

Abstract

As an emerging long-term solution in decarbonization of our energy systems, green hydrogen projects have gained attention for research and investment around the world, with hydrogen often advertised as the energy carrier for hard-to-abate sectors. To increase funding towards hydrogen projects, the German National Hydrogen Strategy launched in 2020 and was updated in 2023. This update includes a new target for 10 GW of installed electrolytic hydrogen capacity in 2030 and massive scaling in renewable electricity to support clean hydrogen production. However, the German economy faces predicted deficits of domestic renewable energy to meet overall energy needs. Energy independence for the state of Germany thus consistently arises in economic policy discourse and may be reframed through new geopolitical relationships in energy trade. The escalation of the Ukraine War in 2022 exacerbated the need for Germany to import fuel, specifically to replace Russian natural gas. This research examines Germany's National Hydrogen Strategy within these contexts and estimates the necessary renewable electricity required to meet energy security needs for green hydrogen. Geospatial analysis is utilized to measure feasibility of renewable electricity supply from solar, onshore wind, and biomass to produce electrolytic hydrogen in Germany and surrounding countries. These figures are compared against goals for green hydrogen generation by 2030 in Germany and analyzed through the geopolitical interactions between Germany, the European Union, and outside energy actors. The research identifies sites of focus for investment into hydrogen communities that produce hydrogen locally and benefit nearby industries through shared infrastructure and deployment of energy.