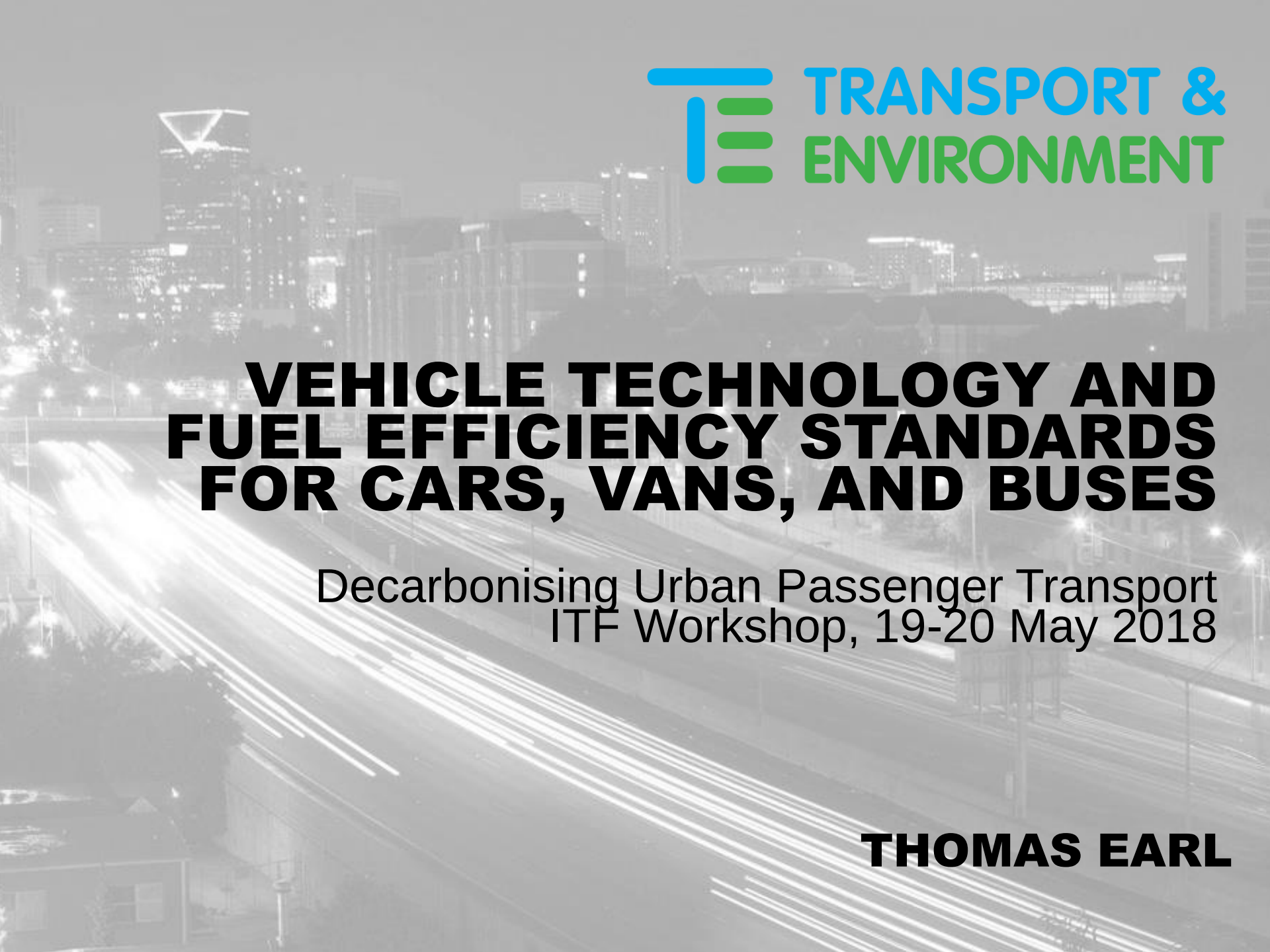


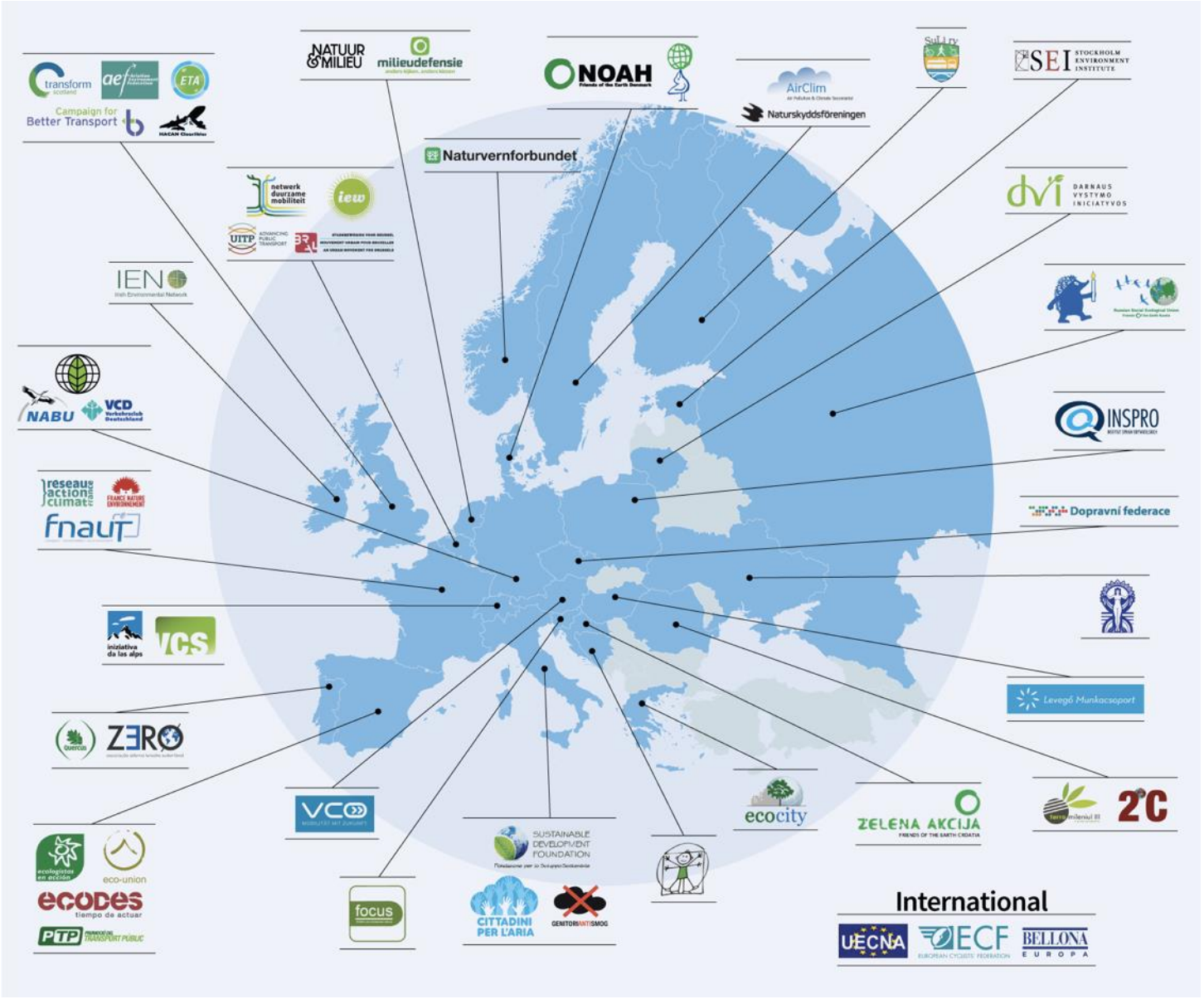
TRANSPORT & ENVIRONMENT

VEHICLE TECHNOLOGY AND FUEL EFFICIENCY STANDARDS FOR CARS, VANS, AND BUSES

Decarbonising Urban Passenger Transport
ITF Workshop, 19-20 May 2018

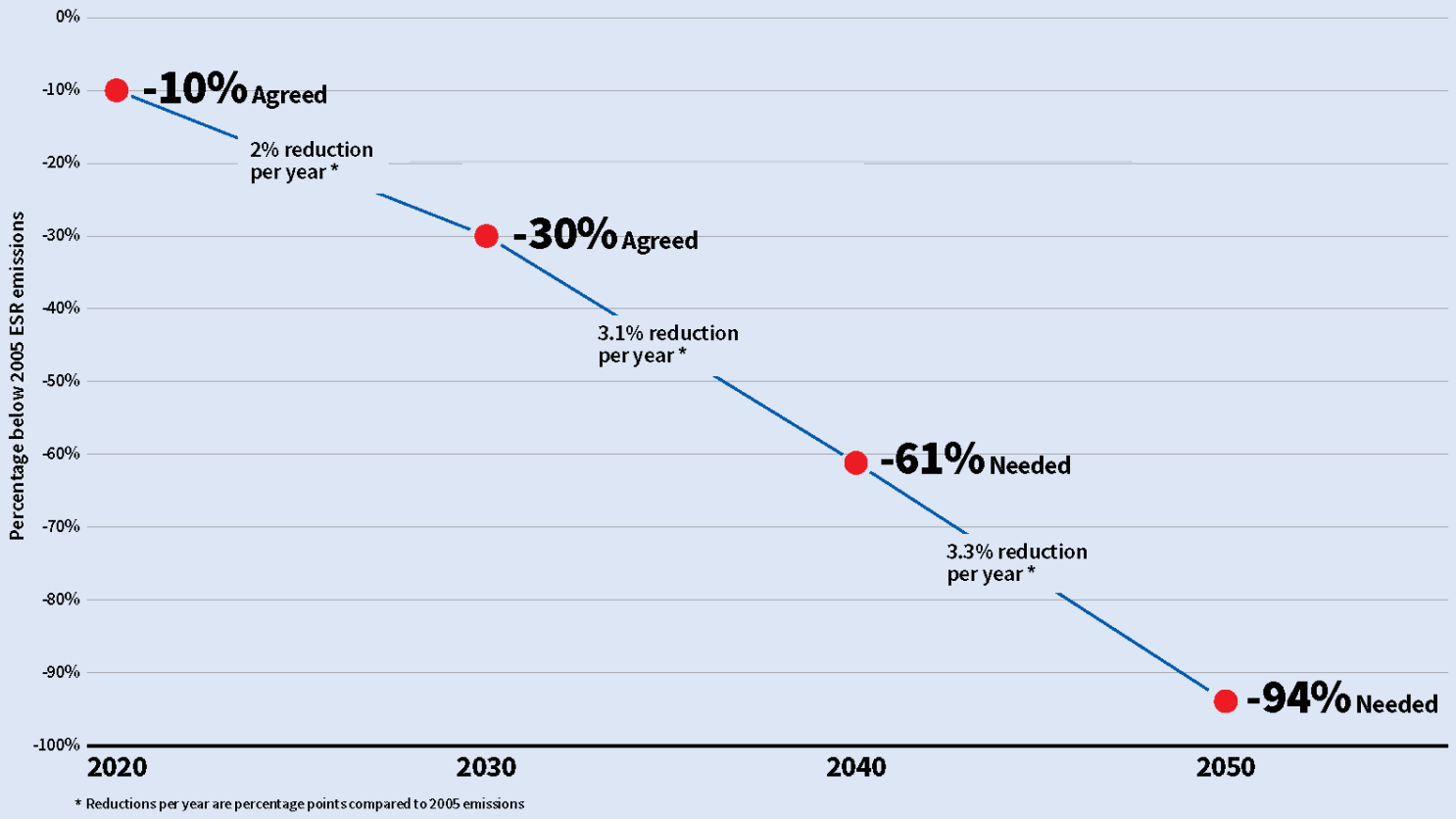
THOMAS EARL

T&E: 26 COUNTRIES, 53 MEMBERS



TRANSPORT EMISSIONS NEED TO BE ZERO IN 2050

ESR targets needed in 2040 and 2050



* Reductions per year are percentage points compared to 2005 emissions

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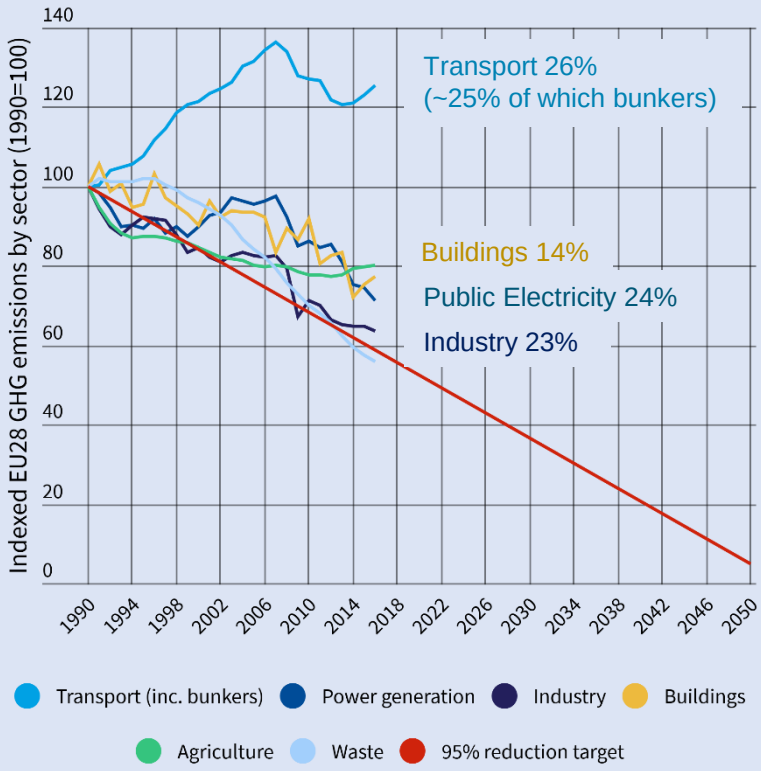
Source: Öko-Institut e.V., 2016 Targets for the non-ETS sectors in 2040 and 2050

ROAD TRANSPORT ACCOUNTS FOR MORE THAN 1/3 OF ESR EMISSIONS

Off track: Transport taking wrong turn to reach EU climate targets



Data source: 1990-2015: Member State reporting to the UNFCCC; 2016: EEA Approximated EU greenhouse gas inventory

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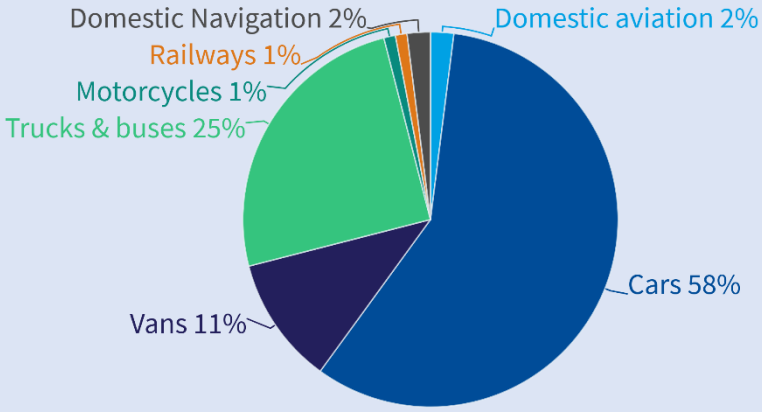
EU transport emission shares in 2015



Data source: Member State reporting to UNFCCC. Transport (excl bunkers) 899 Mt CO2eq

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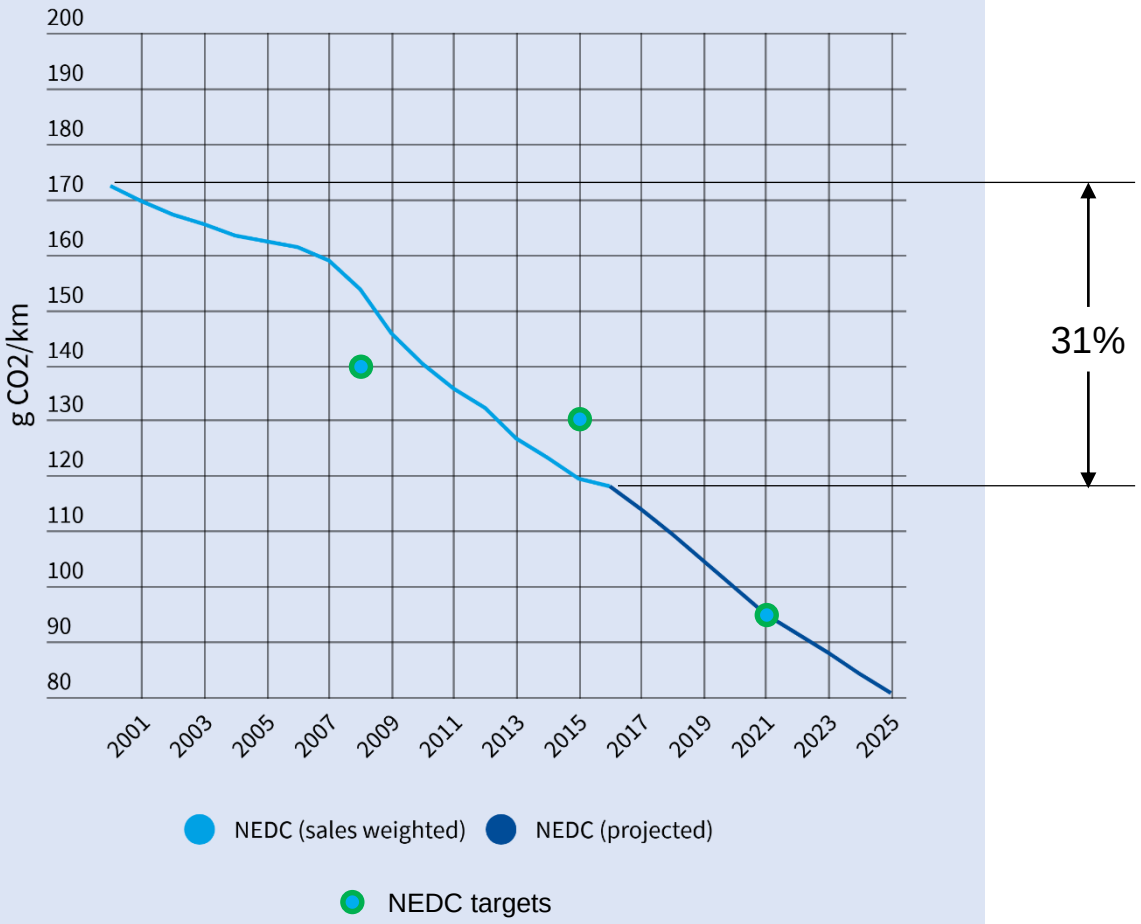
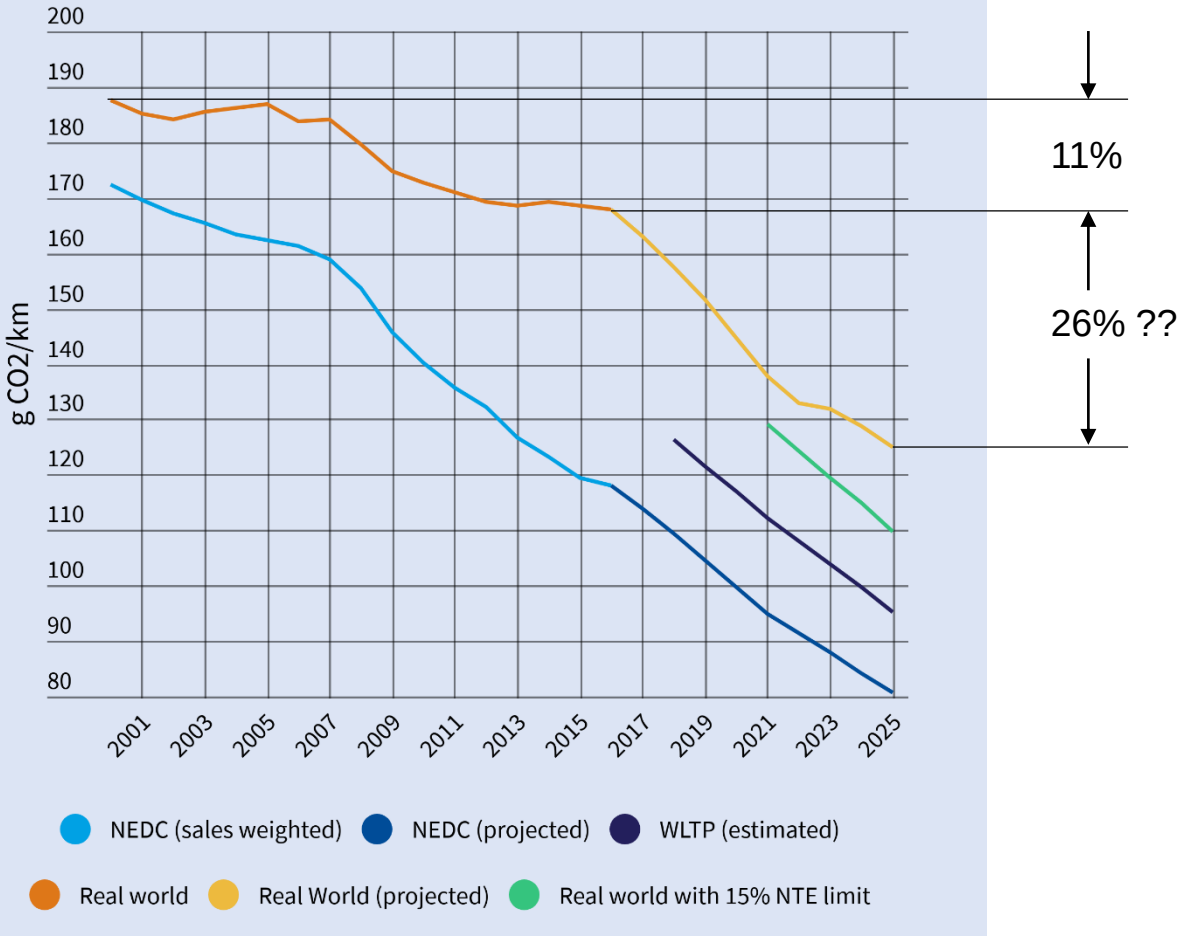
FUEL EFFICIENCY

Lab test emissions and projections



FUEL EFFICIENCY

Lab test and real world emissions projections

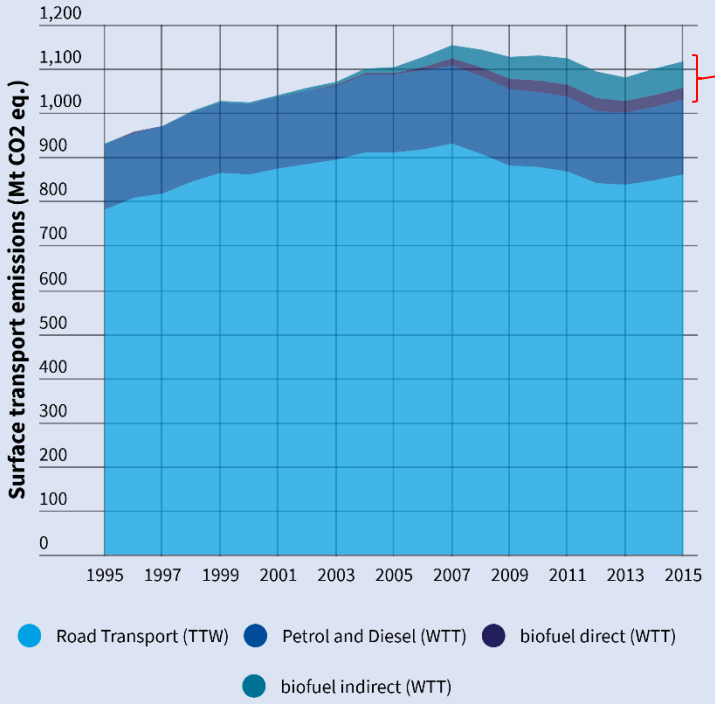


TECHNOLOGY AVAILABLE

	Fuel consumption and CO_2 reduction benefits[a]		Direct manufacturing cost (2015 $)[b]	
	U.S. EPA	ICCT	U.S. EPA	ICCT
Cylinder deactivation	3.5%-5.8%	No change	$75-$149	No change
Dynamic cylinder deactivation[c]	Not included	6.5%-8.3%	Not included	$138-$256
Direct injection[d]	1.5%	No change	$196-$356	$91-$185
Cooled exhaust gas recirculation	1.7%-5.3%	No change	$216	$95-$114
Advanced diesel	20.0%-25.2%	No change	$2,104-$2,950	$1,491-$2,096
E-boost	Not included	5.0%	Not included	$338
Mild hybrid (48-volt)	7.0%-9.5%	10.5%-12.9%	$580	No change
High compression ratio[e]	3.4%-7.7%	10.1%-14.1%	Varies	Varies
Miller cycle[f]	12.4%-20.3%	No change	Varies	$93-$222 lower
Plug-in hybrid electric vehicle[g]	65%-75%	No change	$5,534-$10,371	$3,564-$7,805
Battery electric vehicle[g]	71%-82%	No change	$5,131-$10,663	$2,410-$9,098
Mass reduction (20%)	11.2%-13.7%	11.6%-13.7%	$0.17-$1.15 per pound	No change

BIOFUELS?

Well-to-Wheel emissions in road transport in the EU



Source: Adapted by T&E from Member States' reporting to the UNFCCC and fuel consumption data from Eurostat

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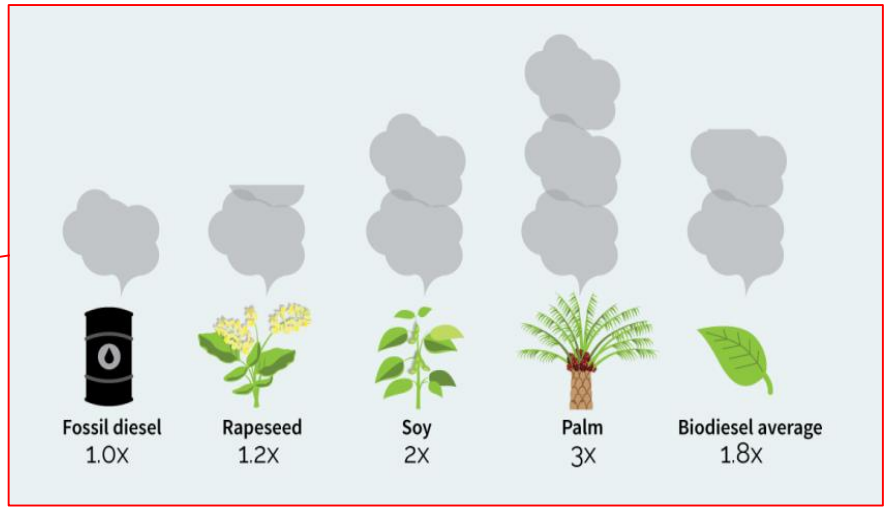
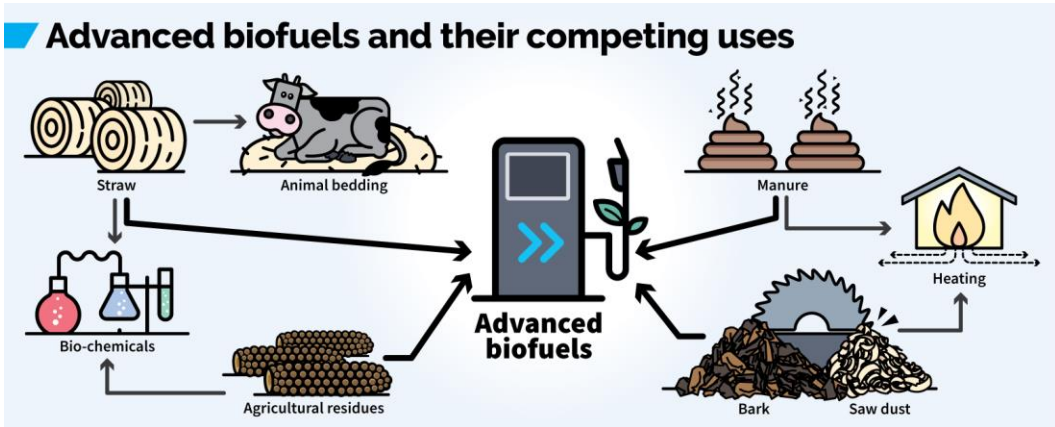


Advanced biofuels and their competing uses



GAS?

Natural gas vehicles: High costs, few benefits

vs.	Natural gas emissions		Natural gas costs	
	CO_2	NO_x	Operator costs	Societal cost
Diesel cars	Big increase	Small increase	€	€
Petrol cars	Big reduction	—	€	€
Vans	Small increase	Small reduction	€	€

Big increase · Small increase · Big reduction · Small reduction · No change · Big cost increase · Small cost increase

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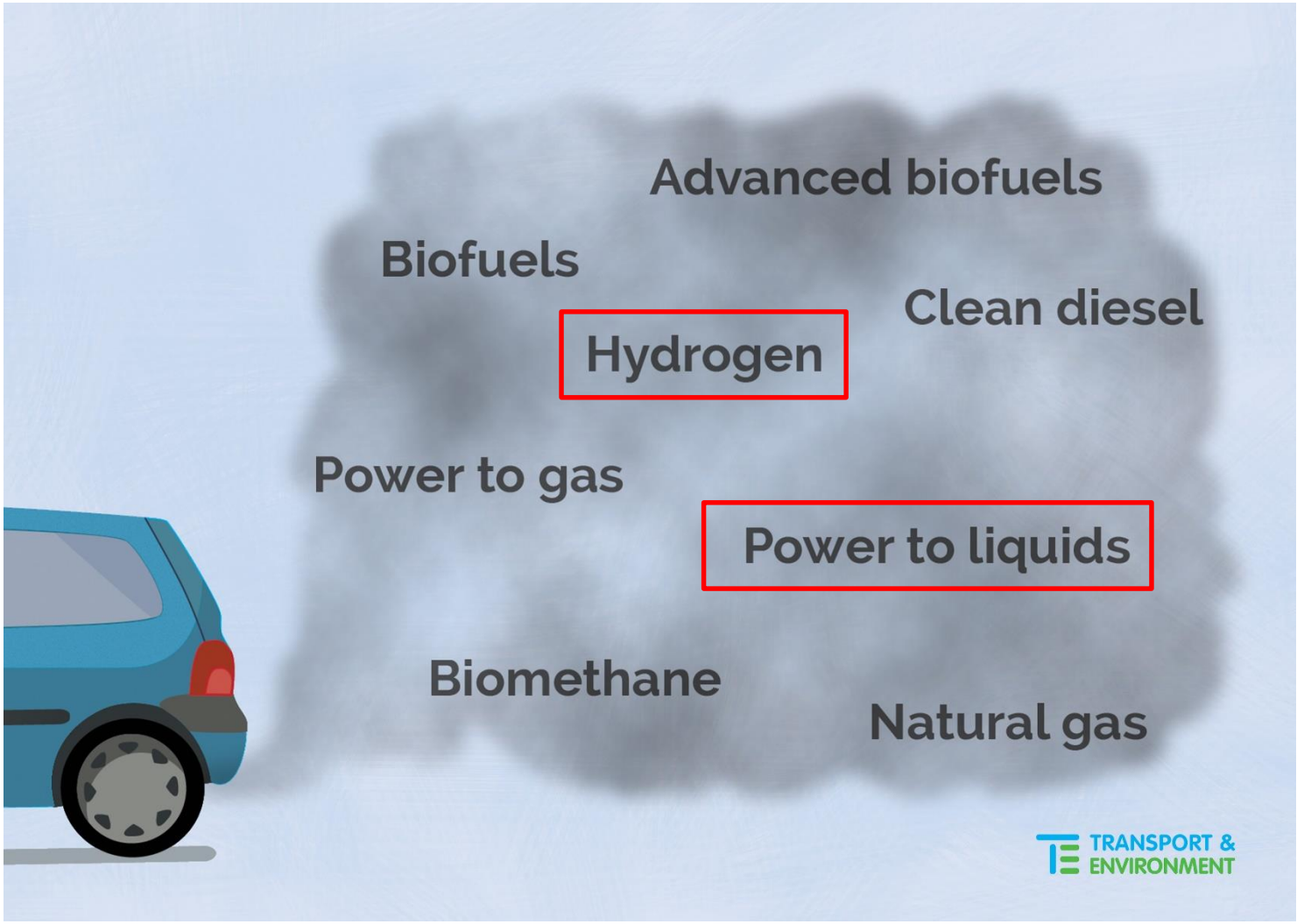
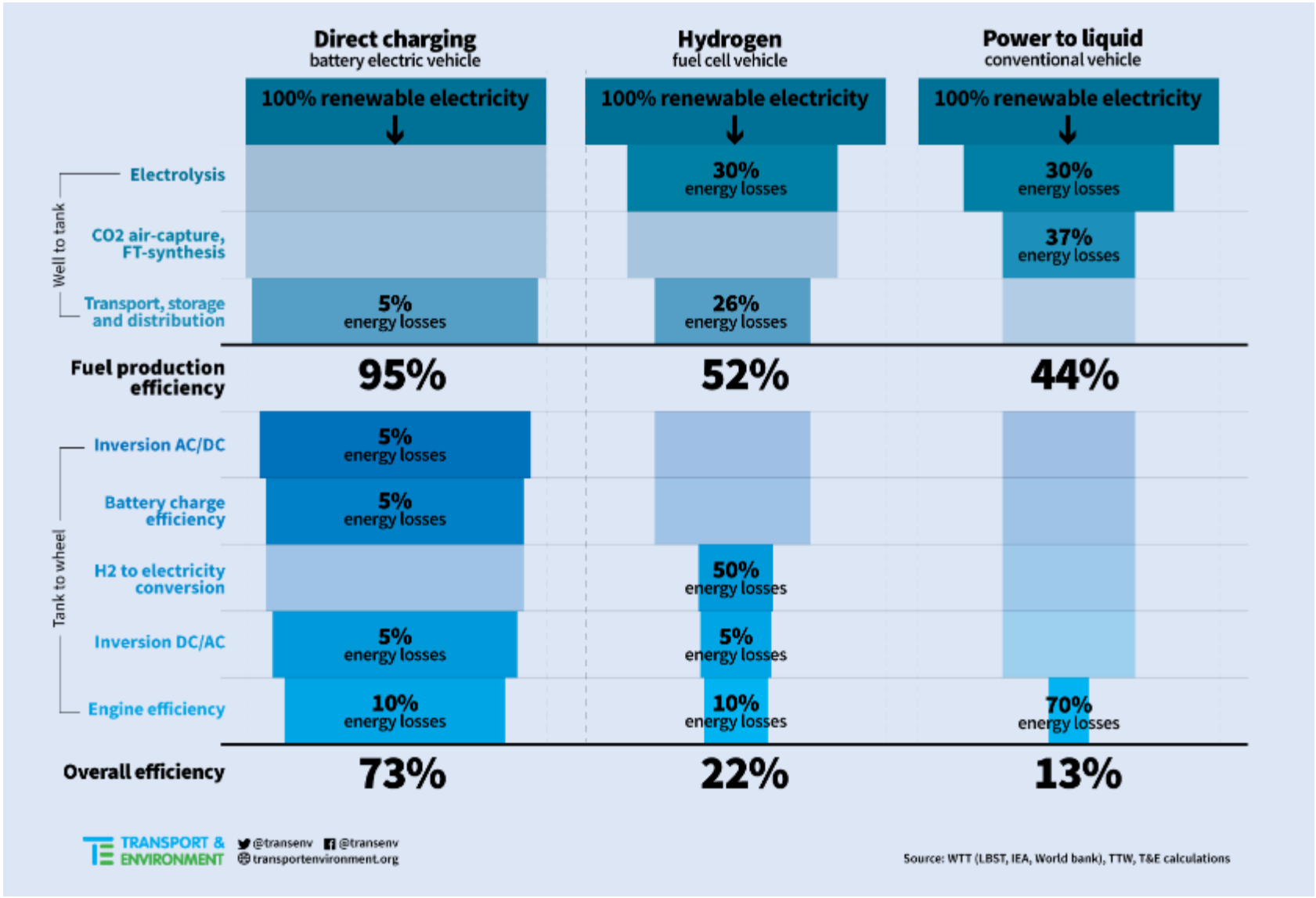
Source: Adapted from Ricardo Energy & Environment

ALTERNATIVES FOR THE INTERNAL COMBUSTION ENGINE

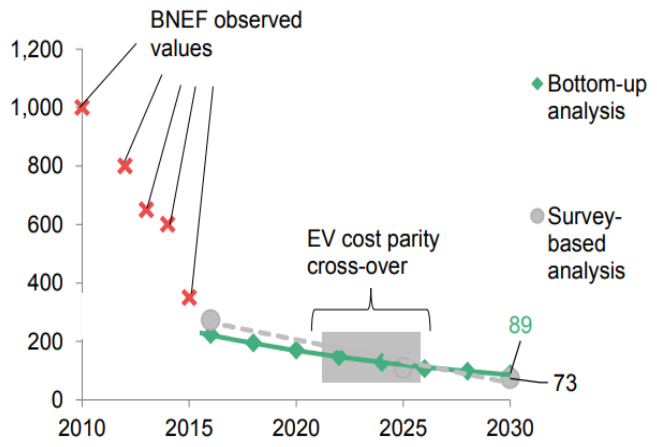


EFFICIENCY FIRST



E-MOBILITY IS THE SOLUTION

2010-30, ($/KWh)



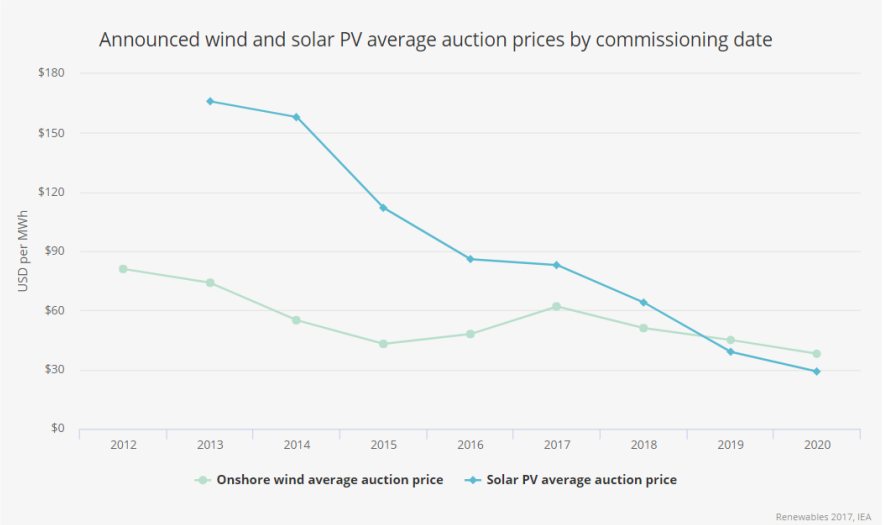
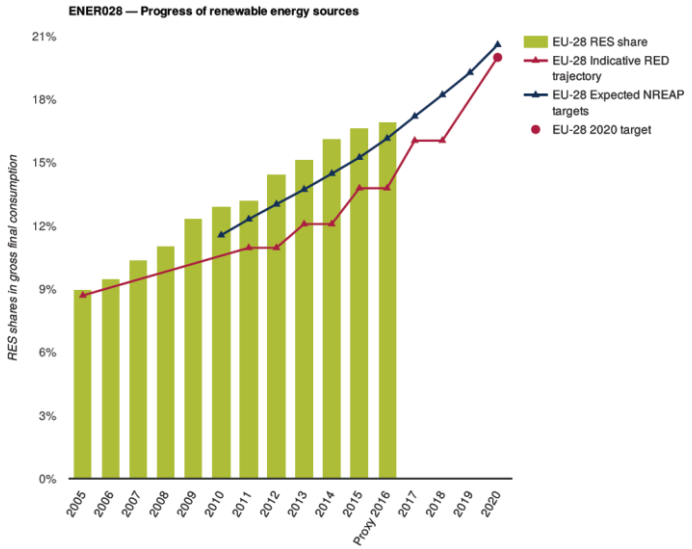
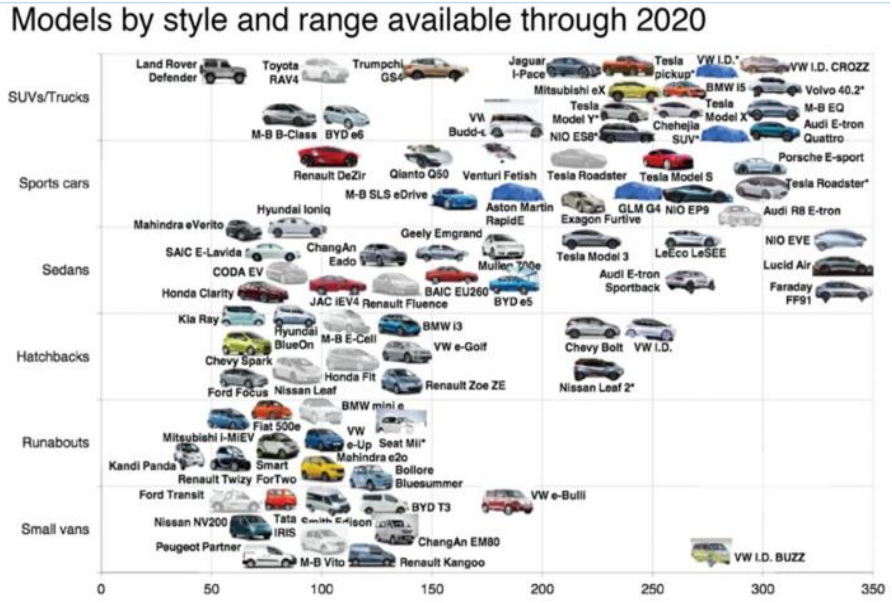
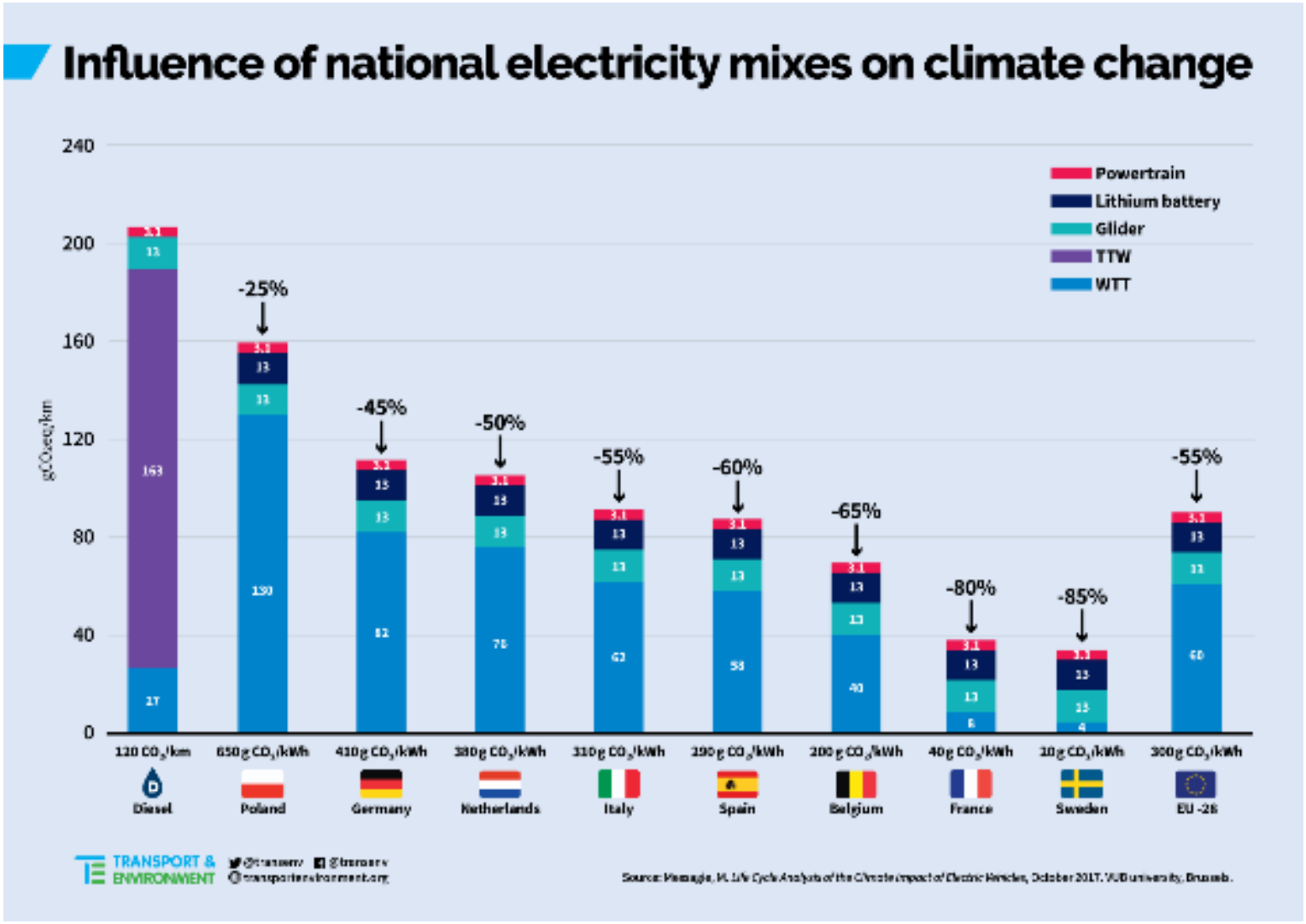


Fig. 1: Progress of renewable energy sources





LIFECYCLE ANALYSIS FOR ENVIRONMENTAL IMPACT

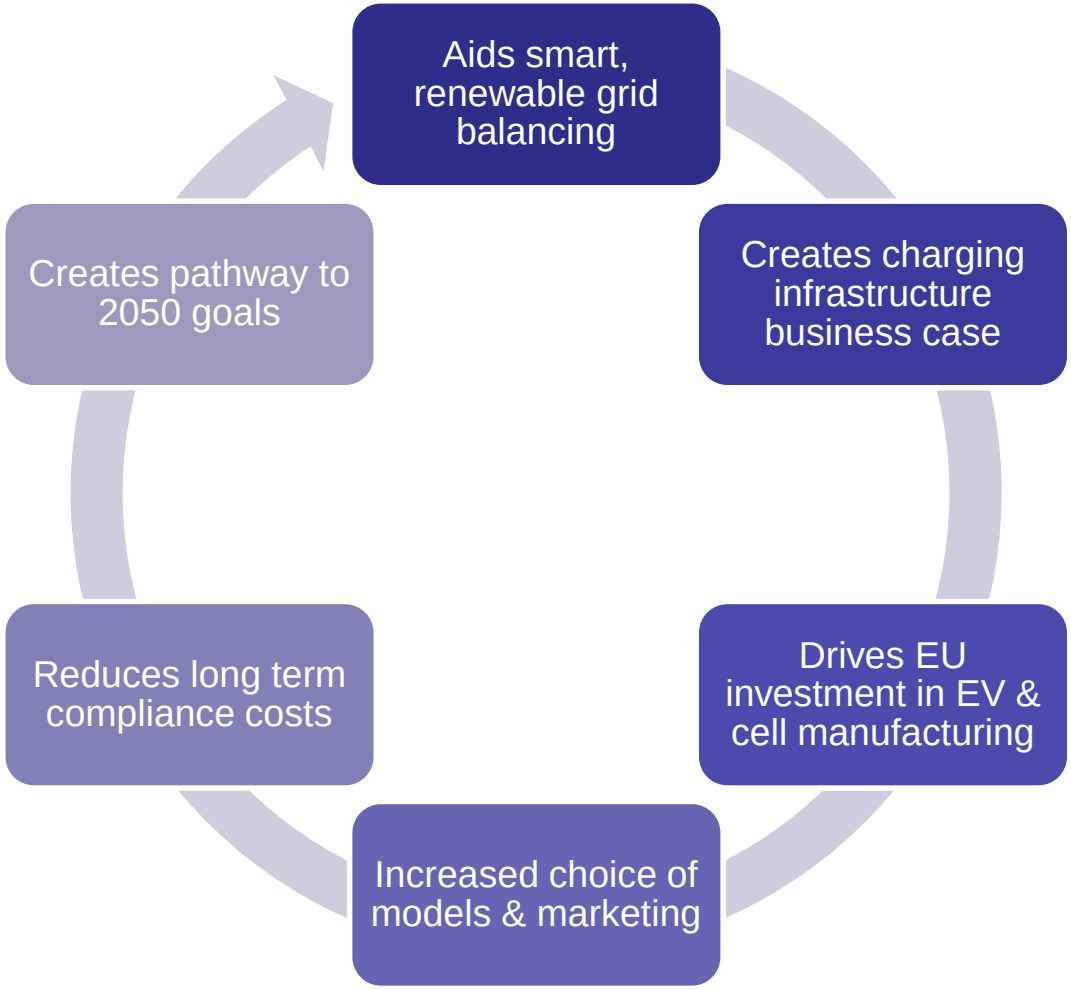


A SALES TARGET FOR ZERO AND LOW EMISSION VEHICLES

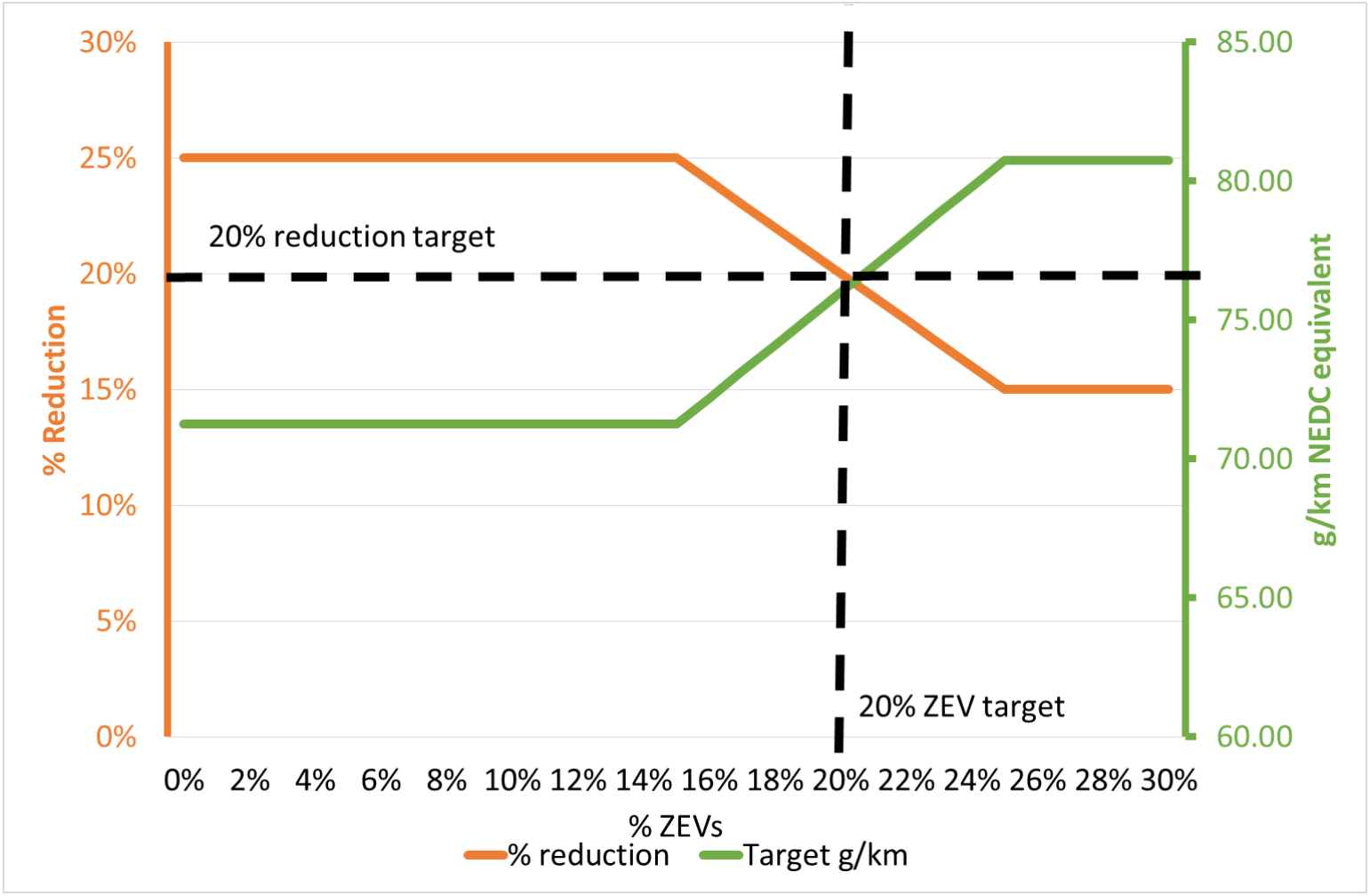
A ZLEV mandate

- 2025 target 20% ZLEV sales
- 2030 range 40-60% ZLEV to be reviewed in 2022
- 2035 goal 100% ZLEV sales

ZEV MANDATE IS WIN-WIN FOR EUROPE



ZLEV TWO-WAY ADJUSTMENT: FAIR EFFORT & SECURES INVESTMENT



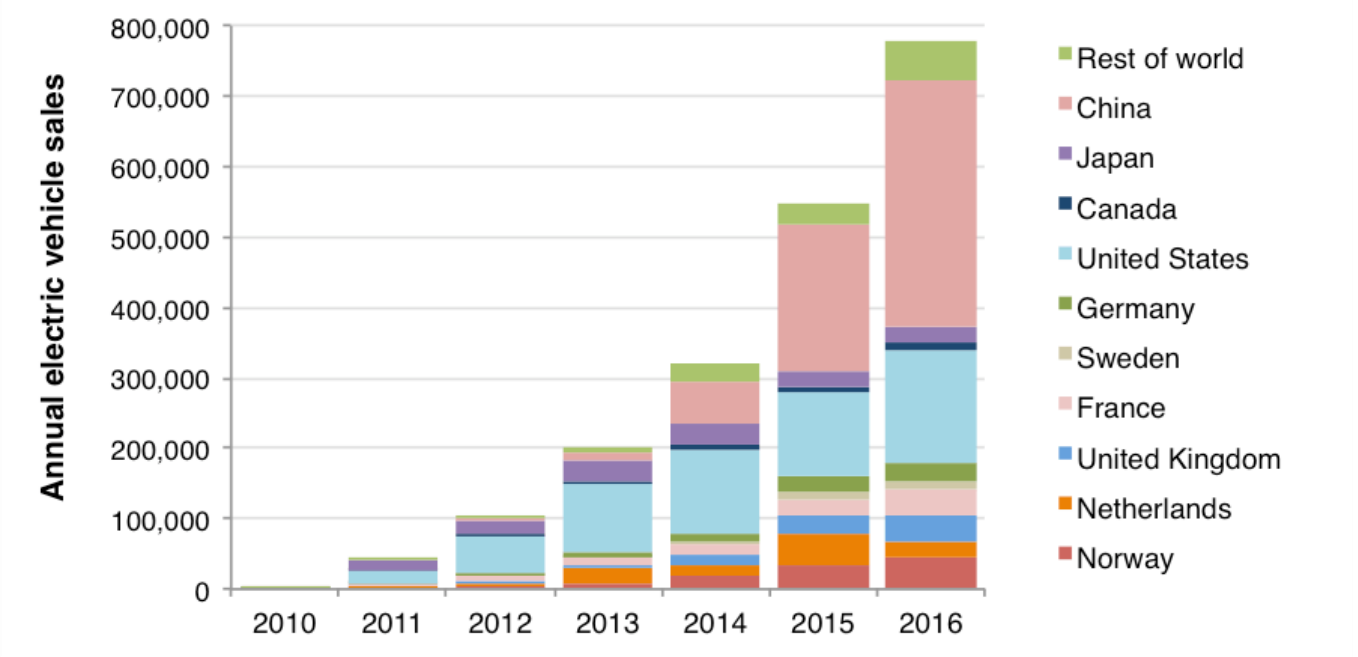
CASE STUDY OF EVS

- VAT exemptions
- Purchase tax exemptions
- Annual road tax exemptions
- Access to bus lanes (local incentive)
- Toll road charge exemptions
- Reduced tax for company e-cars

- Purchase premium of EUR 6,000
- Registration tax benefits
- Road tax exemptions
- Reduced tax for company e-cars
- Easy EV charge point installation

- Registration tax exemptions
- Road tax exemptions
- Reduced tax on company e-cars

- Purchase grant of EUR 4,000
- Ownership tax benefits
- Reduced tax on company e-cars
- Free parking
- Access to bus lanes



CONCLUSIONS ABOUT CARS

Cars are the largest source of emissions and they are on the rise

Fuel efficiency standards are crucial, but do not fully decarbonize

Gen I biofuels should be phased out

Alternative fuels have limited potential (availability, cost)

E-mobility is the most efficient, and costs are coming down

Policies are needed to increase early and fast adoption to meet Paris Agreement targets

APPENDIX

CURRENT EC PROPOSALS NOT IN-LINE WITH PARIS AGREEMENT

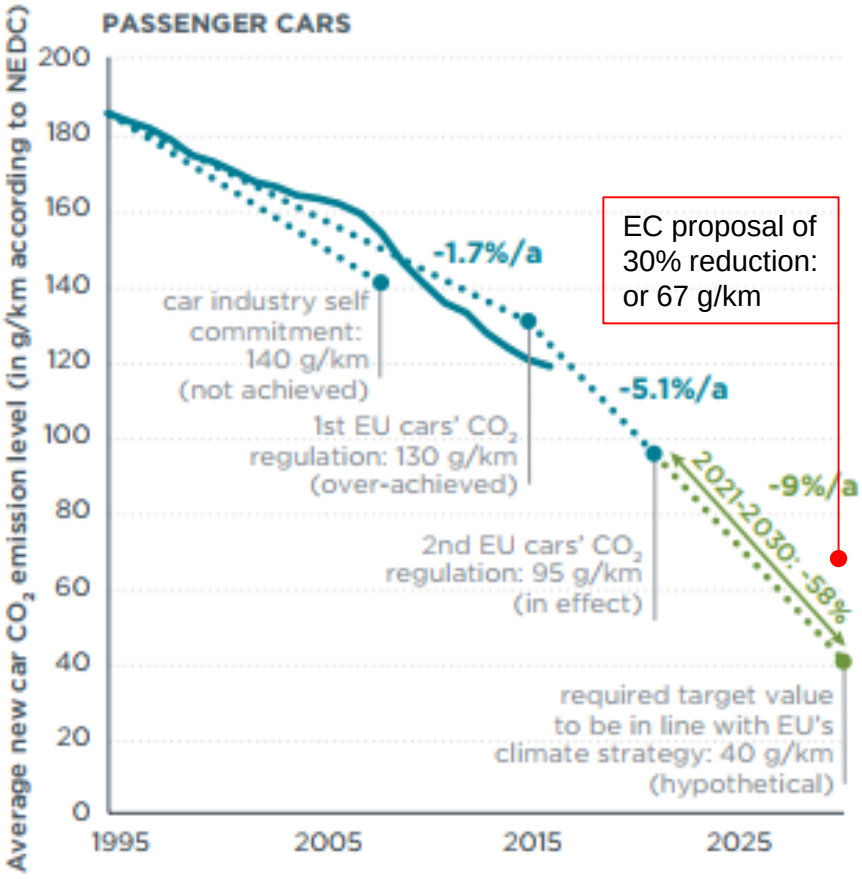


Figure 7. Historic development of average passenger car target CO_2 emission levels and required further development in the 2021-2030 time period to be in line with the EU's climate strategy.[17]

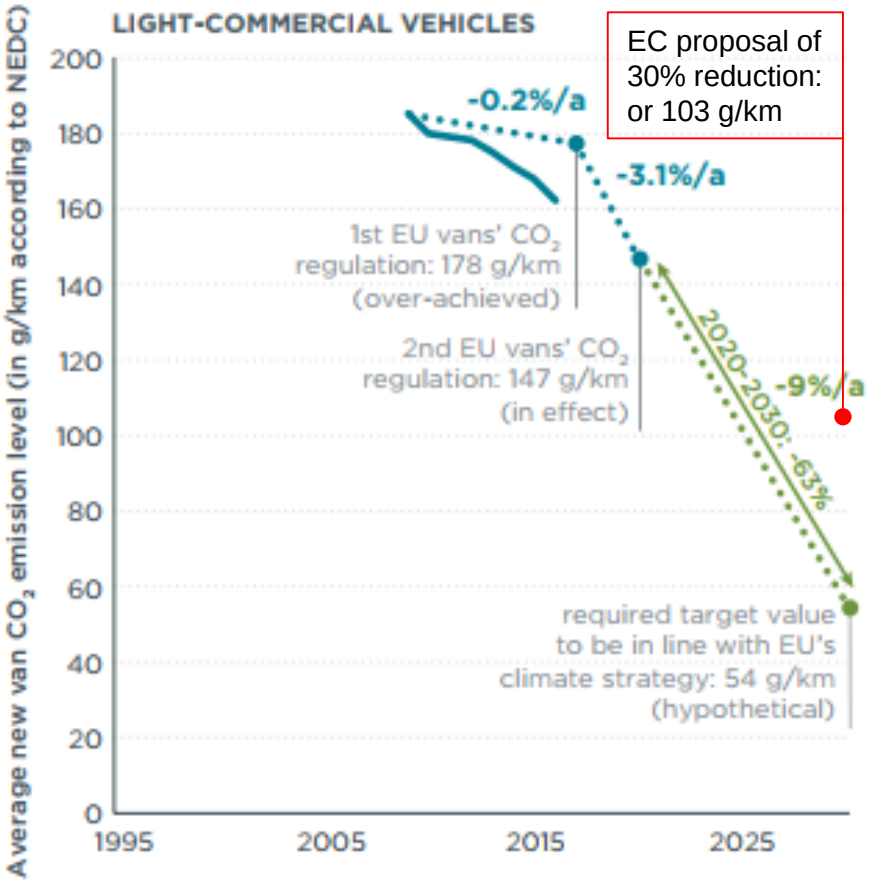
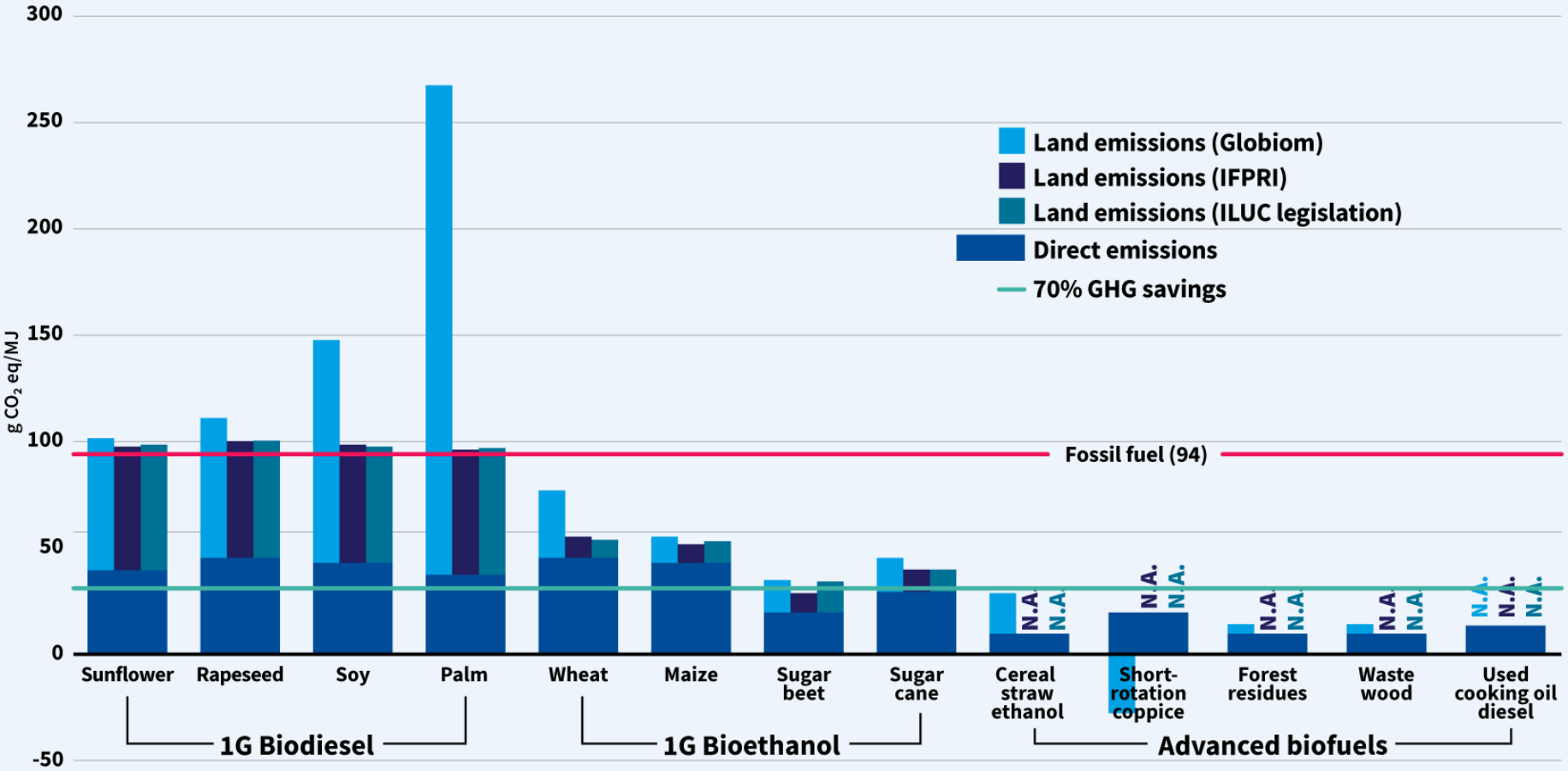


Figure 8. Historic development of average light-commercial vehicle target CO_2 emission levels and required further development in the 2020-2030 time period to be in line with the EU's climate strategy.

FLEXIBILITIES IN NEDC TESTING

Direct emissions plus land emissions



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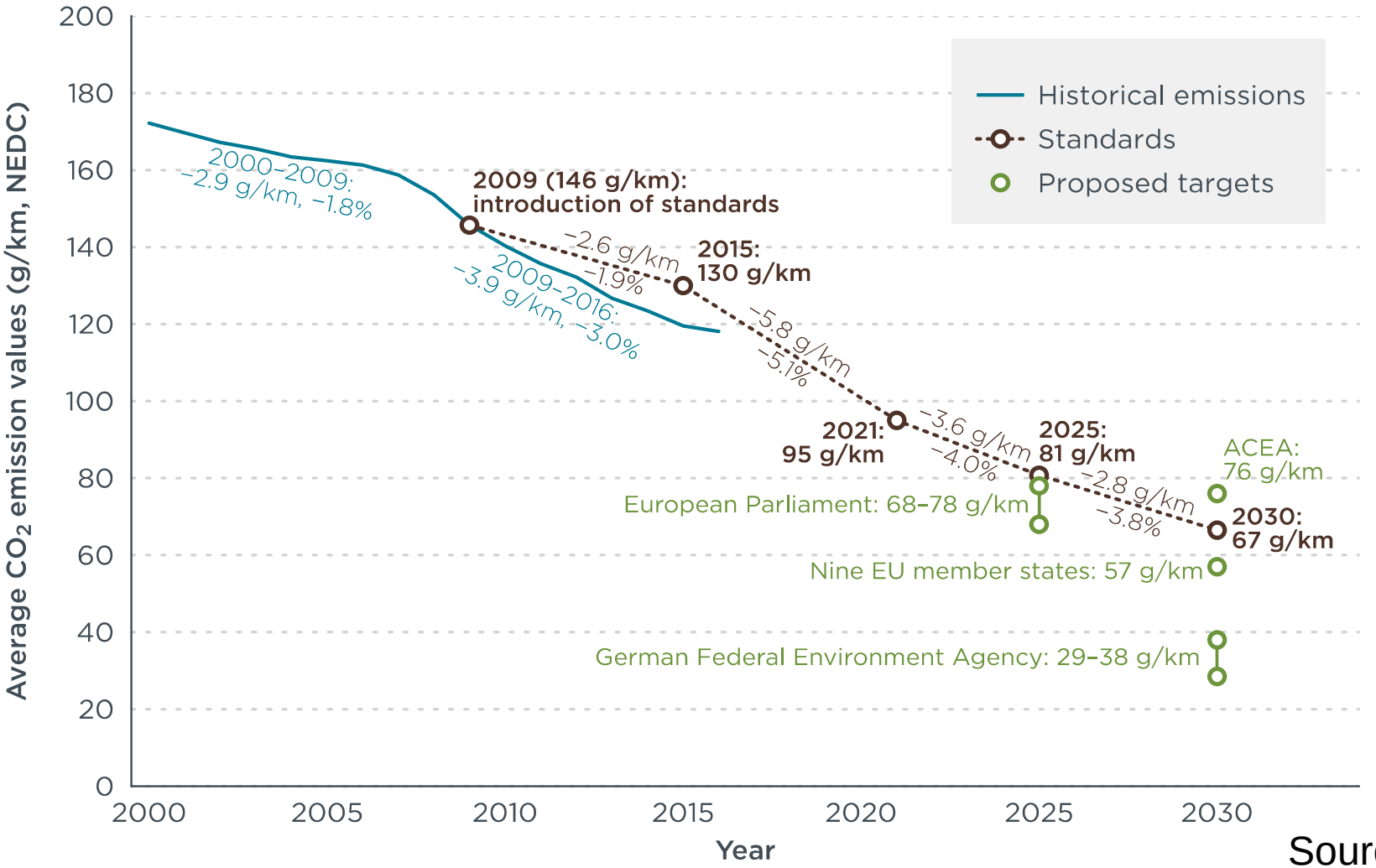
Source: RED II, ILUC directive, Globiom, IFPRI

PROPOSED CARS TARGETS ARE LESS AMBITIOUS THAN THE 2021 GOAL



Source: ICCT 2017

CASE STUDY OF EVS

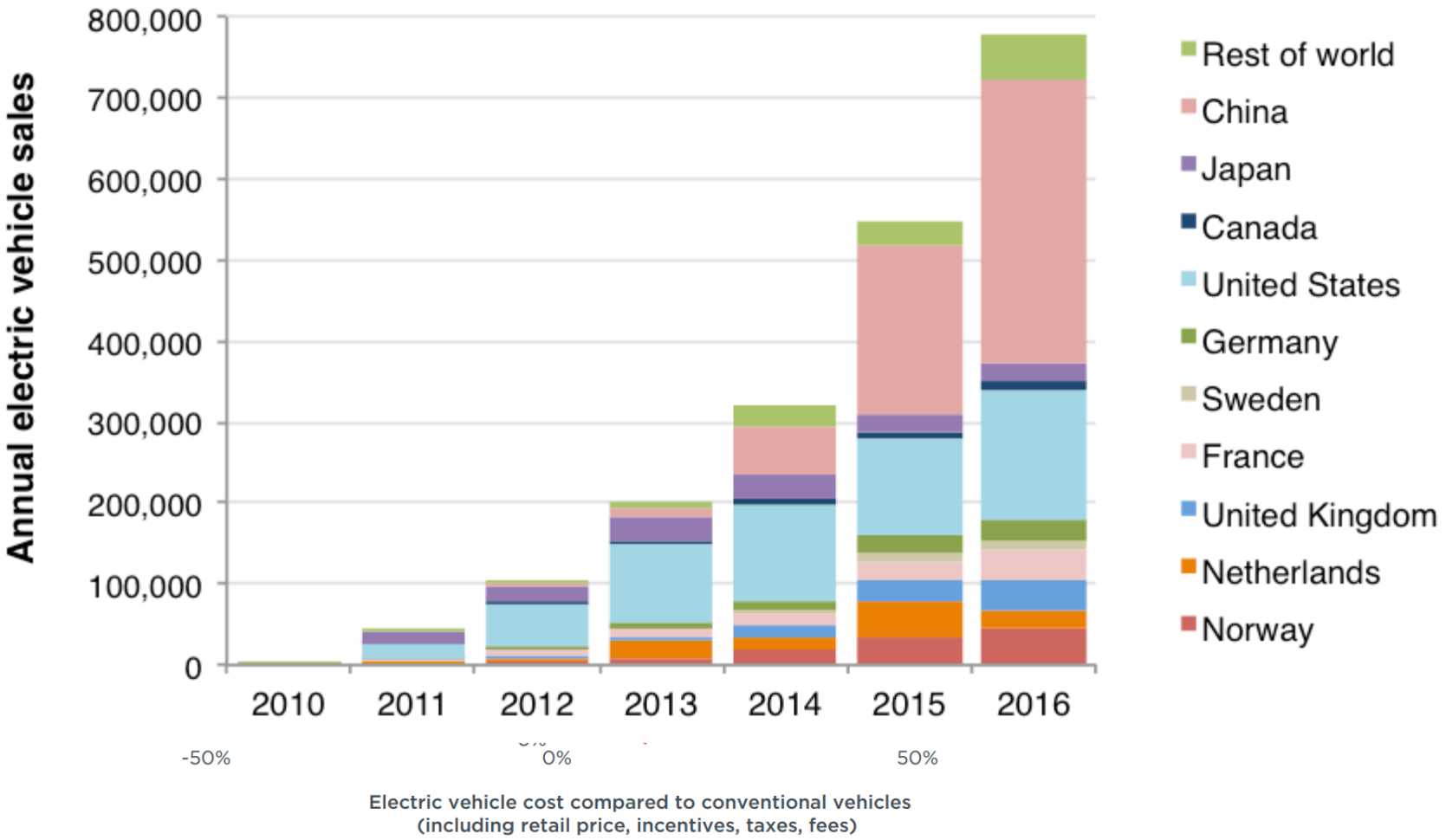


Figure 13. Electric vehicle share of new vehicle sales and average electric vehicle cost difference compared to conventional vehicles

GAS?

Natural gas vehicles: High costs, few benefits

vs.	Natural gas emissions		Natural gas costs	
	CO_2	NO_x	Operator costs	Societal cost
Diesel cars	●	○	€	€
Petrol cars	○	—	€	€
Vans	●	○	€	€
Small rigid trucks	●	—	€	€
Articulated trucks	●	—	€	€
Buses	●	—	€	€

● Big increase · ● Small increase · ○ Big reduction · ○ Small reduction · — No change · € Big cost increase · € Small cost increase

Source: Adapted from Ricardo Energy & Environment