



Thermal-Mechanical-Chemical Energy Storage Workshop 2024

Eric Watson, Director of Sales, North America

WE HAVE BEEN READY SINCE JUNE 2022

First 2.5MW Plant successfully operational
and Grid Connected for over 2 years

Over 2 years of plant operation have
confirmed:

- Maturity of the technology
- Performance validated by

FICHTNER

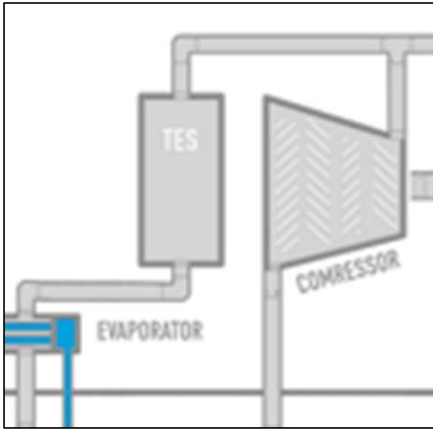
EPRI



The Commercial Demo Plant



Thermal Energy Storage System (TES), Designed by Energy Dome, TRL 7+



Efficiency/Performance maximized via recovery of heat of compression in the TES system

Our Solution = Packed Particle Bed using inert material

- No moving parts, completely recyclable
- Highly efficient, on expansion CO_2 after the TES is only 5°C less than the original inflow from the compressor

Lab Scale Testing
with Politecnico of
Milan in 2021



POLITECNICO
MILANO 1863



FIRST FULL-SCALE CO2 BATTERY

Commissioning in Q4 2024. Location: Ottana, Sardinia, Italy

Standard CO2 Battery
20 MW / 200 MWh
Status: In Construction

Commercial Demo Plant
2.5 MW – 4 MWh
Completed: June 2022

FIRST FULL-SCALE CO2 BATTERY

1

95%+ of all equipment has been ordered. 18 MW Turbine is in transit. 24 MW Compressor has been delivered.

2

Foundations, anchors, and all civil works are nearing completion.

3

Mechanical assembly of the dome has begun. Inflation expected in September.

4

Transformer has been manufactured and successfully tested.

5

First funding tranche from Breakthrough Energy Ventures has been unlocked

6

On-Track for system-wide commissioning in Q4 2024. Operational data and commercial operation to follow shortly.

COLUMBIA ENERGY STORAGE PROJECT

Notice To Proceed in Q4 2024. Location: Columbia Co., Wisconsin, USA

July 2024: Contract signed
between Alliant Energy &
DOE for up to \$30.7M

Standard CO2 Battery
20 MW / 200 MWh
Status: NTP Q4 2024



Full-Scale Plant – Wisconsin

- 20MW / 200MWh
- Partnership with Alliant Energy in Wisconsin
- Operational by 2026
- Selected by US DOE for 50% cost-share
- Installed on a retiring coal facility in WI
- US supply chain for ITCs and cost reduction

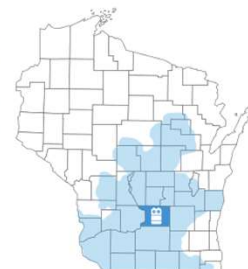
DOE: Columbia Energy Storage Project



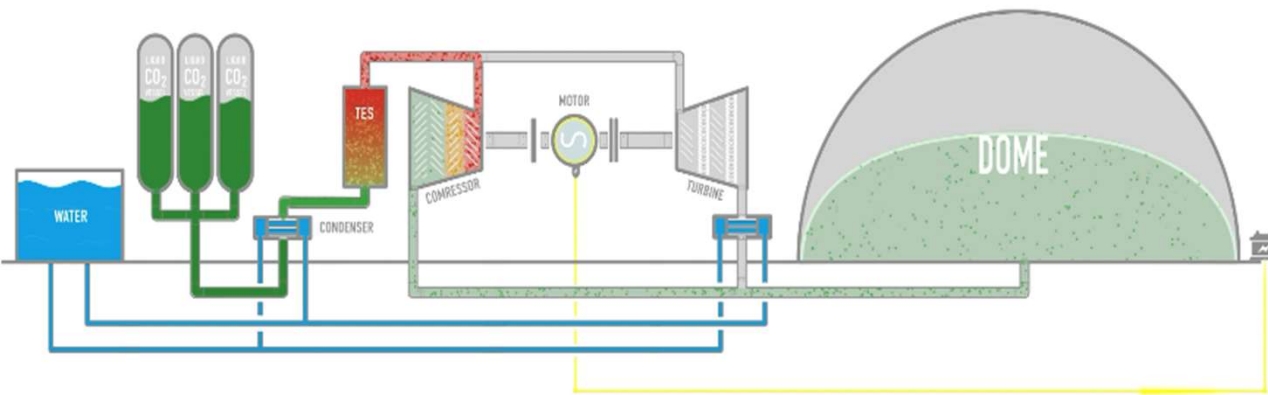
Long-Duration Energy Storage Demonstrations Projects Selections for Award Negotiations

Office of Clean Energy Demonstrations

Alliant Energy and its project partners, including WEC Energy Group, Madison Gas and Electric, UW-Madison, Madison College, Shell Global Solutions US and the Electric Power Research Institute, are teaming up to construct one of the first carbon dioxide-based energy storage systems in the United States, in Wisconsin.



How it works



3 Main States

1 Charging

- CO2 withdrawn from atmospheric gasholder (Dome), and compressed by inter-refrigerated compressor
- Heat generated from compression stored into Thermal Energy Storage System (TES)
- CO2 is condensed into liquid state

2 Idle

- Liquid CO2 stored at ambient temperature in CO2 vessels

3 Discharging

- Liquid CO2 is evaporated and heated by recovering heat from TES
- Reheated CO2 expands in turbine, returning power to the grid
- Gaseous CO2 is stored in Dome at ambient temperature and pressure without emissions to atmosphere

How it works (Video)

[Click here for animation in pdf](#)

Why CO₂?



CO₂ can be stored as a liquid at ambient temperatures in carbon-steel pressure vessels, no cryogenics or chillers needed



CO₂ is a clean fluid. In comparison, air needs to be filtered/managed for pollutants and needs moisture control, CO₂ in closed loop doesn't need conditioning



CO₂ is not corrosive or erosive. Ideal for turbomachinery, less maintenance needed relative to operating similar machinery with air.



CO₂ is widely available. No need for rare earth metals or electrolyte



NOT JUST A STARTUP

Experienced group of people that have been working together for **10 years** delivering disruptive innovation to the energy market



EXERGY

Innovative inhouse development of the innovative **Radial Outflow Turbine**

50+ Turbines Installed and Currently Operational

Design and built of **500+MWe** of Geothermal, WHR and CSP Power Plant



SEBIGAS

Design, construction and management of biogas plants worldwide with a reference list of **80+ biogas plants**

Investors backing Energy Dome – €135m raised

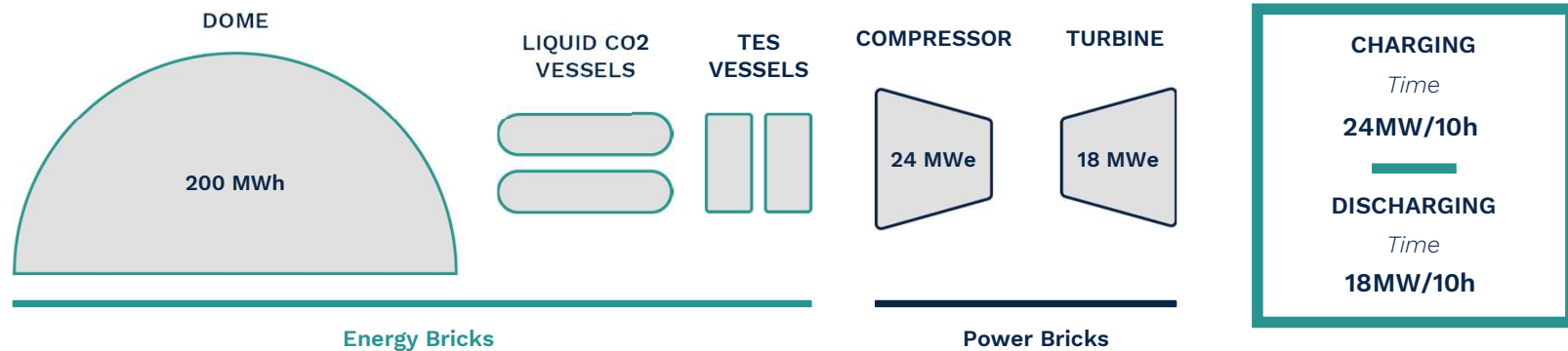




Long Duration, High RTE, Low Cost, Ready-to-Build

Standard Configuration

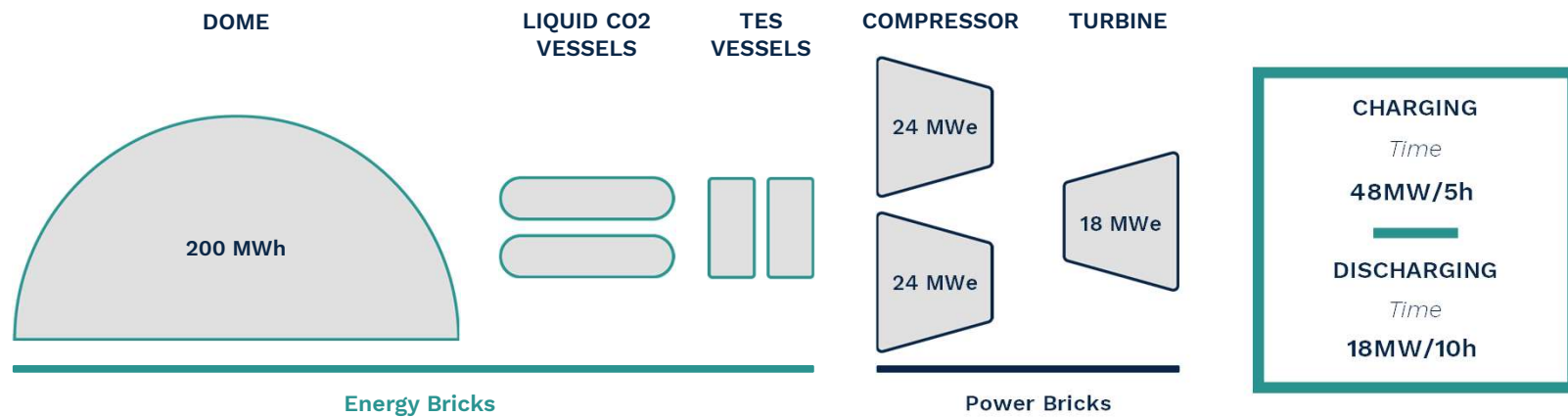
20MW/200MWh Frame



Site-Independent Design (Wind resistance, snow load, seismic)



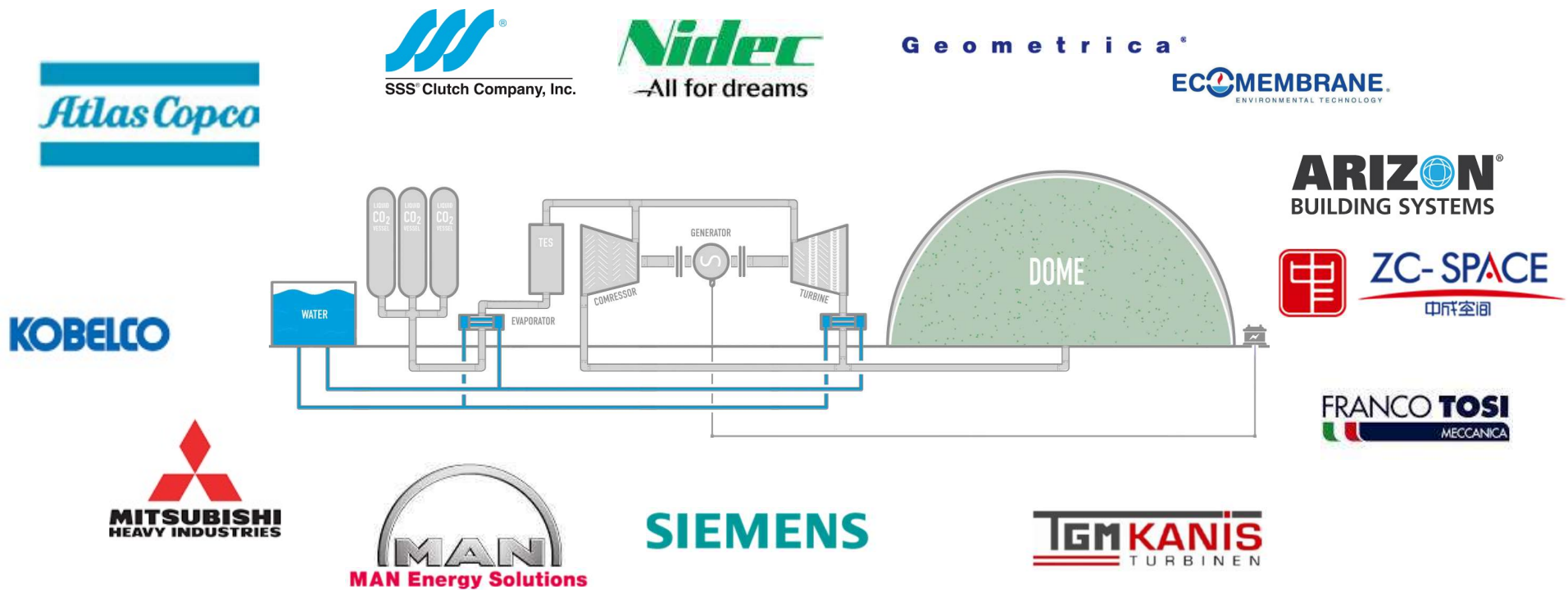
Double-Compressor Configuration



Global and Resilient Supply-Chain



All Readily Available Off-the-shelf components

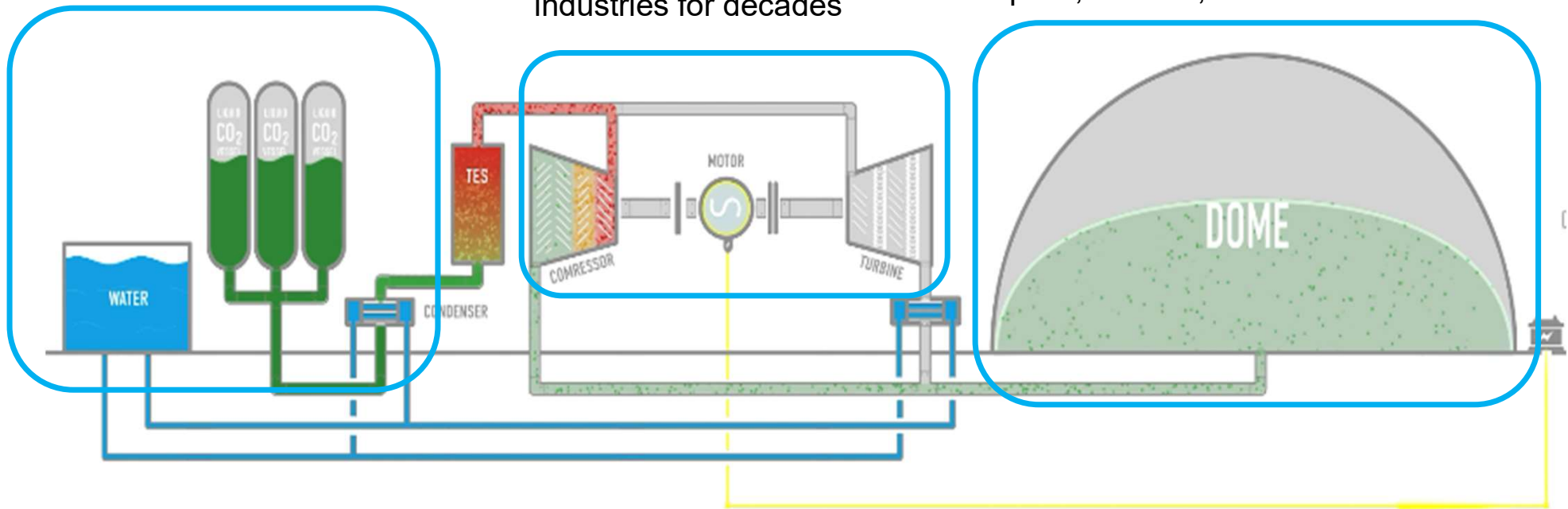


Maturity Level of Major Components is High (TRL 9)

Heat Exchangers, Water and Liquid CO₂ tanks are standard equipment globally, carbon-steel

Compressors, turbines, are firmly established in multiple industries for decades

Dome technology firmly established:
Inflatable structures (e.g. tennis halls),
Biogas applications, as coverings for coal piles, landfills, etc.



The CO2 Battery is highly competitive against other storage technologies

		Lithium-Ion Battery	Pumped Hydro	CAES
BOP RTE	75%	80-85%	~70-75%	60-62%
EOP RTE	75%	68-73%	~70-75%	60-62%
CAPEX	\$225-\$250/kWh	Highly volatile, \$350/kWh	Highly dependent on site conditions	Highly dependent on site conditions, FOAK COD still far away
LIFETIME	30+ y	10 y	50 y	40 y
TIME OF IMPLEMENTATI ON	1 – 2 y	1 – 3 y	5 – 7 y	5 – 7 y
SUPPLIER LOCALIZATION	WORLD	80% CHINA 20% WORLD	WORLD	WORLD



ENERGYDOME

Our WORLD can't wait.

Thank you



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