



Smart and flexible 100% renewable district heating and cooling systems for European cities

Guide for regional authorities

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Foreword



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For anyone interested in sustainable heat supply, these are exciting times! In December of this year, the European Commission will publish for the first time ever a strategy paper specifically dedicated to heating and cooling. More generally, in Member States (and cities!) all across the EU, the question of how to provide citizens with thermal comfort in a manner consistent with Europe’s broader climate and energy objectives is high up the agenda.

While these discussions take different forms and directions from one country to the next, a common thread is the key role that heating and cooling networks can and must play in delivering renewable energy to the heart of our cities. This trend looks set to accelerate as the EU begins to establish a policy framework intended to deliver enhanced energy security and almost total decarbonisation by 2050.

Choosing district energy means saying no to continued dependence on fossil fuels imported from abroad. It means using the locally available resources in our communities. It means choosing to invest instead of simply spending. The SmartReFlex initiative is a welcome and valuable tool to help ensure that this vision becomes a reality on the ground, notably by highlighting the importance of getting the right public policy framework and market conditions in place. I encourage anyone wishing to contribute to this process to give this report deep consideration. You will not be disappointed!

Happy reading and good luck!

Paul Voss
Managing Director Euroheat & Power

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1. Summary

SmartReFlex wants to provide both the knowledge and inspiration on ways in which a high percentage of renewables can be achieved in district heating systems. The approach chosen calls for several activities to be completed in parallel as summarized below:

1 A regional task force should be set up to ensure a continuous commitment and involvement of all key stakeholders as well as the long-term sustainability of the actions. In the participating regions of SmartReFlex the implementation of the task forces has shown that a wide variety of members is needed, e.g. representatives from the regional authorities, town or city councils, DHC experts, city planners, consumer associations, banks and financial institutions, heat planning organisations, etc.

2 The second activity within the SmartReFlex approach is to organise capacity building workshops involving the relevant stakeholders at both regional and national level. This includes the technical and management staff of town/city councils, regional authorities, DHC utilities, DHC industry as well as technical designers and city planners, DHC customers, cooperative unions, consumer protection associations, banks and financial institutions.

3 Another key element of the approach is to involve in the different activities the regional authority with responsibility for implementation or an equivalent representative in order to guarantee successful implementation. The reason for this is that those representatives can help to communicate to other stakeholders in an effective manner and to implement the conclusions and lessons learned from the different activities.

4 And finally, all the participating stakeholders should learn from experienced experts and consultants - also from abroad. This will cover both the technical field of DHC, e.g. integration of a high percentage of renewables into DH systems. As well as the non-technical areas such as providing advice on the important work required relating to policy at regional and local level.

In conclusion, it is essential to bring together the ideas and objectives of the different stakeholders within the region to form a group of people with different expertise, experiences and needs who share a common vision of a sustainable energy future.



2. Introduction



This guide was produced for regional authorities in Europe. It gives recommendations on creating, organising and managing a process for the introduction to market of district heating & cooling (DHC) systems with a high percentage of renewable energy sources (RES). As an example, we demonstrate the Danish success story of integrating renewable energy sources in district heating. The implementation approach of six European regions is also described.



The approaches include for instance:

- Improvement in regional legislation and framework, facilitating and supporting the implementation of RES DHC;
- Integration of RES DHC in heat planning at regional and local level;
- Creation of cooperatively-owned companies to manage RES DHC systems;
- Study, planning and support of new RES DHC projects at local level.



The guide was developed within the SmartReFlex project which includes the ‘coaching’ country Denmark and six implementing regions in four different countries: Catalonia (ES), Tipperary and Kerry (IE), Emilia-Romagna (IT), Schleswig-Holstein and Baden-Württemberg (DE).

The involvement of the regional authorities of the implementing regions (or of equivalent representatives) guaranteed a smooth development of the implementation approaches. The local stakeholders have also been facilitated in the implementation process by a group of consultancy partners.



SmartReFlex -
**Smart and Flexible 100% Renewable District Heating
and Cooling Systems for European Cities**

The SmartReFlex project aims to increase the number of smart and flexible district heating and cooling (DHC) systems with a high percentage of renewable energy sources (RES) in European cities. In order to achieve this target, a mixed project consortium was created, including:

- Regional authorities, which have the power to improve the legislation framework for RES DHC and to support and encourage local authorities and municipalities to develop projects on the ground;
- DHC utilities, which bring both the needs of the industry and the technical expertise;
- Consultancy partners with specific high-level skills in RES DHC and in energy planning at local level.

3. Why district heating?

District heating

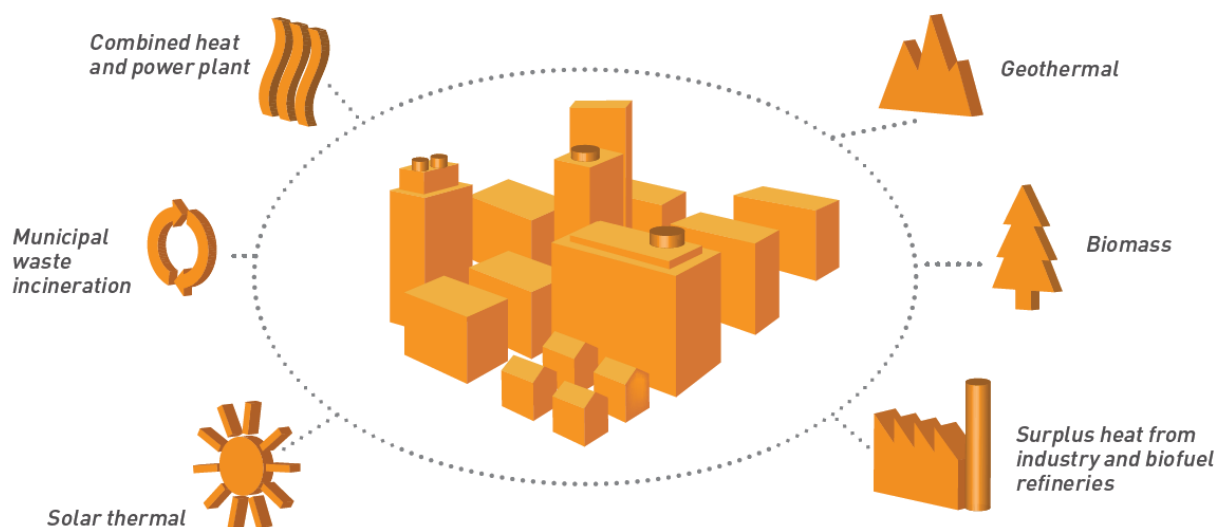
District heating can be described as a system in which water is heated in one or several larger units and is then delivered via pipes to the residential, commercial and/or industrial customer's premises where the heat is extracted for heating purposes or hot water preparation.

District heating systems make it possible to optimally use and combine a large spectrum of energy inputs and different forms of renewable heat such as for instance solar thermal, geothermal or biomass as illustrated in the graphic below. Furthermore, it is possible to use surplus heat from electricity production in combined heat and power plants (CHP) whether using conventional or renewable fuels as well as heat from waste incineration and/or from industrial processes.

Lower carbon dioxide emissions

Among many other benefits, modern district heating and cooling (DHC) systems facilitate the efficient use of energy and allow for the large-scale integration of renewables in urban areas.

Both of these major benefits generate lower carbon dioxide emissions and can significantly contribute to the achievement of national and European Union energy policy objectives.



By using surplus heat from industry and various renewable energy sources the consumption of primary energy resources is reduced. Another advantage to society is waste incineration that solves societal tasks efficiently by saving resources.

It is also important to keep in mind that DHC technologies are suitable for both the residential and non-residential sector including industry.

Impressive fuel flexibility

Modern district heating systems use surplus heat not only from electricity generation, but also from all kinds of heat-generating processes, such as industrial production and waste incineration.

At district heating plants it is technically possible to choose the type of primary fuel that is most appropriate in a specific situation. This means that it is possible to use fossil fuels such as oil, coal and gas, residual products from forestry and agriculture such as wood pellets, straw and woodchips, as well as other sustainable sources of energy - even within one and the same system.

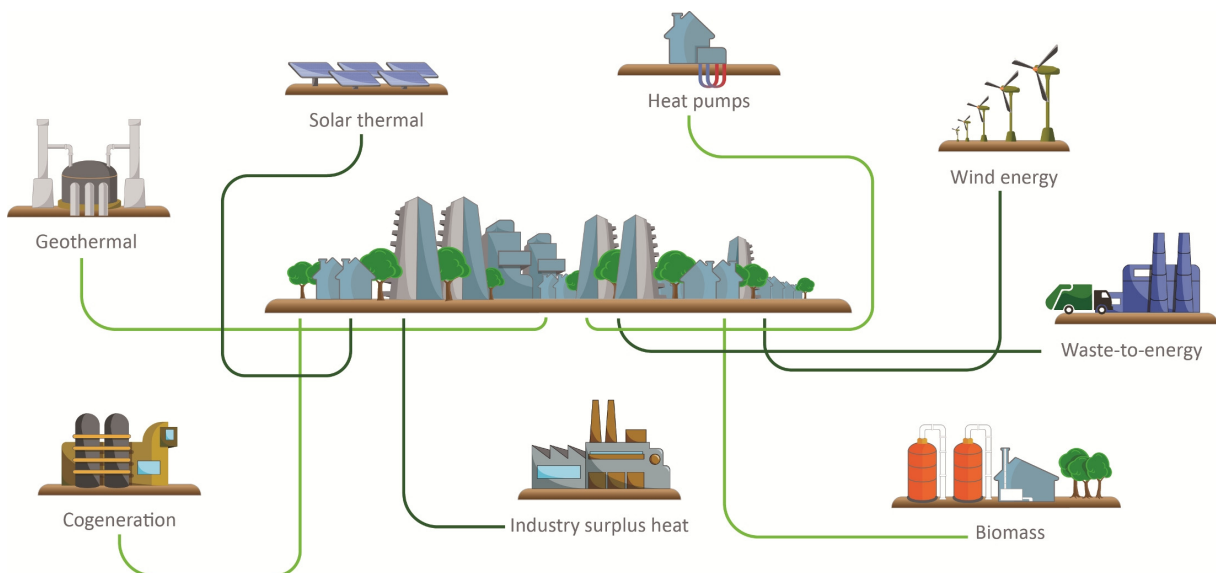
Impressive flexibility in the choice of primary fuel improves supply reliability and decreases dependence on importing primary fuels for energy production.

Another major benefit of district heating is that it can use a wide variety of local energy sources that are less efficiently and cost-effectively deployed in individual applications.

As energy for district heating is generated on a larger scale, it can, for instance, integrate combustible renewables that are difficult to manage in small boilers. This includes most combustible renewables such as wood waste, straw and olive residues and also waste sources like municipal waste and sewage sludge. A variety of biofuels, geothermal energy and also the fluctuating renewable energy production of heat and power, e.g. solar thermal or wind, can be integrated in an efficient manner into the district heating network using different techniques.

The current district heat supply and distribution networks are suitable for current levels of heat demand, but with the increase of renewable energy supply and the decrease in final heat demand, DHC must continue to evolve within its context to continue representing a smart, sustainable and inclusive solution. In future, the distribution networks will be characterised by the capacity to

operate with lower and/or more flexible temperatures. This key change will allow both: lower distribution heat losses and higher utilisation of available RES such as solar thermal, biomass and geothermal energy.



District cooling

Like district heating, district cooling offers solutions tailored to local conditions which use the flexibility of the district heating infrastructure. Compared with conventional electricity-driven chillers, district cooling increases the overall efficiency of energy systems and the environmental standards as it:

- contributes to the phase-out of Hydrochlorofluorocarbons (HCFCs) which are used by traditional compression cooling machines and are harmful to the ozone layer and contribute to the greenhouse effect
- reduces summer peak loads in electricity grids and thus the corresponding investment needs
- provides the opportunity to better exploit existing production capacities (e.g. use of surplus heat) and reduces the need for new thermal (condensing) capacities
- provides the opportunity to use renewables

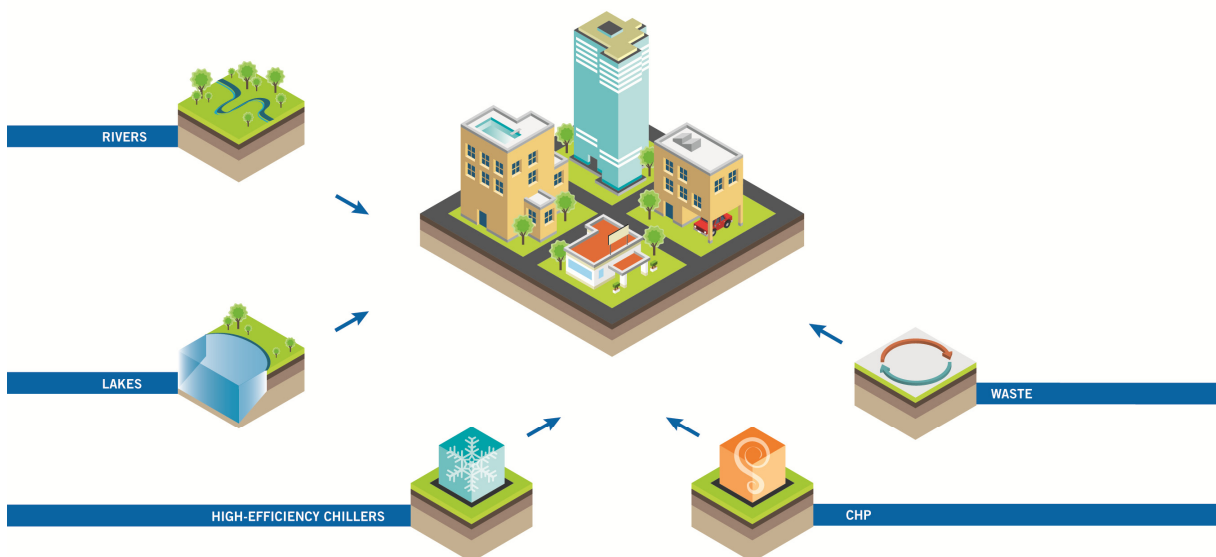
Effective cooling

In district cooling systems cold water at a temperature of approximately 6 °C is distributed.

The cold is extracted at the customer's premises and the chilled water circulates through the building where it collects the heat to cool down the temperature of the building.

Space and process cooling is rapidly becoming a necessity rather than a luxury and this represents an exponentially growing market. This has gone relatively unnoticed by policy planners, partly because cooling needs are traditionally being met by electrical air conditioners hiding the cooling element in the building's overall electricity consumption.

District cooling offers a resource saving alternative to such developments. With chillers driven by surplus heat from district heating networks and with the additional use of other natural energy sources that would have remained unused without the district cooling system (e.g. ground-, river-, lake and sea water), district cooling is 5 to 10 times more energy efficient than electrical air conditioning systems.



4. Successful integration of renewables in district heating

- The Danish story

The story of renewables in Danish district heating systems is about the development of district heating systems itself and about district heating systems being a tool for reaching the goals of the national climate policy. The target is to reach 100% fossil free electricity and heat production by 2035 and statistics demonstrate that the share of non-fossil based energy production is already now substantial.

Planning of the energy infrastructure

Planning of district heating should be undertaken in coordination with other energy planning, in particular electricity. The large - and increasing - amount of wind power in the Danish energy system can only be utilized effectively if electricity is used in heat pumps which also use waste heat from industry etc. District heating does not only concern heat supply and supply of hot tap water - district heating is a crucial part of the energy infrastructure making it possible to use of fluctuating renewable energy sources.

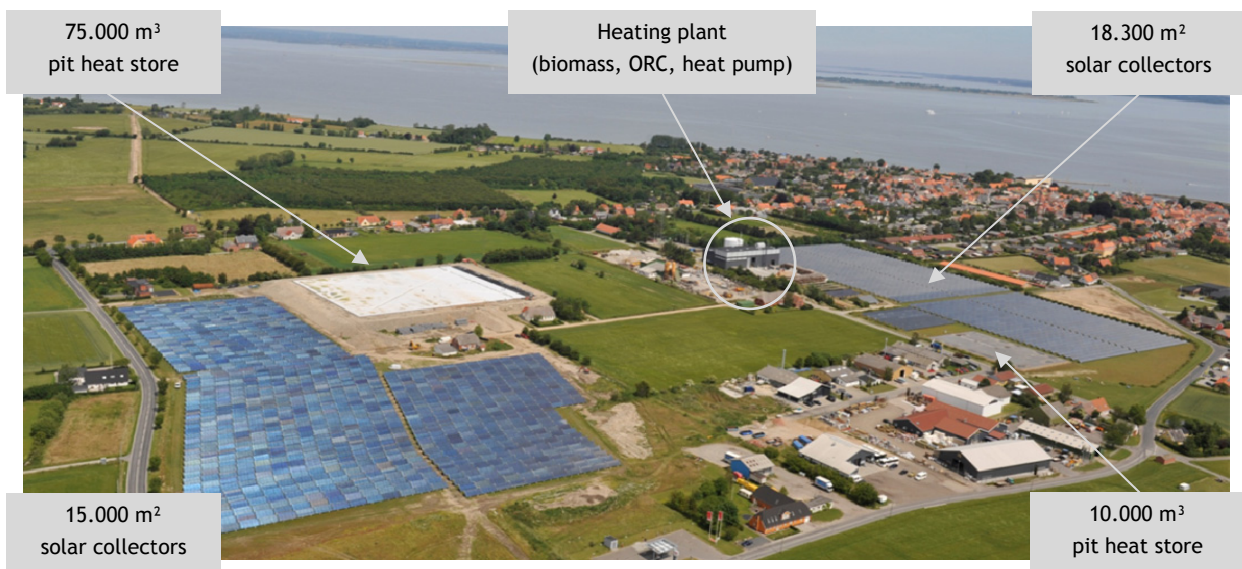
Two key points for success

Consider district heating as an energy infrastructure - which enables and facilitates the use of different energy sources.

Ensure appropriate framework conditions - a regulation that covers part of the external costs and thus provide incentives to the different stakeholders.

Energy efficiency and the efficient use of resources (primary energy factor) should govern the process of planning heat supply. District heating is the obvious choice for an energy infrastructure in many cases (but not always!). As a system, which collects resources which would otherwise be wasted, district heating requires organisation to facilitate its establishment. Organisation is therefore an essential factor - how can this be facilitated?

Aerial view of the 'smart district heating' system in Marstal, Denmark with solar thermal collectors, biomass ORC, heat pump and heat storage system.



Public acceptance

Local acceptance is crucial as is knowledge of local resources and conditions. The framework conditions such as legal issues, taxes etc. are also crucial. Hence, predictability is a key parameter for long term investments such as district heating. Non-profit structures (which does not mean 'not profitable'!) can protect consumers from exploitation of monopolies, and for this reason it is appropriate to consider companies owned and run by local consumers/communities or by the local authority.

An important argument for the introduction of collective (heat) systems is that they are advantageous both for individuals and for society in general. You need organisations to manage the investments and to link the individual and society (in this case the district heating company). In a collective system, public participation and acceptance are crucial. One way to obtain this acceptance is to make it clear that a collective system is the most efficient one, where this is relevant. How would water supply, wastewater or solid waste be handled without collective systems for example? The priorities of a society (e.g. the fight against climate change) justify the restriction of individual solutions. Achieving environmental standards for example is often most cost efficient when managed in collective systems.



Three out of four Danes are supplied through collective heat supply systems (district heating or natural gas). 99% pay less than the costs which would have been charged with individual heat supply systems. The goal should be that all the advantages are reflected in the (lower) price, because the price of different solutions is easy to compare. Even if a small percentage of district heating customers is paying a higher price than individual heating customers, it has serious consequences on the reputation and thus the acceptance of district heating.

However in Denmark district heating started without 'appropriate framework conditions' or national political objectives. The development of district heating was a result of a private initiative - consumers got organised and established a district heating plant. Only in a few cases municipalities were behind the installation of a district heating plant. The primary role of the municipalities was to provide guarantees for loans, which remains an important role today.

Some Danish figures

Denmark has 16 central CHP plants which were originally standard power plants.

There are 415 decentral plants of which 285 are CHP and 130 are heat-only plants.

Originally all decentral plants were heat-only plants. The main purpose of the decentral plants is the production of heat.

The development of district heating in Denmark - private and local initiative

In the beginning of the 1900s surplus heat from power plants was used in hospitals and other large buildings. In the 1920s and 1930s centralized collective heating emerged in larger new building areas. The 1950s saw district heating plants being established on a large scale at a rate of 5 new plants per year. The peak was in the 1960s with 45 new plants in 1964.

District heating thus emerged and developed primarily on local and private initiative - a bottom-up approach. This changed towards a more top-down approach with the two oil crises in the 1970s when an energy policy was introduced in Denmark. This resulted in the first Heat Supply Act in 1979 that introduced rules and a framework for heat planning - a new public planning process: Municipalities now had to map the existing heat demand, the heating methods applied and energy usage.

Furthermore, municipalities had to estimate future heat demand and heating possibilities. The data from the municipalities was applied by the counties in regional heat supply overviews. The municipalities had to develop proposals for the future heat supply; the counties produced regional draft proposals. Based on this the counties drafted regional heat plans describing the areas in which the different heat supply technologies had priority and also the location of future heat production plants and pipelines.



Planning in the 1980s enabled a more environmental friendly supply. A key priority was investment in the domestic natural gas infrastructure. Another priority were combined heat and power (CHP) plants, i.e. the use of the surplus heat from large power plants. In 1986 the State and the public utilities agreed on the installation of 450 MW_{el} of small CHP-plants. This introduced a decentralised structure of production capacity that enabled district heating based on CHP also in smaller cities. The decentralized structure also facilitated a third priority: The investigation of different technologies, including biomass and waste heat (local resources).

A way for municipalities to secure investment from the utilities was a mandatory connection to collective supply systems (district heating or natural gas). It was introduced in 1982 and is still in force but not widely applied, mainly due to the lack of acceptance of this type of measure. Another measure was a ban against electrical heating which was introduced for new buildings in 1988 and for existing buildings with water based heating systems in 1994.

Taxes in Denmark

A high level of taxes which also applies in times of low fuel prices facilitates incentives for energy conservation.

Taxes are applied on fossil fuels for heat production whereas biomass and biogas are exempted from taxes.

After a successful implementation in the 1980s, the objective was to simplify and decentralize the decision-making process for the installation of new district heating plants and to move away from the top-down approach dominating the planning in the 1970s and 1980s. A project-based planning scheme was introduced which is still in force.



The planning hierarchy in the 1980s consisted of three levels: state, county and municipality. In 1990 the municipalities became solely responsible for heat planning within the framework of some overall regulations laid down by the Minister. Today, the municipalities still have this role (after several years without any heat planning).

A key point is the municipal guarantee for loans reducing the capital costs related to the large investments. Furthermore, there is a trend towards strategic energy planning where heat planning is coordinated as part of other municipal planning.

The role of municipalities - authority or owner and operator

Municipalities can have two different roles: Heat authority or owner and operator of a district heating utility. The role as heat authority involves planning and approval. Planning the heat supply in the municipality together with utilities and other relevant actors and approving specific projects in the municipality to ensure the implementation. The municipality can take the initiative on specific projects and be responsible for the coordination with other municipal planning activities. In Denmark approximately 55 district heating utilities (of more than 400 in total) are owned by the municipality. They deliver more than 60% of the district heating demand. But there is also a close cooperation within non-municipal owned utilities - often representatives from the municipality are in the board of the utility.

The municipality as a key stakeholder

In Denmark the municipality is the key authority for heat plans. The regional level no longer has the formal responsibility but facilitates the coordination between municipalities.

A key motivation for the regions - shared by the municipalities and the state - is to generate employment.

Only 35% of municipalities had elaborated heat plans between 1990 and 2006. 10% of the municipalities did not implement the obligatory ban on electrical heating. Only in some cases the Danish Energy Agency has exploited the option to take over the approval of a project from the municipality with regard to mandatory connections or zoning. In 2006, only 8% of the municipalities cooperated with other municipalities on administration of heat supply. However this is changing now with the strategic energy planning.

5. Introduction to market of renewables in district heating & cooling

- Essential steps

To achieve the key goal of providing knowledge and inspiration to the different stakeholders on how to implement renewables in district heating systems, several activities should be undertaken in parallel:

- Setup a regional task force which assures the continuous commitment and involvement of all stakeholders and also a long-term sustainability of the actions.
- Undertake capacity building activities that aim at involving the key stakeholders in the regions and also at national level in the participating countries.
- Involve the responsible regional authority or an equivalent representative in the activities to guarantee a smooth development of the implementation.
- Learn from experienced consultants with specific high-level expertise in policy advice at regional and local levels and on high-RES DHC.



The SmartReFlex approach

Besides the task force activities, an ambitious capacity building programme is carried out within the SmartReFlex project to ensure the different measures are implemented correctly. This capacity building programme involves the key stakeholders at regional and national level who participate in training workshops in each of the participating regions covering the most important topics:

Design and planning

Technical staff and town/city planners from municipalities and regional authorities, DHC utilities and designers are trained in design and planning issues. Local data methodologies for estimating the potential of district heating are introduced and applied. This can be used for putting district heating on the planning agenda and stimulate an appropriate regulatory framework. The application of GIS tools is also provided and the primary focus is on the steps in heat planning:

- Mapping of present and future heat and cooling demand
- Mapping of resources
- Costs and competitiveness - district energy vs. individual solutions

Technical issues

Technical and management staff from DHC utilities, DHC industries as well as technical designers are provided with knowledge on technical solutions including optimisation. The topics comprise the design of substations as well as the layout of DHC grids and productions plants. Focus is on the following main parts of the system:

- Installation in houses
- The distribution and transmission network
- Production facilities

Organisational and financing issues

Technical and management staff, DHC customers, cooperative unions, consumer protection associations, banks and financial institutions are trained on how to organise and manage district heating systems with up to 100% renewables. Based on the Danish experience of private and municipal district heating utilities the key points are:

- Business plan
- Fuel supply
- How to get customers connected?
- Customer contracts
- How to organise a district heating company?
- How to organise monitoring and payment?

Regional Best Practice example:

Catalonia is a region situated in the north east of Spain, next to the Mediterranean Sea and bordering France at the Pyrenees. Due to its location it has different climatic zones ranging from a mountain climate to milder ones. DHC is not a common solution in Spain or in Catalonia although a number of DHC systems have been installed over the last few decades.

Status quo

Catalonia had 57 district heating and cooling networks in 2014. Most of the networks are small heating networks but four of them are bigger and supply heating and cooling at the same time. Two thirds of the networks in Spain consume renewable energy, accounting for only one third if the percentage is expressed in terms of the installed capacity. The main renewable energy used is biomass in small DH networks.

Key barriers and opportunities

In Spain, there is a lack of specific regulation for district heating and cooling networks as well as an unstable energy policy which can lead to regulatory risk. DHC is nevertheless considered an energy efficient option in the recently updated building regulations. The difficulty to realise networks in already urbanized areas is considered as a barrier along with the lack of knowledge of the urban planners and often inadequate call of tenders. There is some public funding available to support the renovation and retrofitting of existing buildings including DHC networks and to promote the installation of biomass, geothermal and solar thermal energy. It is nevertheless difficult to attract investors due to the long term amortisation, the lack of financing from the banks and little public investment. Among the Catalan population there is a lack of knowledge of DHC systems. The strong feeling to have an individual heating system creates also a lack of confidence in DHC systems.

Goals

- Set legal conditions for RES DHC
- Provide favourable financial conditions for RES DHC
- Establish DHC in new areas and incorporate renewable energies in existing DHC
- Increase the use of local energy sources
- Install a pilot plant
- Improve consumer protection
- Improve the social acceptance of DH
- Further develop the energy cooperative format

Short Facts Catalonia



<i>Location</i>	In the northeast of Spain
<i>Total area</i>	32,108 km ²
<i>Population</i>	7.5 million
<i>Heat demand</i>	22.5 TWh
<i>Cool demand</i>	5.7 TWh
<i>DHC systems</i>	57 DHC systems
	242 MW (heat)
	174 MW (cold)

Regional task force

A regional task force has been created to support the transition towards RES DHC in Catalonia, promoting the improvement of legislation and encouraging local authorities to develop real projects. This group consists of sixteen representatives of different stakeholders (see next page).

Several meetings have taken place with the task force in addition to those of the thematic subgroups. Furthermore in a regional survey the barriers and opportunities for RES DHC have been analysed which led to the creation of the regional strategy guidelines.

Promotion of RES DHC in Catalonia



‘The introduction of a DHC network in the development of the residential and economic activity area Parc de l’Alba is a new commitment of the Government of Catalonia and the city of Cerdanyola towards sustainability and energy efficiency.’

Damià Calvet
Director of INCASÒL

Strategy

Establishing legal conditions for RES DH

Proposals to adapt the regional and national regulations will be drafted which is timely as several standards are currently being reviewed. Significant effort will be put into the study of the obligation of connection for consumers using standard requirements.

Procurement and financial tools for RES DHC

A thorough analysis to identify the basic financial conditions for different types of DHC will be completed in addition to the compilation of a list of financial institutions and financial products specifically designed for RES DHC. Possible public funding support measures and tax benefits will be evaluated in order to determine the feasibility of the introduction of public grant aid or subsidies for RES DHC.

Technical and economic viability and best available technologies

The identification of the main local energy sources is a key aspect to determine where potential new RES DHC can be developed or RES introduced to existing DHC. In addition the creation of ‘soft law’ strategies to support industrial symbiosis will be targeted. Several case studies will be studied to determine its feasibility and if it is possible to extrapolate it to other parts of the region. If economically reasonable, a development of a DHC RES pilot plant will be promoted.

Improving the social acceptance of participation in DHC

The social acceptance will be improved by information campaigns and training. The promotion of the public building connection to DHC will be emphasized. The comparison between different managing schemes will be analyzed in the case studies, including energy cooperative format. Simplified specifications for calls of tenders will be created as well as a code of protection of the end users.

Contact INCASÒL
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Main contact Joan Estrada

Website www.incasol.cat



Who cooperates

- **High level representatives of the region:** Department of Environment, Territorial Planning Department, Energy, mines and Industry safety Department, Catalan Energy Institute
- **National and regional associations:** National DHC association, Catalan Cluster for Energy Efficiency
- **Municipalities, urban projects, DHC associations:** Barcelona Energy Agency Consortium, Forestry Property Centre, Consortium of the Natural Interest of Ripollès, Provincial Council of Barcelona, Industrial Engineers Association of Catalonia, Forestry Engineers Association of Catalonia, Consortium of Alba’s Park, Environment and Public Health Service of the Garrotxa
- **Consumer associations:** Catalan Consumers’ Association
- **Law firms:** LENER, Roca Junyent

Regional Best Practice example:

Kerry is a rural county in the southwest of Ireland. The majority of the population lives in rural areas (66%). The main towns in the county are Tralee (23,693 pop.), Killarney (14,219 pop.) and Listowel (4832 pop.). Agriculture, manufacturing (in particular food processing) and tourism are key economic sectors for the county.

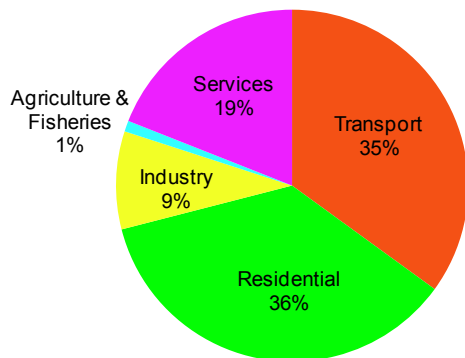
Status quo

Kerry County Council, the local authority for the county is a signatory of the Covenant of Mayors. The energy consumption and emissions baseline inventory for 2008 determined that the total final energy consumption for the county was 4 TWh/a and energy related CO₂ emissions were 1.22 million t/a. Heat represents a significant proportion of the final energy demand at 1.81 TWh/a, 67% of which is used in the residential sector. Close to 60% of the heat demand is supplied by individual oil or LPG boilers, and there is no natural gas supply in the county. The potential for renewable energy in Kerry is very significant, both onshore (6 TWh/a) and offshore (36 TWh/a). Smart district heating has been identified as a central element of the county's transition to 100% renewable energy supply.

Short Facts Kerry County



<i>Location</i>	In the southwest of Ireland
<i>Total area</i>	4,807 km ²
<i>Population</i>	145,502
<i>Heat demand</i>	1.8 TWh/a (final energy)



Total Energy Demand per Sector, Kerry 2008
Transport energy aggregated

Kerry County Council has been at the forefront of promoting the development of district heating in Ireland, with its Mitchels Boherbee 1 MW biomass district heating project in Tralee playing an important demonstration role. The Council is now examining Phase II of this project which would extend biomass district heating to 53 of the largest energy users in Tralee.

Key barriers for the development of DH in Ireland...

- Political** No regulation to directly support DH; lack of DH plan or targets; lack of central heat planning, etc.
- Financial** DH requires a long term financing structure; no support from state or local authority for development of the heat distribution networks, etc.
- Capacity** Lack of technical knowledge & experience in DH project development and in local energy and heat planning among national & local planning authorities
- Organisational** Lack of any national or local organisation with a mandate and authority to develop DH; lack of experience in managing large-scale DH projects
- Social** Little or no understanding of what DH is and the benefits of DH for the individual heat consumers; lack of awareness on DH among decision-makers;
- Physical** Low housing density in Irish towns compared to continental Europe

Kerry County is promoting district heating in Ireland



'From the perspective of the individual representatives of the Task Force, job creation (direct and indirect) in the local community is one of the most important deliverables. Efforts in the area of DH development must be focused toward the delivery of systems utilizing locally sourced renewable fuel supplies thus serving to stimulate local employment.'

Tim McSwiney, Senior Executive Engineer, Kerry County Council

...and opportunities arising from the development of DH

- Increases local employment (DH is suited to local fuel supply from wood based biomass)
- Reduces costs for heat consumers (DH allows the use of low cost fuels such as biomass, which are not always suitable for individual heating)
- Enables greater use of renewable energies
- DH is typically more efficient than individual heating systems, it also enables combined heat and power generation which lowers power distribution system losses
- Allows for greater integration of energy storage

Strategy

Improving the policy framework

- Revise the National Spatial Strategy & Regional Planning Guidelines to empower local authorities supporting RES DHC
 - Adopt a long-term vision for the transition to 100% RES supply, with RES DHC as cornerstone of a future decarbonised energy system
 - Support investment in RES DHC by facilitating access to low-cost finance and providing financial incentives including the introduction of a Renewable Heat Incentive (RHI) to provide security for potential investment in DH infrastructure
- Reinforce the local energy planning framework (Local Renewable Energy Strategies, Heat Mapping etc.), as pillar of Local Community & Economic County Plans
 - Establish a supportive regulatory framework including implementation of relevant articles of the EPBD & EED, promotion of EN technical standards and best practice in contractual agreements

Building Capacity to plan & develop RES DHC projects by defining a methodological framework and developing a set of guidelines & tools for:

- Feasibility study of RES DHC projects
- Design & engineering of RES DHC systems
- Urban planning of RES DHC systems
- Define business models, guidelines & tools for RES DHC project development & operational management, including in the framework of co-operative ownership
- Roll out education and training program on the above
- Develop Irish web portal as repository of knowledge & tools as well as forum
- Support indigenous R&D activity in the area of RES DHC



Contact	Kerry County Council Co. Buildings, Rathass, Tralee
Main contact	Adam Stack
Website	www.kerrycoco.ie
Who cooperates	A task force made of 18 representatives of DH project stakeholders



Regional Best Practice example:

The region of Emilia-Romagna is located in the north of Italy. The land in the area is characterized by coastal areas in the east of the region, flat areas and a mountain-hilly zone mainly concentrated in the west. There are some big cities where a large percentage of the population is concentrated and other urban centres distributed throughout the region. Furthermore there are some important industrial areas.

The heat demand is covered mainly by individual heating systems fuelled by natural gas and biomass (the use of biomass is mainly concentrated in the mountain-hilly zone). In addition there are some DHC networks.

Short Facts Emilia-Romagna



<i>Location</i>	In the north of Italy
<i>Total area</i>	22,451 km ²
<i>Population</i>	4.5 million
<i>Heat demand</i>	159 TWh
<i>DHC systems</i>	53 systems with 195 MW _{el} / 933 MW _{th}

Status quo

The legislation in force established the following regulations to encourage the spread of DHC networks:

- Transposition of the Community directive on DHC through specific national regulations (Legislative Decree no. 28 of 03/03/2011, Legislative Decree No. 102 of 4/07/2014).
- At regional level in Emilia Romagna the energy aspects (including district heating) are regulated by the Regional Law no.26 of 23/12/2004 and by the subsequent Regional Energy Plan (implemented through three-year plans and annual intervention programs). Recently the Regional Law no.26/2004 has been amended by the Regional Law no.21 of 22/12/2011 and through the Regional Law no.7 of 27/06/2014, while the Regional Energy Plan is periodically updated through three-year implementation plans.

Key barriers and opportunities

The main barriers are legal and bureaucratic aspects. The regional area, with different site-specific characteristics and needs, presents barriers and opportunities that are very different within the same study area.

From a regulatory point of view the Regional Law 26/2004 promotes the potential development of efficient district heating and cooling systems and attributed to the municipalities the assessment of the potential adoption of efficient district heating and cooling systems, whose benefits outweigh the costs, also evaluating the effects on the air quality.

Goals

- Create synergies between the private sector and local authorities for future RES DHC installations (industry city symbiosis)
- Empower local authorities for technical and legal aspects regarding the RES DHC sector according to the specific local situation
- Consider metering as a key issue on RES DHC
- Consolidate cooperative and public private partnership (PPP) approaches for RES DHC
- Increase the use of local renewable energy sources (including residual heating from industries)
- Set legal conditions for RES DHC: Analysis of the current situation regarding the regulations, strategies and programmes at national and local level and identify possible points of intervention

Emilia-Romagna - working towards a sustainable energy future



'I am proud that the first solar plant in district heating like this in southern Europe has "found its home" in Varese and I would like to thank the Utility A2A. We can benefit from it in many ways, especially as far as the environment is concerned given the lower CO₂ emissions. Research and innovation are essential added values and the launch of this plant is a clear demonstration of that.'

Attilio Fontana
Mayor of Varese, Lombardy

Strategy

The most appropriate approach to support the development of RES DHC is to implement and share practical tools with local authorities and stakeholders. In particular these are:

Regulatory instruments

One possibility is the introduction of regulations to support DHC systems which would also support the decision-making and planning process.

Information tools

Information measures can be implemented at central level by the region of Emilia-Romagna through data collection and digitisation using Geographic Information Systems. Methodological approaches identified at central level and offered to local authorities to help assess the potential of DHC are also possible.

Discussion and dissemination with the authorities with responsibility for managing the Structural Funds

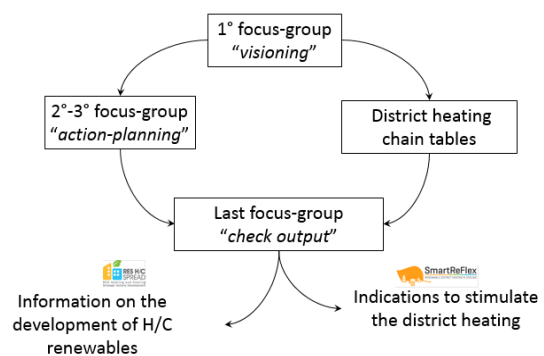
This would help to identify the funding mechanisms available which could finance the implementation of operations in the different regions (assessment, feasibility study, construction, etc.).

Financial models and sources of funding

The creation of working groups to work on this aspect with the aim to analyse the access mode to the thermal incentives and to verify it through Energy Performance Contract or through PPP approaches, as defined by the Regulation 1303/2013 and in Italian legislation.

Evaluation tools

These tools can be used in the assessment regarding the presence and/or the planning of DHC systems and their impact on the region using indicators to assess energy produced, economic and environmental opportunities with a focus on a particular area within the region. In order to improve synergies between the projects SmartReFlex and the RES H/C SPREAD (www.res-hc-spread.eu) a joint task force for the two projects was established. The main aim of the regional task force is to provide tools and guidelines to promote the exploitation of renewable energy sources and waste heat for heating and cooling purposes at the regional planning level.



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Who cooperates Local authorities



Regional Best Practice example:

Schleswig-Holstein is Germany's most northern federal state. Its natural conditions are very similar to those in neighbouring Denmark, but like in the rest of Germany, heat is mostly supplied by individual heating units with natural gas or light oil. Fossil fuel DH systems are in place in some cities but are not common in towns.

Status quo

The strategy of the regional government is based on the replacement of individual heating units with DH systems including heat storage and it wants to establish a suitable legal and market framework for this process. The region's Energy Ministry aims to support local communities to develop integrated local heat strategies and new forms of DH ownership. A consulting initiative with focus on climate protection concepts and heat strategies for communities started in November 2014.

Short Facts Schleswig-Holstein



<i>Location</i>	Most northern federal state in Germany
<i>Total area</i>	15,700 km ²
<i>Population</i>	2.8 million
<i>Heat demand</i>	approx. 36 TWh
<i>DHC systems</i>	approx. 200 systems with 18 GW capacity

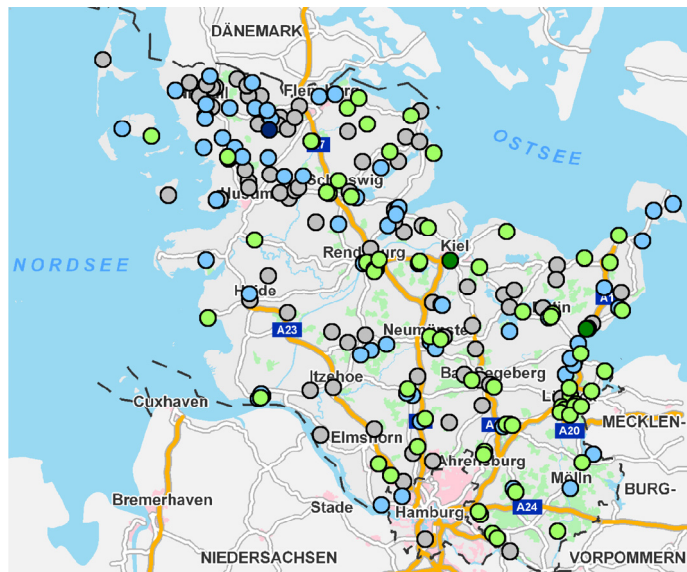
Key barriers and opportunities

Schleswig-Holstein has some experience with smaller district heating systems in rural areas and in larger cities. They face similar problems:

- DH has a bad reputation primarily due to higher prices and the inability to switch between heat suppliers.
- Biomass resources are limited and nearly exhausted; the use of geothermal energy is often too expensive. So solar thermal resources should be used to increase the share of RES in DH which often requires the construction of large heat storages. These storages also help to optimise the operation of the DH systems.

Goals

- Clarify consumer protection related issues
- Optimize the legal and financial framework for the realisation of solar thermal and large heat storages
- Encourage municipalities, which have not been active so far, to consider district heating
- Initialize a large solar thermal pilot project in Schleswig-Holstein



Digital map of district heating networks in Schleswig-Holstein (<http://portal.digitaleratlasnord.de>)

Schleswig-Holstein moving towards solar district heating



‘The government of Schleswig-Holstein will launch a process at municipal level in order to create a sustainable heat supply. With this strategy we will reduce our dependence on fossil fuels for heating purposes!’

Dr. Robert Habeck
Minister of Energy, Agriculture,
the Environment and Rural Areas
Schleswig-Holstein

Strategy

Covenant for Heat Transition

A working group has been established to establish the framework for a generally accepted long-term transition of the heating sector towards efficiency and renewable energies. The primary focus of this task force is to cooperate with all relevant stakeholders to establish common goals and instruments for the transition of the heating sector. The task force started with representatives of the housing industry. Other relevant stakeholders e.g. energy companies and consumer protection organisations will be integrated into the covenant at a later date.

Solar district heating pilot projects

As Schleswig-Holstein is a direct neighbour of Denmark with comparable geographical conditions, it is interesting to learn from the Danish success story in solar district heating (SDH). The pilot projects should demonstrate that SDH is competitive under today’s market conditions for regular use in new and existing DH systems in Schleswig-Holstein.

There will be a systematic assessment of potential sites using different criteria to identify towns with favourable conditions for SDH with the objective to identify concrete proposals for pilot projects.

Regional workshops

Workshops will be used to disseminate knowledge and promote acceptance of SDH in the towns identified in the assessment. The workshops will target municipalities, especially those with favourable pre-conditions for SDH. Associations of municipalities will also be targeted which will facilitate the multiplication of the knowledge among municipalities in the future.

Identify and reduce legal obstacles for RES DH

An analysis of the legal framework for RES in DH has been completed. The aim is to draw conclusions to reduce the identified obstacles. This comprises in particular:

- Support initiatives to improve federal law in the field of consumer protection in DH
- Support strategies at federal level to improve the economic framework for RES DH in comparison to conventional CHP in DH
- Resolve legal uncertainties in the planning process for SDH, particularly regarding the application of state law on water protection in planning permit procedures for SDH units

Contact

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Main contact

Anna Rohwer

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Who cooperates

Housing industry associations, further stakeholders will be involved at a later time



Regional Best Practice example:

The federal state of Baden-Württemberg is situated in the southwest of Germany. It has 10.8 million inhabitants and is characterised by several strong industrial areas combined with extended rural areas in the south.

District heating based on fossil fuels and waste incineration is used in all major cities. However, new district heating systems are also developing in rural areas. These 'Bioenergiedörfer' are often based on biogas CHP.

Status quo

In Baden-Württemberg 438 out of 1,112 municipalities have a district heating system. More than 60% of the district heat demand can be found in municipalities with 1,500 to 50,000 inhabitants (source: IER, University of Stuttgart).

Energy and environmental protection issues in Baden-Württemberg are described in the 'Integriertes Energie- und Klimaschutzkonzept' (IEKK), concluded in July 2014. This Energy and Environmental Protection Plan is part of the Climate Protection Law. It points out goals, strategies and possible measures to reach the climate protection targets (reduction of greenhouse gas emissions by 25% by 2020 and by 90% by 2050). The identified targets are the security of supply, cost certainty, climate protection, regional added value and the obligation of citizens. The document itself was developed through hearings with associations and public participation.

Key barriers and opportunities

Baden-Württemberg is the first German state which has successfully implemented an obligation to use renewable heat for existing residential buildings. In a revision of this regional law the requirements have been further upgraded in 2015. Furthermore the Ministry of the Environment, Climate Protection and the Energy Sector of Baden-Württemberg supports the development of new district heating systems based on renewable energies especially in rural areas. There is interest in informing local initiatives and municipalities about the Danish approach of integrating renewables in district heating systems.

Goals

- Develop a strategy for local district heating systems
- Develop the use of solar thermal energy
- Make use of environmental heat and geothermal energy
- Make use of industrial surplus heat

Short Facts Baden-Württemberg



<i>Location</i>	Situated in the southwest of Germany
<i>Total area</i>	35,750 km ²
<i>Population</i>	10.8 million
<i>Heat demand</i>	approx. 97 TWh
<i>DHC systems</i>	approx. 12 TWh/a of the heat demand are covered by DH



Baden-Württemberg supports local district heating systems



'In Baden-Württemberg we want to increase the share of district heating as a cost-effective, reliable and future-oriented supply option. At the same time renewables such as solar thermal and geothermal energy, industrial waste heat and energy efficiency technologies shall be systematically integrated.'

Franz Untersteller
Minister of the Environment, Climate Protection and the Energy Sector
Baden-Württemberg

Strategy

The strategy in Baden-Württemberg focuses on the development of district heating systems at local level and the integration of different renewable energy sources. According to the IEKK the chosen measures can be addressed in four specific areas:

Local district heating systems

The preparation of local and regional heating concepts will be supported, e.g. the development of a heating atlas software-tool is planned. As requested by the European Energy Efficiency Directive, heating and cooling plans shall also be produced. The integration of heat demand densities in an atlas has been planned to facilitate the production of these heating and cooling plans.

Furthermore, local authorities will be supported in implementing climate-friendly actions within urban land-use planning, e.g. urban heat designs. In this context the legal basis could be improved if necessary.

Use of solar thermal energy

The application of large-scale solar thermal collectors and heat storages connected to heating networks will be supported. Within this context cooperative models are also promoted. Solar thermal district heating systems with seasonal heat storage will also be developed.

Avail of environmental heat and geothermal energy

There are plans to develop a funding programme for geothermal district heating pilot plants. The goal is to increase investment in new heat supply projects based on deep geothermal energy feeding into existing or new heating networks. Furthermore, according to the IEKK the use of geothermal energy in 'cold' district heating systems will be promoted.

Avail of industrial surplus heat

Finally, a market model for the feed-in of surplus heat in district heating systems will be developed. The reason is that practical models have to be created to ensure a fair balance of interests between the feed-in party and the network operator for the feed-in of industrial surplus heat in district heating systems of public utilities.

Contact

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Who cooperates

Local communities, district heating suppliers, utilities, planners, consultants



Baden-Württemberg

MINISTERIUM FÜR UMWELT, KLIMA UND ENERGIEWIRTSCHAFT

6. Recommendations

Recommendations on how to create and manage a successful task force

The regional partners describe below their experiences in the establishment and management of a task force at regional level.

Catalonia, Spain



From our experience the task force must have a wide variety of members in order to cover the full range of aspects to be studied and developed. Our task force therefore includes representatives from the main different areas associated with DHC: planning, environment, energy from public bodies, municipalities, biomass and other RES producers, DHC technical experts and DHC managers, lawyers and financial experts as well as consumers.

Regarding the task force management it is essential not just to organise meetings with the whole task force but also meetings on specific topics where discussions can be more fruitful. In addition, the project progress must be reported to the task force regularly throughout the project. As a result, we achieve the involvement and commitment of the working group. Furthermore, each task force member must have influence within their organisation so that conclusions, lessons learned and capacity building can be effectively transmitted and implemented.

To create better synergies between the SmartReflex project and the RES H/C SPREAD project (www.res-hc-spread.eu) a joint task force was established. At the kick-off meeting the participants played a simulation game structured in 4 parts:

Plenary session: Introduction of SmartReflex and RES H/C SPREAD and definition of the 'visioning' as main goal of the first meeting: 'Imagine being in Emilia-Romagna in 2030 where renewable heat sources are widely diffused and are working very well'.

Individual vision: Every participant assumed a role, e.g. citizen, profit industry, non-profit industry or local authority. In each scenario the following aspects had to be defined: needs, requirements, important factors in the development of heating/cooling renewables, tangible positive outcomes, benefits for individuals or the community, measurable success indicators, fundamental actions and actors of the change.

Group vision: Within the groups of participants playing the same role the different visions had been presented as a group vision. This sort of brainstorming game was an enjoyable and effective way to merge the most important ideas and goals of the main stakeholders of DH and renewables of the region: A group of people with different know-how, experiences and needs but sharing the same idea of a sustainable energy future.

Discussion: Each group presented its vision to the plenary followed by a discussion of the possible problems and synergies.

Emilia-Romagna, Italy



County Kerry, Ireland

At a local level, Kerry County Council is animating a local task force for the development of the Tralee biomass district heating project. The task force is made up of key stakeholders and heat users in the project.



Many of the identified strategic measures have to be realised in the national policy framework. To that effect, the Irish SmartReFlex partners are informing policy-makers about the role district heating should play in the transition to a 100% renewable energy supply, notably in the framework of the preparation of the national White Paper on Energy Policy (to be published in 2015). In addition, the partners are engaging with key lenders, in particular the Irish Energy Efficiency Fund and the National Treasury Management Authority, to define financing mechanisms appropriate for the development of district heating projects.

In terms of capacity building, the Irish team is working closely with the SmartReFlex partners to lead the implementation of training workshops and consultancy activities.

Schleswig-Holstein, Germany



In the beginning, the most important stakeholders in the region should be identified as in district heating there are a lot of different stakeholders involved: municipalities, housing industry, energy companies, and financial institution or consumer associations.

Decide if it is useful to start with all stakeholders or to divide into smaller groups from the beginning. This might be helpful to increase the willingness of the participants to report on their practical experience including best and worst practice examples. In Schleswig-Holstein the task force started with the housing industry. During the first meetings we learned that even in the housing industry there are lots of different needs and interests for which a common denominator has to be found.

There is one overarching goal to which everyone could commit: To reach the climate goals 2050 in the building sector insulation alone is insufficient. Only a combination of energy-oriented refurbishment and an emission free heat supply will lead to success. However, until now there is no common path how to reach that goal between the dialogue partners. Once a common path has been defined within the housing industry, other stakeholder groups will join the taskforce.

Baden-Württemberg, Germany

Different stakeholder groups have been invited to the kick-off event of the task force: local communities, district heating suppliers, utilities, planners, consultants. The kick-off was organized as workshop to which the participants have been invited directly by the Ministry of the Environment Baden-Württemberg.



In preparation of the workshop a short questionnaire (10 questions) has been developed and sent to the participants. The reason for this was to get input and feedback (e.g. barriers and opportunities of RES DHC systems) from the participants before the workshop. This allowed a very specific and target-oriented preparation. The most frequently mentioned issues were discussed in the workshop in an open format to collect as many ideas and solutions as possible.

The aim of the first workshop was to summarize the findings in a paper and to derive the relevant topics and participants needed for the following meetings. The aim is to have 10 to 15 permanent participants.

7. Further information

What does the SmartReFlex project offer?

Regional task forces with experts and interested stakeholders meet in the participating regions of Catalonia (ES), Emilia-Romagna (IT), Kerry and Tipperary (IE) as well as in Schleswig-Holstein and Baden-Württemberg (DE).

Training seminars and workshops are organised in the participating regions for technical and management staff of DHC utilities and industries, town planners from municipalities and regional authorities, cooperatives and consumer protection associations, banks and financial institutions.

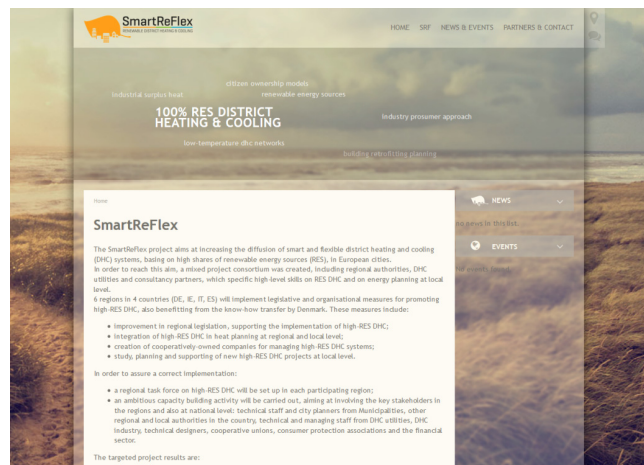
How can I get more information?

Visit the project website www.smartreflex.eu.

Here you will find more information about the project, the resource material produced and the different activities in the participating regions.

Join the events and workshops organised in the different regions.

Contact the project partners directly to benefit and learn from their experiences and use the opportunity to exchange ideas.



The SmartReFlex partners



Studies on different DHC- and RES-related issues

Survey and analysis results of projects completed within the Intelligent Energy Europe (IEE) programme of the European Commission:

EcoHeat4EU www.ecoheat4.eu

- Development of 14 national roadmaps for district heating and cooling
- Including a study that describes the DH legislative framework of: Croatia, Czech Republic, Denmark, Finland, France, Germany, Ireland, Italy, Lithuania, Norway, Romania, Spain, Sweden, United Kingdom

Ecoheat4Cities www.ecoheat4cities.eu

- Establishment of a voluntary labelling scheme to promote municipal and public acceptance of DHC systems
- Including a study that describes the development of a visual label which provides a tool to improve the key stakeholders' understanding of the heating or cooling performances of existing (and planned) DHC systems

SDHtake-off www.solar-district-heating.eu

- The project is supporting the market rollout of solar district heating in Europe
- Within the study 'Boundary Conditions and Market Obstacles' specific national boundary conditions and market obstacles for SDH are identified in AT, CZ, DK, DE and IT
- Within the study 'Market for Solar District Heating' DH markets and SDH markets are analysed in AT, CZ, DK, DE and IT

UP-RES www.aalto.fi/projects/up-res

- Development of specific modules on energy planning and district heating and cooling
- The project produced training materials on energy issues for urban and regional planners. These are available in EN, FI, FR, DE, IT, HU, PL, RO, ES and SE

RESCUE www.rescue-project.eu

- REnewable Smart Cooling for Urban Europe
- The study contains a methodology, toolset and practical guidance for decision makers to facilitate further development and implementation of smart district cooling

Available in German:

The study 'Transformation strategies for fossil central heat supply to heating networks with high shares of renewable energy sources' produced by ifeu-Institut, GEF Ingenieur AG and AGFW was published in April 2013 (available at www.agfw.de).

Imprint

This guide has been developed within the European project SmartReFlex - Smart and Flexible 100% Renewable District Heating and Cooling Systems for European Cities.

The SmartReFlex project aims to increase the development of smart and flexible district heating and cooling (DHC) grids and systems, with a high percentage of renewable energy sources (RES), in European cities. You can find more information about the project on the website www.smartreflex.eu.



Disclaimer

The sole responsibility for the content of this publication lies with the authors. It does not necessarily reflect the opinion of the funding organisations. Neither the funding organisations nor the authors are responsible for any use that may be made of the information contained therein.

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www.smartreflex.eu

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