Commit to Connect 2050 –

A target scenario for a cost-optimised, decarbonised and secure energy system in eastern Germany

By the year 2050 our energy and economic system must become completely climate-neutral. However, the measures taken to date for the Energy Transition are not able to integrate the various energy sources into one system at optimal costs. There is no master plan with a cross-sectoral perspective and networking. For the first time, 14 energy companies and regional suppliers have therefore developed a model for a future energy and infrastructure system for Germany's new federal states in the study "Commit to Connect 2050". The study focused on the question what the economically optimised target scenario would look like for a fully decarbonised energy system in eastern Germany in 2050. For this purpose, the region of eastern Germany was divided into 19 clusters, which were analysed with regard to their energy demand and generation potential in order to determine an optimum plant park and a suitable distribution network infrastructure. Furthermore, it was examined how these individual sub-regions can be connected by means of transmission network capacities and which storage capacities would have to be provided for the new energy system.

Target Scenario 2050: The future energy system consists of green electrons and green molecules

The future energy system will be based on an energy mix that is completely renewable. Today's electricity requirement from wind and photovoltaic technologies (PV) will increase many times over to **82 GW of wind energy capacities** and **57 GW of solar power capacities**.

Electricity that is not directly consumed will be converted into **regenerative hydrogen** through electrolysis and fed into the gas grid and storage facilities that are available with a capacity of 19,000 GWh in the target scenario. Thus, **gas storage facilities** guarantee security of supply in the future energy system.

In the heating sector, direct electrical applications are gaining in importance. The capacity of electric geothermal heat pumps will increase tenfold. However, the increase in energy efficiency will ensure that there is hardly a change in the peak load in electricity consumption. Depending on the settlement structure, heat will be increasingly supplied via **district heating network** or by means of **methane-air heat pumps**.

Central premises in the study design			Target Scenario 2050
CO₂	Permissible GHG emissions	Calculation of a 100% renewable energy system	✓
	Import options	Calculation of energy independence for eastern Germany	✓
	Consideration of cost advantages through actual infrastructure	No → most favourable energy system in the long term	✓
?	Approved technologies	Open for technologies	✓

Source: Wagner & Elbling GmbH, Icons made by Freepik, DinosoftLabs from www.flaticon.com

Openness to various technologies is the key to cost-optimised decarbonisation

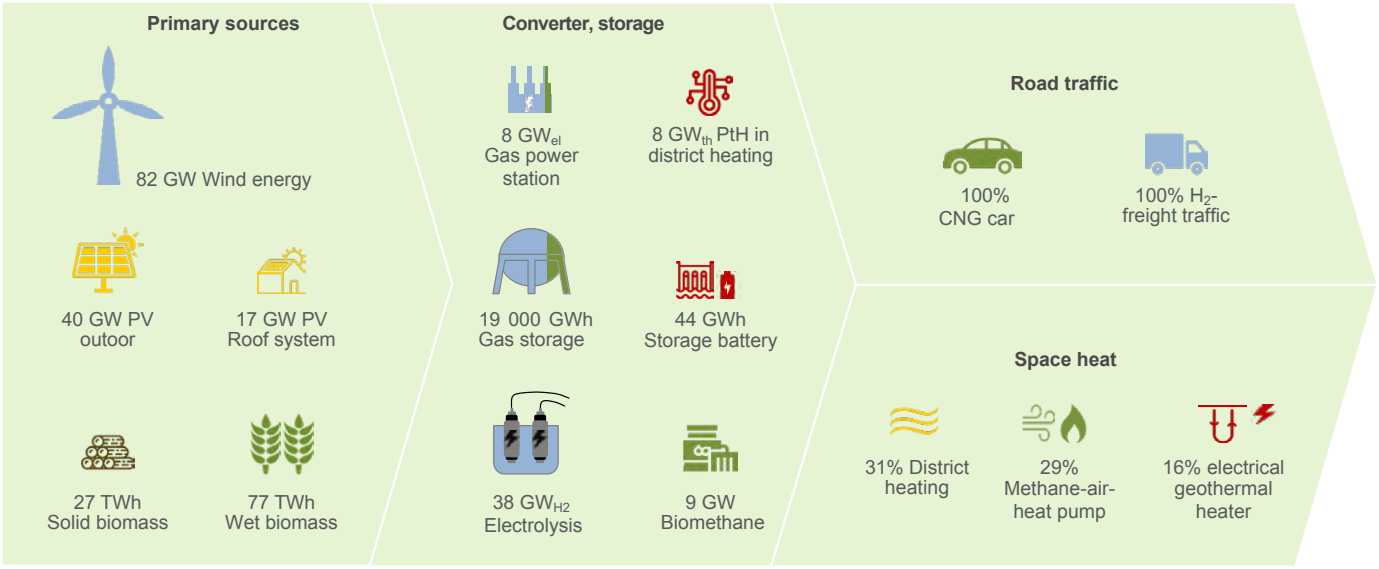
Despite new construction and self-sufficiency, a decarbonised energy system in eastern Germany has comparable annual costs of approximately EUR 53 billion compared to today's real energy system of approximately EUR 50 billion.

These low economic costs are due to the open technology approach of the target scenario. Any restriction in this openness to technologies, however, results in additional costs:

For example, for the purpose of comparison a system calculated without final gas distribution entails additional costs of approximately EUR 9 billion per year. If gas grids and gas storage facilities are not used at all, this will result in additional costs of EUR 19 billion per year.

At the same time there are **no costs for importing raw materials** as the target scenario for 2050 was calculated on the assumption of a self-sufficient energy system.

The Decarbonized Energy System for Eastern Germany in 2050



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The energy system of the future requires no more land than today

Today's energy production from wind, PV and biomass in eastern Germany is associated with a maximum land use of 15 per cent of the region's land area. Although there will be structural shifts, this requirement will remain constant in accordance with the target scenario for 2050. The area requirements for wind energy will increase to 3.4 per cent and for PV to 0.7 per cent of the region's land area, while the requirement for biomass will drop to approximately 11 per cent. In addition, immense areas that are currently used for coal production through open-cast mining will be available.

Hydrogen will complement the electricity system and serve as a cost-effective transmission medium between the sub-regions

The energy sources **biomethane and hydrogen** will play a central role in optimally integrating the different energy sources into one system. Together they provide a capacity of around **200 TWh** and completely replace natural gas.

Because of its high and cost-effective storage efficiency, hydrogen will become a decisive energy carrier in energy transmission, sector coupling and backup of the electricity system. In addition, biomethane also continues to play a fundamental role due to its secure production capacity.

For decarbonisation to be economically efficient, the mobility sector must be considered as open to new technologies

No drive train is superior to any other in the study. Although CNG engines – powered exclusively by biomethane – are the preferred drive technology for passenger cars in the optimum target scenario, cost sensitivity is very high. If the cost forecast for electric vehicles is lowered by only 5 per cent, then the target scenario favours battery-powered cars.

Conclusion

"Commit to Connect 2050" shows that it is possible to establish and operate a completely decarbonised energy system in a cost efficient manner. It is important to look at the entire system for a successful Energy Transition.

This is the only way we can develop solutions and launch green technologies – such as the use of hydrogen in the various sectors – in time.

The study also shows that an open-technology approach is considerably cheaper than scenarios with only partial openness to different technologies.

Partner companies of the "Commit to Connect 2050" project

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