



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

### **Summary report**

#### **Deliverable**

WP 3 Capacity building for stakeholders  
Del. 3.2 Summary report

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Skørping, April 2017

#### **Supported by**



Intelligent Energy Europe Programme  
of the European Union

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## 1 Introduction

Capacity building for stakeholders has been a key activity in the SmartReFlex project. This activity has taken place in the form of workshops facilitating active participation of the regional stakeholders. The focus in these workshops has been on both sharing experience from Denmark and Germany with the regional stakeholders, as well as facilitating building of relations and sharing of experience among the regional stakeholders. Hence, the capacity building has comprised both a dimension of conveying concrete knowledge related to district heating as well as a dimension of building the relations among the regional stakeholders.

Capacity building has taken place in a number of ways and levels in the SmartReFlex project. Technical capacity building was provided regarding mapping of heat demand and design of district heating network and plants. Cooperation on mapping was established with the project 4DH ([www.4dh.dk](http://www.4dh.dk)). A ph.d. student from Aalborg University supported the elaboration of regional mapping of heat demand, thus contributing to the capacity building. At the technical workshops, calculation tools for design of pipe network and calculation of energy production and feasibility were introduced and provided for the participants for further application.

Representatives from the six regions have shared their experiences with the other regions. This took a.o. place at the final workshop in November 2016.

The regional task forces have facilitated continuous capacity building throughout – as well as after – the SmartReFlex project period.

Replication of – some of – the capacity building activities in the regions has already taken place and will continue after the SmartReFlex project has ended.

This report is based on the four country reports on capacity building seminars.

## 2 Workshops

Three types of workshops were held; 1) Design and planning, 2) Technical and 3) Organisation and financing. A kick-off workshop was also part of the scheme, this was merged with the first workshop held in each region, typically workshop 1 "Design and planning". The objective of the kick-off workshop was to present the objectives of the SmartReFlex project, to collect stakeholders' needs and to stimulate interest in renewable district heating. In practice, this purpose was addressed as part of all the workshops.

The workshops were held according to this schedule, indicating the number of participants (cf. output 3.6 that 80 persons from each country (in total 320 participants) are involved in the capacity building):

Region	Workshop 1 Design and planning	Workshop 2 Technical	Workshop 3 Org. and financing	Participants
Catalonia	April 2015	May 2015	June 2015	122
Catalonia replication		June 2016		70
Emilia-Romagna (ER)	Nov. 2015	Nov. 2015	April 2016	118
ER replication			December 2016	35
Baden-Württemberg	April 2016	May 2016	November 2016	171
Schleswig-Holstein	Feb. 2016	April 2016	May 2016	75
Tipperary	May 2015 and January 2017		December 2014	77
Kerry				

The total number of participants in the capacity building workshops in the six regions is more than 600. Two replication events have already taken place (included in the table) and more are planned.

Efforts have been made to coordinate the workshops with other events and the general activities in the regions within the field of district heating. Therefore, the time schedule was adjusted accordingly.

A key characteristic of the workshop programmes was that there were both input from Danish and German experience as well as input from regional stakeholders. This combination of input from "outside" the region as well as input from the region implied that the capacity building took into account the local conditions and competences. This addresses a key feature of district heating, that it is "local business", therefore this approach facilitates the development and implementation of district heating schemes.

The following sections elaborates the contents of the three workshops implemented in the six regions, evaluation and outcomes of the workshops. For the capacity building seminars in Baden-Württemberg a slightly different approach in comparison to the other regions was chosen. Therefore, the points regarding Baden-Württemberg does not follow the same structure as the other regions.

Material (slides etc.) from the workshops in the six regions is available from the SmartReFlex website ([www.smartreflex.eu](http://www.smartreflex.eu)). Applied tools at the workshops is available at the web-pages of ISOPLUS<sup>1</sup>, LOGSTOR<sup>2</sup>

<sup>1</sup> <http://isocalc.isoplus.dk/default.aspx?language=danish;>

<sup>2</sup> <https://www.logstor.com/service-support/tools/logstor-calculator;>

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and EMD<sup>3</sup>.

### 2.1 Workshop 1 "Design and planning"

The main objective of workshop 1 "Design and planning" was to train local authorities staff in design and planning issues on renewable district heating and cooling.

#### Main addressed topics:

- *Urban heat planning, DHC vs. individual heat supply, cooperative ownership (~workshop 3), real examples of project development*
- *Case-studies*
- *Concepts how to stepwise reach 100 % RES, e.g. utilization of excess heat from industry*
- *How to come from case studies to municipal and regional plans, addressing the necessary framework for development of DHC (cf. risk analysis)*

**Expected participants:** Technical staff and city planners from municipalities and regional authorities, DHC utilities and designers.

**Duration:** 2 days.

#### Day one

##### 1. Welcome (30 minutes)

- a. The regional task force: Presentation of regional status, strategy recommendations for 100 % RES DHC and implementation of EU Directive for Energy Efficiency (ART.14) (from WP2) and goal and program for the workshop.
- b. PlanEnergi: The steps in heat planning (mapping of consumption and resources, prediction of future consumption, district heating & cooling or individual heating and cooling, calculation of economical and environmental consequences). Introduction by PlanEnergi.

The following steps 1, 2 and 3 focus on consumption, resources and competitiveness of DH, respectively.

##### 2. Step one (45 minutes). Mapping of present and future heat and cooling demand.

- a. Presentation of methods, including how to estimate heat demand based on m<sup>2</sup> of buildings, standard consumption and applied heating technology. Estimation of future heat and cooling demand.
- b. Example from Denmark (Horsens) including key data for specific consumption (kWh/m<sup>2</sup>)
- c. Example from the region provided by local participants. If possible use of GIS based on local data. Local consultants find local data and methodology. This takes place before the workshop if possible
- d. Discussion of alternative methodologies – how to get a fair estimate of the demand without getting lost hunting data

##### 3. Step two. Mapping of resources (45 minutes)

- a. Excess heat from industries, waste incineration and power production. Solar thermal, biomass, resources for biogas, heat resources for heat pumps.
- b. Example from Denmark showing data for biogas, surplus straw and surplus wood. Presentation of Danish sources of information (covering Denmark).
  - i. Demonstration of tool (spreadsheet)
  - ii. Reports on excess heat and organic waste (types)
  - iii. Data from waste incineration plants
  - iv. Solar radiation from the Danish Meteorological Institute

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<sup>3</sup> <http://www.emd.dk/energypro/>

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- v. Biomass and biogas from spreadsheet from Aarhus University
- vi. Heat sources for large scale heat pumps
- vii. 4DH, mapping of resources ([www.4dh.dk](http://www.4dh.dk))
- c. Local consultants find local data. Example from the local region.
- 4. Step three.** Costs and competitiveness (45 minutes)
  - a. Map of competitiveness (visualization), input data and results (including local data if possible), methodology from 4DH.
    - i. District heating & cooling or individual heating and cooling?
    - ii. Calculation of production prices for individual heating and cooling
    - iii. Calculation of production prices for district heating & cooling.
  - b. PlanEnergi calculates with Danish investment cost. Examples including data for costs for district heating and individual heating (calculation of heat production costs for different individual sources) for heating and cooling
  - c. Local consultants find local fuel cost and if possible local investment cost. Local example (prepared before the workshop)
- 5. Brain storm.** Barriers and advantages for district heating and cooling in the region (20 minutes)
  - a. The purpose is to produce a list of advantages and barriers, thereby get an overview and create a basis for discussion of possible solutions
- 6. Example of how to integrate district heating in regional and municipal planning in DK** (45 minutes)
  - a. Region Midtjylland and 19 municipalities
  - b. Local examples by local consultants
- 7. Group Work 1.** What should municipal and regional heat plans include? (30 minutes group work, + 30 minutes presentations)
  - a. Discussion of elements in a rough heating (and cooling) plan for the region
  - b. Discussion of barriers and how to overcome them

**Day two**

- 8. Design of case studies, general methodologies and cases** (60 minutes)
  - a. Presentation of tools (software programs and spreadsheets)
  - b. Presentation of cases (applications of tools and results)
- 9. Case study from the Region.**(30 minutes)
  - a. Calculation of business economy (heat production price), local economy, consumer economy and environmental consequences for a district heating (and cooling) plant. PlanEnergi calculates with Danish investment costs.
  - b. Local consultants find example, local fuel costs and if possible local investment costs. This is prepared before the workshop by the local consultants, coordinated with PlanEnergi.
- 10. Other case studies** (30 minutes)
  - a. Presentation of local case studies and ideas.
- 11. Group work 2** (60 minutes)
  - a. Where could district heating and cooling be the best solution in the region.
- 12. Presentation** of group work
- 13. Conclusion** by the regional task force
  - a. Announcing the next workshops and how the design and planning workshop will be followed up.

This template for the program for workshop 1 "Design and planning" was applied with minor adjustments in the six regions.

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### Key findings in workshop 1 "Design and planning":

**Catalonia:** Specialists in biomass and geothermy were invited to present the availability of these resources in Catalonia. The Catalan Professional Association of Forestry Engineers presented the availability of biomass in Catalonia, conditioned by atomized ownership and mountainous geography. The different qualities, the labels and certifications, the space requirements and the cost were explained too. A district heating and cooling based on geothermy in the north of Catalonia was described too. Closing this block, INCASÒL presented the mapping of Catalan resources and the planned development of a viewer integrating all the available data in Catalonia regarding resources as well as the heating and cooling demand. Some strategies to guarantee DHC networks connection were also presented.

- What should municipal and regional heat plans include?
  - A regional law about district heating and cooling could help, although there might be the risk to be too general.
  - The main issue is to find which the key factor in the region is. Either creating employment, promoting successful experiences or the deployment of energy policy objectives, like the Covenant of Mayors.
  - Regional and national plans could give guidelines to municipalities by establishing a strategic pathway and establishing the opportunities in the different territories.
- The cooperative model and the initiative by the consumers complemented by the guarantee of the municipality for the loan, was considered a good model, however hardly achievable in Catalonia. The most feasible options were considered to be public-private collaborations.
- A regional plan focused on energy savings could be a good tool as well.
- Regarding the drafting of the new urban law of Catalonia, an effort could be made to ask for including the need of an energy efficiency analysis in the planning stage of new urban developments or urban renewals. Of course, DHC networks would be one of the alternatives of thermal supply that logically would be contemplated in those analyses.
- The dissemination of existing experiences of DHC between municipalities could be suitable to promote DHC as well as the availability of mapping tools.
- In the case specific of the biomass, the regulations should foresee space for storage and drying of biomass in new DHC.
- Where could district heating and cooling be the best solution in the region?
  - Low feasibility of DHC in low density zones as they are zones of low demand, as well with a lot of second residences
  - Urban areas with higher energy demand might have some pollution restrictions which can hinder the installation of biomass plants.
  - There is the idea of finding a ratio to show the feasibility of a DHC in a region, either with density of demand or equivalent hours. However it is difficult to generalize as there are several factors impacting on the feasibility of a DHC. Cooling networks is mainly interesting in offices, but not in residential.
- The use of the DHC network as a storage of electric surplus is an idea to be further studied, however it can be limited by the storage capacity of the network.
  - Should focus be on DHC or in a high electrical grid plus individual electric thermal equipment, the main opinion was the more centralized an installation the better operated.

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- To optimize the operation of the plant and minimize the operation grid it is essential to involve the DHC manager since the beginning of a design of an internal installation.
- The new regulation of nZEB buildings can hinder the development of DHC due to the low demand, however it could be a potential as a 100% renewable DHC could help to obtain the nearly zero energy balance.
- There is a need of high demand for the implementation of DHC. A good place could be where public buildings are close to each other, as well as locations with demand mixture. Local biomass suppliers with high quality products and a company responsible for the whole process including biomass control could be a guarantee of successful DHC implementation. The payback for the DHC should be below 10 years if the banks should provide a loan. Paybacks of higher than 10 years crowd-funding and cooperatives could be an interesting solution.

These findings in Catalonia illustrates a very engaged and qualified discussion, which included many different and relevant actors. Hence, the workshop has to a large extend facilitated better understanding and focus on concrete activities.

**Emilia-Romagna:** (presentations available at: <http://www.smartreflex.eu/it/downloads/workshops/>). In the introductory speech, Alessandro Rossi by ANCI ER stressed the incoming regional conference on Green Economy, which will be the base for developing the new regional energy plan. This is a very good opportunity for SmartReFlex for contributing to this plan with suggestions on DH. The Italian Regulatory Authority for Electricity, Gas and Water (AEEGSI) was attending the workshop, its representative, Marcella Pavan, presented their current activities on DH. The AEEGSI was recently given some specific tasks for regulating the DH sector. The Regional Agency for Environment and Energy (ARPAE) presented the regional map they develop to assess demand and resources for thermal energy. Such a tool, developed within the "twin" project RES H/C SPREAD, created a lot of interest in the audience.



- Active and constant contribution from the audience
- The case studies analysed in the last part of the workshop were three:
  - Mirandola heating network (no specific presentation because the representative from the utility gave a speech);
  - Municipality of Monchio delle Corti (presented by ANCI ER);

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- Municipality of Monte San Pietro (no specific presentation because the representative from the Municipality gave a speech).

**Baden-Württemberg:** The workshop in Baden-Württemberg did not apply the template for the program for workshop 1, because the requirements is more focused on areas for solar thermal collectors (Solar District Heating) regarding legal, ecological and further aspects.

- The important topic 'land areas' was brought on the agenda of the Ministry of the Environment and the Ministry of Agriculture and discussed with different relevant stakeholders.
- A process has been started to improve, amongst others the planning and approval procedure, for solar thermal and other RES installations in urban areas.
- Possible concrete solutions and incentives are:
  - Privilege solar thermal systems in zoning law
  - Tax incentives for farmers to face land sales
  - 'Eco points' (e.g. for a high-quality eco concept)
  - Backing for dealing with local authorities (e.g. official supporting document)

**Schleswig-Holstein:** Bernd Möller presented methodology and findings regarding mapping of heat demand based on GIS. Alexandra Oboda presented methodology on screening of heat demand. Simona Weisleder gave a practical overview of the actual legal situation, financial aspects and funding programs to implement large scale solar thermal heat plants connected to district heating systems.

- More than twenty representatives from regional and local administrations/municipalities, public utilities, climate managers, consulting engineers, planners and politicians came to the regional education centre in Flintbek.
- Main goal of the day was to introduce the Danish way of heat planning and to explore whether and how the German partners could benefit from the Danish experience in the process of expanding and establishing district heating schemes based on renewable energy. The steps of mapping the present and future heat demand and the use of renewable resources in municipalities.
- A lively discussion on the different approaches in terms a technical mapping methods and also political guidelines to reach long term goals.

**Kerry County and Tipperary:** A total of 10 presentations were delivered by local experts from the Irish SRF team and providers of DH solutions and services, sharing their know-how in relevant areas and showcasing case studies they were involved in.

- Workshops 1 and 2 were combined in a 3-day intensive training course, which enables participants to immerse themselves in the technical aspects of RES-Heat district heating project development, from planning to design to implementation.
- The workshops were highly participative, with an ongoing flow of discussions and Q&As involving participants and trainers.
- 'Theoretical' presentations were complemented with exercises, case studies
- A site visit of the RES-Heat district heating system at the Ecovillage in Cloughjordan. Since members of the Ecovillage who operate the DH system participated to the training course, this was also an

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opportunity for them to give an open account of their experience both as operators and users of DH. The participants were also able to get an insight in the user co-operative model of DH ownership and management. This project, which is facing a number of technical issues (excessive heat loss, inadequate controls, deficient solar thermal system) and operational problems, is part of a case study undertaken as part of SRF WP3 & WP4 to support a remedial program.

- Provided participants with a combination of theoretical and practical knowledge, which demystified the process of planning, designing and implementing RES-DH projects
- Gave the participants the competences and confidence to contribute positively to project development in Ireland.
- The training course was also a great opportunity to network and forge relationships among participants, experts and the Irish SRF team.

### 2.2 Workshop 2 "Technical"

The main objective of workshop 2 "Technical" was to provide specific training on how to optimize technical solutions in 100% renewable project implementation.

A key input for the technical workshop was introduction of tools:

- energyPRO (EMD)
  - <http://www.emd.dk/>, <http://www.emd.dk/energypro/>
  - Tutorial (self-study of energyPRO):  
<http://www.emd.dk/files/energypro/Tutorials/The%20complete%20tutorial.html>
- Calculation tools for pipes
  - ISOPLUS, <http://en.isoplus.dk/>, "ISOCALC"
  - LOGSTOR, <https://www.logstor.com/>, "LOGSTOR calculator": <http://calc.logstor.com/#Login>

**Expected participants:** Technical and managing staff from DHC utilities, DHC industry and technical designers.

#### Main addressed topics:

- *Design of substations and lay-out of DHC grid with low temperatures*
- *RES production plants and how to calculate production prices*
- *Case studies*

**Duration:** 2 days.

#### Program - Day one

1. **Welcome** by the regional task force and PlanEnergi (15 minutes)
  - a. Presentation of regional status and goal
  - b. Presentation of the program (overview over technical installations; installations in houses, transmission and distribution network, production technologies)
2. **Installations in houses** (60 minutes). *Where possible, local representatives of suppliers of equipment demonstrate operation and regulation of house installations and heat meters.*
  - a. Diagrams for heating and cooling installations, direct and indirect district heating, prices of house installations, cooling, how to utilize low flow temperatures and secure low return temperatures, heat meter and working principles.
  - b. Presentation of Danish examples by PlanEnergi
  - c. Local examples by local consultants. Prepared before the workshop
  - d. Discussion of local needs of capacity building of installers and how this could take place.

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- e. Includes calculations for one regional case study.
- 3. The transmission and distribution network (120 minutes)**
  - a. Pipe types, dimensioning of pipes (pressure, flow, software, heat loss), heating and cooling, pumps, excavation, prices.
  - b. How to avoid heat losses (low temperature systems). Available software for calculations.
  - c. Presentation of Danish examples by PlanEnergi
  - d. Local examples by local consultants
  - e. Discussion of local needs of capacity building of installers and how this could take place.
  - f. Includes calculations for one regional case study.
- 4. Production technologies (120 minutes)**
  - a. Presentation of technologies: Excess heat from industries, incineration plants etc., Solar thermal, Biomass boiler, Biomass CHP, Biogas CHP, Heat pumps, Geothermal heat, Storage technologies
  - b. Technical solutions, energy in- and output, prices for investment, operation and maintenance. Danish data by PlanEnergi and local data by local consultants.
  - c. Includes calculations for one regional case study.

### Day two

- 5. Calculation of district heating production plant (60 minutes)**
  - a. Simple calculation of production costs in reference and RES system
  - b. Calculation in EnergyPRO of production costs in reference and RES system.
- 6. Group work. Case calculations (60 minutes)**
  - a. Preparation of energyPRO and spreadsheet (installation), introduction to energyPRO before the workshop
  - b. Case calculation, preparation of data by local partners
- 7. Final presentation and discussion of results (60 minutes)**
- 8. Conclusion by the regional task force**

How to follow up upon the technical workshop and introducing the next workshop ("Organization and Financing" in most cases).

### Key findings in workshop 2 "Technical":

**Catalonia:** During this workshop some presentations were done about the cost of solar thermal energy production in Spain and its injection in DHC networks, exemplified with recent studies. A special focus of the workshop was done to district cooling networks, with practical examples. IREC presented a study about energy production cost of solar thermal in Spain, focused on market data and simulation. A recent study on injection of solar thermal energy to DHC, exemplified on two existing networks in Barcelona was explained too. ADAC presented district cooling networks, its challenges and practical examples. Some conclusions gathered during those days were:

- In the specific case of Barcelona, the efficiency of the house installation is around 50% but it could be increased until 70%. Variable flow and variable temperature are required in climates like Barcelona. There is the need to work in system control to reach a better efficiency of the systems and supported renewable energy networks
- A good option is to combine biomass boilers for winter and cover the summer DHW with a small natural gas boiler, due to the behaviour of biomass boilers at partial load.
- Compared with energy production costs of common energy sources, the solar thermal energy could reach similar production cost for systems working maximum at 90°C

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- Regarding cooling networks, it was pointed out that cold is more expensive to generate, requires more space and it is much more difficult to operate. District networks can compete against individual solutions with more efficient equipment. In the example shown DC options were cheaper than individual solutions, especially if residual heat or cold was used.

**Emilia-Romagna:** (presentations available at: <http://www.smartreflex.eu/it/downloads/workshops/>)



Held in Milano, in AIRU offices. Mr. Capretti from the Italian utility A2A (one of the biggest in Italy) presented the state of the art in substation and distribution networks in Italy and the present research in implementing low temperatures network in Italian districts. Mr. Vailati from Italian utility Linea Reti e Impianti presented the generation systems mix of the DH in Lodi, showing their experience in optimization efficiency measures of the network and use of different energy sources (biomass, gas CHP, storages). The DH of Lodi is also the winner of the Global District Energy Climate Award 2015.



- The WS was not only an education event but also an opportunity to network among participants and project partners.
- The themes of the workshop have shown to be very interesting for the target groups: the room availability was of 30 people, but there were 17 more requests in additions to the admitted ones. In

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order to keep the event free of charge, Italian partners have decided not to rent a higher price larger room, but to organize a replication event.

- Another half day would have been useful to perform more analysis and case studies example calculations with EnergyPro. Considering the number of people registered and the interest shown, a replication of the event has been considered.
- Replication event planned for spring 2017.

### **Baden-Württemberg:**

- The current state of solar district heating and its application possibilities was presented and explained.
- An exchange of knowledge and transfer of know-how to planners and utilities took place during the different thematic presentations, workshops and discussions.
- Possible replicators were brought to the plants in Crailsheim and Büsingen and learnt from the operators Stadtwerke Crailsheim and Solarcomplex about their experiences of solar district heating. Advantages as well as challenges were discussed.

**Schleswig-Holstein:** The calculation tool was presented by the German representative of EMD, and a practical example applying the tool was presented by Matthias Sandrock.

- About thirty representatives from regional and local administrations/municipalities, public utilities, climate managers, consulting engineers, planners and politicians came to the Science Centre in Kiel.
- The participants could benefit from the input from PlanEnergi and the expertise of leading Danish Companies like Danfoss, EMD and Isoplus.
- Various possibilities to connect the customer to the district heating grid with the different advantages and disadvantages have been presented.
- Also the design of different sized pipes of a district heating grid have been discussed.
- With the calculation tool "EnergyPro" from EMD the participants could learn how to simulate combinations of heat plants in a district heating grid. As a result of the simulation is a profitability calculation and schedules of the heat plants in the considered period.
- One of the regarded case studies in the SRF project was presented by the Hamburg Institute. It has shown that large solar thermal plants could also in Germany be an economic alternative to fossil fired heat plants in an existing district heating grid. On the second day the participants had the possibility to calculate some prepared tasks and get practical experience to the calculation tool.

**Kerry County and Tipperary:** The workshops 1 and 2 were combined in Ireland. Please see the above section under workshop 1 for Kerry County and Tipperary.

### **2.3 Workshop 3 "Organisation and financing"**

The main objective of workshop "Organisation and financing" was to train stakeholders on how to organise and run 100% renewable district heating and cooling systems.

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**Expected participants:** Technical and managing staff from DHC utilities, DHC customers, cooperative unions, consumer protection associations, banks and financial institutes.

### Main addressed topics:

- *Metering, payment, service to customers, administration*
- *Customer involvement and ownership, business models and financial analysis*
- *Viability of consumer-owned company, legal and financial*
- *Financing, investment costs*
- *Case studies*

**Duration:** 2 days.

### Day one

- 1. Welcome** by the regional task force and PlanEnergi.
  - a. Presentation of regional status, goal and program for the workshop.
  - b. Presentation of the program – the steps in organizing new district heating (Contact to consumers, business plan including break even for connection of consumption, financing, expected consumer prices and organization with statute for members). Invitation to consumer meeting, preliminary contract, tendering, contracts with suppliers, final contracts with customers)
- 2. Business plan** (75 minutes)
  - a. Competitiveness of district heating vs. individual, Municipal loan guarantees
  - b. Group work session providing what input is needed in a business plan from different perspectives (e.g. consumer, investor, municipality). The "Business Model Generation" framework could be applied/mentioned for inspiration.
  - c. Local examples (case studies and related projects) by local SRF partners
  - d. Danish example from Bornholm
- 3. Fuel Supply** (30 minutes)
  - a. Contracts for biomass, biogas etc., Danish examples
  - b. Local examples
- 4. How to get customers connected** (60 minutes)
  - a. Example of procedure from Bornholm, DK.
  - b. Local examples by local consultants.
- 5. Customer contracts** (60 minutes)
  - a. Danish and local examples.
  - b. Regulatory framework, legislation
  - c. Guideline on contract conditions for DH supply, experience and practice
- 6. How to organize a district heating company** (60 minutes)
  - a. The Danish model for coops, the emergence of district heating
  - b. Standard articles of association, experience and practice
  - c. Local examples from local consultants.
- 7. How to organize monitoring and payment** (60 minutes)
  - a. Danish and local examples
  - b. Types of customer relationships
  - c. Heat meters

### Day two

- 8. Case study one** (60 minutes)
  - a. Organizational and financing issues. Discussion of the steps.
- 9. Group work.** Case studies (60 minutes)
- 10. Presentation** of group work (60 minutes)

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### 11. Conclusion by the regional task force. How to follow up upon the organizational and financing workshops.

#### Key findings in workshop 3 "Organisation and financing":

**Catalonia:** On this workshop the attendants could learn the steps to organize a new DHC, exemplified with a case of a large DHC in Barcelona. Afterwards some law firms presented the steps to organize a DHC focused on the legal barriers and how to organize them. Some of the findings of the workshop can be seen below:

- Lack of systematic and comprehensive regulation of DHC in Spain
- Competitive dialogue is the best options for the public-private contracts, however some of the participants on the seminar considered that the debate generated during the process slow down the contracting. There is the possibility that the ownership of the network and the service is not in the same person. In respect to contracting law regarding services and supplying contracts, there is a limitation of 4 years that avoids the contractor to recover the investment.
- As reference to the case of the large DHC in Barcelona:
  - DHC is possible if there is a competitive energy source
  - Regulatory risk and the insure investment situation and the financing difficulties
  - Forecasting of the network, it is difficult to predict were the growth of the city will be, as well as unexpected development projects in stand-by due the crises
  - Important that the public administration is involved and interested in the project, this make the case of Barcelona a success and a case of Zaragoza a failure
- Need to analyse not only the technical feasibility of the district but as well all the legislative feasibility. There is the need of fulfil environmental requirements, land usage, thermal installations, sector legislation, ownership structure and last but not least "social license", the acceptance of the population
- Need of having a specific regulation of DHC and to approve a planning tool to allow the installation via specific planning
- DHC networks are not recognized by law as a public utility

**Emilia-Romagna:** (presentations available at: <http://www.smartreflex.eu/it/downloads/workshops/>)

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- Wide participation especially from Local Authorities, utilities and consultants.
- The participation rate from financial actors was very low and this is without doubt a weak aspect of the workshop. Nevertheless, due to the interest shown by the participants, a replication event is foreseen and this could be right opportunity to involve at a deeper level the financial actors.
- Presentation of case studies provided useful information on local conditions for district heating. One additional case study was presented by the Municipality of Maccaretolo. All case studies are quite relevant because, given the small size and the peculiar situation of rural and pre-mountain areas, seem to be highly replicable in many small Municipalities of Emilia-Romagna and of other Italian regions. Given the interest by the stakeholders, a replication event on the topic of financing was held in Bologna in December 14<sup>th</sup> 2016, focusing on financial aspects and direct involvement of customers in the financing process. 35 participants attended the event, which showed a very high interactivity due to the practical approach of the speakers. The workshop, which lasted from 9:30 AM to 4 PM, included the following presentations (available here under "Workshop 4": <http://www.smartreflex.eu/it/i-risultati-del-progetto/>): Introduction and opportunities for RES DHC in the region, economic analysis of SmartReFlex case studies, detailed price and financial analysis of the Mirandola DH grid, crowdfunding and other financing tools, energy cooperatives and credit by local banks. The workshop contents were ranked by the participants with 4.7 (with 5 as maximum) and similar results were reported for the single presentations.

### **Baden-Württemberg:**

- Discussion about the presented topics and RES DHC perspectives in general.
- Commitment of the regional working group of the VKU (Association of Municipal Companies) to further promote solar and RES DHC (1) through their publications and (2) through meetings of other internal committees (e.g. the next workshop of VKU is scheduled for 11 July 2017 in Reutlingen).

### Deliverable 3.2 "Summary report on outcomes of capacity building"

- Interest of one of the attending utilities (Waste Incineration Böblingen). A follow-up meeting took place in December 2016. A project development is presently evaluated.

#### **Schleswig-Holstein:**

- About twenty representatives from regional and local administrations/municipalities, public utilities, climate managers, consulting engineers, planners and politicians participated
- The different framework in Denmark and Germany regarding price calculations, design of contracts and the possibility to monitor the return temperature in district heating grids were presented and discussed.
- The German and Danish District Heating Organisations showed the different legal frames.
- A local finance institution showed the needs of risk assessment.
- The Hamburg Institute showed advantages and disadvantages of different company structures.

**Kerry County and Tipperary:** local presentations, notably on the financing aspects of DH project development, and ongoing contributions reflecting the local experience emerging from local partners and stakeholders.



### Deliverable 3.2 "Summary report on outcomes of capacity building"

- The workshop was highly participative, with a high level of engagement between participants and trainers, leading to a rich exchange of experience.
- The participation of two key financing institutions in Ireland to the workshop (NTMA and the Irish Energy Efficiency Fund) was very helpful as it is a critical aspect of the Tralee DH project development.
- The workshop was an opportunity to present in details the SRF project and the impacts it intends to have at a local/regional level; the first version of the 'regional strategy for district heating development in Ireland' prepared as part of WP2 was presented at the workshop and feedback was invited from participants.
- The workshop was complemented by a site visit of the Tobar Naofa biomass DH project in Tralee for all the participants, which was a unique opportunity to get an insight into this pioneering DH project in Ireland and to engage with heat users.
- Overall, the strong local input into the workshop helped augment the know-how transfer from Denmark by anchoring the training experience in local conditions and practicalities of developing and operating DH projects.

#### 2.4 Evaluation of workshops

In Catalonia, the summary of the evaluation of workshops is:

- The technical level has been very high and knowledge has been transmitted among participants and speakers
- The participants actively participated by providing information and discussion about many aspects dealt what has allowed to view and compare different experiences around these networks.
- New links have been established among participants and between speakers and participants what will certainly help the development of new projects.
- Two new regional stakeholders, Girona Provincial Council and Roca Junyent, have joined the Catalan task force. The first one is of great interest due to its capability to disseminate knowledge among municipalities and the second one, due to its high expertise of specific law.
- The seminar was also attended by participants of other Spanish region

In Emilia-Romagna, the summary of the evaluation of the workshops is:

- Relatively positive evaluation of the workshops with some variations
- Great interest in participating in the activities related to SmartReFlex and the district heating and cooling based on renewables
- A need of going more in depth and details in the Italian framework has been identified
- When case studies are finalized, it will be very important to organize presentation and events to disseminate them and continue this dialogue with figures and numbers.

In Baden-Württemberg the summary of the evaluation of the workshops is:

Workshop 1:

- The participating utility was happy being able to present the difficulties regarding the availability of land areas directly to the representatives of the ministry
- The Ministry of the Environment could start a process contacting the corresponding public authorities to improve the authorization process

Workshop 2:

### Deliverable 3.2 "Summary report on outcomes of capacity building"

- Very positive feedback from the participants (e.g. good mix of technical presentations and presentations or discussions on the current political and organisational framework on RES DH in Baden-Württemberg)
- Many participants showed interest in attending a follow-up event next year
- The Ministry of the Environment was happy to host the event in its premises

#### Workshop 3:

- The workshop resulted in a commitment of the regional working group of the VKU (Association of Municipal Companies) to further promote solar and RES DHC (1) through their publications and (2) through meetings of other internal committees (e.g. the next workshop of VKU is scheduled for 11 July 2017 in Reutlingen).
- Furthermore one of the attending utilities (Waste Incineration Böblingen) showed special interest. A follow-up meeting took place in December 2016. A project development is presently evaluated.

In Schleswig-Holstein the summary of the evaluation of the workshops is:

- In general very positive.
- All speakers got a good review
- Many participants saw opportunities to use parts of the workshops for their practical work

In Kerry County and Tipperary the summary of the evaluation of the workshops is:

- The evaluation results for the workshop 3 indicated that the great majority (74%) of participants declared that the training content was adequate ('just about right' or 'more than required') and all participants indicated that they would be more likely to investigate the potential of DH in their area as a result of the workshop.
- For workshop 1&2, most participants would highly recommend to others to attend the workshops.
- In addition, the evaluations indicate that the participants would be more likely to investigate the potential for DH in their area.
- A number of suggestions for additional content were made, many relating to the content of workshop 3 (financing and organizational aspects) or requiring more in-depth technical know-how in specific areas.

### 3 Target groups

Description of target groups addressed, evaluation of engagement of target groups and their role in supporting implementation of renewable DHC. The target groups comprised:

Target groups in Catalonia	Description of organisation and role
Regional administration	<p><i>Ministry of Territory and Sustainability</i>  <i>General Directorate of Energy, Mines and Industrial Safety</i>  <i>Catalan Energy Institute, Secretary of Environment and Sustainability</i></p> <ul style="list-style-type: none"> <li>• These institutions have the capacity to lay down mandatory criteria in urbanistic, environmental and energy terms in Regional level. The conclusions and normative concepts of the workshops could be aimed to the regulatory entities with its mediation to try to modify the current regulation, which refers to DHC competences.</li> </ul>
Local administration	<p><i>Barcelona Energy Agency Consortium, Provincial Council of Barcelona, Consortium of Alba's Park, Environment and Public Health Service of the Garrotxa, Consortium of the Natural Interest of Ripollès, Provincial Council of Girona, Forestry Property Centre</i></p> <ul style="list-style-type: none"> <li>• These institutions, enterprises or entities give their experience in DHC issues and also their network of knowledge, information dissemination and their influence in local regulatory issues in terms urban and environmental planning.</li> <li>• They are disseminators and partners at local level.</li> </ul>
Professional associations	<p><i>Industrial Engineers Association of Catalonia, Forestry Engineers Association of Catalonia</i></p> <ul style="list-style-type: none"> <li>• The Technical knowledge of this group is essential for the project's stakeholders. The taskforce will use all this knowledge, are the technical responsible of the development, implementation and management of the DHC project.</li> <li>• They are our technical advisors.</li> </ul>
DHC association	<p><i>Catalan Cluster for Energy Efficiency, ADHAC</i></p> <ul style="list-style-type: none"> <li>• They are who have the sector knowledge with its real problems. They know the reality, the needs and possibilities of the DHC. They also represent the past, present and future of DHC management.</li> <li>• They know how to do a DHC business plan.</li> </ul>
DHC utility	<p><i>Districlima, Cofely, Ecoenergies</i></p> <ul style="list-style-type: none"> <li>• Project developers, network managers, energy suppliers, Know-how, concerns and wishes to promote and develop new DHC or improve the existing ones.</li> <li>• They are the executors, investors, managers.</li> </ul>
DHC manufacturer (equipment supplier)	<p><i>Logstor</i></p> <ul style="list-style-type: none"> <li>• Manufacturer point of view</li> <li>• Collect improving proposals of the DHC responsible</li> <li>• Adjust and improve the prices and models of the application systems.</li> </ul>
Law firm	<p><i>LENER, Roca Junyent</i></p> <ul style="list-style-type: none"> <li>• Knowledge and experience in legal and regulatory fields related to DHC.</li> <li>• Improves in procurement systems</li> <li>• Requirements to ensure users' protection</li> </ul>

	Opportunities for DHC's developers and/or managers.
Financing company	<p><i>Suma Capital</i></p> <ul style="list-style-type: none"> <li>• Knowledge and experience in financial investments and management fields. Delimitation of minimum standards to ensure an external investor's investment.</li> </ul>
Consumers association	<p><i>Catalan Consumers' Association</i></p> <ul style="list-style-type: none"> <li>• Information about users' needs, ensuring clarity in services recruitment for DHC.</li> <li>• Dissemination to users about unknown DHC network world.</li> <li>• Push the administration to include renewable energy in daily life.</li> <li>• They are consumer's voice</li> </ul>

Target groups in Emilia-Romagna	Description of organisation and role
Local authorities	<ul style="list-style-type: none"> <li>• Local Authorities took part mainly in WS1 in Bologna. Their participation was very active. In fact, though with a limited direct experience of DH, especially of new generation DH, they proved to be aware of the main challenges to be faced and of the main opportunities in developing renewable DH.</li> <li>• The role of such a target group, due to economic crisis and budget limitations, will be probably not of direct developers of new DH initiatives but rather of supporters and promoters, for instance by stimulating the creation of local cooperatives to develop and operate small DH grids.</li> </ul>
Utilities and technology providers	<ul style="list-style-type: none"> <li>• This group of stakeholders was largely present in technical WS number 2. They showed a real interest in RES and low temperatures DH in particular to reduce their losses and optimize the systems.</li> <li>• The main question they raised was: "how to apply Danish good practices in Italian framework?" and the discussions at the workshops if not answers at least they have raised some important issues and they have started some analysis process.</li> </ul>
Financial institutions	<ul style="list-style-type: none"> <li>• This stakeholder group has not been sufficiently reached by the capacity building activities. In the third workshop, which was the most suitable one, just one actor participated, even though it is a very relevant one since it supports many banks and financial institutes investing in renewables.</li> <li>• Probably this low involvement was due also to the fact that the case studies had not reached yet the investment decision phase.</li> <li>• Therefore, a replication event has been planned later in a phase where the case studies were in a most advanced phase. (14<sup>th</sup> December 2016) Given the specific interest shown by many stakeholders, the topic of crowdfunding financing had a specific focus in this event, by inviting the Italian platform Ecomill (<a href="http://www.ecomill.it">www.ecomill.it</a>)</li> </ul>

Target groups in Baden-Württemberg	Description of organisation and role
District heating utilities and industry	<ul style="list-style-type: none"> <li>• Operate district heating systems mainly in urban areas</li> <li>• Have many customers and a relevant share in the energy sector</li> <li>• Have a lot of experiences in 'traditional' DH</li> <li>• Could bring in their know-how in implementation of Res DH</li> </ul>
Energy communities and cooperatives	<ul style="list-style-type: none"> <li>• Mainly situated in rural areas</li> <li>• Often already involved in renewables</li> <li>• Are in direct contact with end users or are end users at the same time</li> <li>• Can mobilize also money from end users to invest in 'their' Res DH system</li> </ul>
Local authorities (municipalities)	<ul style="list-style-type: none"> <li>• Municipalities hold a key position thanks to their direct contact with end users</li> <li>• They can play the role of initiator or end user</li> <li>• By connecting public buildings to Res DH they can show an example</li> <li>• Image improvement through innovation</li> <li>• The added-value stays in the commune or region and creates employment and induces taxes</li> <li>• Increase of sustainability for the municipality and firms</li> </ul>
Planners	<ul style="list-style-type: none"> <li>• The technical know-how is lacking and not sufficiently available</li> <li>• Awareness for Res DH should be raised</li> <li>• As potential multipliers, they must receive the necessary knowledge to further advise the decision makers</li> <li>• Improvement of image by initiating and planning Res DH plants</li> <li>• Increased public recognition</li> <li>• Advantage over competitors due to additional qualification</li> </ul>

Target groups in Schleswig-Holstein	Description of organisation and role
Consulting engineers / planners / energy utilities	<ul style="list-style-type: none"> <li>• The participating planners and engineers had already an interest in renewable district heating.</li> <li>• Consulting engineers could recommend renewable solutions in district heating</li> <li>• Awareness for Res DH should be raised</li> </ul>
municipalities / local administration / climate managers / politicians	<ul style="list-style-type: none"> <li>• The participants in the Workshop have been already interested in district heating and renewable energies.</li> <li>• There is still the need to spread the knowledge through out the country.</li> <li>• Local potential of renewable energies in district heating should be realized.</li> <li>• Starting to build new district heating grids.</li> </ul>

Target groups in Kerry County and Tipperary	Description of organisation and role
Local authorities	<ul style="list-style-type: none"> <li>• Local authorities were highly represented among the workshop participants. Generally speaking, they have limited know-how and capability in the area of district heating, except for KCC who has pioneered it in Ireland.</li> <li>• They have a very important role to play in DH project development in terms of local planning, as potential project developers and large users of heat.</li> <li>• Local authorities continue to be a key target group for the SRF partners, in particular in Kerry and Tipperary, in terms of capacity building activities and project development support.</li> </ul>
Financial institutions	<ul style="list-style-type: none"> <li>• Financial institutions are a key target group to enable project development with adequate financing.</li> <li>• While two key financial institutions were involved in workshop 3, finance professionals will be targeted intensively for the next training opportunity to continue building their capability in terms of DH project financial assessment and the design of adequate financing options.</li> <li>• Ongoing interactions between the Irish SRF partners and the Irish Energy Efficiency Fund and the NTMA in relation to the Tralee project, will help tailor support measures in this area (feasibility study models, financing models, etc.) and facilitate replicability among other Irish projects.</li> </ul>
Design professionals and technology providers	<ul style="list-style-type: none"> <li>• Design professionals were well represented at the workshops and constitute a very important target group in terms of capacity building.</li> <li>• While opportunities to exercise their design and specification skills remain low in Ireland at this stage, the training workshops are an important step in raising their awareness and their confidence in the technology and the ability to contribute to DH project development.</li> <li>• Equally, the Irish DH industry is in its infancy but includes a number of motivated and knowledgeable professionals eager to share their experience and develop their market.</li> <li>• The workshops were an opportunity to showcase their wares in that regard.</li> </ul>

## 4 Conclusion of capacity building in SmartReFlex

**Catalonia:** The workshops served to gather the expertise about DHC existing in Catalonia and to learn about the experience of the Danish partners. It has been detected a lack of information regarding heat and cooling demand at city and district level and it misses information regarding available waste heat. Assistants to the workshops showed interest in obtaining such information. A GIS viewer for standard Catalonia climatic zones, resources and energy demand from the existing data have been created. Several discussions about the best locations for DHC in the region as well as how to improve the framework were held. The impact of nZEB buildings and new trends were discussed. The capacity building seminars will undoubtedly have a positive effect on driving new DHC networks. On the one hand, they have served to create contacts between key actors in the field of these networks and, on the other hand, they have allowed to transmit and to share experiences and knowledge regarding these networks. Sustainable in the long term: on February 28<sup>th</sup> 2017 (the very last day of SmartReFlex), the final meeting of the task force was held and there the members have expressed their interest in continuing the activities, committing to meet at least once a year, because of the mutual enrichment and the practical results obtained.

**Emilia-Romagna:** In general WS have created a good platform to create interest, to share experiences, and create a dialogue on issues that already existed maybe, but have not been shared by different stakeholder groups. We can consider them important steps in the process of reducing the gap between utilities and local authorities. WSs have also create awareness over some important tools. RES DH face sometimes difficulties because of lack of support and barriers, but sometimes useful tools exist but stakeholder are not aware or they lack of expertise to use them. WSs have shown enough participation and interest to recognize a big potential to organize new ones. Topics to focus

on have been identified for "second-level" events: organization of the DH company, contracts, pricing and payments, fuels to be used. Replication of technical WS is already planned (spring 2017) in the "AIRU school", an education program of the Italian DH association in collaboration with national Order of Engineers, which aim is the update education about urban energy services. Replication of financial and organizational WS has been done in December 2016, by ANCI: during the SRF WS3 the main purpose was to bring out questions, rise a discussion and start introducing financial institutions in the task force about RES DH. The second edition of December 14<sup>th</sup> 2016, with the participation of financial institutions as speakers, tried to give answers, and to show innovative financial tools such as crowdfunding.

**Baden-Württemberg:** For the capacity building seminars in Baden-Württemberg a slightly different approach in comparison to the other regions was chosen. Reason is that there are quite a lot of experiences with district heating systems in Germany and also some first experiences in integration of solar heat (renewables) in DH. The workshops in Baden-Württemberg were planned as joint events, exploiting synergies from existing activities and projects in the sector, e.g. the regional project SolnetBW. The topics to be discussed have been found and selected together with the different stakeholders before the workshops. Good experiences were made with the additional direct invitation of specific stakeholders, as the more comprehensive issues are discussed the more important it is to invite particular stakeholders to achieve good results. Currently there are considerations with the ministry how to follow up with the issue 'areas for RES heat production' (see workshop 1) as this is still one barrier for realization of RES DH systems. Furthermore there are discussions if and how a second edition of the 'Forum Solare Wärmenetze' (see workshop 2) to provide further information to potential

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replicators (local authorities, energy cooperatives, utilities, etc.) could be organized. Currently, such a follow-up event is planned for May 2017.

**Schleswig-Holstein:** The three workshops based on each other. The first one started with the mapping of heat demand and the local renewable energy potentials. After that the technical possibilities to implement a heat plant or a district heating grid have been shown up. The last workshop dealt with the question how to finance a new district heating grid and a renewable heat plant. The third workshop showed, that regarding the financing sector more information is needed. For utilities and planners it could be hard to find a financing institute for new district heating grids and new solar thermal plants. Because of that, the MELUR, the Hamburg Institute and the Energy- and Climate Protection Initiative Schleswig-Holstein had organized a second financing workshop in September 2016, which addressed specially the financing institutes. The workshop showed the advantages and risks of financing large scale solar thermal plants and district heating networks to the financing institutes. The main conclusions were: for the realization of large scale solar thermal plants, the question of available space is the most important. The funding situation in Germany is quite good, but nevertheless the capital providers are unsure about investing in this sector of renewable energies. The business case on the integration of a plant in existing grids is easier than in building additionally new expensive networks. Therefore it could be a chance by understanding this investment as important for the common good or public interest and support it as other infrastructure projects.

**Kerry County and Tipperary:** From the local SRF partners' point-of-view, the workshops were very successful in that they achieved a high level of know-how transfer and increased capability at a local level. The quality of the exchange of experience and relationship building among participants and trainers were also an important

outcome. The ongoing work of the SRF partners in relation to case studies, regional strategies and project development will continue to feed back in this capacity building process.

**The Final workshop in November 2016** provided key points regarding strategic energy planning and project cases. On strategic energy planning, the key points included; status and next step of the process of strategic energy planning in each of the six regions. Key actors (who do what) in the further activities, including status and expected activities of the regional task forces. Development of concrete projects towards implementation was a key focus of the SmartReFlex project. At the final event, a status of the project activities in the six regions was provided, including next steps and who do what. The ability to replicate development of projects is a key outcome of the capacity building activities of the SmartReFlex project, and was also discussed at the final event. Please refer to [www.smartreflex.eu](http://www.smartreflex.eu) for further information on the findings of this final event of the SmartReFlex project.