



Ray Fernandez – 2020/01/14

Comparison – C-Rates



➤ Li Ion:

- Only capable to charge & discharge at short durations
- Degradation & thermal run-away will occur when charge or discharge for longer periods at medium C-Rates (typically $< 0,5C$, or 2 hours)
- C-rates affect efficiency, faster charge & discharge rates reduce efficiency

➤ Sirius:

- Capable of operating continuously at ultra high C-Rates
- No degradation or thermal run-away will occur
- Efficiency remains very close to 100% even at fast C-rates



Comparison – Temperature Effect



➤ Li Ion:

- If cells operate at higher temperatures than 25 deg C, degradation will accelerate
- Risk of thermal run-away increases at higher temperatures
- Becomes unstable to store energy at low temperatures
- May only operate between 0 deg C and 50 deg C

➤ Sirius:

- No degradation will occur at high or low temperatures
- Can operate at -25 deg C to 80 deg C



Comparison - Degradation



➤ Li Ion:

- Degradation will occur as unit ages
- Temperature, charge and discharge rates accelerate degradation
- Average degradation will be 40% before a warranty claim can be attempted

➤ Sirius:

- No degradation will occur



Comparison - Warranty



➤ Li Ion

- Warranty is not a swop out warranty
- Warranty conditions are near impossible to meet
- Warranty conditions contain many warranty voiding clauses
- Warranty will not replace a unit, but has a very complex compensation scheme where the unit is bought back a fraction of the original purchase price

➤ Sirius

- If degradation occur a new unit is supplied



Comparison – Limited Cycles



➤ Li Ion

- Datasheet indicates best case scenario at STC (standard test conditions)
- Warranty is over at roughly 70% of datasheet “throughput”
- Cycles life deteriorates exponentially if cells run a higher temperatures

➤ Sirius

- Will not be able to cycle a capacitor into degradation



Comparison – Expected Life



➤ Li Ion

- Datasheet indicates best case scenario 10 years if oversized significantly
- Warranty compensation scheme becomes commercially unviable after average 7 years. (costs more to claim than possible buyback)
- Market is flooded with second life lithium, while the Lithium market only started gaining traction around 2015

➤ Sirius

- Not one single degradation warranty



Comparison - Sizing

- Li Ion
 - Design must oversize for average and max DOD (depth of discharge)
 - Design must oversize for degradation
- Sirius
 - No degradation will occur, no oversizing needed



Comparison – Depth of Discharge

- Li Ion
 - May only use a portion of the unit on a daily basis
 - May not discharge the unit completely
 - May not leave the unit empty for more than a few hours

- Sirius
 - Can use 100% of the available energy
 - May discharge the unit completely multiple times per day
 - May discharge the unit to 0V and leave for decades with no damage



Comparison – Health & Safety

➤ Li Ion

- Not safe for air Travel
- Thermal runaway very dangerous
- Cannot be extinguished with water

➤ Sirius

- Safe for air travel

