PLANCK

Technologies

Designing adsorption-based gas separation and storage systems with advanced materials

Planck at a glance

PLANCK Technologies

Who we are

A Norwegian-based startup that **specializes in novel materials** for energy storage and gas-handling solutions

What we do

We **screen for novel materials and optimize their system properties**. We consider the whole value chain of the material production and life-cycle assessment

Our story

Our journey

Maryam found **a gap in the advanced material domain** through leading several initiatives in the innovation department at Equinor, including **technology mapping of metal-organic frameworks, technology strategy for energy storage, and hydrogen roadmap**.

NTNU RWTH AACHEN UNIVERSITY equinor Harvard Business School STANFORD GRADUATE SCHOOL OF BUSINESS

The problem: The world needs more energy

PLANCK
Technologies

Growing energy demand

By 2050, as global energy demand surges past 680 exajoules, renewables are expected to power up to 80% of the world.

Fossil fuels still dominate

However, in 2023, fossil fuels still generated 80% of global power. Capturing their CO_2 could turn a major climate challenge into a new source of clean energy.

Inefficient waste management

Organic waste is an energy resource. When converted to biogas, it could meet up to 20% of global gas demand while reducing emissions and waste.

Much renewable energy is curtailed

Despite the rise of renewables, up to 15% of wind and solar power was curtailed in some countries in 2024. Tackling this challenge is key to a sustainable energy future.

Sources: McKinsey's Global Energy Perspective 2024; IEA's World Energy Outlook 2024; IEA's outlook for biogas and biomethane; IEA's Renewables 2024 report

Common denominator: gas handling

PLANCK Technologies

Competitive biogas upgrading systems

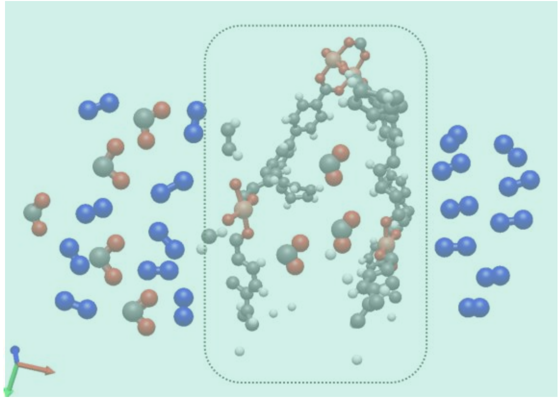
Bottlenecks in the hydrogen economy

Effective long-duration energy storage

Storage and usage of CO_2 for different applications

Higher gas capacity and selectivity for industrial gases

Gas handling based on adsorption



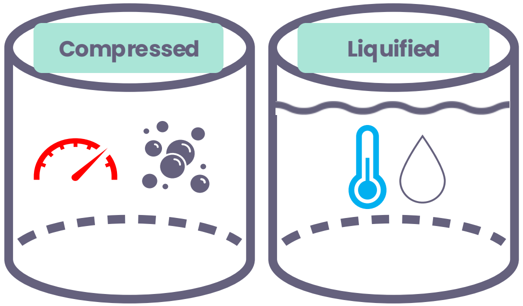
Extreme pressure and temperature conditions
= cost, safety and technical challenges

Ex: Storing Hydrogen at 400 bar is **3 times more expensive** than adsorbed storage at 150 bar

Adsorption: Gas sticks to a solid's surface.
MOFs: Huge surface + high selectivity = great for gas storage and separation.

Adsorption-based storage

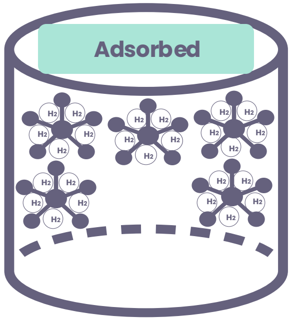
Current solutions



- High pressure or very low temperature
- High CAPEX and OPEX
- High risk of leakage
- Prohibitive safety regulations
- A 50L container at 200bar contains 500-600gr hydrogen

Our solution

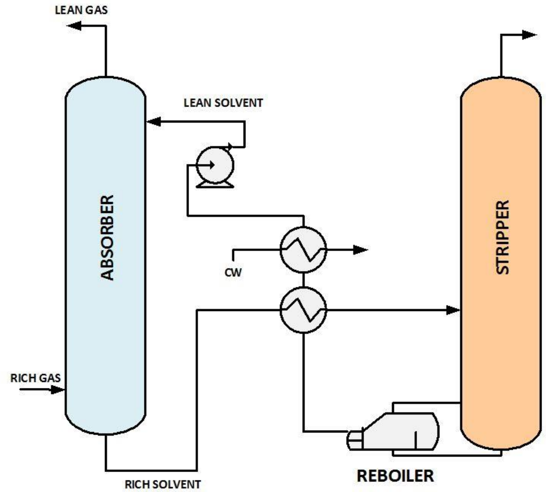
- Sponge-like materials adsorbing gas at milder conditions
- Lower CAPEX and OPEX
- Lower risk of leakage
- Increased safety at milder conditions
- **Much higher storage capacity (e.g. 2-5X for green methane)**



Sources: IEA; Cru Group; Global Market Insights

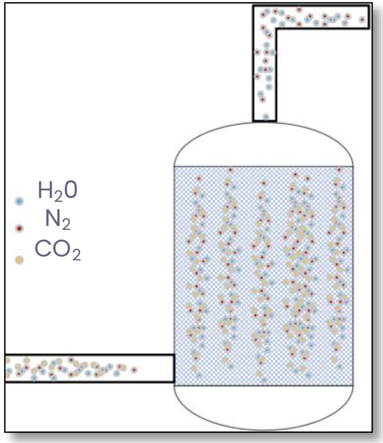
Adsorption-based separation

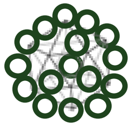
Current solutions



- Toxic by-products that should be kept under control
- Very energy-intensive CO_2 recovery process
- Need for measuring lots of experimental data for design and operation
- Hazards for liquid spill and its degradation

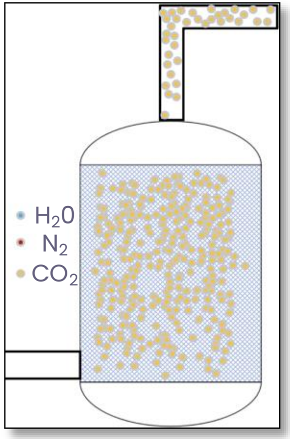
Our solution





The tank is filled with a MOF that captures CO_2 and lets other gases flow through it and out of the tank.

MOFs are 3D structures with high surface area and tunability.



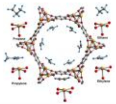
- Possibility of prediction of results with Comp. Chem.
- Deep cleaning possibility
- No release of reaction byproducts
- Lower temperature operation
- Scalability and modularity

Material selection

Requires extremely complex analysis

+1M

Material structures in the
CCDC chemistry database



Multiple families (>1M structures)

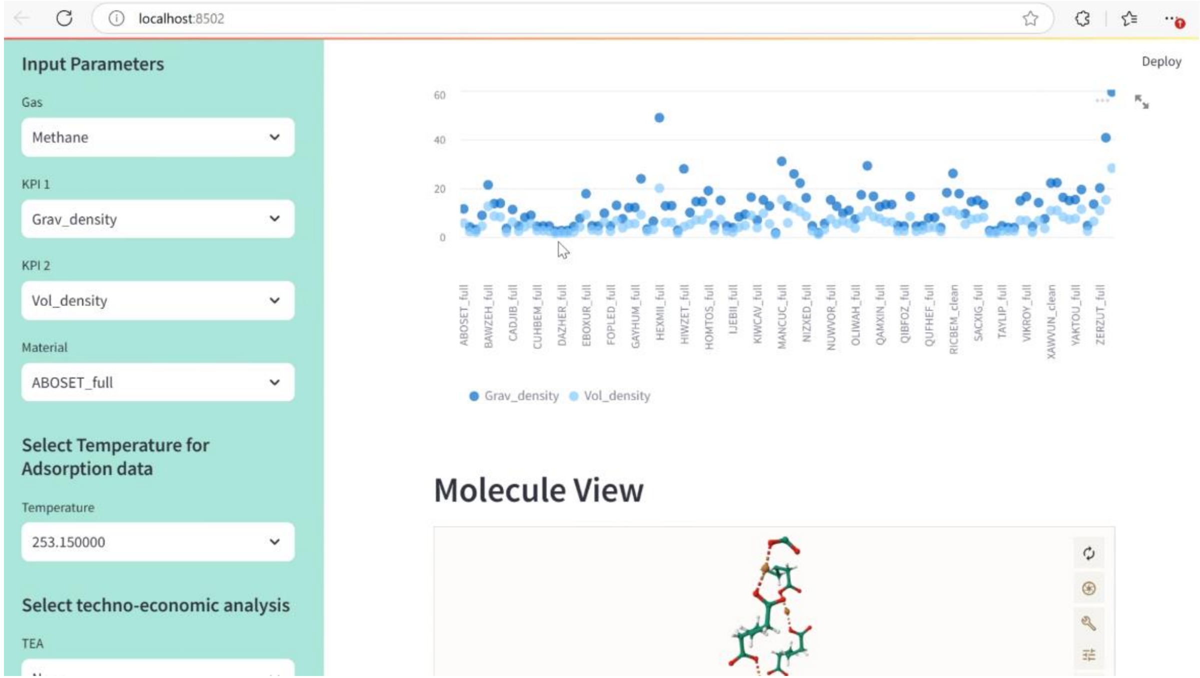
Different properties, e.g. surface area, Shape, etc.

Manufacturing complexity

Costs of raw materials

Our software

System for gas storage tested for methane, hydrogen and CO_2



Product: Patents and licenses

Success story: Patent ongoing for gas storage materials + systems (Lightbringer)

Transport of 3 MT methane on Aframax

PLANCK Technologies

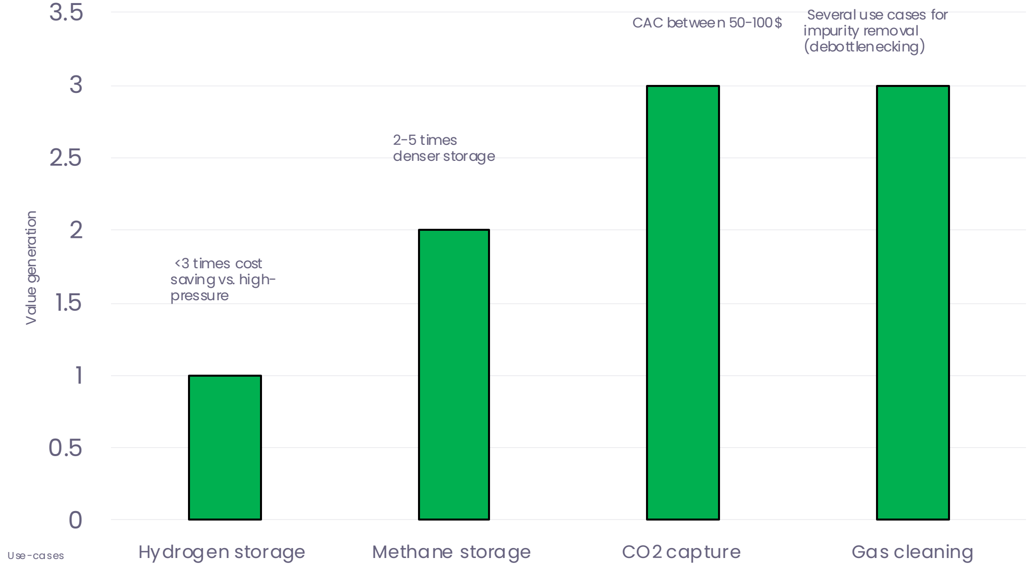
The distance between Hamburg and Barcelona is: 2510.74 nm

	Adsorbed	Compressed
Saving %	5.3%	0%
Saving $	$52.09 million	$0 million
Saving CO_2	21,811 tons	0 tons
No. of ships	11	12

Cost savings: **$52 million** per vessel per year.

CO_2 savings: **22,000 tons** per vessel per year.

Value generation



- **H_2 storage**: <3 times the cost when comparing compression at 400bar with adsorption at 150bar.

- **Methane storage**: 2-5 times denser storage when comparing compression in the range of 30-400bar with adsorption in the range of 30-150bar

Our proposal

- Feasibility study and high-level techno-economic analysis for a gas handling use case.

- The optimal gas separation/storage design based on adsorption, including material screening, integrated with process simulation.

- Sensitivity analysis for the important parameters.

Our team

Dr. Maryam Ghadrdan

Founder & CEO

Ph. D. Chemical Engineering

Dr. Hamid Mehdizadeh

Co-Founder & CTO

Ph. D. Chemical Engineering

Manuel Lopera Huertas

Head of BD & Marketing

Master of Technology Management

Dr. Tim Pongratz

Head of Technology Development

Ph. D. Computational Chemistry

Our advisory team

PLANCK Technologies

Tim Sønderby

Asset Manager

أدنوك
ADNOC

Prof. Yang Shao-Horn

Professor of Materials Science

Massachusetts Institute of Technology

Prof. Mohamad Moosavi

Professor & Director of Artificial Intelligence for Chemical Science

UNIVERSITY OF TORONTO

Thank you!

A sustainable future starts with smart solutions

maryamg@planck-tech.no

www.linkedin.com/in/maryam-ghadrdan-phd-18a7a310/