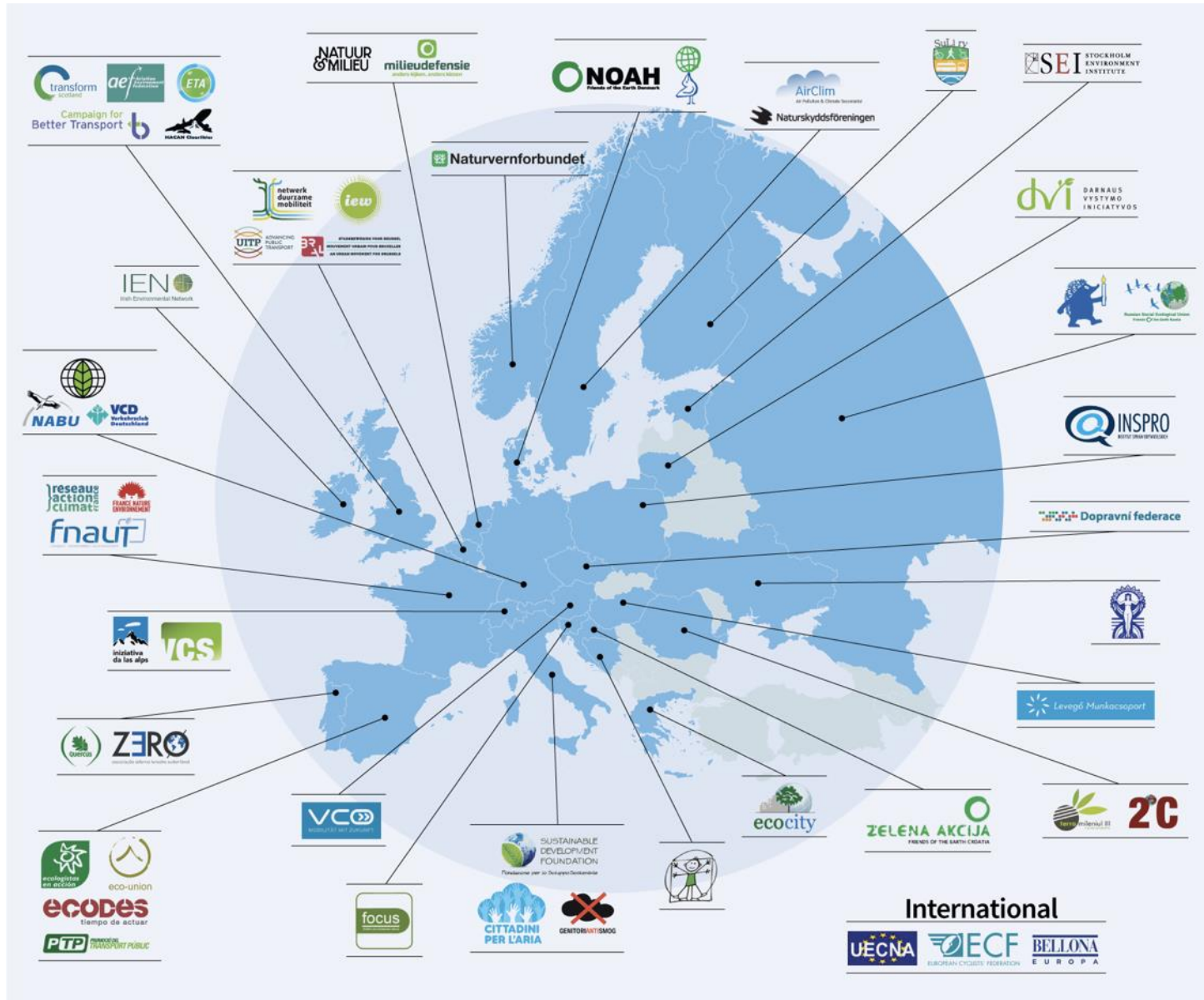


VEHICLE TECHNOLOGY AND FUEL EFFICIENCY STANDARDS FOR CARS, VANS, AND BUSES

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

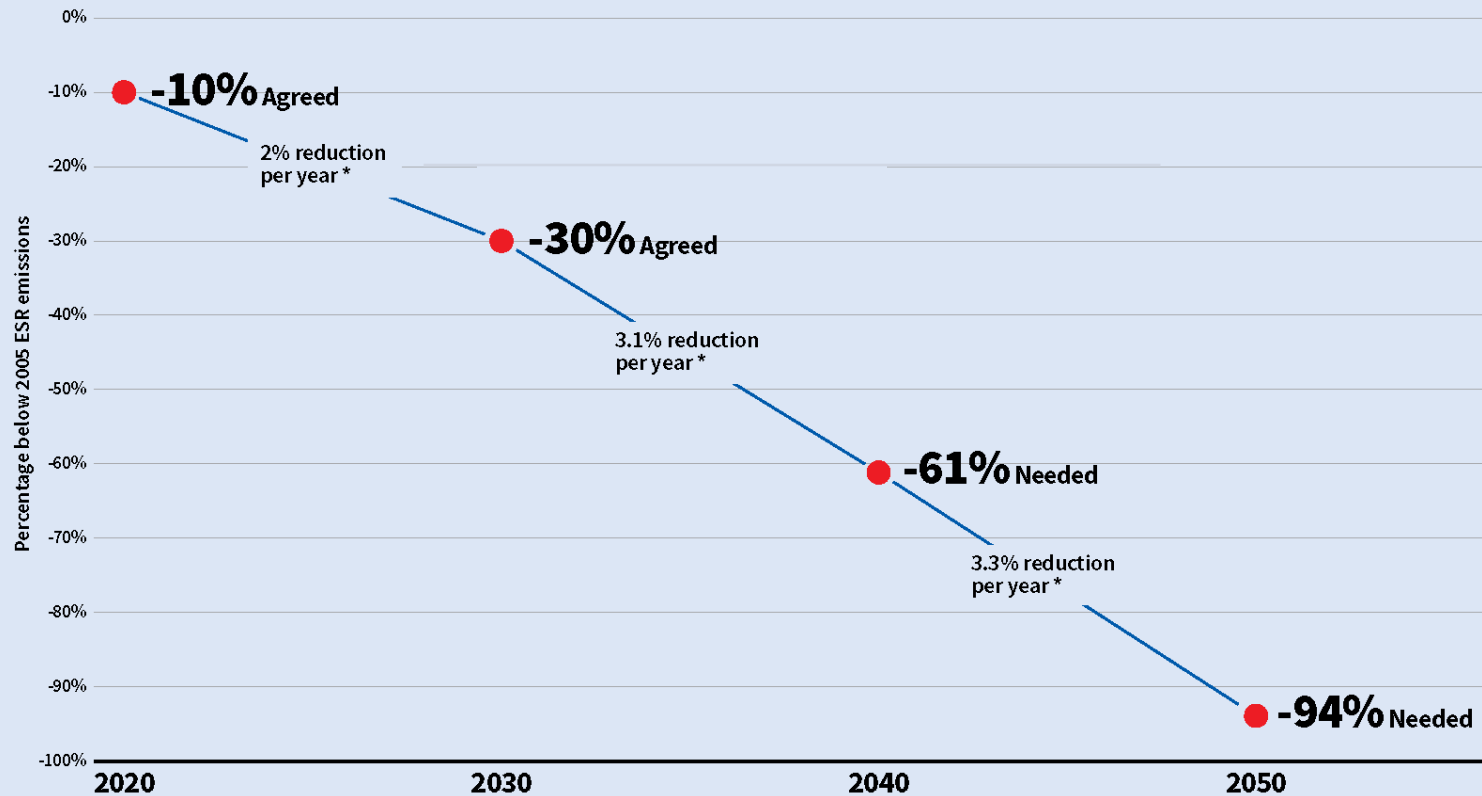
THOMAS EARL

T&E: 26 COUNTRIES, 53 MEMBERS



TRANSPORT EMISSIONS NEED TO BE ZERO IN 2050

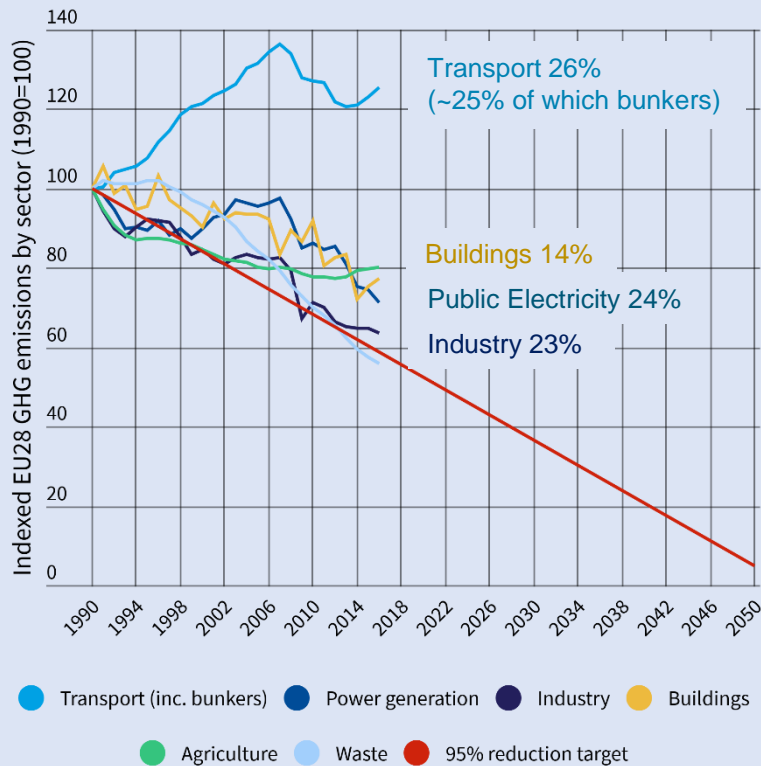
ESR targets needed in 2040 and 2050



* Reductions per year are percentage points compared to 2005 emissions

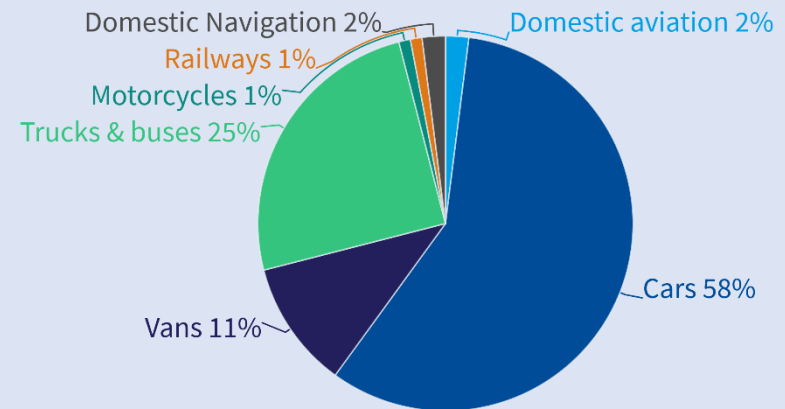
ROAD TRANSPORT ACCOUNTS FOR MORE THAN 1/3 OF ESR EMISSIONS

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.

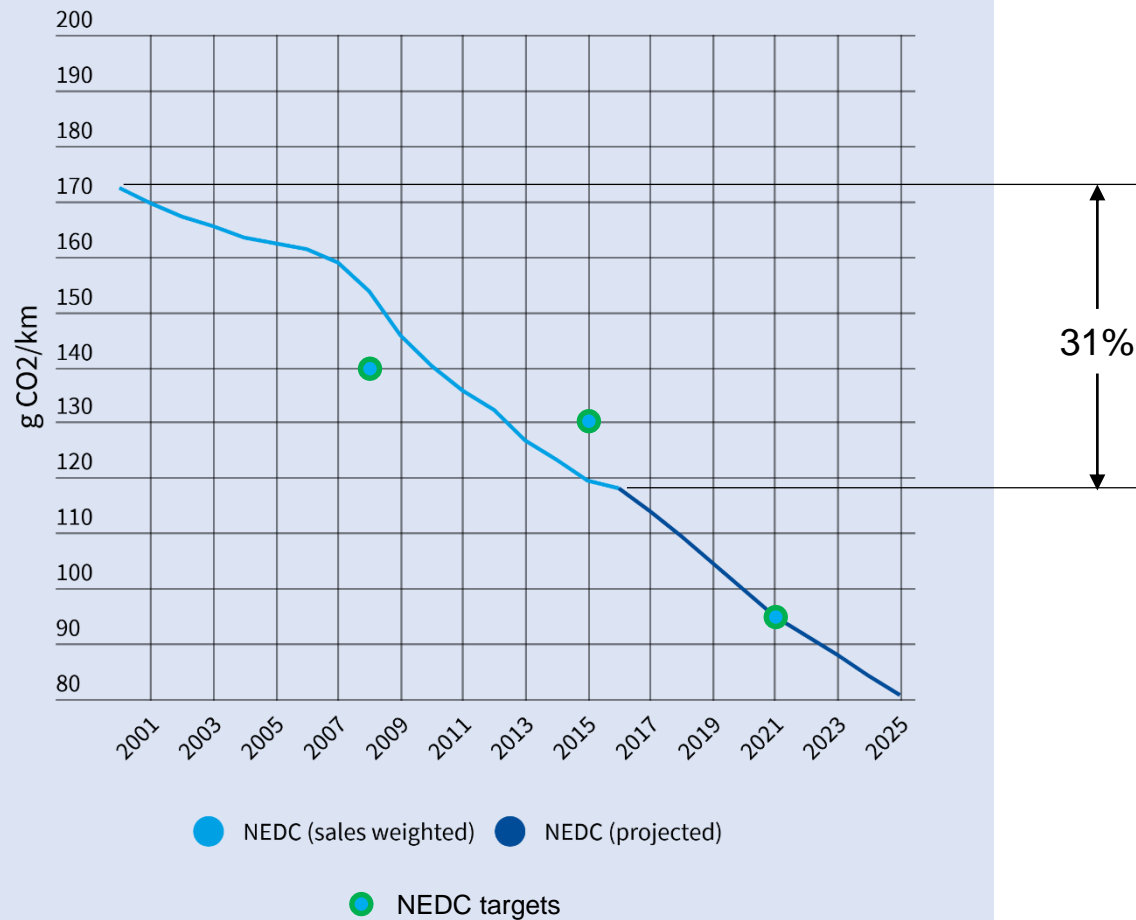
EU transport emission shares in 2015



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

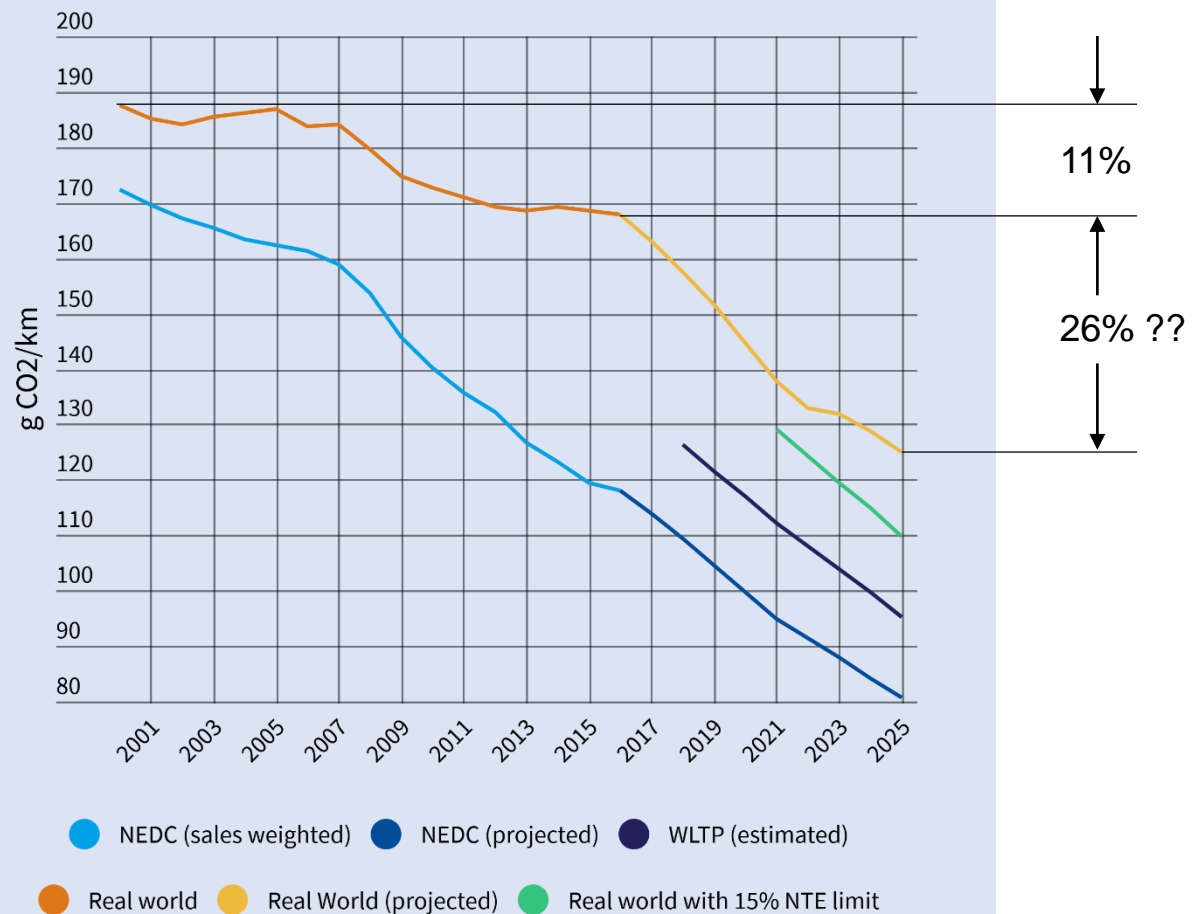
FUEL EFFICIENCY

Lab test emissions and projections



FUEL EFFICIENCY

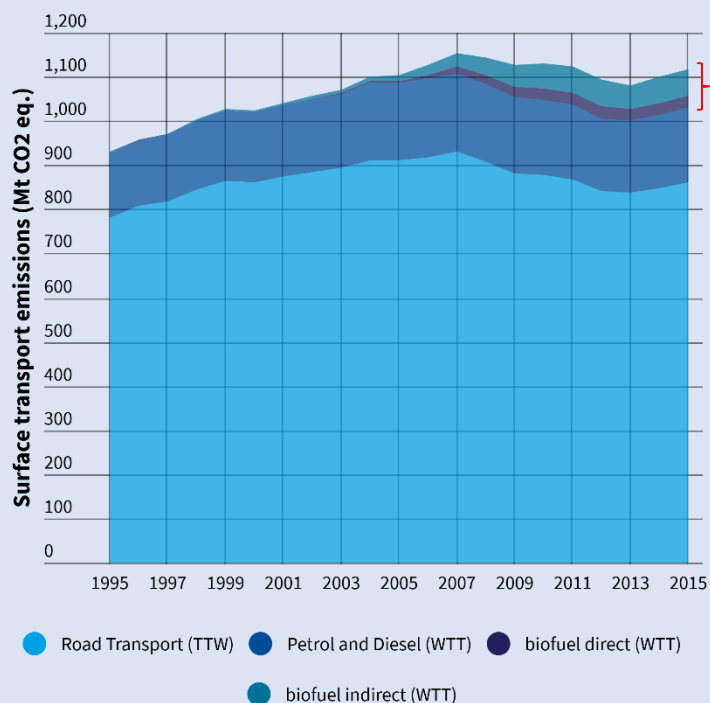
Lab test and real world emissions projections



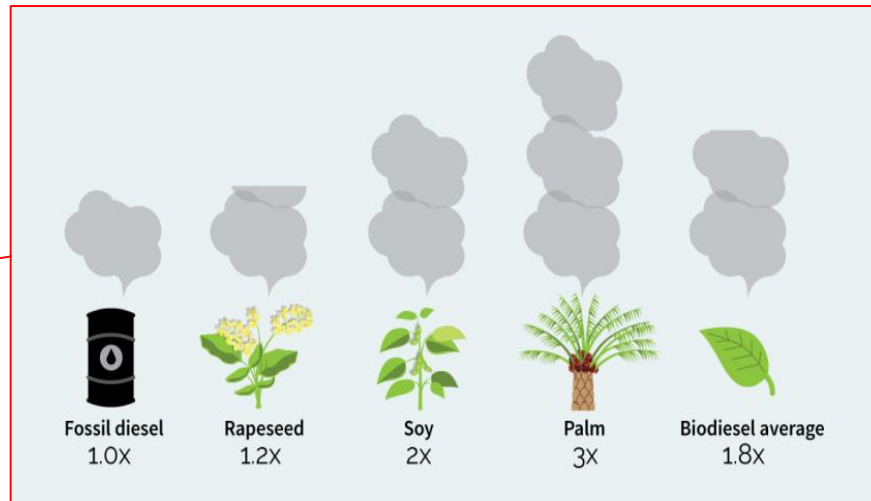
TECHNOLOGY AVAILABLE

	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

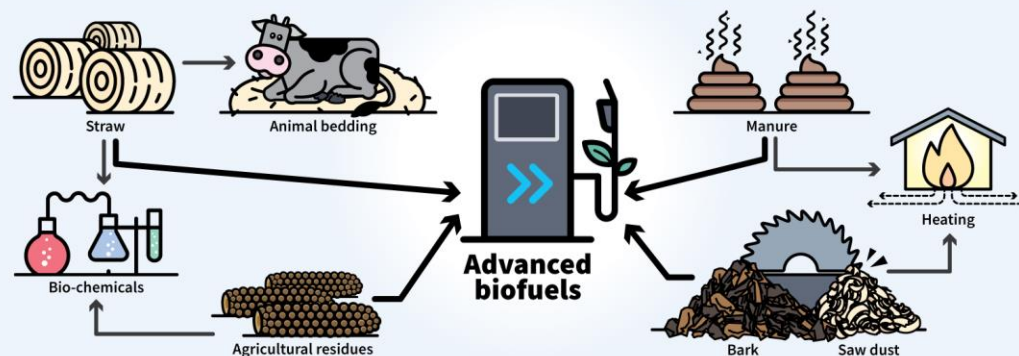
Well-to-Wheel emissions in road transport in the EU

















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

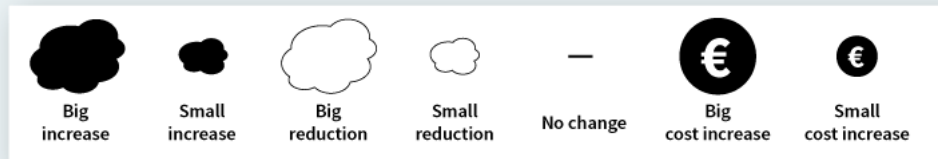


Advanced biofuels and their competing uses

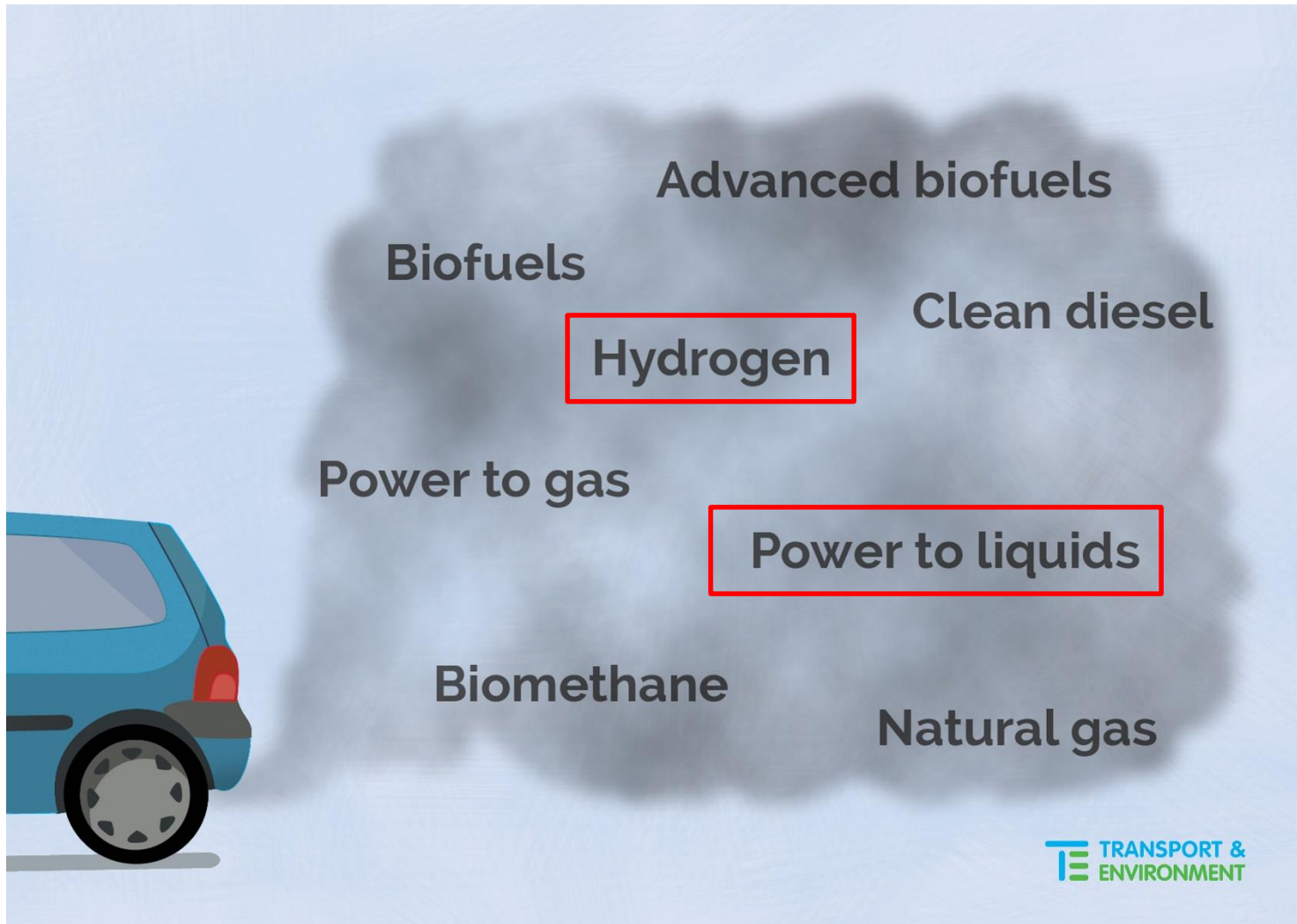


Natural gas vehicles: High costs, few benefits

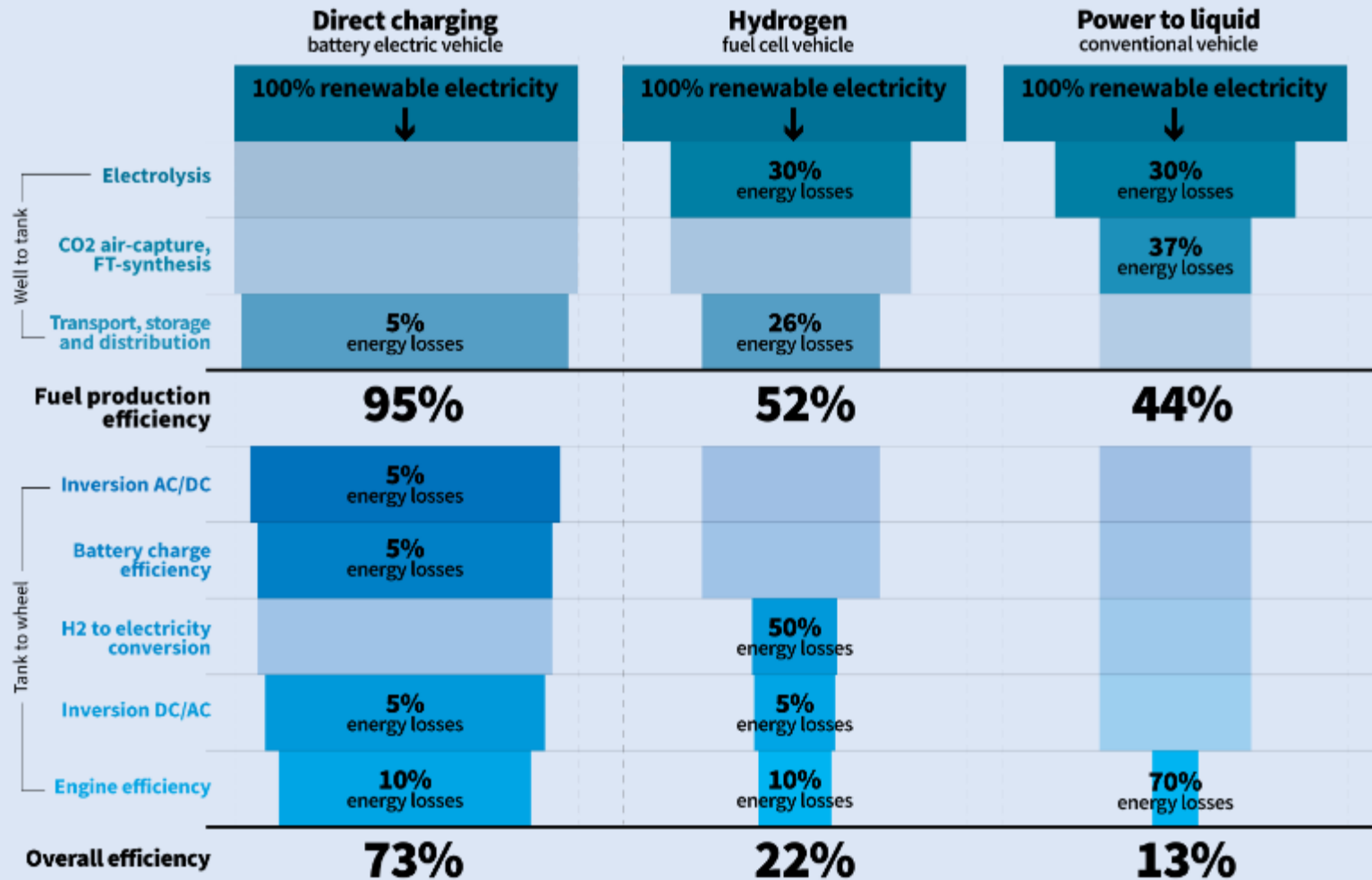
vs.	Natural gas emissions		Natural gas costs	
	CO ₂	NO _x	Operator costs	Societal cost
 Diesel cars				
 Petrol cars		—		
 Vans				



ALTERNATIVES FOR THE INTERNAL COMBUSTION ENGINE



EFFICIENCY FIRST



E-MOBILITY IS THE SOLUTION

2010-30, (\$/KWh)

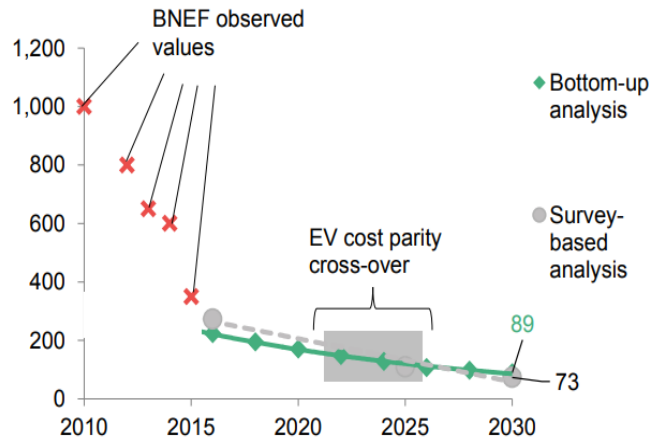
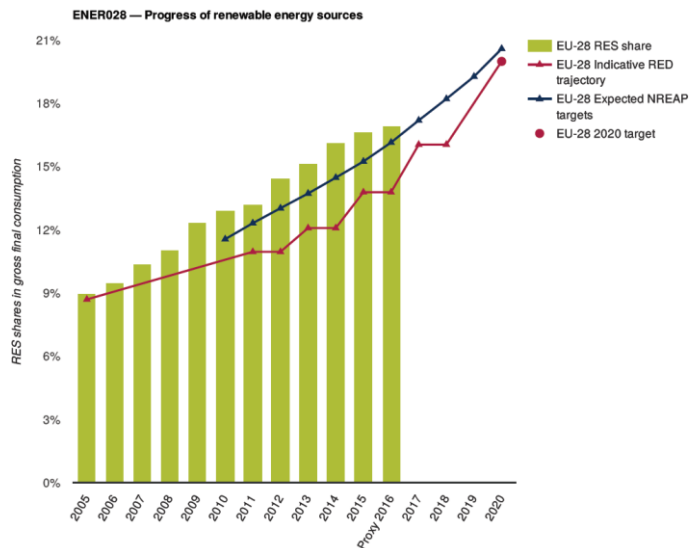
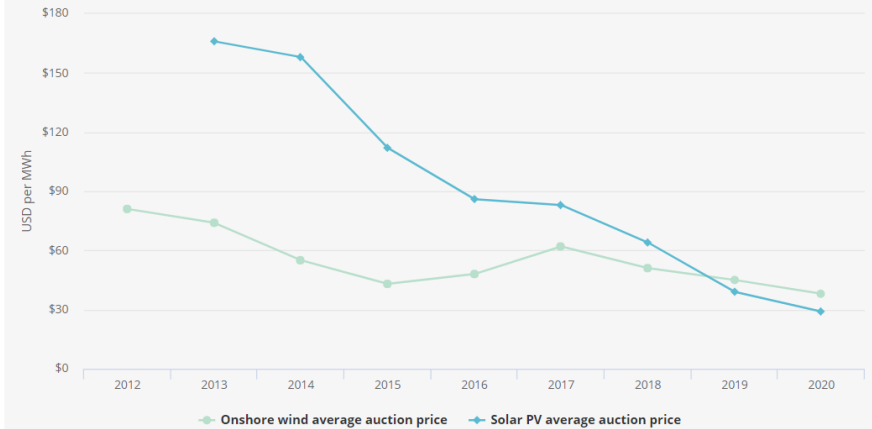


Fig. 1: Progress of renewable energy sources

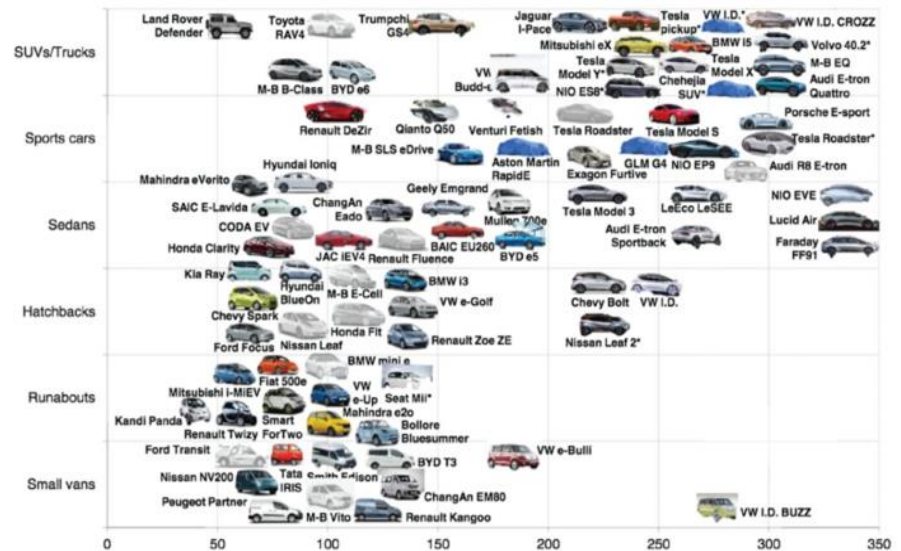


Announced wind and solar PV average auction prices by commissioning date



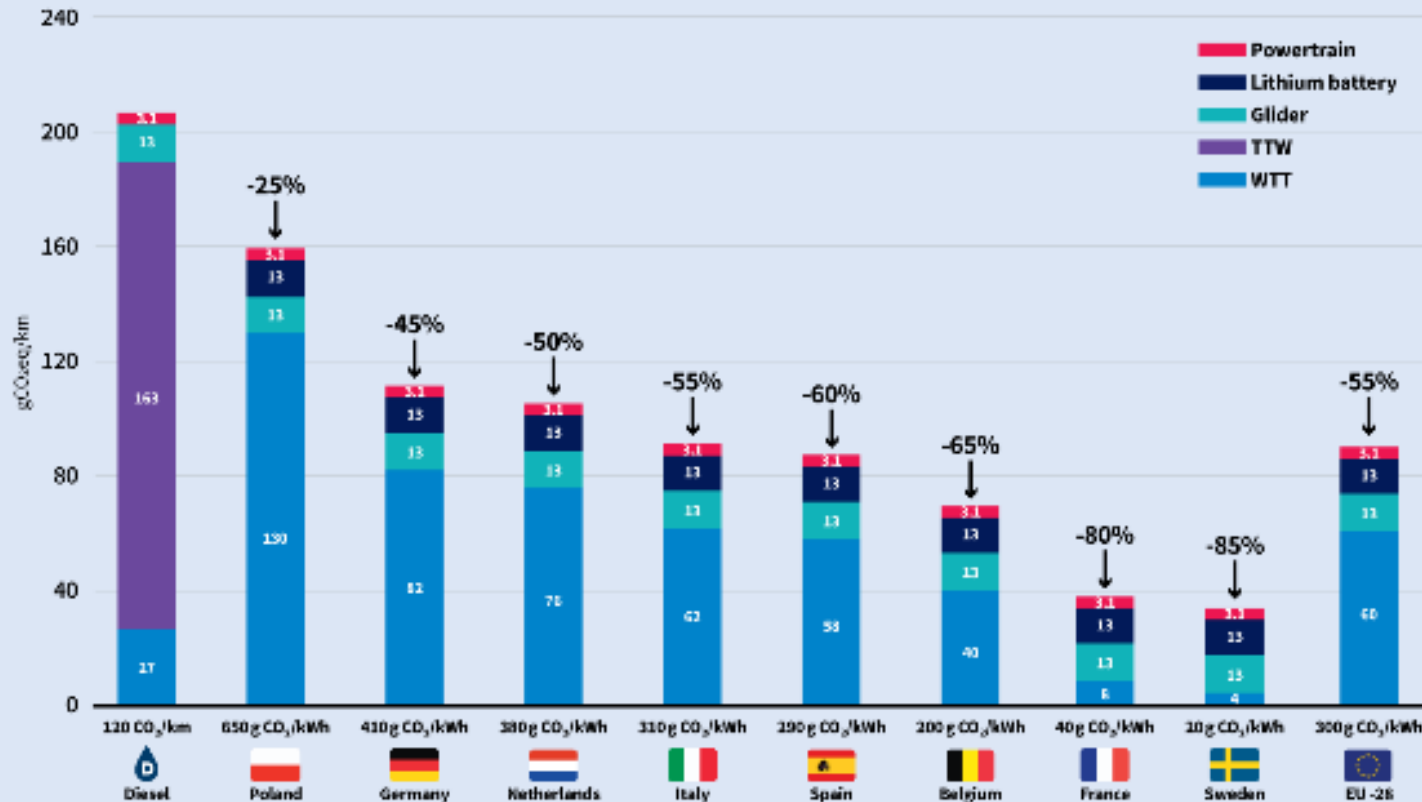
Renewables 2017, IEA

Models by style and range available through 2020



LIFECYCLE ANALYSIS FOR ENVIRONMENTAL IMPACT

Influence of national electricity mixes on climate change

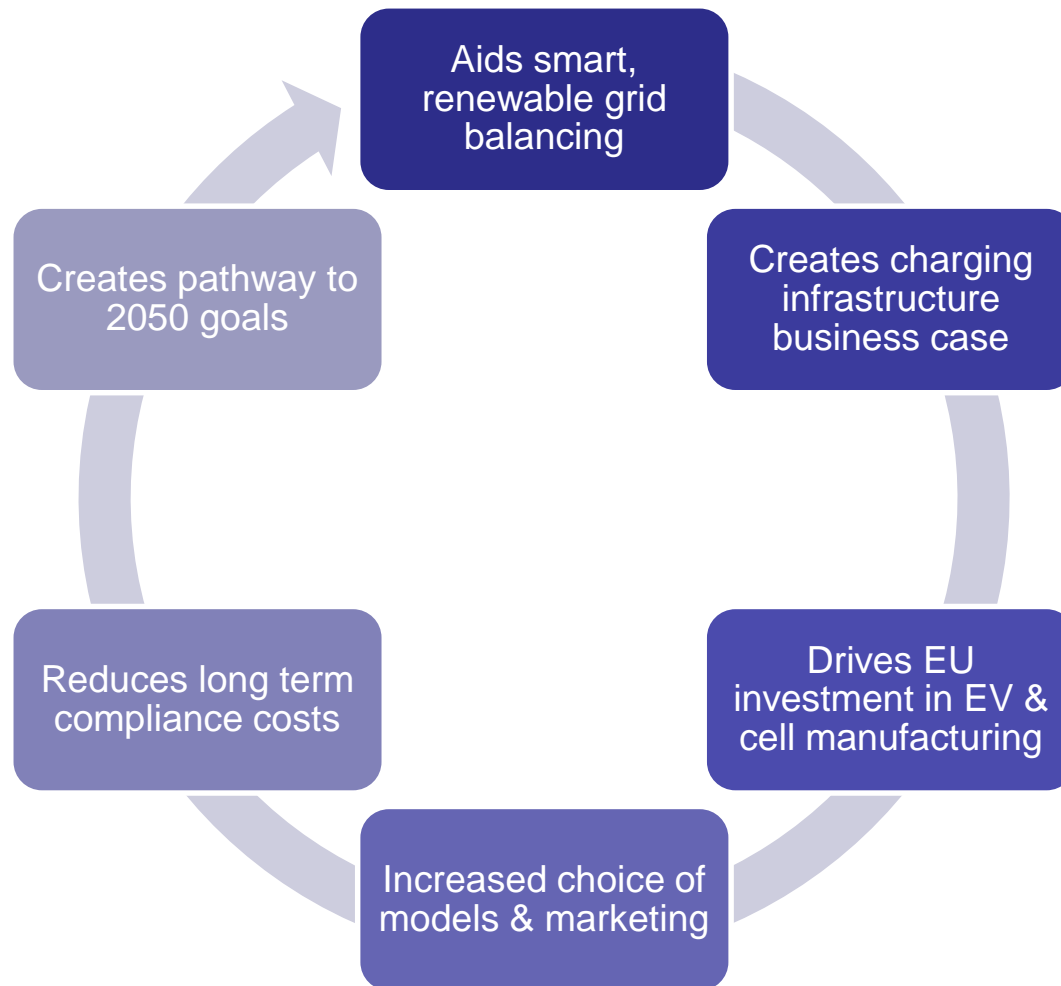


A SALES TARGET FOR ZERO AND LOW EMISSION VEHICLES

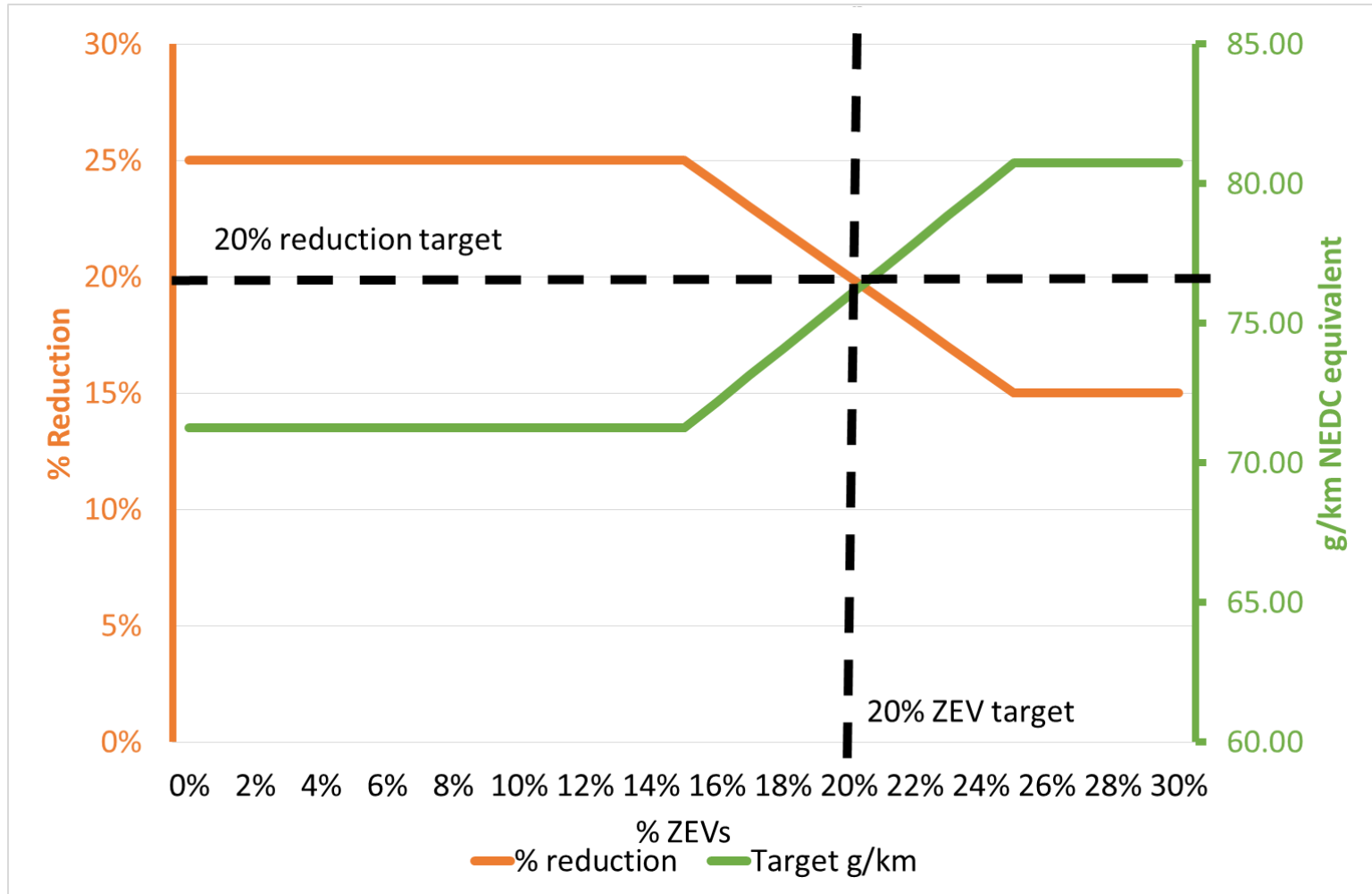
A ZLEV mandate

- 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



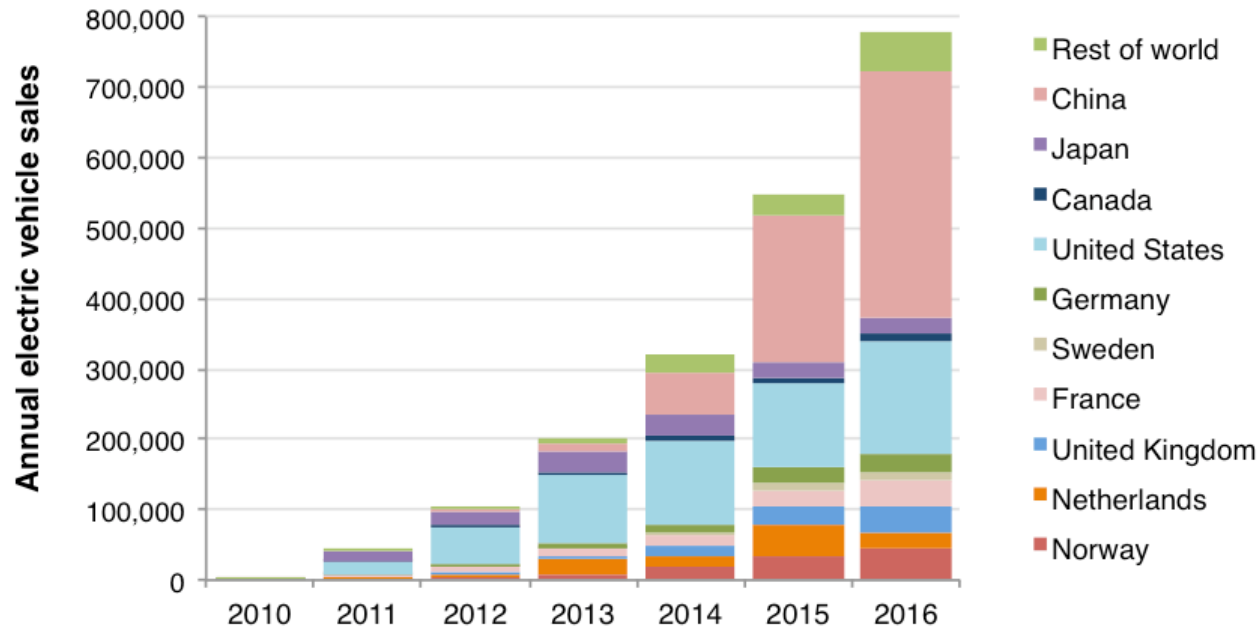
- Purchase premium of EUR 6,000
- Registration tax benefits
- Road tax exemptions
- Reduced tax for company e-cars
- Easy EV charge point installation



- 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

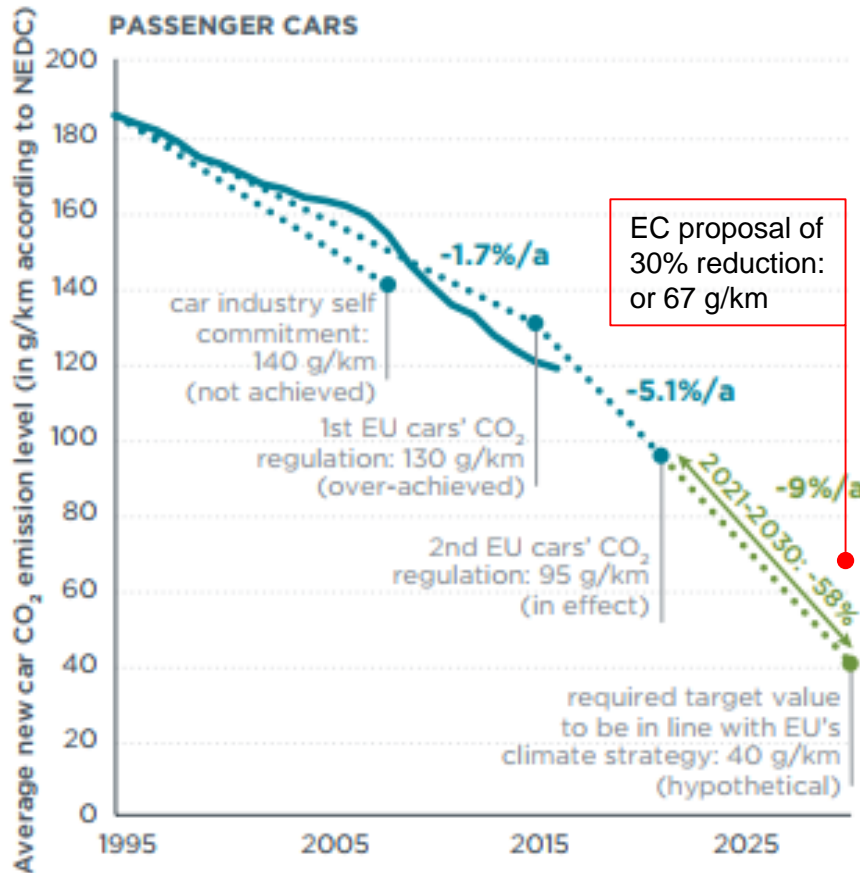


Figure 7. Historic development of average passenger car target CO₂ emission levels and required further development in the 2021-2030 time period to be in line with the EU's climate strategy.¹⁷

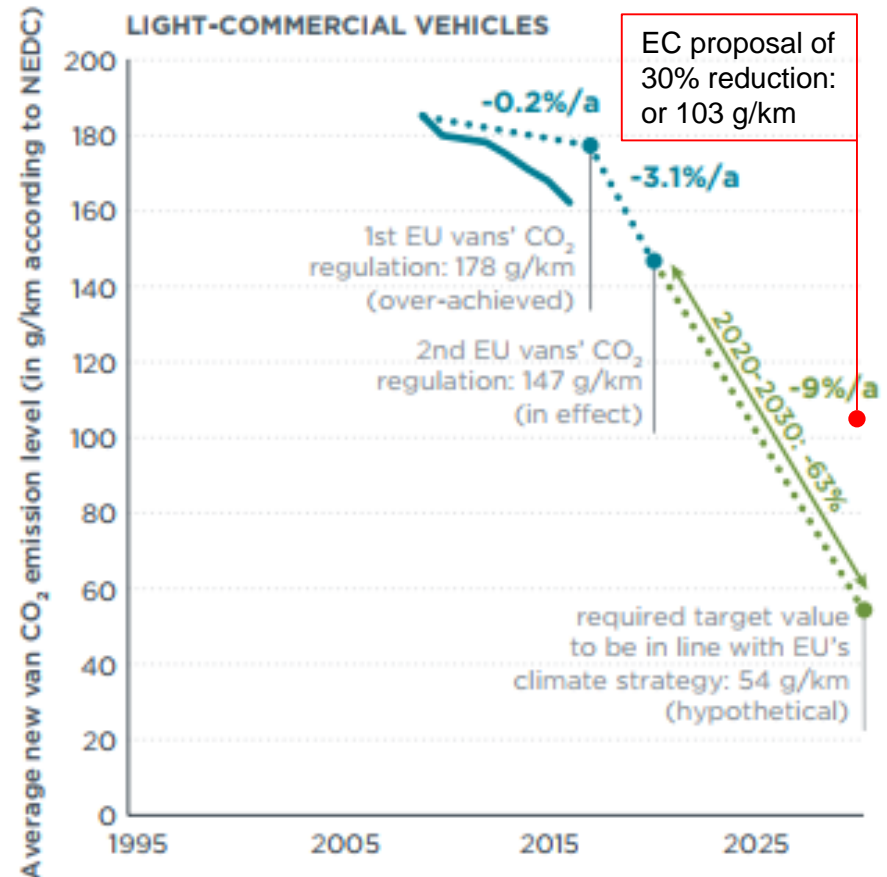


Figure 8. Historic development of average light-commercial vehicle target CO₂ emission levels and required further development in the 2020-2030 time period to be in line with the EU's climate strategy.

FLEXIBILITIES IN NEDC TESTING

Disconnecting the alternator prevents the battery from charging and reduces energy use

TEST BENCH

Carmakers can optimize the engine control strategy to reduce fuel consumption under test conditions

TEST BENCH

Careful lubrication and use of special lubricants help the car run more efficiently

TEST BENCH

Altering wheel alignment reduces rolling resistance

COAST-DOWN TEST

Fitting special tyres with a lower rolling resistance

COAST-DOWN TEST

Overinflating the tyres reduces rolling resistance

COAST-DOWN TEST

For NEDC testing, the lightest available version of a vehicle model is tested. No optional vehicle equipment or payload is taken into account

TEST BENCH

Using higher gears according to a test-optimized gear shift program allows the engine to operate more efficiently than on the road (valid for vehicles with automatic transmission)

TEST BENCH

Taping over indentations or protrusions on the body reduces aerodynamic drag

COAST-DOWN TEST

Pushing the brake pads fully into the callipers reduces rolling resistance

TEST BENCH

CO₂ results declared by the manufacturer can be up to 4% below the actual test results

TEST BENCH



Taking advantage of test tolerances and adjusting the results header

TEST BENCH

COAST-DOWN TEST



Laboratory instrumentation: exploiting the tolerances for laboratory instruments provided for the test

TEST BENCH

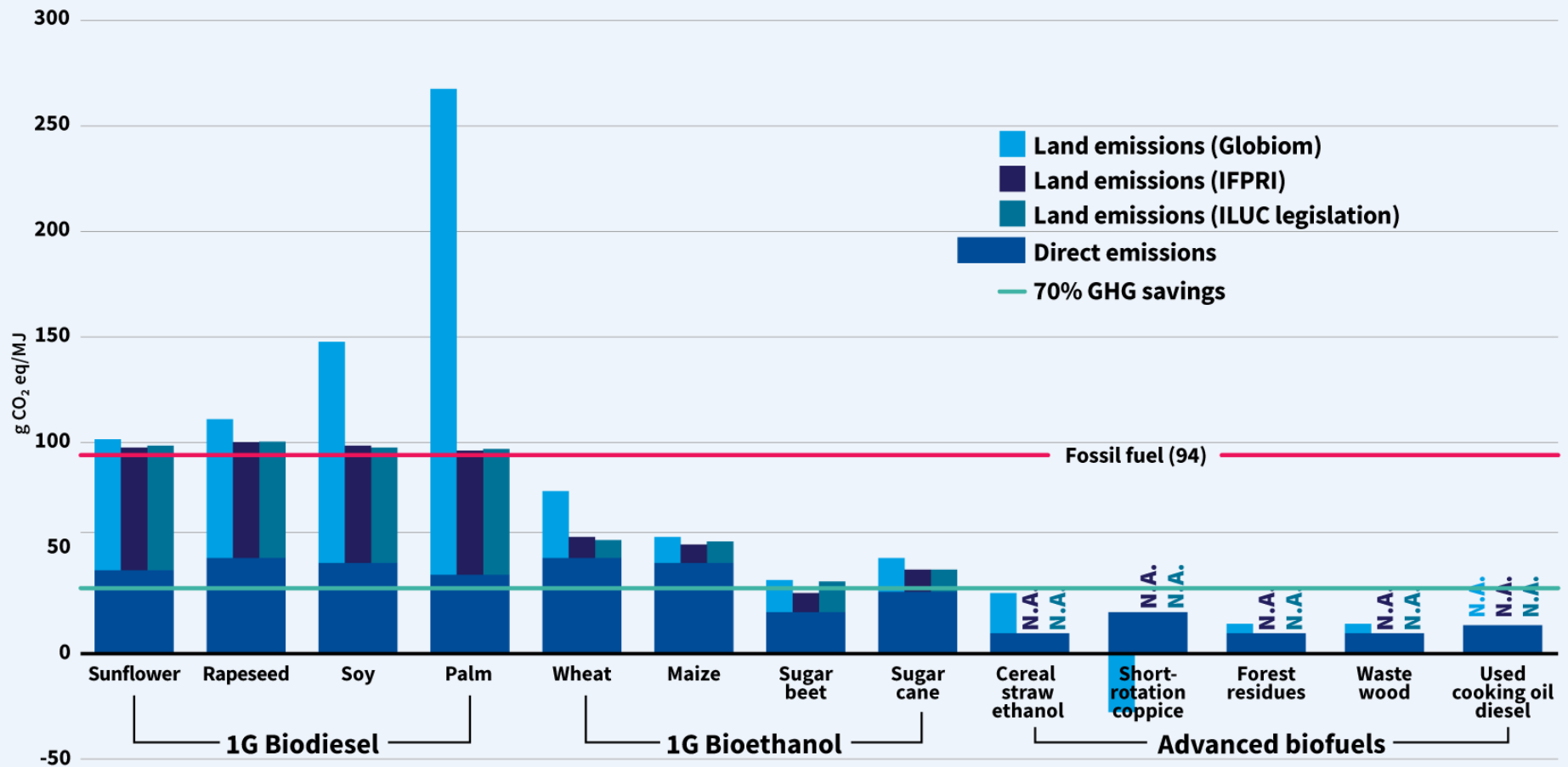


Optimizing the coast-down test track and ambient conditions (e.g. high test temperature)

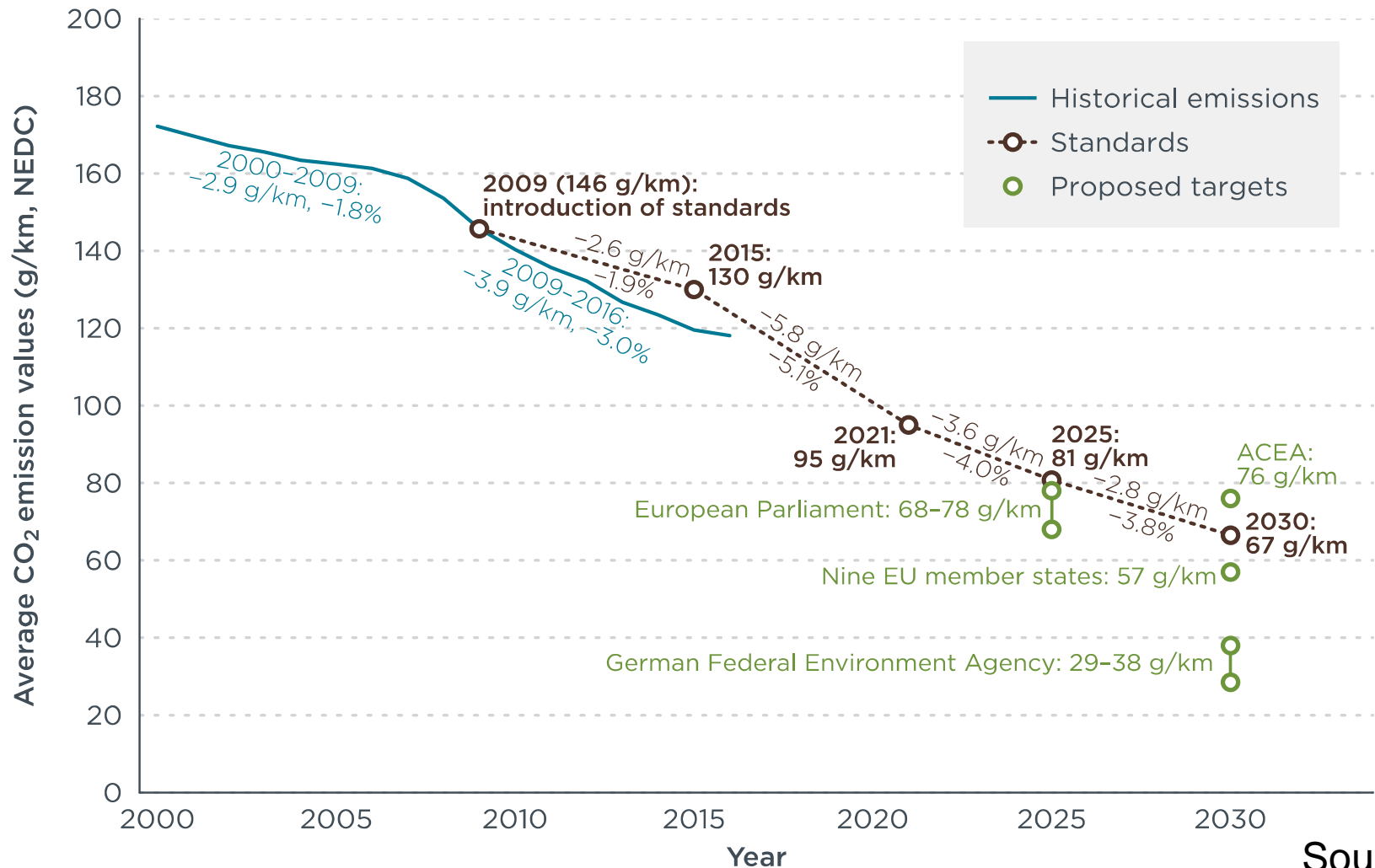
TEST BENCH

COAST-DOWN TEST

Direct emissions plus land emissions



PROPOSED CARS TARGETS ARE LESS AMBITIOUS THAN THE 2021 GOAL



CASE STUDY OF EVS

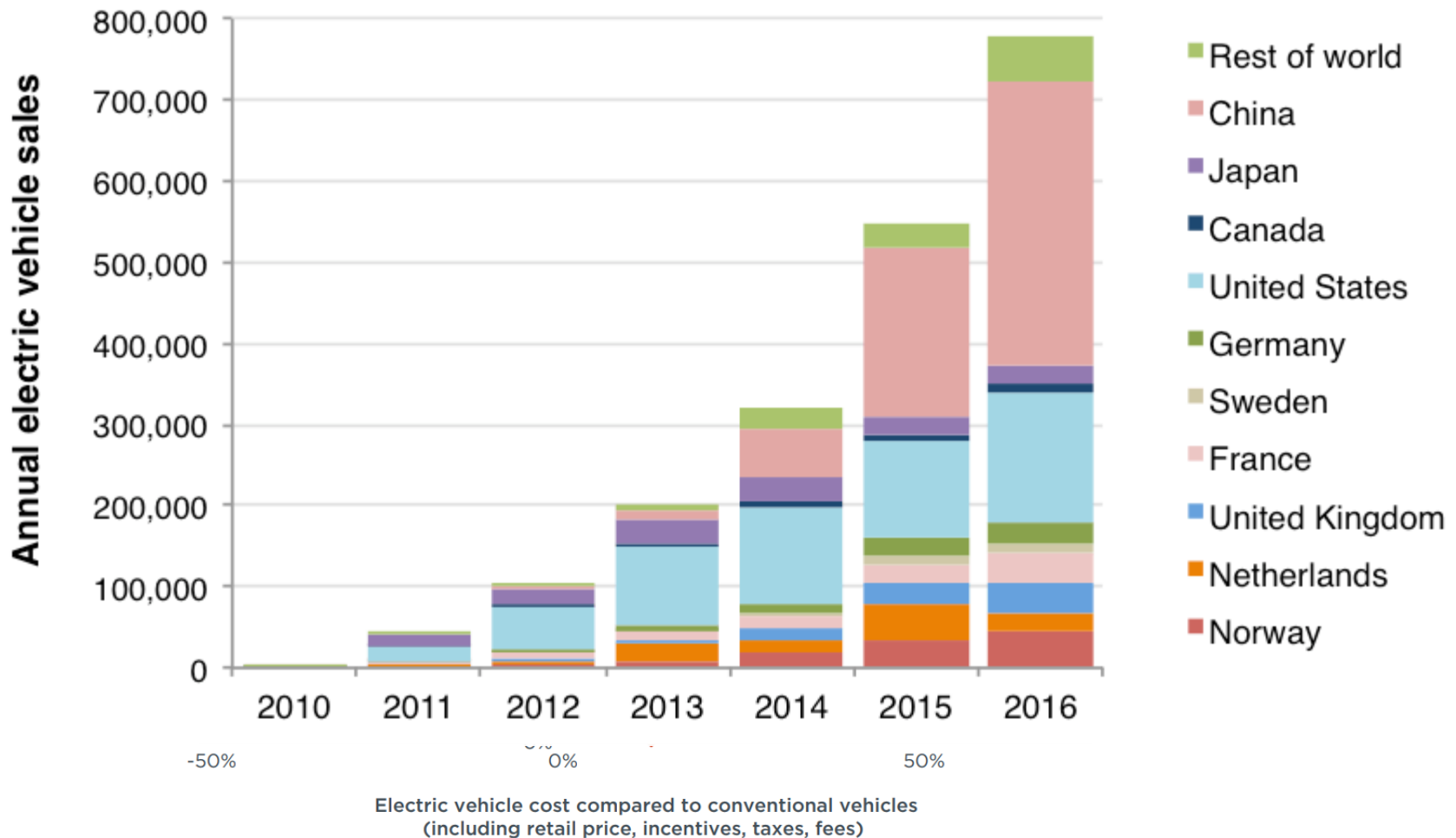


























Figure 13. Electric vehicle share of new vehicle sales and average electric vehicle cost difference compared to conventional vehicles

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		—	