

# Unlocking utility-scale long duration energy storage: CO2 Battery Update.

TMCES Storage Workshop  
Alexandria, VA  
August 3, 2022

Joseph Ferrari  
[J.Ferrari@EnergyDome.com](mailto:J.Ferrari@EnergyDome.com)



Low Cost



Efficient



Fast to Market



# Energy Dome in the News



## Energy Dome Successfully Launches First CO2 Battery Long-Duration Energy Storage Plant in the World

With the launch of their commercial demonstration facility in Sardinia, Italy, Energy Dome's energy storage technology is ready for market

June 08, 2022



### Energy Dome scores first licensing agreement for CO2 battery

By Cameron Murray  
March 11, 2022

Europe Commercial Connected Technologies Grid Scale Products Technology

LinkedIn Twitter RSS Facebook Email

**POWER**

News & Technology for the Global Energy Industry



Feb 1, 2022  
by Darrell Proctor

Energy Storage

### Italian Group Taps CO2 for Energy Storage

ALSO IN THIS ISSUE  
February 1, 2022

CANARY MEDIA

Energy Dome is the rare long-duration storage firm that's moving fast

## Bloomberg NEW ENERGY FINANCE

Energy Dome named BNEF Pioneers 2022 Winner



Advertising Contact

Home News Commercial Residential Grid Scale Off Grid Market Watch Connected Tech

NEWS

### 'CO2 Battery' startup Energy Dome gets US\$11m financing, first agreement to deploy 100MWh project

By Andy Colthorpe  
December 1, 2021



#### Instant Long Duration Energy Storage: Just Add Carbon Dioxide

Carbon dioxide gets a workout in this new long duration energy storage system that can deliver wind or solar power 24/7.

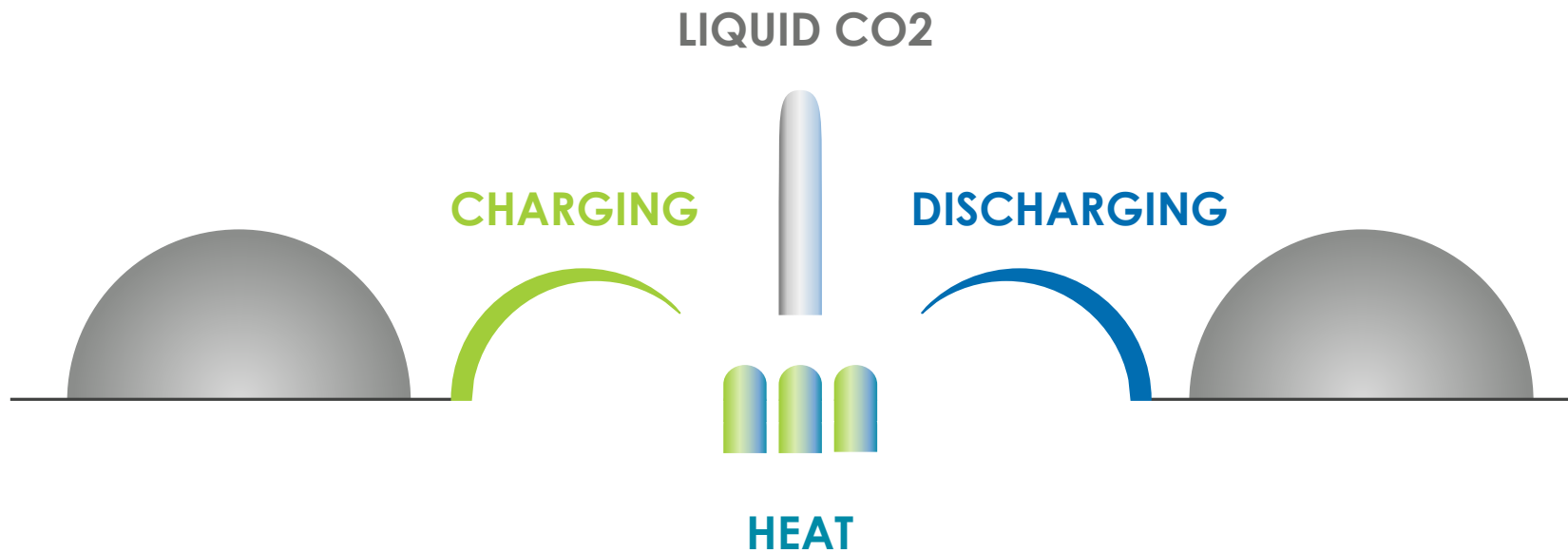
By The Daily Pulse April 22, 2022 28 Comments

Carbon dioxide is getting a bad rap these days, but even a molecule that contributes to global warming can help in the fight to avoid a climate catastrophe. A case in point is long duration energy storage, which is the key to shoehorning more wind and solar energy into the grid, more quickly.

an most loved electric vehicle owner energy and battery need & should use in the world



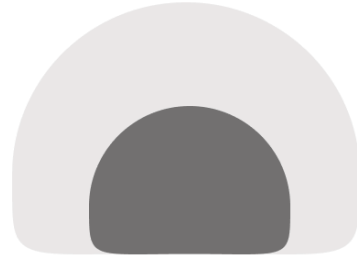
# Our product & tech: The CO<sub>2</sub> Battery



Innovative **large scale long duration energy storage** solution, based on the principle of **manipulating and storing CO<sub>2</sub> in different state conditions**

- Innovation in **process**, not components
- CO<sub>2</sub> as the **perfect working fluid**: Critical temperature 31°C
- Multiple patent families filed & patent strategy in place: **1<sup>st</sup> patent in Feb '19, 6 others filed** and pending approval

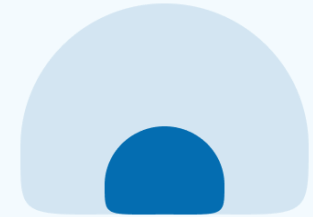
# The **CO2** an ideal working fluid



**AA-CAES**



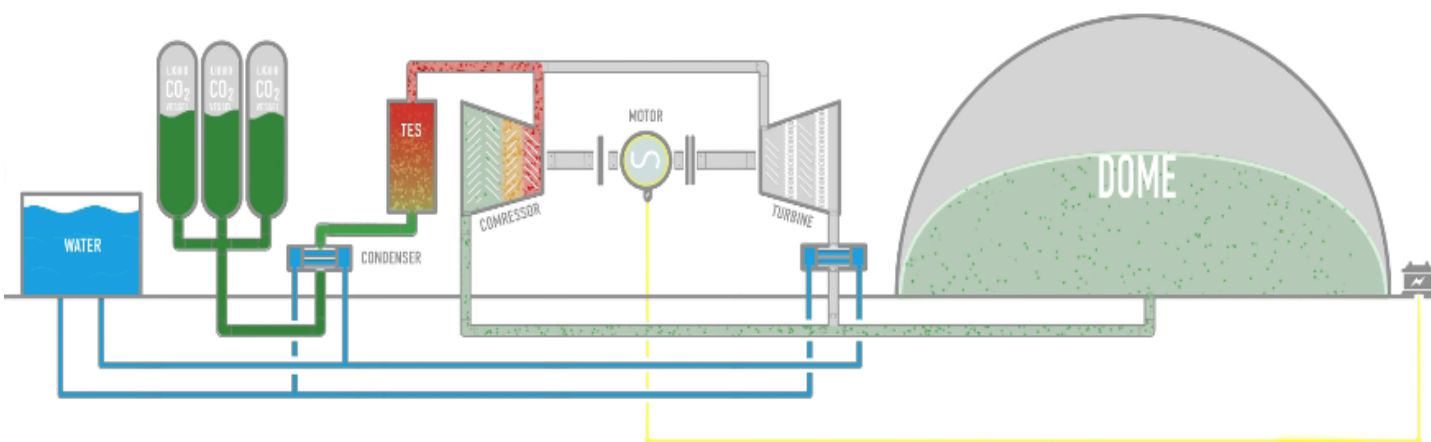
**LAES**



Starting	1 kg of Air	1 kg of Air	1 kg of CO2
Volume at ambient conditions	0.82 m3	0.82 m3	0.55m3
Pressure at Storage conditions	High (70 bar)	15 bar	High (70 bar)
Temperature in storage conditions	Ambient	-190°C	CO2 = Ambient
Volume at Storage conditions	12 liters	1.1 litres	1.3 litres
Energy Storage Density	2-6 kWh/m3	107 kWh/m3	66.7 kWh/m3

**SMALL STORAGE VOLUME AT  
AMBIENT TEMPERATURE  
RESULT IN LOW CAPEX**

# 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

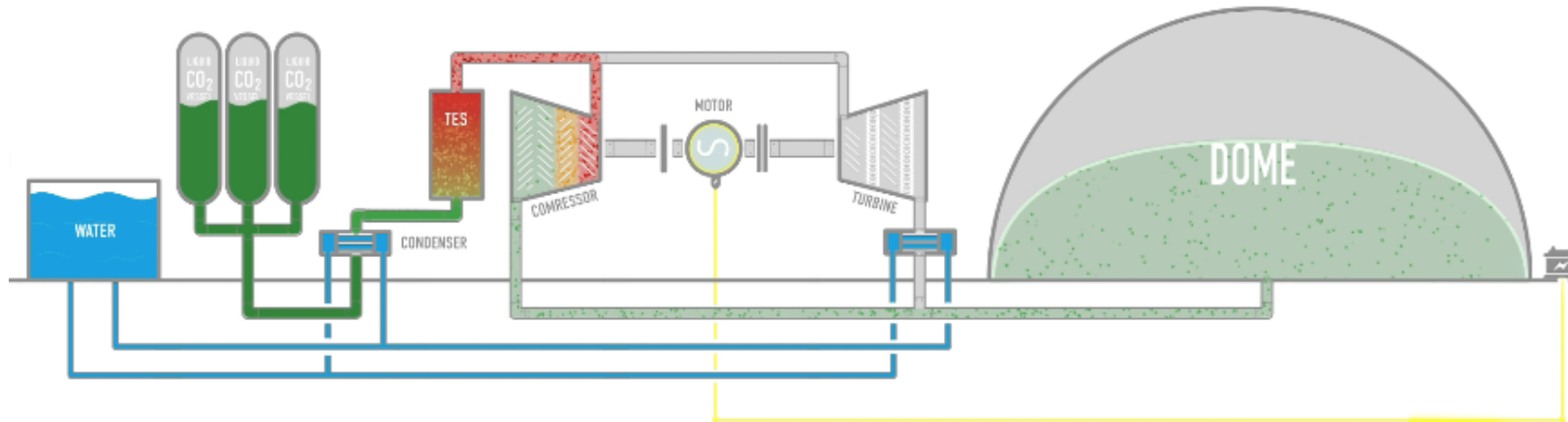
### 3 Discharging

- 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

# Tried and tested off-the-shelf components



Geometrica®







Fastest to market

# Within <2 years, Energy Dome has completed commercial demo plant and signed first contract

Commercial adoption in market

Early 2019

Feb 2020

2Q21

4Q21

May 2022

2023

Patent families  
filed

Start of operations

1<sup>st</sup> commercial  
contract signed  
with Ansaldo  
Energia

Series A closed at  
\$11M

Commercial  
demo in  
Sardinia  
operational

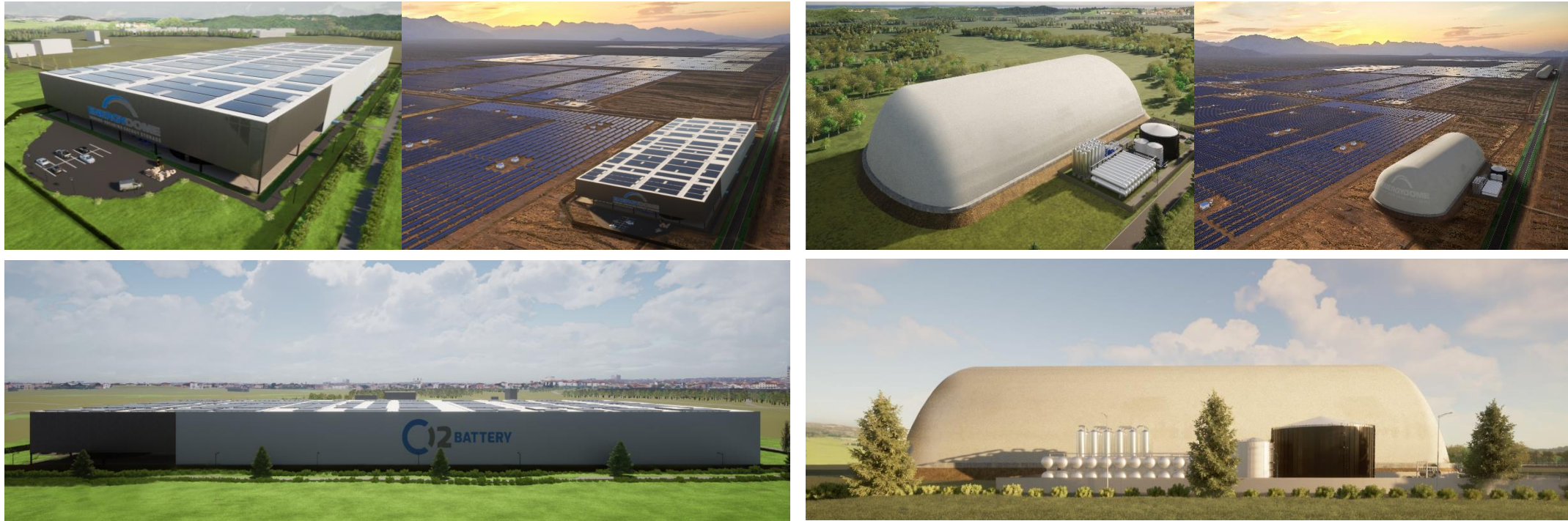
2-3 projects  
to get the  
product  
established in  
market

<2 years





# The general arrangement



Rendering of a 100MWh CO<sub>2</sub> Battery



# DEMONSTRATION PLANT

**2.5MW/4MWh**

**Commissioned  
May 2022**





**Joseph Ferrari (Sales Director USA)**

[j.ferrari@energydome.com](mailto:j.ferrari@energydome.com)

**301-401-9219**



[www.energydome.com](http://www.energydome.com)



[@energy dome](https://www.linkedin.com/company/energydome)

## **HEAD OFFICE**

**Via Giovanni Durando 39  
Milano, MI 20158  
Italy**

## **UK OFFICE**

**The Blade  
Abbey Square  
Reading RG1 3BD**

