Ambri

Batteries for clean energy

March 10, 2021

DOE Workshop - "BIG" Energy Storage:
Priorities and Pathways to Long-Duration Energy Storage

Panel 7: Batteries

-"Liquid Metal Batteries"

Presenter:

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CTO, SVP, Co-founder

Ambri Inc.

Ambri Overview

- **Founded Ambri in 2010**
- **Commercializing unique molten salt 'Liquid Metal Battery'**
- **MIT spin-out, Bill Gates funded**
- **Pivoted to Ca||Sb chemistry in 2017**

Ambri Value Proposition

Lower Upfront System Cost

- 30-50% lower cost vs. future Li-ion
- 4-12 hour applications

Disruptive Performance

- Minimal capacity fade

Safe and Reliable

- No thermal runaway
- Easily recyclable and reusable

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Ambri Today

Company & Timeline Overview

- R&D cells & systems delivered to and validated by energy storage integrator and customers in '18 – '20
- Delivering trial systems in '21
- Deploy next-gen systems in '22
- Launch first high-volume factory in '23
- Commitment from TerraScale to incorporate over 250 MWh of Ambri battery systems

Ambri battery

Ambri facility

Customer system, tested in 2020

50 employees and 40k ft² in Marlborough, MA

2019-2020
Developed and qualified Initial commercial cells

2021
Initial systems deployed

2022
1 MWh commercial system developed, certified and deployed

2023
250 MWh of systems shipped for commercial projects

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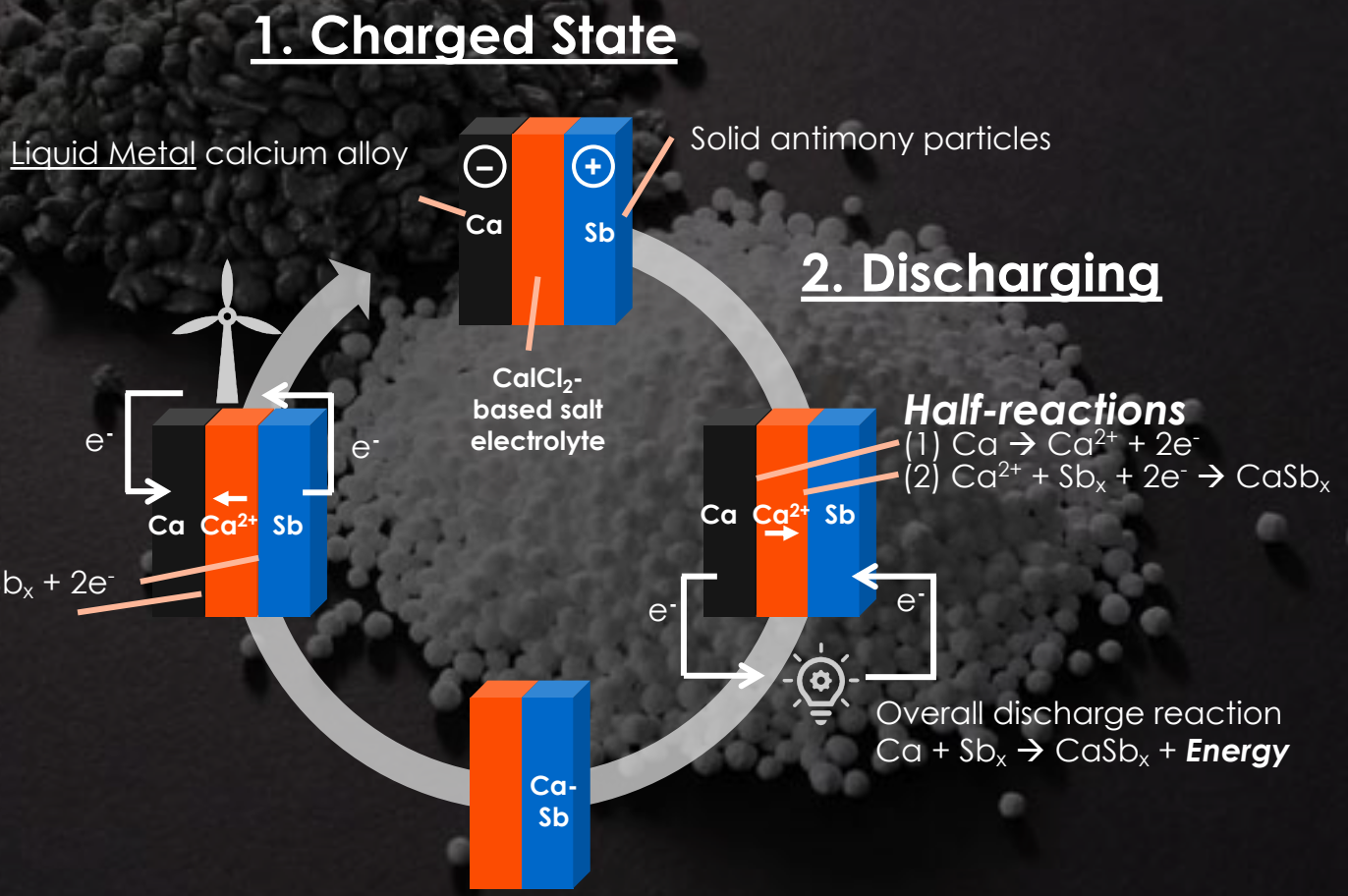
Liquid Metal Battery Chemistry

- **Liquid Metal Electrode Design Offers Distinguished Performance, Minimal Fade**
- **500 °C Operating Temperature**



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Good Efficiency, Minimal Capacity Fade

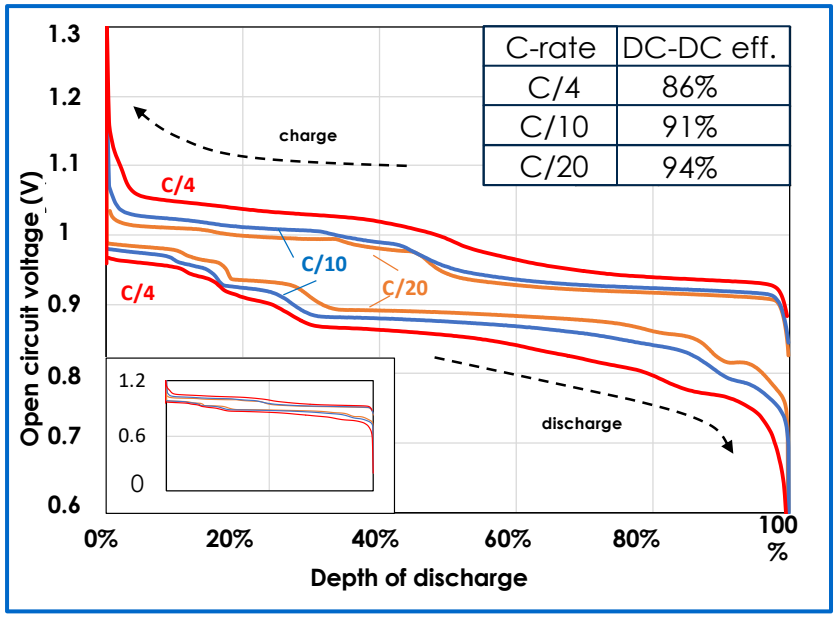
80 – 90% Round-Trip DC-DC Efficiency in Daily Cycling

- Systems 'self-heated' when cycled every 1-2 days, no additional heater energy required

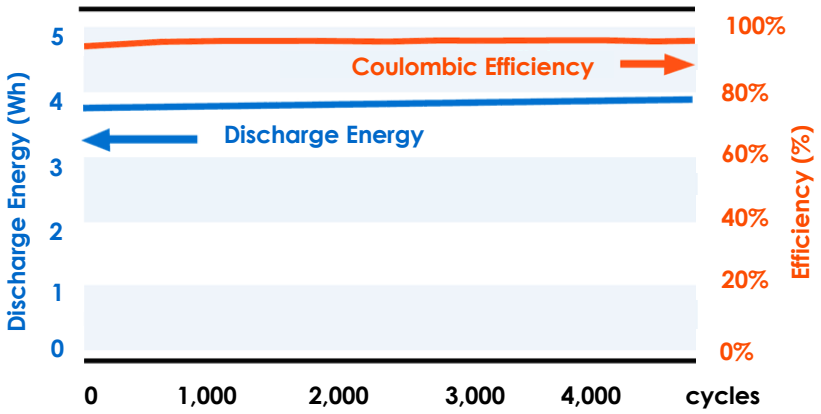
20 Year Design Life With Minimal Capacity Degradation

- Stable performance over thousands of cycles, multiple years

Voltage Profiles & DC-DC Efficiencies of R&D Cells



Accelerated Cycle-Life Test



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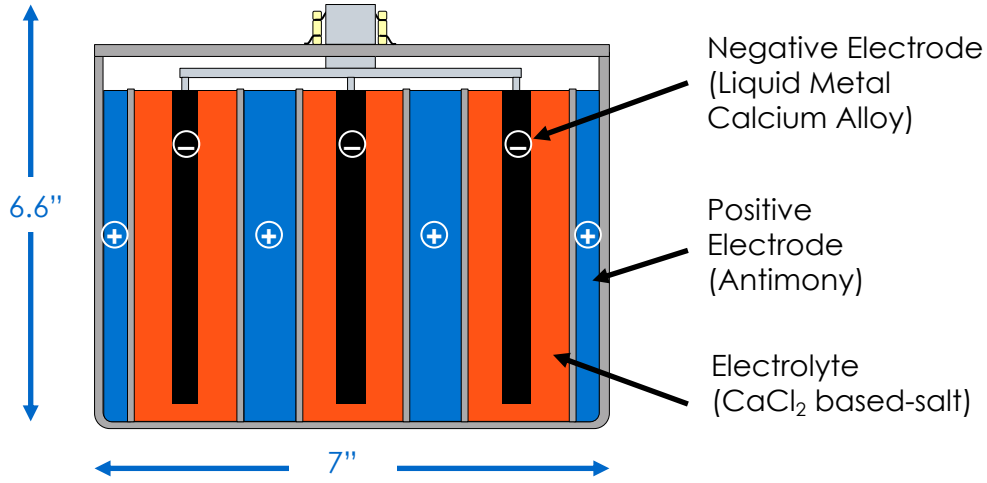
Cell Performance

Targeting Long Duration (>4 hrs) Energy Storage Markets

- Fully sealed, prismatic, 'large lunch box sized' cells
- Increase energy density and reduce cost over time
- Scale to 10's GWh/y production

Commercial Cell Specifications	
Dimensions	305 mm L x 178 mm W x 168 mm H (12" X 7" X 6.6")
Mass	53 lbs
Cell enclosure material	Stainless steel
Nominal OCV	0.95 V
Nominal capacity	1360 Ah

Multi-Plate Vertical Electrode Cell Configuration, Schematic Cross-Section



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System Attributes

Ready-to-Install DC Containers for Applications that Require High Energy Capacity, Frequent Cycling, Long Life and Good Efficiency

Ambri ESS System Specifications

~250kW
Power

1,000 kWh
Energy

~1,000 VDC
Voltage

-50°C to 100°C
External temperature range

80 to 90%
DC Efficiency

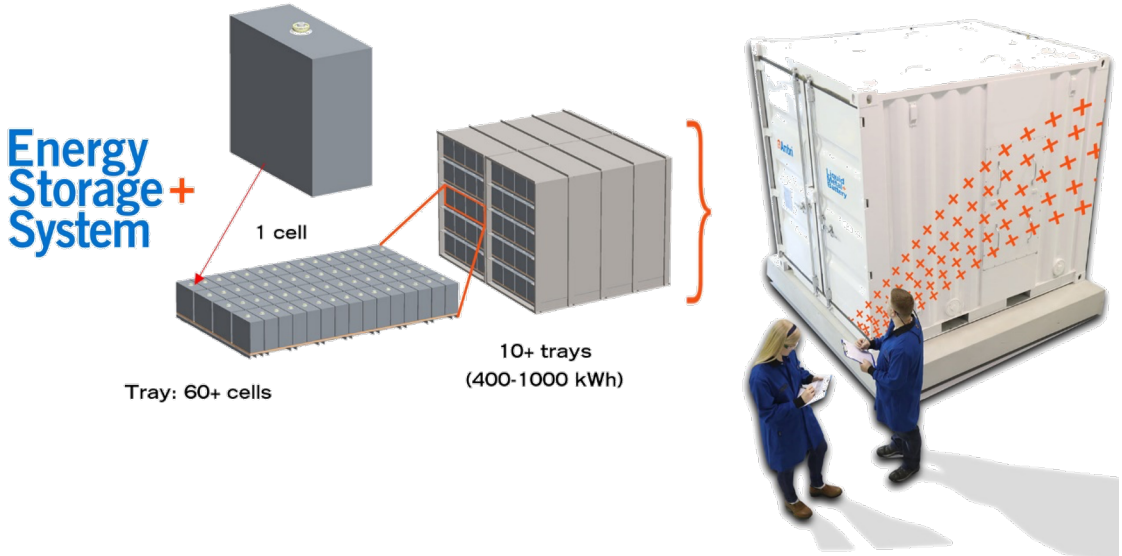
485°C – 525°C
Operating temperature

Millisecond
Response time

10'x8'x10'
Dimensions

Design Life
20 years

Weight
20-30 tons



Targeting a 1 MWh system in a 10-foot shipping container; enough to power ~100 homes when coupled with wind or solar

- Multiple systems placed together on site are connected in parallel → redundancy
- Similar energy density footprint as today's Li-ion systems (4-5 MWh in a 40' container) → important project installation cost factor

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Thank You

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