Global Alliance POWERFUELS

JOINT DECLARATION

from industry and research

Beyond green hydrogen

Multitude of electricity-based energy carriers and feedstocks essential to reach climate neutrality

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German Energy Agency

This declaration was initiated by:

Global Alliance POWERFUELS

It is supported by the following organisations and companies:

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With this Joint Declaration, we, the signatories, affirm our commitment to the goal of the Paris Agreement to limit the increase in mean global temperature to 1.5 °C above pre-industrial levels, and recognise renewable electricity-based energy carriers as essential technological options to achieve this goal.

We acknowledge

that in recent years, countries globally have recognised the central role of renewable electricity-based hydrogen as well as other renewable electricity-based energy carriers and feedstocks from Power-to-X (PtX) processes – also known as electrofuels, e-fuels, e-chemicals, or powerfuels. The European Union, as well as 17 countries, have published national hydrogen strategies. In additional 36 countries, hydrogen strategies are either in preparation or in discussion.

that several global energy system modelling studies explore pathways consistent with reaching climate neutrality by 2050 at the latest. Some of these highlight the importance of powerfuels and their contribution to reaching net-zero emissions. However, major Integrated Assessment Models such as the ones underlying the IPCC AR6 lack the presence of critical electricity-based energy carriers and feedstocks beyond hydrogen, thereby creating a substantial blind spot in the discourse on climate neutrality.

We therefore call

for policymakers to take action to accelerate the ramp-up of PtX production capacities, as well as the market integration of Carbon Capture and Utilisation (CCU) technologies

and

for the research community to integrate renewable electricity-based energy carriers and feedstocks beyond hydrogen in energy system models, on a global but also regional and national level.

Specifically,

We

The **Global Alliance Powerfuels and its members**, together with

- **Prof. Dr. Poul Alberg Østergaard**, Professor in Energy Planning, Aalborg University
- **Prof. Dr. Henrik Lund**, Professor in Energy Planning, Aalborg University
- **Prof. Dr. Brian Vad Mathiesen**, Professor in Energy Planning and Renewable Energy Systems, Aalborg University
- **Dr. Anastasios Perimenis**, Secretary General, CO2 Value Europe
- **Dr. Andreas Förster**, Executive Director, DECHEMA e.V.
- **Dr. Jan Mertens**, Chief Science Officer, ENGIE
- **Dr. Laurent Baraton**, Senior Research Engineer and Project Manager, ENGIE
- **Janice Lin**, Founder and President, Green Hydrogen Coalition
- **Prof. Dr.-Ing. Jens Schneider**, Professor for Interconnected Energy Systems, HTWK Leipzig
- **Léo Laroche**, Business Developer Germany, Hynamics
- **Prof. Dr. Christian Breyer**, Professor for Solar Economy, Lappeenranta-Lahti University of Technology LUT
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- **Prof. Dr.-Ing. Michael Sterner**, Professor for Energy Storage, Hydrogen/Power-to-X and Renewable Energy Systems, Ostbayerische Technische Hochschule Regensburg (OTH Regensburg)
- **Prof. Alberto Cuoci**, Associate Professor, Department of Chemistry, Materials, and Chemical Engineering, Polytechnic University of Milan
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- **Olivier Grauwin,** Chief of Staff, Storengy

- **Prof. Alessandro Parente**, Professor in Chemical Engineering, Université libre de Bruxelles
- **Dr. Riccardo Malpica Galassi**, PhD in Aeronautical Engineering, Université libre de Bruxelles
- **Dr. Salvatore Iavarone**, Research Associate, Department of Engineering, University of Cambridge
- **Dr. Jannik Haas**, Adjunct Senior Fellow, Department of Civil and Natural Resources Engineering, University of Canterbury
- **Prof. Mohamed Pourkashanian**, Professor of Energy Engineering, Head of Energy Institute & Managing Director of the Translational Energy Research Centre, University of Sheffield

Declare our common and shared views

1. Renewable electricity-based energy carriers and feedstocks will be essential for reaching GHG emission reduction targets across several sectors, in particular the transport sector, such as in aviation and shipping, as well as the chemical sector, and to some extent industrial applications with high temperature heat requirements.

2. Powerfuels are a central pillar for the transformation to, and an indispensable component of, energy systems based on 100% renewable energy.

3. A failure to ramp-up the market for powerfuels would constitute a risk for the energy transition towards a net-zero emissions energy system. This concerns not only the development and scaling of renewable hydrogen technologies, but also technologies for processing renewable hydrogen to produce other powerfuels, and for the use of CO_2 from sustainable sources as a feedstock for the production of carbon-based powerfuels.

4. Renewable electricity will cover a significantly increasing share of the global energy supply in the future. Aside from supplying energy for direct electrification, generation capacities of renewable electricity, in particular solar and wind, will also massively have to be expanded for the production of powerfuels. This will be critical for several industrial processes and specific energy demand technologies as those can only become carbon-neutral by the use of renewable energy carriers such as synthetic hydrocarbons or ammonia.

5. Considerable synergies can be derived when streamlining and integrating the market ramp-up of powerfuels and renewable electricity. Studies that investigate the transition to global climate neutrality and 100% renewable energy systems increasingly acknowledge the role of renewable hydrogen. However, further research is needed to differentiate between the contribution of different powerfuels (e.g. hydrogen, e-ammonia, e-methanol, e-kerosene, e-methane) towards reaching net-zero emissions across all sectors.

6. Carbon Capture and Storage (CCS) technologies find a dominant presence across several energy system modelling scenarios, while Carbon Capture and Utilisation (CCU) technologies such as DAC and synthesis technologies are underexplored. The role of CCU technologies should be featured more prominently in research.

Based on the aforementioned common and shared views,

We urge policymakers to

1. Make the establishment of powerfuels as cost-competitive alternatives to fossil energy carriers a political priority.

2. Take measures to close the gap between planned and realised powerfuels projects. Production volumes and market shares of powerfuels are currently still miniscule. However, the global pipeline is significant and growing steadily, at 250 GW as of August 2021[1] for green hydrogen projects alone.

And to this end, work towards

1. Multilateral cooperation to expand CO_2 pricing schemes across sectors and regions to establish long-term market incentives for the transition towards a fully renewable energy supply, and to internalise the costs of environmental damage.

2. Demand-side incentives and/or mandates for the use of renewable hydrogen and other power-fuels (e.g. blending or use quotas, Contracts for Difference etc.).

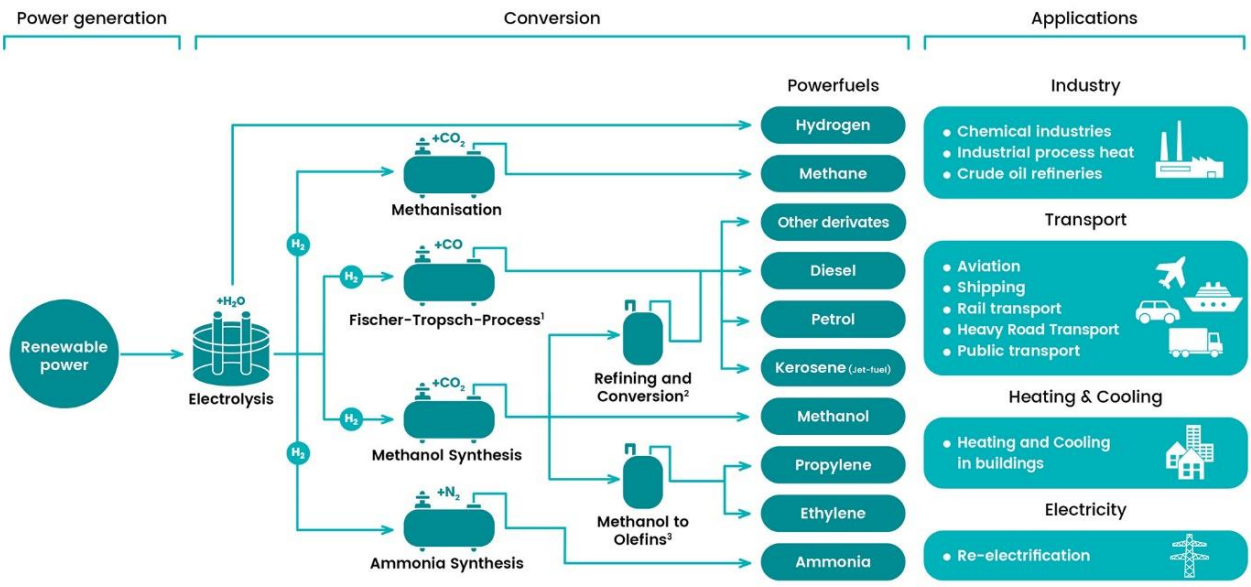
3. International partnerships to ramp-up renewable electricity generation, as well as production capacities of renewable hydrogen and its derived products.

4. Transparent, standardised and globally recognised certification of the 'green' property of power-fuels to facilitate their tradability and ensure that strict sustainability criteria (e.g. regarding their life-cycle greenhouse gas emissions, as well as the renewable electricity and carbon sources used for their production) are met.

[1] See RECHARGE, 2021, „Global green-hydrogen pipeline exceeds 250GW", https://www.rechargenews.com/energy-transition/global-green-hydrogen-pipeline-exceeds-250gw-heres-the-27-largest-gigawatt-scale-projects/2-1-933755

The **Global Alliance Powerfuels** was founded in 2018 and is backed by 16 member organisations and an international network of partner institutions. It is coordinated by the German Energy Agency (dena).

The term **powerfuels** denotes not only renewable hydrogen but all gaseous and liquid energy carriers and feedstocks from power-to-X processes that draw their energy content from renewable electricity.



❶ Includes: Fischer-Tropsch synthesis, hydrocracking, isomerization and distillation.
❷ Includes: DME/OME synthesis, olefin synthesis, oligomerisation and hydrotrating.
❸ Methanol-to-olefins process.

For remarks and questions, please do not hesitate to contact us at powerfuels@dena.de.