

European Batteries – For the long run

Mika Räsänen • Kemian teollisuuden uudet suunnat • 19.1.2009

The situation, as we understand it

- Sustainability demands new forms of energy
- In areas such as transportation and heavy industrial machinery, companies have already begun to adopt new solutions which enable sustainability

Leading the change from the front

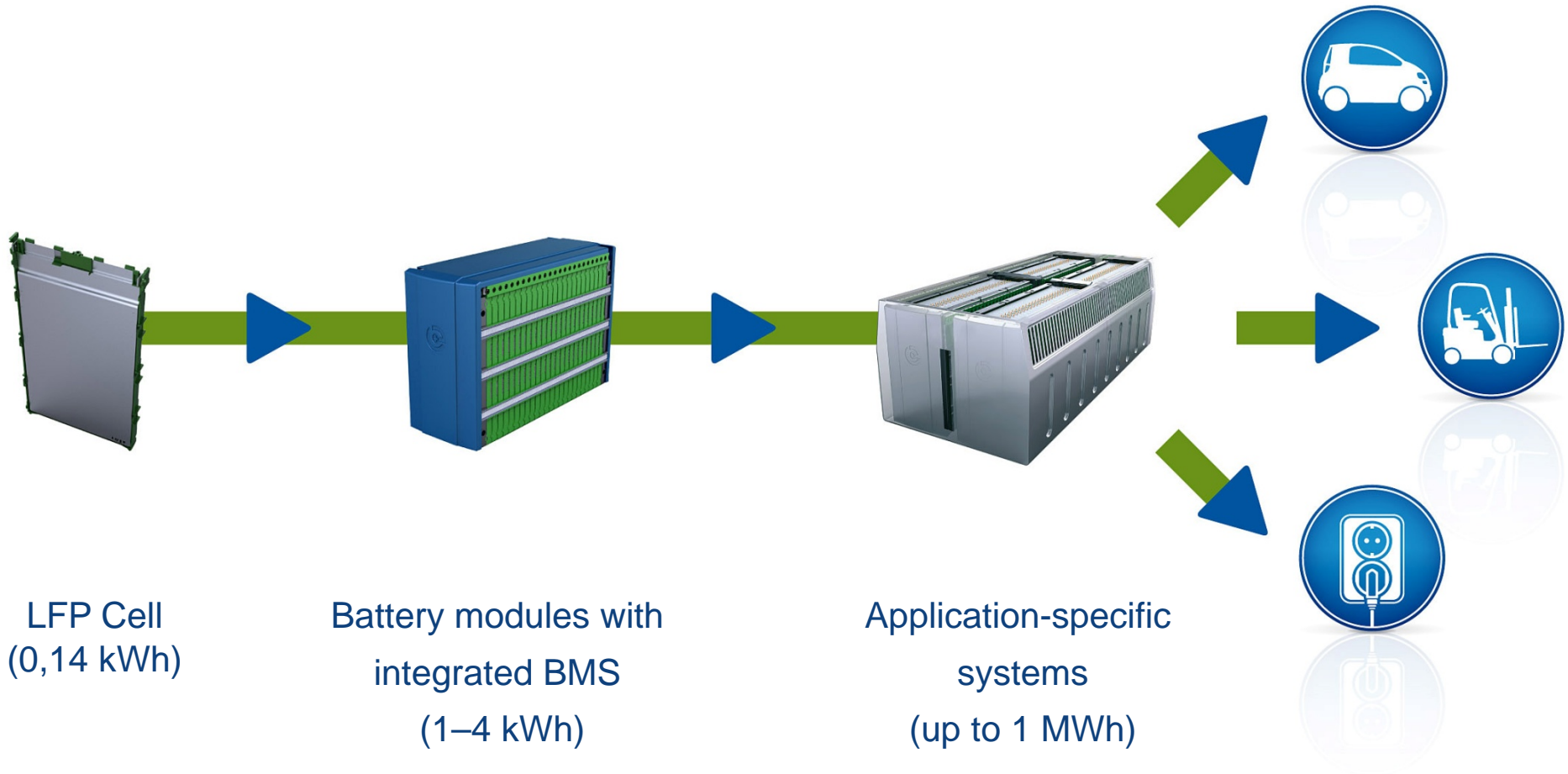
- We will be the first independent large lithium-ion battery manufacturer in Europe
- We provide the entire range from battery cells to comprehensive solutions
- By offering solutions that are both efficient and recyclable, we help our customers in their pursuit of creating new, sustainable solutions

Lithium-ion cell

- High energy density, which means lighter and smaller systems (140 Wh/kg)
- Long life (both cycle and calendar life)
- Excellent safety features thanks to material such as iron phosphate
- Fully recyclable product



Customer industries



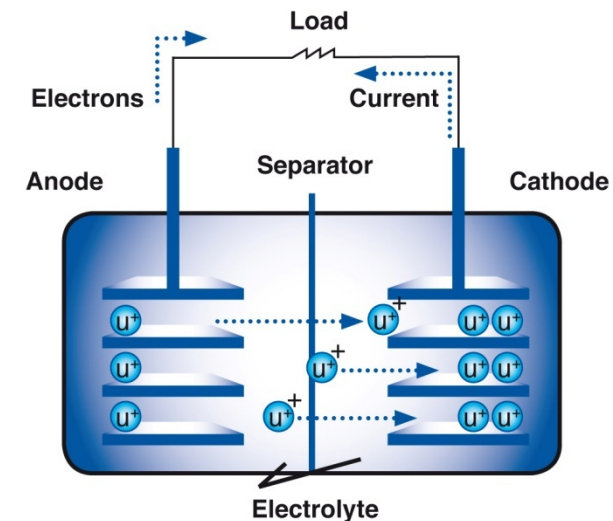
Cell design knowledge

Large-format (>0,1 kWh) prismatic cell design enables high energy density in the battery system level

- 20–50% higher energy density in system level compared to cylindrical cell structure
- Better charging and discharging behavior due to good thermal management of prismatic cell
- Longer cycle and calendar life due to automated high precision cell assembly
- Improved availability due to standard raw materials (LFP)
- More equal cells due to standard materials and in-house processes
- Each cell individually tested and data recorded

5+ years of experience in LFP-cell chemistry with USA technology partner K2 Energy Solutions Inc

- Build in Safety in cell on various mishap e.g. thermal-runaway



Production process knowledge

- Providing sufficient availability in Europe even for large scale producers
 - Capacity up to 300 MWh
- Independent supplier
 - Production opportunities even for local capacity expansion
- Improved quality
 - We have applied tier-one lithium-ion equipment manufacturers
 - In-house production process
 - 20+ step production control
 - Complete traceability through manufacturing execution system (MES)
- Longer product life cycle
 - Excellent temperature, moisture and cleanliness control in factory
 - Advanced dry and clean room facilities for cell assembly
 - Automated formation, conditioning and individual quality check for each cell



Production



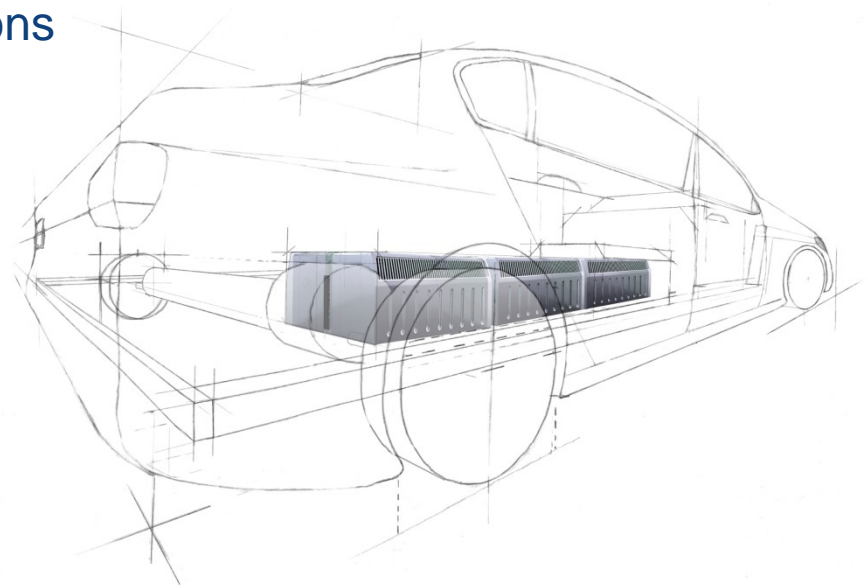
Battery management knowledge

- **Integrated battery management on module level (1–4 kWh)**
 - Best energy density because integrated BMS
 - Better and faster charging and discharging control
 - life-time and improved safety from optimized cell protection and control
 - Better capacity management with data logging and advanced algorithms
- **Remote access to battery systems**
 - Improved service and traceability
 - Shorter downtimes due to forward-looking analysis and service
- **Higher maximum output (W) for battery system**
 - 3,2 kWh module mass 30 kg
 - 3,2 kWh module volume 25 liters



Battery system knowledge

- Reliable lithium-ion battery systems designed since 2003
 - Up to 1000 kWh
- Customer industry focused engineering and integration skills
 - Thermal management (cooling/heating, thermal balancing)
 - Interfaces to customer systems
 - Designing customer industry specific system safety
 - Voltage levels, vibrations, ambient, protections
- Easier co-operation
 - Customer-specific design for housing, installation and testing
 - Turn-key battery system delivery



Customer industries

- Transportation
 - cars, distribution vehicles, buses, trains, marine

- Heavy industrial machines
 - cranes, warehouse trucks, special moving machinery

- Energy storage
 - energy storage
 - uninterruptible power supply



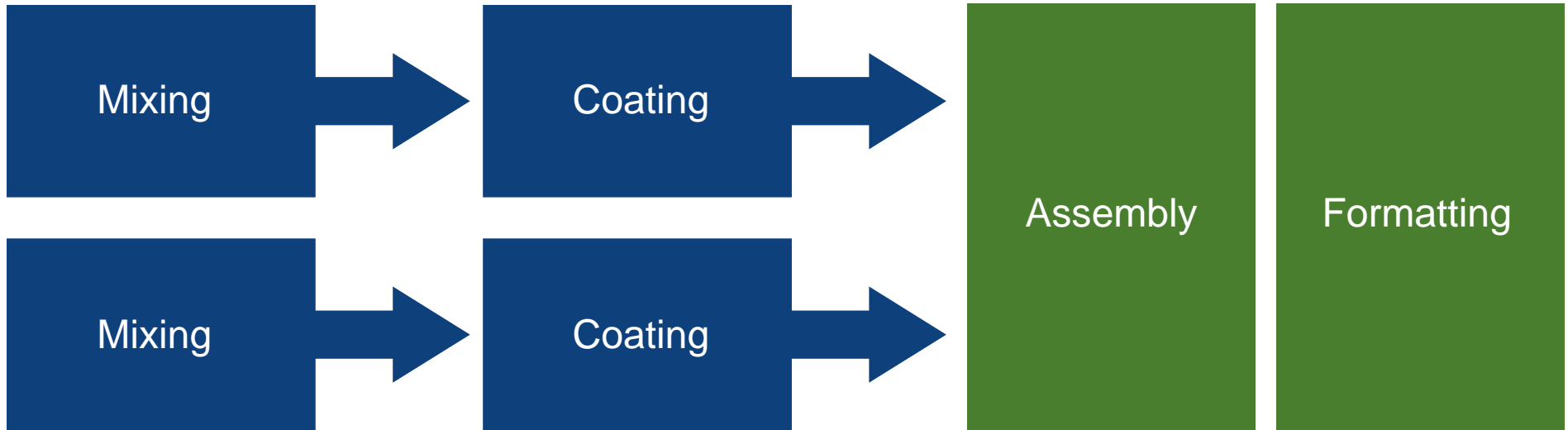
Production

- Manufacturing plant in Varkaus, Finland will begin its operations in spring of 2010
- First independent large battery manufacturer in Europe
- 100 MWh annual production capacity, which equals the need of 3.000 full-electric cars
- Capacity increase to 300 MWh is scheduled to be ready 2012



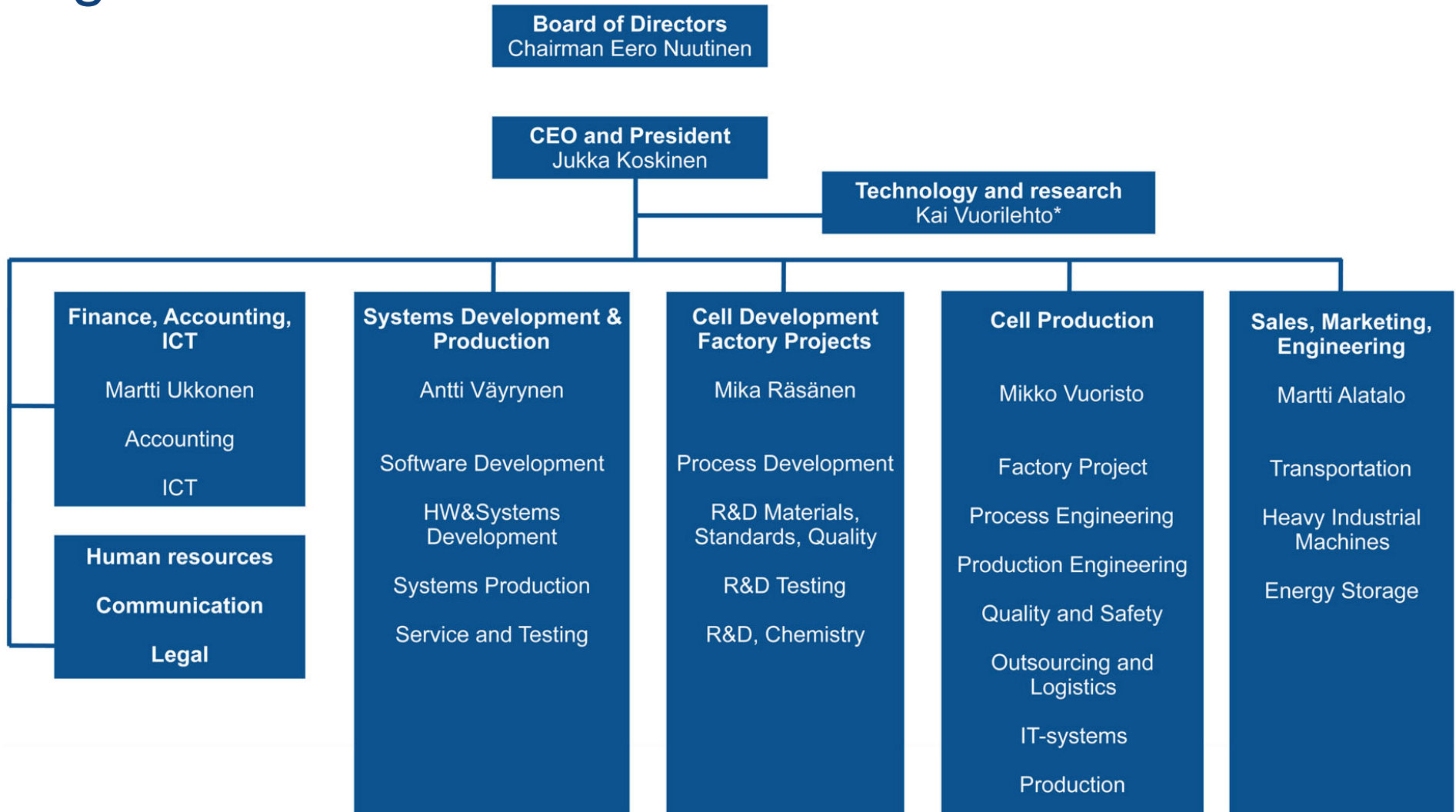
Cell production process

Anode electrode line



Cathode electrode line

Organization



Sustainability

- Fully recyclable product
- Recyclable process waste
- Sufficient cleaning chemicals treatment
- Lithium-ion provides an excellent opportunity to change from fossil based combustion engines to electric energy ones

For the long run

- The first large battery manufacturing unit in Europe
- From cell production to megawatt systems
- Optimized for operational reliability and safety
- High energy density
- Successful customer pilots and tests with technology partner K2 Energy solutions Inc.
- Secured licensed raw material availability
- Sustainable production process
- Long life (both cycle and calendar life)
- Comprehensive energy solutions for those looking for improved performance and sustainability

Future outlook

- The demand for lithium-ion batteries is rising fast
- 1.000.000 cars require 100 factories with 300 MWh capacity
- These require 3 TWh energy per year (15.000km each) which would be 4% of annual electric energy in Finland
- Meeting new sustainability requirements efficiently will provide a crucial competitive advantage for our customer industries
- Plan to three-fold production volume up to 300 MWh in Varkaus

Thank you!