

CO₂ Fleet Targets and Electric Vehicle Market Diffusion

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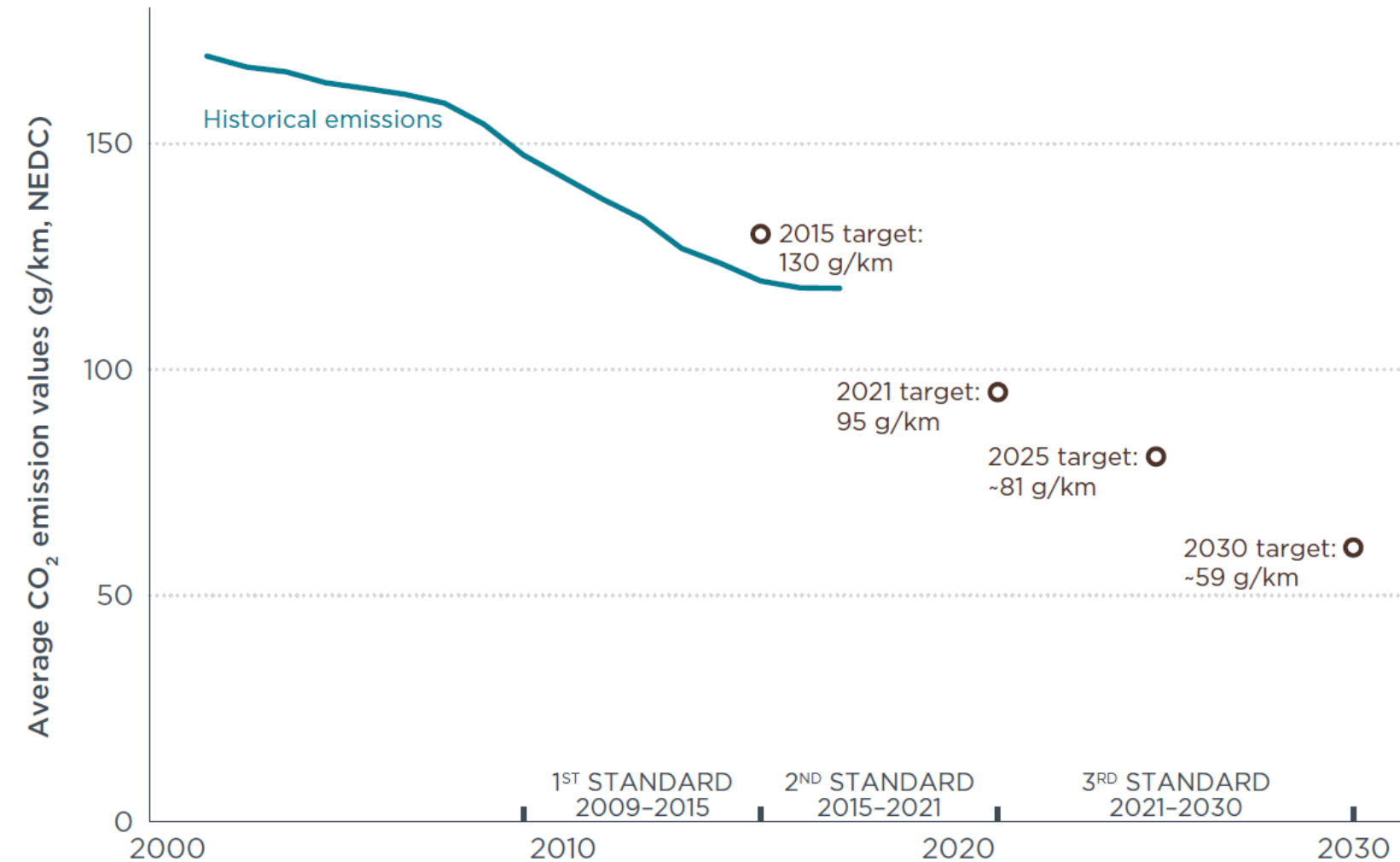
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Data and Methods



Motivation: How do CO₂ fleet targets impact EV sales?



- **Ambitious CO₂ fleet targets push the introduction of electric vehicles**
- Targets below 75 gCO₂/km NEDC difficult with combustion engines in current vehicle sizes
- 2021 target: 95 gCO₂/km
- 2025 target: –15% vs. 2021
- 2030 target: – 30% vs. 2021
- **What EV sales share will be needed to meet targets?**

Source: <https://www.theicct.org/publications/ldv-co2-stds-eu-2030-update-jan2019>

Data: All car sales in Europe by model, variant, & state.

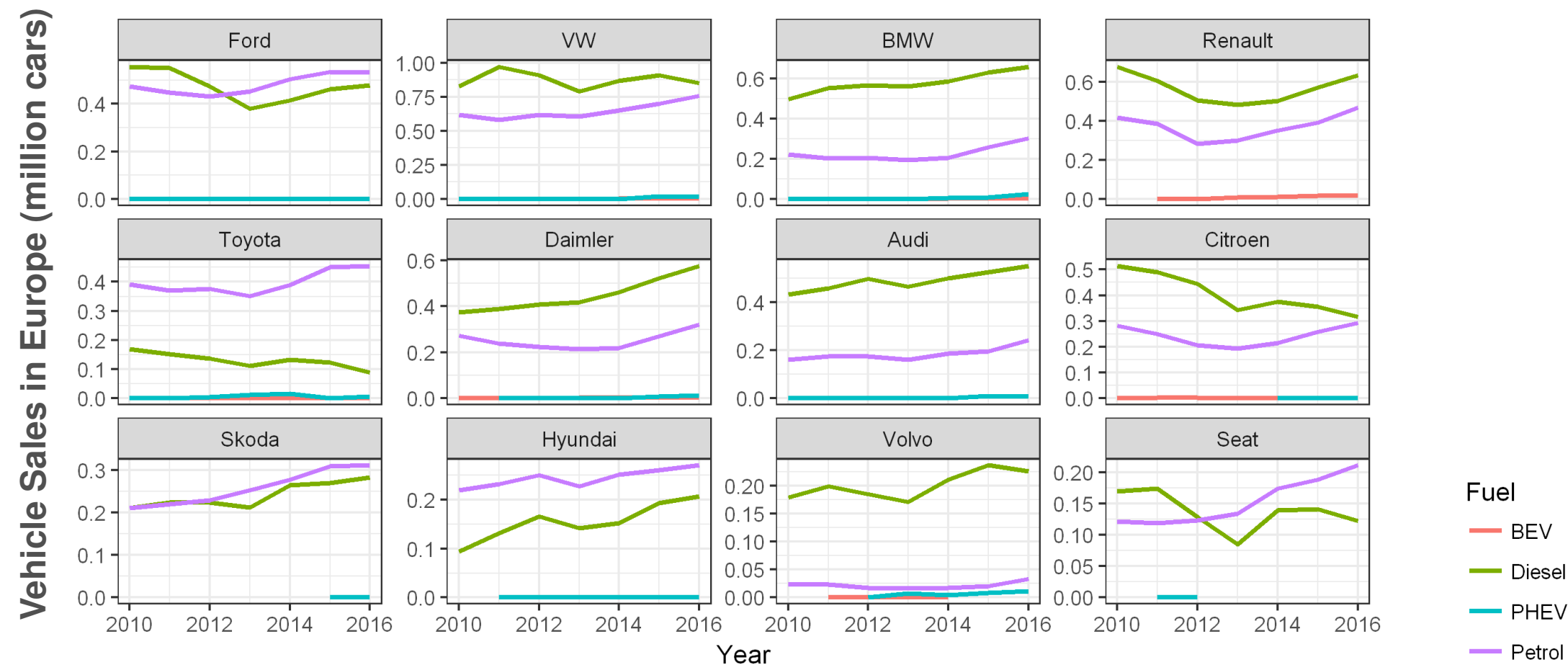
- **Regulation (EC) 443/2009 requires member states to report vehicle sales to European Environmental Agency** by manufacturer, model, variant and version and further technical details
- **2.8 million rows of data in total**
 - 100,000 vehicle versions per member State;
 - 150 Manufacturer and 50,000 models
- A lot of data cleaning required
 - gCO₂/km sometime implausible
 - propulsion system sometimes wrong (e.g. Ampera as „Gasoline“)
- **Overall, data quality is sufficient**



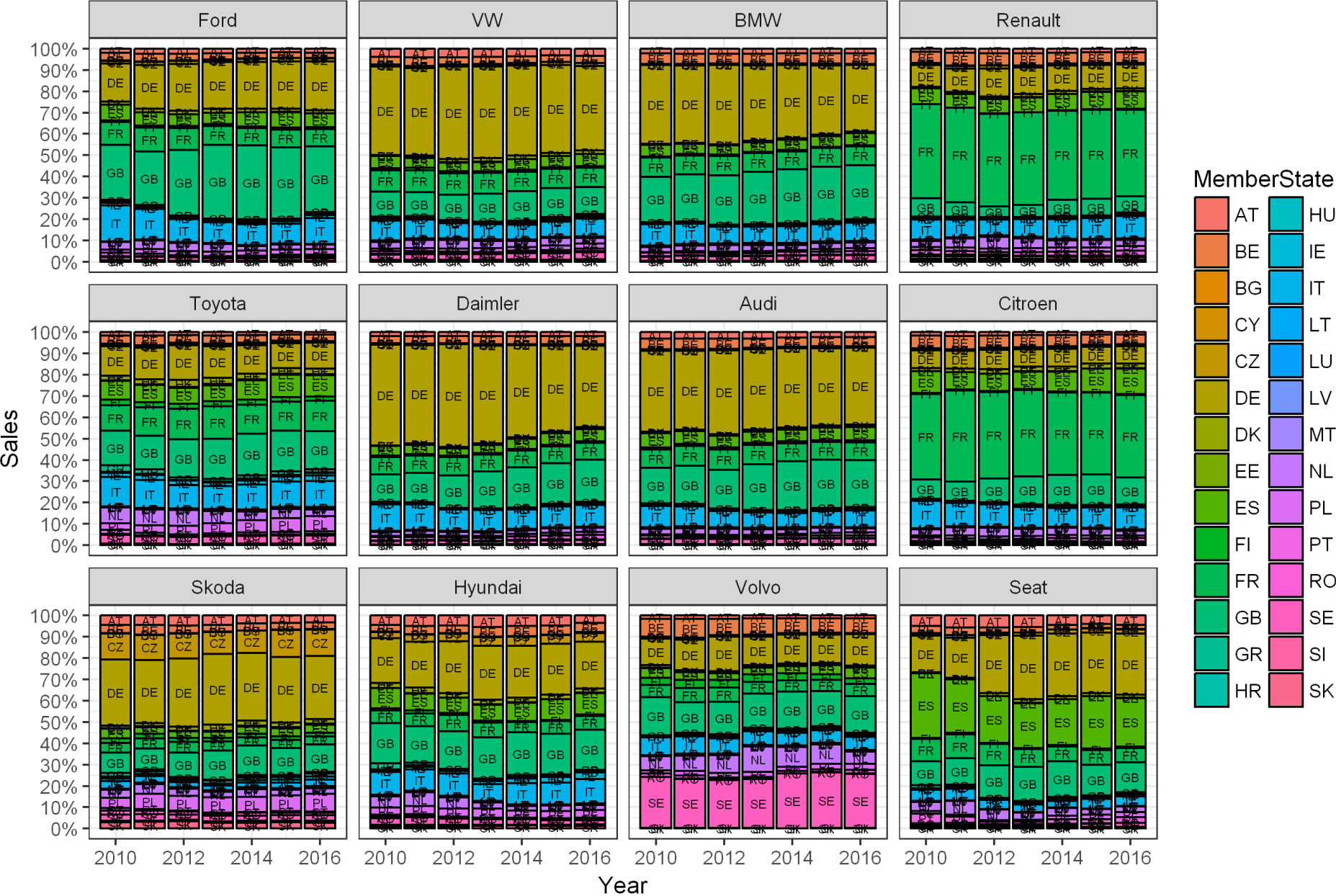
	Manu- facturer	OEM	Sales	CO ₂ emissions	Fuel type	Electricity consumption	Mass	capacity
Missing values	0.03 %	0.76 %	<0.01 %	0.38 %	0.8 %	36.2 %	0.31 %	0 %
Sales weighted	<0.01 %	0.04 %	<0.01 %	0.05 %	0.8 %	19.4 %	0.05 %	0 %

Data publicly available: <https://www.eea.europa.eu/data-and-maps/data/co2-cars-emission-15>

Gasoline and Diesel have dominated cars sales in Europe.



Sales by member state show importance of home markets.

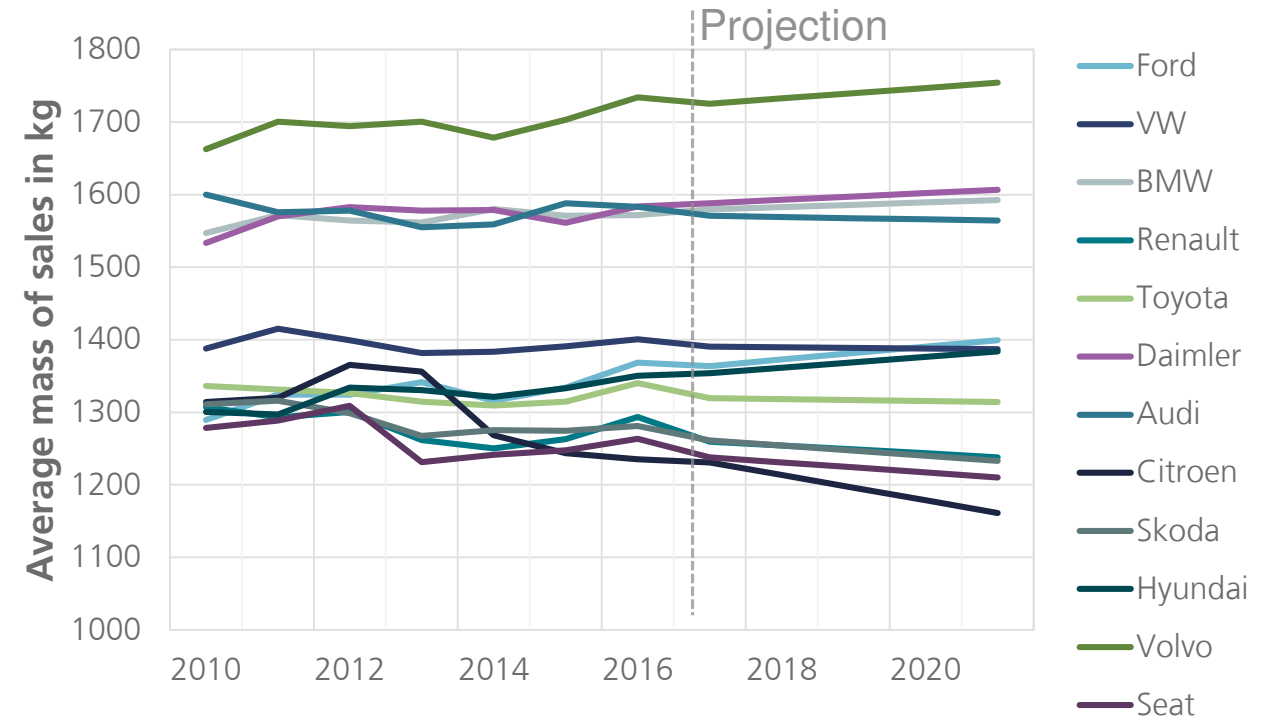
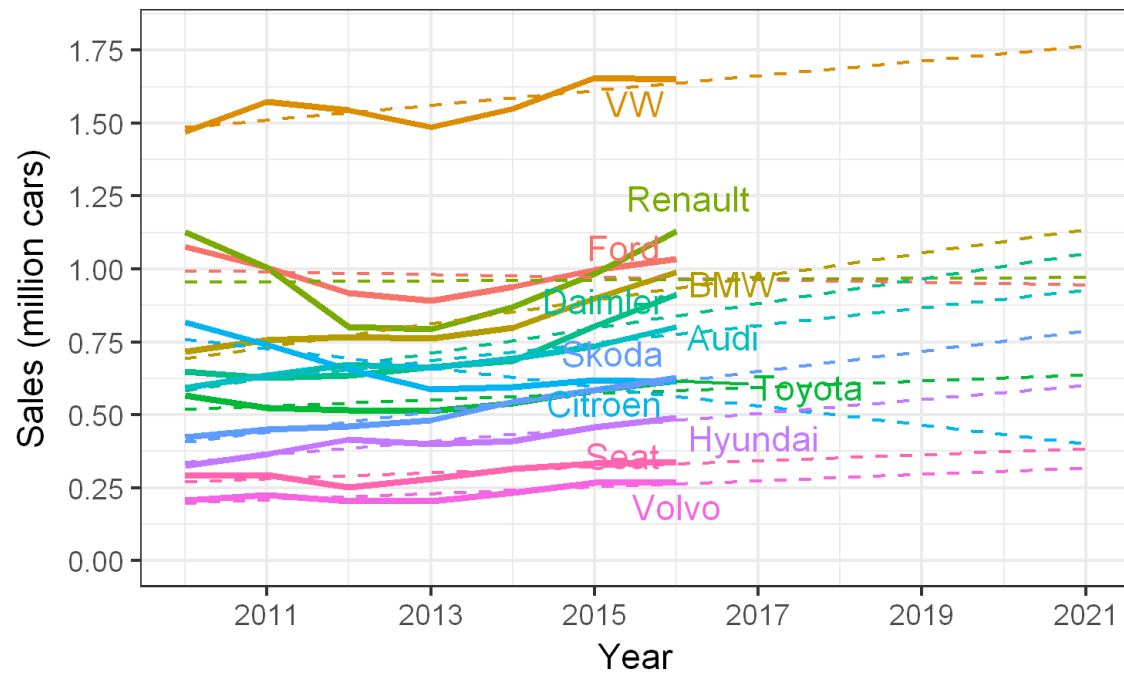


Method: We extrapolate current CO₂ reduction trends and EV sales are then required to meet manufacturer targets.

EV sales share per manufacturer obtained in four steps:

1. We extrapolate car sales, masses and CO₂ reductions of ICEs for each manufacturer
2. Average Mass in 2025 yields manufacturer specific CO₂ target
3. We assume that manufacturers can cost-effectively reduce ICE emissions until 85 gCO₂/km for medium sized cars (and adjusted for other sizes)
4. Rest of CO₂ reduction to meet targets must come from EV:
 - We use 0 gCO₂/km for BEV and assume 28 g CO₂/km for PHEV

Linear extrapolation of sales and mass is an approximation.



Results



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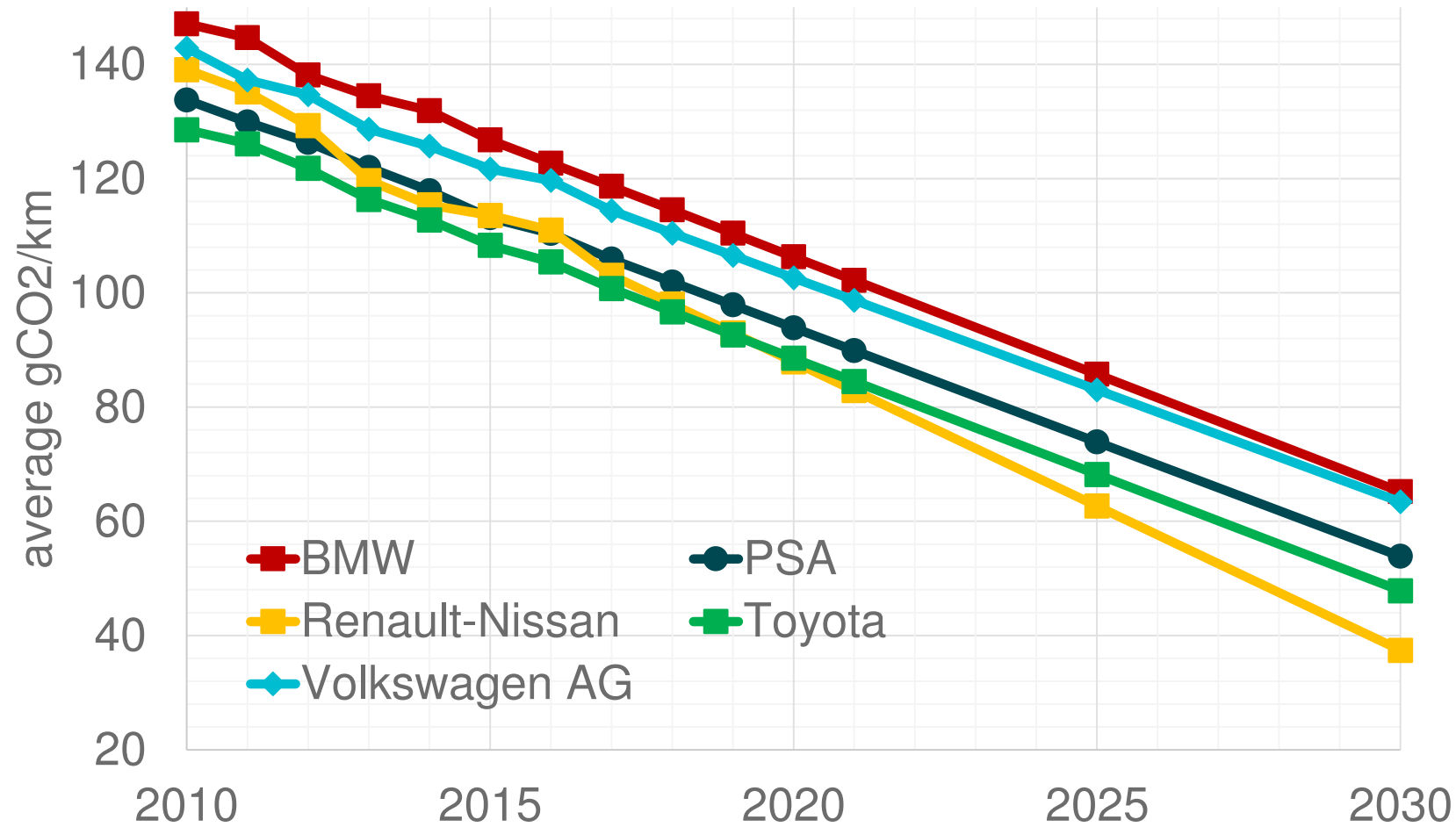
Results: Manufacturers require PEV sales below targets.

Calculated expected CO₂ targets (based on mass) and CO₂ emissions (based on reduction trend)

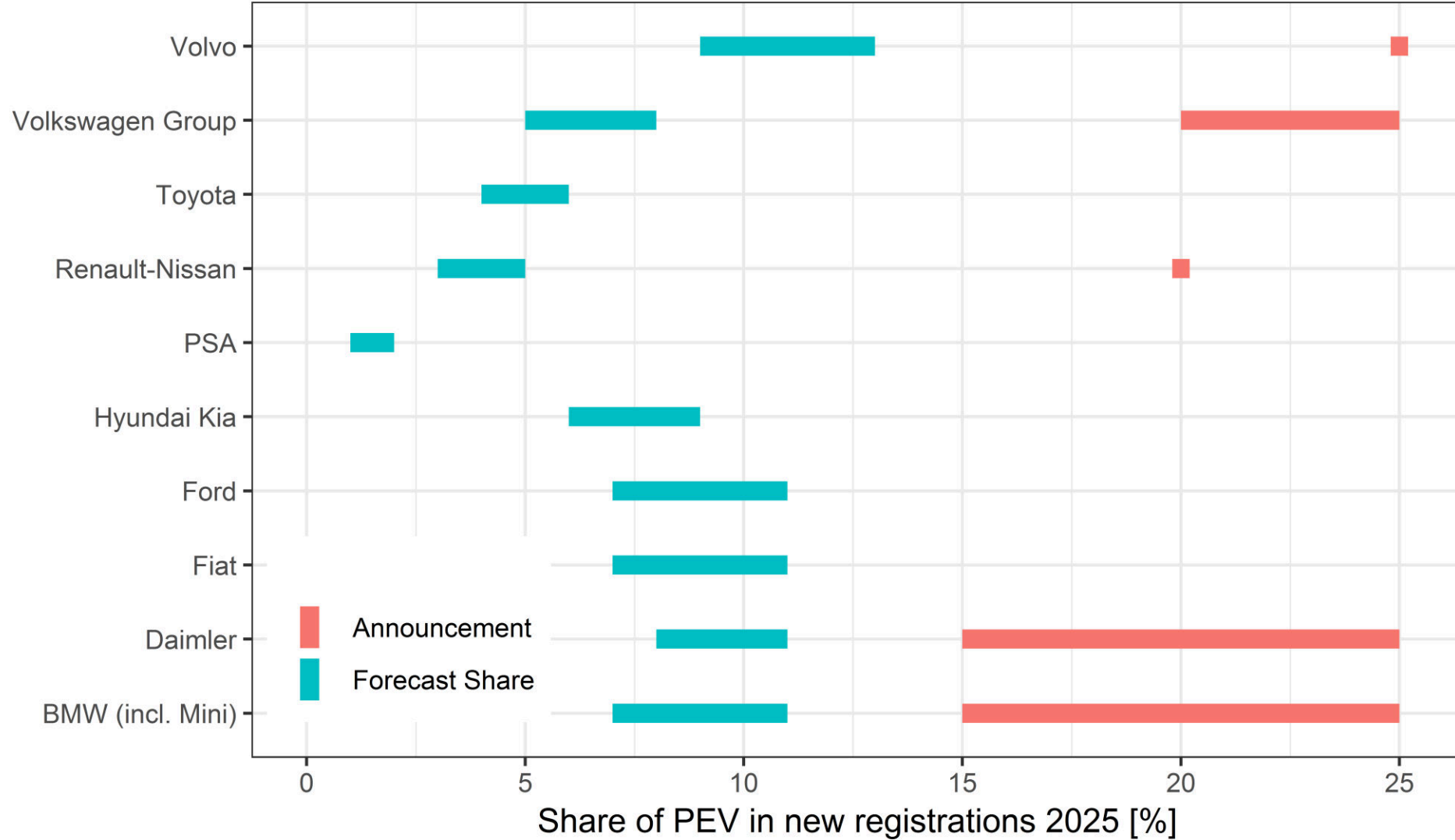
Manufacturer	CO ₂ emission target [gCO ₂ /km]				Expected 2030 [gCO ₂ /km]	Deviation [gCO ₂ /km]	BEV required	PHEV required
	2016	2020	2025	2030				
BMW (incl. Mini)	138	102	87	71	90	19	21%	30%
Daimler	139	102	87	72	91	19	21%	30%
Fiat	123	92	79	65	84	19	22%	34%
Ford	129	95	81	67	85	18	22%	32%
Hyundai Kia	129	95	81	66	83	17	20%	31%
PSA	125	90	77	63	73	10	14%	22%
Renault-Nissan	126	91	77	64	76	13	17%	26%
Toyota	127	92	78	65	78	14	18%	27%
Volkswagen Group	131	95	81	67	82	15	18%	28%
Volvo	146	107	91	75	97	21	22%	31%

➤ **30% reduction in 2030** (compared to 2021) **does not require 30% EVs**

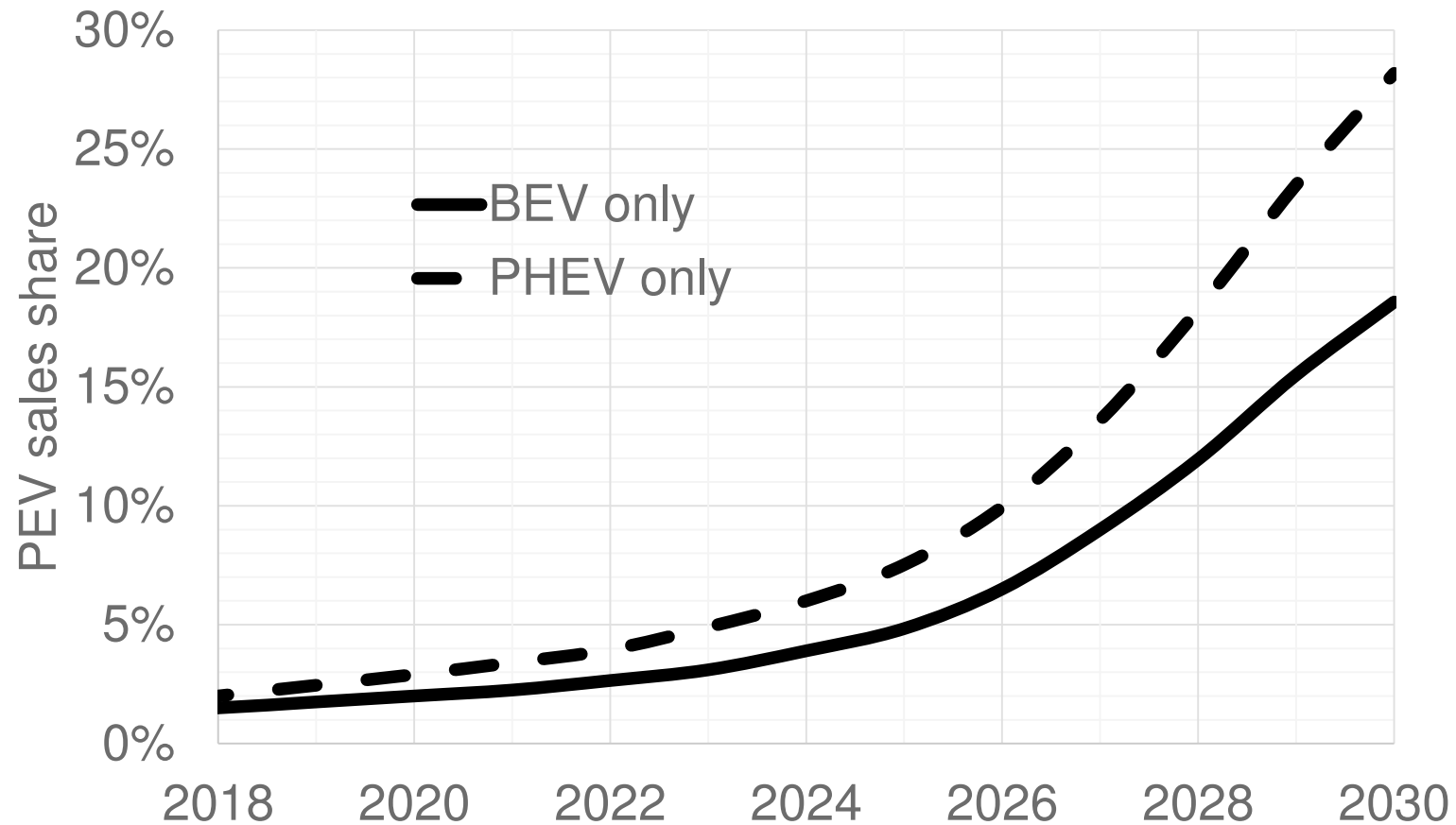
Results: All manufacturers achieve strong CO₂ reductions.



Results: Manufacturers require PEV sales below targets.



Aggregated sales targets imply 19 – 28% EV sales in 2030.



Summary and Conclusions

- **We calculated the market uptake of plug-in electric vehicles for Regulation (EC) No 443/2009**
- **EV required since ambitious CO2 emission targets cannot be reached with combustion engine vehicles**
- **Manufacturers need EV sales shares well below their announced sales targets**
- **PEV sales shares in Europe will grow to 18–27% of newly sold cars in 2030**

Thank you!



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