

ENGINEERING A SUSTAINABLE FUTURE: RESEARCH, COLLABORATION, AND TRUST IN THE JOURNEY TOWARDS A HYDROGEN ECONOMY

TOPSOE



A sustainable future fueled by science with
Topsoe's SOEC electrolysis technology

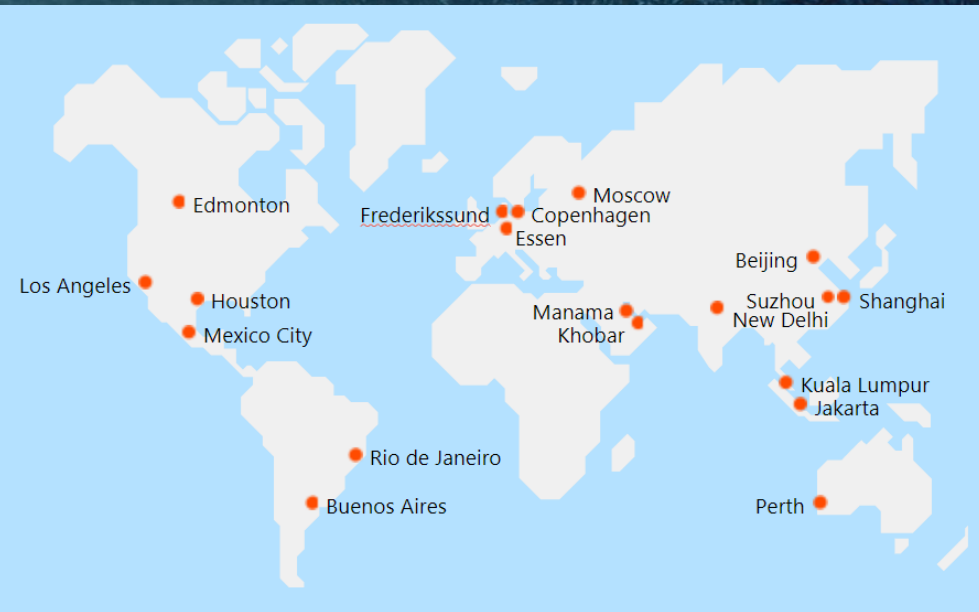
23th January 2025

Tobias Holt Nørby
Stack Manufacturing Expert



TOPSOE: A COMPANY BUILT ON APPLIED SCIENCE

Thanks to decades of exceptional R&D, Topsoe is in a **unique position** to accelerate the transition to sustainable technologies.



~2,800 employees



9%

R&D investments of
annual revenue
(700 DKK million 2023)



+40


Scientific partnerships with
universities and institutes

+600

Patent families

TOPSOES FOCUS IN PTX: CREATING NEW SOLUTIONS FOR THE HARD-TO-ABATE SECTORS (CO2 EMISSIONS)

**Not all sectors
can be electrified,
which is where
Power-to-X
comes in!**



3%

**Cement
Production**



7%

**Iron & Steel
Production**



6%

**Chemical &
Petrochemicals**



2%

Aviation

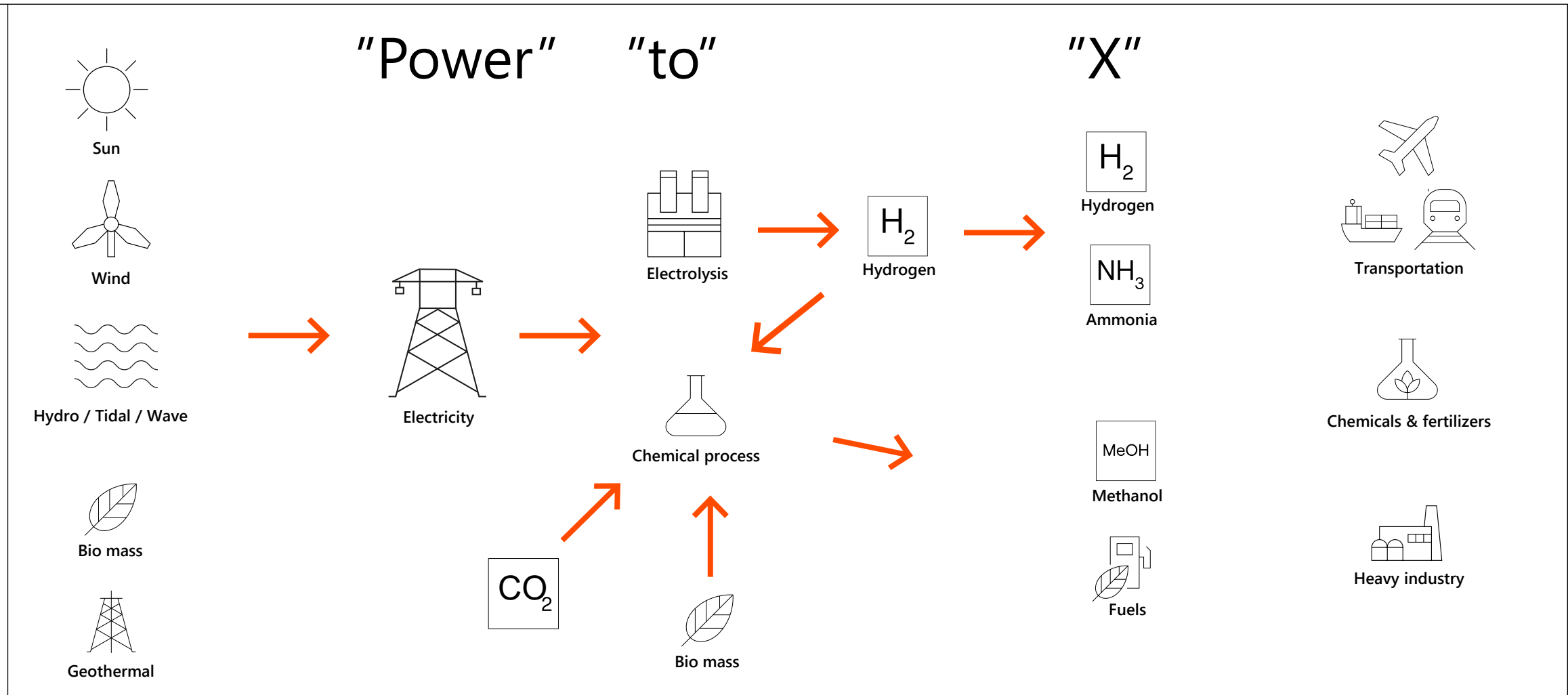


2%

Shipping

WHAT IS POWER-TO-X?

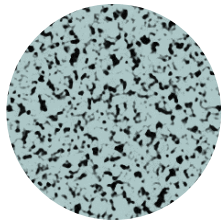
RENEWABLE ENERGY → POWER → CONVERSION → CHEMICAL COMPOUNDS



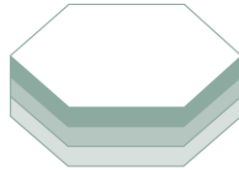
FROM ÅNGSTRÖM TO MEGA

SOEC ELECTROLYSIS AT ALL SCALES

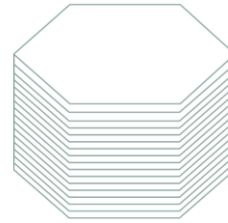
SOEC **electrode**



SOEC **cell**



SOEC **stack**



SOEC **core**



SOEC **section**



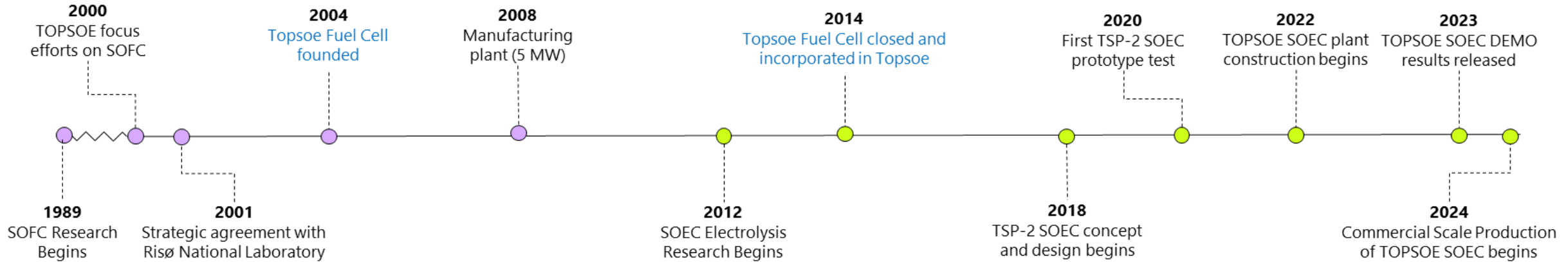
100 MW SOEC **plant example**

Topsoe and First Ammonia signed a 5GW launch company agreement for the reservation of first-of-a-kind, industrial-scale, solid oxide electrolyzer cells (SOEC) to produce green ammonia, a fuel for transportation, power storage and generation, and fertilizer

First Ammonia's 1st commercial-scale green ammonia plant is located at Port Victoria, Texas, United States.

[Learn more](#)

TOPSOE STACK PLATFORM 2 (TSP-2) DEVELOPMENT OF STACK DESIGN OVER TIME



TSP	# cells	Max H ₂ production rate [Nm ³ /h]	Max power consumption [kW]
TSP-1	75	2	~6
TSP-2	25-150	20	~60

- TSP-2 design considerations:**
- Higher **robustness**
 - Higher **cell footprint**/production rate
 - Optimized flow fields for **electrolysis**
 - **Pressurized** operation
 - Large volume manufacturability

RESEARCH AND COLLABORATION

NANO COATED INTERCONNECTS FOR SOFC (NACOSOFC)

Jan Froitzheim
Hannes Falk Windisch
Rakshith Nugehalli Sachitanand
Jan-Erik Svensson

Anna Magraso
Reidar Haugsrud

Tobias Holt

Mats W Lundberg
Robert Berger
Jörgen Westlinder



norden

Top-level Research Initiative

2011 - 2014

RESEARCH AND COLLABORATION

HIGH TEMPERATURE ELECTROLYSIS PART OF MOREH2 PROJECT

Jan Froitzheim
Maria Dolores Paz

Thomas Fröhlich

Hannes Falk Windisch
Sine Ellemann Olesen
Tobias Holt Nørby

Nicklas Norrby
Shunyi Li



TOPSOE



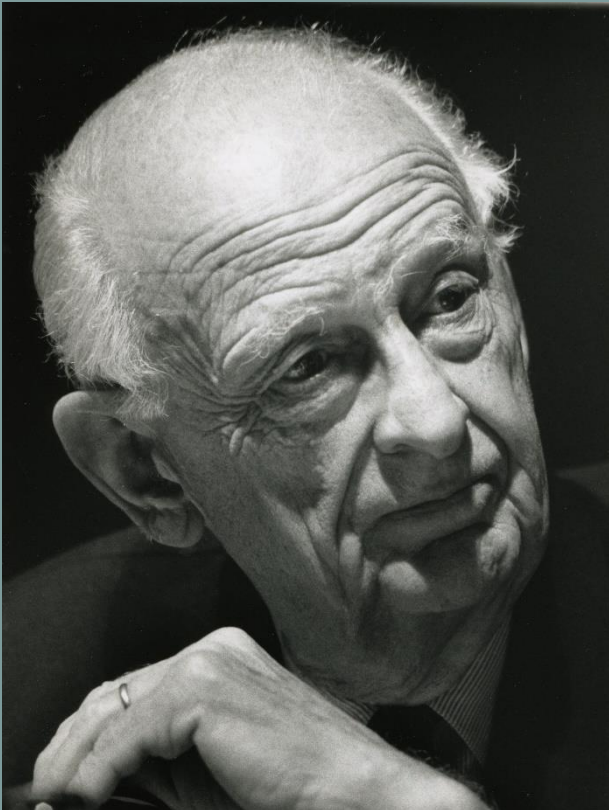
2024 - 2027

RESEARCH AND COLLABORATION

MORE_H2 KICK-OFF MEETING IN GOTHENBURG



DR. HALDOR TOPSOE
FOUNDER AND ENGINEER
OF THE CENTURY



COMBINING AN INNOVATIVE SPIRIT WITH A COMMITMENT TO ALWAYS BETTER HUMANITY

ROELAND BAAN,
CEO OF TOPSOE



“WE’RE TAKING A LEAD ROLE IN THE GLOBAL ENERGY TRANSITION.”

The decision to build a large-scale production of our SOEC technology shows that we are willing, and able, to translate our ambition into reality.”

TRUST IN THE JOURNEY TOWARDS A HYDROGEN ECONOMY

JAKOB TOPSØE
CHAIRMAN OF THE BOARD
OF TOPSØE HOLDING A/S



**“WE HAVE THE ABILITY,
PRIVILEGE, AND THE
OBLIGATION TO USE
OUR SCIENTIFIC
EXPERTISE AS THE
FOUNDATION FOR
OUR BUSINESS IN
ORDER TO CREATE
A BETTER WORLD.”**



TOPSOE SOEC STACK MANUFACTURING FACILITY

HALDOR TOPSOE'S VEJ 2, 7400 HERNING, DENMARK



Funded by the European Union
Emissions Trading System
Innovation Fund



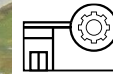
- ✓ Equipment installation completed in most rooms
- ✓ Equipment commissioning started in September
- ✓ **On timeline to soon start to produce stacks!**

IMAGE TAKEN : DECEMBER 2023

Topsoe awarded EUR 94 million for the construction of electrolyzer manufacturing facility in Herring, Denmark.



Initial capacity: 500 MW/year, expandable to 5GW



Production plant size 23,000 m²



Total land area 72,000 m²



150 employees, on-site, when production begins in 2024.



UPDATE OCTOBER 2024
Soon ready to start producing stacks!

About the Innovation Fund

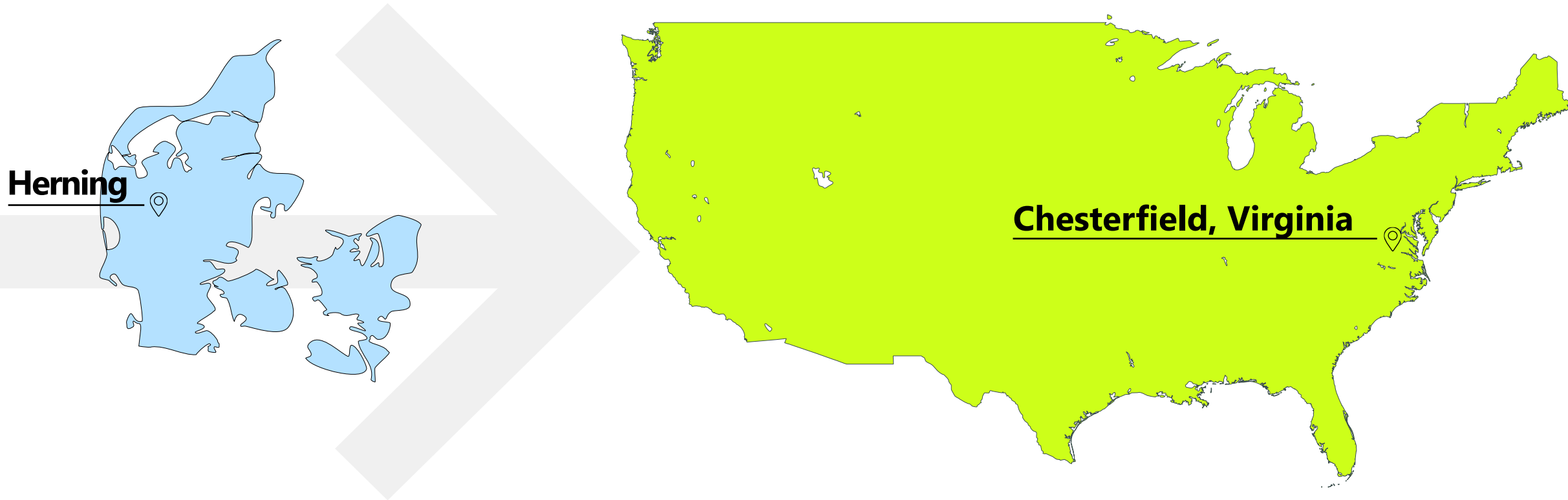
The Innovation Fund is the EU fund for climate policy, with a focus on energy and industry. It aims to bring to the market solutions to decarbonize European industry and support its transition to climate neutrality while fostering its competitiveness. The Innovation Fund is financed through the EU Emissions Trading System (EU ETC).

Disclaimer: Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or CINEA. Neither the European Union nor the granting authority can be held responsible for them.

TOPSOE SOEC STACK MANUFACTURING FACILITY (#2)

FROM DENMARK TO USA...AND BEYOND

We're expanding our SOEC manufacturing capacity to serve the **US market (pending FID...)**



Topsoe received allocation for nearly **\$136 million in tax credits** from the **Inflation Reduction Act (IRA)**

THANK YOU. ANY QUESTIONS?

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