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## MISSING LINK TO A LIVABLE CLIMATE

Given the scale and urgency of the required clean transition combined with the needed growth of the global energy system, all zero-carbon hydrogen production options should be pursued. The potential of advanced heat sources to power the production of large-scale, very low-cost hydrogen (less than USD 1/kg) and hydrogen-based fuels could transform global prospects for near-term decarbonization and prosperity. Our landmark report, *Missing Link to a Livable Climate: How Hydrogen-Enabled Synthetic Fuels Can Help Deliver the Paris Goals*, sets out a pathway to decarbonize a substantial portion of the global energy system, for which there is currently no viable alternative.

While it sounds daunting to achieve the scale of production needed, the scalability and power density of advanced heat sources are a major benefit. By moving to a manufacturing model with modular designs, it is possible to deliver hundreds of units in multiple markets around the world each year to produce abundant clean hydrogen-based synthetic fuels. To achieve global market penetration at the speed and scale required by the climate emergency, these drop-in substitute fuels must be delivered at prices that can outcompete fossil fuels within 10 years, and at a scale that can displace the 100 million barrels of oil that are currently consumed around the world each day.

Governments and industry are already collaborating to demonstrate hydrogen projects at existing nuclear plants, as well as supporting and leading national and international efforts to accelerate cost-effective commercialization of innovative technologies, delivery and deployment models. Seizing this opportunity to massively scale affordable clean energy, combined with aggressive renewables deployment, can help address the immediate global energy crisis, and gives us a fighting chance of achieving the Paris goals of limiting warming to 1.5°C in the very limited time available.

# Clean synthetic fuels gigafactory

A report by TerraPraxis

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## ENERGY INNOVATION FOR A PROSPEROUS PLANET

Powered 100% by philanthropy, TerraPraxis is a non-profit organization that innovates and incubates scalable solutions for a livable planet and human prosperity.

Climate change is an energy problem. We believe that when the true challenges of achieving a clean, affordable, and reliable energy transition by 2050 start to bite, the more necessary zero-carbon advanced heat sources (advanced fission, fusion, or super-hot rock geothermal) will be to protect people and the planet, particularly for the difficult-to-decarbonize sectors of industrial heat, coal, and heavy transport. TerraPraxis has been anticipating this demand and has been designing transformative strategies to achieve the urgency, scale, and low costs required (for coal plant conversion, flexible co-generation, clean hydrogen, and clean synthetic fuels production).

TerraPraxis' flagship programs – Repowering Coal and Clean Synthetic Fuels – could accelerate the reduction of global carbon emissions by repurposing trillions of dollars of existing infrastructure to supply clean, affordable, and reliable energy to billions of people.

### THE MISSING LINK TO A LIVABLE CLIMATE

The world can still meet the Paris goals of 1.5-2°C if sufficient, low-cost, clean hydrogen is produced to replace oil and gas in shipping, aviation and industry, according to a major new report, co-authored by *TerraPraxis: Missing Link to a Livable Climate: How*

### *Hydrogen-Enabled Synthetic Fuels Can Help Deliver the Paris Goals.*

TerraPraxis' report introduces an innovative climate solution for a 'Hydrogen Gigafactory' to produce abundant clean hydrogen-based synthetic fuels at prices that can outcompete fossil fuels within 10 years, and at a scale that can displace the 100 million barrels of oil that are currently consumed around the world each day.

Hydrogen-based synthetic fuels produced via Gigafactories can enable rapid affordable decarbonization of carbon-intensive sectors such as shipping, aviation and industry that are difficult to electrify, and for which there are currently no viable alternative solutions. Oil and gas use in these sectors is currently projected to represent more than half of energy consumption until mid-century, creating a high risk of a 3-4°C trajectory of warming by 2100.

### WHAT IS A GIGAFACTORY?

The Hydrogen/Synfuels Gigafactory is a fully integrated facility that manufactures advanced heat sources and other needed components that are then installed and operated on the same site for highly efficient, low-cost and large-scale production of hydrogen and clean synthetic fuels. The combination of low specific capital cost and low operational costs to produce emissions-free heat and power enables the Gigafactory to produce two million Tonnes of hydrogen per year for less than USD 1/kg on a site of less than 4 km<sup>2</sup>.

The hydrogen can be fed directly into existing gas networks or used for other applications such as conversion to ammonia. The Gigafactory could produce 5.5 million tonnes of ammonia or 50 million barrels of synthetic hydrocarbon fuel per year. The Gigafactory can be sited on former coastal refinery and industrial sites, creating high-paying jobs, often to depressed industrial areas. To give a sense of the scale, just twelve Gigafactories placed on existing former refinery sites in the UK could supply the country's current oil and gas demand.

Since publishing this report in September 2020, TerraPraxis has been leading engagement with a wide range of stakeholders around the world – including governments, large liquid fuels users, major oil producers, policy makers and NGOs – to make the Gigafactory a reality. ■

