MOVIN ON - FOUR THESES ON ZERO EMISSION MOBILITY.

ANDREAS KLUGESCHEID. HEAD STEERING GOVERNMENTAL AFFAIRS, EXTERNAL AFFAIRS AND SUSTAINABILITY COMMUNICATIONS.
I. THE AUTO INDUSTRY IS CHANGING - DECARBONIZATION IS KEY.
ICONIC CHANGES ARE RESHAPING THE INDUSTRY.

CO₂ & emissions targets

Emobility

Driven by climate change

Connected Mobility

Autonomous Driving

Mobility Services

Driven by technology
POLITICS AND REGULATION.

**USA**
- 2015: 160 g/km
- 2020: 124 g/km
  (target 2025: 102 g/km)

**EU 27**
- 2015: 130 g/km
- 2020: 95 g/km
  (target 2030 in discussion)

**China**
- 2015: 164 g/km
- 2020: 119 g/km
  (target 2025: 105 g/km)

**Japan**
- 2015: 146 g/km
- 2020: 117 g/km
  - 20 %
MAJOR CHALLENGES FOR THE DEVELOPMENT OF THE EV MARKET ARE...

- Infrastructure
- Cost
- Charging time
- Resale value
- Range
MORE THAN 100,000 ELECTRIFIED BMW VEHICLES SOLD TILL 2016. ON OUR WAY TO SELL ANOTHER 100,000 UNITS IN 2017.
Each 36th car worldwide sold is a BMW.
MARKET SHARE.

Each 36th car worldwide sold is a BMW.

Each 8th electric car worldwide sold is a BMW i.
THE BMW GROUP OFFERS XEV MODELS IN EVERY SEGMENT.

BEV
- BMW i3
- MINI BEV
- BMW X3 BEV
- BMW iNEXT

PHEV
- BMW i8
- BMW 225xe iPerformance
- BMW 330e iPerformance
- BMW 530e iPerformance
- BMW 740e/Le iPerformance
- MINI Cooper S E Countryman ALL4
- BMW X1 xDrive 25Le iPerformance (China only)
- BMW X5 xDrive40e iPerformance
- BMW i8 Roadster
EV Everywhere: battery cell cost assumed at 75-82% of battery pack cost.
II. POLICY MATTERS – XEV MARKET IS NOT (YET) SELF SUSTAINING.
## FRAMEWORK CLASSIFICATION FOR ELECTRIC VEHICLE INCENTIVES.

**SUBSTANTIAL PACKAGE OF INCENTIVES FOR XEV IN NORWAY.**

<table>
<thead>
<tr>
<th>Monetary Incentives</th>
<th>Non-Monetary Incentives</th>
<th>Framework Conditions</th>
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<tbody>
<tr>
<td>For EV owners</td>
<td></td>
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<td>Public charging infrastructure.</td>
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### Monetary Incentives
- Direct financial incentives
- Purchase incentive for electric vehicles.
- Reduction / waiver of registration and/or circulation tax.
- Reduction / waiver of consumption tax.
- Company car incentive.
- Subsidy for the installation wall-box.

### Non-Monetary Incentives
- Qualitative and indirect support for EV usage
- Use of privileged lanes (e.g. bus or car sharing lane.
- Exclusive parking for electric vehicles; free parking and/or free charging
- Preferential treatment for inner city toll systems.
- Exemption from congestion charges.

### Framework Conditions
- Measures to support the environment for EVs
- Public charging infrastructure.
- Awareness due to public demonstration and research projects.
- Public initiatives and cooperations supporting the uptake of EVs.
- Public procurement programs for EV fleets.
ANNUAL CHANGES TO THE TAX / INCENTIVE SYSTEM CAN CREATE STRONG DISTORTIONS.

- Market distortion due to changed tax legislation

- If tax / incentive systems are **changed too often**, customers will **“rush to buy“** NEVs before the changes take place.

- This is **bad for customers, OEMs and for the market development**, since future planning is made very hard.
YES, IT WAS GOV. HENRY GAGE – AND THIS IS NOT/BUT COULD BE
THE WATSONVILLE STEAM POWER PLANT (IN SERVICE SINCE 1901)
FRUIT FOR THOUGHT:

Total emissions = Carbon intensity \times Energy intensity \times Demand

- Total emissions = \frac{CO2e}{MJ}
- Carbon intensity = \frac{MJ}{km}
- Energy intensity = \frac{MJ}{km}
- Demand = km

**Comprehensive instruments** | Reduction of carbon intensity | Reduction of energy intensity | Reduction of demand
---|---|---|---
Cap & Trade | Low carbon fuel standard | Fuel efficiency regulation | Infrastructure investments
III. MORE THAN JUST THE CAR – THERE IS A NEED FOR PROGRESS IN INFRASTRUCTURE AND A POTENTIAL FOR SMART MOBILITY.
On 29 November 2016, automakers have signed a Memorandum of Understanding on the installation of the highest-power charging network for BEVs in Europe.

Approximately 400 charging sites, built-up between January 2017 and 2020, aim at facilitating long-distance travel routes with BEVs and overall BEV adoption in Europe.

Power levels up to 350 kW will significantly decrease charging time for electric vehicle drivers.

Drawing on CCS (Combined charging system) technology, an open, brand-independent network for BEVs is created. The ultra-fast, high-power charging network will expand existing AC- and DC charging standards.

The Joint Venture is open for cooperations with other OEMs as well as with regional partners.
BEST PRACTICE COPENHAGEN: DRIVENOW OPERATED BY ARRIVA.
INTEGRATING CAR SHARING AND PUBLIC TRANSPORT.

DriveNow
- Full electric fleet.
- 400 BMW i3.
- Intermodal routing.
- Integration into public transport (Rejsekort).

Rejsekort
- 2 mio. Danes have a Rejsekort.
- Nation-wide access to trains, buses, metro.
- Rejsekort is DriveNow access medium.
- 68% of DriveNow customers have registered with Rejsekort.
INNOVATION INSTEAD OF PROHIBITION.
BMW AND CITY OF HAMBURG AGREE ON STRATEGIC PARTNERSHIP.

Hamburg, May 10th 2017: Mr. Scholz (l), Lord Mayor of Hamburg, and Mr. Schwarzenbauer (r), Member of the Board of Management, BMW AG, signing the MoU

Objective:
Scaling of electromobility
- 1,150 charging points
- Privileged parking for Electric and Carsharing Vehicles
- Stepwise electrification of the DriveNow fleet (550 xEVs)
WHAT ELSE CAN YOU DO WITH AN EV – CONVERGENCE OF „ENERGIEWENDE“ AND „VERKEHRSWENDE“ IS THE NEXT BIG THING.
BMW DIGITAL CHARGING SERVICE
CONNECTED DRIVE

BMW DIGITAL CHARGING
NEXT LEVEL CHARGING.

...COMBINED WITH OWN ELECTRICITY TARIFF.
...COMBINED WITH OWN VARIABLE DYNAMIC TARIFF.

...COMBINED WITH OWN SOLAR POWER.
...COMBINED WITH OWN SMART ENERGY.

With BMW i Wallbox Connect

With BMW i Wallbox Connect
INTRODUCING MICHELLE BOGEN
FROM BMW GROUP TECHNOLOGY OFFICE, MOUNTAIN VIEW.
ELECTRIC VEHICLES AS AN ASSET TO THE ELECTRICITY GRID. DEMAND RESPONSE.

Peak demand requires expensive peak power plants.
BMW i CHARGE FORWARD: PROGRAM DETAILS / KEY HIGHLIGHTS.

- Approx. 100 BMW i3 customers around the Bay Area
- Every event required 100-kW load drop
- Two types of events: Day Ahead (24 hr response) and Real Time (4 min response)
- PG&E called over 200 events
- 100 kW / 240 kWh second-life battery contributed remaining load drop by discharging to the grid
- BMW customers received $1k upfront incentive and $1 / day for ongoing participation
- BMW received $3000 / month from the utility for successful participation
BMW i CHARGE FORWARD: SYSTEM DESIGN AND TECHNOLOGY OFFICE SMART ENERGY MANAGEMENT SYSTEM.

CHARGE FORWARD ARCHITECTURE

1. BMW Server

2. Customer Cars

Customer Cars
100 Participants
(SF Peninsula)

BMW Microgrid + 2nd Life Battery System

3. PG&E

100 kW

LIVING LABORATORY:
BMW TECH-OFFICE SMART MICRO-GRID

energy flow

Grid

BMW TechOffice Microgrid Energy Management

Battery storage with 2nd life vehicle batteries
NEXT STEPS: BMW CHARGE FORWARD PHASE 2.

– Overview
- 300-400 participants throughout the Bay Area
- Began grid events in April 2017

– New Features
- Longer curtailment events
- Optimizing nighttime charging
- Increasing charging in response to local/system excess solar on the grid
- Shifting charging across grid locations (home and away-from-home)
- Messaging to engage customers
<table>
<thead>
<tr>
<th>Automated</th>
<th>Connected</th>
<th>Electrified</th>
<th>Shared</th>
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<tbody>
<tr>
<td>• Smooth traffic flow</td>
<td>• Reduce traffic and VMT</td>
<td>• Zero tailpipe emissions</td>
<td>• Reduce congestion</td>
</tr>
<tr>
<td>• Reduce accidents</td>
<td>• Optimize eco-routing</td>
<td>• Increase energy efficiency</td>
<td>• Remove vehicles</td>
</tr>
<tr>
<td>• Increase safety</td>
<td>• Encourage multimodality</td>
<td>• Reduce sound</td>
<td>• Replace old inefficient</td>
</tr>
<tr>
<td>• Increase efficiency</td>
<td>• Improve eco-driving style</td>
<td>• Leverage renewable energy</td>
<td>cars</td>
</tr>
</tbody>
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Leverage innovation to maximize reduction of CO2.
THANK YOU.