

UniEnergy Technologies (UET)

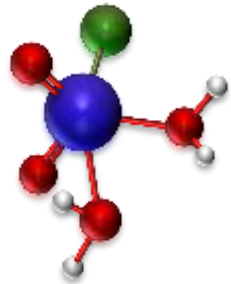


A Leading VRFB Systems and Service Provider in the multi-hour energy storage market

Technologies:

INNOVATION + QUALITY + PARTNERSHIPS

EcoPartners:



Working with SNL, PNNL to
advance reliability



Membrane development and
production, advancing stacks

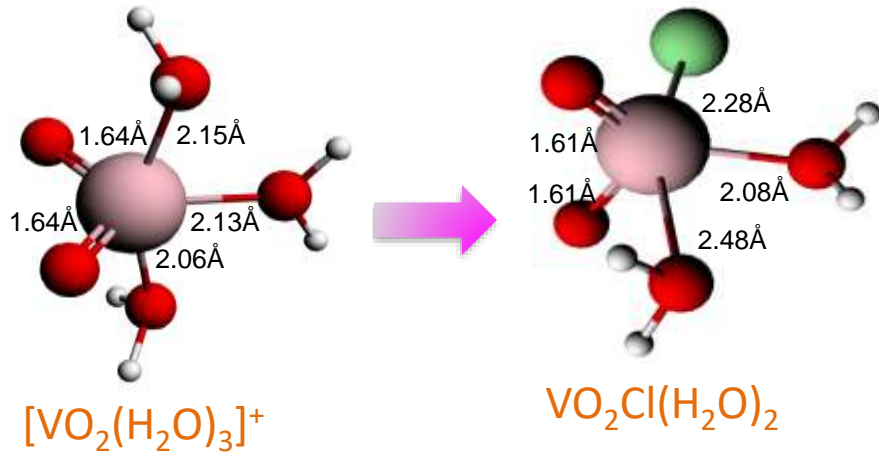


10 years stack field experience, ramping
up GW production capacity

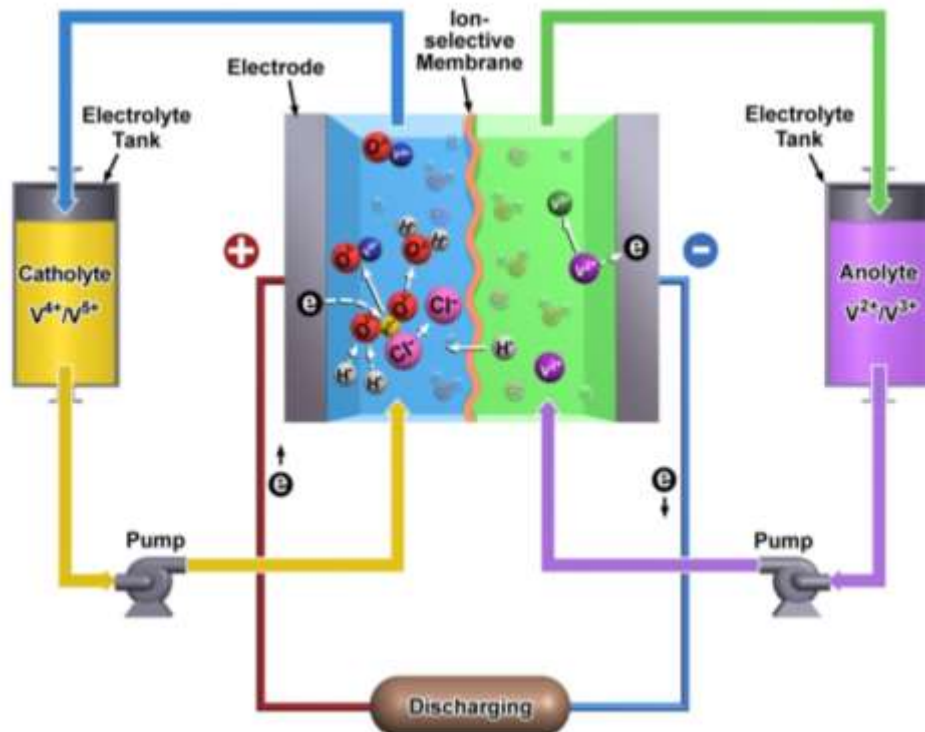


Electrolyte production: 1.5 GWh/yr capacity

Field proven new gen vanadium redox flow battery (VRFB)



Developed at PNNL and optimized at UET. Won the highest US Government Award for Excellence in Technology Transfer and 2017 Presidential Green Chemistry Award



More stable electrolyte chemistry vs traditional:

- 2x energy density
- Up to 50°C or higher

Optimized electrochemistry:

- Inhibiting oxygen activity, mitigating electrode degradation
- Easing electrochemical balancing

Higher chemical activity:

- Less sensitive to impurities
- High chloride activity, more corrosive

Advancing products: From Uni.System™ to ReFlex™



- ❑ Valuable learnings from field demonstration of Uni.Systems
- ❑ Rolling out 2nd generation product – ReFlex systems through value engineering



2012, 2013, 2014

IP DEVELOPMENT

- Electrochemical, Mechanical, Power & Controls Engineering

2015, 2016, 2017

PRICELESS FIELD EXPERIENCE

- Understanding Customers
- Contract Manufacturing

2018

PIVOT TO REFLEX™

- Customer Driven Design
- Flexible, Modular, Resilient

2019

100kW C&I PROJECTS

- High System Availability
- Industrial Design

2020

ELECTRICITY WAREHOUSING

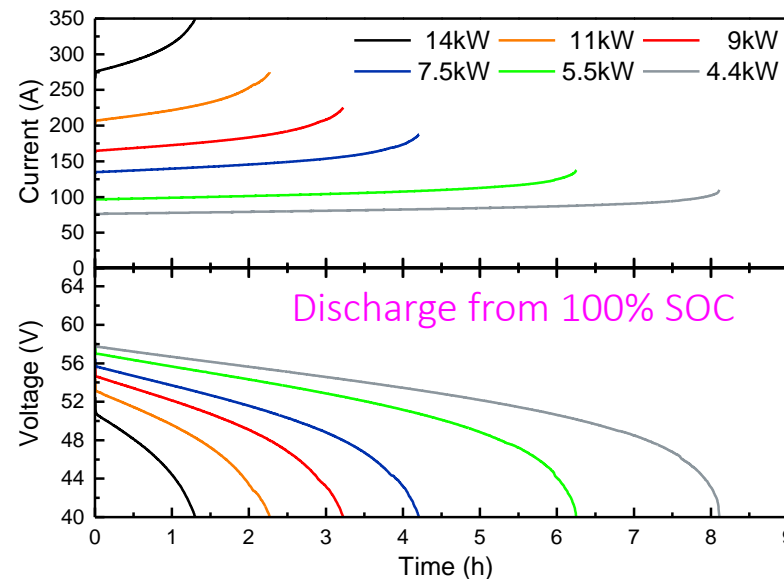
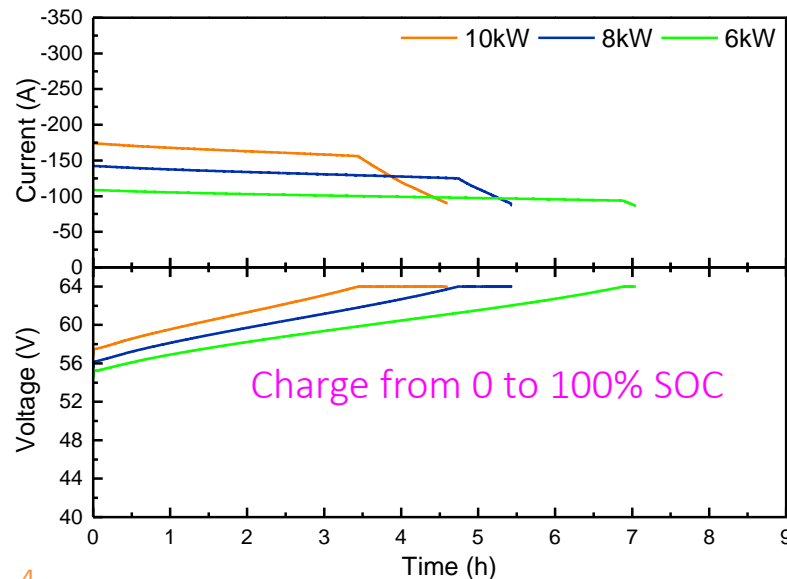
- E'lyte Leasing
- Storage-as-a-Service

Updated performance of ReFlex™

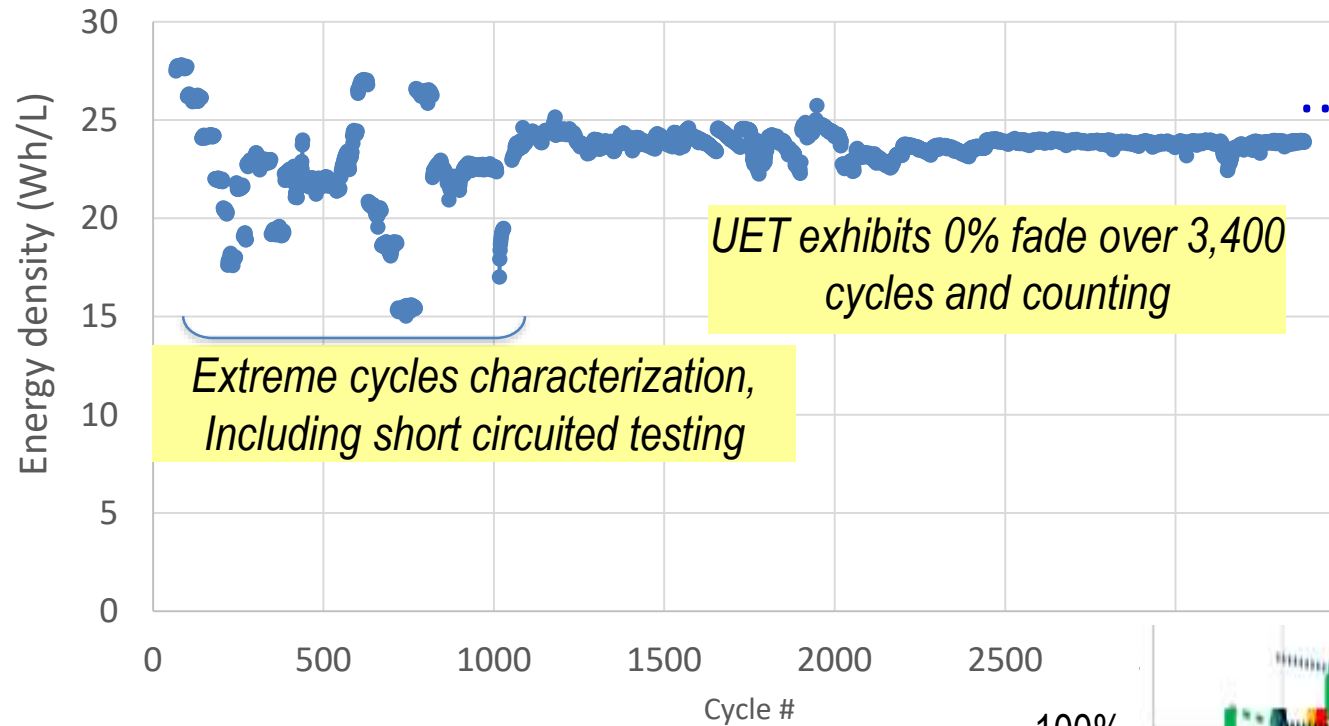
Duration	Power	Energy	DC Efficiency	AC roundtrip efficiency (including Aux consumption)
2h	11kW	22kWh	77%	68~69%
3h	9kW	27kWh	79%	69~70%
4h	7.5kW	30kWh	81%	70~71%
6h	5.5kW	33kWh	83%	70~71%
8h	4.4kW	35kWh	85%	69~70%



25% improvement in vanadium electrolyte utilization!!!



Proved no or negligible degradation over a long life

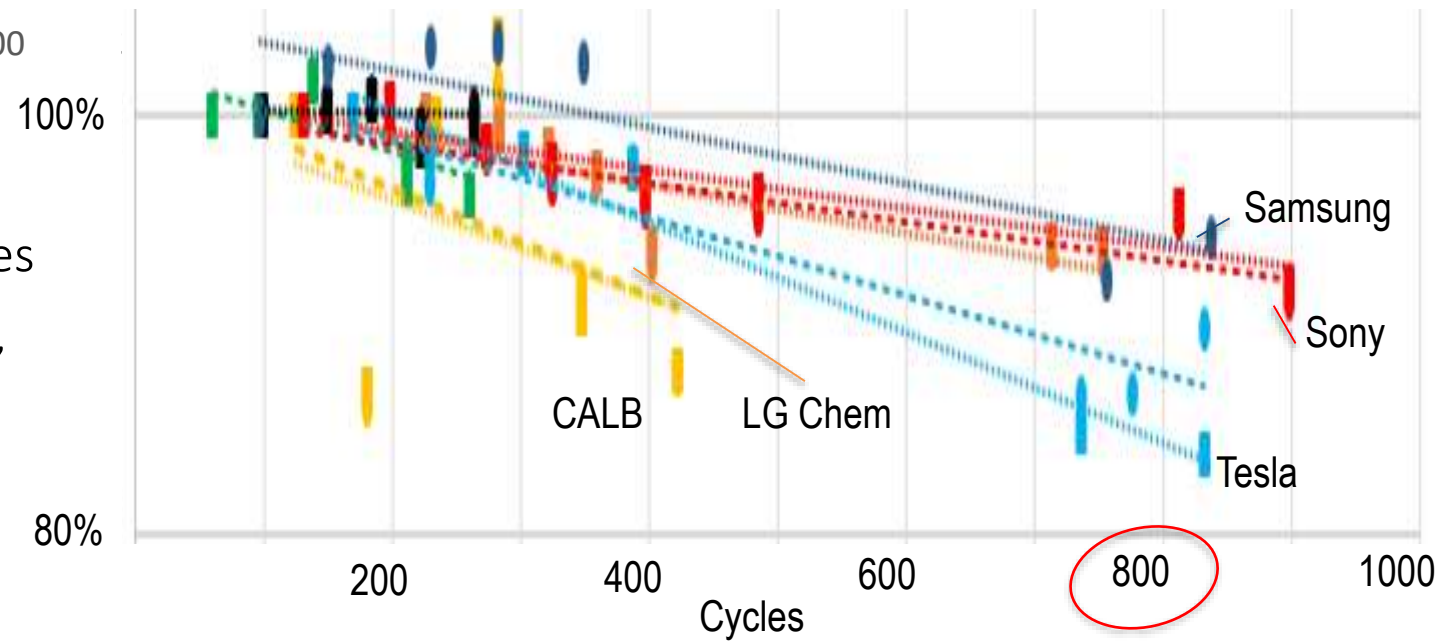


... 100% access to rated capacity, with unlimited cycles (over 12,000 cycles achieved under 100%SOC)

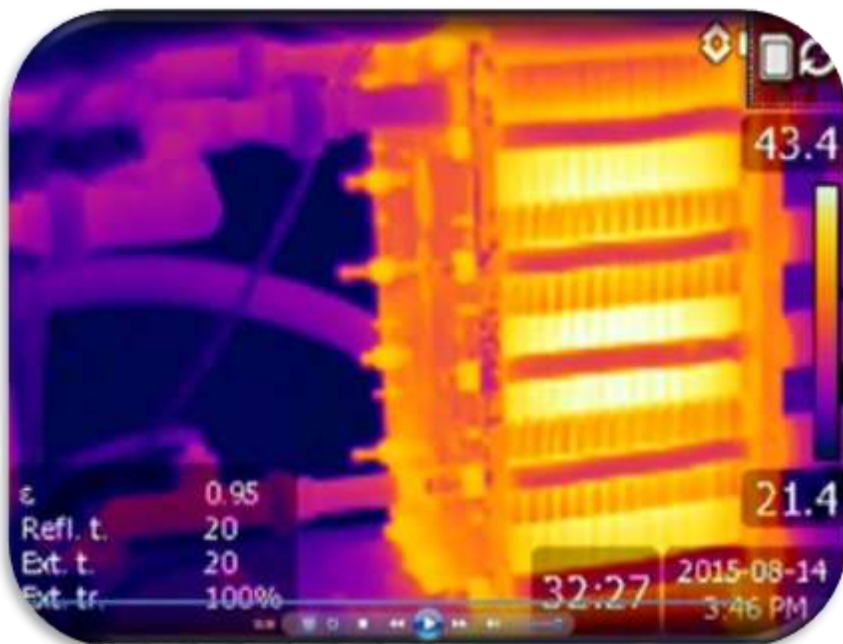
ARENA ITP Report: Ongoing Battery Testing

Source: <http://batterytestcentre.com.au/wp-content/uploads/2017/07/Battery-Testing-Report-November-2017-2.pdf>

- Li-ion, Pb-acid degrading in capacity, even under developer' recommended SOC ranges
- Typically 70~80% of rated at the end of life, partial access to rated capacity

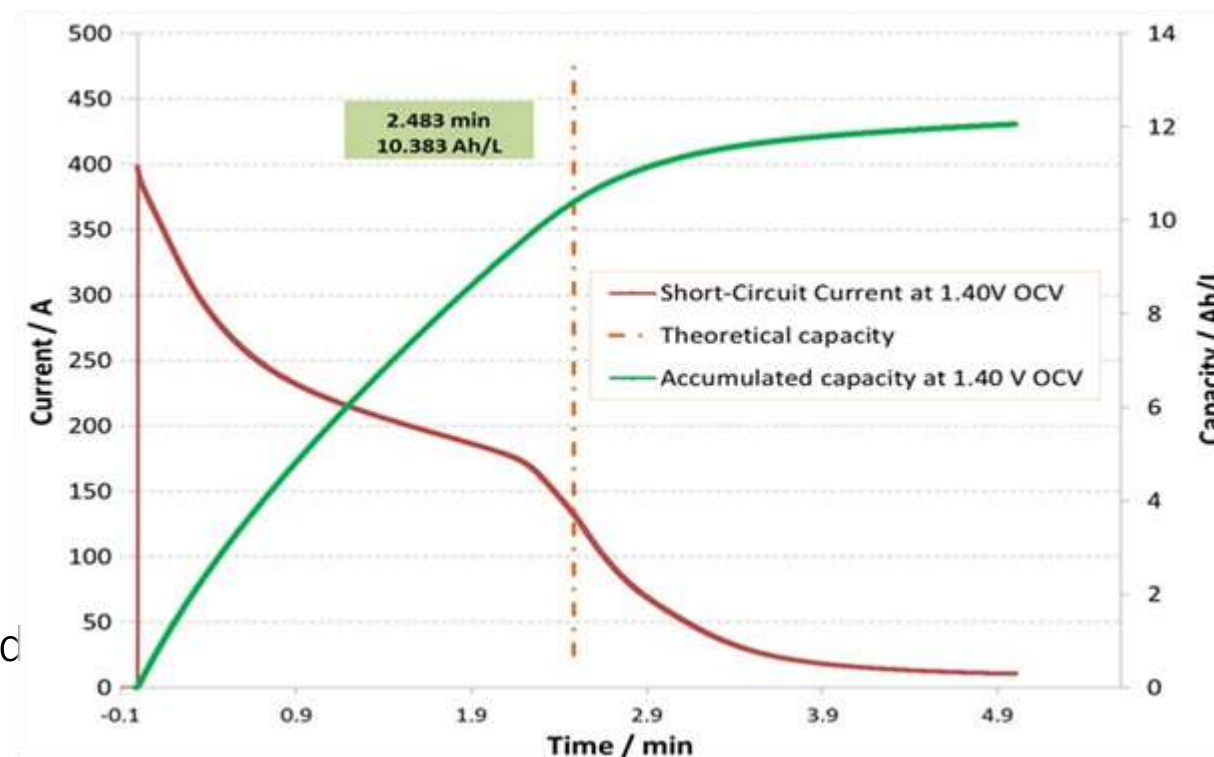


Inherent safe: Non-flammable, no thermal runaway



- ❑ 9.1 °C increase in surface temperature was measured after 29 minutes during an intentional short-circuit at full charge
- ❑ At fully charged, mixing of electrolytes would raise temperature less than 20°C.

- ✓ Shorted cell stack produces no lasting damage
- ✓ No spontaneous reactions when shorted
- ✓ Limited temperature increase
- ✓ Justified simplified cooling



UET VRFB approved by NY Fire Dept with letter of no objection, only after Pd-acid

Features of ReFlex™



- ✓ Compact foot print
- ✓ Short & long duration
- ✓ Zero degradation
- ✓ Unlimited cycles
- ✓ 20+ Year lifetime
- ✓ Non-flammable
- ✓ No thermal runaway
- ✓ Shipped ready to run
- ✓ Highly recyclable

