Upgrading the performance of district heating networks in Europe

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Guideline on business models and financing schemes for retrofitting DH networks

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Upgrade DH website: www.upgradedh.eu

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1. Introduction

The overall objective of the Upgrade DH project is to improve the performance of district heating (DH) networks in Europe by supporting selected demonstration cases for upgrading, which can be replicated in Europe.

The Upgrade DH project supports the upgrading and retrofitting process of DH systems in different climate regions of Europe, covering various countries: Bosnia-Herzegovina, Croatia, Denmark, Germany, Italy, Lithuania, Poland, and The Netherlands. In each of the target countries, the upgrading process will be initiated at concrete DH systems of the so-called Upgrade DH demonstration cases (demo cases). The gained knowledge and experiences will be further replicated to other European countries and DH systems (replication cases) in order to leverage the impact.

Core activities of the Upgrade DH project include the collection of the best upgrading measures and tools, the support of the upgrading process for selected DH networks, the organisation of capacity building measures about DH upgrading, financing and business models, as well as the development of national and regional action plans.

In addition, an image raising campaign for modern DH networks will be carried out in the Upgrade DH project. The outcome will be the initiation of DH upgrading process in the above-mentioned target countries and beyond.

This guideline covers the relevant aspects of the district heating business models, including the basic framework conditions, different ownerships, sustainable financing solutions, as well as different costs and revenues which can occur, and which define the financial part of any project. It is meant as a brief overview of the most important parts of the sustainable business models for all the stakeholders interested in upgrading their district heating systems, but also as a guideline for developing the sustainable business models for the demo cases in the Upgrade DH project.

A good collection of guidelines, reports and tool on upgrading DH systems is also provided by the "Learning Centre" of the H2020 project KeepWarm[1]. One thematic area of this learning centre is focusing on business models and Funding. Furthermore, a "Guidelines on improved business models and financing schemes of small renewable heating and cooling grids" is provided by the H2020 project CoolHeating[2].

[1] http://www.keepwarmeurope.eu/learning-centre/
[2] https://www.coolheating.eu/images/downloads/CoolHeating_D5.1_Guideline.pdf

2. Framework conditions

Framework conditions in this context are external factors, that are not determined by the business models, but that highly influence the business models. This means that the framework conditions cannot be changed by the business but must be considered as pre-given. This is the difference to internal factors that can be changed by internal decision processes of the business.

Framework conditions can be differentiated by its type, such as historical, economic, legislative, political and geographical framework conditions. Often, they altogether impact each other. For example, a European law is based on a certain policy focused on the European Union as a geographical region.

Framework conditions can be very powerful and can promote or block business models. This is especially relevant for relatively new sectors. For example, laws can be used to specifically promote renewable energies and to increase their competitiveness against fossil energies.

In the following section, different framework conditions are presented which should be considered in any business model. Depending on their impact on the business model, they can be of different importance.

Public policies

Public policies are ideas, strategies and action plans agreed by politicians at European, national, or local levels, saying what they will do in a particular situation. Important policies for upgrading DH may include:

- Policies to mitigate climate change, e.g. Clean energy for all Europeans package of the European Commission[3]
- Energy efficiency policies
- Renewable energy policies
- Policies for phasing out fossil fuels, e.g. coal, natural gas or heating oil

In addition, specific policies at local and district level may include:

- City development plans
- Policies to mitigate local air pollution

Public policies are made by politicians. In the energy sector, especially in the traditional fossil energy sector, lobbyism is influencing politicians and thus the public policies. Although this lobbyism is usually a long-term process, it may be an important aspect in a business model, as it may promote or block upgrading of district heating systems. Therefore, good relations to politicians can be of an advantage.

Legislation

Many types of legislation, including for example laws, acts, directives, regulations, or ordinances are very important framework conditions for business models. They can be applicable at European, national and local levels. The legislation on the following topics need to be investigated in a business model:

- Construction works on buildings and piping
- Properties and real estate issues
- Consumer rights
- Renewable energies
- Climate change mitigation
- Energy supply and markets
- District heating
- Emissions
- Financial issues, taxation

[3] https://ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans

- Support schemes
- Safety
- Contracts
- Competition and monopolism

Permitting procedures

Long lasting and complicated permitting procedures are frequently mentioned barriers against the implementation of large-scale renewable energy projects and against district heating systems. Depending on the type, permits can be issued by authorities or by political bodies such as e.g. City councils. Thus, a good relation to employees of the authorities as well as to politicians can help to speed-up and simplify permitting procedures. The main permits that may be needed for an upgrading project are related to the construction permits of heat generators and of the piping system. A business model should investigate the local permitting procedures for the considered upgrading measures.

History and image of DH

The history of a country or region could impact the business model of an upgrading project. This applies to political systems and policies, but especially to the development of the energy sector and of the district heating systems. For example, the upgrading of DH systems that are supplied by coal CHP units into renewable energy systems may be more challenging in traditionally coal intensive regions than in other regions without coal mining. Furthermore, the historical long-term performance of DH may impact the image of DH and thus, the consumer acceptance of upgrading measures.

A business model for upgrading DH systems should thus analyse the consumer acceptance and eventually include measures on how to improve it.

Geography and climate

The geographic and climatic framework conditions are of high importance for any DH business model. However, these issues are usually addressed in the business model by the technical descriptions and plans of the upgrading measure.

Competing sectors and markets

Competing sectors and markets are also external factors that must be considered in a business model. Thereby, competition with other companies needs to be considered, but also to other energy supplies such as individual heating solutions. Current and expected future prices of the different energy carriers and technical solutions need to be investigated. Often, DH competes with natural gas supply.

External risks

Any potential external risks should be part of a business model for upgrading projects. These risks may include for instance political changes, energy price risks, changes in legislation or similar. External risks are accompanied by internal risks which are described in the other parts of this guideline.

3. Ownership models

The ownership of different elements of a district heating system may vary between the consumer side, the DH network owner and the heat production side. Generally, the consumer side belongs to private or public consumers. The network is often a part of municipal property or a private company, which may have public shareholders. The heat production can equally be owned by the network operator but may also have another owner.

Quite many DH systems in Denmark were created from the mid 1980's onwards as direct consumer-owned systems[4].

The following paragraphs will elaborate different strategies for ownership that may appear during upgrading processes mainly based on the work of Zeman et al[6].

3.1. Typical ownership models in the DH sector

The ownership in the district heating sector can be categorized into four main models:

- Fully publicly controlled
- Fully privately controlled
- Mixed: Ownership and management are public or private
- Non-profit community-owned cooperatives

Especially the mixed ownership model provides a range of different possibilities which will be elaborated in more detail in the coming sections.

3.1.1. Wholly public

Historically, many DH systems were owned by municipalities or municipal companies. Through a market liberation, as it happened in e.g. Finland and Sweden since the 1990's, private companies entered the business by buying networks or taking part in the heat production[56].

Usually, public bodies have little experience in taking long term decisions in energy systems. These decisions were therefore often left to DH management groups. The current requirements in GHG and emission reductions, may change this behavior to make increased use of possible benefits of DH systems as the awareness rises about DH system potential.

Discussions about privatization in the past decades or public ownership have led in some cases to stronger and more fruitful relations between the public owner and the DH company. Currently, in some countries (e.g. Germany with Hamburg and Berlin) town or regional governments are re-purchasing DH systems from the private companies in order to have more power over changes in the DH systems e.g. to transform the supplying heat sources to have lower emissions.

An example for a large publicly owned utility in Germany is the Stadtwerke München (SWM), which is owned by the town Munich. It is also shareholder of several other companies, such as regional gas supply companies. Finally, it is an operator (together with local partners) of a Spanish solar thermal power plant (Andasol 3).

3.1.2. Private

The integration of the private sector allows to outsource risks. Private enterprises are better at managing risks especially when it comes to capital- intensive projects. But if infrastructure is

[4] Kristensen, P., (2013) Danish Model for ownership in the district heating sector Denmark (SDHplus, EU IEE Intelligent Energy Europe programme project deliverable)
[5] Okkonen, L., Suhonen, N., (2010) Business models of heat entrepreneurship in Finland
[6] Zeman, J., Werner, S., (2003). District Heating system Ownership Guide

completely owned by the private sector, the public administration loses the ability to influence decisions if points of interest are not part of (e.g. local) legislation[6].

When considering heat supply only, many private industries may provide industrial waste heat to a DH network. Challenges and details are on the subject of industrial excess heat integration can be found in the Upgrade DH handbook, available on the project webpage: www.upgrade-dh.eu.

An example for a private company that owns large DH systems is Vattenfall from Sweden. Vattenfall owns not only the DH system of Uppsala and other smaller cities, but it also owns the large DH system of Berlin and Hamburg, which are in the process of being re-purchased by the towns themselves.

3.1.3. Public – private partnership

Public-private partnerships are very common in many DH networks. There is a range of different types which are focused on the property, services or management of networks. The most relevant types of public-private partnerships are shortly explained in this chapter based on Zeman et al.

Operation and management contracts:

Operation and management contracts may include private companies to manage a system owned by the public. This allows to make use of external expertise and include a different viewpoints on day to day decisions.

Leasing:

In this case, an operator leases e.g. a network for long term and operates it. It is crucial to have a maintaining agreement of the asset to ensure that it is operated sustainably

Concession:

In a concession case, the public owner gives the operation to a privately owned company and with it all the requirements in decisions. At the end of the concession, the ownership might change, depending on the contract. A famous example is the DH network of Paris: CPCU has a concession since 1927 and has to pay annually 1.85 % of the annual turnover to the city of Paris, who also owns 1/3rd of CPCU.

Selected private minority equity partnership:

The municipality has the ownership majority and control. It involves external expertise which can be specifically chosen.

Minority private equity invited through the stock market:

A way of financing for upcoming projects may be the participation in the stock market. It is used to attract private capital and allows rather easy and less expensive financing for development or modernization undertakings.

Majority private equity ownership:

A majority private equity ownership allows leaving the management decisions to a private company while the public institution remains influential power on the DH system.

Full private ownership with municipal support:

A DH network that is fully in private hand but supported by the local government reduces the financial risk for the private company as common goals with local municipalities have been defined. These goals may be expansion plans or plans for environmentally friendly energy supply.

Privatization of heat generation:

Heat generation and distribution were, even when both in public hand, often managed by different institutions. When the institution that was responsible for the power generation started privatization, a private company often started having a partnership with the municipally owned distribution company.

According to Finish experience, the privatization of municipal heat entrepreneurs has had mutual benefits. The municipality has increased heat supply security due to additional heat sources and at the same time reduced operational and investment costs if e.g. thermal energy supply from oil boilers is reduced. The entrepreneur on the other hand can have additional income from forest or agricultural products (as it is mainly the case in Finland)[5].

3.1.4. Prosumerism

The word prosumer is based on producer and consumer. A prosumer supplies and consumes (in the case of district heating) heat to or from a DH network. Prosumers should not be mixed with decentralized heat producers. In contrast to prosumers, decentralized heat producers supply heat to some feed-in point in the network, but do not consume any heat.

In the example of a system in Düsseldorf (Germany), prosumerism can be a housing company that installed a solar thermal collector array on a building complex and feeds the heat surplus into the DH network. As this is not yet common practice in Germany, agreements had to be signed that also contain required feed-in conditions e.g. temperature and pressure levels[7].

A usual question for prosumerism is how they are connected in the DH network. Different hydraulic integration possibilities exist and a strategic control system is required to ensure the networks requirements. A guideline in German language on integration of prosumers in DH networks is available by AAE[8].

3.1.5. Cooperatives

Cooperatives usually exist only in rather small DH systems, as its creation requires larger commitment by the local population.

A cooperative is owned by the investors, who are usually the heat consumers. The investors benefit in this case from cheap heat, as there is no profit-oriented investor. Not having a profit-oriented investor may though be a disadvantage, as they usually operate the networks as cost-effective and thereby efficient as possible.

The active participation and decision-making process in a cooperative often leads to a higher acceptance of an energy transition process. This is also caused by intense discussions that may appear during decision taking processes if the opinions of the investors have a large variety. In many Danish cooperatives this ownership form has also led to increased investment in sustainable heat sources e.g. large solar thermal installations[4][9].

3.2. Application of different ownership models

Many DH systems have one owner for the whole DH system, which has advantages in terms of communication. However, in historically grown DH networks with a central heat generation

[7] Schramedei, R., Schwutke, R., Seier, M., Huther, H., Schäfer, K., Schmid, T., Hincke, R., (2019) SWD.SOL Endbericht

[8] Lichtenegger, K., Moser, A., Muschick, D., Reiterer, D., Wöss, D., Leitner, A., (2018) Einbindung von dezentralen Einspeisern in Wärmenetze, AEE Arbeitsgemeinschaft Erneuerbare Energie NÖ-Wien; http://www.aee-now.at/cms/fileadmin/downloads/projekte/bine2/Publikationen/Bine2plus%20Leitfaden%20final.pdf

[9] Pfister, T., Wallraf, C., Sieverding, U., (2015) Nahwärmegenossenschaften Chancen & Risiken aus Verbrauchersicht, Verbraucherzentrale Nordrhein-Westfalen

unit, the ownership is often separated: the heat distribution is often owned by a public company and the heat generation facility is owned by a private utility[6].

For the implementation of upgrading measures by a private company that is in charge of the whole system, its owner can freely perform upgrading measures considering the usual key performance indicators (KPI), such as return of investment (RoI) or applicable revenue expectations.

For the heat production, the ownership model usually depends significantly on the upgrading measure selected. In cases when the upgrading concerns the already existing system (i.e. optimization of the system operation, storage tanks, etc.), the existing owner will be responsible for the upgrading measure. However, in cases when a new production unit shall be built to increase the share of renewables in the overall system (i.e. building solar thermal plant, geothermal, etc.), additional actors can be included as full or partial owners.

The most significant upgrading measure on the distribution side is the refurbishment of the network. Even though there are networks that have a distribution system that is partly owned by the owner of the heat production and partly by the owner of the distribution side, the existing ownership will be continued in most cases.

For the heat use side, there are two main factors which influence the overall operation of the district heating system; the general refurbishment of the buildings which are connected to the system and the refurbishment of the district heating substations in each separate building. Even though the refurbishment of the building itself, i.e. improving the envelope of the building, replacing the windows, doors, roof, etc. is not directly connected to the district heating system, it still has a major influence on its operation by lowering the overall heat demand, changing the temperature regime in the building, etc.

Therefore, the sustainable ownership models which can be applied for the building refurbishment will be elaborated in the next paragraphs, based on Brown (2018)[10].

3.2.1. Market intermediation model

In the market intermediation model, an intermediary organisation has a crucial role, which coordinates the supply chain of the whole refurbishment process. The involvement of the intermediary can potentially lower the transaction costs while at the same time facilitate the implementation of the project. These benefits can be achieved due to the fact that these organisations often involve local authorities or NGOs and offer procurement guidelines and overall consultancy throughout the process of refurbishment for the building owner. The most relevant service from the intermediary is the financing assistance, however they could also provide various specialist services. The detailed scheme of the market intermediation model is shown in Figure 1.

[10] Brown, D., (2018) Business models for residential retrofit in the UK: a critical assessment of five key archetypes, https://doi.org/10.1007/s12053-018-9629-5

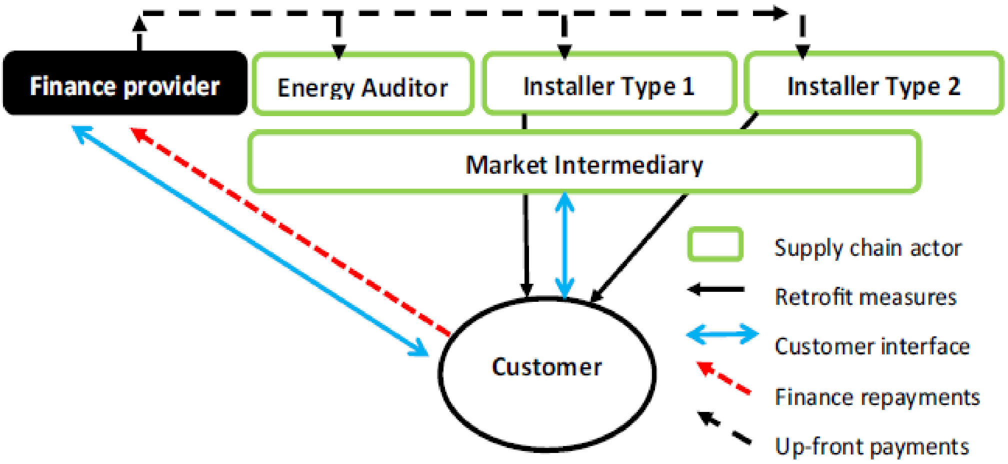

Figure 1. Scheme of the market intermediation model[10]

3.2.2. One stop shop model

In the one stop shop model, the customer has a single point of contact with the service providers. In some cases, the finance provider is also included in the one stop shop, as can be seen in Figure 2. This practically integrates a supply chain and the customer interface in a single company, or in some cases a network of subcontractors. This way, the whole refurbishment process is significantly simplified for the end user, which facilitates the rate of refurbishment in the whole city/region.

Therefore, in a one stop shop model, the company, i.e. the supplier provides a holistic service, including the design phase and the implementation phase. Hence, only one company implements a number of complementary measures, while the end user only needs to provide finance repayments.

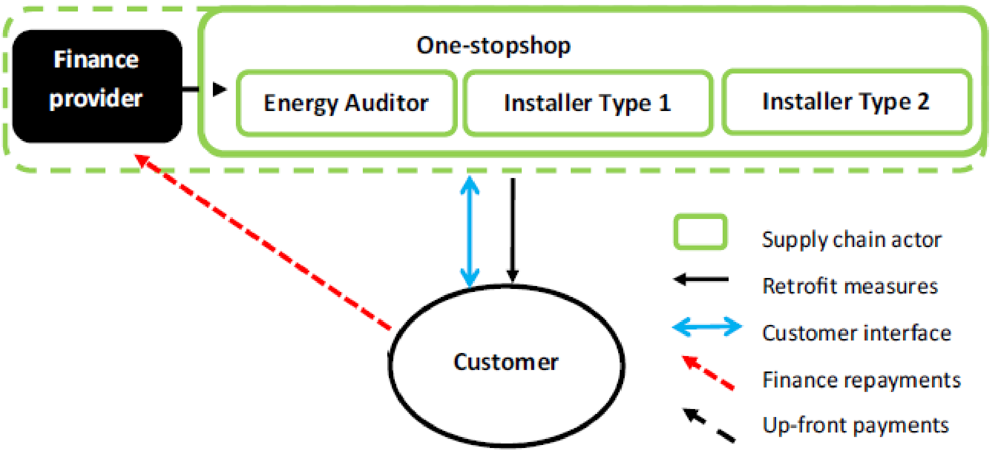

Figure 2. Scheme of the one stop shop model[10]

3.2.3. ESCO model

Energy Service Companies (ESCo) are businesses offering their clients a wide range of energy services. The client, who could be a district heating network operator, can reduce energy consumption and connected expenses for the operation of installations.

This range of energy services can be: energy analysis and audits, energy management, project design and implementation, maintenance and operation, power generation and energy supply, monitoring and evaluation, facility and risk management. The following aspects characterize an ESCO model:

- An ESCo guarantees energy savings and/or provision of the same level of energy service at the lower cost.
- The remuneration of an ESCo is directly connected to the energy savings achieved.
- An ESCo can finance or assist in arranging financing for the operation of an energy system by providing a savings guarantee.
- An ESCo retains an on-going operational role in measuring and verifying the savings over the financing term.

In the building refurbishment sector, the ESCO model includes signing the energy service agreement between the building owners and an ESCo. In this model the owner/users of the building are offered an energy performance guarantee for the energy services. These are typically offered for the timeframe of at least 15 years. That way, the users do not make the finance repayments to the finance provider, but rather pay the energy savings achieved by the refurbishment process to the ESCo.

The users are also guaranteed a level of performance by the ESCo and in case of the lower performances, the company pays the penalties to the users, as defined in the contract. The defined performances can be in a form of the defined temperature, the hourly flow of the water, etc. This model further simplifies the refurbishment process for the end users since the design, implementation and the operation phases are covered under one contract. Figure 3 shows the detailed scheme of the ESCo model.

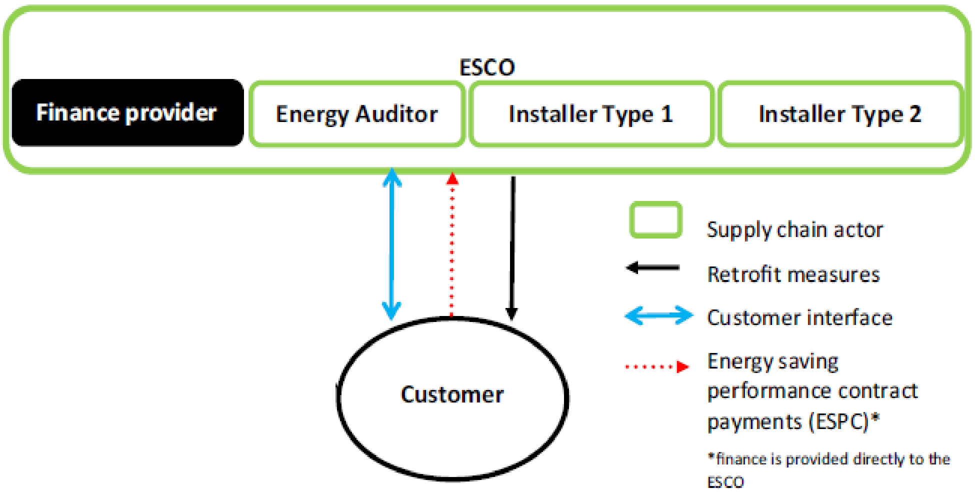

Figure 3. Scheme of the ESCO model[10]

The ownership model, in case of replacing the current substations, depends on the current ownership. The substations can be property owned (i.e. owned by the residents of the building, or the building owner) and utility owned. The latter case, owned by the utility, is favourable from the perspective of network operation, as this means, that settings can be chosen, and components be changed in the interest of network operation.

4. Heat market

An interesting factor, which can affect the business model of the upgrading measure is the availability of a so called “heat market” in the selected city/region. It is still a rather unknown term in the heating sector, although being increasingly relevant in the electricity sector. However, in some countries this kind of market has already taken place. Since one of these countries is Lithuania, the next paragraphs will give a brief description of the heat market with the example from that country.

According to the legal regulation, that has been used for almost 15 years in Lithuania, regulated DH companies have received a fixed income to ensure that the necessary heat production facilities are operational. In addition to their own heat production, DH companies purchased heat from Independent Heat Producers (IHP) if their heat price was cheaper than the price of their own heat generation (variable costs open for competition). This ensured the reliability of the heat supply and ensured the principle of the lowest cost.

The new Heat Auction Regulation in Lithuania introduced in 2019 legalizes competition at ”full cost“ (fixed cost + variable cost). This means that there exists no fixed income for the DH companies any more. The heat generation devices generate revenues only if they are in operation and the ones that do not operate, e.g. due to maintenance or due to low demand, do not receive revenues. The heat price is influenced by the market price and by the number of plants that are selling the heat. During low heat demand months, several heat producers will decide to switch off their devices due to low heat prices. The heat price during low heat demand months decrease due to competition of heat producers and increase dramatically when the market is large enough for everyone to fit in it (see figure of Vilnius DH demand graph below).

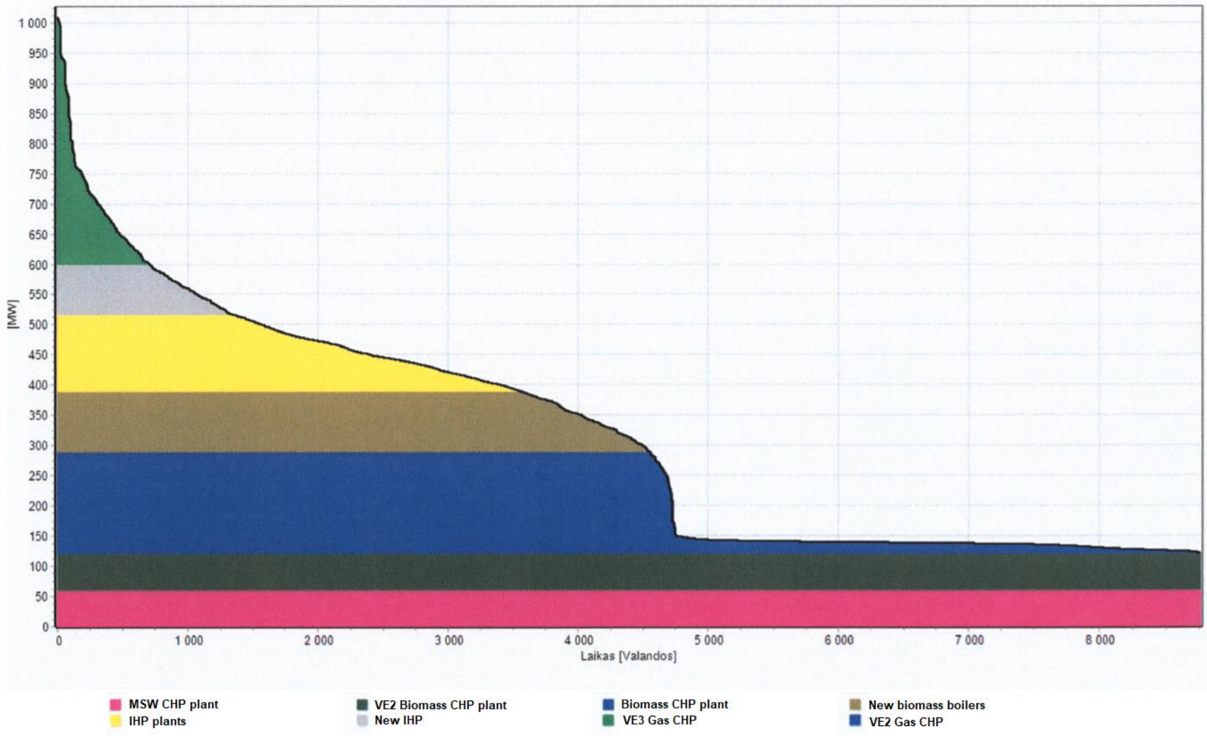

Figure 4: Heat load duration curve of the district heating system of Vilnius showing the different heat suppliers

The current situation is often referred as ‘’wild competition’’. Only strategically planned generation devices can ensure the required parameters for each user and overall reliability of the network. The IHP usually build their generation devices at random locations in the network – regardless of the overall need of the system.

The new Heat Auction Regulation guarantees a good business environment for unregulated and ‘’open-handed’’ IHP. To DH companies it poses a significant risk of losing a part of the income. Some of the DH companies will not be able to regain all investments made for already implemented heat production installations. Accordingly, there will be no funds for fulfilling their financial obligations. There is a risk that the economic and technological bases of district heating will be destroyed. Following facts are relevant for the operation of the heat market in Lithuania:

1. The amount of heat purchased from independent heat producers and/or produced by heat generators owned by heat suppliers is determined by means of a heat auction organized by the operator of the Energy Exchange (Baltpool). The Operator of Energy Exchange shall operate, maintain and administer the heat auction data management system and the heat auction information system in accordance with the procedure established in the Heat Auction Regulation. The Heat Auction Regulation, which lays down the procedural requirements for the heat auction, shall be approved by the Council on the proposal of the Energy Exchange Operator.

2. In accordance with the procedure established by the Council, heat suppliers shall submit to the Energy Exchange Operator the forecasted amount of heat production and/or purchase required to satisfy the needs of heat consumers and other information provided in the Description and Procedure of Heat Production and/or Purchase. Heat suppliers and independent heat producers shall participate in a heat auction organized by an energy exchange operator and submit bids for the production and/or purchase of heat and, after winning the heat auction, produce and/or sell, taking into account the auction results and the conditions referred to in paragraph 3 amount of heat at the price indicated in the offer. The missing amount of heat, which has not been purchased through a heat auction, is produced by the district heating company using its own existing heat production facilities.

3. According to the results of the heat auction, the heat is produced and/or purchased within the limits of the heat demand of the heat supply system users and taking into account the technical capabilities of the heat supply system. In all cases, heat production and/or purchase shall be carried out at a price no higher than the comparative heat production costs calculated by the heat supplier in accordance with the procedure established by the Council.

4. When producing and/or buying heat, priority shall be given to the lowest price offered. If a uniform heat price is offered, the following order of priority shall be established:

    a. high-efficiency cogeneration installations using renewable energy sources or incinerating waste;
    b. combined heat and power (CHP) plants which use renewable energy sources or incinerate waste;
    c. installations for the production of heat from renewable energy sources or from the incineration of waste;
    d. waste heat from industrial installations;
    e. high-efficiency cogeneration units;
    f. combined heat and power (CHP) installations;
    g. fossil fuel boiler houses.

5. Where the price of heat is the same and the order of priority provided for in paragraph 4, priority shall be given to the participant in the heat auction which ensures a longer period of production and / or sale of heat.

All in all, the heat market system has its advantages and disadvantages. On the one side, the heat price is lowered due to competition, especially if the demand of the market is lower than the capabilities of suppliers. On the other hand, it poses significant long-term reliability risks as it is the case for the Lithuania.

5. Financing schemes

This chapter is based on the “Guideline on improved business models and financing schemes of small renewable heating and cooling grids” developed by Sunko et al (2017)[11]. However, the guideline from Sunko mainly focused on smaller new DHC systems, whereas in the present report, the focus is on large DH systems that need to be upgraded. Thus, the guideline of Sunko was used, but slightly modified here for the purpose of upgrading projects.

The financing of upgrading measures depends very much on its size. Usually, smaller upgrading measures are day-to-day business for DH operators and common financing from equity or loans can be used. However, lager upgrading measures, such as e.g. the whole refurbishment of a DH piping system, requires dedicated consideration of the financing. For such larger measures, the upfront capital costs can be significant, and it may happen that amortisation periods are as long as 8-10 years. This requires investors that accept relatively long amortisation periods.

An upgrading project with a low IRR will compete for financing with other municipal, regional or national projects. If the project contributes to the city’s strategic objectives, as reducing environmental burdens, improving resilience or energy security, or providing affordable heat supply, projects often leverage the city’s cash reserves and/or public debt raised based on the balance sheet of the local authority. The lower interest rate of public debt can be a reason for implementing upgrading measures.

For example, the £3.5 million connection between London’s publicly owned Westminster and Pimlico heat networks (Arup, 2014), which aimed to improve efficiency through pooled networks, was far cheaper through public backing (an IRR of 16.6%) than private sector financing (an IRR of 9.24%), even though the anticipated cash flow revenues are the same in both cases. The difference is due to lower risks and financing costs because of public backing.

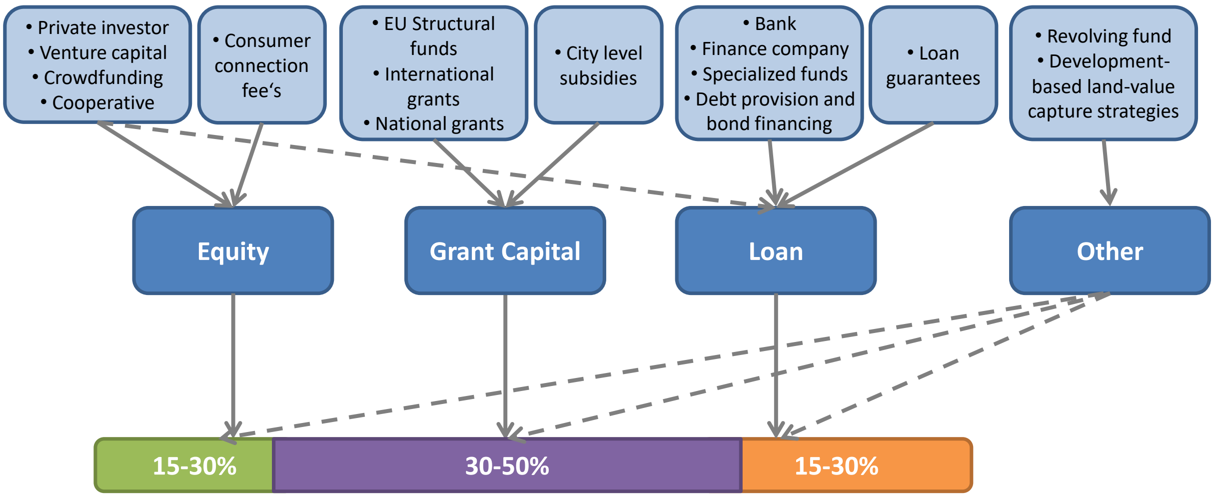

Figure 5: Visualisation of the financing structure. Proportions are indicative (Source: Sunko et al., 2017)

The framework of various types of financing sources employed in an investment represents the financing structure. Commonly, it comprises of stockholders' (shareholders') investments (equity capital), long-term loans (loan capital), short-term loans (such as overdraft or bridging

[11] https://www.coolheating.eu/images/downloads/CoolHeating_D5.1_Guideline.pdf

loan in case of approved investment subsidies), and short-term liabilities (such as trade credit) as reflected on the right-hand side of the firm's balance sheet. In upgrading projects, the financing structure may also include capital from investment support grants. These additional investment funds can make upgrading projects competitive. In the following paragraphs various types of financing relevant for upgrading projects are described.

The usual financing structure for an upgrading project is developed around the possible grants/subsidies obtainable for the desired project. The grant regulative defines the proportion of investment covered by that source. The loan regulation usually defines what amount of equity is expected by the loan-giver to be provided in the financing scheme. Based on that information the required equity is defined.

5.1. *Equity*

Equity capital represents the personal investment of the owner(s) in the project. It is often called risk capital because investors (owners) assume the risk of losing their money if the business fails. In contrast to the loan capital it does not have to be repaid with interest, but it is instead reflected in the ownership structure of the planned project. Equity capital is available from a wide variety of sources which include the entrepreneur's own resources, private investors (from the family physician to groups of local business owners to wealthy entrepreneurs known as "angels"), employees, customers and suppliers, former employers, venture capital firms, investment banking firms, insurance companies, large corporations, and government-backed Small Business Investment Corporations (SBICs).

All investment schemes incorporate equity capital which represents the “cash” in the investment structure. It can be provided internally by those developing the project – municipality/company/cooperative/individual. However, if this is not the case, equity capital can also come from external sources. The most common sources of equity capital are:

- **Private equity** is the provision of equity capital by project initiators or financial investors over the medium or long term. The private equity can be provided by external investors in form of ownership or in the form of a loan. Usually private equity is an expensive part of the financing structure – private equity loans can hold over 10% interest rates. Also, the internal capital of the private (but also public) companies has an internal interest rate. This means for the calculation of an investment this money will not be calculated “for free” and the influence on that internal interest rate on the decision process is significant. Even at public owned or consumer owned business the internal interest rate will take into account some inflation rate and lead to low but not zero interest rates. Therefore, this type of capital should be minimised in a financing structure. It is also advisable to use specialised private equity investors for the sector in which the investment will be executed. Specialised investors possess good knowledge and a wealth of experience and are able to support the investment in its life cycle.
- **Venture capital** usually provided by investors to start-up companies and small businesses that are believed to have long-term growth potential. The risk is typically high for investors, but the downside for the start-up is that these venture capitalists usually get a say in company decisions. Venture capital generally comes from well-off investors, investment banks and any other financial institutions that pool similar partnerships or investments. Capital infusions are just one benefit as this type of equity can provide also a technical and managerial experience. For small businesses, or for up-and-coming businesses in emerging industries, venture capital is generally provided by high net worth individuals (HNWIs) – also known as ‘angel investors’ – and venture capital firms. Most venture capitalists take an active role in managing the companies in which they invest. Many venture capitalists focus their investments in specific industries with which they are familiar.
- **Cooperatives** are business enterprises, not charitable organizations, so they are not the same as non-profits; yet they do not exist to maximize profits, so they are not the same as investor-owned firms. Cooperatives are enterprises that are democratically

owned and controlled by the people who benefit from them and are operated collaboratively for the purpose of providing services to these beneficiaries or members. In DHC cooperatives provide own funds for the investment structure. These funds can represent equity and can be translated into investment ownership. However, cooperative funds, the same as venture capital funds, can also represent a loan given to the project operator and shall be returned by the DHC company, in which case these funds are translated into loan capital.

- **Crowdfunding** is the practice of funding a project or venture by raising small amounts of money from a large number of people, typically via the Internet. Crowdfunding is a form of crowdsourcing and alternative finance.
- Usually minor sources of equity in the investment structure can also be funds provided by the **connection fees**. Return on investment is entirely dependent on the customer base of the network, so it is imperative that a scheme targets customers who can pay. This makes public sector buildings, communal facilities and large manufacturers ideal customers because they should be able to pay their bills. Individual households, on the other hand, represent greater credit risks. The connection fees for large industrial and public consumers can be negotiated, contracted and collected in the investment phase and can represent a minor part of the investment equity capital.

5.2. Loan capital

Debt or loan capital is the capital that a business raises by taking out a loan and which is normally repaid at some future date. Debt capital differs from equity capital because subscribers to debt capital do not become part owners of the business, but are merely creditors, and the suppliers of debt capital usually receive a contractually fixed annual percentage return on their loan. This part of the investment funds must be repaid within a specified period with an established interest rate, irrespective of the company's financial position.

Loan types vary by length of time, by how interest rates are calculated, by when payments are due and by a number of other variables. In its simplest form, interest is the cost of borrowing money, and it is normally expressed in terms of a percentage of the overall loan. Not only will the investor have to pay back the original amount of money borrowed (the principal), but also the cost of borrowing that money (the interest, plus any setting up fees etc.). How much interest has to be paid on any given loan is subject to a number of different factors, depending on which lending institution you borrow the money from and the terms of the loan. Fixed interest rate is simply as the name suggests: a fixed percentage on the loan that must be paid back during the life of the loan. Fixed interest rate loans make it very easy to calculate the exact amount of money the borrower will have to pay back each month as the amount never changes. Typically, fixed interest rate loans attract a slightly higher interest rate than a more common variable interest rate loan - but that higher interest rate is offset by the certainty of the cost of the loan. Variable interest rate loans allow the lender to set the interest rate to whatever market conditions demand at any given time during the life of the loan. The attraction of variable interest rate loans is that the investor can benefit from any future drop in market interest rates when his monthly repayments are reduced to reflect the lower interest rate. However, the opposite also holds true. If the market decides it is time for interest rates to rise, so too will the repayments. The investor must make sure he fully understands the consequences of a variable interest rate loan if he is considering taking one out. If interest rates rise dramatically the project could get in serious financial difficulties and business can default simply due to poor financial management rather than because of operational difficulties.

Loan capital can be further distinguished by the duration of the loans which could be divided into short term and the long-term loans. Short term loans are essentially loans with a validity period of 3 years or less. This means the loan has to be repaid within a time period ranging from 0 to 3 years. Long term loans, however, have a statutory payback period of more than 3 years. The repayment period for long term loans can extend from 3 years to 30 years or even more. It should not be assumed that the difference between the two is purely in the naming.

The actual distinction between short term and long-term loans is quite wide and requires comprehensive understanding, but generally speaking, long term financing is for assets and projects and short-term financing is typically intended for financing continuing operations. A special type of short-term business loan is also a bridging loan. As DHC projects often include in their financing structure investment grants and subsidies, the bridging loans have quite an important role in this type of project financing. Investment grants are normally passed on to the investor only after he can prove the payment of the assets for which the subsidies were granted. This means that the investor has to secure some temporary financing sources until he receives the approved grants. In this situation the bridging loans serve to bridge the gap between the cash outflow for asset acquisition and the cash inflow from the available grants.

And finally, there are also certain loans that are a combination of debt financing and grants. A loan with subsidized interest rate is an example of this kind of hybrid financial mechanism. It does not defer from the normal loan type, the only difference is that the interest rate is lower than the normal market interest rate in the specific time moment. There are usually specific state-owned institutions that provide loans with subsidized interest rate in order to facilitate investments into strategic ventures, which DHC projects certainly are as they form part of the development strategies on the European level.

Certain financing schemes also allow an option of the moratorium or initial deferment. A moratorium period is the duration in the loan term when the borrower does not have to pay any money i.e. no repayment. It is the waiting time before the repayment begins. This tenure usually starts with the date of disbursement of loan. In a common man's language it is the holiday period on the timeline of your repayments and it ensures that the investor's repayments start only after the business operations have been set up, the business cycle starts to generate cash flows from the revenue creating operations and some breathing space being obtained. As the investments in DHC projects are financially intensive and time consuming, a deferred payment or moratorium is usually a very welcoming option for project developers.

Loan capital may be obtained from a bank, finance company or other financial institution as long-term loans, or from specialised funds for projects utilising RES, also from debt-equity investors in the form of debentures or preferred stock (preference shares), and is usually secured by a fixed and/or floating charge on the company's assets. Also called borrowed capital, loan capital therefore can be obtained from a variety of institutions which provide loan capital under different conditions. Typical financial institutions supporting RES projects through the supply of debt capital are national banks, European Bank for Reconstruction and Development (EBRD), World Bank (WB), European Investment Bank (EIB) specialised funds for RES, Swedish International Development Cooperation Agency (SIDA), Kreditanstalt für Wiederaufbau (KfW) et cetera.

Obtaining a loan normally requires providing a loan guarantee or a type of loan insurance. A loan guarantee is a promise by one party (the guarantor) to assume the debt obligation of a borrower if that borrower defaults. A guarantee can be limited or unlimited, making the guarantor liable for only a portion or all of the debt. National subsidy schemes in some countries also provide guarantee schemes for DHC projects utilising RES. In asset-based debt the guarantee is assured by an asset. This means, if the loan is not repaid, the asset is taken. In this sense, a mortgage is an example of an asset-based loan. Typically, these loans are tied to inventory, accounts receivable, machinery and equipment which are the subject of the investment.

5.3. Debt provision and bond financing

Cities can provide low-cost loans to projects by passing on their ability to raise low-cost recourse capital. Similarly, cities can issue general obligation bonds to provide debt to a project. Revenue bonds can also be issued to effectively provide this debt at a higher interest rate. Using non-recourse loans and revenue bonds in project financing will have a high due-diligence cost and is best suited to mature markets or in combination with connection guarantees. In St. Paul, Minnesota USA, long-term revenue bonds were issued to develop both the heating and cooling networks, and the city was able to avoid having to guarantee debt repayments. This was made possible by the signing of long-term contracts with initial customers.

5.4. Loan guarantees and underwriting

Loan guarantees from cities allow access to low-interest debt for projects, which can greatly reduce the total project cost. Creditors may require some form of loan guarantee from municipalities, obliging the city to repay the loan if the project defaults. In the U.K., the Aberdeen City Council underwrites (via a loan guarantee) the not-for-profit district heating company, allowing it to obtain commercial debt financing at attractive rates. In Denmark, district energy companies similarly may request that their municipality act as guarantor for the needed loans. This "kommunegaranti" reduces lenders' risk and thus lowers interest rates. KommuneKredit, a credit union for Danish cities, lends out more than DKK1 billion (US$176 million) annually to district energy companies that hold the kommune-garanti. Since the early 1990s, there has been no instance of a municipal government being called upon to cover the losses of such loans (Chittum and Østergaard, 2014).

5.5. Grants

Many financing structures for DH projects, including upgrading measures, include funds from grants, either in the form of capital grants or in the form of subsidized interest rate loans. Grant funding of DH systems tends to come from higher levels of government rather than the city or town itself. This financing opportunity reflects the national and international importance of DH and the use of RES and represents a key financing element for DH projects. It could reduce the investment cost and thus enabling competitive heating and cooling consumer prices. It also means that the municipalities/cities have the opportunity to better leverage its project money if it is engaged more fully in the business model (such as with equity or debt provision). It is important to underline that the local authority can help individual projects gain funding from national or international grants, e.g. Rotterdam was able to secure a 27 million € grant from the Dutch government to reflect the equivalent avoided social costs of CO_2 and NOX emissions. The project CELSIUS, a grant programme provided by the EU, is financing innovative demonstration projects in London, Rotterdam, Gothenburg, Genoa and Cologne. Brest has attracted a 9 million € grant from ADEME (Agence de l'Environnement et de la Maîtrise de l'Énergie) that will help double the heat network in the city and surrounding area and install seawater heat pumps, biomass boilers and heat storage. This national grant is financed from the country's "Heat Fund" to projects that reduce CO_2 emissions and imports of fossil fuels.

Cities/municipalities may also provide capital grants or annual payments to specific projects to enable their initial development or to help direct them to social or environmental objectives. The City of London has provided development grants for early-stage feasibility assessments and investment-grade audits. The first phase of the Bunhill Heat and Power project in the city's Islington borough, which aims to provide cheap heat to social housing, benefited from £4.2 million (US$6.7 million) in grants from the London Development Agency and the Homes and Community Agency.

Given the type of investor there is a variety of available capital or loan grants for DHC projects based on RES:

- EU Structural and Cohesion funds
  - European Regional Development Fund http://ec.europa.eu/regional_policy/en/funding/erdf/
  - Cohesion Fund http://ec.europa.eu/regional_policy/en/funding/cohesion-fund/ ,
  - European Agricultural Fund for Rural Development http://ec.europa.eu/agriculture/rurdev/index_en.htm
- Grants for innovative, demonstration, pilot, lighthouse projects

  - HORIZON2020 https://ec.europa.eu/programmes/horizon2020/en/
  - NER 300 https://ec.europa.eu/clima/policies/lowcarbon/ner300_en
  - The LIFE Programme and its Private Finance for Energy Efficiency instruments (PF4EE) http://ec.europa.eu/environment/life/funding/financial_instruments/pf4ee.htm
  - ManagEnergy http://www.managenergy.net/
  - EEA Grants and Norway Grants http://eeagrants.org/
  - EIB European Investment Bank http://www.eib.org/
  - European Energy Programme for Recovery http://ec.europa.eu/energy/eepr/projects/
  - Connecting Europe Facility https://ec.europa.eu/inea/en/connecting-europe-facility/cef-energy
  - Breakthrough energy private fond http://www.b-t.energy/
- National specialised subsidy schemes for DH projects in form of capital or loan grants. For access to national support schemes national energy agency and the competent ministry should be contacted.

Many innovative projects were able to receive financing sources from funds which are initially intended for non-energy related projects. Innovative project developers are able to incorporate DH investments also in projects aimed at specific sectors as tourism, agriculture, forestry, regional development.

5.6. City-level subsidies

Although many countries provide national subsidies for low-carbon or energy-efficient heating or cooling, subsidies developed at a city level are less prominent. In Botosani, Romania municipal heat networks historically were heavily subsidized by municipalities to account for inefficiencies in the network and to protect the population from high heat prices (Sharabaroff, 2014). Some cities exploring modern district energy systems have been advancing mechanisms – such as feed-in tariffs, net metering and heat incentives – that internalize the public benefits of these systems, in association with a public utility. Seoul has a city-level feed-in tariff for CHP, and Tokyo even initiated a cogeneration subsidy to encourage increased electricity generation in response to the power outages from the 2011 earthquake.

5.7. International or national funds or loans

Significant international and national funds are being directed to DH in cities, both for initial development and for rehabilitation. Cities can lobby for such funds to be made available to projects. Velenje, Slovenia, was able to secure a 729,000 € long-term loan with subsidized interest rate and repayment moratorium from Slovenia's Eco Fund for its district cooling system that is based on absorption chillers using waste heat. Across Europe, EU Structural Funds play a key role in helping local and national governments modernize dilapidated district heating infrastructure.

5.8. Revolving funds

Some local governments are establishing investment funds or green funds to provide subsidies, grants and zero- or low-cost financing, particularly at early stages, for developments that are in the public interest. These endowments can stem from the sale of a city asset (such as city land, shares in a utility, etc.), a surcharge on utility energy bills or innovative sources such as avoided subsidy costs. The funds are designed to be self-sustaining and to grow through returns on investment, interest rates on debt and other revenues. A revolving fund allows for public support of strategic investments without necessitating direct city ownership, and it caps the city's overall involvement in DH. Often, the fund provides deferral on principal repayment for the first 3–5 years while the system is being constructed and customer revenue has not yet commenced. A revolving fund can support specific district energy starter schemes, designed both to illustrate the feasibility of installing a major heat network and to provide the catalyst for the cost reductions and development of a local supply chain. Capital can be repaid and redeployed in other projects.

5.9. Development-based land-value capture strategies

Converting rural to urban land can increase the land value manifold and this increase can be even higher for high-density urban land. Because such windfalls to the landowner can be captured for public use, land-value capture is described as a "no-brainer," particularly as the value added to the land can be higher than the infrastructure cost needed to develop it. This concept has a long precedent in many countries, based on the "principle of unjustified enrichment" – or the idea that citizens should not accumulate wealth that does not result from their own efforts.

Rural land requisition allows for the development of new urban zones, increasing the value of the land. Future and continuing revenues from selling or leasing land in distinct zones, and capturing taxes from new landowners, provides the finance for infrastructure. This is an excellent demonstration of an integrated approach to district energy. By incorporating urban planning (mixed use zoning, compact land use and high connectivity) with transport and district energy planning, financing of optimal and well-planned district energy projects can be achieved.

6. Revenue management

Economics, i.e. the feasibility of the whole concept is one of the most important parts when analysing different types of projects, including upgrading projects for DH. In order to perform the feasibility analysis, different forms of revenues and costs need to be identified. These can differ significantly depending on the focus of the upgrading measures and their type. Therefore, one can identify *direct revenues* in the form of increased earnings, as well as *indirect revenues* in the form of achieved savings, i.e. decreased costs or increased system lifetime. All of these will be briefly explained in the next couple of paragraphs.

6.1. Heat production

On the heat production side, the potential revenues depend on the upgrading project in question. Some of the most significant revenues will be described.

Increase of heat sales

In case a new production unit is being built, or the existing one is being refurbished, the overall sales of heat and therefore the cash inflow can increase. The feasibility itself depends on the ratio between the increased revenues and the investment and operation costs of the new or refurbished units, being calculated in the form of the levelized cost of energy.

Decrease of fuel costs

In case the existing production units are substituted with the ones which use cheaper fuels, are more efficient or use no fuel at all, the overall fuel costs will be reduced. In the feasibility analysis, this is taken into account as revenue since it provides economic benefits to the investor. This is an example of indirect revenues.

Decrease of operation and maintenance costs

Similar to the above-mentioned fuel cost decreases, another type of indirect revenues are the reductions of operation and maintenance costs. These are the main variable costs of any project and can be reduced by the means of system optimization, equipment replacement, etc.

enabling the economic benefit to the investor. Rising emission expenses (e.g. through the European CO_2 trading scheme) may have a growing importance in the coming years, too.

Equally, technical boundary conditions may prolong the lifetime of equipment, which avoids replacement of equipment or investment in new components.

Sales of the additional product

If the existing system is being upgraded, an additional product can be offered to the market, providing additional revenues for the investor. These products differ, depending on the upgrading in question. For example, a cogeneration system can be built which sells electricity, or an existing system can be converted to the biorefinery selling e.g. bioethanol or pellets.

6.2. Heat distribution

On the heat distribution side, fewer types of potential revenues exist. These can be divided into two types of revenues, as elaborated below.

Reduction of heat losses

A major upgrading measure, when it comes to the distribution network, is the refurbishment of the distribution pipes. In older systems, which do not have pre-insulated pipes, the heat and water losses through the pipes are among the highest losses in the throughout the whole system. By replacing the old pipes with the new, isolated ones, the losses reduce to the minimum. With reduced losses, the fuel costs decrease as well, which is taken as an indirect revenue for the investor.

Reduction of electricity consumption

In order to reduce the cost of electricity at the distribution side, it is necessary to replace the old circulation pumps with the electronic frequency regulated pumps. This enables the reduction of electricity consumption, which in turn leads to lower electricity costs and presents a form of indirect revenues in the project.

6.3. End use

It has already been stated that the end use upgrading measures can mainly focus on the building refurbishment and on the substations. These can be owned by the end users or the district heating supplier, determining from which point of view should these revenues be considered. Usually the main revenue comes in the form of the reduction of energy consumption. When old buildings are refurbished, the specific heat consumption is reduced significantly due to increased insulation, optimized operation of heating/cooling system, etc. This leads to significant economic savings to the owners, making building refurbishments very feasible projects. Similarly, when substations are replaced, the main income also comes from the energy savings of the new, optimized substations and ideally lower return temperatures that increase the heat production efficiency and reduce the distribution heat losses. Improved regulations of the substation may equally reduce return temperatures. If the temperature spread increases the amount of heat could be delivered with less volume flow, that saves pumping energy. Also with modern substations (and a suitable heating system behind) lower supply temperatures are possible, effecting the temperature losses etc. Even the reduction of heat usage is equivalent to less sold heat, the saving potential could be used to connect more users without changing the production or distribution side and could lead to another business model.

7. Cost management

Costs can be divided into several categories, including fixed and variable costs. These costs are further subdivided with regards to the type of the cost. The most common categories will be presented in the next couple of paragraphs.

7.1. Capital costs

As already mentioned, capital costs are usually fixed upfront costs which occur prior to the start of the implementation of the refurbishment process, covering all the required investments. These are also usually the most intensive costs in the whole project and include the investment into the equipment, land, construction of required infrastructure, etc. In order to make these payments, a bank loan is needed in most cases. The investment is depreciated throughout the certain number of years, depending on the equipment in question.

At the heat production side, capital costs can be various, including the costs for the new production units (land, additional roads, transformer stations, solar collectors, geothermal drilling, heat pumps, electric boilers, boiler/CHP building, pumps, boiler/CHP unit itself, etc.), as well as the new parts for refurbishment of the existing units (new boiler, new pumps, new control system, etc).

At the heat distribution side, the main investment cost are the new pipes, as well as the trenches that need to be dug out for the laying of the pipes. Finally, on the end use side, the investment costs concern the material for building refurbishment as well as the required the construction works.

7.2. Operation and maintenance costs

Operation and maintenance (O&M) costs, together with the fuel costs are considered the main variable costs of the project. However, they can also be fixed on the annual level, depending on the technology in question. These include all the costs that occur due to the regular maintenance on the annual level and the operation of the system itself. Usually they are expressed per unit of output energy produced, in case of the variable O&M. For the fixed O&M, the calculation is different in terms that the value is expressed per unit of installed capacity.

Fuel costs

Fuel costs can be the most intensive variable costs, depending on the technology in use. The benefit of renewable sources is that most of them have low or no fuel costs, which usually results in lower levelized cost of energy of such technologies. On the other hand, if fossil fuels are used it is usually a significant part of the overall cost, and one of the highest value variables in the calculation of levelized cost of energy. These are also one of the most uncertain costs since the price of fuel, especially fossil fuels, can change significantly due to different conditions.

Personnel costs

Personnel costs refer to the costs of employing new employees, i.e. the cost of their monthly salaries. These will occur only in cases when the new production units are being built, which require additional manpower, or if the refurbishment process enabled opening of new jobs in order to operate the refurbished system, etc. However, these are usually not significant when taking into account the whole costs of the project.

Other costs

Additional to the aforementioned costs, various other costs can occur. During the preparation of the project, the main costs refer to the design of the upgrading project, as well as required consultancy. Furthermore, during the operation, additional costs can be in form of the management, insurance and lease costs, cost of promotional activities, other services, etc. All of these have to be carefully defined and assumed prior to the project implementation in order to perform the pre-feasibility study.

8. Financial key performance indicators

After the costs and revenues have been defined in the project, it is helpful to calculate the key performance indicators of the project. These usually include the calculation of Net Present Value (NPV), Internal Rate of Return (IRR), and the Payback Period (PP). The NPV is the difference between all cash inflows and the cash outflows through a certain period of time (usually during the loan period) and discounted to the present value. Therefore, if the NPV is larger than 0, the project is feasible. It can be calculated by using the following equation.

$$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t} \quad [€]$$

Where:

R_t is the difference between net cash inflows and outflows during the period

i is the discount rate of the project

t is the number of periods.

On the other hand, IRR is the discount rate for which the net present value of the project equals to zero, i.e. if the IRR is greater than the project discount rate, than the project will be feasible and if it is lower than the discount rate the project will not be feasible. The equation for IRR calculation can be seen below. However, both of these indicators can be calculated easily by using the dedicated formulas in Microsoft Excel program.

$$0 = NPV = \sum_{t=1}^{n} \frac{C_t}{(1+IRR)^t} - C_0 \ [€]$$

Where:

C_t is net cash inflow of the project

IRR is the internal rate of return of the project

C_0 is the investment cost in year 0

t is the number of periods

Finally, the payback period is the time period in which the project will return the investment, i.e. it reaches the breakeven point. Therefore, if the payback period is shorter, the project will be more attractive to the investor.

9. Conclusion

This guideline showed relevant aspects of the district heating business models, including the basic framework conditions, different ownerships, sustainable financing solutions, as well as different costs and revenues which can occur, and which define the financial part of any project. It is useful for any interested stakeholder which wants to upgrade its district heating system, but also to the potential new investors, including the consumers themselves, who can contribute to the upgrading process.

All the parts of a successful business model have been briefly explained in this guideline, including different framework conditions which can greatly affect the feasibility of a certain project. Additionally, the effect of the heat market possibility on the project has been explained on the example of the heat market in Lithuania. Finally, after providing the elaboration of relevant sections of the business model, the template for the business models as a part of Task 5.2 has been integrated at the end of the document to serve as the guideline for the partners during the elaboration of each individual business model for D5.2.

Annex 1 – Template for the elaboration of a business model (for D5.2 of the Upgrade DH project)

1. Introduction

Provide a brief introduction of your demo case, including the relevant figures on the current state of the system, etc. up to 1 page

2. Summary description of the upgrading project

Provide a summary of the “upgrading project”, i.e. the technical details, the reason for implementing the chosen measures. An “upgrading project” may consist of various different upgrading measures which can be implemented at different timelines. Describe the overall upgrading process with a roadmap on the timing which measure is planned when. Combining the background for the measure from D3.3 and D3.4 with the input from D4.3/4.4/4.5 up to 2 pages.

3. Framework conditions in the target country

For the country of the demo case, provide the analysis of the relevant framework conditions considering your upgrading project, including legislation, public policies, public opinion, etc. up to 2 pages. Try to be brief and concise, and specific with regards to the upgrading project in question.

4. Investment data

Provide information on technical and economic data of your project. Elaborate the technical concept for your upgrading project, up to 2 pages. Also provide the detailed investment data for the project. Use tables to clarify the description (example below) up to 1 page.

Investment items per upgrading measure	Investment costs (€)

5. Ownership model

Define the ownership model(s) that will be used for your upgrading project. Explain the reason for choosing one or several specific ownership model and its details. Up to 1 page.

6. Financing sources

Define how your project will be funded. Take into account EU, national and potentially local funding resources. Provide the details of how the full amount of the investment will be funded (private equity, loan, grants, etc.)

7. Revenue management

Define in detail all the revenues of your project, as described in this guideline. Explain how the revenues have been calculated (i.e. what are the prices used, what is the simulated/assumed amount of commodity being saved/produced, e.g. increase of heat production, fuel savings). Also take into account the foreseen development of revenues through time if applicable.

8. Cost management

Define in detail all the running costs of your project, as described in this guideline. Investment is not taken into account here, but only the additional operation costs which occur by implementing the project. Also explain contract details (e.g. for supplying fuel) as well as the development of the foreseen costs through time.

9. Economic calculations and feasibility

Describe here how you calculated the feasibility of the project and its results.

10. Socio-environmental impacts

Take into account the social and environmental aspects of your project and explain it briefly in this section. Take into account local employment increase, reduction of environmental impact, the external costs of the project, i.e. their difference in comparison with the reference case, etc.

11. Realization potential of the upgrading project

Instead of the conclusion, provide the brief description on the realization potential of the upgrading project, based on the meetings with the local working groups, etc. This section can be updated after the meetings in T5.3.