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Women in Geothermal (WING) Denmark – Integrating Geothermal Energy in the Copenhagen Urban Planning

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ABSTRACT

Women in Geothermal (WING) Denmark is a newly established group of professionals working with or having an interest in geothermal energy. The group dedicates their spare time to creating a general awareness and an increased political focus on geothermal energy in Denmark, as well as establishing an international geothermal network.

Denmark is still in an early phase of exploitation of geothermal energy through low-enthalpy doublets established at just three sites. Establishing additional geothermal plants will increase the contribution of geothermal energy to the future energy mix, which may be a significant step towards achieving CO_2-neutrality in Denmark by 2050 and may even assist Copenhagen in reaching its ambitious goal by 2025.

In the coming years, WING Denmark will strive to promote geothermal energy, enabling this valuable resource to be considered in urban planning projects, with the visionary Lynetteholm urban development in Copenhagen as its primary focus.

1. INTRODUCTION

Women in Geothermal (WING) is a non-profit global network that aims to promote the education, professional development, and advancement of women in the geothermal community. WING Denmark was established in December 2017 by a group of men and women with a common goal to first and foremost create more focus on geothermal energy in Denmark.

Three small geothermal plants currently make a minor contribution to the district heating system in Denmark through production of geothermal energy. However, the Danish subsurface has a substantial potential for further geothermal developments (Mathiesen et al., 2009). Approximately 65% of all households in Denmark are connected to local district heating networks, which deliver hot water through a network of ca. 60,000 km pipelines. Several types of heat sources are already combined in the district heating system and although geothermal energy only makes a minor contribution to the total heat mix today, it is believed to be an underutilised renewable resource that may contribute with up to 30%, or even more, in reaching the Danish goal of becoming CO_2-neutral by 2050.

With the 2018 Energy Agreement, the Danish political parties committed to strengthening Denmark's focus on renewable energy, energy efficiency improvements, research and energy regulation. The agreement provides for significant investments to achieve the ambition of a low-emission society by the year 2050.

Political initiatives that may increase interest in investments in geothermal energy include: A reduced electrical heating tax that will make the use of heat pumps considerably cheaper in connection with extraction of geothermal heat, a scheme providing financial risk coverage in connection with geothermal drilling and an analysis of geothermal heat under the new framework to ensure that subsidy conditions are competitive with biomass in heat production (Danish Ministry of Climate, Energy and Utilities, 2018).

WING Denmark aims to further increase the general awareness and political focus on geothermal energy as a significant contributor in the future energy mix through a number of initiatives listed below.

2. WING DENMARK PROMOTING GEOTHERMAL ENERGY

During 2018 the WING Denmark Steering Group defined five focus areas (Figure 1) with the overall aim to create focus on geothermal energy through knowledge sharing and education of stakeholders.

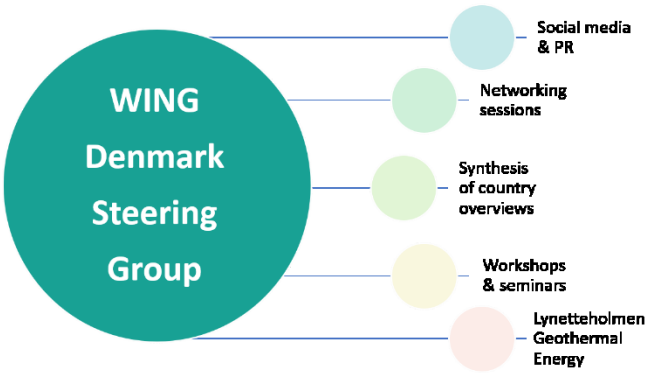

Figure 1: In 2018, five focus areas were defined that will be run by individual project groups within WING Denmark. Any effort put into general knowledge sharing about geothermal energy will be fed into the Lynetteholm Geothermal Energy initiative, which will be the main focus area for the WING Denmark steering group over the coming years.

WING Denmark initiatives:

1. Social media & PR
   In early 2019 WING Denmark set up a LinkedIn group that is open to everybody with an interest in geothermal energy in Denmark. The site is used by the Steering Group to inform about upcoming events and ongoing work in WING Denmark. The platform is used as an open forum to discuss and share information about geothermal energy and it currently has 42 members (July 2019).

2. Networking sessions
   In spring 2019 WING Denmark hosted its first after-work networking session for everyone with an interest in geothermal energy. A brief introduction to WING and WING Denmark was followed by an overview of ongoing WING Denmark initiatives and an insight into the early planning for the Lynetteholm project (see initiative 5 below). The event was closed out with a casual networking event, allowing for everyone to connect and discuss geothermal topics.

3. Synthesis of country overviews
   Throughout 2018 WING Denmark carried out a screening of geothermal energy use and legislation, insurance schemes and subsidies in selected countries. An ongoing effort to synthesise the results of the country overviews will eventually result in recommendations for an ideal geothermal setup in Denmark that should be made available to the authorities.

4. Workshops & seminars
   It is the aim of WING Denmark to offer short courses, workshops or seminars that will allow for an increased understanding about geothermal energy. Four researchers in the WING Denmark steering group will head up this initiative.

5. Lynetteholm Geothermal Energy
   The main focus area for WING Denmark in the coming years will be recommendations for geothermal energy as a source for district heating in the early planning phase of the Lynetteholm urban development in Copenhagen. This project will be discussed in further detail below.

3. COPENHAGEN URBAN PLANNING

There is a vision for Denmark to become CO_2-neutral by 2050. However, in 2009 the capital city of Copenhagen set itself an ambitious goal to become the first CO_2-neutral capital in the world by 2025. The city is already well underway with reduction in emissions due to e.g. phasing out of coal, source separation of waste, new LED street lighting and updating the modes of public transportation (City of Copenhagen, 2016). By 2025 the city aims to be powered entirely by wind, sun, geothermal energy, waste and biomass.

A great advantage for Copenhagen in the quest to cut emissions is that the city has relied on district heating for almost 100 years. Since 1925 the heating in Copenhagen has been produced at central plants and delivered to individual households through an underground network that today constitutes over 1,400 km length of pipes. Being able to utilise this already existing network will make the switch to cleaner energy more efficient than if the change depended on willingness and economical capability of individual households to change to new energy sources.

In late 2018 and early 2019 the Danish government announced two visionary future city developments that will accommodate further housing and workplaces near the capital of Copenhagen. The development of the artificial islands Lynetteholm in Copenhagen and Holmene in Hvidovre is planned to take place over the next 50 years. The islands are going to be attractive business districts with new and efficient traffic solutions but will also act as flood barriers and offer a wealth of recreational nature experiences. It has been

stated that great effort will be put into integrating green energy solutions and assure that the islands are adaptable to future climate change.

The subsurface and the geothermal potential beneath Copenhagen is quite well understood, and the Lynetteholm island project will thus be a key focus area for WING Denmark in the endeavour to ensure that geothermal energy will be taken into consideration for heat delivery planning for the future expansion of Copenhagen.

3.1 Lynetteholm island

With a size of 2 km^2, the Lynetteholm island (Figure 2) will be an expansion of the current Copenhagen area by approximately 2%. The early planning phase will require a focus on the overall future energy demand for Copenhagen city and sustainable urban planning is key to the project that will eventually accommodate 35,000 inhabitants and allow for an additional 35,000 workplaces, whilst functioning as flooding protection for the city of Copenhagen.

The development planning is already underway with an environmental impact assessment and a technical consultancy phase focusing on the design and location prior to handing over the project to the land reclamation phase in 2022. The first inhabitants are expected to be able to move onto the island in 2035.

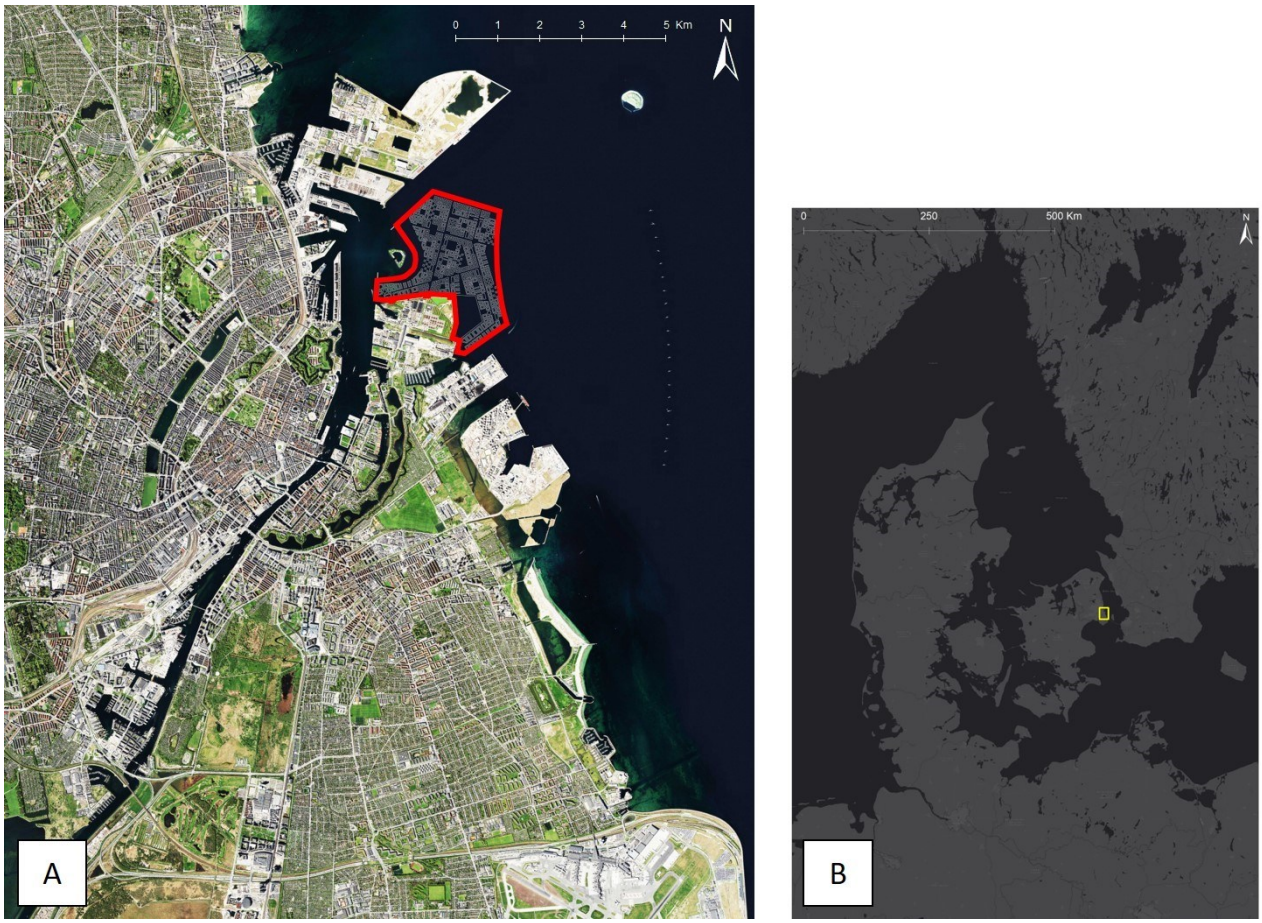

Figure 2: A) The Lynetteholm urban development will be located off the coast of Copenhagen (outlined in red). Visualisation from CPH City & Port Development Corporation. B) Map of Denmark outlining the location of the Copenhagen map (in yellow).

4. CONCLUSION

WING Denmark sees a great potential for geothermal energy being included in the future energy mix for upcoming urban developments near Copenhagen, Denmark.

WING Denmark will focus primarily on the Lynetteholm urban development during its early planning phase, and the first step is to arrange a political debate session about geothermal energy at the Danish Parliament in late 2019. Further efforts will focus on an understanding of the future district heating needs in Copenhagen and subsequent engagement with the technical consultants on how a geothermal development in connection with Lynetteholm may contribute to the vision of a CO_2-neutral capital by 2025.

Through the five initiatives listed above, WING Denmark will seek to influence the agenda through conferences and geothermal education of stakeholders with the aim to enable geothermal energy to be taken into consideration for future urban development plans in Denmark.

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