

ENERGINET

SUMMARY

2024

LONG-TERM DEVELOPMENT PLAN

# THE ENERGY SYSTEM TOWARDS 2050

The Danish energy system is facing major changes. The key factor is that we will use much more electricity – both here in Denmark and in Europe. This is the cornerstone of the green transition, and requires a huge expansion of the electricity grid towards 2050. It also most likely entails the development of a hydrogen and Power-to-X sector that can utilise the renewable energy to supply green fuels for aviation and shipping. The entire gas grid will also be turned upside down in 2030 when more green gas is produced than Danes can consume.

This requires that we adapt, optimise and expand Denmark’s total energy infrastructure. We must also adopt new construction solutions in order to minimise disruption to citizens and nature. We can only succeed in this if we plan long-term.



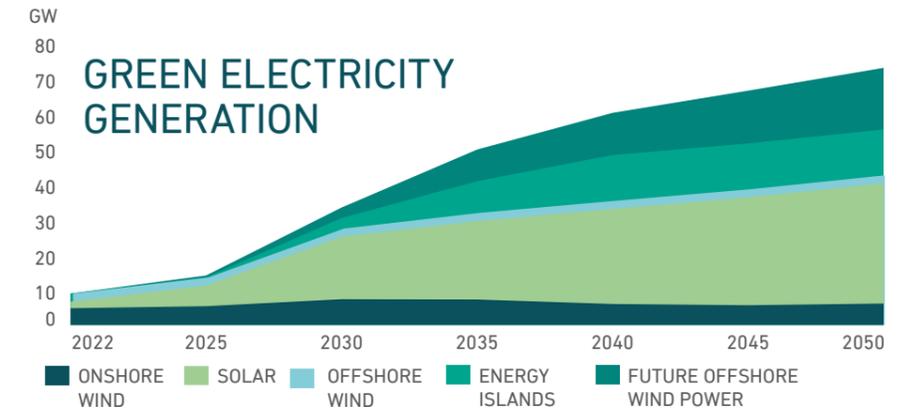
## MANY MORE PYLONS

The Danish goal of being a green energy exporter means that many more pylons and overhead lines will be erected in the scenic Danish landscape and in peoples’ ‘backyards’. Energinet is continuously working on solutions to minimise disruption to citizens.

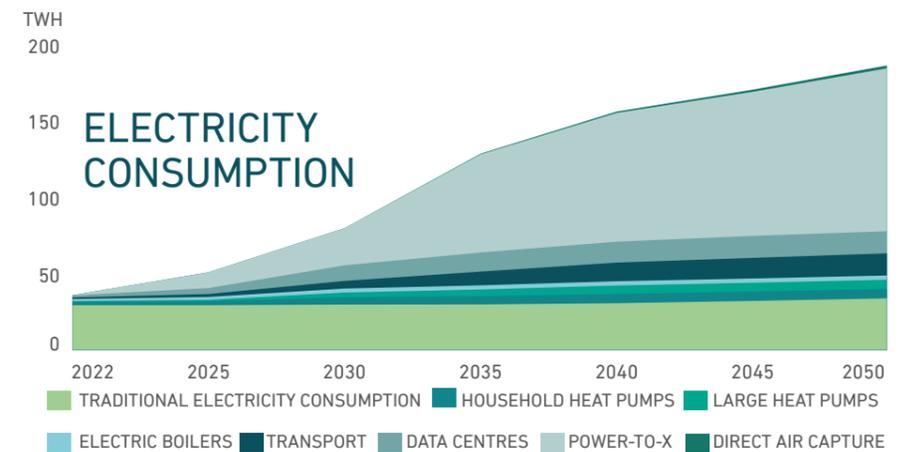


## BUILDING FOR THE FUTURE

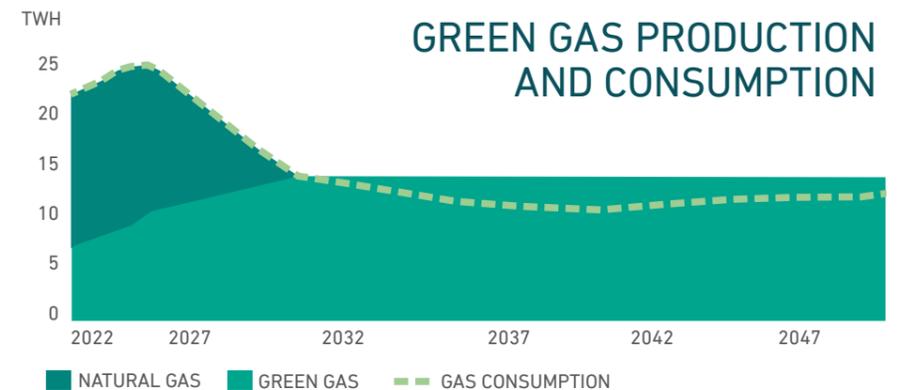
It takes time to plan and establish the electricity grid. If we only build to strictly meet today’s needs, there is a risk that we will not be able to meet tomorrow’s demands. We therefore balance potential and risks against the need to deliver a rapid green transition and achieve more for less money.



The growth in offshore wind power is expected to be a key driver for expansion of the power grid. Offshore wind capacity is currently around 2.3 GW. It is expected to be around 37 GW in 2050. Solar energy is also seeing significant expansion – and this trend is expected to accelerate around 2030.



A massive Power-to-X expansion is expected towards 2030, based in part on a significant number of announced projects in the pipeline. Around 26 GW of Power-to-X production is expected in Denmark by 2050, both onshore and offshore.



A major drop in gas consumption is expected for both households and businesses. At the same time, Danish green gas production continues to increase, and will match total Danish gas consumption by 2030.

# 2050 ELECTRICITY

The electricity grid will play a central role in the transition. Large quantities of green electricity have to be transported from generation to consumption. The electricity grid has already reached its upper limit in many parts of Denmark. There is no room for more wind and solar power until high-voltage substations and connections have been expanded.

Towards 2030 alone, we see a need to build approx. 2,700 km of electricity grid. We expect a further 3,000-4,000 km of electricity grid to be needed towards 2050. These are the yellow lines on the map. 1,000-2,000 km of overhead lines will also be removed.

### EXISTING AND APPROVED

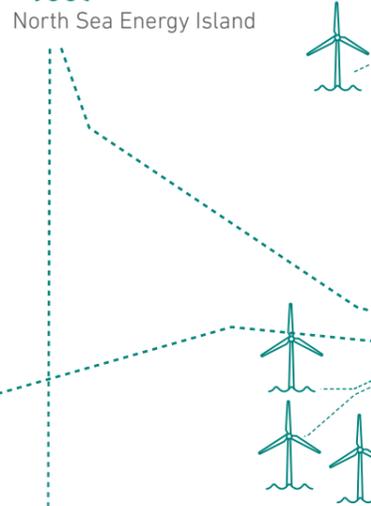
- 400 kV or HVDC overhead line
- 132/150 kV overhead line
- 400 kV or HVDC cable
- 60/132/150/220 kV cable

### POSSIBLE EXPANSION BY 2050

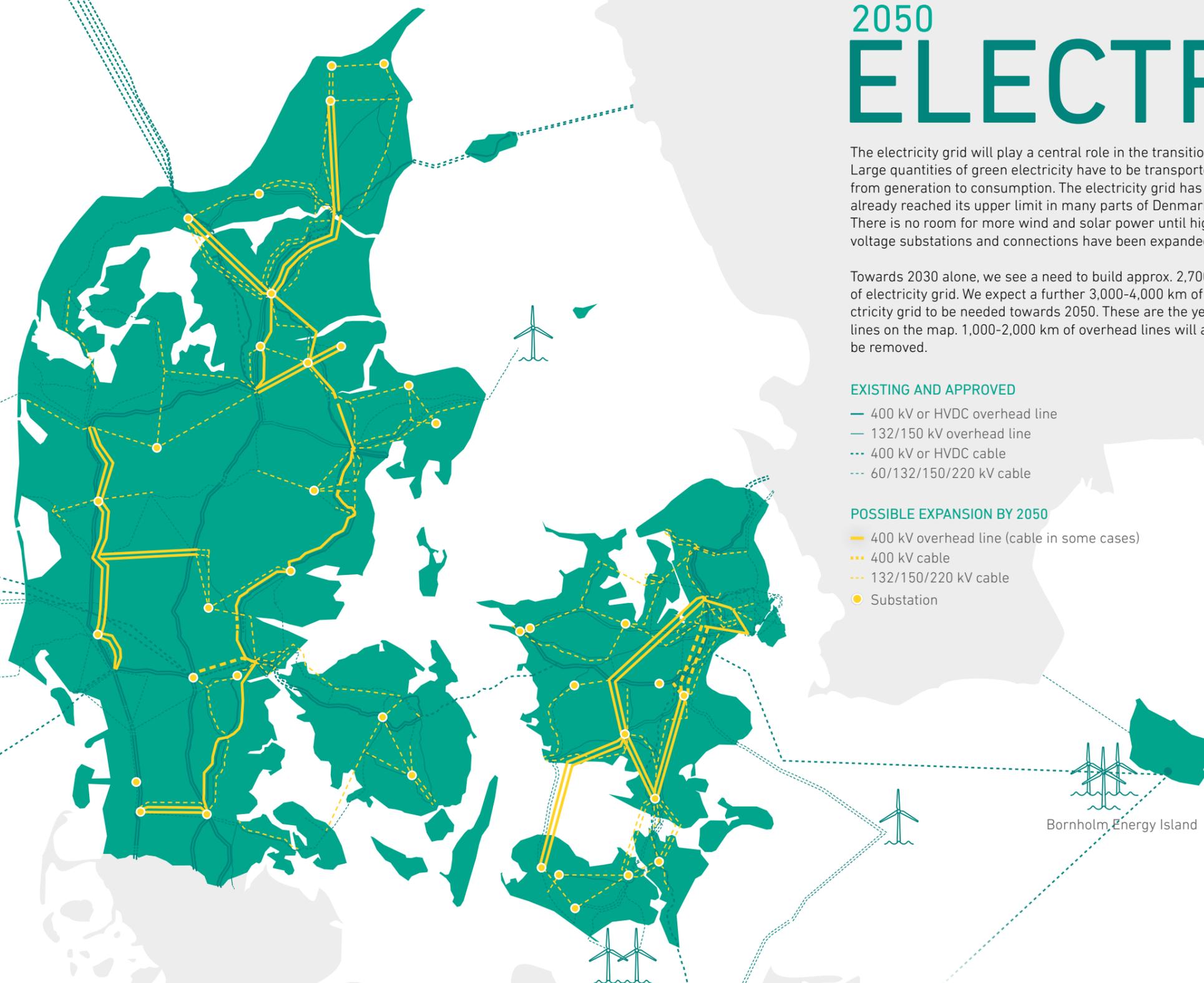
- 400 kV overhead line (cable in some cases)
- 400 kV cable
- 132/150/220 kV cable
- Substation



North Sea Energy Island



Bornholm Energy Island



See 'Long-term electricity transmission grid structure 2023' (in Danish) for more details



## 2050 GAS

The gas grid is undergoing a major transition. As more and more green gas is produced and gas consumption in Denmark falls, the need to send biogas from the distribution grid back into the transmission grid increases. This is the opposite direction to how the gas grid was originally designed. This demands new infrastructure in the form of reverse-flow plants.



For more details, see Geographic project list  
– gas transmission (in Danish)



## 2050 HYDROGEN

The map shows a possible hydrogen infrastructure scenario in Jutland, connecting producers, consumers, export and storage. There is currently no public hydrogen infrastructure in Denmark, at either the transmission or distribution level. The Danish hydrogen grid must therefore be built from the ground up for a market that is still in development.



For more details, see Geographic project list  
– hydrogen transmission (in Danish)

# 4 KEY TRENDS

## POWER GRID MUST BE EXPANDED TO MEET FUTURE NEEDS

We will use much more electricity in the future. This is the cornerstone of the green transition. Large quantities of green power from wind turbines and solar cells have to be transported to energy consumers – or refined into green fuels and hydrogen. We therefore need to add an extra 2,700 kilometres to the power grid by 2030.

## GREATER NEEDS FOR ANCILLARY SERVICES TO MAINTAIN THE POWER SYSTEM STABILITY

The many new green consumption and generation units being connected to the power grid place strain on its stability. As traditional power stations are phased out of electricity generation, there is an increasing need for technical units to help ensure that the power grid does not collapse when faults arise.

## POWER GRID MUST BE UTILISED EFFICIENTLY

Expanding the power grid cannot stand alone. We must minimise the need for expansion. We will do this by digitalising processes and collaborating – and using market solutions, for example, to create incentives to place new plants where there is already capacity in the power grid.

## THE GREEN GAS GRID MUST BE COMPETITIVE

To exploit the potential rising biogas production, investment must be made in plants capable of supplying the green gas to Energinet's gas grid. In the future these investments must be paid for through tariffs collected from a smaller pool of gas consumers. This will demand a strong focus on costs, to ensure that the future green Danish gas grid is competitive.

Energinet's Long-term Development Plan 2024 shows how Energinet expects the Danish energy infrastructure to be developed towards 2050 to meet future needs.



Scan the QR code to read the full version. See the other analyses for the development plan at [energinet.dk/LUP24](https://energinet.dk/LUP24) (in Danish)

**ENERGINET**