RUBICON
SUSTAINABLE TECHNOLOGY

Batteries – 2nd Life: Beyond mobility

Solar Power Africa 2022

21 February 2022

https://www.rubiconsa.com

Contents

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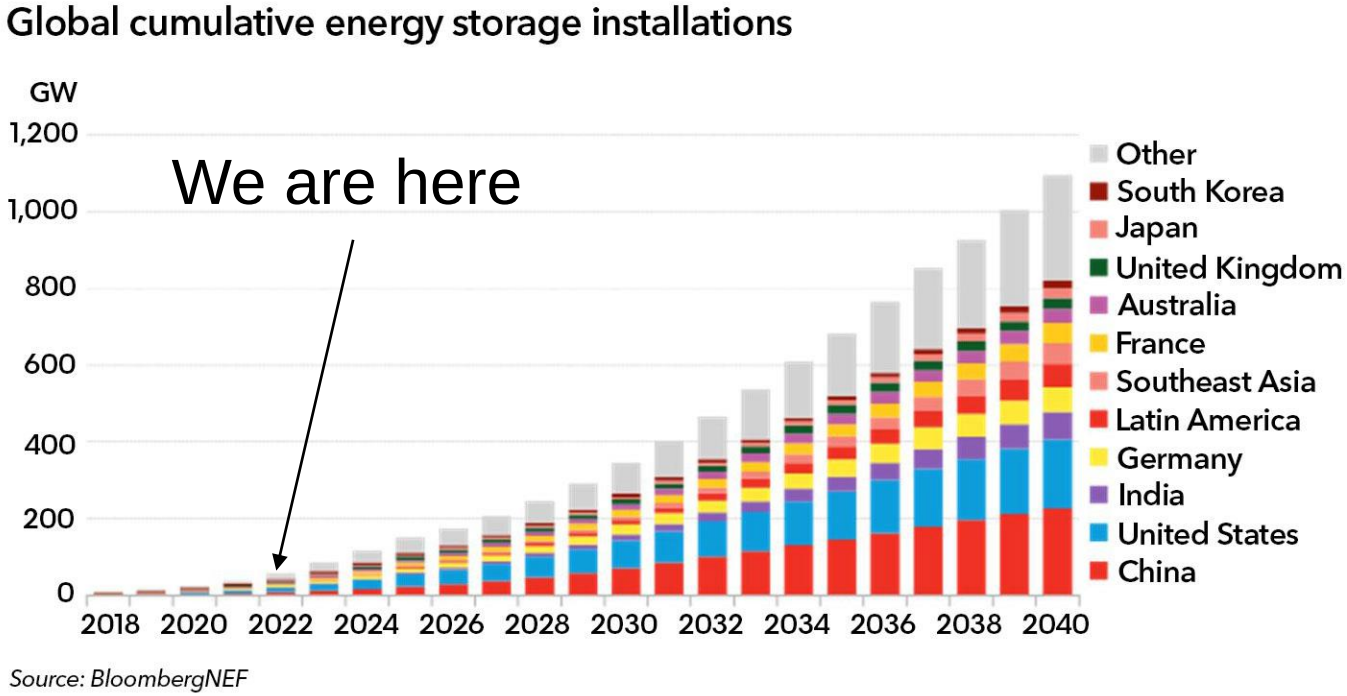
Li-ion production - where are all the cells going?

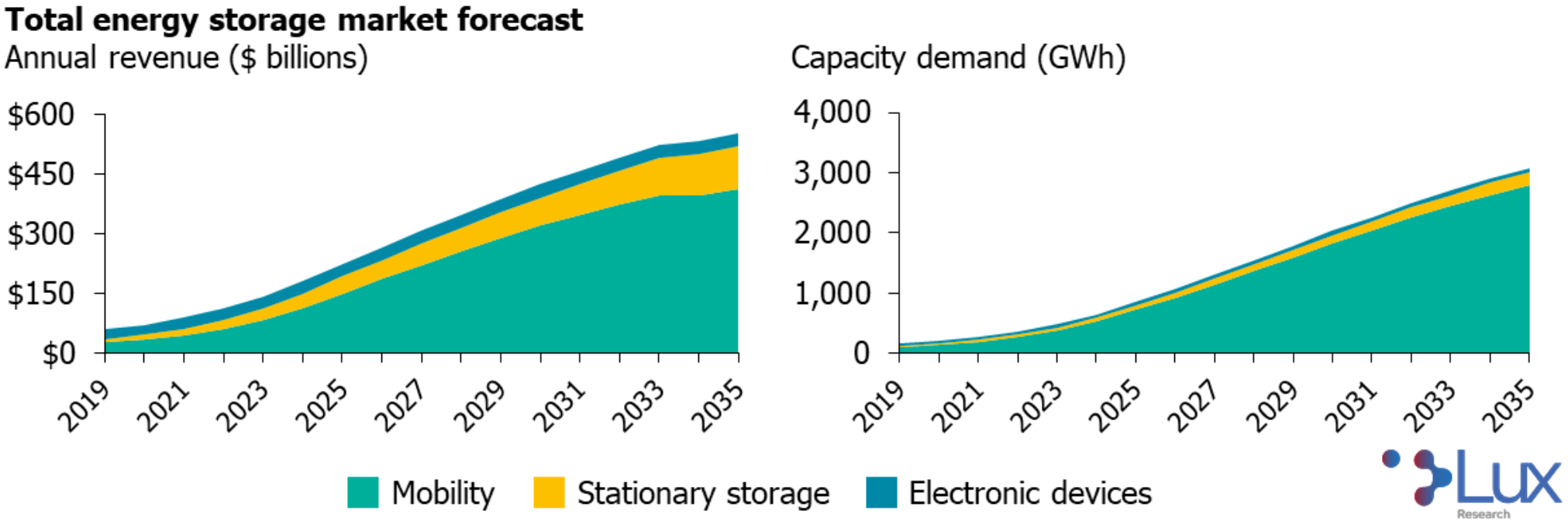
- Globally, the demand for Li-ion cells, and the subsequent batteries made from them is at an all time high
- Between 2010 and 2020 there was an 89% decrease in cost of li-ion battery packs. Prices are now market competitive and material and labour costs will stabilise the cost decline
- Chemicals company Wood Mackenzie anticipates a **31% compound annual growth** in global energy storage by 2030
- BloombergNEF expects global storage installations to surpass 1TW by 2040



Source: BloombergNEF

Li-ion production - where are all the cells going?

- The global demand is being driven by the exponential increase in demand for Electric Vehicles (EVs)
- 95% of lithium ion storage production goes towards e-mobility – driving the global R&D
  - Expected to stay at 90% by 2040



Lux Research

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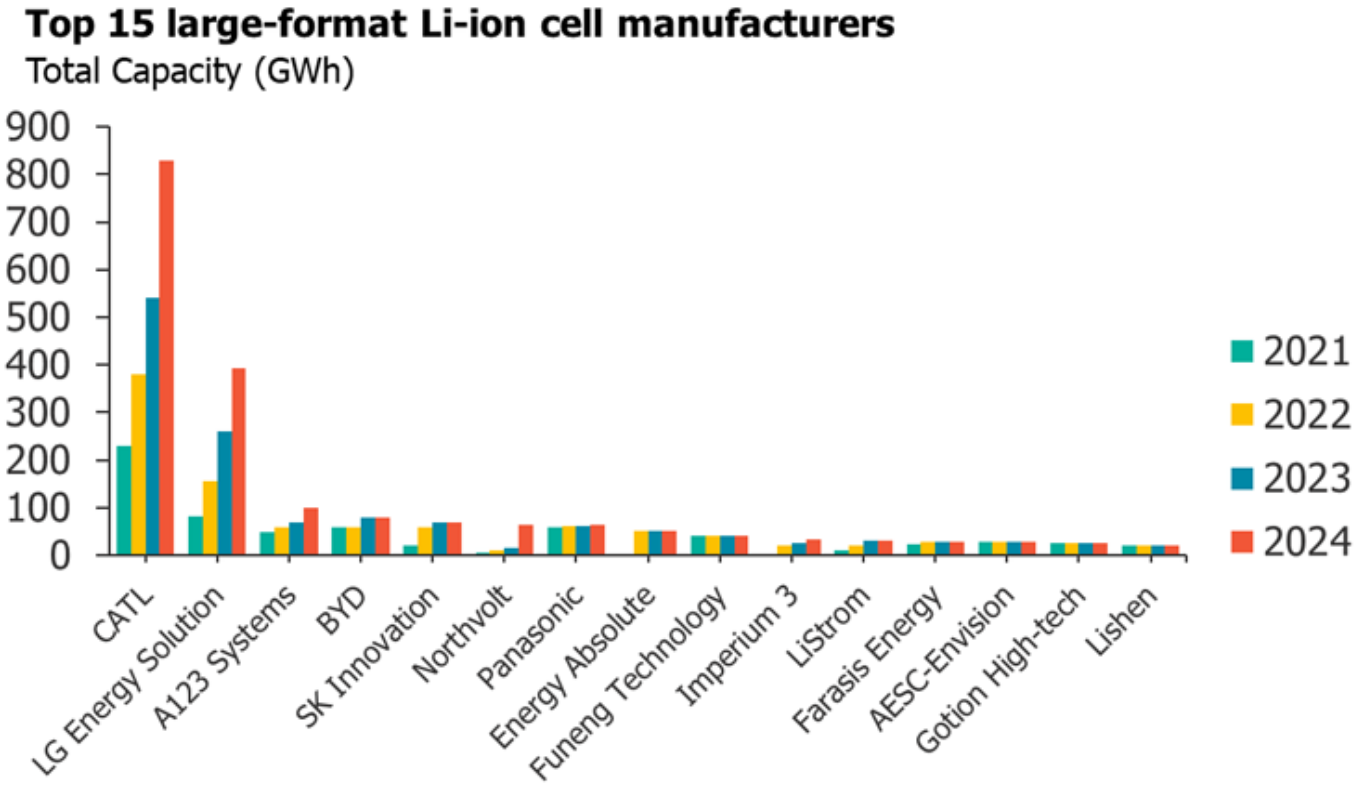
Li-ion production - where are all the cells going?

- New production companies are coming into the market, most with off-taker agreements already in place with EV manufacturers
- China dominates the global supply, currently with around 75% of the market share. This is predicted to decrease to 62% by 2024
- Chinese companies are expanding fast, and they are making their mark by announcing various production facilities in Europe and Asia.
- Automakers will enter the cell manufacturing space. Volkswagen and Tesla recently announced their plans to develop their cells, others like Ford are looking into it as well



Source: https://www.luxresearchinc.com

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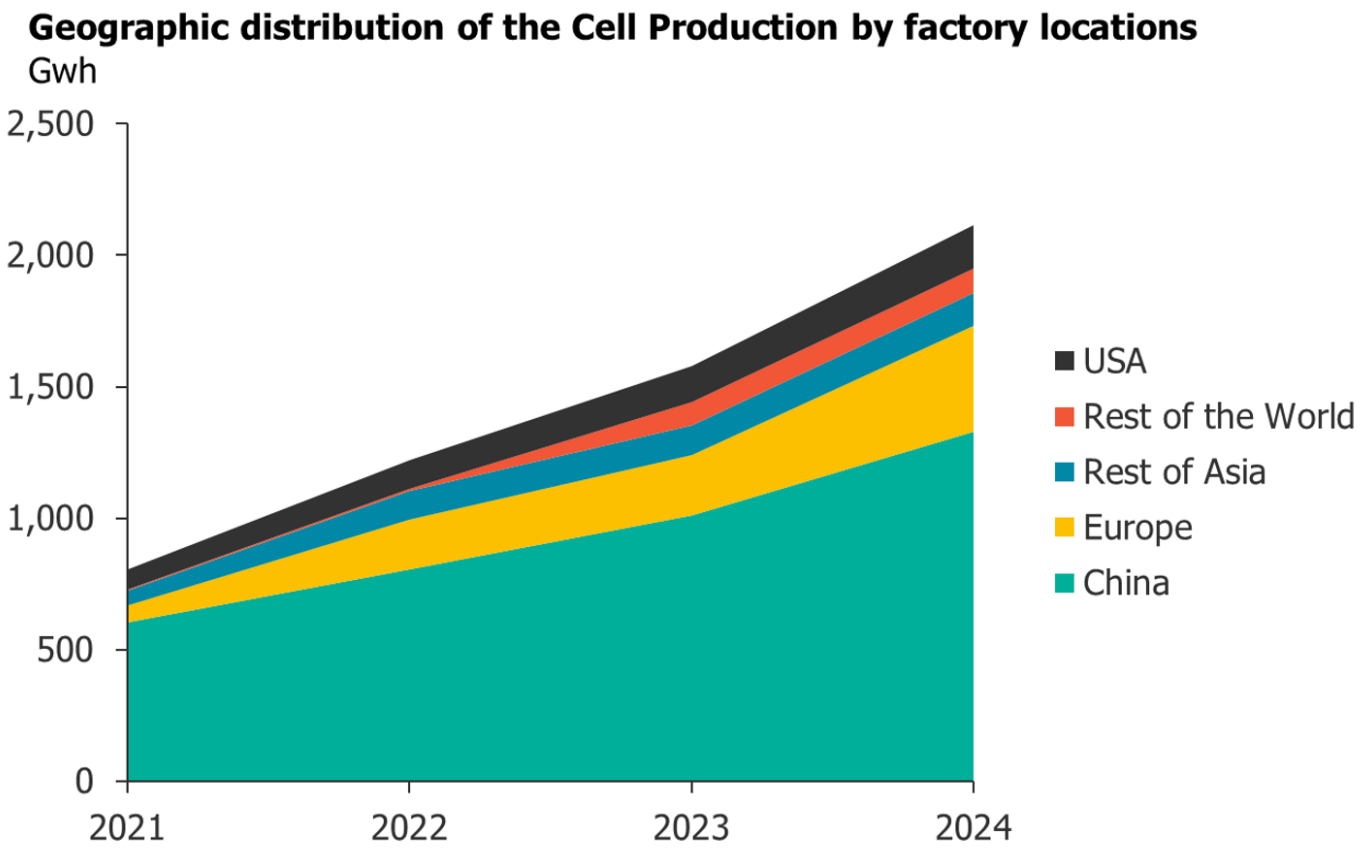

Source: https://www.luxresearchinc.com

The typical EV battery

- EV batteries range between 40 – 100kwh
- Typically NMC (highest energy density)
  - Chinese EVs have been using LFP chemistry, especially in bus fleets
- Tesla batteries – considered the highest quality on the market, are degrading down to 90% over 250’000km
  - We can assume that other suppliers will be reaching these numbers in the future.

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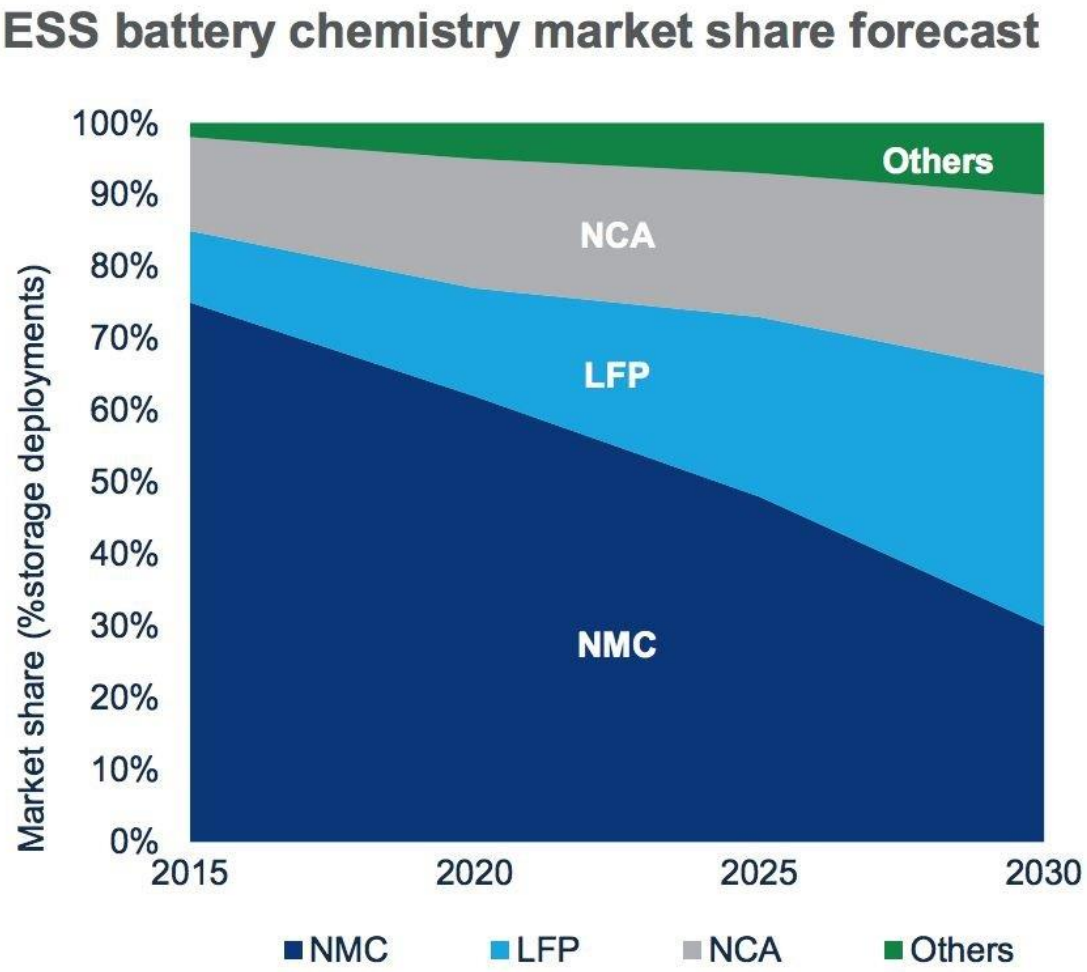

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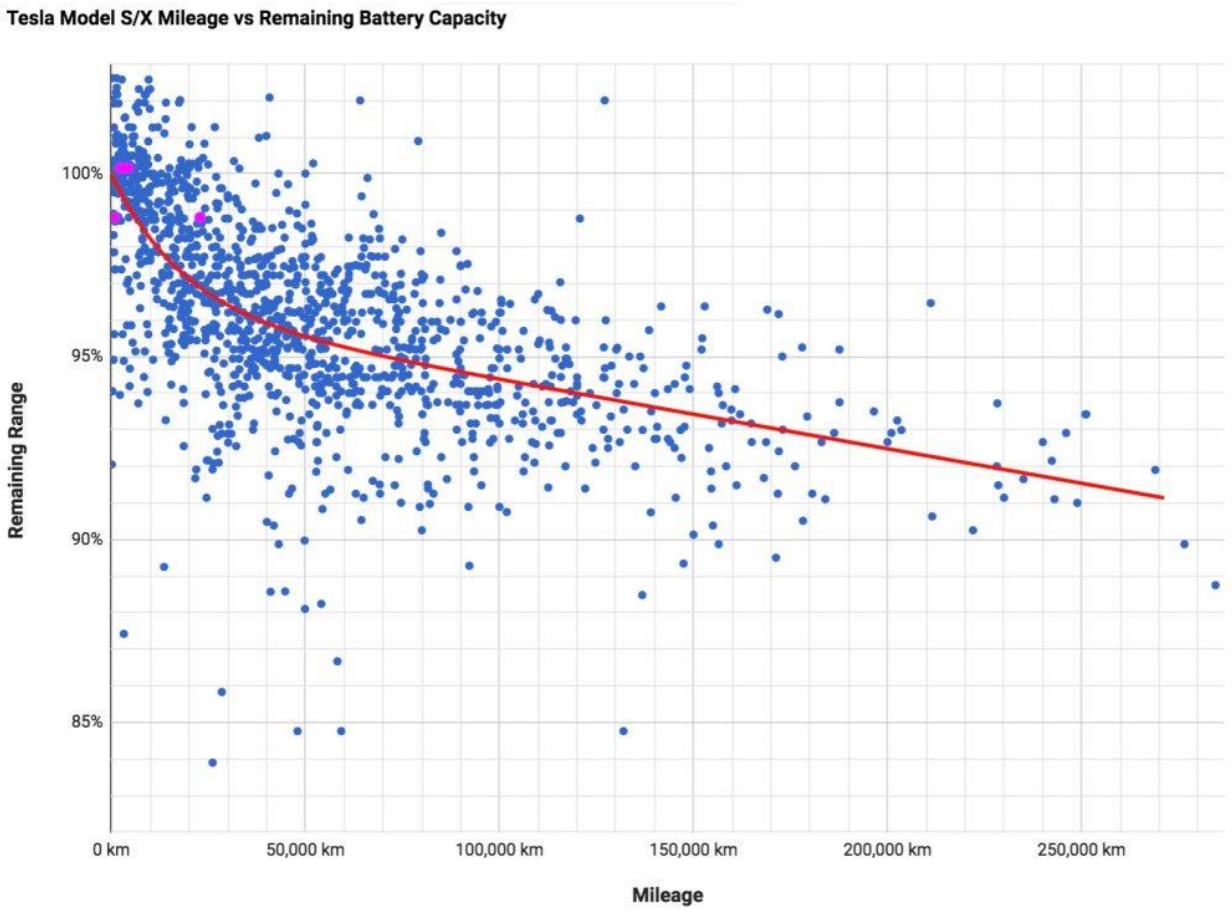
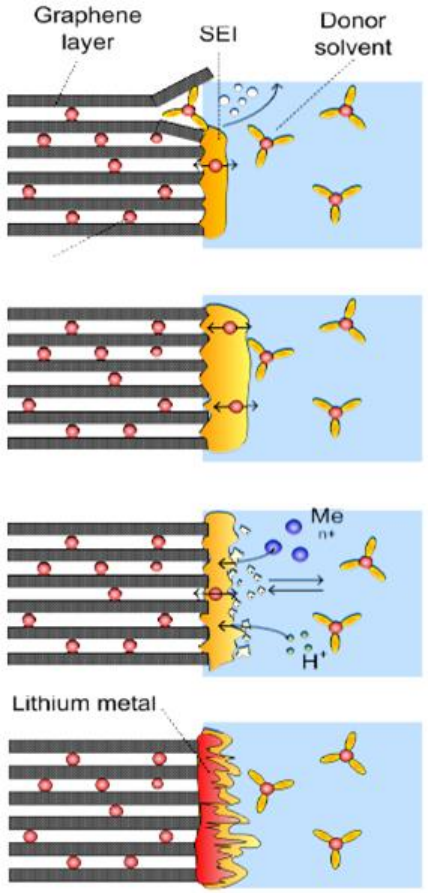


What is end-of-life for an EV battery?



Batteries2020 project; after: Vetter, JPS, 147, 269 (2005)

Anode ageing

- Intercalation of solvent/ peeling of graphite/cracking
- Dissolution of electrolyte (cathodic oxidation / anodic reduction) / dissolution of binder
- Growth of SEI/ Change of surface porosity
- Decrease of active surface (continuous growth of SEI)
- Deposition of metallic lithium/ formation of SEI
- Loss of contact active mass particles because of volume change
- Corrosion of conductor

Cathode ageing

- Structural disordering
- Migration of soluble species
- Electrolyte decomposition
- Corrosion of conductor

Electrolyte ageing

-Decomposition

- Ageing factors (and/or)

-high/low SOC, high current, high/low temperature

KPIs impacted (and/or)

-Capacity, power, efficiency

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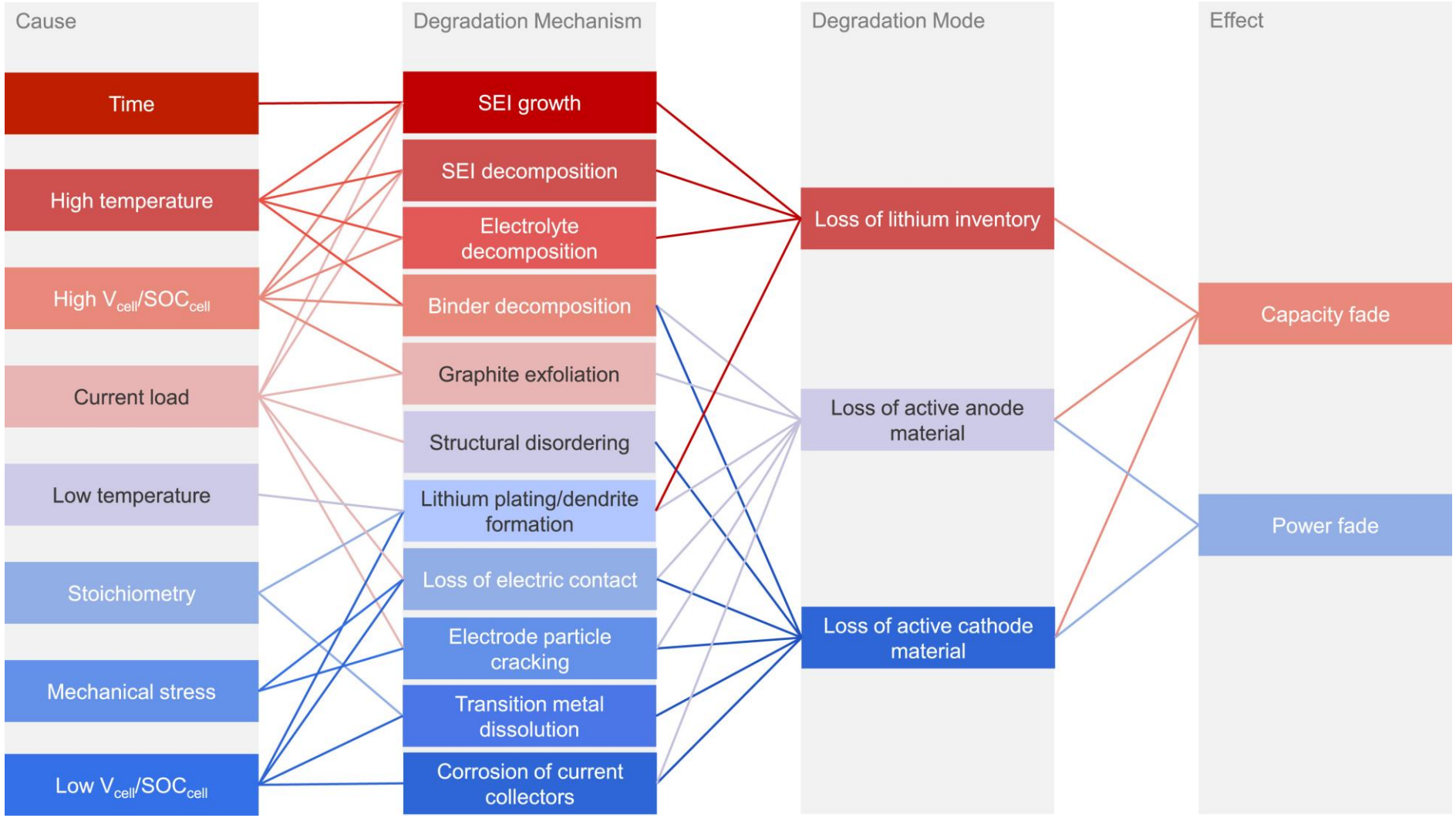
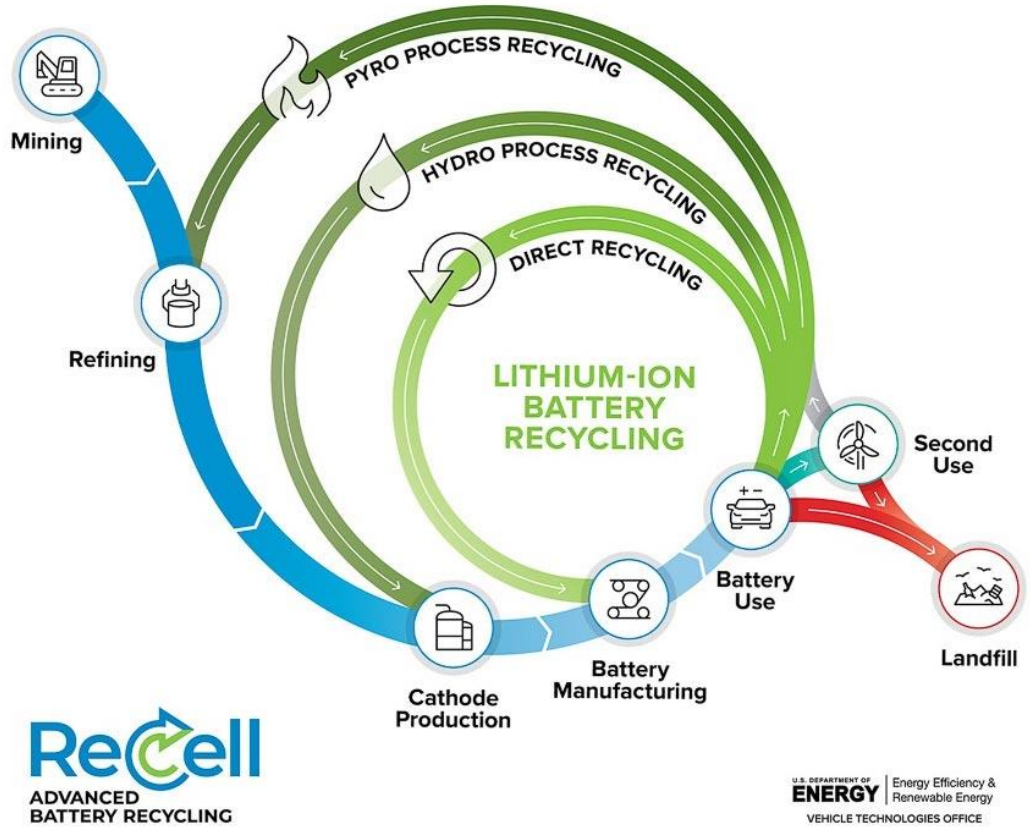


Source: (https://www.sciencedirect.com/science/article/pii/S0378775316316998)

What is end-of-life for an EV battery?

- EVs rely on the active capacity of the battery for its range – thus, battery degradation beyond 80% will signify the end-of-life of the battery
- These batteries can still deliver high power and still has sufficient life to be used for stationary storage applications
- Different Li-ion chemistries (NMC, NCA & LFP) have varying economic feasibilities for recycling, due to content of high-value metals.
  - ~$9/kWh for LFP vs $25/kWh for NMC
  - This makes LFP batteries even more suited for 2nd life BESS as stationary storage
- After 2nd life recycling is more likely to be economically viable



How can EV batteries be used in their 2nd life?

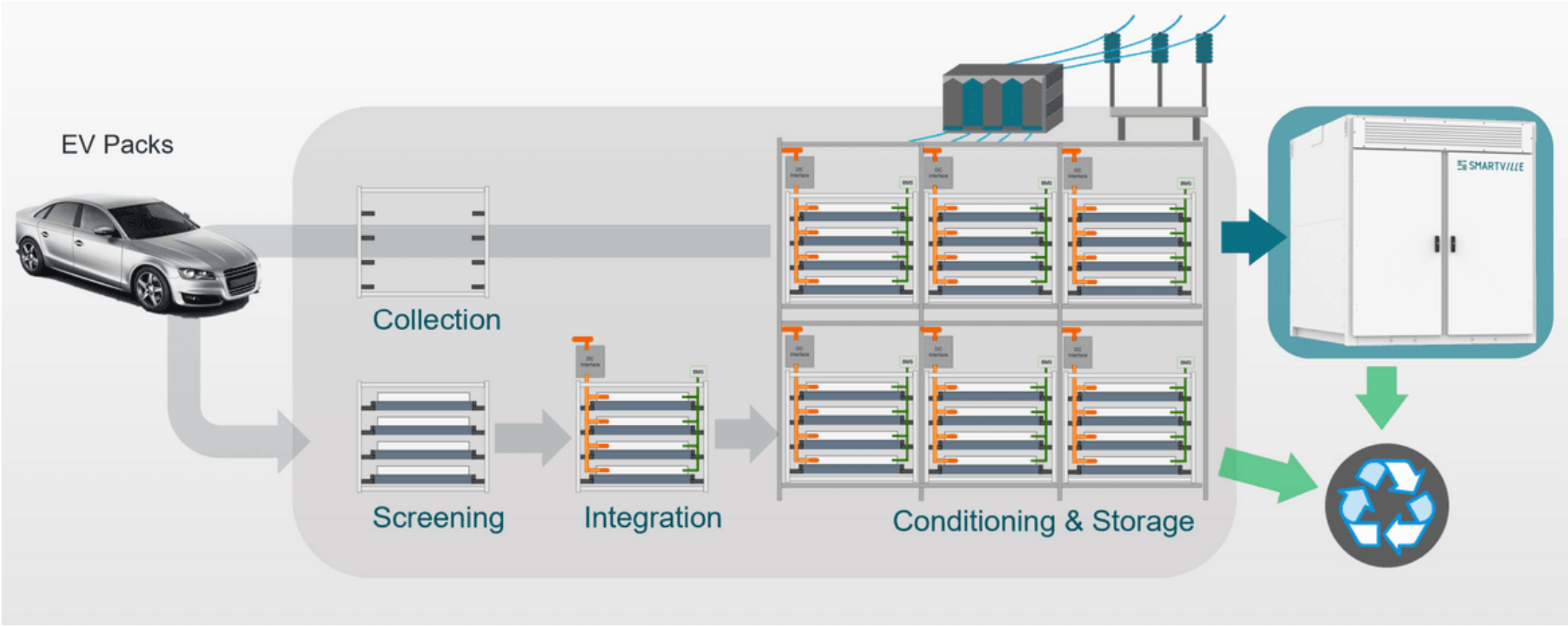
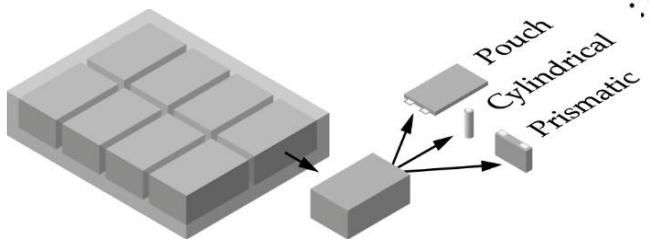
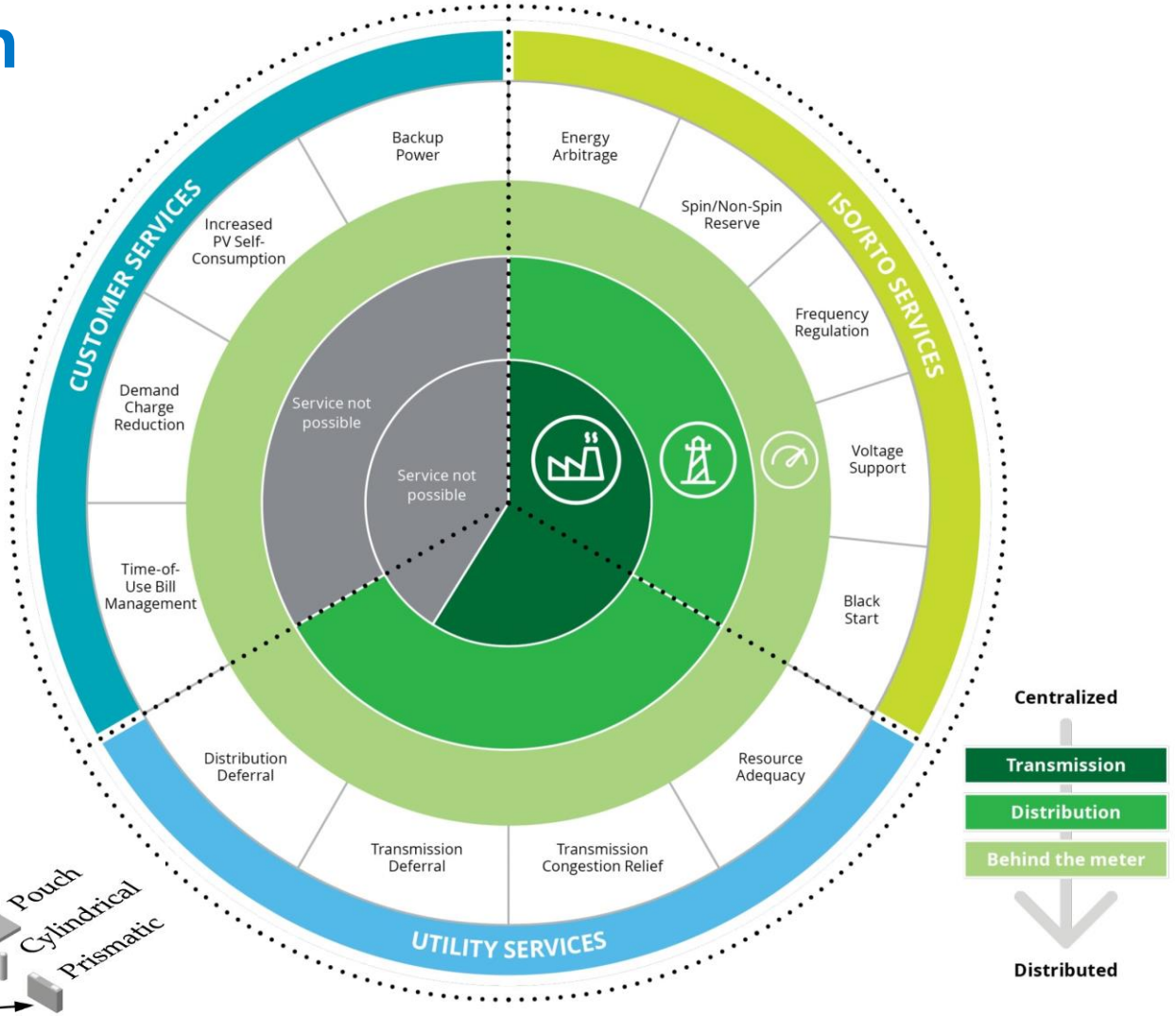


Image credit: Smartville

How can EV batteries be used in their 2nd life?

- 2nd life means repurposing a product or some components used for a different purpose, application, function, or context.
- 2nd life also means that the legal liability lies with the new producer.
- Applications of 2nd life BESS will mostly be:
  - Backup power
  - Increased RE self-consumption
  - Demand charge reduction
  - TOU- arbitrage
  - Spinning reserve





The possibilities for Africa

- Africa's barrier to entry has so far been cost
  - 2nd life batteries are expected to be between 50% and 70% the cost of new batteries
- Direct opportunities for using 2nd life BESS will be to make use of the low costs of storage. Such applications will be:
  - Electrifying rural areas with mini-grids
  - Providing back-up power for grid interruptions
  - Load shifting renewable power
- Other opportunities will be the recycling stations that will inevitably be necessary once the BESS are retired after 2nd life.
- Recycling provides a crucial solution to raw material supply insecurity and price fluctuations.

Summary

1. Li-ion production- where are all the cells going
2. The typical EV battery
3. What is end of life for an EV battery?
4. How can EV batteries be used in their 2nd life?
5. The possibilities for Africa

CLICK TO ADD SECTION TITLE

Thank you for your time

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