

# TH!NK Presentation

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# Vision

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TH!NK provides fun, clean, economic and environmentally sound personal urban mobility

***"Think is a new way of moving"***



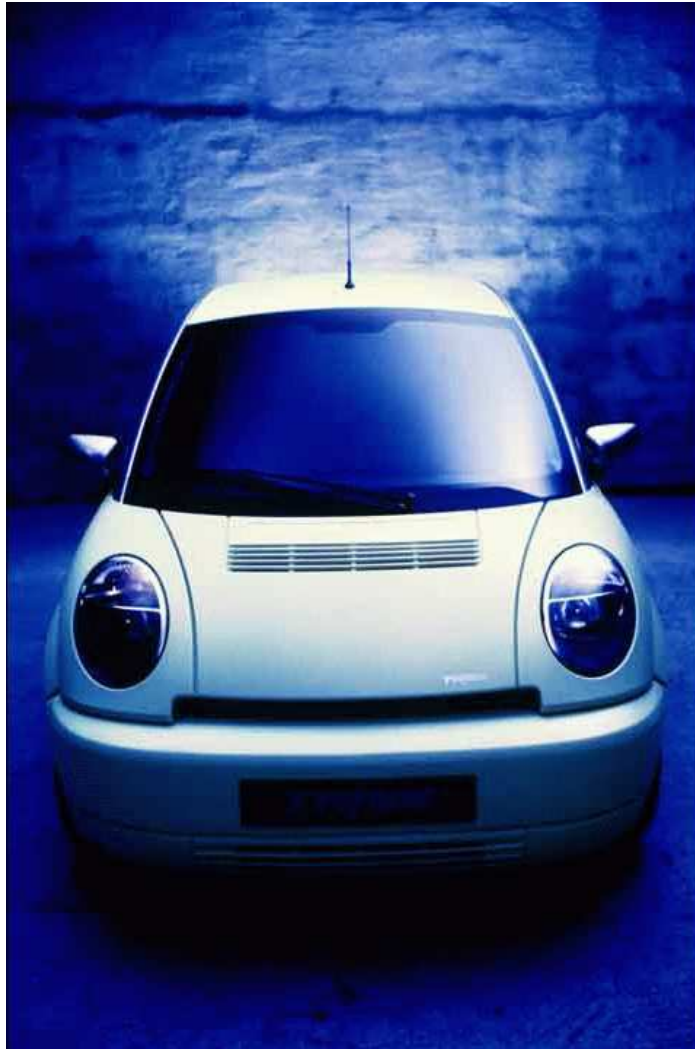
# 15 years of EV product experience

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# TH!NK City – specifications

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Number of seats	2 (option 2+2)
Driving range	170- 180km*
Top speed	100 kph
Acceleration, 0-50 kph	6,5 sec
Acceleration, 0-80 kph	16,0 sec
Turning radius	4,5 m
Overall length	3,120 mm
Overall width	1,604 mm
Overall height	1,548 mm
Curb weight	750 kg + battery
Max load	165 kg (2+2)
Luggage capacity	350 L

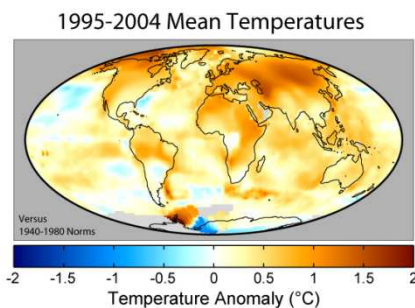
\*

Other battery options with higher driving range are being tested for later release

# The market is ripe – Wide public concerns about global climate change

## Global warming

- Recognised as a international human made problem
- ~25% of the CO<sub>2</sub> emission is from the transportation sector
- EU goal of vehicle CO2 emissions 2012: 130gr/km
- California CO2 reduction by 2020: 30%



## Increased oil price

- Significant impact on consumer economics
- SUV sales have dropped approx. 30-40% in the US
- Fuel efficient cars are gaining market shares



## Oil independence

- In the US Cars, SUVs and other light trucks consume 8.7 million barrels of oil every day
- US oil consumption rose 16 % between 1990 and 2002
- During that same period, American crude oil imports rose 55 percent. If current trends continue, the US will import 70 percent of its oil by 2025

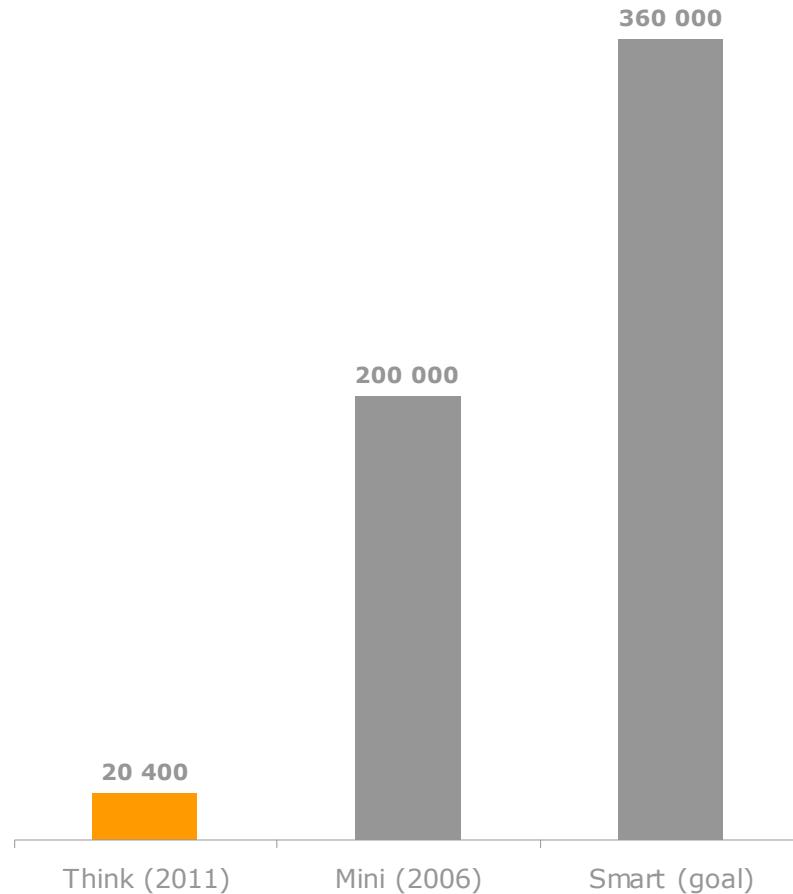


# The market

## Primary market

- Markets with strong political incentives and public support:
  - Norway, Switzerland, The Netherlands, Denmark, Sweden
- Cities with strong policy incentives for zero-emission cars, or heavy congestion and suitable infrastructures
  - London, Rome, Milan, Singapore, Hong Kong
- Cities with policies supporting clean technology
  - San Francisco, Seattle, Paris
- There is no all-electric highway car available today

## Objective – number of cars



# Increasing private or government incentives

## Government incentives

Country	Amount
Spain	€4,808 in region of Castile and Leon
US	\$650 to \$3,150 + individual incentives in various states
France	€2,000
Greece	No car registration or road tax (e.g. €4,872 for 1.8 litre engine)
Netherlands	No car registration tax (e.g. €6,000 for 1.8 litre engine)
Ireland	50% reduction in registration tax, which equates to 22.5-30% of price
Italy	Maximum subsidy of €1,807 (x2 if purchase accompanied by destruction of trade-in vehicle)
Norway	No car registration, no annual car tax (€345), no tollring, free parking
Switzerland	10% cost of cars. 100% discount congestion group

## Company incentives

Country	Company	Premium offered
UK	London Municipality	£1,500 per year (Exemption from congestion charge)
France	MAAF Assurances	€100 on first insurance subscription
	Macif	10-30% on civil liability insurance
Quebec	Desjardins Asurances	10% discount
	Bank of America	\$3,000
	Hyperion	\$5,000
US	Google	\$5,000 (\$2,500 for leasing)
	ST Microelectronics	Subsidy of \$83.34 per month for vehicles that use 39.2-46.2 mpg
	St Paul insurance	10% discount

# Production/Sourcing

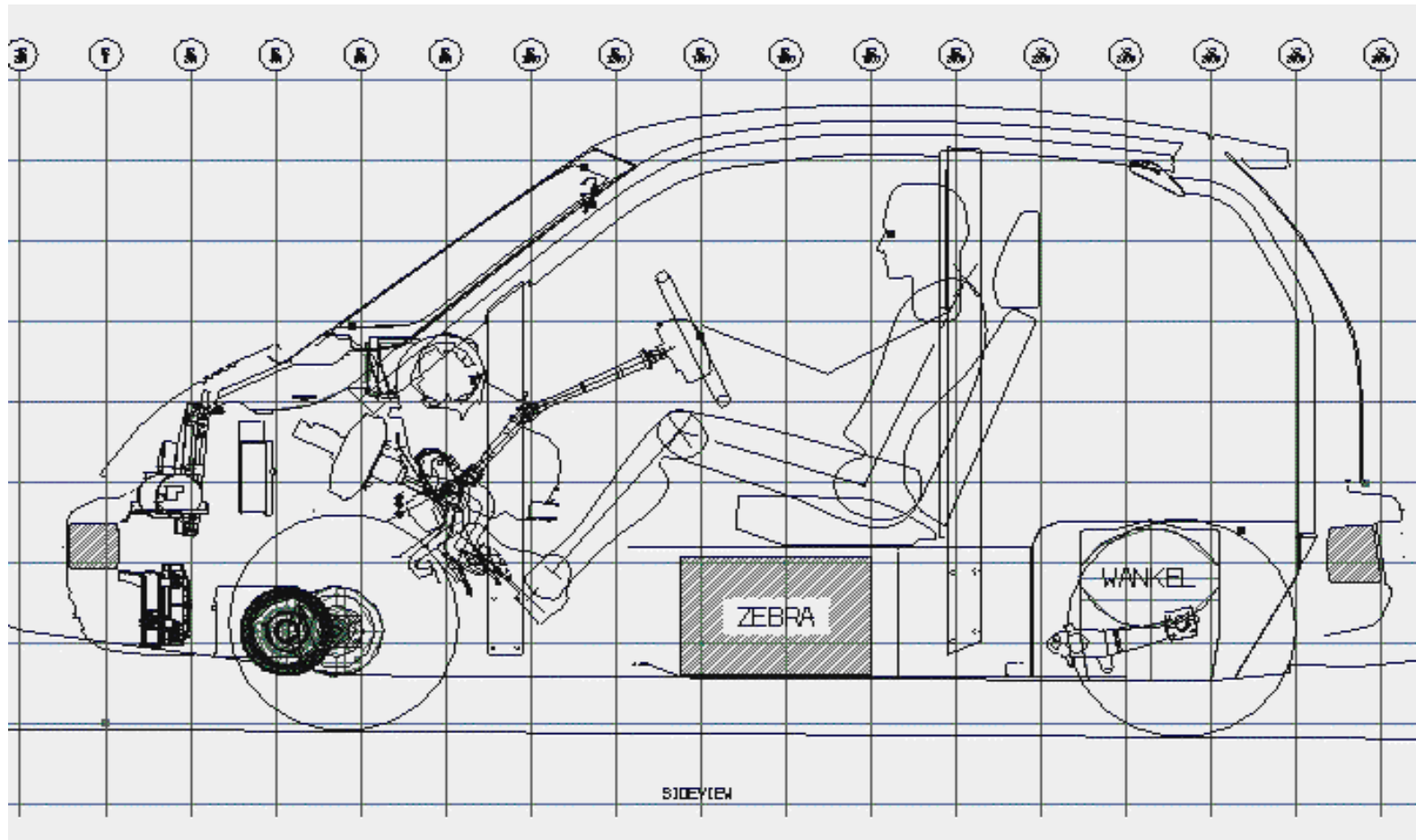
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- Existing plant in Aurskog started production in 2008 and can produce 3,500 units per year per shift
- Sourcing
  - The company's sourcing is from Europe, Asia and the US
  - There is an increasing number of components coming from Asia
  - Carry over automotive products preferred where possible
  - Ford and PSA as system donors
  - Significant cost cutting program through tooling and volume gains



# TH!NK is designed from *Ground up* to have an EV-architecture

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# Modularity allows TH!NK to adapt to any battery or alt. energy source

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- TH!NK distance
  - TH!NK features a 28 kWh Zebra NaCl battery as initial base version at launch
  - TH!NK intends to offer new battery technology when these new technologies are reliable
- TH!NK hydrogen
  - TH!NK has been chosen as ideal basis for others to develop Hydrogen cars – on short list for HyNor project in Norway



# High performance / high tensile steel structure with alu space frame

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- Lower Frame (Thai Summit Autoparts)
  - XF 350 Steel
  - 95 laser cut / folded / pressed & spot welded sheet metal parts
- Alu Upper Frame [Hydro]
  - 600X-series Alu
  - Extruded, stretch bent aluminum

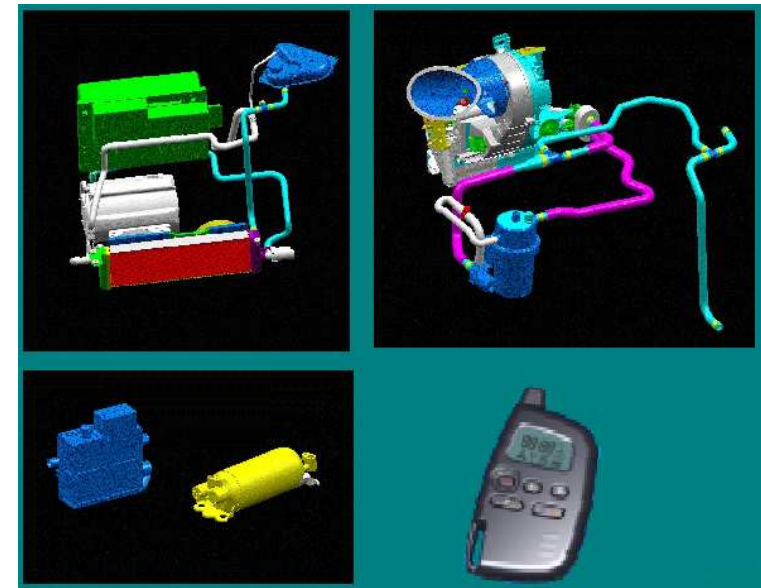
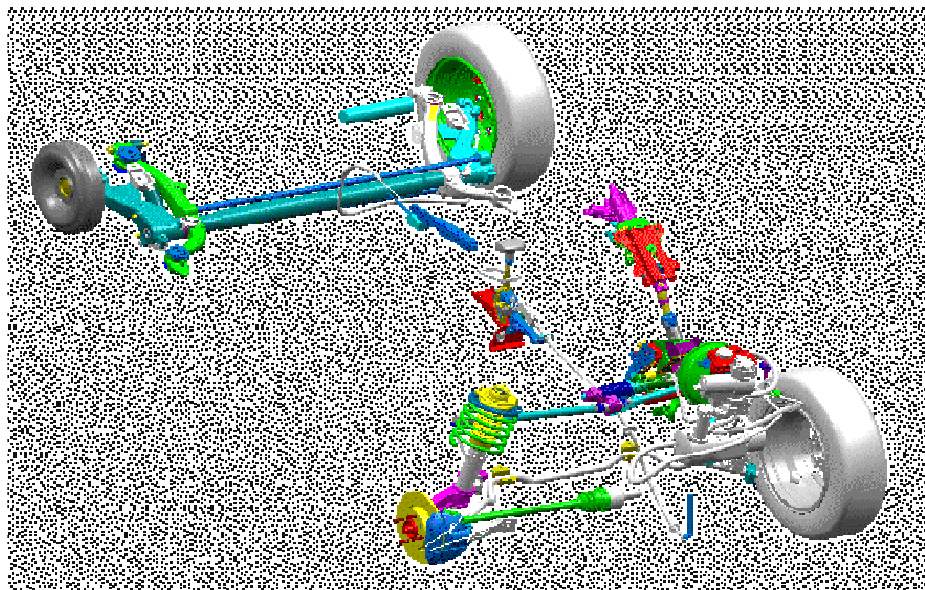


# Carry over automotive high volume validated non visible components Chassis & HVAC

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- c/o Peugeot 106 / 206 suspension
- ABS brakes Ford fiesta
- Power steering – PSA 307
- EL Air Condition – Valeo/C2

Comfortable and fun-to-drive  
Range optimised  
High focus on safety  
High volume, validated c/o parts



# Integrated EV Powertrain co developed with Ballard

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Integrated Power Control Unit (PCU) by Aron's Controls

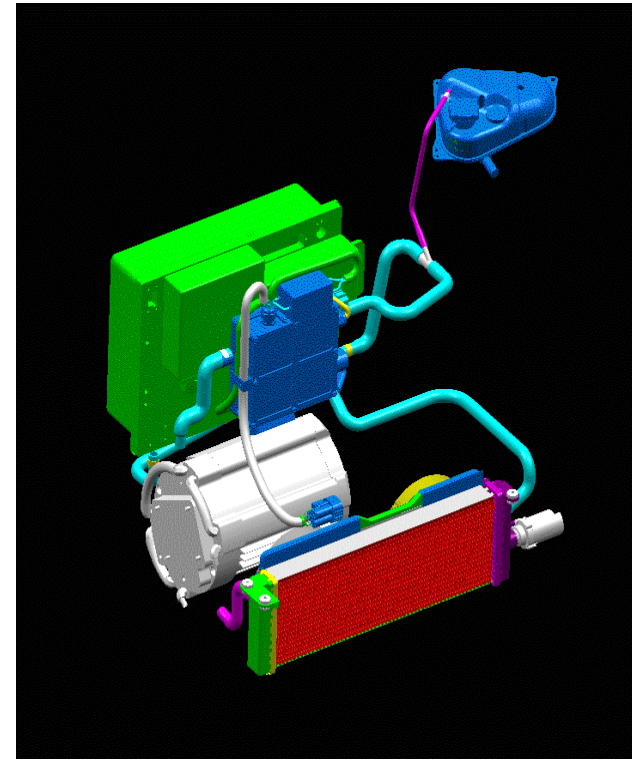
- Continental software
- Traction Inverter
- DC-DC converter
- Battery charger
- Vehicle control hardware and software - CAN interface

Traction Motor by Leroy Somer

- AC / 3 phase induction

Reduction Gearbox by Graziano Italy

- 10:1 fixed reduction & differential
- Park Lock function



- 30 kW peak power, 20 kW continuous
- 90 Nm torque to the wheels



# Exterior

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## Panels

- Through coloured from co-extruded ABS/ASA sheet
- Optimal UV and cold temperature performance
- Grained finish to show material, recyclability & mask scratches and imperfections

## Lights

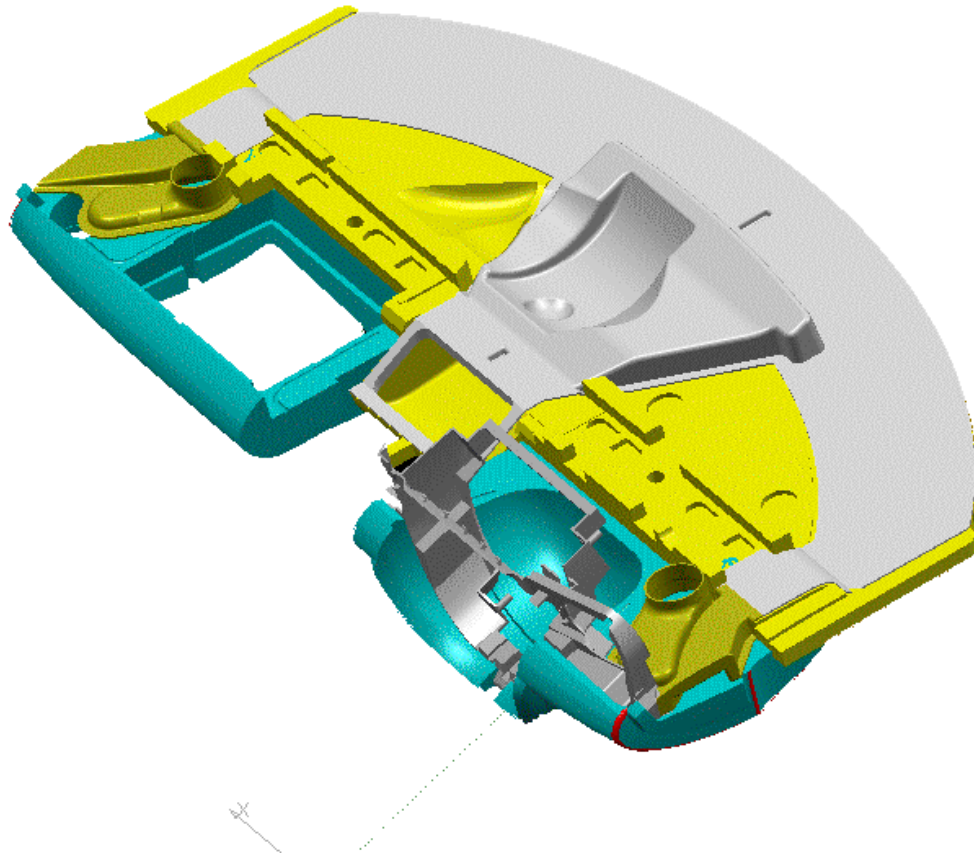
- Combined Headlamp/Indicator/Park lamp
- Quick mounting for assembly and service
- Homologated for European regulations
- Combined EU Fed Side marker/side pos lamp





# Interior

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- Price-winning design
- Safe.
- 130 parts
- High quality look and feel
- Recyclable – 100% PP
- Innovative

**100% recyclable Instrument Panel Assembly with integrated ducting**

# Safety considerations of HV traction batteries

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- Passive and active safety systems
- Electric safety
- EMC
- Safe operation during fault conditions
- Safe operation during normal operation
- Automotive best practice
- Abuse testing

# Safety risks of batteries

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- Sodium batteries:
  - Liquid sodium reacts with air and water
  - Chemistry robust to overcharge and overdischarge
  - Robust against internal short
- Lithium batteries:
  - Different types of chemistries; different level of risk
  - Some chemistries, i.e. Cobalt-chemistries, are self-sustaining when reacting
  - Cells are designed to burst upon fault to prevent pressure build up
  - Need good safety level at cell, module and battery system level

# How to choose a battery for EV?

- Weight limitations
- Space limitations
- Energy and power density
- Safety considerations
- Temperature sensitivity
- Calendar life
- Voltage limitations of power train
- Power output over wide state of charge range
- Price
- Volume production feasibility

# Traction battery supply

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- General supply of mature battery systems
- MES-DEA produce Zebra batteries
  - EV batteries compete with distribution vehicles, city buses and stationary power installations
- Several emerging Li-battery suppliers
  - Prismatic and cylindrical
  - EV batteries compete with other applications for Lithium batteries; power tools, computers, cellular phones, hybrid vehicle batteries and stationary power installations

# Future of HV batteries

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- New emerging battery systems with higher energy density for EVs
- EV market will possibly be dominated by primarily advanced Lithium batteries but also Sodium batteries
- New emerging battery systems with higher power/energy density for HEVs
- Hybrids with higher degree of hybridisation
- Hybrids going towards electric instead of combustion dominated drive trains



# EV market barriers

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- Supply of batteries
- Supply of electric drive train components
- Price of drive train and batteries
- Maturity of technology
- Charging infrastructure
  - Where to charge?
  - Who will pay?
  - Standardised connectors
  - Rating of electric grid

# Think import to Finland

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- Please contact Th!nk PR department at Mrs. Ingvil Ladehaug for additional questions
- [www.think.no](http://www.think.no)

