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Rethinking nuclear

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13th of September 2023

Seasalt Group

Covering two cornerstones of the energy spectrum

SeaSalt group

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4th generation **nuclear energy** technology company developing an inherently safe nuclear Compact Molten Salt Reactor to be deployed on barges on a global scale.

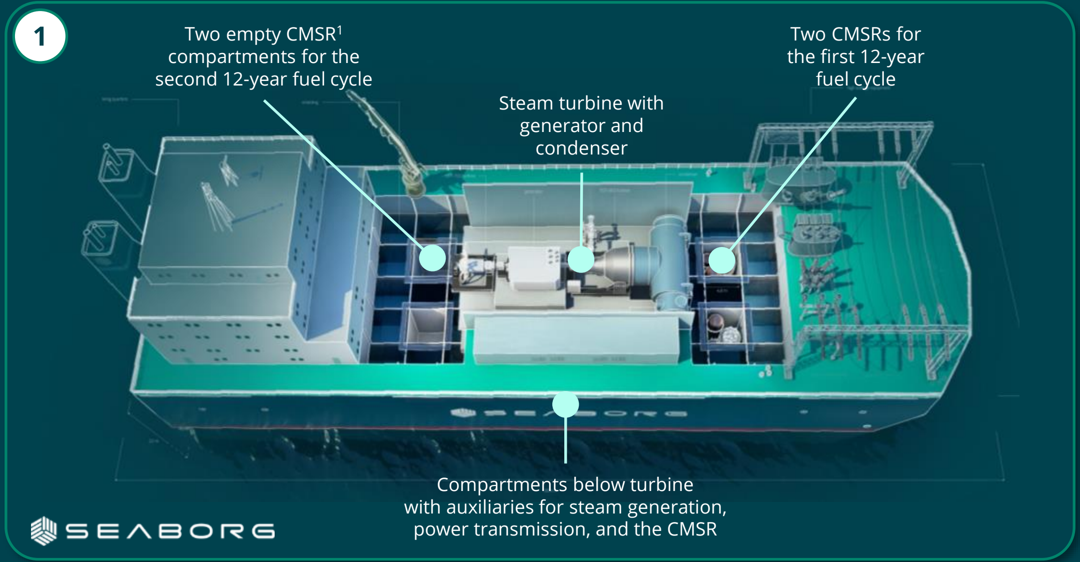
hyme Sustainable. Available.

Energy storage technology company set to deploy hydroxide salts as an inexpensive, grid scale energy storage system to complement renewable energy production, enabled by Seaborg's patented chemistry control technology.

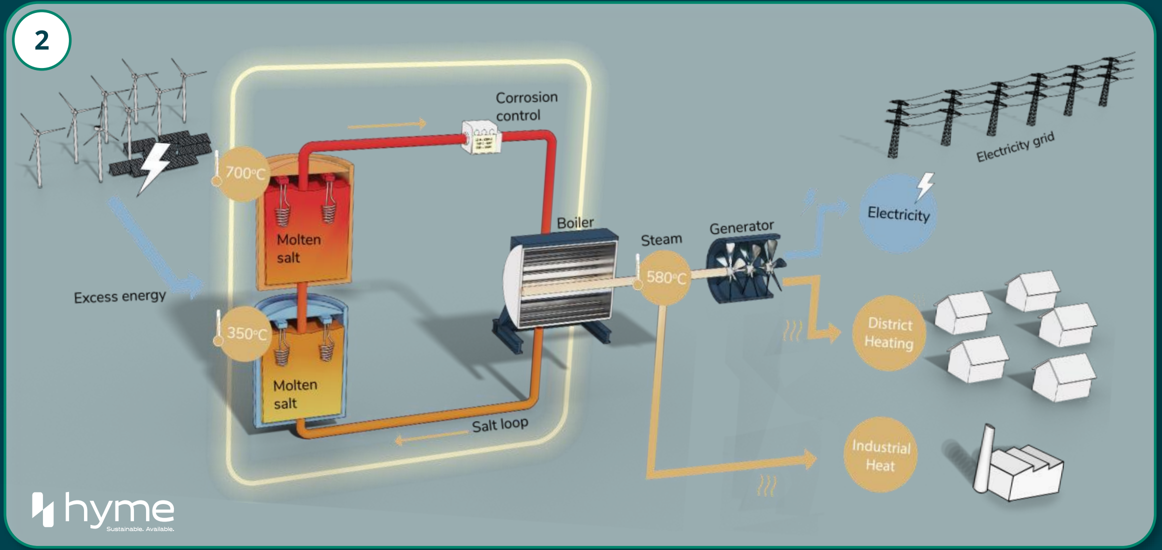
Introduction to Seasalt

Seasalt is comprised of two distinct entities

Nuclear energy technology company (Seaborg) developing a safe nuclear compact molten salt reactor to be deployed on power barges on a global scale



Energy storage technology company (Hyme) set to deploy hydroxide salts as a grid scale energy storage system to complement the energy transition



Note: 1) Compact Molten Salt Reactor

Seaborg in a Nutshell

Founded in **2014**

Privately held and privately funded

120+ employees

26 nationalities

30+ Ph.D.s in nuclear, chemistry and materials

HQ in **Copenhagen**, Denmark

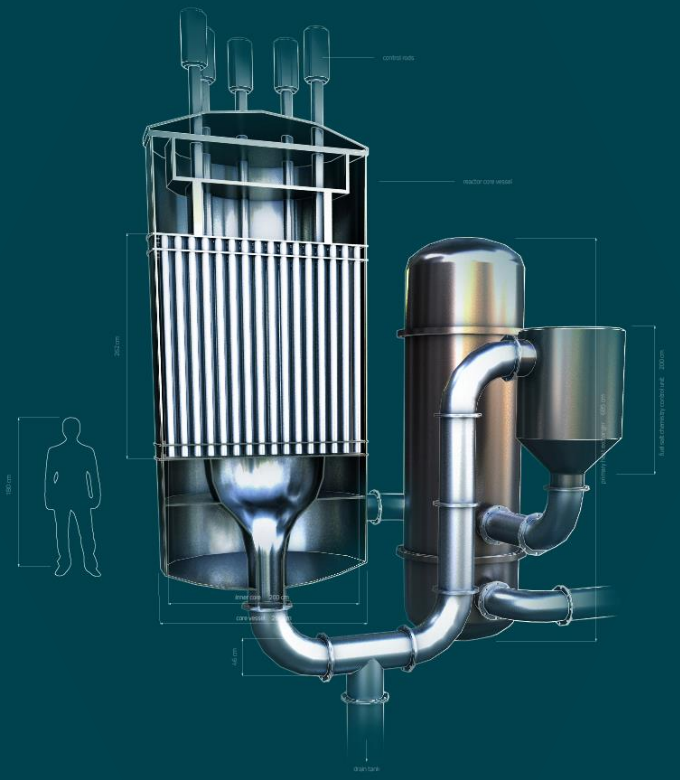
Business office in **South Korea**

Developing a 4th generation safe and affordable nuclear solution called the CMSR Power Barge

First deployment before 2030

Commercially deployed in 2030´s

The CMSR Power Barge



Developing

The Compact Molten Salt Reactor

Small modular nuclear reactor which has **inherent safety characteristics** due to the properties of the salt

Serial produced to achieve economies of scale and budget and schedule reliability

Long term vision of **fuel reprocessing** to minimize radioactive waste

Shipyard construction enabling a 3 years order to delivery cycle

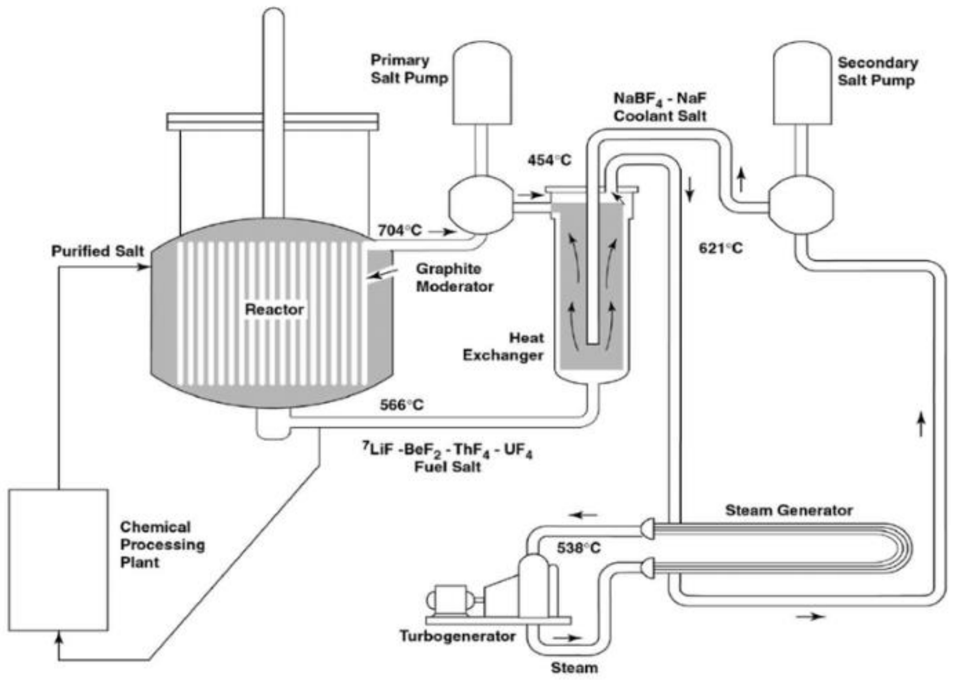
Deployed as

The CMSR Power Barge

MOLTEN SALT REACTORS VS. LIGHT WATER REACTORS

QUICK COMPARISON

The Molten Salt Reactor (MSR) is radically different from the conventional Light Water Reactor



NB! Generic MSR diagram – does not represent the CMSR

LWR/MSR Key Differentiating Characteristics

	Light Water Reactor	Molten Salt Reactor
Fuel	Solid uranium oxide (fissile) in the form of fuel pellets	Fissile material chemically dissolved in liquid carrier salt
Coolant	H_20 (Water)	Liquid carrier salt
Spectrum	Thermal	*Design dependent* (fast or thermal)
Fission products	Trapped within fuel rods under pressure (not removed)	Actively or passively removed + chemically dissolved in carrier salt
Refueling cycle	Typically every ~18 months with associated plant down time (off-line refueling)	*Design dependent* (ranging from online refueling to no refueling)
Operating temperature	~ 300 ºC	~ 600-700 ºC
Operating pressure	~ 150 bar	~ atmospheric
Typical thermal power output	~ 3000 MW	*Design dependent* (down to 10 MW scale)

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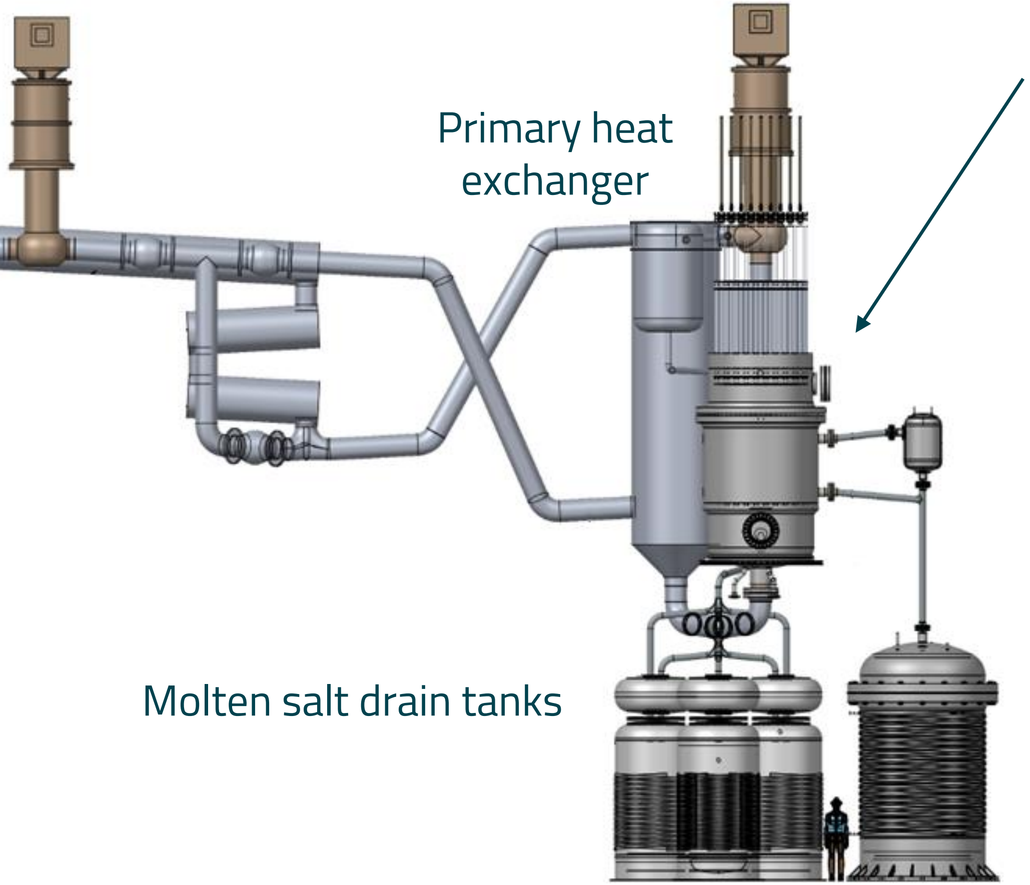
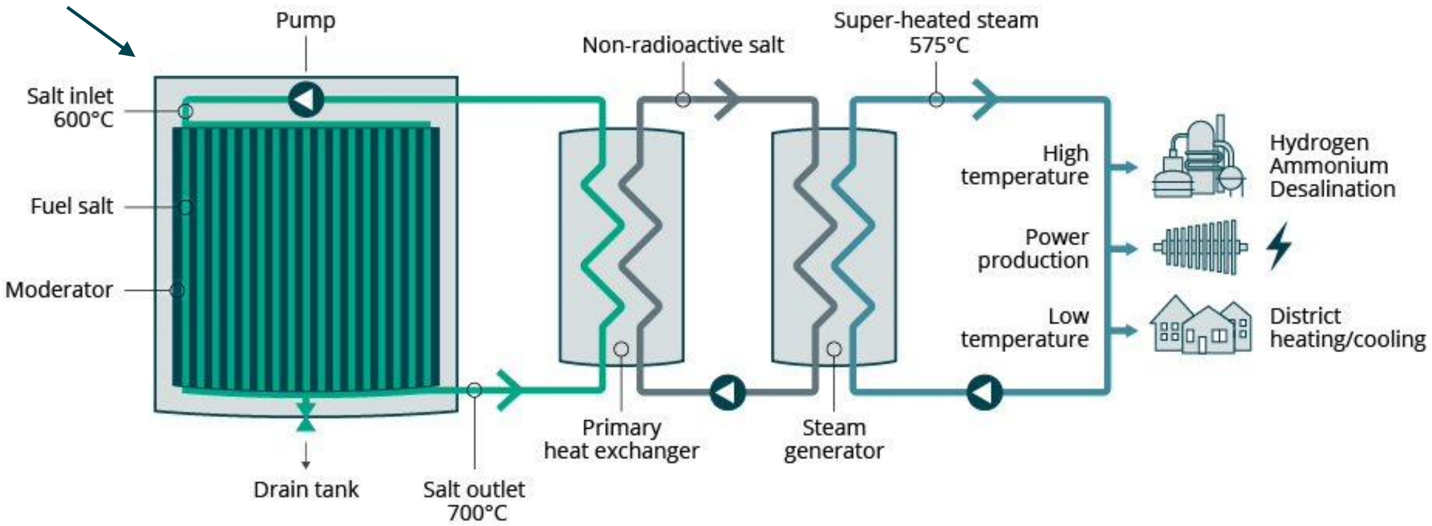
THE CMSR REACTOR – THE HEART OF THE POWER BARGE

REACTOR OVERVIEW



Heat produced via **nuclear fission** process and is generated in fuel salt in reactor core. Heat transported through a series of molten salt loops to steam cycle where heat ultimately converted to **electricity**.

Simplified reactor diagram

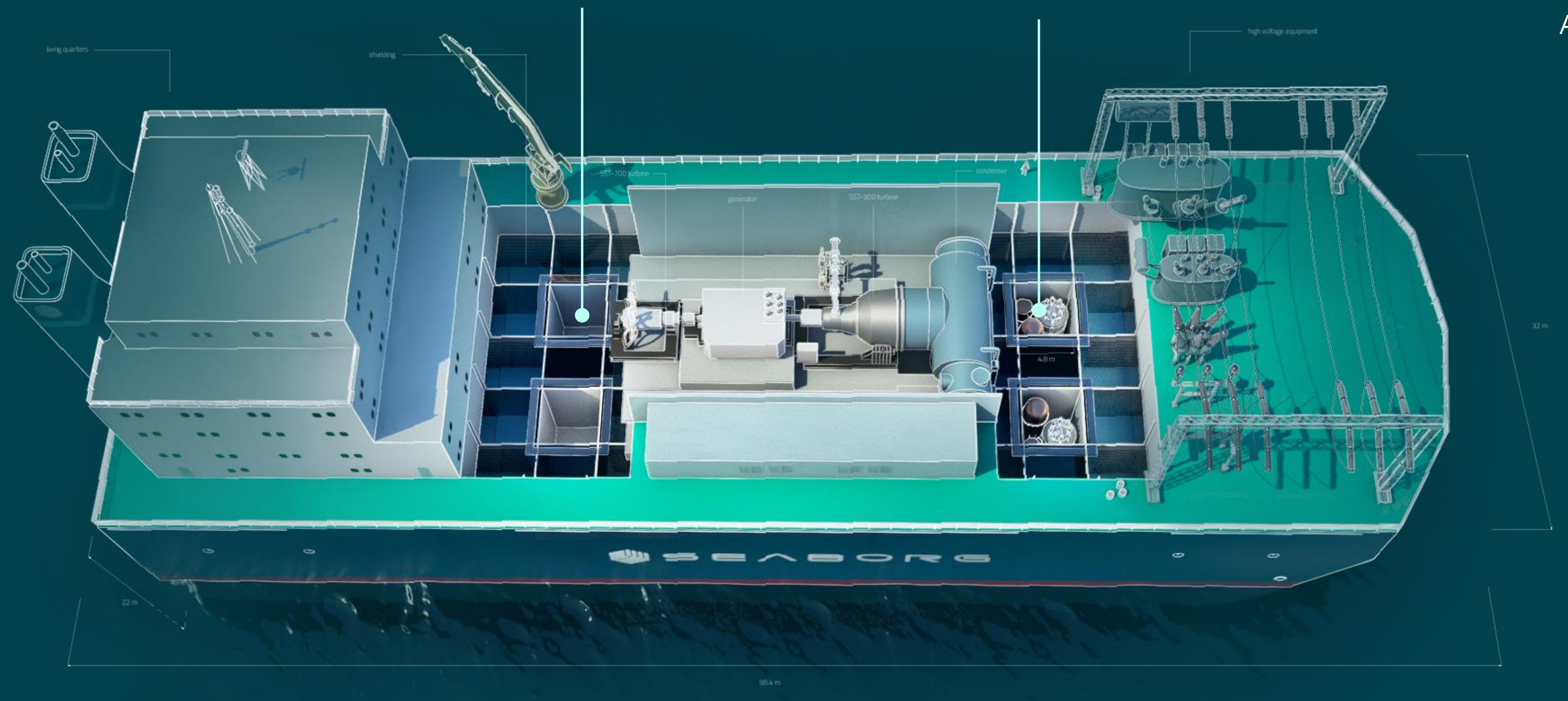


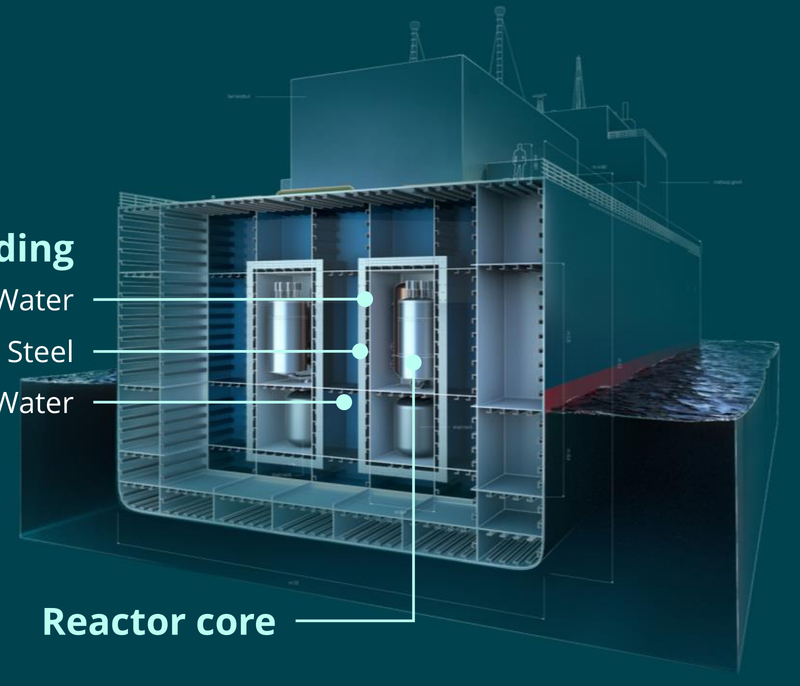
The CMSR reactor is being designed **after highest standards**, including,

- **Safety**, **security** and **safeguards** *by design*
- Neutronic and thermal-hydraulic **design of reactor core**
- **Mechanical design** (ASME-III-div5)
- **Architecture trade-offs** on plant and system level
- Neutronic and **process design** of off-gas unit

Inside the Power Barge

24 years operational life time





Commercial Consortium Agreement in place with key partners in the industry

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Nuclear energy technology company developing a safe nuclear compact molten salt reactor to be deployed on power barges on a global scale

SAMSUNG

SAMSUNG HEAVY INDUSTRIES

One of the **Big Three Shipbuilders** in the world.
SHI has 48 years of experiences in engineering, manufacturing, commissioning for vessels, including floating power plants.

KHNP

Worlds 3rd largest nuclear power operator
(≈25 NPPs[1] worldwide). Responsible for 32.6% of South Korea´s electric power supply.

The **Consortium Partners** joins one of the worlds **leading shipbuilders** (SHI) and **nuclear power operators** (KHNP) with Seaborg and together, the three companies cover and **add value to every step of the value chain**, to **deliver floating nuclear power barges worldwide**

CMSR → Power Barge → Fuel Cycle → Nuclear Test site → Nuclear test and commissioning → Regulatory and license → Operations and Maintenance → Decommissioning

Note: 1) Nuclear Power Plant

Applications extend far beyond supply of grid electricity

CMSR Power Barge → **Electricity** → **Grid**

Electricity → **Hydrogen** (H_2) → **Ammonia** (NH_3)

CMSR Power Barge → hyme (Sustainable. Available.)

- **Electricity Load Following**
- **Industrial heat**

Hydrogen:

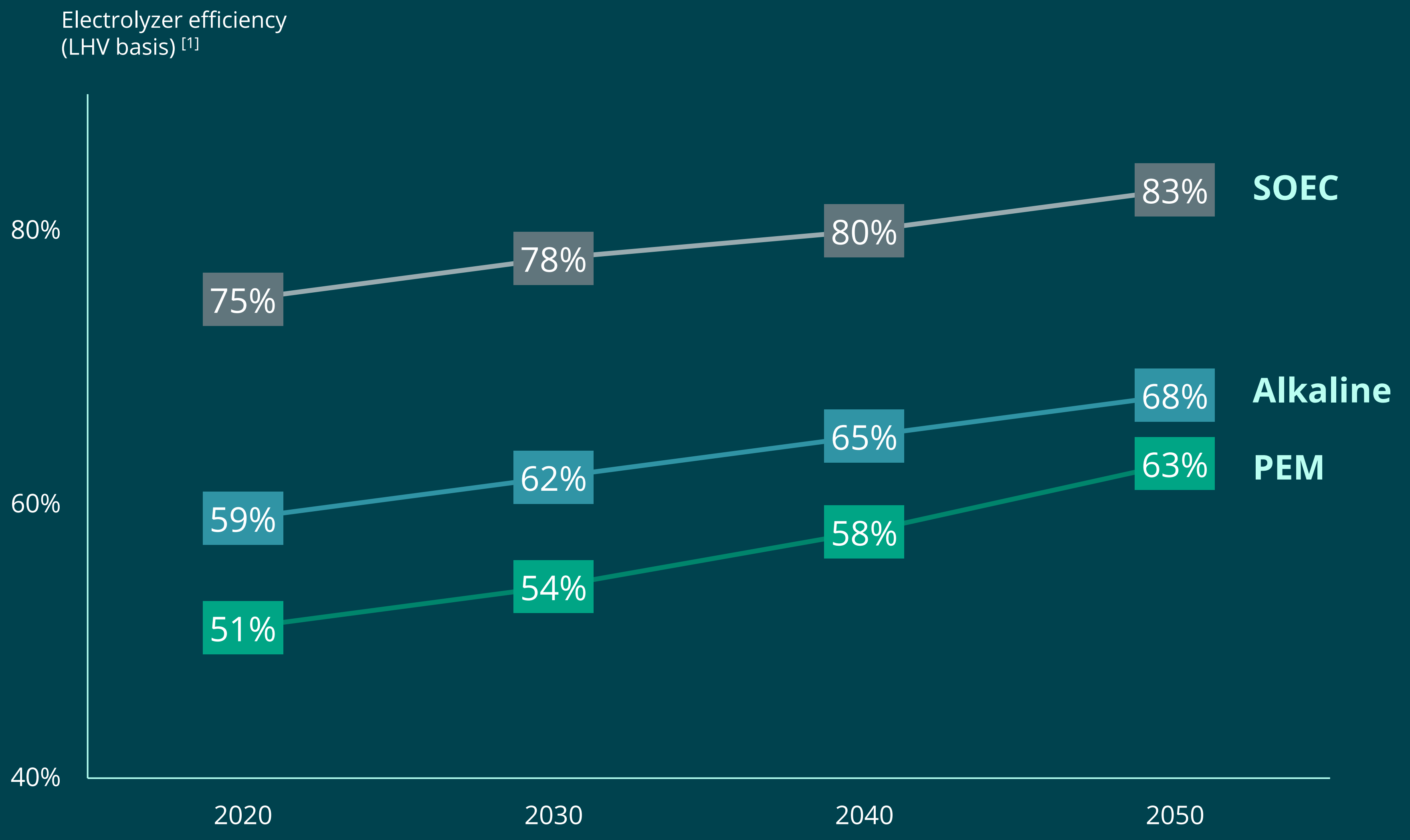
- **Industrial applications**
  Steel production and oil refining processes
- **Road and air transport**
  Fuel cells for cars, buses, and airplanes
- **Electricity re-generation**
  Blending hydrogen into the natural gas pipeline

Ammonia:

- **Energy carrier**
  Solving the transportation issue for hydrogen
- **Marine fuel**
  For ships and offshore units
- **Fertilizer**
  For use in agriculture

While delivering low-cost, high value electricity for the grid and competitively priced hydrogen and ammonia, Seaborg's applications unlock significant opportunities for in-country development and for becoming an exporter of clean energy products globally

Electrolyzer Efficiencies



[1] *Lower Heating Value*

Source: Maersk Mc-Kinney Moller Center for Zero Carbon Shipping – Position Paper – Fuel Option Scenarios

The electrolyzer efficiency is of high importance for the feasibility of PtX production.

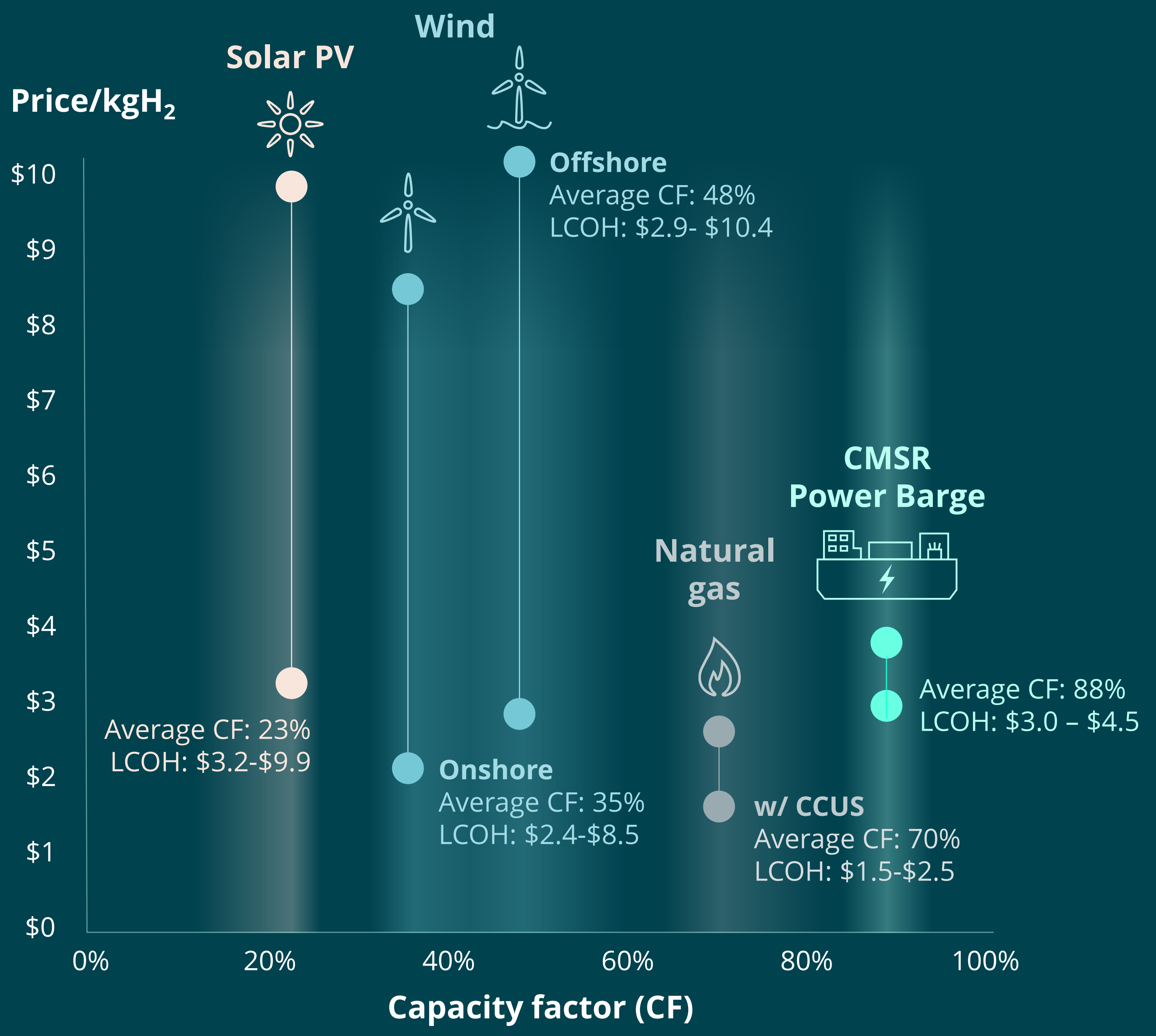
To achieve high efficiencies you also need high availability of the power source.

↑ Efficiencies = ↓ LCOH

The cost of hydrogen production depends on the capacity factor of the generation source.
The **higher the capacity factor**, the **lower the LCOE**, which allows production of hydrogen at lower costs.

	Capacity factor	LCOE $/MWh	LCOH $/kgH$_2$
CMSR Power Barge	**88%**	**65 - 85**	**3.0 – 4.5**
Natural gas	70%	37.8 – 100	1.5 – 2.5
Wind (onshore)	35%	29 – 155	2.4 – 8.5
Wind (offshore)	48%	45 – 200	2.9 – 10.4
Solar PV	23%	34 – 172	3.2 – 9.9

Sources: Lazard. Levelized Cost of Energy Analysis (2020); OECD-NEA (2020)



Source: Energy Option Network. Zero-Carbon Hydrogen: An Essential Climate Mitigation Option (2020)

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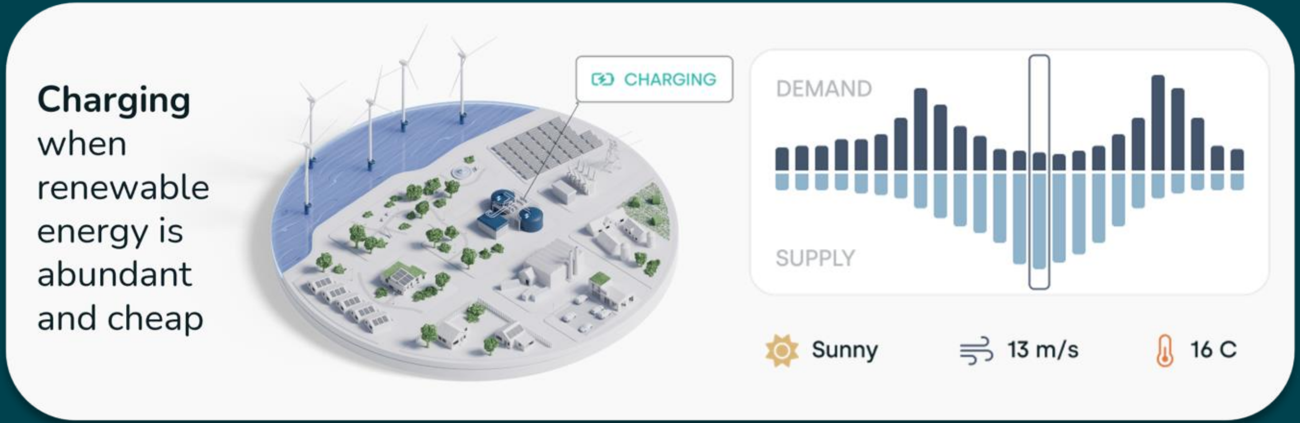
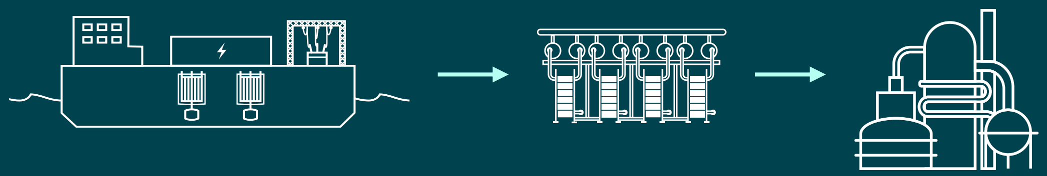
Nuclear in combination with PtX can support renewables

When renewables are cheap and abundant (during the day), the CMSR Power Barge provides 100% electricity to Power to X production

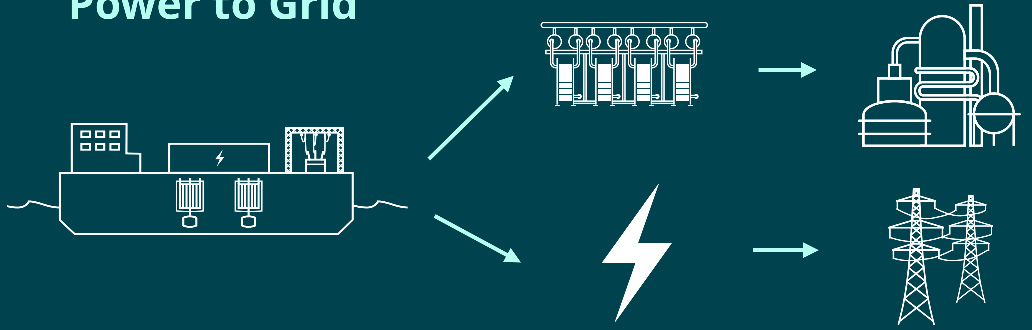


Power to X



During peak hours without renewable energy supply, the CMSR Power Barge can ramp down to Power to grid.
An 800 MWe CMSR Power Barge can ramp down from 100% to 80% PtX, providing 160 MWe reserve capacity to Power to Grid when needed

Power to Grid



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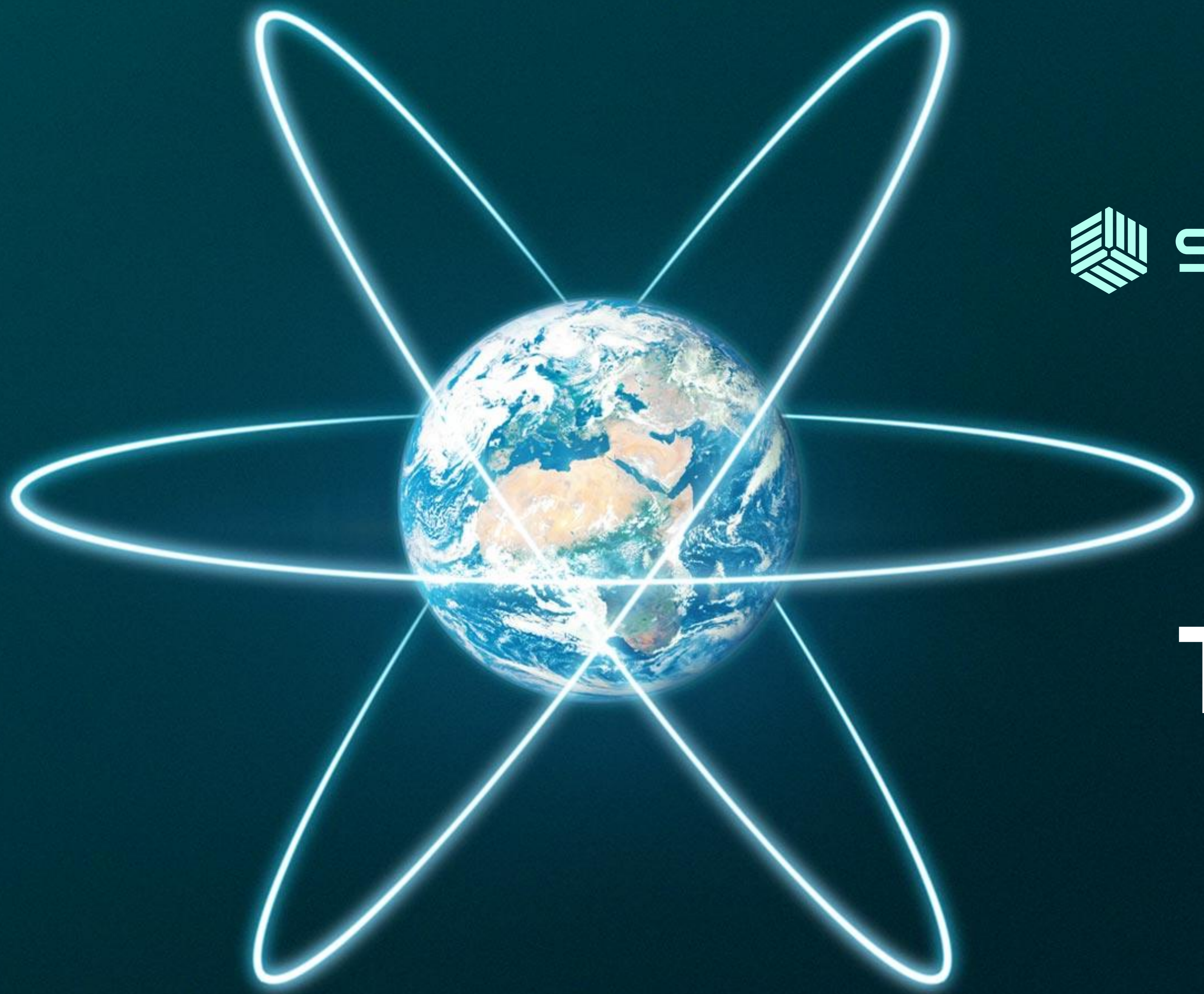
Nuclear in the green taxonomies

Jurisdiction	Status	Effective	Detailed comments
EU	Included in EU taxonomy	27th June 2023	Gen IV and sunset on lifetime extensions ('40) and new builds ('45)
EU	Nuclear not part of RED II	30th March 2023	
EU	Nuclear not mentioned in Green Deal / REPowerEU	2023	
Korea	Included in K-taxonomy	23rd September 2022	All nuclear included, but more focus on SMRs
China	Included in Green Bond Endorsed Project Catalogue	21st April 2021	All nuclear included
UK	Nuclear excluded from green financing		
US	No joint taxonomy, but…		IRA included financing for nuclear
US	IRA hydrogen from nuclear should qualify		But some projects still waiting for final confirmation



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Thank you

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