3 BARRIERS

INTRODUCTION

The listed barriers describe the problems encountered and perceived towards a "self-sustaining steadily growing solar thermal market in Thailand"

The description of barriers is based on:

1. A review of implemented solar thermal systems in Thailand during the last two decades
2. A review of past studies on this subject (mainly four in the last decade)
3. Several site visits to various solar sites during the EU SolTherm project (see as well site visit reports in the annex)

Earlier studies and reviews on the solar thermal applications in Thailand resulted in the following statements concerning barriers and problems encountered:

1. In 1997 the DEDE's site visits revealed four main barriers to long-term operational success.
    a. Firstly, the systems had largely been designed and installed without necessary technical expertise and knowledge of SWH systems.
    b. The SWH products themselves were not standardized so that even if there were communication between different SWH operators, no meaningful comparisons could be made from which to effectively problem solve or draw informative conclusions.
    c. Also, no regular maintenance of the system seemed was scheduled to ensure that problems were diagnosed and fixed effectively.
    d. Lastly, in some areas of Thailand it is necessary to purify the water before it is run through the SWH system and when needed this was sometimes overlooked.

2. According to a study by Martin Vis in 2000, Thailand experienced a long period of SWH system breakdowns because suppliers of the systems were unreliable in repairing them.

3. Additionally, a KMUTT study suggested that lack of knowledge of the everyday use of the systems inhibited their long-term success, and that there was simply no staff to provide the systems' required maintenance.

4. In 2000 ISE, Fraunhofer Institute, one of the partners in this EU project as well, undertook another study on the solar thermal market in Thailand and found the following main barriers:

Constraints for the Dissemination of Domestic Solar Water Heating Systems

The main constraints to the dissemination of domestic solar water heating systems are:

- The financial viability of domestic solar water heating systems is low.
- There is no structure of distributors and skilled installers available.
- Domestic solar water heating systems have a very low reputation in Thailand, due to two facts:
  - owners of solar water heating installations often do not have the habit to care about the systems and, as result, collectors are covered with dust within a short time, which brings system efficiency down,
  - as a result of the lack of infrastructure with regard to distributors and skilled installers, system service and maintenance often is not available.
- In contrast to electric water heating systems, solar water heating systems require a hot water distribution system which normally cannot be installed in existing buildings, consequently domestic solar water heating system are mainly installed in new buildings.
- The heat generation from solar power is not reliable. A backup should therefore be installed in order to guarantee the hot water supply even during periods of low solar gains. However, most manufacturers realised this and install either an electrical backup heater or use the waste heat of a chillers as backup heat source.
- There are no national standards for tests and, as result, no data to compare the performance of different products are available.

Constraints for the Dissemination of non-residential Solar Water Heating Systems

The constraints for the dissemination of non-residential solar water heating systems are more or less the same as those for domestic systems.

The lack of skilled designer and computer design tools, in particular, is a limiting factor for the distribution of large scale water heating systems for non-residential applications.

Another observation made during the visits to several installations was that most of the installed collectors were completely covered with dust, sometimes the glass panes were broken and the collectors were corroded completely in some systems. In other words, the owners do not care about the installations, most of them even do not notice that the system does not work any more because non-residential systems have a compulsory back-up system and hot water is available without solar assistance.

This might be a crucial point for the dissemination of non-residential solar water heating systems. A promotion programme should therefore include conditions like those described below to assure system service and maintenance.

The "Vicious Solar Thermal Circle" in Thailand

The general problem with the solar thermal market in Thailand was that it was in a negative vicious circle:

1. Reputation and performance expectation of solar thermal application is low.
2. Therefore customers are not willing to spend a lot of money for planning, installation, good quality of components, control and monitoring of the system.
3. Suppliers offered inferior components, sub-optimal designs, little warranty and hardly any maintenance to meet the financial requirements/limits of the customers.
4. Measurement equipment to prove energy saving was never installed.
5. Many customers did not even care about the system on their roof, so they did not know if something went wrong, as the back-up system still was providing the necessary hot water.
6. Customer had hardly any interest in regular maintenance of the system and if the supplier were asked they did not to come to fix the problem, as warranty time was expired, it was too short (6 months) anyway and additional service was not factored into the investment costs and maintenance contract were not signed.
7. This situation lead to deteriorated, non-functioning installed solar systems often working unsatisfactorily:
    a. low performance of the system,
    b. leakages in the piping and the collectors
    c. and non-functioning of the control systems
    d. clogged piping due to non-purified water etc.

    were leading to unsatisfied customers in the long run.

8. The consequence was: The image of solar thermal systems was getting even worse!

The general perception about solar thermal systems in Thailand is:

=> The investment cost is too expensive!
=> It is not economical!
=> It is not reliable!
=> It requires too much maintenance!

This image of solar thermal applications in Thailand is the consequence of the negative development in the last 20 years!

How could it happen?

1. The early systems installed had inferior material and were not properly designed, as once aimed to make it "cheap" and partly as solar thermal technologies were not developed in the early days.
   (In Europe technology was inferior as well at that time.)
2. Regular maintenance and warranty was not provided and customers did not understand the system concept.
3. Monitoring and measurement of achieved system performance and achieved energy saving was never done. If data were recorded they were not analyzed later.
4. Customers got disappointed as realized systems did not hold the promises given before by the suppliers. That led to a disappointment.
5. Once a major component failed, like the controller, it was not replaced and the whole system was dismantled or abandoned.
6. The consequence was another "solar ruin" on the roof, which made the image of solar systems even worse.
7. The government undertook very limited activities to overcome this problem. Hardly any awareness, training and research were initiated and supported.
8. The research intuitions "lost" interest in the subject in the late eighties
9. Companies in the sector dropped out as market size was reducing
10. Most systems still sold were according to the method: "sell it and forget the customer", like a consumer good.
11. The result is that the negative image of solar thermal applications spread out and many institutions, companies lost their interest in that energy field.
12. The consequence is that the market for solar application is stagnating or even shrinking, which leads to negative growth of the market.
13. Cost reduction for solar systems could not be achieved in such a market, as solar systems were "made by demand".

This kind of development of a solar thermal market happened the same way in Europe and other countries as well. It was the "normal" development path for this energy technology in the eighties and early nineties.

But the main point is: How to break this vicious circle and how to move it to a positive circle, which leads in the long run to a self-sustaining growing solar thermal market, as in many other countries in Europe or Israel. How could it happen, that Germany has a steady growing market of more than 1 Mio. m^2/a despite the fact, that solar systems in Germany are expensive, the pay-back period is between 10 -15 years and sunshine is half of that in Thailand? The answer is in chapter 8, where we deal with adequate policy that makes the changes possible.

Before we come to this in the later chapters, we like to describe the various barriers encountered here in Thailand, as they show what has to be done to improve the situation and to come to a positive circle concerning solar thermal applications. The main barriers had be mentioned already in early studies, cited above, but in the

following we try to look at it in a more systematic way to show what has to be done to change the “vicious circle” to a “positive upward oriented circle”

MAIN TECHNICAL BARRIERS

The technical barriers can be defined along the planning, installation and operation process of solar thermal systems:

1. The knowledge for correct planning, design, selection of appropriate components and material as well as correct installation of solar systems is not available with the suppliers/manufactures of solar thermal systems

- The sizing of the solar system is done based on “rules-of-thumb” and not based on measurement of the actual hot water demand.
- The sizing of the components and the optimization of the system is not done by using a dynamic simulation software.
- The final design of the system is done without “good practice engineering”, like sizing of pipes, heat exchangers etc.
- Corrosion aspects are neglected by selecting wrong material and combining material, that should not be used together.
- Used material and components are of inferior quality and do not perform on the long run.
- Problems of sediment in pipes and solar collector resulting from poor water quality were not considered in system design (open primary solar loop)
- The knowledge of correct installation process is missing.
- Basic rules for installation of systems are neglected or are not know (vertical or horizontal storage, fixing point for back up system too low, etc.).

Example:
- See as well “Conditions of typical Thai large commercial solar hot water systems” described in chapter 4.1 (Quality of installations)
- See as well chapter 6 case studies, where individual solar systems visited are described
- See as well site visit reports in the annex, which give a detailed description of individual solar systems visited.

Reason for this is:
- A lack of training and a lack formal education for the suppliers/manufacturer.
- Non- engineering companies have entered the solar thermal market and do not know the standard practice of detail engineering for such systems.
- The suppliers are not willing to invest in the purchase of a simulation software (less than 1000 US$).
- Some materials for installation and repair such as insulation or controllers are not available in local hardware stores, so they do not get replaced.
- Lack of skilled technicians for proper installation, repair and maintenance.
- Solar thermal technology is considered a “simple” low technology, so the supplier

and the technician did not care too much about the technical requirements and standards to be applied.
- Customers did not request “high” technology standards, as they were only interested in a “low” investment costs. They did want to save energy, but even more they wanted to save investment costs. They were not willing to spend more as they did not trust the systems offered.

Consequences are:
- Inferior design, under- or over sizing of the components, which lead to underperformance of the system.
- Investment costs are relative too high for the performance of the system
- The predicted pay-back period for the investment is not achieved.
- Low performance of the system and mal-functioning systems after a short time.
- Finally unsatisfied customers.

2. Neither many customers nor most of the suppliers cared for the solar systems during operation in an adequate way.
3. No monitoring and measurement equipment is installed to monitor status and document “saved” energy
4. High maintenance costs due to climate conditions and non appropriate technical material. For instance, the degradation of rubber seal and water deposits were most common in a solar water heating system. These problems caused water leaking and damages in water pipe and water tank - particularly corrosion - and could happen within 2-3 years of installation.

Reason:
- As indicated in earlier studies(see above) many collector arrays were covered with thick dust as they were not cleaned, piping systems were leaking and not repaired, non-functioning control systems were not replaced, etc.
- Inappropriate material and components used in the installation.
- Not to install measurement equipment: To save investment costs and customer are not willing to pay for this equipment as they were not convinced to need it!

Consequences are:
- Customers and suppliers do not know if the solar system is still operating and if is still operating, what is the performance of it. So nobody can tell, if the predicted pay back period for the investment is achieved or not. This gives room for “feelings” like: I think I save energy or the system does not work and solar thermal applications are too costly.
- As long as there is no systematic and consistent monitoring of performance introduced in as many as possible solar systems, there is no chance to reverse this perception and come up with concrete data and reliable figures, how much kWh of fuel energy per m^2 of collector has saved in one year.

Figure 3.1 Picture of a neglected solar system In Thailand

OTHER TECHNICAL BARRIERS

1. In residential applications no central hot water system exists. Typical Thai houses and buildings are not designed for hot water service (only cold water pipe and single way water tap).
2. Low hot water demand in domestic sector and in low budget hotels. Therefore this customers group is not suitable for solar thermal systems in Thailand

=> In this energy sector (existing residential houses and low budget hotels) solar water systems can hardly be introduced.

3. Lack of Early Integration of SWH into Building Design.
   As a solar water heater system requires a precise piping work, the system must be brought in the early stage of the building construction so that necessary hot water pipes could be properly designed and installed. It could be very complicated, costly and thus not convinced to install the systems for existing buildings where no hot water pipes are available (in houses) or hot water supply systems is not centralized in the case of commercial buildings.

NON-TECHNICAL BARRIERS

1. Relative high investment costs for solar thermal systems compared to electrical heater or LPG boilers, lead to pay-back periods, which are sometimes higher than accepted by customers. (See as well chapter 5 economical and financial aspects)

2. Missing standards for collectors and systems performance lead to a non-transparent market. The performance of “cheap” components and of “expensive”

components can not be compared. The consequence is that the selling of the solar systems is done mainly over the prize, regardless of their performance. This leads to a decrease of quality of the components offered over the time. (see as well chapter 4.2. equipment standards)

3. Testing of components and systems is hardly done, so the performance of the different collector systems can not be measured and compared. (see as well chapter 4.3. standard testing)

4. Quality labels and certification does not exist, so the quality of products can not be recognized in the market (see as well chapter 4.4. Quality label and certification)

5. Lack of financial incentives by government. In Thailand there is no financial support for the installation of solar water heater (see as well chapter 8 policy and framework)

6. Lack of awareness. There is hardly any awareness activities, demonstration activities and promotion activities for solar thermal applications in Thailand. Customers do not know the benefit of the systems or are wrongly informed by perceptions or bad experience of old systems installed 20 years ago.

7. Lack of a long term policy to promote solar thermal applications. So far it does not exist. There is hardly any interest in this renewable energy by the government so far.

SUMMARY OF BARRIERS

To summarize the main barriers:

1. Lack of technical expertise by suppliers to design and install solar thermal systems
2. Lack of quality of installed material and components
3. Lack of maintenance during operation
4. Lack of monitoring and evaluation of system performance during operation
5. Lack of standards for components and systems
6. Lack of testing facilities for components and systems
7. Lack of quality labels and certification
8. Lack of awareness by customers for their installed solar systems
9. Lack of financial incentives
10. Absent of adequate government policy to support the development of a solar thermal market in Thailand

To reverse the “vicious circle” to a “positive self-sustaining growing circle” it is necessary to tackle as many as possible of the listed 10 barriers.

It is necessary to systematically deal with these identified barriers and to design an adequate program and to promote the private sector companies currently in the market, that want to improve the quality of their products offered and want to overcome the negative image of solar thermal systems in Thailand.

This EU SolTherm project was a first step to identify the barriers and to revitalize the solar thermal market in Thailand. The first response by the manufactures and suppliers is very positive, but as this project lasted only for one year not all barriers could be tackled and it is expected that the respected government agency DEDE will take up the points identified in this project and develop it further in a systematic way.