



Next-generation Battery Manufacturing Tech Innovation Hub

A west coast ecosystem for battery manufacturing



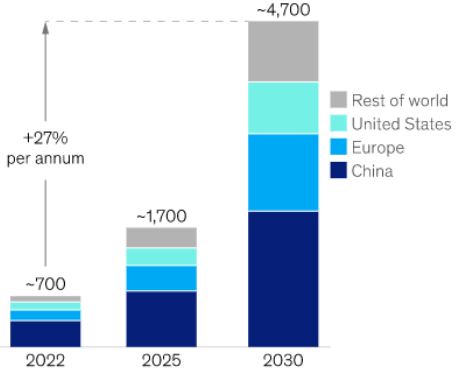
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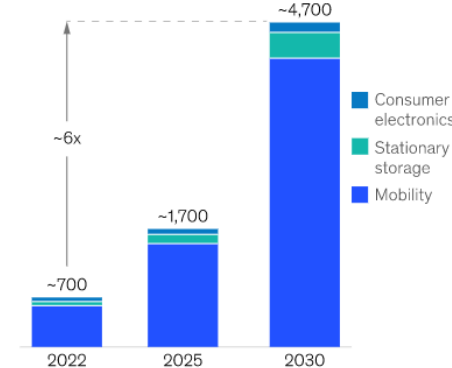
Global Market for batteries is growing

Global Li-ion battery cell demand, GWh, Base case

By region



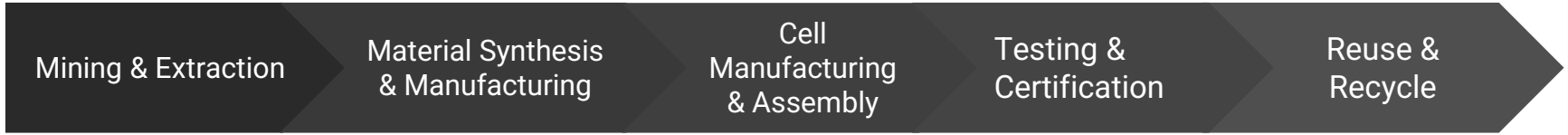
By sector



*Including passenger cars, commercial vehicles, two-to-three wheelers, off-highway vehicles, and aviation. Source: McKinsey Battery Insights Demand Model

Demand is expected to grow by about 33% annually to reach 4,700 GWh by 2030, worth ~\$400B

Domestic production currently represents 7% of global demand



Source: McKinsey market reports for Li-ion batteries ~\$200B (2030) ~\$200B* (2030) ~\$2B* (market creation) ~\$13B* (2030)

U.S. Energy Storage Economy

U.S. transportation and stationary energy storage combined markets estimates*

- 2.5–4 terawatt-hours (TWh) annually, by 2030 (driven by transportation sector)
- 3x-5x the current 800-gigawatt-hour (GWh) market

Current gen Li-Ion batteries

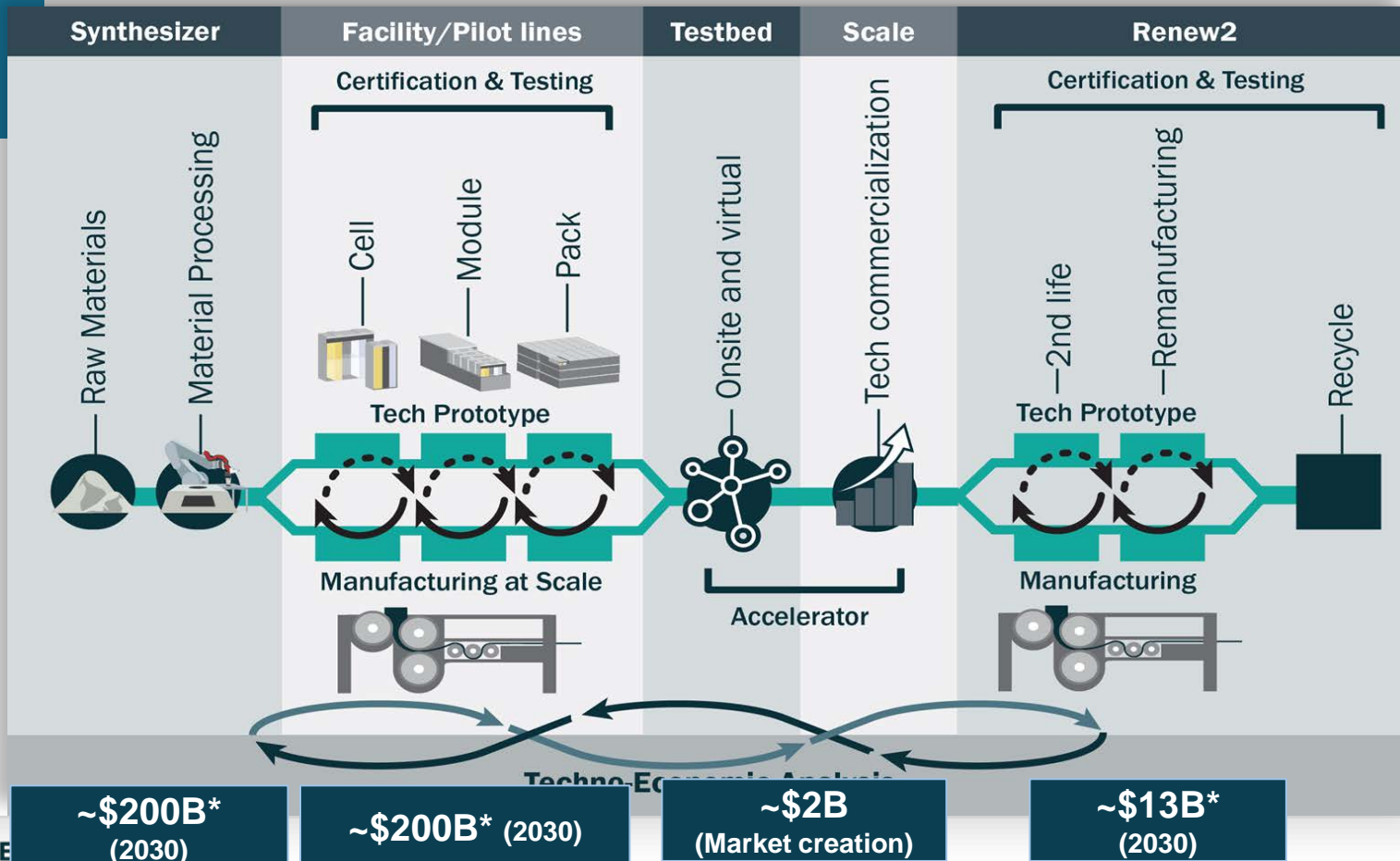
- Will meet near term energy storage market growth
- Will not be sufficient to meet performance and demand of ubiquitous EVs and grid storage

Next-Gen Batteries

- Will need higher energy densities, longer lives, uncompromised safety
- Will need new chemistries that use raw materials from domestic sources

Domestic production will need pilot & demonstration scale R&D for commercialization & manufacturing

Hub Concept



CA has an opportunity to meet decarb policy goals and plant flag as leader for next-gen battery techs

Demo & Scale-up

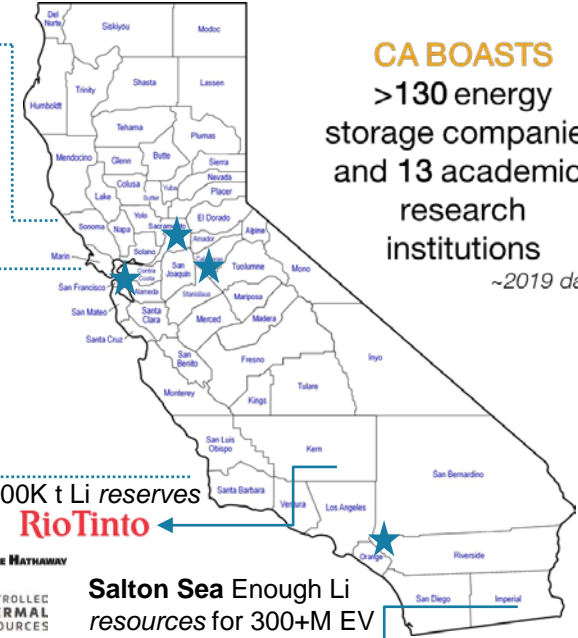
- Interest in Sacto which is ideal for fabrication and demonstration and scale up

Innovation & Prototyping

- Interest in revitalization of the Northern Waterfront in Contra Costa County – Ideal for material processing and small-scale pilot line production

Materials Processing

- Recent award of an EDA planning grant to UC Riverside related to those Li reserves



Mojave Desert >300K t Li reserves (largest domestic) **RioTinto**



Salton Sea Enough Li resources for 300+M EV batteries

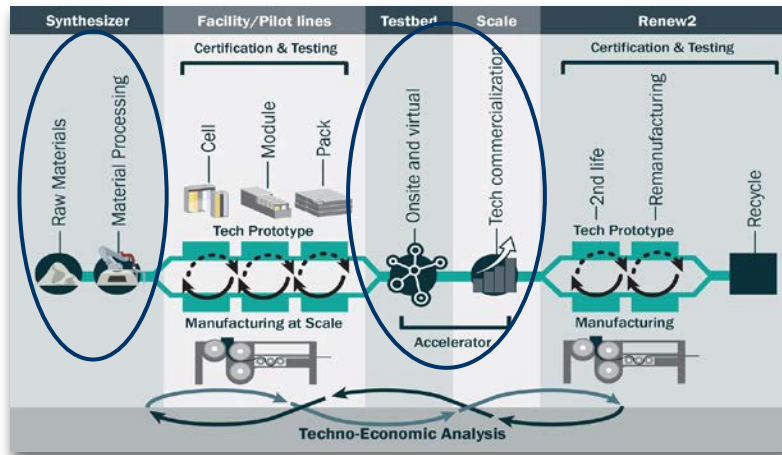
Rare opportunity to coalesce industry and government to meet emerging technology needs

Hub Facility I Materials Processing

In order to accelerate battery technology development, manufacturing and scale-up...

Industry needs:

- New methods for mining & extracting natural sources
- Improved processes for separation and conversion of raw materials into chemical precursors
- Advances in chemical processing of precursors into battery active electrode and electrolyte components
- Innovative scale-up synthesis engineering: to go from lab to pilot to commercial scale faster
- Innovative materials processing for direct recycling of battery materials.



Synthesizer pilot & materials accelerator facility:

- Chemical synthesis amenities for production of active materials at kilogram scales
- Process and material specifications for commercial scale production
- Rapid materials performance validation in coin or pouch test cell configuration

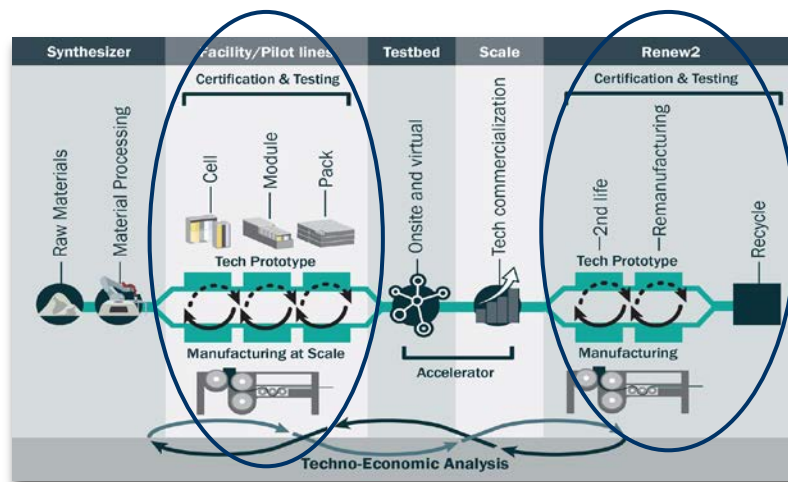
Hub Facility II

Battery Components & Assembly

In order to accelerate battery technology development, manufacturing and scale-up...

Industry needs:

- Manufacturing and optimization of the composite battery electrode composition and architecture
- Pilot scale cell production and evaluation
- New technologies integrations
- Commercial scale demonstration facilities of battery cell assembly and optimization
- Evaluation of battery performance under realistic operating conditions



Battery cell manufacturing pilot & testing facility:

- Battery component fabrication
- Battery cell assembly
- Testing for optimization and end use
- Modular design of the pilot cell production facilities for new technology integration

The Battery Value Chain

Additional Slides



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Needs of the U.S. Energy Storage Industry

Mining & Extraction

- Processing technologies for extraction, separation
- Raw material conversion into precursor materials from non-traditional sources of Li etc. such as geothermal brine (Salton Sea)

Material Synthesis & Manufacturing

- Chemical processing of precursors into battery active electrode and electrolyte components
- Scale-up synthesis engineering: to go from lab to pilot to commercial scale faster

Cell Manufacturing & Battery Assembly

- Manufacturing and optimization of the composite battery electrode composition and architecture
- Commercial scale battery cell, module and battery pack optimization
- Evaluation of battery performance under realistic operating conditions

Certification

- Testing in real world conditions
- Validation of battery performance
- Certification of batteries for end use applications

Reuse & Recycle

- Low cost battery disassembly and material extraction
- Manufacturability for recycling
- Reuse, 2nd life application