



Redoxblox, Inc.

Thermal-Mechanical-Chemical Energy
Storage Workshop

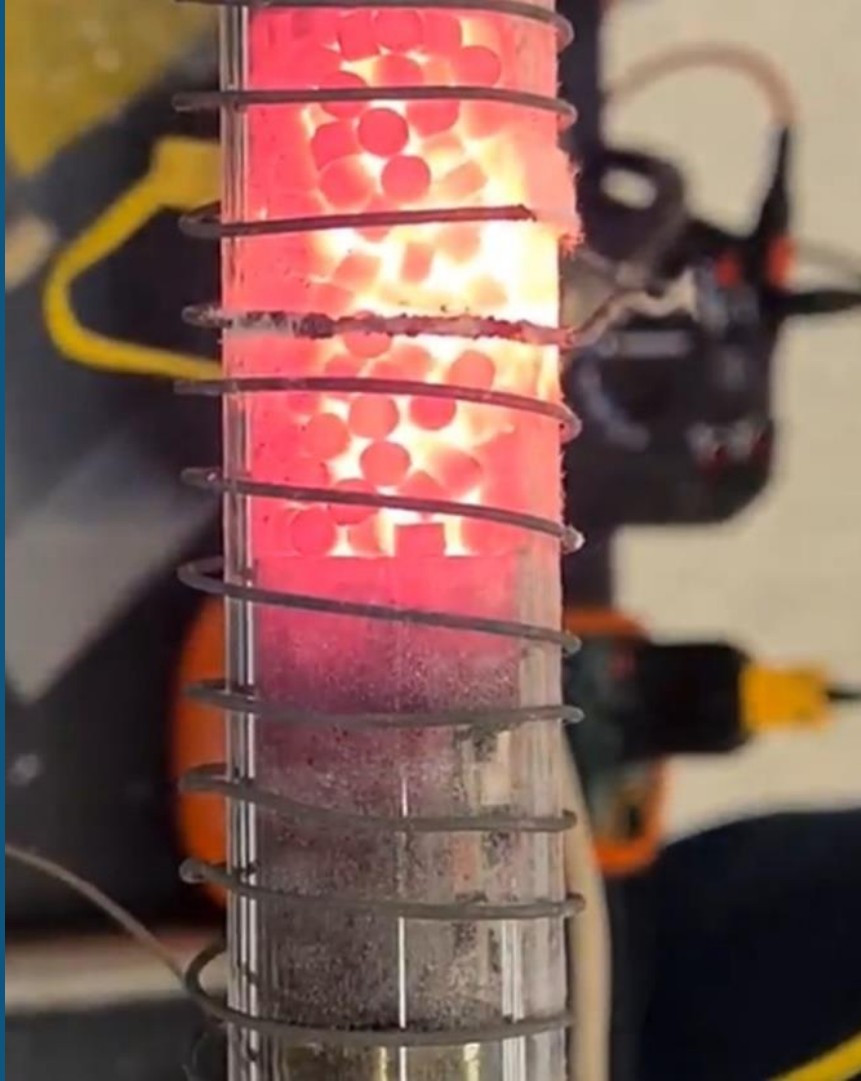
System Level Solutions to Global Decarbonization

Dane Boysen, CEO

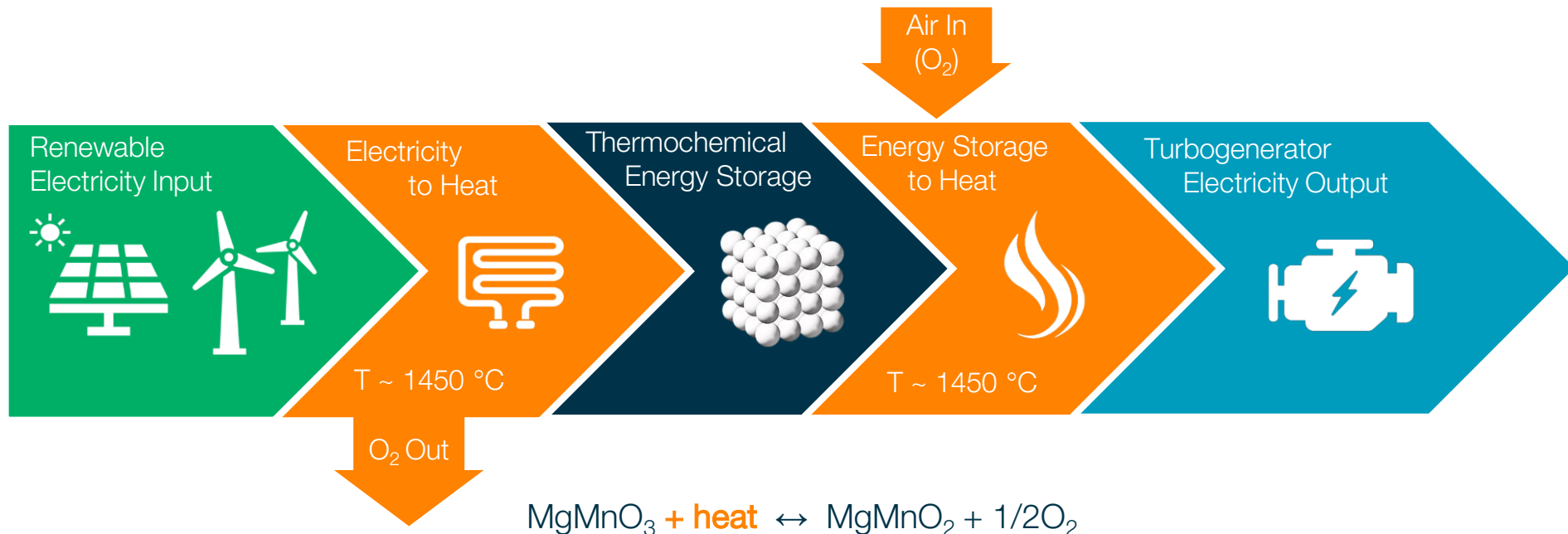
James Klausner, Executive Chairman

Joerg Petrasch, CTO

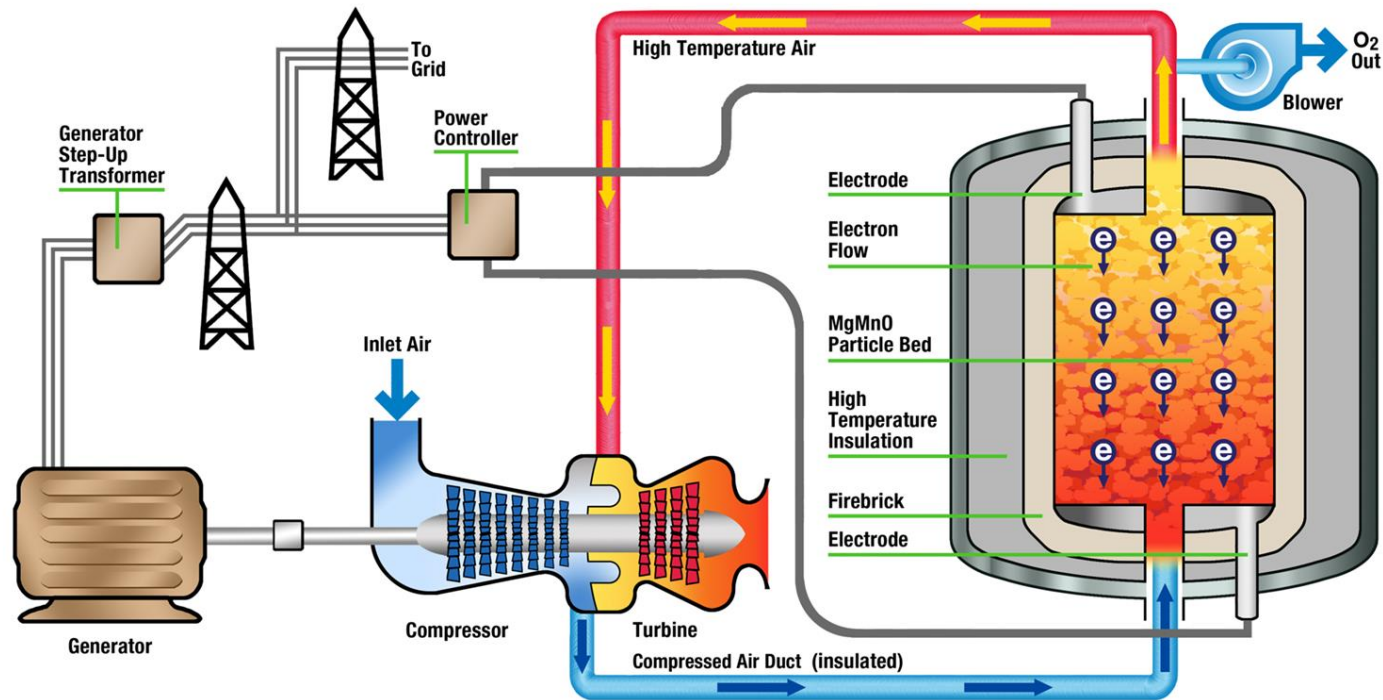
August 3, 2022



“thermochemical battery”



how does it work?



grid storage
~ 55%eff

electricity



heat



store

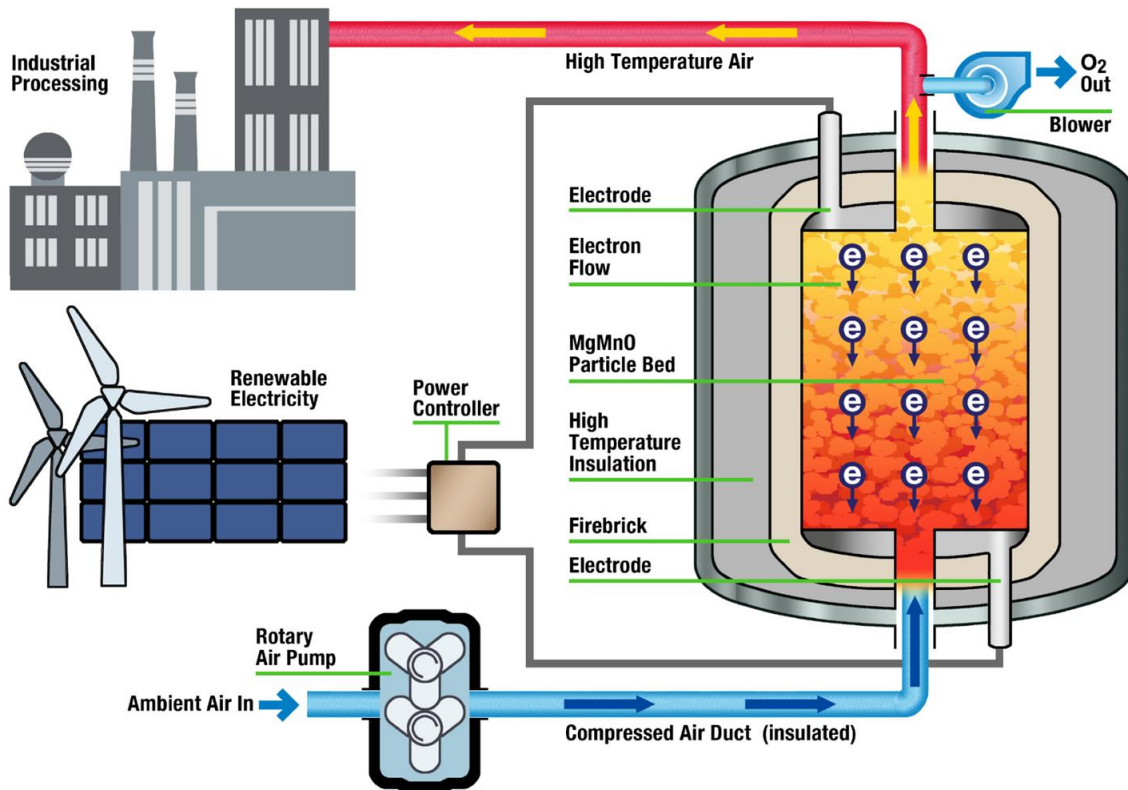


heat



electricity

how does it work?



industrial heat
~ 95%eff

electricity



heat

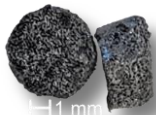


store



heat

record-breaking thermal storage material



magnesium-manganese oxide (MgMnO_2)



cheap & abundant

- 600 \$/ton processed cost
- literally dirt cheap
- 1st, 7th, 12th most abundant elements



record performance

- energy density of 2400 MJ/m³
- specific energy of 1.5 MJ/kg
- 3x energy of molten salts



high temperature

- operation at 1000-1500 °C
- ideal for gas turbines
- carnot efficiency of 77-83%



robust & long life

- 100+ cycles & 1000+ h and counting
- no observed loss in capacity
- no particle/pellet degradation



safe & sustainable

- non-toxic
- non-corrosive
- non-combustible
- 100% recyclable



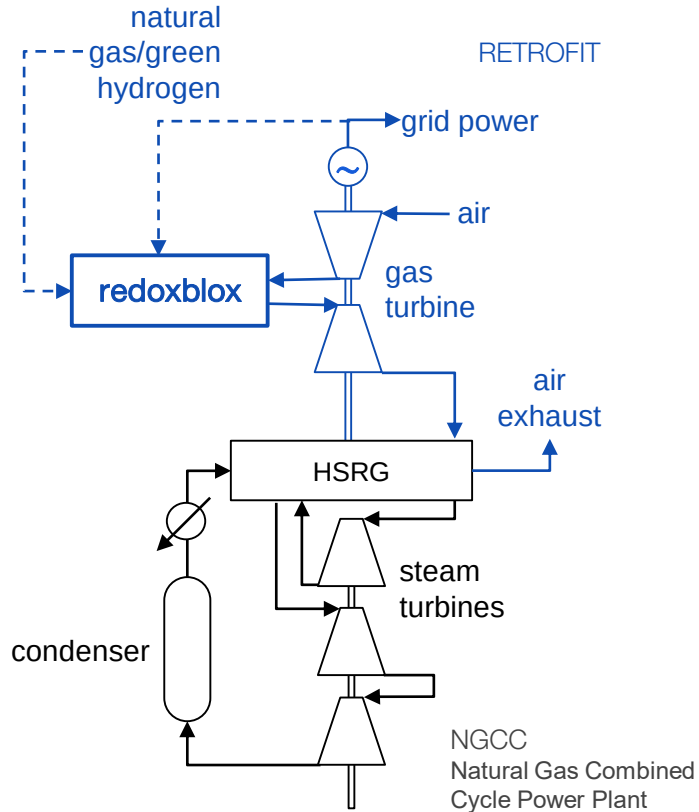
patent protected

- 4 utility patents, 1 patent app
- option for exclusive license with UFlorida & Mich State



Grid-Scale Storage

NGCC POWER PLANT RETROFIT



RedoxBlox
XE-5000S Thermal Storage
(5 GWh)



silo combustor



Siemens Energy
SGT-2000E Gas Turbine
(275 MWe)

simple economics of cyclical energy storage

S – Spread; [energy selling price (\$/kWh) – purchase price (\$/kWh)]

I – Capital cost of energy storage system (\$/kWh)

E – Capacity of energy storage system (kWh)

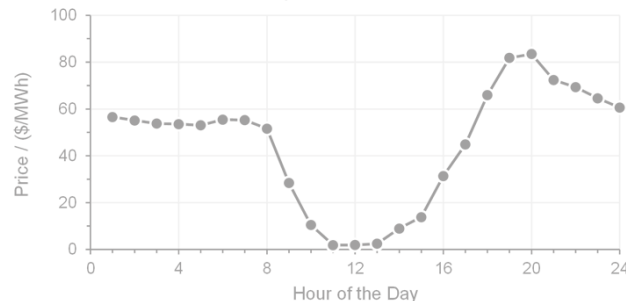
R – Revenue per cycle of storage (\$/kWh/cycle)

$$R = [S - \text{operating cost } (\$/\text{kWh})]$$

$$\# \text{ of cycles for payback} = \frac{I}{R}$$

$$\text{Profit} = E \{ R [\# \text{ of cycles}] - I \}$$

San Diego Gas & Electric Day-Ahead Electricity Price
September 19, 2021



Example

I = \$10/kWh

S = \$0.02/kWh

Operating cost \$0.005/kWh

$$\# \text{ of cycles for payback} = \frac{10}{.02 - .005} = 556 \text{ cycles}$$

E = 500 MWh

$$\text{Profit (1000 cycles)} = 500 \times 10^3 \{ .018 \times 1000 - 10 \} \\ = \$4 \text{ million}$$

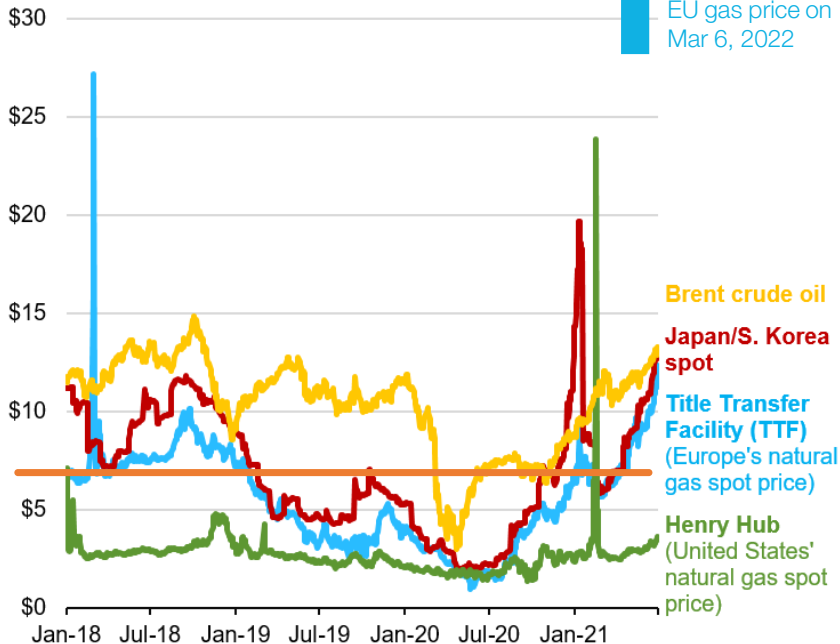
carbon-free heat competitive with gas

- + solar power (6h)
5.9 \$/MMBtu (2.0 ¢/kWh)
- + storage cost (18h)
1.0 \$/MMBtu (30% margin)
- = industrial heat (24h)
6.9 \$/MMBtu (1400 °C)

redoxblox

**Daily crude oil, natural gas, and liquefied natural gas (LNG)
spot prices (Jan 1, 2018–Jun 30, 2021)**

dollars per million British thermal units



moving clean energy technology from lab to market



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