Manual of good practices for setting up RHC integrated support schemes

OCTOBER 2016
DELIVERABLE NUMBER: (D.2.4)

FROnT
FAIR RHC OPTIONS AND TRADE

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ABOUT THE FRONT PROJECT

The FROnT project, co-funded by the European Union through the Intelligent Energy Europe programme, aims to develop strategies for a greater deployment of RES-HC technologies and improved understanding of the costs of heating and cooling technologies. It analyses both existing support schemes and end user decision factors, in order to help establishing strategic policy priorities for RES-HC.

The project is led by a consortium gathering European industry associations and national energy agencies from Spain, Portugal, The Netherlands, Poland, and UK assisted by the Austrian Institute of Technology, CREARA (consulting and energy management company), and Quercus (non-profit environmental organisation based in Portugal). More information available at http://www.front-rhc.eu/

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EXECUTIVE SUMMARY

In the energy sector, market prices do not fully capture negative externalities from fossil fuels, especially concerning health and environment, and do not automatically reflect all of the positive externalities from sustainable and local renewable energy sources. In order to develop a wide range of technologies at the necessary scale needed to decarbonise the economy some form of financial support is needed to help accelerate the market uptake of Renewable Heating and Cooling (RES-HC or RHC) technologies that are not yet competitive under current market conditions. Support schemes are also instruments to give a signal to industry and to help increase confidence in technologies, contributing to widely affordable and sustainable heating and cooling solutions.

This FROnT Manual of good practices provides recommendations for the design and implementation of successful financial support schemes for RES-HC technologies. It covers technical, economical, financial, legal and marketing aspects. The good practices reported are not exhaustive, but are rather inspiring examples of how successful support schemes could be implemented across Europe. The solutions presented depends on the market conditions of each individual country.

Based on the findings of the assessment of 28 support schemes implemented in nine EU Member States, the following factors are considered to be critical to the success of a support scheme:

- Contribution of different stakeholders;
- Stability and predictability;
- Transparency and accountability.
- Balance between financial adequacy and efficiency; and
- Ensuring quality and performance.

Additionally, ensuring easy to understand and non-burdensome administrative procedures, reducing administrative costs, providing support to applicants as well as communication and marketing throughout the different phases of a support scheme are also considered very relevant factors.

The main recommendations for decision-makers and professionals in the public sector include the following:

Ensuring long-term development through the right mix of instruments

- Differentiate financial instruments according to the market conditions and the technical characteristics of each technology. In the medium and long-term, this would ensure stability and a more cost effective deployment of a sufficiently broad portfolio of technologies;
- In order to provide stability a scheme should run for at least 5 years. Stop and go policies could be avoided through the establishment of off-budget financial instruments (e.g. funds from carbon tax as in Switzerland or levies on gas bills).
- Avoid conflicting support schemes (e.g. to fossil-based heating systems)

Design & implementation

- Differentiate the methodology for setting support levels according to the target group. In the case of support mechanisms addressing the supply-side (e.g. project developers, utilities, ESCOs), competitive allocation mechanisms can be desirable. When the beneficiaries are households, then the support level can be adjusted according to income level, providing more support to vulnerable groups, helping to tackle energy poverty, In the case of isolated communities, the support can be accrued in order to reflect the additional benefits of local energy generation;

- In order to keep costs under control, the scheme must be sufficiently flexible and be complemented by a built-in revision mechanism to adapt the support level to falling technology costs;

- Implement a robust control mechanism to secure the participation of competent professionals, certified equipment and the execution of durable systems and, in this way, help boost the confidence in the technology;

- Empower the end users (beneficiaries) by providing a mechanism through which they can register their complaints and demand response whenever the claim is acceptable.

- Reduce the administrative costs and procedures to a minimum, both for the applicant and for the organisation running the scheme. During the design of the support scheme, a test should be carried out to see which parts of the application process carry the most burden, and these should be streamlined.

Evaluation and other aspects

- Undertake periodic evaluation to track whether policy objectives are being met.

- Use evaluation of results to fine-tune scheme conditions;

- Communicate the gains and success of the support scheme to help policy makers and the public understand the distributional impact of a scheme in terms of costs, environmental performance, private investment leveraged, reduced energy imports, job creation, etc.;

- Assess the possibility to provide pro-active support and advice.

If selected and adapted to the specific national circumstances, the positive examples proposed in this manual could contribute to the further development of competitive, affordable, and sustainable renewable heating and cooling solutions.

1.INTRODUCTION TO THE MANUAL

This Manual provides case-studies and recommendations for the design and implementation of successful support schemes for renewable heating and cooling technologies (RES-HC). It covers technical, economical, financial, legal and marketing aspects.

The good practices reported here are not exhaustive, but are rather inspiring examples of how successful support schemes could be implemented across Europe. The solutions depend on the market conditions of each individual country. For instance, markets with lower RES-HC uptake, probably indicating barriers related to poor awareness and confidence in newer technologies, may require a different approach, including in terms of monitoring and control.

Developed within the framework of the IEE FROnT (Fair Renewable Heating and Cooling Options and Trade) project, this document is designed to complement the European Commission Guidance for the design of renewable energy sources support schemes dedicated to electricity. It aims to inspire policy-makers and support professionals in charge of devising and managing support schemes for RES-HC, including those embedded in wider programmes promoting energy efficiency as a whole.

Against this background, it is worth highlighting that financial incentive is an important tool to support the uptake of a technology, but is not the only one. As illustrated in Fig.1, it should always be considered in combination with other measures.

Fig. 1: Financial incentive and Interaction with other measures. Source: K4RESH project.

The manual is structured as follows. Chapter 2 describes the methodological approach; chapter 3 looks at strategic policy-making and the need to ensure long-term stability and a tailor-made approach; chapter 4 assesses aspects relating to design and implementation; chapter 5 analyses evaluation, marketing & communication as well as assistance to applicants. Finally, chapter 6 summarises the main recommendations in a checkbox. An overview of RES-HC technologies (deep geothermal, biomass, solar thermal, geothermal and air-source heat pumps) is provided as an Annex.

2. METHODOLOGICAL APPROACH

For simplicity, examples and recommendations in this manual are reported for each of the ideal/typical phases characterising a support scheme.

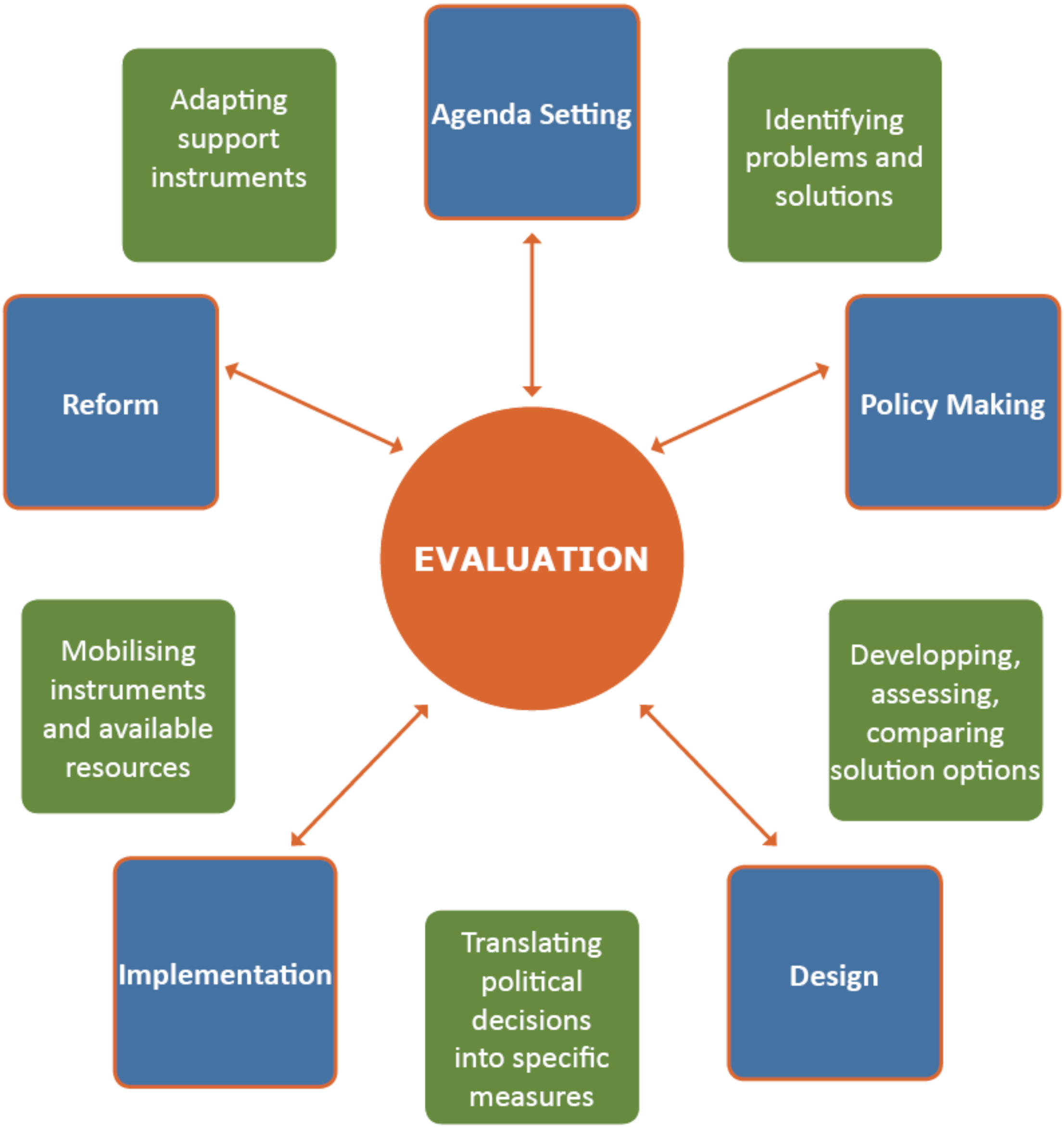


Fig. 2: Ideal-typical stages of a support scheme, adapted from Crabbé & Leroy, 2008 (p. 3)

Depicted in Fig.2 through a policy-cycle, these overlapping phases are the following:

- **Agenda setting** – In which barriers and broad objectives of public intervention are identified.

- **Policy-making** – In this phase, solution options are developed, assessed and compared on the basis of cost-benefit analyses.

- **Design**– When political decisions are translated into specific measures. One or more entities are given the responsibility for implementation: they mobilise instruments and available resources, organise a plan, specify eligibility criteria and procedures, set support level for different technologies, etc.

- **Implementation** – It is a period of interaction between entities and staff in charge of the daily management of the support scheme and institutions and undertakings which will apply and benefit from it. In this phase, rules and procedures are applied with the main objective of attaining the goals previously set.

- **Evaluation** – It is the assessment of the intended effects of a support scheme. It takes place not only before and after, but at regular intervals during the implementation phase. During the design phase, different monitoring options are presented and discussed with the intention of demonstrating their main benefits for the scheme. Monitoring methods enable effective evaluation and possible adjustments to be introduced.

- **Reform** This phase follows the evaluation phase and involves considerations on whether the supporting instruments are to be continued or modified. As for the agenda setting, a support scheme may fall within considerations taking into account achievements, costs, and benefits of a wider policy package as well as new domestic objectives and/or international commitments.

The content of this manual is primarily based on the findings of the assessment of 28 support schemes implemented in nine EU Member States[1]. Through such review, the consortium has identified the following factors considered to be critical to the success of a support scheme:

- **Contribution of different stakeholders;**
- **Stability and predictability;**
- **Transparency and accountability.**
- **Balance between financial adequacy and efficiency; and**
- **Ensuring quality & performance.**

Those factors have then been validated in each of the 5 project countries (Austria, Spain, Portugal, The Netherlands, and the United Kingdom) through national consultation platforms. The validation was also extended to a European Advisory Committee composed of experts from different sectors. Along the consultation process, a number of other relevant factors have emerged, notably the **need to ensure non-burdensome administrative procedures** and **support to applicants** as well as the essential role of **communication and marketing** throughout the different phases of a support scheme.

If selected and adapted to the specific national circumstances (e.g. market maturity, resource availability and national preferences, traditions, and culture), the good practices proposed in this manual could contribute to the further development of competitive, affordable, and sustainable renewable heating and cooling solutions. As highlighted in the next section, such development is associated with many positive benefits not often captured by market price.

[1] The nine countries assessed are the following: Austria, France, Germany, Italy, The Netherlands, Portugal, Poland, Spain, and UK.

3. AGENDA SETTING, STRATEGIC POLICY-MAKING & REFORM

Support schemes may be part of a wider policy package in which overarching problems (e.g. need to reduce greenhouse gas emissions and stabilise energy prices) have already become relevant for the system and reached government attention.

As a policy-maker, you may wonder: why should governments support RES-HC technologies? This section will reply to that question and highlight what are the main challenges for policy-makers and how long-term stability could be ensured through the right mix of financial instruments and innovative funding sources.

3.1 WHY SUPPORT RES-HC TECHNOLOGIES?

The primary objective of public intervention in the private domain is to correct market failures, thereby promoting the general interest. In the energy sector, market prices for the consumer do not fully capture negative externalities from fossil fuels such as climate change. Similarly, markets do not automatically reflect all of the positive externalities from sustainable renewable energy sources, including the creation of more stable jobs, allowing for cleaner air, reducing economic leakage from Europe towards third countries due to fossil fuel imports.

Economists tell us that the most efficient way to internalise negative externalities of energy conversion would be through taxation or a cap and trade system (e.g. the EU Emissions Trading System). Yet, they also recognise that this adjustment alone may not be sufficient to develop the wide range of technologies at the necessary speed needed to decarbonise the economy by mid-century (Linares et.al., 2013). This is because other market failures occur, including knowledge spill-overs in R&D, time-inconsistent preferences, information asymmetries, non-competitive markets, principal–agent problems. Additionally, despite their lower operating costs, most renewable technologies require higher initial investment which hampers their widespread deployment. This is the main reason why some form of support is needed to help accelerate the market uptake of RES-HC technologies that are not yet competitive under current market conditions. Support is also intended to help increase confidence on the RES-HC technologies and, ultimately, contribute to widely affordable and sustainable heating and cooling solutions to European citizens and businesses alike.

3.2 CHALLENGES FOR POLICY-MAKERS

In devising policies and support schemes for RES-HC, it is necessary to consider the following factors:

Investors and end-users are very diverse

They include:

- Large and small-scale utilities;
- Large and medium -sized industrial and commercial users;
- Energy Service Companies (ESCOs)
- The public sector;
- Commercial property developers;

- Social housing associations;
- Millions of private house owners and tenants.

Each of these stakeholders has different investment priorities and perceptions of risk. Distinguishing among industrial, commercial, public, and household investors is likely to be more successful than a "one-size-fits-all" policy. (IEA/OECD, 2014 p. 59).

RES-HC interaction with energy efficiency

In general, there are many synergies between RES-HC and energy efficiency: for instance, the integration of RES-HC is facilitated in energy efficient buildings with low-temperature heating systems. As for energy efficiency measures, the deployment of RES-HC may be strongly influenced by building regulations (e.g. minimum energy performance, minimum requirements of renewable energy use). Additionally, investors in RES-HC may be the same as for energy efficiency, e.g. building owners and the industry sector, which may lead to some degree of competition, especially when direct competing technologies (e.g. condensing oil and gas boilers) are promoted within the framework of wider energy efficiency programmes.

In designing a support scheme, you should therefore consider the wider regulatory framework in place, notably building regulations. Your new /reformed support scheme should be in line with short, medium and long-term objectives.

RES-HC technologies are heterogeneous and have different levels of maturity

RES-HC technologies can vary significantly in terms of scale, value chain, risk-profile, and applications (See Annex I for more information). Additionally, they are not all at the same level of development and commercial market uptake and their maturity level may vary from one location to another. The next section will report examples of support mechanisms designed to address this particular challenge.

3.3 ENSURING LONG-TERM DEVELOPMENT THROUGH THE RIGHT MIX OF FINANCIAL INSTRUMENTS

There are direct (i.e. financial aid and/or obligations) and indirect forms (e.g. favourable building codes, R&D funding) to support RES-HC technologies at different levels of maturity. This manual focusses on issues related to financial incentives only.

A variety of financial instruments are used by public authorities to support renewable energy. The type and the level of support have a varying impact on the profitability of RES-HC systems with regards to reference technologies. They may also affect the business models of project developers and manufacturers and attract new investors.

The main broad categories of financial instruments used for RES-HC technologies are the following:

- **Grants:** are direct financial contributions that are funded by public authorities and administrated on state or regional level. The aim of grants is to contribute to initial costs and therefore make the technology more attractive to customers. Grant schemes have low transaction costs, are easier to implement and can provide incentives for technology diversification. However, if stemming from public budget, they may be volatile and dependent on political agenda.

- **Convertible grants:** provide the ability to shift from grant to loan in case of successful realization of the project. This instrument offers a useful way to support early stage project development and high risk large-scale renewable energy technologies. This type of instrument offers a safety buffer for the beneficiaries of public finance support should the desired outcome not materialise (IRENA, 2016).

- **Soft loans and loan guarantees:** usually stem from public authorities and have a very low interest rate. One key advantage of soft loans is that they have less impact on public budgets and are often more cost effective than grants. In many cases soft loans complement grants or tax incentives.

- **Operating aid:** like feed-in tariff or a bonus for each kWh_{th} produced. It may be complex to apply for heating and cooling projects. Indeed, it means the thermal energy output should be measured. This is the case in regulated district heating installations, but only rarely in small-scale installations. For the latter, the cost of measurement is still too high compared to the total system costs, which can make it unattractive. As a result, in the case of operating aid, the "useful heat" should be either measured or estimated, and different options for monitoring systems supported by the scheme can be considered (see section 4.5).

- **Tax-related instruments:** Several tax related instruments are available. Tax credits as well as VAT exemptions or VAT reduction act as an incentive for companies to use renewable energy technology. On the other hand, carbon taxes apply the 'polluter pays' principle, especially for medium and small-scale installations not covered by the EU emission trading system, an indirect and complementary way to support renewable alternatives. The main advantage of taxation is that it is straight forward. However, its effectiveness may depend on the market and technology maturity and other conditions (e.g. investment costs).

Obviously, supporting a promising niche technology like solar cooling in Southern Europe is not the same as promoting bioenergy in forests-rich Nordic countries with renewables policies already in place for more than 40 years. In its 2011 study "Deploying Renewables: Best future policy practice", the International Energy Agency advices policy makers like you to adjust priorities as renewables' deployment grows, taking a dynamic approach in the different phases of inception, take-off, and consolidation (see Fig. 3 overleaf).

Widespread diffusion, therefore, requires time and efforts. While the first attempts to influence the introduction of a new technology may fail, continuous support is needed to overcome initial shortcomings. Amongst the above set of instruments, therefore, the choice of the financial instruments, which is eventually a matter of national preference could be differentiated according to the market maturity and the technical characteristics of each technology (e.g. cost, size, risk profile, project lead time,). This would **ensure stability for newer technologies and a more cost effective deployment of a sufficiently broad portfolio of renewable energies**.

	INCEPTION	TAKE-OFF	CONSOLIDATION
Market and regulation adaptation			
Infrastructure adaptation			
Manage growth and policy cost			
Public acceptance / confidence in the technology			
Economic deployment support for mass market			
Awareness			
Supply chain development			
Financing			
Targets			
Initial plants / large scale demonstration			
Institutional and human capacity building			
Resource/cost, technology portfolio assessment			

Fig. 3 Deployment journey of RES-HC technologies. Adapted from IEA/OECD (2011)

The case of Sweden, today the country with the highest share of renewable energy in the heat sector, shows how the choice of the instruments can evolve over time in order to adapt to falling costs. **Through a learning-by-doing process, Sweden has learnt how to ensure long-term stability until technologies become mature** and are supported only through favourable building regulations and a carbon tax.

Box 3.1: Evolution of support schemes in Sweden from grants in the 1970s to taxation-only today

In the early 1970s, oil was by far the most used energy source in Sweden, especially in the district heating systems developed since 1948. Even in the countryside, in the midst of vast forests, farmers replaced firewood boilers with heating oil boilers. All of the oil was imported and the dependency rate in that period amounted to 70-80%. Following the dramatic oil crises in 1973 and 1979, the Swedish State committed to decreasing such no longer sustainable dependency and introduced support schemes to substitute oil in boilers and district heat plants for biomass, coal and peat. Research and development grants were given to several technologies, like bioenergy, solar energy, and geothermal and air-source heat pumps.

Early development (1975-1984) – Example of heat pumps:

In the 1970s and early 1980s, the high oil price was the main driver of the early market development of renewables to replace heating oil. The Swedish government put in place the first instruments to boost this process. Between 1977 and 1985 a subsidy-scheme granted heat pump installations direct investment grants and favourable loans, which reduced the total installation cost by 10-15% on average. Since 1975 the Government also funded heat pump oriented R&D programmes at technical universities with around € 20-30 million in total funding. Another key initiative for supporting technology development since the 1980s was the development of test facilities. Those pilot projects were considered a vital element for providing reliable and high quality heat pumps. Consequently, the technology gained credibility.

Similar developments took place for other technologies, like wood chip combustion and solar heating.

Abrupt discontinuation (Mid-1980s):

When the oil price went down, the Government took away the subsidies, the interest rate went up. Sales of heat pumps plummeted and many companies went on the brink of bankruptcy.

Renewed support, varying instruments (1990s):

In the 1990s, on top of some new subsidies, the development was highly promoted by the introduction of a carbon tax, established in 1991, and with procurement programmes in the municipalities and information campaigns for renewable energy solutions. The carbon tax made fossil fuels more expensive and, as a consequence, renewable energy more competitive. The carbon tax was set at a reduced level for industries, but full tax was levied on domestic households. Over the years, the carbon tax was gradually increased several times and reached a level where it doubled the price of heating oil. Thanks to those instruments, bioenergy and heat pumps have become the most competitive and affordable technologies. During the 1990s, pellets heating was introduced on a broad scale, and in district heating, biomass, including waste, took over as the major fuel.

Today:

In 2014 RES-HC covered 68% of the heating demand in Sweden (EUROSTAT SHARES – Detailed results, 2016). With fossil fuels being phased-out of the heating market, the carbon tax is today complemented only by some investment support for district heating infrastructure. The carbon tax deduction for industry, outside ETS, is step by step removed, creating a market for renewable heat in this sector.

Sources: Andersson (2012), RES-H Policy, Kiss et al (2012)

That said, it is worth underlying that a 'silver bullet' for supporting renewables does not exist. One of the main findings of the IEE project 'RES-H Policy' is that "[e]ffective policy must consider many factors, addressing multiple barriers and requiring different instruments to be applied simultaneously whilst avoiding overspending". Therefore "[t]here is a need to be able to identify and satisfy the particular support needs of disparate technologies" (Connor P. et al, 2013: p. 14). In other words, each policy measure should address a specific market failure/barrier and aim to achieve a pre-determined result. This should always be considered by policy-makers when designing support schemes, including for RES-HC technologies.

Two positive examples in that respect are reported in Box 3.2 and 3.3. The first is the way by which the Netherlands has established a risk mitigation facility addressing the very technology-specific resource risk of deep geothermal projects. That instrument is an **effective way to provide stability** to geothermal developers and complements the main support scheme open to all technologies The second example concerns special tariffs for consumers with heat pumps, a measure aiming to protect them against high levies in electricity bills.

Box 3.2: Tailor-made incentives: Risk-mitigation scheme for deep geothermal in The Netherlands

In deep geothermal projects, most of the investment falls into the high-risk phase While the project is being developed, the required budget changes successively.

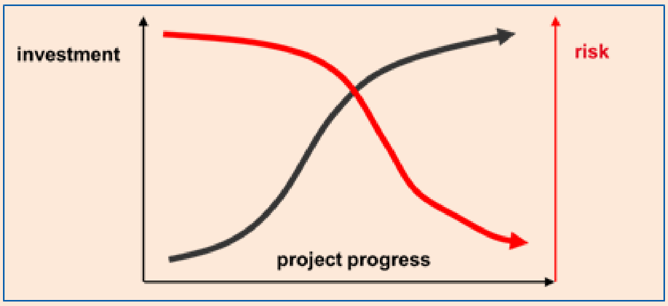


Fig.4: Risk and cumulative investment during the project progress.

The bottleneck of many geothermal projects is that in most cases debt financing by banks is possible only following the completion of the long-term flow tests. Furthermore, due to the limited practical geological knowledge in some regions, private insurers consider the operation to be too risky. Under those conditions, tailor-made instruments (including some form of risk insurance) are crucial for the successful financing of a project.

In order to consolidate the development of deep geothermal heat and remove this very technology-specific barrier related to the resource risk, the Netherlands have established a geothermal risk mitigation facility complementing the main programme to promote renewables (the SDE+ feed in premium scheme).

In the Dutch scheme, the participants pay an "insurance fee" of 7% of the maximum support. The maximum support/ risk covered is 7 million euro (normal) – 13 million euro (deep project). The same instrument is used in France (covering also groundwater heat pump systems), and is considered a best technology-specific policy instrument for emerging markets. For very juvenile markets, however, convertible grants may be a more appropriate instrument to attract private investors and improve knowledge of the local geology.

Sources: GeoDH (2014); IRENA (2016)

Box 3.3: Eco-tariff for electricity consumption of heat pumps and other renewable energy heating equipment in Hungary

Electricity prices are often higher due to several levies. This can make operating costs of heat pumps artificially higher than for oil and gas boilers. This represents a barrier for the market uptake of efficient heat pumps in many countries. As an example, the graph below shows the evolution of the price of different energy carriers in Germany.

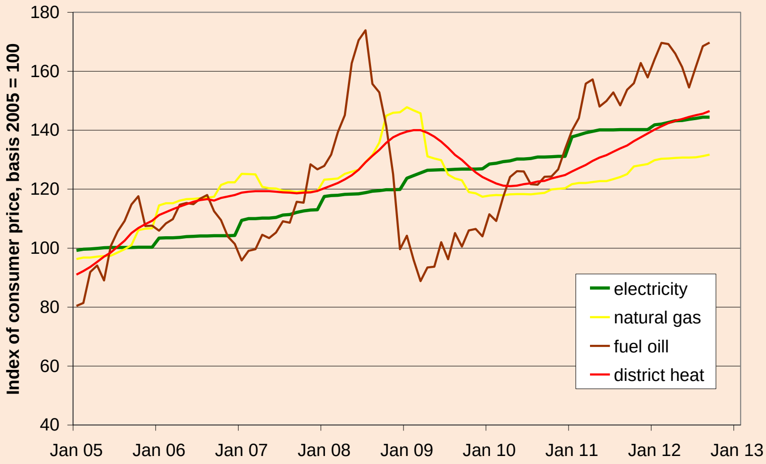


Fig.5: Development of energy prices for the residential sector in Germany

(Sources: StatBa / ReGeoCities)

An interesting solution to address this barrier has been found in Hungary, where the eco tariff ('H tariff') provides a preferential tariff for the electricity consumption of heat pumps and other equipment (e.g. thermal solar collectors, circulation pumps, etc.) used for the heat supply of buildings from renewable energy sources. This is a national obligatory scheme, introduced in a ministerial decree (70/2009 (XII.4) KHEM) and is available for all consumers eligible to use the countrywide electricity service [Electricity Act Art. 3(7)]. The subsidised tariff is available only in the heating season.

3.4 ENSURING STABILITY: MOVING OFF-BUDGET?

Fluctuations and abrupt changes in the support provided are amongst the main factors hampering the development of RES-HC. Incentives should be stable so that the decision making process can be captured in formulas, allowing investors and developers to know when and how an incentive may be. In addition, it has been observed, the decision process to choose less spread technologies takes more time compared with the time it takes someone to replace his conventional boiler for a newer and more efficient one.

Therefore, it is suggested that a scheme should run for at least 5 years. This might be the timeframe that most suits the RES-HC investor, considering that some are new solutions or require some years in order to be realised (e.g. a social housing renovation project). **In order to provide stability, it is also important to avoid long-periods between announcement of a financial incentive and its actual application.**

However, in several EU countries, this is not the case. As a matter of fact, due to budgetary constraints short-term support mechanisms are sometimes not continued. A moment of rapid growth is thus abruptly followed by one of economic decline. It is now well understood that stop and go policies undermine the confidence of investors, sometimes irrevocably. Although focused on the electricity sector only, the 2013 European Commission's "Guidance for the design of renewables support schemes" recommends **off-budget financing to avoid fiscal impacts and uncertainty.** This can be done by financing the support scheme through a levy on gas consumption as it happens already in the most of the support schemes for renewable electricity. **An alternative way to move off-budget and provide stability** is found in Switzerland, where the 10-year long *Buildings Programme* is to a large extent financed through a carbon tax (see box 3.4).

Box 3.4: Funding a Buildings programme through carbon tax in Switzerland

The Buildings Programme is based on the CO_2 Act. This provides for a CO_2 tax levied on fuels. Since 2010, a third of tax revenue is paid to the Buildings Programme, nearly 300 million are available each year to clean buildings. At least two thirds of the tax revenues are for the domestic part of the program (Part A) or the financing of measures in order to enhance the energy performance of buildings. The rest is spent on part B of the program, that is to say investments in renewable energies, recovery of waste heat and improvement of technical facilities; this amount (between EUR 55 and 91 million a year), is supplemented by cantonal benefits of the same magnitude. In accordance with the CO_2 Act, the Buildings Programme will continue until 2019.

As CO_2 emissions from fuels remained above the intermediate target, the tax was increased in 2016 to 84 CHF per tonne of CO_2. Depending on the evolution of emissions, a further increase is possible in 2018.

Source : Office Fédéral de L'Environnement (OFEV) http://www.bafu.admin.ch/klima/13877/14510/14511/index.html?lang=fr

4. DESIGN AND IMPLEMENTATION

The political decisions taken at previous stages are translated into specific measures during the design phase. Here agencies mobilise instruments and available resources, specify eligibility criteria and procedures, set support level for different technologies, etc.

This section, essentially based on the findings of the analysis of 28 support schemes implemented in 9 EU Member States, presents a number of good practices in designing support schemes which have proven to work well and have delivered good results. These successful experiences, tested and validated, could be replicated and should to be shared so that a greater number of future support schemes can include them.

4.1 ENSURING THE CONTRIBUTION OF DIFFERENT STAKEHOLDERS

From the onset, you can involve other public entities, trade associations, private consultants to take informed decisions and ensure different experiences are embedded in the scheme, including in terms of equipment quality, technology costs and barriers, control mechanisms and certification of professionals. By assuring the participation of regional and local entities you have a valuable experience and know how on local conditions that could contribute to the increased uptake of RES-HC.

Consultation

Relevant stakeholders should be consulted in different phases of the decision-making process. This is to **ensure the utmost transparency** and **can be done either through well-organised expert meetings and/or online public consultations.**

In some cases, the consultation can follow a simple format such as requesting the participants to fill out an on-line form with a set of previously prepared questions (see Box 4.1 for the consultation process in the UK Renewable Heat Incentive). In other cases, technical meetings with the participation of well-qualified specialists might be needed to discuss certain details. Whatever methodology is adopted, the consultation process should be adequately prepared, advertised and made more inclusive. Indeed, lack of publicity could inhibit the participation of less traditional entities such as private sector consultancies, specialist financial organisations, academic institutions, consumer protection and community groups.

What to avoid

The consultation processes should not disrupt industry progression. Delays related to budget confirmation, brought about by a consultation process, can stall the market as clients wait until the new scheme becomes available. Whilst this point was made in the broader acknowledgement that consultation processes can help improve the operability of a scheme – care should be taken over the time, timing and level of information provided to the public, minimising the risk of market stagnation.

It is not to be used by different entities to support their dominant position in the market and, in this form, exclude the entrance of new products or least develop products.

It is also important that the consultation procedure is not used to prevent the participation of certain entities or the use of certain equipment and that results are published in a transparent manner and are not distorted.

Box 4.1: Public consultations in the UK

The Renewable Heat Incentive (RHI) is a government financial incentive to promote the use of renewable heat in the UK. It has been introduced in November 2011. It operates in the same manner as a Feed-in Tariff system and was introduced through the Energy Act 2008. It was initially for non-domestic buildings. The RHI was then extended to domestic building as the Domestic RHI in April 2014.

The UK Department of Energy & Climate Change (DECC) often consults stakeholders and experts on the RHI. Several consultations were launched regarding the scheme; some of them can be found below:

August 2011: **Consultation on Renewable Heat Incentive Guidance**. It sets out how Ofgem intends to administer the scheme and invites comments from stakeholders

October 2011: **Northern Ireland: RHI consultation**. It seeks views of stakeholders on the design and implementation of a RHI for Northern Ireland, as well as on other proposals to develop the renewable heat market in Northern Ireland. Included in the consultation is a specific 'Call for Evidence' on the development of deep geothermal energy in Northern Ireland.

December 2012: **Consultation On Domestic RHI**. DECC consulting on proposals for a subsidy scheme aimed to help households replace their existing fossil fuel-based heating systems with renewable-based ones.

The most recent consultation took place in March and April 2016; t**he Renewable Heat Incentive: A reformed and refocused scheme**, with which the DECC launched a new consultation to reform the RHI.

Other relevant aspects

Some of the aspects related to the design of a support scheme, e.g. the level of support, ought to be developed based on the best available information and may require the involvement of external experts. The detail of a support scheme should be established following a consultation of relevant stakeholders, e.g. interest groups, consumer and environmental organisations, etc.

Depending on financial and human resource availability, there may be the need for a technical body providing support to the institution governing the support scheme. The governing body of the support scheme should actively search if such structures already exist and evaluate the possibilities of requesting and securing their collaboration. In this way, a coherent and independent technical advice team will be secured. If such a structure does not exist, an evaluation work should be carried out by the support scheme governing body to see how it can be put in place.

4.2 ENSURE TRANSPARENCY

One of the most important aspects of a support scheme is its transparency for all of the participants. Transparency should feature in all aspects of a support scheme: when defining the rules, the technical and financial aspects, verification mechanisms, and the evaluation criteria. The pre and post implementation impact assessment should be available to the public.

How to establish transparent rules

When setting the financial aspects of the support scheme a list of clear eligibility criteria should be established. Additionally, compensation mechanisms, support levels, and timeframe should be clearly indicated so that investors can more easily assess their risks and make their long-term decisions.

When setting the technical features of the support scheme, it becomes easier for the potential investor if the scheme defines, upfront, what are the technical solutions that might be compatible with the programme. The environmental gains and constraints should also be clearly stated for all participants. It is also very important that any decision following the adoption of the scheme is swiftly communicated to the concerned parties so as to allow them time to eventually contest that decision.

What to avoid

Firstly, the environment gains should not be translated into complex calculations that only a few experts can understand. End-user tools for a pre-feasibility assessment of the solutions offered can help. Secondly, adjustments to the rules should not change the essence of the support scheme. Lastly, requirements should be as much as possible adapted to the technologies considered, though balanced. In the case of RHI, the requirements for solar thermal systems providing only hot water are similar to those providing space heating, including the requirements in terms of building insulation, which are logical for space heating tough arguable when it comes to water heating.

Other relevant aspects

In compliance with Art.14 of Directive 2009/28/EC (RES Directive), information on support measures adopted should be made available to all relevant actors, such as consumers, builders, installers, architects, and suppliers of heating, cooling and electricity equipment and systems. In order to ensure transparency, it is therefore crucial that national authorities comply with this provision.

4.3 STRIKING A BALANCE BETWEEN FINANCIAL ADEQUACY, PREDICTABILITY, AND FLEXIBILITY

Whenever a support scheme contemplates multiple technologies and diverse eligible groups, it becomes useful to differentiate the level of support according to available income of the end-user as well as the individual requirements of each technology. In doing so, care should be taken to keep costs under control without making the scheme too complex or increasing its management costs.

How to ensure a balance between financial adequacy, predictability and flexibility

In general, allocation mechanisms for public support which make market players reveal as much information as possible during the process and which adapt to changing market circumstances are preferable. It is only if the market information or competitive allocation mechanism is not reliable, for example, due to a limited number of market players or very immature technologies, that public authorities should need set the level of support on methodologies based on detailed cost calculations (European Commission, 2013).

Policy-makers like you could decide to differentiate the methodology for setting support levels according to the target group. Firstly, in the case of **support mechanisms addressing the supply-side** (e.g. project developers, district heating utilities), **competitive allocation mechanisms such as auctions can be desirable**. This could be complemented by setting a cap for a maximum level of support calculated through a more accurate methodology taking into account average investment and generation costs. Secondly, **when the beneficiaries**

are households, then the support level can be **adjusted according to the income level**, providing more support to vulnerable groups, helping to tackle energy poverty. Furthermore, in the case of islands and isolated communities, the support can be accrued in order to reflect the additional benefits of local energy generation. As illustrated in Box 4.2 below, an example of differentiated support level is found in France for solar thermal collectors producing collective hot water for the tertiary, industrial, and agricultural sectors.

Box 4.2: Differentiated support level for solar thermal in France

In France's Heat Fund (*Fonds Chaleur*), the amount of support for projects whose solar collector surface area between 25 m² and 100 m² depends on the collector surface and the geographical area.
For example:

- in Northern regions, the flat-rate aid is €650/toe useful solar
- in Southern regions, the flat-rate aid is €600/toe useful solar
- in Mediterranean regions the flat-rate is €550/toe useful solar

For projects whose solar collector surface area is above or equal to 100 m², the aid is calculated by analysing the production cost and by comparison with fossil reference solutions. However, support cannot exceed €1100/m².

Source: Ademe

In order **to keep costs under control**, **the scheme must be sufficiently flexible and be complemented by a built-in revision mechanism** to adapt the support level to falling technology costs, without undermining the overall stability of the sectors involved.

The adjustment of support levels should be planned in advance. For instance, **pre-defined volume induced digression** (see Box 4.3 below for a description of this mechanism in the UK) in the support level is a good way to adapt the support level if costs of new installations fall faster than expected and/or growth in installations grows beyond reasonable expectations. On the contrary, in the event the technology does not attract the expected level of investments, the reasons should be properly assessed. Such evaluation could suggest that either the support level is increased and/or that some eligibility criteria are modified. An overall cap on the maximum yearly expenditure per technology could guarantee compliance with the overall budget for scheme.

Box 4.3: Tariff digression in the UK

RES-HC technologies are expected to get cheaper as volumes increase. For this reason, the UK Government has decided to adjust some tariff levels for systems installed in future years.

The mechanism that controls these tariffs is known as digression. DECC have to keep the Domestic RHI within budget and they do this by lowering the tariff rates for new applicants if uptake of the scheme is higher than the approved budget, by either 10% or 20% according to rules set out in the Regulations.

If uptake of a technology in a quarter hits a digression trigger, then the tariff for that technology is reduced by 10%. If the uptake in a quarter is much greater than predictions, then a 'super trigger' may be hit. If the super trigger is hit, the tariff rate for that technology is reduced by 20%. If neither trigger is hit, the tariff rate remains the same.

DECC publish how close to digression triggers each of the eligible technologies are, on a monthly basis, and review whether a trigger has been passed on a quarterly basis. DECC publish a digression announcement at least a month before any change in tariff is due to take place.

Triggers are set individually for each technology type.

Source: Ofgem

What to avoid
It is important to avoid setting volume and/or budget caps without a built-in revision mechanism. This can bring about abrupt collapse in terms of new installations, which can seriously undermine investor confidence (see section 3.4 on how to avoid this by financing support schemes off public budgets).

Other relevant aspects

Apart from financial adequacy, the flow support rate can also be an important factor. For medium and low-income households as well as for small businesses, the full reimbursement soon after the approval of the application is desirable. For the supply-side, including ESCOs, the flow support could be modulated as to ensure a minimum period of operation and to take into consideration the upfront investment. Support can be modulated with constant decrease along the years of the programme. However, it is important to calibrate the budget so as to avoid abrupt interruption. In some case it can also be considered a mixed approach combining a grant and operating aid. The initial grant would have an effect on reducing the weight of the upfront investment, while the operating aid would bring the motivation of a retribution over time (as in a feed-in tariff), while keeping the owner concerned about the performance of their system.

4.4 COMPLIANCE WITH EU STATE AID RULES

Any kind of public financial support needs to comply with EU State Aid rules. As far as RES-HC are concerned, the most important pieces of regulation are the following:

- Regulation (EU) No 1407/2014 of 17 June 2014 of 18 December 2013 on the application of Articles 107 and 108 of the Treaty on the Functioning of the European Union to *de minimis* aid.
- Regulation (EU) No 651/2014 of 17 June 2014 declaring certain categories of aid compatible with the internal market in application of Articles 107 and 108 of the Treaty
- Guidelines on State aid for environmental protection and energy 2014-2020(2014/C 200/01)

The conditions under which public support is compatible with the internal market differ for operating and investment aid.

Regarding operating aid for renewable heat (e.g. the non-domestic Renewable Heat Incentive in the UK), according to Paragraph 3.3.3.2 of the Guidelines, it is compatible with the internal market if the following cumulative conditions are met:

• the aid per unit of energy does not exceed the difference between the total Levelised Costs of producing Energy ('LCOE') from the particular technology in question and the market price of the form of energy concerned;

• the LCOE may include a normal return on capital. Investment aid is deducted from the total investment amount in calculating the LCOE;

• the production costs are updated regularly, at least every year;

• aid is only granted until the plant has been fully depreciated according to normal accounting rules in order to avoid that operating aid based on LCOE exceeds the depreciation of the investment.

Regarding investment aid, the table overleaf summarises notification thresholds, eligible costs and maximum aid intensity for renewable heat and district heating infrastructure (% of eligible costs) compatible with the internal market:

	Notification threshold	Eligible costs	Intensity aid compatible with the internal market		
			Small enterprise	Medium-sized enterprise	Large enterprise
Aid for environmental studies		The eligible costs are the costs of the studies.	[70] %	[60] %	[50] %
Aid for renewable energies	EUR 15 million per undertaking per investment project	The counterfactual is a conventional power/heat plant with the same capacity in terms of the effective production of energy.	[65] %, [100] % if bidding process	[55] %, [100] % if bidding process	[45] %, [100] % if bidding process
District heating infrastructure	EUR 20 million for the network		65% [100] % if bidding process	[55] %	[45] %
			The aid intensities mentioned above may be increased by a bonus of [5] % point in regions covered by Article 107(3) c or by a bonus of [15] % in regions covered by Article 107(3) a Treaty up to a maximum of 100% aid intensity.		

4.5 ENSURING QUALITY & PERFORMANCE

The lack of component quality and poor system performance can be impeditive of large scale uptake of RES-HC technologies. In order to benefit from public support, beneficiaries and/or project developers should therefore comply with a number of pre-defined conditions relating to the equipment, the installers, etc. **This is to ensure ex-ante quality and performance and to boost the confidence in the technology.**

How to ensure quality and performance

For equipment

According to the RES Directive (Art. 13.6) only renewable energy heating and cooling systems and equipment that achieve a significant reduction of energy consumption should be promoted. Yet, any technical specifications which must be met in order to benefit from support schemes should be clearly predefined and appropriate certificates or standards developed at EU level should be accepted (see Box 4.4 below for the example of Solar Keymark). For heat pump systems in particular, a pre-determined level of efficiency in terms of COP or SPF should be established in order to incentivise the most efficient heat pump systems. For all small-scale installations, aid should be exclusively reserved to the most efficient class of the EU energy labelling system.

Box 4.4: Example of European Standards: Solar Keymark

The Solar Keymark is a voluntary third-party certification mark for solar thermal products, demonstrating to end-users that a product conforms to the relevant European standards and fulfils additional requirements.

The Solar Keymark is used in Europe and increasingly recognised worldwide. The Solar Keymark was developed by the European Solar Thermal Industry Federation (ESTIF) and CEN (European Committee for Standardisation) in close co-operation with leading European test labs and with the support of the European Commission. It started covering the collectors, and then evolved to also include factory made systems, and then also custom build systems, such as controls and storage. It is today the main quality label for solar thermal products and is widely spread across the European market and beyond.

The Solar Keymark is required in most European support schemes for RES-HC, such as the German MAP, or the Italian Conto Termico.

The Solar Keymark
CEN Keymark Scheme

Recently a similar scheme for heat pumps has been set up – the Heat-pump Keymark.

For installers

Installers should be certified or have a specific equivalent qualification. In this context, Member States are to ensure that **certification or equivalent qualification schemes** are available (since 2013) for installers of small-scale biomass boilers and stoves, solar thermal systems, shallow geothermal systems and heat pumps (Art.14 RES Directive). Additionally, a list of installers who are qualified or certified could be made be available for the public and a principle of mutual recognition between EU Member States should be put in place.

On top of that, it is however worth reporting that during the FROnT consultation process, it was reported that in some countries certification is perceived to be very expensive for installers, especially for heat pumps and solar thermal installers, which creates a barrier to the uptake of these technologies.

For the installations
Some markets may need to evaluate whether the support schemes should use existing structures to help evaluating system performance and help secure the success of the programme. In some markets where highly qualified technical structures already exist, they may be used in the support scheme. If such structures do not exist, it may be useful for the entity managing the support scheme to evaluate whether it needs to be established. It is clear that creating such entity just for a specific aim of supporting a scheme represents additional costs that should be avoided. On the other hand, there is also the concern that public funds should be used to assure consumers that the systems supported work properly. Objective testing and monitoring are a secure way to know whether the systems supported can ensure good performance. Such evaluations should collect information feeding back into training and qualification and certification schemes, in order to improve them and avoid the most common installation problems.

System **monitoring and tests** can be done in different ways.

Tests can be carried out prior to pilot projects to evaluate the performance a new technology entering the market via support scheme. A second way is to carry out an evaluation at the end of the programme. In this case two objectives will be attained, the evaluation of the entire programme and the evaluation of the systems. Care should be taken as the evaluation at the end of the program will likely have an impact on the calendar of the support scheme. The monitoring schemes should be evaluated upfront and the participants in the schemes should be provided with all the details. In any case, it is suggested to go through random tests by technology, region; or targeting a group of professionals who has revealed some major difficulties in the execution of systems. (see example from Spain in Box 4.5 below).

Box 4.5: Verification system in Spain

Spain has implemented a system in which IDEA, the national energy agency, verifies 100 % of the documentation needed to demonstrate that the installation has been properly installed (licenses, invoices, payments, etc.) and tests only a part of the total.

Once the documentation has been evaluated and approved, it is selected a sample which must be statistically representative. The number of projects must represent a minimum percentage in terms of budget from the total amount allocated through the programme. From those projects, some are selected taking into account: the amount of the support given to any individual project, they must represent geographically the whole territory.

Source: IDAE

Another way to ensure quality and performance is to oblige installers to offer **free maintenance for a given number of years.** As explained in Box 4.6 below, from the experience in Portugal and Poland this promising idea proved to be a huge challenge for the authorities in charge of managing the scheme. This is especially the case when specific accompanying provisions secure the installation owner/user in case of bankruptcy

Box 4.6: Maintenance warranty in Portugal and Poland

In Portugal, the maintenance warranty was introduced during the Medida Solar Térmico 2009 (MST2009) but could not be followed up since most of the companies that participated in the scheme went bankrupt before any warranty could be claimed. This way the few companies that did not went bankrupt were penalised for the simple fact that they will be carrying a task that most of the others will not do. On the other hand, it was not previously defined what was to be the object of regular maintenance. There were no provisions of what to do in case a company participating in the scheme files for bankruptcy. To aggravate the matter, the systems were implemented without a project, which makes it difficult to know which components were adequately selected and correctly placed in the circuit. Without the project, it becomes extremely difficult to assess the responsibilities related to maintenance.

A similar scheme is in force in Poland, where the entrepreneur responsible of the installation is obliged to give 5-year warranty. Also in this case, however, there are no any special provisions, which secure the installation owner/user in case of bankruptcy.

Complementary options to those described above are the possibility to register the installed systems and for applicants to submit complaints (online, direct line or helpdesk) so as to provide direct feedback to the managing authority. Such options imply the verification of the anomaly in site or through the monitoring to avoid to take into account false claims and will necessarily increase the managing costs of the support schemes. However, it can provide valuable information and assist in monitoring the effectiveness of the scheme, while helping to improve the support schemes and other related instruments (training, qualification or certification).

The publication of information on performance of systems might also be considered. In fact, a recent EC call for tender N° ENER/C2/2016-501 (Ref. Ares (2016)3175107 - 04/07/2016), designated Competitiveness of the Renewable Energy Sector, refers the need to organise the heating and cooling sector so that a data collection structure be put in place, providing a clear indication. Some options would include the treatment of reliable indicators in order to provide information on items such as number of RES-HC systems that are working properly with no reported problems, number of systems that were subject to maintenance, typical investment and maintenance cost, typical maintenance operation per RES-HC technology, etc. This information can be available to help consumer select heating/cooling option and help deterring practices of over-selling, since reliable and structured information will be available for any potential buyer.

It is true that most of the consumers will be able to evaluate whether the acquired system delivers the level of comfort previously contracted (promised). It is also true that consumers might be able to give opinions about the selling tactics of a particular professional. However, the evaluation of installer performance is a more complex task and might be challenging for regular consumer. In fact, when we refer evaluation of installer, it should be correctly referred to as ‘evaluation of the supply chain’.

Adding to the complexity of the problem is the fact that RES-HC systems require the assembling of many different components which have to be selected according to certain criteria, and that incorrect selection of one of them could render the system obsolete in short period of time. Therefore, there is a share responsibility between the designer, who proposes what, where and how to install, and the installer who follows all the instructions and indications of the designer, which, in some cases, makes it difficult to prove the degree of responsibility of different players in the supply chain.

It may be difficult for consumers to have a clear idea of the performance of the installation, which could make installer and system evaluation very subjective and probably unfair. For the RES-HC system to deliver affordable, robust, reliable and efficient installations and contribute for the displace carbon base systems, their performance should match the latter. On the other hand, some RES-H systems mixes two or more energy sources, which makes the evaluation much more complex, even for experienced professionals.

One of the possibilities to simplify the certification or evaluation of professionals is to evaluate the system, considering that by doing so, we are evaluating the whole supply chain, including the installer performance. Whenever we evaluate the system, we have to look at details of the project, considering that even the smallest system needs someone to think about what components to put together, who it will serve, how it should be installed and how it will operate. The scheme (often included in the quote) is the guide that the installer will have to use to carry out the installation and, in subsequent years, carry out the required maintenance in order to guarantee that the system operates adequately. For large installations, the scheme will have to detail every aspect of the system. Afterwards, a field test has to be carried out to evaluate the system. The field evaluation can be a quick check of the system or a complex evaluation that might include system monitoring, using complex tools and instruments to collect a set of data that will be treated and reported. Finally, the evaluation of the maintenance plan and maintenance already carried out will be done. Only after this three-part evaluation is completed, is it assumed that the system evaluation is completed and a set of eventual recommendations will be presented. In case there are no entities to secure the evaluation of the installations and support all the costs, like the UK´s Microgeneration Certification Scheme, costs associated should correctly be assessed by the entity in charge of managing the support scheme.

Buildings energy performance certificates

Making the financial support conditional to the mandatory possession of buildings' energy performance certificates may be useful in order to assess in advance whether energy efficiency measures could accompany the installation of the renewable system, to assess the heating demand and therewith inform about the most appropriate size of the system.

Such requirements might be valuable in order to ensure a good combination between energy efficiency and renewable heating and cooling generation in the building, especially if the support is provided as operating aid. This is the case of the Renewable Heat Incentive in the UK, where there is a need to avoid incentivising the generation of excessive heat that could be lost through inefficient buildings or just vented into the atmosphere. Though, in the case of RHI, such requirements apply equally to systems providing space heating or those providing only hot water, which seems excessive for the later, as the level of energy efficiency of a building has almost no effect on the performance of a hot water system.

All in all, imposing the energy performance certificate to have access to support may increase the administrative burden of the scheme, thereby reducing its efficiency as well as effectiveness.

Box 4.7: Energy Performance Certificate's requirement in the UK's Renewable Heat Incentive

The RHI scheme for domestic installations is based on tariffs reimbursed for 7 years. The support level is set on the basis of metered heat for some technologies (e.g. for bi-valent heat pump systems or 2nd / holiday homes) or on the "deemed" heat requirement of the property (e.g. for mono-valent systems).

In order for the annual heat demand of the property to be deemed, the customer has to have a separate energy assessment of the property carried out in order to obtain an Energy Performance Certificate (EPC). As well as providing the basis for the RHI "deeming", it is a requirement that the property meets a minimum energy performance level, e.g. through insulation / draught proofing etc. in order to avoid excessive payment being made on highly inefficient properties.

Source: Curtis and Pine (2016).

Other relevant aspects relating to quality and performance
Monitoring system performance may require a metering system. While always appropriate for large installations, a meter for all small-scale installations may dramatically increase costs. Alternative options might be considered, such as the scheme operators including monitoring in some systems that could serve as reference for other similar systems in the same area. This can be enhanced with a registry to map new installations and a feedback process, contributing to improve statistics. Other options, such as random audits, some forms of guarantee and a direct line between the beneficiary and the managing authority (see section 4.6) could be also appropriate ways forward to ensure quality and performance for small residential and non-residential installations.

What to avoid
The entity managing the support scheme should not carry out monitoring with timeframe superior to the scheme running period. In other words, the entity should always reconcile system monitoring timeframe and support scheme functioning period.

4.6 PROMOTING INNOVATION, WHILE ENSURING FAIR COMPETITION

Any scheme should be designed in such a way that it will not inhibit the participation of new products or systems. On the contrary, it should encourage the appearance of new products, as long as they are developed according to high technical standards and do not add unnecessary burden to the public finance. **A way to support more innovative technologies in integrated multi-technology support schemes is to reserve a higher level of support, as is the case of the Innovation Bonus in Germany** (see Box 4.8 below).

The eligibility criteria of a support scheme will define, among other things, whether the financial aid is provided for the refurbishment of existing heating installations only or is open for new built as well. The choice may depend on existing building regulations and in particular on eventual minimum requirements of renewable energy in new buildings. Indeed, in several countries where such minimum requirements for renewables in new buildings are in place (e.g. in Spain), support schemes cover exclusively existing buildings. As described in Box 4.8 and 4.9, two notable exceptions are found in Germany and Austria, **where financial incentives are available also for innovative and more efficient RES-HC systems in new buildings**

Box 4.8: Reward of innovation in Germany's Market Incentive Program (MAP)

In Germany, since April 2015 innovative designs and applications going beyond the state of the art are rewarded with an innovation bonus and are applicable to new buildings despite a minimum renewable energy obligation.

Therefore, geothermal and air-source heat pumps achieving a seasonal performance factor of 4.5 are eligible for standard support if installed in new buildings and for a higher support (more €500) if installed in existing buildings.

For solar installations with 20 to 100 m² gross collector area, they are limited to residential buildings with three or more parties, other buildings with a minimum of 500 m² floor space, and hotels with minimum of six rooms as well as 1- to 2-family buildings with a solar share of more than 50 % of the heat demand:

- Solar water heaters in new buildings: 75 EUR/m² gross collector area
- Solar water heaters in existing buildings: 100 €/m² gross collector area
- Combi Systems for hot water and space heating in new buildings: 150 €/m²
- Combi systems for hot waters and space heating in existing buildings: 200 €/m² gross collector area
- Provision of process heat for newly built or existing buildings: 200 €/m² gross collector area
- Solar cooling in existing buildings: 200 €/m² gross collector area

Alternatively, the incentive for innovative designs can be paid as a performance based incentive calculated with the following formula:

0.45 EUR/kWh and year according to the additional table of the Solar Keymark certificate of the collector, calculated for site Würzburg, Germany, and a collector temperature of 50 °C

Box 4.9: Support scheme for new buildings in Upper Austria

In Upper Austria, financial incentive is given to end-consumer in relation to the building standard of the new build house and on the mandatory usage of renewable energy sources or energy efficient heating systems.

The support programme supports the overall investment and the establishment of 'energy-saving constructions' in Upper Austria. Therefore, support is just granted if the overall efficiency of the house corresponds to a building certificate label A or a better building standard and the usage of a combination of innovative heating systems, e.g. heating systems based on low-emission, biomass fuels, gas condensing or LPG condensing boiler systems, heat pump systems with a seasonal performance factor of at least 4 or at least 3.5 for air-source system, district or local heating need to be combined with either a solar thermal system with at least 8 m² aperture area or with a photovoltaic system with a capacity of at least 2 kW peak. The combination is not mandatory if it is not feasible to use a solar thermal system or a photovoltaic system due to bad conditions on site or too low sunlight respectively.

As an alternative, new build houses with a building certificate label A or a better building standard (or B in case of a heat recovery from ventilation systems) and the proof of calculation with a reference climate can be granted if the innovative main heating system is based on: heating systems based on low-emission biomass fuels, electrically driven heat pumps systems with a seasonal performance factor of at least 4 or at least 3.5 when using an air-source whereas the heat pump can be combined either with a photovoltaic installation up to a capacity of at least 1 kW peak or with a solar thermal system with a minimum aperture area of 4 m² or with proof of an operation with electricity from 100% renewable energy sources (based retailer mix); natural gas condensing or LPG condensing boiler systems in combination with solar thermal systems with a minimum aperture area of 4 m² or natural gas-fired condensing boiler or LPG condensing boiler systems with a usage of at least 30% share of gas from renewable energy sources ; efficient district heating.

Source: AIT.

Another aspect to be carefully evaluated while defining the eligible technologies in wider energy efficiency programmes is the impact of subsidies for the replacement of conventional small-scale fossil-based heating systems with more efficient condensing gas and oil boilers. From the analysis of the National Energy Efficiency Action Plans it is possible to observe that several EU Member States are complying with the energy efficiency targets also through subsidies to fossil-fuel-based heating systems. Such subsidies compete with support schemes for renewables may in practice offset the benefit of supporting RES-HC technologies in the same or in a parallel scheme. **In order to promote innovation, ensure fair competition, and avoid lock-in effects, it may be wise to plan a phase-out of competing subsidies for fossil fuel-based heating systems and to reserve them in the short-term for vulnerable consumers only.**

4.7 ENSURING NON-BURDENSOME ADMINISTRATIVE PROCEDURES

It is important to reduce the administrative costs and procedures to a minimum, both for the applicant and for the organisation running the scheme. During the design of the support scheme During the design of the support scheme, a test should be carried out to see which parts of the application process carry the most burden, and these should be streamlined.

Once identified, these documents and processes should be adjusted or removed from the system. The essential paper work should be clearly rated and, probably, some capacity building sessions should be carried out to help better prepare the staff.

As it is observed in the Netherlands, digital applications are simplifying the process: more than 95% of domestic applications and 100% of professional applications are done electronically and this is enormously reducing the administrative burden.

5. EVALUATION, COMMUNICATION & SUPPORT TO APPLICANTS

5.1 ENSURING CONTINUOUS MONITORING AND EVALUATION

In a bid to improve the overall scheme's accountability and transparency there is a need to undertake periodic evaluation to track whether targets are being met. A communication of the gains and success of the support scheme needs to be done to help policy makers and the public understand the distributional impact of a scheme, both in terms of costs and environmental performance. Particular attention should be paid on the impact of the support scheme for those more susceptible to energy poverty, other vulnerable groups and the main target groups for the support scheme.

The evaluation of environment, energy, and climate policies is a well-established discipline. In its 2016 report "Environment and climate policy evaluation", the European Environmental Agency (EEA) proposes practical approaches for environmental evaluation. The EEA highlights in particular the following critical evaluation criteria:

- inputs — the resources dedicated to the design and implementation of a measure (staff, administrative structures, financial investment, training, awareness raising, etc.);

- outputs — the tangible results of a measure (e.g. the number of new renewable energy installations, etc.).

- impacts — the ultimate effects of these changes in behaviour on the environment and human health; impacts may occur, after a certain period, among direct addressees or indirect addressees;

- results — more immediate changes stemming from direct intervention on addressees at the end of their participation in an intervention. An example of this type of evaluation is reported in figure 6 below and concerns the private investment leveraged by public support in Germany's Market Incentive Programme. In this case, from 2000 to 2013 with about EUR 2.8 billion in funding, the programme triggered EUR 18.8 billion in private investments.

- external factors (e.g. the weather) and other policies (e.g. a fossil fuel subsidy) — these can intervene on, that is, support or weaken, the effect of policies. In this regard, the EEA recommends to assess to what extent is a public intervention coherent with other interventions. It is also important to take other macro-economic aspects into consideration and compare the budget dedicated to promote RES-HC with other state interventions in the energy sector. Indeed, it has been observed that efforts to promote the switch from fossil fuels to renewables in the heat sector has been negligible if compared to state intervention in the power sector and large natural gas infrastructure.

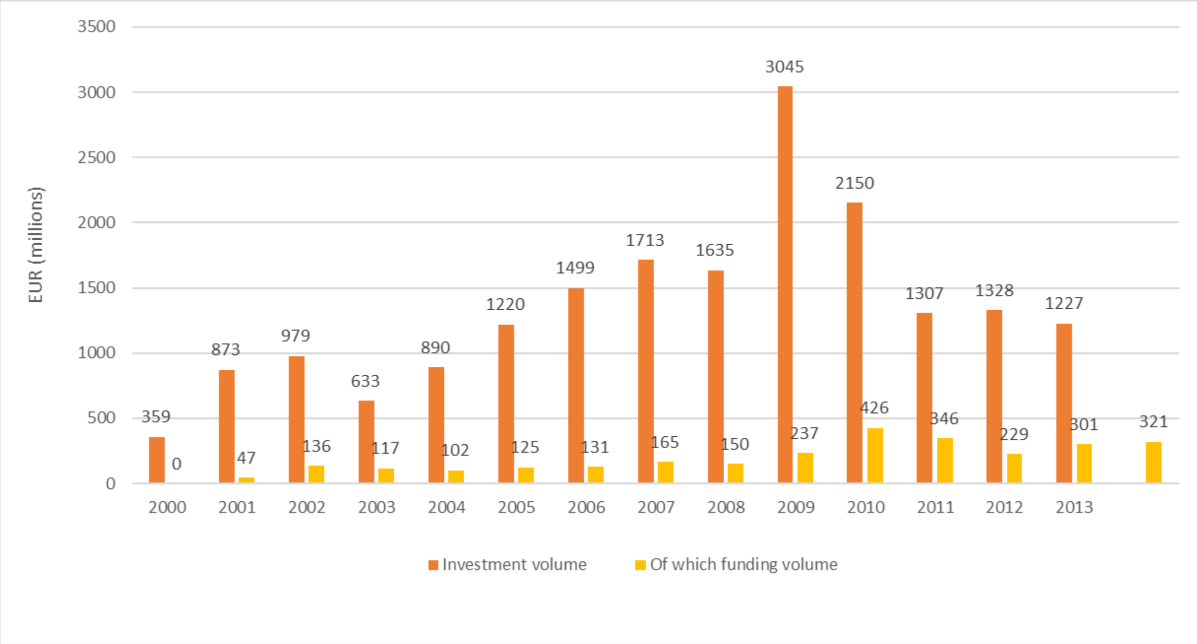


Fig. 6 Impact on leveraged private investments of renewable energy support in the heating sector under MAP, 2000-2013 Source: BMWi, 2014

5.2 ENSURING PROMOTION AND COMMUNICATION

Communication and advertising of the scheme is another important element for the success of support schemes. Apart from setting a viable communication strategy, it is important that potential buyers understand RES-HC technologies and their impact on the economy, environment, and other aspects. To this end, it is crucial to earmark some budget for communication and marketing.

Box 5.1: Promotion of support schemes in Spain

IDAE, the Spanish national energy agency, spreads the knowledge about the available support schemes towards regional and local energy agencies, installers and professionals which, in turn, explain them to the end-user. In addition, IDAE participates in energy fairs and, in the case of subsidies for more efficient cars, has even advertised support schemes on TV.

Source: IDAE

In communicating, it is also important to take wider macro-economic aspects into consideration and all of the aspects concerning evaluation and reported in Section 5.1 above. compare the budget dedicated to promote RES-HC with other state interventions in the energy sector. Indeed, it has been observed that efforts to promote the switch from fossil fuels to renewables in the heat sector has been negligible if compared to state intervention in the power sector and large natural gas infrastructure.

5.3 ENSURING SUPPORT TO APPLICANTS

In order to facilitate applications from households and small enterprises, the support scheme could include a service providing effective and pro-active support, including prior advice on the most cost-efficient measures and on the most adequate heating system. As illustrated in Box 5.2 below this is the case in the Brussels-Capital Region in Belgium.

Box 5.2: Support to applicants – The Energy House in the Brussels-Capital Region

The Energy House (Maison de l'Energie/ Energiehuis) is an initiative of the Brussels-Capital Region coordinated and financed by the Energy and environmental agency (Bruxelles Environnement/ Leefmilieu Brussel).

Established as a non-profit organisation, the Energy House offers free advice and accompanies the households in their renovation works.

During a visit, experts offer the following:

- research and explanation of technical solutions (insulation, installation and regulation of heating and hot water, ventilation, renewable energy);
- identification and explanation of regulatory aspects (EPC, planning, etc.);
- comprehensive analysis and financial simulation: estimating gains on energy bills;
- analysis, estimation, explanation and preparation of financial aid and funding solutions (grants and loans);
- identification and initial information on the formalities and administrative and legal steps;
- small interventions that could be achieved at lower costs, of which three of them can be made for free by consultants during another visit;

Sources : http://www.environnement.brussels/ ; http://www.maisonenergiehuis.be.

6. CHECKBOX FOR ESTABLISHING SUCCESSFUL SUPPORT SCHEMES

This chapter summarises the main recommendations in a checkbox, a useful and easy to use tool for policy-makers and civil-servants.

STRATEGIC POLICY MAKING	DESIGN AND IMPLEMENTATION	EVALUATION AND OTHER ASPECTS
☑ Differentiate financial instruments according to the market conditions and the technical characteristics and maturity of each technology ☑ Avoid long-periods between announcement of a financial incentive and its actual application ☑ Run the scheme for at least 5 years in order to provide stability ☑ Avoid stop and go policies and assess the establishment of off-budget financial instruments (e.g. funds from carbon tax like in Switzerland or levies for the gas bill) ☑ Avoid conflicting support schemes (e.g. to fossil-based heating systems) ☑ Consider/request robust data and clear information in the design of any new scheme	☑ Ensure the contribution of different stakeholders ☑ Launch on-line public consultations and /or well-organised meetings with experts and civil society ☑ Avoid that consultation brings about delays and abrupt interruptions ☑ Establish clear and transparent eligibility criteria ☑ Differentiate the methodology for setting support levels according to the target group ☑ Complement the scheme with a built-in revision mechanism to adapt the support level to falling technology costs ☑ Implement a robust control mechanism or alternative measures to secure the participation of competent professionals, certified equipment and the execution of durable systems ☑ Provide a mechanism through which the consumer can register their complaints and receive public advice /support ☑ Reduce the administrative procedures to a minimum ☑ Check compliance with State aid regulations ☑ Promote innovation in new buildings and through bonuses	☑ Undertake periodic evaluation to track whether policy objectives are being met. ☑ Pay particular attention on the impact for those more susceptible to energy poverty ☑ Communicate the gains and success of the support scheme to help policy makers and the public understand the distributional impact of a scheme ☑ Earmark some budget for marketing and communication ☑ Assess the possibility to provide pro-active support and advice ☑ Use the information gathered during the evaluation phase to help on the design of new support schemes ☑ Use the information gathered during the evaluation to promote training sessions for people running the scheme ☑ Make sure that information gathered during different phases of the scheme is shared with stakeholders (trade associations and installers), whenever adequate ☑ Write the final report on the scheme and share it with the public after excluding sensitive information ☑ Generate useful indicators about the scheme that can be easily understood and used by market agents

ANNEX: OVERVIEW OF RENEWABLE HEATING AND COOLING TECHNOLOGIES

This section aims to provide policy-makers with an overview of RES-HC (deep geothermal, biomass, solar thermal, geothermal, hydrothermal, and air-source heat pumps), their different sizes and applications.

GEOTHERMAL ENERGY

Geothermal energy is the heat from below the earth, which is extracted through boreholes. Geothermal heating & cooling can supply energy at different temperatures (even up to 250°C, usually for industry), at different loads, and for different demands.

Geothermal heat pumps and other shallow systems

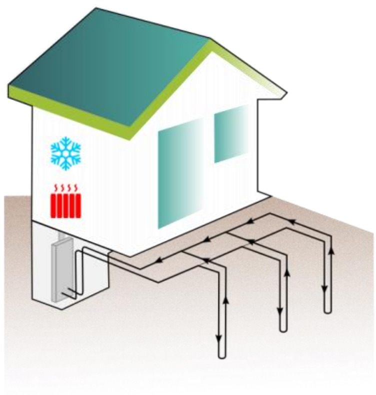
Shallow systems typically use heat at depths of up to 400m coupled with heat pumps to provide space heating, domestic hot water and space cooling with a single device. Thermal energy can also be stored at these depths. Shallow geothermal energy can be installed almost everywhere in Europe.

Two techniques exist for the use of shallow geothermal energy.

- Open loop systems extract groundwater, reinjecting it after the thermal energy has been used.

- Closed loop systems use a closed circuit underground. Closed loop systems can either be Horizontal closed loop, or vertical loop, also known as a borehole heat exchanger- these can reach depths of hundreds of metres.

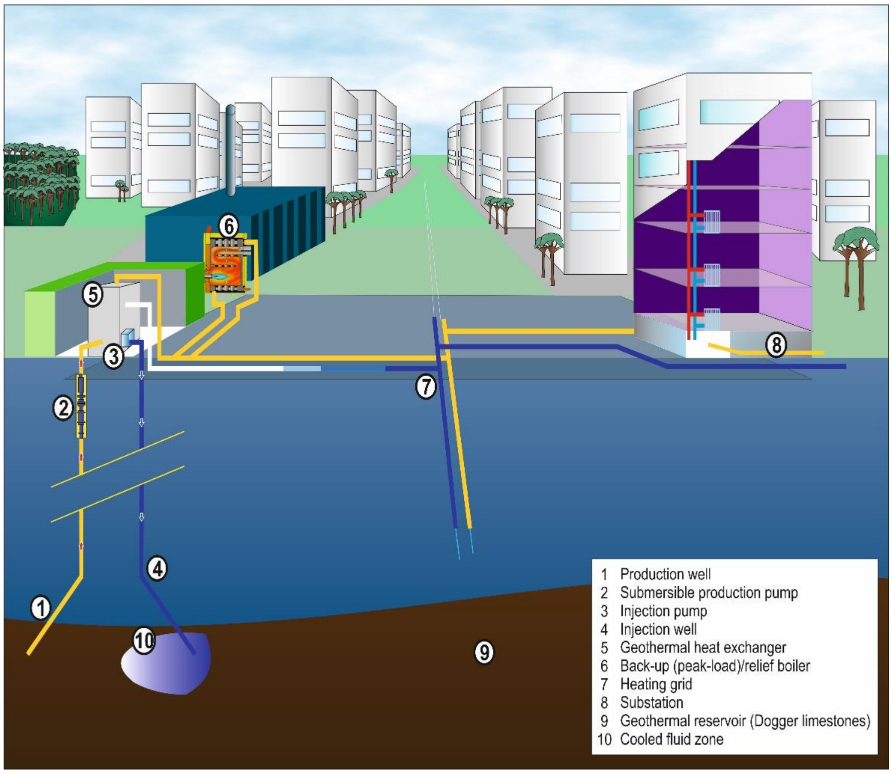
Storage systems are known as Aquifer Thermal Energy Storage (ATES) and Borehole thermal energy storage system (BTES system)



Shallow geothermal system, copyright IF technology/ ReGeoCities

Shallow geothermal systems are available virtually everywhere, but local geology affects the costs of installation. Factors which have an impact include the availability of groundwater and the thermal properties of the underground.

The cost of operating a system depends on the cost of the energy supplying the heat pump and its seasonal performance factor). Another factor which affects the costs is the final use, as systems which deliver both heating and cooling are generally more efficient than systems which deliver heat only.



Geothermal district heating system. Copyright GPC IP/ GeoDH

The initial cost of installing a geothermal heat pump can be higher than installing a traditional gas boiler, however after installation the operational costs of a Ground Source Heat Pump are stable and low, meaning that the initial cost is paid back relatively quickly.

More information about shallow geothermal energy can be found at regeocites.eu.

District heating

Geothermal District Heating (GeoDH) is the use of geothermal energy to provide heat to buildings and industry through a distribution network.

The main services available from a district heating system are space heating, hot water distribution, and space cooling. A district heating system also include co-generating power plants, conventional boilers, municipal incinerators, solar collectors, groundwater heat pumps, and industrial waste heat sources. Depending on the temperature of geothermal water, it may be advantageous to develop a hybrid system including a heat pump and/or conventional boiler for peaking purposes.

Many geoDH systems are based on areas of hot sedimentary basins, and on the doublet concept of heat extraction. Modern doublet designs include two wells drilled in deviation from a single drilling pad. Hole spacing is designed to secure a minimum twenty-year life span, before cooling of the production well occurs. Depths of the well (deviated) of 2,000m to 3,500m are not uncommon; these are often located in sensitive, densely populated urban environments, therefore require heavy duty, silent rigs (up to 350 tonnes hook loads, diesel electric drive).

A geothermal district heating system comprises three major components, as shown in the figure above

The first part is heat production which includes the geothermal production, conventionally fuelled peaking station, and wellhead heat exchanger (elements marked 1-2-3-4-5 on the figure above).

The second part is the transmission/distribution system, which delivers the heated or cooled water to the consumers (element 7).

The third part includes central pumping stations and in-building equipment. Geothermal fluids may be pumped to a central pumping station/heat exchanger or to heat exchangers in each building. Thermal storage tanks may be used to meet variations in demand.

District cooling

Cooling based on absorption chillers, using water as a refrigerant and lithium bromide (or ammoniac) as an absorbent seems an appropriate answer, provided minimum geothermal temperatures stand above 70 °C. The refrigerant, liberated by heat from the solution produces a refrigerant effect in the evaporator when cooling water is circulated through the condenser and absorber. In the Paris Basin, for instance, absorption chillers can be placed in grid substations and the primary hot fluid supplied by the geothermal heat plant. The chilled water can be piped to consumers via the same flow circuit used for heating and the same heaters although, in this respect, alternative devices (fan coils, ceiling coolers) would be preferable. Note that each absorption chiller unit needs to be equipped with a cooling tower.

Geothermal in agriculture

Geothermal is increasingly being used in the agri-food industry as it meets many of the sectors' requirements. Low or medium temperature geothermal heat is available everywhere, and the systems enabling its use are simple and easy to maintain. Geothermal projects are installed locally and provide heating and cooling at competitive prices. They create direct and indirect jobs across the value chain.

Here are the different uses for Geothermal energy in agriculture:

- Geothermal energy in greenhouses: Replacing traditional energy with geothermal energy has decreased energy cost by 80% and operating costs by 5 to 8%;
- Geothermal energy for drying food;
- Geothermal energy for warm water irrigation: geothermal is used to give the right water temperature for plants;
- Geothermal energy in open field heating: geothermally heated water can be used in open field heating;
- Geothermal energy for aquaculture

AIR-SOURCE AND HYDROTHERMAL HEAT PUMPS

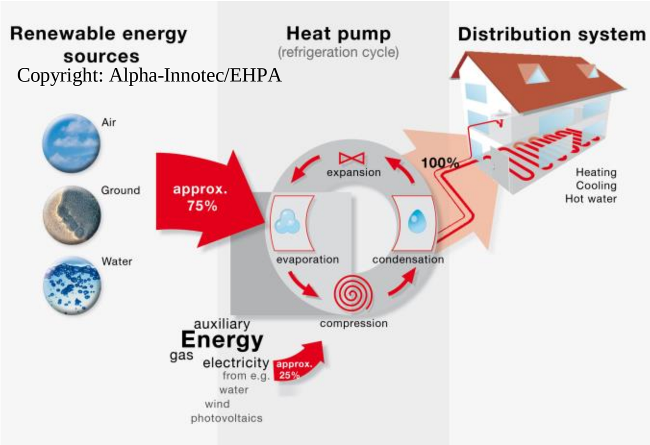
A heat pump is a device that can provide heating, cooling and sanitary hot water for residential, commercial and industrial applications. It converts energy from air (aerothermal), ground (geothermal) and water (hydrothermal) to useful heat. This conversion is done via the refrigerant cycle.

Typical capacities range from 2-20kW for single family buildings up to 100kW for multi-dwelling residential applications. For commercial applications, the capacity is even bigger, and for industrial and district heating installations, the capacity can reach the range of several MW.

Heat pumps transform renewable energy from outdoor air or water to useful heat. A heat pump system consists of a heat source, the heat pump unit and a distribution system to heat/cool the building.

The main type of refrigeration cycle that is used is the electric compression cycle, that works in the following way: a transfer fluid (refrigerant) transports the heat from a low-energy source to a higher energy sink. Auxiliary energy is needed to run the compressor and the pumps (usually electricity or gas).

Heat pump systems can be used for heating or cooling. In the heating mode, outdoor ambient energy is the heat source and the building is the heat sink. In the cooling mode, the building is cooled down using the outside as heat sink.



Energy distribution: Heat pumps use air or water as heat distribution media inside the building. Depending on system design, they can use the air directly at the installation point or use a duct (air) or pipe (water) distribution system to provide energy to fans, radiators or floor heating systems. Ductless heat pumps are installed on a wall and act as a localized heat source, like a wood/pellet stove. This is a typical solution for homeowners, in particular when also cooling is needed.

Air source heat pumps: This technology comes in several variants, with the most typical ones being:

1. compact (monobloc) units: all heat pump components are combined inside one case;

2. Split systems: the outside and the inside heat exchanger are installed in two cases, with one installed on the outside of the building and the other inside. Both are connected via a refrigerant line. In single family buildings, most often single split systems are used in which the outside unit is connected to one inside unit. In multifamily or commercial applications, typically multi-split solutions are used where one outside unit supplies several inside units.

Efficiency considerations: The efficiency of heat pumps depends mainly on the temperature difference that needs to be overcome. The higher the sink temperature required by the distribution system, the less efficient the heat pump. This fact makes heat pumps more suitable for the connection to low temperature heat distribution systems (fan coils, floor heating or low temperature radiators).

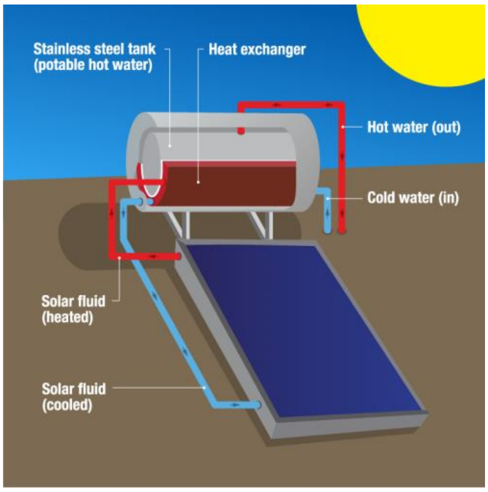
SOLAR THERMAL

The basic principle common to all solar thermal systems is simple: heat from solar radiation is conveyed to a transfer medium – usually a fluid but also air in the case of air collectors. The heated medium is used either directly or indirectly, by means of a heat exchanger which transfers the heat to its final destination. Solar thermal can be used in a wide variety of applications, including domestic water heating, space heating, space cooling, district heating, process heat generation for industry, etc.

Solar Domestic Hot Water (SDHW)

Solar Domestic Hot Water systems is the most common use of solar thermal energy worldwide. These are usually divided in thermosiphon and forced circulation systems.

Thermosiphon (or natural flow) systems: Thermosiphon systems use gravity to circulate the heat transfer medium (usually water) between collector and tank. The medium is heated in the collector, rises to the top of the tank and cools down, then flows back to the bottom of the collector. Domestic hot water is taken either directly from the tank, or indirectly through a heat exchanger in the tank. The main benefit of a thermosiphon system is that it works without a pump and controller. This makes the systems simple, robust and very cost effective. In most thermosiphon systems, the tank is attached to the collector and both are situated on the roof. This solar thermal system is most common in the frost-free climates of Southern Europe.



Forced circulation systems: These are most common in Central and Northern Europe, but are also the dominant application in some Southern Europe countries such as Spain, particularly for medium-sized applications. The tank can be installed anywhere as the heat transfer fluid is circulated by a pump. Therefore, integration with other heating systems is easier. The aesthetic benefit of these systems is that the tank does not have to be located on the roof. A forced circulation system will need sensors, a controller and a pump.

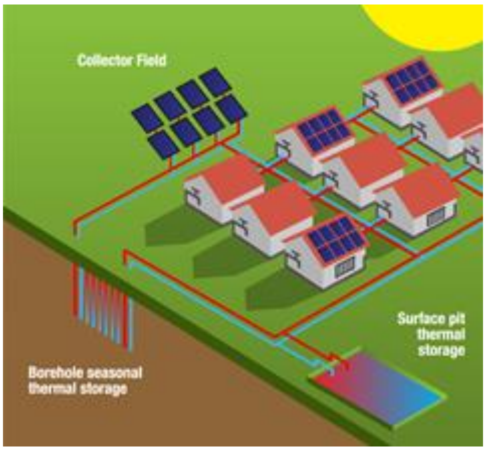
Collective SDHW for larger buildings: Central water (and space) heating is common in larger buildings. Increasingly, collective solar domestic hot water systems are being installed into multi-family houses, hotels, office buildings etc. These collective systems have a collector surface ranging from ten to several hundred square metres.

Combined DHW and space heating & Cooling (Combi-systems)

In Central and Northern Europe, solar thermal systems that provide heat both for domestic hot water and for space heating are commonly installed. These combi-systems are often more complex than solar systems supplying DHW only and, as a result, system design must be adapted to the specific requirements of the building.

Different practices are used in different countries. In Southern Europe, combi-systems are still rarely used, but there is a huge potential for these systems to generate space heating in winter and air-conditioning in summer, as well as DHW throughout the year.

District heating



Solar district heating (SDH) plants are a very large scale application of the solar thermal technology. These plants are integrated into local district heating networks for both residential and industrial use. During warmer periods they can totally replace other sources, usually fossil fuels, used for heat supply. Thanks to technological developments, it is now also possible to store heat in summer for winter use. Currently there are many plants in operation in Sweden, Denmark, Germany and Austria. Denmark remains the unchallenged leader in SDH: out of the six largest solar thermal installations worldwide, four are Danish SDH. The currently largest SDH, in Vojens, consisting of 70,000 m² collectors (49 MWth), is however about to be surpassed and dwarfed by a 450,000 m² (350 MWth) SDH system currently being planned in Graz, Austria.

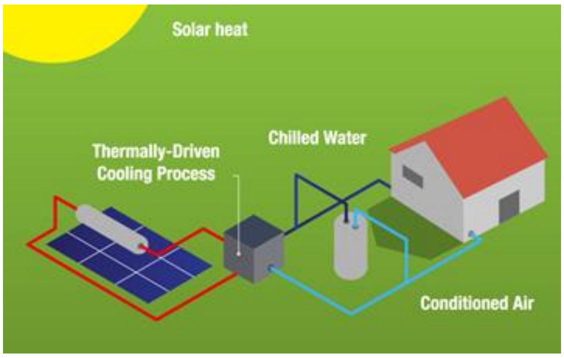
Process heat for industry

Commercially available solar thermal systems are well suited for generating low temperature heat up to 150°C. Most solar applications for industrial processes are on a relatively small scale and still largely of an experimental nature. There are already well known applications of solar thermal heat in breweries, dairies, mining, agriculture (crop drying) or textile sector. In 2015 about 150 large-scale SHIP systems are documented worldwide ranging from 0.35 MWth to 27.5 MWth (39 300 m²).

Recently, there have been developments in collector technology that allow solar thermal systems to be used in low temperature industrial processes ranging from drying to pasteurisation or sterilisation. There is great potential for this application in the food, beverage and transport equipment sectors.

Systems providing solar heat for industrial processes includes a large or very large solar collector field, through which a working fluid circulates. Collectors can vary, from flat plate to solar concentrating collectors, which can reach temperatures over 250 ºC. By means of a heat exchanger, the heat is transferred from the primary circuit to the process heat circuit. The system may incorporate a heat storage unit.

Solar cooling



The main feature of a solar cooling system, beyond the solar collector field, is the thermally driven chiller. On the thermal supply side, the solar thermal system is rather conventional, consisting of high quality solar collectors, a storage tank, a control unit and pipes.

For the cooling process, the main element is the thermally driven cooling machine but the process of heat rejection is also important. This means that cooling towers or other heat rejection solutions are required. The most common technological solution is an absorption cycle: the heat is used to chemically “compress” the refrigerant by desorbing (separating) it from a sorbent, cooling is produced as the “compressed” liquid is expanded in the evaporator to turn into gas.

BIOMASS

"Biomass means the biodegradable fraction of products, wastes and residues from biological origin from agriculture (including vegetable and animal substances), forestry and related industries including fisheries and aquaculture, as well as the biodegradable fraction of industrial and municipal waste" Renewable energy directive (2009/28/EC). In other words, biomass is any material of organic origin. Wood, straw, vegetable oil, manure, and agro-industrial and organic waste are all biomass and can all be used to produce energy.

Biomass heating can be achieved with a wide variety of fuels such as wood pellets, wood chips, briquettes or wood logs and can be used in a wide variety of technologies. For domestic purposes, firewood or wood pellets are most frequently used.

Biomass stoves

Biomass stoves produce heat only, typically for one single room but sometimes more than a room. They are logwood, woodchip or wood pellets burning stoves that can complement your conventional boiler to supply heating. Traditional wood burning stoves are using wood logs. More sophisticated models run on wood pellets which are mainly made of compressed sawdust. The use of the resource is highly efficient as the thermal efficiency of modern stoves ranges from 80 to 91%.

- Firewood stoves: These stoves can be used to heat single rooms or small houses and are available with outputs from 3.5 kW to 20 kW. Stoves can be found in wide variations in design, such as doors with or without viewing glass or casings of tiles or soapstone.

- Wood pellet stoves: Pellet stoves are more sophisticated than firewood stoves because of the automatic operation. Pellet stoves usually have a small fuel pellet storage, from which the pellets are conveyed by a small auger to shaft from where they fall into the combustion chamber. A fan provides the air needed for combustion. Advantages as compared to firewood stoves are: fully automatic operation, higher efficiency, cleaner burning, and easier to use. Capacity range of domestic pellet stoves is between 1.5 kW to 12 kW

Where do they go?

Biomass stove are installed indoors, ideally central to the volume to be heated. A typical domestic biomass stove itself can be quite small, the size of a domestic washing machine. However, the fuel store can be bigger depending on how much fuel is needed and how often supplies are purchased.

Recharging and storing

Pellet stoves are equipped with a pellet tank to be refilled with bags of pellets once every 1-3 days. The frequency of recharge depends on the size of the storage unit and the heating demand. While storing, the wood based solid biofuels should be protected from humidity as the quality of the fuel is critical for the efficient running of the boiler.

Biomass boilers

Biomass boilers for residential purposes can be used to provide heat and domestic hot water, and can replace your conventional boiler as they can be fully automatic just like their oil and gas equivalents. Modern boilers are also highly resource efficient as they achieve efficiencies between 80 and 107%.

- Firewood boilers are more suitable for houses and they are popular in rural areas. Firewood boilers are designed to be loaded with more wood than wood stoves. Wood is manually loaded into the appliance, and their capacity range is between 15 kW to 70 kW. The technology has been improved dramatically; Two-stage combustion with automatic ignition, blower fan and reduced heat losses are examples of these improvements. Modern firewood boilers achieve efficiencies of more than 90%.

- Wood chip-fuelled boilers may be used to provide heat in larger houses, for farm buildings, or for industrial furnaces. Automatic operation and low emissions because of continuous combustion are the advantages of wood chips heating systems. Wood chip-fuelled boiler capacity ranges between 15 kW and industrial scale.

- Wood pellet boilers are used for capacities in the range between 15 KW and industrial scale. These boilers are usually installed in a basement or in a separate container outside the house; fuel storage should ideally be located close or next to the boiler room. Wood pellet boilers operate fully automatically, whether they are top feed, horizontal and underfeed burners. Ash removal is generally automated and the exterior ash box requires emptying once or twice a year.

How do they work?

Wood pellets are stored in a dedicated storage place and transported automatically up to the combustion chamber. The amount of air in the combustion chamber is controlled to burn the wood as efficiently as possible, leaving very little ash and almost no smoke. Therefore, it requires emptying the ashes only 1 to 5 times per year. Like any other boilers, yearly maintenance from a professional is required. Above the combustion chamber, heat exchangers are used to heat water, which is then piped throughout the house's radiators.

Where do they go?

The boiler and the fuel storage are generally installed in the cellar or garage. However, the installation can be flexible as the storage can be up to 20 meters away from the boiler.

Recharging and storing

The storage is recharged generally once/twice a year using blower trucks.

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Co-funded by the Intelligent Energy Europe
Programme of the European Union