



RENEWABLE  
ENVIRONMENTAL  
THERMAL

# NREL ENDURING Demo Pitch

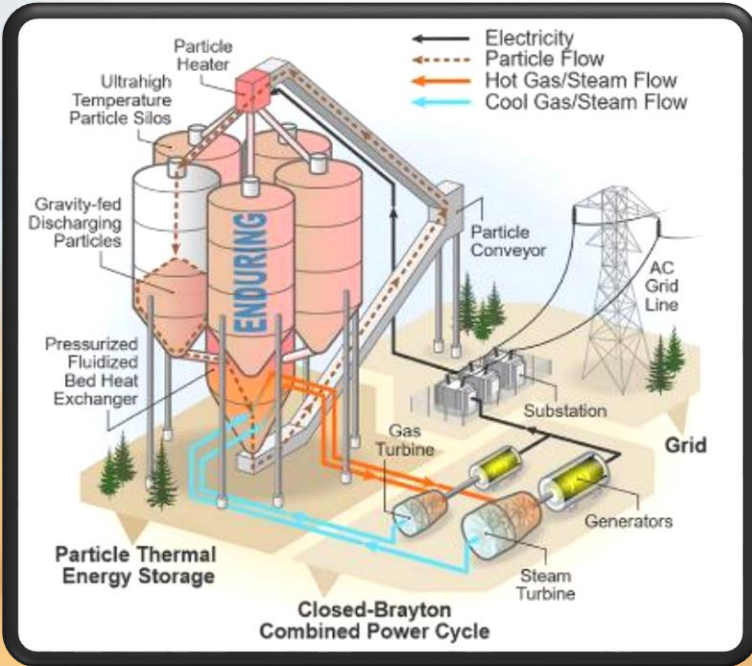
**Brian Higgins**

Director of Advanced Technologies

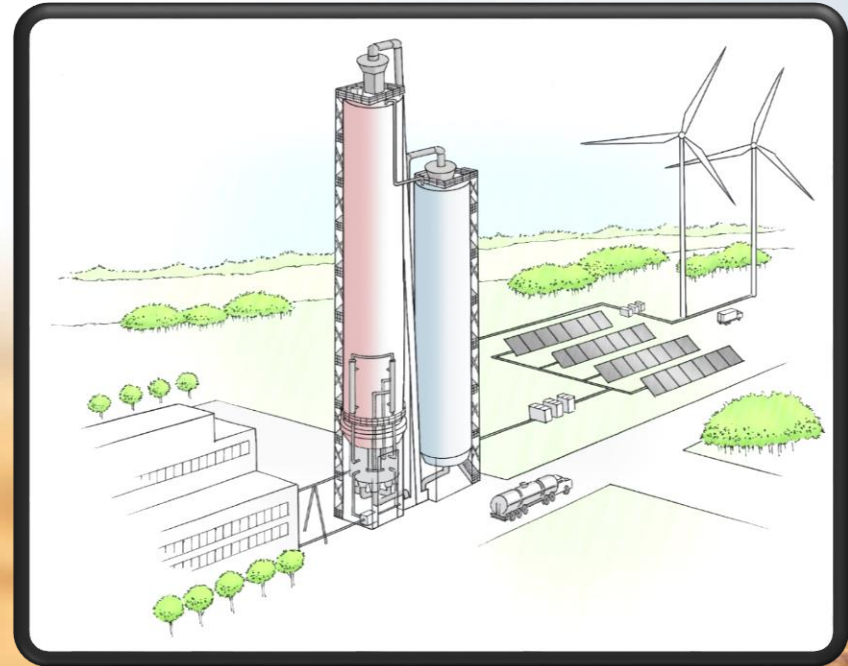
Email: [bhiggins@babcock.com](mailto:bhiggins@babcock.com) or Office: +1 330-860-2096

# B&W – Thermal Storage

## NREL ENDURING



## Green Steam



Combined Power Cycle  
Closed-Brayton

Energy Storage  
Particle Heater

Ultrahigh  
Temperature  
Particle Silos

Particle Heater  
Particle Silo

# Discharge Cycle (Produce Electricity)

## Produce Electricity

- ▶ When renewable electricity is expensive

## B&W PFBHX

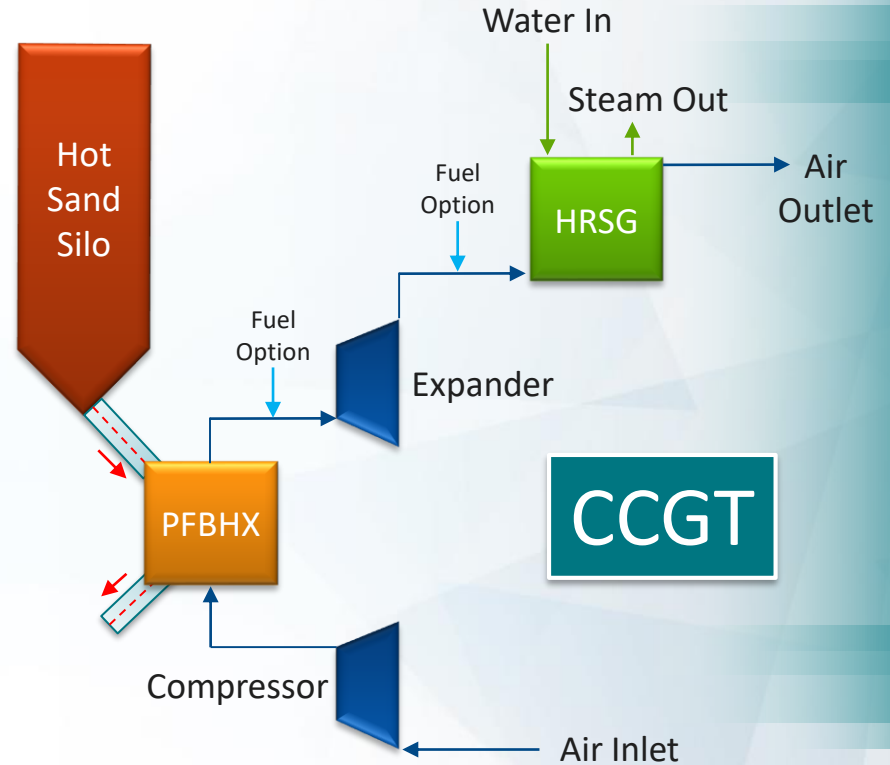
- ▶ Pressurized Fluidized Bed HX
- ▶ B&W Design
- ▶ Hot Sand In -> Cold Sand Out
- ▶ Cold Air In -> Hot Air Out

## Waste Heat Boiler (HRSG)

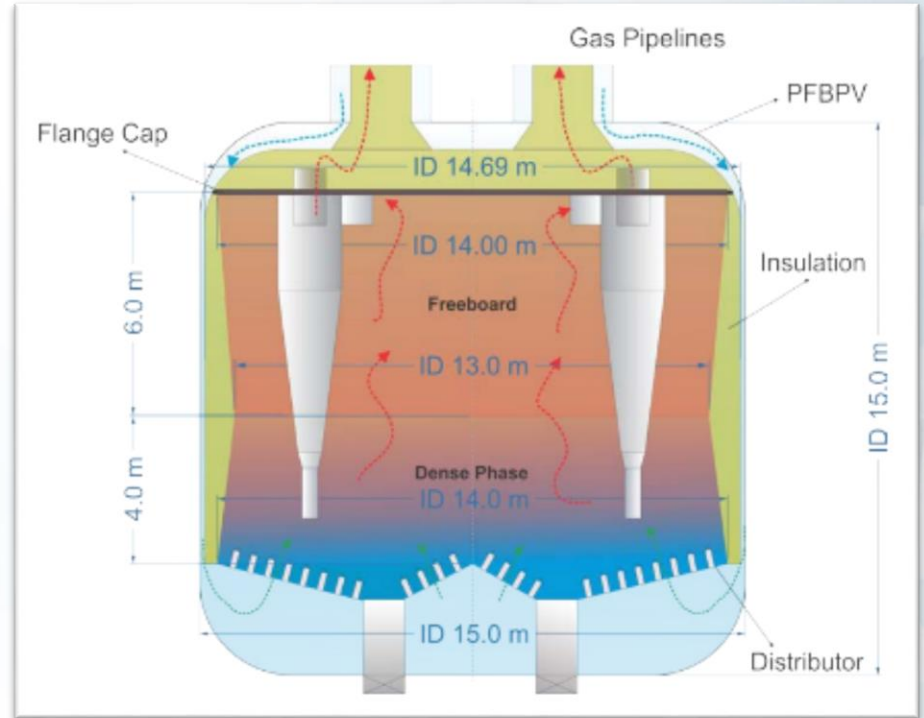
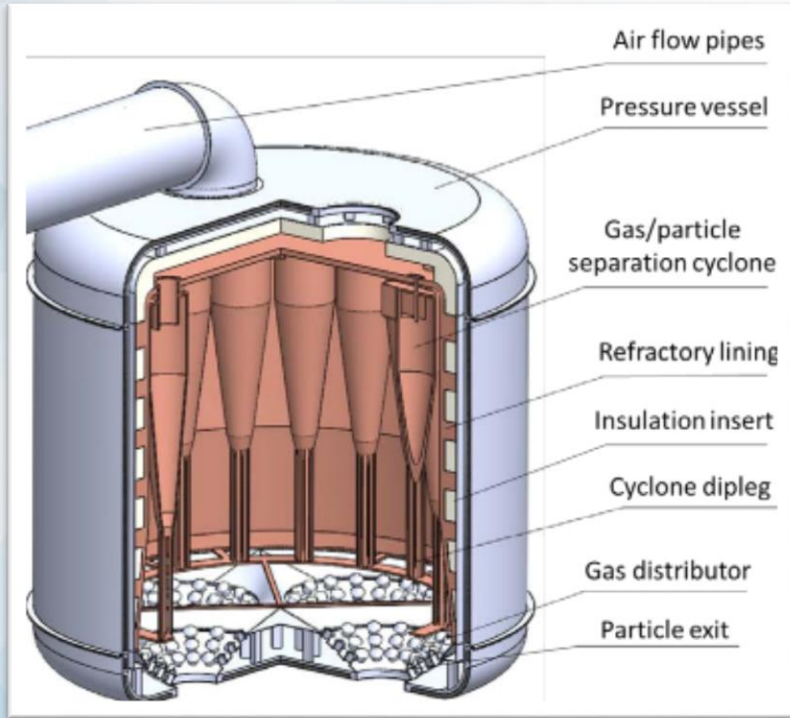
- ▶ B&W Quick Start Design

## Alternate Cycle Options

- ▶ Renewable Fuel Option



# Pressurized Fluidized Bed HX B&W Design



# ENDURING is Less Expensive at Scale (135 MWe)

## Lithium Ion CapEx:

- 4 hours = \$ 100 M
- 16 hours = \$ 400 M
- 100 hours = **\$2500 M**

RTE = 87%  
Life = 10 y

Lazard LCOS V6.0, page 15, low-cost case

## NREL ENDURING CapEx:

- 4 hours = \$140 M
- 16 hours = \$170 M
- 100 hours = **\$370 M**

RTE = 50%  
Life = 30 y

NREL CapEx Estimate

# The “Ask”

## Looking for partner sites

- ▶ Arbitrage Use Case
- ▶ Capacity Payments
- ▶ Spinning reserve
- ▶ ITC/PTC

## Solar Arbitrage Use Case:

- ▶ 16 – 18 hours per day
- ▶ 330 days per year (90% CF)
- ▶ \$0.02/kWh charging
- ▶ \$0.06 – 0.07/kWh discharging

## DOE LDES Proposal:

- ▶ Demo = 42% RTE
- ▶ 5 MW<sub>e</sub> Discharge (16 h)
- ▶ 200 MW<sub>th</sub> Thermal Storage (sand)
- ▶ \$40M Project Estimate

## Readiness:

- ▶ Ready today:
  - Silos/Sand/Elevators/CCGT
- ▶ Needs the demo:
  - Heater/PFBHX



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# Contact us today.

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**Brian Higgins**

Director of Advanced Technologies

Email: [bhiggins@babcock.com](mailto:bhiggins@babcock.com) or Office: +1 330-860-2096