Connecting municipalities

The basic idea is to find a win-win concept i.e. creating a joint operation in order to utilize each parties resources and thus in doing so creating value for all parties. The benefits could be cost reduction, environmental benefits and delivery reliability. There are several different types of examples of connected municipalities and hence key reasons for the implemented connections.

Assets

Key reasons for the connection between municipalities

In Gothenburg, Sweden the district heating network in Gothenburg has been connected to the systems in two other municipalities, Mölndal and Kungälv. This enables a better optimization of the heat in the overall system, and allows for example the smaller utility companies planning flexibility in periodic maintenance. Excess heat in one area can be moved to another and the overall system has more degrees of freedom for optimisation.

The system connection between the City of Gothenburg and the City of Mölndal where implemented during the 1980s, with the local utility companies Göteborg Energi and Mölndal Energi. The system connection between the City of Gothenburg and the City of Kungälv where implemented during the 2000s, with the local utility companies Göteborg Energi and Kungälv Energi.

During summertime the heat demand in general decreases in a district heating system which implies that the utility company needs to match this demand with reasonable heat production. If the DH system contains excess heat sources this could also imply that the excess heat sources needs to be adjusted and adapted to the current situation. Otherwise there is large amount of excess heat that needs to be cooled down. Göteborg Energi had a surplus of heat in the system due to connected excess heat sources and was interested to find good solutions in how this excess heat could be utilise. The smaller utility companies where on the other hand interested in reserve power which reduces their needs to invest in new power capacity and to buy heat during specific time periods to be able to close down their own plants for maintenance and audits, i.e. planning flexibility in periodic maintenance.

As the systems are connected, there has now been created a commercial opportunity to both buy and sell heat between the parties based on where the heat demand exists. For example during summertime the smaller utility companies can if needed close down their own production and buy price worthy heat from the larger system that can keep down their heat prices due to the connected excess heat sources. During winter time the larger utility company can for example buy price worthy heat from the smaller utility companies instead of starting top load boilers run buy more expensive fuels.

Today the connections have led to extensive benefits for all parties such as cost reductions, environmental benefits and delivery reliability.

Description of the technology

In general when different DH systems are being connected there will be a need of defining the connection point and how to extend the networks to that point, i.e. there might be a need for installing new pipes, pumps and substations (heat exchangers, mixing equipment performing the lowering of temperature and pressure and control valves). There might also be a need to evaluate how this new energy flow will affect the different DH systems and if possible to evaluate the whole DH system and then perform the needed reconstructions.

Technical issues and applied solutions

When different DH networks are connected there might be a need to redesign parts and sections in the district heating network in order to handle the new mass flow. For example there might be a need for larger pipes and new pump capacity in some sections in the network along with new measuring instruments at the connection point in order to log the energy flow at defined time periods.

There will always be a risk that the each separate DH system has rapid production losses if for example one boiler needs to be stopped urgently.
Applied solutions necessitate strategies in how to handle rapid losses of heat flows. More specifically solutions could be

- If possible have quick backup systems such as boilers (for example CHP plants run by biofuels) in the district heating system that quickly can start or increase its production, to compensate the unexpected heat loss.
- Good relations between counterparts,
- Respect and understanding for the complexity of the counterparts processes
- If possible agree upon how to act in different situations relating to technical issues. This includes good routines and clear responsibilities. This way each counterpart's operation team will know how to act when different technical issues arise. Unforeseen situations are to a degree compensated by good relations.
- Good routines and clear responsibilities internal and external.
- Good monitoring systems
- Agree the frequency of the meetings between counterparts and which questions to discuss on a frequent period of time…

List of key variables to monitor, equipment etc.

The main key variables to monitor when it comes to an effective collaboration between two utility companies are the amount of energy that are being transferred during defined time periods. Example of key variables to monitor are for example effect [MW/defined time period], temperature, pressure etc. This requires for example good metering instruments at the connection point and good data handling to be able to withdraw the exact amount of sold/purchased energy per defined time period.

Stakeholders

Commonly the stakeholders are the two utility companies from each municipality that will be connected their DH and/or DC systems along with respective municipality and owners.

Finance

There are several different business models that must be analyzed and be applied on a case by case basis.
One example of a negotiation process are:

- Decide how the investment costs should be divided. One example could be that each party, for example two utility companies, decides a connection point, and are responsible for the required investments in their own systems up to the connection point. The investments could be financed by the companies own balance sheet.
- Decide payback time and the cash flow
- Determining the frequency of the coming subsequent negotiating sessions and how to act after the costs have been paid back. For example after the costs have been paid back a new agreement can be made based on a marginal income discussion, i.e. share the marginal benefits

Depending on business model there might be the possibility to change the heat flow between the connected systems and thus the business possibilities of purchase and sails. When one party has cheaper costs of producing heat the other party can buy it and vice versa.

Specific risks and solutions

A risk is if disagreements occur in how the investment costs should be divided. This could lead to time delay and in the worst case scenario no agreements in the negotiations which in the end is non beneficial for all parties and the environment. A solution could be to use a neutral third party participated during the negotiations and who audits both parties' arguments.

When several parties are involved in larger infrastructural projects there might be a challenges to adapt to future challenges or adapt to strategies that the municipalities might have on a longer time period. A large collaboration might require large coordination between the parties.
For a successful handling of future challenges and strategies there is a requirement for good interaction between parties and a cohesive group that coordinates, manages and pushes the important issues forward. One main aim is always to find solutions that are the most beneficial for all parties.

Examples

The Helsingborg-Lund-Landskrona Heat Ring

In an effort to increase security of supply and improve its economies of scale and production efficiency, Helsinborg has pursued a strategy of establishing connections to neighbouring municipalities. Firstly, a connection to the town of Landskrona in 2005, and this year 2015, with the planned connection to the city of Lund. The connection to Landskrona is 29 km long linking Örtofta and Landskrona district heating network. Kraftringen (Landskrona municipality owned district heating company) and ÖresundsKraft operate the scheme jointly on a 50/50 profit sharing base depending on hourly asset utilization. The payback period for this investment was only 7 years. The investment amounted to SEK300M and was funded by the municipalities of Helsingborg and Landskrona using their respecting credit rating that offer better financing rates than Swedish banks. The final regional capacity of the district heating system with the Lund connection will amount to 2.2TWh. Another planned connection is planned for 2020 with the smaller district heating system of Ångelholm (160Km). Computational studies using the Swedish regional analysis and forecasting system (RAPS) estimated that the Helsingborg district heating has contributed to a carbon dioxide emission reduction of 131,000 tons, the creation of 1358 jobs and the increase of 196million in local purchasing power (disposable income). Currently the district heating system has a primary energy factor of 0.1. It is important to note that a key factor of the economic viability of district heating in Sweden has been the carbon tax and green certificates for production units.

Rotterdam Heat Roundabout

The increase of heat demand in the future may lead to extension of the city DH itself. In the region of Rotterdam and farther westwards, there are plans to create a roundabout of the district heating. The contour of the DH roundabout is sketched between the cities (Rotterdam, the Hague, Westland…) even northwards up to Leiden and industrial and production areas. The completion of roundabout would make it possible the transport of residual heat from industries to users in urban areas.

Read more

Technical Toolbox

- Heat demand forecasting techniques
- Energy Potential Mapping (demand)
- Energy Potential Mapping (supply)

Case Studies

- Integration with other municipalities in Gothenburg
- Exploiting excess heat from a converter station in Endrup, Denmark - a ReUseHeat example