The road to less carbon.
Cap-and-Trade in the Transportation Sector.

Andreas Klugescheid
Vice President Governmental Affairs  BMW Group,
Sacramento
March14, 2013
**Worldwide Policy Challenges.**
The challenge of defining responsibility along the value chain.

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>
</tr>
</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>
<td></td>
</tr>
</tbody>
</table>

Definition:
- Governments need to ensure the “net benefit” of the overall chain.
- Additional demand for EVs need to be generated without fossil fuels.
2 factors matter: efficiency of cars and carbon content of fuels

Carbon footprint of alternative fuels is with production, and varying.

Source: PIK
AES Alamitos Gas Power Plant, Los Angeles County.

Approx. 2000 MW NG power plant - 1956
PUTTING IDEAS INTO PRACTICE, REC SOLUTION.

- BMW provides a renewable energy option for the Active E, allows customers to “top up” at end of year based on actual usage.
- Cost (Customer): $48/2-yrs.
- BMW customer has a choice about the source of energy for charging.
PUTTING IDEAS INTO PRACTICE, RESIDENTIAL SOLAR.

CONGRATULATIONS, ELECTRONAUT

The Power of Zero

Tweet

With the exceptional technology of the BMW ActiveE, you are leading the way in a zero-emissions commute. Now you’re ready to make a statement with the power of zero.

At Real Goods Solar, we are honored to have been selected by BMW to help you take the next step in making your ultimate driving machine® into the Ultimate Green Machine.

Learn about Real Goods Solar’s EXCLUSIVE BMW ActiveE offer.

Start immediately on power bills, enjoy a fuel-free future, and bring the beauty of zero home.

LET’S GET STARTED.

Map tools: Choose your state

©2012 Real Goods Solar, Inc. ©2012 BMW of North America, LLC. All rights reserved.

Power up for Ø down…
Regulatory approaches for CO2-emissions

Status Quo.

Overall CO2-emissions are defined by the following 4 factors:

<table>
<thead>
<tr>
<th>Downstream</th>
<th>Upstream</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Efficiency of combustion engines and conventional drivetrain</td>
<td>3. Production of fuels for conventional engines</td>
</tr>
<tr>
<td>- Car manufacturers</td>
<td>- Mineral Oil and gas industry, producers of biofuels etc.</td>
</tr>
<tr>
<td>2. Efficiency of electric drivetrains</td>
<td>4. Power generation</td>
</tr>
<tr>
<td>- Car manufacturers</td>
<td>- Energy utilities</td>
</tr>
</tbody>
</table>

In principle a comprehensive policy framework therefore should

- properly address all of these factors
- attribute responsibility directly to those responsible
- and create/ensure transparency along the entire chain
Regulatory approaches for CO2-emissions of EVs

- **Electric**: Not covered
- **Conventional**: Not covered
- **Existing GHG Regulation**: Measurement in g/mi
- **Downstream (vehicle)**
- **Upstream (fuel / power)**: Not covered

Level of regulatory intervention
Regulatory approaches for CO2-emissions

**Alternative options – element 1.**

- Efficiency of Drivetrain
  - Electric
  - Conventional

- Downstream (vehicle)
  - Not covered

- Upstream (fuel / power)
  - Full coverage of all upstream emissions
  - Introduction of a LCFS-based cap and trade system
  - Introduction of a LCFS-based cap and trade system

Level of regulatory intervention

Existing GHG Regulation: Measurement in g/mi
Regulatory approaches for CO2-emissions
Alternative options – element 2.

Level of regulatory intervention

- Phased-in introduction of efficiency standards for electric drives
  - Full coverage of all drivetrains
  - Existing GHG Regulation: Measurement in g/mi

- Not covered

Efficiency of Drivetrain
- Conventional
- Electric

Downstream (vehicle)
Upstream (fuel / power)
Regulatory approaches for CO2-emissions
Alternative options – best case scenario.

Level of regulatory intervention

Downstream (vehicle)

Upstream (fuel / power)

Efficiency of Drivetrain

Conventional

Electric

Phased-in introduction of efficiency standards for electric drives

Existing GHG Regulation: Measurement in g/mi

Introduction of a LCFS-based cap and trade system

Introduction of a LCFS-based cap and trade system

Full coverage of all factors driving emissions
“THIS AND THAT”, NOT “EITHER, OR”. EVOLUTION AND REVOLUTION.

The BMW Group’s approach to future mobility includes a broad spectrum of current and future technologies.
THE BMW i3 CONCEPT.
THE PURPOSE DESIGNED URBAN VEHICLE.
THE BMW i3 – THE PURPOSE DESIGNED BATTERY ELECTRIC VEHICLE.

- Life-Modul with CFRP passenger compartment
- Drive Modul
- Body surfaces
- Lithium-Ion Battery
- Electric motor with Power Electronics
THE BMW i3 IS AN EXTREME LIGHTWEIGHT VEHICLE.

- MINI E: 1.465 kg, 2 seater, BEV Conversion
- BMW Active E: 1.815 kg, 4 seater
- BMW i3: ~1.250 kg, 4 seater, BEV Purpose Design
- Comparison EV: 1.526 kg, 4 seater
ENSURING BEST EFFICIENCY AND BEST DRIVING PERFORMANCE: 33% EXTRA MILES WITH SAME BATTERY CAPACITY.

**Battery electric vehicle** of comparable size with typical vehicle driving resistances, conversion design

<table>
<thead>
<tr>
<th>Aerodynamic drag</th>
<th>Powertrain efficiency</th>
<th>Energy recuperation</th>
<th>Rolling resistance</th>
<th>Weight</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>100% range</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Lightweight **BMW i3** with very low driving resistances

**Optimization of**
- aerodynamics
- tires
- recuperation

**lightweight**

+ 33% range

with same battery capacity
PRODUCTION OF BMW i MODELS IN LEIPZIG IS SETTING BENCHMARKS IN THE AUTOMOTIVE INDUSTRY.

- 50% energy
- 70% water
- 100% renewable energy
THE CUSTOMER DEMANDS ON ELECTROMOBILITY REQUIRE MORE SOLUTIONS THAN JUST A CAR.
EXTERNAL RECOGNITION FOR SUSTAINABILITY.
The BMW GROUP IS THE INDUSTRY LEADER.

- Dow Jones Sustainability Indexes/Dow Jones STOXX Sustainability Indexes: Industry leader since 2005, the only automotive company continuously listed since 1999.
- FTSE4Good: listed in FTSE4Good, FTSE4Good Environmental Index.
- Sustainalytics: 1st place in "DAX 30 Nachhaltigkeitsrating" in 2009.
- ÖKOTREND: certificate for outstanding corporate responsibility (most points in the automotive industry).
THANK YOU FOR YOUR ATTENTION!