

Geopolitics of the Energy Transformation The Hydrogen Factor



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ABOUT IRENA

The International Renewable Energy Agency (IRENA) is an intergovernmental organisation that supports countries in their transition to a sustainable energy future and serves as the principal platform for international co-operation, a centre of excellence and a repository of policy, technology, resource and financial knowledge on renewable energy. IRENA promotes the widespread adoption and sustainable use of all forms of renewable energy, including bioenergy, geothermal, hydropower, ocean, solar and wind energy, in the pursuit of sustainable development, energy access, energy security and low-carbon economic growth and prosperity.

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FOREWORD

The accelerating deployment of renewables has set in motion a global energy transformation with far-reaching geopolitical implications. The report “A New World”, released in 2019 by IRENA’s Global Commission on the Geopolitics of the Energy Transformation, was the first foray into this area. It highlighted how the advent of a new energy age would reshape relations between states and communities and bring about a “new world” of power, security, energy independence and prosperity.

Given the fast pace of change, it is critical to monitor the geopolitical drivers and implications of the transition, stay abreast of developments and play an active role in shaping the future. In 2020, the IRENA Assembly requested the Agency to advance this work under the Collaborative Framework* on the Geopolitics of the Energy Transformation. Hydrogen was identified as a prominent area for further analysis, given the recent surge of interest. Several times in the past, hydrogen attracted much attention but remained a niche in the global energy discourse. Today, the policy focus is unprecedented, given its central role for decarbonisation of harder-to-abate sectors.

There are still many uncertainties about how the hydrogen market will develop, who will emerge as market leaders, and what the geopolitical implications may be. In writing this report, IRENA provides an informed analysis about how these uncertainties could play out. Much will depend on the policy frameworks governments put in place, including the incentives they choose against a backdrop of the social and economic consequences of a global pandemic, the increasingly evident climate impacts and the urgency to decrease the gap between the haves and have-nots.

IRENA’s World Energy Transitions Outlook envisages it could meet up to 12 percent of final energy consumption by 2050. To achieve this, it will be essential to set the priorities right, especially early on, while markets are developing and costs are high. And hydrogen’s positive contribution to climate and development efforts will be ensured only with transparent and credible rules and standards and a coherent system that transcends national, regional and sectoral boundaries. Crucially, with international co-operation, the emerging hydrogen market has the potential to be both decentralised and inclusive, with opportunities for developed and developing countries alike.

We have a long way to go. For example, just as the UN Climate Conference kicked off in Glasgow in October 2021 an energy crisis took hold of global energy markets. The volatility of oil and gas prices triggered a range of emergency measures to reduce the impacts on producers and consumers worldwide. These are a stark reminder of the persistent centrality of fossil fuels to the geopolitics of energy. They also underscore the urgency of the move to resilient energy systems, aligned with the climate and development imperatives set out in the Paris Agreement and the Agenda 2030.

Today, governments have a unique opportunity to shape the advent of hydrogen, by contributing to the design of markets supportive of the energy transformation while avoiding existing limitations and inefficiencies, reducing inequalities, and influencing geopolitical outcomes towards cleaner and fairer energy systems. The challenges are many, but so are the opportunities. I hope that this report will help policy makers and stakeholders effectively navigate the unknowns, mitigate risks and overcome obstacles in the years ahead.



**Francesco
La Camera**
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International Renewable
Energy Agency*

* IRENA Collaborative Frameworks are platforms for public, private, and other actors to exchange experience, deepen analytical work and promote international cooperation on energy transitions.

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i Those that are listed here reflect the experts that have consented to being named.

Summary for Policy makers

The ongoing energy transition is unprecedented due to its scale and the profound impact on the established socio-economic, technological, and geopolitical trends around the world. Renewables, in combination with energy efficiency, now form the leading edge of a far-reaching global energy transition. This transition is not a fuel replacement; it is a shift to a different system with commensurate political, technical, environmental, and economic disruptions. The central question this report addresses is whether and to what extent hydrogen exacerbates or mitigates these disruptions and in what ways.

Hydrogen, until now the missing piece of the clean energy puzzle, is likely to further disrupt energy value chains in coming years. The climate change imperative has been the main driver of the renewed policy focus on hydrogen. IRENA's 1.5°C scenario envisages that clean hydrogen¹ could meet up to 12% of final energy consumption by 2050. Majority of this would be produced using renewables, with the rest from gas and carbon capture and storage.

Hydrogen is likely to influence the geography of energy trade, further regionalising energy relations. With the costs of renewable energy falling, but those of transporting hydrogen high, the emerging geopolitical map is likely to show growing regionalisation in energy relations. Renewables can be deployed in every country, and renewable electricity can be exported to neighbouring countries via transmission cables. In addition, hydrogen can facilitate transport of the energy renewables produce over longer distances via pipelines and shipping, thus unlocking untapped renewable resources in remote locations. Some existing natural gas pipelines, with technical modification, could be repurposed to carry hydrogen.

Countries with an abundance of low-cost renewable power could become producers of green hydrogen, with commensurate geoeconomic and geopolitical consequences. Green hydrogen could be most economical in locations that have the optimal combination of abundant renewable resources, space for solar or wind farms, and access to water, along with the capability to export to large demand centres. New power nodes could arise in places that exploit these factors to become centres of hydrogen production and use.

The hydrogen business will be more competitive and less lucrative than oil and gas. Clean hydrogen will not generate returns comparable to those of oil and gas today. Hydrogen is a conversion, not an extraction business, and has the potential to be produced competitively in many places. This will limit the possibilities of capturing economic rents akin to those generated by fossil fuels, which today account for some 2% of global GDP. Moreover, as the costs of green hydrogen fall, new and diverse participants will enter the market, making hydrogen even more competitive.

1 The present report refers to this mix of green and blue hydrogen as "clean hydrogen". Also see Figure 2.2.