

Young Researchers Seminar 2015

Rome, Italy, June 17 - 19, 2015



The socio-economic impact of the deployment of electromobility on greenhouse gas and local emissions on EU-level

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Background

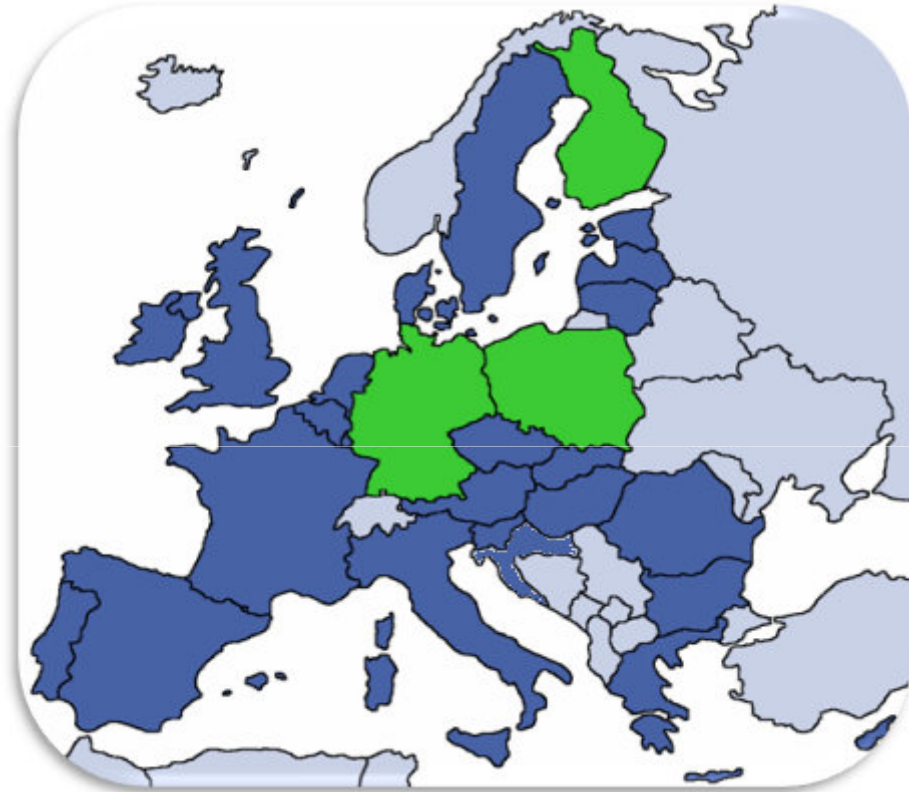
- Global warming emissions
- Local pollutants
- EU's dependence on oil

- Electromobility as an important part of the solution
 - Broad market penetration of electric vehicles coupled with energy from renewable resources
 - To reduce carbon emissions, electric vehicles are widely seen as one of the promising options

- The effect of regulation and technological development on the possible deployment paths of electric vehicles, emission reduction and on economic factors has not been examined in detail yet.

Project Overview

- Focus: Market penetration of electric cars in the EU, Finland, Germany and Poland until 2030
- Project duration: 2012/07 – 2015/05
- www.project-emap.eu
- 6 partners from Finland, Germany and Poland



Electric vehicles



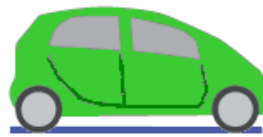
Combustion engine

Diesel, petrol or autogas vehicles. Their efficiency potential is not yet exhausted.



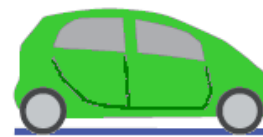
Hybrid (HEV)

Combination of a conventional internal combustion engine drive with an electromotive drive powered by a battery. Recharging via recuperation.



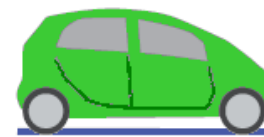
Plug-in Hybrid (PHEV)

Similar to mild-hybrid vehicles, uses a larger battery that can be recharged at the grid. Enables short-distance pure electric driving.



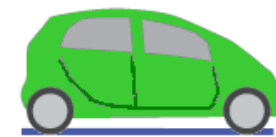
Range extended electric vehicles (REEV)

Range-extenders are subunits that can extend the range of electric vehicles beyond the battery-capacity. An internal combustion engine recharges the battery.



Battery electric vehicle (BEV)

Electric vehicle with electric drive powered only by a battery.



Fuel-cell electric vehicle (FCEV)

Focus of eMAP-project

Source: NPE

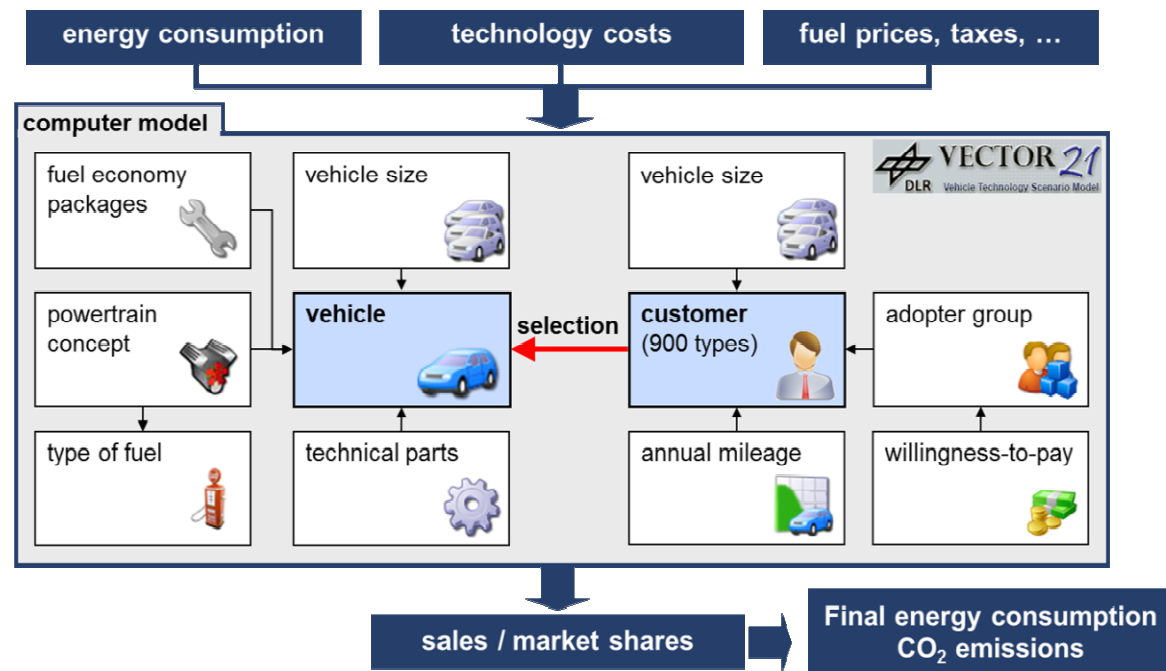


● ● ● | Project contributions to the key
dimension: Socio-economic issues

- Broad picture of customer's awareness/knowledge/attitude towards EVs on a national and European level
- Assessment of the influence of exogenous factors as well as promotion measures on the deployment pathway of EVs
- Ranking and comparison of market penetration scenarios with regard to their socio-economic impacts
- Support for the strategic alignment of the national and European transport policy

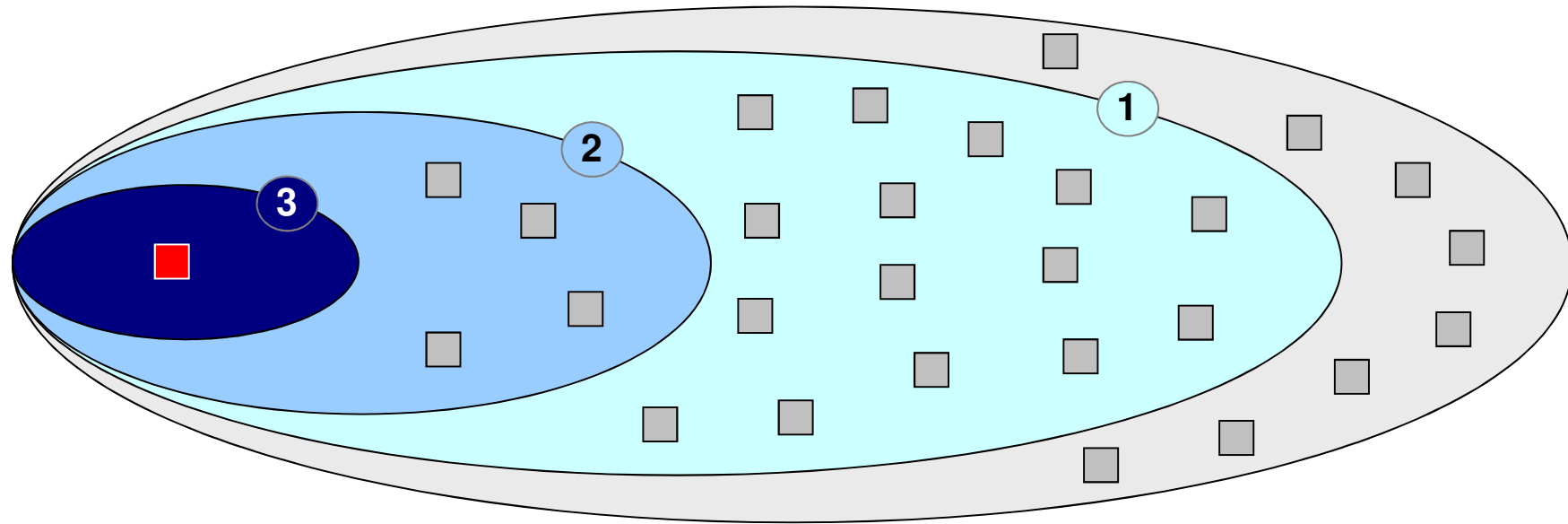
VECTOR21 model approach

- Different **customers** are specified (vehicle size, mileage, WTP)
- **Vehicles** are technically, economically and environmentally specified
- **Political** regulations and boundary conditions are modelled
- Expected **development** and changes of key parameters can be considered
- A RCO¹ based purchase decision is integrated
- Vehicles with less CO₂-emissions are preferred



¹RCO = Relevant Costs of Ownership

●●● | Purchase decision process for each year and customer group



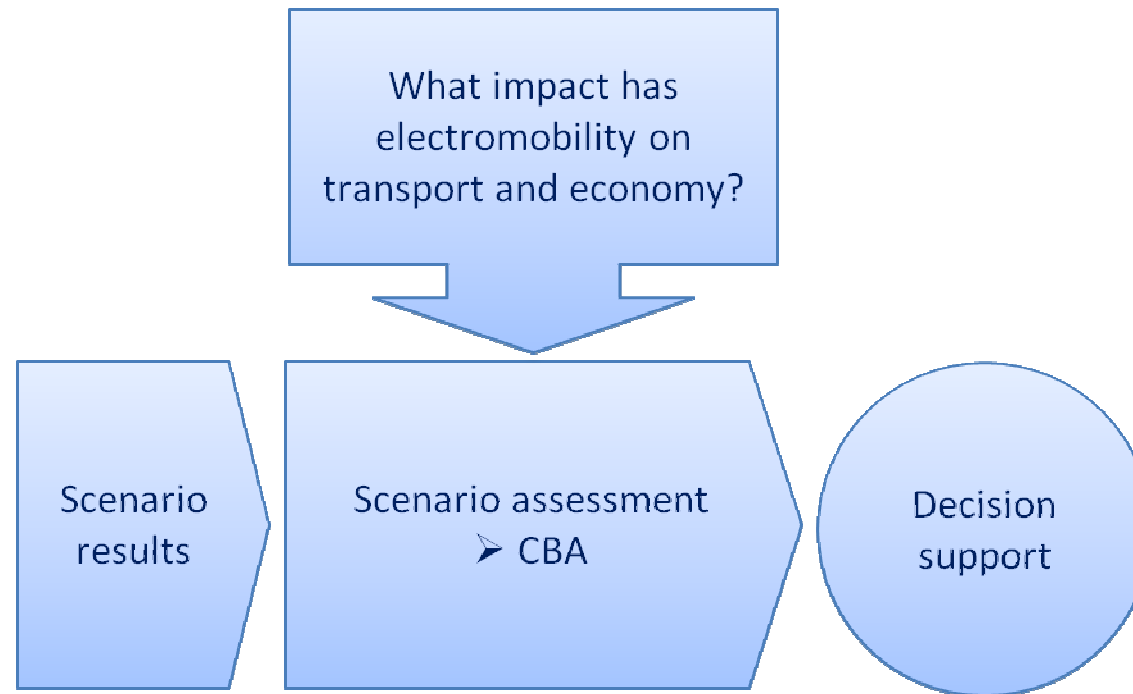
■ Vehicle variants (combination of vehicle technology and fuel)

1 Step 1: Filter for vehicle segment and basic requirements

2 Step 2: Choose lowest Relevant Cost of Ownership (RCO)

3 Step 3: Choose lowest well-to-wheel CO₂-emissions (Assumption: Customer knows about WTW)

●●● | CBA as an option to rank scenarios



●●● | Cost-Benefit-Analysis

- Benefit-Cost-Ratio (BCR)
The benefit-cost-ratio is defined as the ratio between benefits and costs caused by a measure:

$$BCR = \frac{\textit{present value of all benefits}}{\textit{present value of implementation costs}}$$

- Compares costs and benefits of scenarios
- Reference scenario is scenario Business as Usual (BaU)
- Technology Driven (TeD) and Policy Driven (PoD) scenarios are compared to BaU scenario
- Scenario is efficient if
 - Benefit-Cost-Ratio > 1
 - Benefit-Cost-Balance > 0

●●● | Cost-Benefit-Analysis

- Costs are
 - Costs for charging infrastructure (public and private)
 - Costs of car production (net costs without taxes and subsidies)
- Benefits are
 - Savings in operating costs
 - Savings in noise costs
 - Savings in costs of air pollution
 - Savings in CO₂-Costs

- Results for

- EU28



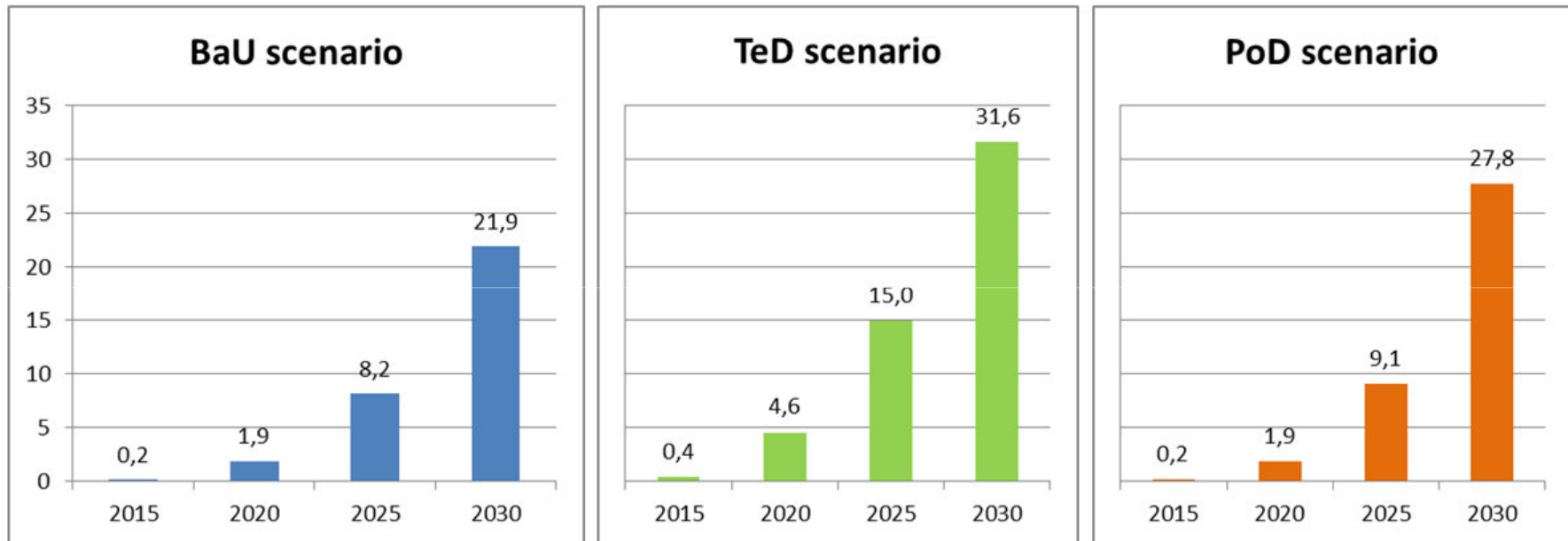


Scenario overview

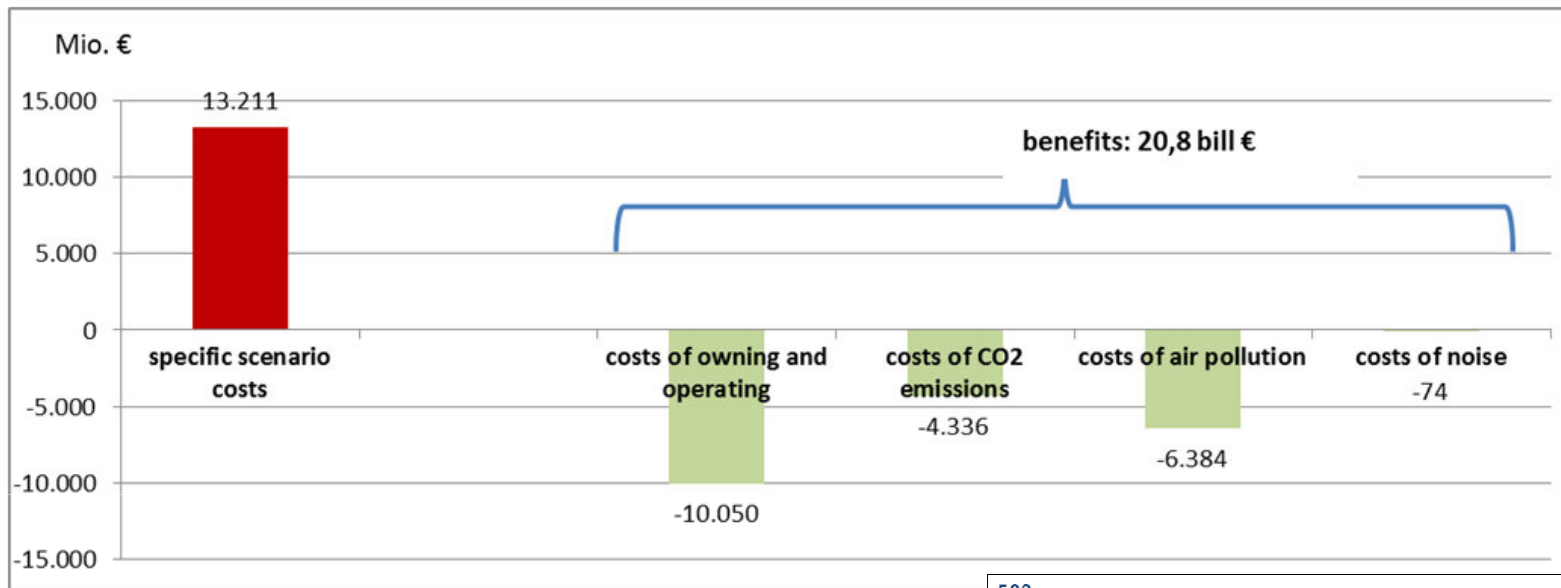
Scenario	Experience Curve of the battery system	Vehicles	CO ₂ limits [g/km]	Taxation scheme/ subsidies
BaU	Function is fixed, but the curve depends on the sales of the last years	120 different types of vehicles - distinguished by powertrain, size and implemented level of fuel saving technologies	2015: 130, 2021: 95, 2030: 75, phase-in and super credits taken into account	As current legislation
TeD	Decrease faster than in BaU	Higher efficiency of electrified vehicles	Same as BaU	Same as BaU
PoD	Same as BaU	Same as BaU	2030: 60	Same as BaU

Scenario results

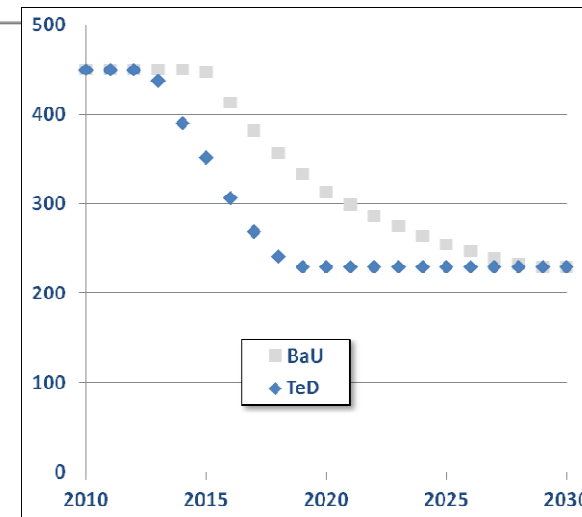
Number of EVs in stock (EU28, in million)



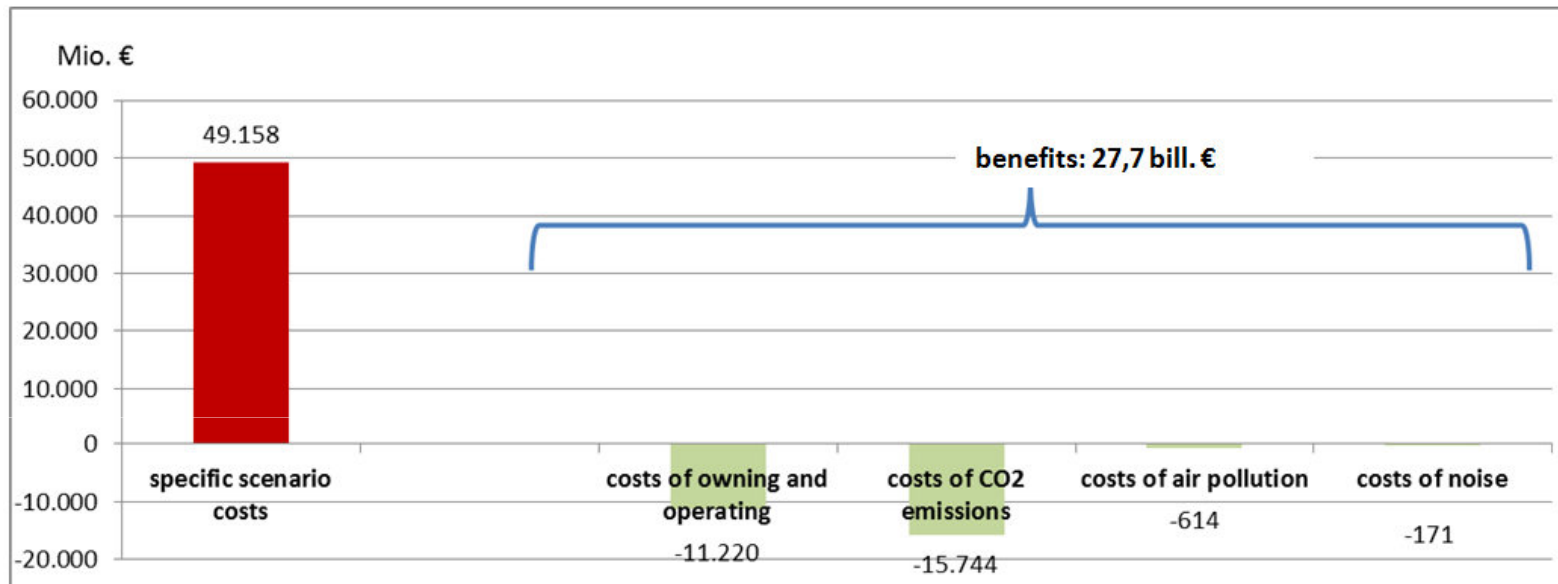
CBA results TeD



- Benefit-cost-difference (over 20 years) of about 7.6 bill. €
- Benefit-Cost-Ratio = 1.6



CBA results PoD



- Benefit-cost-difference (over 20 years) of about -21.4 bill. €
- Benefit-Cost-Ratio = 0.6



Conclusions

- Even in the Business-as-Usual scenario the share of EV will increase mainly due to the assumed CO₂-target in 2030 (75 g/km).
- The market penetration of electric vehicles on EU-level can be enhanced by both technical and policy measures (regulation).
- If technologies develop further and costs for EV components decrease significantly, tightened CO₂ limits could be met without other regulative measures.
- The stronger CO₂ limits in the Politically Driven scenario (PoD) is not efficient, whereas the Technology Driven scenario (TeD) has a positive socio-economic impact (Benefit-Cost-Ratio > 1)



Thank you for your attention!

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