Decarbonizing the Gas Grid: Lessons from Europe

Oct 19 to 24, 2025

DRAFT Agenda – subject to change (Revised August 6, 2025)

Oct 19 (Sun)

- Arrival in Copenhagen, introductions and welcome dinner. Be sure to arrive in Copenhagen by early afternoon, which means you need to fly from the Pacific Northwest on October 18 or earlier!

Oct 20 (Mon) – Copenhagen

- **State of Green** - Denmark's Green Transition has been a fifty-year story of embracing sustainable energy solutions through public-private partnerships, broad political agreements, strong research and development and a private sector bold enough to take action at an early stage. The State of Green is a not-for-profit, public-private partnership – working with both the Danish Government and the leading business organizations in Denmark to facilitate this transformation. This presentation will provide an introduction to Danish perspectives on the role of renewable energy and renewable fuels, with an emphasis on how Danish companies and solutions are allowing the nation to decarbonize the energy sector while creating new jobs and achieving economic growth.
- **The Danish Energy Agency**, established in 1975, is an agency of the Danish Ministry of Energy, Utilities and Climate and Energy. It is responsible for activities related to energy production, supply and consumption, as well as Danish efforts to reduce carbon emissions. This includes responsibility for the regulations regarding government subsidies and other support for sustainable biogas and hydrogen production. The Agency will discuss how the government's policies have accelerated the growing biogas economy, and will provide an overview of climate goals and government policies related to green hydrogen production through Power to X.
- **Dansk Metal** is the union that represents the metal workers in automotive, IT, telecommunications, construction, aviation, and other industries, and thus encompasses many of the personnel who are key to the growth of the Green Energy economy in Denmark. We will be hearing about labor's role in this transition, and Dansk Metal's initiatives to provide housing, training and workforce development for these critical workers.
- **Crowne Plaza Copenhagen Towers** – We will be a site visit to one of the world's most advanced Aquifer Thermal Energy Storage (ATES) systems, located underground in the basement of the Crowne Plaza Hotel. Ground source heating and cooling systems (geothermal systems) take advantage of the relatively constant temperatures beneath the earth's surface - this constant earth temperature is higher than average winter temperatures, and lower than average summer temperatures. Heat pumps can operate efficiently by transferring heat between a building and the earth, and ATES systems improve the efficiency of heat pump operations even more. The system uses cold groundwater for cooling during the summer, while the heat rejected from this process is stored and reused for heating during the winter. No active refrigeration is required for the hotel's hydronic air conditioning system. By reversing the flow, the warm groundwater is

available for heating during the winter season – the groundwater is cooled to a temperature similar to the temperature of the untouched groundwater and returned to the aquifer's cold well.

Central Denmark (Oct 21)

- **EnergiNet** – As the Danish national transmission system operator, Energinet owns, operates and develops the transmission systems for both electricity and natural gas in Denmark. Energinet also oversees the green certificates issued for carbon credits for biofuels, and established the quality guidelines for RNG that is injected into the national distribution system. The presentation will provide an introduction to Energinet, discuss the Danish biomethane experiences, and provide an update on the future Danish hydrogen backbone connection to Germany.
- Depending on timing and logistics, we will be visiting one or two of the following facilities:
    - **The HySynergy Power-to-X plant**, in Fredericia, is one of Europe's largest Power-to-X plants with an initial electrolyzer capacity of 20 MW and expected expansions to 1 GW. The Phase 1 electrolyzer contributes to decarbonization of industrial processes at the adjacent Crossbridge Energy Refinery. HySynergy will also offer a competitive supply of green hydrogen as zero-emission fuel for heavy-duty mobility. Further expansion plans include the development of additional green hydrogen production capacities in Denmark to supply industrial demand in Germany, through the EU Hydrogen Backbone.
    - **European Energy e-methanol plant, Kassø plant** – The world's first large-scale commercial green methanol plant began operations in March 2025, with power from a solar plant converted into e-methanol. E-methanol has an excellent potential to reduce the fossil CO_2 footprint across heavy transport and the chemical industry, sectors which have historically been challenging to decarbonize. In the transport sector, e-methanol can be used directly as a green fuel for shipping and trucks and further processed into sustainable aviation fuel (SAF). In the chemical industry, e-methanol can replace traditional fossil methanol in processes such as the production of plastics. The Kassø Power-to-X plant will produce up to 42,000 tons of e-methanol annually, which will initially be delivered to Maersk to fuel the Laura Mærsk, the world's first container ship powered by e-methanol, and Circle K, Novo Nordisk, and the LEGO Group.
    - **Nature Energy Power-to-X Plant in Glansager** is the first in the world to commercially increase the production of biogas via electrolysis and biological methanation. An electrolyzer plant converts excess electricity from the sun and wind into hydrogen that is fed into Nature Energy's methanation plant where it combines with CO_2 to form e-methane, thereby increasing biogas production from the existing biogas plant and reducing the amount of CO_2. The hydrogen produced boosts Nature Energy's production of green gas by almost 450,000 ft^3 of gas per day.

Hamburg, Germany (Oct 22)

- **Hydrogen Aviation Lab** – a collaboration between the City of Hamburg, Lufthansa, the Hamburg Airport, and others, the Hydrogen Aviation Lab is a test bed to research the challenges of working with liquid hydrogen as a potential aviation fuel in an airport environment. Since hydrogen in liquid form behaves differently from kerosene, the traditional fossil aviation fuel, kerosene, the Lab is exploring how operators, airports and manufacturers can handle liquid hydrogen so that it is not only environmentally friendly but also safe for use, as well as

evaluating how existing infrastructure and airport operations need to be adapted for liquid hydrogen.

- **Hydrogen Technology Conference & Expo Europe 2025** – this international conference and expo event focuses on advanced technologies for the hydrogen and fuel cell industry, covering the entire hydrogen value chain. It will feature a vendor exhibition and a large conference with over 300 speakers, and is projected to attract over 20,000 attendees. We will be able to spend several hours at the event to visit with vendors and potentially attend some of the conference sessions.

Groningen, Netherlands – HEAVENN Hydrogen Valley project (Oct 23 and 24)

- This area is located on Europe's largest natural gas reserve, which has served as the main energy provider for the Netherlands and large parts of Western Europe. The region has committed to be the Green Hydrogen Capital of Europe, making the transition from gray, via blue, to green hydrogen production, distribution and utilization. We will be visiting several locations that are part of this Hydrogen Valley.
    - **New Energy Coalition** leads the HEAVENN project, which has established the Hydrogen Valley in this portion of the Netherlands. This region was historically one of the most important centers for the production and distribution of natural gas in Europe, but existing extraction and purification installations are being closed down as a result of the phasing out of natural gas production in the Netherlands. The Coalition is looking at opportunities for reuse of this infrastrucutre to create sustainable energy hubs. In June 2025 they also launched the Green Molecules Collective (GMC), designed as a national hub to promote collaboration in renewable gases—such as synthetic methane, hydrogen, and syngas—connecting research, industry, and government efforts.
    - **Gronongen Seaports** operates an industrial H2 pipeline 'ring' system feeding output from the Nobian chlor-alkali facility to existing industrial customers. Green hydrogen will be used for the production of green methanol (20 MW) and the production of green kerosene (40 MW). A trailer outlet is being completed, enabling green hydrogen to be loaded onto trailers and transported to users in the region, and a hydrogen-powered barge with a hydrogen fuel cell emergency power supply demonstrates a zero-emission shore-based power supply.
    - **Municipality of Hoogeveen** is developing 100 new homes that will rely on a 100% hydrogen supply, and 250 existing homes are being converted from natural gas to hydrogen. In addition, a data center is being fitted with an emergency power supply that uses a hydrogen fuel cell. If this proves to be effective, it will demonstrate how fuel cells can provide data centers with a reliable electricity supply even when the electricity grid is constrained.
    - **GeTec Park Emmen** – this industrial park is part of Chemical Cluster Emmen, dedicated to manufacturing and chemical enterprises, and is the largest of its kind in NW Europe. It is particularly focused on developments with bio-based chemicals. The gas treatment plant in Emmen is being converted into a Next Energy Hub, with a 4 MW electrolyzer to produce green hydrogen from green electricity. This will be transported from the GZI Next complex to the GETEC industrial park in Emmen via a newly constructed pipeline, thus making a significant contribution to the greening of industrial consumption of natural gas. GETEC's gas turbine will be adapted to supply "green" steam to the industry at the park.

- **Gasunie** is the major gas distribution utility in the Netherlands and the northern part of Germany, and is responsible for managing and maintaining the infrastructure for large-scale transport and storage of gas. Although currently this network is primarily serving natural gas, Gasunie is now developing a national hydrogen network, with a focus on connecting industrial clusters and facilitating both onshore and offshore hydrogen transport. The company is also involved in international connections and aims to establish the Netherlands as a key hydrogen hub. The Ministry of Economic Affairs and Climate commissioned Gasunie to build a network to ensure that industry has access to hydrogen as a cleaner form of energy. Gasunie subsidiary Hynetwork will be converting around 80 miles of natural gas pipeline and laying another 50 miles of new pipeline, with work expected to be completed by the end of 2027.

- Farewell dinner in Amsterdam, night of Oct 24. Our program will officially end with this dinner, but your hotel accommodations in Amsterdam for the night of Oct 24 are also included.

Oct 25 and beyond– Amsterdam

- You should book your return flight from Amsterdam any time on Oct 25 or later. For those considering spending some extra time in this vibrant city, Amsterdam will be pulling out all the stops on Oct 27 to celebrate 750 years since the city received its official city rights in 1275, with 24-hour neighborhood festivals and a nine-mile-long street party.