



DECARBONISATION OF THE TRANSPORT SECTOR CONSIDERING GLOBAL LEARNING AND FLEXIBILITY POTENTIAL FOR THE ELECTRICITY SYSTEM

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3 main strategies to decarbonize the transport sector





Flexibility potential and efficiency of decarbonisation options





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Selected options for decarbonisation in High-RES scenarios



Selected technology and fuel options considering efficiency and flexibility



Scenario assumptions



Mod-RES Reference
High-Res central
High-Res decentral

Roadmap COM 1990 - 2050: -54 to -67% → Target -60%

by using digital technologies, smart pricing, etc.

by fuel and vehicle taxation, investments in refuelling infrastructure, stricter fuel efficiency standards, etc. Battery price decline simulated via experience curves, EVs favourable for roof-top PV owners, phase-out

based on infrastructure deployment, policies, R&D and subsidies, higher perceived reliability in centralized energy system

large plants vs. on-site

consumers more familiar with demand side management in decentralized energy world



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Methodology: Modelling Approach

ASTRA - Assessment of Transport Strategies

Main characteristics:

- System Dynamics -Vensim® software
- 1995 to 2050
- EU28 + CH/NO
- Modular structure
- Simulation of single policy measures and bundles
- Technology diffusion based on an adapted total cost of ownership approach





Simulating the vehicle technology choice in ASTRA





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Simulating global learning for electric cars by model coupling





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Scenario results of TE3 – development of key non-EU car markets



Effects on cumulative battery capacity



Cumulated battery capacity BEV: High-RES – Cumulated battery capacity BEV: Mod-RES –

→ Battery capacity doubled for High-RES in comparison to Mod-RES for BEV



Scenario results for EU28: Emissions and drivers

Modal shift for freight & passengers

Diffusion of electric drives & fuel efficiency improvements for all road vehicles

Increase of biofuel share, in particular for non-road modes



Tank-to-wheel CO₂ emissions in Mt



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Scenario results for EU28: Fleet technology composition



Main drivers of the BEV/PHEV diffusion

- Soon competitive prices due to worldwide production of batteries
- Charging infrastructure and increased ranges
- Inducements for PV-owners to buy BEV/PHEV
- Phase-out implementation of pure Internal Combustion Engine cars by 2040



Main drivers of the FCEV diffusion

- R&D and subsidies for acceptable prices
- Reliable H₂-refueling infrastructure deployment for trucks along motorways including sufficient H₂ supply or on-site production
- Policies increasing costs for diesel trucks (e.g. stricter CO₂-standards, emission-based registration taxes and road tolls)



Scenario results for EU28: Modal share for freight & passengers





Scenario results for EU28: Energy demand in Mtoe

Total energy demand is decreasing strongly in High-RES due to increased efficiency improvements and electrification



Scenario results for EU28: Energy demand by energy carrier

Strong and timely responses are required to meet the GHG emission reduction targets while transport demand is growing

MEASURES TO BOOST THE ENERGY EFFICIENCY OF THE TRANSPORT SYSTEM

MEASURES TO SUPPORT THE ELECTRIFICATION OF ROAD TRANSPORT

- Strict fuel efficiency and CO₂ standards for all new road vehicles, forcing the automotive industry to innovative vehicles with zero-/ low-emission drives
- Supporting modal shifts to more efficient modes, e.g. rail and public transport systems but also active modes and sharing mobility in urban areas
- Complementary measures aiming at increasing car occupancy rates (sharing mobility) and optimizing the city logistic chain in urban areas
- Subsidies, tax and pricing strategies to support the transition to new drive technologies by increasing their financial attractiveness in the first years of market entry
- Charging infrastructure incl. fast-charging capability to be deployed sufficiently and timely to reduce range anxieties
- Phase-out of pure internal combustion engines for cars, urban buses and vans

ALTERNATIVE FUELS TO COPE WITH LACK OF MATURE LOW-EMISSION TECHNOLOGIES

Alternative fuels in form of biofuels or synthetic Power-to-X fuels based on electrolysis and additional treatments for modes for which mature lowemission drive technologies will not be developed in the near future (i.e. aviation and ships)

