Energy Economics Group

Vienna University of Technology
Electric Vehicle related Projects

- **ELEK-TRA Project** (2008-2009):
  - **Joanneum Research** Forschungsgesellschaft mbH
  - **AVL List GmbH**
  - **Hybrid & Electric Vehicles**
    - Technological Assessment
    - Ecological Assessment
    - Economic Assessment
    - Model-Based Scenarios of market- & fleet penetration

- **Vehicle-to-Grid Strategies** (2010-2012): AIT
  - **ICT - Vienna University of Technology**
  - **Salzburg AG**
  - **Interaction of EV on Grid**
    - Grid Requirements
    - Load Profiles
    - Charging Infrastructure
    - Business Models

- **Vehicle-to-Grid Interfaces** (2010-2011): ICT - Vienna University of Technology
  - **CURE**
  - **Salzburg AG**
  - Interfaces for EV use
MARKET- AND FLEET-PENETRATION OF HYBRID AND ELECTRIC CARS IN AUSTRIA
MODEL BASED ANALYSIS 2010-2050

Maximilian Kloess

Energy Economics Group – Vienna University of Technology
Background:

- ELEK-TRA Project 2008/2009:
  - Technological Assessment
  - Ecological Assessment
  - Economic Assessment
  - Model-Based Scenarios of market- & fleet penetration

Hybrid & Electric Vehicles

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Methodology

• **Combination of bottom-up and top-down modelling approaches**
  - Bottom-up vehicle technology model
  - Bottom-up fleet model
  - Top down modeling of transport demand and service level
  - Dynamic cost comparison of propulsion systems and fuels
  - Logit-model approach for consumer decision modelling (market shares of technologies)

• **Input parameters**
  - Fuel prices
  - Income level
  - Costs of technologies (components → vehicles)
  - Political framework conditions

→ **Scenarios 2010-2050**
  - Market- and fleet penetration of vehicle technologies
  - Mean vehicle characteristics (mass, power, efficiency)
  - Energy Consumptions (well-to-wheel)
  - Greenhouse gas emissions (well-to-wheel)
Scenario Settings

Scenario framework conditions:
• Fossil fuel price development (scenarios)
Scenario Settings

Scenario framework conditions:

• Fossil fuel price development (scenarios)
• Political framework conditions (taxes, subsidies etc)
  – Fuel Taxes: gasoline: 0,45€
     diesel: 0,35€
  – Tax on acquisition: 0-16%
  – Tax on ownership: 0 - 1500€

Policy Scenarios 2010 - 2050
Scenario Settings

Scenario framework conditions:

• Fossil fuel price development (scenarios)
• Political framework conditions (taxes, subsidies etc)
• Technological Learning of alternative powertrain technologies (key components)
• Fuel supply scenarios:
  – Biofuel blending
  – Sources of Electricity
Assumptions for presented results:

- Policy – Business-as-usual (BAU)
- Policy – Active + low fuel price scenario

<table>
<thead>
<tr>
<th>Year</th>
<th>Business as Usual Policy</th>
<th>Active Policy</th>
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<tbody>
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<td>2030</td>
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**Vehicle Taxes**
- **Tax on Ownership**
  - Engine Power
- **Tax on Acquisition**
  - Status 2010
  - CO2 threshold-140g/km
  - CO2 threshold-120g/km
  - CO2 threshold-100g/km

**Fuel Taxes**
- Status 2010
- Scheme 1
- Scheme 2
- Scheme 3
- Scheme 4

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<tr>
<th>Fuel Type</th>
<th>Status 2010</th>
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Results

Business-as-usual (BAU)

Fleet development:

Final energy consumption:
Results

Business-as-usual (BAU)

WTW – Energy Consumption:

WTW – Greenhouse Gas Emissions:

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Results

Policy – Active

Fleet development:

2050:
70% Electric or Plug-In Hybrid Cars

Final energy consumption:

2050:
50% electricity in the energy supply
Results

Characteristics of new cars in the two scenarios:

Average mass:

<table>
<thead>
<tr>
<th>Year</th>
<th>BAU Scenario</th>
<th>Policy Scenario</th>
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<tbody>
<tr>
<td>2010</td>
<td>1400 kg</td>
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<tr>
<td>2020</td>
<td>1150 kg</td>
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<td>2030</td>
<td>1100 kg</td>
<td>1350 kg</td>
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<td>2040</td>
<td>1050 kg</td>
<td>1400 kg</td>
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Greenhouse gas emissions:

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<th>Policy Scenario</th>
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<tr>
<td>2010</td>
<td>180 g km⁻¹</td>
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<td>160 g km⁻¹</td>
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<tr>
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<td>120 g km⁻¹</td>
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Average power:

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<th>Policy Scenario</th>
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<tr>
<td>2010</td>
<td>60 kW</td>
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<td>2020</td>
<td>70 kW</td>
<td>80 kW</td>
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<tr>
<td>2030</td>
<td>75 kW</td>
<td>90 kW</td>
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<tr>
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</table>

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Results

Policy – Active

WTW – Energy Consumption:

2010-2050:
-50% fossil energy demand with 100% renewable electricity

WTW – Greenhouse Gas Emissions:

2010-2050:
-50% with fossil electricity (nat. gas)
-65% with 100% renewable electricity
Results

Business-as-usual (BAU)

Fleet development:

Active Policy Scenario

Fleet development:
Thank you for your attention!

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