

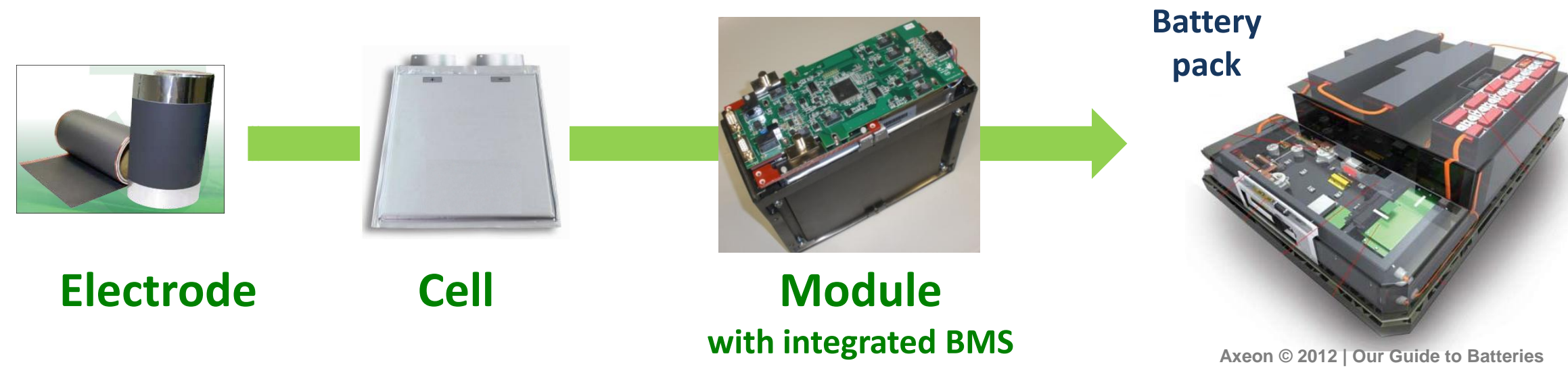
# GREENLION : Advanced Manufacturing Processes for Low Cost Greener Li-Ion Batteries



## FROM GREEN MATERIALS TO GREENER BATTERIES

status M18 / 48

Actions at 3 key levels of the battery value chain:



- i) more environmentally friendly production of the battery components
- ii) substantial shortening of the battery assembly procedure
- iii) easier and more effective disassembly and end-of-life recycling

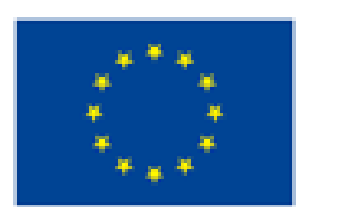
**GREENLION** is a 4-year Large Scale Collaborative Project within the FP7 leading to the manufacturing of greener and cheaper Li-Ion batteries (electrodes, cells & modules) for EV applications.

Call: FP7-2011-GC-ELECTROCHEMICAL-STORAGE  
Topic: **Advanced eco-design and manufacturing processes for batteries and electrical components**

- Total budget: 8.6 M€
- EC contribution: 5.6 M€
- Duration: 01/11/2011 – 01/11/2015

**16 partners from 7 member states:**  
10 industries, 3 research centres, 3 universities

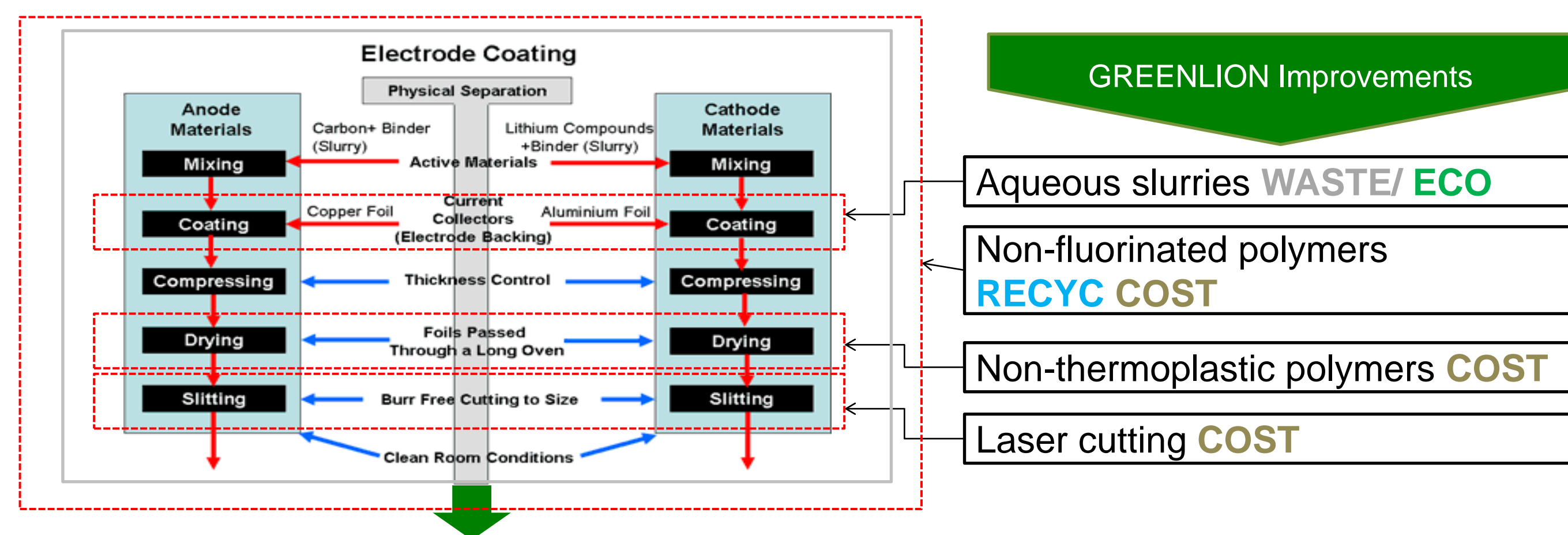
European Green Cars Initiative



IK4 CIDETEC  
Research Alliance  
(Coordinator)

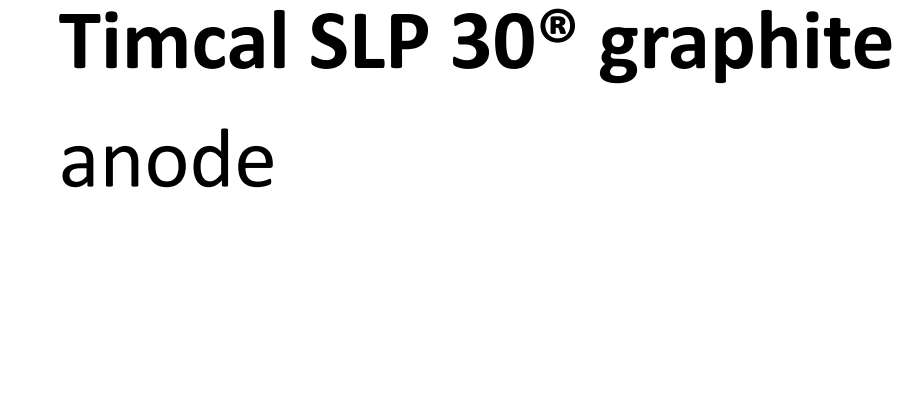
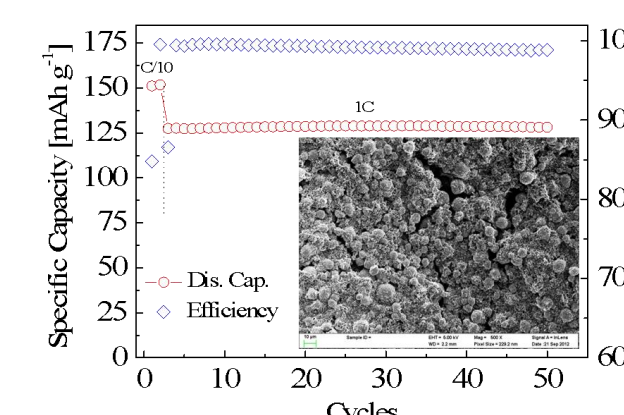


## ELECTRODES: Aqueous Processing using Natural Binders

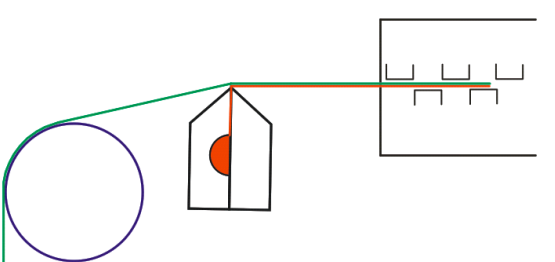


- **Aqueous slurries** (water 0.20€/L) vs. toxic organic volatile (1.2€/L pure NMP):  
Reduced investment on solvent recovery system and coating environment management, health and safety requirements

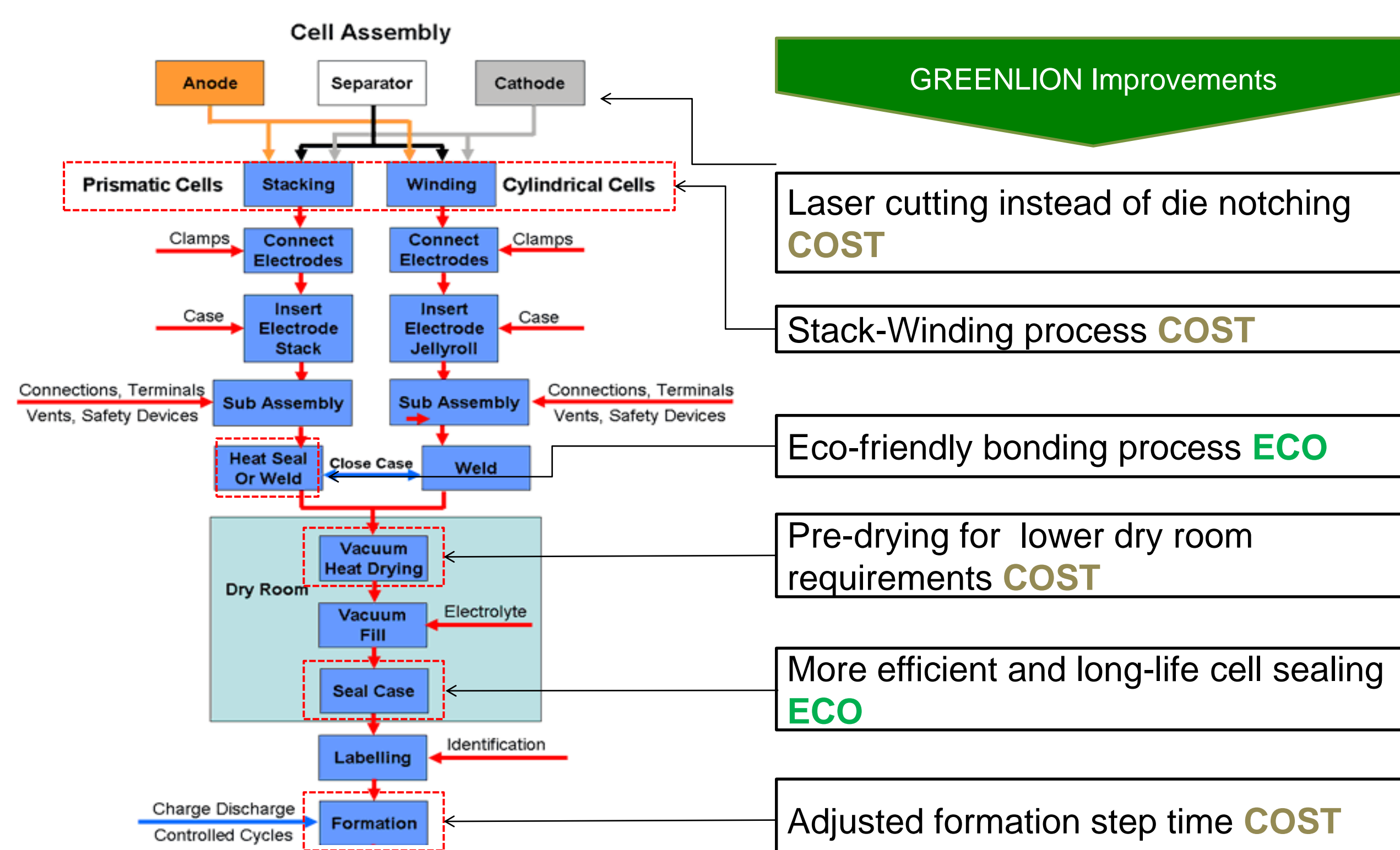
- Development of fluorine-free **CMC based electrode formulations**: Electrode tapes (~1m<sup>2</sup>)  
**NMC cathode**  
**Timcal SLP 30<sup>®</sup> graphite anode**



- **Slot-die coating on pilot line** (increase production speed & efficiency):  
Adjustment of kiss-coating mode for simultaneous coating on both sides of substrate

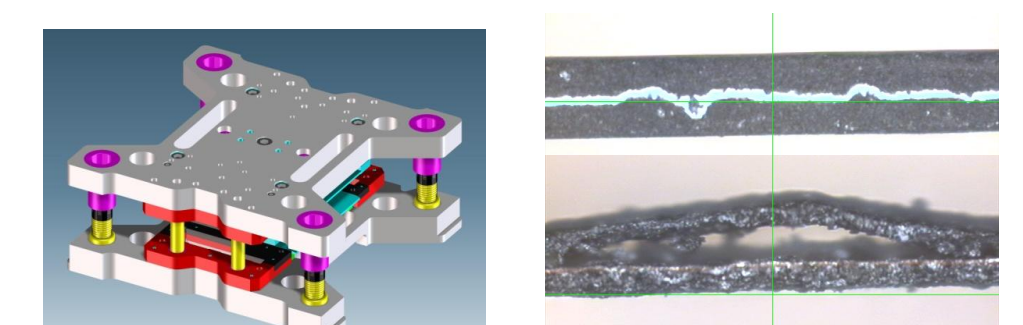


## CELL ASSEMBLY: Laser Cutting and Stack-Winding



Aim to increase energy efficiency and shorten times (and hence lower costs) during the manufacturing process

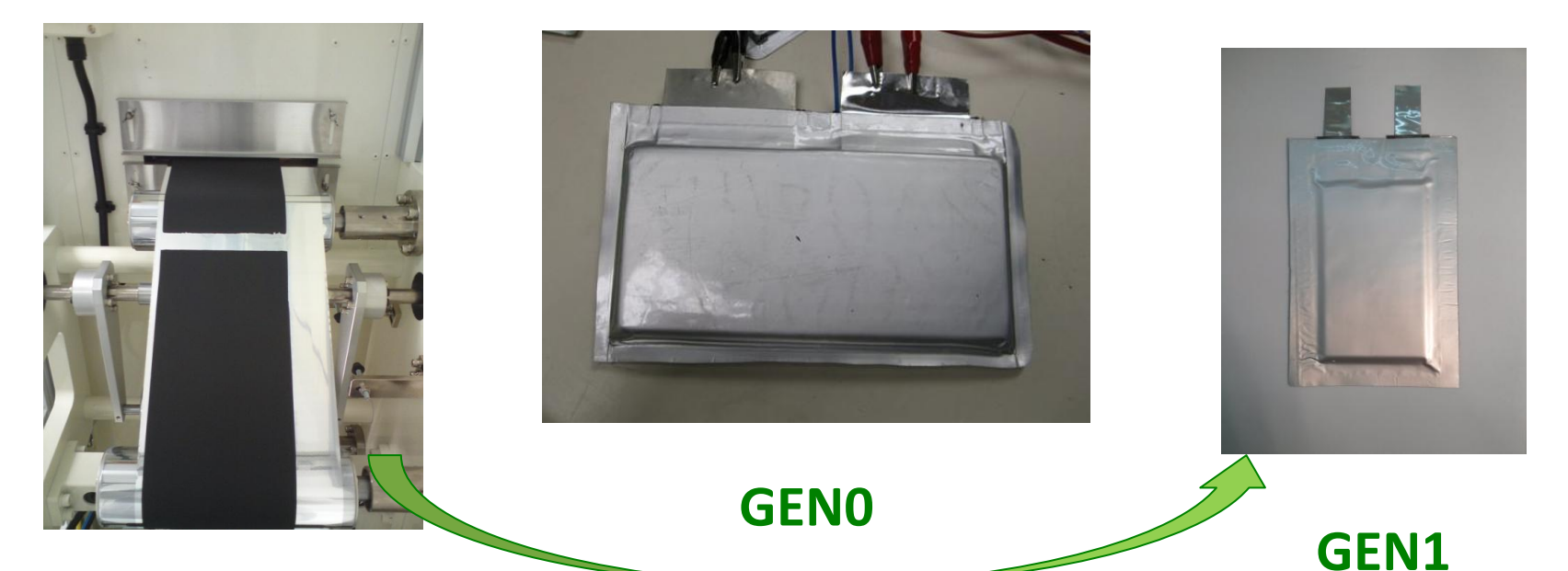
- **Laser cutting instead of mechanical notching**:  
**ONGOING** adjustment of laser parameters to ensure efficient material removal and minimize heat-affected zone to avoid coating degradation



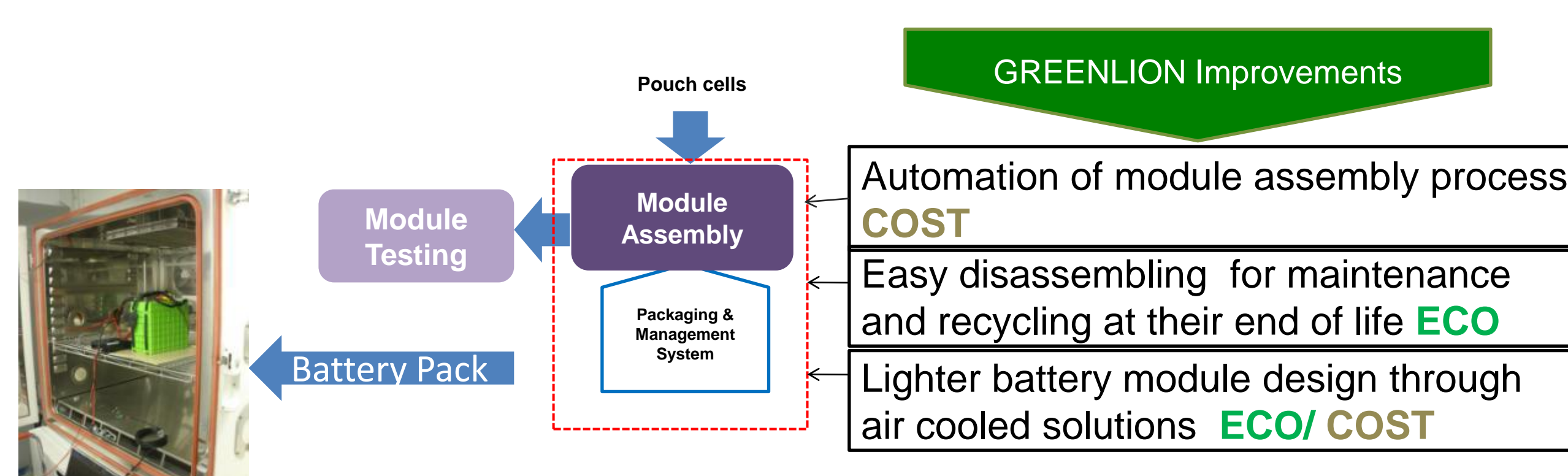
Burrs and delamination with mechanical notching

- **GEN0** (baseline, C/LFP,) and **GEN1** (C/NMC) cell prototype assembly

- **GEN2 cell design**  
Power-oriented



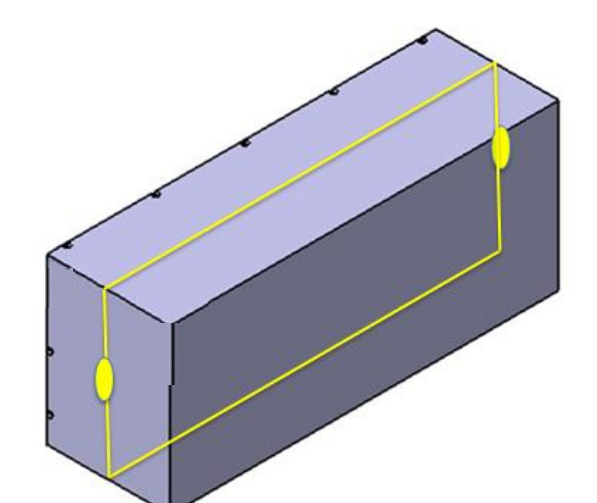
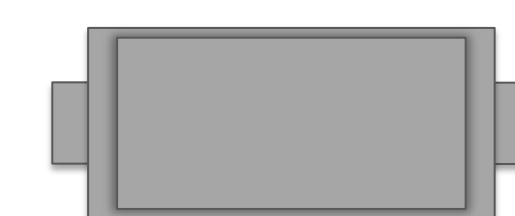
## Lighter MODULES using Eco-designed Bonding Techniques and Automation



- **Lighter module design (-20% weight) with easy disassembly**:

Electrical and thermal simulation of GREENLION cells to develop a module including BMS and Thermal Management System.

**ONGOING**  
design coupled to GEN2 cell



- **3D design of automated battery module/pack assembly line**:

Pilot line in 3D as a turn-key production line for Li-ion module manufacturing

IK4 CIDETEC  
Research Alliance

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Joint EC European Green Cars Initiative Workshop 2013  
Brussels, 10th April 2013

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