Project no. EIE/04/059/S07.38622

"ST-ESCOs"

Development of pilot Solar Thermal Energy Service Companies (ST-ESCOs) with high replication potential.

Intelligent Energy – Europe (EIE)

Type of action: SAVE

Key action: Buildings Sector

Coordinator: CRES

ST-ESCOs Market Analysis: Austria

Project website: www.stescos.org

1 ST ESCOs market in Austria

In recent years further considerable growth has been achieved. The basis for this was an increasing environmental awareness and the return of confidence in solar technology due to the introduction of improved, cheaper systems. Although there are more favourable sites in Europe in terms of the climate (Spain, Italy, Greece, etc.) Austria leads the per capita solar statistics in Europe with an installed collector area of approximately 360m²/1000 inhabitants (Status: as of end 2004). Austria’s equally pioneering role when it comes to technology can be seen from the export share of sun collectors of more than 100% in relation to the volume of own brands in 2004. The present market analysis report describes activities and framework conditions which have led to success in the field of solar energy in Austria as well as strategies to further extend applications for solar energy. The success in the field of solar thermal energy in Austria could be increased through implementation by ESCO models.

As of the beginning of the 1980’s the use of solar energy using solar thermal collectors has been the subject of constant growth in Austria. At the beginning of this development systems were installed in the main for warm water preparation in private small-scale plants as well as the first larger-scale plastic absorber areas to heat swimming pools. The production of collectors was performed exclusively by small trading and artisan companies who mostly only offered their products to a regional market. The other components such as the storage tank and control system were bought from other companies and the overall plant was adjusted by plumbers to suit the customers’ requirements. As of the mid 1990’s there was a clear expansion of the applications for solar thermal plants. As of this time the first combisystems were installed for partial solar space heating, plants for multi-family homes and hotels as well as solar-supported biomass local heating networks.

The conquest of new applications for solar thermal plants was triggered off and supported by research and promotion programmes from the Federal State and the Provinces. In particular the development of systems for solar space heating triggered off numerous innovations due to larger collector areas required and new requirements regarding storage tanks. The market share for these combisystems (warm water and space heating) of the collector area installed rose continuously and as of 1998 it has made up for around the half of the collector area installed annually.

The largest plants, with a collector area over 1000 square meters (the largest plant comprises 1,440m²) were installed as support for biomass local heating plants respectively to increase the backflow in district heating networks. Solar plants with an area larger than 200 m2 (e.g. for multi family residences, hotels…) are especially suited for ST ESCO models.

Above all the change from commercial to the industrial production of components and systems towards the end of the 1990's made it possible to change the approach to cover larger markets beyond the borders of Austria. This development was expressed by a significant increase in the export share.

In parallel fashion to the creation of industrial collector productions numerous technological innovations were achieved in close co-operation with research institutes and solar energy companies. These developments range from various product developments (collectors, storage tank concepts, control systems, etc.) to visually attractive solutions to be integrated in buildings (roof and façade integrations) through to special know-how on system-technical solutions in the field of large-scale plants which are in the area of application of ST ESCOs.

Apart from extending applications in the construction of residential buildings, in tourism companies, in sports centres, in local and district heating networks, in hospitals, etc. the segments of „low temperature heat in industrial companies" (solar process heat) and „solar cooling" offer considerable future potential especially for ST ESCOs.

At the moment it seems like the market is stabilising at a high level. For example in 2004 191,500m² of collector area were installed. Out of this area 180,010m² are covered by flat collectors (95.0%), 1,915m² by vacuum collectors (1.0%) and 9,575m² by non-covered plastic absorbers (4.0%).

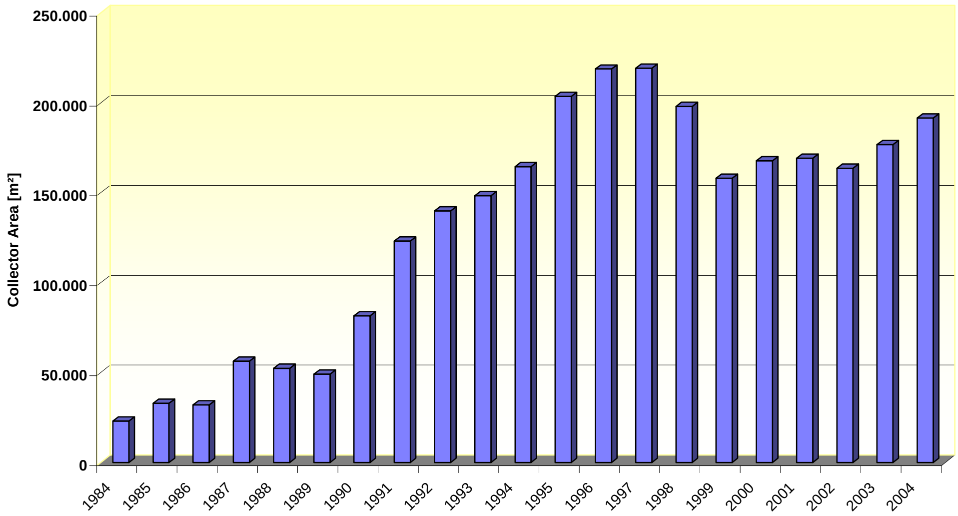
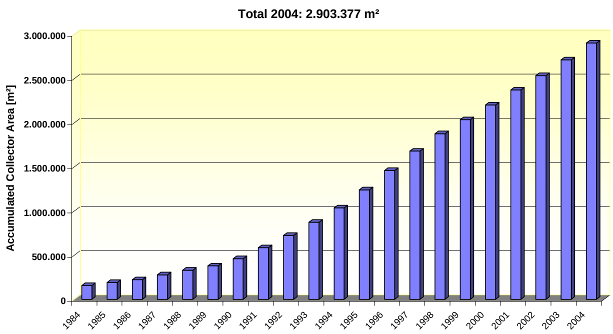


Figure 1: Collector area installed yearly as of 1984 (Faninger, BVS, 2005)

All in all 2,903,377m² of collector area were installed in Austria by the end of 2004. Flat and vacuum collectors are mostly used for heating of domestic hot water and space heating.



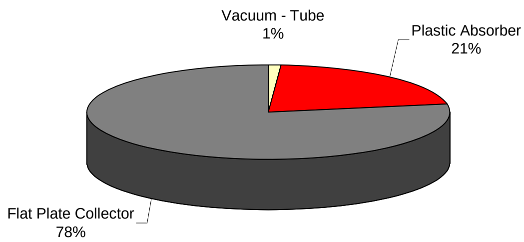


Figure 2:

Accumulated depiction of the overall collector area installed in Austria (1984 to 2004).

Figure 3:

Break-down of overall installed collector area in Austria by the end of 2004 into products.

Table 1: Installed collector area at the end of 2004 and annual solar thermal energy production (Faninger, BVS, 2004)

	Flat plate collectors	**Vacuum collectors**	**Unglazed collectors**	**Total**
Installed collector area in the end of 2004	2.256.855 m²	34.124 m²	612.398 m²	2.371.457²
Annual solar yield in kWh/m²	350 kWh/m²	550 kWh/m²	300 kWh/m²	-
Annual solar thermal energy production in 2004	789,9 GWh	18,8 GWh	183,7 GWh	992,4 GWh

1.1 Producers of solar thermal collectors

The collector area produced in Austria (492,700 m² in 2004) surpasses the domestic market volume (169,147 m² in 2001) enormously. The number of imported collectors has been in considerable decline for years and plays no role in the Austrian solar market at 4.800 m² of collector area in 2004.

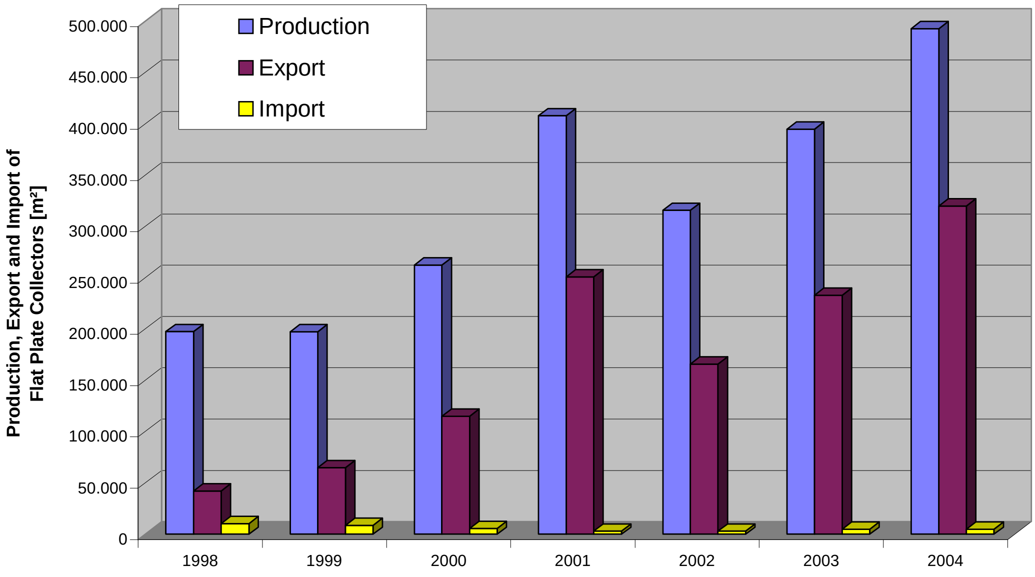


Figure 4: Development of production, export and import figures for thermal solar collectors in the last four years (Faninger, BVS, 2004)

The most important producers in Austria are:

- GreenONEtec
- Böhm Energietechnik
- Sunmaster
- Doma Solartechnik
- Gasokol
- Riposol
- MEA
- Kalkgruber Solar- & Umwelttechnik
- VIcoM Solarsysteme ProduktionsgmbH
- Ökotech
- Solar Einkaufs GmbH
- Söb & Sun
- GEO-TEC
- SIKO Energiesysteme
- Sun-System
- Teufel & Schwarz
- Prima Sun

Flat collectors are of a high technical level and most of them are based on selectively coated absorbers. In the last years there has been great demand for large-scale collectors with an area of between 6 and 12m² which are laid professionally by truck-mounted cranes. In this way the time for installation can be considerably reduced in addition to energy advantages.
The quality of the products installed is basically high. In calculations collectors are given a life cycle of 20 years. According to practical experience and in line with guarantee specifications from collector manufacturers longer product life cycles can be assumed. Austrian producers give guarantees of on average between 5 and 10 years for flat collectors. In Austria installation engineers have to issue a performance guarantee for the system as a whole (Association of the Protection of Consumers, 2002).

In Austria a lot of projects with third party financing have been realised at the moment, but they have still no great influence on the Austrian solar market. Often diluted forms of guaranteed results are used as the basis for grants in some provinces which means that the grant issuing authority only released the sum to the builder when proof of the agreed solar yields has been furnished (mostly 350 kWh/m²a). Individual builders pass this guarantee obligation on to the installer performing the work and retain the liability amount withholded. (mostly 3% of the investment volume) until proof of the agreed yield is furnished. If the agreed yield cannot be achieved, the liability discount to cover the higher need for auxiliary heat is used, projected for the life cycle of the plant.

1.2 Energy policy concerning solar energy

The energy policy of the Austrian Federal government has enabled the use of solar energy systems in the last ten years since they established constant framework conditions uninfluenced by government bodies. Effort is clearly being undertaken to reach national climate goals by establishing different budgets to promote this cause and pertinent research projects. The most important of these are listed here.

- On behalf of the Federal Ministry for Traffic, Innovations and Technology the programmes were started in the year 2000 entitled „House of the Future“, „Factory of the Future“ and „Energy Systems of the Future“ within the research programme

„Austrian technologies for sustainable development". The main points of solar energy research are taken into consideration in these programmes.

- For years the Federal Ministry for Agriculture and Forestries, the Environment and Watermanagement supported companies with the erection of energy-saving measures (as well as solar energy) by awarding them direct grants of up to 30% of the cost of the plants.
- Definition and resolution concerning a national strategy on the climate to satisfy the stipulations of the Kyoto-Resolution in which Austria has agreed to reduce emissions contributing to the greenhouse effect by 13% by the year 2008/2012 (BMLFUW, 2002).
- Instructions from the Federal government to the governments in the provinces, to restructure the funds for housing grants (new constructions and renovation projects) in accordance with the national climate goals (BMLFUW, 2002) with regard to increasing the energy efficiency and the use of renewable sources of energy.
- In 2004 the Federal Ministry for Agriculture and Forestries, the Environment and Watermanagement was started a programme of action entitled the „climate". Solar energy should represent a major point of emphasis of this programme. This Subprogramm is called "solar**wärme**" (www.solarwaerme.at) and managed by the AEE INTEC.
- All of the provinces allow grants for solar plants in the framework of housing grants.
- Many local communities and towns promote the erection of solar plants.

The affords to promote solar energy systems are of course also supportive for the implementation of ST ESCOs.

Subsidies, tax incentives, loans, rental etc., other government policies

NO direct Federal grants are awarded in Austria for residential buildings. Grants for solar plants are taken care in the federal states which means that there are different grant models for solar plants in each of the nine provinces. Direct grants, cost-favourable loans or annual repayment grants exist for solar plants in multiple family homes depending on the province (e.g. Styria: 300 Euro (domestic hot water preparation) or 500 Euro (DHW preparation and space heating) as a basic grant and additionally 50 Euro/square meter collector area).

In addition to the grants available in the individual provinces towns and communities in individual provinces issue grants for the installation of solar plants.
A special grant arrangement for solar plants exists at federal level for commercial companies. For years the Federal Ministry for Agriculture and Forestries, the Environment and Watermanagement has supported companies with the erection of energy-saving measures such as solar plants by offering them direct grants with a standard grant rate of 30%.
When it comes to solar plants in multiple family houses the extent of the grant is in contrast the main reason why the builder can or cannot be motivated to install a solar plant. The grant conditions in Austria for solar energy are not favourable in all of the provinces respectively for all fields of application. Overcoming these deficits and creating optimum framework conditions has to be a common goal of the growing solar lobby. This can only be achieved in close co-operation with the Federal government and the provinces.

In some provinces there are complex housing grants which means that carrying out several defined measures to save energy (for example higher thermal insulation, a ventilation plant with heat recovery or indeed a solar plant) results in a higher grant. The province of Salzburg has for example had experience with a housing grant model of this kind for 10 years. Apart from the permanent reduction in the U values of the components in the past an enormous increase in the solar plants in multiple-storey buildings has been achieved with this combined grant mechanism. In 2001 around 60% of the newly constructed multiple family houses in Salzburg has solar plants.

1.3 Solar thermal branch associations

Austria Solar

Austria Solar is an association which promotes thermal solar energy and has 24 leading solar energy companies as its members. The main focus of Austria Solar is one the one hand information from end customers and decision-makers, independent of companies, and on the other hand the creation of improved framework conditions and the increase in the presence in the media of thermal solar systems.

Guild of gas, water, heating and ventilation installation companies

In Austria this guild of gas, water, heating and ventilation installation companies has around 2,800 members. Their main tasks include representing the interests of this group of professionals as well as offering standard and profound further and vocational training programmes for installation companies.

1.4 Courses for installers

The installers get the basic know-how concerning solar plants from training programmes offered by solar energy suppliers (producers, wholesalers, etc.). In addition in individual cases different institutions (ECONOMIC Chambers, Energy-Saving Associations, Research Institutes, etc.) offer further training at different levels for installers.

- Training as a „Solateur"

As of the beginning of the 1990's a training programme has existed to train as a „Solateur". This is organised by the Viennese Solar School and covers solar thermal applications as well as photo-voltaic matters and heat pumps. As of 1998 this training course has been EU-certified and is offered all over Europe in two phases:

Solateur practitioners (245 training units)

Solateur technicians (425 training units)

To date one „Solateur practitioner" course has been held in Austria with five participants (Solarschule Pinkafeld, 2002)

- Training seminar „Solar Space Heating"

In 14 training units participants receive a basic knowledge of solar combisystems. Wihtin the course of the last five years around 80 people took part in this training seminar (WIFI Upper-Austria, 2002).

- Training seminar „Solar multiple family houses"

In five training units participants receive a basic knowledge of solar plants in multiple family houses (Upper-Austrian Energy Saving Association, 2002).

- Vocational School training as a „Solar- and Eco-Energy Technician"

In autumn of 2002 a new training course will commence in Linz to become a „Solar and Eco-Energy Technician“. This course aims at giving installation training with the focus on solar and eco-energy techniques. (Vocational School in Linz, 2002)

- Various courses, seminars and symposia

Various courses, seminars and symposia are offered by institutions (Energy Saving Institutes, Research Institutes, Vocational Promotional Institutes, Economic Chambers, etc.) on different solar-specific subjects.

- Certified solar installer and planer training

(within the framework of the klima:aktiv program from the Austrian ministry of life)
In 65 training units participants receive a intensive knowledge all over different solar thermal systems. Including climate protection, components of solar heating systems, characteristics of solar heating systems, selection of the accurate system, dimensioning of solar heating systems, dimensioning of components, installation, putting into service & maintenance, operation & yield controls, consideration of costs and economic efficiency of solar thermal systems marketing and practice.

- Contracting for installers and SME

The course is for managerial employees of installation companies and interested end users (building owners). The aim is to give necessary information about economic, legal and financial issues concerning the topic energy services and TPF. As a result the installer gets the necessary know how to avoid problems and errors in the field of legal, technical and economic questions.

1.5 Information and campaigns in Austria

Numerous activities and initiatives exist and are planned in Austria to raise the level of acceptance and dissemination of solar plants. The most important initiatives and programmes (this does not claim to be complete) are listed in the following.

National activities

Action program - climate

In 2004 the Federal Ministry for Agriculture and Forestries, the Environment and Watermanagement was started a programme of action entitled the „climate“. Solar energy should represent a major point of emphasis of this programme. This Subprogramm is called “solar**wärme**” (www.solarwaerme.at) and managed by the AEE INTEC.

Activities on behalf of Austria Solar

Austria Solar, the Association of Austrian solar energy companies for the promotion of thermal solar energy, organises well-planned marketing and lobbying activities in Austria.

OPTISOL

OPTISOL is a national project from AEE INTEC to disseminate optimised solar-supported heat supply networks for the preparation of domestic hot water and solar heating support in multiple family houses.
Project duration: 2001 to 2004

Monitoring large-scale plants (Q-Sol)

This is a national project from the Test and Research Centre ARSENAL in cooperation with AEE INTEC in specially for multiple family houses. The main field of work is to create a standardized monitoring concept for thermal solarsystems and heating networks in multiple family houses (Test and Research Centre ARSENAL, AEE INTEC, etc.).
Project duration: 2005 to 2006

Mosol-Net

Mosol-Net is a national project from AEE INTEC to carry out efficient solar thermal systems for district heating systems. The project directs the attention to residential buildings which are built in several steps of construction.
Project duration: 2004 to 2006

Parabolrinne

Parabolrinne is a national project from AEE INTEC to develop and optimize a parabolic trough collector for higher temperatures (100 to 200°C) in industrial process heating.
Project duration: 2003 to 2005

SolProBat

SolProBat is a national project from Joanneum Research in cooperation with AEE INTEC and the technical university of Graz to develope and optimize simulation programmes for solar heating in industrial batch-processes.
Project duration: 2004 to 2005

NEGST

NEGST is an European project. The Austrian essences are done by AEE INTEC. The aim of the project is to transfer different European experiences in the whole field of solar energy.
Project duration: 2004 to 2005

Regional Activities

Climate protection programme of the City of Vienna

The City of Vienna has set itself the goal of installing 40,000 solar plants by the year 2010 in the City area. Initiatives and measures are being correspondingly taken and supported.

SOLAR-NET

The Test and Research Centre ARSENAL is conducting the technology offensive „Solar Energy-Vienna Hungary“ to promote solar plants in small and large applications. The basis to achieve the climate goal of the City of Vienna will be laid in this project (40,000 solar plants by the year 2010).

Solar League in Upper- Austria

The Energy Saving Association in Upper-Austria motivates and documents Upper-Austrian local communities to record and newly install solar plants within the framework of a competition. The Solar League finds out in what community the largest number of solar plants are installed.

Training programmes in Upper-Austria

As already mentioned the province of Upper-Austria offers numerous training possibilities in the field of solar energy and eco-energy.

Multiple family houses and industrial applications

The Energy Saving Association in Upper-Austria tries to integrate solar plants in the province of Upper-Austria in multiple family houses and in industrial applications via different programmes.

Communal energy concept of the town of Graz

The communal energy concept of the City of Graz foresees an extensive programme to disseminate solar collectors. The goal of this concept is the new assembly of 200,000m² of collector area by the year 2010. The City of Graz has taken the first steps towards achieving this goal by installing a corresponding solar grant and taking other initiatives.

Thermoprofit

Thermoprofit is a project from the Energy Agency in Graz to reduce the energy demand in buildings with the help of the „contracting“ implementation model. The increased implementation of solar plant within the realm of third party financing is included in this program.

Solar sports centres

In the province of Styria AEE INTEC tries to motivate sports centre operators to install solar plants within a special programme.

Solar consultation services in Styria

AEE INTEC conducts numerous activities in Styria (consultation services for final consumers, Telephone Service, exhibitions, the organisation of events, etc.) in the field of solar energy.

Solar campaign Styria 2005

In 2005 the solar campaign Styria make to suit the requirements of the Styrian solar market. Preparatory work and talks in this field have already been started.

Solar campaign Tirol 2005

In 2005 the solar campaign Tirol make to suit the requirements of the solar market in tirol. Preparatory work and talks in this field have already been started.

Solar campaign Vienna 2005

In 2005 the solar campaign Vienna make to suit the requirements of the solar market in Vienna. Preparatory work and talks in this field have already been started.

Solar radiation screen in Tyrol

In the province Tyrol a solar radiation screen (conducted by Energie Tirol) is being carried out. Final customers are given information on radiation and solar hours for the planning of buildings and solar plants.

Solar Hitparade of communities in Vorarlberg

Within a competition local communities are motivated by the Energieinstitut in Vorarlberg to construct new solar plants and record those which already exist. The winners are ascertained by drawing up a Solar Ranking.

1.6 Lessons learned by the market in the past

- Communication and co-operation (forming networks) between all players pays off.
- Solar energy needs a lobby
- There are numerous possibilities and strategies to disseminate the technology
- The same initiatives and measures do not lead to the same goal in all regions (different framework conditions and mentality)
- Professional sales and distribution networks play an important role when it comes to disseminating the solar plants.
- As of a certain market size, new and often larger companies (for example heating wholesalers) enter the market aggressively.
- Solar plants can only argue in terms of economic viability to a small extent.
- Grants are important incentives when it comes to installing solar plants
- To make grant models effective they have to be „constant“ to a certain extent.
- New models like contracting can reduce a lot of barriers

2 Identification of relevant sectors

Buildings and facilities, which are suitable for large solar thermal plants:

· Multifamily residences (existing and new buildings)

- Tourism facilities (e.g. hotels)
- Hospitals and old people's homes
- Sport centres (gymnasia, swimming pools, etc.)
- Industry buildings, especially food and beverage industry, textile and chemical industry
- Office buildings (solar cooling)
- District heating networks (feeding-in)

These buildings have in common, that they need lots of hot water and mostly independent of the season. Therefore they fulfil the necessities for the implementation of ST ESCO projects.

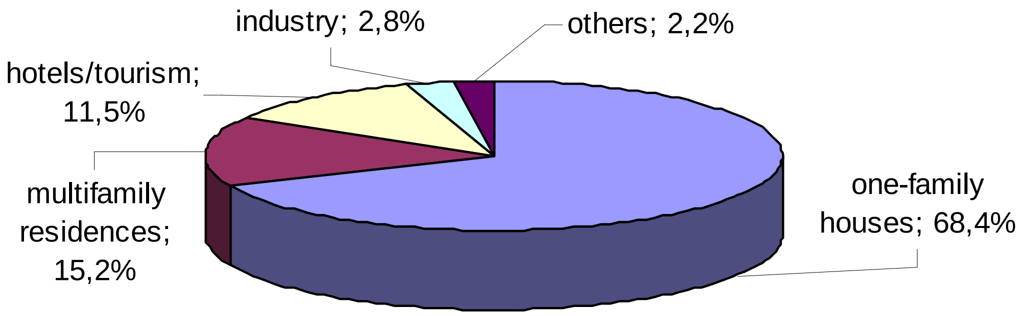


Figure 5: Application area of solar plants for hot water production (Faninger, Der Solarmarkt in Österreich 2004, BMVIT)

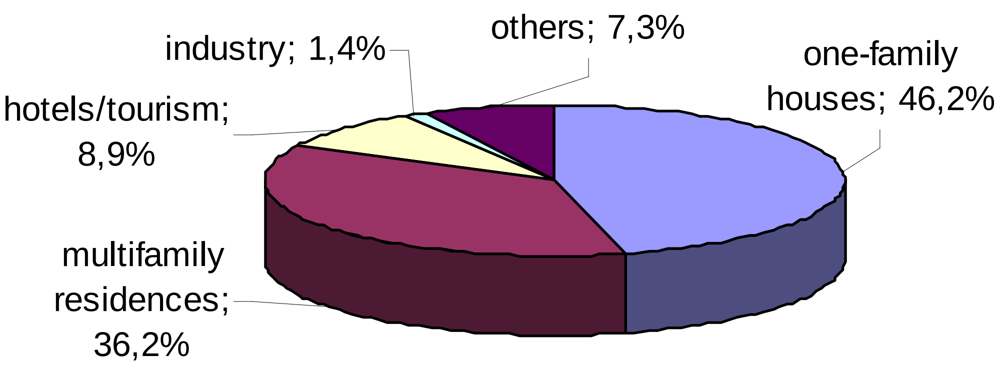


Figure 6: Application area of solar plants for integration in space heating systems (Faninger, Der Solarmarkt in Österreich 2004, BMVIT).

2.1 Large solar systems for domestic hot water preparation and space heating

In general this category comprises applications in multiple-story residential buildings, sports centres, tourism, hospitals, old people homes, etc.. Around 500 to 600 plants were erected in the field of multiple-storey residential buildings. Compared to the available potential (around 50% of the Austrian population lives in multiple-storey residential buildings), this segment still has a lot to offer. All in all a maximum of 5% of the collector area installed in Austria (flat collectors and vacuum collectors) is accounted for this application.

<u>Potential in the field of multiple family houses:</u>

In the year 2000 Austria had around 8.145 million citizens. Of these 43% lived in multiple family homes. The number of apartments/houses with the main place of residence (one family homes and multiple family houses) equalled 3.26 million in the year 2000. Of these around 1,947,400 are defined as multiple family homes (Statistics Austria, 2002).

<u>Large solar systems for domestic hot water preparation and space heating</u>

The main application in this field is the preparation of domestic hot water for multiple family houses. At the end of 2001 the plant number is estimated at around 600 and this corresponds to a collector area of around 40.000m². Assuming 2m² of collector area for each apartment and 1.947 millions of apartments in multiple family houses then 1 % of the existing apartments (basically domestic hot water preparation) were reached with solar energy so far. This means there is still a vast potential for the implementation of large solar plants considering also the integration of space heating.

Average assumed dimensions for solar plants in multiple family houses (Fink, Riva, Heimrath, Mach, 2002):

Collector area:	1,5 – 2,5m²per flat
Storage volume:	40 to 80 litres per m² collector area
Solar Fraction on the domestic hot water demand:	20-40%
Specific yield:	350 – 400 kWh/m²
System costs incl. installation and VAT:	€ 340 - € 650

Error! Reference source not found. illustrates the specific system costs of flat plate collector systems (mean values out of three offers from solar companies) with increasing collector area. The red line shows the mean value of the blue lines, the upper blue line gives cost numbers with unfavourable boundary conditions and the lower blue line with favourable conditions.

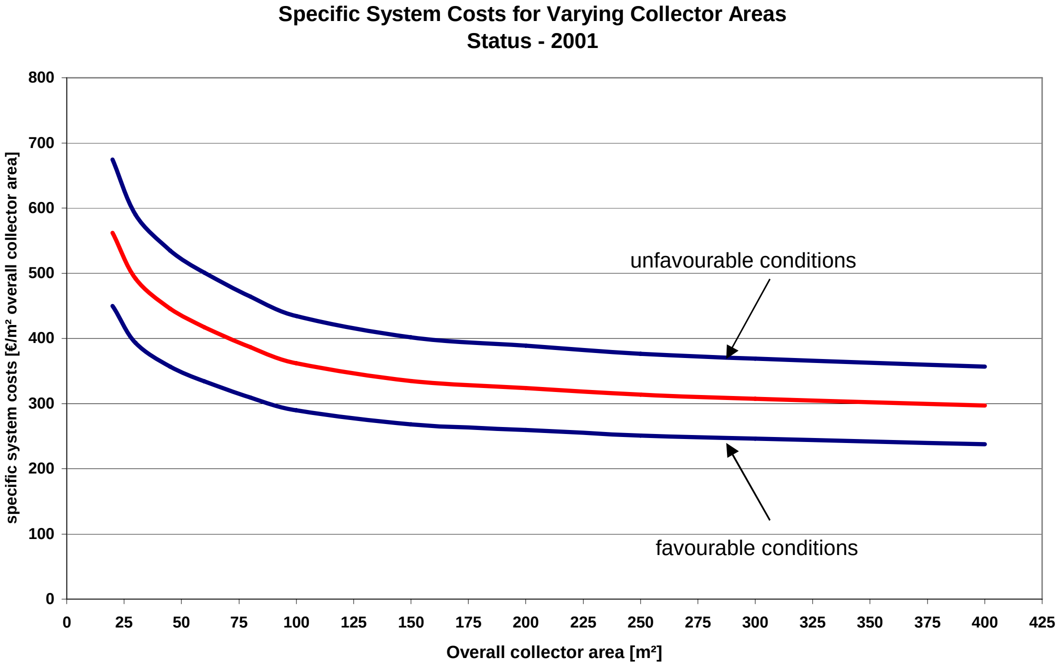


Figure 7: Specific system costs – Austria

There are great chances when it comes to existing buildings which make up a main part of the energy required in the „apartments/houses“ sector. Here it is important to make solar plants interesting both for domestic hot water as for partial space heating in multiple family houses via corresponding combinations with grants (roof renovations, exchange of boiler). When it comes to the sector of multiple family houses well-trained facility management planners and architects and information campaigns for builders could offer important help. In parallel fashion increased demand for flats/houses erected with due consideration to energy-saving aspects (including the use of solar energy) ,on behalf of those advertising the potential properties, would put pressure on the house building companies and make the decision making „pro solar system“ easier (energy pass for buildings). The increase in funds for solar plants respectively the general adaptation of grant models for residential buildings are also absolutely essential.

As a consequence the promotion of energy services for solar plants is important. Besides general information about solar water heating systems and the advantages for the target groups special information about energy services is significant. Energy services will make it possible to plan large solar plants without own investment capital. Energy services respectively third party financing is a solution for many barriers, for example financing shortage, lack of know – how, lack off human resources. The energy service companies are planning, financing and carrying out energy efficiency projects (solar thermal plants). They guarantee a high quality of the installation, a solar yield and a fixed heat price.

2.2 Solar plants for local and district heating networks

The largest plants, with collector areas above 1000 square meters, were integrated in district heating networks. Many of the local heating networks assume the almost 100% preparation of domestic hot water in the summer months and thus eliminate the need to operate the main energy source in periods in which the load is low. The potential for integration of solar plants in district heating networks is high as there is a large number of district heating networks fired with biomass. Here solar plants are a good solution to bridge the weaker load periods in the summer without the ecological and economically harmful start-up of the main boiler.

Until now some 25 thermal solar plants between 300 and 1440m² have been integrated in Austria in district heating networks. This complies with a collector area of 20.000m². The largest plant in this category and in Austria comprises 1,440m² of collector area. This plant is implemented with an ESCO model and feeds in the district heating network of the City of Graz. The share of district heating plants of the overall collector area installed (flat collectors and vacuum collectors) is below 1%, this is also a field which ST ESCOs are especially suited as it is favourable that operating, service and maintenance are sourced out.

2.3 Industry buildings

In the field of industry processes the integration of solar energy is not an established technology. Until now the implementation of solar thermal systems in industry is counted for infeasible and not economic. In the last three years the topic “solar process heat” is the focus of research, especially to identify the potential of solar process heat and make it known by industry.

Particularly concepts for integration of solar systems in industrial processes are currently being carried out within the framework of national and international projects. E.g. ALTENER project “PROCESOL II” and the national “energy systems of the future”-project “SolProBat” and also the IEA Solar Heating and Cooling Task 33.

With the state of the art solar technology processes with temperatures with up to 80 °C are feasible. A great potential in the field of food industry (washing, concentrating, tempering), textile and timber industry (washing, bleaching, dyeing, drying) as well as chemical industry is shown in the study executed in the scope of the project PROMISE (fabric of the future). The whole low-temperature energy demand of the Austrian industry amounts to 85 PJ/a (1997). Out of that amount about 3,3 PJ/a (917.000 MWh/year) are process heat up to 100 °C which could be prepared with solar thermal plants.

2.4 Solar cooling

Although there is a great market potential for solar cooling the state of the art of solar cooling is not economically comparable with the usual electric driven cooling systems. Reasons for this are the high investment costs for thermal cooling devices and the low prices for usual fuels respective electricity. The situation could be changed if the costs for the different components (solar collectors, cooling devices, controlling system…) decrease and the performance increases.

2.5 Pros and Cons for ST ESCOs in the above mentioned sectors

The economic facts take precedence over emotional arguments in this field. The following arguments favour the implementation of ST ESCOs projects:

- No or very low investment cost, minimizes the financial risk
- Guaranteed development of solar energy price, advantage compared to other energy sources
- Complete energy service package provided by one company, no implication of the customer with technical issues
- Guarantee of state-of-the-art technical and economic solution, maximum solar output (is in the ESCOs interest)
- No problems with respect to operation and maintenance of the system
- Take advantage of grants
- Constant framework conditions for the establishment of a fruitful business

- Prestige (standing out from one's competitors, a positive attitude towards new technologies)
- Marketing strategies (to also sell ecological advantages, to sell engineering)

Arguments frequently used against the implementation of ST ESCO projects:

- Long contract period
- Payment for outsourcing the energy supply
- Solar energy price too high (compared with up to now used energy source)
- Confidence that the fossil energy prices will continue to be favourable

A lack of quality is generally not an impediment in Austria when it comes to further extending the market volume. Likewise there is no problem with insufficient guarantees since these are in part better, or just as good, when compared with conventional heating products.

Contracting respectively third party financing is a solution to overcome many barriers, for example financing shortage, lack of know – how, lack off human resources. The energy service companies are planning, financing and carrying out investments of solar plants and energy efficiency measures. They guarantee a high standard of planning, installation and a solar yield as well as a fixed heat price.

Numerous organisations offer advice and information on solar plants and solar contracting:

- Landesenergievereine
- Local energy agencies (like Graz Energy Agency)
- Austria Solar
- AEE (four offices in Gleisdorf, Wiener Neustadt, Villach and Vorarlberg)

3 Economic analysis for ST-ESCOs implementation in Austria

3.1 Market prices for ST-ESCOs implementations

The chance of making solar thermal third party financed projects more attractive in the future could be approached by reducing the investment costs. However, different factors have to be considered here:

- **Collectors and substructure**
  About 50-70% of the total investment costs is the price for high-efficiency solar collectors including an appropriate substructure. We could try to work on the technological part to see if costs can be reduced here.
- **Engineering costs**
  The costs for project development, engineering, contracts still represent a very notable cost item. Experience and know how in the work with solar thermal ESCOs, collaboration with experienced partners, utilization of good and efficient tools and – last but not least – the replication of similar plants may represent ways to reduce the overall engineering costs for a solar thermal project.
- **Subsidies**
  On the long term, subsidies must be expected to drop rather than to stay at a high level. This results in an increase of the effective investment costs, and this effect must be attenuated or by other factors. Once a high technological level of solar thermal plants is reached, attention could be paid to linking possible subsidies with a function control of the plants and a guaranteed energy output, rather than taking the m^2 of installed collector area as a basis!
- **Conventional energy price**
  As the prices for conventional (fossil) energy continue to increase, the price for solar thermal energy is not touched by this trend. Due to this reason, solar thermal becomes more and more attractive as the payback periods become shorter.

Revenue from reduction of CO_2 emissions

Some development in the economic approach towards solar thermal ESCO projects has to be done in the area of the trade with CO_2 emission certificates. Today (to nahwaerme's knowledge) there exists no approach suitable for getting economic benefits out of saving

CO_2 with solar energy on an easy practicable way. Such a tool is a basic prerequisite for the implementation of a financial recompense for the solar company for its contribution to the reduction of CO_2 emissions.

The idea behind the concept which we should develop is based on the assumption that the customer of the solar thermal plant (e.g. a manufacturing company) is registered to take part in the trade with CO_2 certificates. Then, the installation of the solar plant helps gives the company the possibility to reduce its CO_2 emissions and therefore sell their CO_2 emission certificates. This is an additional financial benefit for the customer stemming from the installation of the solar plant, and it results in a shorter payback time. Alternatively, the income from the trade with CO_2 certificates should be transferred directly to the ESCO, for the simple reason that this amount of money is linked to the solar plant, and the solar plant is the ESCO's property.

However, a practical approach (= a real-world tool) for calculating the financial benefit stemming from the CO_2 reduction from a solar thermal plant has still to be developed. The financial recompense should be the same amount of money that the customer of the solar plant may earn through the trade with CO_2 certificates. This means that the basic tool should include the basic steps shown in the following diagram.

As one can see, the starting point is always the energy output of the solar thermal plant. This is the reason why a solar company (and consequently also the corresponding solar thermal ESCO) must ensure a very energy output of the plant in order to get the maximum benefit from its contribution to the reduction of CO_2 emissions. The step from the solar kWh to conventional primary kWh includes possible distribution losses. At this point, the efficiency of the primary energy supply must be included in some way, and it seems to be important to make realistic assumptions here! E.g., often the efficiency is very low in summertime due to bad partial load behavior, this also applies to some of the new boilers. In this way one gets the amount of primary energy in kg or m^3, and the equivalent amount of CO_2 produced in the combustion can be calculated with available tools. This is the amount of CO_2 really saved by the solar thermal plant, and can be sold via emission certificates by the customer. That way the saved CO_2 emissions are translated into a corresponding sum in €, and this amount (or maybe a certain percentage of it) should be attributed to the solar ESCO.

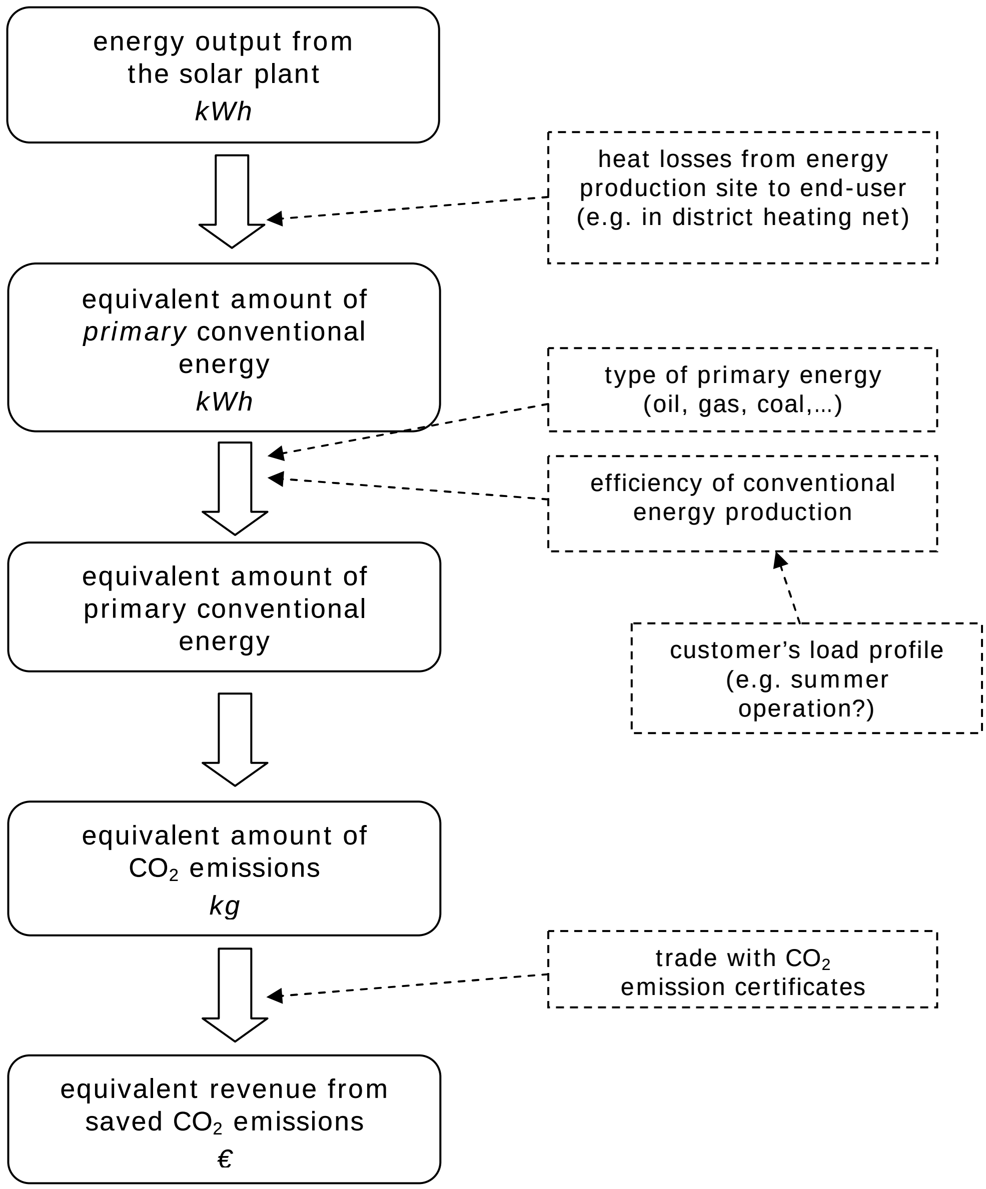


Figure 8: Calculation of the financial benefit stemming from the CO2 reduction from a solar thermal plant (source: nahwaerme.at)

Some market analysis data

This section deals with the following items:

- Price of solar thermal kWh
- Usual terms for bank loans

The price for the solar thermal kWh coming from a solar thermal ESCO can vary in a rather broad range. This amount depends on a lot of factors, but the main influence stems from the competitive source of conventional energy that the solar thermal plant must deal with. If the alternative to the solar thermal plant would be a very modern, large scale gas boiler with condensing boiler technology (with very good efficiencies over a broad range of operating conditions) and with a good load profile (reflected again in low consumption values), then the price of the solar thermal MWh might be limited by some 25 € per MWh.

On the other hand, if the energy source we compare the solar plant with, is direct electric hot water preparation (such as is the case in many multi-family-houses), then the conventional energy source is rather expensive, and the investment of changing is rather high for, the price for solar thermal energy might be as high as 70 € per MWh.

So, it is very hard to give a useful and precise answer to the question of the price of solar thermal energy, as the spectrum of variation is very broad. It depends not only on the conventional energy form, but also on the use of the solar energy (feeding into a district heating net, family houses, industry applications, solar cooling), and last but not least on the load profile.

The same discussion applies to the question on the usual terms of bank loans. No standardized answer can be given to this question: Up to now, the experience of nahwaerme with terms of bank loans has shown that the terms and conditions for the bank loans have to be agreed upon separately in every single project. Of course, they also depend on the key interest rate (or Euribor) and on the type of bank (be it a small, regional bank with good contacts to the upper management between bank and ESCO, or be it a large over-regional bank with quite fix conditions and few margin left). The main variation comes from individual negotiations with the banks in question, and again it helps if we succeed in convincing the personal contact in the bank about the project and about solar thermal energy as a mature technology in general. Thus, the usual bank loans vary somewhere between 3 and 6%.

3.2 Comparison of the effect of different economic terms

The following tables compare the effects of different possibilities of economic measures to the result of a solar ESCO. These effects include:

- Different price of a solar thermal system depending on the system size
- Different price paid per kWh solar thermal energy.
- Different percentage of subsidy to the investment costs.
- Different system costs for small or large plants.
- Reduction of investment costs due to reduction of engineering costs and / or collector costs, or due to possible trans-associational agreements and joint projects.

Additionally, there are two possibilities of charging up two different amounts of money to the solar thermal kWh price:

- The energy tax that conventional district heating operators are required to pay if they burn fossil fuels. This amount may total up to 4 € per MWh.
- The revenues from the trade with CO_2 emission certificates: every kWh of solar energy makes the emission of CO_2 from fossil fuels unnecessary; the trade with the corresponding certificates may work as described above.

The price paid by the customer depends on various factors, but is mainly oriented at the fossil fuel price it has to compete with. I.e., if the fossil fuel prices tend to rise, there is a much higher range in which the solar thermal energy price may vary, thus it may rise as well (although not directly linked to any fossil fuel price). This is simply the effect of the competence (conventional energy solutions) becoming weaker over the years, since they become more expensive!

Low loan rates have very little influence to the economic results of a solar thermal ESCO. The current bank loan rates are already very low, so the loan rates could only be reduced very slightly. However, in the long run, a slight reduction of the loan rates is a very ineffective measure when compared with the possibility of considering e.g. the benefit of saving the energy tax and charging this money up to the solar thermal kWh. This corresponds to a higher price paid per kWh of solar thermal energy. Revenues from the trade with CO_2 certificates should also be directly charged up to the solar thermal kWh, and so every kg of CO_2 not emitted because of the use of a solar plant must directly correspond to a higher price per kWh of solar energy!

The quintessence is, that the price increases of competitive conventional energy forms, the money from the (fossil fuel) energy tax and the revenues from the trade with CO_2 emission certificates have most influence on the economic terms of a solar thermal ESCO. The effect of loan subsidies by the state is minimal, but direct subsidies to the investment costs are a rather important figure.

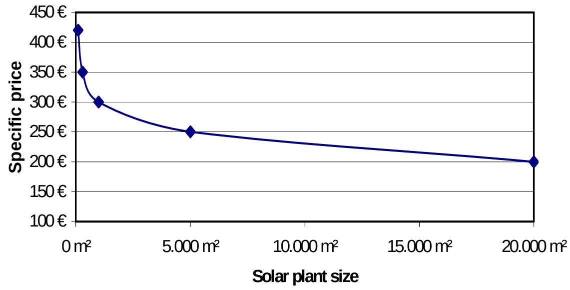
Specific system costs LSP

Specific solar thermal plant prices (in € per m²), depedant from solar plant size

1 Roof-integrated systems

Solar plant size	Price per m² collector area
20.000 m²	200 €
5.000 m²	250 €
1.000 m²	300 €
300 m²	350 €
100 m²	420 €

Prices are to be interpreted as approximate numbers!



2 Roof-mounted systems

Specific system costs are higher due to longer and more complex pipework and substructure for collector mounting.

Pipework	0.2 … 1 running meter per m² collector area 10 … 50 € per running meter
Substructure	30 … 70 € per m² collector area

Figure 9: Specific system costs (source: nahwaerme.at)

See the tables below (two tables for two different system sizes), including different assumptions on energy prices and subsidies, for a numerical reflection of the above explanations (source: nahwaerme.at).

Comparison of the effect of different economic terms – part 1: small system (250 m²)

Small plant (250 m²), two price scenarios: 40 €/MWh or 50 €/MWh

The two scenarios might reflect the consideration of the energy tax saved by the solar thermal plant, the revenues from trade with CO_2 emission certificates or simply a better price for the solar energy due to the increase in the fossil fuel prices.

Table 2: Comparison of the effect of different prices of solar thermal energy (source: nahwaerme.at)

Solar plant size	m²	250
Yearly yield of solar plant	MWh/a	100
Price per m²	€/m²	360
Total plant price (investment cost)	€	90,000

Price per MWh of solar thermal energy	€/MWh	40	50
Yearly revenue	€/a	4,000	5,000
Expenses for service and maintenance	€/a	800	800
Net yearly revenue (= annuity paid to ESCO)	€/a	3,200	4,200
Approx. estimated investment cost that may be covered by the yearly plant revenue	€	32,000	42,000
Amount of investment cost that needs to be covered by subsidies	€	58,000	48,000
Percentage of subsidy	%	64	53
Maximum investment costs allowed to reach the same effect caused by the price increase (from 40 to 50 € per MWh)	€	68,570	
	%	76.2	
Necessary reduction of investment costs	%	**23.8**	

Same plant characteristics as above (250 m²), two price scenarios: 25 €/MWh or 35 €/MWh

Table 3: Comparison of the effect of different prices for solar thermal energy (source: nahwaerme.at)

Price per MWh of solar thermal energy	€/MWh	25	35
Yearly revenue	€/a	2,500	3,500
Expenses for service and maintenance	€/a	800	800
Net yearly revenue (= annuity paid by ESCO)	€/a	1,700	2,700
Approx. estimated investment cost that may be covered by the yearly plant revenue	€	17,000	27,000
Amount of investment cost that needs to be covered by subsidies	€	73,000	63,000
Percentage of subsidy	%	81	70
Maximum investment costs allowed to reach the same effect caused by the price increase (from 40 to 50 € per MWh)	€	56,670	
	%	63.0	
Necessary reduction of investment costs	%	**37.0**	

Comparison of the effect of different economic terms – part 2: large system (5,000 m²)

Small plant (5,000 m²), two price scenarios: 40 €/MWh or 50 €/MWh

The two scenarios might reflect the consideration of the energy tax saved by the solar thermal plant, the revenues from trade with CO_2 emission certificates or simply a better price for the solar energy due to the increase in the fossil fuel prices.

Table 4: Comparison of the effect of different prices for solar thermal energy (source: nahwaerme.at)

Solar plant size	m²	5,000
Yearly yield of solar plant	MWh/a	2,000
Price per m²	€/m²	250

Total plant price (investment cost)	€	1,250,000

Price per MWh of solar thermal energy	€/MWh	40	50
Yearly revenue	€/a	80,000	100,000
Expenses for service and maintenance	€/a	3,000	3,000
Net yearly revenue (= annuity paid by ESCO)	€/a	77,000	97,000
Approx. estimated investment cost that may be covered by the yearly plant revenue	€	770,000	970,000
Amount of investment cost that needs to be covered by subsidies	€	480,000	280,000
Percentage of subsidy	%	38	22
Maximum investment costs allowed to reach the same effect caused by the price increase (from 40 to 50 € per MWh)	€	992,270	
	%	79.4	
Necessary reduction of investment costs	%	**20.6**	

Same plant characteristics as above (250 m²), two price scenarios: 25 €/MWh or 35 €/MWh

Table 5: Comparison of the effect of different prices for solar thermal energy (source: nahwaerme.at)

Price per MWh of solar thermal energy	€/MWh	25	35
Yearly revenue	€/a	50,000	70,000
Expenses for service and maintenance	€/a	3,000	3,000
Net yearly revenue (= annuity paid by ESCO)	€/a	47,000	67,000
Approx. estimated investment cost that may be covered by the yearly plant revenue	€	470,000	670,000
Amount of investment cost that needs to be covered by subsidies	€	780,000	580,000

Percentage of subsidy	%	62	46
Maximum investment costs allowed to reach the same effect caused by the price increase (from 40 to 50 € per MWh)	€	876,870	
	%	70.1	
Necessary reduction of investment costs	%	**29.9**	

One may see that the main effect in the possibilities for a reduction of the necessary subsidies comes from a direct price increase of the solar thermal energy price. The rate of change of the price for the kWh solar thermal energy is much higher than the rate of decrease in price of the investment costs. So, it has taken about 10 years for the investment costs to decrease by some 25 %, but the increase in the price for the solar thermal energy may change in a very much quicker range of time, as it is linked to the fossil fuel price which is known to vary quite heavily, with a strong increase over the past years. As stated above, the consideration of the energy tax saved by the solar thermal plant and the revenues from trade with CO_2 emission certificates have exactly the same effect. This shows that the consideration of these last two quoted items is a very important measure to help reduce the percentage of subsidies needed in order to make a solar thermal ESCO solution economically feasible.

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ANNEX

Regulatory framework, planning regulations, relevant standards, certificates

The following standards describe specifications for the planning and design of solar plants in Austria:

ON EN 12975: 2001-02-01

Thermal solar systems and components - Solar collectors –

Part 1: General requirements

Part 2: Test methods (1997-12-01)

ON ENV 12977: 2001 10 01

Thermal solar systems and components - Custom built systems -

Part 1: General requirements

Part 2: Test methods

Part 3: Performance characterisation of stores for solar heating systems

ON M 7701: 1985-09-01

Solar energy installations; approximate calculation method for the dimensioning of flat collectors in domestic hot water systems

Bbl 1 1985-09-01

Solar energy installations; forms for approximative calculation method for the dimensioning of flat collectors in domestic hot water systems

Bbl 2 1985-09-01

Solar energy installations; general characteristics for the calculation of passive solar installations and for flat plate collectors used in domestic hot water systems

ON M 7731

Solar heating systems for heating of water - requirements

ON EN ISO 9488

Solar energy, Vocabulary

ON M 7700: 1991-05-01

Solar energy - Terms with definitions

Independent testing / publication of product information

Test centres, testing and certification

In Austria sun collectors are tested at the Federal Research and Test Centre ARSENAL, Vienna. The Austrian test standard ÖNORM M 7714 was replaced in 2001 by the EU standard EN 12975.

Obligatory / voluntary / needed for incentives

In general there is no legal obligation for producers to have their solar thermal collectors tested. For almost all collectors offered in Austria a collector test was carried out. In standard applications the performance tests of collectors scarcely influence the decision to purchase and do not represent an absolute must. The situation is different with regard to large-scale solar applications in which the requirements made of the collector efficiency rate are already anchored in the tendering process and proof has to be furnished by the companies taking part in the form of test certificates.

Publication / accessibility of test results

A list of currently tested collectors can be obtained from the Federal Research and Test Centre ARSENAL. The performance tests can be directly obtained from the suppliers (producer, wholesaler, installer).