

# Opportunities of European Hydrogen Supply Potentials for Germany's Hydrogen Market

Drin Marmullaku<sup>1,2</sup>, Theresa Klütz<sup>2</sup>, Jochen Linßen<sup>2</sup>, Detlef Stolten<sup>1,2</sup>

<sup>1</sup> *Forschungszentrum Jülich GmbH, Institute of Climate and Energy Systems (ICE) – Juelich Systems Analysis, 52425 Jülich, Germany*

<sup>2</sup> *RWTH Aachen University, Chair for Fuel Cells, Faculty of Mechanical Engineering, 52062 Aachen, Germany*

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## Abstract

Based on the Green Deal, the European Commission is committed to reducing net greenhouse gas emissions and achieving greenhouse gas neutrality by 2050. Germany aims to achieve this goal by 2045. This transformation will be driven by a significant increase in renewable energy production and the substitution of fossil fuels in areas where electrification is either not feasible or not economically viable. Important substitutes include green hydrogen and other electricity-based fuels. The expected hydrogen demand in Germany in 2045 varies between 365 and 700 TWh, mainly driven by the industrial, transport and conversion sectors. However, the demand for hydrogen is driven by the price, which is influenced by several factors, including the potential and cost effectiveness of renewable energy sources. Due to limited national renewable energy resources and high energy demand, Germany is likely to become a significant importer of green hydrogen. Europe has significant energy resources, especially in the southern and northern regions, which could provide the opportunity for the establishment of a European hydrogen market. This could provide significant potential for Germany, which is likely to become a central trading hub for hydrogen. This work provides a detailed assessment of supply potentials across the European landscape for the target year 2050 based on the optimization framework ETHOS.FINE using a high temporal and spatial resolution. Based on the NUTS 3 classification, a hydrogen supply curve is derived for each region by minimizing total annual costs for different hydrogen production levels. Thus, a detailed basis for the supply of hydrogen over a wide geographical scope is established. The regional supply curves are aggregated into country-specific export curves, taking into account national characteristics and transportation costs. Based on these high-resolution export curves, different import scenarios are derived to analyze the impact on the German hydrogen market in terms of demand and price. The opportunities in the context of a European hydrogen market are identified by comparing the scenarios.