Setting verifiable targets for Solar Thermal

Intelligent Energy Europe

Introduction

The present document was produced by ESTIF (www.estif.org) within the framework of the Intelligent Energy-Europe project Key Issues for Renewable Heat in Europe (K4RES-H)[1]. The project looks at providing guidelines for best practice policies to support renewable heating and cooling (RES-H) technologies.

Targets and target-setting have become a powerful tool in policy-making. From municipal targets to reduce local particulate imissions to specific acceptable levels up to international treaties such as the Kioto treaty to reduce greenhouse gas emissions to clearly defined levels within a certain timeframe, targets are serving as a yardstick against which policies and developments are measured.

The Heads of State of the 27 EU Member States decided in March 2007, to increase the share of renewables in Europes energy mix to 20% by 2020. Soon, the Member States will be asked to draw up national action plans for each energy sector, to show how much renewable energy will be introduced until 2020.

Summary

Verifiable targets for solar thermal can be set with reasonable effort and accuracy. For shorter periods (e.g. up to 2020) the target should be set based on the existing penetration of solar thermal, measured in kW_{th} per capita. Benchmarks should be the penetration level achieved already in other countries and regions. As a minimum, each Member State should aim at achieving by 2020 the solar thermal penetration in Austria today. And as a whole, the EU should be able to reach at least $1m^2$ of solar thermal collectors in operation per capita.

In order to make the targets verifiable a system of monitoring the development of solar thermal capacities in operation must be put in place. This could be achieved either by collecting data on newly installed capacities and subtracting old systems, deemed to have gone out of operation. Or to directly assess the capacity in operation, e.g. by building up and maintaining a national register of existing solar thermal systems, verified each year by competent inspectors of heating systems (such as the chimney cleaners in Germany and other countries.

[1] The K4RES-H homepage can be found at: http://www.erec.org/50.0.html

Short term targets and long term potential

The long term potential of solar thermal in Europe has been estimated to be at least 100 times higher than today's usage. But it cannot be fully realised in a few years. For (shorter) periods for which operational targets are needed (e.g. 2020) the technical potential will definitely not be a limiting factor, not even in the most advanced ST markets. For the shorter term questions of today's usage and achievable growth rates are of utmost importance. Targets and measures to achieve them are inevitably interdependent. With stronger measures, higher growth and ultimately higher targets can be achieved. And setting of ambitious targets should help focus on strong measures to achieve them.

Importance of intermediate targets

If targets are to have an effect as guideline for policy making and as a benchmark for the success so far, then it is clear that intermediate targets are essential. Waiting until 2020 only to find out that a target was missed, is not sensible. Instead the progress must be verified in frequent intervals and policy measures adapted where necessary.

Short to medium term target (up to 2020)

Ideally the target should be determined in a detailed bottom-up study taking into account demand in different sectors, availability of suited roof and facade areas, development of the availability of skilled professionals etc.

But such a detailed study takes time to produce and therefore a more pragmatic approach should be applied: Meaningful targets for 2020 can be set also based on estimations, comparisons, and analogies.

The two approaches shall be outlined below, beginning with the pragmatic one that could be used by EU Member States in the development of their national action plans to fulfil the new binding target of 20% RES in Europe by 2020.

In any case the target should be set based on a simplified statistical conversion from solar thermal capacity (or collector area) to solar thermal energy production.

Based on the works of the International Energy Agency's Solar Heating and Cooling Programme (IEA-SHC), ESTIF uses a European average collector energy yield of 500 kWh/(m^2 * a). This factor takes into account the energy produced by 1m^2 of collector area in typical local solar thermal systems and weighs the different country-factors according to their relative market size. Each country may in the future calculate its own specific factor based on the typical systems, applications and specific energy productions in their country.

Approach 1: Programmatic setting of ST target

In the heating sector changes do not come over night and any policy measure introduced now will take time to take full effect. Therefore, it is fair to say that 2020 is already very close. The typical opportunity for including solar thermal into buildings or industrial processes comes with the new installation or renewal of the heating systems. This is one of the factors limiting the fast penetration of solar thermal technology.

Until 2020 there will be a lot of technological advancement in this market but a large part of the new installations will be with products of today or similar to today's. Even a breakthrough in the field of e.g. advanced heat storages by 2015 would not have a huge impact on achieving a target for 2020. This would be radically different if the time horizon was 2030 or even further.

This means essentially, that for the setting of 2020 targets, one can start with what has been achieved today and extrapolate from this level taking into account the positive framework conditions that are to be realised to promote solar thermal.

The analysis of different countries shows that the very different penetration of solar thermal does not depend much on climatic conditions (two of the leading solar thermal markets in Europe, Austria and Germany, are not in the sunny Mediterranean region, whereas Italy, France and Spain have much lower solar thermal penetrations). Therefore, it is reasonable to benchmark most European countries not against neighbouring countries but against the market leaders and.

Two benchmarks are of highest relevance in this context:

- Solar thermal capacity in operation per capita
  This parameter is both, closely linked to energy production (because it looks at the installed capacity) and it takes into account the different size of the national markets. It shows very well the relative penetration of solar thermal in different countries.

- Actual past growth rates of the solar thermal market
  This parameter can be used as "reality check". What growth rate would be needed to achieve a certain target in 2020, and has such a growth rate been realised in at least one country over a longer time span, i.e. could it be used as a yard-stick for the period 2007-2020.

Solar thermal capacity in operation per capita

The EU leaders in this category are Cyprus (479 kW_{th}/1.000 capita at the end of 2005), Austria (199 kW_{th}/1.000 capita) and Greece (193 kW_{th}/1.000 capita). For comparison: The EU-average is 24 kW_{th}/1.000 capita.

As a central European country, Austria is a very interesting example and can serve as a benchmark for the rest of the EU. This country has taken 20-30 years to reach this level of solar thermal usage. When solar thermal started to grow in Austria, there were hardly any commercial solar thermal systems and most systems were self-built. Over the years a strong industry has developed and technology has become highly efficient and reliable.

With today's products and know-how it should take other countries much less time to achieve similar rates. The "Austria Benchmark" should serve as a minimum target for 2020 for any EU country.

Depending on many country-specific factors, higher numbers seem well achievable in many Member States.

The European Solar Thermal Industry Federation is advocating a 2020 target of $1m^2$ of collector area per European. These are 700 kW_{th}/1.000 capita and would translate into 320 GW_{th} installed capacity in 2020.

This target applies for the average of the EU. Some countries, like Cyprus, Austria, Greece, Germany should achieve even higher levels while others will not be able to reach $1m^2$ per capita by 2020. As a very minimum each of them should target the "Austria Benchmark" of 199 kW_{th}/1.000 capita.

	Capacity in Operation 2005 GW_{th}	Capacity in Operation 2020 GW_{th}	ST Energy 2020 mtoe/a	Average market growth rate 2006-2020 % p.a.	Capacity in operation per capita 2020 kW_{th}/ 1000 capita
"Austria scenario" (minium target)	10,9	91,2	5,6	16%	200
"$1m^2$ per capita scenario" (ambitious target)		320,4	19,7	31%	700

Actual past growth rates as "reality check"

If the market grew with a constant growth rate until 2020, how fast would it have to grow to achieve a certain target in terms of capacity in operation per capita. In many countries, the solar thermal market is still in its infancy and therefore very high growth rates can be expected in the coming years. But the question is, what growth rate can be realistically achieved on a longer-term, e.g. from now until 2020.

For the EU to achieve the ESTIF target of $1m^2$ per capita by 2020, the EU market would have to grow at around 31% every year from 2007 to 2020.

In order to check how realistic such a growth rate is, it could be compared to the biggest national solar thermal market over a time span of the same length (1993-2006): During this period, the German solar thermal market grew at least by 20% in 11 out of these 14 years, and in 6 of these the growth rate exceeded 30%. For a country that has relied so far on "soft" support measures such as awareness raising campaigns and financial incentives, this is a remarkable achievement. One can only speculate what could have been achieved with stronger measures, such as solar thermal (or renewable heat) obligations for new buildings and for those buildings undergoing major renovations.

A sustained growth rate of 31% seems to be a well achievable rate, where a government is serious about the continued support for solar thermal.

Adjusting targets to country specific conditions

ESTIF's overall target for the EU in 2020 needs to be broken down by Member State. As pointed out earlier, not every single country will reach 1m² of collector area by 2020.

Instead the European target should be adjusted to the local conditions. Important success factors for the near term future are:

- Current level of solar thermal usage (implying also a certain level of solar thermal awareness and of market infrastructure)
- Current level of usage of other RES-H technologies
- Current energy technologies used for heating and cooling
- Cost competitiveness with existing heating technologies
- Other (policy) priorities in the heating/cooling sector (e.g. efficiency measures in buildings, district heating networks)

Approach 2: Detailed bottom-up study to set ST target

Another approach to set a target for the short- to medium term (up to 2020) is to conduct a detailed study on the realisable potential in this time span.
In this case it should be assessed how much low-temperature heat is currently being used, in which market segments and for what applications. Based on the rate of new-built heating systems as well as the typical renewal rates for existing heating equipment in the different segments and applications, the immediately available potential for the introduction of solar thermal should be assessed. This potential needs to be adapted to take into account that not every low-temperature heat demand could be covered by solar thermal (e.g. because of lack of suitable roof or facade area in high-density urban environments).

Outline of a detailed target-study:

- Total potential: Low- to medium temperature heat demand

- Short-term technical potential: Low- to medium temperature heat demand that could be covered by solar thermal technology available today or in a few years.
- Realisable technical potential 2020: Share of heat demand, which is covered by heating systems, which are to be newly built or renewed between now and 2020
- Solar thermal target 2020: Based on this realisable technical potential 2020, governments need to determine how much of this they want to realise. This would be their 2020 solar thermal target.

The policies they enact should then be targeted at reaching that share.

Monitoring of progress towards reaching a target

After having shown how targets for solar thermal could and should be set at national or local level it is important to point out how these targets can be made verifiable. A target without frequent and verifiable monitoring of the development of solar thermal installations would be meaningless. How could policy makers assess the success of their support policies without a feedback on the number of existing installations.

Two options are feasible:

1. Collecting data on newly installed capacities and subtracting capacities assumed to not be in operation anymore. The continued survey of the solar thermal market would allow keep track of the newly installed capacities. From the accumulated capacity, the very old systems, which are believed to have gone out of operation, must be subtracted in order to receive a realistic figure for the “capacity in operation”.

2. Directly collecting data of solar thermal capacity in operation: If done correctly, this would give higher quality results. But it creates additional costs for the collection of these data.

Collection of data on newly installed capacities and assumption on life time of solar thermal systems

This approach has been used so far by EU Member States, national solar associations and other bodies publishing solar thermal statistics. A thorough analysis of such statistics has been conducted within the K4RES-H project (see Deliverables 2 and 4) and recommendations on how to improve the quality of solar thermal statistics have been given therein:

(1) Improvement of data collection

Whilst no national register of solar thermal systems exists (“what is where installed and in operation?”), data collection should be based on:

- Surveys of solar thermal manufacturers/importers, which are done in co-operation with the relevant national trade association and which keep the individual data confidential
- Data obtained from financial support schemes at national level, if they are generally believed to cover most of the solar thermal market (i.e. only few installations are done, which do not receive these financial incentives)
- Ideally, the two methods are used together in order to cross-check the data and to fill potential information gaps

(2) Non-inclusion of old systems, which can be assumed not to be in operation anymore

Statistics which do not foresee that old systems are decommissioned at some point in time will show less and less realistic figures.

ESTIF strongly recommends using a uniform assumption on the usage time of solar thermal systems. In the ESTIF statistics the average usage time of a solar thermal system is assumed to be 20 years (15 years for systems that were installed before 1990). While there are many systems running already for 30 years, many systems are decommissioned earlier, e.g. because the building is demolished or has changed its use. The ESTIF assumption means that systems installed before 1990 are not considered anymore in today's statistics of solar thermal systems in operation.

Direct collection of data on solar thermal capacity in operation

In various EU Member States frequent checks of heating systems are required by law. In Germany for example, chimney cleaners measure emissions of ovens and boilers on an annual basis. And as most solar thermal systems have a back-up heater typically burning either gas or biomass it would be simple to add a requirement on having a look also at the solar thermal part of the heating system. Such a requirement would allow building up and maintaining a register of currently existing solar thermal capacities and it could help ensure that the systems are functioning properly.

Longer-term targets (beyond 2020)

The longer-term target should be to cover as much as possible (i.e. close to 100%) of the low-temperature heating and cooling demand with solar thermal.

On the longer-term, today's level of solar thermal usage has almost no influence on the overall result: Even a country which has only little usage so far has enough time to close the gap to today's front-runners and to eventually overtake them. Therefore, an extrapolation from today's penetrations would not be appropriate to set a longer-term target.

A longer-term target would have to take into account longer term scenarios for the heating and cooling demand as well as the expected – or possible – technical development.

In the solar thermal sector, the European Solar Thermal Technology Platform (ESTTP), which was officially launched in May 2006, is already working on these issues and aims at developing a comprehensive roadmap for solar thermal in Europe, encompassing technological and non-technological barriers to growth and measures to overcome them. Any government aiming at setting longer-term targets for solar thermal should support the ESTTP work in this field and take the results of the ESTTP as input to their own studies, where suitable.

Conclusion

Verifiable targets for solar thermal can be set with reasonable effort and accuracy. For shorter periods (e.g. up to 2020) the target should be set based on the existing penetration of solar thermal, measured in kW_{th} per capita. Benchmarks for the target setting in one country or region should be the penetration level achieved already in other countries and regions. For each EU Member State the minimum target for 2020 should be to achieve a solar thermal penetration reached already today by Austria. As a whole, the EU should be able to reach at least $1m^2$ of solar thermal collectors in operation per capita.

In order to make the targets verifiable a system of monitoring the development of solar thermal capacities in operation must be put in place. This could be achieved either by collecting data on newly installed capacities and subtracting old systems, deemed to have gone out of operation. Or to directly assess the capacity in operation, e.g. by building up and maintaining a national register of existing solar thermal systems, verified each year by competent inspectors of heating systems (such as the chimney cleaners in Germany and other countries.