Impacts of Electric Vehicles

The main results of the recent study by CE Delft, ICF and Ecologic
Presentation overview

• Brief overview of the study
• Impact assessment
  • Three scenarios
  • Impacts:
    - vehicle sales and fleet
    - fuel and electricity demand
    - electricity production
    - emissions
• Policy assessment (focus on vehicle regulation)
• Policy conclusions
Brief overview of the study

- Commissioned by DG CLIMA
- Carried out by CE Delft (lead), ICF and Ecologic
- Objectives:
  - Assessment of status and expectations
  - Impacts of market uptake of EVs in the EU
  - Up to 2030, focus on passenger cars
- Deliverables ([www.cedelft.eu](http://www.cedelft.eu)):
  - D1 - Market developments
  - D2 - Battery and vehicle technology
  - D3 - Future Electricity sector
  - D4 - Economic analysis and business models
  - D5 - Impact analysis rios and policy implications
  - Summary report
Scenario analysis

- Three EV scenarios designed to cover the playing field
- Reference scenario: TREMOVE 3.3.1
  - Current policy measures implemented, no EVs
- 4 vehicle types:
  - Internal Combustion Engine Vehicle (ICE)
  - Full Electric Vehicles (FEV)
  - Plug-in hybrid electric vehicles (PHEV)
  - Extended range electric vehicle (EREV)
- In all scenarios: EVs replace ICEs
  - i.e. number of vehicles and annual mileages are the same in all scenarios.
- Passenger cars only
Three EV scenarios

- **Scenario 1: ‘Most realistic’**
  - Input parameters based on results of WP1-4
  - Only ‘innovators’ interested while costs are high.
  - Production capacity, # of charging points increase over time.
  - Smart charging (i.e. during base load) from 2020 onwards

- **Scenario 2: ICE breakthrough**
  - Optimistic estimates for costs and fuel efficiency of ICEs
  - Battery costs reduce less fast than in scenario 1.
  - Consumer interest limited to innovators and niche markets, charging possibilities remain limited

- **Scenario 3: EV breakthrough**
  - Rapid decrease of battery cost, from 2015 onwards.
  - Cost become competitive, ranges increase and costs reduce
  - Volume growth restricted by production capacity, consumer scepticism, grid bottlenecks etc.
Vehicle sales and fleet: scenario 1
Vehicle sales and fleet: scenario 2

Scenario 2

EU27 car sales per year (million vehicles)

- conventional
- PHEV
- EREV
- FEV
- Reference conventional

Vehicle sales and fleet: scenario 2

number of vehicles in EU27 (million)

- conventional
- PHEV
- EREV
- FEV
Vehicle sales and fleet: scenario 3
Impact on fuel and electricity demand

- Petrol use EU 27 (PJ)
  - Scenario 1
  - Scenario 2
  - Scenario 3
  - Reference

- Electricity use EU 27 (PJ)
  - Scenario 1
  - Scenario 2
  - Scenario 3
Impact on electricity production

- Electricity sector modelled with IPM model (by ICF)
  - IPM distinguishes various EU regions
- Results:
  - Impact on capacity mix forecast
  - Impact on power generation forecast
  - Impact on electricity prices
  - Impact on emissions
Net changes in electricity production mix - scenario 1
Overall impact on emissions: CO₂

Direct vehicle emissions:

Excl. ETS effects
Overall impact on emissions: NO\textsubscript{x}

Direct vehicle emissions:
Impact of EV market uptake: main conclusions

- Petrol and diesel demand reduces
- Power capacity and production increases (mainly gas and coal)
- $\text{CO}_2$ emissions reduce (4-10% in 2030)
- $\text{NO}_x$ emissions increase, PM$_{10}$ emissions reduce
- Effects limited, at least until 2020/2025
- Lithium: significant production increases required
- A large range of economic impacts
- Government revenues reduce over time, if not adapted
A large range of relevant (existing) policies

**Vehicle regulation**
- CO₂ and Cars Regulation, CO₂ regulation for light commercial vehicles
- Framework Directive for Type-approval of Motor Vehicles

**Regulation of energy carriers**
- Renewable Energy Directive
- Fuel Quality Directive
- ETS Directive

**Fiscal policies**
- Framework Directive for the Taxation of Energy Products and Electricity
- Eurovignette Directive

**Other relevant policies**
- Various goals may be pursued:
  - Facilitate EV market uptake
  - Influence impacts
  - Avoid harmful market distortions
- Policies may vary over time

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**EV related policy goals and timing**

- Facilitate EV market uptake
- Influence impacts
- Avoid harmful market distortions
- Policies may vary over time
CO₂ and cars regulation (1)

- EVs may have significant impact on the CO₂ and cars regulation and vice versa
  - Zero counting
  - Super credits (temporary)
- Effective incentive for EV development and sales
- CO₂-emissions of electricity production neglected
  - Risk of market distortion
  - Actual (WTW) emissions higher than the CO₂ standard suggests
- Energy efficiency in EVs not promoted.
CO$_2$ and cars regulation (2)

- **Policy options:**
  - Maintain the current system
  - Add EV energy efficiency limits to existing regulation
  - Establish WTW GHG emission standards
  - Replace current system with energy efficiency standards

- **Conclusions:**
  - Current system effective for the short term,
  - but should be adapted if EV market shares increase.
  - Establish WTW emission standards, with EU average Well-to-Tank emissions for both fuels and electricity
Policy conclusions

- EVs impact on a large range of policy areas (and vice versa)
  - Many need to be adapted when EVs enter the market
  - Some may require action in the short term
    - e.g. standardisation of charging
  - Others should be reviewed to assess whether action is needed in the medium or longer term
    - e.g. CO₂ regulation of cars, harmonisation of fiscal policies, smart charging, charging infrastructure issues
Thank you

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