ESS INC

Catalyzing a Clean Future. Every Day.

May 2022

The Global Imperative to Transition to Renewable Energy

Extreme climate-driven weather events are now the norm. Deadly extreme weather for US cost at least $145 billion in 2021.

The world's appetite for electricity is growing unabated. Global electricity demand rose by 6% or 1,500 terawatt hours (TWh) in 2021.

The risks of today's aging energy infrastructure are readily apparent – and more dangerous. Today's solutions need to last for decades.

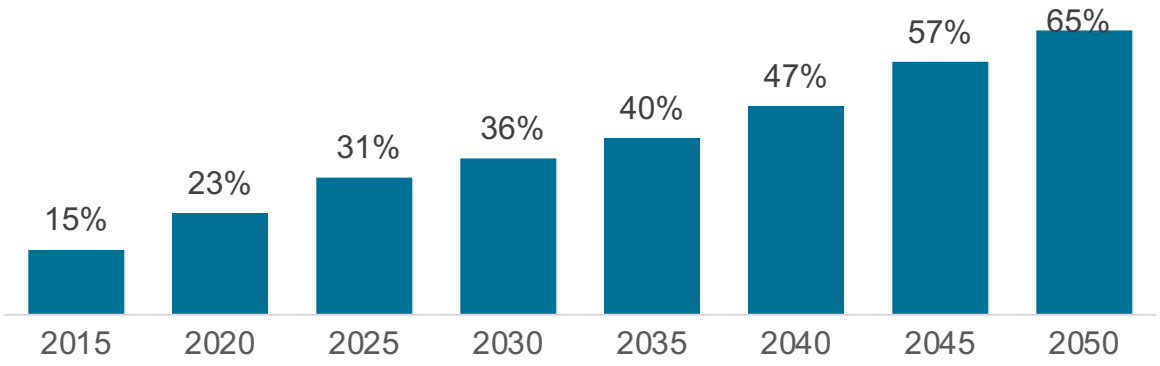
Increasing concern for energy and national security.

The cost for utility-scale solar PV power has declined 82% since 2010 and the costs for onshore and offshore wind have declined 39% and 29%, respectively *(both are cheaper sources of electrons than burning fossil fuels).*

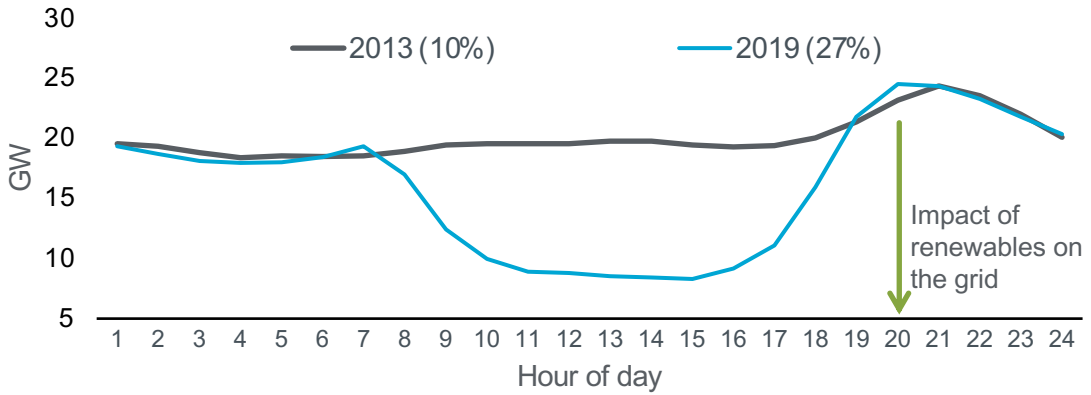
A global transition to a decarbonized world is underway. To preserve a livable climate, greenhouse-gas emissions must be reduced to net 0 by 2050.

The Challenge: Stabilize the Grid and Accelerate Renewables

US Renewable Energy Penetration (2015-2050)[1]



California Duck Curve and % Renewable Penetration[1,2]



Renewable intermittency creates challenges for the grid, particularly >25% penetration

- Decarbonization is the goal
- Intermittency and curtailment are barriers
- 4-hour storage does not efficiently bridge the duck curve
- Lithium-ion batteries are toxic, hazardous and not practical to address 6+ hours of storage
- Despite the increase of renewables, approximately 60% of electricity generation is still from gas. LDES helps to get to net-zero.

1 BloombergNEF.
2 IEA, "The California Duck Curve", December 2019. % figures represent solar and wind power penetration in each year.

140 TWh of Long Duration Energy Storage Needed

COP 26: Major global report by McKinsey declared that LDES is key to energy transition

LDES sits between lithium batteries and hydrogen

LDES defined as two categories: 8-24h and >24h storage

Lithium will continue to play a role for <6h but too expensive for longer durations

LDES is the largest single storage category needed

1 TWh of LDES needed by 2025 to stay on track

140 TWh needed by 2040 for full decarbonization

Initial study shows that full decarbonization is technically and commercially feasible

Long-duration energy storage is essential – decarbonization not feasible without it

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With LDES, total energy system costs can go down
Renewable power with LDES can be cost effective

More information www.ldescouncil.com

Longer duration

Non-toxic, non-hazardous

Ultra-low cost at high cycle levels

Flexible and easy to deploy

Commercially available

Made in America

Simple but revolutionary technology purpose-built to solve energy storage, now and for decades to come

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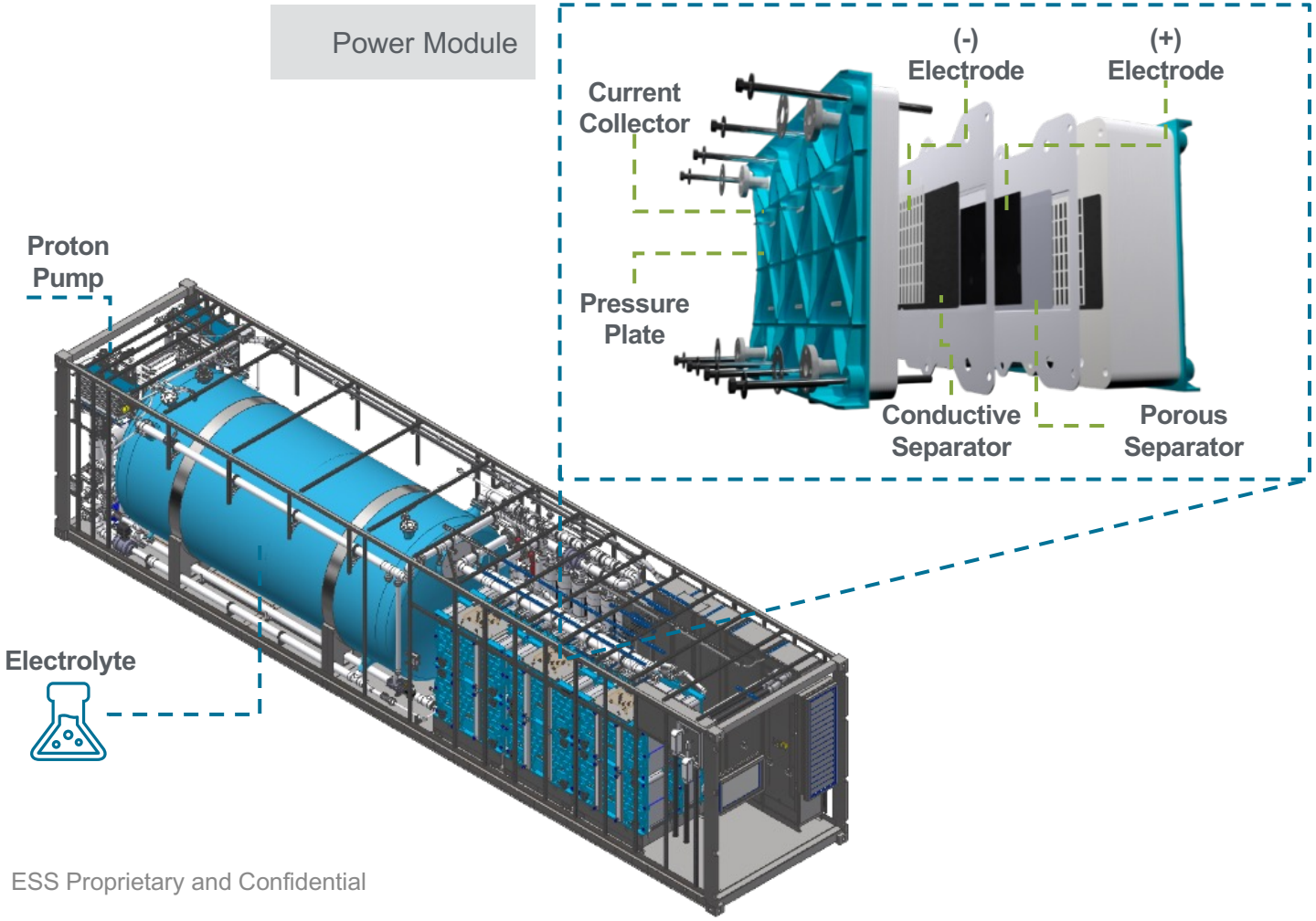
ESS Benefits

What Customers Demand	ESS INC	How ESS Transforms the Grid
Longer Duration	• Up to 12 hours (current version) • No capacity fade • No power fade	• Can replace coal and gas with solar and wind • Designed for utility-scale applications
Low Cost	• Lower LCOS than other technologies • Incremental cost of storage <$20/kWh	• The first truly low-cost flow battery • Field-proven, in commercial production today
Power On Demand	• <1 second response time • >20,000 cycle life – $0 marginal cost per cycle • Flexibility allows multiple revenue streams	• Improved grid resiliency and flexibility • Enables multiple use cases
Safety, Reliability, and Bankability	• Non-flammable, non-toxic, no explosion risk • Wide operating temperature range • Munich RE insures technology risk	• Can deploy in a wide range of geographies • No HVAC needed – cuts CAPEX and OPEX • Customers have a bankable solution
Sustainability	• Easily sourced materials; recyclable components • “Plug and play” with 25-year operating life	• Environmentally sustainable • Accelerates clean energy transition

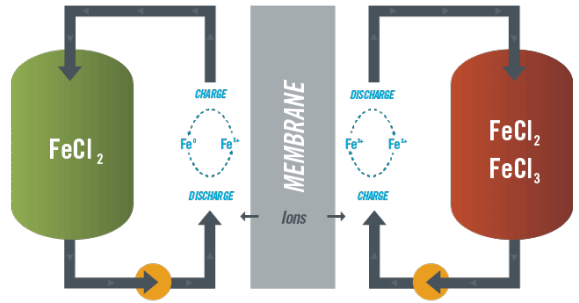
How the Technology Works

ESS Battery Technology

ESS technology



Electrochemistry



$$Fe^{2+} + 2e \underset{discharging}{\overset{charging}{\rightleftarrows}} Fe^{0} \qquad E^{0}=-0.44V$$

$$2Fe^{2+} - 2e \underset{discharging}{\overset{charging}{\rightleftarrows}} 2Fe^{3+} \qquad E^{0}=+0.77V$$

- ✓ During charging iron collects (electroplates) on the negative electrode
- ✓ During discharging iron dissolves back into solution
- ✓ Passive design proton pump continuously refreshes electrolyte in closed-loop system

Scalable, Low Cost, Long Duration Energy Storage

Iron flow battery scaling

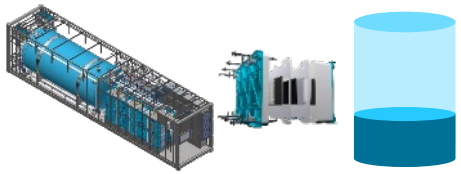
A theoretical 100kW/400kWh ESS battery contains

Component	Number	Cost
Fixed Equipment: i.e., power electronics, tank, structure/supports	1x	▲
Power Module	1x	■
Electrolyte	4x	●●●●

- More electrolyte – Longer duration
- ESS electrolyte is low cost – made from iron, salt and water
- Incremental cost of increasing storage duration is low

Increasing storage duration = same system, more electrolyte

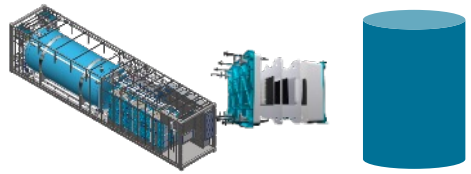
400kWh configuration



400kWh cost[1]

▲ + ■ + ●●●●

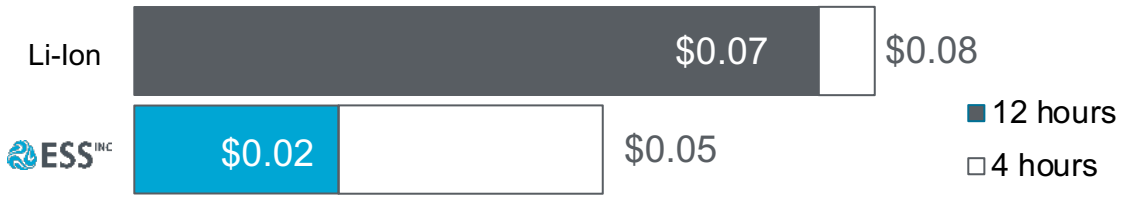
1,000kWh configuration



1,000kWh cost

▲ + ■ + ●●●●●●●●

LCOS at 12 hours vs 4 hours[2]



ESS Decouples Energy from Power

1 Figures shown are illustrative
2 Economics based on Levelized Cost of Storage (LCOS).

$$\text{LCOS} = \frac{\sum.\text{CapEx} + \sum.\text{Installation} + \sum.\text{Disposal} + \sum.\text{O\&M}}{\sum.\text{Annual Usable KWh}}$$

Investment Grade Warranty

Industry-leading warranty

Product cover	10-year extended warranty on entire technology stack
Project cover	Assignable warranty provides additional surety to owners and financiers

"The ability to ensure battery performance is a key piece of the puzzle in decarbonizing our energy sector."

- Peter Röder, Member of the Board of Management, Munich RE

Bankability

Munich RE

Warranty backed by investment grade insurer that covers every product, every where.

US Export-Import Bank Qualified
Pre-qualified financing available for overseas buyers

Energy Warehouse™ Overview

Product Summary

Behind-the-meter solution

First commercial deployment in 2015

Generation II launched in 2020

Containerized fully-integrated design for turnkey delivery

Easy to permit = Fast to deploy and commission

Current Specifications

Configurable Range	75kw – 90kW (peak power)
Rated Capacity	400 kWh
Total Capacity	500kWh
Response Time	<1 second
Module Cycle Life	>20,000 cycles
Ambient Temperature	-5°C to +50°C (*Additional weatherization option available)
Expected Life	25-year service life
Warranty	1 year comprehensive, 10-year extended warranty on battery modules and electrolyte management sys

Stackable
Seismic Rated

Energy Center™ Overview

Product Summary

Front-of-the-meter solution

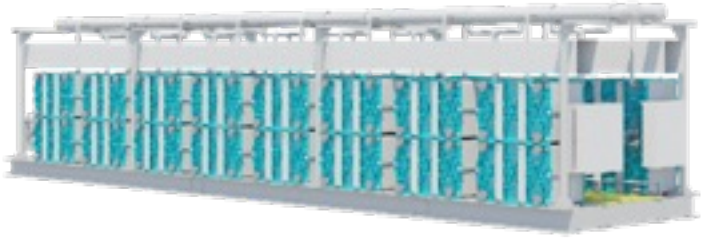
Deployments starting in Fall 2022

Modular design for utility-class

Power capacities starting at 3MW

Same Technology as Energy Warehouse

Power Train

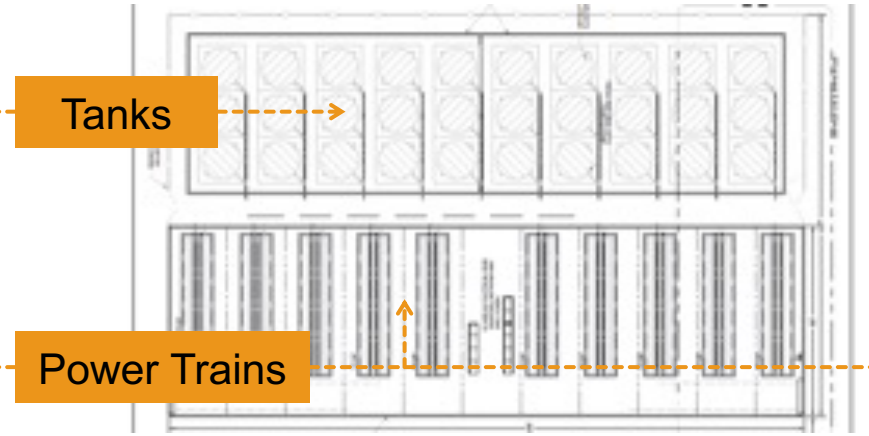


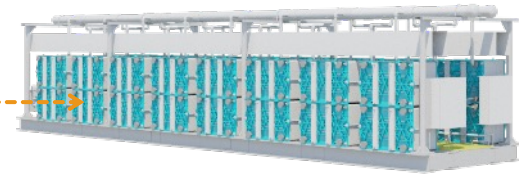
Quad Pods

Current Specifications

Configurable Range	Customizable up to GW scale
Rated Capacity	10MWh / MW
Total Capacity	12 MWh / MW
Response Time	<1 second
Module Cycle Life	>20,000 cycles
Ambient Temperature	-5°C to +50°C (*Expandable range)
Expected Life	25-year service life
Warranty	1 year comprehensive, 10-year extended warranty on battery modules and electrolyte management system

Energy Center™ Overview





3MW - 36MW
30 Tanks; 10 Power Trains

Product Summary

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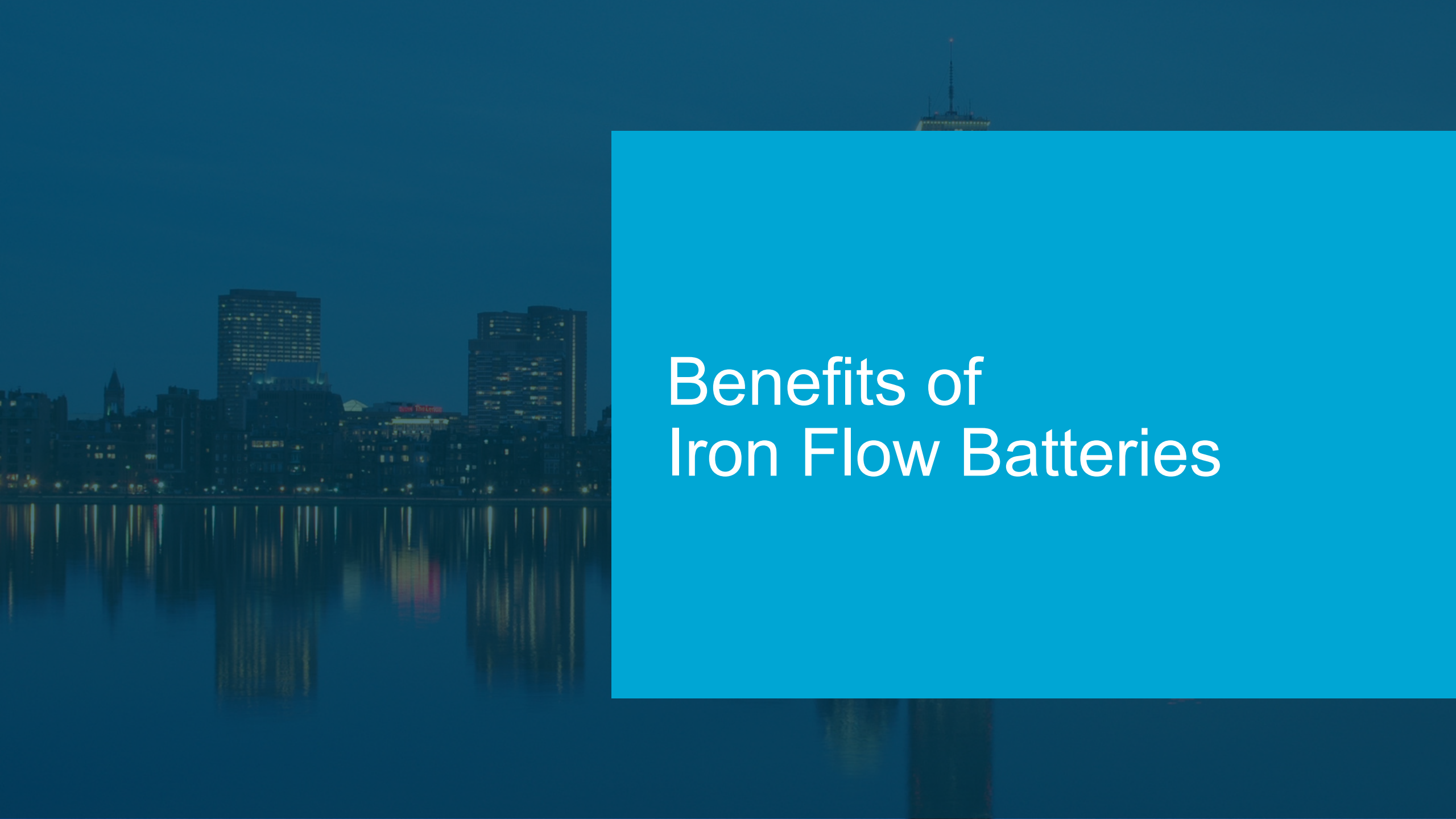
Competitive Comparison for Long Duration Storage

	ESS INC	Li-Ion	Li Metal	Vanadium, Zinc Bromine	Sodium Sulfur	Compressed Air	Pumped Hydro
Low cost at 4-12 hours	●	○	○	●	○	○	○
Commercially available [1]	●	●	○	●	●	○	●
Earth abundant materials	●	○	○	●	●	●	●
Unlimited cycling	●	○	○	○	○	●	●
Zero capacity face	●	○	○	○	○	●	●
Wide operational temperature range	●	○	○	●	○	●	●
Environmentally sustainable	●	○	○	○	●	●	○
No fire/ explosion risk	●	○	○	●	○	○	●

Note 1 Internally developed table based on company data and publicly available information.
Based on our Generation I products, which are no longer deployed.



Benefits of Iron Flow Batteries

Enabling Renewable Energy to be Baseload Energy. All Night. Every Day.

Flexible

One long duration energy storage solution that address multiple use cases

- Resiliency and ancillary services
- Reliability and green hydrogen production

Durable

25-year design life, no capacity fade

Cost Effective

Lowest cost of storage

Easy

Easy to site and deploy. Easy to augment, increase capacity (just add water)

Proven

Field tested

Sustainability Advantages

Sustainability Focus Areas	ESS INC
Responsibly sourced materials	Iron, salt and water are earth-abundant
Global warming potential (GWP)	67% lower CO_2 emissions than Li-Ion[1]
Recyclability	Contains no toxic materials and requires no special permits for disposal[2]

Note GHG impact is dependent on specific Li-Ion chemistry.

1 He, H. et al. “Flow Battery Production: Materials Selection and Environmental Impact.” Journal of Cleaner Production. Vol. 269. 1 October 2020. Noguera, E., Comparative LCA of stand-alone power systems applied to remote cell towers, 2014.

2 No hazardous materials compliance plan required.

Case Studies

FTM Microgrid (Utility-Owned)

Use Case

Customer	Domestic Utility
Project Location	California
Use Case	• Microgrid solutions required to mitigate Public Safety Power Shutdown impacts • Solar + storage microgrid • Energy Warehouse™ product (540kW/3MWh storage)
Project Benefits	• Multi-day resiliency for critical needs customers during PSPS events
Why ESS Won	• Safety (non-flammability, non-explosive) • Ability to participate in CAISO market • Ability to provide distribution grid ancillary services during non-PSPS events

BTM Microgrid (Customer-Owned)

Use Case

Customer	Medical Device Manufacturer
Project Location	Southern California Multiple sites
Use Case	• Behind the meter microgrid owned by customer • Customer is a vertically integrated medical device manufacturer • Multiple project sites and generation sources (microturbines, solar) • Energy Warehouse™ product
Project Benefits	• Reduced energy costs • Operational resiliency (PSPS events)
Why ESS Won	• Lowest total cost of ownership • Battery safety characteristics • Ease in permitting

FTM Microgrid (Utility-Owned)

Use Case

Customer	Utility
Project Location	Chile
Use Case	• Remote grid served by RoR hydro and diesel gensets • Storage systems will minimize genset usage • Energy Warehouse™ product (300kW/2MWh)
Project Benefits	• $3.1M incremental savings over LIB • Avoids 12 years of diesel genset emissions
Why ESS Won	• 3x greater savings over LIB • Sustainability and environmental friendliness of IFB

Ambri

Batteries for clean energy

Liquid Metal Batteries for Large Scale Energy Storage

Executive Summary

Ambri's batteries are ideal for daily cycling, 4-24 hour duration energy storage applications

- Energy storage systems CapEx at 25% - 50% below 4-hour, Li-ion systems
- 20+ years lifespan with minimal fade
- Safe – no gas generated, no thermal runaway
- Uses commonly available materials

Commercialization Path

- Direct system sales to utilities, IPPs in grid scale energy storage market
- Plan to build, own and operate production of complete DC systems from 2024

Liquid Metal+ Battery

Company Background

- Spun out of MIT in 2010
- Investors include Bill Gates, Reliance New Energy Solar, Paulson & Co, Fortistar, GoRozen, Japan Energy Fund

Ambri Energy Storage Systems

Ambri cell, tray, tower configuration

Energy Storage + System

Ambri-based system

Insulated container with outer wall at ambient temperature

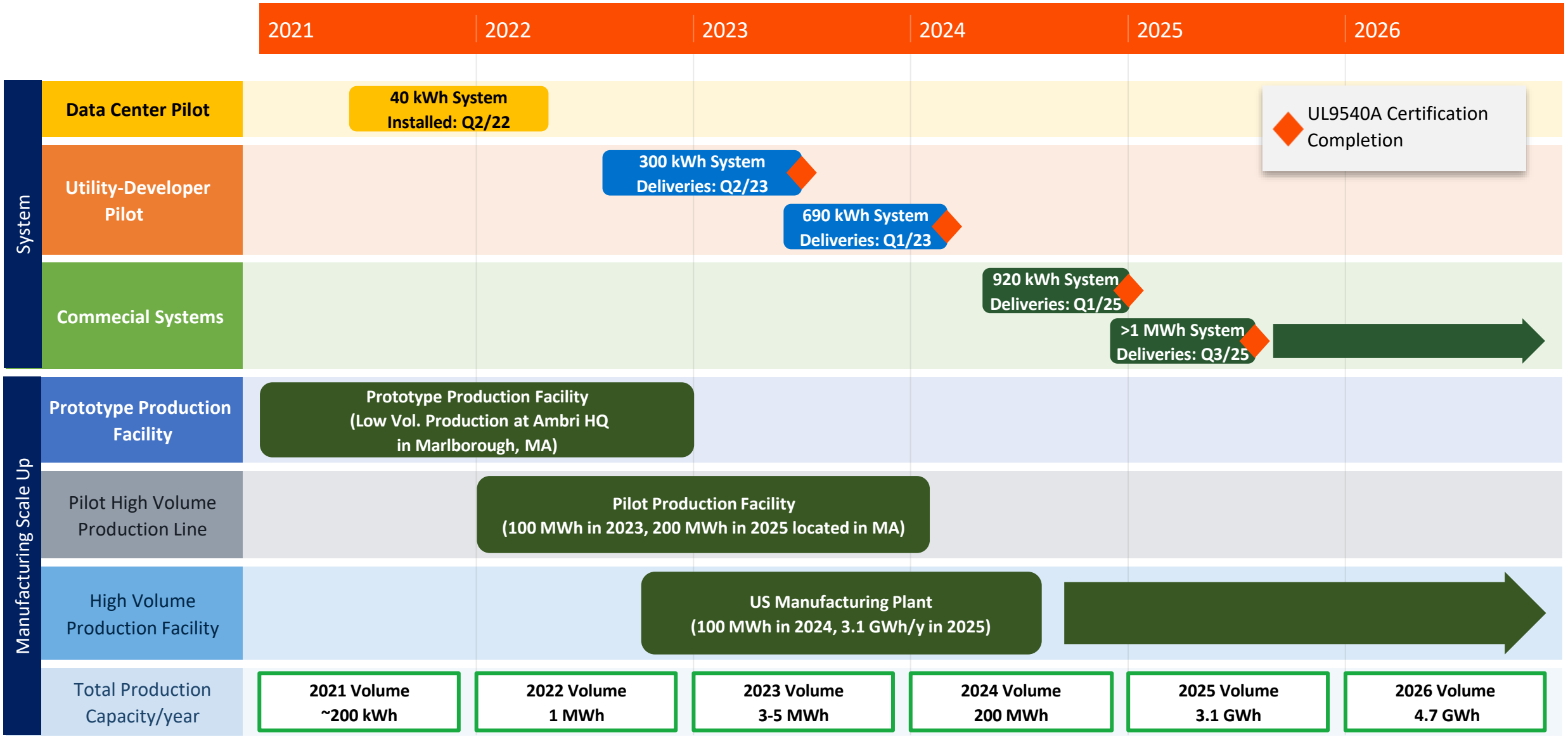
Liquid Metal Battery cell → Tray: 50+ cells → System: 10+ trays per 10' shipping container

Projected System Specifications

Power at rated energy	250 kW
Energy at Cp/4	1 MWh
Voltage	550 - 1150 VDC
External temperature range	-50°C to 100°C
DC-DC Efficiency	80% to 90% from C/4 to C/12
Internal operating temperature	485-525°C
Response time	Instantaneous
Dimensions	10' x 10' x 8' container
Design life	20 years

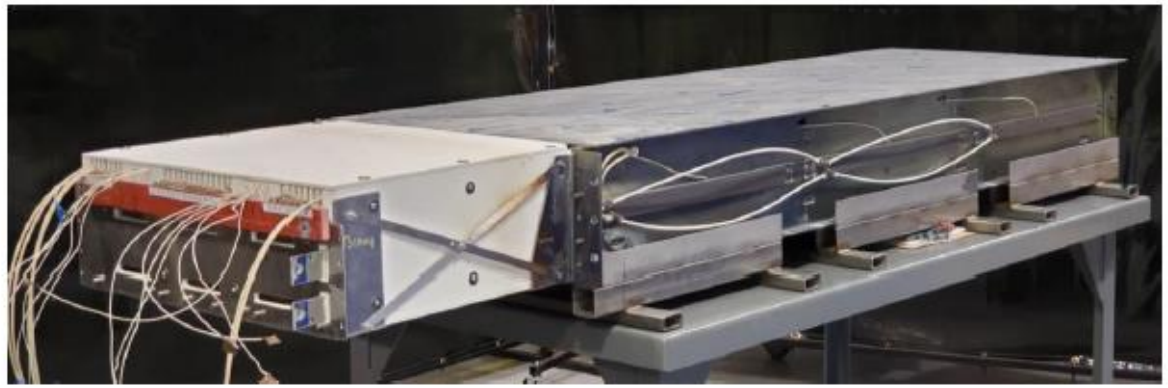
- **Modular design** – Fully populated containers to be combined for GWh-scale projects
- **Reliable** – No moving parts, always operating, redundant design
- **Scalable** – Global production capacity with commonly available materials
- **High performance in all environmental conditions** – no HVAC required in all ambient conditions

Ambri Product and Manufacturing Roadmap

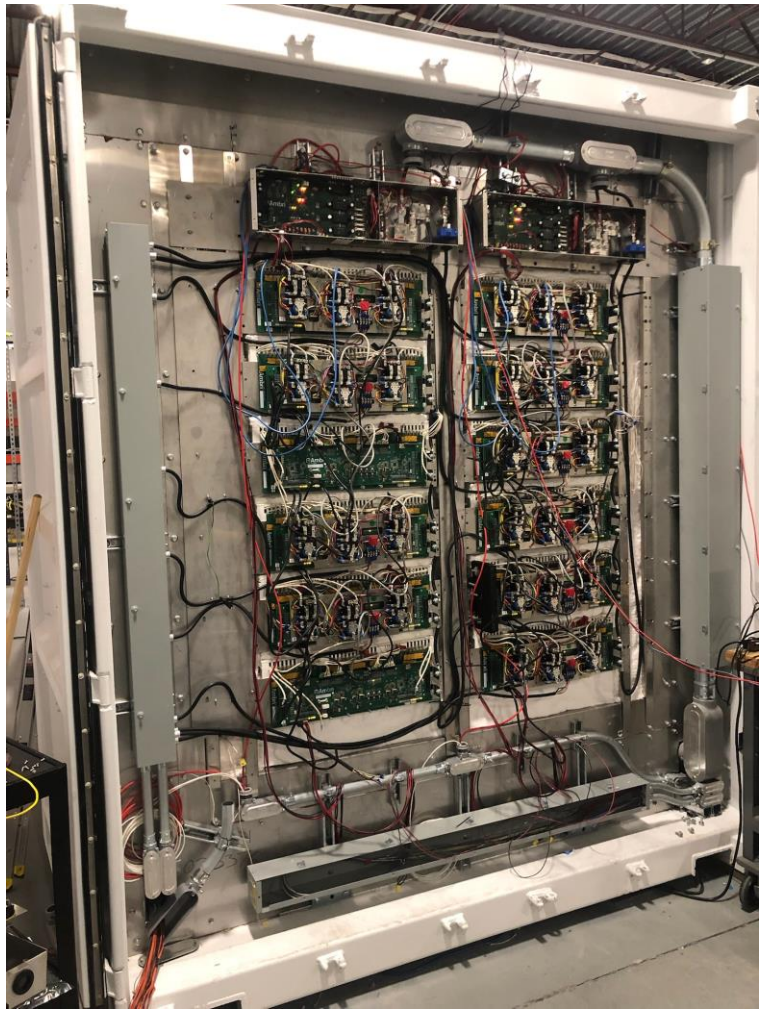


System Set-Up – Tray and System

Completed Tray



Assembled System



Ambri

Batteries for clean energy

Technology Overview

High Temperature Ambri Batteries

Ambri's batteries – a high temperature, Calcium || Antimony cell

- 500°C operating temperature inside insulated container
  - Self-heated from usage – no parasitic load

→ Use of low cost materials

  - Anode and electrolyte melt at high temp – "liquid metal battery"
  - Non-conductive solid metals at room temperature

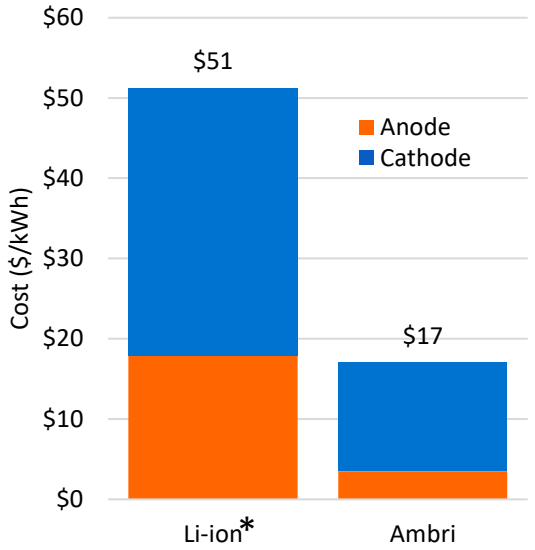
→ Minimal capacity degradation

→ Does not generate pressure or overheat under short, overcharge, over-discharge conditions

Targeted at Large Scale Energy Storage Market, 4 – 12 hour duration

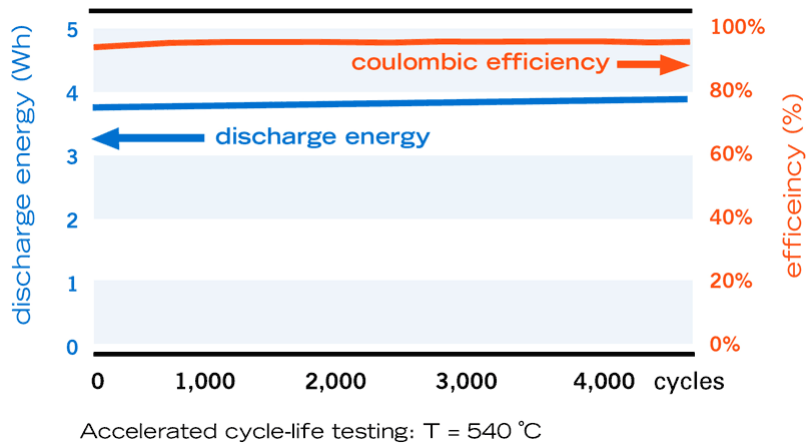
- Best suited for >10MWh, daily cycling applications
  - Solar + storage
  - Clean Peak
  - T & D deferrals

Li-ion electrodes cost 3x more than Ambri's



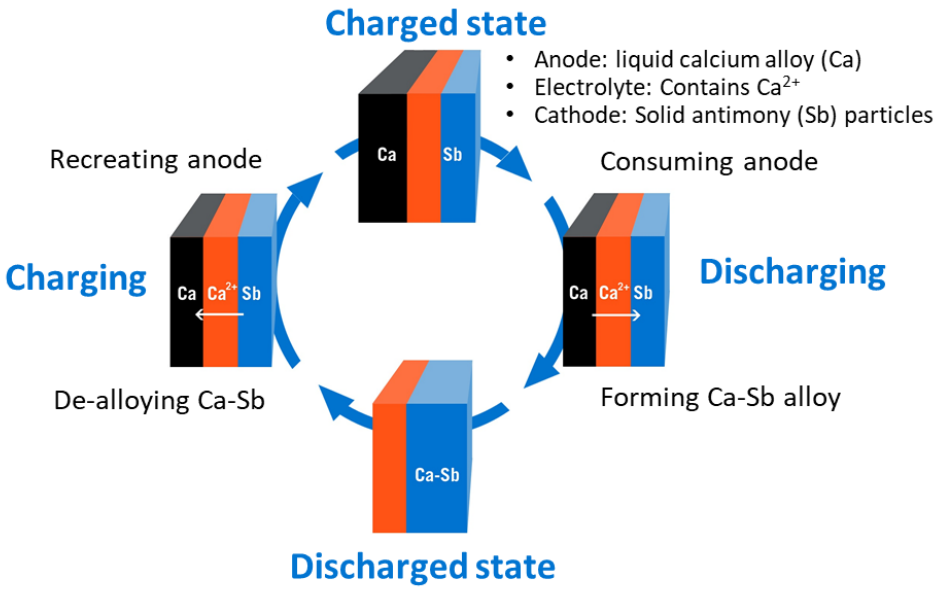
**Source: Bloomberg NEF, based on Li-ion NMC chemistry*

Stable cycling performance

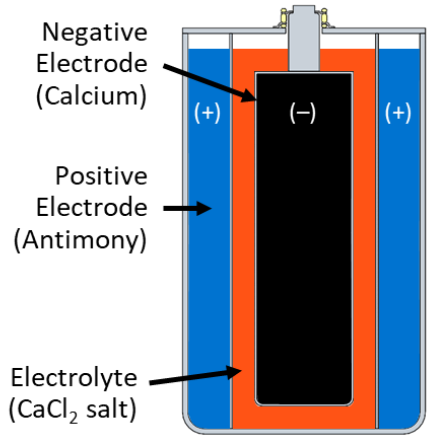


Accelerated cycle-life testing: T = 540 °C

The Liquid Metal Battery



Cell Cross Section



Novel Cell Technology

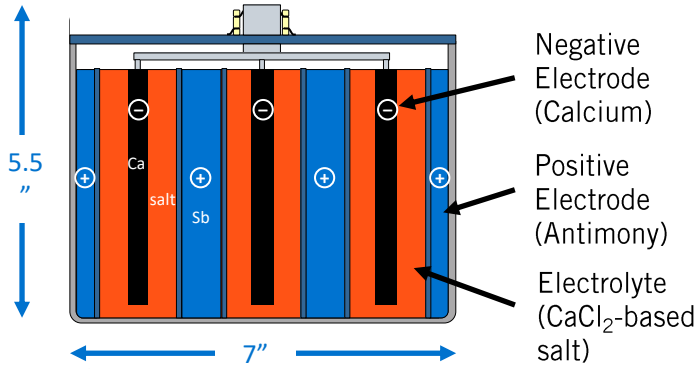
- Commonly available materials
  - Molten calcium alloy anode
  - Solid antimony cathode
  - Molten salt electrolyte
  - Stainless steel cans and anode plates
- Hermetic, welded prismatic construction

Cell Design

Key characteristics:

- **Multiple** vertical electrode plates
- **High-capacity** cells (500 → 1200 Ah)
- **"Lunch-box" sized** cells
  - *Allows for ~1000 cells in series per container, to reach required voltage vs. "one massive cell"*
- **Simple assembly**

Multi-plate vertical electrode cell configuration, Schematic Cross-Section



Cell can assembly from key supplier

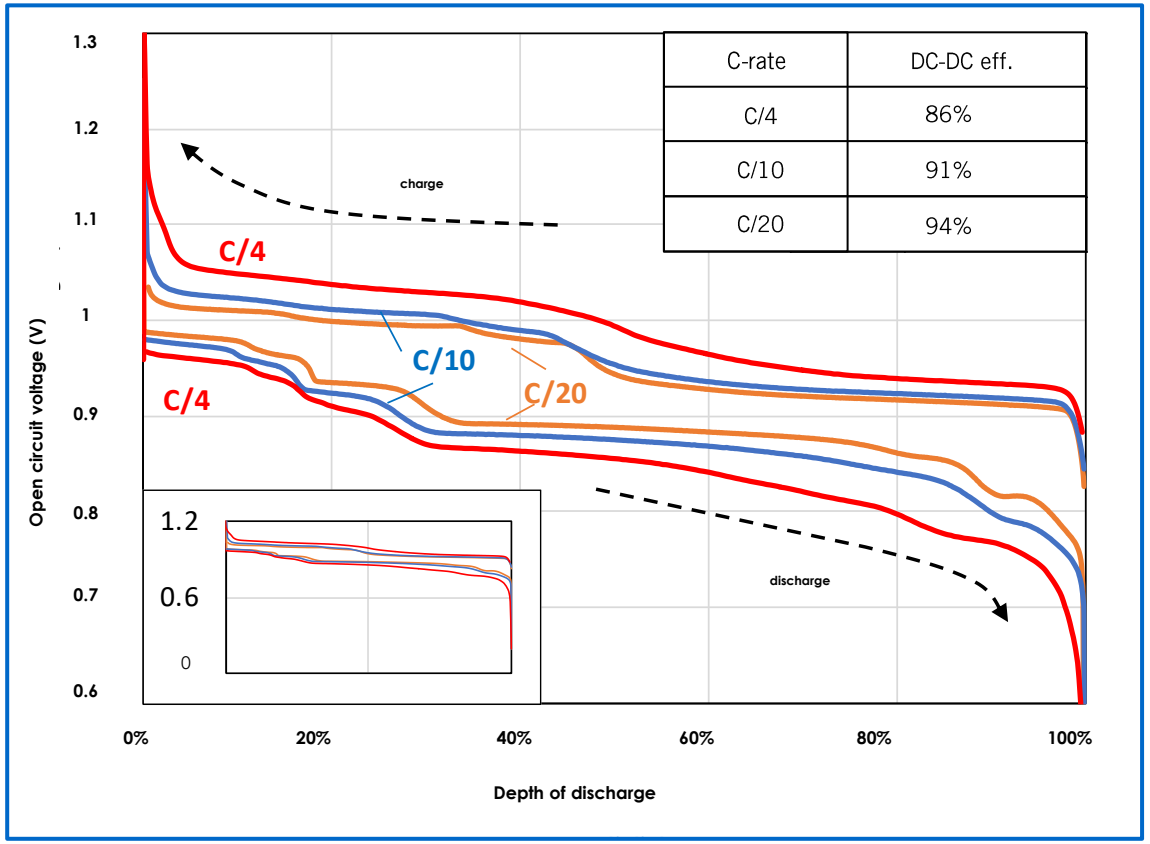
Final cell assembly

Good Cell Efficiency

80 – 90% Efficiency in Daily Cycling

- R&D cells with 86-94% round-trip DC-DC efficiency
- Commercial cells targeting 80-90% at 4 hr cycling rate
- → ***Performance confirmed by independent third-party testing group in 2021***

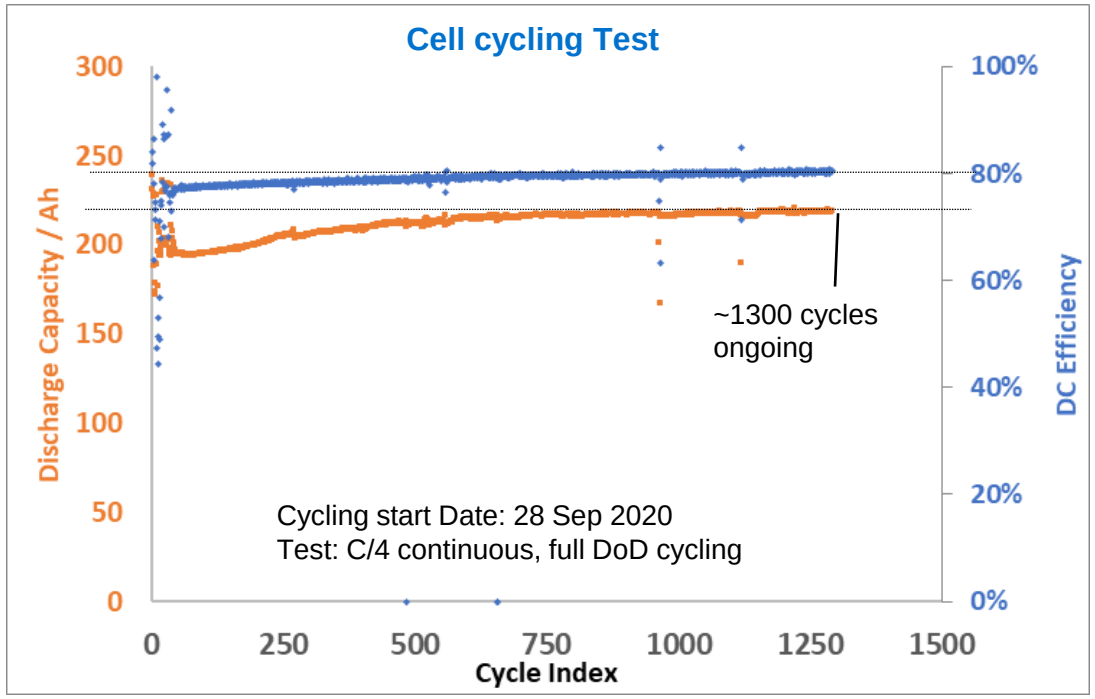
Voltage Profiles & Efficiencies of R&D Cells



Ambri

Cell Development Update

18 Months of Repeated Cell Production



No capacity degradation during ongoing testing of production cells

Fundamental Waste Advantages

- Recycling and disposal
  - Stainless steel and Sb easily collected and recyclable
  - $35,000 value for these materials per container
  - Suggests positive decommissioning value at end of life

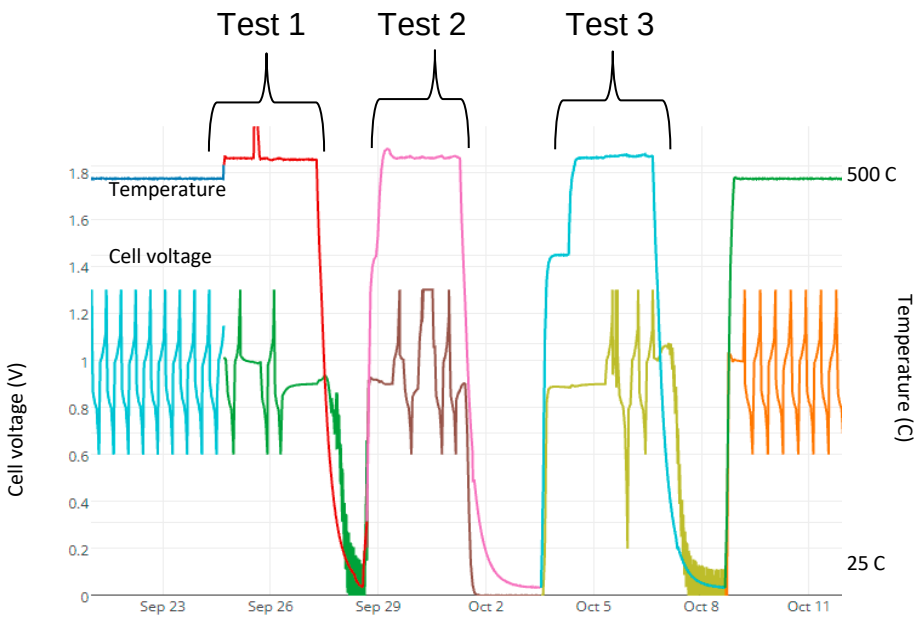
Cell materials are safety handled and processed

Safety Testing: UL1973

UL 1973 Safety Certification Complete

- Temperature excursion, high voltage float, short circuit
- No safety issues, ran successfully thereafter

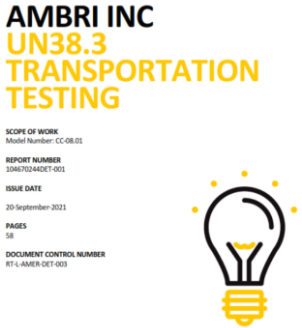
UL 1973 Test

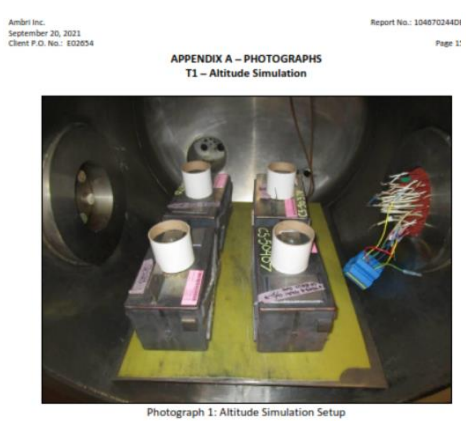


Cell used to perform UL1973 testing on a "cycled cell". Cell not only completed the test without failure but returned cycling with no performance impact. In fact, the capacity grew 3-4% during the testing (Cell: C5-50252).

Safety Testing: UN38.3 Transportation

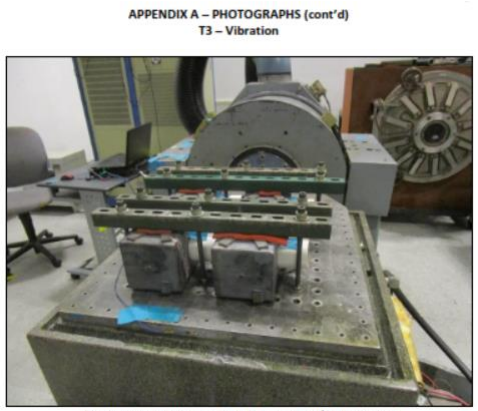
Ambri's cells tested by 3rd party for transportation safety; passed all tests





Photograph 1: Altitude Simulation Setup

Photograph 2: Thermal Test Setup



Photograph 3: Vibration Test Setup – Fore/Aft Direction

Results – Ambri's initial commercial-sized passed UN38.3 Transportation testing, not safety issues to report.

RESULT SUMMARY: The tested samples met the test requirements. See below breakout for tests performed.

Specification Section	Test Description	Results
T1	Altitude Simulation	Conforms
T2	Thermal Test	Conforms
T3	Vibration	Conforms
T4	Shock	Conforms
T5	External Short Circuit	Not Applicable
T6	Impact/Crush	Conforms
T7	Overcharge	Not Applicable
T8	Forced Discharge	Not Applicable

*Tests T5, T7, and T8 were not applicable as the battery cells are not electrochemically active at ambient temperatures below approximately 500°C.

Ambri Building Block of Energy and Power

Building block of energy and power:

- 8 MW / 8.34 MVA / 32 MWh

Similar footprint density to the best Li-ion

300 MW, 1,200 MWh Layout

8 MW / 8.34 MVA / 32 MWh
Power Block

Site Layout:

38 power blocks

317 MVA total

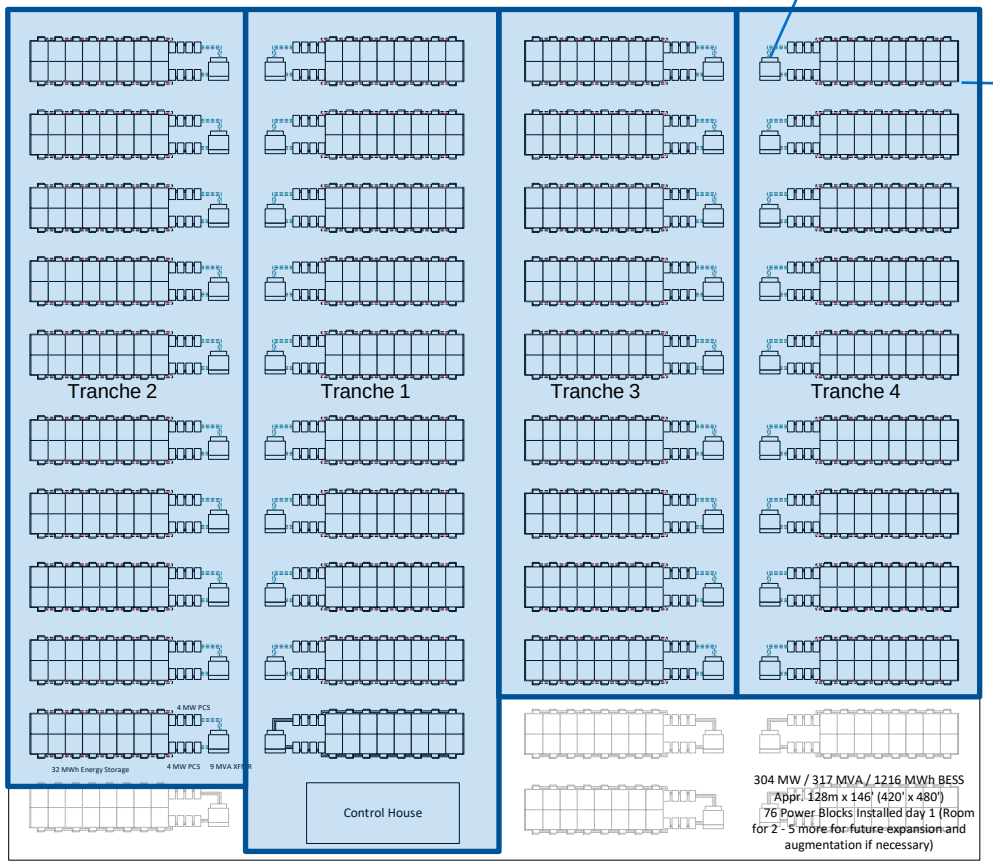
304 MW total

1216 MWh

128m x 146m (4.6 Acres)

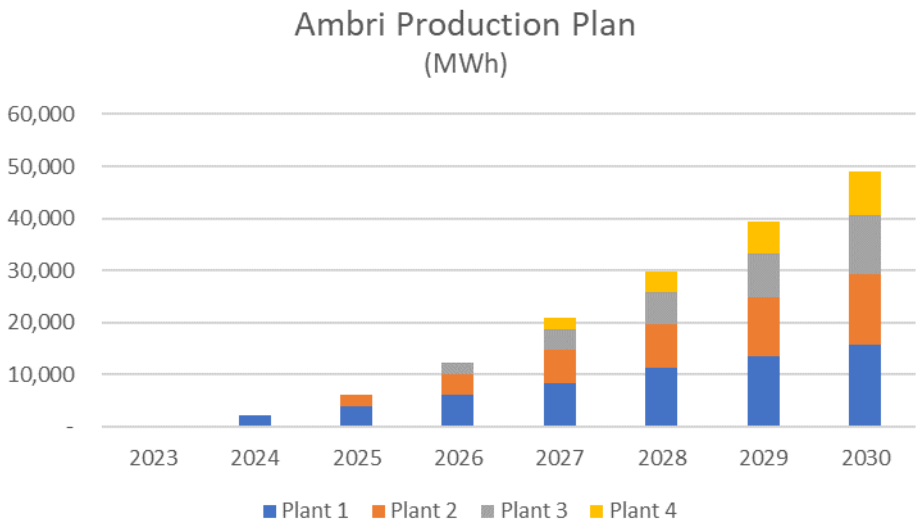
(5 spare spaces for future augmentation if necessary)

65 kWh/m^2



Simple Cell Design Allows For Low-Cost Manufacturing Plants

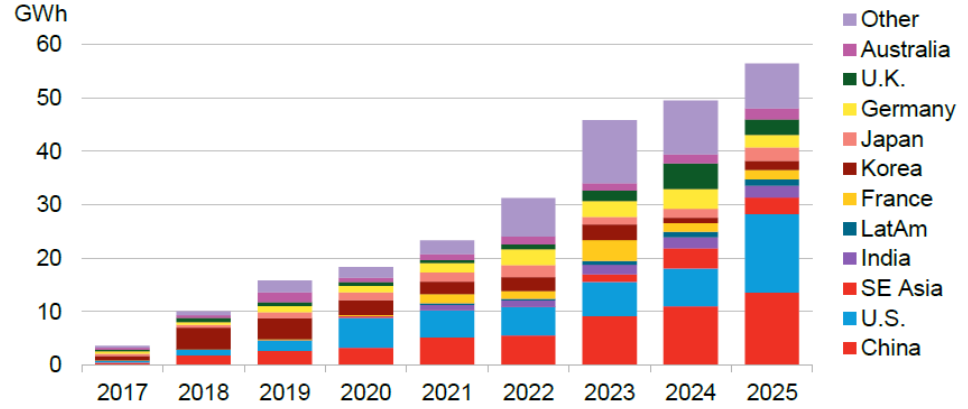
- Ambri planning to build/own/operate GWh cell and system manufacturing plants
- 3-4 total facilities would serve regional markets
  - US, Europe, SEA/Australia, and/or MEA
  - JV partners to be considered in some cases



$56M for Ambri GWh factory vs. $114-142M for Li-ion*

*"Gigafactory" , Tesla, https://www.tesla.com/sites/default/files/blog_attachments/gigafactory.pdf

Figure 10: Global annual deployments by country based on energy capacity



Source: Bloomberg NEF

Two thirds of the market is to be installed in China, the U.S., India, Japan, Germany, France, Australia, Korea and the U.K

Thank you for your interest

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