100% CO_2-free electricity by 2035

English summary

CE Delft

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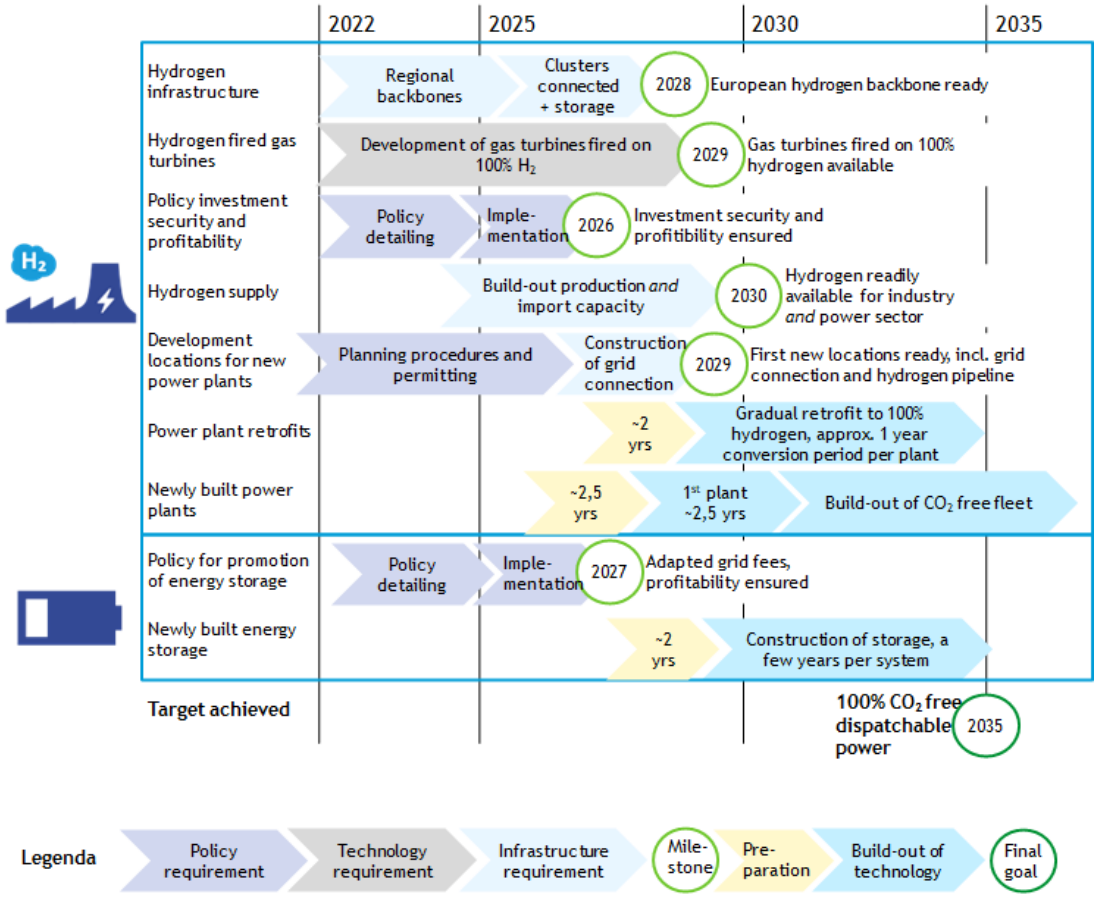
Summary

Policies are needed today to achieve 100% CO_2-free electricity by 2035

In this study, commissioned by the Foundation for Nature Conservation and Environmental Protection (Stichting Natuur en Milieu), CE Delft provides a roadmap for a fully CO_2-free electricity sector by 2035 and presents the policies needed to achieve this. Without new policy measures, there will be no CO_2-free regulating capacity to make up for long-term shortfalls from solar and wind. The technologies (hydrogen-fuelled power plants and fuel cells) need to be developed further in terms of efficiency and costs, but above all, CO_2-free standards will have to be adopted. The government will need to ensure security of the supply of a large share of solar and wind by means of a capacity market, high fines or its own investment in generation assets. Short-term shortfalls can easily be resolved by the use of batteries, a mature technology that is waiting for policies in order to scale-up.

Figure 1 - Roadmap to 100% free electricity by 2035



In order to limit global warming to 1.5°C, advanced economies such as the Netherlands must arrange for their electricity supply to be CO_2-free by 2035. In addition, the war in Ukraine has sparked a strong movement in Europe towards less energy dependency through an accelerated roll-out of renewables on home soil. Replacing the gas consumption of controllable power plants is also part of this trend. The Foundation for Nature Conservation and Environmental Protection asked CE Delft to map out a time path towards a CO_2-free electricity sector by 2035. In this report, we present the 'Roadmap to CO_2-free electricity'.

Roadmap to 100% CO_2-free adjustable capacity by 2035 (Section 6)

Figure 1 shows visually what needs to be done specifically, and by when, in order to have sufficient CO_2-free adjustable capacity by 2035. This path is explained further below.

In particular, the timeline for new construction and the conversion of gas-fired power plants to hydrogen is tight.
It is essential to get started quickly. Developing new policies, developing new locations for the power plants, developing and scaling up the technology and expanding the supply of hydrogen have long lead times. All of these things are necessary for the operation of hydrogen-fuelled power plants and the government needs to start working on all these things now in order to open the first gigawatt-scale plants around 2030.

A CO_2-free electricity supply requires CO_2-free power plants (Section 1)

Dutch demand for electricity is increasingly being met by electricity from solar and wind. The increasing share of solar and wind means that there are increasingly periods of surplus, while fossil power plants are used to supplement the shortfalls. A completely CO_2-free electricity supply requires that surpluses are put to good use and shortfalls are replenished without this resulting in CO_2 emissions.

The Netherlands will have to build new controllable power plants (Section 2)

The demand for electricity will increase significantly in the coming years due to the electrification of homes, transport and industry. Increasing electricity demand means that a higher capacity of controllable power plants is needed to meet the demand when no electricity is available from solar and wind. Despite the increasing demand for controllable power from power plants, fewer power plants will be available in the future. There are no plans for new power plants, while there are plans to close power plants and combined heat and power (CHP) is becoming economically less attractive. This means that new power plants will have to be built, starting in the late 2020s, to ensure security of supply.

Most technologies are technically ready for 2030, but are not yet cost-effective (Section 3)

Batteries, hydrogen-fuelled gas plants and fuel cells can provide CO_2-free power. Although gas power plants and hydrogen fuel cells are not yet technically ready to be built on a gigawatt scale, batteries are. However, all technologies will have to compete with natural gas power plants (depreciated assets). Hydrogen will remain more expensive than natural gas for a long time, and batteries have to pay high network tariffs. Without policy changes, this means that these techniques will not be cost-effective by 2030.

Policies are needed to encourage investment in CO_2-free power plants (Section 4)

In the Dutch energy market, investors must recoup their investment by selling electricity at a profit. There are no significant other sources of income. Solar and wind, however, are providing more and more hours at low market prices, making it all the more unpredictable for investors in new power plants to know how many hours the plant will operate and what the electricity price will be during those hours. In addition, literature shows that society and energy suppliers have conflicting incentives: society benefits from an ample supply of electricity, while suppliers benefit from scarcity.
If new power plants are built it is not self-evident that they will be CO_2-free. Natural gas plants are cheap and market parties are familiar with them.

This means that policies are needed to both increase investment security and ensure that the new power plants are CO_2-free. This could be done, for example, by imposing additional taxes on fossil-fuelled power plants by requiring a minimum share of CO_2-free electricity at all times or by paying new CO_2-free power plants a capacity fee.

A timely start to the realisation of non-financial preconditions (Section 5)

In addition to a business case, other things need to take place for the timely provision of sufficient controllable power:

- Space must be reserved for both the new power plants and the high-voltage lines leading to them. This will take a significant amount of time due to spatial procedures.
- A nationwide hydrogen infrastructure, including storage, needs to be built. This is expected to be completed in good time.
- Both domestic production and the import of hydrogen will have to be scaled up considerably. This additional demand comes on top of existing demand, but is necessary in order to have enough hydrogen to supply power plants as well as industry and heavy transport.