

Leading Deployment and Applications of Safe, Reliable and Flexible New Generation VFB

Remote island grid



C& I, With PV



ReFlex™



- Highly modularized
- Safe
- Reliable
- Flexible
- Sustainable
- Value-competitive

Microgrid, with PV



T&D application



Specifications of ReFlex™



- ZERO CAPACITY DEGRADATION**
- NON-FLAMMABLE ELECTROLYTE**
- UNLIMITED CYCLES**
- NO THERMAL RUNAWAY**
- 20+ YEAR LIFETIME**
- HIGHLY RECYCLABLE**
- SHIPS WET, 50% CHARGED**
- SELF-POWERED AUX BACKUP**
- SECONDARY CONTAINMENT**
- REDUNDANCY OPTION**
- AIR COOLED**

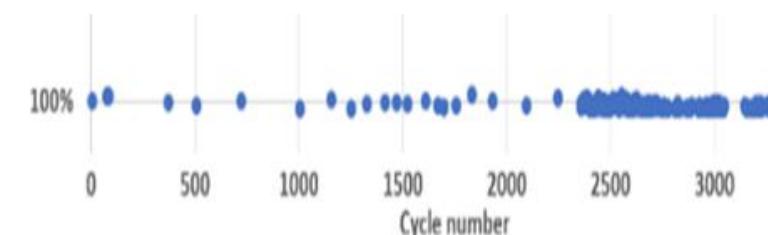
DISCHARGE PERFORMANCE

Duration	Power	Energy	Efficiency
2 Hour	14 kW	28 kWh	75%
4 Hour	9.5 kW	38 kWh	80%
6 Hour	7 kW	42 kWh	82%
8 Hour	5.5 kW	44 kWh	84%



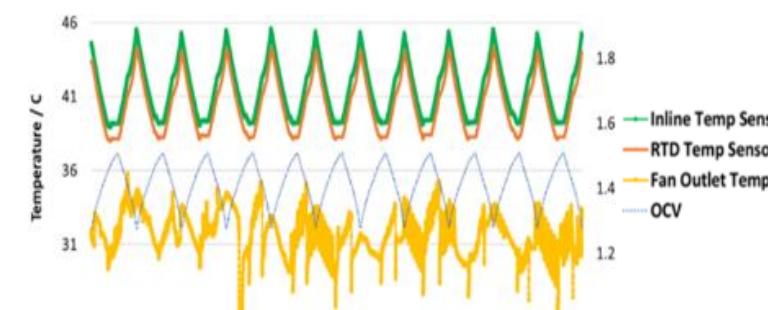
Up to multi-MWs

Rigorously tested, being UL/CE certified



Cyclability and Stability:

no capacity fade over
>3400 cycles at 100%
DOD



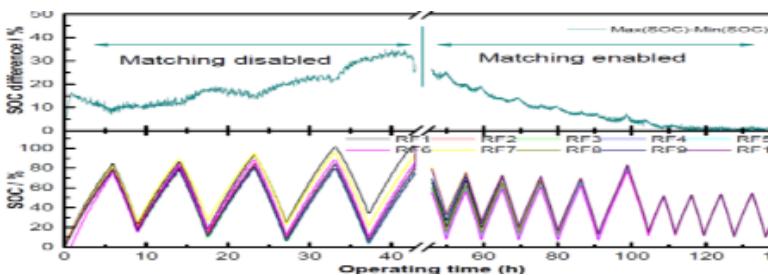
Heat Management,

validated with only fan cooling adequate



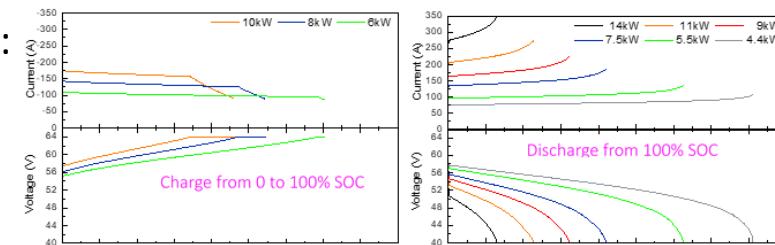
Stacked Up:

Seamless bypass,
150X in availability
over Uni.System™



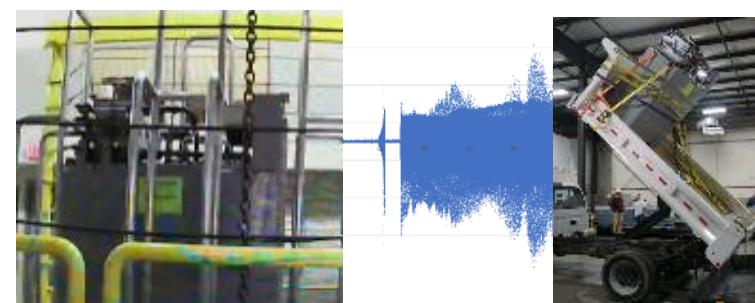
Balancing management:

Preoperatory control,
98% capacity alignment,
achieved long term
stability



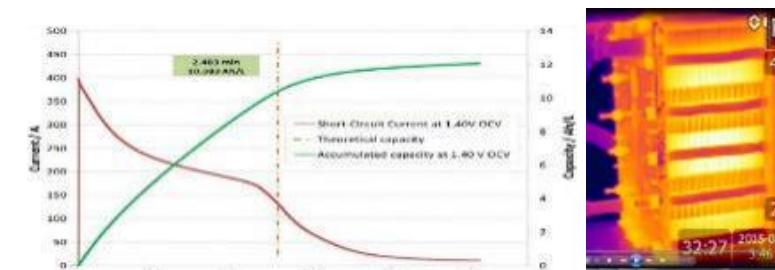
Flexibility in Performance,

meeting customer
demands in kW and kWh



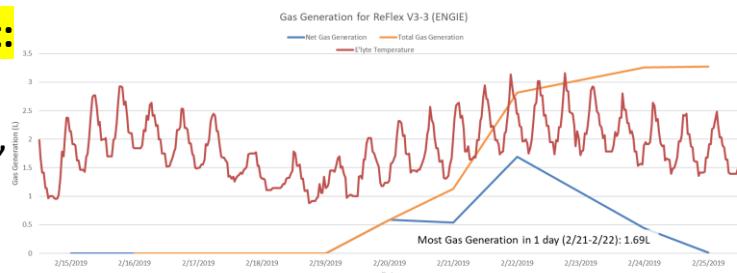
Mechanical Integrity -

Transportation/Shipping
Validation



Safety Validation:

Short circuited, Increasing
by only 9°C; No thermal
runaway



Gas management:

Negligible gas evolution
under normal operation,
fully managed under
extreme conditions

Accumulated over 500K hrs operation, achieved 98% availability



From C&I, Microgrid to T&D, plus renewable integration



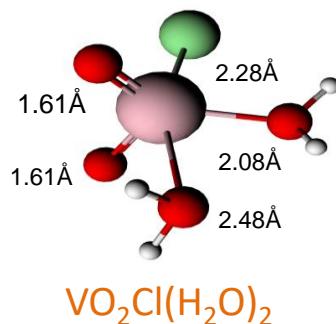
A long journey from lab to a safe, reliable and flexible products



2008~2011

Discovery at PNNL

- Developed new generation VRFB chemistry



2012~14

Early Productization

- Engineering, prototyping, rolling out container products

2015-17

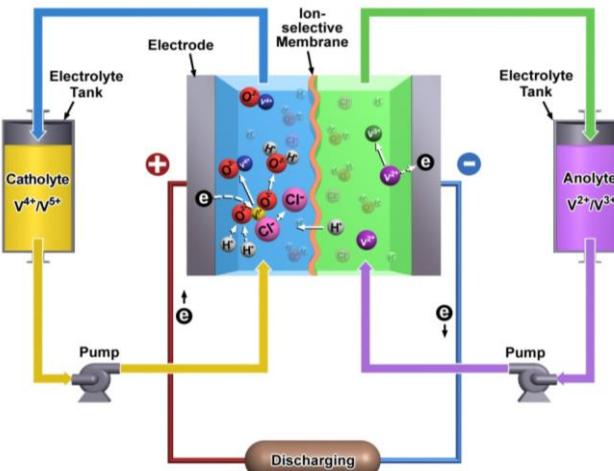
Field Demons & Validation

- Manufacturing, field-deployment and operation
- Understanding customers

2018~present

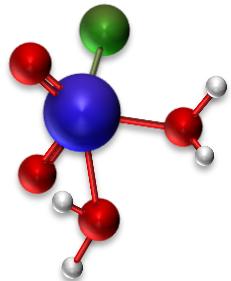
Product Maturation

- Customer driven-design
- Flexible, Modular, Resilient



Leading Development, Deployment and Applications of Safe, Reliable and Flexible New Generation VFB

Technologies:



Working with SNL, PNNL to
advance safety, reliability

INNOVATION + QUALITY + PARTNERSHIPS



Channel partners on
deployment



Membrane development and
production, advancing stacks

EcoPartners:



10 years stack field experience, ramping
up GW production capacity



Electrolyte production: 1.5 GWh/yr
capacity