedures, lack of understanding and so motivation of key influencing professional groups such as heating installers, system designers, architects and other construction staff, etc.

Therefore, if a FIS is not accompanied by other associated measures designed to tackle the other barriers to growth existing within the market, the FIS will almost certainly be a partial failure. Without a “systems” approach to the market intervention in favour of ST, growth will be restricted.

A FIS requires financial resources

Obviously, a financial incentive scheme induces a cost burden. Usually, the source of finance is the public budget, either in form of expenditure or of reduced tax revenues. In times of ever scarcer public budgets this has often been a problem: Support programmes were reduced or ended prematurely because either budgets were exhausted or new governments directed priorities away from funding solar thermal FIS.

Following the Polluter-pays-Principle, the money should in any case not be borne by the general public (the tax payer) but by those who use conventional fuels. FIS financed by the users of conventional energies have been successfully applied in the electricity market, where feed-in tariffs for renewable electricity are (indirectly) paid by the normal electricity ratepayer. For solar thermal, and in general for renewable heating, such a scheme has never been employed within Europe. However, it is being successfully applied in Australia, where solar thermal water heaters can participate in the tradable Renewable Energy Certificates scheme of the electricity sector.

It must be noted that the net balance for the public budget of a FIS for ST can be positive. This is the case for the German market stimulation program (see case study below), where the costs of the scheme are balanced by the additional VAT revenues.

A FIS requires administration

Obviously, some administration costs are unavoidable. Even though there are no reliable official figures for an accurate comparisons of the administration costs between different schemes, our knowledge and experience shows that these costs can be significantly reduced if the scheme is well-designed and efficiently managed.

A FIS can create market distortions

Any state intervention in a market can create distortions. These distortions can be easily outweighed by the public benefits arising from the intervention.

One typical distortion is the creation of windfall gains. In a region or country with a FIS for ST, some of the ST systems would be installed with or without the incentive. In these cases, the buyer acquires a windfall gain. However, in the case of FIS for ST, this gain is usually small for the individual investor. From a general perspective, the best strategy to minimise this market distortion is to enact a FIS capable of creating an additional strong growth in ST installations, so as to minimise the impact of any windfall gains.

Another possible distortion may arise from the technical requirements of the FIS: It could favour one technology or application over another. Various examples exist, e.g. in France, there used to be a minimum collector area of 2 square metres, independent from the efficiency of the collector. In certain cases, this has probably resulted in a low performance larger system having been installed, instead of higher performing but smaller system. Any FIS should clearly not favour systems with lower quality over better quality systems. ESTIF recommends to the authorities providing

FIS for ST to enact appropriate rules to guarantee the quality of the installed systems.

A FIS does not lead to smaller solar fractions

The purchaser of a ST system still has a strong economic interest to maximise their energy savings, in order to minimise their conventional fuel costs. For the same reason, industries are keen to develop systems that maximise the solar fraction to gain an advantage in the highly competitive market.

Guidelines for best-practice financial incentive schemes for ST

In this chapter we take a deeper look into existing types of FIS, the key parameters of FIS and what lessons can be drawn from the experience and in particular the case studies undertaken.

Types of FIS

This section describes the main types of financial incentive schemes applied, or in principle applicable, to ST systems. This is not a theoretical treatise and it does not intend to cover all imaginable FIS. Attention is concentrated on schemes that are either particularly common or are currently under discussion:

- Grants (direct support to investment
- Tax reductions (direct and indirect taxes)
- Loans at reduced rates
- Tradable certificate schemes

Grants (direct support to investment)

A grant is a direct support to investment provided by a public authority to those who either purchase or install a ST system, thus reducing their investment costs.

So far, this has been the most common FIS for ST in Europe. It is, or has been, provided in a number of European countries by local, regional and national governments.

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

Experience with direct support to investment for ST is heterogeneous. In numerical terms of installed ST systems, the most successful scheme of this nature is the German MAP scheme (see case study). At a regional level, such schemes have been successfully employed in Austria which has resulted in the highest level of ST capacity per capita outside of the Mediterranean countries. In contrast, other countries (e.g. see Italian regional scheme case study) such schemes have been far less successful.

Tax reductions (direct and indirect taxes)

Several countries have offered tax benefits to those who installed/purchased solar thermal systems. The first part of this section looks at reductions in income or corporate tax and the second section looks at VAT reductions.

Direct taxes: Personal income or corporate tax
Part, or all, of the investment in a ST system can be made deductible from income tax or corporate tax.

For example, this type of scheme has been used in France since 2005 with excellent results, and led to an acceleration of the already significant market growth. In 2005 the market more than doubled compared with the previous year. In the past, tax reductions were also successfully applied in Greece.

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

Firstly, a reduction in the income or corporate tax leads to a benefit only one or two years later (when the income is declared and the tax returned). But typically a benefit at some point in the future is valued less by people than an immediate payment (which could be accomplished with a grant). The longer spread between the expenditure (purchase of a solar thermal system) and the incentive (tax reduction or return) means that the person has to finance the whole investment for a longer time, which could furthermore reduce the value of the incentive.

At the same time, the very successful French example, introduced in 2005, shows that the positive effects of a tax reduction can be substantial and outweigh any disadvantage: The tax reduction/return removes the need to apply for a grant before purchasing a solar thermal system. This drastically reduces the procedure for receiving the FIS and removes the waiting period between the application for a grant and the approval of it.

It should be noted that a real tax reduction can have socially unjust implications: As low-income households typically pay no or very low taxes, the absolute tax reduction may be lower as for the medium to higher income persons. However, in the current French tax break scheme, the purchaser of a solar thermal system receives 50% of the hardware costs back – independent of the total taxes he has to pay.

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

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

Indirect taxes: Value added tax (VAT)
In principle, a reduction, or abolition, of the VAT applied on the solar thermal products and services needed to install and maintain a solar thermal system can be a very effective financial incentive for private individuals: Like a grant it immediately lowers the overall investment costs to the end consumer. And it does not involve the

processing of any grants or additional items in a tax declaration and is thus very simple to apply.

However, according to current EU law, it is forbidden to apply a reduced VAT rate to ST products and services. Directive EC/388/77, amended many times since 1977, does not allow the Member States to apply a reduced VAT rate on products or services not explicitly mentioned by the Directive. Among them, the “supplies of natural gas and electricity provided that no risk of distortion of competition exists”.

Some EU countries have in fact applied a reduced VAT to gas and/or electricity – but not to solar thermal products – and thus created a clear disincentive for private persons to invest in solar thermal systems.

The only category under which ST products could be awarded a lower VAT rate would be the “supply, construction, renovation and alteration of housing provided as part of a social policy". However, this provision could lead to the inclusion of a variety of other buildings products, including those with a negative impact on energy efficiency or the use of renewable energy. Therefore, the specific incentive for solar thermal is low or non-existent.

In recent years, according to ESTIF information, at least two Member States have refrained from lowering the VAT rate on solar thermal systems due to the provisions of Directive EC/388/77. Amendments to this Directive can be proposed by the European Commission or by any Member State and they must be approved unanimously by the European Council.

Loans at reduced rates

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

However, they can be an interesting complement to other support measures. In Germany, the public KfW bank offers low interest loans for the overall improvement of the energy performance of existing buildings or the new construction of low-energy or passive houses. Solar thermal systems are included in the list of possible improvements and thus benefit from the favourable loans. Even solar thermal companies have tried to offer their customers a loan to finance the purchase of their products.

But due to the rather small size of the typical solar thermal investments (often in the range of 1.000-5.000 Euro), a loan for a solar thermal system alone does not seem very attractive to many consumers, as the overhead costs for both the bank/government and the end-consumer are quite high. Only as part of a package, as in the above mentioned German KfW-programmes, has it shown to have an impact.

In principle, a privileged loan is an appropriate answer to one of the main barriers to growth for ST, i.e. the high rate of upfront investment cost. The loan leads to

spreading of the investment costs so that the energy cost savings of the solar thermal system can be used to pay off the loan.

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

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

Tradable certificate systems

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

Two examples of such systems in which solar thermal heating and cooling are eligible to obtain certificates are analysed in the case studies below. In both cases, the TCS has not been developed specifically for the heating sector: in Australia it is mainly a system for green/renewable electricity and the obligation lies on the electrical utilities; whilst with the Italian White Certificate, the scheme aims to develop energy efficiency measures and the obligation lies with the large electricity and gas utility suppliers. The certificates are expressed in energy units (MWh for Australia, toe in Italy).

In the electricity sector, TCS typically award certificates for each produced and measured unit of energy. As the price of the certificates varies according to supply and demand, the income from certificates is not known in advance. This, critics of TCS have often maintained, would not create the market stability needed for the young and growing RES-electricity sector.

It should be therefore noted that in both schemes analysed, the quantity of certificates awarded for the installation of a ST system is fixed upfront and based on known system parameters. Therefore, solar thermal systems do not need a metering system for these TCS. In Australia, ST systems receive, according to the specified parameters, advance certificates equivalent to 10 years of operation. In Italy, the White Certificate Scheme is not yet mature enough to know whether the risk of price fluctuation will affect the ST market.

As the number of certificates is known, the financial benefit from the certificates can be calculated upfront. To the consumer such a TCS appears like a grant.

Theoretically, ST could be included in the European CO_2 emission trading scheme. However, this is unlikely to happen because of the small dimensions of the typical ST system. Moreover, since CO_2 savings are only one of the advantages of solar thermal, it seems reasonable to consider support schemes targeted at this particular technology.

What is the best kind of FIS for ST?

All of the systems described above have advantages and disadvantages. Some of the schemes discussed worked well under certain market conditions and not as effectively in other situations. Depending on the legal and political framework, on the state of development of the solar thermal market and on other factors, each region or country may have good reasons to choose one or other of the schemes.

According to the experience from many countries, the type of financial incentive scheme seems to be less relevant to its success than the quality of its design and implementation as well as the choice and implementation of flanking measures. In the next section we will look at a number of parameters that should be established by financial incentive schemes. The choice of the FIS is only one of these parameters. The correct setting and fine-tuning of the scheme to adapt them to the specific situation is essential for the success of the FIS.

Key parameters of any FIS

When a Financial Incentive Scheme (FIS) for ST is designed, a number of parameters need to be defined, such as:

- Continuity of the FIS
- Coherence of the parameters
- Clear target
- Quality criteria
- Monitoring and evaluation of the FIS
- Financial resources
- Basis of the financial incentives: Collector area or energy yield
- Specific amount of the incentive
- Simplicity of the application and payment procedures
- Flanking measures

In the following section, some aspects of these constituent parameters are analysed.

Continuity of the FIS

This factor is very important. Short term or sporadic support is the single most important factor leading to the failure of a FIS. In some cases, sporadic availability leads to a stop-&-go market dynamic that seriously disrupts the development of

healthy market structures. This sometimes outweighs the benefits of the financial incentive scheme.

The most obvious effect of erratic support is that people postpone their purchase until the support is available. In numerous cases, this had a strong slowing effect on the market. By discussing, or even announcing, a support scheme in the future, the market actually decreased rather than increased.

The most striking example of such problems can be observed in Italy. For several years, within the framework of a national programme which has provided 50% of the regional funding, financial incentives for solar thermal has been provided by the Regions (see comparative case studies below). But in most regions, it took up to two years before the regional scheme was implemented. And then, frequently, the financial support was only available for one or two months. After this time, the public expected that a new support scheme would be offered. Under these conditions, many decisions to invest in a ST system may be delayed until an indefinite future time when an effective FIS is available. It seems likely that in certain cases, the number of discouraged purchases was actually higher than the number of systems installed under the FIS.

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

Following certain negative experiences with changes of the Market Stimulation Programme in Germany, the responsible authorities and the industry associations have learned to not disclose changes in the programme until very shortly before they come into effect.

Coherence of the parameters

The requirements in a FIS must be tailored to the targeted technology/application/target group. Otherwise they quickly become incoherent and thus hamper the success of the FIS: A prime example of such incoherencies is the FIS in the Italian Regione Campania (see case study); there, small systems were strongly discouraged through the requirement of a guaranteed results contract as such a contract would be too costly for small systems. At the same time, other parameters of the scheme, such as very short time slots for application and low grant amounts, were not appropriate for large systems and so this FIS produced very little effect in the market.

Clear target

A Financial Incentive Schemes can be targeted at a very specific application or market segments (e.g. only at individual domestic hot water systems, or at large

collective combisystems, at swimming pool heating or at solar thermal heat for industrial processes). Others try to target a variety of applications and technologies.

Targeting a FIS at a specific application allows the scheme designer to fine-tune the parameters to specific characteristics. However, such targeted schemes also risk involuntarily giving a message to the market that certain applications are "worth more" than others.

Sometimes, it can make sense that the same FIS differentiates between different kinds of applications or technologies. In several FIS, Evacuated Tube Collectors (ETC) receive a higher amount in terms of €/m² installed than Flat Plate Collectors (FPC). This is reasonable because ETCs typically have a higher annual energy yield and are also more expensive than FPCs. Since 2005, the German Market Stimulation Programme provides to "combisystems" (ST systems that generate hot water and space heating as compared to the "standard" systems which only generate hot water) a higher level of support per surface area installed. This approach is reasonable because even though combisystems are more expensive to install they replace significantly more conventional energy.

In the future, special attention should be paid to applications with a particularly high social value. For instance, solar assisted cooling reduces electricity demand during peak loads and so has extra benefits for the community.

When a FIS is targeted at a specific customer group, it is essential that group specific awareness raising campaigns are enacted. The very low support scheme success rate achieved by the FIS of the Italian Ministry for the Environment is an example of such problems (see case study). In Italy, one provincial administration offered a FIS for ST targeted exclusively at agricultural companies. The idea was good because of the substantial potential for solar thermal within this sector. However, parts of the funds remained unspent for a long time due to a lack of applications. This was caused by difficult application procedures in combination with a lack of awareness of this FIS, due to not having planned a specific awareness raising campaign.

Quality criteria

A FIS should always include minimum quality requirements in order to prevent bad quality systems from receiving financial support. In order to guarantee open markets in Europe and to avoid any trade barriers, they must be fully compatible with the relevant European standards (EN 12975, EN 12976 and EN 12977) and certification scheme (Solar Keymark).

Monitoring and evaluation of the FIS

While not strictly necessary for the well functioning of a FIS, it is very important that the FIS is continuously monitored and the results evaluated. It allows governments to fine-tune the working of the scheme and prevent major problems in the future.

Evaluation should be done in close cooperation with market experts (solar thermal industry, installers, architects, construction companies etc.). They often know best why certain FIS work well or not.

Financial resources

Any financial incentive must be financed by someone, somehow. The different FIS models are not only different in terms of how they set the incentives, but also in where the financial resources come from.

The most typical FIS, a governmental grant scheme, is usually financed through the public budget, i.e. through taxes. This means that all taxpayers contribute to the financial incentives granted for solar thermal. It also means that the budget is limited – as approved by the parliament. And this often creates problems: As the government sets-up a grant scheme, they define the amount of the grant, e.g. based on the estimated energy savings from the solar thermal system. When the total amount of grants issued, nears the available budget, the government has three choices. Either a) it continues spending the money until the budget is exhausted, or b) it reduces the specific amount granted, in order to stretch-out the FIS, or c) it asks the parliament to approve a budget increase. All three approaches have been seen throughout Europe.

The typical consequences are: In case a) – termination of the FIS, when the budget has run out – the market recedes or even collapses. This is the most undesirable consequence and should be avoided by all means. It seriously hampers the development of healthy market structures and leaves the industry always waiting to see what will happen next. Under such situations, manufacturers will not invest in new capacity, installers will not invest in solar-specific training, and traders will limit their risk, by stocking only limited numbers of solar thermal products.

Case b) is better in the sense that it reduces the symptoms encountered in case of a complete stop of the FIS. It may even help bridge the time until a new year/new budget is reached and the FIS can be re-started. However, the impact on the market development is difficult to foresee, as has been the case in Germany: In 2002, the decline in the financial incentive unfortunately coincided with other adverse market conditions for solar thermal (see case study for details) and together they led to a shrinking of the market of approximately 40%. In 2006, the specific amounts of the Market Stimulation Programme were reduced twice, but this time the market conditions were favourable enough so that it did not have a considerable negative impact on the market development.

Case c) is obviously the optimal one in terms of contribution to healthy growth and market structures. However, even the discussion about a possible change in the FIS, or its continuation, can have unwanted effects on the market. Often customers rush to apply for the seemingly last financial incentives, only to learn later that the FIS continues anyway. This leads to unease in the market, and delays in delivery/installation followed by a certain slow down of the market growth.
Therefore, it is of utmost importance for any government that sets up a FIS, to plan long-term, to have budgets approved, which allow for enough market growth in the future.

Several experts have proposed to use a grant-like scheme, but to finance it not from the public budget but through the sales of conventional fuels. This model has been

very successfully employed in the electricity market. Several European countries, e.g. Germany, have a feed-in tariff for RES-electricity, which is eventually financed by all electricity consumers. However, it must be noted, that such a model has not been tried in the heating/cooling sector so far, partly because of the different nature of the market itself (non-existence of a central grid). In Germany, such a model has been elaborated and promoted by the German Solar Industry Association (BSW) and other renewable energy associations. Under their proposal, the suppliers of gas and oil to end consumers would have to finance the installation of solar thermal and other renewable heating systems. Those companies could then add those costs to the cost of the gas and oil they sell, thus letting the end consumer of those fuels finance the renewable energy installations.

Such a model would have several benefits compared with a traditional governmental grant scheme:

- It would remove the constraint stemming from the public budget (both in terms of total amount available, and approval procedures)
- It would satisfy the Polluter-Pays-Principle, as it would put the burden on the user of conventional energy.
- It would minimise the administrative burden for the government

Because the funding would be outside the public budget, such a model would more likely lead to more stable support over time. Of course, the parliament can and should adjust the “grant” given to solar thermal from time to time, but such a decision would not have to be taken every year under the pressure of budget talks in the parliament.

Tax reductions would have an effect on the budget, as they would lower the income. But the total amount of the financial incentive would remain unlimited as long as the tax reduction was in place. Thus, tax reductions too, provide a better framework for continuous market growth, and the French income tax scheme introduced in 2005 proves that it can be highly effective.

Basis of the financial incentives: Collector area or energy yield

As explained above, financial incentives for solar thermal shall help increase the use of solar thermal technologies and thus contribute to tackling several important energy policy goals, mainly: Securing the energy supply and avoiding environmental costs attached to conventional fuels. Eventually financial incentives aim at reducing the consumption of conventional and mostly imported energy. Therefore, the amount of the incentive given is typically related to the size or capacity of the supported system: Larger systems receive higher incentives than smaller ones. Traditionally the incentive has been based on the square meters of collector area, sometimes differentiating according to certain size brackets, applications or technologies.

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

Determining the energy yield of a solar thermal system: Two different approaches are available: Actual measuring of the solar energy production and (ex-ante) calculation of the annual energy yield of the solar thermal system.

The actual measurement requires the installation of metering equipment, and the reading and processing of the data. Typical metering technology for solar thermal systems – including their benefits and costs – is discussed in detail in another report produced within the K4RES-H project. That report concludes that due to the relatively high costs of the metering equipment such a solution should only be required in cases where energy measurement is typical anyway. As with electricity or gas meters, the consumer would be asked to send in his annual meter readings, based on which he would receive financial incentives for that year. The collection and processing of the data could be outsourced to the Energy Service Company in charge of electricity and/or gas supply in that area. As long as the incentive paid per kWh is known at the time of installation of the system, the incentive for the operator of the solar thermal system would be similar as a feed-in tariff for electricity from renewable energy: He would have a fixed price income but take over the weather risk (i.e. less solar irradiation than in a typical year). This system would inherently provide incentives to keep the solar thermal system in good working condition as it would increase the annual income from the energy based incentive.

The (ex-ante) calculation of the energy yield should be chosen, where the costs of installing and maintaining a metering and meter reading procedure would outweigh any benefit from it. This is typically the case in small(er) solar thermal systems. In these cases it is recommended to base the financial incentive on a few simple parameters: the collector performance (as tested under EN test conditions), the collector area and the geographical venue of the system (to take into account different climatic conditions). An individual simulation of smaller systems must be avoided in order to keep the system simple. Even a calculation based on individual system types can quickly become a complicated process: In Australia for example, more than 5.000 different systems/configurations with their specific values are listed in the database of the tradable Renewable Energy Certificates scheme.
A suitable method for the calculation of the energy delivery of individual solar thermal systems has been proposed and will most likely be included in the European norm EN 12975. As it is still under discussion amongst solar thermal experts, this methodology will be published as soon as it is generally agreed.

Specific amount of the incentive

Experience with many FIS shows that the absolute amount of financial incentive given is not the most important factor. The correlation between the amount and the market growth does not seem to be high. There is no “right” amount.

If the overall market framework conditions for solar thermal are good, then the amount can be lower and still present a good enough incentive to increase the number of newly installed systems. On the other hand, the decrease of financial support can have very disruptive effects on the market, if it comes at the wrong time. The German solar thermal market in 2002 recorded a very bad year, as a consequence of a number of factors ranging from high and increasing

unemployment, a sluggish economy, political uncertainty (federal elections), consumer unease with the new EURO currency. Under those circumstances the reduction of the financial support under Germany's Market Stimulation programme contributed to a 40% decrease of the solar thermal market, compared with 2001.

In times of high and rising energy prices, on the other hand, even relatively small amounts of incentives help trigger considerable market growth as could be seen in 2005 in many European countries.

It is obvious that while ST becomes a mainstream product – first for domestic hot water, then also for space heating, later for other applications – the specific investment costs go down. Studies have shown steady cost decreases of domestic hot water systems in Germany since the 1980s. Mass production and -marketing will lead to further cost reductions and thus make financial incentives for standard products less and less necessary. The amount of support for a certain application should therefore be digressive over the years.

Simplicity of application and payment procedures

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

As discussed above, tax reductions are typically the easiest to administer: If countries could lower the VAT on solar thermal systems, the consumer would benefit without having to apply for the incentive. If the tax reduction was on the income (or corporate) tax, he could declare the investment without seeking prior approval.

In the case of grants or low interest loans, the application procedure should be as easy as possible. Forms should be short and easy to fill in, even by laymen. It should be possible to file applications by post or even electronically in order to avoid having to go to authorities personally. In many countries, installers or traders help their customers file applications.

Many people purchase a solar thermal system when their existing heating system reaches the end of its lifetime. Then, the customer often needs a new heating system very soon (short window of opportunity). Therefore, a FIS should be offered all year long and – where prior approval is necessary – be granted as quickly as possible. Any delay could mean a lost opportunity for solar thermal.

However, it is important that any FIS procedure foresees the collection of as much information as is necessary to check the fulfilment of the requirements of the scheme. E.g. in order to be able to assess whether or not a certain product fulfils the technical and quality requirements, it may be necessary to collect data about the concrete product that will be installed.

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

In various cases throughout Europe, consumers can benefit from more than one financial incentive scheme (e.g. from the national government and additionally from their local municipality). In those cases, attention should be paid to streamline the requirements and procedures of applying for grants etc. E.g. the municipality can give additional money based on the prior approval of a grant by the national authority. This helps avoid unnecessary administrative burdens.

Overall, there is a high potential for learning between public authorities (within one country and between countries): The problems encountered while administering a FIS are often similar and could be avoided by learning from the procedures applied by other authorities. Good examples often come from the bigger markets, which have longer experience with FIS for solar thermal, e.g. the Upper Austria province has provided financial incentives for solar thermal for 30 years and has continuously improved their administrative procedures. Internationally, the authors hope that this study contributes to learning between countries.

Authorities involved in the management of FIS

Which agency is best suited to manage a FIS cannot be decided per se (energy agencies or other specialised agencies, local, regional or national authorities). It depends on the type of FIS, as well as on the structures on competencies of the relative governments.

It is more important that the responsible authority is motivated to support solar thermal and to actually spend the money. Bad examples come from Italy, where in several regional support schemes, a part of the money was provided by the national government and the regional authorities had an incentive to not spend it on incentives for solar thermal.

As with the FIS itself, the responsibility for the administration of a FIS should be kept as stable as possible. Building up a broad FIS has a certain learning curve and the shifting of responsibilities for the administration of a scheme disrupts the learning and thus the effective working of a FIS.

Flanking measures

The importance of flanking measures cannot be underestimated – a FIS alone almost never has a significant impact on the uptake of solar thermal. The most successful support policies for solar thermal target the different barriers to growth for solar thermal and provide a package of measures. The upfront investment costs are only one issue, yet an important one.

FIS – like other support measures – should aim at creating stable and positive market framework conditions, which allow solar thermal to reach self-sustained growth. Once a critical mass is reached, public support such as FIS or awareness raising campaigns can be reduced and finally ended. Then the solar thermal sector

can market their products alone, and costs of solar thermal systems will have fallen to a point where it is attractive for large parts of the potential market.

- Any FIS is typically useless if nobody knows about it: Public relations are an absolute must for any FIS.
- If the general public is not informed about solar thermal applications any FIS will reach only those, who already know about the benefits of solar thermal: Especially in the less developed solar thermal markets, awareness raising campaigns are immensely important. People who have not heard about solar, who may think it cannot be applied in their geographic region, who have doubts that solar energy can really provide enough heat for essential functions such as domestic hot water, will not invest in solar thermal – even if they are offered financial incentives. Awareness raising campaigns are a very powerful tool to get people interested in solar thermal.
- The public will believe in the benefits of solar thermal more if the public sector also uses it: Solar thermal installations in schools, public swimming pools, town halls etc. can set a good example for private and commercial decision makers, who have to decide about their next heating system.
- The impact of a FIS remains limited if there are not enough professionals who sell, plan and install solar thermal systems: Education and training of professionals (installers, planners, architects etc.) is important in order to help solar thermal into the market and to guarantee a sufficient quality of the installation.
- FIS fail to attract many suppliers, if building regulations (or the FIS itself) has technical requirements, which are not in line with the relevant European standards: Different technical, testing or certification requirements in FIS, in building regulations etc. have severely hampered the development of a single European market for solar thermal products. In those cases, fewer companies and products are on the market, and consumers are deprived of their free choice.
- Tomorrow's markets must not be forgotten: As solar thermal is still a relatively young technology, it is important to support R&D into new applications and technologies. FIS are typically focussed on products available in the market today, but in order to exploit the full potential of solar thermal, research must be done, which will lead to higher efficiencies, lower costs and new market opportunities for solar thermal.

Avoidable weaknesses of FIS for solar thermal

The most important problems identified above are:

- Announcements of new, or higher, financial incentives in the future, have a destructive effect on the market in the near term, as consumers wait for the FIS to be enacted.
- Lack of continuity leads to stop-&-go dynamics, which discourage the industry from investing into solar thermal long-term (e.g. into new production facility,

marketing, training of professionals). Under such circumstances a healthy market cannot develop.
- Without suitable and targeted flanking measures, FIS typically fail to produce significant growth in the market.
- Complicated and slow administration procedures do not work if the consumer needs a new heating/cooling system soon (e.g. because the existing conventional heating system broke down).
- Lack of (sensible) quality criteria leads to many low-quality systems being installed, which may undermine the long term European renewable energy targets.

Positive lessons learned ("best practice")

- A long-term support strategy, consisting of a financial incentive scheme and suitable flanking measures (especially awareness raising, training of professionals) has shown to have the highest impact on market growth.
- Specific financial incentives must be high enough to really have an effect on the market.
- To guarantee continuity of the FIS, sufficient funds must be available at all times – if this cannot be guaranteed from the public budget, other sources should be tapped.
- Easy and lean application and payment procedures (where necessary) are necessary for broad acceptance of the FIS.
- Quality requirements which are fully compatible with the relevant EN standards strengthen the consumers' confidence in solar thermal technology and contribute to further market growth.

Annex I: Case Study of Market Stimulation Programme – Solar Thermal Energy Germany

Identification of the Financing Scheme

Title of the financing scheme

The programme is called “Programme to stimulate measures for using renewable energy sources”, in short “Market Stimulation Programme (MSP)”.

Brief description of the financing scheme

In the market stimulation programme (MSP), solar thermal systems are supported through a financial incentive of 105 € per m² of collector area for systems, which are used for heating domestic hot water and 135 € per m² of collector area for systems, which also support space heating (so called combisystems). Systems larger than 200 m^2 receive a subsidy of 60 € per m^2 for each square meter, which exceeds 200 m^2. The financial incentives cover around 15% of the investment costs. Those entitled to apply include amongst others, private individuals, small and medium-sized companies, municipalities and registered associations. This application must be filed prior to placing the order. There is no legal title to receiving the subsidy. Over 90% of the solar thermal systems installed in Germany receive incentives through the MSP.

Promoter

The MSP is a financial incentive scheme of the German Federal Ministry for the Environment.

Type of actor

The MSP is implemented and financed by the German Federal Government (out of the public budget).

Financing scheme priorities

The MSP is a German financial incentive scheme. All types of solar thermal systems are supported: for heating domestic water, supporting space heating, large-scale systems for apartment buildings, district heating systems, generating process heat and solar cooling systems.

The scheme requires that the collector used has a minimum annual energy yield of 525 kWh per m^2 of collector area at a solar fraction of 40% at the city of Würzburg. This means that plastic absorbers typically used for heating swimming pools as well as other unglazed collectors are not supported.

Description of the Financing Scheme

General description of the financing scheme

Background

The MSP was introduced in 1999. A predecessor programme has existed since 1994; however, its financial backing was insufficient and therefore it did not have a significant impact. In 1999, the funds for the MSP were significantly increased so that it is assumed that since that time, 90% of the collector area installed in Germany has received support under the MSP.

Financing scheme design/management

The market stimulation programme is part of the political strategy of the German Federal Government to expand the share of renewable energy. In addition to the subsidies in the MSP, low-interest loans for solar thermal systems are also available in the CO_2 reduction programme. However, these loans have been utilised only to a very limited extent.

At the end of 2002, the responsibility for the MSP shifted from the German Federal Ministry of Economics to the German Federal Ministry for the Environment (BMU). The BMU controls the programme, establishes the guidelines and provides the funds. The programme is implemented by the German Federal Office of Economics and Export Control (BAFA) in Eschborn (www.bafa.de). The applications must be filed there. The BAFA staff review the applications and authorise financial incentives. Once the installation of a solar thermal system is completed, the investor informs the BAFA and claims the allotted subsidy. The BAFA is also responsible for executing the payment.

The solar industry associations are in close contact with the German Federal Ministry for the Environment to discuss at an early stage any possible guideline changes. The Ministry coordinates programme changes and the financial planning with the members of parliament, since the funds must be approved by parliament each year as part of the federal budget.

Objective of the financing scheme

The motivation for implementing the programme is specified in the preamble of the MSP: “In the interest of a future-oriented, sustainable energy supply and in view of the only limited availability of fossil energy sources as well as to protect the environment and the climate, it is necessary to increase the share of renewable energy in the energy market. To achieve this, the market penetration of renewable energy technologies must be strengthened. An incentive to use such technologies is therefore required. For this reason, the federal government supports the increased usage of renewable energy in accordance with these guidelines…. A central objective of the support according to these guidelines is to implement investment incentives, … to strengthen the sales of technologies of renewable energy in the market and thus lower their costs and to contribute to improving their economic efficiency.”

Specific quantity goals have not been identified in the programme. However, at the end of 2002, the German government set a goal of doubling the total installed collector area by the end of 2006 (as of the end of 2002: 4,35 million m^2). The MSP is the most important programme in achieving this goal.

Actions

In 1999, the MSP began with the goal of substantially increasing the use of solar thermal energy, which – partly also because of the sharply increasing oil prices – was initially extremely successful and in 2001, led to a record number of applications. Since the funds were insufficient to cover the large demand, the specific financial incentives were significantly reduced in 2001. As a consequence, and also because of the significantly decreasing oil prices, the number of applications drastically diminished. Since 2003, the demand has again greatly increased and in 2005, it surpassed the record value of 2001 for the first time.

The specific financial incentives and the annual number of applications and the collector area applied for are listed in the following table:

Year	Specific financial incentives	Number of grant applications / collector area applied for
1999	Programme start date was 1/09/99 Incentive for flat plate collectors < 100 m²: 250 DM/m² (128 €) Evacuated tube collectors (ETC) < 75 m²: 325 DM/m² (166 €)	
2000	Expansion of existing systems: 100 DM/m² (51 €) By the end of 2000: Incentive for installing a functional control device/heat volume meter Simultaneous boiler installation renders an incentive of 20%, max. the sum of the solar energy incentive Minimum collector output: 350 kWh/m²	93.541 applications 751.260 m²
2001	Change in specific financial incentives as of 23/03/01 Simultaneous boiler installation guarantees a lump-sum incentive of 500 DM (256 €) Max. 50,000 DM (25.565 €) per system incentive is applied for each m^2 of collector area* Change in specific financial incentives as of 25/07/01 Flat plate and ETC collectors < 100 m²: 170 DM/m² (87 €) Incentive no longer available for simultaneous boiler installation	101.789 applications 875.519 m²

2002	Change in specific financial incentives as of 23/03/02 Flat plate and ETC collectors: 92 €/m² Max. 25,000 €	58.589 applications 524.059 m²
2003	Change in specific financial incentives as of 01/02/03 Flat plate and ETC collectors: 125 €/m²	152.647 applications 1.506.228 m²
2004	Change in specific financial incentives as of 01/01/04 Flat plate and ETC collectors: 110 €/m² Expansion of existing systems: 60 €/m² The size of the system is no longer restricted As of 01.06.04: Minimum collector output: 525 kWh/m²	83.908 applications 814.881 m²
2005	Change in specific financial incentives as of 01/07/05 Up to 200 m² of collector area: - Systems for heating drinking water: 105 €/m² - Systems for heating drinking water + backup heating: 135 €/m² More than 200 m² of collector area: 60 €/m² Expansion of existing systems: 60 €/m²	approx. 150.000 applications approx. 1.350.000 m²

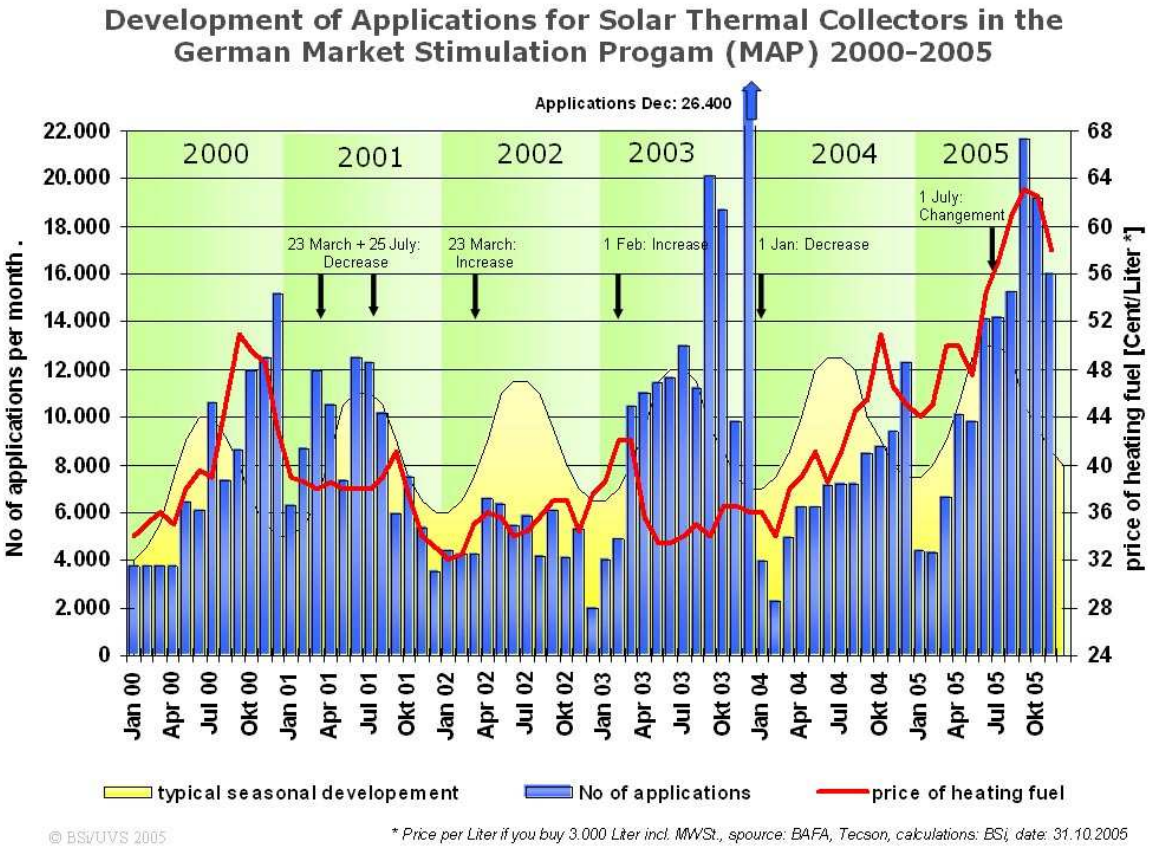
*Since 23/03/2001, the incentive has not been based on the actually installed collector area, but on every commenced square meter of collector area, e.g. a system with 5.2 m^2 of collector area, receives a financial incentive for 6 m^2. This significantly simplified processing the applications. This means that the collector area applied for listed in column three is approximately 10% higher than the actual collector area applied for.

The changes in the specific financial incentives took place for the following reasons:

- The grant levels increased in order to increase the market stimulation effect since the previous market development was not satisfactory (this was the case on 23/03/02, 01/02/03 and 01/07/05),
- The grant levels decreased if the funds became insufficient to authorise all applications (this was the case on 23/03/01 and on 25/07/01) or
- The grant levels decreased at pre-defined times as a result of the general digressive design of the programme and in order to be able to authorise more systems under the assumption that if a subsidy is successful the specific incentive could be continuously reduced (this was the case on 01/01/04).

The fundamental problem of the government-financed programmes lies in the difficulties of providing sufficient funds in the annual budget, despite strong fluctuations in the demand.

The fluctuations of the monthly number of applications as well as the heating oil prices since the project's beginning are shown in the following graph. Both the effects of the specific financial incentives and the oil price are clearly depicted.



As a result of the significant increase in applications in 2005, all funds were depleted by mid-October and the grants in the market stimulation programme were halted. The grants are expected to resume again in the spring of 2006, however, the grant level will be moderately reduced.

Alongside the programme, the government also co-finances solar thermal campaigns. From 1999 to 2001, the "Solar – na klar!" solar thermal campaign and since 2003, the "Initiative Solarwärme plus" have been supported. Since 2005, the "Wärme von der Sonne" initiative has also been co-funded by the German Ministry for the Environment. The initiative supports regional solar energy initiatives in holding information and publicity events. The financial support typically covers 50% of the campaign costs.

Possible changes to the MSP guidelines to take effect in spring of 2006 are currently being deliberated. In addition, a renewable heating law, which will replace the market stimulation programme, is to be instituted by 2009.

Prompt and non-bureaucratic processing times are a decisive requirement for the programme's success. Over the years, the German Federal Office of Economics and Export Control (BAFA) has optimised the administrative processes and simplified filling in applications so that it usually takes only 2 to 4 weeks for an application to be authorised.

Timing

The MSP started in 1999 and is currently limited until 31.12.2006. In the fall of 2005, the new federal government announced its decision to continue the programme until 2009. A corresponding provision is expected to be incorporated in the guideline change during the spring of 2006.

Costs of implementing the financing schemes

Similar to the strong fluctuations in the number of applications, the costs for the MSP subsidies strongly fluctuate from year to year. In 2005, subsidies totalling approximately 130 million €, which accounted for roughly 15% of the investment costs, were allocated for solar collectors. That means that the German government collects more money in value-added tax from the system investment than it distributes in funds. In the years to come, increasing financial requirements are expected as a result of market growth.

The administration costs of the MSP are not known.

Finances

The programme will is financed from the federal budget, which must be approved each year.

Financing Scheme Results

Quantitative results

From 01/09/1999 up until 30/09/2005, the following results were achieved in the MSP:

Number of received applications	598.532
Funds applied for	740.655.004 €
Planned investment volume	4.607.322.721 €
Subsidy ratio	16%
Collector area applied for	5.561.312 m²
Net collector area applied for (less the rounding up of collector area)	approx. 5,0 million m²
Portion of systems not implemented	15%
Implemented collector area	approx. 4,3 million m²
Implemented collector capacity	approx. 3,0 GW
Annual solar energy yield	approx. 1.720 GWh per annum

Environmental

Boiler efficiency	75%
Annual final energy conservation (oil/gas)	approx. 2.300 GWh per annum
Annual CO_2 conservation	530.000 tonnes of CO_2 per annum

Local indicators

Costs kWh oil/gas (average)	3,5 ct/kWh
Reduction of oil/gas import costs = local increase in purchasing power	80 million € per annum

Replication potential

A financial incentive programme, such as the MSP, will work also in other countries, if it is attractive enough.

Communication

The MSP is publicised primarily by the solar energy industry and the installers. In addition, the associations frequently mention the programme in their press reports. The solar awareness raising campaigns inform the general public about the advantages of using solar thermal energy and the financial incentive scheme, primarily through the print media.

Monitoring & Lessons Learned

Monitoring

The German Federal Ministry for the Environment commissions an independent institute to evaluate the programme at irregular intervals. The institute is selected through a call for tender. The evaluation reviews the effectiveness of the programme, the efficiency, possible windfall gains and the advances of the technologies. Suggestions are made regarding the further development of the programme.

The last evaluation took place over the time period between January 2002 and August 2004 and was carried out by the Centre for Solar Energy and Hydrogen Research in Baden-Württemberg and the Fraunhofer Institute for System and Innovation Research.

Monitoring of the installed and supported systems in order to inspect the quality of the installations and the functional capability of the systems, has not taken place so far.

Analysis and lessons learned

The strong fluctuations in demand, the programme interruptions and regular programme corrections clearly indicate that a subsidy programme can only be successfully implemented under the following conditions:

- The programme must be established over the long term, for at least 5 years.
- The programme must run continuously by ensuring that sufficient funding is provided so that applications can be continuously authorised.
- The sum of the subsidy must create a sufficient subsidy effect. The amount depends on the motivation of the investors, and a 15% subsidy is considered the lower limit (ideally, the subsidy should cover the additional costs of the solar thermal system compared to other energy sources).
- The annual funds provided must be sufficient to ensure that the applied for collector area can be granted and an annual market growth is possible, i.e. the funds must increase annually if the programme is successful and stimulates market growth.
- The process of filling out the application must be as simple as possible, and the processing of the application must be prompt and guaranteed within a few weeks so no administrative barriers are created.
- In addition to the subsidy programme, it is advisable to hold awareness raising campaigns for solar thermal in order to stimulate the demand.

It should be noted that the MSP almost only reaches private investors, who use the solar thermal energy in private residential buildings. The amount of the incentives are not attractive enough to also stimulate investments in systems for commercial applications, as in the rental apartment market, hospitals, retirement homes, hotels or commercial businesses. In addition, there are further barriers, which must be overcome in these areas, such as e.g. invoicing the tenant for solar thermal energy.

If you consider the following elements, how would you describe their relevance/importance or priority in the development of the financing scheme

Under the specified conditions, a subsidy support programme is an excellent instrument to stimulate market growth in an emerging solar thermal market. However, experience has shown that the risk of having to repeatedly stop the programme is great, since the demand is not constant and continuously providing funds poses a problem. In developed solar thermal markets, the subsidy must be made independent of a budget, since the funds are difficult to provide and stopping the subsidy programme can massively jeopardise the developing solar energy industry.

Effects of existing financial schemes

Since solar thermal incentives are almost only focused on the MSP, there are no other programmes with noticeable influences.

Annex II: Case studies for Italy: Public support from the Ministry of Environment to Local Authorities

Summary

The support programme of the Ministry of Environment (MATT) for the installation of solar thermal plants, targeted to Local Authorities and municipally-owned Gas Distribution Companies, was a very good idea to foster the spreading of solar thermal technology in public bodies.

The programme had a quite good start and even a specific awareness raising campaign had been planned, basing on contacts with associations of local administrations. Unfortunately, the campaign was interrupted because of the changing in Italian government.

So far, only 1 M€ has been assigned in more than 4 years, leading to total investments of about 3,3 M€ and therefore to about 3,5 MW_{th} of thermal power installed (5.000 m2 and clean energy production of 3.500 MWh/year, considering a system yield of 700 kWh/m2 year).

1 M€ corresponds to about 17% of the total resources and therefore the programme had a quite negative exit.

The main reasons for that are:

- the absence of an awareness raising campaign;
- as a consequence of the above issue, the lack of interconnection between the centralized administration of the programme and the Local Administrations;
- the subsidy share (30%) was too low to be “appealing” for Local Administrations; that is a typical share for private investors, but, for public subjects, a 50% share could have been more helpful.
- no technical skill of the internal personnel of Local Administrations for developing the feasibility study required for submitting the project application;
- scarce knowledge of the technology and of the most suitable applications; many Local Administrations were interested in schools, even with a very low hot water consumption, instead of focusing on gyms, sport centres, swimming pools, etc.;
- the foreseen contract for the guarantee of solar results could act as a barrier, given the fact that the solar thermal market in Italy is not at a very developed stage and therefore the small actors operating could be not able to sign and respect this kind of quite strict contracts; in this programme, however, the real barrier was the lacking of demand by the Local Administrations.

Identification of the Financing Scheme

Title of the financing scheme

Support programme of the Ministry of Environment (MATT) for the installation of solar thermal plants, targeted to Local Authorities and municipally-owned Gas Distribution Companies.

Brief description of the financing scheme

This national subsidy programme started in 2002 and it foresees a maximum 30% contribution (VAT excluded) on turn-key plant costs, for the installation of solar thermal systems by Local Authorities and municipally-owned Gas Distribution Companies.

Details are provided in the following sections.

Promoter

The only promoter of this subsidy programme is MATT. There are no Regional Authorities involved in the scheme. All applications are submitted directly to MATT and also subsidies are provided by MATT.

Type of actor

MATT is responsible for both developing the subsidy scheme and administering the resources. ENEA (National Energy for Research on Energy and Environment) wrote the technical guidelines which, however, were not developed specifically for this programme, but for the whole solar thermal subsidy action, therefore for the regional subsidy schemes.

Financing scheme priorities

The financing scheme includes low-temperature solar thermal systems, namely for domestic hot water, swimming pool heating and space heating and cooling, installed on buildings (roofs or façades).

The incentive scheme is working at national level.

Description of the Financing Scheme

General description of the financing scheme

Background

The public sector has always been a focal point for energy efficiency in Italy. About 95% of the Italian solar thermal market is due to private initiatives, while a good energy efficiency policy in the public sector is out of doubt lacking.

In 1991, Law no. 10 stated that the use of energy efficiency measures and renewable energy sources was of high priority. This law was scarcely applied, because of the absence of corresponding fines and of the lack of specific knowledge on the side of technical personnel of Local Authorities.

Financing scheme design/management

This subsidy scheme was initiated by MATT as part of a larger strategy, which included also co-financing of Regional subsidy programmes.

The plant size must be above 20 m^2, but this minimum size could also be reached by adding several plants (minimum sub-plant size: 6 m^2).

The applications must include a preliminary project of the plant and are evaluated by a specific commission chaired by MATT, which assesses the technical level of the projects and then ranks them on a “first come, first served” basis.

The costs that could be covered by the subsidy include design, components (also the monitoring system) and installation. If the application is accepted, the owner receives 50% of the subsidy when the construction starts and the remaining 50% when the plant has been built.

The plant owner must assure that the plant will be kept in operation for at least 10 years.

Regarding quality and guarantee, it should be highlighted that:

- The monitoring of the plant is mandatory, to measure both the total heat consumption and the thermal energy delivered by the solar plant (and therefore the solar fraction); the monitoring system could be included in the subsidised turn-key cost, with a maximum of 10% of the overall cost and with a maximum of about 8.000 €.
- The installing company should sign a contract for the guarantee of solar results; this contract foresees a guaranteed minimum energy yield, in terms of minimum solar fraction, measured by the plant monitoring system, which delivers data about the energy supplied by the solar plant and the energy consumed by the user.

- The solar collectors used should be certified and/or qualified by European or Italian Institutes and an installation manual should be provided; this statement was rather vague in the text of the financing scheme, but from a practical point of view, the certification according to the EN standard was accepted.

Objective of the financing scheme

The main objective of this programme was to raise interest towards solar thermal by public actors, given their scarce participation so far in this field (see above description of the background).
The total installation foreseen was about 21 MW_{th} (30,000 m^2), basing on the total resources available and on the turn-key cost of solar thermal systems in the Italian market.

Actions

A specific awareness raising campaign had been planned, basing on contacts with associations of local administrations. Unfortunately, the campaign was interrupted because of the changing in Italian government and therefore in the main personalities in the Ministry of Environment, in particular the General Director of the Renewable Energy Sources section.

However, the programme has always been presented in workshop and seminars.

Timing

The subsidy programme started in 2001 and it is still open; the current status is still uncertain, but it is likely that the programme could be interrupted very soon, given the scarce answer by the public sector.

So far, a huge amount of resources is still available (see Finances).

Costs of implementing the financing schemes (costs on the side of the administration and on the side of the investor)

The support given to the beneficiaries is a subsidy on plant investment cost, with a maximum value of 30% (VAT excluded). A smaller value could be given in case of non-optimal yield foreseen for the plant, for instance if shadowing issues or bad collector tilt or orientation could not be avoided.

The cost for MATT is roughly 3 man-years for developing and administering the subsidy scheme, while the consultancy given to ENEA for developing the technical guidelines is not easily quantifiable, since these guidelines were developed also for the regional subsidy programmes.

Finances

About 6 millions of Euros were stored by MATT for the subsidy programme, 2/3 of which for Local Authorities, while 1/3 for municipally-owned Gas Distribution Companies for installing systems for public or private subjects.

So far, only about 1 M€ has been assigned; this will lead to a total investment of about 3,3 M€, corresponding to about 3,5 MW_{th} of thermal power installed (5.000 m^2). Today 5 M€ of resources are still left and, although there are no official communications about the end of the programme, it is likely that, given the long time since the beginning of the availability of the subsidy scheme, the resources will be retired in a very short time.

Financing Scheme Results

Quantitative results

A complete assessment of the results of the programme is not available up to now, since it is still open.

However, some global results are worthy to be highlighted:

- Total budget for the programme: 6 M€
- Assigned resources: about 1 M€, leading to:
  - total investments of about 3,3 M€
  - about 3,5 MW_{th} of thermal power installed (5,000 m^2)
  - clean energy production of 3.500 MWh/year (considering a system yield of 700 kWh/m^2 year)
- Resources still available: about 5 M€

Replication potential

The chance of promoting the use of solar thermal in public bodies is quite interesting; therefore, the replication potential of the herein presented scheme is definitely high, providing the following suggestions are taken into account:

- enhance the connections between the programme management (e.g. the central government of the Ministry) and the local actors by specific awareness raising campaigns;
- provide a higher contribution on investment cost (about 50%)

Communication

No specific communication policies and awareness raising campaigns were developed (see above), though target-oriented actions had been planned at an early stage of development of the programme.

Monitoring & Lessons Learned

Monitoring

MATT is updating the list of all the applications submitted as well as of the projects realized or in progress.

The list of applications approved by MATT is available at:
http://www2.minambiente.it/sito/settori_azione/iar/FontiRinnovabili/solare_termico/progetti/progetti_programma_st.asp

The project realised or in progress are listed at:
http://www2.minambiente.it/sito/settori_azione/iar/FontiRinnovabili/solare_termico/progetti_ministero/progetti_ministero.asp

Additionally, as already stated above, MATT will collect the data coming from the monitoring systems of the largest plants co-financed by the programme.

Analysis and lessons learned

The programme had a negative exit, given the large resources still left available after 4 years of the subsidy scheme being running.

The main problems faced by this programme are:

- on MATT side
  - the absence of an awareness raising campaign;
  - as a consequence of the above issue, the lack of interconnection between the centralized administration of the programme and the Local Administrations;
  - the subsidy share (30%) was too low to be “appealing” for Local Administrations; that is a typical share for private investors, but, for public subjects, a 50% share could have been more helpful.
- on Local Administration side:
  - no technical skill of the internal personnel for developing the feasibility study required for submitting the project application;
  - scarce knowledge of the technology and of the most suitable applications; many Local Administrations were interested in schools, even with a very low hot water consumption, instead of focusing on gyms, sport centers, swimming pools, etc.;
- on installer side:
  - the foreseen contract for the guarantee of solar results could act as a barrier, given the fact that the solar thermal market in Italy is not at a very developed stage and therefore the small actors operating could be not able to sign and respect this kind of quite strict contracts; in this programme, however, the real barrier was the lacking of demand by the Local Administrations.

However, in the last year (2005), an acceleration of the submissions has been noticed, mainly depending on:

- wider promotion of the programme through workshop, seminars, technical courses, etc.;
- ever growing interest in the renewable energy sector in general.

Annex III: Case studies for Italy: Regional subsidy schemes – Two examples

Summary

The Italian regional programmes were born in the framework of a wide initiative coming from MATT side, which provided the Regions with 50% of the resources needed to launch subsidy schemes for solar thermal at regional level. Such programs have been implemented in most of the 20 Italian regions. This study compares two of them, that led to very different results.

The regional programs are usually based on a common scheme: the Region provides the final user (both private or public) with a contribution on the investment cost of the solar plant or an amount of money proportional to the expected thermal energy production.

Huge differences were observed, however, in the Regions, given the following:

- large cultural and technical gaps, regarding renewables and energy in general: some Regions (e.g. Lombardia) replied very quickly and very precisely to the input from MATT, while the same cannot be said about Campania;
- regional autonomy in Italy foreseen for the Regional Administrations.

Coming to the analysed case studies (Lombardia and Campania), we should highlight a positive exit of the Lombardia programme, for following reasons:

- the “open-tender” approach: as soon as new resources are available, an announcement is made on the programme web site;
- a list of installers available on the programme web site, which increases the confidence of the final user;
- the submission by the installer and not by the final user;
- the electronic procedure for the submission of applications.

On the contrary, the Campania regional programme showed a quite negative exit, for the following reasons:

- wrong (too low) figures for the turn-key cost of the solar plants, leading to subsidies of 10%-20% of the investment cost; instead, the programme meant to give a subsidy share of about 30%;
- the programme demanded a monitoring system also for very small domestic plants; in this case, the cost of the monitoring system could raise even to 30% of the total investment cost;
- the programme had the usual “closed tender” approach and, furthermore, it was launched in the summer months (almost at the end of July);
- lacking of specific communication policies and awareness raising campaigns.

Identification of the Financing Scheme

Title of the financing scheme

Subsidy programme of Italian Regions for financing solar thermal (ST) plants. The cases of Lombardia and Campania will be here analysed, to pinpoint analogies and differences.

Brief description of the financing scheme

The Italian regional subsidy programmes are usually based on a common scheme: the Region provides the final user with a contribution on the investment cost of the solar plant or an amount of money proportional to the expected thermal energy production.

See point below for details.

Promoter

The promoter of this subsidy programmes is the Ministry of Environment (MATT), which provides the Regions with 50% of the resources needed to activate the programme.

Type of actor

As already stated above, the role of MATT is to promote this programmes.
Regions are then in charge of:

- providing the missing 50%;
- administering the resources and the programme;
- reporting the final results to MATT.

Lombardia
Region Lombardia manages the programme through his web site, receiving the applications and providing the subsidies. Actually, the subject managing the programme on behalf of Region Lombardia is the Associazione Rete di Punti Energia, a sort of association of local energy agencies.

The other actors officially involved are the registered installers, a list of whom is included in the web site and is accessible by the applicants (see below).

Campania
Campania Regional Administration provided resources to the Provinces, which should then manage the subsidy scheme at provincial level, also reporting the results to the Region. The Region is then in charge of providing general statistics and figures about the programme.

The installation of a monitoring system in all plants is mandatory and the owner of the plant shall send to the Province Administration, at least for 3 years, a form filled up with the operating results of the solar thermal system.

The managements sounds quite more complicated than in the Lombardia programme.

Financing scheme priorities

The financing scheme refers to solar thermal plants for both private entities and public bodies. Usually not every solar thermal application (domestic hot water, space heating, etc.) is explicitly foreseen in the programme official text, but it is a matter of cultural approach.

Lombardia

In Lombardia, for instance, the programme supports ST plants using both water or air collectors, for domestic hot water preparation and heating purposes, both installed on buildings (roofs or façades) or mounted on the ground.

Furhtermore, all application sectors (residential, commercial, industrial, etc.) are included in the scope of the programme.

Campania

Here, that level of detail is not provided and the financing scheme refers in general to solar thermal systems for domestic hot water preparation and heating purposes.

Description of the Financing Scheme

General description of the financing scheme

Background

As reported above, the regional programmes were born in the framework of a wide initiative coming from MATT side, which provided the Regions with 50% of the resources needed to launch subsidy programmes for solar thermal at regional level.

We should also take into account that large cultural differences, regarding renewables and energy in general, are to be expected between the Regions. Lombardia, for instance, replied very quickly and very precisely to the input from MATT, while the same cannot be said about Campania.

Financing scheme design/management

The technical requirements of the plants for these regional subsidy programmes are based on a text developed by the Italian Agency for Energy and Environment (ENEA). However, given the autonomy of the Regions in energy matters, every Region only partially adopted this text, often raising “technical nonsense”.

Lombardia

Subsidy: the subsidy is given basing not on the investment cost, but on the expected annual yield of the plant. The tariff foreseen is 0,30 €/kWh. However, the subsidy cannot be higher than 25% of the plant investment cost and, in any case, the maximum subsidy foreseen for a single system is 50.000 €.

An additional subsidy of 130 € is given in case the installation of the plant needs special permitting requirements.

Application submission: the applications for getting the subsidy go through an internet-based procedure, on the web site of Region Lombardia. The applicants should choose one of the authorised installers (classified by Province and Municipality) listed on the web site. Afterwards, the installer will look after the application and the subsidy.

The applications are ranked basing on chronological order.

Campania

Subsidy: the maximum investment cost that could be subsidised is calculated on an energy production basis:

- 1 €/kWh for plants with a total yearly energy output lower than 10.000 kWh/year;
- 0,6+4.000/E (€/kWh) for plants with a total yearly energy output higher than 10.000 kWh/year (“E” is the yearly thermal energy output).

However, the investment cost could never be higher than the values reported in the table below (“S” is the plant surface area).

Maximum turn-key cost foreseen for the solar thermal plants

Collector technology	Plant surface area (m^2)	
	<20	>20
Flat plate or integrated storage	600 €/m^2	360+4.800/S €/m^2
Evacuated tubes	720 €/m^2	440+5.600/S €/m^2
Unglazed	360 €/m^2	220+2.800/S €/m^2

The maximum subsidy foreseen is 30% of the total investment cost (VAT excluded; VAT on solar thermal systems is, at the time of writing, 10%).

Let's make an example: a 2 m^2 ST plant (with flat plate collectors) for domestic hot water installed in Rome could have an energy yield of 1.600 kWh/year, therefore the maximum allowable cost is:

Basing on energy production: 1 (€/kWh) * 1.600 (kWh) = 1.600 €
Basing on plant surface area (see table): 600 (€/m^2) * 2 (m^2) = 1.200 €

The maximum turn-key cost foreseen has to be chosen looking at the minimum value, therefore 1.200 €. Basing on this value, the user could apply for a 30% contribution, therefore 400 €.

If we look at the real turn-key cost of such a small solar thermal plant in Italy, including also bureaucracy and monitoring system costs, this contribution represents a quite smaller share, let's say 15-20%.

Application submission: the applications for getting the subsidies should be sent to the Provincial Administrations within 60 days from the scheme publishing date.
The documentation needed for applying include: a technical sheet of the proposed plant, a preliminary project and also the percentage of contribution required (max. 30%).

The applications are ranked basing on chronological order. If two applications are sent on the same date, they will be ranked based on the percentage of contribution required: the lower the percentage, the higher the ranking.

Objective of the financing scheme

The main objective of this programme was the installation of solar thermal plants as specified above.

Actions

No specific awareness raising campaigns were developed. However, in Lombardia, the programme was widely advertised at regional level.

Timing

Lombardia

The subsidy programme started in 2002 and then more resources were added in 2004. No deadline is foreseen, since the programme is open as long as resources are still available.

Campania
The subsidy programme was officially launched on 18/07/2005. At the time of writing, no news are available on the possibility of a new programme which could substitute the previous one, given its quite negative exit.

Costs of implementing the financing schemes (costs on the side of the administration and on the side of the investor)

The cost on the side of the regional administration is due to the work needed to:

- prepare the programme tender;
- possibly launch awareness raising campaigns;
- receiving and analysing the applications;
- reporting the final results to MATT (however, this task is almost never fulfilled).

The cost on the side of the investor is the paper work needed to submit the application. From this point of view, the Lombardia programme was quite good, since the final user, just going on a very user-friendly web site, could choose an installer, which will be then responsible for carrying out the application.

Finances

Lombardia
The total resources for this programme are about 950.000 €.

Campania
The total resources for this programme are about 2 M€: 70% for private bodies and 30% for public bodies. The total budget was divided among the five Provinces in the Region, according to the amount of population.

Financing Scheme Results

Quantitative results

No official statistics about the regional subsidy programmes are available so far. However, MATT is in charge of these tasks, that will be developed hopefully in the next months.
For Campania, even though there are no official statistics, according to our knowledge, the programme had a very negative exit, leading to a quite low number of applications submitted.

Replication potential

Actually, many regional subsidy programmes were launched in the last years, but the replication potential of some specific issues of the Lombardia programme is very high, namely:

- the internet-based submission;
- the “open-tender” approach (see point 4 for further details).

Communication

See Actions.

Monitoring & Lessons Learned

Monitoring

No statistics are available so far (see Quantitative Results).

Analysis and lessons learned

Lombardia

The main positive differences which this programme showed with respect to other similar regional initiatives are:

- the "open-tender" approach: as soon as new resources are available, an announcement is made on the programme web site;
- a list of installers available on the programme web site, which increases the confidence of the final user;
- the submission by the installer and not by the final user;
- the electronic procedure for the submission of applications.

Campania

The main reason for the negative exit of the programme are:

- wrong figures for the turn-key cost of the solar plants; a maximum total cost of about 600 €/m2 was foreseen; therefore, given the real turn-key cost of small plants (see calculation example in paragraph 6.b), the subsidy was bewteen 10% and 20% of the investment cost; instead, the programme meant to give a subsidy share of about 30%;
- the programme demanded a monitoring system also for very small domestic plants; in this case, the cost of the monitoring system could raise even to 30% of the total investment cost;
- the programme had the usual "closed tender" approach and, furthermore, it was launched in the summer months (almost at the end of July);
- lack of specific communication policies and awareness raising campaigns.

Assolterm asked for substantial changes in the subsidy programme, especially regarding the cost issue. It is likely that the programme will be revised and launched a second time in the first semester of 2006.

Annex IV: Case studies for Italy: White Certificates scheme for energy saving and energy efficiency

Summary

The new mechanism for the promotion of energy saving and energy efficiency has its basis on the fact that large gas and electricity distribution companies must meet annual mandatory targets for energy savings in final uses.

The scheme, which operates at national level, aims at reaching energy saving targets for both electric and thermal energy; therefore any project leading to heat or electricity savings, in principle, could be included in this scheme.

Solar thermal is one of the technologies involved explicitly, with even a standard calculation sheet to assess the savings obtained by using solar thermal plants.

In order to meet their obligation, the involved companies can, first of all, build up their own energy saving projects. For instance, an electric utility could distribute low consumption bulbs to all their customers, then certifying the overall savings.

Another possible solution for the companies is to buy “White Certificates”, which correspond to energy saving projects carried out by other subjects, the ESCOs (Energy Service Companies).

Even though in Italy this “White Certificate” scheme is quite important to spread also the culture of energy efficiency, such an incentive system has out of doubt some weak points:

- the selling of White Certificate is done on a market basis, so general uncertainty about the prices is expected; this means that energy efficiency and renewables cannot rely on fixed incentives;
- as a consequence, as in the Green Certificates schemes, ESCOs prefer to carry out energy saving projects with a low payback time; therefore the “competition” among different solutions is based almost completely on the economic issue; this could lead to a mass spreading of, for instance, low consumption bulbs and to a very few solar thermal installations
- the working principle is not so “user-friendly” and for a small operator, typical of the Italian market, not always easy to be understood; this is due above all to the large amount of actors involved and to the high number of deadlines and papers to be submitted.

Identification of the Financing Scheme

Title of the financing scheme

White Certificates scheme for energy saving and energy efficiency.

Brief description of the financing scheme

The herein described new mechanism for the promotion of energy saving and energy efficiency has been in operation in Italy since January, 1st 2005.

The key concept of this scheme is that large (more than 100.000 customers) gas and electricity distribution companies must meet annual mandatory targets for energy savings in final uses, expressed in Mtoe (tons of oil equivalent)/year.

Promoter

The promoter of this scheme is the Ministry of Industry, but several different actors are involved in the operation of the mechanism (see Type of Actor below).

Type of actor

The main actors involved are the following:

- the Ministry of Industry (MAP): it was responsible for developing the general framework for the scheme operation;
- the Ministry of Environment (MATT): it helped MAP in developing the regulatory framework;
- the Italian Authority for Gas and Electricity (AEEG): it is in charge of delivering the technical guidelines;
- large gas and electricity distribution companies, which are obliged to meet the established targets;
- the Energy Service Companies (ESCOs): they can carry out energy saving and efficiency projects, then selling the obtained savings to the distribution companies (see below for the details about the working principle);

Financing scheme priorities

The scheme, which operates at national level, aims at reaching energy saving targets for both electric and thermal energy; therefore any project leading to heat or electricity savings, in principle, could be included in this scheme.

Solar thermal is one of the technologies involved explicitly, since AEEG delivered even a standard calculation sheet to assess the savings obtained by using solar thermal plants.

Description of the Financing Scheme

General description of the financing scheme

Background

The first National Decrees which introduced the White Certificates scheme were published in 2001. Then AEEG did not accomplish its duty, providing technical guidelines for the actual application of the Decrees. In the meanwhile, due to a strong pressure from some stakeholders (large energy distribution companies above all), the Decrees had been revised: this process led to 3 years delay, with the final Decrees together with the application rules being published in 2004.

Financing scheme design/management

As already reported above, the key concept of this scheme is that large (more than 100,000 customers) gas and electricity distribution companies must meet annual mandatory targets for energy savings in final uses, expressed in Mtoe (tons of oil equivalent)/year.

In case these companies fail their objectives, they will face a proportional fine, higher than the average investment cost that would have been necessary to reach those targets.

The measures that could be used include everything which brings to real energy savings, e.g. replacing old lamps with high efficiency bulbs or electric boilers with gas boilers, use double glasses, improve walls and roof insulation, improve electric motors efficiency, use low-consumption electrical appliances (fridges, washing machines, etc.), adopt water-saving devices (e.g flow reductors or air/water mixers), install solar thermal collectors or photovoltaic modules, use heat pumps, etc.

In order to meet their obligation, the involved companies can, first of all, build up their own energy saving projects. For instance, an electric utility could distribute low consumption bulbs to all their customers, then certifying the overall savings.

Another possible solution for the companies is to buy “White Certificates”, which correspond to energy saving projects carried out by other subjects, the ESCOs (Energy Service Companies). Therefore, the White Certificates system works very similarly to the Green Certificates scheme.

Let us suppose that an ESCO carry out an energy saving project (e.g. the installation of a solar thermal system for hot water supply to a dairy); then the ESCO applies for the amount of White Certificates corresponding to the obtained savings in toe/year. The savings are usually calculated basing on standard parameters, provided by AEEG, and White Certificates are given yearly to the ESCO for a total period of 5 years for solar thermal plants. The last step is the selling of the White Certificates from the ESCO to the interested companies; this selling could be done on a bilateral contract or in a specific market for White Certificates. The price depends, as in any

market, on the matching between offer and demand, but the maximum price foreseen is 100 €/toe saved.

Going back to the example given above, let us say that the solar thermal plant installed by the ESCO covers a total area of 100 m^2, uses flat plate collectors, is located in Roma and will operate together with an electric boiler. For the assessment of the energy savings that could be certified, a calculation sheet has been made available from AEEG. This sheet reports the Gross Specific Saving, expressed in toe/m^2 of solar collectors installed. The GSS values depend on: the installation site (Italy is divided into five areas, basing on solar resource), the solar collector technology (flat plate or evacuated tubes) and the energy replaced by the solar heat (gas, electricity, oil, etc.). Incorrectly, the calculation sheet does not take into account at all the tilt and the azimuth of the collectors.

From the table below, we can see that the GSS for the project under study is 181*10^{-3} toe/m^2 year and therefore the total savings could be easily calculated: 18 toe/year for 5 years.

Assuming the maximum price of 100 €/toe saved, this would mean additional income for the ESCO of 1.800 €/year for 5 years.

Example of Gross Specific Savings due to the installation of a solar thermal plant

	Flat plate collectors		Evacuated tubes collectors	
	Replaced energy			
	Electric boiler	Gas/Oil	Electric boiler	Gas/Oil
Gross Specific Saving	10^{-3} toe/m^2 year	10^{-3} toe/m^2 year	10^{-3} toe/m^2 year	10^{-3} toe/m^2 year
Milano	122	61	153	76
Roma	181	90	209	104
Catania	247	123	269	134

Objective of the financing scheme

The overall goal of this system is raise a total energy savinge of 2.9 Mtoe in the time period 2005-2009, of which 1,6 Mtoe for electricity and 1,3 Mtoe for gas.

Actions

The White Certificates scheme has been widely advertised, thanks to the large number of stakeholders involved (MATT; MAP, AEEG; ESCOs, etc.).

Timing

The subsidy programme started in January 2005; the first step will end in 2009 and then MAP, MATT and AEEG will revise the scheme working mechanism and the mandatory targets for the following period.

Costs of implementing the financing schemes (costs on the side of the administration and on the side of the investor)

The costs on the side of the administration are very hard to quantify, given the large number of actors involved (see Part I, Type of actor). However, AEEG is in charge of the heaviest task, since it is supposed to check the compatibility of the applications and also to verify the fulfilment of the annual targets.

Some work is also expected by the Electric Market Manager Authority (GME), but it is not easy to estimate this amount of work, since the market has just started.

It is also worthy to highlight that the solar thermal is just a fraction of this complicated mechanism, therefore only a fraction of these costs on the side of the administration should be allocated to the solar sector.

On the side of the investor (distribution companies and ESCOs), the costs to be considered are related to the preparation of the projects to be submitted to AEEG; even though for solar thermal plants, the procedure is very easy (see Financing scheme design/managment), since the calculations are based on standard sheets, it is however additional work.

Finances

Just as happens with the PV feed-in law in Italy, a fraction of the expenses faced by the distribution companies to reach their targets could be charged on electricity and gas tariffs. Therefore, part of the cost of the scheme is faced by the final consumers, even though this amount has not been decided yet.

Financing Scheme Results

Quantitative results

So far, no quantitative results are available, but the whole scheme and especially the checking of annual mandatory targets will be monitored by AEEG.

It is interesting to mention the fact that there are already, in Italy, ESCOs which carry out projects on solar thermal plants.

Replication potential

The replication potential is the White Certificates scheme is quite high, given the following reasons:

- in most of the countries, the potential of energy saving and energy efficiency in reducing consumption and polluting emissions is very high;
- the selling of White Certificate is done on a market basis, so it could be adapted to national conditions; however, this kind of “market-based” incentives are quite dangerous, since they create general uncertainty about the prices, therefore not promoting easily the diffusion of renewables and energy saving measures.

Communication

As stated above, the White Certificates scheme has been widely advertised, thanks to the large number of stakeholders involved (MATT; MAP, AEEG; ESCOs, etc.).

AEEG web site (www.autorita.energia.it) is a quite good and complete communication tool, since all relevant technical and regulation documents regarding the White Certificates system could be find there.

Monitoring & Lessons Learned

Monitoring

So far, no quantitative results are available, but the whole scheme, including the verification of the annual mandatory targets will be monitored by AEEG.

Analysis and lessons learned

It is too early to do a complete assessment of the scheme, but several positive issues should be already highlighted:

- the involvement of ESCOs is leading to the birth of new companies;
- the improvement of an “energy efficiency culture”;
- the White Certificate acts as an additional incentive for the installation of solar thermal systems.

The negative sides are:

- the working principle is not so “user-friendly” and for a small operator, typical of the Italian market, not always easy to be understood; this is due above all to the large amount of actors involved and to the high number of deadlines and papers to be submitted.
- as in the Green Certificates schemes, ESCOs prefer to carry out energy saving projects with a low payback time; therefore the “competition” among different solutions is based almost completely on the economic issue; this could lead to a mass spreading of, for instance, low consumption bulbs and to a very few solar thermal installations.

Annex V: Regional case study for Austria – Upper Austria

Summary

Upper Austria is the most successful region in solar thermal penetration in Austria. One out of four solar thermal systems in Austria have been installed in this province so far. For almost 30 years, solar systems have been subsidised without any interruption, based on a balanced network of long term thinking regional politicians, active solar companies and the regional energy agency "OÖ Energiesparverband" as driving force and mediator. Subsidies have been given for new houses market as well as for renovation houses market.

The financing scheme is enacted and administered by the regional government of Upper Austria. The regional energy agency "OÖ Energiesparverband" is in charge of energy consulting for private and commercial costumers and of monitoring the financing scheme. Based on this monitoring changes of the financing scheme (subsidy level) always have been suggested by the energy agency to the government. Private house owners, housing associations, installers and solar companies have been the beneficiaries of the financing scheme, as it has led to the only continuously growing solar market over decades in Austrian provinces so far.

The official aim of the government of Upper Austria is to double the total installed collector area up to 1M m² until 2010. By then the province should have 0,72 m² collector area per inhabitant.

For sure a lesson to be learned of Upper Austria is that long term establishment of a continuously growing solar market needs stable conditions in terms of uninterrupted subsidy, awareness campaigns and training activities for installers and a stable communication network of public authority and private companies to secure stable conditions.

Identification of the Financing Scheme

Title of the financing scheme

Upper Austria is the most successful region in solar thermal penetration in Austria. One out of four solar thermal systems in Austria have been installed in this province so far. For almost 30 years solar systems have been subsidised without any interruption, with subsidy levels slowly increasing during the years. Subsidies have been given for new houses market as well as for renovation houses market.

Brief description of the financing scheme

Direct subsidy for private houses with three flats maximum and attached houses: for solar domestic hot water systems and solar combisystems for domestic hot water and space heating, also in combination with heat pumps. Direct subsidy is also given for enlargement or exchange of existing solar systems. The up-to-date subsidy is about 20 to 30 percent (depends on system size) of total investment costs or 50 percent of total investment costs (excl. VAT), maximum subsidy is 3.000 Euro.

Promoter

For almost 30 years the successful financing scheme of Upper Austria is based on a balanced network of long term thinking regional politicians, active solar companies and the regional energy agency “OÖ Energiesparverband” as driving force and mediator.

Type of actor

The financing scheme is enacted and administered by the regional government of Upper Austria. The regional energy agency “OÖ Energiesparverband” is in charge of energy consulting for private and commercial customers and of monitoring the financing scheme. Based on this monitoring changes of the financing scheme (subsidy level) always have been suggested by the energy agency to the government. Private house owners, housing associations, installers and solar companies have been the beneficiaries of the financing scheme, as it has led to the only continuously growing solar market over decades in Austrian provinces so far.

Financing scheme priorities

The financing scheme priorities are solar domestic hot water systems and solar combisystems for domestic hot water and space heating, also in combination with heat pumps. The scheme does not aim to district heating, air-conditioning and industrial process heating. For these applications a national financing scheme granting 30 percent of total investment costs is valid.

Description of the Financing Scheme

General description of the financing scheme

Background

The financing scheme of Upper Austria is a rare example of an uninterrupted scheme with continuously increasing subsidy levels over almost 30 years. Also previously the scheme is not limited in time.

Financing scheme design/management

The financing scheme of Upper Austria was initiated by the regional government as a reaction to the first oil crisis in the 1970s. Meanwhile the financing scheme for solar subsidies is part of the Upper Austria Energy Strategy “Energy 21” including all issues relevant to energy consumption. The scheme is operated by the regional government, in strong cooperation with regional solar companies and the regional energy agency “OÖ Energiesparverband”. Evaluation of the indicators for success and quantifiable benefits of the financing scheme is done by the regional energy agency “OÖ Energiesparverband”, which also suggests scheme changes to the government.

Objective of the financing scheme

The official aim of the government of Upper Austria is to double the total installed collector area up to 1M m² until 2010. By then, the province should have 0,72 m² collector area per inhabitant.

Actions

Training activities for installers have been started in the 1980s and progressed to date, leading to hundreds of well trained installers for solar systems in Upper Austria in the meanwhile. The training activities were promoted and operated by trade training organisations and vocational schools delivering technical training facilities. These training activities will be prolonged because more trained installers are still needed for enhanced solar market penetration in the region.

The financing scheme has been accompanied by several awareness campaigns in the last decades, with the latest campaign in autumn 2005. Meanwhile most of the costumers and companies in Upper Austria know about the solar subsidy given by the government. Nevertheless continued awareness activities are necessary for enhanced solar market penetration in the region.

Timing

The financing scheme of Upper Austria was started in the 1970s and is still ongoing without a closing date.

Costs of implementing the financing schemes (costs on the side of the administration and on the side of the investor)

The costs for the administration side are for enacting the financial scheme and administration of the thousands of application forms for solar subsidies. Additionally the regional energy agency, “OÖ Energiesparverband”, is supported by the

government to energy consult custumers and evaluate the financing scheme. In the last years around 45.000 m² collector area has been installed annually, leading to approximately 3.500 subsidised solar systems per year (average subsidy around 2.000 Euro per solar system), with less than 8M Euro solar thermal subsidies by the government in total.

Finances

See the above section.

Financing Scheme Results

Quantitative results

The quantitative results of the financing scheme in Upper Austria is an annually installed collector area about 45.000 m² during the last years, leading to an energy delivery of 15 GWh solar heat per year or environmental savings of more than 7.000 tons of CO_2 per year. Financial investments by costumers in solar systems in total reached over 30M Euro annually in the framework of the financing scheme in the last years.

Environmental

Estimated reduction of CO_2 emissions by year: over 7.000 tons of CO_2.

This might be difficult for local actors and depends strongly on the energy locally used and replaced by the RES heating technology. ESTIF suggested adopting a conversion factor for a certain energy mix like the IEA solar heating task force did.

Replication potential

For certain, a lesson to be learned of Upper Austria is that long term establishment of a continuously growing solar market needs stable conditions in terms of uninterrupted subsidy, awareness campaigns and training activities for installers and a stable communication network of public authority and private companies to secure stable conditions.

Communication

Over 15.000 energy consultations of costumers annually in Upper Austria, done by the regional energy agency “OÖ Energiesparverband”, have been a major factor in the communication strategy to promote the financing scheme in the last decades.

Monitoring & Lessons Learned

Monitoring

See above.

Analysis and lessons learned

A well established communication network of all relevant market actors, a sufficient budget for solar subsidies also in a growing market, a commitment of the relevant market actors for duration of the financing scheme, an unbureaucratic system of financing scheme management and a high quality of solar systems on the market – these factors all together are highly favourable to lead to market success over a longer period.