Electromobility with Bosch

Electromobility has a bright future.
Make it happen with Bosch.

Markus Schmidt, Robert Bosch GmbH, Executive Vice President Sales Automotive Electronics
Megatrends: e-mobility

Urbanization | Energy | Climate Protection

Resources | Demography

Technology | Energy Storage

Electric Scooter | eBike | Electric Vehicle
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Evolution: electric driving

- Decreasig battery cost
- Increasing acceptance of e-mobility

- eBike, eScooter
- Hybrid
- Plug-in Hybrid
- Electric vehicle

Time
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Our portfolio covers a wide range

Ecological energy harvesting

Intelligence for infrastructure

Efficient systems for eMobility

High tech components

Reliable complex subsystems
Market Volume: Sales per year, annual growth

- **World**
  - 2008: 0
  - 2012: 20
  - 2015: 30
  - 2018: 50
  - CAGR: 11%

- **South America (NAFTA)**
  - 2008: 0
  - 2012: 20
  - 2015: 40
  - 2018: 60
  - CAGR: 30%

- **Europe (W-EU)**
  - 2008: 1
  - 2012: 10
  - 2015: 20
  - 2018: 40
  - CAGR: 32%

- **Asia**
  - 2008: 10
  - 2012: 20
  - 2015: 30
  - 2018: 40
  - CAGR: 10%

- **Market trends**
  - Asian markets dominate with “Scooter Style Electric Bike“;
  - W-EU and NAFTA dominated by E-Bikes/Pedelecs

- **Business case for electromobility**
  - Commuting
  - Low-spending power
  - Working class
  - Legislation / regulation
  - Energy saving
  - Commuting
  - Health, comfort, fun
  - “Be green” image

Source: Hannes Neupert Consulting

Automotive Electronics
Drivers of Powertrain Electrification

- Oil-Reserves & fuel price
- Urban traffic limits / Megacities
- Business model
- Taxes
- CO₂-Legislation
- Soft factors

Base: Progress in Battery Technology and Charging Infrastructure

Bridging Technology

Internal combustion engine → Hybrid vehicle → Plug-in Hybrid → Electric Vehicle
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Market Development

Sales PC & LCV<6t (mio. vehicles) *

2011

2015

2020

EV: 0.1
HEV/PHEV: 1.1

7.8

22.2

57.2

HEV: 6.5

76.7

98.4

103.3

PHEV: 3.1

51.4

23.7

27.0

EV: 2.5

17.8

27.6

27.6

HEV = sHEV & mHEV, thereof ca. 90% sHEV

* Prognosis RB

Automotive Electronics

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Market Development – Electrification

Sales PC & LCV<6t (mio. vehicles) *

World

<table>
<thead>
<tr>
<th>Region</th>
<th>EV</th>
<th>PHEV</th>
<th>HEV</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>World</td>
<td>12.1</td>
<td>2.5</td>
<td>3.1</td>
<td>18.7</td>
</tr>
<tr>
<td>WEU</td>
<td>3.3</td>
<td>1.1</td>
<td>1.2</td>
<td>5.6</td>
</tr>
<tr>
<td>US</td>
<td>4.6</td>
<td>0.6</td>
<td>3.0</td>
<td>8.2</td>
</tr>
<tr>
<td>CN</td>
<td>2.5</td>
<td>0.6</td>
<td>1.4</td>
<td>4.5</td>
</tr>
<tr>
<td>JP</td>
<td>0.3</td>
<td>1.1</td>
<td>0.3</td>
<td>1.7</td>
</tr>
</tbody>
</table>

World vehicle sales 115 mio.

HEV = sHEV & mHEV, thereof ca. 90% sHEV

* Prognosis RB
Regional Trends

<table>
<thead>
<tr>
<th>Region</th>
<th>Main Systems</th>
<th>Market Trends</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Europe</strong></td>
<td>Main systems: Parallel Hybrids, electric Axle drives (Hybrids, EVs)</td>
<td>Electric driving is fun</td>
</tr>
<tr>
<td></td>
<td>High volume prognosis for EVs+PHEV</td>
<td></td>
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<td></td>
<td>High willingness to pay of end customers for real inner city e-driving</td>
<td></td>
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<tr>
<td><strong>NAFTA</strong></td>
<td>Main systems: Powersplit Hybrids</td>
<td>Fuel economy (MPG!)</td>
</tr>
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<td></td>
<td>Plug-In Hybrids + EVs remain niche markets</td>
<td></td>
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<tr>
<td></td>
<td>CAFE regulation is main driver.</td>
<td></td>
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<td></td>
<td>Influence of gasoline price decreasing due to small vehicle introduction</td>
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</tr>
<tr>
<td><strong>Japan</strong></td>
<td>20% Hybrid vehicle share in 2012*</td>
<td>Desire for new technologies, fuel efficiency</td>
</tr>
<tr>
<td></td>
<td>5 top selling vehicles are Hybrid only / have hybrid option</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hybrids B and C-segment</td>
<td></td>
</tr>
<tr>
<td></td>
<td>End customer focus: cost &amp; technology</td>
<td></td>
</tr>
<tr>
<td><strong>China</strong></td>
<td>Government focus: independence of oil</td>
<td>Market drivers influenced by government</td>
</tr>
<tr>
<td></td>
<td>main systems: Plug-in Hybrids, EV</td>
<td></td>
</tr>
<tr>
<td></td>
<td>New Energy Vehicle legislation released: high volume targets for 2015/2020</td>
<td></td>
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<td></td>
<td>Dynamic market, many players</td>
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</tbody>
</table>

*YTD 09/2012

**EV**: Electric Vehicle  
**CAFE**: Corporate Average Fuel Economy
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(e)Mobility Software Products and Solutions

- Provision and Management of Charging Infrastructure Network
  - The eMobility Starter Package as a software solution for Service Provider, running and managing a charging infrastructure for electric vehicles.
  - Integrates users, service providers, vehicles, charging stations and services on a cloud-based software platform.
  - Customers can charge the vehicle on different locations

- Brokering Service to establish Mobility ecosystems (connected intermodal mobility on demand)
  - Solution for Mobility Provider, also different branches like OEM, Broker of Rental Cars, Bike-Sharing and public transportation, to mutual share their services.
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Summary

Trend towards Light eMobility
- eBike in Europe for individual commuting, energy saving, health and fun
- eScooter very successful in Asia because of commuting, affordable product and legislation. Governmental support still missing in Europe.

Trend towards electrification of Passenger Cars
- Combustion engine still dominating
- Electrification is coming driven by Fuel price, CO2 Legislation and Megacities

Bosch well prepared for all kind of electrification:
- Battery
- Electric motor
- Power electronics
- Photovoltaic inverters
- Drive systems
- Software backbones
- Power electric vehicle infrastructure

eMobility: Attractive opportunity for Bosch
Thank you!