ON THE ENVIRONMENTAL BENIGNITY OF ELECTRIC VEHICLES

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Content

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✓ Electric vehicles
  - Economic and environmental assessment
✓ Policies
✓ Conclusions
EU-28: Final energy consumption

Transport

Non-Transport

26% 32%
Development of GHG emissions in EU-28 countries (1990=1)
Electric vehicles

Level of electrification of electric vehicles

- ICE vehicles
- HEV
- PHEV
- REX
- BEV

0% electrification to 100% electrification

Rechargeable electric vehicles

Zero-emission EVs
Global stock of EVs

Development of the global stock of EVs

- HEV
- FCV
- BEV, REX, PHEV
Sale of EVs in 2012

Sale by region in 2012:
- HEV: 91.5%
  - USA: 30%
  - Japan: 60%
  - Other: 11%
- BEV: 4.3%
  - USA: 20%
  - Japan: 40%
  - Other: 4%
- PHEV: 4.2%
  - USA: 40%
  - Japan: 40%
  - Other: 20%
Costs of electric vehicles

Total investment and battery costs of selected BEVs related to power of car
Economic assessment

Total costs of service mobility per 100km driven in passenger cars
Environmental assessment

Well-to-Wheels (WTW)

Primary energy source

Fuel

Car

Mobility

Well-to-Tank (WTT)

Tank-to-Wheels (TTW)

Energy supply chain
Environmental assessment

CO₂ emissions per km driven for various types of EVs in comparison to conventional cars (power of car: 80kW)
Monetary measures

In Europe, the most commonly used monetary measures are subsidies and exemptions (or reductions) from:

- road taxes (e.g., in DE, DK, CZ)
- annual circulation tax (e.g., in DE, GR, NO, SE, UK)
- company car tax (e.g., in FR, UK)
- registration tax (e.g., in NO, BE, DE, FI, NL)
- fuel consumption tax (e.g., in AT)
- congestion charges (e.g., in NO, SE, UK)
The most important non-monetary measures are:

- free parking spaces,
- possibility for EVs drivers to use bus lanes,
- wide availability of fast charging stations,
- permission for EVs to enter city centers and zero emission zones.
<table>
<thead>
<tr>
<th>Country</th>
<th>Electricity-specific factors (gCO₂/kWh)</th>
</tr>
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<tbody>
<tr>
<td>Austria</td>
<td>176.80</td>
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<tr>
<td>Belgium</td>
<td>224.77</td>
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<tr>
<td>Germany</td>
<td>672.22</td>
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<tr>
<td>Denmark</td>
<td>474.75</td>
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<td>Finland</td>
<td>225.46</td>
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<tr>
<td>France</td>
<td>70.93</td>
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<td>Greece</td>
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<td>Ireland</td>
<td>521.19</td>
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<td>Italy</td>
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<td>Norway</td>
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<td>Portugal</td>
<td>400.15</td>
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<td>Sweden</td>
<td>23.03</td>
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<td>United Kingdom</td>
<td>508.50</td>
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</tbody>
</table>
Greece

- a carbon intensity of electricity mix in Greece is very high

MONETRAY MEASURES:
- EVs: exemption from the registration tax and the luxury tax

- EVs and HEVs with an engine capacity up to 1,929 cc are exempt from the annual circulation tax;

- HEVs with a higher engine capacity pay 50% of the normal circulation tax rate.
Norway

- **MONETRAY MEASURES**: EVs are exempted from registration tax, VAT, annual car tax, road toll and congestion charges

- **NON-MONETRAY MEASURES**: in Oslo drivers of EVs have access to bus lanes and free parking spaces

- **INFRASTRUCTURE**: a good public charging network is provided, about 10000 charging stations

- **PRICE**: gasoline price is very high, and electricity price is relatively low

- a **carbon intensity** of electricity mix in Norway is very low
Environmental assessment

CO₂ emissions per km driven for BEVs powered by grid electricity in different countries
Conclusions

- For broader penetration of electric vehicles …cost reductions, improvement of battery characteristics as well as development of infrastructure

- Different policies and measures are implemented to increase attractiveness of EVs ….most of the policies implemented will be abolished with the increasing number of EVs
Conclusions

- The final goal is not just to increase number of EVs, the goal is to reduce GHG emissions and air pollution.

- Full environmental benefit – only if EVs are powered by electricity generated from renewable energy sources.