

Utility-Grade Energy Storage



September 2021

Presenters



Larry Zulch Chief Executive Officer

- CEO, Avalon Battery
- Over 25 years as CEO of investorbacked technology businesses
- Focus on companies transitioning from development stage to commercialisation
- CEO of Dantz, acquired by Dell EMC
- CEO of Savvius, acquired by LiveAction (IVP - \$23 billion PE)



Peter Dixon-Clarke Chief Financial Officer

- CFO, Kuwait Energy plc
- CFO, Hotspur Geothermal
- CFO, Rockhopper Exploration plc
- CFO, Help for Heroes
- Amlin Insurance plc
- Deloitte





Invinity Vanadium Flow Batteries Utility-Grade Energy Storage

Invinity VS3

78 kW, 220 kWh, 20' shipping container form factor, unlimited cycles over 25 year life.



INVINITY ENERGY SYSTEMS

Established

Formed 2020; merger of redT energy (UK) and Avalon Battery (N. America)

Expertise

Over 150 employees, deep flow battery expertise. More than 70 patents.

Joint development Siemens Gamesa Renewable Energy,

projects by California Energy Commission.

Proven

Validated

50 projects, over 25 MWh installed.

Global presence.

The Energy Storage Imperative

Energy storage has always been critical to generating electricity.

> Energy storage at a coal power plant in North Carolina



Pre-production storage enables power plants to be what utilities call a *load*following asset. The global move toward primary energy sources introduces intermittency.



Post-production storage enables renewable energy to become a load-following asset.



Market Size Projections

Analysts & researchers forecast immense growth...



....aligned with political will.

California: "Governor proposes US\$350m support for long-duration energy storage"

UK: "Government's US\$100m long-duration energy storage funding competition underway."

EU (IEA): "[Market design and falling costs] are projected to drive... utility-scale deployments reaching 220 GW by 2040.

US DOE: The President's Fiscal Year 2022 Budget Request included a total of \$1.16 billion for (energy storage) activities



Utility Grade Energy Storage Characteristics

	Lithium Ion	Vanadium Flow
Safe	Prone to catching on fire – difficult to put out.	No fire risk – electrolyte is mild, water- based, battery acid.
Long life	Degrades with use – five to seven years of daily cycling.	Unlimited cycles – over 20 years of continuous operation.
Economical	Lower upfront capital cost, but high cost per MWh over life (LCOS).	Low cost per MWh over life (LCOS).
Proven	Many installations at utility scale around the globe.	Invinity's first utility-scale installations currently underway



Energy Storage Market Targets

INVINIT

ENERGY SUPERHUB OXFORD Urban Decarbonization





"Lithium Barrier" (4 hours, 250 cycles per year)

Energy Superhub Oxford

THE UK'S LARGEST FLOW BATTERY

- Supporting Oxford's decarbonization
- 2 MW / 5 MWh flow battery system
- Flow batteries for heavy cycling
- 27 Invinity VS3 batteries
- Construction / manufacturing currently underway
- First phase to go live within weeks













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Yadlamalka Solar + Storage

WORLD'S LARGEST SOLAR-POWERED VFB

- 8 MWh Invinity Battery System + 6 MWp Solar PV
- Manufacturing underway
- 41 Invinity VS3s
- Australia's largest flow battery
- First shipment H2 2021





Soboba Fire Station

CALIFORNIA ENERGY COMMISSION-FUNDED

- Delivering clean power to critical infrastructure
- 0.5 MWh flow battery system integrated with onsite solar PV
- 10-hours storage duration, supplying resiliency in a region heavily affected by wildfires
- Project to go live in San Jacinto in 2021









European Marine Energy Centre

INVINITY TO DELIVER 1.8 MWH BATTERY SYSTEM

- Announced November 9th 2020
- Tidal power > Invinity energy storage > Hydrogen electrolyser
- To be installed at EMEC in Orkney, Scotland
- Eight Invinity VS3s
- Delivery 2021





Hydrogen and systems integration with renewables will be a key part of our energy transition pathways.

Paul Wheelhouse, Scottish Energy Minister









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Inside a VFB

Durable/Reliable/Economical/Proven



VANADIUM

Element 23, readily available and more abundant in the Earth's crust than copper. Accessible reserves in Australia, South Africa, United States, Canada, Russia

REUSABLE

Virtually unlimited working life. 97% proven recovery rate from used electrolyte

SAFE

Electrolyte is ~70% water, non-flammable with no risk of thermal runaway





GRID SERVICES PROVIDERS

- T&D cost deferral/avoidance
- Balancing & ancillary services
- Wholesale market trading

COMMERCIAL & INDUSTRIAL

- Energy cost reduction
- Carbon reduction
- Improved resiliency

OFF GRID

- Secure 24/7 renewable power
- Fuel cost reduction
- Carbon emissions reduction

