

Position Paper
District Heating

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1 District Heating driven by demand

The development will set focus on end-user demands, independence of fuels and the interaction of multiple heat sources. It will also highlight substations in a very important role. The substation is a key element in the ongoing transition process. The fact that it can be regulated to supply – with great accuracy – the demanded level of temperature provides the basic mechanism leading to energy saving. Only the heat really “asked for” will be accepted by the system.

“demand-driven” application of the district heating technology - as opposed to “production-driven”.

In a production-driven system the production plant regulates the volumes of heat delivered to residents. The residents have no technical means to regulate the heat reaching their apartments. Sometimes people need to open windows to get rid of excess heat, while they have to put on outdoor clothes when there is too little heat delivered.

In the future, the heat production increasingly has to follow the resident’s actual demand of heating. There are encouraging examples from a number of countries that have started to work according to this formula. Consequently, substation functionality and performance are the key elements in order to change the operational approach from a production-driven to a demand-driven one.

Another issue is the choice between large group substations or smaller in-house substations. In general, the in-house substations turn out more economic than the group substations. Two-pipe systems with production of hot water in connection to every building will be the most economic solution.

District Heating must be considered as a total system, and as all systems it is needed to have a holistic view, i.e. to make sure you are optimising and working with the total system and not only focusing on parts of the system. For district heating it is crucial to have products and components in the system that work together in an optimal way as well as with optimal individual function.

2 The Action Plan

2.1 Two pipe systems

A modern well insulated high quality 2-pipe district heating network built according to modern installation methods which minimize material, movements and stresses in the ground , and equipped with a surveillance-system makes it possible to have constant control over the whole network against damages, so the operating costs are minimal throughout the entire service life of the district heating network.

In any two pipe system it is desired to strive for a maximised temperature difference between primary side and secondary side. When this is utilised it is possible to reduce pipe dimensions, i.e. investment costs, and also pump capacities, i.e. both investment costs as well as operational costs.

In systems where this is not utilised water flows are relatively voluminous due to the small difference in temperature in the supply- and return water. Therefore, they require relatively large pipe dimensions and relatively high pump capacity. These factors obviously increase both operational and investment costs.

2.2 Eliminating leaking pipes and waste of water

Leaking pipes and leakages in general are stealing cost and energy, not to mention water, from any given system. Eliminating leaking pipes and measuring of all “new and fresh water” that needs to be put in the system is crucial when enabling energy savings in any district heating network.

In addition to minimising leaks, an important part in minimising waste of water is to make sure that the district heating systems are working in closed circuits, i.e. it is important not to work with open systems where the hot water from within the district heating network is being consumed. This type of open systems are wasting energy as well as reducing the lifetime of the total network since it demands new fresh water being continuously being pumped into the system causing corrosion etc.

Gaining control of the situation with both leaking pipes as well as ensuring to have closed circuit systems will enable substantial energy savings in any given district heating network.

2.3 A substation in every building

Installation of modern individual consumer substations in all buildings connected to the main networks is an important factor to enable the demand driven development.

The substation is a key element in the ongoing transition process, focused on energy savings. The fact that it can be regulated to supply – with great accuracy – the demanded level of temperature provides the basic mechanism leading to energy saving. Only the heat really “asked for” by the substation, i.e. only the heat needed, will be accepted by the system. The settings for each individual substation can be defined according to the wishes from the owner of the house/building.

Normally, a modern substation should be able to consider the local climate, the thermal profile of the building as well as both in-side and out-side temperature.

Consequently, substation functionality and performance are the key elements in order to change the operational approach from a production-driven to a demand-driven one. This solution will provide the possibility to measure the energy consumption for each building.

Another issue is the choice between large group substations or smaller in-house substations. In general, the in-house substations turn out more economic than the group substations. Two-pipe systems with production of hot water in connection to every building will be the most economic solution. Four pipe systems obstruct an individual based payment and use of energy.

2.4 Every individual household shall have individual metering

Long term goal is that every individual household shall have an individual metering.

This is essential when believing that each individual household wanting to control own costs and also consumption. When consumption is not put into the individual household's responsibility it will not be obvious how to make a difference and there is no obvious gain.

In some countries people choose to cancel their district heating subscriptions in favour of installing individual gas-boilers. The reason for this is coming from the fact that people want to have control of their consumption, control of their costs and control of the indoor climate. This solution can also be made available when offering a demand driven district heating network. Furthermore, the district heating solution will always be more environmental friendly, i.e. less boilers giving less emissions, and it should also be more cost-efficient. This is especially valid when utilising energy that otherwise would be lost.

2.5 Connecting small district networks to the main city networks

The options to start District heating in small scale, i.e. using the term community heating, is essential both for smaller communities as well as for being able to start in small scale in larger communities.

In terms of adaptability to changes of basic fuels, district heating as well as community heating systems are flexible. They are also safe, as combustion can be located at some distance from the residential areas. Finally, the technical responsibility and surveillance will rest in the hands of a capable professional organisation. Even if it is decided to have the energy produced close to where people are living it is a "clean" technology due to the facts that there will be less emission with fewer boilers and less emissions with professionally handled boilers.

This type of development can be devised for development of one district heating area in a city. The gains generated by cost reduction can thus be used for further investment and to shorten the pay-back horizon for loans. Besides this, this heating area can be a model of "best practice" for further improvement in other districts.

2.6 A thorough analysis

A thorough investigation and analysis of options for supply of non-fossil, and preferably locally produced, fuels needs to be made in order to identify the best plan for each area.

In terms of adaptability to changes of basic fuels, district heating as well as community heating systems are flexible. Furthermore, the analysis must consider all available options for use of "waste or surplus" energy from local industries, recycling plants, garbage stations, etc. District heating offers a unique level of utilization when it comes to this kind of heat sources.

In a modern district heating system, a number of different heat sources can be set to operate in parallel – i.e. connected to integrating loops forming a comprehensive distribution network. The customer may get heat

from multiple heat sources and from different directions. This improves the reliability and frequently also the economy. In a looped system, heat sources can be located in different places in the city - connected to the integrated network and supporting each other.

2.7 The individual building

For each building, as well as for each network and system, it is crucial to consider four basic actions that are vital for all energy saving actions:

- Acceptable insulation
- Radiator and Tap water systems in balance
- Substation efficiency
- Leakage elimination

The need for substation efficiency and the elimination of leaking pipes in the distribution network are essential corner stones for energy savings and are mentioned earlier. In addition, on a building level the actions must be supporting efforts for having radiator systems and tap water systems in balance as well as making sure that there is sufficient insulation.

2.8 Essential aspects before and during planning

Making sure that District Heating with all its possibilities for saving cost, enabling energy savings, reducing emissions and in general for being a clean technology is always considered when making investment plans.

The environmental advantages attached to district heating stems from the fact that efficient district heating boilers - where it is possible to control the emissions - replace many small boilers generating uncontrolled emissions. Matching district heating with combined heat and power production – CHP - offers a unique opportunity to produce electric power at a high level of efficiency.

In addition to this, the option to use industrial waste energy from local sources will in some cases produce drastic reductions of emissions, environmental impact and cost.

2.9 A gradual transition

To strive for having a gradual transition and that the renovation and new construction plans always are based on a long term plan considering the total aspects from supply of fuels and source of energy to creating comfortable living climate for everybody.

In the current situation - where district heating is affected by under-investment as well as technical and financial shortages - the development has to be carried out in stages. A priority investment programme will be the first step. When elaborating the first steps, however, it is very important to have the long-term objectives in mind. The municipality will play an important role in this development, as the responsible body for strategic planning and as a major stakeholder. But also with an interest to make customers pay their bills with a feeling that district heating is the best alternative for them.

In a typical case, a short-term (0 – 5 years) priority investment programme - with focus set on short-term profitability - will be devised for development of one district heating area in a city. The gains generated by cost reduction can thus be used for further investment and to shorten the pay-back horizon for loans. Besides this, this heating area can be a model of “best practice” for further improvement in other districts. The long-term strategy should target the development of a fully modern district heating system with improved – i.e. demand-driven - heating service standards and enhanced independence of imported fuel resources.

Installation of substations in every building and replacement of the four-pipe systems with a two-pipe system and continuous production of hot water in every building will give a saving of gas with 30 - 50 percent,

depending on the local conditions. It also gives a better in-house climate and more steady supply of domestic hot water during the entire year.

3 Financing

From a governmental point of view, the policy instruments for financing modernization of district heating systems have to be developed, allowing owners of district heating companies to access capital for project implementation. There is a need for motivation instruments at the stages of generation, transport and consumption of heat and hot water, and they need to be implemented to encourage energy saving.

Ukraine's government should strive for a separation of district heating and the social system with targeted social support to those in need. With a better social net in place it would be possible to let the district heating companies charge and get paid for their services on a sustainable level, without risking social unrest.

In the current situation where district heating is integrated in the social system incentives for the district heating companies to improve operations are vague. A district heating company that increases energy efficiency and saves considerable amounts of gas, may end up with less resources than before the investment and thus they remain unmotivated to take action. Actions that would improve the country's economy and benefit the society both on the local and national level.

Not only physical investments are important. Many institutional/operational changes within the district heating companies can improve cost efficiency within the companies. This kind of measures can be worked upon within institutional support projects financed by donor organisations. But also here it would be important to have a system that incentivises the companies to become more cost efficient.

In terms of available financing for physical investments in district heating in Ukraine, there are a number of available options. However, it is important to remember that as long as the financial solution is not a grant, i.e. "soft" money, it will be a loan and all loans require security, and come with a cost that is an interest rate. The government seem to be working on ways to facilitate procedures for municipal guarantees and giving sovereign guarantees. This work is an important part of the work to make the country's district heating financially sustainable

The banks and organisations offering financial support are often found among the IFIs, i.e. such as the World Bank Group (IBRD and IFC), EBRD, EIB, NEFCO, NIB etc. There is also a current initiative called the E5P initially initiated by Sweden and today sponsored by many countries and headed by the European Bank for Reconstruction and Development, EBRD.

In addition, it is possible for a company in Ukraine to apply for Carbon Financing in accordance with the Kyoto protocol. If the above project can comply with the framework of Kyoto Protocol, the project owner may receive one carbon credit for every ton of CO₂ it achieves in emission reductions. The future for this programme is still not decided and as it is designed today it will disappear in 2012.

3.1 Municipal Projects

District Heating systems in Ukraine are mostly owned by municipality. Historically, DH companies have been functioning based on the principal "cheapest service for the population", and thus have not shown profits for decades. Currently, when the infrastructure requires urgent modernization, attracting investment is a challenge, given absolute non credit worthiness of the enterprises. Currently International Finance Institutions can provide loans based on:

- Guarantee – In some cases a municipal guarantee is OK, however, for the majority of the cities the approval of Ministry of Finance is needed, which is often the bottleneck for project implementation. Sometimes it can be the reason for the projects to freeze.

- Assets - in some cases assets of municipal companies (for example, heating companies) are strategic targets (pipelines, pipes, heat networks etc.) and according to Ukrainian law can't be coverage/guarantee for banks and IFI's. Assets in forms of municipal property is also very vague concept, both because it is hard to evaluate the real wealth of such assets and due to complicated procedure of issuing such guarantees by the city.

One way for the government to assist in these municipal projects would be to provide an efficient system of providing National Guarantee for the Investor; Facilitating the bureaucratic procedure of receiving approvals from the Ministry of Finance for smaller cities to offer the municipal guarantee for Investor;

3.2 Energy Service Companies (ESCOs) – energy service contracting

In order to deal with lack of investment capital required for modernizing the DH infrastructure, attracting private investment is required. In order to interest private investor the government has to create opportunities for profitable business, by for example, applying the concept of energy service contracting, allowing companies to re-invest their saving-based profits into even more energy saving technology.

3.3 Energy Saving motivation Policies

The following are examples on policies for energy savings possible for the government to implement:

- Raising tariffs for population to encourage savings, and thus increase the ROI of projects
- Increase technical requirements for eliminating leakages in pipes by setting standards for new pipes, and implementing fines for non compliance
- Allow companies to "make profit" based on what they save, and encourage them to reinvest the margins into more energy saving measures.

4 Conclusion on Energy Saving for District Heating

When the demand driven approach is used for district heating, and the main focus is on energy savings, the following steps are crucial;

First focus on modern substations, leaking pipes, insulation of the houses and on having both radiator systems and tap-water systems in balance. By doing this you will create energy savings and you will be able to identify the real need for energy.

Secondly, it is needed to analyse and identify all possible sources of heat and energy, such as surplus energy and waste-energy from industries in the area. This type of energy sources is crucial to use, and studies show that this is a big potential regarding available energy. Today, in east and west Europe we let steam (a high energy carrier) go into the air and hot water out into the oceans etc.

When these two initial actions are completed it is time to focus on the remaining need for energy and possible ways of producing this need. In this work it is important to carefully investigate and identify locally available fuels and the possibilities of using both household- and industrial waste as a fuel.

Finally, the remaining energy is what needs to be produced, and if possible by using locally available fuels. Regardless of what type of furnace, boiler or heating technology that will be used, it is important to use a Combined Heat & Power plant to ensure a high yield and to avoid energy being wasted. Furthermore, in the international community of today the incentives for, and the awareness of, choosing energy producing solutions with minimal CO2 emissions and environmental impact is high.