SRP Long Duration Energy Storage Perspective
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Who is SRP

- Established in 1903
- Phoenix area water and power supplier
- 3rd Largest Public Power in US
  - 1.1M customers
  - 7620 MW peak system load
  - 8 reservoirs on Salt and Verde Rivers
- Carbon Intensity Goals
  - 65% by 2035, 90% by 2050
Technology Phases to Low Carbon Future

Phase 1
- Solar
- 4-hour batteries
- Less coal
- Wind
- Geothermal
- Biomass

Phase 2
- Solar
- 6-12 hour storage
- End coal
- Wind

Phase 3
- Solar
- 12+ hour storage
- Wind
- Hydrogen?
- Carbon capture and sequestration?
- Direct air capture?
- Advanced nuclear?

2035 Goal: 65%
2050 Goal: 90%
Historical Grid Operation
Need For Long Duration Storage

- Solar: 3.3 hr, 6.0 hr, 9.6 hr
- Nuclear
- Natural Gas/Coal
- Existing Wind & Geothermal
- 1000 MW Storage Durations

This diagram illustrates the need for long duration energy storage to complement renewable energy sources like solar and wind, which have varying generation profiles throughout the day.
Seasonal Variation in Storage Needs

**July Peak Day**
- 6 GW Solar
- 5 GW @ 4hr
- Natural Gas/Coal
- 500 MW - 12 hr

**April Sunny Day**
- 5 GW @ 4hr
- 6 GW Solar
- 500 MW - 12 hr
- Charging
- Curtailment
Near Term Challenges for Li-ion Batteries

- Limited cost-effective duration
  - 4 hour most common today
- Safety issues
- Lack of operational experience
- Supply chain risks
- 2X Capacity = 2X the Cost
Many Emerging Non-Li-ion Technologies

- Phase change: Highview, Energy Dome
- Flow batteries: Many players
- Gravity: ARES, Energy Vault
- Advanced compressed air: Hydrostor
- Thermal: Storworks, Echogen, others