Navigating the Roadmap for Clean, Secure and Efficient Energy Innovation

SET-Nav
Strategic Energy Roadmap

Pathways for decarbonizing the transport sector

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SET-Nav Regional Workshop

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GHG EMISSIONS AND TARGETS FOR THE TRANSPORT SECTOR

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Transport sector in 2015

- 28% of the EU GHG emissions
- 84% of these emissions from road transport
- road transport emissions mainly caused by passenger cars (61%) and by heavy duty trucks & buses (26%)

EU Roadmap for moving towards a competitive low-carbon economy:

GHG reductions compared to 1990	2005	2030	2050
Total	-7%	-40 to -44%	**-79 to -82%**
By Sector			
Power	-7%	-54 to -68%	-93 to -99%
Industry	-20%	-34 to -40%	-83 to -87%
Transport (incl. aviation, excl. maritime)	**+30%**	**+20 to -12%**	**-54 to -67%**
Residential and services	-12%	-37 to -53%	-88 to - 91%
Agriculture	-20%	-36 to -37%	-42 to -49%
Other non-CO2 emissions	-30%	-72 to -73%	-70 to -78%

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Reference Scenario Fails To Meet GHG Targets By Far

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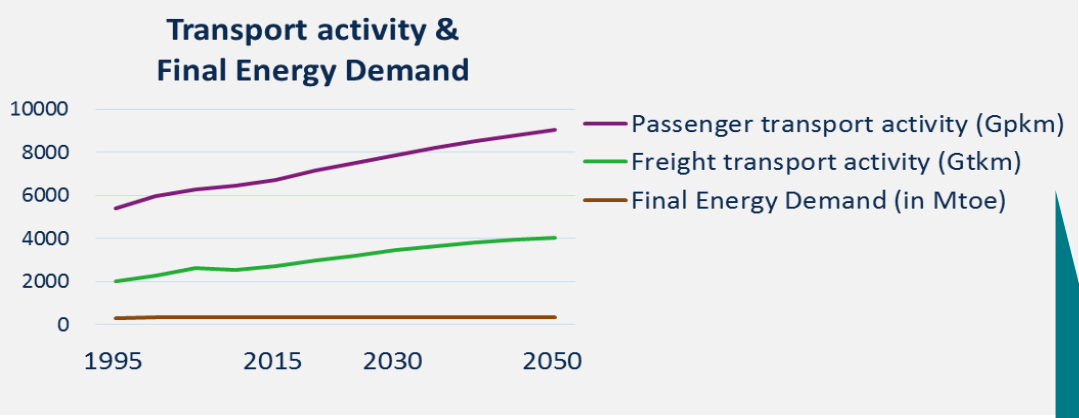

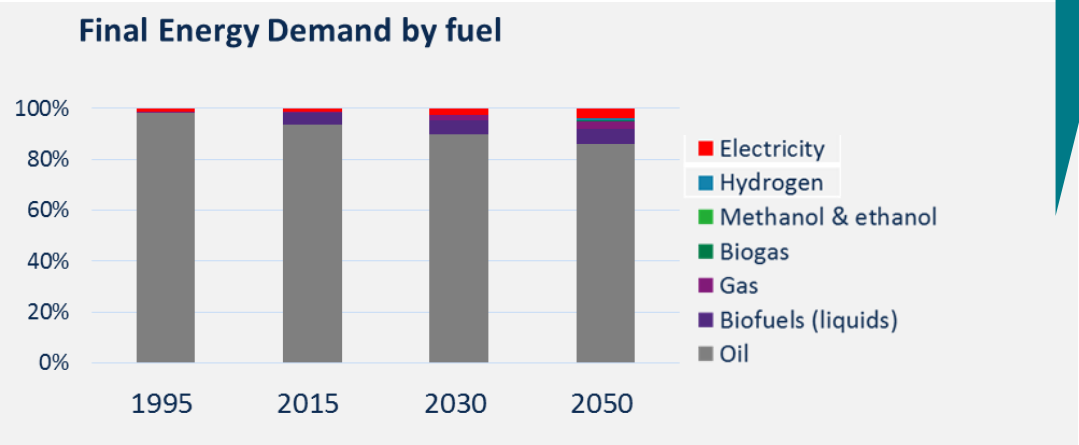

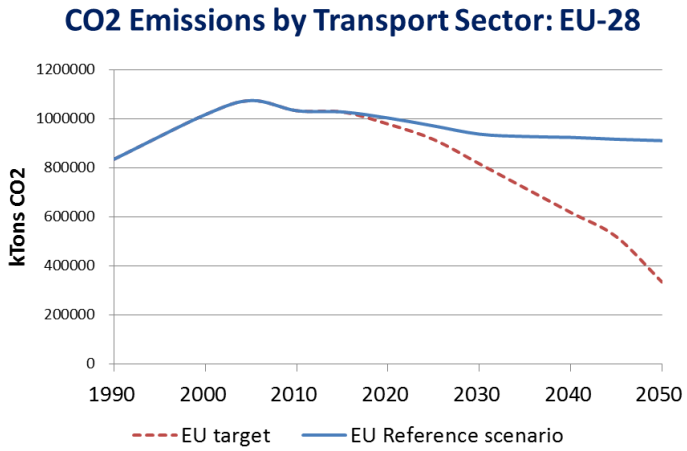

Source: based on EU Reference Scenario EU28 for transport

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3 MAIN STRATEGIES TO DECARBONIZE TRANSPORT

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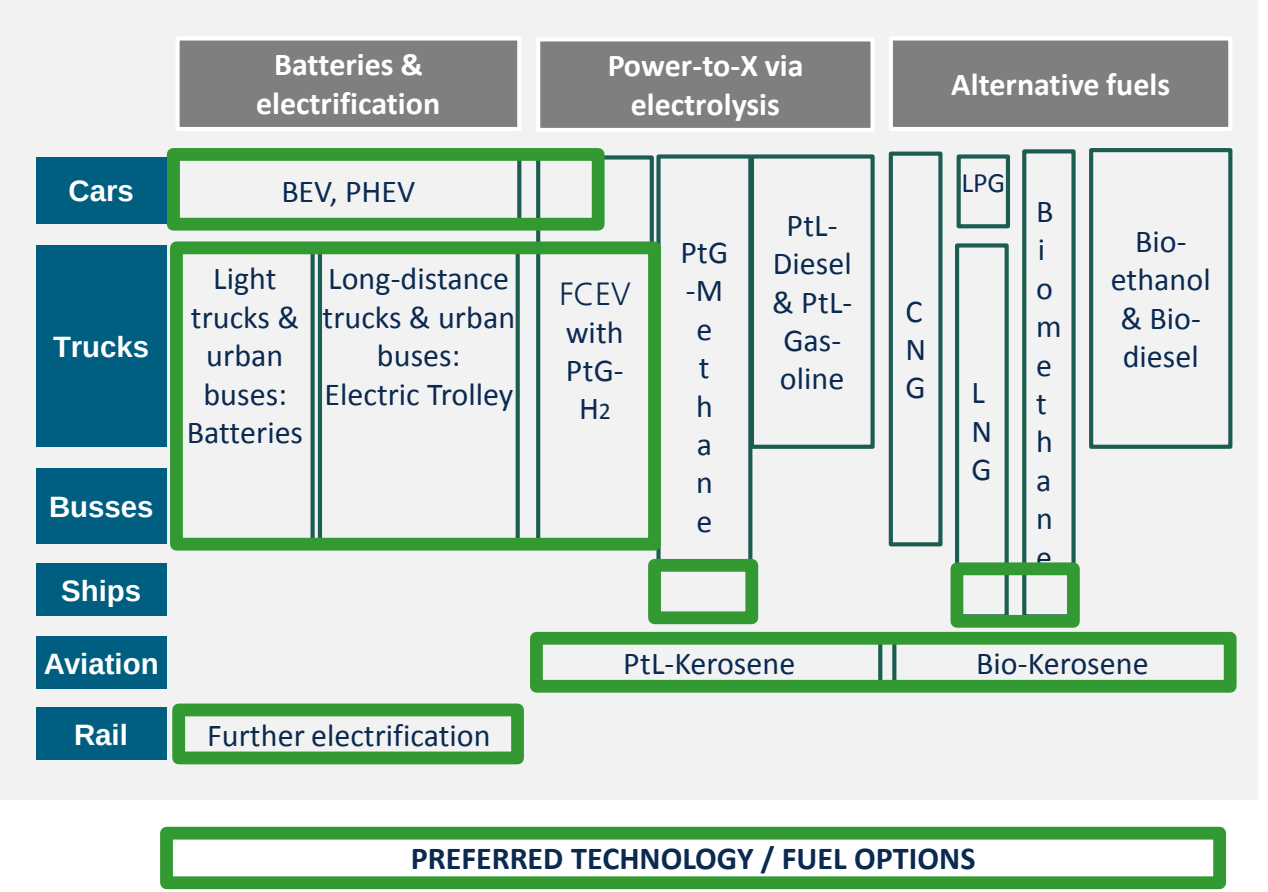
1. **Shift to more efficient transport modes**

2. **Diffusion of low/zero-emission technologies**

3. **Alternative fuels: bio & synthetic fuels**



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Measures and policies to enable the transition

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Modal Shift

- **financial measures** like smart pricing, road infrastructure or congestion charges in cities,
- measures to **improve the infrastructure** of public transport, cycling and walking pathways,
- measures to **improve the accessibility and the use of multi-modal transport**, **bike-, car- and ridesharing services** by better applying digital technologies and
- **regulatory measures** like lower speed limits for passenger cars, prioritised traffic flows of non-motorised modes and public transport on crossings and high parking fees

Low emission technologies & fuels

- **Stricter fuel efficiency or CO_2 standards** until 2030 and beyond
- **Subsidies for electric vehicles** in early market phases
- Vehicle **registration taxes based** on bonus-malus systems related to **emissions**
- Increased **energy taxation** for conventional fuels, **reduced fuel tax** for electricity, biofuels, hydrogen and renewable synthetic fuels
- Spreading **road charges based on CO_2 emissions**
- **Banning** fossil-fuel based cars **from entry into cities**
- Regulating a general **phase-out of pure ICE vehicles** at least for passenger cars

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PATHWAYS

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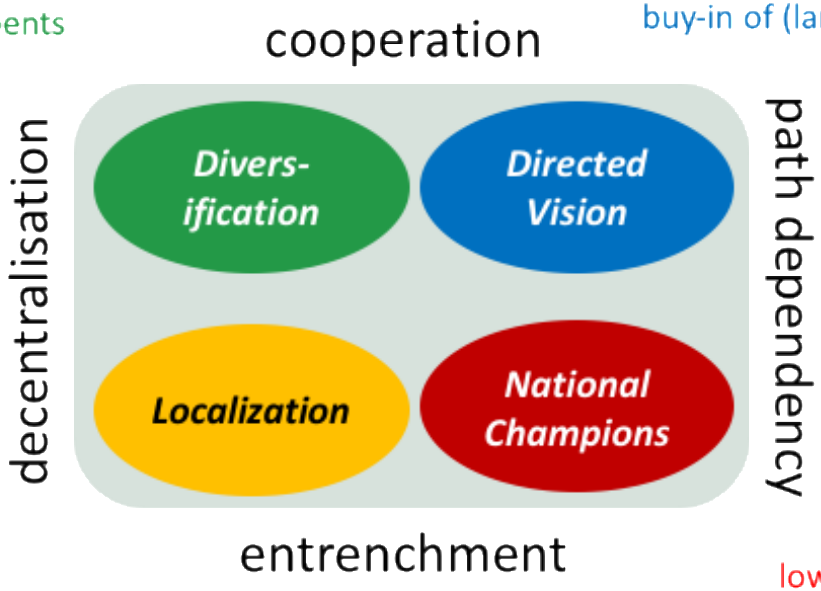
- many new entrant
- heterogeneous actors
- active consumers
- coordination, digitalisation, open platforms
- regulatory opening
- challenges to incumbents

clear shared vision -
EU in guiding role -
strong coordination between member states -
durable and stable policy framework -
buy-in of (large) stakeholders -



- local resources
- national differentiation
- resistance to big infrastructure
- experimentation & diversity (but weak spillovers)
- winner-takes-all digitalisation

low transitional risks -
strong role for incumbents -
regulatory capture -
large-scale projects & balance sheets -

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Pathway Interpretations for Transport

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Diversification	Directed Vision
"Mobility as a service" system with new business models, shared and increasingly autonomous vehicles for freight and passengers. Range of various technologies and policies adapted across EU countries.	Joint infraststructure and policy decisions across EU countries. Strong electrification of road transport with trolley truck infrastructure and phase-out of pure ICE vehicles. Biofuels mainly used for non-road modes.
Localisation	**National Champions**
Strong role of car-sharing, public transport, walking and cycling for local mobility. Technologies differ between countries. Decentral roof-top PV installation incentivizes electric car purchases for households. Biomass as local resource is part of the decarbonization strategy.	National development of new technologies and policies. Low- and zero-emission technologies diffuse relatively slowly. Biofuels adopted on a large scale, also for road transport. Low changes in modal split and car ownership.

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Methodology: Modelling Approach

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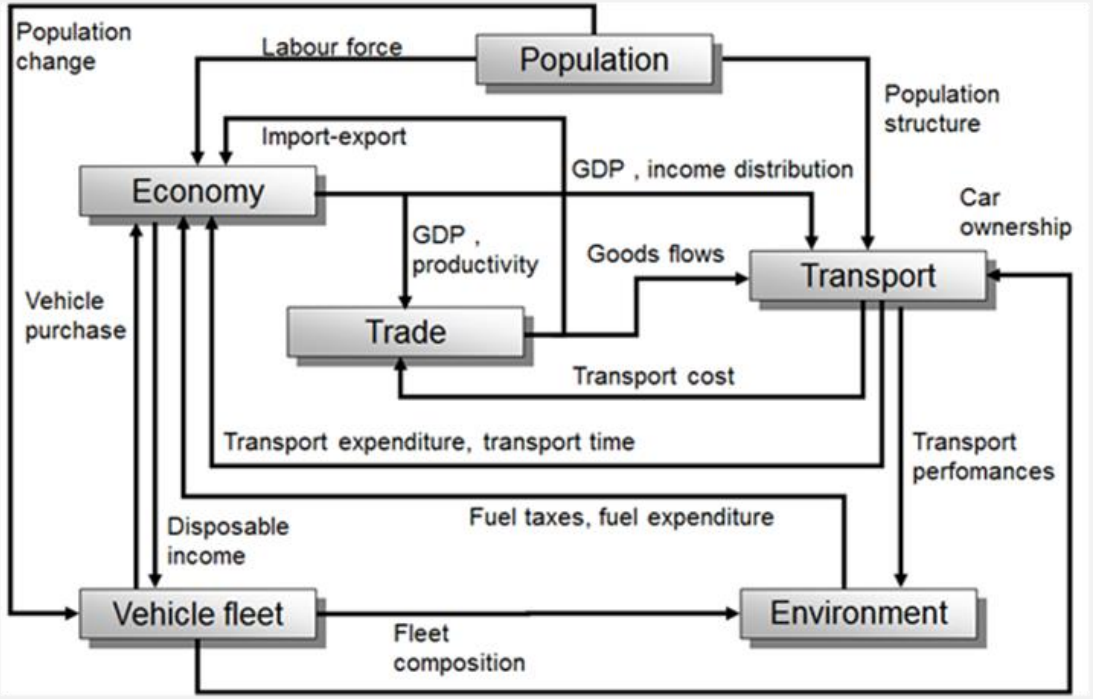
ASTRA - **As**sessment of **Tra**nsport Strategies
www.astra-model.eu

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



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Pathway Model Assumptions

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	Diversification	Directed Vision	Localization	National Champions
Trolley truck infrastructure	DE, NL, DK, FI, SE, NO	Trolley trucks in most countries (wo islands)	-	DE, DK, FI, SE, NO
Measures for FCEV diffusion	Different levels	in countries wo trolley trucks →UK, IE, CY, MT	Different levels	Very low, selected countries only
Measures for CNG/LNG diffusion	Different levels	Very low, selected countries only	Different levels	Selected countries only
Biofuel share	Different levels low to high	Low for road modes, very high for aviation	Different levels low to high	Very high in all countries also for road modes
Phase-out ICE vehicles	Urban buses, cars & LDV in selected countries 2030-40	Urban buses in 2030, cars & LDV in 2035	Urban buses in 2030 for EU15/NO/CH, cars/LDV in selected countries in 2035/40	Urban buses in 2030 for EU15/NO/CH, in 2040 for EU13
Autonomous driving	Scenario „World of mobility services“	Scenario „World of car ownership“		
Car sharing, active modes	Variations of levels for several parameters, e.g. highest level of improvement of public transport in Directed Vision, lowest diffusion of car sharing in National Champions, highest level of e-bike penetration in Localization.			
Policies to push a transition to a decarbonized transport sector	Strict efficiency standards for vehicles of all road modes, measures to increase costs for conventional vehicles while decreasing them for low-emission vehicles (vehicle registration tax and fuel tax based on emissions, R&D and subsidies for new technologies), deployment of charging stations and alternative fuelling infrastructure, measures for non-road modes, in particular increased electrification for railways and emission standards for aircrafts and ships			

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Results: GHG Emissions in Mt CO_2

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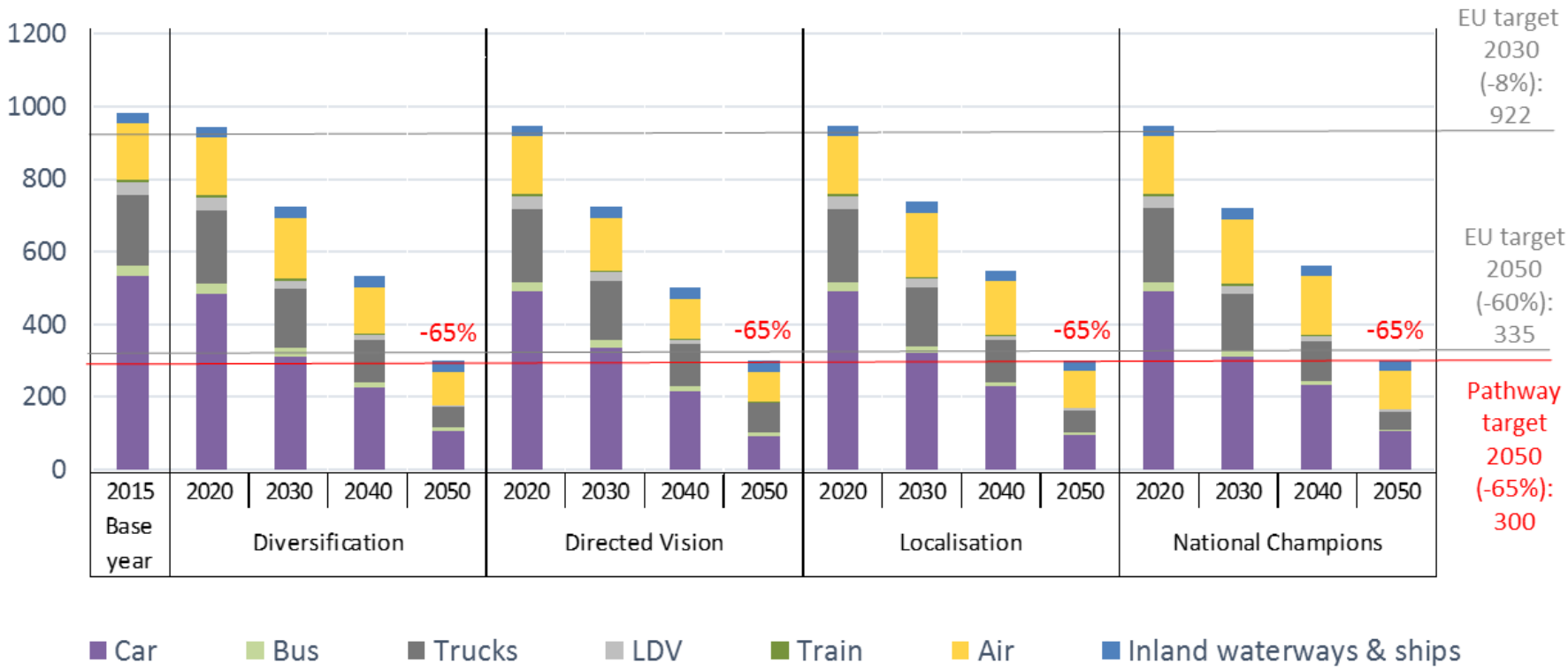

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Results: Modal Shift & Activity

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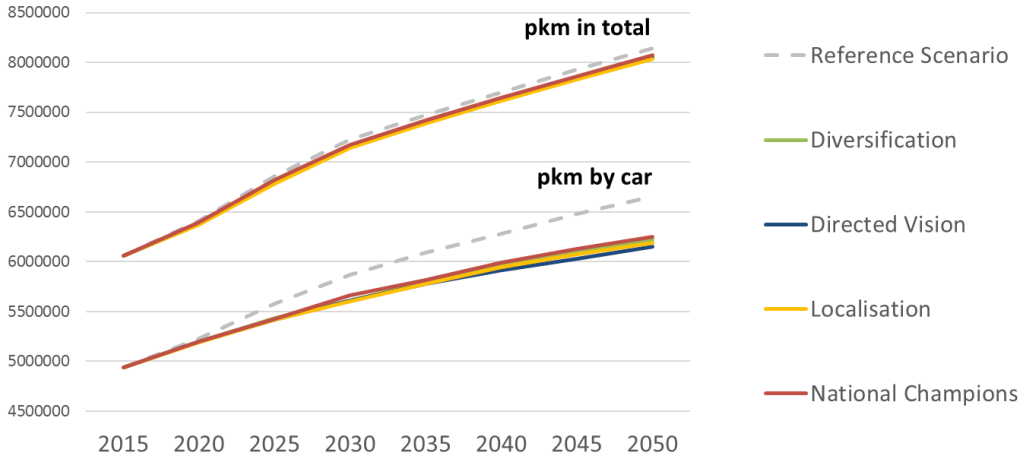
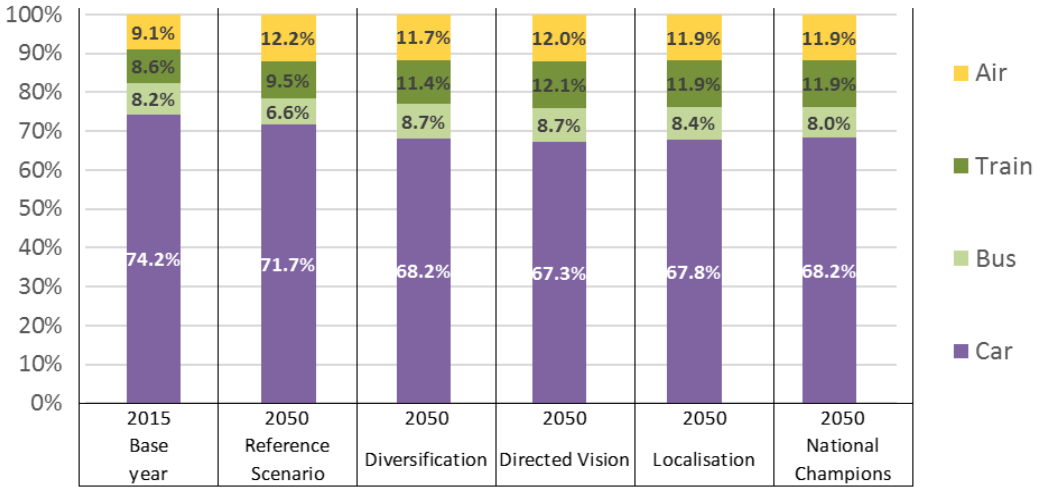
Passenger land transport

Transport demand in Mio. passenger kilometers (pkm)



Modal split based on pkm origin country



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Results: Fleet Composition

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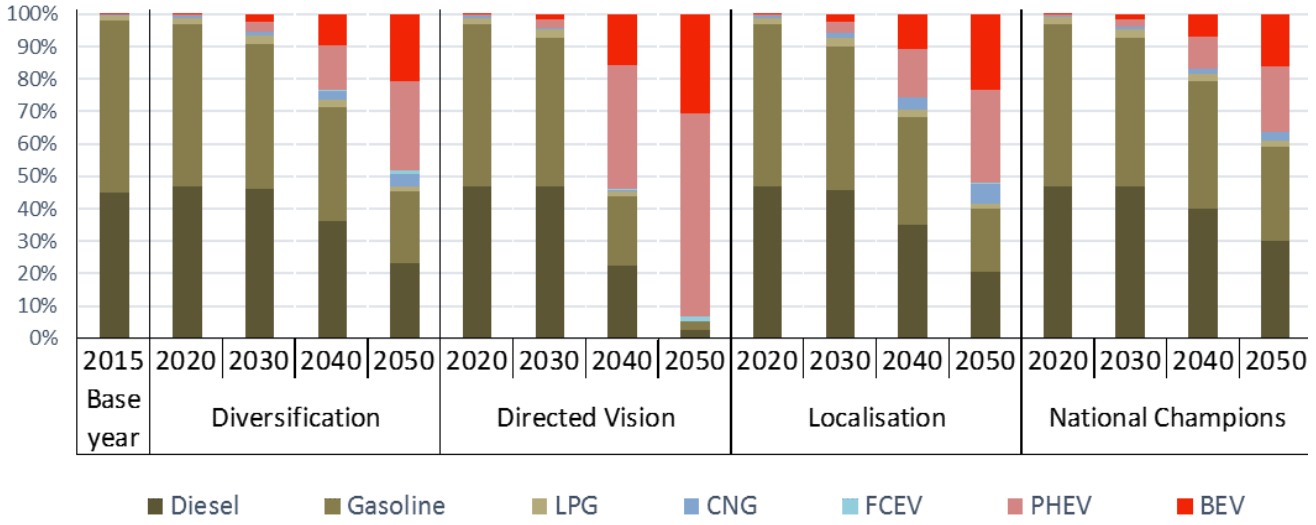
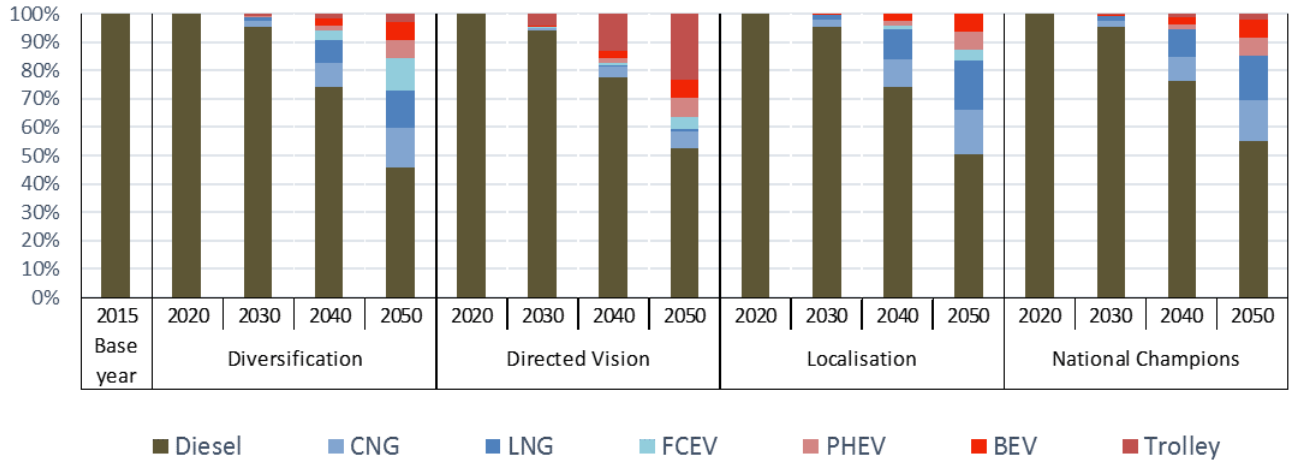
CARS



TRUCKS



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Results: Final Energy Demand in TWh

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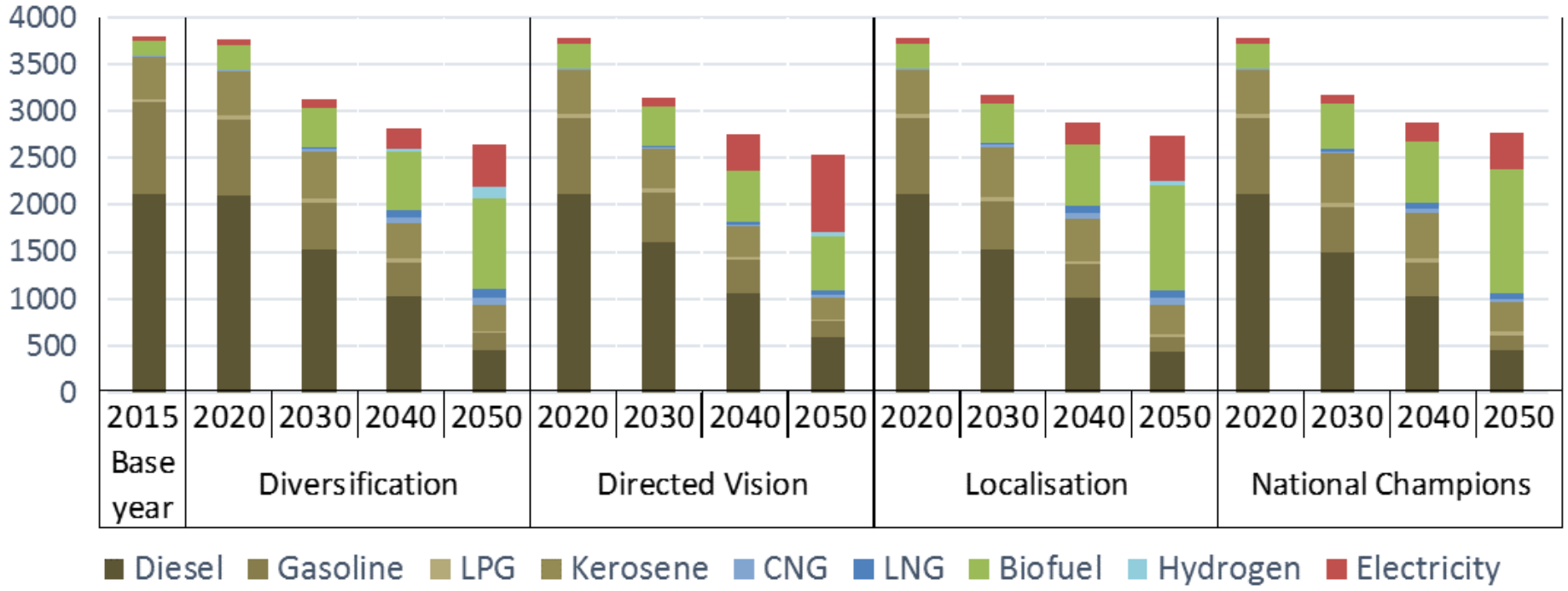

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Results: Biofuel Demand in TWh

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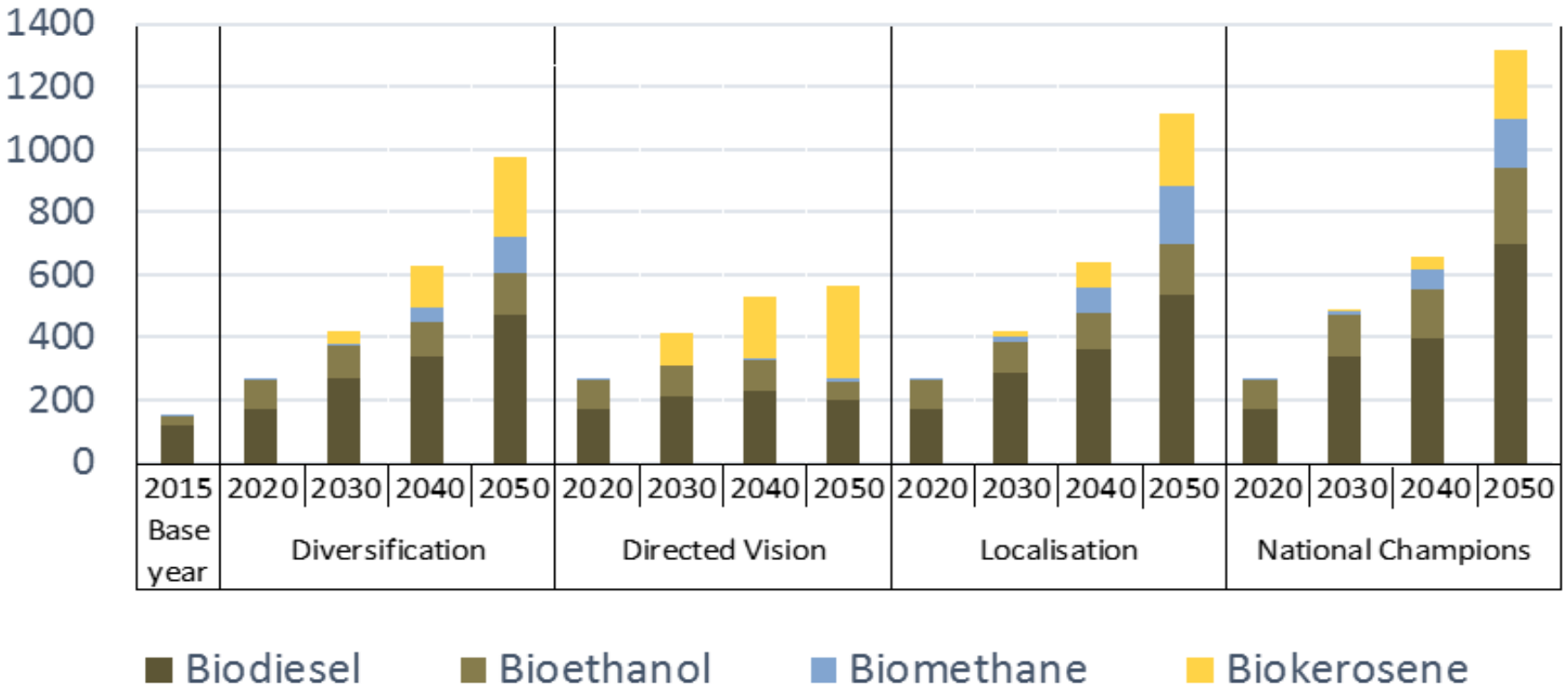

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Results: Link to the electricity Sector

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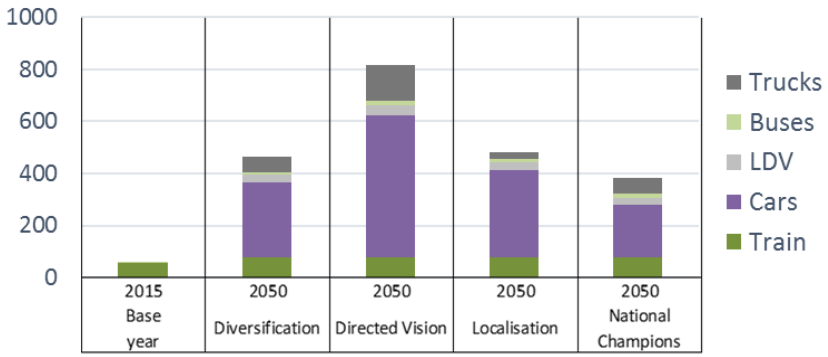
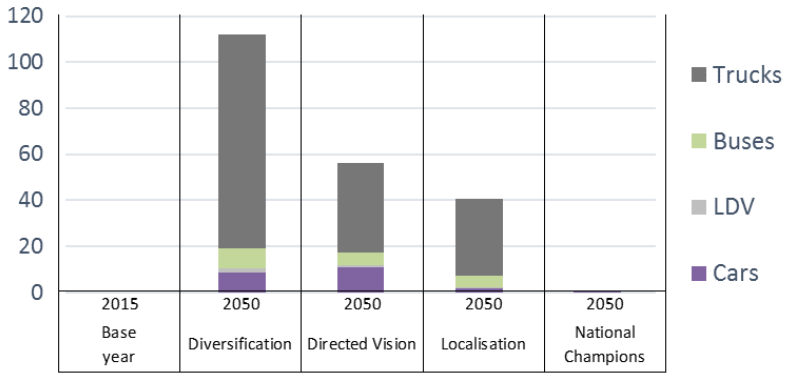
Annual consumption for EU28 in TWh

Electricity

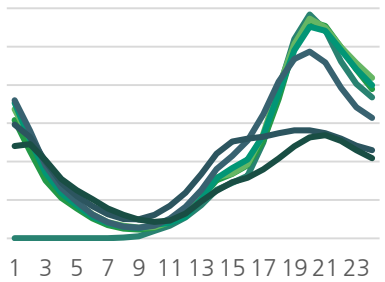


Hydrogen

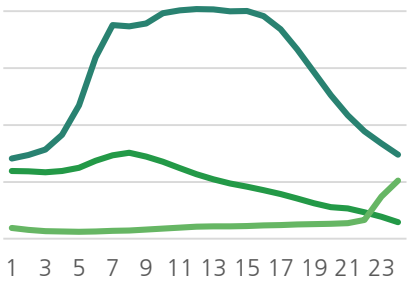


Flexibility potential and overall efficiency

BEV / PHEV



Trolley Trucks



FCEV

- Flexibility potential due to production in times of electricity oversupply and option for reconversion
- Lower overall efficiency

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Conclusions

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GHG reduction of - 65% is possible

- Decarbonizing transport by -65% is possible.
- Efficiency improvements contribute, but are by far not sufficient.
- Really strong measures are required to enable the transition, the sooner the better.

Several pathways exist, strategies have to be combined

Three main strategies have to be combined:

- Shift to more efficient transport modes (public transport and active modes for passengers, railway & ships for freight, multi-modal transport) important, but limited due to infrastructure capacity, additional efforts for logistics, behavior change required.
- Diffusion of low/zero-emission vehicles for road transport contributes substantially: BEV/PHEV soon competitive prices – range anxieties to be resolved, FCEV/Trolley trucks as options for freight to be further evaluated
- Alternative fuels play an important role, in particular for non-road modes – to be covered either by biomass or by synthetic PtX-fuels

All pathways require strong measures soon

- Research & discussions on the best policy & technology mix is required, overall efficiency, financial, social & ecological impacts to be considered
- Investments for infrastructure & production capacities needed
- Trigger transition with technology-independent measures first

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Thank you!

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Results: Fleet Composition

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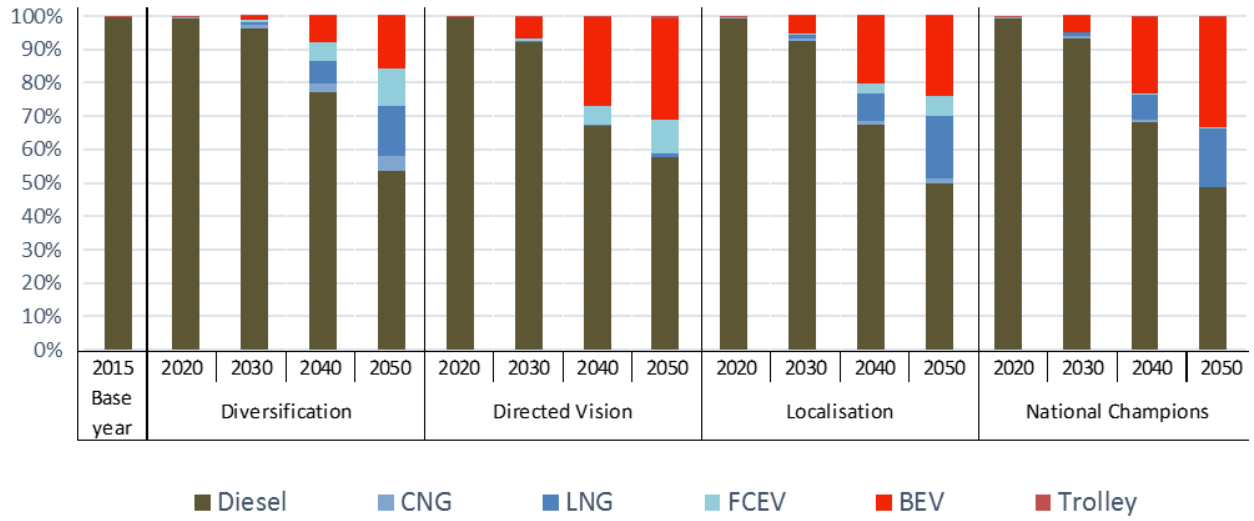
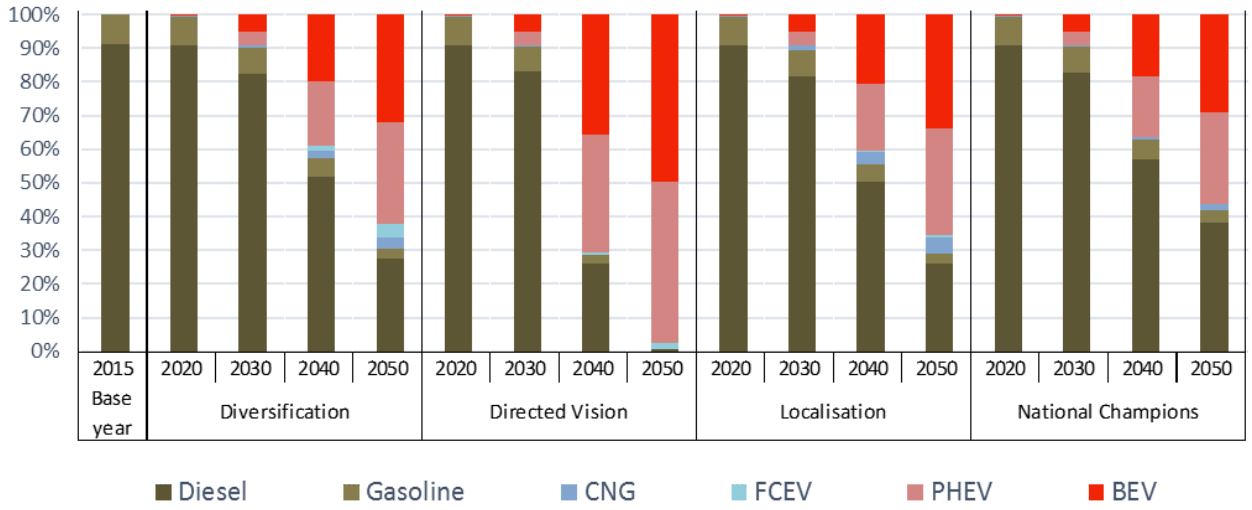
BUSES



LDV



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Results: Modal Shift & Activity

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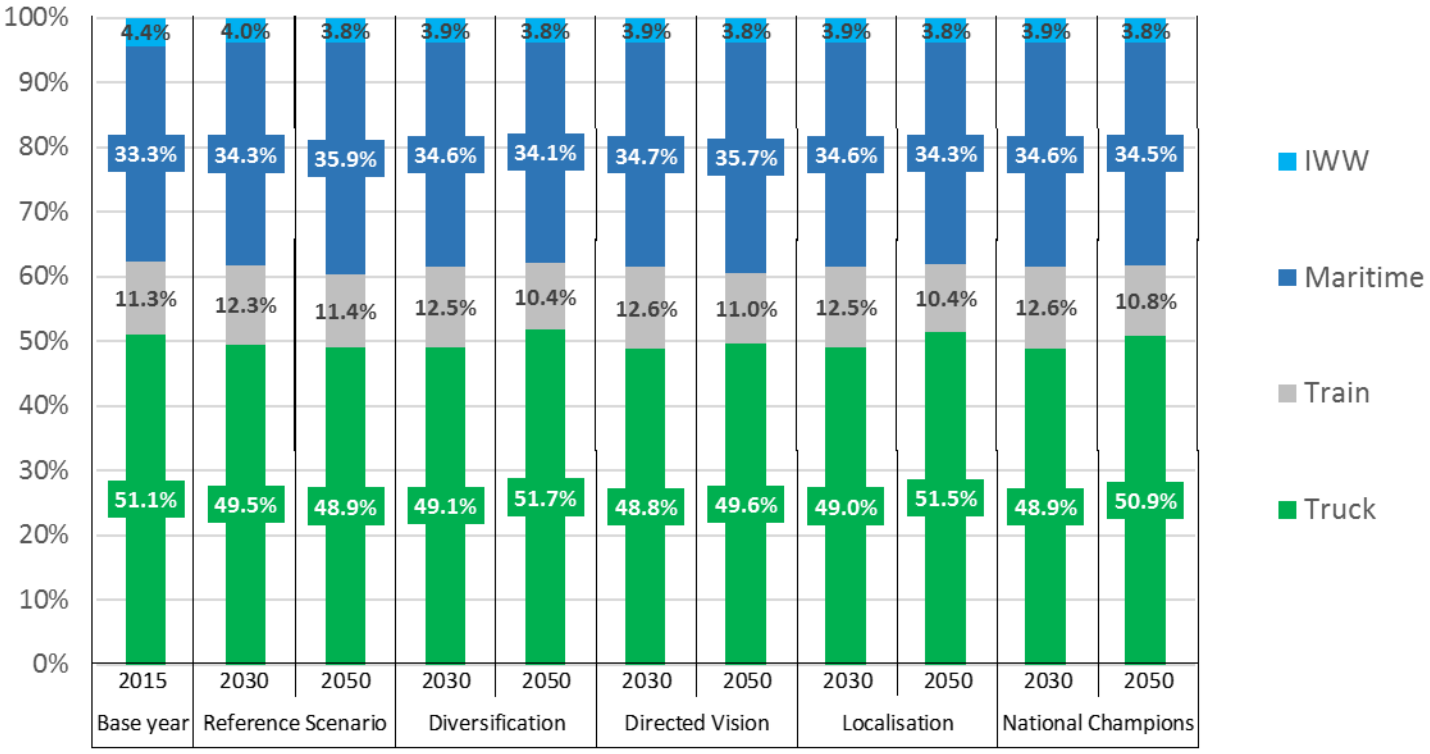
Freight land transport

Modal split based on tkm origin country



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