Enduro USA

CHARG Australia

Selecting Grid Batteries

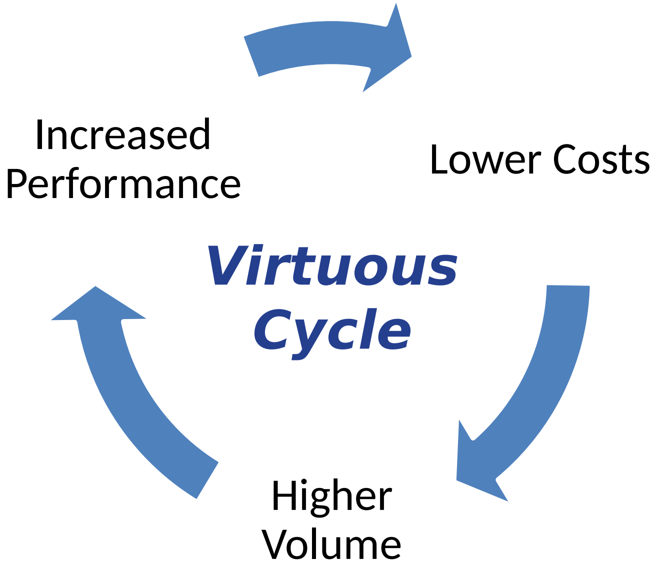
Rick Winter

IFBF Budapest, 2026

It’s a long path from molecules to ~~MW~~ GW

- ⇨ 60 years of Early Development (Qty 0 → 1)
  - » Since 1966, we’ve explored 1000’s of electrochemistries and developed 1000’s of prototypes
  - » Solid lab performance can secure funds to build prototypes
- ⇨ 30 years of Product Development (Qty 1 → 10)
  - » Since the 1990’s, low volume systems have emerged with increasing reliability and reduced technical risk
  - » Pursuing **TRL9** to achieve successful field deployments
- ⇨ 10 years of Design for Manufacture (Qty 10 → 1000)
  - » Billions invested into volume production, maturing supply chains, and higher performance have yielded significant cost and risk reductions
  - » Pursuing **MRL10** to achieve volume production, lean manufacturing, with continuous improvements
  - » The goal is to achieve costs below 1.3x raw materials cost

Dr Phil Symons invented the ZnCl flow battery in 1966 with utility funding (US Pat #3713888)



Considerations when selecting a battery

- ⇨ Globally abundant materials that will support GW production
  - » Customers take a big risk when adopting a technology
- ⇨ It takes 10 years from molecules to MW
  - » Brilliant and passionate developers can have blind spots outside their expertise
- ⇨ Look for real data showing hundreds of full-scale 100% AC cycles
  - » Battery performance characteristics are complicated
  - » Evidence-based durability claims, both calendar and cycle life
- ⇨ All components must be field-proven
  - » particularly the stacks and e'lyte,
  - » … and there's a lot more to a battery than the battery

There’s a lot more to a battery than a battery

⇨ Customers expect complete AC systems rather than individual components

⇨ Think Ready-to-Run

1. Modular, high availability battery
2. Enclosure – global logistics
3. Power Electronics (GaN)
4. Secure & stable control systems
5. Simple logistics
6. Easy to deploy
7. Communications with notifications
8. Simple user interface
9. Operational flexibility

⇨ Supporting technologies are continuously improving

⇨ Must still treat the battery as the weakest link

Evolving Requirements

EnduroCHARG

Storage requirements are changing as the market matures

⇨ Storage duration is increasing due to lower system costs and the opportunity to support renewables

⇨ Growing emphasis on regional supply chains to reduce geopolitical and logistical risks

⇨ Maintenance-Centric designs

» Operators favor systems designed for ease of service and minimal downtime.

» This includes **concurrent maintainability**, where components can be serviced without interrupting system operation.

⇨ Safety remains essential, but improved system designs have made safety risks more manageable and predictable

Changes that will quickly change battery design

- ⇨ Leasing
  - » How to halve flow battery CapEx to compete with lithium
  - » E'lyte vs full systems
- ⇨ Solid State Transformers (SSTs) will change the grid within 2-3 years
  - » 12kV to battery voltage in one step at 98.5% efficiency
  - » No low voltage copper or switchgear
- ⇨ Wind applications
  - » Large, high cycle applications ready to go that is tough for lithium
- ⇨ New e'lytes, and existing e'lytes aren't standing still
  - » Cheaper raw materials, additives, etc

Value streams are evolving

EnduroCHARG

⇨ We must focus on the top 2-3 values to deliver <5-year ROI

1. **Arbitrage** value is increasing due to high PV penetration – the Nessy curve
2. **Peak shaving** remains a top value proposition, but shorter duration
3. **Ripple current** has become a big issue with AI datacenter
4. **Grid stabilization** – “power abundance” or “power dominance”

Example of a Datacenter Value Stack

1. 5x9’s onsite availability with extended outage ride-thru
2. Perfect power quality by eliminating grid sags & swells
3. Increase datacenter peak power beyond grid interconnection limits
4. Grid noise cancellation for the datacenter
5. Datacenter noise cancellation for the grid
6. Grid outage ride-thru
7. Improve asset utilization of Medium Voltage circuits
8. Load flexibility for permits & pricing
9. Accelerate adoption of new clean generation
10. Accelerated permitting process by proposing a controlled and predictable datacenter load
11. Reduce annual power purchase costs by 50% by offering grid interactive services, such as peak shaving during peak price periods
12. Secure sites in densely populated areas by eliminating diesel backup generators
13. Higher utilization of grid assets

Final thoughts

⇨ Flow batteries are ideally suited to meet the needs of the global energy transition, which is the biggest macroeconomic shift of our lifetimes

⇨ It is up to us to take a clear-eyed view of flow battery weaknesses, build to their strengths, and adapt to our radically changing market

2MW/10MWh Grid Battery on $165m^2$