Mobility for Tomorrow -
The influence of trends on the automotive industry

Jeff Hemphill
Megatrends in mobility

"Mobility for Tomorrow"

Society

Technology

Urbanization

Complexity

Zero emission

Affordability

Biosphere

Economy
Mobility for Tomorrow – drivers and consequences

**CO₂ Legislation Worldwide**

- Light vehicles in g CO₂
- Proposed target
- Enacted target
- USA: incl. light duty vehicles
- China: 117 g in 2020
- Japan: 105 g in 2020
- EU: 95 g in 2020
- USA: 109 g in 2025

Source: icct 2013

**Powertrain Concepts Worldwide**

- Light vehicle production
- 2013: 98%
- 2020: 80%
- 2030: 56%
- 2013: 2%
- 2020: 19%
- 2030: 9%
- USA: incl. light duty vehicles
- China: 117 g in 2020
- EU: 95 g in 2020
- Japan: 105 g in 2020
- USA: 109 g in 2025

Source: IHS 2013; University of Duisburg-Essen 2012
Conflicting priorities in North America

China: 117 g in 2020
EU: 95 g in 2020
Japan: 105 g in 2020
USA: 109 g in 2025

Cheap energy VS

Sensitive consumers

ahhhh… comfort!
Affordability

You Are Here!

Innovation Required!
Affordability

Value Innovation in transmission components
Megatrends in mobility

- Urbanization
- Zero emission
- Biosphere
- Economy
- Society
- Technology
- Complexity
- Affordability

Schaeffler Symposium 2014
Jeff Hemphill
NVH issues

Source: 2014 SAE World Congress
Powertrain optimization

Improved efficiency  Improved NVH
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Use versus acquisition – car sharing members

Source: Navigant Consulting, Avis Budget Group
Miles driven in the US – permanent change?

Source: Navigant Consulting, Avis Budget Group
US population living in urban areas

Source: US Census Bureau
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Affordability
Smartphone or car?
Connected and complex

Actuation and systems engineering

Enablers for new vehicle concepts
Energy source for electricity generation in the US

Will cheaper natural gas become a vehicle fuel directly or by providing cheaper electricity to PHEV’s and BEV’s or by providing Hydrogen to FCV’s?

Source: IEA, 2013 Report
The infrastructure race

Source: NGV America

CNG stations

Tesla Superchargers
Local impact

Brunswick, OH

Columbus, OH
Alternative energy

ACTIVeDRIVE
- Basis: Skoda Octavia
- All-electric vehicle with four-wheel drive
- Active electric differential allows torque vectoring

CO₂ concept
- Basis: Porsche Cayenne
- Optimized version of the conventional internal combustion engine
- 10% reduction of CO₂ emissions

► Efficient energy recuperation
► Increased vehicle performance
► Electric all-wheel drive
► Active torque vectoring
► Highly integrated powertrain
► Enabling new vehicle concepts

Degree of electrification

<table>
<thead>
<tr>
<th>2010</th>
<th>2015</th>
<th>2020</th>
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<tbody>
<tr>
<td><strong>1</strong> Hybrid module</td>
<td><strong>2</strong> Electric axle</td>
<td><strong>3</strong> Wheel hub drive</td>
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<tr>
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Current status
- Series production
- Series development
- Advanced development
Real world experience to understand our world

- Schaeffler Efficient Future Mobility North America
- Schaeffler Efficient Future Mobility India
- Schaeffler Efficient Future Mobility India
- China Concept Car

Cars:
- Schaeffler Hybrid
- Fiesta eWheelDrive
- Schaeffler CO₂ncept-10%
- Schaeffler ACTIVeDRIVE
- Diesel Eco Drive
- Gasoline Technology Car
- System 48V
- Schaeffler Efficient Future Mobility India

Countries:
- EU
- USA
- China
- India
"Mobility for Tomorrow"
People who don't take risks generally make about two big mistakes a year. People who do take risks generally make about two big mistakes a year.

Peter Drucker
1909 – 2005