

BREAKTHROUGH

AGENDA

Hydrogen Briefing Pack for COP29

November 2024

About The Breakthrough Agenda: The BA convenes countries and initiatives to strengthen international collaboration by providing a framework to prioritise, coordinate, and enhance collaborative action across seven high emitting sectors that cover over 60% of global emissions.

The Hydrogen Breakthrough: The Hydrogen Breakthrough Agenda aims to facilitate coordinated action and establish an inclusive framework within the multilateral landscape. Our shared goal is to ensure that affordable renewable and low-carbon hydrogen is globally available by 2030, in line with a net-zero emissions scenario. Additionally, the agenda supports countries and initiatives in navigating this landscape, fostering connections, and maximizing their collective impact.

<https://breakthroughagenda.org>

Hydrogen is increasingly recognized as a critical enabler in the global shift toward sustainable energy systems, particularly for its potential to decarbonize high-emission sectors that have been challenging to address through other means. Sectors such as heavy industry, long-haul transportation, and large-scale energy storage are beginning to leverage hydrogen’s versatility, scalability, and low-carbon potential, positioning it as a cornerstone of the clean energy transition. With the COP29 Hydrogen Declaration anticipated to take center stage, COP29 offers a unique platform to underscore hydrogen’s role in achieving the Paris Agreement targets, advancing innovative partnerships, and setting robust frameworks for future investment and policy development.

The global community’s focus at COP29 on hydrogen highlights both its current contributions and its expansive future potential in meeting ambitious climate goals. This briefing note outlines key considerations and strategic opportunities for your engagement at COP29, ensuring alignment with international hydrogen commitments and enhancing collaboration to accelerate hydrogen’s deployment at scale.

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1. Hydrogen's Strategic Role in Recent COPs (26-28) and Pathway to COP29

In recent COPs, hydrogen has emerged as a strategic pillar within the global decarbonization agenda, building momentum towards the Hydrogen Declaration anticipated at COP29. These milestones highlight hydrogen's growing importance in meeting global decarbonization targets.

COP26 (Glasgow, 2021)

- **Breakthrough on Clean Hydrogen under the Glasgow Breakthrough Agenda**, supported by over 40 countries, establishing a multilateral framework to foster enhanced coordinated international action to make affordable, renewable, and low-carbon hydrogen widely accessible by 2030.

COP27 (Sharm El-Sheikh, 2022)

- Hydrogen was featured during COP27 event agenda, including the Leaders' Summit and a dedicated public-private dialogue on cross border renewable hydrogen projects.

COP28 (Dubai, 2023)

COP28 had a dedicated Presidential Action featuring:

- **Hydrogen Declaration of Intent on the Mutual Recognition of Certification Schemes for Hydrogen and its Derivatives**, endorsed by ~40 countries to advance hydrogen in line with Paris Agreement targets.
- Launch of the **ISO Technical Specification Methodology** for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate (ISO/TS 19870:2023), serving as seed document for a multi-part series of international standards (ISO 19870-x).
- **Public-Private Action Statement by the International Hydrogen Trade Forum (IHTF) and the Hydrogen Council**: Representing a joint commitment between public and private sectors, focused on building hydrogen supply chains and infrastructure.

COP29 Hydrogen Declaration: A New Milestone

The Hydrogen Declaration at COP29 builds upon these previous milestones by formalizing commitments and setting an ambitious trajectory for global hydrogen deployment. This Declaration seeks to establish hydrogen as a cornerstone in achieving the Paris Agreement's decarbonization targets. Key commitment to:

“Work together to scale up renewable, clean/zero-emission and low-carbon hydrogen production and deployment and accelerate decarbonisation of existing hydrogen production from unabated fossil fuels to facilitate energy transitions and achieve near-zero GHG emissions from hydrogen production, targeting particularly end-use sectors that are difficult to decarbonise, taking into consideration national circumstances”.

2. Key messages in Hydrogen from latest reports (2024)

1. Current Status and Long-Term Vision

- **Global Hydrogen Demand:** Hydrogen demand reached 97 Mt in 2023, predominantly in refining and chemical sectors, with less than 1% of global production from renewable and low/zero-carbon sources. Expanding clean hydrogen use in priority sectors is essential for meeting climate targets¹.
- **Emissions Reduction Potential:** The emissions intensity of hydrogen production needs to fall by 40% by 2030 for a 10% reduction in total emissions².
- **COP29 Hydrogen Declaration – Main Call to Action:** The Hydrogen Declaration at COP29 calls on countries and stakeholders to work together to scale up renewable, clean/zero-emission, and low-carbon hydrogen production and deployment. It also stresses the need for accelerating the decarbonization of existing hydrogen production from unabated fossil fuels to achieve near-zero GHG emissions and facilitate energy transitions, focusing on hard-to-decarbonize sectors while considering national circumstances³.

2. Standards and Certification

- **International Collaboration on Certification:** Nearly 40 governments have committed to pursuing mutual recognition of their national certification schemes for hydrogen and its derivatives⁴. This commitment is now being translated into an action plan and first pilot projects (Section 8).

- **Strengthening Regulation for Low-Emissions Hydrogen:** Governments should implement clear regulations consistent with the ISO methodology for GHG emissions assessment, ensuring regulatory alignment and transparency⁵.
- **Sustainability Beyond Emissions:** Growing need to consider broader sustainability factors, such as water management, community acceptance, and job creation, in hydrogen deployment strategies⁶.

3. Demand Creation

- **Accelerate Demand Creation for Low-Emissions Hydrogen:** Governments should bolster policies such as quotas, mandates, and contracts for difference to incentivise long-term offtake. Leveraging industrial hubs and public procurement can pool demand and mitigate offtake risks for producers, promoting early adoption⁷.
- **Role of Hydrogen Derivatives in Trade:** IRENA and the WTO, projects that by 2050, half of all globally traded hydrogen will be in derivative forms like ammonia and methanol, emphasizing the need for standardized trade frameworks⁸.

4. Supply and Infrastructure

- **Support for Hydrogen Infrastructure Development:** Governments should focus on early planning and repurposing existing natural gas pipelines and storage facilities. Public-private partnerships and cross-border cooperation are

¹ IEA Global Hydrogen Review 2024

² Breakthrough Agenda Report 2024

³ COP29 Declarations and Pledges

⁴ Breakthrough Agenda Report 2024

⁵ IEA Global Hydrogen Review 2024

⁶ IRENA, "International Cooperation to Accelerate Green Hydrogen Deployment"

⁷ IEA Global Hydrogen Review 2024

⁸ IRENA, "International Trade and Green Hydrogen: Supporting the Global Transition to a Low-Carbon Economy".

essential for bridging the supply-demand gap⁹.

5. Finance and Investment

- **Investment Growth and:** Seven-fold increase in capital committed to hydrogen projects reaching FID in the past four years. Global clean hydrogen projects reaching FID have grown from 102 in 2020 representing USD 10 billion, to 434 in 2024, representing some USD 75 billion in committed capital¹⁰.
- **Project Pipeline Maturation:** Clear shift from announcements to advanced project stages, coupled with natural attrition. The pipeline of announced projects has grown by a factor of seven since 2020 from 228 projects in 2021 to 1,572 projects in 2024. Between 2020 and 2024, investments made in front end engineering design (FEED) stage projects increased by a factor of 20. Natural attrition drives maturation by phasing out less viable projects and prioritizing those with the highest potential - similar to the early years of wind and solar¹¹.
- **Investment Needed for Climate Goals:** Achieving climate goals requires significant investment jump. To accelerate the global energy system decarbonization, an 8-fold increase of investments in hydrogen is required until 2030, compared to the current investment of USD 75bn past FID. Addressing this challenge calls for a joint effort by government and industry. In the next two years, we need greater regulatory clarity and certainty, support for

demand drivers alongside the development of enabling midstream infrastructure¹².

- **De-Risking Mechanisms for Emerging Markets:** MDBs, DFIs, and technical partners should provide financial and technical assistance to address high capital costs and investment barriers in developing economies¹³.

6. Global Cooperation and Coordinated Action¹⁴

- **Articulating a Comprehensive Standards Plan:** Governments need a clear plan for developing and implementing a comprehensive portfolio of standards for hydrogen and hydrogen-based fuels, supported by financial and human resources. Aligning with globally recognized standards like ISO is crucial for regulatory consistency.
- **Coordinating International Commitments:** Governments and industries should work together to boost the use of low-carbon hydrogen through policies and firm purchase agreements that signal strong demand.
- **Expanding Demonstration Projects:** A significant increase in demonstration projects across key sectors and regions is needed, supported by shared reporting and knowledge-sharing practices.
- **Scaling Financial Support:** Comprehensive financial support, including de-risking mechanisms, is essential for viable projects in developing regions, ensuring policies and investments align effectively.

⁹ IFA Global Hydrogen Review 2024

¹⁰ Hydrogen Council, "Hydrogen Insights Report 2024"

¹¹ Hydrogen Council, "Hydrogen Insights Report 2024"

¹² Hydrogen Council, "Hydrogen Insights Report 2024"

¹³ Breakthrough Agenda Report 2024 IFA Global Hydrogen Review 2024

¹⁴ Breakthrough Agenda Report 2024

3. Hydrogen in current Nationally Determined Contributions (NDCs)

A Critical Moment for Enhanced Ambition

Nationally Determined Contributions (NDCs) are the foundation of the Paris Agreement, where countries outline their specific climate action plans to reduce greenhouse gas emissions and build resilience against climate impacts. Each successive round of NDCs is intended to reflect a ratcheting up of ambition, with all parties required to submit their next round, known as NDC 3.0, by February 2025. According to the recent UNFCCC synthesis report, while many countries have strengthened their commitments, the current global climate pledges still fall short of what's required to meet the Paris Agreement targets of limiting warming to 1.5°C or 2°C. The UNEP Emissions Gap Report 2024 underscores this gap, showing that even with full implementation of current NDCs, global emissions are projected to remain close to 2019 levels by 2030. To stay within a 1.5°C pathway, emissions must decrease by 43% by 2030, or by 27% for the 2°C limit. "In terms of specific technologies that Parties intend to use for achieving their adaptation and mitigation targets, the most frequently identified were related to the energy sector (e.g. enhancing use of renewable energy and green hydrogen, and decarbonizing power systems and boosting their storage capacity)" ¹⁵. These reports stress the need for heightened ambition, especially from major emitters, and emphasize the importance of financial and technological support to help developing nations achieve their conditional targets.

The Role of Clean Hydrogen in NDCs: A Path to Decarbonizing Hard-to-Electrify Sectors

Recognizing the potential of clean hydrogen, many countries are setting ambitious clean hydrogen targets within their NDCs, aiming to scale up production, expand infrastructure, and integrate clean hydrogen across high-energy-demand sectors. The latest NDCs reflect a strong commitment to clean hydrogen as a foundational element of long-term decarbonization strategies and a pathway to achieving net-zero goals. As the February 2025 deadline approaches, ambitious clean hydrogen strategies within NDCs could play a pivotal role in closing the emissions gap and driving the transition to a resilient, low-carbon global economy.

36 of 198 parties to the UNFCCC mention hydrogen in their latest NDC documents

Key Trends in Hydrogen Strategies Across NDC Submissions (*Full list and summary in Annex B.*)

1. Diverse Production Pathways

- **Green Hydrogen:** Many countries, including Australia, Canada, Chile, and Oman, prioritize green hydrogen production from renewable sources such as wind, solar, and hydropower. Mauritania, for example, leverages its solar and wind resources to power green hydrogen projects, aligning with ambitious renewable energy targets.
- **Blue Hydrogen with CCUS:** Some countries incorporate blue hydrogen (derived from fossil fuels with Carbon

¹⁵ [NDC Synthesis report: FCCC/PA/CMA/2024/10](#)

Capture, Utilization, and Storage) to meet emissions targets. For instance, Saudi Arabia and the United Arab Emirates emphasize both blue and green hydrogen, with CCUS essential to producing low-emission blue hydrogen.

- **Pilot Projects and Research:** Nations such as Bolivia and Bhutan are exploring hydrogen through pilot projects, focusing on developing hydrogen technology and assessing its potential in their domestic energy strategies.

2. End-Use Applications in Focus

- **Transportation:** Countries like Chile and Jordan prioritize hydrogen use in hard-to-electrify transport sectors, including heavy transport and maritime applications.
- **Industrial Decarbonization:** Hydrogen plays a key role in industrial applications for several countries, such as Australia (low-emissions steel production) and Oman (hydrogen-based steel). Namibia similarly targets hydrogen for green industrialisation.
- **Power Generation:** Some NDCs, including those of Mexico and Vietnam, highlight hydrogen for power generation, as it supports reducing reliance on coal and other carbon-intensive fuels.

3. Import/Export and Domestic Use Strategies

- **Export Ambitions:** Countries like Australia, Saudi Arabia, Mauritania, and the UAE see hydrogen as an export commodity, particularly green hydrogen, positioning them as potential suppliers for global hydrogen markets.
- **Domestic Applications:** Nations like Bhutan and Dominica focus on hydrogen for domestic use to boost

energy security and support local industries.

4. Regional Variability in Hydrogen Priorities

- **Middle East:** Saudi Arabia and the UAE emphasize hydrogen production for both domestic use and export markets. Saudi Arabia highlights green hydrogen from solar energy and blue hydrogen, integrating CCUS to support its Circular Carbon Economy.
- **Africa:** Countries such as Mauritania and Namibia aim to capitalize on vast renewable resources (solar and wind) for green hydrogen, enhancing energy security and exploring export options.
- **Asia:** Jordan and Vietnam are in the early stages of hydrogen integration, conducting feasibility studies and pilot projects as part of broader sustainable development frameworks.
- **Latin America:** Chile and Bolivia leverage hydrogen to decarbonize sectors like transport and industry. Chile sees hydrogen as essential for achieving carbon neutrality and decarbonizing heavy transport.
- **Europe:** Despite Europe's prominent role in global hydrogen development, individual European NDCs do not uniformly reflect hydrogen ambitions. This absence contrasts with Europe's leadership in hydrogen markets, especially in industrial decarbonization and renewable energy integration.

5. Integration with Broader Plans and Policies

- **Carbon Capture and Storage (CCUS):** CCUS is frequently referenced, especially for blue hydrogen. Countries like Saudi Arabia and Turkey incorporate CCUS with hydrogen production to reduce

emissions while utilizing existing gas infrastructure.

- **Sustainable Transport and Industrial Policies:** Many countries, including the UK and Canada, align hydrogen strategies with sustainable mobility and low-carbon industrial policies to support overall climate objectives.

6. Recent Hydrogen Strategy Updates

- **Updated Hydrogen Strategies:** Countries like Australia and Turkey have updated or released new hydrogen strategies post-NDC submission, showing an evolving commitment to hydrogen. For instance, Australia's strategy aims to scale green hydrogen to reach cost parity with fossil fuels.
- **Feasibility Studies and Roadmaps:** Other countries, such as Jordan and Bhutan, are conducting feasibility studies and pilot projects to analyze hydrogen's role, supporting national energy and climate goals.

7. Alignment with Domestic Climate Policies

- **Integration with National Goals:** Countries like Canada and Mauritania align hydrogen initiatives with national targets on carbon neutrality and renewable energy, embedding hydrogen within their broader climate frameworks.
- **Economic Growth and Resilience:** Hydrogen strategies in countries like Cameroon and Oman support economic diversification and resilience, aiming to reduce dependency on fossil fuels.

8. Countries Highly Active in Hydrogen Yet Underrepresented in NDCs

- **Norway, Japan, Morocco and Brazil:** Although these countries have robust national hydrogen strategies,

including production, infrastructure, and export plans, their NDCs often lack specific hydrogen mentions.

- **Opportunity for EU:** The EU has a substantial role in hydrogen strategy via the European Green Deal, aiming to scale renewable hydrogen production. However, this ambition is not fully represented in individual European NDCs.

9. Outdated Hydrogen Information in NDCs

- **Average Document Lag:** Many NDCs are 2–3 years old and may not capture recent advancements in hydrogen strategies. For instance, Chile and Costa Rica have significantly progressed since initial hydrogen mentions.
- **Fast-Evolving Hydrogen Markets:** Some NDCs do not fully reflect the current status of green and blue hydrogen production, highlighting the rapid development pace in this field.

A Path Forward for NDCs 3.0: Enhancing Hydrogen Ambition, Investability, and Alignment

As countries prepare to submit their next round of NDCs (Nationally Determined Contributions), a new approach—NDCs 3.0—can drive both clarity and high ambition in hydrogen and other climate initiatives, making these contributions actionable and finance-ready. Here's a roadmap for elevating the next generation of NDCs:

1. Reflecting High Ambition Levels and Detailed Pathways

NDCs 3.0 should go beyond pledges by providing clear, actionable pathways to reach high ambition levels. Detailed roadmaps for hydrogen initiatives, including specific targets for production, use, and sectoral integration, can

demonstrate commitment and allow for measurable progress. By explicitly including hydrogen milestones and indicators, NDCs can effectively convey ambition and provide benchmarks for accountability.

2. Incorporating Hydrogen in Technology Needs Assessments (TNAs) Aligned with NDCs

To unlock access to climate finance, it is essential to align hydrogen initiatives in NDCs with Technology Needs Assessments (TNAs). By identifying hydrogen as a critical technology for decarbonization and embedding it into TNAs, countries can access support for technology deployment and capacity-building while aligning hydrogen projects with broader NDC objectives. This alignment allows for a more cohesive and finance-ready approach, connecting NDCs to practical climate finance avenues.

3. Making NDCs Investable During This Critical Year for Climate Finance

With an increasing focus on climate finance, NDCs should be crafted to appeal to investors and financial institutions. This requires making hydrogen initiatives in NDCs detailed and “investable” by defining clear goals, potential impacts, and pathways for private-sector engagement. Countries can also detail necessary regulatory reforms and risk mitigation measures to foster investor confidence and mobilize funding. By presenting hydrogen as a bankable and viable path for emissions reduction, NDCs can attract the financing needed to scale up these projects.

4. Using Transparency Reports to Assess Progress from Biennial Transparency Reports (BTRs)

The Biennial Transparency Reports (BTRs), starting this December, will offer a first look at the progress made on NDC targets, providing an opportunity to assess and recalibrate goals based on actual outcomes. Integrating hydrogen targets within these transparency reports will enable a clearer picture of achievements and challenges, setting the stage for evidence-based updates in NDCs 3.0. These reports will also enhance accountability and signal to stakeholders where additional support or adjustments are required.

5. Linking to Policy and Domestic Coordination for Effective Integration

A successful NDC is not only an international commitment but a domestic policy tool. For hydrogen initiatives to succeed, NDCs must be tightly linked to national policies and involve coordination across ministries, sectors, and stakeholders. This means embedding hydrogen into economic, industrial, and energy policy frameworks and ensuring that national and local stakeholders are aligned. By fostering an integrated approach, countries can create a cohesive framework where NDC targets are actionable and supported by enabling policies.

NDCs 3.0 offer a pivotal opportunity for countries to elevate their climate ambitions with a focus on clarity, investability, and accountability. By embedding hydrogen initiatives within a structured and finance-ready framework, countries can create a robust foundation for scaling up green technology and achieving net-zero goals.

4. COP29 Hydrogen Deliverables

Link to the live tracker: The **Breakthrough Agenda COP29 Deliverables Tracker** can be filtered by sector and provides a live overview of all major hydrogen-related announcements and deliverables aligned with the priority actions. *[Please note that information is subject to updates; refer to the live tracker for the latest developments].*

PRIORITY ACTION 2025	OVERVIEW OF COP29 DELIVERABLE	Coordinated by
<p>H1. Standards and certification: Accelerate delivery of a coordinated portfolio of international standards and certification solutions.</p>	<p>COP29 Recommendations report (Section 8) The recommendations outlined in the report build on the COP28 Declaration of Intent (DoI) on the Mutual Recognition of Certification Schemes for Renewable Energy and Low-Carbon Hydrogen and Derivatives (Dubai, 5 December 2023). The objective of the report is to outline the key takeaways from the work that has been undertaken to date.</p>	IPHE
<p>H2. Demand Creation & Management: Strengthen demand for clean hydrogen through coordinated commitments and policies that accelerate deployment in existing and new priority application sectors.</p>	<p>Call to Action for Maritime Sector Decarbonization: Building on last year’s success—where nearly 30 organizations, including fuel producers, ports, ship operators, and NGOs, came together around hydrogen-based fuels as scalable zero-emission solutions— this Call to Action invites stakeholders to support the maritime sector’s transition to net-zero emissions by 2050. In collaboration with RMI, the UN High-Level Climate Champions, University College London (UCL), and the UN Foundation, this year’s focus is on broadening geographic representation and supporting IMO measures that encourage innovation and competition for zero-emission advancements. For more information or to discuss endorsement, please contact Connor Kerr at connor.kerr@rmi.org or maritimepolicy@rmi.org.</p>	High Level Champions & Rocky Mount Institute (RMI)
	<p>COP29 Call to Action by the global hydrogen industry: Supported by nearly two dozen hydrogen industry associations and initiatives, highlights the need for making a collective commitment to scale demand for clean hydrogen and its derivatives by 2030 underpinned by robust off-take incentives and mandates. This Call to Action showcases private sector support to the COP29 Declaration, highlighting the key areas for public-private collaboration for the next two years which dove-tail with the Hydrogen Breakthrough priority actions. It features an important call for inclusion of hydrogen in the NDCs. Interested parties can reach out to Daria.nochevnik@hydrogencouncil.com</p>	Hydrogen Council
<p>H4. Finance & Investment: Strengthen international assistance for clean hydrogen projects by identifying financing opportunities and de-risking mechanisms; and supporting programs to mobilize catalytic funding in emerging markets and developing economies.</p>	<p>10 GW Lighthouse Initiative Joint Communique: DFIs/IFIs pledge collective support to the 10 GW Lighthouse Initiative, committing to facilitate the development of large-scale projects (ranging from 100 MW to 1 GW electrolyzer capacity) and bringing them to FID within the next six years. This initiative will enable the commissioning of 10 GW of electrolysis capacity in EMDEs by 2030.</p>	Breakthrough Agenda H4 (World Bank)
<p>H5 - Landscape Coordination: Improve coordination among international initiatives to enhance global efforts and foster alignment.</p>	<p>Baku International Priority Actions (Annex A.): As part of the Breakthrough Agenda, supporting countries agreed on a set of ‘Baku’ Priority International Actions for Hydrogen to help coordinate global efforts to make clean technologies and sustainable practices more accessible in order to address climate change. The actions provide a measurable way to help improve collaboration and accelerate progress towards key sustainability targets for 2030 and beyond.</p>	Breakthrough Agenda
	<p>COP29 Hydrogen Declaration: Calling for scaling up renewable, clean/zero-emission, and low-carbon hydrogen production while accelerating the transition from unabated fossil fuel-based hydrogen, aiming for near-zero greenhouse gas emissions—particularly in sectors that are challenging to decarbonize. By endorsing this declaration, stakeholders can collectively build momentum for just energy transitions and seize a unique opportunity to unite global efforts to keep 1.5°C within reach. This declaration aligns closely with the Hydrogen Breakthrough priority actions, creating a platform for coordinated international action. Interested parties can reach out to hydrogen@cop29.az to endorse it.</p>	COP29 Presidency

5. COP29 Hydrogen Events Calendar

[Link to the live tracker:](#) The **Breakthrough Agenda COP29 Events Calendar** offers a streamlined, live tracker to key sector-specific sessions, panels, and initiatives at COP29. Hosted by countries and organizations under the Breakthrough Agenda, these events spotlight the latest in hydrogen innovation, policy, and cross-sector collaboration. Users can filter by sector to focus specifically on hydrogen-related developments, ensuring visibility and access to discussions, *[Note the below is subject to change and updates, check the live tracker for the latest information]*

TIME	EVENT	LOCATION	EVENT DESCRIPTION	ANNOUNCEMENTS	ORGANISERS	FORMAT	SENIORITY
13TH NOVEMBER							
15.00-16.15	Enabling the renewable hydrogen economy & developing new supply chains	IRENA Pavilion (Global Renewables Hub)	Co-hosted by IRENA, COP29 Presidency and Hydrogen Council, this event will explore the development of policy frameworks, strategies, project plans, and investment in the emerging hydrogen and derivative sectors in the Central Asia and South Caucasus region. The event aims to strengthen international cooperation in the field of low carbon hydrogen trade, encouraging integration of renewable, clean/zero emission and low-carbon hydrogen and its derivatives into national climate and energy plans to unlock hydrogen economy in the Central Asia and South Caucasus regions.	TBC	IRENA, Azerbaijan Renewable Energy Agency, Hydrogen Council	OPEN - Keynote and interventions from invited speakers	TBC – senior official and CEO expected
14TH NOVEMBER							
13:00	Launch of Maritime Book & Claim System	Danish Pavilion	Any business that relies on maritime transport must ask itself: How do reduce our supply chain emissions? As the maritime industry transitions from fossil fuels to sustainable fuels, cargo owners are looking for ways proactively contribute to lowering their emissions and accelerating decarbonization. This event aims to spur the uptake of sustainable fuels in the maritime sector with the Maritime Book & Claim platform, which allows cargo owners to access low emission transport and helps shipping companies recover their investments in decarbonization technologies. Join the Rocky Mountain Institute and the Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping as we	Launch of 'Katalist', a book and claim system for the Maritime Sector	RMI and Mærsk Mc-Kinney Møller Center for Zero Carbon Shipping & Rocky Mountain Institute	Presentation and Panel	Open to Public

			launch the Maritime Book & Claim platform and discuss how book & claim can accelerate maritime decarbonization at this high-level event at the Danish Pavilion.				
14:00-15:00	Investing in the Future of Hard-to-abate Sectors with Low-Emission Hydrogen	Side event room 8, Zone E (Blue Badge Access only)	The event will explore the critical role of investing in low-emission hydrogen in transforming the difficult to abate sectors – with focus on transportation, addressing key challenges, innovations, and progress in its application across the value chains. The event highlights progress in low-emission hydrogen technologies, discusses the role of partnerships between governments and the private sector, and showcases efforts in pioneering the cleaner use of hydrogen	Envisaged: - Announcement of the project approval and launch - China Green Hydrogen: from Production to Hard-to-Abate End Uses	UNIDO, IHFCA and IHEC	OPEN	High-level
14:00	Making Green Iron Corridors a Reality	Mauritanian Pavilion	According to the latest IEA 1.5C scenario, over a third of primary steel making will need to be produced through hydrogen reduction in 2050. Globally, steel supply chains are dependent on key regions that supply iron ore. When these iron ore reserves are co-located with optimal renewable energy resources, a higher value green hydrogen-based iron product can be produced. This presents the opportunity to decouple the traditional iron and steelmaking processes, with steelmaking remaining in regions with strong manufacturing and production of green iron taking place in regions with lower cost & low emissions hydrogen. This session will explore the emerging trade dynamics for Green Iron Corridors, bringing together key public and private actors from import and export regions to provide a platform for partnership towards decarbonizing the iron and steel sector		RMI	Presentation and Panel	Open to Public. Ministers and CEO Panel
15:30-18:15	Breakthrough Agenda and ITA High-Level Ministerial	Nasimi Room (UNFCCC space)	The Breakthrough Agenda and the Industrial Transition Accelerator (ITA) are co-hosting a 2hrs 45 mins main stage event celebrating international collaboration and championing the need for a gear shift in our collective efforts to make clean	Major announcements across the Breakthrough Agenda	Breakthrough Agenda, Industrial Transition Accelerator	OPEN - Theatre event	Ministerial / Head of Organisation

			technologies and sustainable practices more affordable, accessible and attractive than their alternatives. Convening Ministers and senior decision makers from key international organisations, the event will showcase the progress being made, the shared high ambitions for the year ahead, and highlight where great efforts are most needed. The event will deep dive on the urgent need for demand-stimulating policies to accelerate the decarbonisation of heavy industry and international transport sectors.				
16:00-18:00	The Future of Green Hydrogen	Green Zone – Conference Room Universe	Join a dynamic panel discussion with industry experts, moderated by PwC, exploring the latest in green hydrogen technology. Topics will include the current state of green hydrogen, economic and market considerations, infrastructure and supply chain challenges, policy and regulatory frameworks, and environmental sustainability. The panel will also address technological innovations, sector-specific applications, investment and financing options, and the future outlook for green hydrogen. Engage in a Q&A session to gain insights into the roadmap ahead for this transformative energy source.		PwC	O	
17:00-18:00	Enablers for global trade in renewable hydrogen and its derivatives	Trade House, WTO pavilion	Launch the WTO-IRENA joint report "Enablers for global trade in renewable hydrogen and derivatives". This will be followed by a discussion on concrete opportunities and challenges.	Launch of IRENA-WTO joint report on enablers for trade in renewable hydrogen derivative commodities	IRENA and World Trade Organisation	OPEN - Keynote and panel discussion	Ministerial
18:30-20:00	Catalyzing Investment and Addressing Shared Challenges to Scale Clean Hydrogen in EMDEs	Hirkan Room, UNFCCC Sp (Blue Badge Access only) ace	The Strategic Dialogue gathers senior representatives to explore strengthening international collaboration to catalyze finance for clean hydrogen. Covering innovative financing models, adapting regulatory frameworks, and enhancing technology transfer, the discussion builds on the COP29 Hydrogen Declaration to set actionable milestones, advancing a just and inclusive global hydrogen economy.	Updates on deliverables under the priority actions	Breakthrough Agenda, IPHE and Hydrogen Council	CLOSED-DOOR roundtable	Senior officials

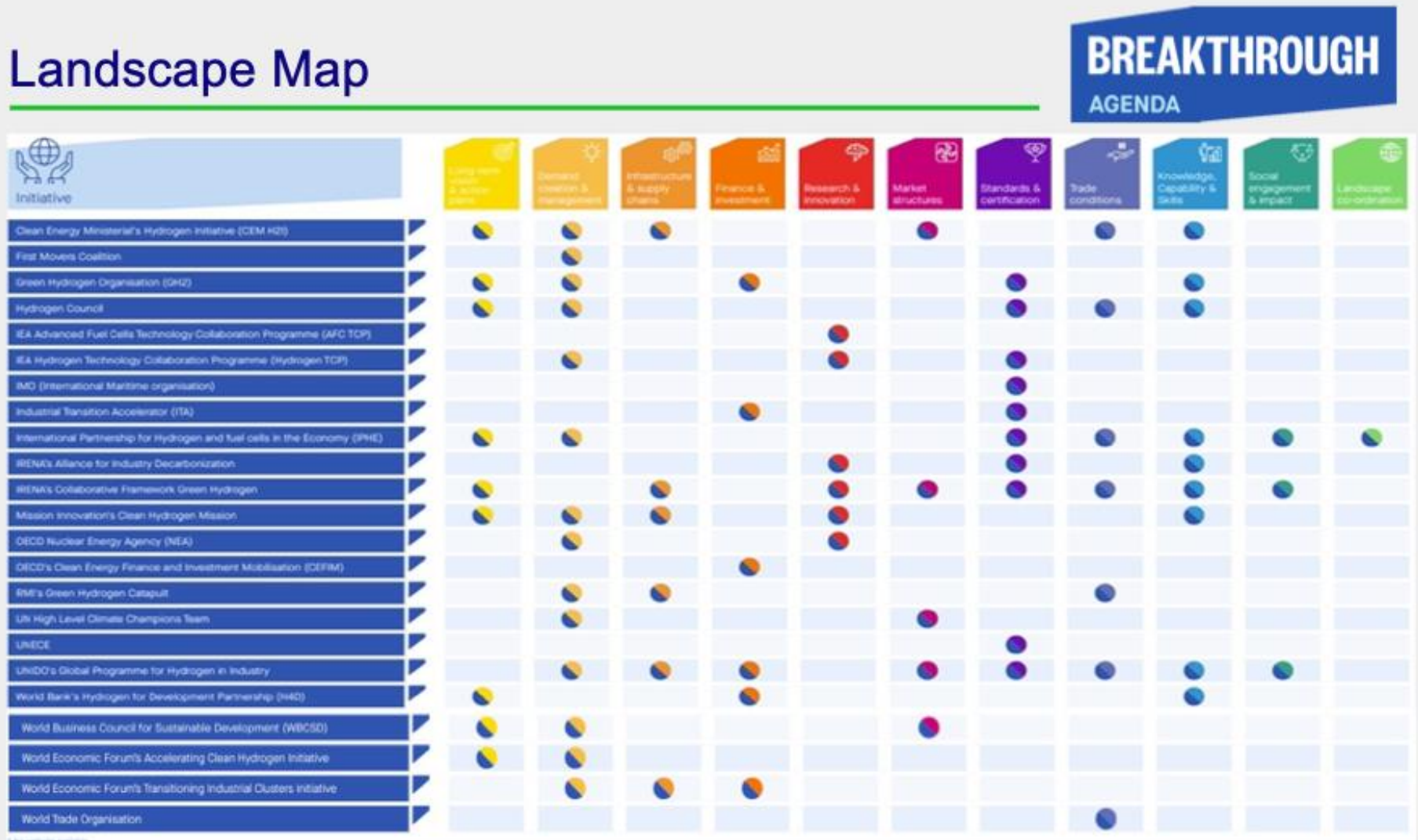
18:30-20:00	Realising the Just Energy Transition through Ambitious and Sustainable Hydrogen Projects	Side event room 8, Zone E (Blue Badge Access only)	In alignment with the COP29 Presidency, UNIDO and its partners recognize the need to bolster climate ambitions whilst enabling governments to implement their commitments, for example through large-scale hydrogen projects. To establish the sustainability of such projects, the side event explores guidelines that help governments transparently prioritize proposals that satisfy national SDG goals by accelerating a just energy transition. The initiative is backed by a broad coalition of UN and non-UN stakeholders and co-organizers: UNCTAD, UNEP, UNECE, IRENA, AfDB, IDOS, as well as consulting governments. In accordance, the side event will outline key considerations and criteria for sustainable hydrogen projects, which are structured along the following categories: - Power (Production, access & efficient use of renewable energy) - People (Labour standards, social responsibility) - Planet (Water use, environmental protection) - Prosperity (Local value creation, financing mechanisms)	Announcement of forthcoming publication by UNIDO, UNCTAD, UNEP, UNECE, IRENA, AfDB, IDOS on Guidelines for Sustainable Hydrogen Projects	UNIDO	OPEN - official UNFCCC side-event Panel session	Director level panelists
15TH NOVEMBER							
10:30-12:30	Ministerial Meeting on COP29 Energy Initiatives	“Mugham” Special Event Room	Official COP29 Ministerial Meeting on COP29 Energy Initiatives	Storage and Grids Pledge, Green Energy Zones and Corridors Pledge, Hydrogen Declaration	COP29, UNIDO, UNECE, UN ESCAP	Closed-door	Parties and observers – Ministerial level
14:15-15:15	Shifting gears: Accelerating clean hydrogen deployment by 2030 to reach the mid-century climate targets	UAE Pavillion, Blue Zone	Provide an update on the implementation of the COP28 Hydrogen Action Agenda: COP28 Declaration of Intent on mutual recognition of certification schemes and global standards for GHG emissions assessment of hydrogen • Take stock of hydrogen deployment globally progress achieved based on the latest data insights and challenges with commercialisation of hydrogen projects • Put the spotlight on industry Call to Action, public-private collaboration and key enablers for scaling hydrogen demand.		UAE MOEI, Hydrogen Council, Masdar	Invite only - Majlis	Senior Officials

18:15-20:30	Hydrogen Connect: Partnering for the hydrogen transition in developing countries (Global Programme for Hydrogen in Industry)	UNIDO Pavilion (A7, Zone E, Blue Badge Access only)	This event is of a serious yet celebratory nature, where, with the help of our long-term partners and collaborators, we look back and reflect on the work that has been achieved by the Global Programme for Hydrogen in Industry thus far in contribution to tackling some of its challenges. Without losing sight of the work that is still required to resolve the many bottlenecks of a global hydrogen industry, we also look forward and anticipate the big new milestones of our work as planned for 2025.	New initiatives and publications under UNIDO's Global Programme for Hydrogen in Industry	UNIDO	OPEN	Long-term partners and collaborators of UNIDO's Global Programme for Hydrogen in Industry
All day	The Hydrogen Transition Summit	Climate Action Innovation Zone , Baku Marriott Hotel Boulevard, Azerbaijan	The mission of the Hydrogen Transition Summit is to facilitate global collaboration alongside COP to accelerate the development of a global hydrogen economy and market. Our aim is to unite key stakeholders to foster demand, enable supply, and establish a supportive regulatory framework. By doing so, we will scale up hydrogen production and significantly contribute to reaching net-zero emissions by 2050.		Climate Action	Link to register	500 key stakeholders, including investors, hydrogen producers, offtakers, tech innovators, project developers, and policymakers, to advance the hydrogen economy at speed on a global scale
16TH NOVEMBER							
09:30-11:00	Eyes on 1.5°: Innovative solutions for financing H2 Infrastructure	UNIDO Pavilion (A7, Zone E, Blue Badge Access only)	To foster the hydrogen market ramp-up, a forward-looking and rapid development of a transport and storage infrastructure is essential to connect production and demand. Both, production and demand side, need clarity regarding infrastructure developments to make informed investment decisions. In a market that is still in its infancy, the development of this infrastructure requires immense investments. There is a need therefore for innovative financing mechanisms, risk-sharing arrangements, and strong policy support. This side event explores the shapes and forms which these innovating mechanisms could look like.		UNIDO, H2Diplo	OPEN - Panel	CEO/Minister level panelists
10.30-11.45	Quality infrastructure as an enabler of sustainable green hydrogen value chains	IRENA Pavilion, Global Renewables Hub	IRENA and Physikalisch-Technische Bundesanstalt (PTB) have collaborated to produce a roadmap for the development of robust quality infrastructure services, to support the development of sustainable hydrogen value chains. This roadmap will be launched at COP29, and this event will provide a platform for discussion on the importance of quality	Launch of IRENA-PTB quality infrastructure roadmap for green hydrogen value chains	IRENA and Physikalisch-Technische Bundesanstalt	OPEN - Keynote and panel discussion	Technical and officials

			infrastructure to supporting investment and driving added value project development in this sector.			
10:45-11:45	Accelerating Innovation in Clean Hydrogen	UNIDO Pavillion	Launch of the A2D 'Clean Hydrogen' Market Assessment	UNIDO/HINICIO	Theatre event (invite only)	Senior Officials and Stakeholders

6. Hydrogen Breakthrough Landscape Map

The Breakthrough Agenda convenes and provides a service to the landscape of key international initiatives in each sector. Below is the Hydrogen ‘landscape map’ intended to showcase the different initiatives that work in each sector to show the breadth and linkages in activity.



7. Text Precedents of Hydrogen in Multilateral Climate and Energy Agreements (2023-2024)

G7 Ministers' Meeting on Climate, Energy, and Environment (Sapporo, Japan, 16 April 2023)

[Paragraph 67:](#) "Low-carbon and renewable hydrogen and its derivatives such as ammonia: We recognize low-carbon and renewable hydrogen and its derivatives such as ammonia should be developed and used where they are impactful as effective emission reduction tools to advance decarbonization across sectors and industries, notably in hard-to-abate sectors in industry and transportation. We also note that some countries are exploring the use of low-carbon and renewable hydrogen and its derivatives in the power sector to work towards zero-emission thermal power generation if this can be aligned with a 1.5°C pathway and our collective goal for a fully or predominantly decarbonized power sector by 2035, while avoiding N₂O as a GHG and NO_x in general as a regional air pollutant and precursor to tropospheric ozone. Some countries also consider to utilize hydrogen for the conversion of electricity surplus from renewable energy. We affirm the importance of taking action to reduce the cost gap between low-carbon and renewable hydrogen and its derivatives and fossil fuels, including RD&D, and enabling infrastructure. We will enhance our efforts to develop the rule-based, transparent global market and supply chains based on reliable international standards and certification schemes while adhering to environmental and social standards, in particular with regard to water use conflict in diverse ways including liquefied hydrogen and liquid organic hydrogen carriers, and promote organic collaboration between supplier and consumer countries to reduce costs. We will build the enabling environment to encourage safety use of hydrogen, promote relevant regulations, safety codes, and standards in order to accelerate deployment and emissions reductions from hydrogen use. We affirm the importance of developing international standards and certification including for a GHG calculation methodology for hydrogen production and mutual recognition mechanism for carbon intensity-based tradability, transparency, trustworthiness and sustainability. We welcome the IEA report 'Towards hydrogen definitions based on their emissions intensity' as a contribution to the discussion towards reliable international standards and certification schemes on expanding low-emission hydrogen and its derivatives and fostering common understanding. We note with appreciation that the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) has advanced progress of the hydrogen standards and certification action. We also stress that countries producing low-carbon and renewable hydrogen for export and domestic use should fully benefit from and advance its development."

G7 Hiroshima Leaders' Communiqué (Hiroshima, Japan, 30 May 2023):

[Paragraph 25:](#) [...] We recognize that low-carbon and renewable **hydrogen and its derivatives** such as ammonia should be developed and used, if this can be aligned with a 1.5 °C pathway, where they are impactful as effective emission reduction tools to advance decarbonization across sectors and industries, notably in hard-to-abate sectors in industry and transportation, while avoiding N₂O as a GHG and NO_x as air pollutant. We also note that some countries are exploring the use of low-carbon and renewable **hydrogen and its derivatives** in the power sector to work towards zero-emission thermal power generation if this can be aligned with a 1.5°C pathway and our collective goal for a fully or predominantly decarbonized power sector by 2035. We will enhance our efforts to develop the rule-based, transparent global market and supply chains for low carbon and renewable **hydrogen** based on reliable international standards and certification schemes adhering to environmental and social standards. We affirm the importance of developing international standards and certification including for a

GHG calculation methodology for **hydrogen** production and mutual recognition mechanism for carbon intensity-based tradability, transparency, trustworthiness and sustainability. [...]

G20 Leaders' Summit (New Delhi, India, 9-10 September 2023)

Paragraph 38 iii: Support the acceleration of production, utilization, as well as the development of transparent and resilient global markets for **hydrogen produced from zero and low-emission technologies and its derivatives** such as ammonia, by developing voluntary and mutually agreed harmonising standards as well as mutually recognised and inter-operable certification schemes. To realise this, we affirm the 'G20 High Level Voluntary Principles on Hydrogen', to build a sustainable and equitable global hydrogen ecosystem that benefits all nations. We take note of the Presidency's initiative to establish the Green Hydrogen Innovation Centre steered by the International Solar Alliance (ISA).

COP28 Global Stocktake (Dubai, UAE, 13 December 2023):

Decision 1/CMA.5 Paragraph 28(e): Accelerating zero- and low-emission technologies, including, inter alia, renewables, nuclear, abatement and removal technologies such as carbon capture and utilization and storage, particularly in hard-to-abate sectors, and low-carbon hydrogen production;

Apulia G7 Leaders' Communiqué (Italy, 14 June 2024)

Page 16-17: We commit to accelerating the transition toward decarbonization in the industrial sectors and particularly in the hard-to-abate sectors. We will promote and facilitate the scale-up of investments in the industrial sector for innovative technologies, smart clean electrification, improved energy efficiency, direct use of renewable heat, sustainable bio energies, sustainable production of energy from waste, sustainable biogases and biofuels, renewable, clean/zero-emission and low-carbon hydrogen and its derivatives such as ammonia and direct use of renewable energy close to demand centers, the use of carbon management technologies. We also commit to accelerate the reduction of emissions from transport. We will continue working on this, including through the G7 Industrial Decarbonization Agenda as well as the Climate Club and its ambitious work program.

Reaffirming our commitments in the 2023 Hiroshima Leaders' Statement, we note that G7 countries have made significant progress in reducing dependency on Russian fossil fuels, including through energy savings and gas demand reduction in a manner consistent with our Paris Commitments and address the global impact of Russia's war on energy supplies, gas prices and inflation, and people's lives, recognizing the primary need to accelerate the clean energy transition. We recognize that restricting Russian energy revenues is an essential part of our support to Ukraine and are pursuing to end significant dependency on, and to work on transitioning away from imports of Russian gas as soon as possible. In this context, we stress the important role that increased deliveries of LNG can play and acknowledge that investment in the sector can be appropriate in response to the current crisis and to address potential gas market shortfalls provoked by the crisis. In the exceptional circumstance of accelerating the phase-out of our dependency on Russian energy, publicly supported investments in the gas sector can be appropriate as a temporary response, subject to clearly defined national circumstances, if implemented in a manner consistent with our climate objectives without creating lock-in effects, for example by ensuring that projects are integrated into national strategies for the development of low-carbon and renewable hydrogen.

8. COP29 Recommendations Report on hydrogen certification to support market development and trade of certified hydrogen and hydrogen derivatives

Context

The recommendations outlined below build on the **COP28 Declaration of Intent (DoI) on the Mutual Recognition of Certification Schemes for Renewable Energy and Low-Carbon Hydrogen and Derivatives**¹⁶ (Dubai, 5 December 2023). The objective of this paper is to outline the key takeaways from the work that has been undertaken to date.

The work on the mutual recognition of certification schemes marks a significant step towards facilitating a global market for renewable and low-carbon hydrogen, in which the participants “declared their intention as follows”:

1. In order to pave the way for development of global market [for] renewable and low-carbon hydrogen and hydrogen derivatives, the Participants seek to work towards mutual recognition of their respective certification schemes;
2. The Participants seek accelerated development of technical solutions to enable mutual recognition of their certification schemes, including through cooperation of the Participants with and under the framework of the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) and the Hydrogen Technology Cooperation Programme (Hydrogen TCP);
3. The Participants seek to, where possible, nominate government experts to IPHE and Hydrogen TCP to facilitate the development of relevant solutions for mutual recognition of their certification schemes for renewable and low-carbon hydrogen and hydrogen derivatives;
4. The Participants may consider further steps to support the process of mutual recognition of certification schemes, including by taking into account adoption or consistency with globally recognised standards, such as the ISO methodology for determining the GHG emissions associated with the production and transport of hydrogen;
5. The Participants intend to monitor progress on cooperation of towards mutual recognition of certification schemes on annual basis.

Noting these shared intentions, the implementation of the COP28 DoI has been coordinated by The International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) and the International Energy Agency Hydrogen Technology Collaboration Programme (IEA H2 TCP), with support from other international organizations [including IRENA, UNECE] within the framework of the Hydrogen Breakthrough Agenda Priority Action H1 on standards and certification. The recommendations are a summary of the work from these organisations aimed to accelerate the delivery of the Declaration of Intent (DoI) on the Mutual Recognition of Certification Schemes for Hydrogen and its Derivatives.

Scope of work

Building on that declaration, experts from IPHE countries, have compared seven (7) existing certification schemes for hydrogen and hydrogen derivatives and fourteen (14) certification schemes

¹⁶ [COP28 Declaration of Intent - Hydrogen](#)

that are at different stages of development – for purposes of regulatory markets (compliance) or voluntary markets (disclosure or reporting). This assessment was carried out in cooperation with the IEA H2 TCP and IRENA, within the Breakthrough Agenda H1 priority focus area, with support of many experts inside and outside the IPHE.

The comparison showed considerable differences between certification schemes. The experts expect many of the differences concerning product attributes, operational set-up and procedures, governance, and the chain of custody model to have adverse impacts on trade of certified hydrogen and hydrogen derivatives between different markets relying on different certification systems.

The Mutual Recognition Framework document developed by the IEA H2 TCP Task 47 on Hydrogen Certification R&D complements this analysis with technical solutions to enable interoperability between certification schemes for hydrogen.

Recommendations

Noting the above, the experts put forward the following recommendations, which were developed based on the premises that they should be (i) politically feasible, and (ii) pragmatic on a technical level:

1. **Pursue incremental Progress Towards Mutual Recognition:** Progress on mutual recognition should be regarded as an incremental process to enable information exchange, transparency, consistency in terminology, and comparability of certification schemes, with the need to achieve a certain degree of commonality in order to have measurable improvements.
2. **Consider a Modular Approach:**
 - a. A modular approach could be pursued to address the differences between requirements in different markets and jurisdictions applied by certification schemes, in view of improving tradability of certified hydrogen and hydrogen derivatives. Such a modular approach could entail a number of common modules, that different jurisdictions or scheme owners agree on and from which they can opt in or opt out, as well as modules that would remain specific to individual jurisdictions or certification schemes.
 - b. A modular approach can be limited with fewer common items or more ambitious where a more comprehensive agreement on the content within the common modules can be reached. A more ambitious approach would bring higher benefits for international market development and trade of certified hydrogen and hydrogen derivatives.
3. **Explore a Digital Hydrogen Passport:** For all levels of ambition, this modular approach could be implemented in the form of a digital hydrogen passport which contains the necessary information to determine whether a quantity of hydrogen certified under one scheme complies with the requirements of another scheme.
4. **Prioritise Greenhouse Gas (GHG) Emission Intensity:** For product attributes, it is suggested to start with greenhouse gas (GHG) emission intensity. A common module could consist of a single agreed-upon methodology for GHG emissions for specific elements along the hydrogen value

chain. The standard series being developed by ISO/TC197/SC1/WG1¹⁷ could serve as a base of such a common module or a number of modules. If jurisdictions and/or scheme owners cannot agree on a common methodology, a less ambitious approach could entail companies along the hydrogen value chain providing all data needed to estimate GHG emissions under all relevant methodologies. The standard series under development by ISO could serve as reference. Once progress has been made on GHG emissions, lessons from that process could be applied to other attributes.

5. **Establish Operational Set-Up and Procedures** For the operational set-up and procedures, jurisdiction or certification scheme owners putting in place the regulatory requirements for the certification schemes could agree on a set of voluntary technical standards that certification bodies, issuing bodies, accreditation bodies, and auditors are required to adhere to under the respective certification rules. Certification schemes that currently do not adhere to such voluntary technical standards for their operational set-up and procedures should be supported to apply relevant provisions by sharing best practices and by providing practical guidance on implementation.
6. **Harmonise Chain of Custody Models:** The choice of the chain of custody model used to track and trace products and certificates generally depends on the purpose of the certification scheme, either regulatory compliance or voluntary reporting. Depending on the purpose, jurisdictions or scheme owners could agree on a single chain of custody model, i.e. either mass balancing or book and claim, with a set of common provisions with the aim to prevent substantial future differences between requirements. Many jurisdictions are still in the process of developing the necessary requirements and where requirements exist, many scheme owners are still in the process of translating those requirements into practice. This current early stage of development provides an opportunity for an agreement.
7. **Align within the Joint implementation Plan (Annex 1):** To advance the delivery of the COP28 Declaration of Intent (DoI) on the Mutual Recognition of Certification Schemes for Renewable Energy and Low-Carbon Hydrogen and Derivatives, countries should consider supporting and committing resources to the joint implementation plan that lays out the key milestones for multilateral cooperation under the DoI until 2030.

¹⁷ [ISO/CD 19870-1.2 - Hydrogen technologies — Methodology for determining the greenhouse gas emissions — Part 1: Emissions associated with the production of hydrogen up to production gate](#)

Annex 1: Proposal of Draft Joint Implementation Plan of the Development of Mutual Recognition of Hydrogen Certification Schemes

Context

At COP28 in Dubai, 39 countries endorsed the Hydrogen Declaration of Intent on Mutual Recognition of Certification Schemes for Renewable and Low-Carbon Hydrogen and its Derivatives, (hereafter the DoI) reaffirming political commitment to pursuing mutual recognition between their respective national certification schemes and implementing this initiative through the existing political and technical fora, in particular, the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) and the International Energy Agency Hydrogen Technology Collaboration Programme (IEA H2 TCP), coordinated with support from other international organizations [including IRENA, UNECE, The International Hydrogen Trade Forum, Hydrogen Council] to support and deliver this initiative within the framework of the Hydrogen Breakthrough Agenda Priority Action H1 on standards and certification.

Objective

The signatory Parties to the DoI have committed to the following practical actions:

1. *In order to pave the way for development of a global market renewable and low-carbon hydrogen and hydrogen derivatives, the Participants seek to work towards mutual recognition of their respective certification schemes;*
2. *The Participants seek accelerated development of technical solutions to enable mutual recognition of their certification schemes, including through cooperation of the Participants with and under the framework of the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) and the Hydrogen Technology Cooperation Programme (Hydrogen TCP);*
3. *The Participants seek to, where possible, nominate government experts to IPHE and Hydrogen TCP to facilitate the development of relevant solutions for mutual recognition of their certification schemes for renewable and low-carbon hydrogen and hydrogen derivatives;*
4. *The Participants may consider further steps to support the process of mutual recognition of certification schemes, including by taking into account the adoption of or consistency with globally recognised standards, such as the ISO methodology for determining the GHG emissions associated with the production and transport of hydrogen;*
5. *The Participants intend to monitor progress on cooperation towards mutual recognition of certification schemes on an annual basis.*

High-Level Overview and Key Milestones for DoI implementation

Phase 1 [2023] Establishing political commitment and momentum
Milestone: At COP28, 39 countries endorse the Hydrogen Declaration of Intent on Mutual Recognition of Certification Schemes for Renewable and Low-Carbon Hydrogen and its Derivatives, to pursue mutual recognition of certification schemes for renewable and low-carbon hydrogen and its derivatives.
Phase 2 [2024]: Operationalisation of the DoI
Key objective: Establish delivery plan and initial technical frameworks
Key activities – technical track: <ul style="list-style-type: none">• Establishment of the DoI Implementation Taskforce (DoI ITF): Led by IPHE and IEA H2 TCP, the DoI ITF will lay out an implementation plan with underlying political and technical milestones and be responsible for annual COP updates/ progress reports.
2024 progress report and COP engagements to feature:

- **State of play** – update of the certification 101 paper to ensure speaking the same language and review of certifications schemes by IPHE to present recommendations when establishing certification systems.
- **Develop technical principals for mutual recognition framework** - IEA H2 TCP to present the technical mutual recognition framework (MRF) document prepared in consultation with IPHE and international experts.
- Progress update on ISO standards' development for GHG emissions assessment of hydrogen on a life-cycle analysis basis. COP28 featured the launch of the Technical Specification " Hydrogen technologies - Methodology for determining the greenhouse gas emissions associated with the production, conditioning and transport of hydrogen to consumption gate" (ISO/TS 19870:2023) developed by ISO Technical Committee 197 subcommittee 1 (ISO/TC 197/SC 1) Hydrogen at scale and horizontal energy systems. This Technical Specification serves as seed document for a multi-part series of international standards (ISO 19870-x) covering the hydrogen supply chain from production to consumption gate on a life-cycle analysis basis. COP29 will mark the finalisation of the international standard for the Methodology for hydrogen production pathways (ISO 19870-1).

COP29 Milestones:

DoI Implementation plan and progress report

Phase 3 [2025]:

Key activities:

Political track:

- New country signatories to the COP28 DoI
- Definition of the purpose and the scope of a digital hydrogen passport to facilitate the DoI implementation
- **Nomination** process for pilot mutual recognition projects among volunteering countries in collaboration with the International Hydrogen Trade Forum (IHTF)
- **Roundtable discussion led by IPHE** – towards mutual recognition of attributes and methodologies, paving the way for advancing mutual recognition to MRF.

Technical track:

- **Pilot project ToR** development

COP30 Milestones:

- **Country MoUs launch for Mutual Recognition Pilots** – at least four countries initiate bilateral or multilateral pilot projects.
- **Launch of ISO 19870-2-3-4** completing the ISO 19870-1-2-3-4 suite of standards.

Phase 4 [2026]:

Key activities:

Technical track:

- Progress report on the pilot projects launched at COP30.
- Launch of pilot mutual recognition projects including digital hydrogen passports

Political track: IPHE-led roundtable to discuss policy solutions for advancing towards mutual recognition of methodologies and attributes used in certification schemes.

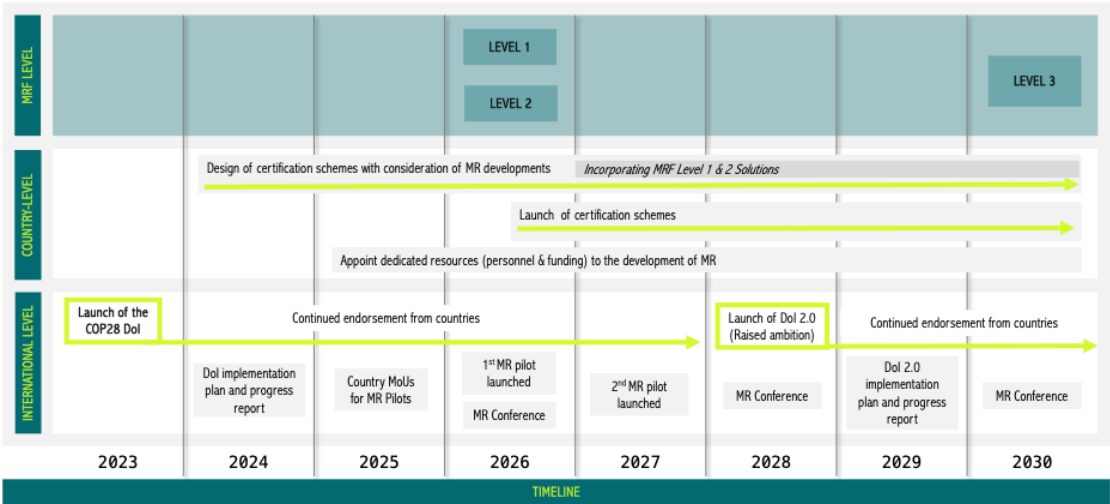
COP31 Milestones:

Launch of 1st round of pilot round of mutual recognition pilot projects – at least four countries initiate bilateral or multilateral pilot projects.

Phase 5 [2027]:

<p>Key activities: Technical track: stock take report on the pilot projects launched at COP30 & COP31.</p>
<p>COP32 Milestones: MRF conference - a dedicated conference to present and analyze the results from the pilot projects. The conference will gather stakeholders, including government officials, industry leaders, and technical experts, to discuss findings, identify challenges, and propose refinements to the scheme.</p>
<p>Phase 6 [2028]:</p>
<p>Key activities:</p>
<p>COP33 Milestones:</p> <ul style="list-style-type: none"> • Annual Review and Updates: Presentation of the first comprehensive review of the scheme's implementation, with updates to standards and guidelines based on technological advancements and market needs.
<p>Phase 7 [2029]:</p>
<p>COP34 Milestones:</p> <ul style="list-style-type: none"> • Ongoing Improvements: Continuous updates and improvements to the mutual recognition framework, regular annual reviews, and further international cooperation to ensure the scheme's relevance and effectiveness in the evolving global hydrogen market. • Annual Review and Updates: Presentation of the first comprehensive review of the scheme's implementation, with updates to standards and guidelines based on technological advancements and market needs.
<p>Phase 8 [2030 and beyond]:</p>
<p>COP35 Milestones:</p> <ul style="list-style-type: none"> - Official Launch of the Mutual Recognition Framework/ Mechanism: Full operationalization of the scheme across participating countries, ensuring readiness for international trade of certified hydrogen.

DoI DELIVERY AND TIMELINE



A. Hydrogen breakthrough: priority international actions for 2025

1. This document outlines the Priority International Actions for 2025 under the Hydrogen Breakthrough, in response to the recommendations in the [Breakthrough Agenda Report 2024](#) from the International Energy Agency (IEA) and the UN High Level Climate Champions (UN HLCs). These Priority Actions have been developed collaboratively by countries participating in the Hydrogen Breakthrough and leading initiatives. They seek to build on the range of important wider work underway and planned across the international landscape, including outcomes of the 28th and 29th UN Climate Change Conferences (COP28 and COP29), to build on the processes to develop, communicate and implement new nationally determined contributions, and to take forward the outcomes of the first Global Stocktake under the Paris Agreement. These aims will be pursued by strengthening international collaboration in specific areas where in doing so we can accelerate progress towards our shared Hydrogen Breakthrough Goal to make:

“Affordable renewable and low-carbon hydrogen¹⁸ globally available by 2030.”

2. Noting that each country will have its own national pathway to decarbonise key sectors and approach to competing for future clean technology market opportunities, and with full recognition of the many excellent wider international activities and partnerships already underway, we intend to prioritise our international efforts to advance specific Priority International Actions and projects as listed below.
3. Progress on these actions in 2025 will be tracked through the next Breakthrough Agenda Report from the IEA and UN HLCs, discussed through the Hydrogen Breakthrough dialogues co-led by the United Kingdom, the United States of America and India, and supported by the Hydrogen Breakthrough Facilitator hosted by the International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE), in collaboration with the Clean Energy Ministerial, Mission Innovation and World Business Council for Sustainable Development, and reported on at COP30, alongside an updated set of Priority International Actions for Hydrogen for 2026.
4. In order to implement the Breakthrough Agenda launched by 45 World Leaders at COP26, and now backed by [59 governments, set out below are the Priority International Actions being taken forward by individual countries and governments as appropriate to their national

¹⁸ The term *clean hydrogen* is used throughout the rest of this document, replacing the previously used *renewable and low-carbon hydrogen*. This reflects new terminology to be adopted in future Breakthrough Agenda annual reports, and it is based on the same understanding and definition as *renewable and low-carbon hydrogen* (as used in the 2024 Breakthrough Agenda Report), which encompasses *renewable and low-carbon hydrogen* and other similar terms, such as *clean and low-emissions hydrogen*, *low-emissions hydrogen*, and *zero-emissions hydrogen*, based on clean technologies countries choose to deploy.

priorities, noting the ambition to strengthen the international offer of assistance to Emerging Markets and Developing Economies (EMDEs) in all Priority Actions.

Breakthrough Agenda Report Recommendation on H1 - Standards and certification			
<p>Governments working together through the international initiatives involved in the Hydrogen Breakthrough need to urgently present a well-articulated plan that defines resource needs for the development and implementation of a comprehensive portfolio of national and international standards for hydrogen and hydrogen-based fuels. Governments and businesses should provide financial and human resources in line with that plan to ensure the development of that portfolio. Governments should facilitate regulatory interoperability by committing to adopt, or ensuring consistency with, globally recognised international standards, such as the ones developed by the ISO methodology, in their regulations, which is an important step to support the process of mutual recognition of certification schemes. Governments should anticipate building technical capacity of their national systems to verify compliance with international hydrogen standards.</p>			
<p>Summary: <i>Accelerate delivery of a coordinated portfolio of international standards and certification solutions.</i></p> <p>Full text: Accelerate and resource the implementation of a coordinated and time-bound programme of work to support the development of a comprehensive portfolio of international standards for clean hydrogen and its derivatives, reflecting the best available science and the enabling framework for mutual recognition of certification schemes. The multi-year programme will submit an annual progress report at subsequent UN Climate Change Conferences (COP summits).</p>	<p>How this will be taken forward By identifying resources for coordinating and partnering initiatives to implement an inclusive, multi-stakeholder, multi-year, global programme to support the development of international standards, certification solutions, and related initiatives, including:</p> <p><i>Mobilising & Coordinating Resources:</i></p> <ul style="list-style-type: none"> ● Developing a time-bounded plan, with clear milestones, to support the development and implementation of a comprehensive portfolio of international standards for hydrogen and hydrogen-based fuels and mutual recognition of certification schemes. ● Clearly define resource needs ● Identify resources to support coordination and partnership efforts, ensuring initiatives have the necessary financial and logistical support. <p><i>Progressing International Standards:</i></p>	<p>Coordinating initiative(s) <i>Coordinated by:</i></p> <p>International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE)</p> <p><i>Partners:</i></p> <ul style="list-style-type: none"> - Hydrogen Council - International Energy Agency (IEA)'s Hydrogen TCP 	<p>Collaborating governments <i>(to be confirmed)</i></p> <p>Australia Cambodia Canada European Commission Finland France Germany Guinea Bissau Ireland Italy Japan Netherlands Norway</p>

	<ul style="list-style-type: none"> ● Coordinate the work of multiple international stakeholders to support the timely development of global standards for life cycle GHG emissions assessment to promote consistency and transparency, reflecting the best available science. ● Support the development of and advocate for rigorous safety protocols and guidelines. ● Promote standardised operational procedures to enhance efficiency and reliability across various sectors ● Support technical capacities needed in EMDEs to verify compliance with international standards. <p><i>Developing Mutual Recognition Framework:</i></p> <ul style="list-style-type: none"> ● Coordinate and expand activities that support progress towards mutual recognition of certification schemes by engaging in political and technical collaboration and the implementation of work plan for the COP28 Declaration of Intent, including through pilot projects. <p><i>Coordinating Pre-Normative Research:</i></p> <ul style="list-style-type: none"> ● Collaborate with initiatives involved in Priority Action H3 to identify and address pre-normative research needs. This will ensure that foundational research supports the development and harmonisation of international standards and certification processes. 	<ul style="list-style-type: none"> - International Renewable Energy Agency (IRENA)'s Collaborative Framework on Green Hydrogen - International Hydrogen Trade Forum (IHTF) - United Nations Economic Commission for Europe (UNECE) - United Nations Industrial Development Organization (UNIDO) 	<p>Panama Spain Sweden United Arab Emirates United Kingdom United States</p>
<p>Breakthrough Agenda Report Recommendation on H2 – Demand Creation & Management: Governments and companies should co-ordinate internationally to increase commitments for the use of low-carbon and renewable hydrogen and hydrogen-based fuels, particularly in sectors where hydrogen is already used, supported by the implementation of specific policies and the signing of solid purchase agreements, to collectively send a strong demand signal and mobilise investment in production. In new priority application sectors, countries should share learnings to accelerate early deployment. This should be done in a manner that ensures a level playing-field in international trade.</p>			

<p>Summary: Strengthen demand for clean hydrogen through coordinated commitments and policies that accelerate deployment in existing and new priority application sectors.</p> <p>Full text: Strengthen demand by facilitating the delivery of existing and new firm and sustained demand-side measures and public and private commitments to offtake clean hydrogen and its derivatives at scale. Focus on displacing unabated fossil fuel-derived hydrogen deployment in existing and new priority application sectors through supportive policies, global targets and purchase agreements, considering the need for just transitions. Leverage existing platforms to continually share learnings and best practices to accelerate early deployment. Sectoral targets and aggregated commitments to be announced by COP30 and updated at subsequent UN Climate Change Conferences.</p>	<p>How this will be taken forward By joining and working through existing initiatives in this field to collaborate and encourage coalitions of leading countries and companies, with the aim of:</p> <p>Driving commitments to Clean Hydrogen by COP30, with a focus on stimulating demand in both existing and new priority application sectors, such as shipping, steel, fertilizer, and aviation, including by:</p> <ul style="list-style-type: none"> • Supporting the development of aspirational sector-specific demand targets • Encouraging increased and firm commitments, from public and private sector actors to clean hydrogen use in end-use applications. • Aggregating and communicating these commitments within global fora. <p>Addressing enabling conditions, through shared learning and exemplar projects that: Support the development of effective policies and sectoral roadmaps to accelerate demand creation:</p> <ul style="list-style-type: none"> • Mitigate financial and non-financial risks and utilize relevant instruments and initiatives, developed under priority actions: H1 on Standards & Certification; H3 on Research & Innovation; H4 on Finance & Investment 	<p>Coordinating initiative(s) <i>Coordinated by:</i></p> <p>Clean Energy Ministerial Hydrogen Initiative & Rocky Mountain Institute (RMI)</p> <p><i>Partners:</i></p> <ul style="list-style-type: none"> - Green Hydrogen Organisation - H2 Global - Hydrogen Council - IEA's Hydrogen Technology Collaboration Programme - International Partnership for Hydrogen and Fuel Cells in the Economy - Mission Innovation 	<p>Collaborating governments <i>(to be confirmed)</i></p> <p>Australia Cambodia Canada European Commission Finland Germany Guinea Bissau Ireland Italy Japan Kenya Netherlands Norway Panama Spain Sweden United Arab Emirates United Kingdom United States</p>
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		<ul style="list-style-type: none"> Clean Hydrogen Mission - United Nations Climate Change High-Level Champions - United Nations Industrial Development Organization - World Bank – Hydrogen for Development Partnership - World Business Council for Sustainable Development - World Economic Forum’s Accelerating Clean Hydrogen Initiative & 	
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		First Movers Coalition	
<p>Breakthrough Agenda Report Recommendation on H3 -Research & Innovation: <i>Governments and companies should work together to dramatically increase the number and geographical distribution of demonstration projects for hydrogen use and to ensure that these appropriately cover each of hydrogen’s high-value end-use sectors, including maritime shipping, heavy industry and long-duration energy storage. Governments and the private sector should agree on minimum reporting principles to guide a deeper and more rapid sharing of knowledge among these demonstration projects and with the broader stakeholder community, including a commitment to share the lessons learnt from all publicly funded demonstration projects.</i></p>			
<p>Summary: Increase global clean hydrogen research and demonstration projects across diverse sectors and regions, with mechanisms to share learnings rapidly.</p> <p>Full text: Support the drive for a significant increase in the number and geographical distribution of new, innovative clean hydrogen research and demonstration projects spanning a wide variety of technologies for clean hydrogen production and infrastructure and end -use across a diverse array of hydrogen’s high-value sectors, backed by mechanisms to broaden and more rapidly share learnings from projects. Increase pre-normative research activities to support accelerated delivery of international standards. Progress to be reported on by COP30.</p>	<p>How this will be taken forward By joining and/or increasing support for and engagement with international R&I programmes, including:</p> <p><i>Delivering a wider portfolio of new, innovative clean hydrogen research and demonstration projects</i></p> <ul style="list-style-type: none"> • Support advancing the 100 Hydrogen Valleys under Mission Innovation Clean Hydrogen Mission • Support IEA’s Hydrogen and Fuel Cells TCPs • Strengthened or develop platforms for information sharing. <p><i>Driving forward research priorities</i></p> <ul style="list-style-type: none"> • Collaborate with initiatives involved in Priority Action H1 to take forward identified pre-normative research needs. 	<p>Coordinating initiative(s) <i>Coordinated by:</i> Mission Innovation Clean Hydrogen Mission <i>Partners:</i></p> <ul style="list-style-type: none"> - IEA’s Hydrogen and Fuel Cells TCPs - International Partnership for Hydrogen and Fuel Cells in the Economy (IPHE) - International Renewable 	<p>Collaborating governments <i>(to be confirmed)</i></p> <p>Australia Cambodia Canada European Commission Finland Germany Guinea Bissau Ireland Italy Japan Kenya Netherlands Norway Panama Spain Sweden</p>

		Energy Agency (IRENA)	United Arab Emirates United Kingdom United States
<p>Breakthrough Agenda Report Recommendation on H4 - Finance & Investment: Governments, MDBs, DFIs and relevant technical partners should work to deliver and scale up support by financing instruments and de-risking mechanisms, particularly for viable projects that are being delayed by high costs of capital and other obstacles to investment. This should include appropriate and coordinated technical and financial assistance, particularly in developing countries, to assist governments with policy design.</p>			
<p>Summary: Strengthen international assistance for clean hydrogen projects by identifying financing opportunities and de-risking mechanisms; and supporting programs to mobilize catalytic funding in emerging markets and developing economies.</p> <p>Full text: Enhance the overall public offer of international assistance for clean hydrogen projects, by coordinating and facilitating better access to financing instruments and expanded de-risking mechanisms and support programmes that address obstacles to investment, with the goal of mobilising catalytic funding at scale in emerging markets and developing economies. Targeted</p>	<p>How this will be taken forward By collaborating with relevant institutions and drawing on the insights gained in 2023 from World Bank, OECD, and UNIDO’s reviews of barriers to investment (—in particular, risks that increase the cost of capital of projects) and UNIDO’s mapping of current international assistance, to strengthen support for clean hydrogen projects), in EMDEs with the aims of:</p> <p><i>Supporting the development of a consolidated and enhanced package of international assistance for clean hydrogen production & use by COP30</i></p> <ul style="list-style-type: none"> This could include: analysing the volume of finance required to be mobilised this decade and underpinning metrics for regional distribution to emerging markets and developing economies; and seeking to secure a broad commitment to strengthening a coordinated package of international assistance through to 2030. <p><i>Supporting the development of a matchmaking platform</i></p>	<p>Coordinating initiative(s) <i>Coordinated by:</i></p> <ul style="list-style-type: none"> the United Nations Industrial Development Organisation (UNIDO) World Bank <p><i>Partners:</i></p> <ul style="list-style-type: none"> Donor countries Hydrogen for Development (H4D) Organisation for Economic 	<p>Collaborating governments <i>(to be confirmed)</i></p> <p>Australia Azerbaijan Cambodia Canada European Commission Finland Germany Guinea Bissau Ireland Netherlands Panama Spain Sweden</p>

<p>support in emerging markets and developing economies (EMDEs) through the 10 GW lighthouse initiative and a coordinated matchmaking platform that facilitates access to support mechanisms is to be delivered on a pilot basis by COP30.</p>	<ul style="list-style-type: none"> This would seek to coordinate, mobilize, and facilitate access to finance and related support, helping to connect EMDEs with bespoke support mechanisms. <p><i>Identifying and supporting viable projects through the 10 GW lighthouse initiative.</i></p> <ul style="list-style-type: none"> This would seek to: identify a priority portfolio of the most viable ‘lighthouse’ projects that have a prospect to reach final investment decision in coming years; identify the country and project specific barriers for deployment; develop methods of best practices to strengthen project governance, improve business models and deploy effective economic, de-risking and financing instruments; and support targeted and tailored assistance to overcome those obstacles. 	<p>Co-operation and Development (OECD)</p>	<p>United Arab Emirates United Kingdom United States</p>
<p>H5 - Landscape Coordination</p>			
<p>Summary: Improve coordination among international initiatives to enhance global efforts and foster alignment.</p> <p>Full text: Support and facilitate the global landscape of initiatives and countries under the Hydrogen Breakthrough, facilitating information sharing and coordinate activities. Utilize the Breakthrough Agenda annual cycle to embed a process for regularly reviewing</p>	<p>How this will be taken forward Countries and initiatives will seek to further strengthen forums and institutions that support international co-operation in clean hydrogen, with sufficient participation, deeper analysis and communication of the potential gains from co-ordinated international action, supported by a dedicated Hydrogen Breakthrough Facilitator role, hosted by IPHE to jointly support the Breakthrough Agenda Annual Cycle, which includes:</p> <p><i>Coordinating the Breakthrough Agenda Annual Cycle</i></p> <ul style="list-style-type: none"> Embed in the international landscape a light-touch process for regularly reviewing and updating a 	<p>Coordinating initiative(s) <i>Coordinated by:</i> Breakthrough Agenda Secretariat, Hydrogen Breakthrough co-leads IPHE <i>Partners:</i> All leading international</p>	<p>Collaborating governments <i>(to be confirmed)</i> Australia Azerbaijan Cambodia Canada European Commission Finland Germany</p>

<p>and updating a detailed map of international hydrogen initiatives and their workstreams, fostering a shared understanding of roles and plans, identifying gaps and overlaps, and brokering support for delivery. Focus of delivering guidance and alignment with the multilateral political energy and climate landscape.</p>	<p>detailed map of the landscape of international initiatives and their hydrogen workstreams.</p> <ul style="list-style-type: none"> Facilitate a shared understanding of respective roles and plans, identify gaps and overlaps, develop options, and support delivery. <p><i>Guiding Priority Actions</i></p> <ul style="list-style-type: none"> Use the Breakthroughs Agenda report to capture priority actions and facilitate alignment with international goals and strategies for hydrogen development. Prepare and develop supporting plans, resources and deliverables (where requested and relevant by initiatives and countries) to support the delivery of priority actions. <p><i>Facilitating Information Sharing</i></p> <ul style="list-style-type: none"> Work with initiatives and countries under the Hydrogen Breakthrough to facilitate the sharing of information, delivery of key priority actions and light-touch coordination of activities where useful. Coordinate an international annual calendar of events Develop a single web-based portal as a transparent and accessible entry point for all global initiatives working in hydrogen 	<p>hydrogen initiatives</p>	<p>Guinea Bissau Ireland Japan Netherlands Norway Panama Spain Sweden United Arab Emirates United Kingdom United States</p>
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Growing priorities for collaborative action

Over the past 12 months, several emerging areas of interest have been identified by interested countries and organizations for potential further collaboration and coordinated action. Through collective feedback, the following key areas have been identified for potential future focus in the Breakthrough Agenda framework, subject to prioritization and resource availability. These include:

1. **Skills and Capacity Building:** Enhancing the skills and capacities of stakeholders across the ecosystem is essential to drive innovation and effective implementation of clean hydrogen, including through identifying and addressing skill gaps, fostering knowledge exchange, and building the capacity of individuals and organizations.
2. **International Trade:** Accelerating international trade is crucial for setting up cross-border hydrogen and derivatives corridors and establishing a global market for clean hydrogen. Efforts could reflect the ongoing work of the International Hydrogen Trade Forum, that is bringing exporting and importing countries together and is facilitating the private-public dialogue.
3. **Social Acceptance and Community Engagement:** Achieving widespread adoption of hydrogen technologies requires the support and active participation of communities, including through ensuring that the benefits of hydrogen innovations are widely understood and shared.

B. Overview of Hydrogen in current [NDC submissions](#):

Party	Summary
Antigua and Barbuda, Revised First NDC Version 2 02/09/2021	<p>In Antigua and Barbuda’s Nationally Determined Contribution (NDC), the strategy for energy transformation includes the eventual integration of “hydrogen” into the country’s energy mix. Specifically, it envisions a transition to a “nationally sourced energy sector based on hybrid systems of wind, solar, batteries, LNG, LPG and eventually hydrogen.” This approach is intended to build resilience and foster economic growth within the energy sector. The NDC emphasizes reducing fossil fuel imports by 86% by 2030 through local renewable energy generation, positioning hydrogen as part of a diverse set of energy sources aimed at achieving this reduction. The document underscores that hydrogen, along with other renewable and hybrid sources, is part of a "long-term process" that aims to make the national energy sector resilient and sustainable.</p>
Australia, Revised First NDC Version 4 16/06/2022	<p>Australia’s updated Nationally Determined Contribution (NDC) includes investment in “green hydrogen, energy storage, and low emissions steel and aluminium” as part of its efforts to accelerate low-emissions and clean energy technologies. This aims to reduce the costs of these alternatives and make them competitive with higher-emission technologies.</p>
Azerbaijan, Revised First NDC Version 2 10/10/2023	<p>In Azerbaijan’s NDC, hydrogen is included through a “Framework Agreement” signed with Fortescue Future Industries, focusing on joint cooperation for the “study and development of renewable energy projects and the potential of ‘green hydrogen’ in Azerbaijan.” This agreement covers the study and implementation of projects for producing renewable energy and “green hydrogen,” with an outlined capacity target of up to 12 GW.</p>
Bhutan, Second NDC Version 2 24/06/2021	<p>In Bhutan's NDC submission, hydrogen is addressed under the "Green Hydrogen Roadmap." The roadmap aligns with the Sustainable Hydropower Policy 2021, exploring hydrogen produced from green renewable electricity. The Royal Government of Bhutan has initiated studies to examine hydrogen fuel production, green ammonia, and other hydrogen derivatives. The roadmap also includes plans for feasibility studies, development of the Green Hydrogen Roadmap itself, and pilot projects focused on energy storage and alternatives to fossil fuels.</p>
Bolivia, Second NDC Version 2 15/04/2022	<p>In Bolivia’s NDC submission, hydrogen is included under the initiative to implement energy storage systems. By 2030, Bolivia aims to establish “3 pilot projects for technologies for energy storage and management,” which includes “battery banks, pumping stations, and green hydrogen production” as complementary measures to increase the participation of renewable energy sources in the electrical system and support a long-term energy transition.</p>
Cameroon, Revised First NDC Version 2 11/10/2021	<p>In Cameroon’s NDC, hydrogen is mentioned as part of a strategy to attract investment for clean energy development, to “keep its commitments made within the framework of its NDC.” The document states that Cameroon aims to attract investors for “structuring projects relating to hydroelectricity, gas and other clean energies such as hydrogen and ammonia.” This approach is aligned with the goal of expanding its energy mix while enhancing climate commitments.</p>

<p>Canada, Revised First NDC Version 3 12/07/2021</p>	<p>In Canada’s Enhanced Nationally Determined Contribution (NDC), hydrogen is included as a key element of the nation’s clean fuel and emissions reduction strategy.</p> <p>Federal Initiatives:</p> <ul style="list-style-type: none"> • The NDC emphasizes the role of the Clean Fuels Fund, which includes implementing the “Hydrogen Strategy for Canada” as part of Canada’s broader effort to support low-carbon fuels. • The federal government is promoting investments in hydrogen production through measures like an accelerated capital cost allowance for clean energy equipment. This specifically includes equipment used for hydrogen production, storage, and dispensing, supporting the development and scalability of clean hydrogen technology. <p>Provincial Strategies:</p> <ul style="list-style-type: none"> • Manitoba: Developing a “Hydrogen Strategy” aimed at reducing dependency on fossil fuels and lowering greenhouse gas emissions. • Ontario: Released a “low-carbon hydrogen discussion paper” to inform a strategy focused on job creation and meeting greenhouse gas reduction targets. • Quebec: The “2030 Plan for a Green Economy” includes the diversification of renewable energy sources, specifically noting “bioenergy and green hydrogen” as part of the province’s decarbonization goals.
<p>Chile, Revised First NDC Version 2 09/04/2020</p>	<p>The Chile NDC document emphasizes the role of hydrogen, specifically mentioning the use of "hydrogen produced from renewable energy sources" as critical in achieving carbon neutrality. It highlights that hydrogen, particularly for "cargo transportation," will play a "crucial role" in reaching emissions neutrality, though it acknowledges that the technology is still developing and may become commercially competitive around 2030. Additionally, within the context of decarbonizing the electric matrix by 2040, the document identifies hydrogen as part of a broader strategy, where it is aligned with "electro-mobility" initiatives, targeting "heavy vehicles and machine units" to reduce emissions further.</p>
<p>China, Revised First NDC Version 2 28/10/2021</p>	<p>The Nationally Determined Contribution (NDC) document includes hydrogen-related measures as part of the strategy to "accelerate the development of hydrogen energy infrastructure." It highlights efforts to "promote the construction of hydrogen refueling stations," along with advancements in "new energy and clean energy vehicles," particularly to "support the adoption of fuel cell vehicles." Additionally, China emphasizes a commitment to international technological and industrial cooperation for tackling climate change. The NDC highlights the need for a global low-carbon transition to enhance climate resilience and achieve carbon neutrality, with support for developing "low-cost, safe, and controllable" modern technologies that deliver strong economic, mitigation, and adaptation benefits. China seeks technological breakthroughs across renewable energy, hydrogen energy, smart grids, energy storage, CCUS, circular economy, low-carbon transportation, and smart cities. It calls for global multilateral cooperation to establish international platforms, centers, and networks dedicated to R&D and</p>

	technology transfer, fostering joint research on breakthrough technologies to expedite their application and drive a sustainable, low-carbon global economy.
Costa Rica, Revised First NDC Version 3 29/12/2020	The Nationally Determined Contribution (NDC) document of Costa Rica highlights hydrogen measures under its "Energía" thematic area, specifically mentioning that by 2022, Costa Rica aims to have developed a "strategy for the development and promotion of green hydrogen in the country"
Democratic People's Republic of Korea, Revised First NDC Version 2 19/09/2019	The Republic of Korea's NDC submission includes an elevated 2030 target for the deployment of "zero-emission vehicles such as the ones powered by electricity and hydrogen." This is part of a broader strategy to reduce emissions in the transportation sector, with additional efforts to improve public transportation services, reduce car trips, and focus on distributing "eco-friendly ships" and enhancing the operational efficiency of aircraft in the shipping and aviation sectors.
Dominica, Revised First NDC Version 2 04/07/2022	In the NDC document for Dominica, hydrogen is included as a key component of their low-carbon transition strategy. Dominica aims to develop "green hydrogen production" as part of the Green Industrial Eco Park (GIEP) initiative. A Memorandum of Understanding (MOU) between the Climate Resilience Execution Agency for Dominica (CREAD) and Kenesjay Green Ltd. (KGL) has been signed to "facilitate collaborative development" in this area. This partnership will focus on generating "cost-competitive green hydrogen" and pursuing commercial applications through geothermal reservoirs, exploring "breakthrough clean technology" for both "upstream and downstream applications" of hydrogen. Additionally, in the transport sector, the NDC outlines the potential for "hydrogen vessels" as part of their low-carbon transition, with a particular focus on assessing the "entire hydrogen value chain," which includes "hydrogen production based on electrolysis using RE, hydrogen logistics, hydrogen filling stations, and hydrogen vehicles."
Egypt, Revised First NDC Version 3 26/06/2023	Egypt's NDC submission outlines a commitment to advancing green hydrogen and sustainable industrial practices. It includes a \$140 million investment in "green hydrogen" for "green ammonia" production, supporting low-carbon nitrogen fertilizer production. Additionally, Egypt plans sector-specific improvements such as mechanizing the charcoal industry and requiring compliance action plans, alongside a ban on charcoal exports since 2016. A key focus is also on developing "eco-industrial parks" to boost resource efficiency, foster green industries like recycling and renewable energy, and enhance the economic, environmental, and social performance of businesses. These initiatives reflect Egypt's drive toward a sustainable and low-carbon industrial future.
Fiji, First NDC Version 2 31/12/2020	The Fiji NDC submission includes "hydrogen fuel cells" as a long-term focus within its energy transition strategy. Specifically, it sets forth plans to "continue research and development" into energy solutions involving "hydrocarbon resources and hydrogen fuel cells." This falls under Fiji's goal of reducing its reliance on imported fossil fuels and enhancing its renewable energy portfolio, aiming for renewable energy to constitute approximately 99% of electricity generation by 2030.

<p>India, First NDC Version 1 26/08/2022</p>	<p>India's NDC highlights hydrogen as a critical component of its low-carbon strategy, emphasizing its potential to reduce greenhouse gas emissions and enhance energy security. The document includes plans for the advancement of "hydrogen fuel cells" for both transportation and stationary applications and focuses on developing "composite cylinders for on-board hydrogen storage" to ensure safe and efficient use in vehicles. Additionally, India prioritizes "research and development" in hydrogen technologies to address existing challenges and facilitate broader adoption, underscoring hydrogen's role in India's transition to a sustainable energy future.</p>
<p>Jordan, Revised First NDC Version 2 12/10/2021</p>	<p>The NDC document for Jordan outlines the significant potential of "hydrogen production" in supporting both decarbonization and economic growth. It emphasizes Jordan's renewable energy capacity as a key factor enabling the country to participate in the emerging global hydrogen market, particularly for sectors that are hard to electrify, such as "maritime transport, aviation, and heavy land transport." The document notes that hydrogen, with properties similar to natural gas, could effectively substitute for carbon-intensive fuels in these areas. Jordan views hydrogen as a pathway to "new economic opportunities," potentially allowing the country to reduce its dependence on imported fuels while opening a new export market for hydrogen and its derivatives, particularly "ammonia" for the fertilizer industry. Investment attraction is highlighted as critical, with a focus on infrastructure and production facilities to support hydrogen development. The document also stresses the need to meet "sustainability criteria" for hydrogen production, especially in terms of ecological impacts, water demand, and energy use for desalination and electrolysis. To support these goals, Jordan's public and private sectors are actively conducting analyses to quantify the country's hydrogen potential for investment and exports.</p>
<p>Kazakhstan, Revised First NDC Version 2 27/06/2023</p>	<p>The Kazakhstan NDC document mentions "green hydrogen" as an important component of the country's transition to renewable energy sources. This aligns with Kazakhstan's broader commitment to increasing the share of renewables and implementing "alternative sources of energy," including green hydrogen, as part of structural reforms aimed at reducing carbon emissions and enhancing energy independence. The document includes the promotion of green hydrogen as part of the shift towards a low-carbon economy and acknowledges its potential role in industrial and energy sectors, contributing to the country's goal of achieving carbon neutrality by 2060.</p>
<p>Lao People's Democratic Republic, First NDC Version 2 11/05/2021</p>	<p>Lao PDR's Nationally Determined Contribution (NDC) mentions the Ministry of Natural Resources and Environment is responsible for undertaking research on the use of water resources and will collaborate with the Ministry of Energy and Mines on studies concerning production of hydrogen fuels.</p>
<p>Mauritania, Revised First NDC Version 2 12/10/2021</p>	<p>Mauritania's updated NDC outlines ambitious plans for integrating green hydrogen into its renewable energy strategy, aiming to leverage its substantial solar and wind resources. In partnership with GWP Global, Mauritania's "Aman" program will develop up to 30 GW of renewable energy capacity in the country's north, specifically to power electrolyzers for green hydrogen production. By 2030, the country aims to achieve a 50.34% renewable energy share in its energy mix, with a target of 93% renewable energy, made possible by green hydrogen and the Desert to Power initiative, leading to significant carbon emission reductions. To support these goals, Mauritania is investing in infrastructure expansions, such as extending the Nouakchott wind power plant and implementing</p>

	national grid interconnections, while also modernizing its regulatory frameworks, including an updated electricity code. A report under the PADG Project is also being prepared to assess Mauritania's potential for both blue and green hydrogen production, which will inform a national low-carbon hydrogen roadmap with applications across various sectors. Collectively, these efforts mark Mauritania's commitment to a low-carbon future, positioning it as a key player in renewable energy and green hydrogen in Africa.
Mexico, Revised First NDC Version 3 17/11/2022	The updated NDC submission of Mexico includes significant references to "green hydrogen" as part of its renewable energy strategy. Mexico emphasizes partnerships to expand clean energy infrastructure, aiming to achieve ambitious goals in the use of renewable sources. Specifically, green hydrogen is targeted as a key area for innovation and technological advancement, aligning with Mexico's long-term strategy for emissions reduction and renewable energy deployment. This approach is bolstered by recent collaborations and policy support for renewable energy projects, which focus on using green hydrogen for electricity generation and storage, thus reducing the country's carbon footprint.
Monaco, Revised First NDC Version 2 28/12/2020	Monaco's NDC outlines efforts to reduce maritime emissions by banning heavy fuel oil in its waters, installing shore power systems for docked ships, and exploring hydrogen as a potential clean fuel alternative for maritime use.
Namibia, Revised First NDC Version 3 17/01/2024	In Namibia's updated NDC, "green hydrogen" is addressed as part of its energy sector mitigation strategy. The plan includes replacing fossil fuels with green hydrogen, particularly in road transportation. This involves converting a substantial number of light and heavy vehicles from internal combustion engines to those powered by green hydrogen or battery electric vehicles. This measure aligns with Namibia's broader objectives to reduce emissions and increase renewable energy use. Furthermore, the NDC outlines the need for international support for early-stage projects related to green hydrogen development, reinforcing the goal of transitioning to low-carbon technologies.
Oman, Second NDC Version 3 29/11/2023	Oman's updated NDC submission outlines an ambitious vision for hydrogen development as part of its decarbonization strategy. Oman targets substantial production capacities for "renewable hydrogen," with specific goals of achieving 1 million tons by 2030, 3.75 million tons by 2040, and 8.5 million tons by 2050. The "Oman Hydrogen Center" has been established to drive these efforts. Additionally, Oman has secured five agreements for green hydrogen projects across various industries, including Sohar Aluminum and Asyad maritime. The country emphasizes "green hydrogen" in advancing "hydrogen-based steel production" and aims to replace traditional gas with green hydrogen in specific sectors. The NDC also highlights the integration of green hydrogen into its power sector to address rising energy demands, aligning with a targeted 3% reduction in emissions by 2030.
Paraguay, Revised First NDC Version 2 16/07/2021	In Paraguay's updated NDC, "green hydrogen" is included as part of the country's energy and transport sector strategies. The document explores green hydrogen as a potential solution to replace conventional fuels, particularly for vehicles, aiming to reduce fossil fuel dependency by using clean, renewable energy alternatives.

<p>Qatar, Revised First NDC Version 2 24/08/2021</p>	<p>In Qatar's NDC, hydrogen is highlighted within a broader commitment to sustainable technology and renewable energy. The document mentions "hydrogen fuel" as part of Qatar's interest in diversifying its energy mix and improving energy efficiency, aligning with its climate action goals. Additionally, it underscores Qatar's commitment to collaborating on advanced technology, including hydrogen, to help meet the Paris Agreement's targets.</p>
<p>Saudi Arabia, Revised First NDC Version 2 23/10/2021</p>	<p>In Saudi Arabia's updated NDC, "green hydrogen" is highlighted as a key technology within the renewable energy sector. The NDC mentions that Saudi Arabia, leveraging its abundant solar and wind resources, is positioned to lead in global "green hydrogen" production. This includes the NEOM project, a significant initiative expected to produce large-scale green hydrogen using over four gigawatts of renewable energy from solar and wind. Additionally, "blue hydrogen" is noted as part of Saudi Arabia's hydrogen strategy, utilizing carbon capture, utilization, and storage (CCUS) technologies to produce hydrogen with lower associated carbon emissions. The Kingdom is developing a "National Hydrogen Strategy" to support its vision of becoming a leader in hydrogen production and to advance hydrogen technologies across multiple sectors.</p>
<p>South Africa, Revised First NDC Version 2 27/09/2021</p>	<p>In South Africa's NDC document, hydrogen is referenced as part of the country's broader strategy to reduce greenhouse gas emissions. The document includes plans for the potential adoption of "hydrogen fuel cells" as an alternative energy source, particularly in the transportation sector, aiming to replace conventional fuels and decrease the carbon footprint. The NDC emphasizes the role of "green hydrogen" produced from renewable energy as a significant contributor to the decarbonization of hard-to-abate sectors like heavy industry and transport, helping the country meet its climate targets.</p>
<p>Sri Lanka, First NDC Version 3 24/09/2021</p>	<p>In Sri Lanka's NDC submission for the transport sector, hydrogen is mentioned as part of the strategy to "improve fuel quality" by <i>reducing the carbon intensity of fuels</i> through substituting petroleum-based products with low-GHG alternatives, including "natural gas, bio-methane, biofuels, electricity or hydrogen produced from low GHG sources." This approach aligns with the goal of enhancing energy efficiency and fuel economy within the sector, aiming to curb GHG emissions by transitioning to cleaner fuel options and advancing vehicle technologies.</p>
<p>Thailand, Revised First NDC Version 3 02/11/2022</p>	<p>Thailand's NDC submission includes "hydrogen" as part of research, development, and deployment efforts in advanced technologies. Specifically, hydrogen is mentioned in the context of exploring advanced mitigation technologies such as "carbon capture and storage (CCS), carbon capture, utilization and storage (CCUS), Bio-energy with CCS, direct air capture (DAC), and hydrogen." This focus is part of Thailand's commitment to advancing innovative, low-emission energy solutions to support its greenhouse gas reduction goals.</p>
<p>Tunisia, Revised First NDC Version 2 10/10/2021</p>	<p>In Tunisia's updated NDC submission, hydrogen is highlighted as part of the renewable energy and sustainable mobility strategy. Specifically, "green hydrogen" is noted for its potential in renewable energy development, alongside wind and photovoltaic power. Additionally, hydrogen is included in research and partnership efforts focused on advancing sustainable mobility solutions, supporting Tunisia's goals of reducing greenhouse gas emissions and fostering a low-carbon economy.</p>

<p>Turkey, Revised First NDC 13/04/2023</p>	<p>Türkiye's updated NDC includes a focus on hydrogen within its renewable energy and decarbonization strategies. The submission details the publication of a "Hydrogen Technologies Strategy and Its Roadmap" to advance hydrogen technologies, emphasizing its role as a low-carbon alternative fuel and a key element in reducing greenhouse gas emissions. Additionally, Türkiye aims to achieve a battery capacity of 2.1 GW and an electrolyzer capacity of 1.9 GW by 2030, supporting renewable hydrogen production. These measures align with Türkiye's broader commitment to diversify energy sources, enhance energy security, and contribute to its net-zero goal by 2053.</p>
<p>United Arab Emirates, Third NDC 06/11/2024</p>	<p>The UAE's NDC submission details an extensive commitment to hydrogen as part of its climate strategy, emphasizing low-carbon hydrogen production and application across multiple sectors. Key components include:</p> <ol style="list-style-type: none"> 1. Production Capacity: The UAE aims to become a leader in low-carbon hydrogen and ammonia production. ADNOC is constructing a large-scale facility with a goal of producing up to 1 million tons per annum (mtpa) of low-carbon hydrogen and ammonia, using the UAE's existing gas resources and carbon capture and storage (CCUS) infrastructure. 2. Global Partnerships and Export Potential: The UAE is developing hydrogen as a key export product, leveraging international partnerships to establish the nation as a significant player in the global hydrogen market. This aligns with the UAE's vision of supporting global decarbonization and its ambition to be a leader in low-carbon technology deployment. 3. Regulatory Framework for Hydrogen in Transport: Since 2021, the UAE has a regulatory framework in place to manage "hydrogen and fuel cell vehicles" to support the safe integration of hydrogen-powered transport options. This infrastructure is crucial for promoting hydrogen as a clean fuel alternative in the UAE's sustainable transport transition. 4. Industry Decarbonization: The industrial sector is targeted for decarbonization through the application of hydrogen in hard-to-abate sectors, such as steel and cement, which benefit from low-carbon fuel options like hydrogen and ammonia to meet emissions reduction goals. <p>Through these initiatives, the UAE integrates hydrogen into its energy and climate action framework, focusing on both domestic decarbonization and international leadership in hydrogen technology. This approach supports its Net Zero by 2050 strategy and aims to strengthen its climate commitments in alignment with global emissions reduction targets.</p>
<p>United Kingdom, Revised First NDC Version 3 22/09/2022</p>	<p>The UK's NDC submission references hydrogen as a critical element within several key initiatives supporting decarbonization and green industrial growth:</p> <ol style="list-style-type: none"> 1. Sectoral Breakthroughs: The UK supports the "Glasgow Breakthroughs Agenda," which includes hydrogen among priority areas for global collaboration to accelerate clean energy technologies and industrial transformation.

	<p>2. Hydrogen Strategy and Roadmaps: The UK's "Hydrogen Strategy" outlines the role of hydrogen in achieving net-zero emissions, with sector-specific "investor roadmaps" for automotive, hydrogen, and carbon capture, usage, and storage (CCUS) to guide private investment towards low-carbon technologies.</p> <p>3. Funding and Trials: The £240 million "Net Zero Hydrogen Fund" is dedicated to supporting the growth of the hydrogen industry. This includes a "Hydrogen Village trial," which will involve using 100% hydrogen in approximately 2,000 buildings for at least a year, providing a pilot for large-scale hydrogen deployment in heating.</p> <p>These efforts collectively position hydrogen as integral to the UK's strategy for transitioning to a net-zero economy by 2050, with specific applications across energy production, transportation, and heating in line with national and international climate goals.</p>
<p>United States, Revised First NDC Version 2 22/04/2021</p>	<p>The United States' NDC submission includes hydrogen within its plans to decarbonize multiple sectors. Hydrogen is noted as a "carbon-free" energy carrier in the energy sector, which will support the shift towards "carbon pollution-free electricity" and aid in industrial decarbonization. The NDC outlines the intention to incentivize the use of "new sources of hydrogen" produced from renewable energy, nuclear energy, or waste to power industrial facilities, reflecting a commitment to scaling up low-carbon hydrogen as part of achieving net-zero emissions by 2050.</p>
<p>Uruguay, Second NDC Version 2 30/12/2022</p>	<p>In Uruguay's NDC submission, hydrogen is mentioned in several contexts, reflecting its role in decarbonization strategies. By 2030, Uruguay aims to introduce 600 hydrogen fuel cell vehicles into its transportation fleet. Additionally, regulatory frameworks, capabilities, and incentives will be developed to support the implementation of the "Green Hydrogen Roadmap." This roadmap aims to enhance Uruguay's commitment to alternative low-emission fuels, positioning hydrogen as a key element in the shift towards cleaner energy sources in transport and industry.</p>
<p>Vietnam, Revised First NDC Version 3 08/11/2022</p>	<p>Vietnam's NDC includes hydrogen as part of its strategy to transition away from coal power. The document highlights the development of "green hydrogen and ammonia fuels" for various applications, including "power generation, industries, and transportation." Additionally, it outlines plans to apply "mixed fuel combustion technologies," specifically mentioning the combination of "biomass or ammonia and coal" as well as "hydrogen and natural gas." Furthermore, Vietnam intends to implement carbon capture, utilization, and storage (CCUS) technologies to manage emissions from "coal power plants and heavy industry facilities." This approach demonstrates Vietnam's commitment to integrating low-emission technologies within its energy sector.</p>