



Lithium Ion Battery Integration in the Automotive Market

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MAGNA STEYR Battery Systems

A3PS Vienna

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- Introduction of MAGNA STEYR Battery Systems
- Battery Systems Product Portfolio
- Li-Ion Batteries for automotive – general trends
- Magna Steyr Development Process
- Future Trend



Management Structure MAGNA Int.



Don Walker	Chief Executive Officer
Vince Galifi	Chief Financial Officer
Jim Tobin	Chief Marketing Officer, President Magna Asia
Jeff Palmer	Chief Legal Officer
Tom Skudutis	COO Magna Interiors, Exteriors, Seating, Mirrors, Closures and Cosma
Swamy Kotagiri	Chief Technology Officer
Marc Neeb	Chief Human Resources Officer
Guenther Apfalter	President Magna Europe
Mike Sinnaeve	VP Operational Improvement & Quality

Joe Pittel
President

Mike Bisson
President

MAGNA SEATING



Seating

Joe Pittel
Acting President

MAGNA EXTERIORS



Exteriors

Albert Lidauer
President

MAGNA INTERIORS



Interiors

Frank Seguin
President

MAGNA MIRRORS & MAGNA CLOSURES



Vision, Closures, Lighting, Sealing & Roof Systems

John Farrell
President

COSMA INTERNATIONAL



Body & Chassis

Jake Hirsch
President

MAGNA POWERTRAIN & MAGNA ELECTRONICS



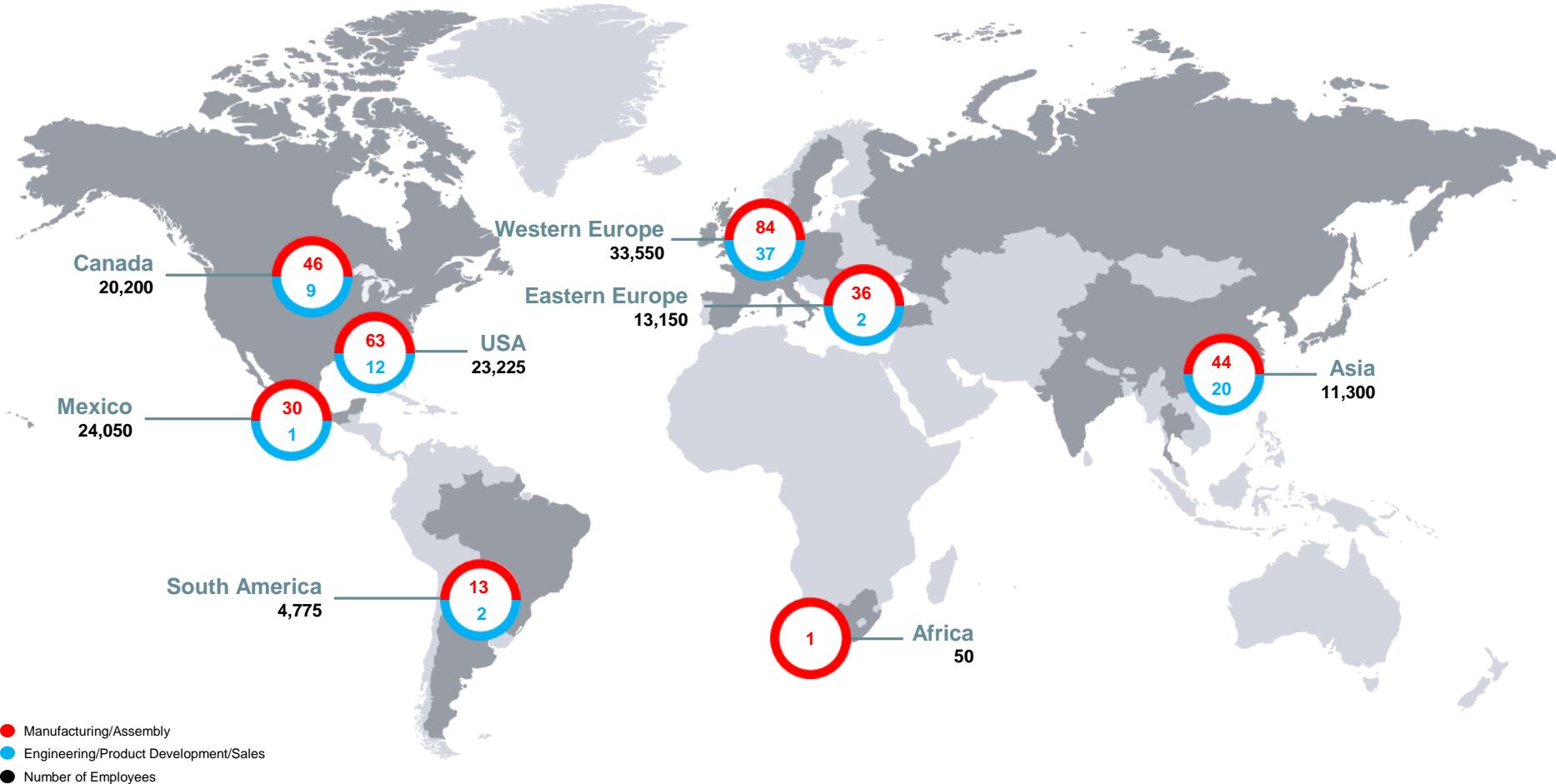
Powertrain & Electronics

Guenther Apfalter
President

MAGNA STEYR



Vehicle Eng & Contract Mfg; Fuel & Battery Systems



~ 130,000 People | 29 Countries | 317 ● 83 ● | \$34.8 Billion (2013 Sales)

(@ Q2 2014)

Austria - Zettling (HQ)

- **Plant Size:** 14,000 m²
- **Functions**
Battery Pack Engineering
Prototype Battery Builds
Battery Pack Assembly
- **Products:** Li-Ion PHEV Battery Pack, 12V
Li-Ion battery
- **Production cap. PHEV:** >35.000 Units /
year (2 shifts)



USA (MI) - Auburn Hills

- **Plant Size:** 7,630 m²
- **Functions**
 Battery Pack Engineering
 Battery Testing
 Material Testing
- **Test equipment:**
 Materials Test Lab



	Pack	Module	Cell
Channels	22	8	381



Changchun (planned)

- China, Jilin Province
- Expansion of existing plant
Planned size: ~10.000 m²
Planned Production volume:
~35.000/ (year)

SOP: Q2/ 2016

• Functions

Battery Pack Assembly
Battery Pack Engineering

- **MAGNA STEYR overall footprint in China:**
640 employees in 5 locations (as of 03/2013)



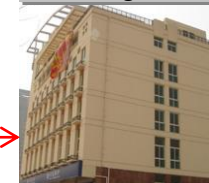
Changchun



Shenyang



Shanghai

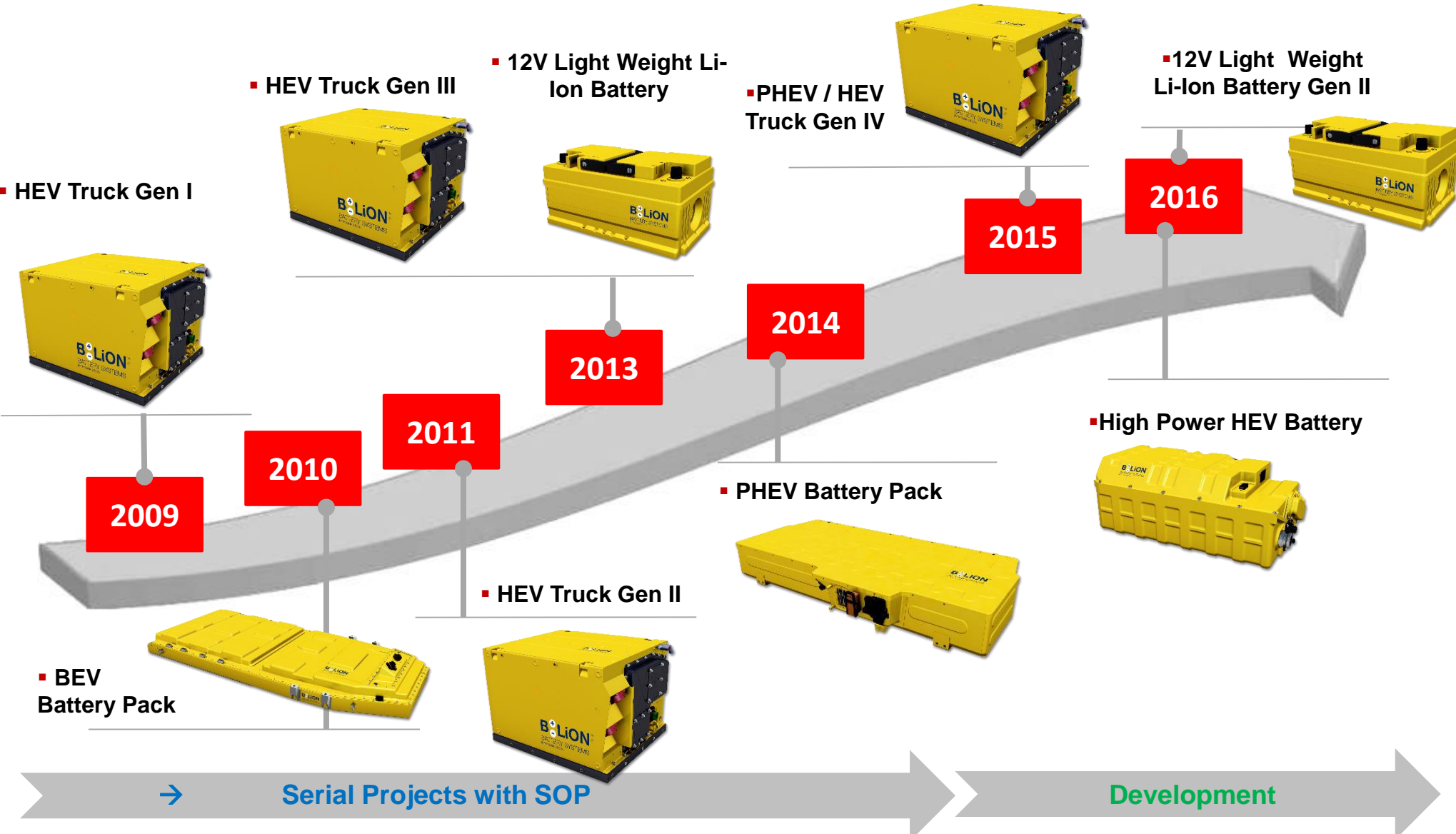


Wuhan






● Engineering Services

● Fuel Systems + Battery Systems (planned)

MSBS Track Record



Battery Systems Product Portfolio

	Energy	Plug-In	Heavy Duty	Hybrid	12V
					
Energy Content	16 - 36 kWh	6 - 18 kWh	1,8 - 6 kWh	0.25 - 3 kWh	240 - 800 Wh
Power	50 - 120 kW	50 - 120 kW	50 - 120 kW	10 - 50 kW	~ 3 kW
Voltage	400 V	400 V	400 / 700 V	120 / 400 V	12 V
Weight	180 - 400 kg	80 - 200 kg	70 - 220 kg	10 - 40 kg	~ 5 kg
Cooling	liquid (optional)	liquid	liquid	air / liquid	passive
Life time	>2000 full cycles	> 6000 full cycles	> 25.000 h	> 10.000 h	> 10 years
Manuf. Capacity	3,000 / year	> 35,000 / year	3,000 / year	50,000 / year	< 100,000 / year

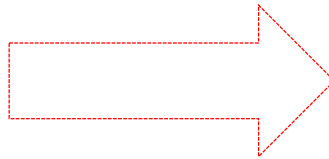


Li-Ion Batteries for automotive – general trends

Energy



~150 km
(up to 400)
driving range



- 400 km driving range
- High energy density
- High integration

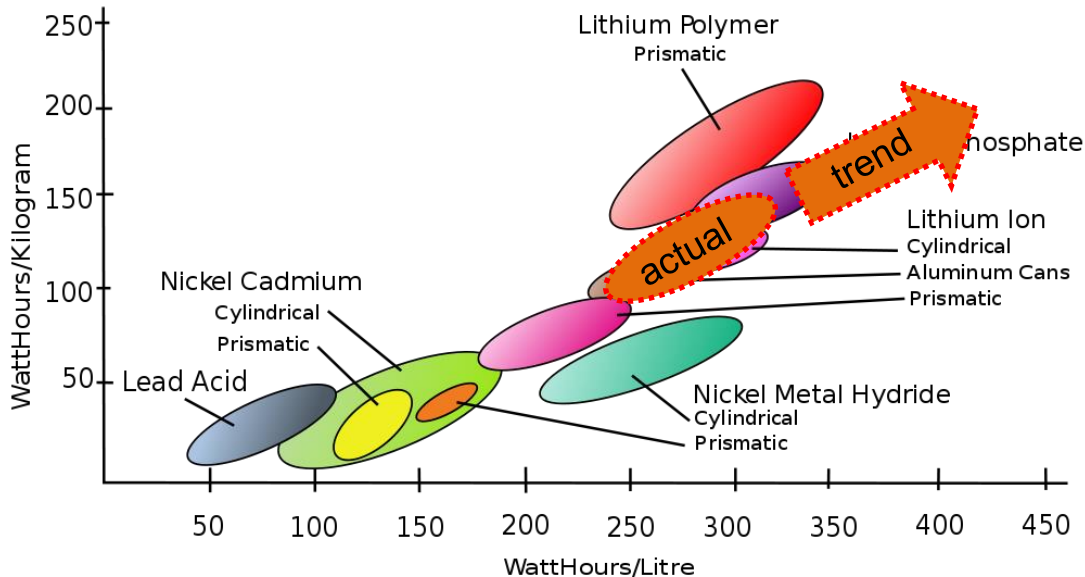
Plug-in



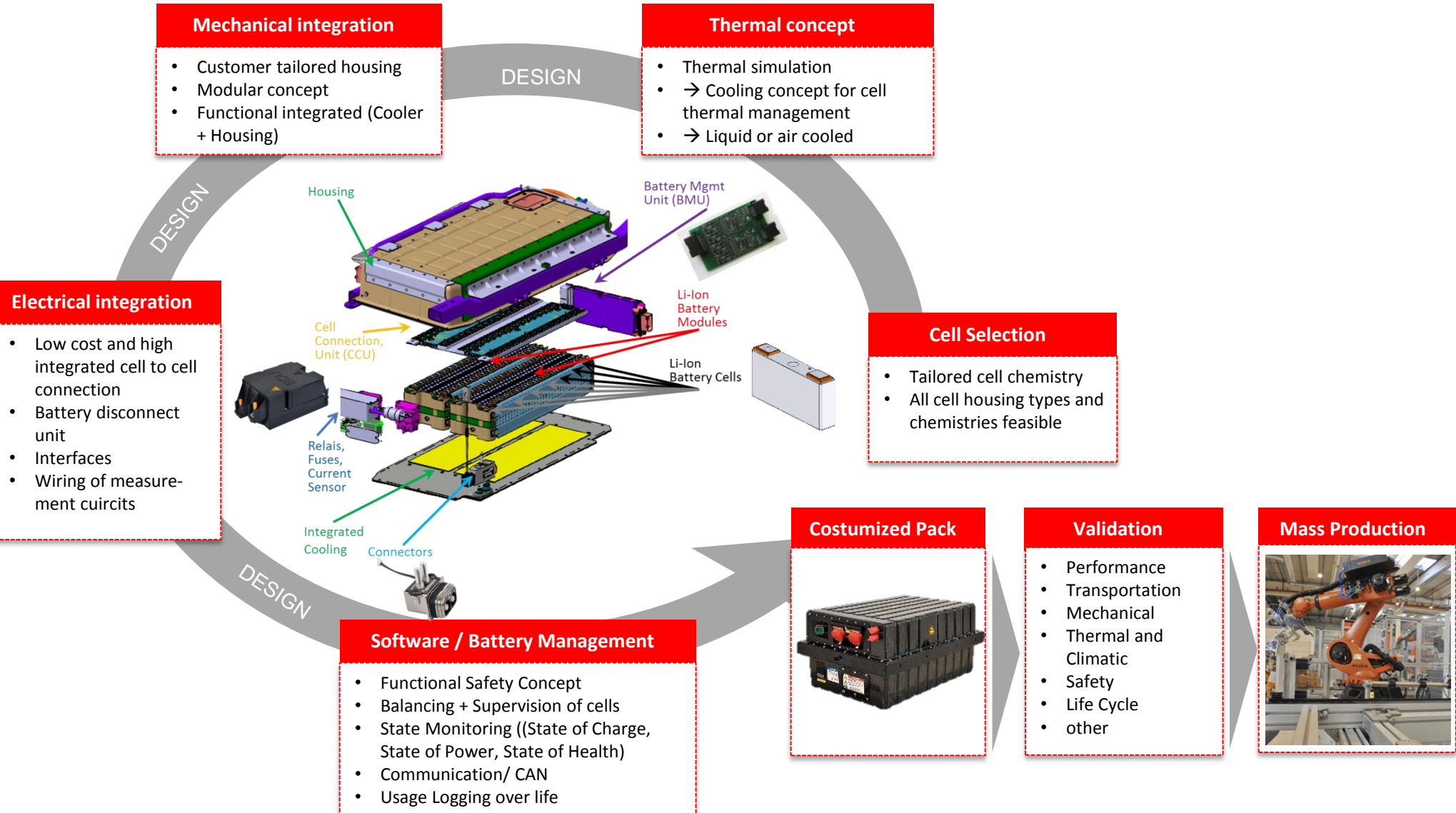
~30 km range
~80 kW power



- > 50 km range
- > 100 kW Power

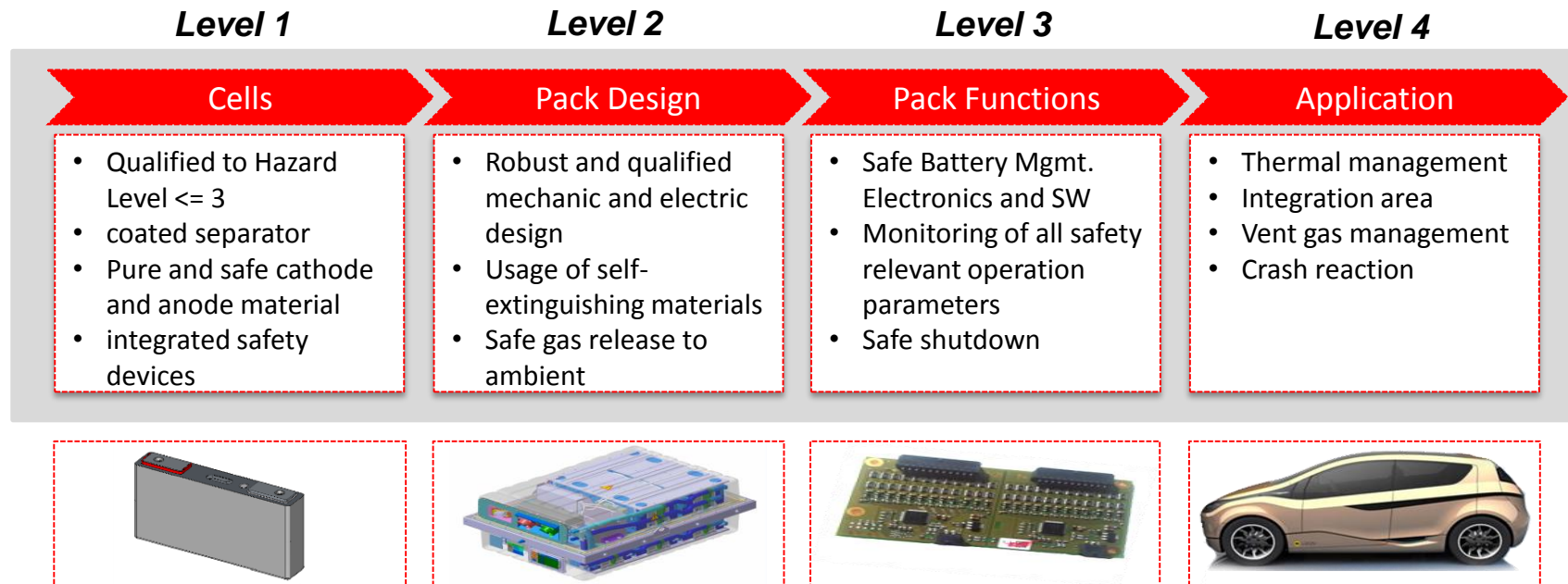


MAGNA STEYR Battery Systems Development Process



Safety Risk minimization by a 4 Level Safety Concept

- Cell Design Qualified to Hazard Level ≤ 3
- Robust and qualified mechanic and electric pack design
- Safe Battery Management Electronics and SW
- Integration into vehicle safety concept
- **Extensive Validation**

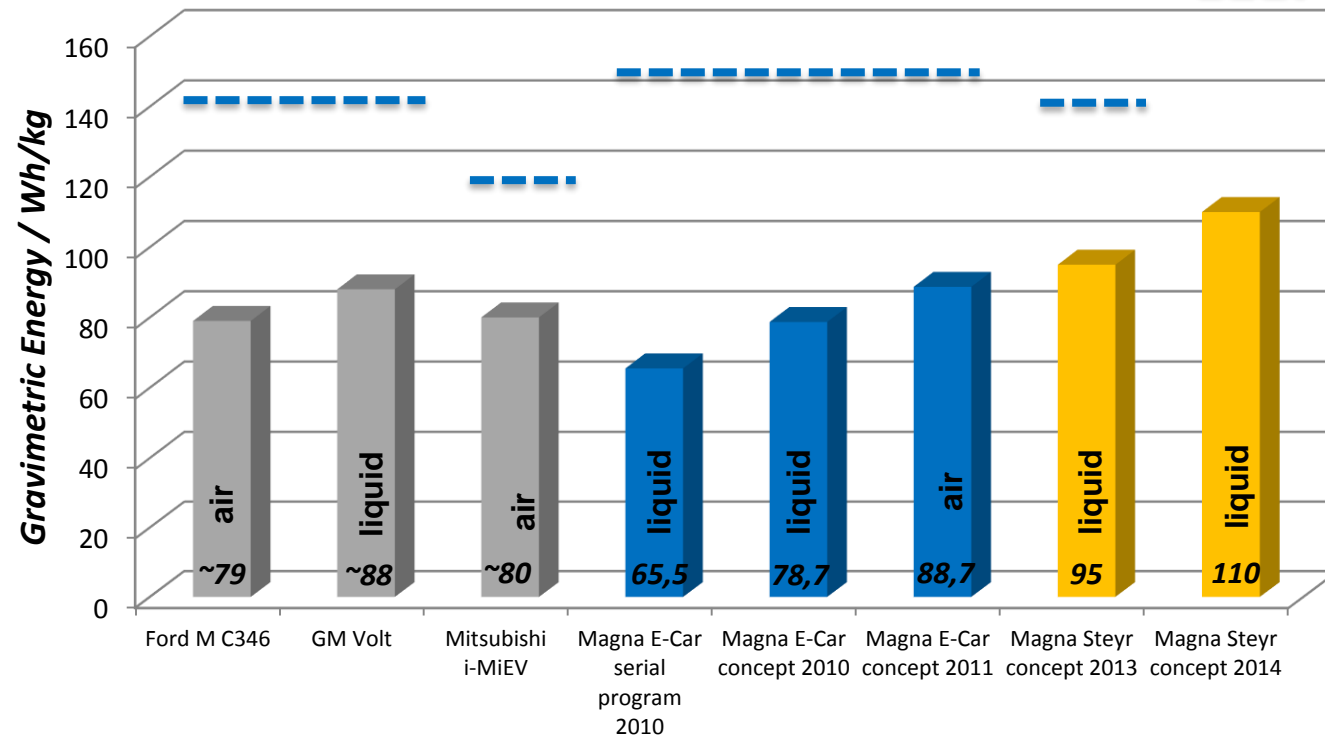


Check list of measures to get abuse reactions under control:

	Housing	HV Electric Design	Electronic / Software Design	Battery Management Unit	Software Design	Vehicle integration
Onset temperature		✓	✓	✓	✓	✓
Gas temperature	✓		✓		✓	
Gas volumes	✓		✓		✓	✓
Gas production rate	✓		✓		✓	✓
Toxic substances	✓		✓		✓	
Flammable substances		✓		✓		
SoC dependence			✓	✓	✓	✓

Magna's 4 Level Concept ensures the development of safe batteries for future performance.

Wh/kg on cell level



Weight: 110 kg (10,5 kg/ kWh)

Dimensions: 1000 x 250 x 600mm (b x h x t) mm

Pouch housing

Steel metal can housing

Al can housing

Pouch housing

2011

Self supporting module structure
Cell is used as mechanical structural part
Reduced weight of cooling → air cooled system



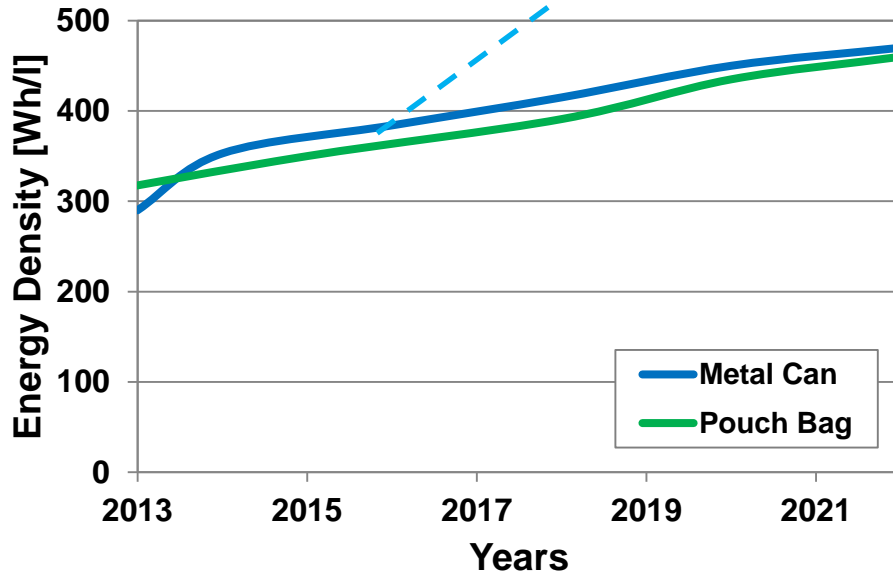
2014

Package based on Standard Modules
Functionally combined Housing and cooling
Crash resistant Al housing

Roadmap for energy density

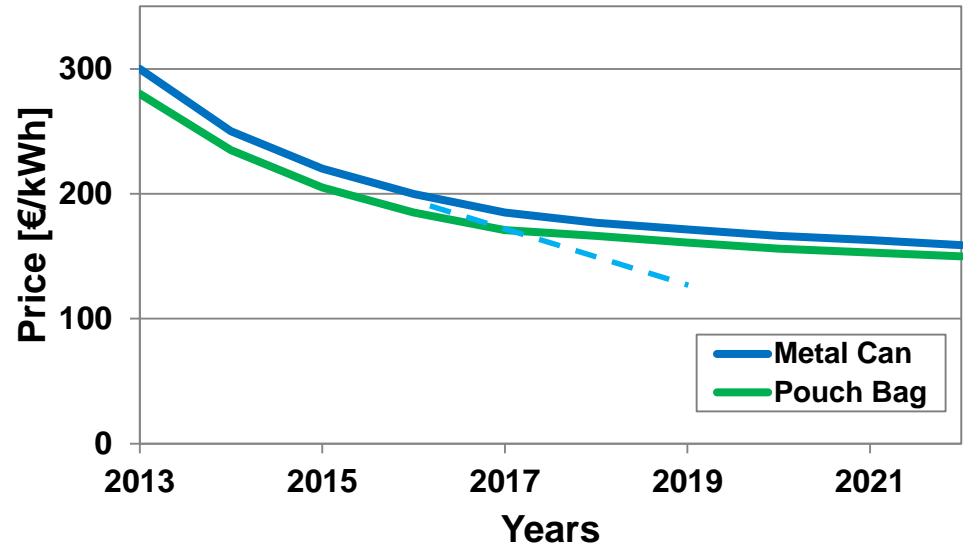
Metal Can vs. Pouch Bag Cell

Estimated Energy Density Evolution



* Estimation based on Magna-internal informations

Estimated Price Evolution



* Estimation based on a volume scenario of 24,71Mio PHEV cells

Higher energy density → More installed energy in same space → increased driving range

Reduced cost per kWh → increased driving range for same battery cost

**COME INTO A DEEPER TOUCH WITH THE
BATTERY SYSTEM FROM MAGNA STEYR
AT OUR ON-SITE BOOTH.**





The future is ours to make.

