e-harbours

WP 3.5 Application of Smart Energy Networks

Technical and Economic Analysis
Summary results of showcase City of Malmo

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1.1 Introduction

Smart energy networks are intelligent and flexible solutions which combine flexible energy consumption, local generation of (renewable) energy and energy storage on different levels. In any smart energy network, the presence of both technical/economical and organisational/legislative conditions is crucial.

The e-harbours report 3.7 focuses on the *organizational and legislative aspects* of smart energy solutions. A long list of general barriers has already been composed (deliverable 3.3).
The report 3.7 addresses the analysis on a local basis (country/city/harbour), where the smart energy solutions are hampered.

This e-harbours report 3.5 focuses on the *technical and economical aspects* of smart energy solutions. The scope of WP3.5 is the translation of the 6 universal business cases (e-harbours report WP3.4) on the level of every showcase. It gives an overview of the potential for the exploitation within the existing local (national) rules and regulations.

This document summarizes the results for each of the showcases in the Northern Harbour.

Universal business cases: 6 possibilities defined

The final document of WP3.4, "Strategies and Business Cases for Smart Energy Networks " [1], gives an overview of universal business cases for the exploitation of smart energy networks. Demand side flexibility is a term which is used for devices, installations and/or companies which are able to adapt the energy consumption to some extent without compromising their proper operation. Examples are installations which can shift non critical activities in the time or devices which can store energy for later use. The economic potential of the flexibility, offered by these devices, installations and/or companies is estimated in the WP3.4. WP3.4 summarizes the following cases:

1. Contract optimization: The present flexibility can be used in order to reduce the energy cost within the margins of the existing energy contract. Examples are shifting energy consumption to cheaper off-peak tariff hours or reduction of the peak power.

2. Trade on the wholesale market: Significant amounts of energy are traded on energy exchange markets. Due to the variable price on these energy markets, the presence of flexibility can be used for energy cost reduction.

3. Balancing group settlement: Balancing responsible parties (BRP's) are responsible for balancing electricity production and consumption in their portfolio. Flexible consumers can help a BRP in order to maintain the balance of his portfolio.

4. Offer reserve capacity: In case BRP's are not able to maintain the system balance, the transmission system operator (TSO) has reserve capacity in order to restore the balance. Customers can offer their flexibility directly to the TSO for balancing purposes of the total system control area.

5. Local system management: The local distribution grid has a limited capacity and some combinations of local power injection and consumption may result in congestion. Flexibility can be used to operate the local grid in an optimal way within its constraints.

6. Offer further grid stabilization services: Large scale producers and consumers can offer flexibility for reactive power balancing or preventing congestion of the transmission grid.

The scope of WP3.5 is the translation of the “theoretical” business cases of WP3.4 into realistic business cases in your context.

1.2 The strategy in case study Northern Harbour

Identification

For identifying the flexibility in the Northern harbour a mapping of the energy flows, including transports and waste, of the largest business operating in the Northern harbour was made. These businesses were interviewed and results put together in a report. The results were also presented at a workshop with all stakeholders in the Northern harbour area and the City of Malmö.
The following companies have been included in the case:

Energy actors and users: Cementa, EON Öresundsverket, EON Flintrännan, Finnlines, HJ Hansen, IL Recycling, Lantmännen Cerealia, Lantmännen Lantbruk, Norcarb, OKQ8, Ragnsells, Scandinavian Tank Storage, Stena Malmö, Stena Verkö, Sysav, Vindkraft Boel, VA Syd Sjölundaverket.

Energy producers: EON Öresundsverket, EON Flintrännan, Norcarb, Sysav, Vindkraftverk BOEL, VA syd Sjölundaverket.

Quantification

The flexibility is based on estimations. It is based on the actual energy production today and an estimation of the future potential energy savings and the capacity for increasing electricity production.

Valorisation

The value of the flexibility in the Northern Harbour consists in shifting natural gas to renewables into the district heating grid. In this way, the renewable share for the district heating in Malmö will go from 0 to 23%.

Exploitation

Up-scaling: No up-scaling scenario is foreseen since EON:s district heating grid is the only one supplying the city with district heat.

Introduction renewable: The renewable sources that will be introduced are wood-based incineration.

1.3 Scope of the e-harbours case study Northern Harbour

The deliverables of this case study are:

- The report ”Studie om industriell samverkan i Norra hamnen” (EN: Study on industrial collaboration in the Northern harbour), City of Malmö, Sweden, published by City of Malmö.
- The report “Utveckling av industrisamverkan i Norra hamnen, Malmö - sammanställning av arbete, data och resultat under 2012” (EN: Development of industrial collaboration in the Northern Harbour, Malmö – compilation of work, data and results 2012)”, published by the City of Malmö.

2 RESULTS

2.1 Northern harbour

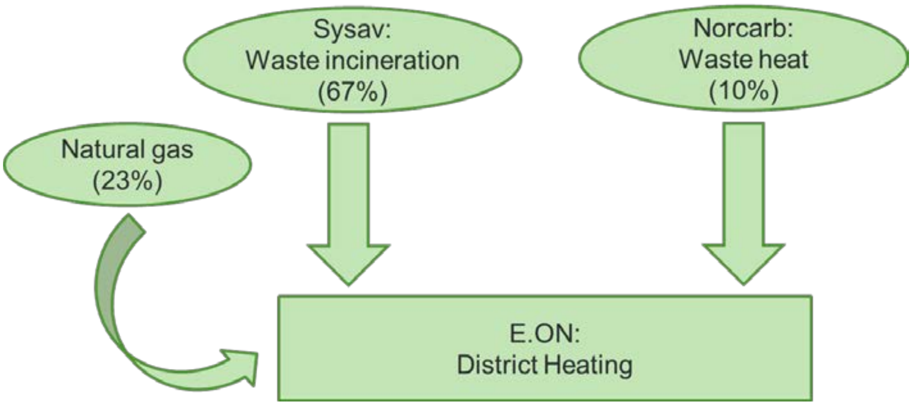
2.1.1 Introduction

The Northern harbour is the node for energy production for City of Malmö and the region of Skåne. EON and Sysav are the large producers of electricity, heat and biogas, which is distributed to the harbour and the city net for district heating, electricity and gas. The harbour area is 230 ha and now locates about 85 companies and is undergoing an expansion of another 450 ha.

The challenge for the City of Malmö and the region as a whole is that there is a lack of electricity production while there is an excess of heat, and that the energy mix is mainly based on conventional energy carriers. But, there exists a big potential in better matching production and demand, reusing excess heat and making capacity available for electricity production, as well as increasing the share of renewables of the energy mix.

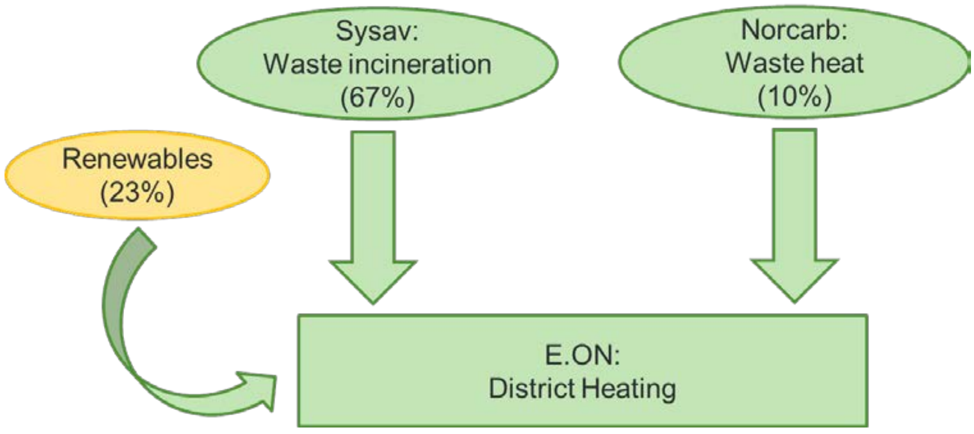
The scope of this case is to show how collaboration between companies in the Northern harbour and the City of Malmö can generate increased reuse of excess energy, capacity for electricity production and a greener district heating. The method is based on investigations and collaboration between the City of Malmö and companies in the Northern harbour, such as E.ON (energy producer and owner of the district heating grid), SYSAV (energy producer of district heat and electricity) and Norcarb (industry and producer of excess heat).

The first step in this cooperation is illustrated in the picture below.



The excess heat from Sysav and Norcarbs plants is transferred into E.ONs district heating grid. Sysavs part is 67%, Norcarbs part is 10% and the remaining part (23%) consist of natural gas from EON (Öresundsverket).

The **n**ext step in this cooperation is illustrated in the picture below:



The part of natural gas is supposed to be switched to renewable energy sources. This part is supposed to come from wood-based incineration.

A part from this, it will also be investigated how the heat generation from SYSAV and Norcarb can be made even more efficient. For example, SYSAV wants to invest in an accumulation tank to save heat during the day and use it during the night.

2.1.2 Investigation summary

Available information

The information available is energy production, energy use, transports and waste, from the different business in the Northern harbour, in terms of electricity, heat, steam, gas, oil, fuel. The share of renewable versus conventional heat production has not been distinguished.

Available data comes from the reports that have been written about the Northern harbour. The following are the figures that concern the show case in the Northern harbour:

EON Öresundsverket: 1 TWh heat per year to the district heat grid of Malmö (natural gas incineration)
Norcarb: 81 GWh heat per year to the district heat grid of Malmö (oil incineration)
Sysav: 1400 GWH heat from per year to the district heat grid of Malmö (waste incineration)

Power consumption analysis

Energy used:
Electricity: 148 GWh
Heat: 13 GWh

Energy produced:
Electricity: 3 247 GWh
Heat: 2670 GWh

Quantification of the flexibility

Since the tariffs for district heating are the same before and after the intervention, the flexibility is 0%.

Upscaling scenarios region/country

If more excess heat producing companies get connected to the district heating grid, the grid can be further developed in the region and provide more users with heat.

3 Overall Conclusions

3.2 General Overall Conclusions

The overall conclusions of the show case are the following:

- The flexibility of the case study is 0%, due to the fact that the tariffs don't change.
- The grid can be further developed in the region if more excess heat is transferred into the grid.

4 Lessons learned

4.1 Technical issues

One technical issue found is that there is actually more excess heat available for the district heating grid than used. This is because the infrastructure needed to connect to the grid is missing because of lack of incentives.

4.2 Economic issues

One economic issue found is the fact that the show case contributes to more renewables in the district heating grid but still doesn't lower the costs for the users.

4.3 Ideas for further investigation

Develop the efficiency of SYSAVS waste incineration and Norcarbs excess heat production.

5 References

[1] The report "Development of industrial cooperation in the Northern Harbour, Malmö"