



Innovation-driven enterprise transformation towards circular battery production

KOMBIH PowerHour | Prof. Dr.-Ing. Franz Dietrich

22. July 2024

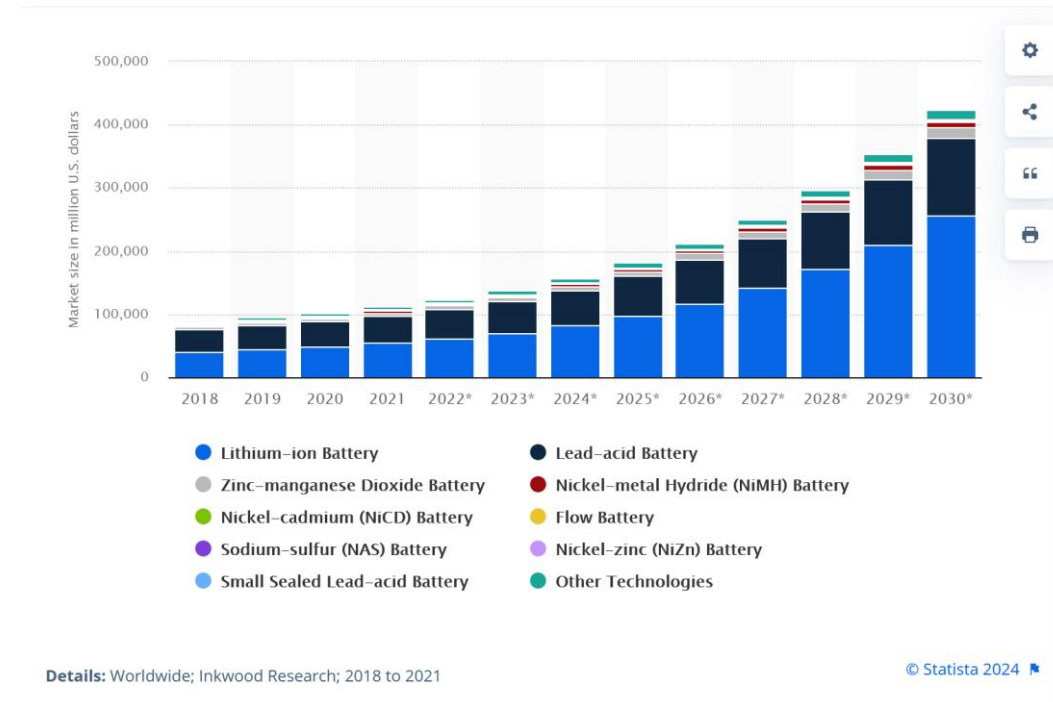
Market pull for transformation: unicorn-like numbers!

Weltweiter Markt für Batterien: Nachfrage wächst um 30 Prozent pro Jahr

16. Januar 2023 | Press Release

Teilen Drucken

McKinsey-Studie mit der Global Battery Alliance: Nachfrage steigt von heute 700 GWh auf dann 4700 GWh - Engpass bei Rohmaterialien droht: Lithium ist knapp - Recycling-Markt wächst nach 2030 stark, notwendige Technologien und Geschäftsmodelle werden heute industrieübergreifend entwickelt



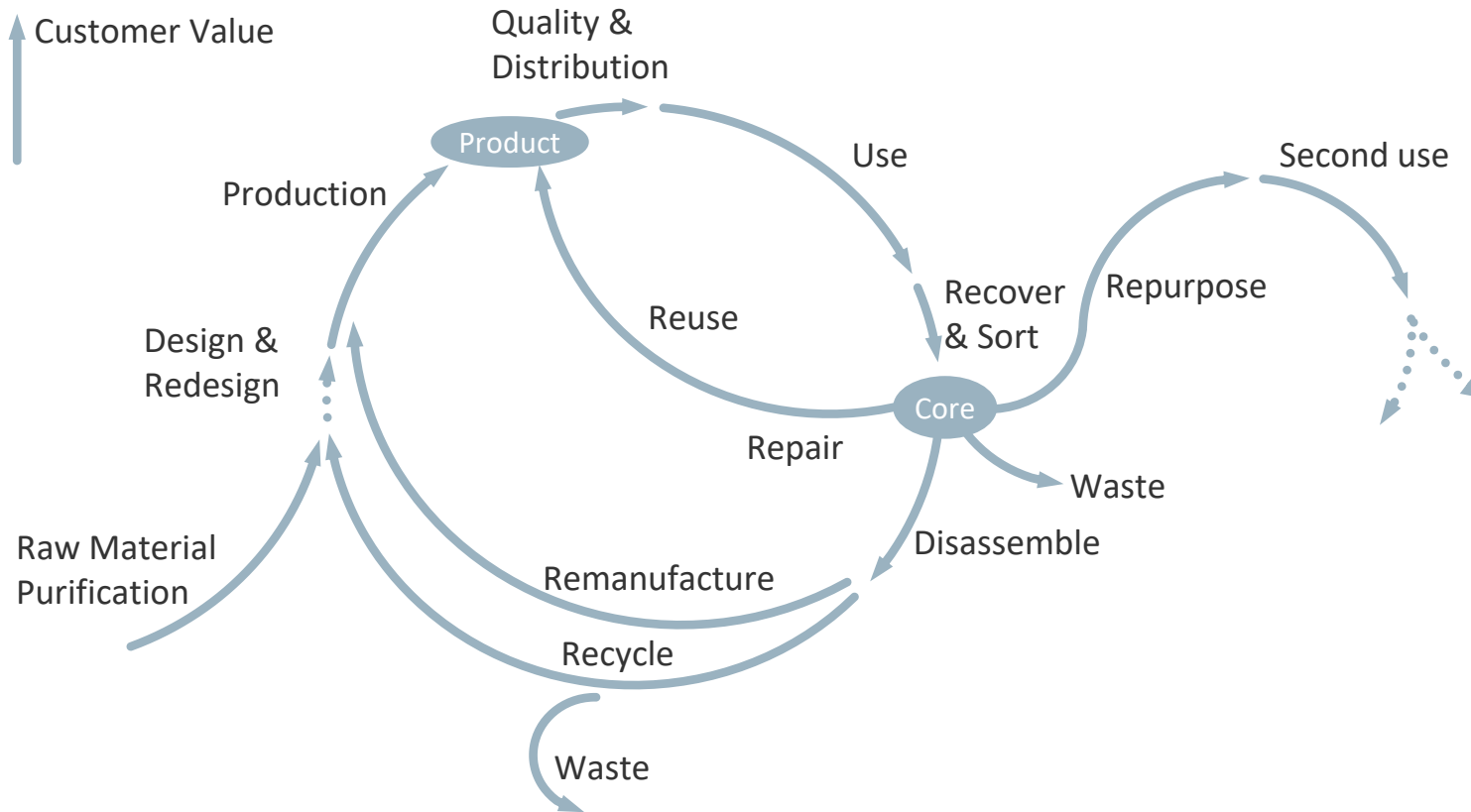
Political push towards transformation: traditional industrial sectors are forced to change completely!



The screenshot shows the top navigation bar of the European Parliament website with the 'Topics' menu selected. The breadcrumb trail reads: Topics > Climate and environment > Climate change > EU ban on the sale of new petrol and diesel cars from 2035 explained. The main heading is 'EU ban on the sale of new petrol and diesel cars from 2035 explained'. Below the heading, the text states: 'All new cars and vans sold in the EU as of 2035 should not produce any CO2 emissions. What does this mean in practice? Check out our FAQ to find out.' Metadata includes: Published: 03-11-2022, Last updated: 30-06-2023 - 13:11, and a 5 min read duration. A video player is visible at the bottom with the title 'Cutting CO2 emissions with cleaner cars'. A red 'Link' label is positioned at the bottom right of the screenshot.

The screenshot shows the top navigation bar of the European Parliament website with the 'Topics' menu selected. The breadcrumb trail reads: Topics > Climate and environment > Circular economy > New EU rules for more sustainable and ethical batteries. The main heading is 'New EU rules for more sustainable and ethical batteries'. Below the heading, the text states: 'As batteries become a strategic market, the European Parliament has adopted new rules to tackle related environmental, ethical and social issues.' Metadata includes: Published: 03-03-2022, Last updated: 15-11-2023 - 09:13, and a 6 min read duration. The text continues: 'At least 30 million zero-emission electric vehicles are forecast to be on EU roads by 2030. While electric cars are expected to significantly decrease greenhouse gas emissions, they have an environmentally damaging downside: their batteries.' A final paragraph begins: 'On 14 June 2023, the European Parliament adopted an update to ensure that batteries can be repurposed, remanufactured, or recycled at the end of their life.' A red 'Link' label is positioned at the bottom right of the screenshot.

Where to position in the battery value creation chain? Value creation along the battery life cycle(s)



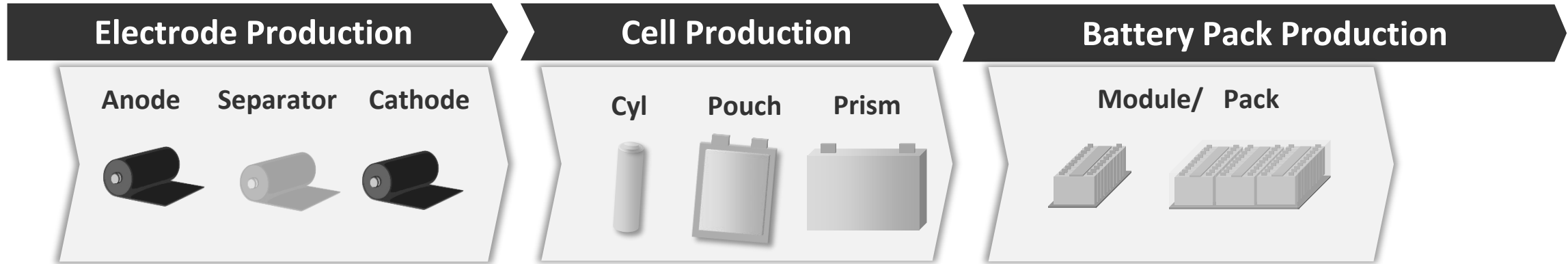
Recovery and sorting:
End-Of-Life Inspection (part of reverse logistics)



Disassembly:
Variety of processes needed makes disassembly hard to automate

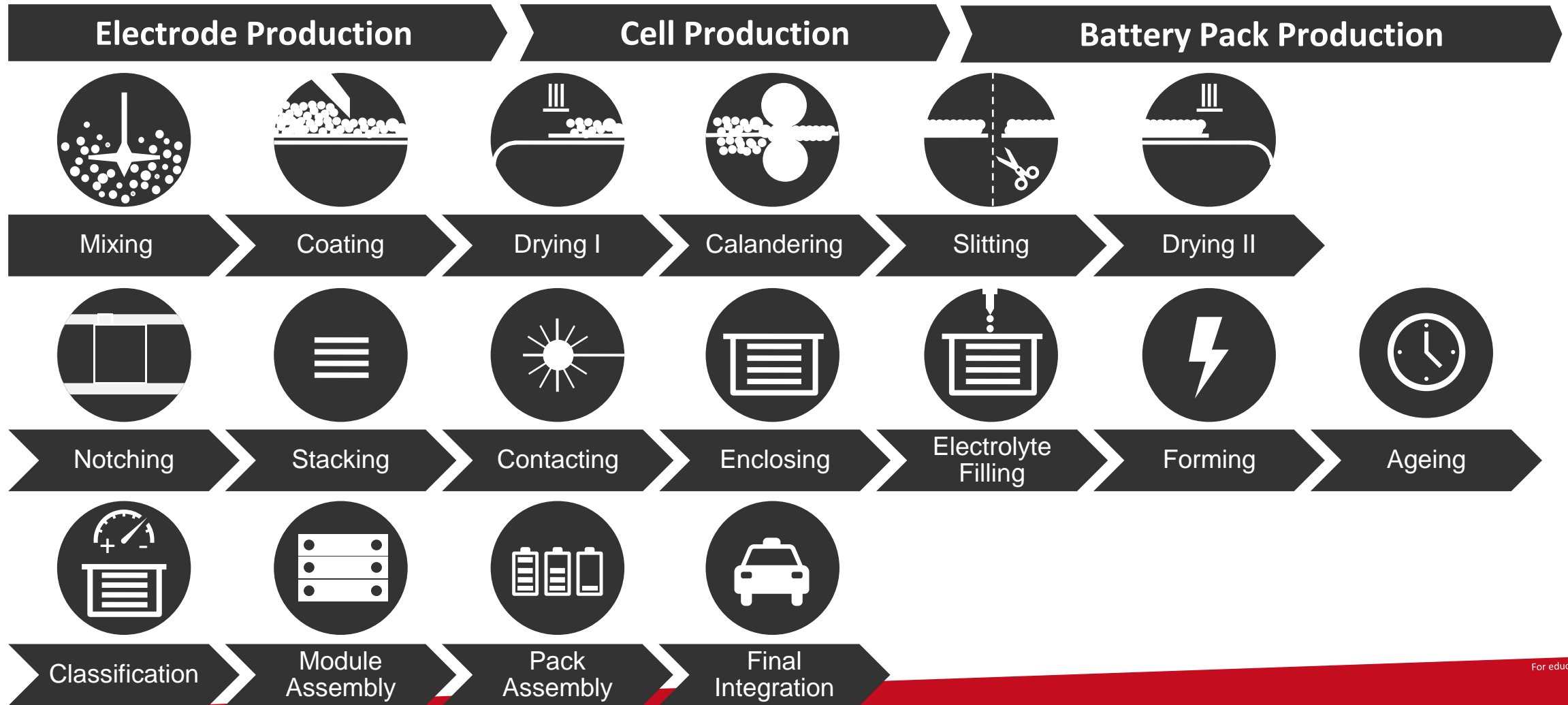
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Where to position in the battery value creation chain? Value creation in battery (pack) production



Where to position in the battery value creation chain?

Value creation in battery (pack) production



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Approaches for innovation-driven transformation and growth

(and some highly acclaimed examples)



Innovation
by invention
e.g.: new chemistry,
new process technology



2025
Graphene
Supercapacitors
(Gen 2)

skeletontech.com/

Pressebox.de /
acp Systems

Innovation
by technology transfer
e.g.: from medical, PV,
print, packaging

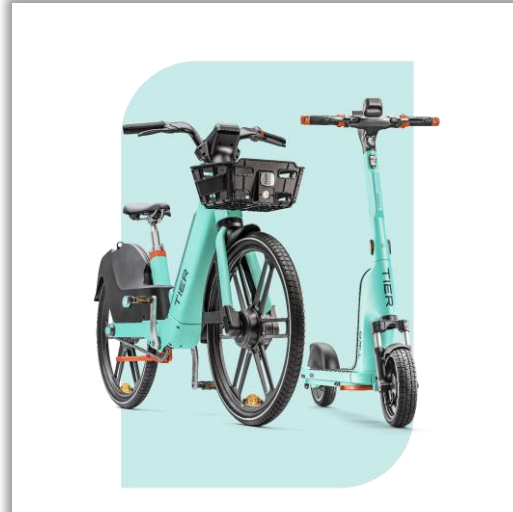


Jonas & Redmann
The Automation Company

GESCHÄFTSFELDER	KOMPETENZEN
■ Photovoltaik	
■ Energiespeicher	
■ Medical Engineering	
■ Montageautomation	

jonas-redmann.com/

Innovation
by new business models
e.g.: product-services systems,
extremely lean models,
purely digital models



tier.app

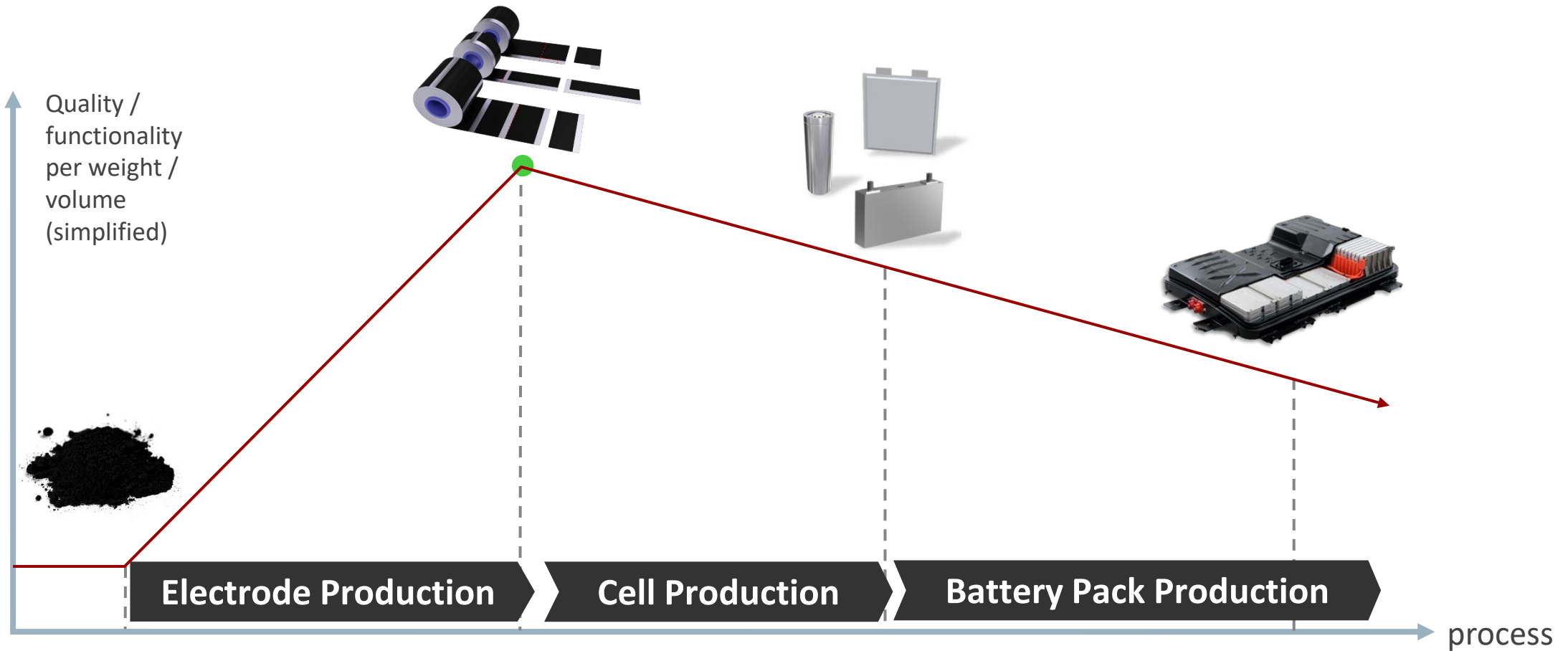
Innovation
by establishing new markets
e.g.: extreme customization,
engineering tools,
end-of-life, second life, car-to-grid



customcells.com

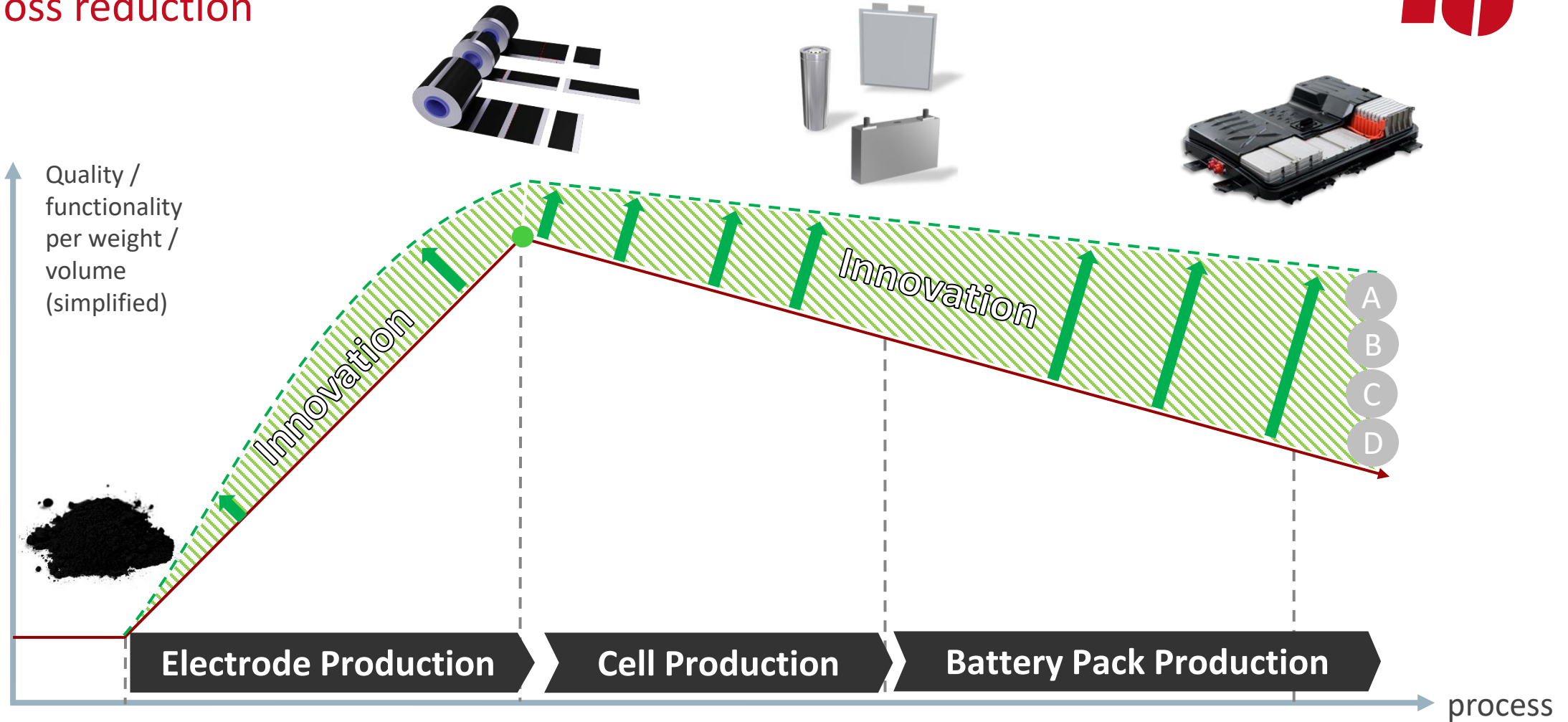
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Example: Technology innovations towards quality improvement and/or loss reduction



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Example: Technology innovations towards quality improvement and/or loss reduction



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Where to start?

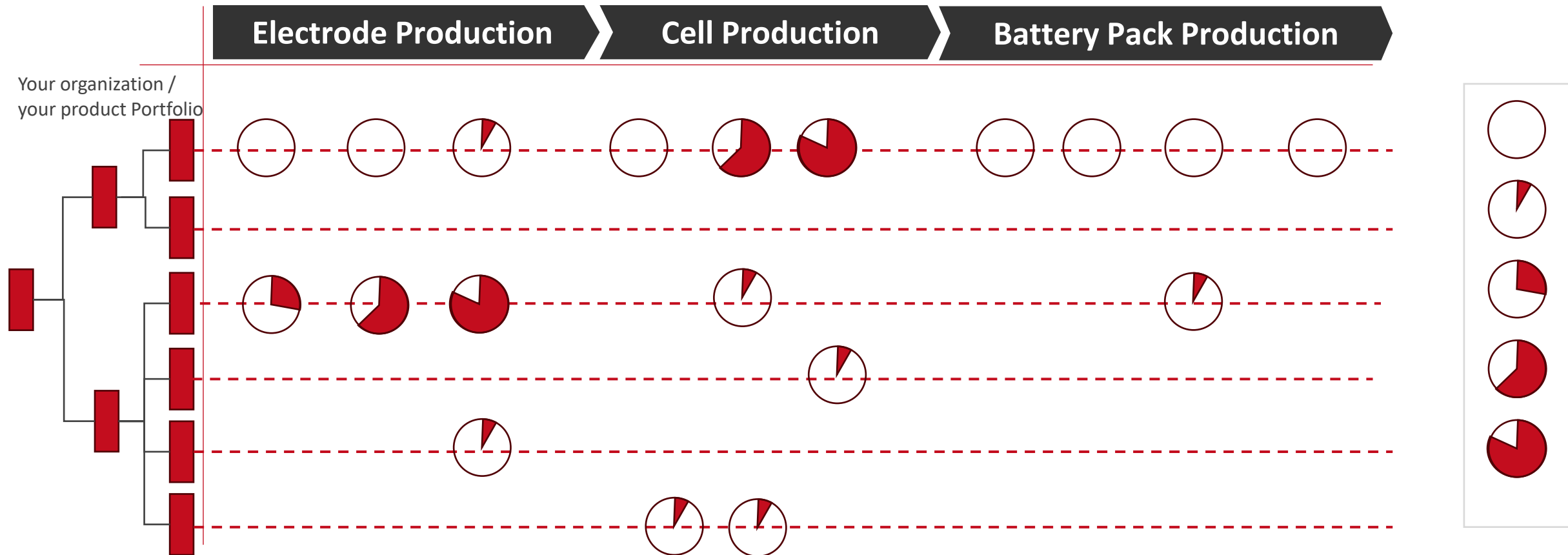
Internally

- **Know your stance and reach.**
Map existing competences, market accesses and network connections to the battery value chain
→ determine your proximity to be able to drive innovations in a certain niche.
How much would need to be added?
- **Develop innovation power.** Battery innovators need skills in various domains of knowledge
- **Know the competition.** Build up a technology radar and evaluate your „readiness“ to push such innovations into the market. What is left to do technologically, organisationally and market-wise?

Externally

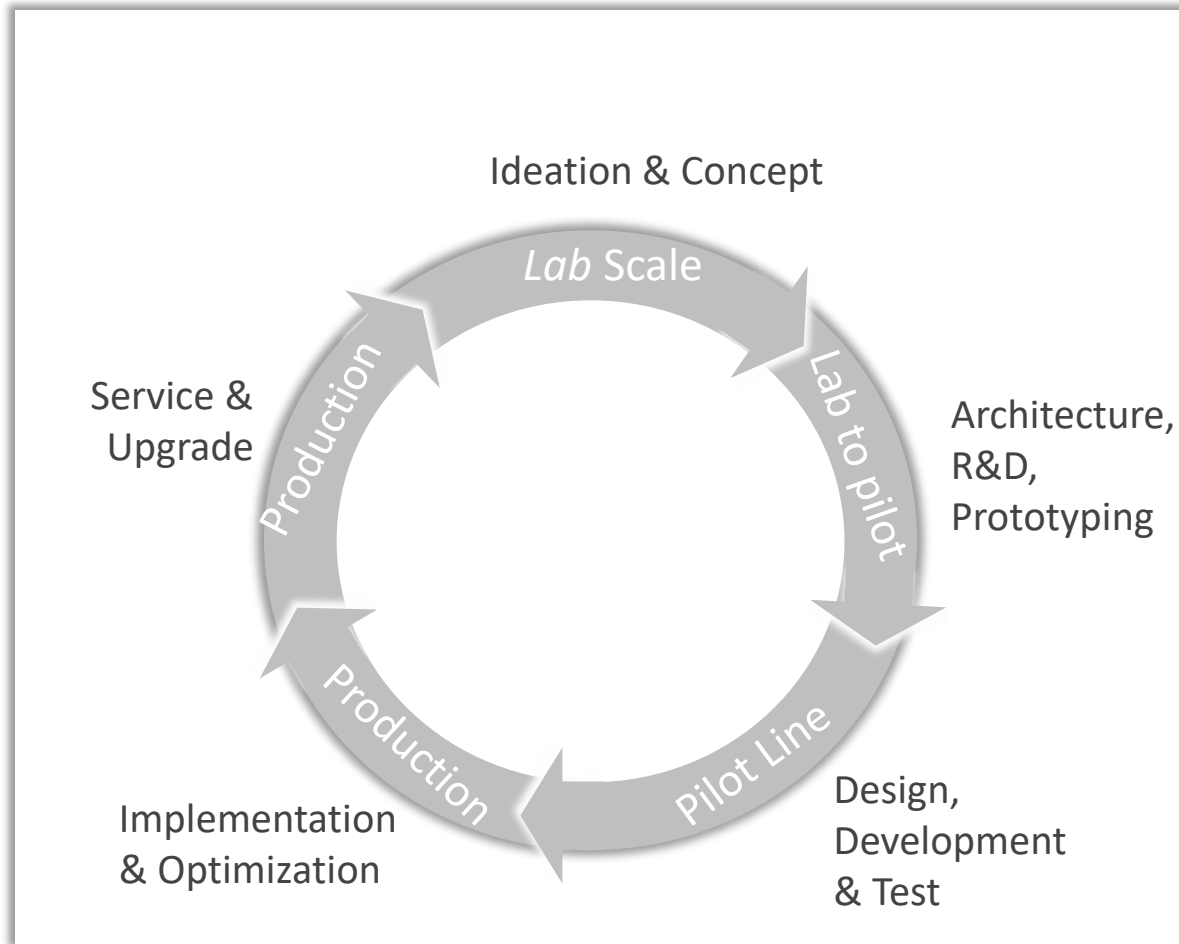
- **Develop your radar.**
Make sure you have sufficient inflow of insights, e.g. via networks
- **Develop your visibility.**
e.g. engage in innovation projects, engage in pilot plants as supplier or benchmark, engage as a supplier in turnkey projects
- **Develop innovation partnerships.**
e.g. team up with upstream or downstream technology suppliers

Competence heat map / distance map



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Each innovation stage requires a different infrastructure!



- Lab scale:
Processes at lab scale,
mostly manually,
For fundamental exploration studies,
low batch size
→ Large Industry, Research Institutions
- Pilot Line:
Industrialized equipment,
down-scaled industrial processes,
for fast try-outs,
for small to medium sized batches
→ Large Industry, Research Institutions
- Production Line
Fully industrialized equipment,
processes at full scale
→ Large Industry

Pilot lines are helpful to develop innovations

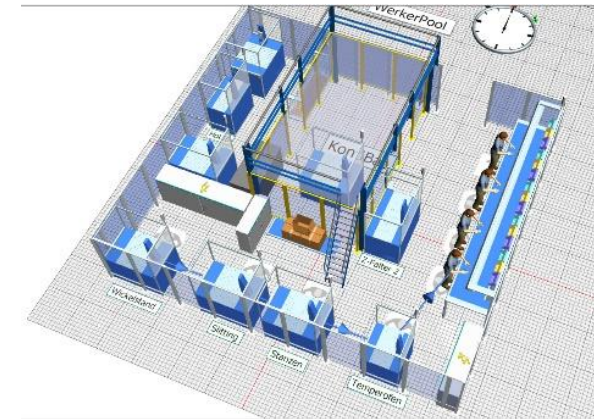
- ▶ Battery Production Pilot Lines in Germany
Kompetenznetzwerk Lithium-Ionen-Batterien KLiB e.V has recently compiled a list



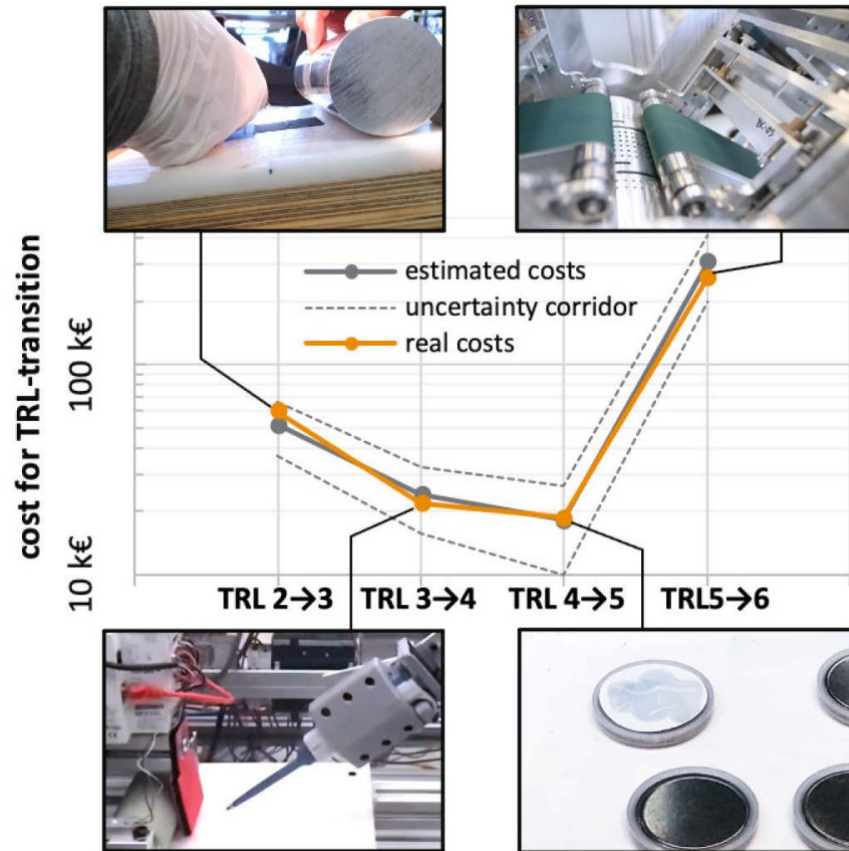
- ▶ Battery Pilot Lines in Europe: LiPlanet Initiative (<https://liplanet.eu/>)



- ▶ Battery Pilot Line at TU Berlin



Example: Cost estimation to increase technology readiness of a new fast glueing technology for battery stacking



“Decision support based on cost and risk estimation to prioritize battery cell assembly technologies”

<https://doi.org/10.14279/depositonce-12333>

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Innovation support from political spheres: pushes and pulls



Political Push

- Regulations, Incentives
 - Recycling quota
 - Design-For-X
 - ...for end-of-life,
 - ...for second-life,
 - ...for recycling
 - Minimization of Eco-Impact
 - Supply chains
- Transparency enables ecosystem efforts
(Engineering Data / Lifetime Data)
Important: Win/Win situation!

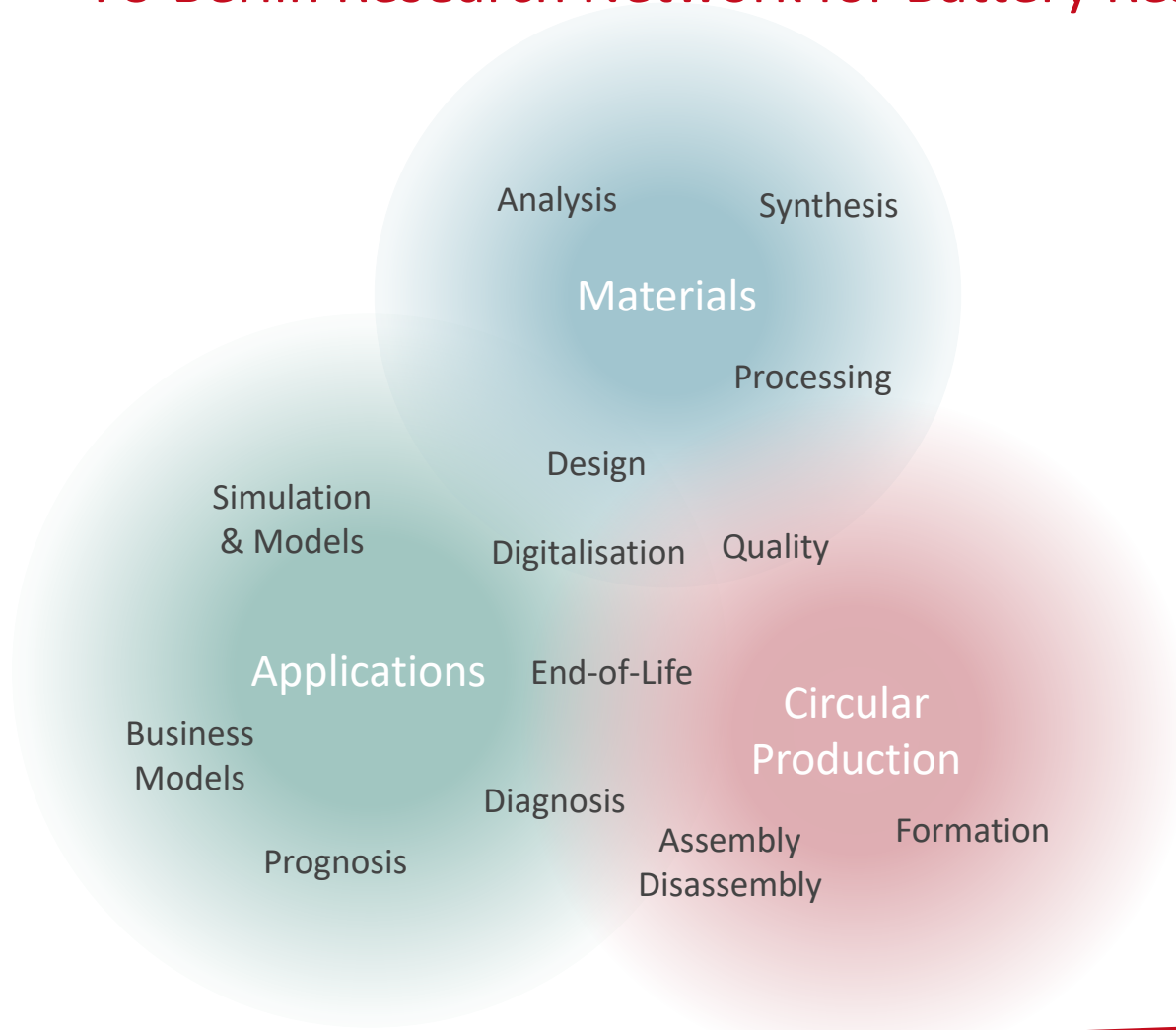
Political Pull

- Investment Support & Guarantees
- Network Support
- Innovation Money
- Support at sustainability accounting, sustainability transparency, certification, trade etc.
- Turnkey / SME cooperatives vs. cartel regulations?

Political Education / Incentives

- Development of customer awareness / behaviour
- Incentives for customer behaviour
- Incentives for companies
- Development of labour market / education market

Battery Circuit Berlin: TU Berlin Research Network for Battery Research



Our Profile

- Goal:
Scientific network to strengthen battery research at TU Berlin and around
- Approach:
 - Networked agenda
 - Cooperation
 - Complementary infrastructure
- Research on battery (production) and recycling since 2010
- Strong regional and nationwide partnerships
- Teaching portfolio, also as further training for companies



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Battery Circuit Berlin: Circular battery production – on cell level, on module level, on system level



Our Agenda

- Systems level:
 - End of life diagnosis, sorting and treatment
- Module level
 - Highly flexible assembly and disassembly
- Cell level
 - High-throughput processes and machine concepts
 - Manual vs. automated processes
 - Scale-up by cloud manufacturing principles



Let's discuss your innovation and transformation challenges!



“Production rationalization
for a more sustainable and human-friendly world”

- Handling, assembly and disassembly
- Automated and manual processes
- Fundamental research and industry innovations
- From theoretical research
through modelling
to full-scale experimentation

Prof. Dr.-Ing. Franz Dietrich & Team

Let's discuss your innovation and transformation challenges!



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