

# Phase II – Pathways to 2050

## Why this study?

To achieve Paris Climate Agreement targets for CO2 emission reduction, energy supply, energy demand and the connecting energy infrastructure must undergo a profound transition.

The coupling of the complementary energy infrastructures for electricity and gas (hydrogen and methane) is considered to be a key concept to integrate renewable energy sources on a large scale in the energy system and to ensure security of supply.

TenneT and Gasunie have conducted the study Infrastructure Outlook 2050 (IO2050) in 2019 to understand future designs of the integrated energy system for Germany and the Netherlands in the year 2050.

Based on findings and open questions of IO 2050, the follow-up study Phase II: Pathways to 2050 (Phase II) focuses on transition pathways of the energy infrastructures towards an integrated European energy system.

## What did we do?

With this study we analyzed the impact of distinct future developments regarding RES supply and energy demands on the transforming energy infrastructure. For this purpose, an integrated energy system model is developed. The model determines transition pathways of the European energy infrastructure by minimizing the total investment and operational costs of various technological options (i.e. energy transmission infrastructures, power-to-gas (PtG) units, power plants and storages). Based on this, the study puts a special focus on the Netherlands and Germany (focus area) and covers the timeframe from 2030 to 2050 in 5 year steps.

## Scenarios

Building on the results of IO 2050 and other latest studies, three different scenarios have been developed. All scenarios assume a 95% decarbonization target within the energy system. The scenarios vary type and amount of installed RES as well as energy demand (focus on electrification vs. focus on gas).



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## Key insights

- Phase II has once again confirmed that the integration of the gas and electricity networks is necessary in order to achieve the energy policy goals of the Paris Climate Agreement and the Federal Government.
- Imports are essential: from 2030, imported CO<sup>2</sup>-neutral gases (green hydrogen, synthetic methane, biomethane and others) will be an essential energy source for Europe.
- Further development of the energy transmission infrastructures for electricity, hydrogen, and methane plays a crucial role for the future energy systems. Power-to-Gas is a key technology for enabling the energy transition.
- Phase II shows us that the course for successful grid integration must already be set today, especially in the five northern and the two southern German states.

## What do we need to do?

- We need political courage to develop clear regulatory and legal frameworks to push the energy transition.
- Improved or faster approval procedures for adjustments on the energy transmission infrastructure are necessary if we want to make energy transition affordable.
- Increasing dependencies of energy transmission infrastructures in Europe as cost-minimal source for flexibility require strong political cooperation, alignment within Europe and also globally.
- Several actions are required for a successful market launch program, e.g.:
  - tendering procedure for electrolysers in connection with tenders for offshore wind farms
  - tendering electrolysers at suitable onshore grid connection areas
  - reform of levies and charges to create a level playing field for P2X plants