“Here Come the Cars”.

UC Policy Forum Series Session 2 – Sacramento 06/06/2012.
THE BMW GROUP.
THREE PREMIUM BRANDS. THREE SEGMENT LEADERS.
The BMW Group is the most sustainable company in the automotive industry.

The BMW Group is ranked Supersector Leader in the Dow Jones Sustainability Index for the 7th time.
THE FUTURE OF MOBILITY.

DRIVING FACTORS

Environment
Climate change and the subsequent effects

Urbanisation
By 2030, over 60% of world population will live in cities.

Politics and Regulations
CO₂ and fleet regulations, Restrictions on imports

Economics
Shortage of resources, increase in the price of fossil fuels

Culture
Sustainable mobility as part of a modern urban lifestyle; assumption of social responsibility

Customer Expectations
Changing values

Dr. Thomas Becker, BMW Group, June 20, 2011
BMW GROUP’S EFFICIENT DYNAMICS STRATEGY.

<table>
<thead>
<tr>
<th>TODAY</th>
<th>TODAY</th>
<th>NEAR FUTURE</th>
<th>FUTURE</th>
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<tr>
<td>- Optimisation of fuel consumption and emissions.</td>
<td>- Full and mild hybrid vehicles.</td>
<td>- First limited electric vehicle production in 2008.</td>
<td>- Commitment to and validation of technology.</td>
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<td>- Lightweight construction.</td>
<td>- Initial step towards electrification of the drivetrain.</td>
<td>- MINI E on the road since 2009.</td>
<td>- Optimisation of BMW H2 ICE.</td>
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<td>- Introduction BMW i3 2013.</td>
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BMW Group’s drive strategy provides a broad technology spectrum for today and the future.

- Combustion engine
- Hybrid technology
- E-vehicle
- Hydrogen
ELECTRIC VEHICLES BY BMW.
EXPERIENCES WITH EVS AT BMW.
MINI E AND BMW ACTIVEE SERVE AS KEY LEARNING PROJECTS FOR THE BMW I3.

- **MINI E** 2010
- **BMW ActiveE** 2011
- **BMW i3** 2013

Use of renewable energy.
Market-potential.
Transfer scenarios.
User behaviour.
Acceptance.
Demands of e-infrastructure.
Strengths and weaknesses.

**MINI E** and **BMW ActiveE** serve as key learning projects for the **BMW i3**.
THE BMW I3 – OUR URBAN VEHICLE.

Vehicle: LifeDrive lightweight concept
Purpose Design: 4-seater
Drivetrain: Rear motor Rear wheel drive
Battery: Lithium-Ion Battery Active cooling
Usable trunk space
SUSTAINABILITY DEFINES THE project i PRODUCT LIFE CYCLE.

New vehicle concepts
New materials and recycling
Production concept of the future
New electric drivetrain

Integrated approach of BMW i

New processes
Employees
Pioneering design
New customers
The Challenge ahead for industry and government:
- Shares of the overall impact on the environment between Well-To-Tank (WTT) and Tank-to-Wheel (TTW) differ massively.
- Car manufacturers thereby lose control of the impact on the environment.
- Customers want assurance that driving electrically is a sustainable choice.

<table>
<thead>
<tr>
<th>Gasoline</th>
<th>Well-To-Tank (oil industry, power generation)</th>
<th>Tank-To-Wheel (automobile industry)</th>
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</thead>
<tbody>
<tr>
<td>EVs</td>
<td>Need to address politically</td>
<td>0 g/mi</td>
</tr>
<tr>
<td></td>
<td>Already addressed by GhG standards</td>
<td></td>
</tr>
<tr>
<td></td>
<td>⇒ EV: 0 g/mi</td>
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</tbody>
</table>

**Definition:** Governments need to ensure the “net benefit” of the overall chain.
- Additional demand for EVs can be generated without fossil fuels.
**RENEWABLE ELECTRICITY PRODUCTION. NATIONAL RENEWABLE ENERGY SOURCES EXTENSION.**

- **Rule of thumb:** 1 mn BEV → 1 TWh electricity demand (EU assumption)
- **Yearly rise of electricity demand through EVs till 2025 is much lower than planned RES extension**
- **Only a small share of the yearly RES extension (lower one digit % number) needs to be reserved for EVs → utilization of full GHG emission reduction of EVs**

New car registration USA 16.1 Mio (2007, source ACEA); 10% BEV (new car sales) = 1.6 Mio units; about 10 Mio units in car park in 2025 if assuming ramp-up curve; Energy consumption about 100-120 Wh/km; 10,000 km per year
MANAGED CHARGING LINKS CLIMATE PROTECTION AND AUTOMOBILITY:
WIND INTEGRATION [W2V], LOCAL LOAD MANAGEMENT [LLM] AND PEAK SHAVING [V2G]

Wind-to-Vehicle (W2V)
Charge the Battery preferably with Excess Wind Energy

Grid and Load Management
Wind integration and load balance

Vehicle-to-Grid (V2G)
Recharging of Wind Energy during Peak Periods in order to substitute Gas Power Plants

Local Load Management (LLM)
Priority Rules at Hot Spots with Excess Demand
STRATEGIC FRAMEWORK E-MOBILITY.
A MARKET POTENTIAL OF EV AND PLUG-IN VEHICLES OF APPROX. 5% TO 15% IN 2020 IS PROJECTED.

Minimal Scenario*
- Low oil price (60$/b)
- High battery costs (600€/kWh)
- Economy of scales low
- No fiscal incentives

Base Scenario *
- Oil price (ca. 150$/b)
- Battery costs (ca. 500€/kWh)
- Economy of scales medium
- Low fiscal incentives

Optimistic Scenario*
- High oil price (ca. 300$/b)
- Low battery costs (ca. 300€/kWh)
- Economy of scales „high“
- High fiscal incentives

* Sources: BCG, MCK, Dt. Bank, Bain, R. Berger, PA Consulting

Market potential depends strongly on political environment and customer demands.
THE CUSTOMER DEMANDS ON ELECTROMOBILITY REQUIRE MORE SOLUTIONS THAN JUST A CAR.
CONTROVERSIAL TOPICS – “FRUIT FOR THOUGHT”.

THE STICK IS THERE – WHAT ABOUT THE CARROT?
How can OEMs, regulators and policymakers make EVs a rational buying decision?

BRAIN IS ONE THING – EMOTION THE OTHER.
OEMs need to come out with attractive products – how can all stakeholder help to make EVs part of Joe and Jill Sixpack’s mindset?

WHAT ABOUT A CA VISION THAT IS “CLEAN CARS FUELED BY CLEAN FUELS”?
Can we effectively combine policy tools and thus enhance the attractiveness of EVs?
THANK YOU VERY MUCH.