



# Unleashing the Potential of Sodium-Ion: Securing Domestic Battery Manufacturing for the DoD

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DPEC 2024  
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New Business Development Manager

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06.06.24





## Chemistry-agnostic battery developer and manufacturer based in Columbus, OH



Tier 1 Battery Testing Service Launches for Automotive & Battery OEMs

2009



NewCo for Energy Storage, IoT & Enterprise Innovation Programs

2014



Fiat-Chrysler begins sole sourcing its global lithium cell testing and supplier qualification to CAR Tech

2016



Technicity LLC adds Battery Design & Prototyping to Connected Products Portfolio

2019



**CAR Tech + Technicity are Consolidated to form Acculon**

2022



**GWh Battery Manufacturing Capacity is Commissioned**

Q4 2024





## What Are They?

*Rechargeable batteries, similar to lithium-ion, with China leading in development followed by Japan and U.S.,*

## & Why Should Industry Care?

- 1) *Application Specific Performance Benefits*
- 2) *Potential for Cost Advantages*
- 3) *Favorable Supply Chain*

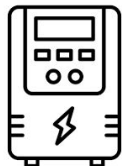




## Stationary Storage



Grid



UPS



Sodium-ion: 100MWh BESS project to be built in China's Hubei province in 2024

## Mobility



LSEV



E-Bikes

### **pv magazine**

## **TAILG unveils two-wheelers powered by sodium-ion batteries**

China-based TAILG has revealed its new sodium-ion battery technology. The company's luxury e-bikes will be the first to feature its sodium-ion batteries, and they will initially be available in China.

DECEMBER 28, 2023 **MARIJA MAISCH**



# SiB Performance Capabilities





SiB

LiB

Cell type	Volumetric energy Density [Wh/L]	Gravimetric Energy Density [Wh/kg]	D [mm]	H [mm]	Spec max continuous C rate	Spec max pulse discharge C rate
32140	250.54	112.36	33	140	3C	10C (30s) 15C (3s)
40140	264.31	119.23	40	140	5C	10C (10s)
46145/32140	221.81	116.25	47/33	150/140	5C	15C (3 sec)
60130	265.26	128.57	60	132	2C	N/A
Prismatic 75Ah	251.62	129.17	50/160 (h/w)	118	5C	N/A
Prismatic 210Ah	259.80	138.51	71/173 (th/w)	204	1C	3C (30sec)
32140	400	168	33	140	2C	6C (10sec)

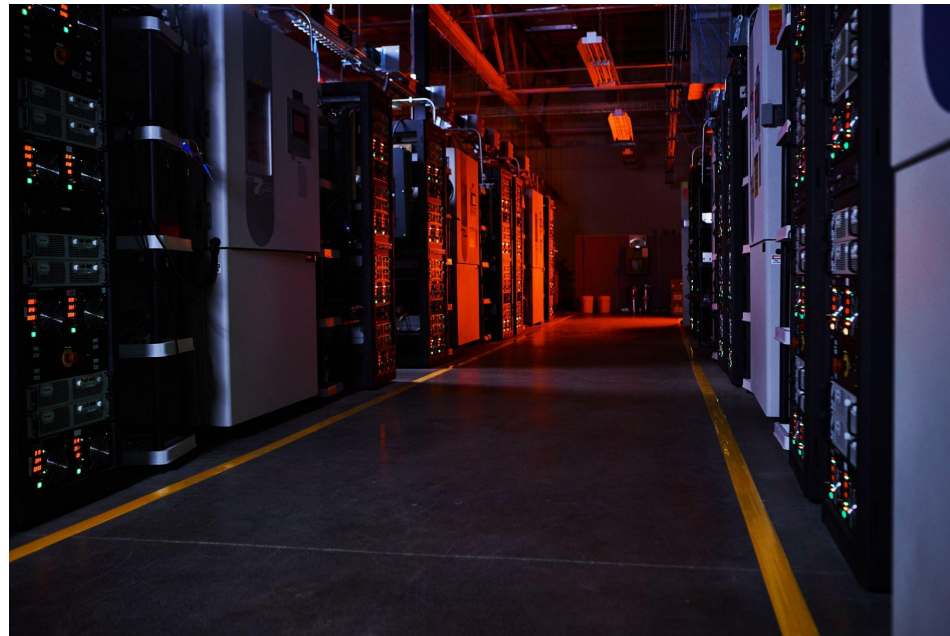
**SiB cell compositions with Oxide cathode & Amorphous carbon anode showing greatest promise**



Tier 1 Battery Testing Service With:

116x Cell Channels  
8x Pack Channels  
Multiple Thermal Controls

4 TB of data collected across Cell  
Characterization & Aging Tests &  
worked with:



*5,000 sq ft :: Opened 2009*

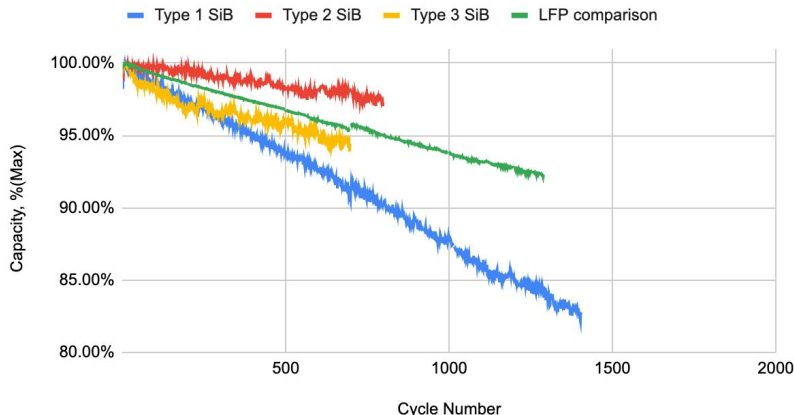


## Cycles to 80% Capacity SoH:

**6500** cycles linear regression for TYPE 2;

**1600** cycles linear regression for TYPE 1

C/2 CCCV Ch C/2 CC Dch Room Temperature



Battery	Round-trip Efficiency, %
LFP	94-96
SiB	94-96
Lead-Acid (deep cycle)	75-85

## Safe to Transport at 0V

### IT'S A THING:

Acculon Energy team visited running 100% capacity sodium-ion gigafactory in China at Jan 2024 (type 2 cell manufacturer)

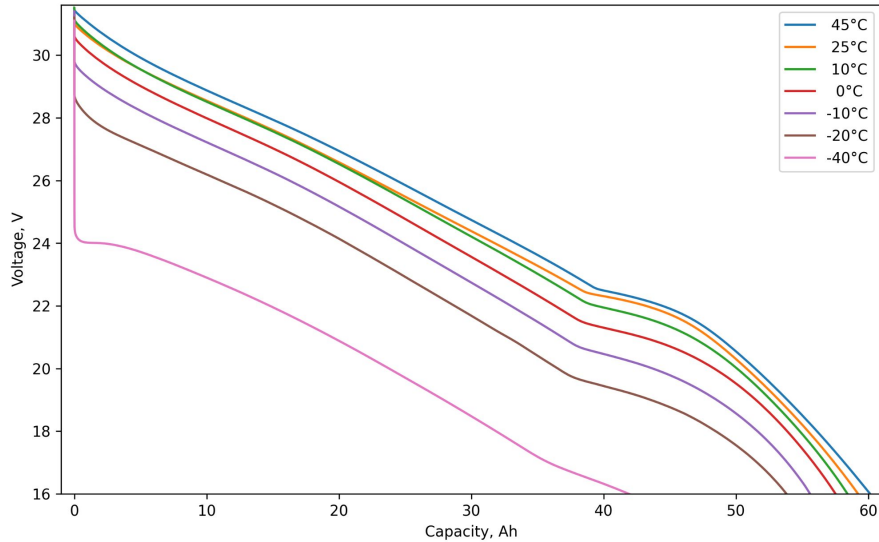




# Battery Module Discharge Curve Comparison



## SiB 24V



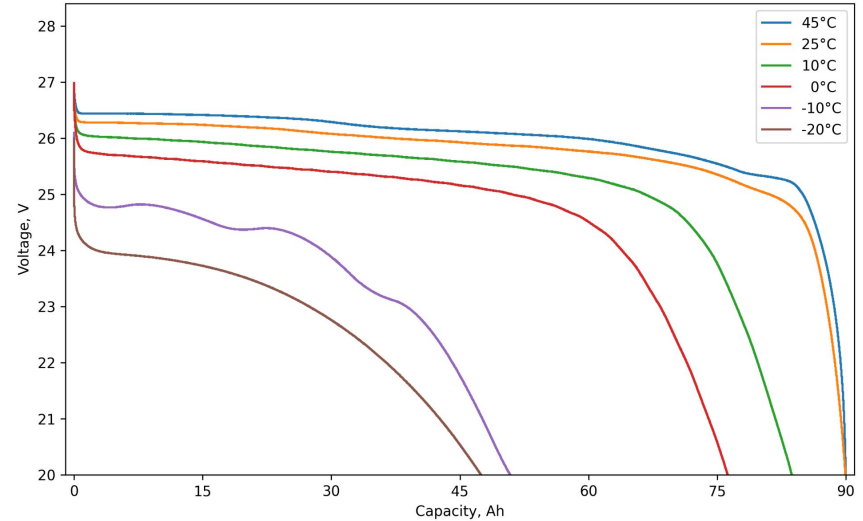
**Operating Temperatures**

**Charge: -20°C to +55°C**  
**Discharge: -40°C to +55°C**

**Max Continuous C-Rates**

**Charge: 2C**  
**Discharge: 3C**

## LiB 24V



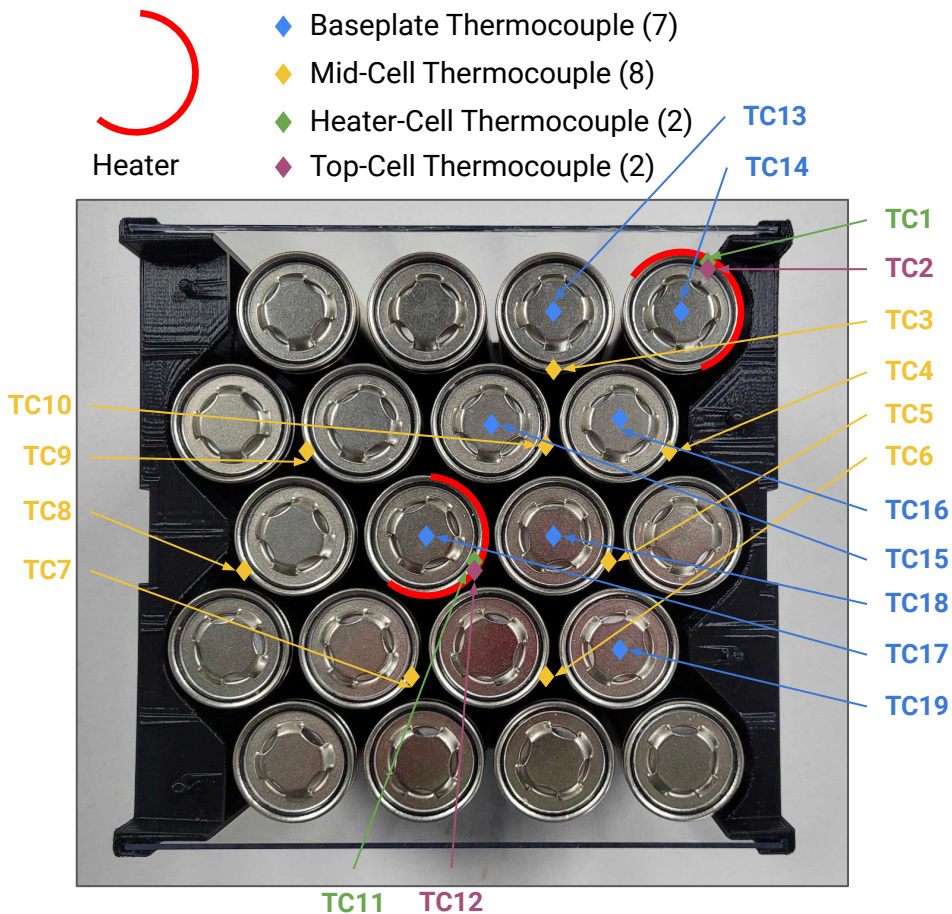
**Operating Temperatures**

**Charge: 0°C to +55°C**  
**Discharge: -20°C to +55°C**

**Max Continuous C-Rates**

**Charge: 1C**  
**Discharge: 1.5C**

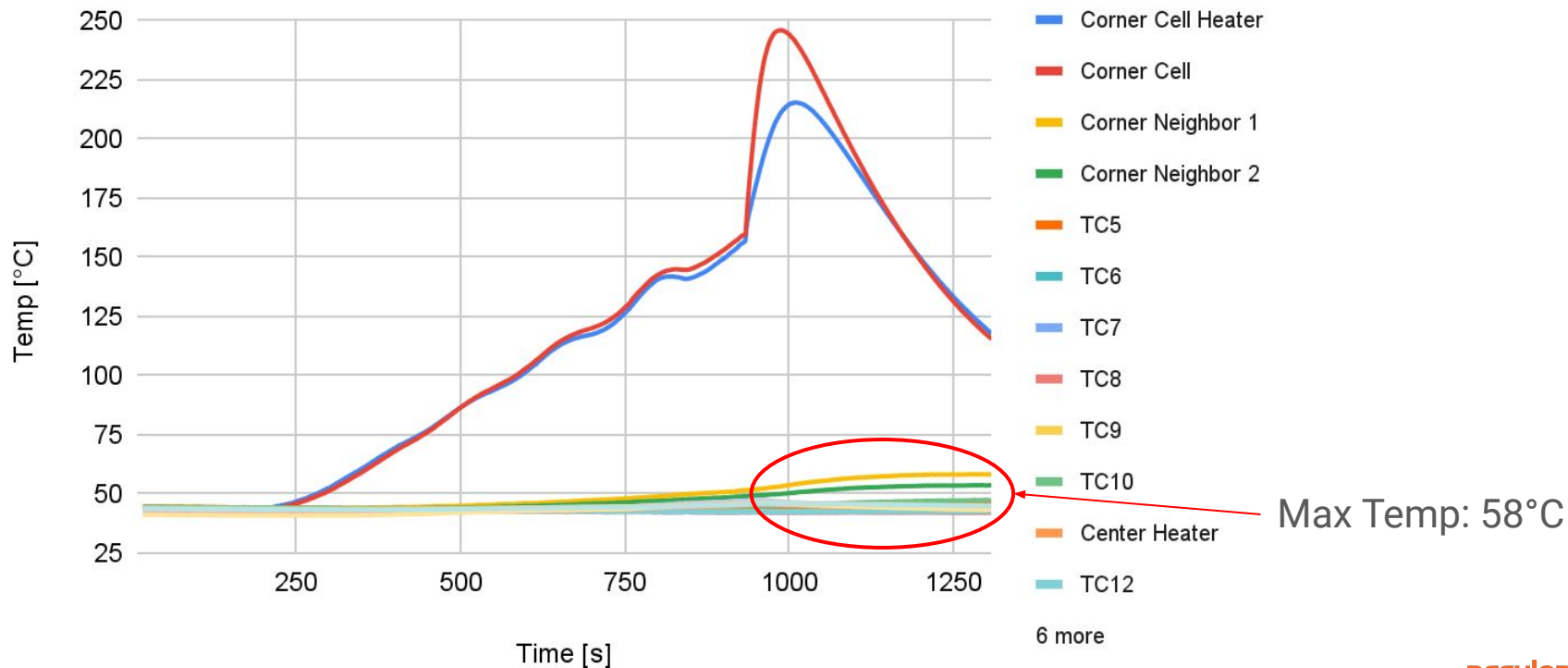
# Pre-Certification Testing on Na+ Submodule



- 4S5P Na-ion sub-module
  - The modules were fully electrically connected with wire bonds
  - The modules were encapsulated with foam
- The module had 19 K-type thermocouples attached to the cells and baseplate to measure temperatures
- A heater was placed on one of the corner cells as well as a middle cell



## Na-ion 32140 Corner Cell





### Applications Well Suited For SiB (not mutually exclusive)

#### Alternative to LiB

- Need to operate in low temperatures
- Need for higher power
- Need for faster charge/discharge
- Minimal space constraints

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#### Alternative to Lead-Acid

- Need for reduced O&M
- Need for improved Cycle Life
- Need for greater energy and/or power density
- Need for faster charge/discharge



- **Drop-in Replacement for 6T, Group 31, Auxiliary Power**
- **Remote Power**
- **EV Battery Buffering**
- **Mobile Energy Storage**





# SiB Cost Comparison





LiB Today  $\approx$  \$56/kWh<sub>1</sub>

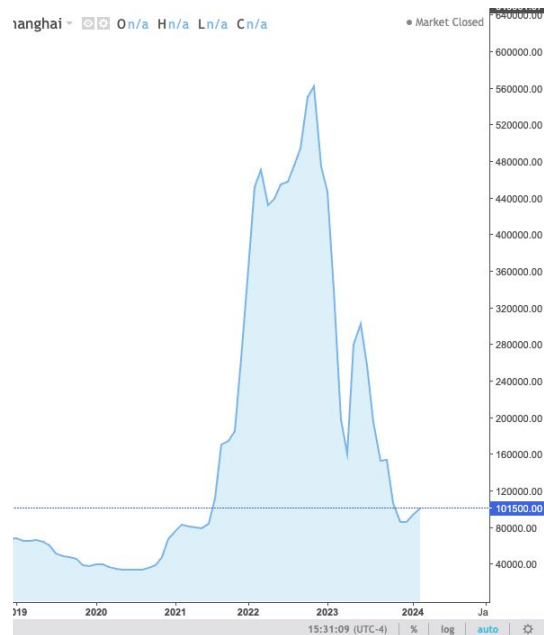
SiB Today  $\approx$  \$87/kWh<sub>2</sub>

Projected SiB < 5 Years  $\approx$  \$40/kWh<sub>2</sub>

**Additional Balance of System  
Cost Savings Possible Based on  
Simpler Thermal Management**

- 1) <https://www.theinformation.com/articles/the-electric-chinas-iron-based-batteries-are-ev-en-cheaper-than-we-thought>
- 2) <https://www.pv-magazine.com/2024/01/11/acculon-launches-production-of-sodium-ion-battery-modules-packs/>

## Reduced Exposure to Lithium Carbonate Prices



Lithium Carbonate Price Historical data, CNY/ton



# SiB Battery Supply Chain

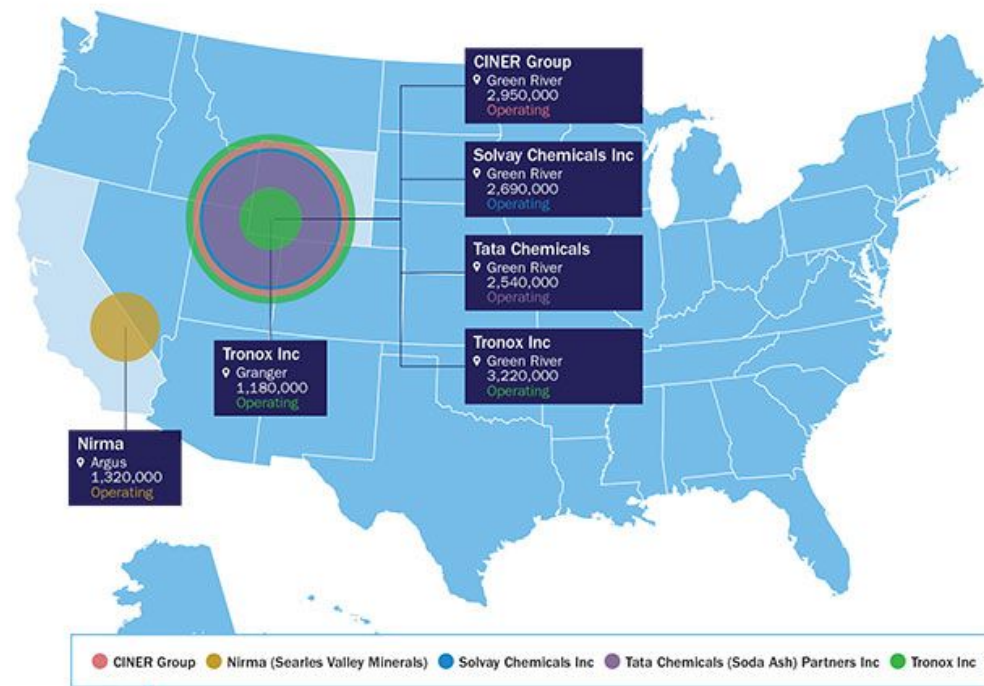




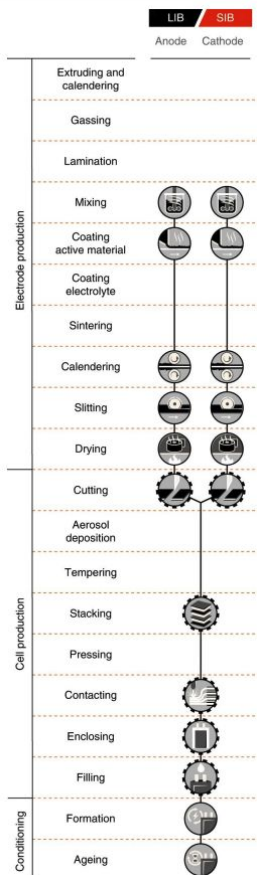


- Sodium 1000x more abundant than Lithium,
- Found in natural deposits and electrolysis of molten mineral sodium chloride
- It is plentiful in the U.S. and active mining exists
- Low risk of conflict materials

US SODA ASH (TONNES/YEAR)



1) <https://physics.aps.org/articles/v17/73#:~:text=Sodium%20is%201000%20times%20more.lowering%20battery%20costs%20%20Tarascon%20says>



## ← Cell Manufacturing

- Virtually identical to Lithium ion
- Form factors are flexible, i.e. cylindrical cells, prismatic, pouch cells are manufacturable for both SiB and LiBs<sub>1</sub>.

## Module Design & Manufacturing →

- Can use same BMS across SiB and LiB
- Can use same line as LiB
- Take advantage of high-volume automation



Acculon's 2 GWh production line

# Current Domestic Options



Lab

Pilot

Scale

**PEAK ENERGY**



*Relies on Prussian blue electrodes, costly*

**ENLIGHTEN\***

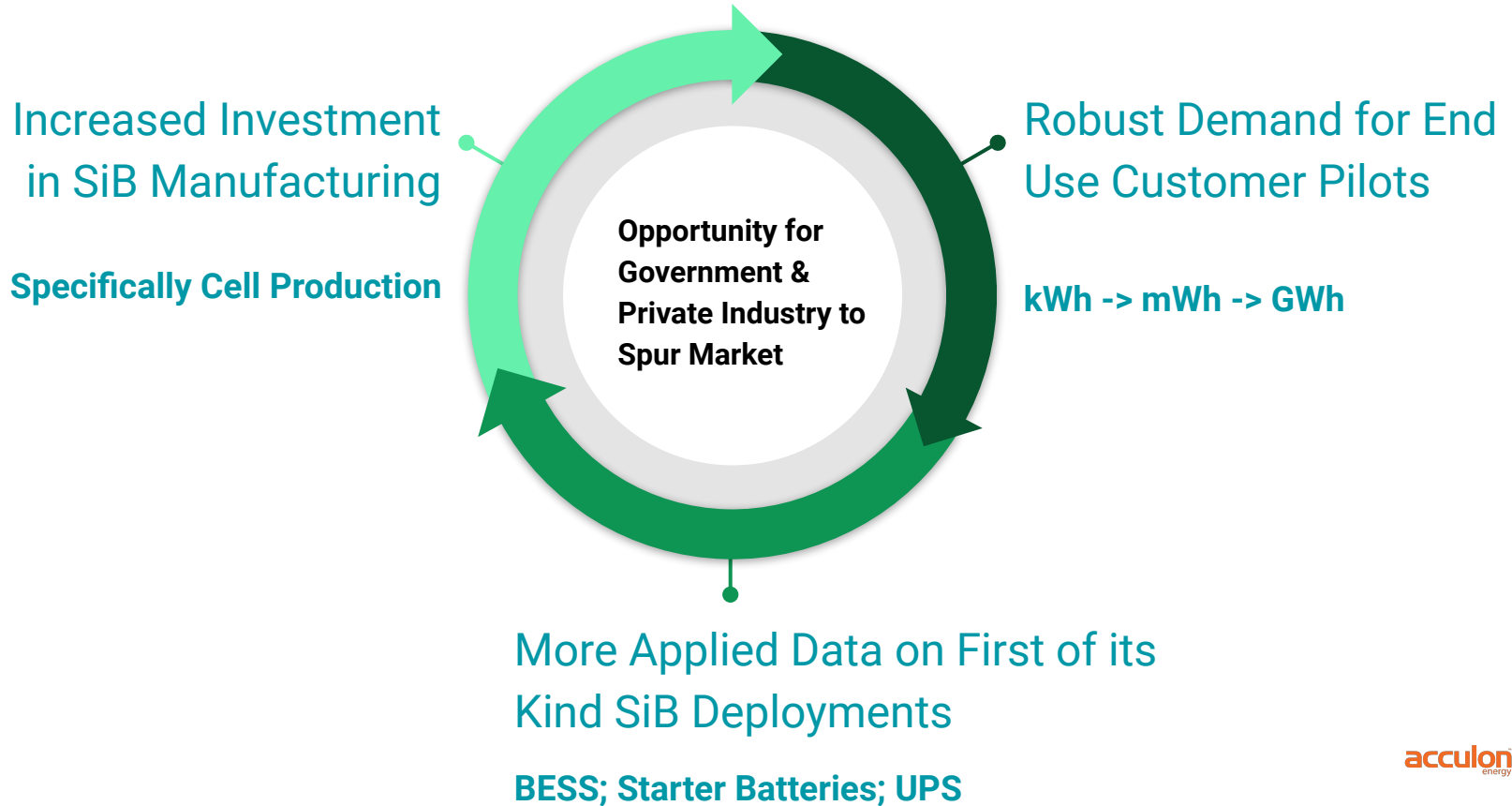


*GWH scale manufacturing  
Multiple cell geometries*



**BEDROCK MATERIALS**





acculon<sup>™</sup>  
energy

Thank you!

