Best practice policies to develop Renewable Heat markets

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CONTENT

A) Structure of the document

This document is part of the REACT project (Renewable Energy in Action) and is a draft version of “Best practice policies to develop Renewable Heat markets”.

In the following the structure is outlined:

- The **first chapter** gives a short overview of the current RES heat market penetration in EU-15 countries; the European Commission’s (ECs) renewables target; RES related EC directives and their influence on RES heat issues. Currently there is no legislation in place addressing renewable heat production or supply targets, respectively. Recommendations for the national implementation of these directives regarding an increased RES heat deployment are, where possible, deduced.

The main message of this chapter is that the EC target for renewables can only be met if the deployment of RES heat can be increased, surpassing current trends substantially. Together with successful transition management approaches stimulating RES in the heat market, a renewable heat directive could be the solution to assure the necessary immediate growth rates.

- **Chapter two** comprises short summaries of case studies conducted by the national partners within REACT, which were selected as the best examples of successful policies to introduce RES heat resources into heat markets.

- **Chapter 3.1** gives a one side summary on what “best practice policies to develop renewable heat markets” should focus on. **Chapter 3.2** is the main chapter and points out the different aspects of dedicated best practice policies to develop renewable heat markets.

1 Introduction

Heat from renewable energy sources (RES heat) normally comprises energy from

- biomass (e.g. local space-/hot water heating, CHP and distributed heat, district heating)
- direct solar thermal systems (e.g. local space-/hot water heating)
- environmental heat (e.g. heat from the ambient air or from the surface-near ground as indirect solar heat) [1]
- and from geothermal sources (heat from the interior of the earth).

RES heat can play a role in reducing greenhouse gas emissions[2], securing energy supply[3] (as indigenous energy sources are used), reducing price volatility, in stimulating of economic growth, jobs creation (often in rural areas) and in improving living conditions through improved social equity and protection of the environment at all levels. These benefits are reflected in political goals such as the targets for renewable energy formulated in the Commission's 1997 White Paper[4], which mentions a heat production from renewable sources of 38.7 Mtoe in 1995 (mainly biomass) and a projection of 80 Mtoe in 2010 for active systems, to be supplemented by 35 Mtoe for passive solar (building design contributing to space heating). RES heat is very important for achieving the 12 % objective for renewables (see heading b).

a) The actual RES heat penetration in the EU-15 countries

The overall penetration of heat from renewable energy sources (RES heat) in the EU-15 amounted up to 43.3 Mtoe in 2002 (the increase from 2001 was 2.3 %). As is shown in Figure 1, the major contribution to the overall RES heat generation came from biomass, i.e. nearly 42 Mtoe in 2002.

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[1] RES-H benefit with heat pumps normally relates only to the environmental free energy part (e.g. temperature-rise achieved with ambient air or ground – and not the required electric or fossil drive energy. However 66 to 80 % of the total heat-energy output comes from the environment as renewable ambient/solar heat.

[2] Kyoto target.

[3] COM(2000)769. Green Paper: Towards a European strategy for the security of energy supply

[4] COM(97) 599 final. White Paper: Energy for the future – renewable sources of energy

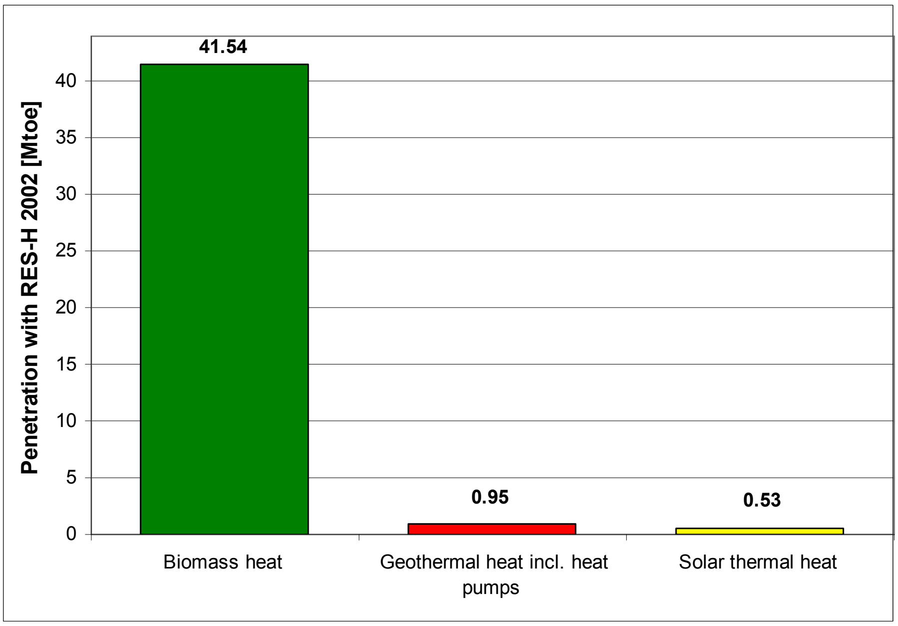

Figure 1: Penetration of RES heat in EU-15 in 2002 per technology

In 2001 the overall electricity generation from RES in EU-15 was 384 TWh, equivalent to 33 Mtoe (consolidated figures for 2002 are not yet available).

In general it is rather difficult to get more detailed data about deployment of RES heat. As there are still differences in definition there is a need to come to an EU-wide accepted definition and measuring protocol for the different RES heat resources.

Figure 2 shows the distribution of the generation of RES heat across the Member states of the EU-15. Obviously the absolute heat generation from RES is highest in big countries such as France, Italy and Germany. The market penetration of RES heat is relatively high in Finland, Sweden and Austria.

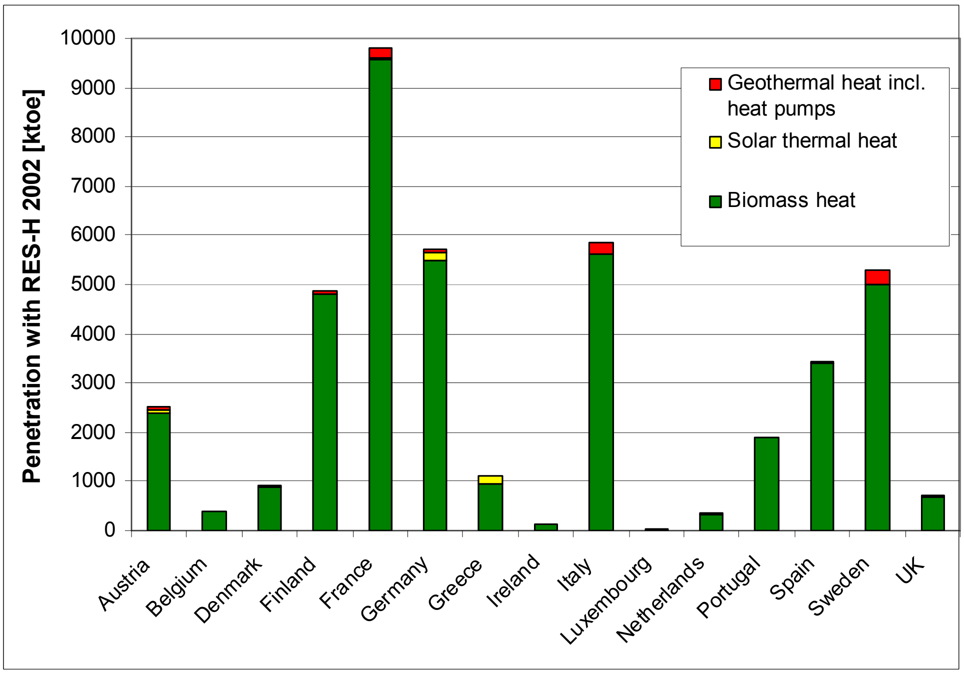

Figure 2: Penetration of RES heat in EU-15 in 2002 by Member State

Table 1 shows detailed data of RES heat market penetration per country and technology, as well as and annual growth rates since 1997.

Table 1: Data according market penetration of RES heat in EU-15 in 2002 by Member State

	Biomass heat			Direct solar thermal heat			Geothermal heat and Environmental heat*			
	Penetrat-ion 2002 [ktoe]		Growth rate since 1997 [%]	Penetrat-ion 2002 [ktoe]		Growth rate since 1997 [%]	Penetrat-ion 2002 [ktoe]		Growth rate since 1997 [%]	Penetrat-ion 2002 [ktoe]	Growt h rate since 1997 [%]
Austria	2373	**	-2	74,3		9	80		74	*	*
Belgium	384	**	5	1		-	6		-	*	*
Denmark	891	**	-2	9,9		8	15,7		67	*	*
Finland	4818	**	3	0,8		22	45,9		44	*	*
France	9567	**	1	37		18	196		10	*	*
Germany	5480	**	6,3	158		18	65,2		49	*	*
Greece	962	**	1	146		5	11,9		39	*	*
Ireland	145	**	6	0,1		-	1,3		92	*	*
Italy	5613	**	9,2	17,1		20	213		-	*	*
Luxembourg	24,6	**	26,3	0,1		0	0		-	*	*
Netherlands	324	**	0	11,3	**	15	7,9	**	-	*	*
Portugal	1885	**	0,3	19		4	1		-	*	*
Spain	3383	**	0,7	35		7	8		4	*	*
Sweden	4995	**	-2	5,02		2	299		-	*	*
UK	700	**	-5	16		13	0,8		0	*	*

* e.g. heat from the ambient air or from the surface-near ground as indirect solar heat;
Currently there are no separate data for this energy source available, so there is just one data column which is the sum of both, Geothermal heat and Environmental heat (this is also for most of the graphs, where a distinction is not conducted yet).

** 2001 data, Source: The share of renewable energy in the EU SEC(2004) 547

b) Meeting the EC renewables target(s)

According to the recent evaluation of the contribution of renewable energy sources in the EU[5] there are some national success stories in woody biomass (e.g. in Finland and Sweden) and solar heat, e.g. in Germany, Greece, Austria and Cyprus (see Table 1). Geothermal heating is growing at a good speed (see Table 1). Nevertheless, the overall development of renewable energy in heating does not give rise to optimism.

If present trends continue in RES heating (for 2010 a contribution of 54 Mtoe is estimated), and if Member States implement their national plans for electricity and fulfil the requirements of the biofuels directive in transport, the share will reach 9 % in 2010. As the figures in the table below show, even if the targets for renewable electricity generation and biofuels are met, extra 29 Mtoe of renewable energy for heat production will still be needed to achieve the 12 % objective by 2010.

Table 2: RES heat development 1997–2002 and updated target for 2010.

RES heat potential	1997	2001 Results	2002 Results	2010 Heat contribution to 12% target[6]
EU-15	38.7 Mtoe	42.3 Mtoe	43.3 Mtoe	72 Mtoe
Biomass	38.04	41.1	42	66
Geothermal	0.4	0.7	0.8	4
Solar thermal	0.26	0.5	0.5	2

With the measures that have been put in place, the Commission estimates that the share of renewable energy sources in the EU15 is on course to reach 10 % in 2010. The shortfall compared to the 12 % target is caused by sluggish growth of renewable energy markets for heating and cooling, leading to the conclusion that considerable extra action is needed in this sector to enable the full 12 % target to be reached.

The 2010 targets set in the White Paper will not be met at current levels of political and financial support. Fulfilment of the 12 % target by 2010 will require a speed change in national policies towards the use of renewable energy in heating.[7]

Several years ago it was under discussion whether a separate Directive might be needed.[8] From the EC point of view targets for renewable energy sources' heating would be difficult to establish because there is no single "heating supply industry" to whom they could be addressed. Nevertheless there are a number of other legal instruments that are in place or being proposed that also cover at least some of the RES heat issues, such as

- the RES-E Directive[9],
- the Energy performance of buildings Directive[10]

[5] COM(2004) 366 final: "…evaluation of… the contribution of renewable energy sources in the EU…"

[6] The 72 Mtoe is the updated scenario.

[7] COM(2004) 366 final: "…evaluation of… the contribution of renewable energy sources in the EU…"

[8] Heat from Renewable Energy Sources – The RES-H initiative and the impact of related Directives, ECCP, 5. September 2002

[9] Directive 2001/77/EC: "... on the promotion of electricity produced from renewable energy sources..."

- the Combined heat and power (CHP) Directive[11] and
- the proposed Directives on Eco design[12] and Energy services[13].

The **RES-E Directive** gives a definition of renewable energy sources, but leaves out heat pumps. Targets, certification, support schemes, etc. for RES-E will help RES heat only when the green electricity comes from CHP plants (e.g. biomass), but there are neither specific targets nor certificates at an EU level for heat production.

The **energy performance of buildings Directive** must be implemented by Member States (MS) in 2006. It addresses the households and the tertiary sector responsible for about 40 % of the final energy demand in EU. The long term potential for energy savings is estimated at about 22 %. The Directive introduces a common methodology for integrated energy performance standards for buildings, including integration of renewable energy supply and cogeneration. The standards are applied not only to new buildings but also in the event of the major renovation of large existing buildings.

Following article 5 of the Directive, for new buildings with a total usable floor area over 1,000 m², MS shall ensure that the technical, environmental and economic feasibility of alternative systems such as:

- decentralised energy supply systems based on renewable energy
- CHP
- district or block heating or cooling, if available
- heat pumps, under certain conditions

will be considered and taken into account before construction starts.

According to article 8 MS shall take measures for a one-off inspection of the whole heating installation for boilers older than 15 years (with an effective rated output > 20 kW). On the basis of this inspection experts shall provide advice to the users on the replacement of the boilers, other modifications to the heating system and on alternative solutions.

There is a need for the buildings Directive to be implemented in a way that stimulates the integration of efficient biomass boilers, solar water and space heaters, heat pumps and other forms of (especially local) heat production from renewables (e.g. for cooling appliances) in residential and tertiary-sector buildings. Specific targets for RES heat will not arise.

There is also a need to encourage a greater share of biomass in cogeneration and in district heating systems, especially where existing systems can be economically refurbished (which is the case in many of the new Member States). The **Directive on promotion of cogeneration** is centred around the concept of promoting “high efficiency CHP”, for which support schemes and certification will be used and saving potentials established. In that context the reference values for CHP from renewable energy sources compare very favourably to e.g. CHP from fossil fuels. In other words, the efficiency requirements for a CHP plant using e.g. biomass are far less stringent to be qualified as “high efficiency” than for e.g. a fossil fuel fired plant. The CHP Directive does not give targets: not for CHP as a

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[10] Directive 2002/91/EC: “... on the energy performance of buildings”

[11] Directive(2002) 415 final: “... on the promotion of cogeneration based on a useful heat demand…”

[12] COM (2003)453: “Proposal on … Eco design requirements for energy using products”

[13] COM(2003) 739 final: „Proposal …on energy end-use efficiency and energy services”

whole, let alone for CHP from RES heat. MS will be required to identify saving potentials in 2006.

Energy efficiency is as important as renewable energy for increasing security of energy supply and reducing emissions of greenhouse gases. The proposed **Energy efficiency and energy services Directive** would require Member States to reduce the amount of energy distributed to final customers by 1 % a year. It aims – amongst others – at facilitating and promoting active energy services such as performance contracting, leasing, selling, renting appliances by energy services companies (ESCO's). For these ESCO's, which might or might not be utilities, the supply of (district) heat is often an important 'service product'. The promotion of district heating (DH) plants from RES heat (non-CHP) could partly be covered through extra provisions on the subject by the Energy Services Directive that is underway. Actually there are no provisions according to certain energy sources that should be preferably utilized or switched to respectively.

The proposed Directive on **Eco design requirements for energy using products** should make it possible to set active minimum efficiency requirements or to promote the voluntary agreements in this field.

There is also a broad consensus that the **EU Emissions Trading Scheme** (ETS) will have a positive effect on the take off of renewable energy in the EU from 2005 onwards. The positive effect will affect the 2010 extrapolations, although this might be premature as the allocation of allowance has not yet been finalised.

c) Conclusion

Renewable energy in heating has grown slowly over the past seven years. The Directive on the promotion of cogeneration (CHP Directive) and the Buildings Directive have a direct impact on efficient heat use. But there is no legislation in place addressing renewable heat production. By the existing and upcoming legislation certain opportunities for promoting DH from RES through legislation will not be covered, which might be an important subject in view of the New Accession Countries (NACs). Specific RES heat targets are missing, but could partly be an integrated part of targets for the energy performance of buildings or an integrated part of the saving per Member State for CHP.

The existing and upcoming legislation will not cover RES heat related to small scale biomass boilers and thermal solar in new buildings smaller than 1,000 m², nor does it cover larger scale application of biomass boilers in industry, waste heat from biomass power plants, etc. RES heat is still a sector dominated by traditional biomass use and a new dynamism is needed to deliver the necessary contribution to achieve the objective of a 12 % share in renewables by 2010 and to develop the sound potential that exists in the new Member States.

The European Commission will bring forward further initiatives – if necessary, legislative proposals (annotation of the authors: i.e. a RES heat directive) – to accelerate the fulfilment of the potential of three key technologies – modern biomass heating, solar heating and geothermal heat. These initiatives could include targets for specific technologies or requirements for suppliers of heating oil and gas to supply e.g. wood pellets and biogas.[14][15]

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[14] COM(2004) 366 final: "…evaluation of… the contribution of renewable energy sources in the EU…"

[15] The solar branch is actively lobbying for a heat directive (via Estif). To bring forward this issue the biomass and heat pump industry should team up with them.

2 Summaries of the case studies

Within REACT several countries have set activities on the RES heat market and the following case studies were selected as the best examples of policies to introduce RES heat resources. The case studies are described in alphabetic order of the corresponding countries.

2.1 AUSTRIA

a) The model of the Salzburg housing subsidy (and its impact on the use of biomass and solar energy for heat-supply)

Ten years ago Salzburg introduced an innovative provincial housing subsidy model on the basis of an existing federal subsidy scheme for construction of residential buildings. Within the scheme more support is granted, if buildings are constructed with significantly improved thermal insulation and use of biomass and solar energy for heating. The amount of financial incentives is determined by a point system for various conservation and energy supply measures. As the design of the points system is non-linear, optimising of additional costs and the corresponding additional financial incentive (in form of an increase of a financially supported loan) becomes dynamic and attractive for the planner.

After ten years nearly all multiple storey residential buildings and about 85 % of single family houses are addressed by the additional points model. The average specific heating energy demand of subsidised buildings decreased by 58 percent. In 2004 the share of newly constructed buildings using solar thermal collectors reached 70 % and the share using biomass heating reached 67 %.

The key idea of using an existing subsidy scheme and adding new criteria such as RES heat use as conditions for receiving full scale financial incentives seems to be highly attractive and replicable, where ever suitable financial incentives exist. Such an approach can move significant investment volumes without necessarily adding public expense.

b) The introduction of wood pellet heating in Austria

Pellets were first introduced 1994 into the market. Since then, pellets have taken an unexpected dynamic growth with nearly doubling annual sales for a few years, now finding its level at about 5,000 sold boilers per year.

This development was mainly triggered by: stringent emission regulations for wood boilers combined with dedicated R&D programs focusing on biomass combustion, an official testing site for wood boilers releasing public testing results stimulating a sharp competition between the manufacturers (efficiency increased from around 50 % to above 90 %), investment support schemes (1,500 to 2,000 € for households replacing oil or gas boilers) and also the pellets themselves (better combustion, handling properties and cheaper boilers compared to wood chips).

The main problems to solve were: quality problems with the newly developed boilers (big efforts of industry), quality problems with pellets (a quality label and tracking system was developed), at the beginning installers were not involved and had no interest to promote pellet heating (manufacturers changed their policy), lack of qualification (education of installers, chimney sweeps, etc.) and problems with transport and storage of pellets (education of lorry drivers, standards for storage design were developed).

For a further development the increase of oil and gas prices are expected to be the main drivers. There are no serious resource limitations in Austria (enough additional fuel wood to substitute 50% of fuel oil used for heating, furthermore straw pellets would be a possibility).

c) The introduction of biomass district heating in Austria

In Austria, the development and installation of biomass district heating networks in rural areas started in the 1980ies and experienced a significant boom since then. In most cases, agricultural cooperatives were actively promoting this kind of plants. Due to the considerable financial volume and technical complexity of setting up district heating systems, interested provincial governments soon offered organised and funded consulting services to help farmers to set up such projects. These consultants helped to identify new projects, gave advice to farmers and organized communication between boiler producers and operators to reduce technical problems, which occurred in the beginning. Furthermore they lobbied for financial support and other political measures to facilitate new projects. In provinces that did not establish such structures and supporting policies, technology started to disseminate only ten years later. This fact shows how important supportive policies were during the phase of technology introduction.

As financial incentives still amount up to 30-40 % of investment costs, in the recent past approx. 50 new installations per annum were registered. By the end of 2003, as many as 843 plants have become operational with a total capacity of 1,005 MW. A recent survey revealed that the majority of the plants is equipped with over-dimensioned boilers, storage facilities and too long grids (often caused by over-optimistic heating demand assumptions). A comprehensive quality assurance programme for project planning and execution is going to be implemented in near future.

2.2 FINLAND

a) National energy advisors network in Finland

The National Climate Strategy of Finland (2001) shows up needs and measures to increase the use of wood fuels. Hence, it was decided to stimulate energy production on local level, e.g. in small industrial sites, farms, schools, hotels, regional heating plants and power plants.

To achieve this, a network of wood energy advisors was set up. The advisors are trained by polytechnic institutes specialised in forest and wood energy education. They are mainly placed in regional forest centres and assist farmers and local biomass heating entrepreneurs starting and managing wood-fuelled heating plants. With their knowledge about local heating habits and wood energy resources they can offer effective advice on wood fuel procurement and quality, heat production technology and systems as well as for planning and preparation of heating plant projects.

There are currently 60 advisers in Finland and there is the need for doubling the number to reach regional coverage throughout Finland.

b) Biomass heating entrepreneurship in Finland

Biomass heating entrepreneurs operate heating plants and earn income from selling heat. The main fuel is wood that typically comes from the entrepreneur's own forest or from local forest owners. Entrepreneurs can be individual persons, co-operatives, limited companies or a group of companies.

At the beginning of the nineties first entrepreneurs were trained and started to operate in 1992. By the end of 2003, 220 heating objects with an output of 110 MW have been installed. The further target is to have 50 new objects p.a., with 500 by 2010. The heat output of plants is growing with customers being mainly public buildings or residential blocks. So far only one plant is providing heat to an industrial company.

Main driving forces were new income possibilities for forest owning farmers. In addition, municipalities get benefits through new opportunities for the local economy. The major problems were to find suitable heating objects outside existing district heating grids. With the rising number of potential new entrepreneurs providing an appropriate training was an issue, which is solved by the mentioned "energy advisors".

Together with the emergence of the entrepreneurs, great improvements of the fuel chain could be achieved, supported by a Bioenergy Technology Programme.

2.3 FRANCE

a) Small scale district heating (DH) systems: use of wood resources (France)

In France wood is already a key primary energy source (9.3 Mtoe annually). By 1999, 1,500 biomass based DH systems were installed. The issue was to focus on heat production and distribution from wood materials through DH systems of small or medium size. Therefore a programme was started in the mid-90's which received strong interest from communities, so in 1999 a new seven year lasting programme was designed.

The programme has a local approach: promotion is organised around local initiatives involving small and medium sized communities. It's co-ordinated centrally by ADEME which concludes annual contracts with regional partners on concrete objectives. This decentralised organisation is considered as very important. National networks of experts are involved and regional partnerships have been developed to support dissemination and share the financial burden.

The programme resulted in 489 projects (with 450 MW installed) and 40 territorial wood supply schemes realised in 2000–2002, so the 2006 target with 1,000 additional DH systems and 100 territorial wood supply schemes could be exceeded.

An improvement in DH technology and quality of establishing and operating have led to better energy performance ratios and lower environmental impacts. Due to budget constraints in the support scheme there is a certain concentration on larger projects which need less support. The main conclusions are that local involvement of communities and forestry actors is needed. An investment support (20-30 %) is needed to compete with fossil fuels.

b) Plan Soleil: large scale deployment of solar water heaters in France

The objective of Plan Soleil was to initiate a market for solar water heaters as the technology was virtually unknown in France until 1999. This initiative serves three segments of solar hot water solutions: small scale systems for individual housing, large solar systems for residential blocks, hospitals, hotels, etc. and solar combi-systems supplying heat and hot water. A six-years programme (2000–2006) with clear objectives was set up, consisting of a support scheme (investment subsidies), public awareness campaigns, partnerships with regional councils, manufacturers and a successful quality chart in combination with a qualification scheme for professionals.

The programme resulted in annual market growth of about 40 % (target 2006: 112,000 m² p.a. and 2010: 200,000 m² p.a.) and an investment cost reduction of about 30 % (2000-2003).

Main drivers for the success are the long-term-approach of the programme (six years) and the involvement of manufacturers and professionals within networks. Also the co-operation with established energy suppliers (e.g. common promotion) was considered to be very promising, as they could be encouraged to include solar thermal into their portfolio of products. Public awareness creates demand and the challenge was to meet the demand in terms of marketing procedures.

The lack of consistent European standards was stated as limitation for the development of a European solar market.

2.4 GERMANY

a) Solar thermal programme (Germany)

In connection with the ecological tax reform, Germany introduced a market incentive scheme for renewables in 1999. The tax's yield is partly fed back as a direct financial incentive or as low-interest loan for larger renewable energy plants. Although the programme was not dedicated exclusively to solar thermal appliances about 90 % of the support has gone into this sector.

Originally no quantitative targets have been set but the potential was estimated to be about 25 % of the heating requirement. In 2003 the target was set to 10 million m² of solar thermal panels in 2006.

From 1997 to 2001 there was a special communication-campaign by the government which raised public interest for solar thermal appliances. Afterwards, a mostly privately financed campaign was started to inform professionals as well as the public. In the beginning, the important issue of education and training has been very technology-related. Nowadays, marketing issues are important: home-owners and professionals have to be convinced of the benefits of solar heating. Although quality of products and services was no issue itself, since June 2004 appliances have to fulfil efficiency standards as a precondition for financial incentives. The financial incentive itself dropped from 125 €/m² in 2003 to 110 €/m² in 2004.

The support programme led to significant growth in installations with currently about 5.5 million m² installed and an annual installation of about 500,000 to 900,000 m². The case study clearly showed that the market development highly depends on financial incentives (there were almost no installations before introducing support programmes and less installations in 2002 when funds were shortened). Although prices dropped by 50 % within ten years solar thermal heat is not economic yet.

An active involvement of NGOs, often together with professionals, mainly on local and regional level, seems to be very supportive..

2.5 GREECE

a) Domestic solar water heaters (Greece)

In the middle of the eighties, a tax exemption scheme was set to promote deployment of domestic solar water heaters in Greece. Due to the deduction of the income tax, up to 40% of the investment costs of a solar appliance could be saved. At the same time, public interest was raised by (governmental supported TV based) promotion campaigns organised by the solar industry association (in 1984 and 1986). In 1994 the Public Power Corporation joined the efforts to promote solar water heaters. Although research did not play an important role, national standards for performance and quality were developed and became common practice for all products on the market. To overcome the lack of installer's qualification, the larger manufacturers established own shops, where their products were sold, installed and repaired.

These conditions induced a volume growth in installed surface from 1.7 million square meters in 1990 to 3 million square meters of collectors in 2001. Thus, 25 % of all Greek households operate a hot water solar system and produce about 4.3 PJ of heat, mainly replacing electricity.

Beside the huge solar potential in Greece, the case study states the simplicity and attractiveness of the subsidy scheme and a reliable technology and installation as main success factors. The combination of well organised marketing campaigns for consumers and actors within construction industry (architects, town planners, civil engineers etc.) appeared to be very successful.

As the tax exception was abolished in 2003, development is expected to slow down. Furthermore, some studies indicate that the potential is going to reach a certain plateau and new approaches will be needed to further expand the market. The implementation of the EU buildings Directive could offer a chance to further market expansion particularly regarding the yet underdeveloped market for large solar systems. Central solar systems for larger commercial and industrial buildings also have a considerable and so far unexploited potential. So the incentive schemes, subsidies and tax deductions are now concentrated in this direction. Moreover, third-party-financing based on contracts on guaranteed solar results are expected to be used especially for industrial installations.

2.6 PORTUGAL

a) Solar hot water programme (AQSpP – Água Quente Solar para Portugal)

In Portugal the market potential for solar panels is estimated to be 15 million m^2. As solar hot water can supply up to 50 % of the final energy consumption of an average Portuguese family for water heating, particularly the domestic market is interesting. As development has not been up to this potential, the government launched the “Solar Hot Water” Programme starting in 2001 and ending in 2004.

The programme congregated key actors from the national solar energy market and comprised activities like: promotion of the image and the economic and social interest of solar heating, training and certification of professionals, financial incentives bound to certified installers, application of minimum six years of guarantee on solar equipment and monitoring of the market (evaluation of installers, installations, etc.). Financial incentives were granted to private users (income tax reduction) and to non-privat users (direct support and company tax reductions). Furthermore a new concept of direct sale of hot water (for avoiding risks to consumers on the purchase of solar equipment) was introduced.

The objective to install a market of 150,000 m^2 of solar collectors per year reaching 1,000,000 m^2 of installed capacity by 2010 could not be reached. Such a market development was expected to rely at 80 % on the domestic sector and at 20 % on industry and services. Although the general opinion about the programme was positive, estimates state only a limited installation rate of about 10,000 m^2 (in 2003). The direct sale system was not put into practise by potential service suppliers.

Among the reasons why the well designed programme did not kick-off were: a rather bad reputation of solar systems from the 80ies (the market was not prepared yet, quality problems harmed the image); a much (especially for the important promotion in the media) too limited budget and duration of the programme and the governmental support of the less capital intensive natural gas supply. Furthermore Portugal is still one of the most expensive countries in the world to install solar collectors and as the country had to cope with a difficult economic situation families did not invest.

Future efforts will address the industry (cost reduction of installations, quality improvement by certified equipment and qualified installers) as well as the state (VAT reduction similar to heat pumps, improvement of financial incentives).

2.7 SPAIN

a) Regulations on solar energy in buildings (Spain)

This case describes a model of municipal by-laws on solar water heaters, which was published by IDAE and the Spanish Federation of Municipalities and Provinces (FEMP) in 2001. The model was designed to provide local governments with a base that can be adapted to local requirements for encouraging development of solar thermal energy in building construction. Furthermore it can give municipal technicians and advisers (environmental officers) the required knowledge. The by-law has an optional nature and makes it mandatory to include solar energy installations in newly constructed or renovated buildings by establishing minimum limits on the amount of energy to be supplied from solar. To assure quality a series of technical measures of obligatory fulfilment is included. Additionally to the model by-law tax rebates can be included in municipal fiscal by-laws.

The potential in the new foreseen residential space is estimated at 50 % in collective buildings and 26 % in single-family houses. Solar energy can provide up to 60 % of the energy consumed for hot water production, depending on the local climate.

By now, 20 % of the Spanish population live in cities where solar by-laws are approved, being at different states of development or application (alongside the IDAE & FEMP model a number of other by-law models exist).

b) Support programme for solar thermal energy (Spain)

In Spain solar thermal energy has been promoted by a yearly call for proposals (based on competitive assignment) since 2000. The programme will last until 2010 and 4.8m m² of solar collector area should be installed by then (+4.5m m² surface from 1998-2010).

While the average number of applications was rather constant exceeding 1,000 per year the installed area has increased. Among the reasons for this development were increasing maximum prices for installed m² supporting rather compact equipment for single house collectors at the beginning, allowing for larger, centralised systems to supply blocks of buildings in the following years. From 2000–2002 the annual growth rate of the whole market was only 4 %, leading to a total yearly installation of 60,000 m² in 2002. As there were several other national, regional and local promotion activities approx. 30,000 m² were installed because of the tender scheme described.

Since last year the projects are promoted by the “ICO-IDAE Line” of financing for renewable energy projects, allowing for more money for promotion and less administrative formalities for application. The new support comprises 30 % of investment and low interest financing for the other 70 %. One of the main barriers of development is the fact that the present growth capacity is limited by the production and installation capacity of companies in the field and the lack of information for potential users (although there have been information campaigns).

Among the main drivers of development are the municipal by-laws (see above) and the current Technical Building Code, under which it is obligatory to provide at least a percentage of energy for hot water production by solar thermal energy in buildings established according to climate zone and use of the building. It is stressed that such obligations must be accompanied by the usual actions of public support for investment; obligations without public aid may create inequality and damage the companies in the sector. Municipal by-laws together with new technical regulations underway are believed to provide a new driving force on the market.

If the new Technical Building Code (among other things, systems used for heating and hot water production in all Spanish buildings are specified new) is approved, an annual installation rate of about 500,000 m² solar collectors’ area can be expected. In R&D new applications are developed for use in refrigeration.

2.8 SWEDEN

a) Information for the heat market (Sweden)

As a consequence of the Swedish energy taxation, the fuel mix in district heating plants has changed considerably within the last twenty years. The mix shifted from over 90 % usage of oil in 1980 to a present bio fuel input of 57 % excluding peat, mainly in the form of felling wastes and by-products of the forestry industry. However, use of biomass in households did not increase directly as a consequence of energy taxes.

In Sweden especially ***municipal energy advisers*** were important channels to provide proper information on energy issues to households, small enterprises and organisations. By now, in all 290 Swedish municipalities advisers are available.

The Swedish Energy Agency provides advisors with information on efficient and environmental-friendly energy systems and finances them to a large extent. In the 2002 energy bill, 59 million € were allocated for information and training activities on municipal and regional level over a five years period, which is the double amount of the 1997 bill.

The advisors arrange activities like discussions or seminars on energy-related topics and are present in the public life of the municipalities. Since 2002, they do not only inform on energy issues but also on a wider field, including for example indoor climate.

A further initiative aims at an ***increased use of pellets in detached houses***. Due to energy taxes on fossil fuels and rising electricity prices there was an interest to switch heating fuels. Unfortunately households were confronted with a lack of information at the beginning. Hence, the Swedish Energy Agency started a project to create industrial networks providing information about pellets as fuel for single-family houses. In co-operation with three regional energy offices, players from the pellet industry (heating companies, pellet producers, boiler manufacturers, heating engineers, chimney sweeps, etc.) were gathered to create simple routines to foster easier information access for households. As an example, a ***“one-stop-shop” for*** the ***households wanting a pellet boiler*** was created. The ***“home heating campaign”***, launched in 2002 aimed at informing homeowners about renewable alternatives. Within four months, 100 towns were visited with presentations, 320 exhibitors of products and services took part.

This information measures (of course together with the tax raises on fossil fuels and electricity, see below) led to an increasing demand of advice, additionally driven by an increasing electricity price, resulting in increasing numbers of pellets users. Within six years the amount of sold pellets grew by eight times in the detached house sector; in the overall domestic use numbers doubled from 2002 to 2004.

The authors state that it is very important to have a responsible central authority acting on a local level and forcing actors in the production chain together. Networks between experts, advisors and regional energy offices as well as between advisers have to be established and strengthened.

b) Taxes on the heat market (Sweden)

Energy taxation has a relatively long tradition in Sweden, under varying objectives over the years (from public financing and shifting use from oil to electricity to environmental issues). In the 1990ies, a more ecological taxation took place by taking the carbon content of fossil fuels into account. In 2000 a shift towards environmental issues was done by raising taxes on energy use and emissions, compensated by reduced taxes on labour. With this change, about 3.3 billion € were shifted within a ten years period.

Beside general basic energy taxation, the taxes reflect the fuel’s content of carbon and sulphur as well as its NO_x emissions. When the CO_2 tax rose by 16 % in 2002, general energy tax was lowered. Accordingly, electricity tax was also increased to avoid a shift to electricity. By now, the CO_2 tax amounts to 10 cent/kg CO_2 (except biofuels and peat). Because there is a tax surplus, the tax income is repaid in a way that only operators with the highest emissions are net payers.

In respect of heat production, the fuels are taxed, but not the use of heat, however. Thus, biofuels are tax-free for all producers (except peat which attracts the sulphur tax).

As a main result, the share of fossil fuels in the heat market decreased to 17.2 % in 2002, hence, taxation is a cost effective instrument of making biofuels competitive.

Despite the sophisticated taxation system, external costs of fuels are not fully reflected. Furthermore, due to the uncertainty about future energy taxation in the EU, long-term investments in capital-intensive plants may be hampered now in Sweden.

The case study concludes that “Taxes are necessary as they constitute the base for the shift to a more sustainable energy system. Other measures would not be as efficient on their own, without the basic condition that is implied by the change in relative prices of the fuels.”

c) RD&D in the heat market (Sweden)

In 1997 Sweden launched a long-term energy research programme. The seven years programme focussed on renewable energy as well as on conversion and end use energy technologies. The focus in the heat sector was on technology development for biomass CHP, fuel supply, ash recycling, solar energy and energy efficiency in buildings, industry and transport.

RD&D is seen as the backbone of the Swedish long-term strategy on a sustainable energy system. To reach the objective of decreasing production costs for bio-energy, technical as well as pre-market-development was supported. The cases study underlines the importance of co-operations between public and private sector, there are often RD&D activities funded, running in parallel and in co-operation with universities and industry. So far, about 1,700 to 1,900 projects were conducted.

As an important factor of success the case study mentions the active collaboration between research community and business sector and states that, according to an evaluation, more than 50 % of the projects are headed by industry representatives and over 70 % consist of applied research, development or demonstration.

The further objectives of the programme are aimed at an improvement of the entire bio-fuel chain, energy crops, technological issues concerning combustion, and especially at the development of standards for biofuels, codes and legal framework.

3 Analysis and Recommendations

Heat from renewable energy sources (RES heat) is used in many different ways (not only for heat purposes but also for cooling). Heat demand for industrial purposes often calls for high temperatures or steam at high pressure. For such requirements renewable heat will typically be provided via the combustion of biomass (wood or industrial waste and residues), in some cases with co-firing of fossil fuels in boilers or in dedicated (high temperature) steam boilers (for heat or combined heat and power production).

When heat is needed for heating or cooling buildings and for hot water, the demand can be met by a wider range of technologies and sources. For larger-scale demand such as district heating and major buildings (commercial/public/residential), centralised supply is possible and economies of scale can encourage investment in technology (large boilers, geothermal, heat pumps, etc.).

Domestic heat demand and other small-scale demands can be met by using other technologies such as solar panels, wood stoves, geothermal sources, etc. At present by far the largest amount of RES heat in the EU is provided by traditional domestic heating with wood logs.

3.1 Summary: "Best practice policies to develop Renewable Heat markets"

The case studies on renewable heat technologies, which have been assessed in the course of the REACT project, deliver a clear message: if appropriate policies are applied, rapid market take off can take place and lead to multiple benefits including sustained growth of renewable energy industries. There is not a single case, where the market by itself was able to deliver significant RES H use, except traditional use of wood logs for heating.

Successful policies analysed in the case studies show a considerable number of similarities. They apply a comprehensive approach and do not rely on simple individual measures as incentives, regulations or R&D. They involve substantial financial resources that create a level playing field for renewable heat with a long term scope.[16] Appropriate program durations were considered to be at least six to seven years.

Due to the complexities of running a comprehensive approach dedicated program managers were implemented in most successful policies, which had a wide scope for action and which took major efforts in involving all relevant stakeholders in the design and execution of the programs.

In many cases a regional approach proved critical as RES H projects are small and need to be implemented locally. Quality of products and services is a fundamental issue that was addressed by all successful programs. Eventually a harmonised approach for ensuring high quality of RES H appliances and associated services should be established in Europe to create common grounds for a European Renewable Energy Industry.

Dissemination and marketing is a key activity for developing RES H markets. A common problem however is inappropriate funding. RES industries are still too small to be able to

[16] The market place should be corrected to reflect the full costs and benefits of all energy options, a process often referred to as "levelling the playing field".

finance full scale marketing campaigns and public bodies have been reluctant to spend even a fraction of the budgets the energy industry usually spends on marketing for fossil energy.

There is an in increasing share of manufacturers of conventional appliances which offer RES heat solutions additionally to their traditional technology portfolio. Whatever reasons are be responsible for this development – suppliers of conventional energy or manufacturers of carbon appliances should be addressed to promote RES heat solutions to their consumers in order to accelerate the dissemination of renewables. Another possibility of promotion might be to apply RES heat solutions in public infrastructure thus setting good examples. An innovative approach for implementation of RES heat systems (in public and private sector) might also be contracting.[17]

Economic incentives have been part of every successful case of market development. According to the European Environment Agency (EEA) total subsidies in the energy sector of EU-15 (excluding external costs) are estimated at about 29 billion € a year, of which only 18 % were spent on renewable energy.[18] It is not conceivable that presently marginalised forms of energy use will be able to make substantial contributions to our energy system unless getting considerable support.

Regulations can be an effective and in terms of public budgets cheap measure to ensure widespread adoption of RES H technologies. This is demonstrated by building regulations obliging new buildings to have solar water heaters in a number of Spanish municipalities (see page 14). Such obligations can only be effective however, if the markets have grown to a sufficient size to serve the demand created by such regulations.

R&D does not play that big a role in RES H technologies as these technologies have been developed to a high level of efficiency and reliability in the last two decades. From the point of view of these technologies it is difficult to understand that R&D in technologies still far from market introduction receives so much more attention than the efforts for market introduction of existing technologies that are fully developed. If the EU wants to achieve significant progress in using domestic renewable energy sources at modest costs RES H technologies offer an excellent opportunity. However, the efforts to make market introduction happen would need to be increased significantly.

3.2 The most relevant aspects of successful RES H market development efforts

[17] While in heat delivery contracting, the focus is set on energy supply, energy performance contracting carried out by a so-called energy service company (ESCO) aims to reduce the overall energy demand.
With **energy performance contracting**, a company – the so-called "contractor" or TPF (third party financing) company – identifies plans and implements energy-saving measures for buildings. Energy reductions can be realised by all kinds of methods to increase efficiency: the technical facilities in the respective buildings are modernised, operation costs are reduced and a contribution is made to environmental protection. In energy performance contracting, the contractor's remuneration is based on the cost savings achieved.
In **heat delivery contracting**, an ESCO invests in facilities used for energy conversion at the client's and provides the necessary fuels. In addition the services provided by the (TPF) company also comprise the operation and maintenance of the installed systems. The settlement of accounts is based on the delivered heat and / or electricity volumes, respectively. Of course both concepts could and in some cases are already combined, i.e. investment in energy efficiency measures and renewable energy supply systems are both realised.

[18] “Energy subsidies in the European Union: A brief overview”, EEA Technical report 1/2004, European Environment Agency.

3.2.1 Comprehensive approach

Just the number of different aspects being addressed by the diverse examples shows, how complex the development of RES H is. We are talking in this case about the dissemination of technologies to be used by vast numbers of clients, involving a wide range of commercial, educational, technical, administrative and political actors. To make RES H work means, all these players must act in a coordinated and meaningful way supporting RES H which is by no means simple. Last but not least, strong competing forces, massive inertia etc. work against RES H.

A number of case studies are excellent examples of how this complexity can be addressed, e.g. the cases of pellet heating and biomass district heating (A, page 10), biomass heating entrepreneurship (FI, page 10), Plan Soleil (F, page 11) or the Portuguese solar hot water program (see page 13). Whenever programs are too simplistic, addressing only individual aspects of supporting RES such as R&D (e.g. SE, page 17), financial supports (e.g. Clear Skies, UK), taxes (SE, page 16), regulations (ES, page 14) there will be “missing links” that prevent successful diffusion or at least delay it significantly. These missing links may be the lack of skilled personnel, the lack of companies actually delivering what the market would be asking for, technologies unsuitable for market introduction, lack of information among the potential clients or other issues preventing market take off.

It should be emphasised that even financial incentives alone will not necessarily lead to successful market development. In Sweden e.g. high energy taxes had very little effect on individual houses which sticked to their oil and electric heating (see page 16). The domestic pellet heating market only started to grow dynamically, when access to pellet heating systems was facilitated by the “Pellet arrangement” offering a one stop shop for the final customer to get his pellet heating system, and when wide spread marketing was established (see page 15). Clear skies[19] in Great Britain has established financial incentives but no resources for promotion and education of installers, leading to limited market response.

Comprehensiveness is thus a fundamental precondition for successful policies and can best be established by involving all potentially relevant stakeholders in the definition of the policy.

3.2.2 Sufficient resources and a level playing field

Some of the programs presented in the case studies seem to have been excellently designed and operated and yet deliver only little market response – e.g. the Portuguese solar thermal program (see page 13). The reason is, as we believe, insufficient funding. Unless the financial incentives in place are sufficient to offset economic disadvantages and the funds for promotion are similar to promotion budgets of similar commodities, programs will not deliver or deliver only slowly. The issue of low funding is present in many of the examples. Just to mention a few: the R&D budget for solar thermal in France is 1.5 Mio €, almost ridiculously low when compared to nuclear R&D (see page 11). The budget for promotion in this program is 0.8 Mio € per year. That seems to be much and certainly more than would have been spent in any other described case study. Yet in terms of the usual costs for a full scale marketing campaign targeting at a market as large as France it would be very little. None of

[19] Clear Skies aims to give householders and communities a chance to realise the benefits of renewable energy by providing grants and access to sources of advice. Householders can obtain grants between £ 400 to £ 5,000 whilst not-for-profit community organisations can receive up to £ 100,000 for grants. Source: www.clear-skies.org.

the case studies described, reports marketing efforts that would come even close to standard campaigns of utility or gas companies.

The resources necessary to establish well working conventional energy supply systems have been profound and have reached hundreds of billions of Euros for developing supply networks, production facilities, R&D etc. Massive amounts of public funds have been supporting the establishment of these systems and are still supporting them. According to the European Environment Agency (EEA) total subsidies in the energy sector of EU-15 (excluding external costs) are estimated at about 29 billion € a year.[20] Support to renewable energy amounts to 5.3 billion € (18 % of total) that means that the amount of financial incentives granted to fossil fuels is five times higher.

External costs – including health, safety, security, and environmental – are typically much larger for conventional energies than for renewable energies, and the limited accounting of these costs in the market place works strongly against renewables. At the same time, renewables provide benefits that are not reflected in energy policies and market conditions, including increased employment, reduced dependence from importing energy, and reduced burdens on foreign exchange. The market place should be corrected to reflect the full costs and benefits of all energy options, a process often referred to as “levelling the playing field”.

Sufficient resources must be available for all essential activities necessary to make the new energy systems expand, including program management, direct financial incentives, promotion etc. It should be noted at this point, that the levels of support needed to develop RES H markets would be significantly lower than the level of support needed for RES electricity markets as RES H is generally more competitive than RES E. Also, the type of financial support is different. While RES E production needs continuous financial compensation for the higher production costs, RES H market development depends on kick off financing to overcome the barrier of high upfront investment and on resources for program management which are both vastly lower and of temporary nature until a well functioning market has been established. Consequently the need for financial support is substantially lower.

One of the reasons why most member states prefer support to RES E, regardless of its higher costs, is the fact that additional costs can be directly charged on the electricity users via their electricity bill and thus put no strain on state budgets. Means need to be found to pass the temporary financial burden for the change to RES H technologies in similar ways to the general public.

3.2.3 Long term commitment

Several authors of case studies emphasised the need for continued action over extended periods of time. The French programmes for solar water heaters (see page 11) and for biomass district heating (see page 11) run for six and seven years, respectively. The German support programmes (e.g. solar thermal, see page 12) have a long term commitment and so do other programs.

The need for continuity results from the slow pace at which energy systems can be changed that constitute significant capital investments. It also results from the time scales involved

[20] “Energy subsidies in the European Union: A brief overview”, EEA Technical report 1/2004, European Environment Agency.

due to long lead times in construction industry and the time it needs to create awareness, to grow businesses, to educate large numbers of people etc.

As some authors of the case studies emphasize, discontinued or fluctuation supporting policies can be worse than non existent policies as they lead to strongly fluctuating sales potentially ruining the engaged industries (see page 12). If supporting policies are continued, as in the case of Austrian biomass heating policies, which have been continued for 20 years, or as is the case in the Danish, German, or Spanish support to wind power, very significant industrial development and international technology leadership can be the result.

3.2.4 Program management and networking

Given the mentioned comprehensiveness of the task to boost RES H markets it is obvious, that dedicated actors are necessary, that manage the necessary programs. A number of case studies show, that these program managers can indeed play a critical role. In some cases it can be industrial associations, as in the case of the Greek solar industry association (see page 13) or the Finnish heat pump association, which managed to pool funds for effective marketing and to introduce quality assurance of products and services. Very often it will need public initiative however, to establish a management that extends its responsibility over the entire range of necessary actions. In fact, as in the mentioned Finnish case, or in the case of the Swedish pellet arrangement (see page 15), a public actor took the decisive steps to initiate industry cooperation and the establishment of a "program manager".

Other cases, where program managers played a key role is the case of biomass district heating in Austria (see page 10), where regional specialised consultants and agricultural chambers took this role and the French and Portuguese RES H initiatives (see page 11 and page 13) where the energy agencies managed the programs. In a number of cases it was mentioned as essential, that management capacity was available at the local or at the regional level, to be successful in market development (A, F: district heating (page 10 and 11), FI: heat entrepreneurs (page 10), F: solar thermal (page 11), SE: information for the heat market (page 15), ES: solar thermal (page 15)).

Establishing committed program managers, that ensure smooth market development by addressing all issues that need to be dealt with is not only a precondition for success, it is also a particularly cost effective measure. The Dutch example of how the utilisation of landfill gas was developed by a small dedicated program management is an excellent example for this fact.[21]

In innovation research significant attention has been given recently to the "Strategic niche management" approach, suggesting that very often innovation starts off in a small niche, where it has particular advantages. Strategic niche management makes sure that within the niche a support system is established that ensures the functioning of the innovation. This could be the supply of necessary materials, skilled personnel, adapted technical environment, adapted regulatory and institutional environment etc. As the technology matures in the niche the support systems established can be expanded to support technology in new applications outside the niche. This type of managed market introduction is what RES H technologies call for, at least in the majority of member states, where they have entered the markets only on a negligible scale so far.

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[21] See "Reducing Greenhouse Gas Emissions by Landfill Gas Extraction" at www.react.novem.nl/documents.htm.

One further, very important issue of program management is to ensure sufficient resources. By now wood energy is the most important RES heat source in Europe. In 1997 more than 98 % of RES heat deployment came from biomass, 2002 the share of biomass still was more than 96 %. Successful examples as the Swedish or Finnish wood energy programs (see page 17) show that countries with considerable wood resources can optimize the biomass supply chain leading to a bigger amount of economical fuel wood.

3.2.5 Regional approach

In contrast to biofuels or large scale renewable electricity schemes the diffusion of renewable heat technologies depends to a much greater extent on local availability of information, local development of projects based on a detailed knowledge of local circumstances, communication flows, influential persons etc. A number of case studies have laid particular emphasis on this local dimension, such as the Finnish and Swedish approaches to create networks of energy advisors. In Sweden (see page 15) these are available in every municipality, they receive significant support from the federal state both for operation and for continued training, their budget is continuously increased instead of reduced and so is the scope of their work extending from advising citizens to offering advice to small and medium businesses at the local scale. In Finland (see page 10) a comprehensive network of wood energy advisors was created with a very sharp focus on supporting the start up of small energy service companies supplying biomass heating. Also in Sweden big efforts are being made, to train the advisors and ensure continued learning.

The study on the successful French Plan Soleil (see page 11) emphasises the importance of regional implementation of the campaigns by establishing cooperation between the regional office of ADEME and the regional government, regional businesses and other stakeholders.

Other cases showing the importance of a regional approach are those on small scale district heating in France (see page 11) and Austria (see page 10) and the Spanish approach to promote regulations at the municipal level enforcing the use of solar thermal in new buildings (see page 14 and 15). In all the cases transfer of knowledge and motivation of local actors has been essential for kicking off diffusion. Often projects seem to have a similar effect as a stone thrown into a pond. Waves of information are spreading around the place through informal networks and kick off new initiatives.

Local energy agencies could be an essential resource for regional development of renewable energy projects and even for program management at the regional level. Such an enhanced use of the potential of this existing network of actors would need to come along with substantially enhanced financing and targeted training activities however.

3.2.6 Quality of products and services

Quality of products and services is a fundamental issue that has been addressed by virtually all successful programs. Lack of attention to quality has led to the collapse of the dynamic start up of solar water heater markets in the late 1970ies in many countries, and a similar problem stopped the development of heat pumps. The poor image created in that period is still today – decades later – a barrier mentioned by a number of case studies (e.g. Portuguese solar heaters – see page 13). There are only few cases, where industry by itself was able to settle all quality issues (e.g. Greek solar – see page 13). In most other cases public initiative was critical to ensure, that both the products and – similarly important – the services as product installation, maintenance, pellet delivery etc. met the required levels of quality to compete with fossil fuels.

As many case studies highlight, installers play a key role for all RES H technologies. The lack of trained installers is a key bottleneck for RES H market development throughout Europe. Unless installers are properly educated in how to fit solar collectors, pellet boilers or heat pumps they will either not install these systems at all or they will make mistakes resulting in poor performance. There are a significant number of independent initiatives presented in the case studies in educating installers in solar, biomass and heat pump technology. There seems to be a scope to compare the experiences of these different approaches and work towards harmonised training and education curricula. A European project identifying best practices of installers training and certification could be of interest. A longer term goal could be to define a “European solar energy drivers license” for installers (just as the European Computer drivers licence) and similar qualification schemes for heat pumps and biomass boilers based on standardised curricula and certification procedures.

The establishment of high quality standards is also essential for the RES H products. Particularly in the field of heat pumps and biomass boilers quality differences in the market are impressive. A state of the art logwood boiler could have twice the efficiency, and emissions that are almost 3 orders of magnitude lower than those of a traditional device. Again, a wide diversity of approaches has been taken, from rather strict to permissive approaches that hardly restrict poor products from the market. A European approach ensuring uniform high quality requirements could form the basis for international leadership of European high tech RES H industry. A European initiative is needed to develop European certification schemes for biomass boilers, solar products, heat pumps, etc. instead of numerous incompatible national schemes.

Establishing high quality products and services does not only imply to achieve certain fixed skills, but also, to keep learning, as these technologies are still young and will be further improved as more and more experiences are gained. A fundamental precondition of learning is close monitoring, of what has actually been achieved and of feeding back the results to all relevant actors. A number of cases such as the case of biomass district heating in Austria (see page 10) show, that unless sufficient attention is drawn to this aspect of monitoring and steady improvement, technology performance and economics can be frozen to a state of the art that is far from what could be achieved but works sufficiently well to continue with the way it is. Precise monitoring of technological and economic performance of RES H installations and feedback of the results to the relevant actors should be an element of any serious policy targeted at the development of RES H markets.

Given the enormous potential size of RES H markets it seems likely, that eventually it will need the resources of the present major players in conventional energies, to supply the volume of services at the required levels of quality in a well organised way. In order to speed up their involvement in the RES H market it will be necessary to consider suitable incentives for these big players. In the success stories on RES H investigated in the REACT project big energy companies did not play a significant role so far – presumably due to the lack of adequate incentives. Such incentives could be created by the possibility to get RES E credits for delivering RES H, by making subsidies for fossil fuels dependent on the parallel development of RES H, by RES H quota to be met by gas and oil companies etc.

3.2.7 Information and promotion

Getting RES H technologies into the European market implies informing hundreds of millions of citizens and hundreds of thousands of professionals. Both information and promotion independent from direct commercial interests and commercial promotion are essential. First of all, public funds spent at present would need to be expanded by an order of magnitude or more to achieve reasonable results. For the second, commercial promotion has to be strengthened and co-ordinated within the RES H industry. The RES H industry is still too small and fragmented to achieve results on one's own behalf. Only in a few cases as the solar water heater promotion in Greece (see page 13) or the Finish heat pump association companies actually managed to cooperate and join forces, in both cases with enormous success. In most cases, competitive attitude would keep companies from investing jointly into promotion.

Promotion activities that have been described in the case studies are targeted frequently at relevant professional groups as architects, engineers, installers etc, or at selected market actors as building promoters or selected industries (e.g. wood industries in Portugal[22]) as this is significantly less costly than addressing the whole end consumer markets.

As some case studies point out (French solar, Portuguese and Spanish solar, page 11, 13, 15) it is important, that industry is well prepared to deliver sufficiently, both in terms of capacity and quality, before major promotional action is taken. Appropriate scheduling of initiatives is one of the important activities a dedicated program management has to ensure.

3.2.8 Economic incentives

There is not a single case study reporting successful market development without financial incentives. Even in the case of the Spanish regional building regulations enforcing solar thermal installations for new buildings (see page 14) the author comes to the conclusion, that discontinuing financial support after implementing the regulation was a major mistake leading to controversy and non implementation of the regulations.

The case studies do not suggest, however, a preferential way of organising financial incentives. In Greece tax incentives have been highly successful in supporting full scale market introduction of solar water heaters (see page 13). Tax incentives have a number of advantages such as easy administration – in fact no new administrative capacity is needed – they are easy to apply for and they offer security to the customer. She (or he) does not depend on an administrative decision whether she will get a financial incentive or not, she knows she will be able to reduce her tax payment if she (or he, respectively) presents the bill for the solar water heater.

In Sweden it was high energy taxes, which paved the way for renewable heat (see page 16). The energy taxes were particularly effective in making commercial actors change their behaviour. Most major district heating companies changed to biofuels as a consequence of taxation. Taxation had less effect on individual behaviour however, as market failures occurred making it very difficult to change e.g. to a pellet heating system.

In French, German and Austrian case studies direct financial incentives were described as critical for market take off (see page 9, 11, 12). Direct financial incentives seem to be particularly attractive to the consumer and less appreciated by commercial actors. The final consumer seems to be highly motivated by actually getting money from the state (rather than having to pay less). Surveys conducted in Austria showed, that the amount of financial incentives seemed to play a minor role than the fact that there was a financial incentive which also gave a signal to the consumer she or he was doing the right thing. The big danger of financial incentives is that they are dependent on budget availability and therefore can be discontinued due to lack of funds. This danger is particularly high when markets actually take

[22] See "Biomass in Industry" at www.react.novem.nl/documents.htm.

off, as the demand of financial incentives may rise in an unexpected and dynamic way. To prevent this from happening often only very limited promotion efforts are made, as a result market take off does not occur. This is obviously not the right way to go. A solution for this dilemma is, to reduce the financial incentives step by step in a foreseeable way. This creates an additional incentive for consumers to accelerate their decision making and levels the impact of sharply growing numbers of installations on the demand for financial incentives budget.

In France the Plan Soleil has resulted in such a strong market take up (see page 11), that a switching from direct supports to tax incentives is now being considered, both to reduce the administrative load and to ensure a more stable support regime. There could be a slowdown of development however, as tax rebates are considered less attractive, even if resulting in the same support level.

shows an interesting solution: the financial incentives are reduced step by step in a foreseeable way. This creates an additional strong incentive for consumers to accelerate their decision making and levels the impact of sharply growing numbers of installations on the demand for financial incentives budget.

Smart financial incentives should be easily accessible, quickly available, well communicated, reliable, preferably connected to energy savings, performance-based and predictably declining. Furthermore high quality requirements should be a precondition for access to financial incentives (compatible with EU regulations): e.g. for large scale solar installations a guarantee of solar results (GRS) should be imposed to get public support (monitoring should be offered in this case), heat pump installations should be monitored whether the expected COP[23] is being met or not and biomass boilers can be required to achieve very low emissions and high efficiencies.

Another economic incentive can be procurement. If procurement is linked to incentives to deliver higher quality products it can be a very effective means of market transformation, as has been proven by a Swedish procurement program for heat pumps, which lead to both substantial technical improvements and a very significant and sustained market growth. Public buildings offer a major opportunity for using RES H throughout the EU and member states could be asked to achieve certain shares of RES use in these buildings.

A Spanish example shows yet another option of financial support – third party financing (TPF) realised by a public body, which invests in financially feasible renewable energy projects. This example has kicked off a highly successful wind power development but also a number of projects involving biomass for providing industrial process heat. It was designed to overcome the reluctance of banks to invest in RES projects. A broader innovative approach for implementation of RES heat systems (in public and private sector) can be contracting. A precondition for this market segments are sufficient project sizes and profits to pay back investments.[24]

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[23] Coefficient of Performance of a heat pump means the ratio of the rate of useful heat output delivered by the complete heat pump unit (exclusive of supplementary heating) to the corresponding rate of energy input, in consistent units and under operating conditions. COPs vary with the outside temperature: as the temperature falls, the COP falls also, since the heat pump is less efficient at lower temperatures. The higher the COP, the more efficient the system.

[24] While in heat delivery contracting, the focus is set on energy supply, energy performance contracting carried out by a so-called energy service company (ESCO) aims to reduce the overall energy demand.
With **energy performance contracting**, a company – the so-called "contractor" or TPF (third party financing) company – identifies plans and implements energy-saving measures for buildings. Energy reductions can be realised by all kinds of methods to increase efficiency: the technical facilities in the respective buildings are

Finally, an innovative way of creating economic incentives has been demonstrated by the Austrian case study on the utilisation of an existing subsidy for promoting RES H (see page 9). This option is possible where existing subsidy schemes providing financial incentives can be adapted to accelerate RES heat deployment without additional total budget costs. In Austria the terms of reference for an existing major subsidy scheme for housing construction were changed in such a way, that full financial incentives were only granted, if the housing constructed would achieve highest standards of energy conservation and had a renewable heat supply based on solar water heating in summer and a biomass heating system for winter. This measure was able to lead to a complete market transformation within 10 years, with almost 70 % of all new residential buildings using solar water heaters and over 60 % using biomass heating systems.

It would be interesting to consider to transfer this model e.g. to the subsidies for fossil fuel systems and make their continuation dependent on the condition that the recipients of these financial incentives made clearly defined and substantial efforts to develop renewables.

3.2.9 Non economic incentives

Non economic incentives such as awards can have a very positive role both in motivating actors, in creating awareness and even in technology development. Key improvements in heat pumps were a result of a competition in Sweden, in Austria major technical breakthroughs were achieved in a competition for small scale wood chip boilers (see page 9). Other competitions have been geared towards services such as the “Heating entrepreneur of the year” award in Finland (see page 10). Awards are an inexpensive measure to create motivation and awareness for renewable energy, which could be applied more frequently. Creating an inventory of RES H awards might be a rewarding exercise to disseminate good ideas.

3.2.10 Regulation

An interesting way to get renewable heat into mainstream business has been explored in Spain with the municipal by-laws enforcing solar water heaters for newly constructed buildings (see page 14). This approach is also mentioned in the Plan Soleil as the next step to massively increase solar thermal use (see page 11). Looking at the Spanish case in detail does reveal the difficulties of this approach when it comes to a very young market. The lack of professionals able to actually deliver the systems demanded has been a major barrier for achieving the target set by the regulation. Regulation could be a highly effective and – from the point of view of public budgets – low cost approach that can be applied as soon as markets reach a certain maturity and capacity to match the demand created by such a measure.

The national approaches for implementation of the EU Building Directive offer an excellent opportunity to introduce regulations encouraging the use of renewable heating technologies. Best practices in terms of encouraging RES H should be monitored and communicated. Das verstehe ich nicht, die Direktive ist abgeschlossen, da kann man nichts mehr integrieren.

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modernised, operation costs are reduced and a contribution is made to environmental protection. In energy performance contracting, the contractor's remuneration is based on the cost savings achieved.
In **heat delivery contracting**, an ESCO invests in facilities used for energy conversion at the client's and provides the necessary fuels. In addition the services provided by the (TPF) company also comprise the operation and maintenance of the installed systems. The settlement of accounts is based on the delivered heat and / or electricity volumes, respectively.

Another type of regulatory approach is considered in France and the UK – the introduction of renewable heat obligations. Such obligations could e.g. apply for suppliers of conventional energy as heating oil, gas or electricity for heating and oblige them to invest into renewable heating systems to meet their obligations.

3.2.11 R&D

This analysis puts R&D at the end of a long list of efforts necessary to make successful market introduction possible. This is firstly due to the fact, that technologies for RES H today are sufficiently mature to be marketed successfully. Solar thermal systems as well as heat pumps and biomass boilers have reached very high levels of efficiency and reliability and further improvements are realised in commercial research, which will, of course, need public co-funding. An exception are RES cooling technologies – here significant R&D is still necessary.

Secondly, it is to put into question actual EU policies, spending vastly more resources on long term energy related R&D than on efforts to enhance market deployment. A Swedish case study presents the remarkable result of an extensive evaluation of a seven years program spending more than 1 billion € on energy research. A commission evaluating the programme "found abundant evidence that excessive faith was placed … on the capacity of energy research, development and demonstration to bring about the restructuring (of the energy system)". The Commission states that both R&D and energy-system restructuring take time. For at least the next ten to twenty years, other macro-economic measures designed, for example, to generate incentives for investments (e.g. taxes, general framework conditions for enterprises and various forms of support) have more influence on restructuring the energy system.

If this even applies to a program that was successful in integrating academic research with business research it becomes quite clear, that a broadening of focus in EU policies from "R&D first" to R&D and market development as two equally important and equally funded activities is necessary.