

A large, solid yellow chevron pointing to the right, positioned to the left of the main title.

Battery Cell Production Technologies

Challenges and Opportunities for European Collaboration

Dr. Ulas Kudu

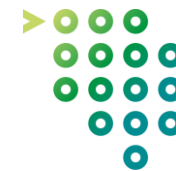
Four decorative green arches of varying shades of green, arranged horizontally along the bottom edge of the slide.



Outline

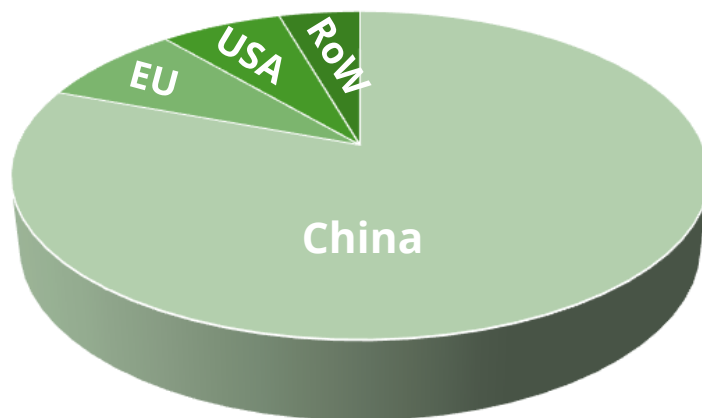
- 01** Battery cell production market and the EU challenge
- 02** Battery cell production steps: Main bottlenecks and promising innovations
- 03** NL & DE: Core Strengths and Potential Complementary Areas
- 04** Hybrid Cell Manufacturing by Jan-Steffen Lang
- 05** Panel Discussion

➤ Battery cell production market and the EU challenge



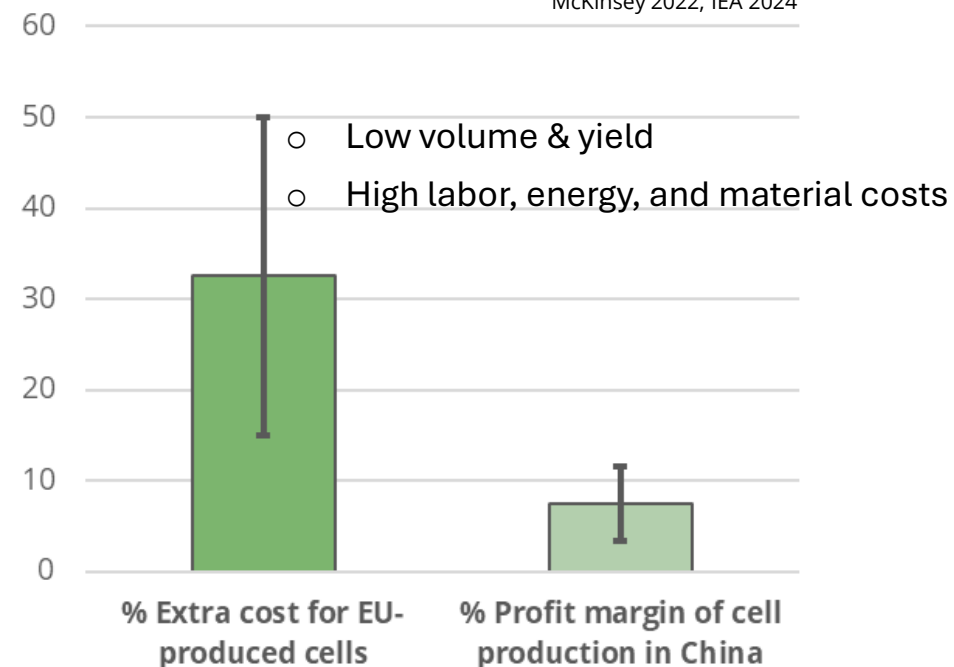
Battery production and sales lead by China
(> 80%)

IEA Global EV Outlook
2026; Rhodium Group
Global Clean Investment
Monitor 2025



EU cost premium vs profit margin in China

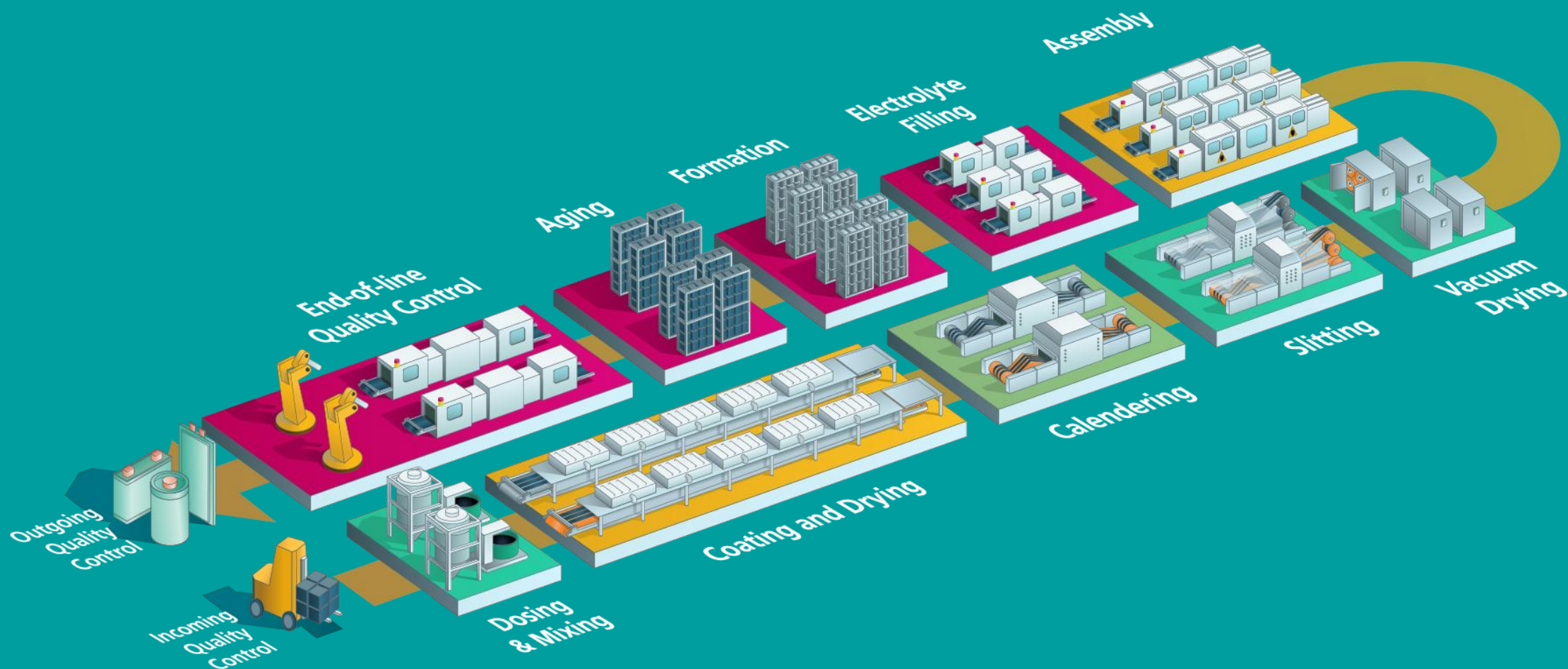
McKinsey 2022, IEA 2024



Additional value needs to be created to compete

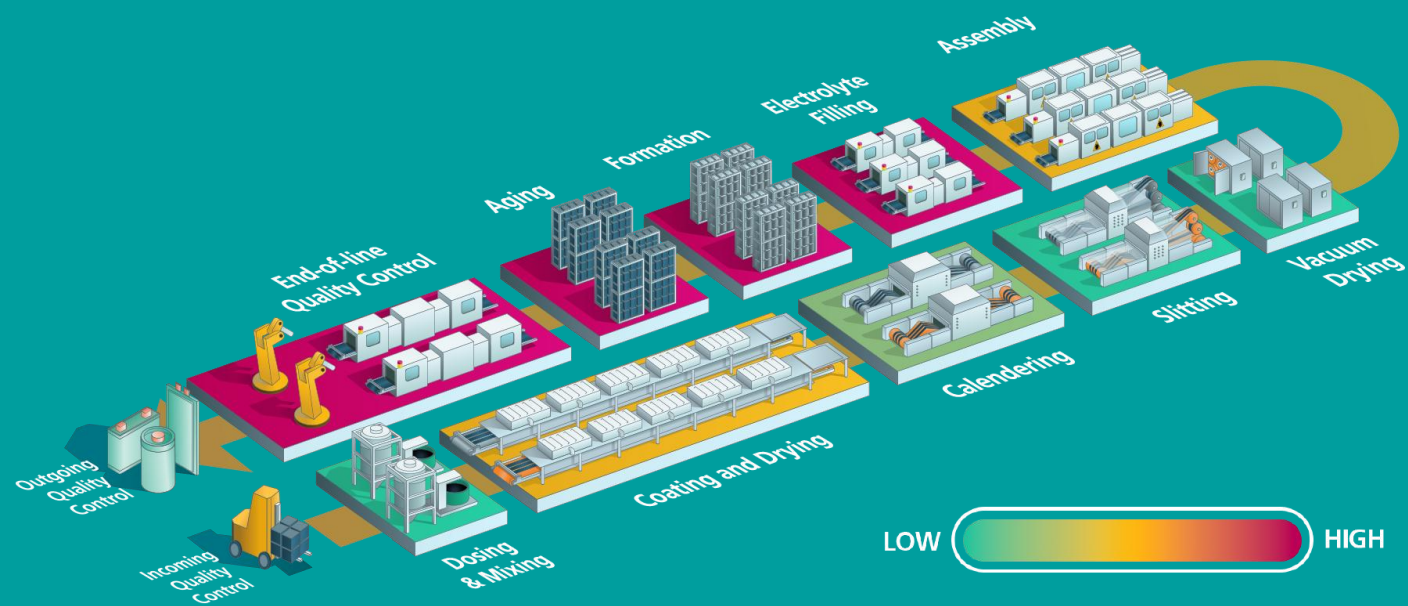
- Higher performance (next-gen battery cells)
- Higher flexibility: Production lines adapted to seamless transition between different cell designs

Battery cell production steps



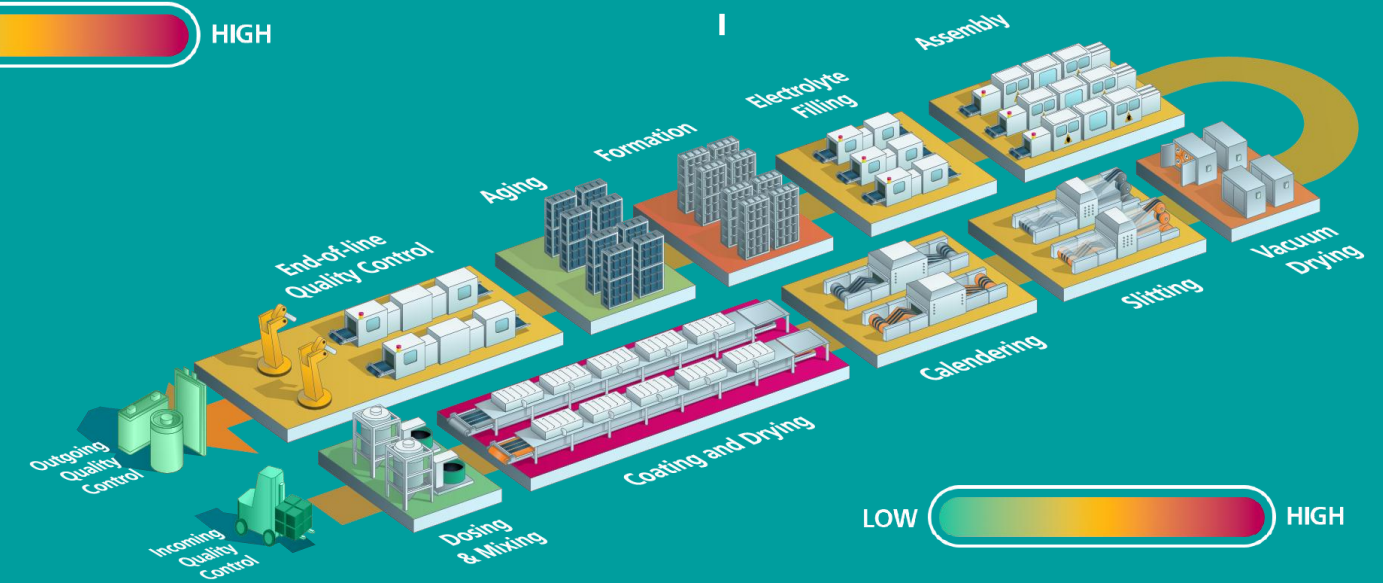


Battery cell production steps



Influence on
energy consumption

Influence on CAPEX

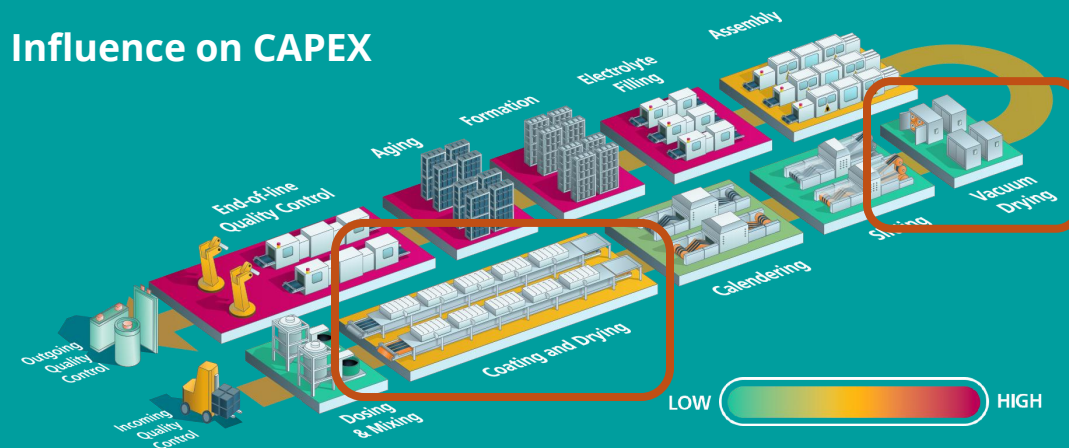


Main bottlenecks and promising innovations

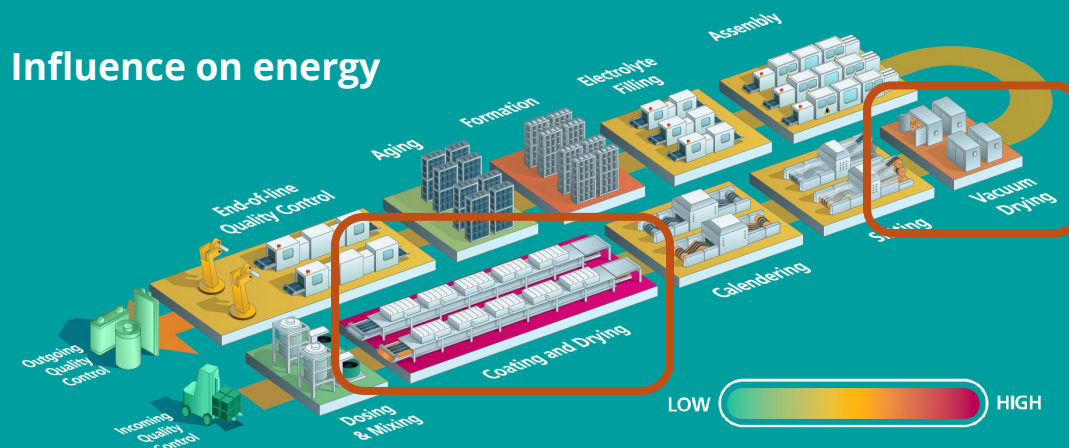
❖ Electrode coating and drying: ~ 35 - 50% of total energy

- Solvent-free (dry) coating
- Advanced drying techniques (laser, near-IR, conductive)

Influence on CAPEX



Influence on energy



Main bottlenecks and promising innovations

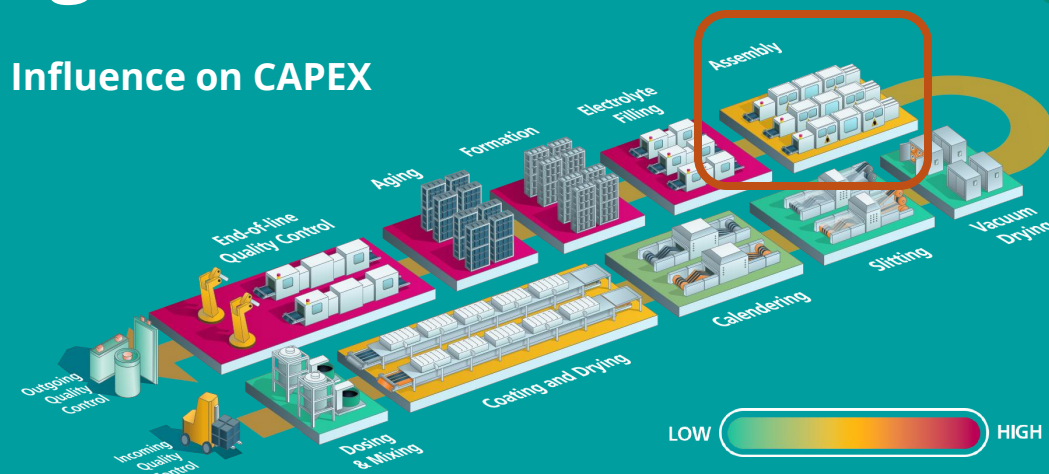
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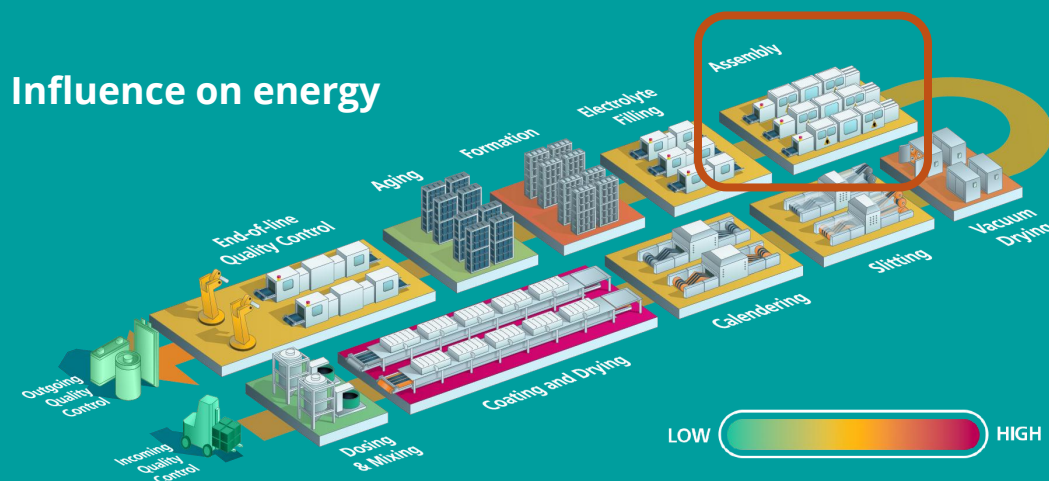
- ❖ Assembly: ~ 10 - 15% of total energy

- Increased throughput and yield (using continuous & high speed stacking, laminated electrode / separator composites, advanced robotics)

Influence on CAPEX



Influence on energy





Main bottlenecks and promising innovations

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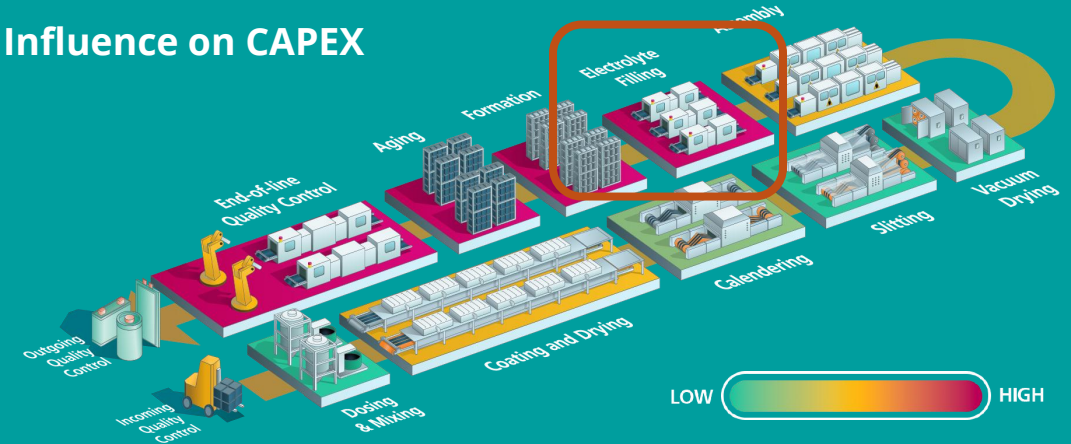
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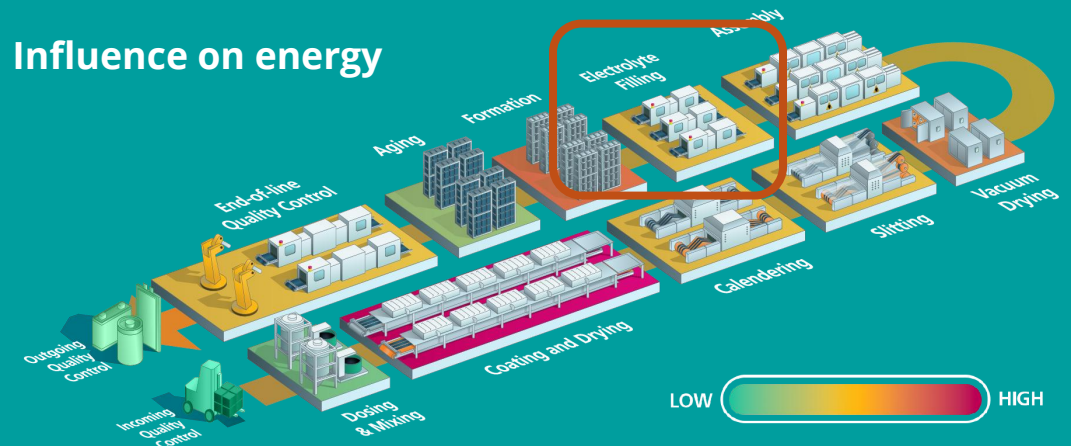
❖ Electrolyte filling & wetting

- Increased throughput and yield (pressure assisted wetting, plasma treated separators, optimized electrolytes)

Influence on CAPEX



Influence on energy

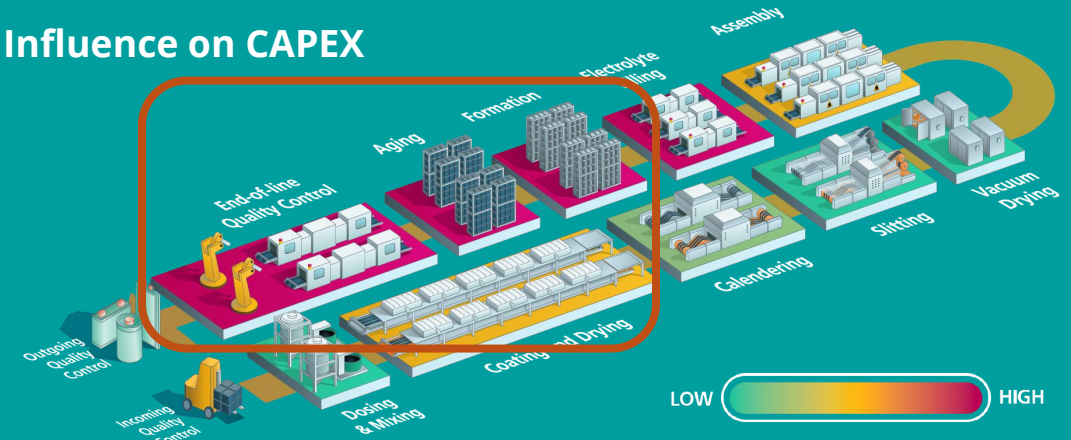




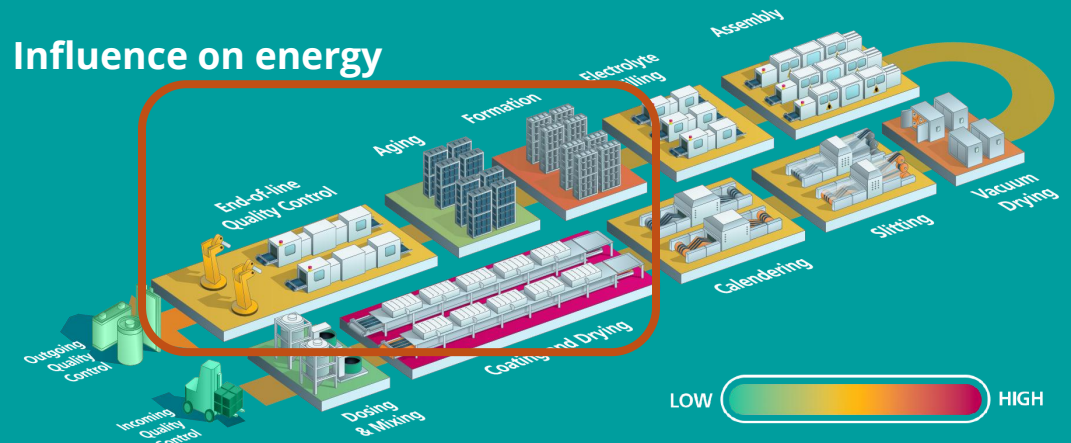
Main bottlenecks and promising innovations

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- ❖ Electrolyte filling & wetting
 - Increased throughput and yield (pressure assisted wetting, plasma treated separators, optimized electrolytes)
- ❖ Cell finishing: ~ 10 - 30% of total energy
 - Faster formation and aging protocols (potentially through digitalization and AI-assistance)
 - Energy recuperation for maximum efficiency

Influence on CAPEX



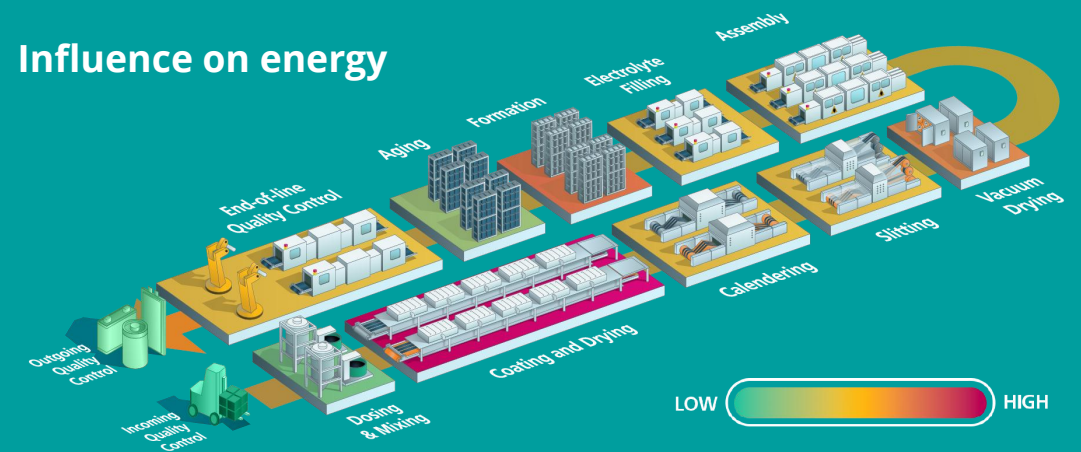
Influence on energy





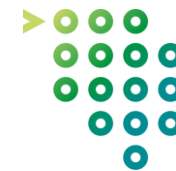
Main bottlenecks and promising innovations

- ❖ Yield increase & scrap reduction: 70% of cell costs originate from materials
 - Inline metrology throughout the process chain
 - Digital twinning and AI-assisted process optimization
 - Higher degree of automation
- ❖ Dry room energy consumption: 20 – 40% of total energy
 - Mini environments
 - Low dewpoint optimization
 - Adaptive HVAC control
- ❖ Smart combination of different process steps and innovations
 - “Single step rapid electrolyte filling”



➤ The Netherlands and Germany

Core Strengths and Potential Complementary Areas



- ❖ Next-gen battery cathodes
- ❖ Equipment engineering
- ❖ Automation & Industry 4.0
- ❖ Scale up



- ❖ Next-gen battery anodes
- ❖ Precision manufacturing
- ❖ Pilot manufacturing
- ❖ Logistics & supply chain



- ❖ Scaled next-generation anode manufacturing
- ❖ Innovative equipment for cheaper and more flexible cell production
- ❖ Digital twinning and AI-assisted process optimization
- ❖ Next-generation cell design & scaled manufacturing



➤ Collaboration opportunities



❖ Feasibility study about “Battery cell manufacturing equipment“

- ❖ Funded by EZK, in collaboration with InvestNL and Nxtgen Hightech
- ❖ Deep dive into bottlenecks and innovations by interviews with leading cell & equipment manufacturers
- ❖ Results will be shared with our partners in a workshop
- ❖ Leading to projects in Techbridge, Eureka, Horizon EU and IPCEI programs

❖ BCC-NL would be happy to think along with you

- ❖ To create project ideas
- ❖ To identify and help you contact potential partners

❖ Innovation architects' contact information:

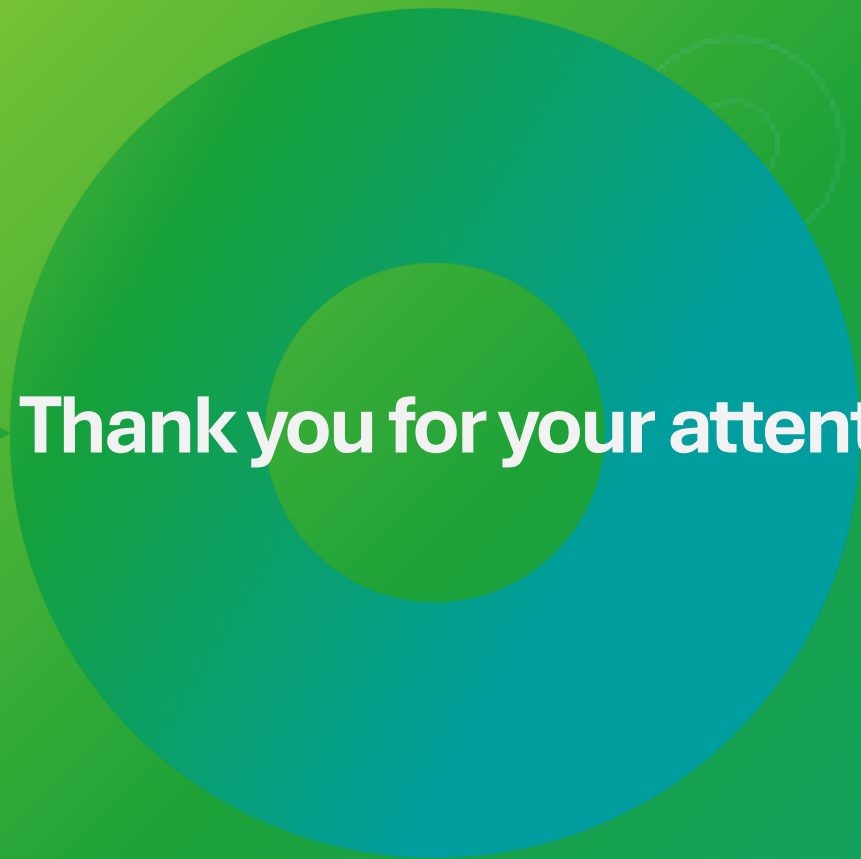
- u.kudu@batterycompetencecluster.nl
- e.orlova@batterycompetencecluster.nl

**Become a BCC-NL partner
& receive updates for free**



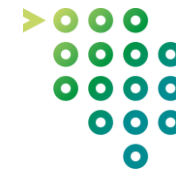
**National Battery
Action Agenda**





Thank you for your attention

➤ Special thanks to:



Provincie Noord-Brabant

