Joint-Agreement on the Responsible Deployment of Renewables-Based Hydrogen

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Dubai; December 5th, 2023; Today, representatives from across the world have come together to sign a *Joint-Agreement on the Responsible Deployment of Renewables-Based Hydrogen*.[1][2] This agreement aims to ensure that the implementation of renewables-based hydrogen technologies is conducted in a manner which sufficiently prioritises the intentional and judicious scaling of deployment, outlines required principles and standards for the production, application, and trade of hydrogen; and sets forth a framework for understanding the potential impacts (both negative and positive) on local communities, the natural environment and the climate, as well as the inclusive and equitable energy transition in the context of a global 1.5C pathway.[3][4][5]

The Flagship Partners and Endorsing Organisations – representing regional hydrogen alliances from across the world, hydrogen organisations & corporations, national labs, industry stakeholders, academia, government institutions, public agencies, environmental organisations, and civil society – hereby join forces to address the urgent issue of climate change and codify the world's mutual understanding of renewables-based hydrogen as a potential solution in a truly net zero future (if and only if it is deployed responsibly). We unequivocally agree to the understanding that the only scalable, truly near-zero emissions hydrogen is produced from water using renewable energy (including solar, wind, geothermal and hydro power – i.e., renewables-based). In recent years, renewables-based hydrogen has emerged as a means of decarbonising select hard-to-abate / hard-to-electrify sectors around the world. These include what The Breakthrough Agenda Report 2023 has defined as "Priority Sectors", including some specific products/processes in chemicals and steel (fertiliser, methanol, chemical feedstock, direct reduced iron), maritime shipping (as a renewables-based hydrogen power-to-x derivative), aviation (as a renewables-based hydrogen power-to-x derivative), seasonal electricity storage when renewable supply to the grid is >100%, and some very limited segments of heavy-duty trucking / off-road mobility.[6][7] However, notably, renewables-based hydrogen presents a range of opportunities and challenges which must be proactively and holistically accounted for in order to avoid any pitfalls on the journey to a net zero economy. In comparison to other solutions, renewables-based hydrogen can often be both inefficient and more costly. Additionally, it has the potential to add a range of complexities to the energy transition – delaying our progress towards delivering on a 1.5C pathway.

Recognising the urgency of the climate crisis, specifically the ever-increasing potential risks and real-world impacts on vital ecosystems and weather patterns around the world, we are committed to taking immediate action to ensure a pathway of 1.5 degrees Celsius warming is achieved in a truly responsible manner as it relates to the hydrogen sector and its impactful but limited role in a net zero future. As such, we acknowledge the need for a broad range of principles and standards guiding the deployment of renewables-based hydrogen around the world. These principles and standards, outlined below, will support global actors in ensuring the growth of the hydrogen economy is both climate positive and puts people + the planet at the forefront of hydrogen-related development.

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By endorsing this document, representatives from across the world demonstrate their collective willingness to both promote and collaborate on the implementation of a set of principles and standards related to responsible production, transportation, and end use of renewables-based hydrogen technologies – as well as to collectively address the challenges and opportunities associated with the growth of hydrogen ecosystems around the world. We recognise that, while all Flagship Partners and Endorsing Organisations hereinafter codify their support of the principles and standards contained in this document, only some actors will be able to play an active role in the implementation of specific principles and standards in the years to come.

These principles and standards are built upon existing international conventions, treaties and frameworks – including but not limited to: The Ten Principles of the United Nations Global Compact, the United Nations Sustainable Development Goals, the Universal Declaration of Human Rights, the International Labour Organization's Declaration on Fundamental Principles and Rights at Work & Convention 169, the Rio Declaration on Environment and Development, the United Nations Framework Convention on Climate Change and the United Nations Convention Against Corruption.

The implementation and monitoring processes of these principles and standards, as well as specific timelines, will be outlined in a support document, known as the Guiding Document for the Implementation of the *Joint-Agreement*.

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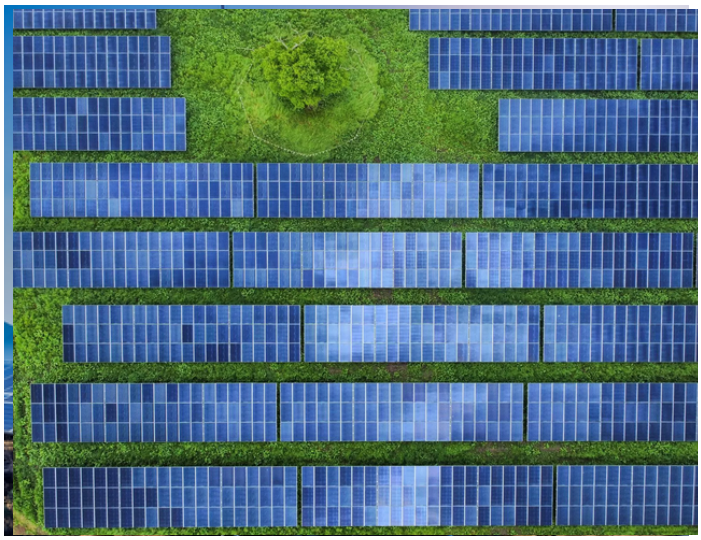
1. The term 'renewables-based hydrogen' refers to hydrogen which is produced from water using renewable energy (this includes solar, wind, geothermal, & hydro power). The term does not refer to or include what is known as "white" hydrogen removed from subsurface deposits. The term does not include or exclude what is known as "dark green" hydrogen but reserves the right to make a distinction on the value of this technology and its role in responsible deployment.
2. We recognise and are pleased to expand on the initial work done by the UN Climate Change High-Level Champions for COP25 and COP26: known as the *Guiding Principles for Climate-Aligned Hydrogen Deployment*.
3. The term 'intentional scaling' refers to the establishment of a hydrogen market which - while greater than the current hydrogen market size - is developed with the intent to serve only those end use applications which are considered unavoidable, that it is primarily produced locally to avoid transportation-related emissions and costs, and it is part of a broader system of solutions which will maximise value to communities, the natural environment, and the climate.
4. The term 'responsible' will hereinafter refer to the language referenced here - wherein responsible deployment indicates the implementation of of renewables-based hydrogen technologies is conducted in a manner which sufficiently prioritises the intentional and judicious scaling of deployment, outlines required principles and standards for the production, application, and trade of hydrogen; and gives guidance on potential impacts (both negative and positive) to local communities, the natural environment and the climate, as well as the inclusive and equitable energy transition in the context of a global 1.5C pathway.
5. We recognise that, while not completely exhaustive, it is necessary to address specific environmental, ecological, and social concerns, including but not limited to: avoiding harm to sensitive habitats, delivering a net-positive impact on biodiversity, prioritising sustainable water management, implementing regenerative practices, ensuring climate change resilience, fostering community benefits, engaging communities transparently, promoting local job creation, prioritising social inclusivity, adhering to responsible sourcing, and upholding labour rights and safety throughout the project lifecycle.
6. IEA/IRENA/UN Climate Change High-Level Champions, The Breakthrough Agenda Report 2023, https://mc-cd8320d4-36a1-40ac-83cc-3389-cdnendpoint.azureedge.net/-/media/Files/IRENA/Agency/Publication/2023/Sep/IRENA_IEA_UNCCHLC_Breakthrough_agenda_report_2023.pdfrev=ad8e40e358e6407fa0a6dc17198016c1
7. We recognise this list is both non-exhaustive and the reality that these end use applications are variable to change as 'responsible' deployment of climate-aligned renewables-based hydrogen is concerned.

Thematic Grouping #1

Continuously defining and integrating a holistic, dynamic approach to technology readiness levels – as well as stringent methodologies and thresholds for emissions intensities – into investment & project decision-making criteria



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For the responsible deployment of renewables-based hydrogen to be accomplished, comprehensive and iterative collaboration involving robust measures for evaluating all-encompassing technology readiness levels and emissions intensities will be necessary to ensure positive and sustainable outcomes are delivered through the deployment of hydrogen technology and hydrogen-related infrastructure.

1. We agree on the urgent need to phase out all fossil fuel-based hydrogen in alignment with a global 1.5C pathway.

2. We agree to work collaboratively to support solutions that ensure the responsible production, deployment, and use of renewables-based hydrogen (and its relevant derivatives), with a focus on minimising environmental impact. Our collective efforts aim to advance technologies and practices that contribute to the reduction of greenhouse gas emissions, promote sustainability across the entire hydrogen value chain, and prioritise the conservation of ecosystems. By doing so, we aspire to achieve outcomes that are truly beneficial for the climate and the natural environment.[8]

3. We agree to integrate holistic, dynamic Technology Readiness Levels (TRLs)[9][10] into feasibility and viability criteria throughout the project lifecycle; which include analysing environmental and social impacts in accordance with international policies.[11] We acknowledge that certain international policy may not be established or there may exist some variability of international policy frameworks for a specific topic area.[12] Therefore, we commit to addressing this issue by establishing clear and consistent criteria for technology readiness.

4. We commit to full life cycle accounting for all relevant climate warming-related emissions from renewable-based hydrogen and its relevant derivatives, including all relevant timescales and scope 1, 2, and 3 emissions across all stages of the project lifecycle. This includes the independent monitoring and certification that the hydrogen in question is in fact produced from renewable energy sources via a certification of origin (CO) scheme or comparable tool for ensuring transparency and reliability in developing countries where a CO scheme may not be feasible, and that the hydrogen production is not driving an increase in fossil fuel generation on the electric grid where it is located; while also achieving near-zero emissions from leakage and venting from well-to-X supply chain processes (well-to-wake, well-to-wheel, etc.). We recognise the difficulty and climate imperative of safely and effectively managing production and transmission / distribution systems to appropriately safeguard against hydrogen leakage which can undermine hydrogen's climate benefits.[13] Additionally, we encourage the consideration of embodied or embedded emissions when accurately reporting the net impact on emissions of hydrogen deployment. Finally, we agree to work collaboratively to establish regional and international harmonisation of certification schemes in alignment with the above emissions accounting methodology.

5. We recognise the need to achieve verifiable emission intensities that trend towards near-zero by 2030.

8. The term 'relevant derivatives' refers to a broad spectrum of products and applications stemming from renewables-based hydrogen. This includes, among others, direct applications like ammonia and methanol, as well as integration into processes such as chemical feedstock and direct reduced iron production. The term acknowledges the diverse range of downstream product and end use applications within the hydrogen value chain, representing the varied contributions of renewables-based hydrogen in a net zero economy.
9. Technology Readiness Levels (TRLs) are a type of measurement system used to assess the maturity level of a particular technology. Each technology project is evaluated against the parameters for each technology level and is then assigned a TRL rating based on the project's progress. There are nine technology readiness levels. TRL 1 (lowest) to TRL 9 (highest).
10. A 'holistic, dynamic approach to technology readiness levels' implies an ongoing assessment and reassessment of the relevant technologies across the renewables-based hydrogen value chain. This does not explicitly include or exclude the assessment of any one specific technology.
11. While non-exhaustive – we recognise the following international policies in this agreement: The Ten Principles of the United Nations Global Compact, the United Nations Sustainable Development Goals, the Universal Declaration of Human Rights, the International Labour Organization's Declaration on Fundamental Principles and Rights at Work & Convention 169, the Rio Declaration on Environment and Development, the United Nations Framework Convention on Climate Change and the United Nations Convention Against Corruption.
12. When considering various international policies, we recognise that in some instances there may not be an established, internationally-recognised policy or there may be a lack of consensus from region-to-region; therefore, we recognise the importance for global and sectoral collaboration to streamline the required frameworks for decarbonising hard-to-abate, hard-to-electrify sectors which are inherently integrated.
13. According to the latest science (Sand, M., Skeie, R.B., Sandstad, M. et al. A multi-model assessment of the Global Warming Potential of Hydrogen, https://doi.org/10.1038/s43247-023-00857-8 & Warwick, N. J., Archibald, A. T., Griffiths, P. T., Keeble, J., O'Connor, F. M., Pyle, J. A., and Shine, K. P.: Atmospheric Composition and Climate Impacts of a Future Hydrogen Economy, https://doi.org/10.5194/acp-23-13451-2023, 2023.), hydrogen has ~12 times the climate warming power of CO2 by mass over 100 years after release (GWP 100); additionally, it is even more powerful in the first 20 years (37x that of CO2 (GWP 20).

Thematic Grouping #2

Tailoring the application and end use of renewables-based hydrogen technologies to specific regional/sectoral sensitivities

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Successful deployment of hydrogen technologies will require a bespoke approach – to responsibly supersede other available solutions – each region and sector will require contextualized strategies best suited to an efficient, effective transition in pursuit of 2030/2050 net zero targets.

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6 We agree to assess key geotemporal regional and sectoral supply and demand sensitivities which will – when considered in concert with environmental, social, and economic risks – maximise the achievement of the Sustainable Development Goals (specifically SDGs 6, 13, 14, and 15 which are considered fundamental to mitigating the impacts of climate change as well as SDGs 7, 9 & 12 which renewables-based hydrogen will have a direct impact on).[14]

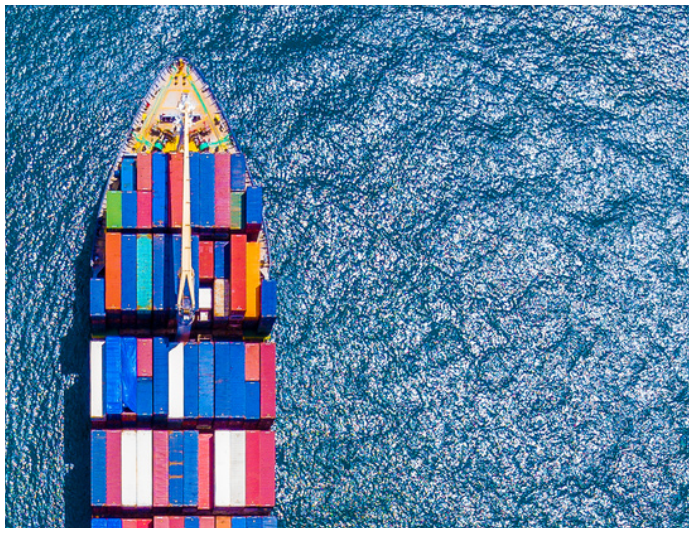
7 We agree to both a) prioritise the displacement of fossil fuel-based hydrogen and b) focus the use of renewables-based hydrogen on specific hard-to-abate sectors which have the potential to be key applications of renewables-based hydrogen as we work to achieve economy-wide near-zero emissions intensities; such key applications will likely include (but are not limited to) specific products/processes in chemicals and steel (fertiliser, methanol, chemical feedstock, direct reduced iron), maritime shipping (as a renewables-based hydrogen power-to-x derivative), aviation (as a renewables-based hydrogen power-to-x derivative), seasonal electricity storage when renewable supply to the grid is > 100%, and some very limited segments of heavy-duty trucking / off road mobility.[15]

8 We agree to prioritise deployment of renewables-based hydrogen technology and infrastructure which does not cannibalise the use of more efficient, fitting solutions, perpetuate unnecessary dependencies on fossil fuels and related fossil fuel subsidies, or prevent the permanent displacement of fossil fuels (including but not limited to most use cases related to residential & commercial heating and power generation).

14. The term 'geotemporal' refers to a combining of the variables space and time. In other words, the question is not only what are the right use cases for hydrogen but when should we deploy hydrogen-related infrastructure based on the region/market in question.
15. This implies reassessing hydrogen applications and projects as technology matures and – as such – this list may change as the responsible end use applications of hydrogen are reassessed over time.

Thematic Grouping #3

Providing guidelines for global trade & commoditisation



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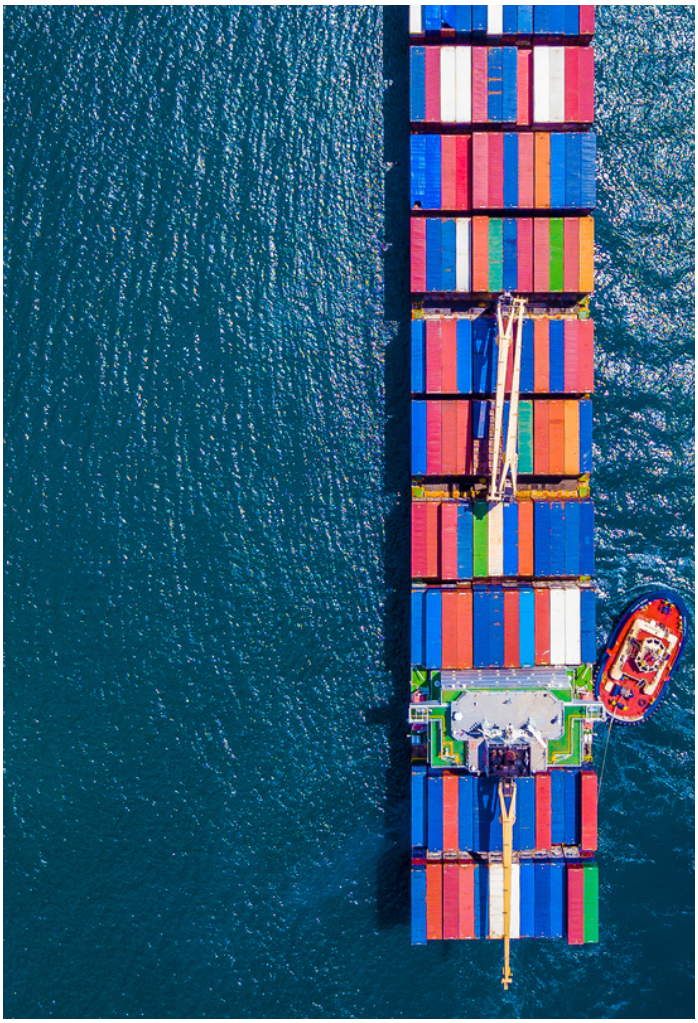
Responsible hydrogen trade must be built around the development priorties of emerging economies; related agreements, regulations & market-based mechanisms should therefore take into account the economic, environmental, and social viability of a project insofar as it supports decarbonisation of all involved parties as well as working collectively towards harmonised certification to ensure net positive impact is delivered to the environemnt.



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9 We agree to only support the development of a renewables-based hydrogen trade ecosystem which properly delivers on the principles and standards outlined in this document; specifically principles/standards 1, 2, 3, 4, 5, and 18 – and takes into account national development priorities of emerging economies.

10 We acknowledge the importance of leveraging and deploying regulation and market-based mechanisms which embody the spirit of the Joint-Agreement (specifically as it relates to the reversing of the historical dominance donor economic priorities have had over the sustainable development of emerging economies in North-South partnerships). This includes an agreement to work towards harmonised certification schemes for product quality, origin, and emissions intensity.

11 We will assess the economic, environmental and social viability of an export project – as well as regional and sectoral supply and demand sensitivities (as previously outlined) – and in so doing support the general decarbonisation of emerging economies which are projected to be net exporters of renewables-based hydrogen and/or its relevant derivatives.

Thematic Grouping #4

Addressing crucial aspects of capital deployment, financing, & policy schemes

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Evaluation of capital deployment, financing, and policy schemes for the responsible deployment of renewables-based hydrogen must extend beyond traditional frameworks – encompassing consisderations around social, environmental, and resiliency impacts. Equally important is transparency in all financial transactions as well as shared emphasis on specific policies and capital deployment in alignment with TRLs for responsible hydrogen production, transport, and end uses which are truly climate-positive and nature-centric.

12 We agree to conduct cost analysis – evaluating economic feasibility and competitiveness of renewables-based hydrogen projects – which goes beyond traditional frameworks to include specific methodologies for assessing both the potential negative and positive outcomes to local communities; including but not limited to: the potential negative impacts of climate change, biodiversity loss, and increased presence of air pollutants as well as the potential benefits such as job creation, enhanced air quality, increased energy resilience, and the overall advancement of sustainable and resilient local economies.

13 We agree to establish transparent financial mechanisms which ensure the responsible deployment of financial resources for renewables-based hydrogen projects; and/or Flagship Partners and Endorsing Organisations agree to engage responsible, transparent financiers who adhere to the same standards of transparency and fossil fuel divestment. Additionally, we commit to promoting transparency in all financial transactions between hosting states, operating companies, and supporting states.[16] This includes subsidies provided by supporting states to operating companies.

14 We agree to ensure equitable access to funding for renewables-based hydrogen projects, including end uses, particularly for underserved regions and sectors (any public funding for the project should be used in a way that increases transparency and ownership for the general public).

15 We recognise the necessity for significant increases in RD&D budgets – which are essential in delivering the required work to achieve acceptable TRLs for a broad range of production, transportation, and application technologies. We also recognise the need for increased budgets to develop the testing infrastructure required to accelerate and support the development/deployment of those technologies which have advanced to a higher TRL.

16 We recognise the critical role of policy instruments in fostering responsible hydrogen deployment, and hereby agree to coordinate on cross-border carbon trade agreements, subsidies, and related policy schemes for hydrogen production and end uses.

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16. The term 'hosting state' refers to the country or territory where a specific project development takes place; whereas the term 'supporting state' refers to those countries or territories who are typically holding ownership of those operating companies or investment vehicles and are often located in the Global North.

Thematic Grouping #5

Preventing and/or mitigating any adverse effects on local communities

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Inclusion and equity for communities in which hydrogen development and deployment are undertaken will involve deep engagement and collaboration with local residents to provide the greatest possible benefit and consent. Just and responsible deployment in these localities will prioritise access to resources such as healthcare, housing, water, energy, upskilling and reskilling where necessary, and opportunities for employment as well as local offtake of a portion of project resources.

17 We agree to work collaboratively to support solutions that ensure the responsible deployment and use of renewables-based hydrogen (and its relevant derivatives) is truly inclusive and equitable.

18 We recognise the importance of developing robust community benefits agreements and grassroots ownership models to create shared value in host communities (e.g., community training for jobs above the prevailing wage, addressing legacy pollution, improvement in local air quality, clean energy security and access, and/or other community-identified benefits). We recognise that consistent auditing and reporting is required to ensure these benefits and new ownership models are delivering the intended outcomes (such efforts on "responsible" reporting must be focused on open access to information and stringent methodologies for assessing real-world impact).

19 We agree to avoid, to the best of our ability, impacts to disadvantaged or at-risk communities in alignment with best practices regarding environmental justice outcomes – i.e., primarily ensuring impacts do not exacerbate undue environmental burden onto disadvantaged communities. Where not possible, environmental restoration and cultural preservation plans, that are developed in consultation with impacted communities, will be put in place. In addition, investments in community development, such as improved housing and healthcare facilities, will be put in place.

20 We agree to prioritise local usages of renewable-based hydrogen to provide social, environmental health, and economic benefits to local communities. Additionally, we agree to the general consensus that clean energy access and national just energy transition plans should be prioritised ahead of export models which do not provide direct benefits to the most disadvantaged communities in question.

21 We agree, in areas with limited electricity or clean water access, to allocate a portion of renewable energy and/or water production for local consumption.

22 We agree to promote and follow responsible sourcing practices for input materials into renewables-based hydrogen production (e.g. responsible mining of input materials for proton-exchange membrane catalysts).

23 We agree to actively involve all impacted communities in an accessible manner, in their respective local languages, and with full disclosure of information – ensuring free prior and informed consent from indigenous people and local communities from the initial pre-feasibility phase of the project design process through operations; as well as establishing a comprehensive process for engaging civil society throughout the project lifecycle that is informed by impacted communities' input (International Labour Organization Convention 169 must be respected for all affected populations).

24 We commit to respect local labour laws, human rights and implement health and safety measures for all workers, contractors and suppliers throughout construction and operations phases.

25 We agree to prioritise local job creation through upskilling/reskilling and workforce contracting, as well as considering local suppliers of materials and services. In any region with high renewable energy potential, this will include training and employing local residents in the operation and maintenance of all related infrastructure.

Thematic Grouping #6

Protecting the natural environment & delivering a net-positive impact on ecological systems

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The protection of sensitive habitats, biodiversity, and critical resources is essential to the responsible deployment of renewables-based hydrogen. From initial project design, to construction, to operations – responsible hydrogen deployment will require consideration of a range of environmental management practices as well as considerations of resiliancy due to the ever evolving impacts of climate change.

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26 We commit to prevent the compromising of sensitive habitats during renewables-based hydrogen project development and operation.

27 We agree to take into consideration the required measures to make all hydrogen-related infrastructure resilient to the impacts of climate change, ensuring safe and efficient delivery of power or fuel to the end user.

28 We commit to delivering a net-positive impact on biodiversity and local ecology specifically as it relates to new installations or retrofits for existing infrastructure – acknowledging the interconnectedness of biodiversity loss and mitigation efforts.

29 We agree to prioritise non-freshwater sources for all required volumes of ultrapure, cooling, and raw water usage – if and only if desalination ensures proper dissemination of the resulting brine to avoid damage to salt-water environments and fish populations. In water stressed areas, sustainable water management practices will be enacted in cooperation with the local community.

30 We will prioritise regenerative practices as it relates to soil and land usage with a mitigation plan for restoring any impacted terrains at close of operations.

Expo City – Dubai; December 5th, 2023

We, representatives from diverse sectors and regions, come together with shared dedication in driving the responsible deployment of renewables-based hydrogen. By developing and signing this document, we affirm our commitment to the principles and standards outlined herein – thus ensuring the widespread adoption of renewables-based hydrogen in a manner that is just, inclusive, and sustainable.[17]

17. The Flagship Partners are very grateful to all external and internal experts who reviewed the Joint-Agreement at length. The reviewers do not carry any responsibility for the final publication, which is the sole responsibility of the authors.

To date, the *Joint-Agreement on the Responsible Deployment of Renewables-Based Hydrogen* is endorsed by the following stakeholders:

Please indicate your interest in endorsing the *Joint-Agreement on the Responsible Deployment of Renewables-Based Hydrogen* by contacting:

Bradford Willis | bradfordwillis@climatechampions.team

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