

Towards a Unified Hydrogen Standard: Benchmarking G20 Nations' Hydrogen Economy Maturity

Project team:

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Challenge Statement

Hydrogen is widely regarded as a cornerstone of the global net-zero transition. However, its development and deployment face significant obstacles due to regulatory fragmentation and policy inconsistency across G20 nations.

One of the key challenges is the lack of a universally accepted hydrogen standard. Different definitions – such as the varying use of the “green hydrogen” label – undermine perceptions of quality and create barriers to trade compatibility. A second challenge stems from policy misalignment, with inconsistent national approaches generating uncertainty for investors, complicating infrastructure planning, and impeding the integration of international markets. Finally, uneven levels of national maturity further exacerbate the issue: while some G20 members have developed strong legislation, strategies, and investment programmes, others remain without clear plans or regulatory frameworks.

Research Response

Contribution of Research

This study represents the first comprehensive review of hydrogen standards, financial commitments, national strategies, and future plans

across the G20. Using a Weighted Scoring Model (WSM), the analysis rates each nation on a scale from 1 (lowest maturity) to 10 (highest maturity) across these dimensions. This enables direct cross-country comparison, identification of maturity gaps, and the development of a structured basis for international policy alignment.

Regional Relevance

For the UK – and particularly regions such as South Yorkshire seeking to embed themselves in the hydrogen economy – this benchmarking provides insight into the country’s competitive positioning relative to other G20 members. It also identifies opportunities for strategic investment and informs policy design that reflects and aligns with emerging global standards.

Evidence and Outputs

Research Findings

The study highlights the US, China, and the UK as frontrunners in hydrogen economy maturity. These countries already combine standards, strategy, and investment, giving them significant influence over global market rules and trade. Their leadership sets the direction for others, and they are well-positioned to drive international standard harmonisation, scale manufacturing, and provide

technical and financial support for emerging markets.

Other advanced economies such as Germany, France, Italy, and Australia show strong progress in policy and investment but need to focus on moving from ambitious strategies to binding regulations and large-scale deployment. Japan demonstrates strong planning but underinvestment, while Brazil, South Africa, Argentina, and India face uneven progress across criteria. These countries would benefit from closing gaps between strategy and financing, building institutional capacity for certification and safety, and deploying pilot projects that match local resources.

At the lowest maturity, Mexico and Russia lack clear hydrogen strategies or standards, which risks their exclusion from future global markets. For these countries, the priority is to establish basic national roadmaps and regulatory frameworks, while leveraging multilateral and bilateral support to develop pilot projects and build institutional capability.

Overall, the results show that the frontrunners must take responsibility for shaping international standards and financing mechanisms, while

lagging countries urgently need targeted support to build the foundations of hydrogen economies. Without this alignment, fragmented approaches and investment gaps will slow progress toward a global hydrogen market and delay the role of hydrogen in achieving net-zero goals.

[Published academic papers on this research project can be found here¹.](#)

Scalability and Commercialisation

The findings offer clear pathways for scaling hydrogen deployment. In South Yorkshire, maturity benchmarks can help target investment towards production, storage, and distribution projects that comply with international certification criteria. More broadly, the maturity scoring model can be applied to other regional clusters or international groupings to assess and benchmark progress.

Nuances and Trade-Offs

Some trade-offs must be considered in the pursuit of hydrogen market development. While global standardisation could slow short-term deployment due to the negotiation and alignment process, it is essential for ensuring long-term interoperability and stable market conditions. Furthermore,

¹ Shamoushaki, M., Koh, S.C. Lenny, [Novel maturity scoring for hydrogen standards and economy in G20](#), Renewable and Sustainable Energy Reviews, 212, (2025).

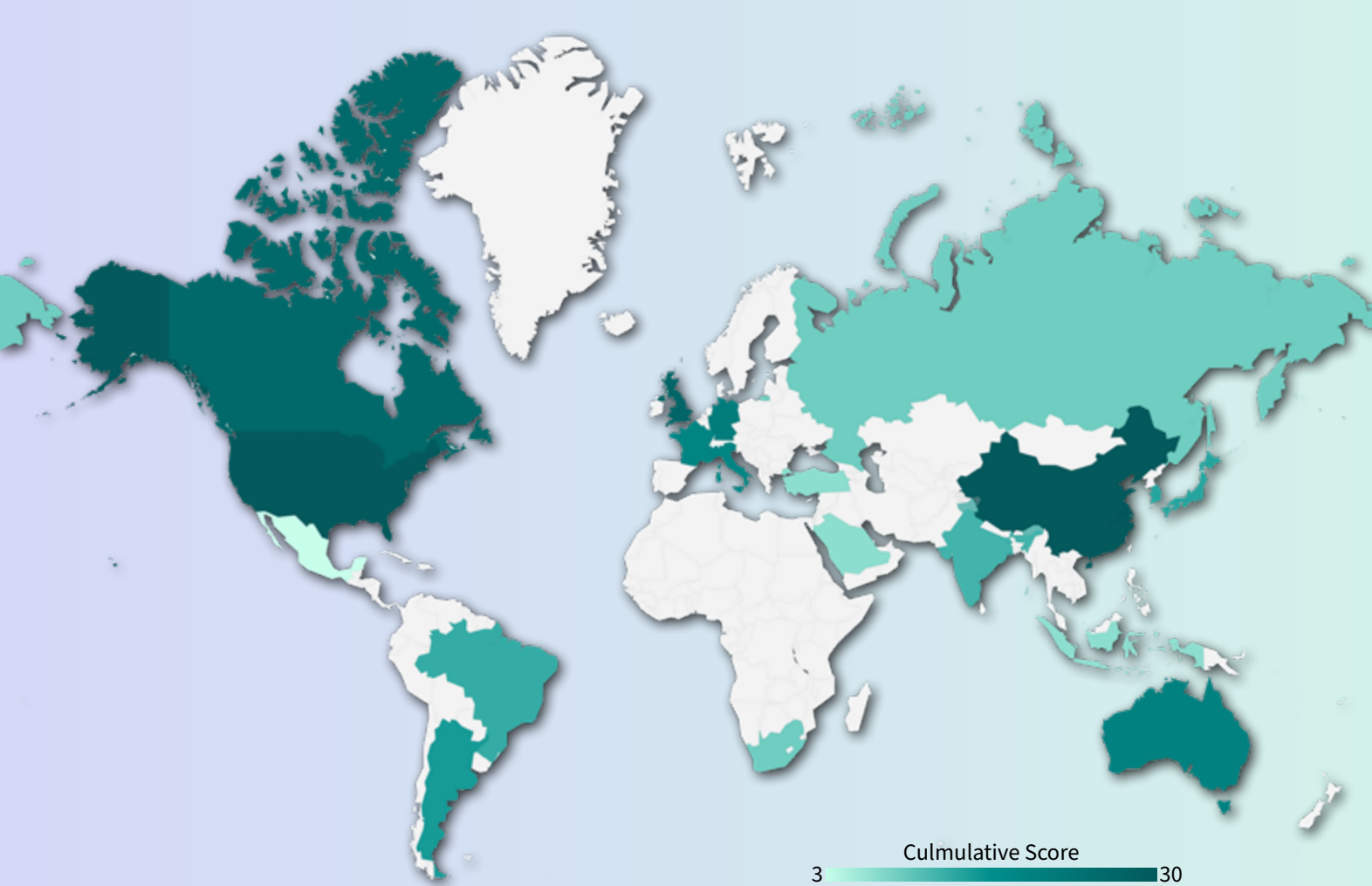


Figure 1: Maturity of hydrogen standards in G20 Countries demonstrated on a world map

regions must carefully balance the pursuit of unique strategic advantages with the need to remain aligned to global frameworks, avoiding potential isolation from emerging international markets.

Policy Insights

While the findings of this research hold global importance as it compares the hydrogen economy in all G20 countries, actionable recommendations can be drawn for South Yorkshire. The following section sets out key policy insights, building on the conclusions and recommendations drawn from the selected publications.

1. Continue to leverage first-mover advantage

- The UK Low Carbon Hydrogen Standard provides a benchmark for emissions that can be used in international comparison, as well as the UK Low Carbon Hydrogen Certification Scheme – Consultation & Response, and the UK’s Hydrogen Strategy which has sections on trade and exports, and explicitly states the importance of keeping “standards

and certification for low carbon hydrogen consistent with international standards and schemes where appropriate.”

- As one of the few countries with a formal hydrogen standard, the UK can influence global certification frameworks and international trade agreements.
- ### 2. Continue to close strategy–investment gaps
- In the 2022 UK public sector hydrogen research and innovation document, the government includes “international initiatives” among its focus areas, as well as within UK’s Hydrogen Net-Zero Investment Roadmap, there is mention of developing business models for hydrogen transport & storage, export opportunities, and supporting alignment via certification work.
 - Further initiatives are required to ensure the UK’s hydrogen strategy is backed by proportionate investment to maintain credibility and leadership, avoiding the “policy–investment mismatch” observed in

other G20 nations.

Regional

1. Align with global standards

- Promote regional readiness by positioning South Yorkshire’s hydrogen projects, such as ITM Power, GeoPura, Lhyfe, and Clean Power Hydrogen group, to meet international certification requirements, ensuring competitiveness in global supply chains.

2. Strategic investment has been targeted

- South Yorkshire Mayoral Combined Authority’s (SYMCA’s) partnership with Schrodgers Capital includes infrastructure investment focus via hydrogen generation and storage among other clean energy infrastructure, bringing in external capital.
- It is recommended to use the Hydrogen Economy Maturity Index to prioritise local investment in hydrogen production, storage, and distribution.

3. Build capacity and skills

- Work with Sheffield’s universities, colleges, Advanced Manufacturing Research Centre (AMRC) training centre, and industry to create specialist training (e.g. accredited courses/apprenticeships) in hydrogen technologies, ensuring a skilled workforce for scaling.

Next Steps

The research identifies several immediate and longer-term actions. At the international level, the UK should lead diplomatic and technical initiatives aimed at finalising a global hydrogen standard. The Hydrogen Economy Maturity Index should be updated regularly to reflect new standards, financial commitments, and national strategies. In parallel, hydrogen standards should be integrated into trade agreements to ensure that policy frameworks align with market access and competitiveness.

Further research is required to apply the maturity scoring model at sub-national scales and within industry sectors. In addition, economic analyses should be conducted to assess how the adoption of global hydrogen standards will influence trade flows and national competitiveness.

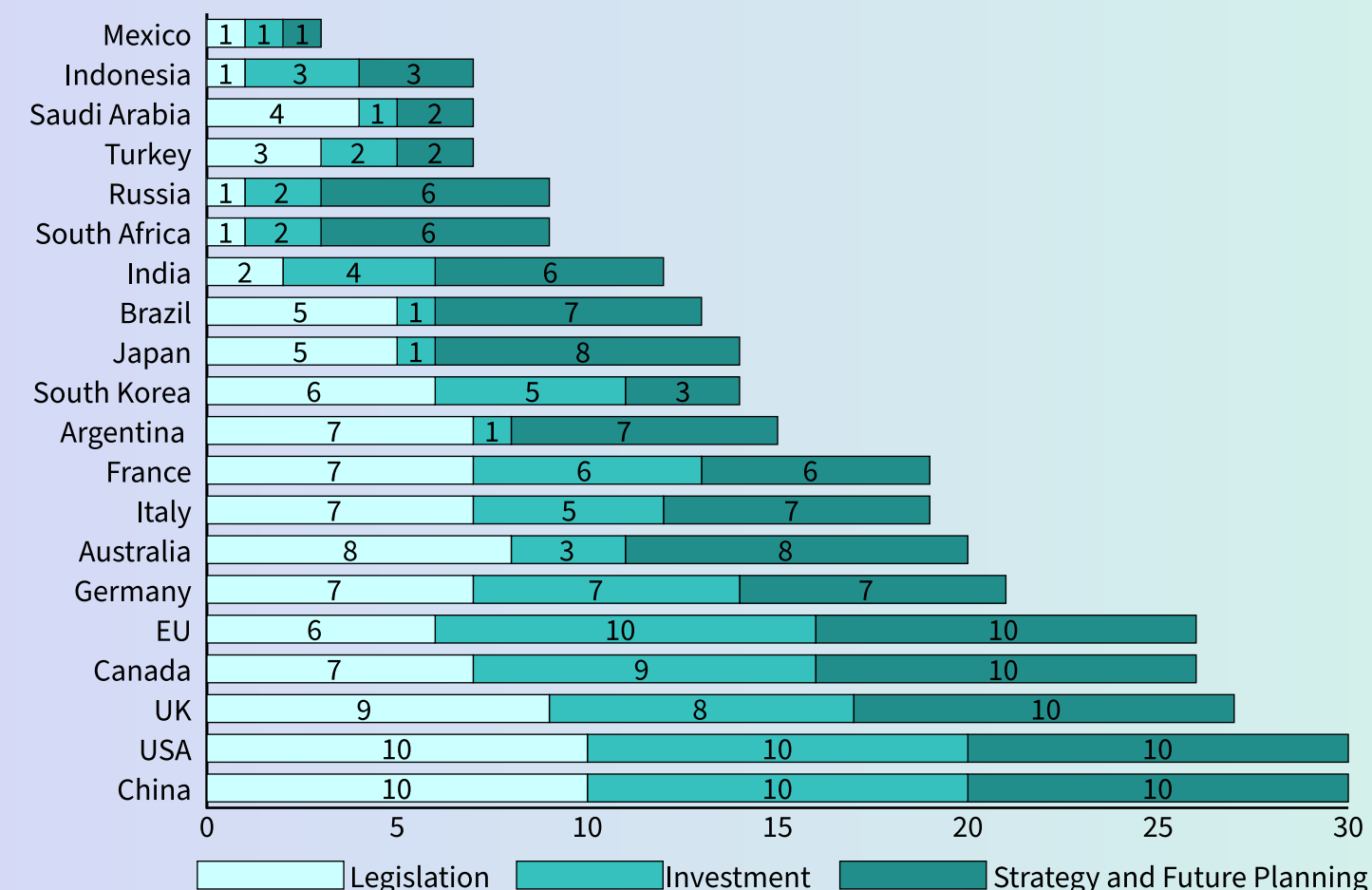


Figure 2: Maturity of hydrogen standards in G20 Countries