DNV·GL

European Carbon Neutrality: The Importance of Gas

A study for Eurogas – Executive summary

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Considerable efforts to mitigate and adapt to climate change are needed to keep Europe's societies habitable. The European Commission (EC) is committed to tackling climate change head on and aims to make Europe the world's first climate-neutral continent by 2050. The impact of transitioning to a net zero economy without greenhouse gas (GHG) emissions will be felt throughout the EU and in the energy sector in particular.

The European gas industry must find ways to thrive in a world where greenhouse gas emissions are gradually eliminated. This will mean supporting a vast expansion of renewable electricity generation and aggressively reducing emissions from fossil fuel use. This report was commissioned by Eurogas and investigates a continued and supporting role for gas in a decarbonized European economy by 2050.

To assess how to achieve a decarbonized future for the European energy sector and European consumers DNV GL developed a 100% CO_2 emissions reduction pathway (net zero) - labelled the 'Eurogas scenario'. This scenario builds on the strengths of the European gas sector and the advantages of energy delivery through existing gas networks. The Eurogas scenario was subsequently compared with an alternative pathway focusing on replacing gaseous energy with (primarily) electricity. This is called the 1.5TECH scenario in this report, and is DNV GL's interpretation of the EC's 1.5TECH scenario presented in 2018 as part of the *"long-term strategic vision for a prosperous, modern, competitive and climate neutral economy"*.

In both scenarios, all sectors need extensive decarbonization to achieve the reductions in emissions needed to meet the EC's net zero target by mid-century. In particular, it is clear that the electricity generation and manufacturing sectors (in both scenarios) must go carbon negative to achieve this. In the Eurogas scenario, electricity generation and manufacturing use energy produced from biomethane and biomass – decarbonized through carbon capture and storage (CCS) technology – to compensate for the remaining emissions produced by the increasingly less carbon-intensive buildings and transport sectors. The same occurs under the 1.5TECH scenario, although to a lesser extent. This scenario sees emissions reduced more evenly across all sectors.

There are several noteworthy similarities between both scenarios:

- Decarbonization of the electricity and manufacturing sectors depends on CCS technology and infrastructure being scaled
- Biomass use and second-generation biomethane technologies are pillars of Europe's decarbonization efforts. They are crucial for net negative emissions
- The road transport sector becomes increasingly electrified in both scenarios lead by battery electric vehicles (BEVs). Fuel cell electric vehicles (FCEVs) complement BEVs in commercial road transport.

In both scenarios, energy demand from the buildings sector does not reduce to the same extent as in other sectors in 2050. However, the energy carrier supplying this sector varies between the two scenarios. In the Eurogas scenario, natural gas and the scaled use of biomethane and hydrogen continues to deliver a substantial share of the sectors energy use. While in the 1.5TECH scenario a strong increase in the use of electricity for heating is observed.

The overall comparison of the two scenarios provides us with the following key findings:

Decarbonization of the European energy system

- In 2050 gaseous energy supply continues to play an important role delivering 32% of European final energy demand in the Eurogas scenario.
- The use of biogas and biomethane can result in significant negative carbon emissions (when coupled with CCS) making cost-efficient emission reduction available for otherwise hard-to-decarbonise sectors of energy demand.
- Hydrogen, biomethane and CCS can reduce the carbon footprint of the European gaseous energy supply chain by 89% in 2050 (and beyond if net negative emissions are included) in the Eurogas scenario.

Costs to society

- Continued gaseous energy supply in the Eurogas scenario delivers a net zero energy system at significantly lower cost (130 billion euro in annual savings) in 2050.
- Gaseous energy use reduces the cost of extensive renovation of the building sector and power grid expansion to accommodate for all-electric heating. It therefore provides society with a cheaper pathway to reducing emissions (~10 trillion euro in savings between 2018-2050).
- Continued use of gaseous energy in the Eurogas scenario reduces the estimated capex for European power grid expansion by around 1.3 trillion euros until 2050 (compared with the 1.5TECH scenario).

Decarbonization of gas supply

- Hydrogen production through methane reforming coupled with CCS (blue hydrogen) supplies the bulk of medium-term demand for hydrogen, reaching 820 terrawatt-hours (TWh) of supply in the Eurogas scenario in 2050.
- In both scenarios CCS is an indispensable technology for the decarbonization of the power and manufacturing sector with capacity between 895 and 1048 million ton of CO_2 sequestered per year (CO_2/yr) in 2050 for the 1.5TECH and Eurogas scenario respectively.
- Increasing availability of Variable Renewable Energy Supply (VRES) and cost reduction in electrolysis technology cause hydrogen production from renewable electricity ("green hydrogen") to reach 964 TWh in 2050 in the Eurogas scenario.
- Biomethane (second generation) can sustainably deliver 1014 TWh of energy in 2050, with supply costs impacted by feedstock scarcity in the longer run.

Infrastructure investment needs

- The combined effect of continuing the use of gaseous energy supply infrastructure and demand response technologies in the power sector reduce the peak-to-average capacity need by 19% from 2017 to 2050.
- Investment need for the continued use of gaseous energy is a fraction (11% of total capex in the Eurogas scenario) compared to the investment needed in the build-up of power grids to 2050.
- In the Eurogas scenario over 80% of the investment need in gaseous energy networks is for the accommodation of hydrogen into the networks (blended, retrofit and new build).

An energy supply for society

The energy sector underpins much of the lifestyle that citizens of advanced economies have become accustomed to, and that developing economies are increasingly relying on. Therefore, the symbiotic relationship between the need to decarbonise and the means that society has available to deliver decarbonized energy, are crucial to achieve deep decarbonization. As such, economic costs to society are of special concern, particularly to the economically disadvantaged.

In the Eurogas scenario, the total cost of delivering the EC's net zero ambitions by 2050 is 4.1 trillion euro (7%) lower than the 1.5TECH scenario. This difference approximates 0.5% of European GDP. This is equivalent to saving 130 billion euros per year or 600 euros per household per year over the 32-year period between 2018 and 2050. There are two primary reasons for the lower costs in the Eurogas scenario:

1. The subsidies required to incentivise/help consumers choose decarbonized energy are 80% or (10.1 trillion euros) lower in the Eurogas scenario. The comparable 1.5TECH scenario requires subsidies of 300 billion euros per year to electrify heating in the buildings sector.
2. The Eurogas scenario saves cost by repurposing the existing gas infrastructure instead of building new electricity infrastructure. The capex need in gas and electricity networks combined are 35% lower in the Eurogas scenario than in the 1.5TECH scenario.