TAKE THE SEID ROAD

Terje Hauan / CTO

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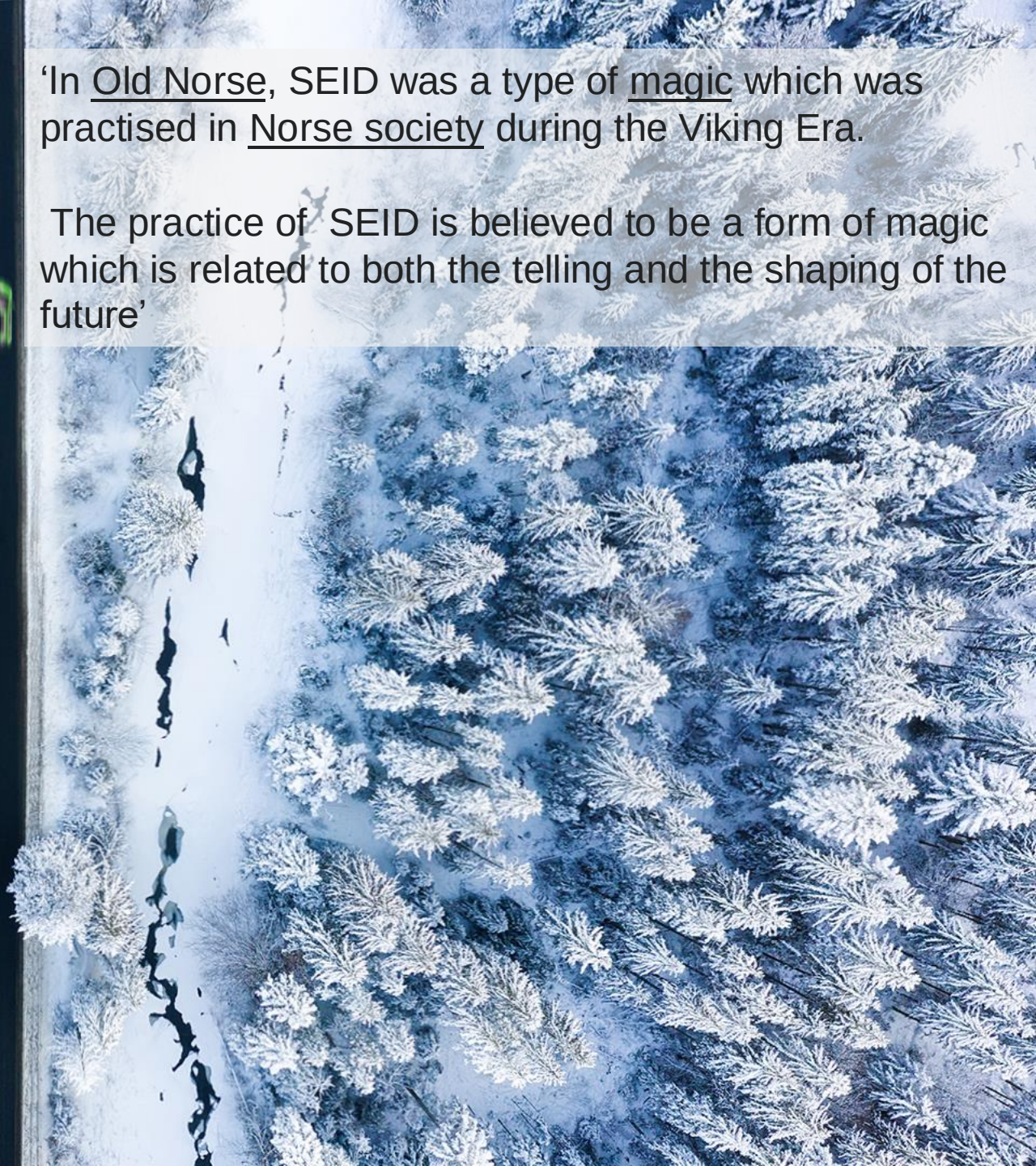


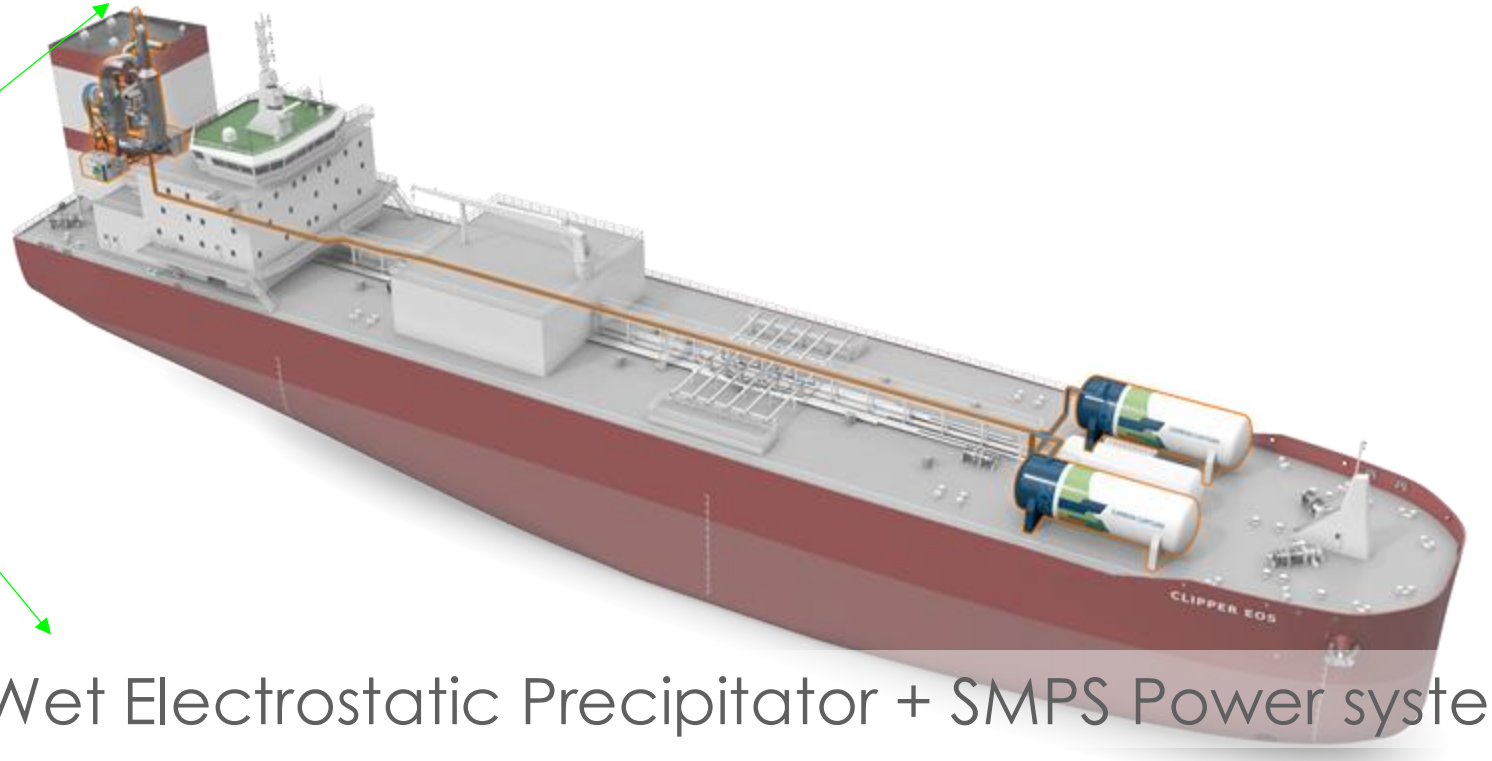
Industrial Air Pollution (APC) | We deliver clean AIR

Industrial Air Pollution (APC) | We deliver clean AIR

SEID

Next-generation Exhaust Gas Treatment:

- Reduction of Black Carbon emissions
- Enabling CO_2 capture/storage
- CCS-ready



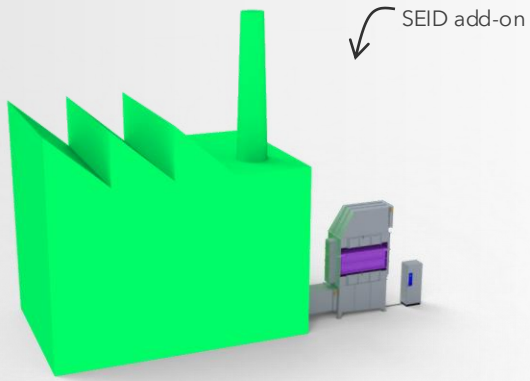
Wet Electrostatic Precipitator + SMPS Power system

pure technology

CORE BUSINESS

- SEID has since 1997 developed, produced and sold modular air pollution systems to Tier1 clients worldwide.
- Commercialised proprietary plasma technology for use in the industrial organic industry by displacing gas burning to treat exhaust gases to remove odour, VOC and PMs, and deliver cost-effective, efficient, emissions-free exhaust gas treatment.

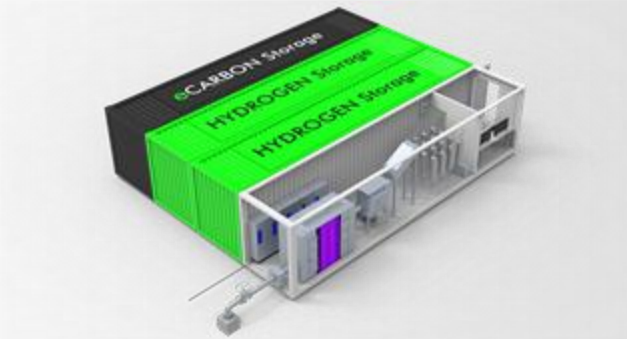
Business model: Product sales + after-market.



TRANSITION SEGMENT

- Utilizing SEID's proprietary non-thermal plasma technology to produce low-carbon hydrogen and elemental carbon from natural gas and biogas
- An alternative energy- and cost-efficient way of producing hydrogen versus Steam Methane Reforming or Electrolysis

Business model: Flexible.



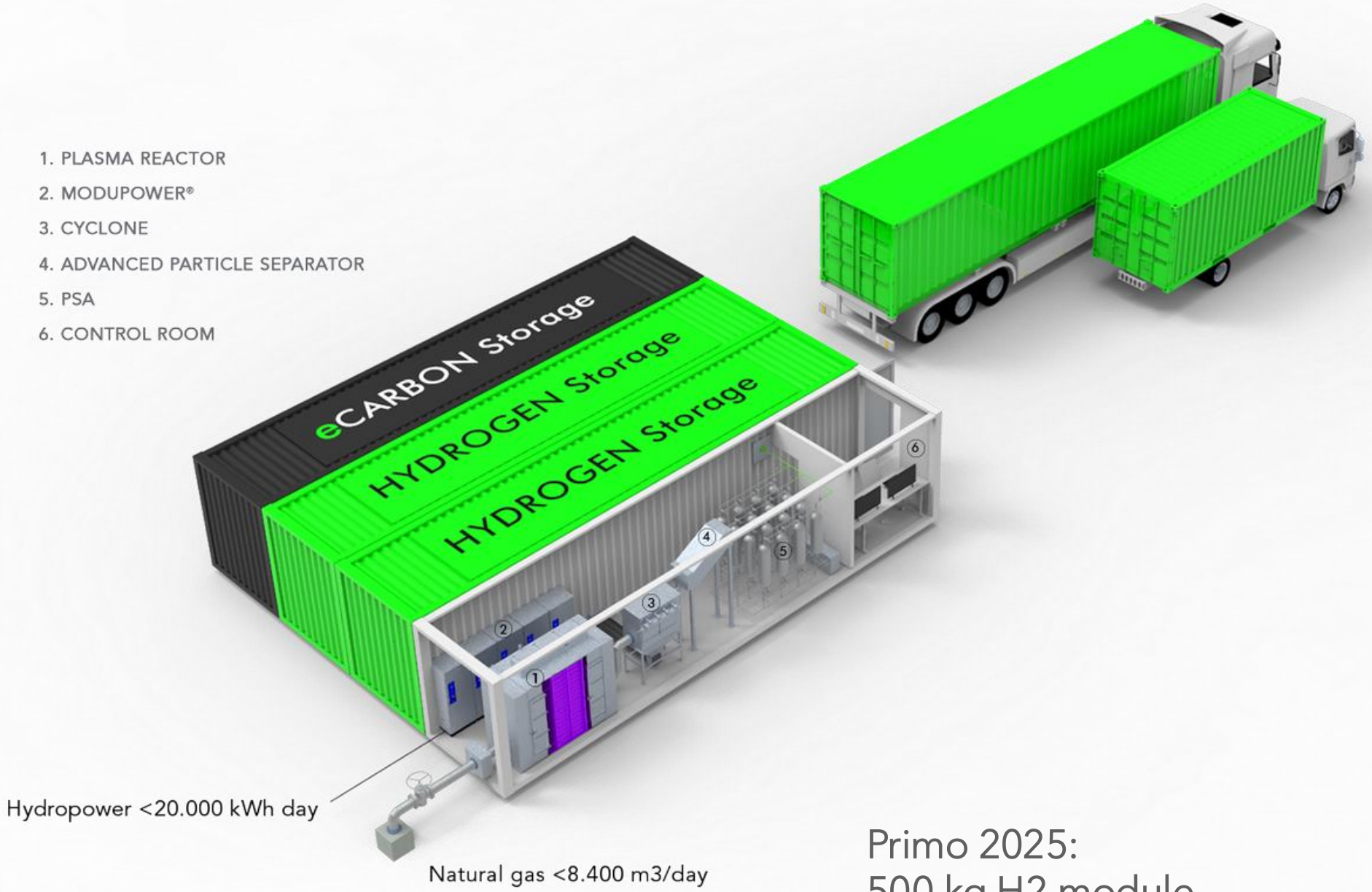
SAME TECHNOLOGY, SAME COMPONENTS, SAME COMPETENCE || DIFFERENT APPLICATIONS

Cold Methane Pyrolysis

PROJECT COLDSPARK®

A novel approach to sustainable Hydrogen production

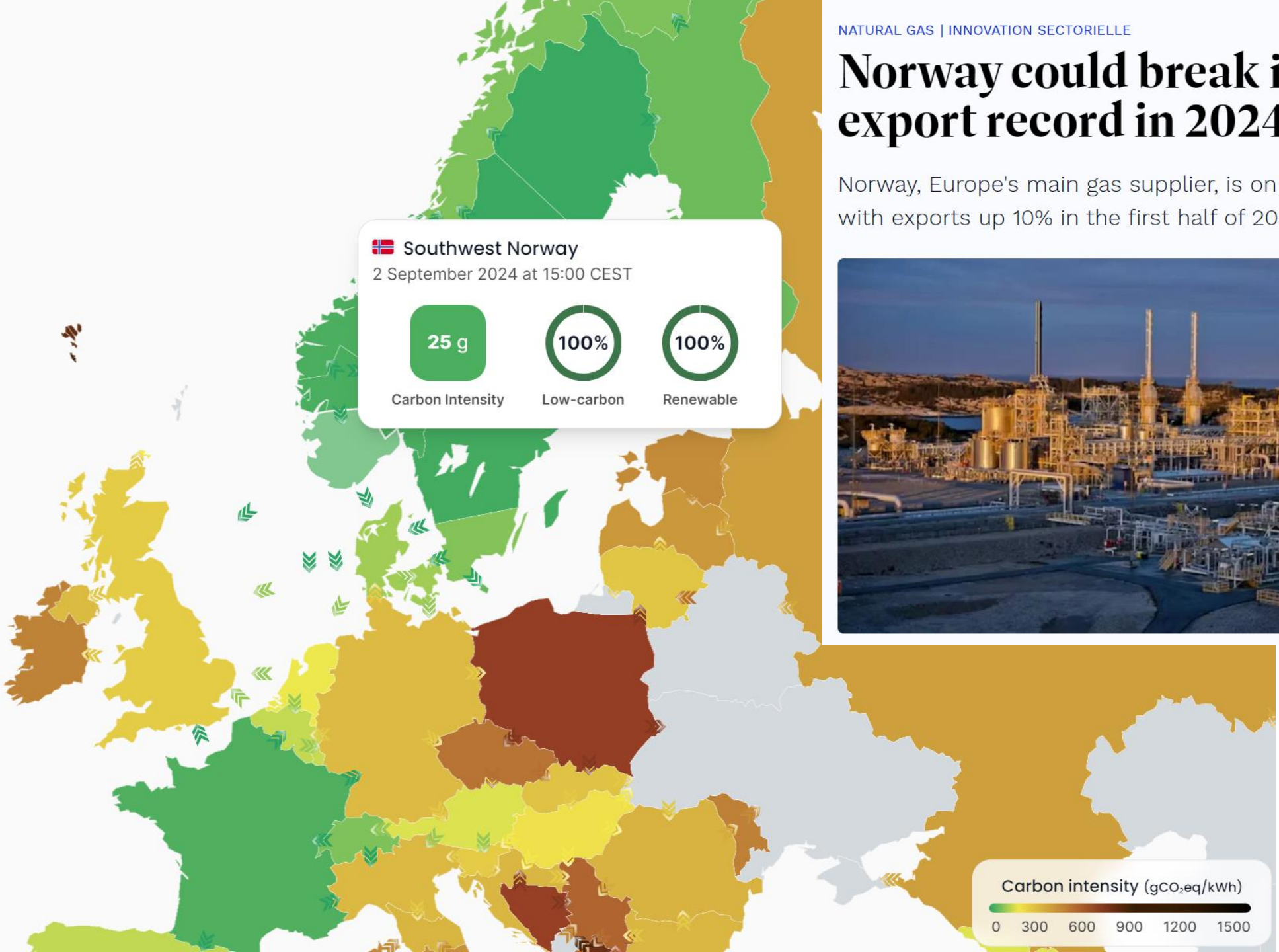
Project ColdSpark® has received **Euro 3 million in funding** from the European Union's Horizon Europe Research and Innovation Programme Grant Agreement ID: 101069931. Score **14.5 out of 15** points.



Primo 2025:
500 kg H2 module

Science allows you to do a lot of **stupid** things…

- Norway has a lot of Hydropower
- Norway has a lot of Natural Gas (Methane)
- Norway is a very small country …

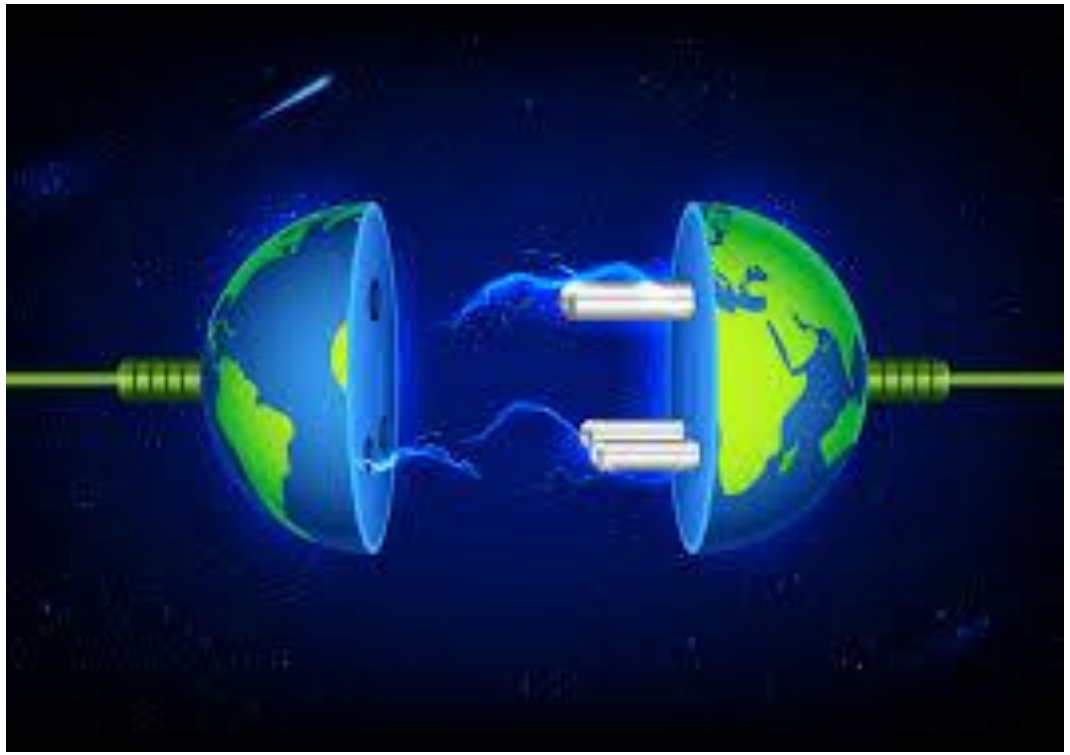


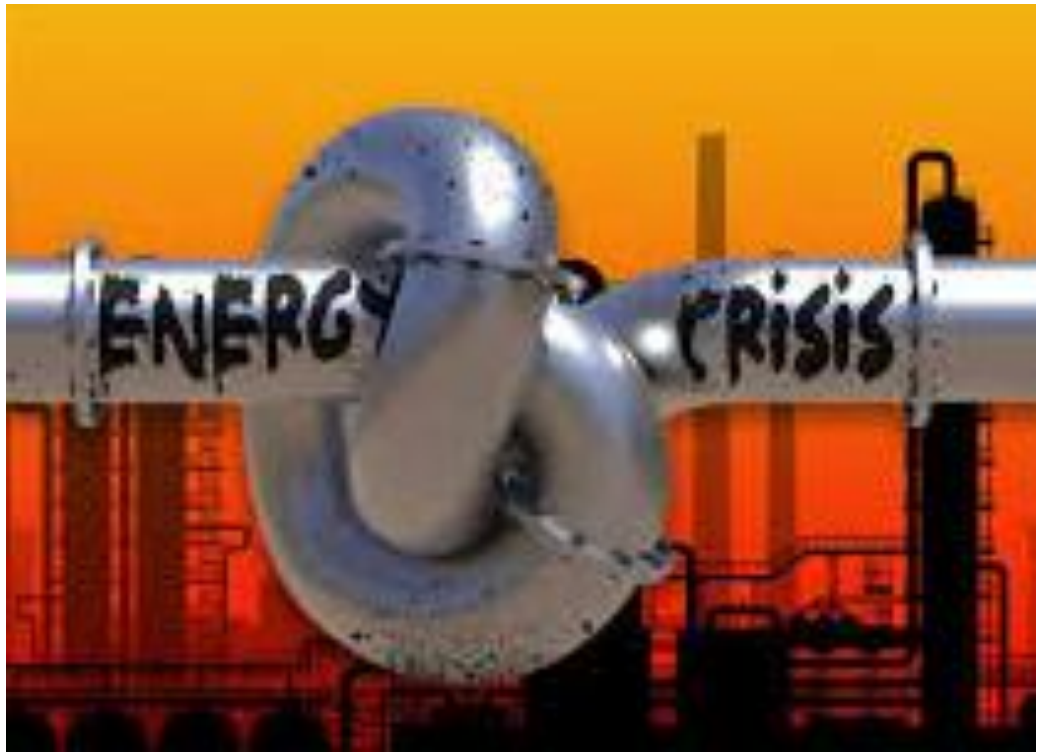
NATURAL GAS | INNOVATION SECTORIELLE

Norway could break its natural gas export record in 2024

Norway, Europe's main gas supplier, is on track to exceed its 2017 record, with exports up 10% in the first half of 2024.

When scientific understanding is **crucial** and real-world implications are considered, **energy efficiency** becomes an essential factor.



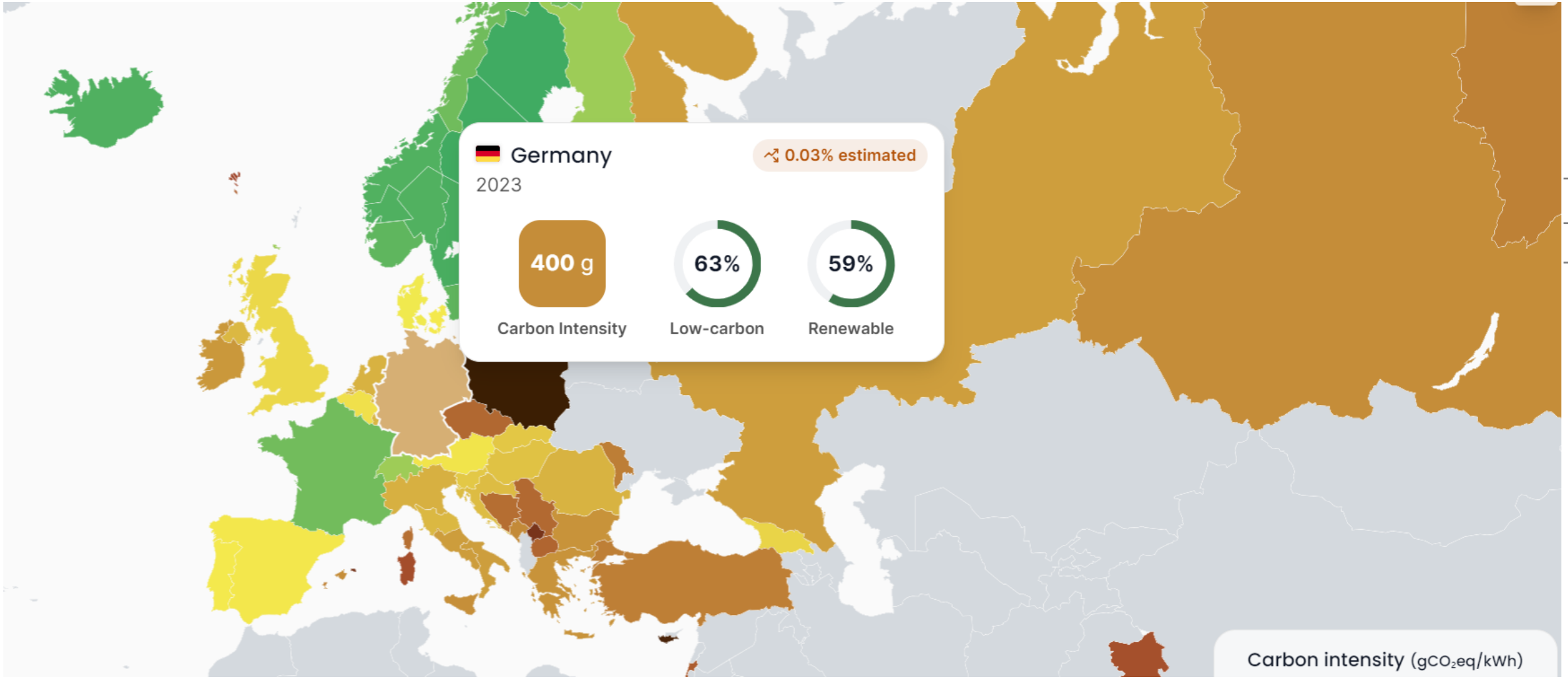


Science allows you to do a lot of stupid things…

Germany has **limited** hydropower resources.
Germany **needs** substantial natural gas imports.
Germany is a large, heavily **industrialised** nation.

Industries need **stable and non-intermittent** power

The European Electricity grid in 2023



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Germany's Energy Transition - A Story of Missed Opportunities?

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SEID

The Case for Biogas and Biohydrogen: A Carbon Tax Reality Check?

If CO2 is the problem, should CO2 be taxed?
If CO2 is taxed, the cost for industries goes UP

If the cost for industries goes UP, and society must pay for it, with higher prices and more costly electricity…

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Largest biogas capacity per capita

SEID

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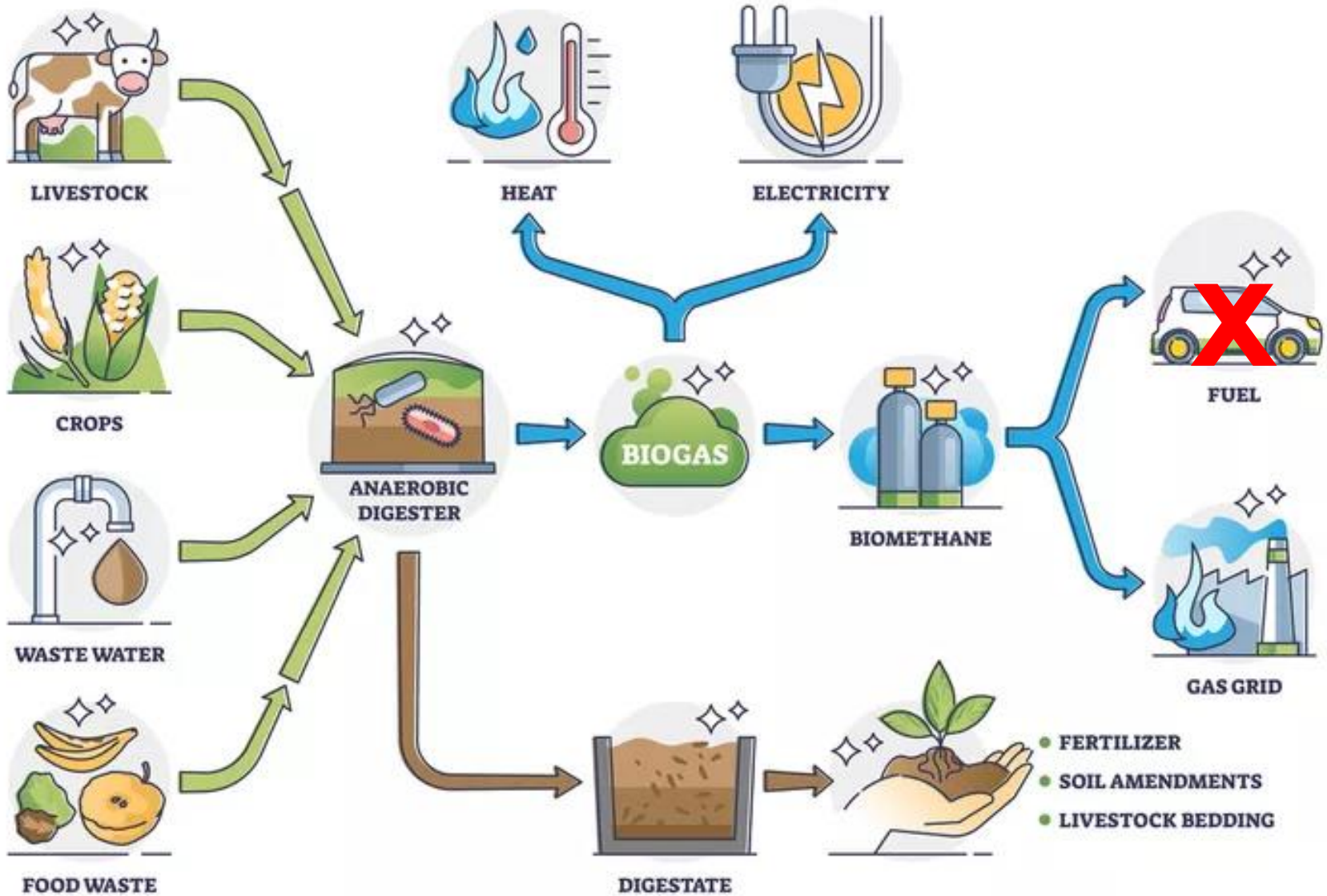
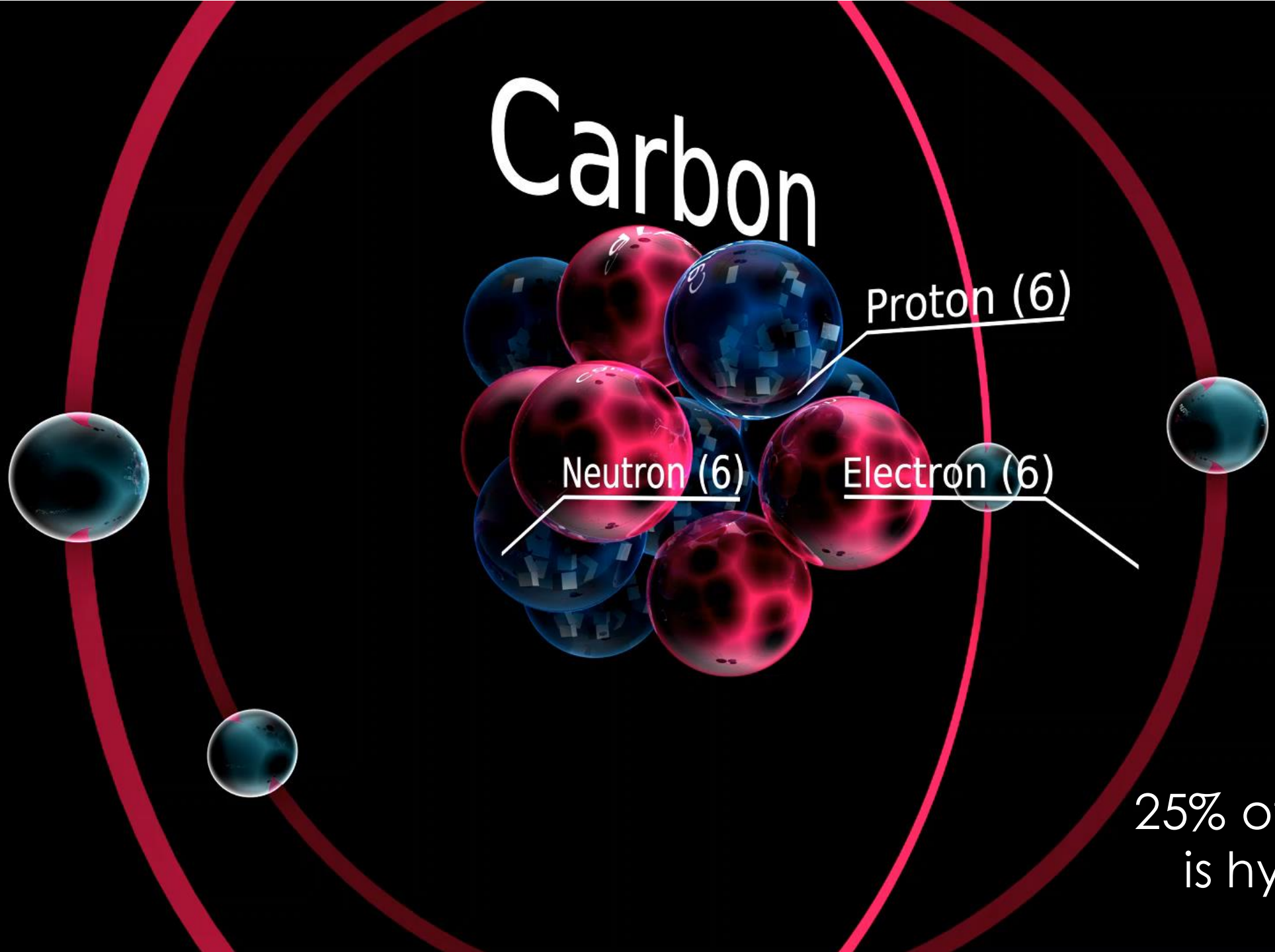
BIOGAS





25% of methane is hydrogen!

Methane & BioMethane: Europe's Transition Fuel

Methane (CH4): A bridge to a sustainable future

Vision: Transform Methane into Decarbonised Hydrogen

…without CO2 and no need for CCS,
no need for water and in Germany?

The problem **isn't methane**,
even if it's "fossil" methane.

The problem is that **we burn** it to make electricity, just like with **COAL**, leading to enormous CO2 emissions!

Our proposal: Don't burn methane, but combine it with low-carbon electricity

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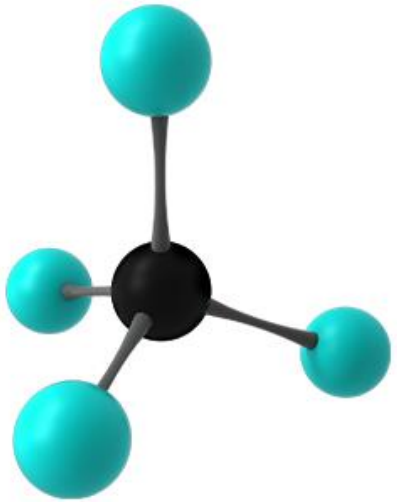
- Natural Gas

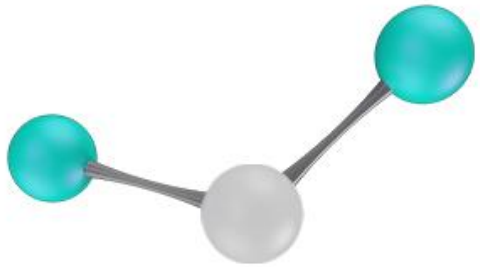


Methane Pyrolysis

Energy required per H_2: **1**

Fundamental physics = bond energy

- Water



Water Electrolysis

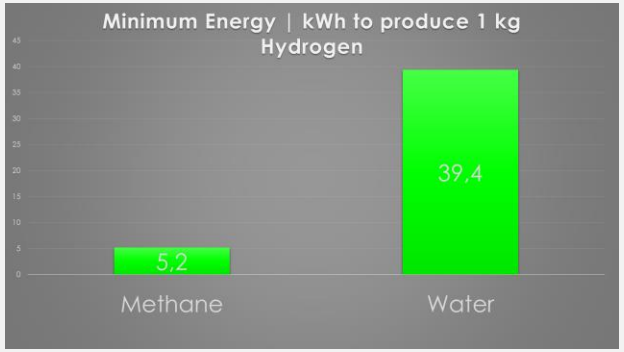
Energy required per H_2: **7.5**

COLD SPARK

Norway: Make 1 kg Hydrogen

~ 420 grams of CO_2

Required electricity <15kWh



Norway: Make 1 kg Hydrogen

~ 1650 grams of CO_2

Required electricity >50kWh

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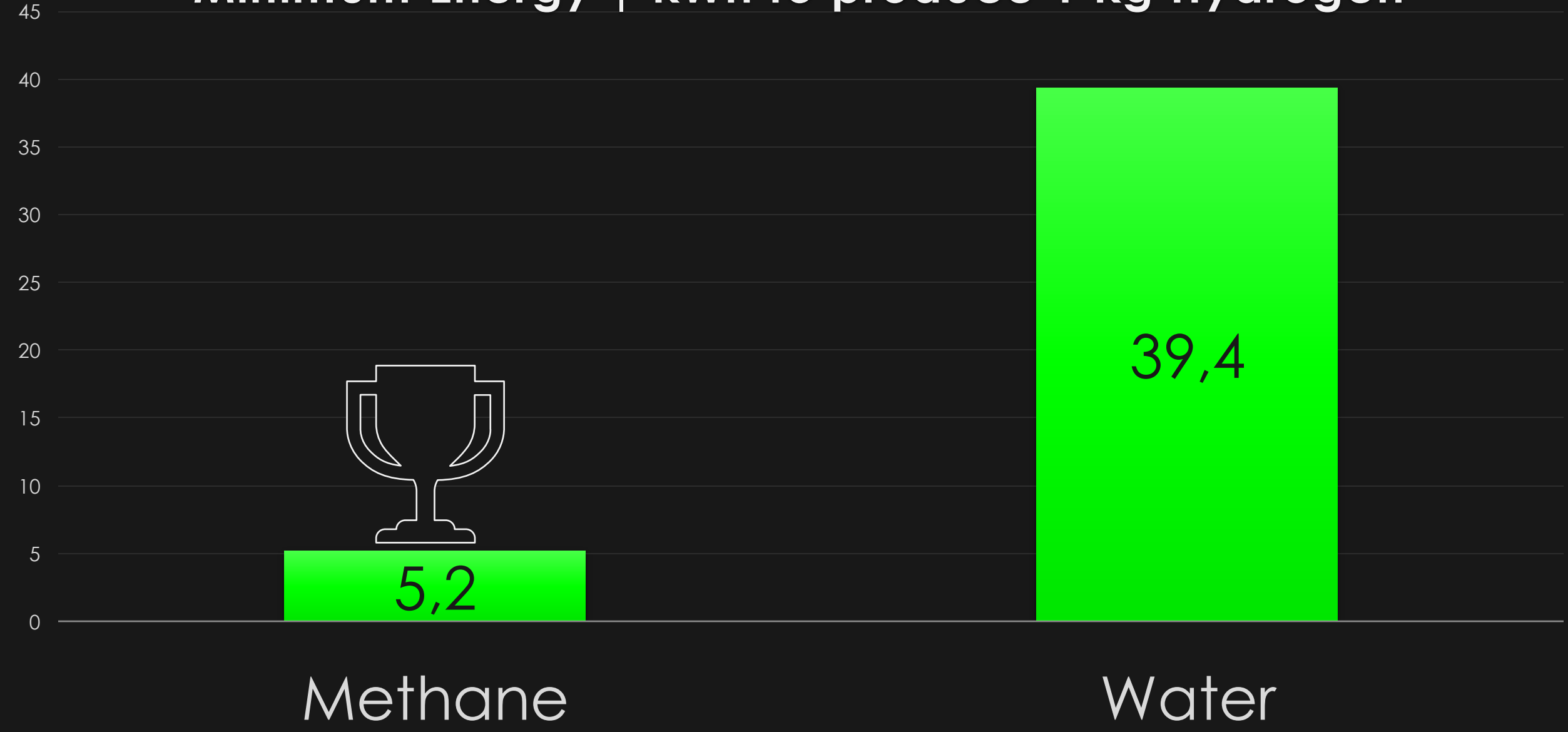
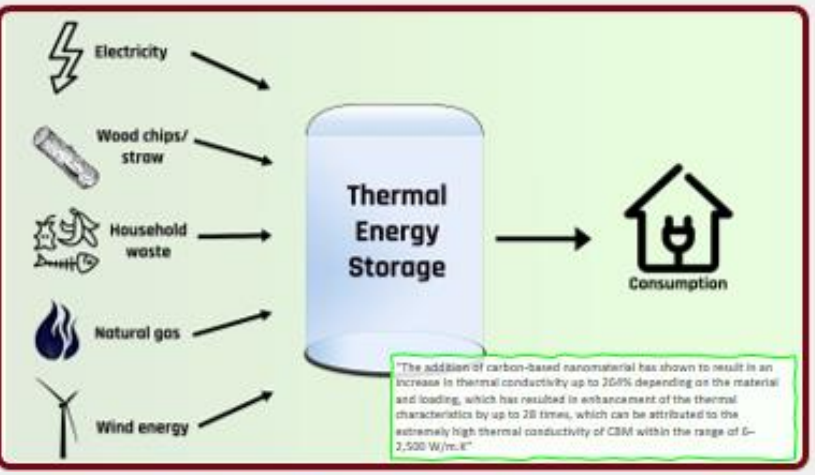
LCA N orwegian electricity ~30 grams CO2e/kWh in 2022
https://www.nve.no/energy-supply/electricity-disclosure/

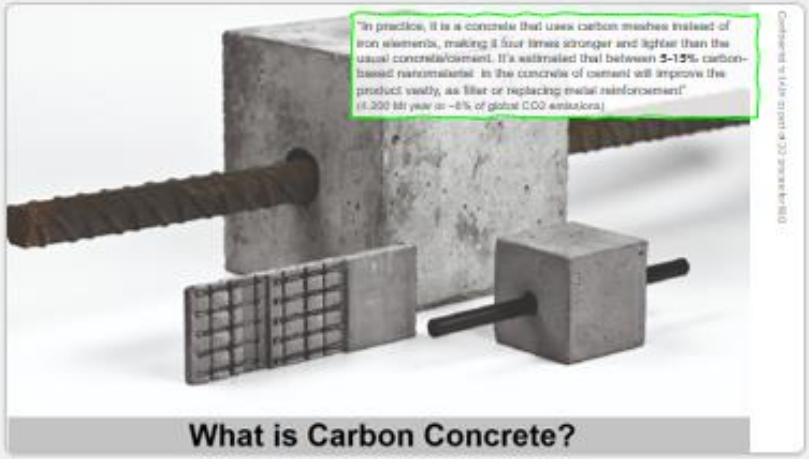
Minimum Energy | kWh to produce 1 kg Hydrogen

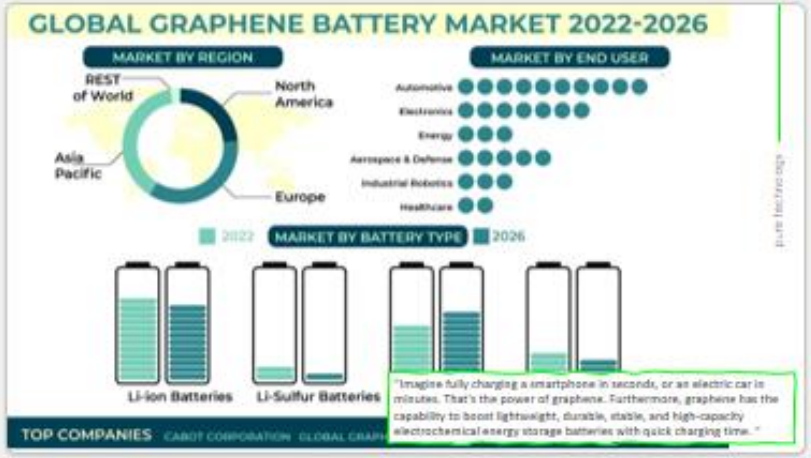


- Zero CO_2 emissions
- No need for carbon capture and storage (CCS)
- Less electricity consumption
- Much lower carbon intensity vs 'green' hydrogen

- Potential for valuable carbon byproducts


Electricity
Wood chips/ straw
Household waste
Natural gas
Wind energy
Thermal Energy Storage
Consumption
"The addition of carbon-based nanomaterial has shown to result in an increase in thermal conductivity up to 259% depending on the material and loading, which has resulted in enhancement of the thermal characteristics by up to 28 times, which can be attributed to the extremely high thermal conductivity of CBM within the range of 6–2,500 W/m.K"


"In practice, it is a concrete that uses carbon meshes instead of iron elements, making it four times stronger and lighter than the usual concrete/cement. It's estimated that between 5-15% carbon-based nanomaterial in the concrete of cement will improve the product vastly, as filler or replacing metal reinforcement."
What is Carbon Concrete?


GLOBAL GRAPHENE BATTERY MARKET 2022-2026
MARKET BY REGION
REST of World
North America
Asia Pacific
Europe
MARKET BY END USER
Automotive
Electronics
Energy
Aerospace & Defense
Industrial Robotics
Healthcare
2022
MARKET BY BATTERY TYPE
2026
Li-ion Batteries
Li-Sulfur Batteries
"Imagine fully charging a smartphone in seconds, or an electric car in minutes. That's the power of graphene. Furthermore, graphene has the capability to boost lightweight, durable, stable, and high-capacity electrochemical energy storage batteries with quick charging time. "
TOP COMPANIES


"Graphene oxide membranes have been shown in the laboratory to be effective at removing contaminants from water to an exceptional level. The research conducted on graphene membranes today is bringing the possibility of delivering clean, safe drinking water to millions in developing countries ever closer. "


"Graphene-enhanced asphalt shows 32% cost saving. Research into the use of a graphene-enhanced asphalt super modifier has found that the additional upfront cost is soon more than compensated by the increased lifespan of the repaired surface. Asphalt is the pavement of choice for sustainability. In fact, 94 percent of asphalt is recycled."


"Steel companies make nearly 2 billion tons of high-strength material. One tons of steel require around 770 kg of coal in the process. As a result, the industry accounts for roughly 8 percent of annual carbon dioxide emissions, as well as a toxic soup of air pollutants."

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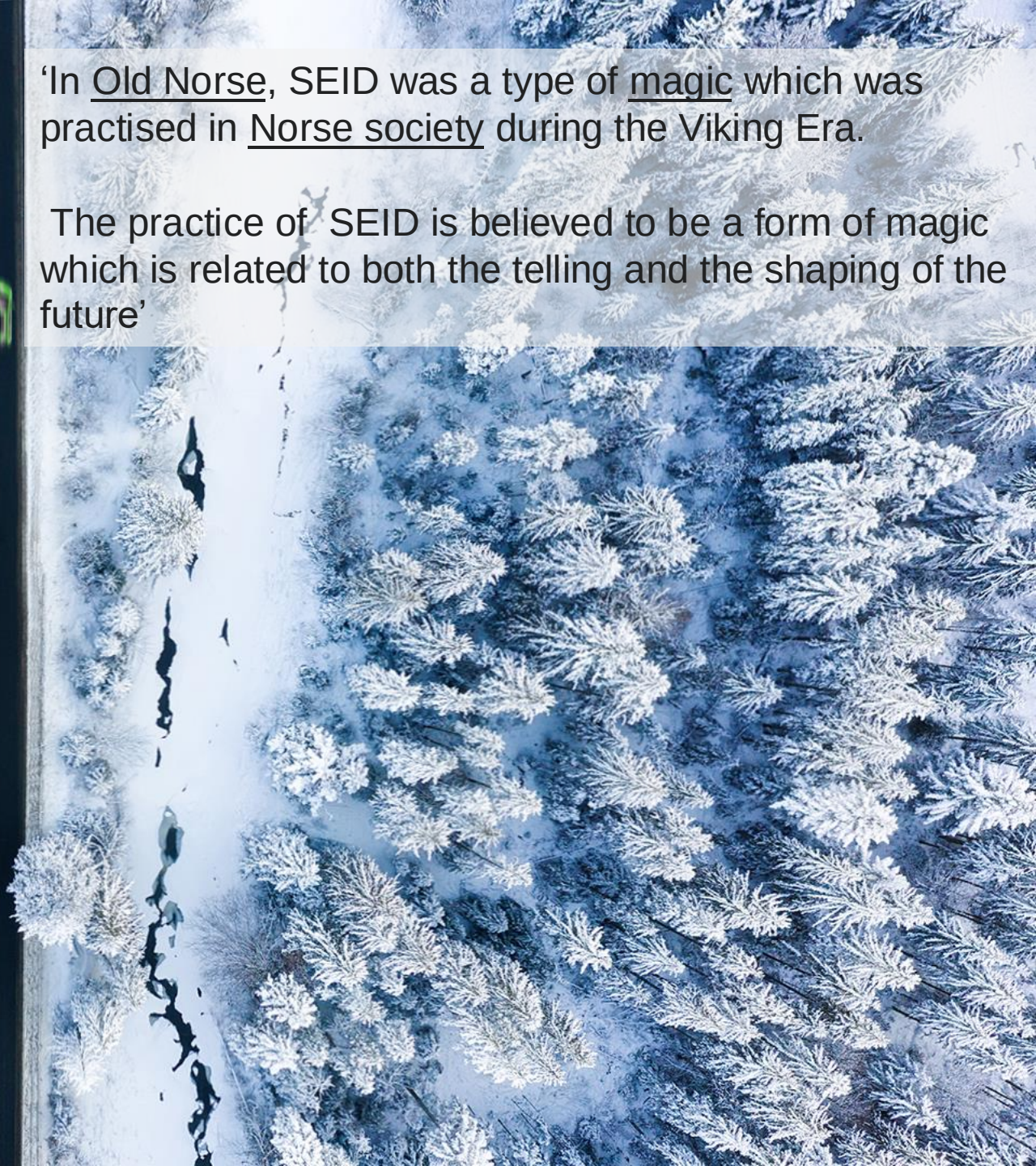

The Case for Biogas and Biohydrogen: A Carbon Tax Reality Check

The introduction of a carbon tax dramatically shifts the energy landscape. Suddenly, the hidden environmental costs of natural gas become painfully apparent, driving up its price and making cleaner alternatives like biomethane shine.

With its lower carbon footprint, Biomethane emerges as a cost-competitive contender, especially when produced efficiently. This isn't just a win for the environment—it's a smart economic choice in a carbon-constrained world.

While green hydrogen remains a promising long-term solution, its high production costs due to the laws of physics remain challenging. Even with abundant, cheap renewable electricity, the reality is that direct electrification will likely be prioritised, leaving green hydrogen struggling to compete.

In contrast, biogas and biohydrogen offer a more immediate and practical path towards decarbonisation. They can leverage existing infrastructure, utilise various waste streams, and provide a flexible energy source that complements other renewables.

The carbon tax reality check highlights a crucial truth: sustainable solutions aren't just about environmental responsibility but economic resilience in a changing world. Biogas and biohydrogen stand ready to deliver on both fronts.

Business Case for Biogas-Derived Hydrogen Production in Germany

Opportunity:
Germany faces a critical challenge in decarbonizing its energy sector while ensuring grid stability. Biogas presents a unique and realistic solution to address both issues simultaneously. **Abundant Resource**: Germany boasts a thriving biogas industry, with significant potential for expansion. This provides a readily available feedstock for hydrogen production.

Decarbonisation:
Biogas-derived hydrogen offers a pathway to significantly reduce carbon emissions compared to fossil fuel-based hydrogen production.
Grid Stability: Biogas can be stored and used flexibly, making it an ideal complement to intermittent renewable sources like wind and solar, enhancing grid stability. Economic Benefits: The biogas industry generates jobs and supports rural economies. Expanding into hydrogen production can create further economic opportunities.

Carbon Black Co-Product: Pyrolysis of biogas produces valuable carbon black, a crucial industrial material, adding another revenue stream. Challenges Technological Development: While promising, biogas-to-hydrogen technologies require further development and scaling up .Infrastructure: Investments in biogas upgrading and hydrogen production infrastructure are necessary. Policy Support: Favorable policies and incentives can accelerate biogas-derived hydrogen adoption.

Why Biogas Outperforms Other Options Green Hydrogen Limitations: Domestic green hydrogen production faces constraints due to limited land availability for renewable energy expansion and grid instability. Importing green hydrogen is costly and energy-intensive. Wind & Solar Intermittency: Overreliance on wind and solar creates grid instability. Battery storage is expensive and faces resource limitations. Biogas Advantages: Biogas offers greater flexibility, scalability, and cost-effectiveness compared to other solutions. It can be produced and stored locally, reducing dependence on imports and enhancing energy security.

Recommendations: Invest in R&D: Accelerate the development and commercialization of biogas-to-hydrogen technologies. Expand Biogas Production: Incentivize the expansion of biogas production and upgrading facilities. Develop Infrastructure: Invest in hydrogen production, storage, and distribution infrastructure. Policy Support: Implement policies that favor biogas-derived hydrogen production, such as feed-in tariffs or carbon pricing mechanisms.

Conclusion
Biogas-derived hydrogen production offers a compelling solution to Germany's decarbonization and grid stability challenges. By leveraging its existing biogas industry and investing in technology development and infrastructure, Germany can lead the way in sustainable hydrogen production and achieve its climate goals while strengthening its energy security.