
# Li-Ion Cells & Battery Packs Manufacturing Automation Market 2020

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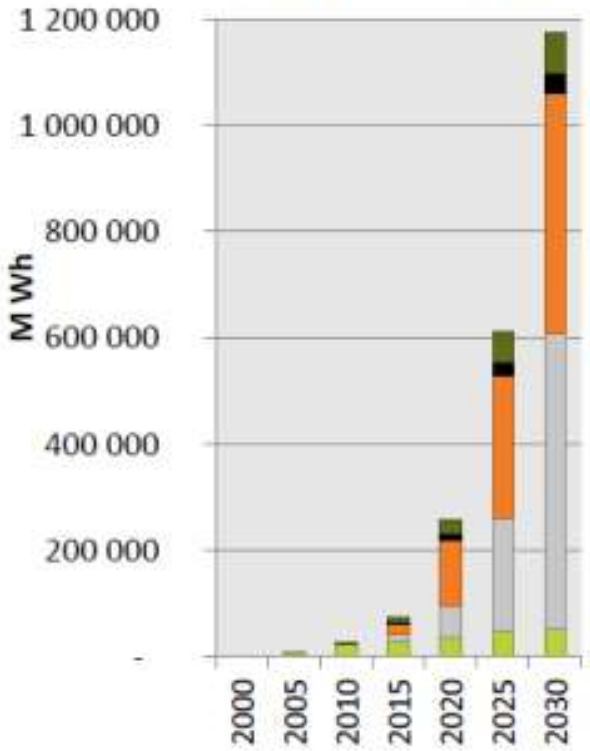
# Li-Ion Battery is Fast Growing Market

From 120 GWh in 2017 to >1,2 TWh

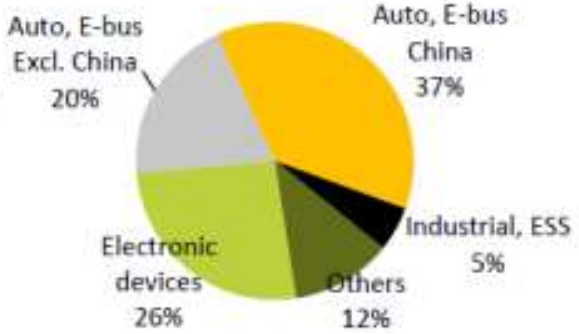
CAGR 2015/2030
+20 % per year in Volume

**Li-ion Battery sales, MWh, Worldwide, 2000-2030**

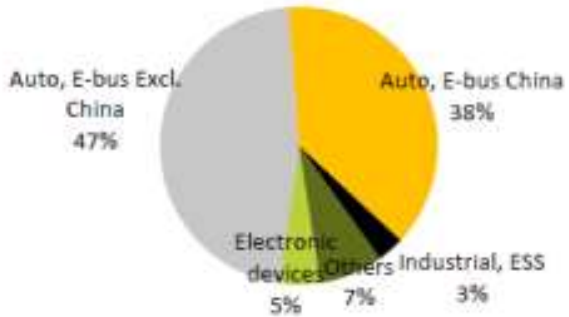



| | CAGR 15/30 (Optimistic) |
|---|---|
| Others | 14% |
| Industrial, ESS | 18% |
| Auto, E-bus China | 24% |
| Auto, e-bus Excl. China | 29% |
| Electronic devices | 4% |

**2017: >120 GWh**



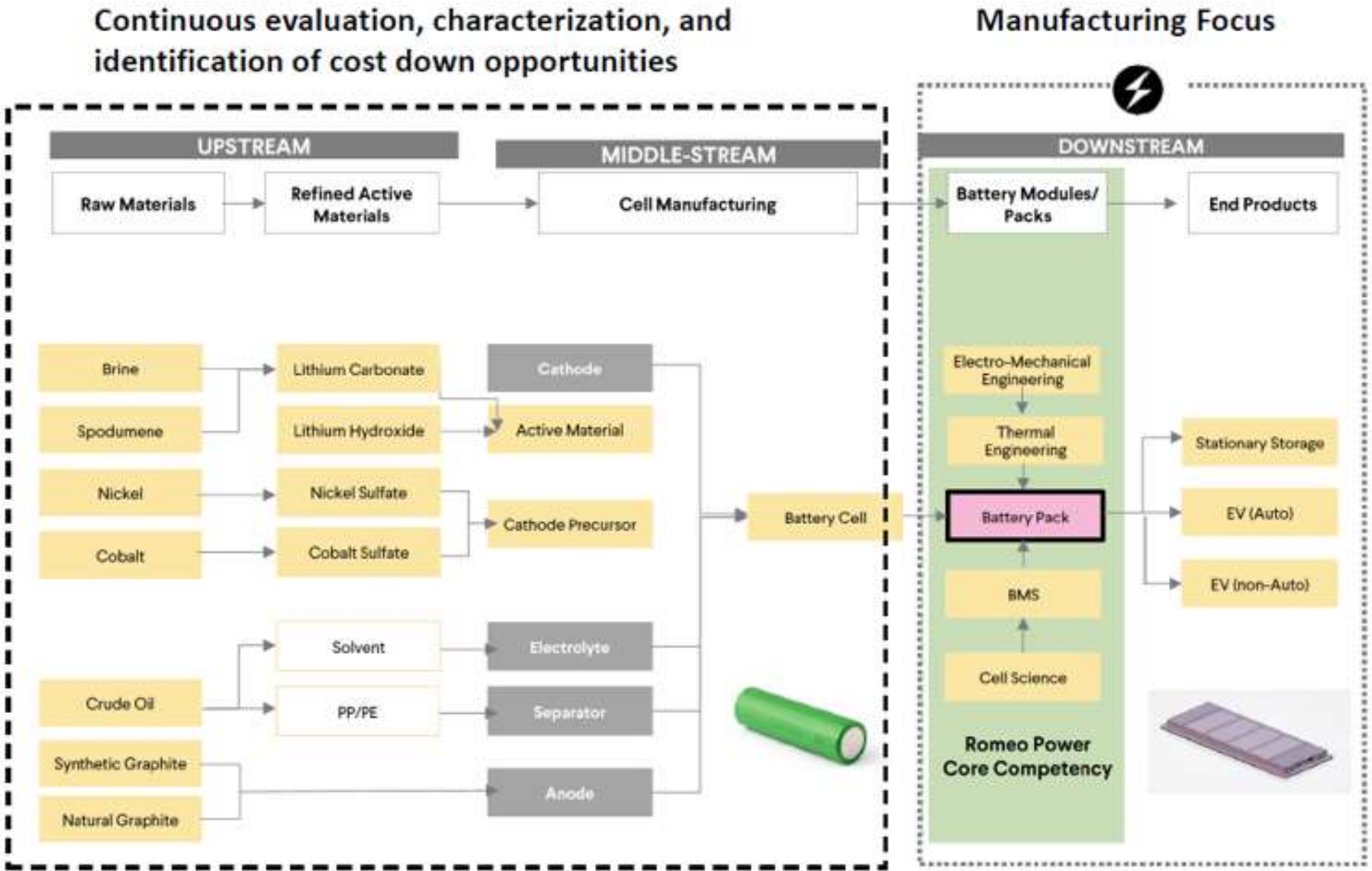

**2030: 1200 GWh**




*Others: medical devices, power tools, gardening tools, e-bikes...*

*Source: AVICENNE Energy 2019*

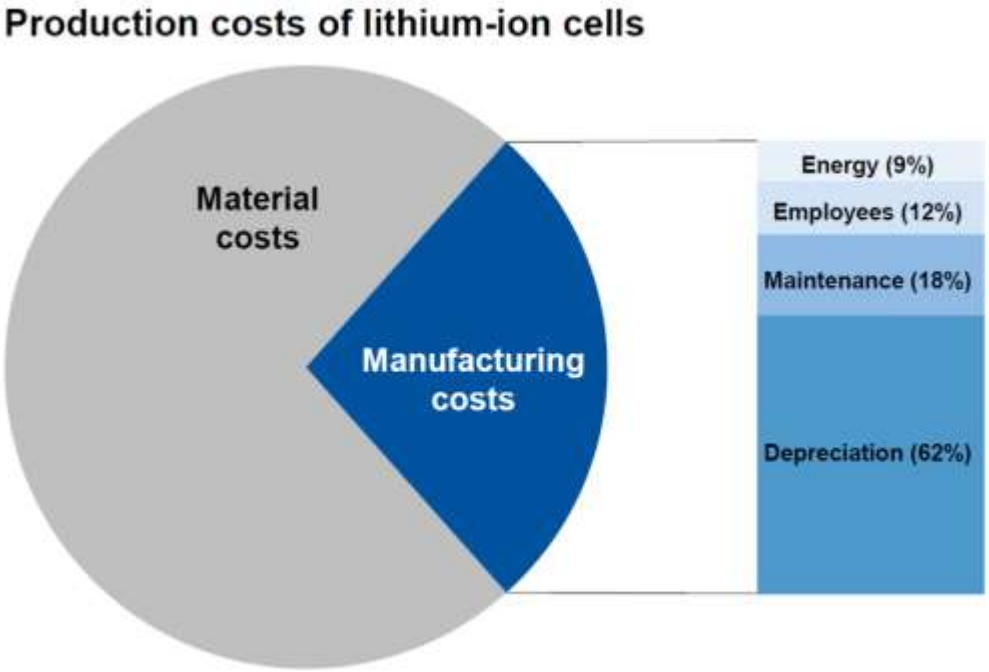
# Li-Ion Battery Supply Chain



# Battery Automation Generate Cost Reduction

Haituoer 海拓尔

Power battery automation production line in China



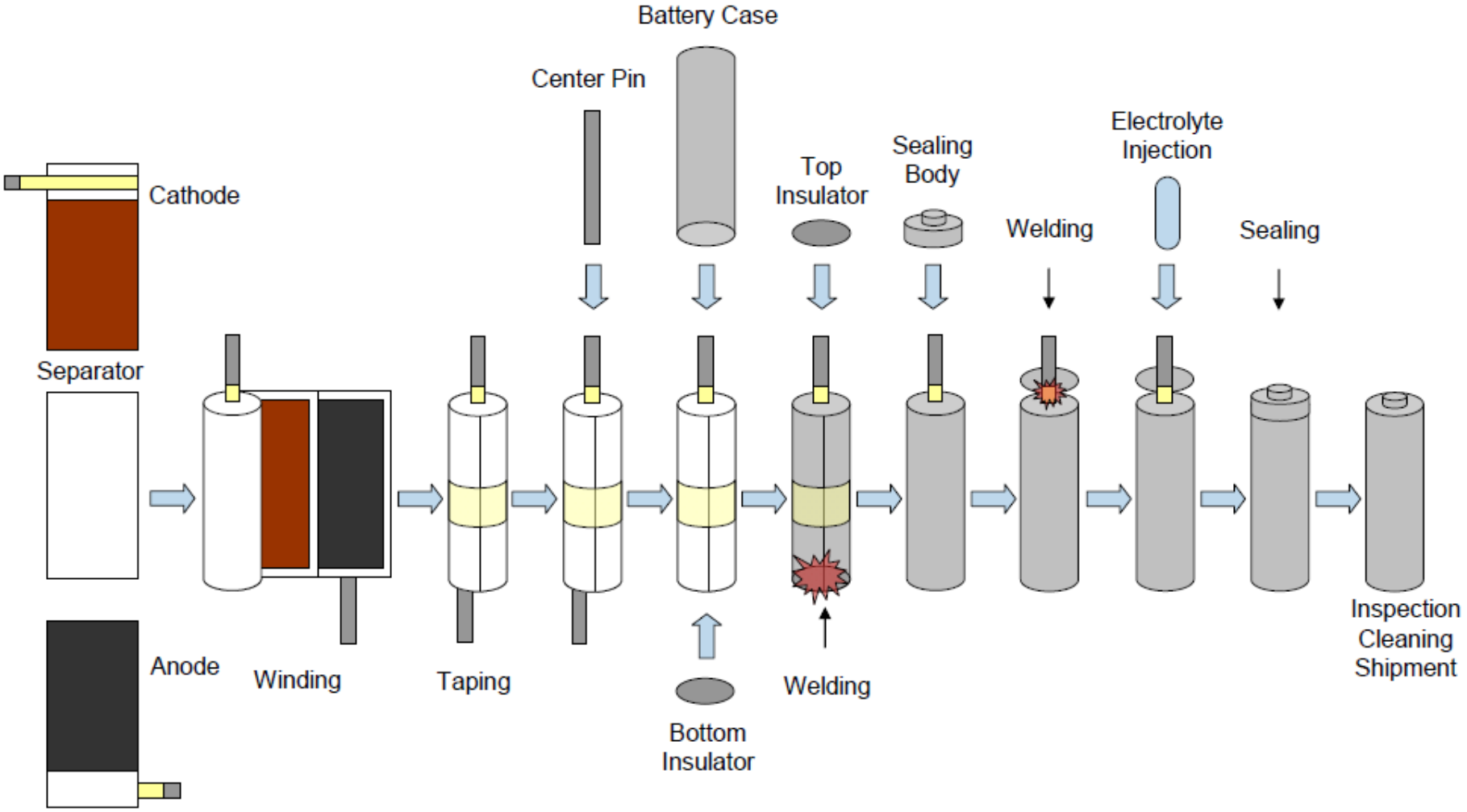

Manufacturing cost ~30% of total production cost

# Battery Automation - Requirements

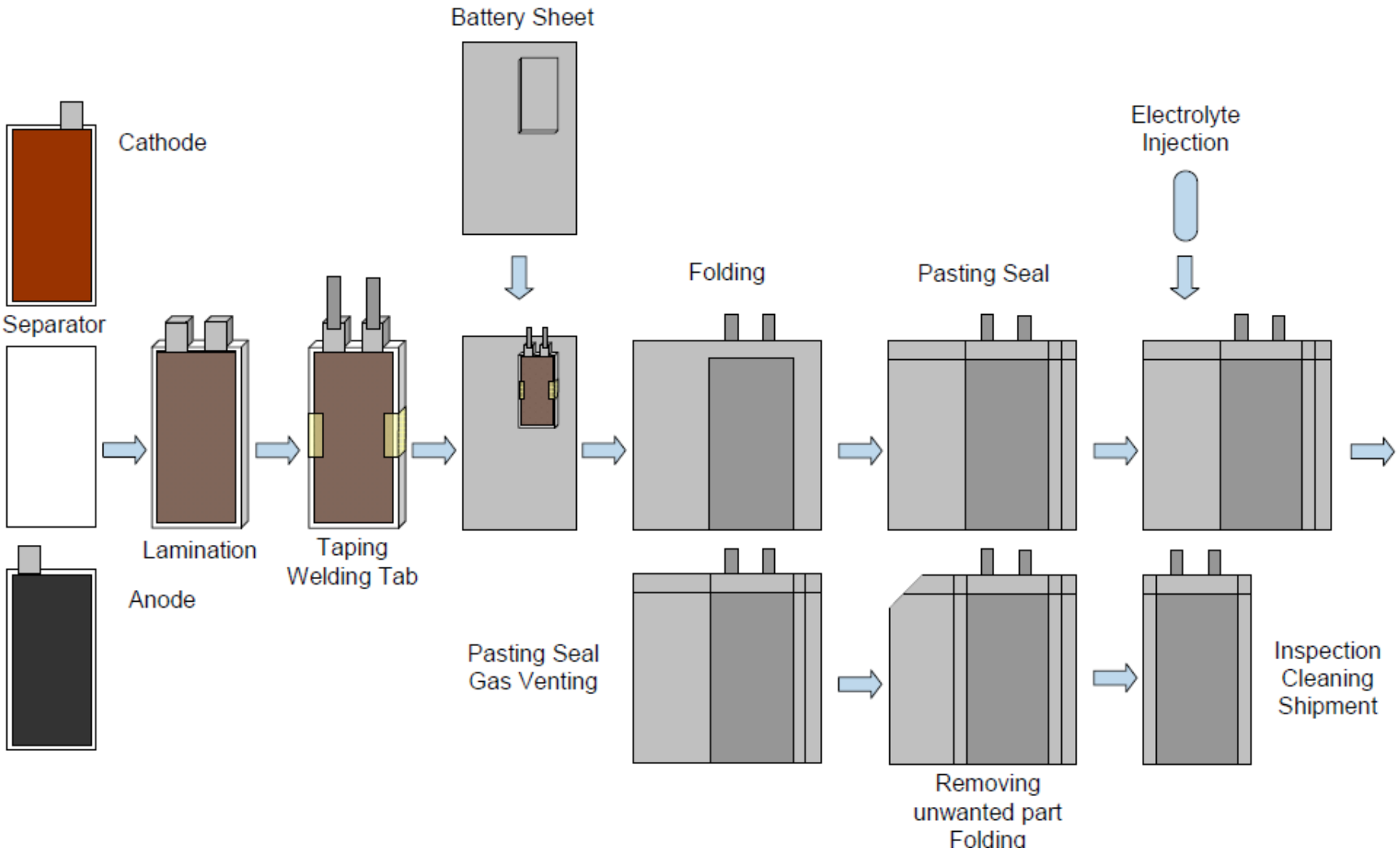
| Raw materials handling | Electrode production | Cell assembly | Module and Battery pack production |
|---|---|---|---|

- Production capacity
- Production speed
- Investment as function of cost reduction
- Production cost optimization
- Infrastructure; Production area, Electricity…
- Human power required
- Product size flexibility
- High Quality and accuracy

# Cylindrical Hard Case Cell Production



# Pouch Soft Case Cell Production



# Level of Automation

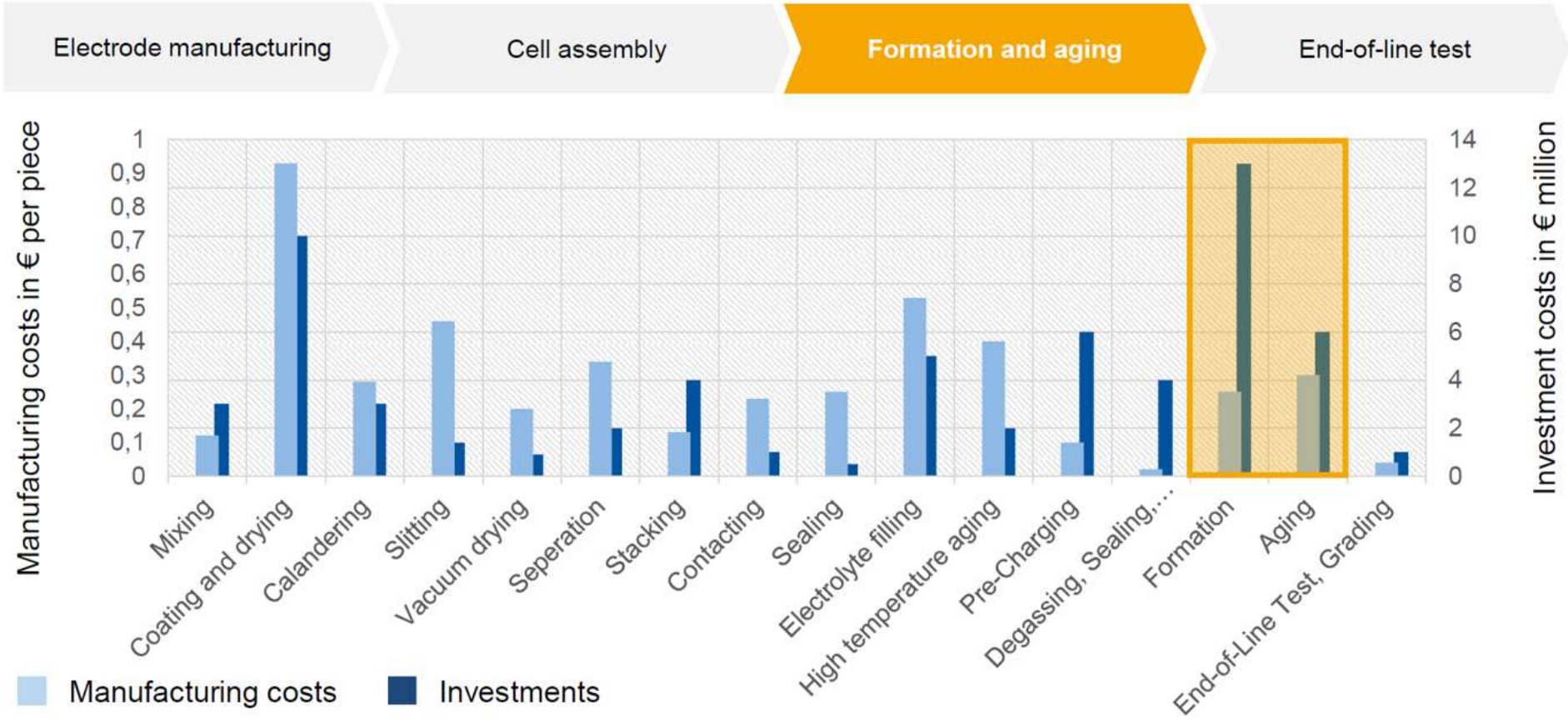
- **Lab scale manufacturing (For development)**
- **Prototype scale manufacturing**
- **Full scale mass production**

RIT Battery Prototype manufacturing Line

MTI Lab Scale Coater

Li-Ion Battery pack assembly line in China

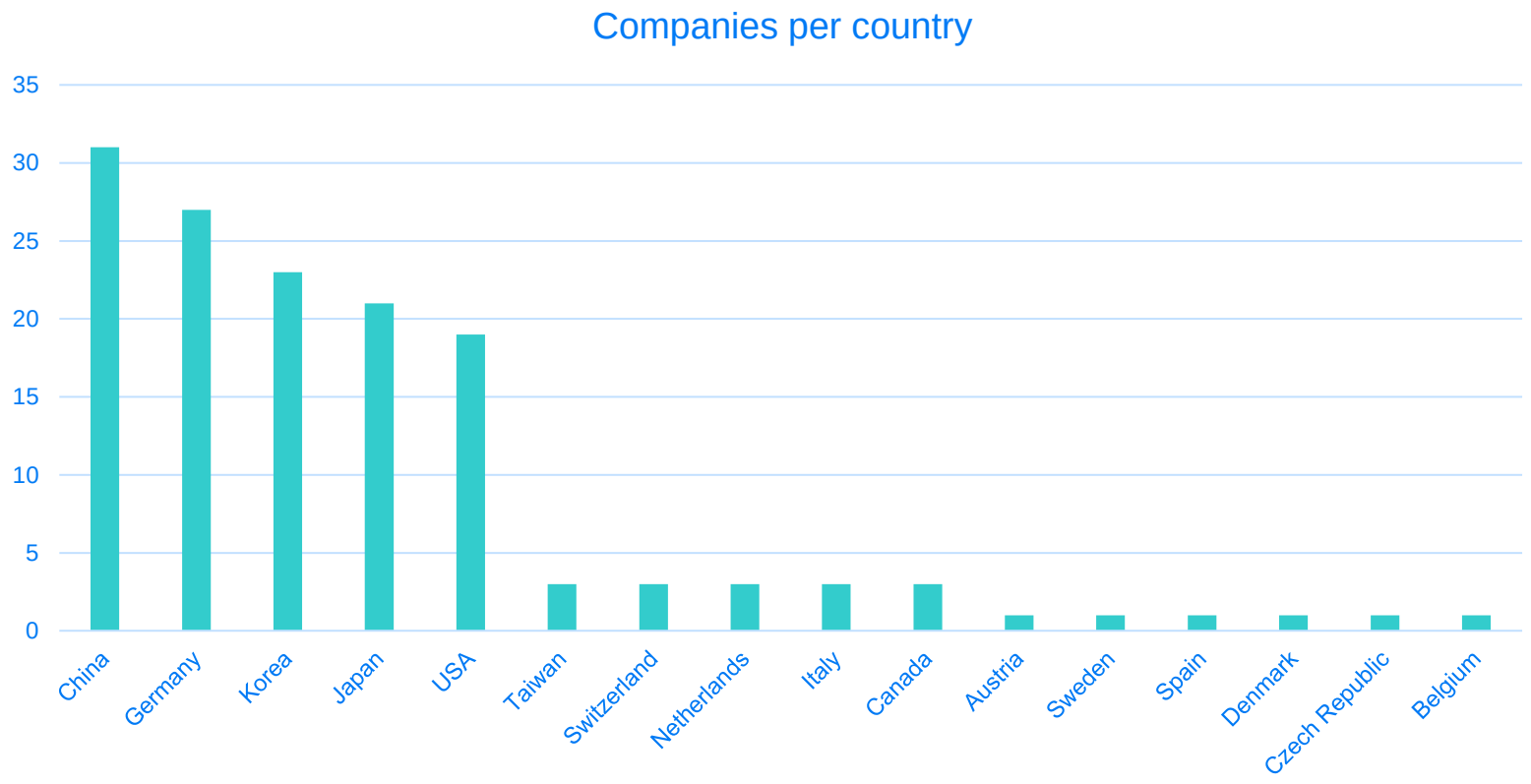
# Manufacturing Cost & Investments



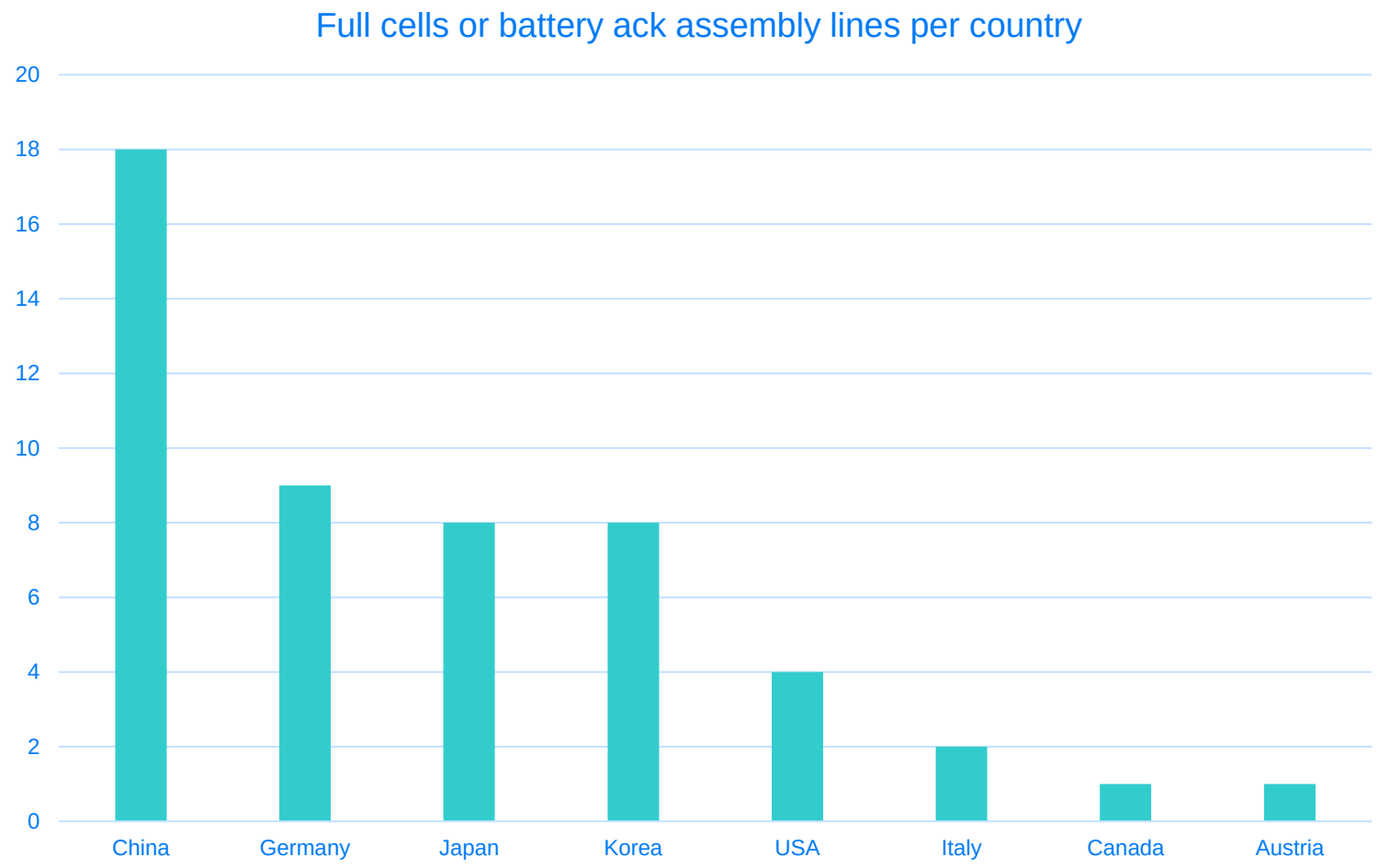

Sources: PEM der RWTH Aachen

# Cells & Battery Pack Automation Market Review 2020

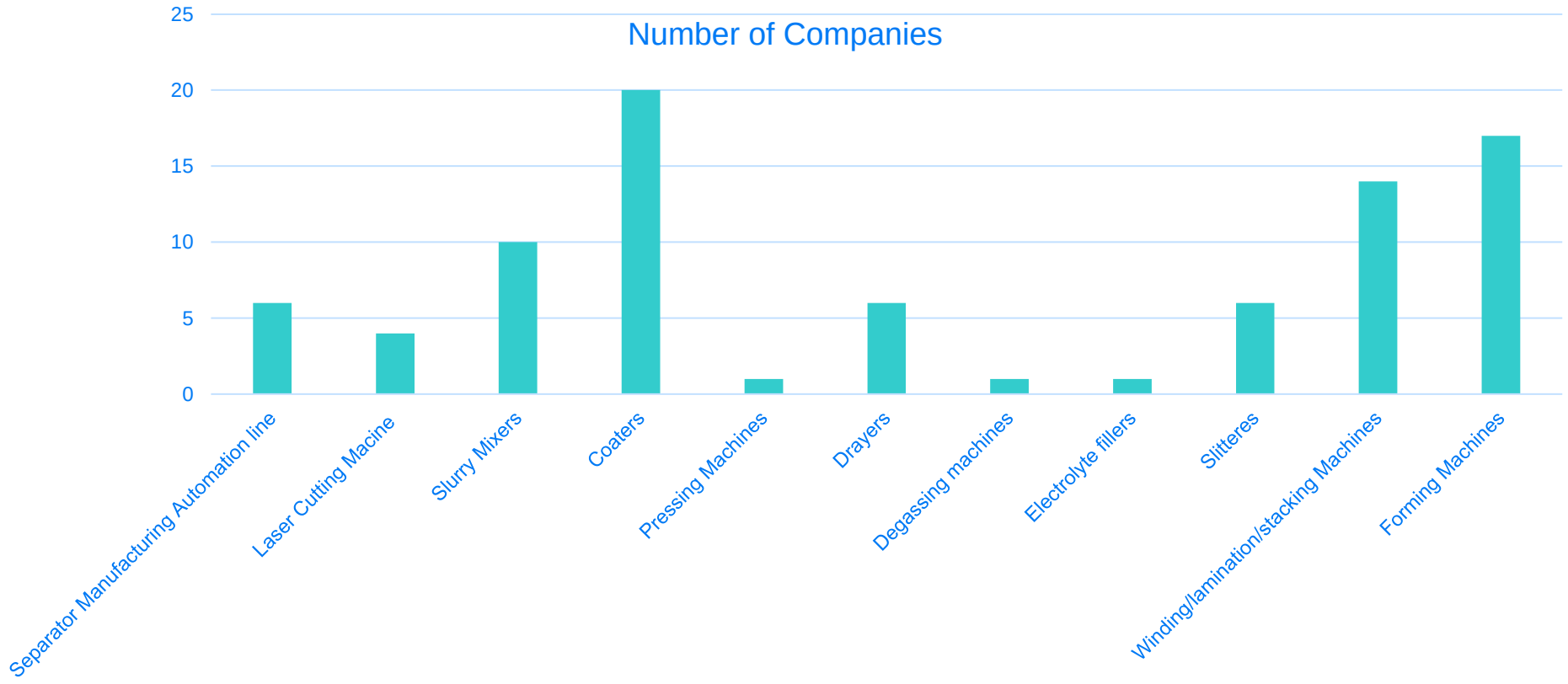
- **We found 142 cells & battery pack automation companies globally offering partly or fully battery production lines**
- **Far east 78 companies, Europe 42 companies, North America 22 companies**



# 52 Companies Offer Full Production line



# 90 Companies Offer Part of Production line

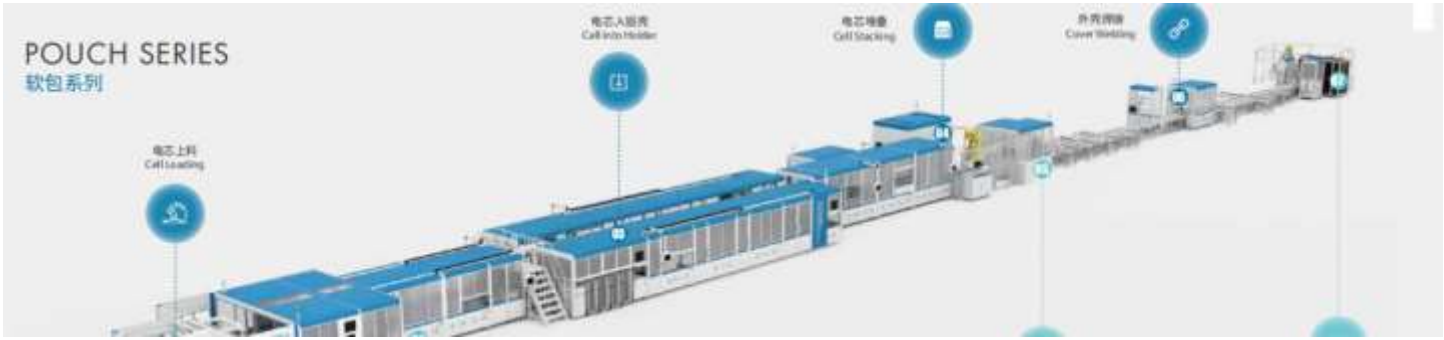


# Some of the Leaders per Manufacturing Segment

- Mixers: Buhler, Ross
- Coaters: Megtec, Mathis, Frontier
- Dryers: Munters
- Slitering: Kubt
- Winders/Stackers: Koem, Fuji
- Forming: Keysight, PEC

# Wuxi Autowell Intelligent Equipment China






http://autowellgroup.com/EN/

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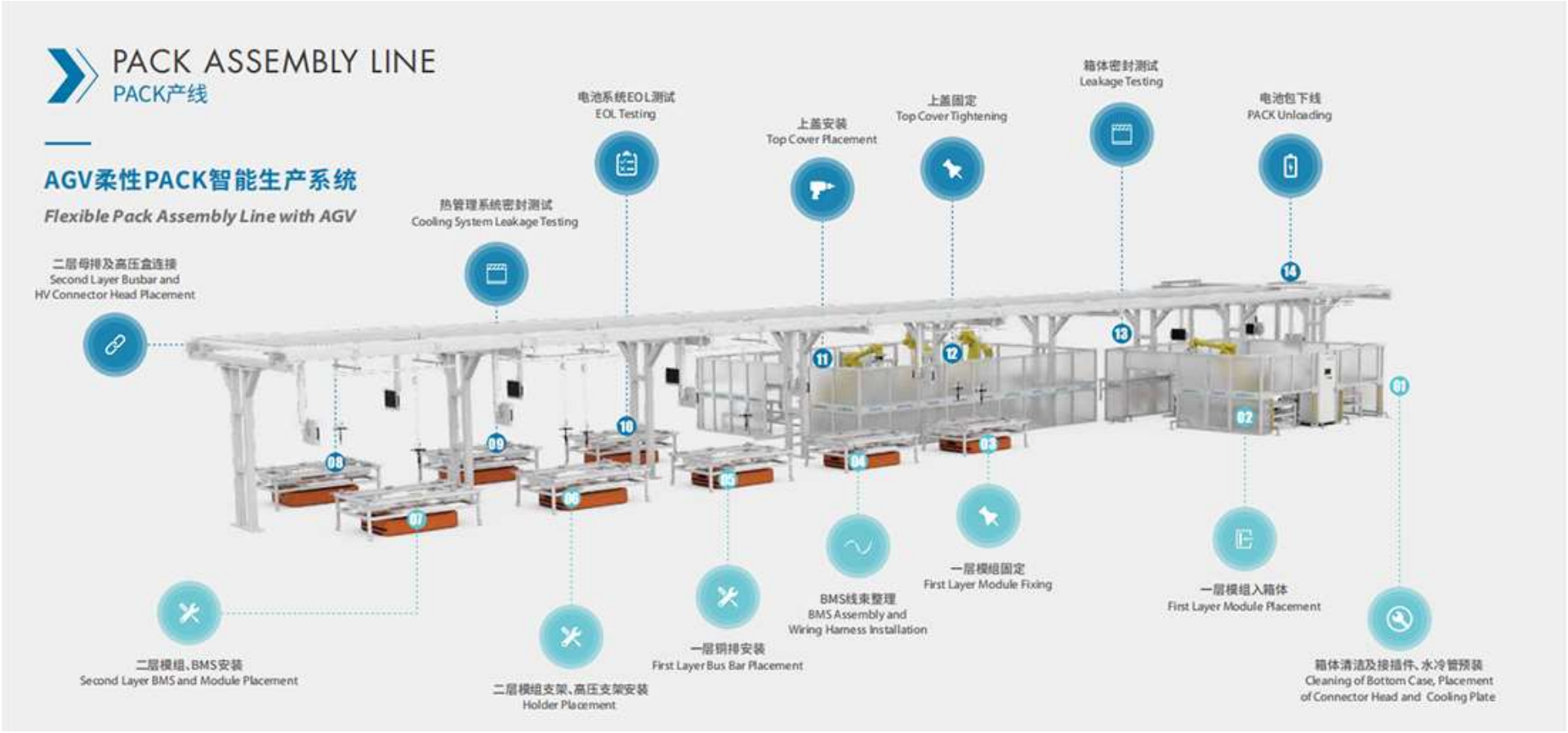



http://autowellgroup.com/EN/

# Corn Korea

## Pouch


Notching


Stacking


Tab Welding


E/L Filling


Final sealing

## Prismatic


Prismatic cell whole line


Winding cell pressing taping


Terminal welding


Welding cell inserting


Can cap welding

## Cylindrical


Point Welding


Winding


beading


E/L Filling


Crimping

**제조 라인**
- 전극 제조 장비
- 조립 장비

**Scale**
- Lab
- Pilot
- Mass

**셀 타입**
- 파우치
- 각형
- 원통형
- 코인

https://www.mycorn.co.kr/

# Mitsubishi Electric Japan


https://www.mitsubishielectric.com/en/index.html

# Hitachi Japan

## Li-Ion Battery Assembling Machine

Request Info | Print

We offer and supply system solutions for assembly of secondary batteries.

(Left) Cam link-driven automated assembly machine driving a cam link.

### Features

**Assembly system supports small volumes and a range of types**

Short changeover time ; Improved production efficiency

**Can handle high production volumes**

Stable production of 1-2 million pieces per month

https://www.hitachi-hightech.com/

# Kuka Germany

KUKA

**Optimization of Overall line Concepts**

**Logistics**
Ease of providing product components to the line

**Cost & set-up lead time**
Project cost & duration

**Efficiency of used resources**
Energy, consumables, air, …

**Technical availability**
Redundancy, robustness, stability

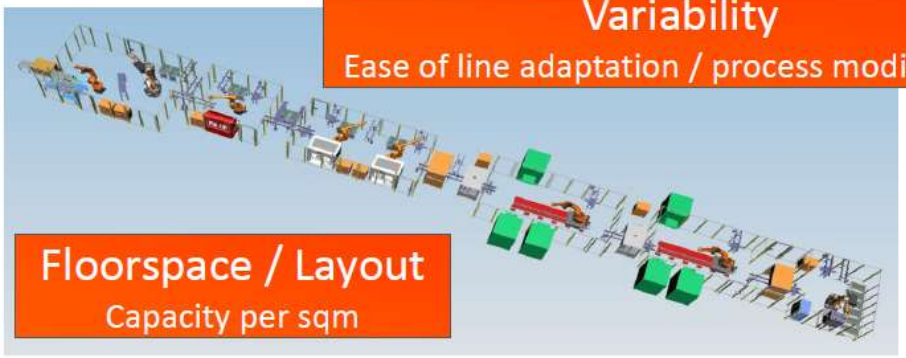
**Production Yield**
Minimization of NOK parts produced

**Scalability**
Ease of capacity adjustment

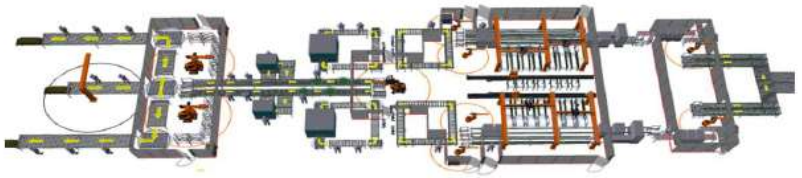
**Maintenance & ease of use**
Ease, frequency & volume of maintenance needs

**Variability**
Ease of line adaptation / process modification

**Flexibility**
Capability to produce various product variants

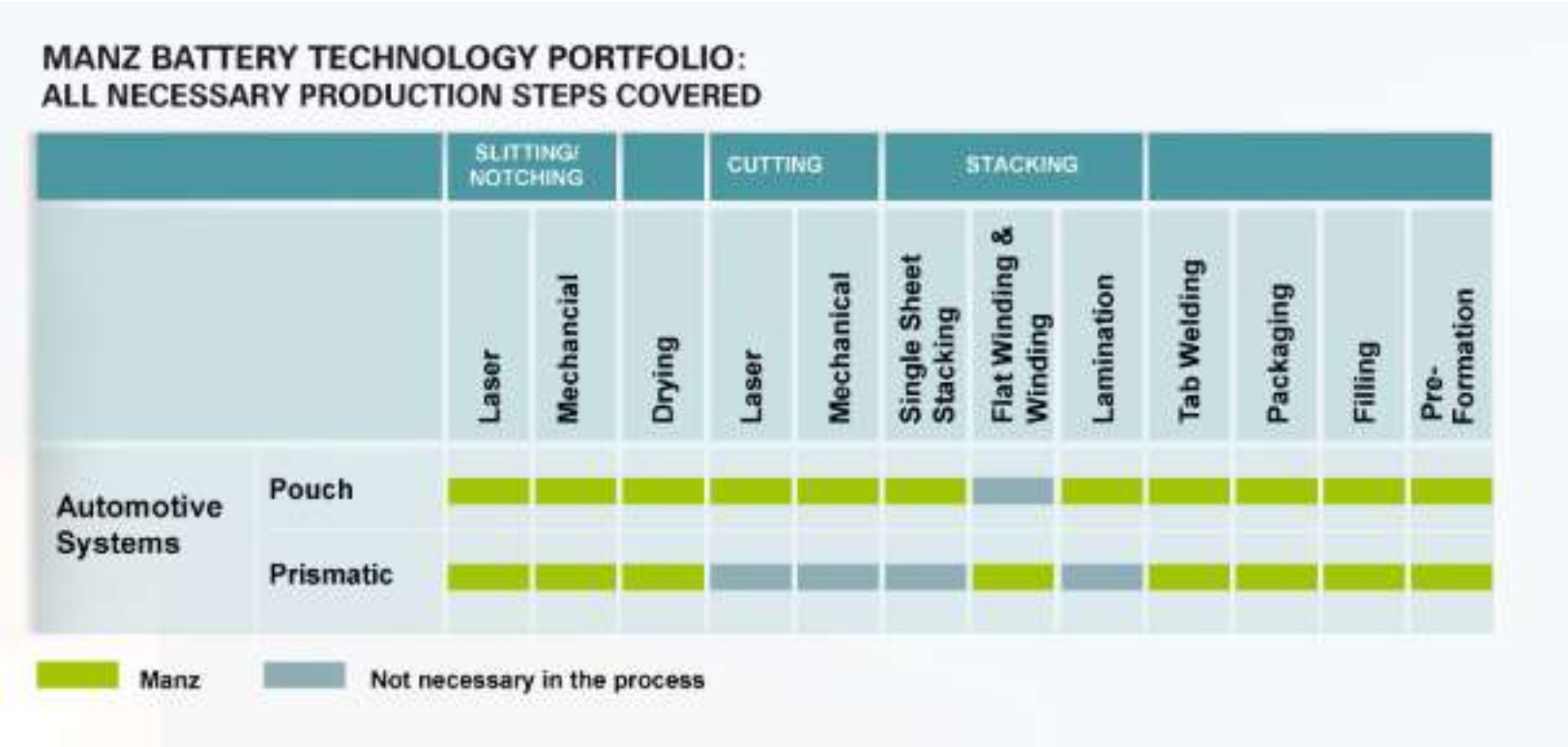


**Floorspace / Layout**
Capacity per sqm



https://www.kuka.com/en-de/industries/energy

# MANZ Germany

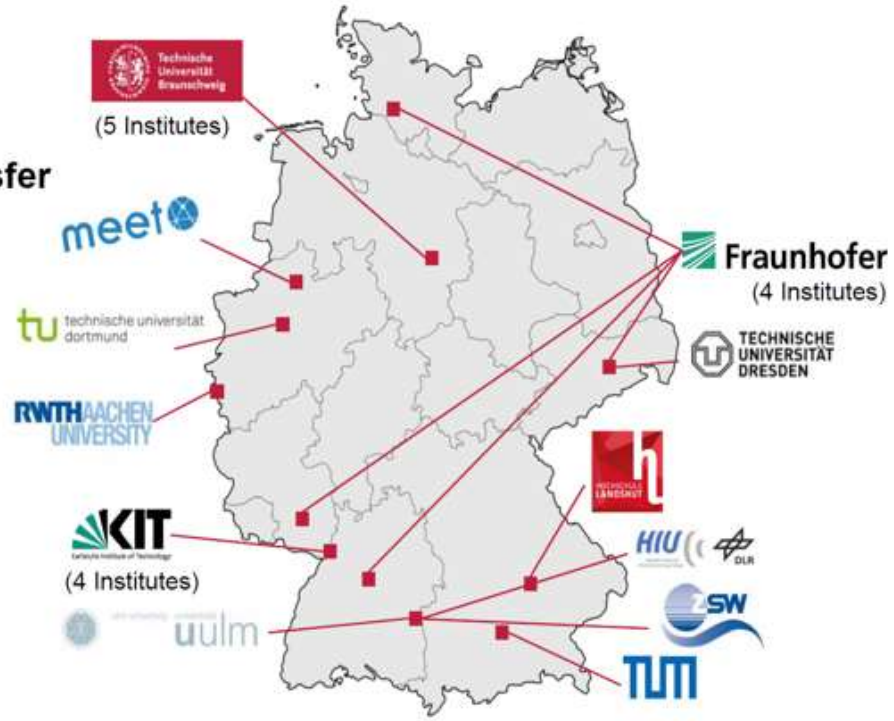



http://www.manz.com

# ProZell Competence Cluster Academy – Industry Cooperation

Closing gaps between industry and research institutions - a key component for the creation of an ecosystem for battery cell production in Germany and Europe


**Intensive knowledge transfer**



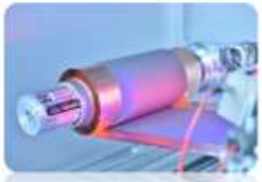
# Research Aims of ProZell Projects
with specific focus on one particular process step

ProZell
Kompetenzcluster zur Batteriezellproduktion

**HiLo** – processes and electrode structures for high-load cathodes

**LoCoTroP** – low-cost dry coating

**Roll-it** – R2R intensive drying



**Cell-Fi** – process optimization for efficient electrolyte filling

**QS-Zell** – QA methods in the production of large-format LIB-cells

*Coating* *Dry Coating* *Drying* *Electrolyte Filling*

*Dispersing* *Drying* *Calendering* *Assembling* *Formation*

**KonSuhl** – continuous slurry processing

**MultiDis** – multiscale simulation of slurry processing

**HighEnergy** – high-capacity structured electrodes

**ProKal** – modelling the calendering process

**OptiZellForm** – energetic optimization of formation

**Sim2Pro** – multi-level simulation of process-product interactions

# Summary

- **Li-Batteries: Attractive grow market**
- **Intelligent production technologies are the key for cost reduction**
- **Quality and process performance are critical**
- **Battery automation market is growing as well as the battery demand grow**
- **New battery technologies like li-ion solid state batteries will require new automation technology**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**Information for presentation obtained by:**

1. **Public web sources.**
2. **Shmuel De-Leon Battery/Energy Sources DataBase ® (Includes 29000 cell PDF data sheets ) http://www.sdle.co.il/Default.asp?sType=0&PageId=45580**
3. **Shmuel De-Leon Energy market report: Li-ion Cells & Battery Packs Automation, Assembly Lines, Production Equipment Market Review 2020**