

Market uptake of small modular renewable district heating and cooling grids for communities

Project No: 691679



***Framework conditions on small district  
heating and cooling grids in  
Macedonia and Karposh***

***WP 2 – Task 2.5 and 2.6 / Deliverable2.5***

3 November 2016



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This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 691679. The sole responsibility for the content of this report lies with the authors. It does not necessarily reflect the opinion of the European Union nor of the Innovation and Networks Executive Agency (INEA). Neither the INEA nor the European Commission are responsible for any use that may be made of the information contained therein.

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# Contents

<b>1</b>	<b><i>Introduction – facilitating DHC</i></b>	<b>4</b>
<b>2</b>	<b><i>Framework conditions for DHC in Macedonia</i></b>	<b>5</b>
2.1	Energy policy	5
2.2	DHC related legislation	7
2.3	Incentives – taxes and subsidies	8
2.4	Permitting procedures	8
2.5	Time for authorization and transaction costs	9
<b>3</b>	<b><i>DHC in Karposh</i></b>	<b>10</b>
3.1	Karposh	10
3.2	Supply of heating and cooling in Karposh	11
3.3	Energy resources available in Initiation, planning, implementation and operation of DHC in Karposh	12
3.4	Potential and barriers for DHC in Karposh	12

## 1 Introduction – facilitating DHC

The framework conditions are important for the establishment and operation of collective district heating and cooling systems. A characteristic of collective systems compared to individual systems is that a collective system requires organization – and therefore requires appropriate framework conditions e.g. to facilitate that the investments in hardware. The costs of financing should be minimized, reflecting the low risk characterizing district heating and district cooling supply.

Subsidies and taxes are instruments which can influence the behavior of the consumers. E.g. in Denmark the tax levels are relatively high, providing further incentive for energy efficiency.

This report (one of five reports constituting deliverable 2.5 in the CoolHeating project) provides an analysis of the framework conditions for small heating systems in the target country, Macedonia. The analysis comprises the different levels; EU-level (increasing capacity to enact EU-legislation), national level as well as regional and local level.

A key aspect of collective systems is trust. Trust is crucial for realizing the synergies of a collective system. This implies obligation of the consumers to pay for part of the fixed costs, i.e. to provide security that the investments will be reimbursed.

This report is supplemented by a Best Practice report (deliverable 2.1), which contains descriptions of numerous examples of renewable district heating plants in operation. Another supplementing report is on information material for the public (deliverable 3.3), which addresses the aspect of local acceptance.

The template for the report is provided by PlanEnergi, and the content is provided by the partner in Macedonia.

## 2 Framework conditions for DHC in Macedonia

Underlying documents:

- Assessment of Renewable Energy Action Plan Implementation and Progress of Renewable Energy in Energy Community<sup>1</sup>
- Renewable Energy Action Plan for the Republic of Macedonia until 2025 with vision until 2030<sup>2</sup>
- Energy Law of the Republic of Macedonia<sup>3</sup>

Key positive aspects:

- Existing legislation regarding the Heating Energy Sector, Renewable Energy Sources and Energy Efficiency as part of the Energy Law. However, there is considerably more focus on renewable energy implementation in the power sector than in the heating sector
- Harmonization of national legislation with EU legislation in the field of renewable energy
- Macedonia possesses a significant RES potential that could be utilized in the heating energy sector

Key negative aspects:

- The Energy Regulatory Commission regulates the district heating sector. This may result in additional administrative challenges and barriers
- The low price of electricity does not motivate consumers to connect to a district heating or cooling network
- Lack of incentives and legislation for renewable district heating and cooling systems
- Lack of proper banking support, subsidies or tax incentives for RES related projects and equipment
- Lack of a national energy efficiency fund
- Lack of a one-stop shop for coordinating all steps in the process of authorisation or giving a licence/permit

### 2.1 Energy policy

Being a candidate country for EU accession, Macedonia aims to harmonize its policies with the EU to promote closer integration with other European countries. This process includes harmonization of national legislation with EU legislation in the field of renewable energy, thus developing a proper legal framework for the energy sector that provides the basis for institutional and policy reforms that support renewable energy promotion.

The Energy Law, which is in force since February 18<sup>th</sup>, 2011, provides a legal framework for the Macedonian energy market including a chapter on Renewable Energy Sources and Energy Efficiency. According to the adopted Energy Strategy, the future plan is to increase

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<sup>1</sup>[https://www.energy-community.org/portal/page/portal/ENC\\_HOME/DOCS/3858301/229DEF054B006737E053C92FA8C0693D.PDF](https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3858301/229DEF054B006737E053C92FA8C0693D.PDF)

<sup>2</sup>[https://www.energy-community.org/portal/page/portal/ENC\\_HOME/DOCS/3996377/2AEF1526B32439F9E053C92FA8C03714.pdf](https://www.energy-community.org/portal/page/portal/ENC_HOME/DOCS/3996377/2AEF1526B32439F9E053C92FA8C03714.pdf)

<sup>3</sup><https://www.energy-community.org/pls/portal/docs/850177.PDF>

the share of electricity produced by renewable energy sources, as well as to utilize waste biomass for combined heat and power production.

The responsible body for energy policy and planning is the Ministry of Economy. The other relevant ministries are The Ministry of Environment and Physical Planning, The Ministry of Transport and Communications, The Ministry of Agriculture, Forestry and Water Supply. Besides ministries, the key energy stakeholders are the Energy Regulatory Commission, the Energy Agency, public utilities, non-government organizations, equipment suppliers and municipalities. Moreover, there is a Macedonian Energy Association (MEA) operating within the Economic Chamber of Macedonia. In the frames of MEA two groups are established: Group for heating, cooling, ventilation and air conditioning and Group of investors in small hydro power plants.

Aside from the Energy Law, a number of relevant strategic documents have been adopted in the area of energy policy, such as:

- **Strategy for Energy Development in the Republic of Macedonia until 2030<sup>4</sup>** which provides an outlook of the most favourable long term development of the energy sector in the Republic of Macedonia with a view of providing a safe and reliable operation of energy networks, good quality of energy supplied to the energy consumers and increasing the utilization of renewable resources
- **Strategy for Utilization of Renewable Energy Sources in the Republic of Macedonia by 2020 (RES Strategy)<sup>5</sup>** under which, according to Article 144 of Macedonia's Energy Law, the policy on the use of renewable energy sources is stipulated
- **Strategy for Improvement of the Energy Efficiency in the Republic of Macedonia until 2020 (Energy Efficiency Strategy)<sup>6</sup>** under which, according to Article 130 of Macedonia's Energy Law, the policy on energy end-use efficiency is stipulated

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<sup>4</sup>[http://www.ea.gov.mk/projects/unece/docs/legislation/Macedonian\\_Energy\\_Strategy\\_until\\_2030\\_adopted.pdf](http://www.ea.gov.mk/projects/unece/docs/legislation/Macedonian_Energy_Strategy_until_2030_adopted.pdf)

<sup>5</sup> <http://iceor.manu.edu.mk/Documents/ICEIM/Strategies/Strategy%20for%20utilization%20RES.pdf>

<sup>6</sup>[http://www.ea.gov.mk/images/stories/E\\_Izdanija/Regulativa/Strategija\\_za\\_unapreduvanje\\_na\\_EE\\_vo%20RM\\_do\\_2020\\_godina\\_SV%20143-2010%20\(1\).pdf](http://www.ea.gov.mk/images/stories/E_Izdanija/Regulativa/Strategija_za_unapreduvanje_na_EE_vo%20RM_do_2020_godina_SV%20143-2010%20(1).pdf)

**Table 1. Contribution of RES in ktoe according to the NREAP scenario for 2020, 2025 and 2030**

<b>CONTRIBUTION OF RES 2020-2025-2030 (ktoe)</b>			
	<b>2020</b>	<b>2025</b>	<b>2030</b>
<b>Electricity from RES</b>	<b>177</b>	<b>270</b>	<b>370</b>
HPPs	158	228	288
LHPPs	117	174	228
SHPPs	41	54	60
WPPs	9	26	53
PV Systems	3	4	11
Biomass	2	3	4
Biogas	5	7	7
Heat from RES			6
<b>Biomass</b>	<b>219</b>	<b>252</b>	<b>269</b>
Solar energy	204	233	245
Geothermal energy	5	5	7
Biofuels	11	14	17
<b>TOTAL RES</b>	<b>57</b>	<b>67</b>	<b>78</b>
<b>GFEC</b>	<b>454</b>	<b>588</b>	<b>717</b>
<b>RES share (%)</b>	<b>2,156</b>	<b>2,350</b>	<b>2,563</b>
<b>Electricity from RES</b>	<b>21.0%</b>	<b>25.0%</b>	<b>28.0%</b>

In accordance with the Energy Law, the Government of the Republic of Macedonia adopted the National Renewable Energy Action Plan (NREAP) until 2025 with vision until 2030. This Action Plan presented the Scenario 2020-2025-2030 of RES share in the final energy consumption. RES share of the GFEC that could be achieved based on this scenario is 21% in 2020, 25% in 2025 and 28% in 2030 (Table 1).

## **2.2 DHC related legislation**

There is no legislation and support schemes aiming to encourage the use of district heating and cooling using renewable energy sources. Regarding legislation, Macedonia's Energy Law governs:

- Energy policy objectives and its enforcement
- Energy activities and manner of energy activities regulation
- Construction of energy facilities
- The status and competences of the Energy Regulatory Commission of the Republic of Macedonia
- Electricity market; natural gas market; crude oil, oil derivatives and fuels for transport market; and heating energy market
- Energy efficiency requirements and promotion of the use of energy from renewable sources
- Other issues of importance in the energy field

In the Energy Law, the term heating energy is defined as “the energy in the form of hot water or steam obtained at heating energy generation plants using fuels (fossil, biomass or biogas), geothermal sources or solar energy”. Additionally, terms such as heating energy distribution, heating energy distribution system operator, regulated heating energy generator and heating energy distribution system are also defined in the Energy Law. The roles and obligations of

each entity that is significant in the heating energy production, distribution and supply are defined as well under the section **IX Heating Energy Market**.

### **2.3 Incentives – taxes and subsidies**

There are existing support schemes to encourage the use of renewable energy sources in small-scale heating and cooling. Since 2007, the Government of Macedonia introduced subsidies of 30% from the total investment up to 300 EUR per household that installs solar water heaters. This measure was repeated in 2009, 2011, 2012, 2013, 2014 and 2015, comprising 500-600 households per year (total subsidized households: 3,612 (11,659 applied); total budget in €: 800,000. However, these subsidies no longer exist. In addition, the VAT rate for solar collector systems has been lowered from 18% to 5% (Government of the Republic of Macedonia, 2015).

The Macedonian Government has announced subsidies for pellet stoves. With this measure 70% of the cost for the pellet stove will be covered, but not more than 30,000 Denars per household.

The positive effects from the incentive measures are as follow:

- Annually, with the introduction of solar thermal collector, a household saves about 2,400 kWh if household uses the solar system about 8 months during the year; According to the final price of electricity in the country, the financial savings for a household per year is approximately 13,000 Denars (200 €)
- Raising public awareness of the positive effects of the use of solar energy in households;
- Promotion of RES and greater involvement in final energy consumption;
- Protection of the environment

Although there are no support schemes which encourage the use of renewable energy sources in district heating and cooling grid for residential or industrial purposes, there are two rulebooks on the guarantees of origin for electricity generated from renewable energy sources and high-efficiency cogeneration plants, and granting status of preferential generator of high-efficiency cogeneration plants. The heating energy produced from the CHP could therefore be used for district heating purposes.

### **2.4 Permitting procedures**

The permitting procedure for the installation of district heating and cooling grids in Macedonia varies depending on the grids capacity, function and type. There are guidelines for the procedures of the development and construction of power plants utilizing renewable energy sources, issued by the Ministry of Economy and the Energy Agency of the Republic of Macedonia. Although continuous improvements of the legislative and regulatory framework in the past few years have substantially simplified and shortened the administrative procedures, there is still room for improvement. Further simplification is possible and is expected to come with adoption of the new energy law.

Furthermore, there are authorization procedures for grid connected power plants which take into account the specificities of the different renewable energy technologies. First, there is an adopted principle for elaboration of administrative procedures for renewable energy power plants with capacity below or above 1 MW. The first group below 1 MW deals with authorities for issuing construction permits at the local level (municipality). For power plants with capacities larger than 1 MW, other authorities such as the Ministry of Transport and Communications on behalf of the Government of Macedonia and the Ministry of Economy are responsible.

As well, the procedures for small-scale decentralized installations are simplified since they are not tied with certain permits, such as land rights. If small-scale installations are used for



other purposes rather than applying for feed-in-tariffs there is no need for procedure applications.

The construction authorization for new electricity and/or heating energy generation facilities shall not be necessary provided that:

- the energy generation facility has total installed electricity and/or heating energy capacity equal to or less than 10 MW;
- the expansion of the energy generation facility results in total installed electricity and/or heating energy capacity increase by up to 10 MW;
- the energy generated by the energy facility will be used only for own consumption.

Some unnecessary obstacles or non-proportionate requirements related to authorization, certification and licensing procedures applied to plants and associated transmission and distribution network infrastructure for the production of electricity, heating or cooling from renewable energy sources have been detected, such as:

- Large number of institutions involved in permitting procedures
- Lack of coordination among involved authorities
- Lack of a one-stop shop for coordinating all steps in the process of authorization or giving a license/permit

## **2.5 Time for authorization and transaction costs**

In Macedonia, the fees with applications for authorization/licenses/permits for new installations are published on websites of relevant ministries, relevant laws or sub-laws that govern procedures. The fees are correlated to the administrative costs as the relevant legal act explicitly states that these are meant to “cover the costs arising from the licensing procedure”.

The licensing procedures are considered long and may take up to two years.

### 3 DHC in Karposh

This section provides the local perspective, describing the potential for DHC from an implementation point of view.

#### 3.1 Karposh

The Municipality of Karposh (population: 59,666; surface area 35 km<sup>2</sup>) is located in northwest Macedonia, in the central-west part of the City of Skopje. It is one of the ten municipalities in Skopje and it has 12 urban and 2 rural units. The Municipality of Karposh is mostly covered by the Skopje DH network.

The local government's structure is such that it has fourteen sectors. Each of them is responsible for different topics such as finance, legal affairs, public procurement, community development, public relations etc. Among these sectors, the Ecology and Energy Efficiency Sector is responsible for environmental issues and energy efficiency in the community.

Regarding the topic of energy efficiency, the Municipality of Karposh has adopted the following documents:

- **Rulebook for energy efficiency<sup>7</sup>** – describes the measures that should be undertaken and the energy efficiency criteria that the new buildings and the reconstructed old buildings should meet in order to get an approval for construction
- **Energy Efficiency Program in the Municipality of Karposh 2013-2015<sup>8</sup>** – the successful implementation of the Energy Efficiency Program in the Municipality of Karposh 2008-2012 has encouraged the continuation of the municipality's measures and policies. This document gives an overview of the results and proposed policies in the different sectors: street lighting, primary schools, kindergartens, transport and residential sector
- **Report on energy savings with realization of the Program for Energy Efficiency 2008-2012<sup>9</sup>** – gives an outlook of the energy savings which resulted from the implementation of the measures of the Energy Efficiency Program in the Municipality of Karposh 2008-2012
- **Catalogue of energy efficient buildings in the Municipality of Karposh until 2013<sup>10</sup>** – displays the buildings under the municipality's jurisdiction which have gone under an energy efficiency transformation. At present, a new and updated version of this catalogue is being prepared

Regarding the topic of environmental protection and ecology, the Municipality adopted the:

- **Local Environmental Action Plan<sup>11</sup>** – because of the obligations towards the Macedonian Environmental Law, a Local Environmental Action Plan has been developed. The primary purpose of this action plan is to identify the environmental state of the municipality, to initiate a process of public participation in order to identify the problems of biggest priority and to suggest measures and action for solving these problems

Karposh is the only municipality in Macedonia which has subsidized the energy efficiency in buildings and the renewable energy use for heating and cooling, covering 15% and 20% of the communal tax for the respective buildings. Out of 244 buildings, constructed over the period 2012-2015, 117 buildings are of A+, A and B classes, and 68 of them have installed

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<sup>7</sup> [https://issuu.com/opstinakarpos/docs/pravilnik\\_za\\_energetska\\_efikasnost\\_02\\_za\\_web\\_2](https://issuu.com/opstinakarpos/docs/pravilnik_za_energetska_efikasnost_02_za_web_2)

<sup>8</sup> [https://issuu.com/opstinakarpos/docs/konecna\\_verzija\\_na\\_meep\\_2013-2015](https://issuu.com/opstinakarpos/docs/konecna_verzija_na_meep_2013-2015)

<sup>9</sup> [https://issuu.com/opstinakarpos/docs/brosura\\_ee\\_2013\\_krajnaaa](https://issuu.com/opstinakarpos/docs/brosura_ee_2013_krajnaaa)

<sup>10</sup> [https://issuu.com/opstinakarpos/docs/katalog\\_energ.efikasn.finalen\\_cel\\_e](https://issuu.com/opstinakarpos/docs/katalog_energ.efikasn.finalen_cel_e)

<sup>11</sup> [https://issuu.com/ivaivkamanova/docs/leap\\_karpos\\_3\\_10\\_2011\\_spa](https://issuu.com/ivaivkamanova/docs/leap_karpos_3_10_2011_spa)

heat pumps for heating and cooling. Furthermore, as per the Strategic Plan of Local Economic Development until 2019 and Energy Efficiency Programs (2008-2012 and 2013-2015, all the reconstructed buildings under the municipal jurisdiction (in total 20 schools and kindergartens, 14 fully reconstructed) should replace the oil boilers with renewable energy based heating by the end of 2018. So far, three buildings have installed renewable energy based heating – two with heat pumps and one with biomass wood chips (under construction). In addition, under the Program for renovation of the facades of the collective housing buildings, facades of 13 buildings have been reconstructed with thermal insulation and new carpentry.

### **3.2 Supply of heating and cooling in Karposh**

Today, a certain area of the Municipality of Karposh is covered by the district heating network. In the past, the production, distribution and supply of heating energy had been done by different companies under the Toplifikacija AD Skopje. Since 01.01.2013, Balkan Energy Group (BEG) has taken over these services and they are provided by the three companies which constitute BEG: Production of Heat BE, Distribution of Heat BE, and Supply of Heat BE. Other companies are also a part of the regulated heating energy sector of Macedonia, but they do not act in the Municipality of Karposh. Among these companies are Skopje Sever AD and ELEM AD (affiliate Energetika).

The entity responsible for heat production, Production of Heat BE, is the biggest heat energy producer in Macedonia. This company is adapted for working as a regulated heating energy producer, for which it has a proper license as defined in the Energy Law.

The company responsible for distribution of the heating energy is Distribution of Heat BE. The activities of this company include to undertake, distribute and to deliver the heating energy to the consumers of the heating system.

Supply of Heat BE performs the business supplying of the heat according to the Resolution for awarding a license by the Energy Regulatory Commission of the Republic of Macedonia with effect from 1<sup>st</sup> January 2013. The primary mission and objective of the Company is to provide secure, continuous and quality supply of the heat in accordance with the Rules for Supply of Heat.

The heating supply season is from October 15<sup>th</sup> (at earliest October 1<sup>st</sup>) until April 15<sup>th</sup> (at latest April 30<sup>th</sup>).

The company has focused their efforts on lowering the price of heating energy and to persuade the old consumers to reconnect to the district heating network

When all is taken into account, the competition regarding the heating and cooling sector in the Municipality of Karposh is not fierce, i.e. the only company dealing with district heating is BEG. In the Karposh Municipality heating and cooling solutions which utilize renewable energy sources have been implemented in separate buildings as a result of the above mentioned subsidies. These individual systems have lowered the expenses for heating and cooling, but no district heating or cooling network with renewable energy sources has been developed so far. Taking into account the fact that Macedonia is a developing country and that the electricity market is not fully liberalized, the price of electricity is fairly low. Therefore it can be concluded that the main competition of the district heating systems is the electrical power system. There have been a number of cases where consumers of the district heating network detached from the systems because it had been more economically justified to use electricity as the main heat source. On the other hand, the price of electricity is expected to rise with the market liberalization, making investments in sustainable and renewable district heating and cooling systems a good strategic move.

### **3.3 Energy resources available in Initiation, planning, implementation and operation of DHC in Karposh**

The Municipality of Karposh has various renewable energy sources available. Firstly, this is due to the geographical position of Macedonia as a country, but it is also the result of the local environment as well. The most important renewable energy sources for district heating and cooling systems available in the Municipality of Karposh are:

- Groundwater - according to the Study on wastewater management in Skopje<sup>12</sup>, the City of Skopje has considerable amounts of groundwater. Groundwater below Skopje consists of two main aquifers: high yield semi-confined aquifer of superficial sand and gravel with clay horizons and low yield aquifer in underlying marls. The groundwater can be found from in depths larger than 4m in the ground. This makes it possible to implement water-to-water heat pump systems
- Urban biomass - available from maintenance of local parks. This biomass is suitable for wood chips and other biomass based heating systems
- Solar energy - As a result of the big exposure to sun irradiance, solar energy could be utilized in a combined system for heating and cooling purposes, but also for heating of sanitary hot water
- Waste management – waste selection allows for the implementation of waste to energy heating system

Additionally, the municipality of Karposh has 2,536 heating degree days. Climate and environmental conditions are suitable for ground-to-water and air-to-water heat pumps.

In the case of a potential project, the challenges would certainly depend on the type of project. Because of the lack of experience in building small and renewable district heating and cooling systems, a number of relevant questions arise. These questions are not so much related to the technical aspect of the project as they are to the business models, proprietary aspects, overcoming the present state and perception of district heating systems etc. The preliminary project process may involve a questionnaire for compliance of the residents, a feasibility study, receiving a permit from the Energy Regulatory Commission of Macedonia, defining the regulated price of heating energy etc.

### **3.4 Potential and barriers for DHC in Karposh**

The key points when assessing potential and barriers for DHC in Karposh could be placed in two groups:

- Potential and barriers in heating and cooling systems for new building/housing complexes
- Potential and barriers for heating and cooling systems for existing but renovated building/housing complexes

In the case of new building/housing complexes, it appears that the compliance and permitting procedures would go more smoothly. This case holds the following barriers and potential:

- The investor or contractor of the new building complex could be the investor or contractor for the heating and cooling system
- If the investing company does not have the expertise in the field of heating and cooling systems, it could hire a company with adequate district heating and cooling expertise. This could be a separate entity with no legal, economic or proprietary link to the investing firm or the construction company
- In the case of new buildings, the sales agreement would state the terms and conditions under which a buyer purchases the home or business facility. These terms

<sup>12</sup> [https://www.jica.go.jp/english/our\\_work/social\\_environmental/archive/pro\\_asia/pdf/mac01\\_04.pdf](https://www.jica.go.jp/english/our_work/social_environmental/archive/pro_asia/pdf/mac01_04.pdf)

and conditions would include the information for the heating and cooling systems along with distribution of energy for cooling and heating

- All of the homeowners would be aware of the positive and negative aspect of these systems, and would have agreed to the terms and conditions of having them in their homes or business facilities

When implementing district heating and cooling systems in already existing building/housing complexes, the number of barriers and problems may become larger. This is due to the overall state of district heating and cooling systems in Macedonia, as well as the costs, habits and lifestyles of the habitants of these building/housing complexes. Among these barriers are:

- Uncertainties regarding of the number of consumer, which would be interested in being a part of the district heating and cooling system. The main dilemma for these residents could be the economic pay-off if the transfer to the new heating and cooling system took place
- Defining a location for a common heating/cooling substation. The heating/cooling substation could be on land owned by the municipality and the need for adopting changes in the Detailed Urban Plan of the municipality would arise (as is the case with electrical substations)
- Uncertainties regarding the type of the contract for the heating/cooling system (ESCO, Public-Private Partnership, Public enterprise as part of the municipality etc.)
- Defining the system's minimal period of use and the economic justification for its' construction

Furthermore, planning and financing upgrades of the systems in order to connect new consumers may become an issue with time, if the existing systems don't prove to be efficient and less costly than individual systems which utilize electricity, biomass of other sources. Although the Municipality of Karposh already provides subsidies for energy efficient buildings, allocating and defining resources for subsidies for district heating and cooling systems pose a number of uncertainties.