

# Long Duration Energy Storage - Gravity

Sandia National Labs - March 2021

Andrea Pedretti, CoFounder & CTO



**ENERGY VAULT**

Enabling a Renewable World

# Technology Comparison

45% - 55%



~50-60%



60-70%



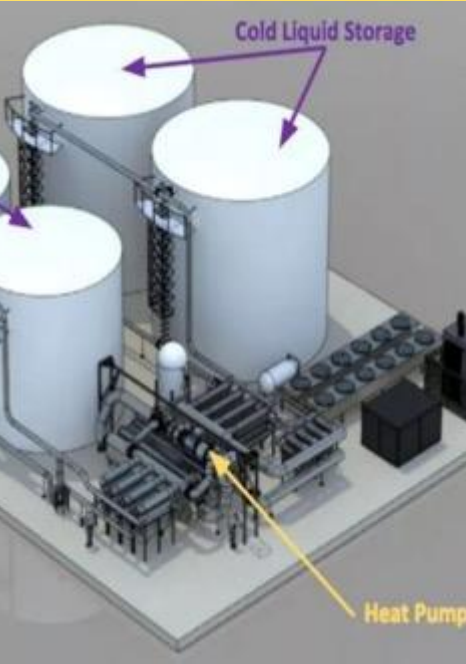
> 82%+



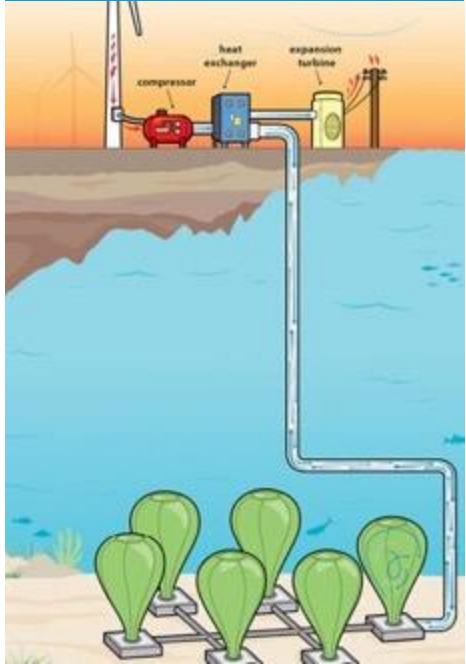
87-89%



**Thermally**  
Hot or Cold Storage



**Mechanically**  
Compressed Air



**Mechanically**  
Pumped Hydro



**Mechanically**  
Energy Vault (CDU)



**Chemically**  
Batteries of All Types



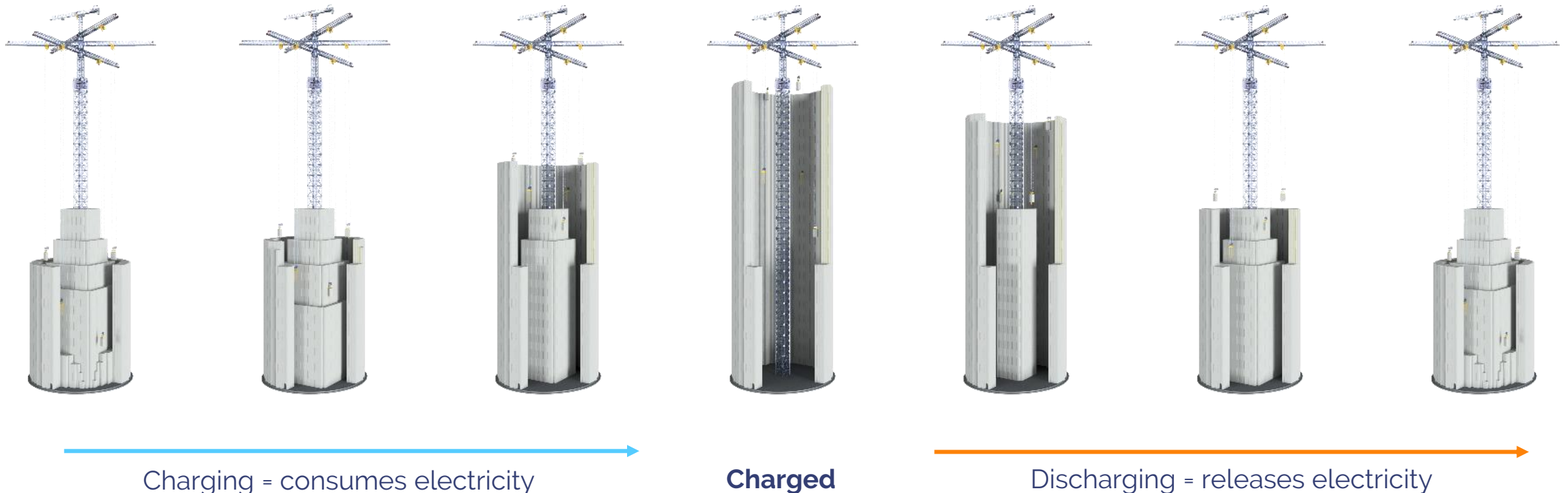
# Gravity Energy Storage - How does it work?

EV<sub>1</sub> Product

Power: 5 MW  
Energy: 35 MWh

Using gravity and kinetic energy to charge, store, and discharge energy

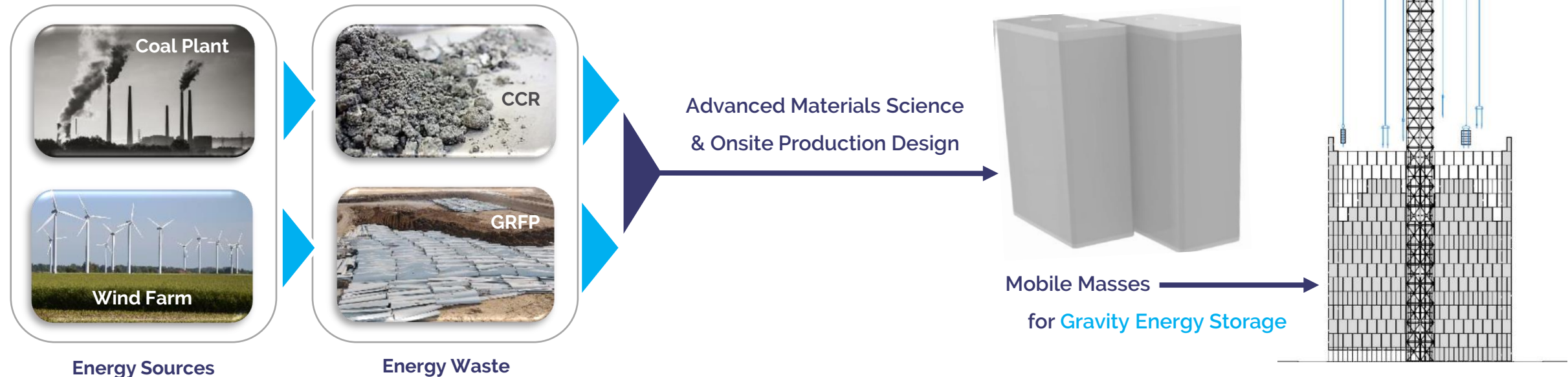
- Energy Vault places bricks, one top of another, to store potential energy and lowers bricks back toward ground, to release energy
- Fully automated 6-arm crane operated by software, provides up to 5 MW of electricity without interruption
- Can charge and discharge between 4 and 50 hours depending on product and customer needs



# Waste to Energy Storage Opportunity

Converting environmental liability to value via beneficial reuse of waste materials

**Energy Vault** is the only energy storage solution that repurposes **coal combustion residuals (CCR)** and **glass fiber reinforced plastics (GRFP)** to manufacture proprietary, advanced materials to manufacture the mobile masses that comprise the system.



# Gravity Energy Storage

Energy Vault offers **gravity-based energy storage solutions** that are transforming the world's approach to delivering reliable and sustainable electricity.

## Value Proposition

Energy Vault's technology helps Load Service Entities, Independent Power Producers and Large Energy Users, that need affordable, sustainable and dispatchable power, by reducing their green energy and storage procurement cost.

## Advantages

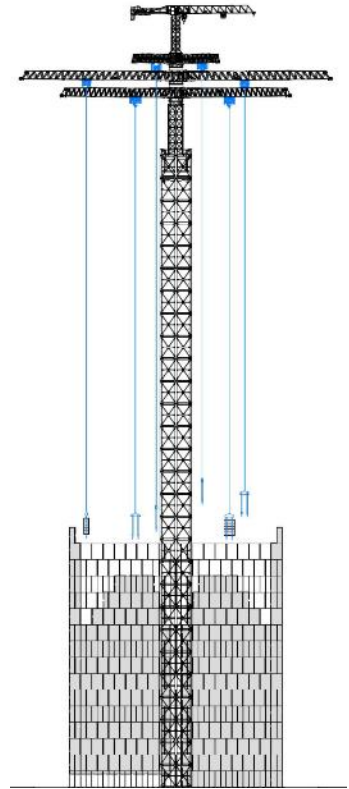
- no storage medium degradation >> *lower Capex and Opex*
- no end-of-life disposal issues >> *lower environmental impact*
- no fire and hazardous gas risks >> *higher level of safety*
- leveled cost of storage 40% lower than equivalent Li-ion solution.

## Applications

- Renewable shifting
- Peaking capacity replacement
- T&D investment deferral
- Microgrid resiliency

## Environmental Remediation

Energy Vault provides the **unique opportunity to remediate environmental liabilities at low cost** by sequestering waste materials into the large bricks and beams used in the storage system.



### Proven Technology

fundamental physics combined with proprietary automated control software



### Environmental Remediation

opportunity to sequester waste material for mobile mass production



### Best In Class Economics

40% lower LCOS; 100% automated operation with minimal OpEx



### Unmatched Performance

35+ year life with zero degradation & up to 85% round trip efficiency



### Flexible - Modular Scalable

portfolio of solutions from power applications to long duration storage (10+hrs)

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1<sup>ST</sup> Commercial Scale Unit -  
Mechanically completed in  
July 2020  
Power: 5 MW  
COD: Sep 2020