

Kompendium 5.2

Electric cars section



Electric cars: Very different markets

New registrations and market shares in the year 2021



New registrations BEV/PHEV: 302,929



Market share
4.1%



New registrations BEV/PHEV: 151,921



Market share
86.2%



New registrations including EFTA and UK
BEV/PHEV: 2,105,484



Market share
18.0%

World 2021
6.4 Million



New registrations BEV/PHEV: 3,334,170



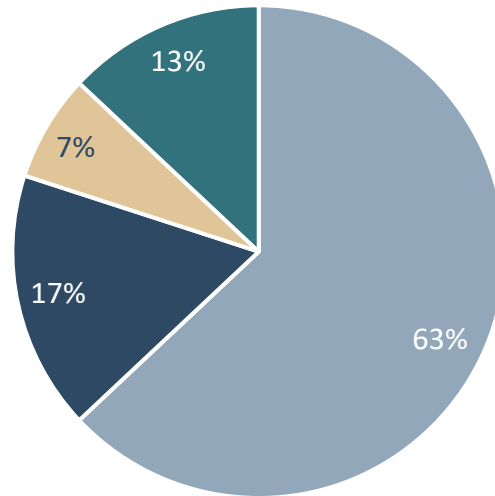
Market share
15.8%

Quelle: ACEA, VDA; ev-sales.blogspot, 2021

Lithium ion cells: Asia dominates right now

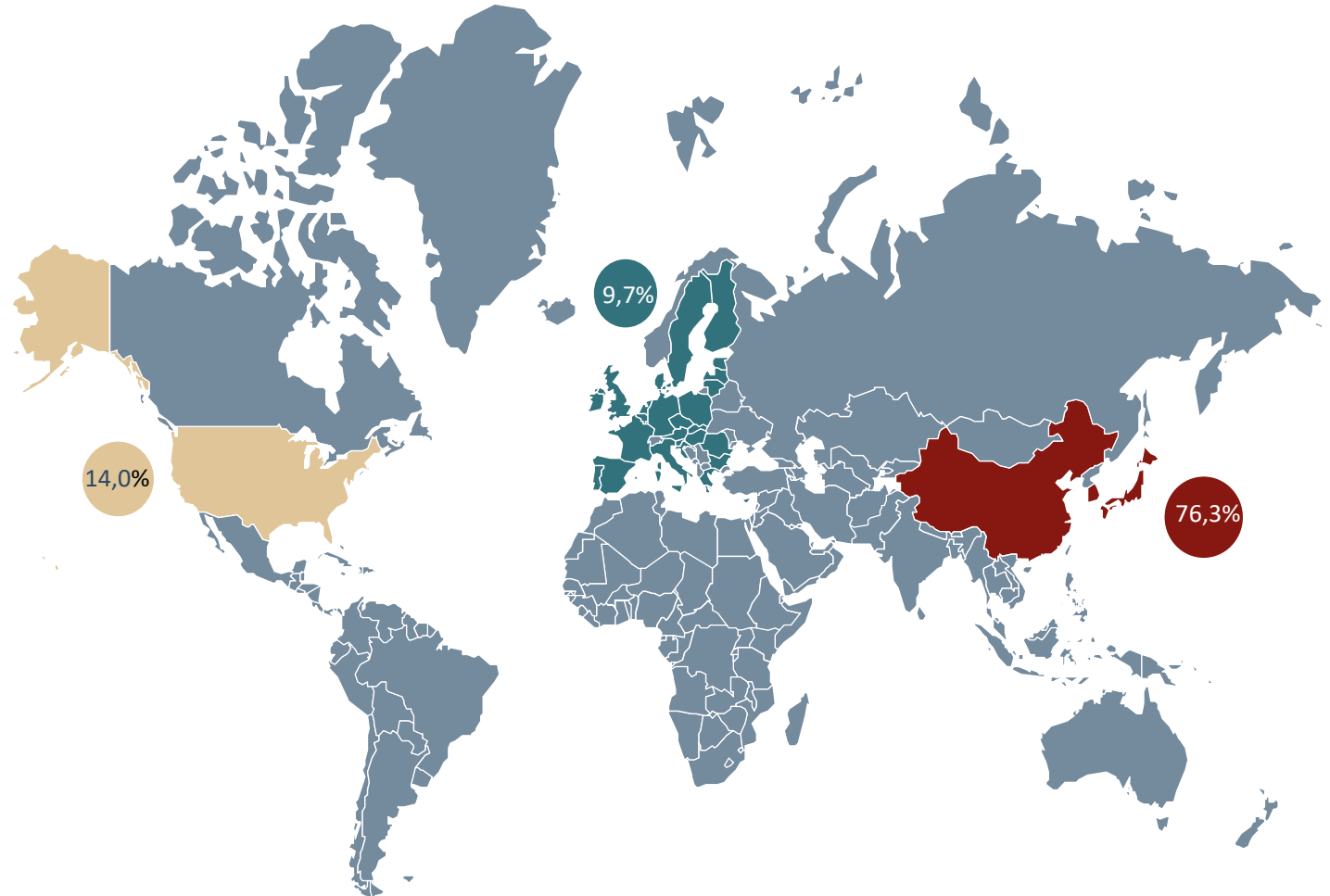
Share of installed, under construction and planned battery cell manufacturing

By homecountry of the company



- Chinese companies (CATL, BYD, Lishen, CBAK etc.)
- Korean companies (LG Chem, SK, Samsung)
- Japanese companies (Panasonic, AESC)
- American companies (Tesla, Boston Power)

By production sites

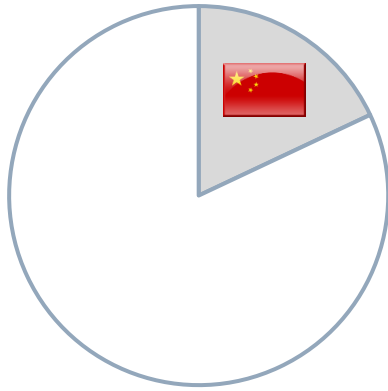


Source: PEM RWTH Aachen, 2019

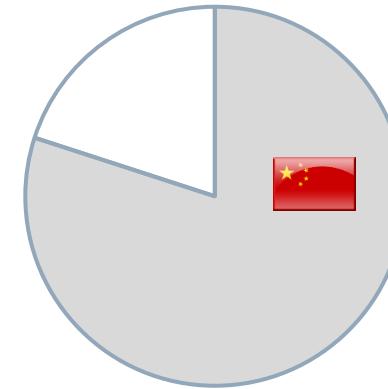
China has secured large parts of the value chain

Share of chinese companies in 2019

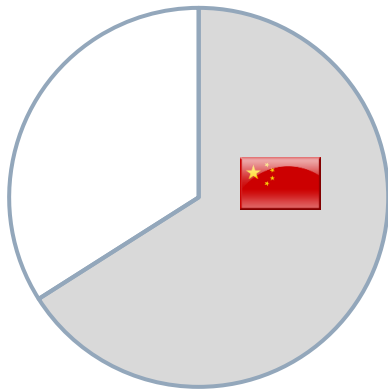
Raw materials (lithium, nickel, cobalt, etc.)



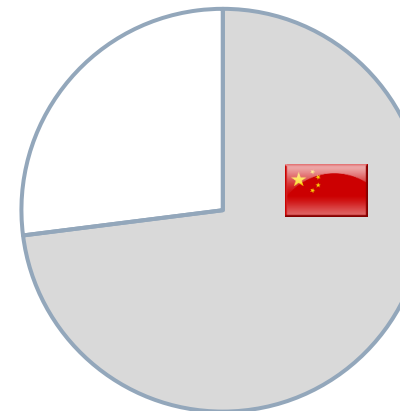
Refining of raw materials (lithium carbonate, cobalt sulphat, etc.)



Production of anodes und cathodes



Battery cell production

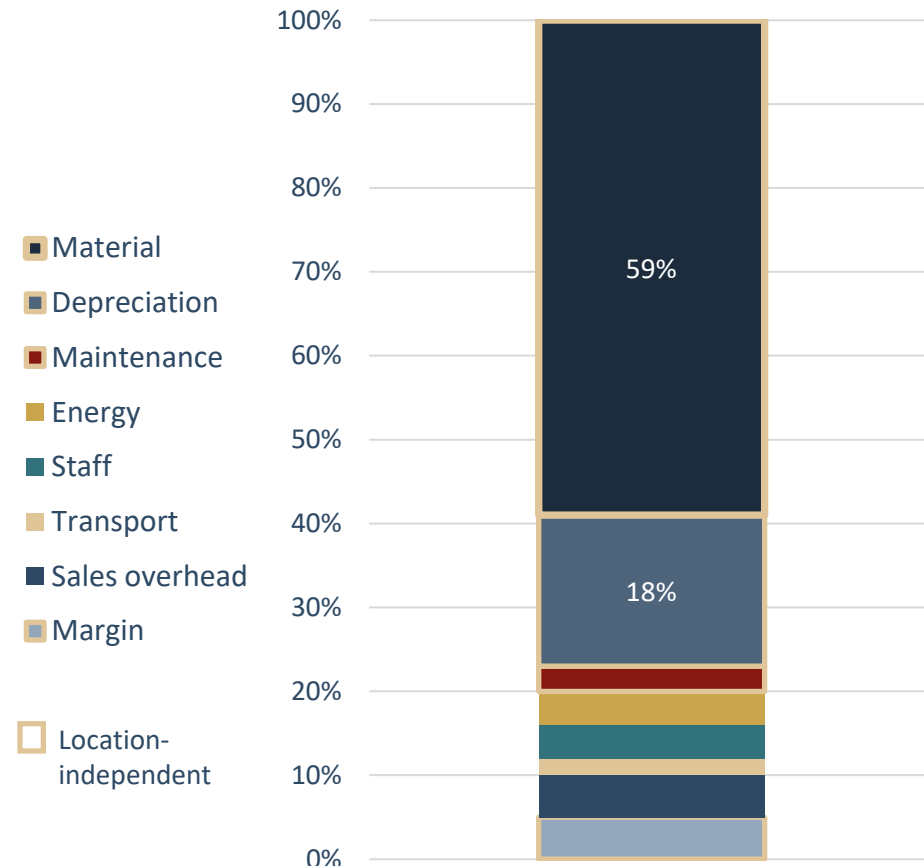


Quelle: Deutsche Rohstoffagentur, 2020; Automobilwoche, 2020

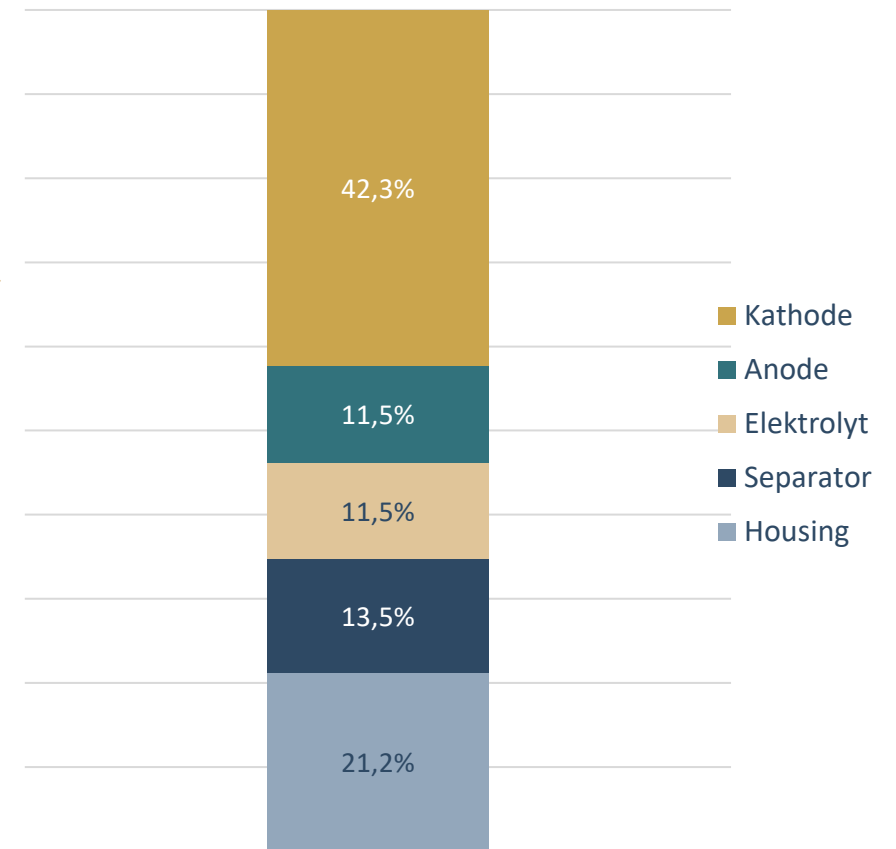
Cell manufacturing: a major part of the costs is location-independent

Cost structure of a battery cell produced in Germany

Total cost structure of manufacturing



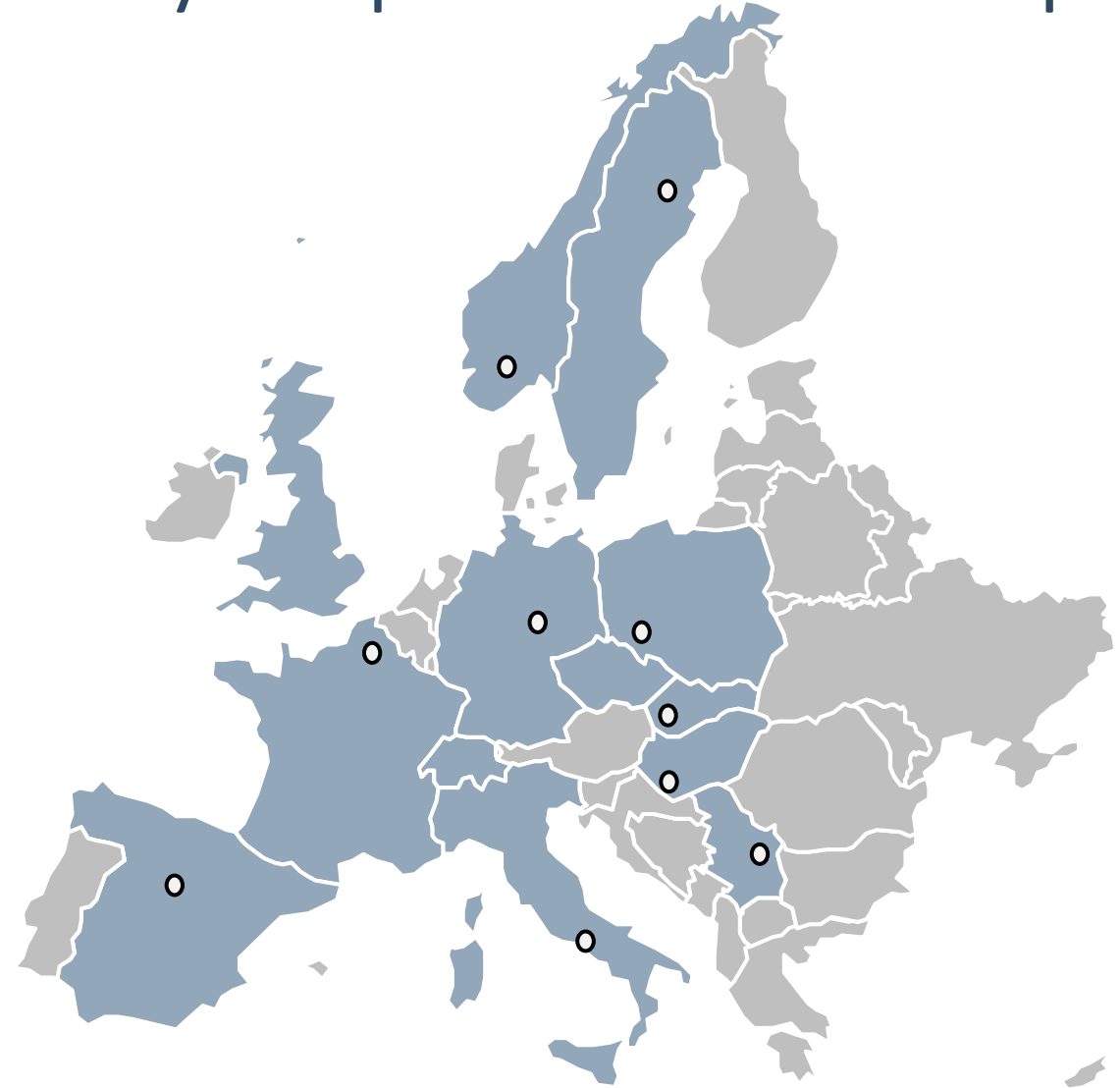
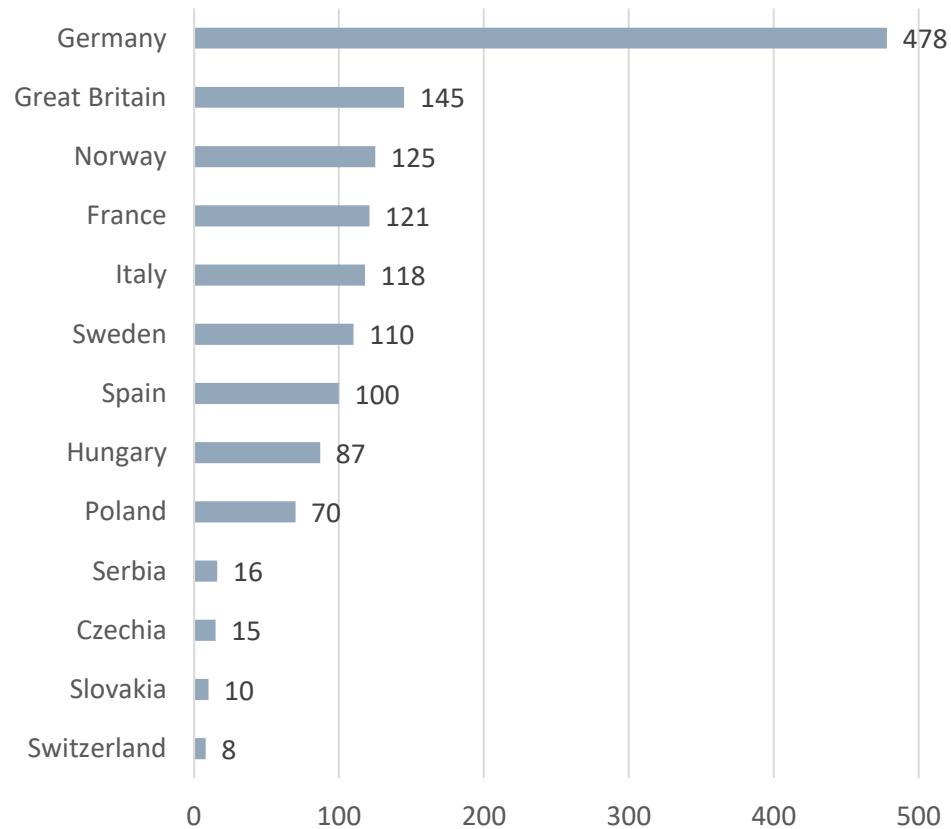
Cost structure of material costs by components



Source: PEM RWTH Aachen, 2019; Avicenne Energy 2017+2018

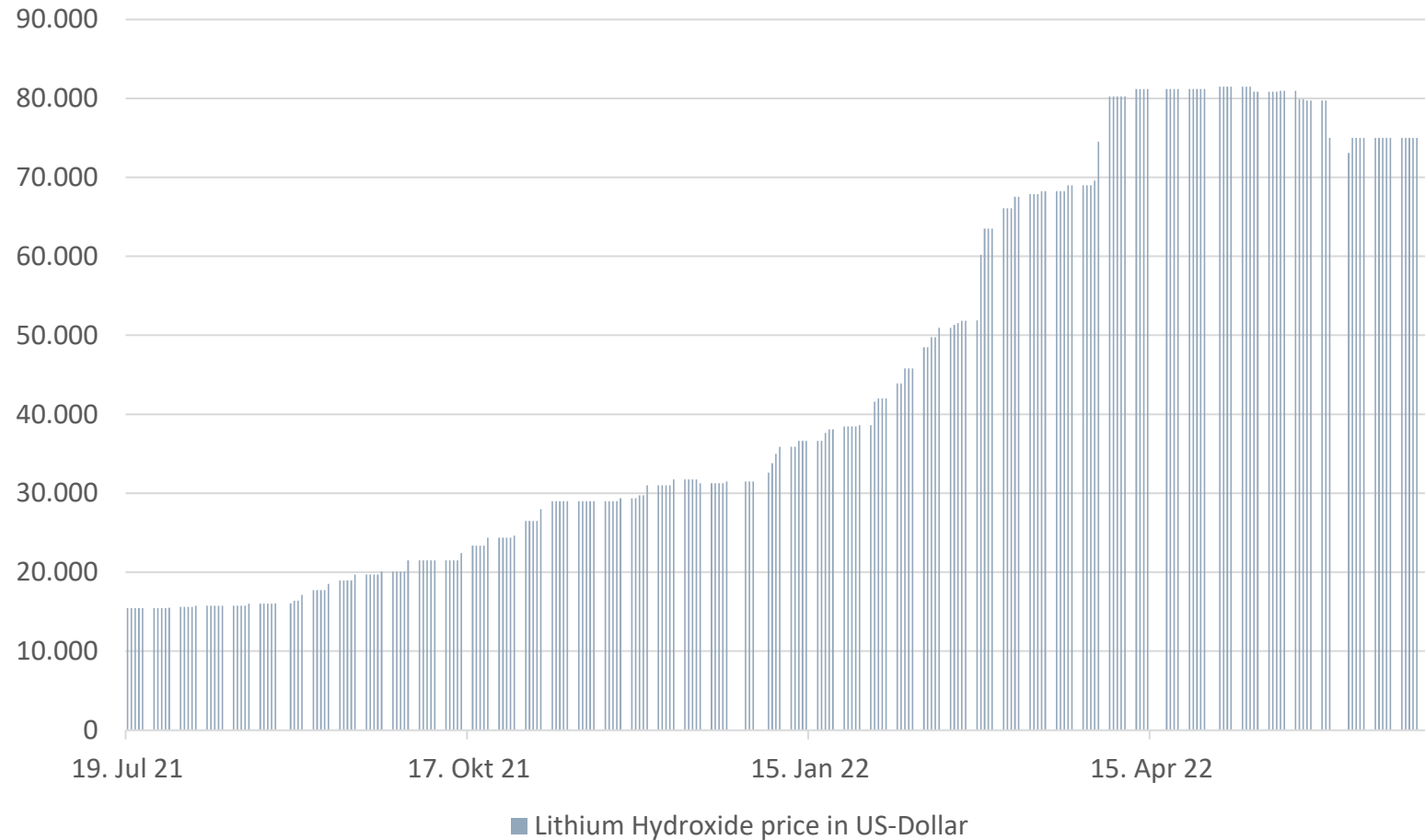
Massive expansion: planned battery cell production in Europe

In GWh capacity (installed and planned)



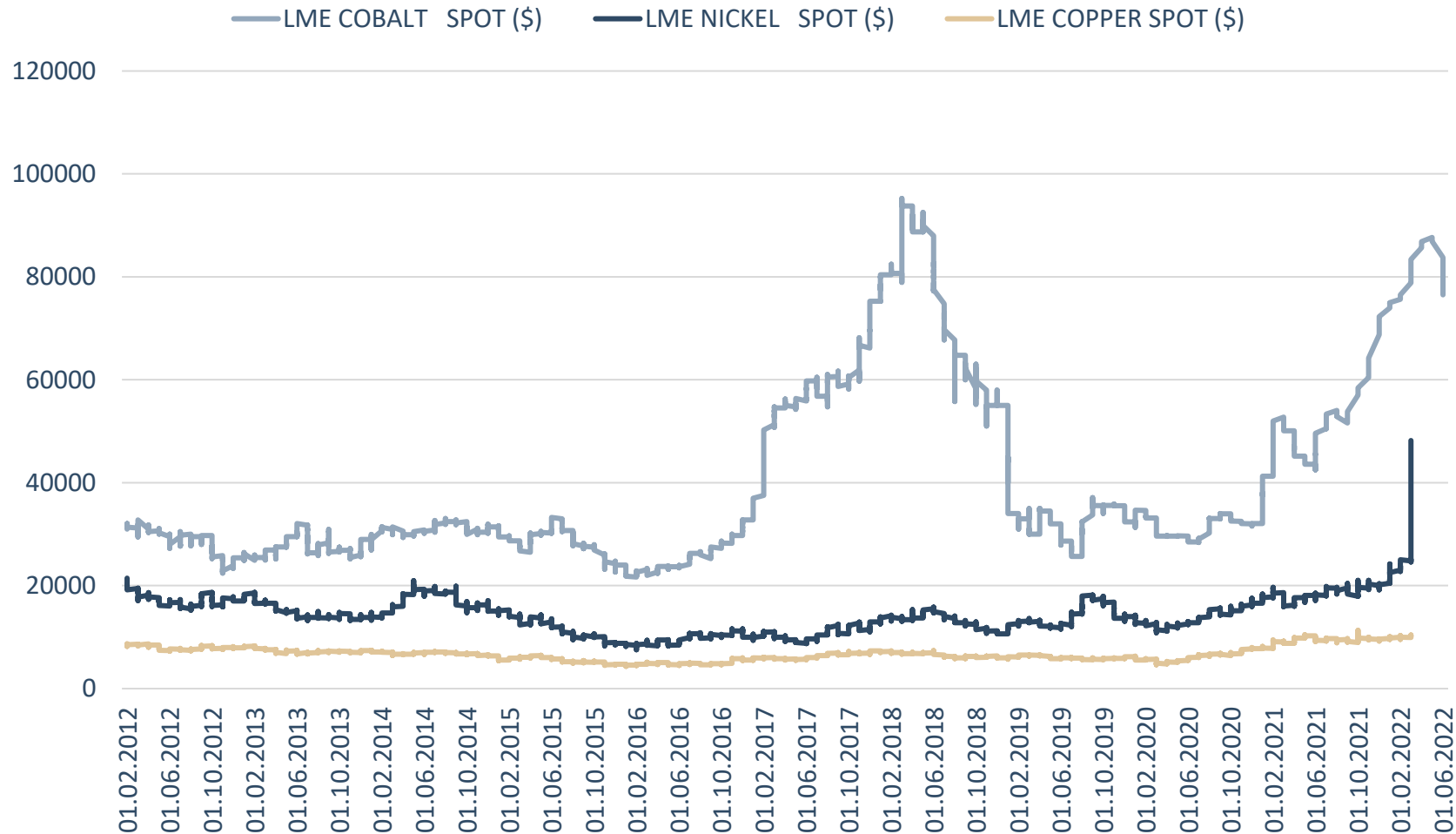
Quelle: Battery-news.de, 2022 (July 2022)

Lithium: Prices soared in 2021



- Lithium is highly reactive and therefore traded in the form of Lithium Hydroxide.
- Prices collapsed in the aftermath of a price rally from 2015 to 2018.
- In the year 2021 prices for battery grade Lithium Hydroxide tripled.
- 80 Percent of the global Lithium supply is controlled by only four companies..

Spot prices for important raw materials



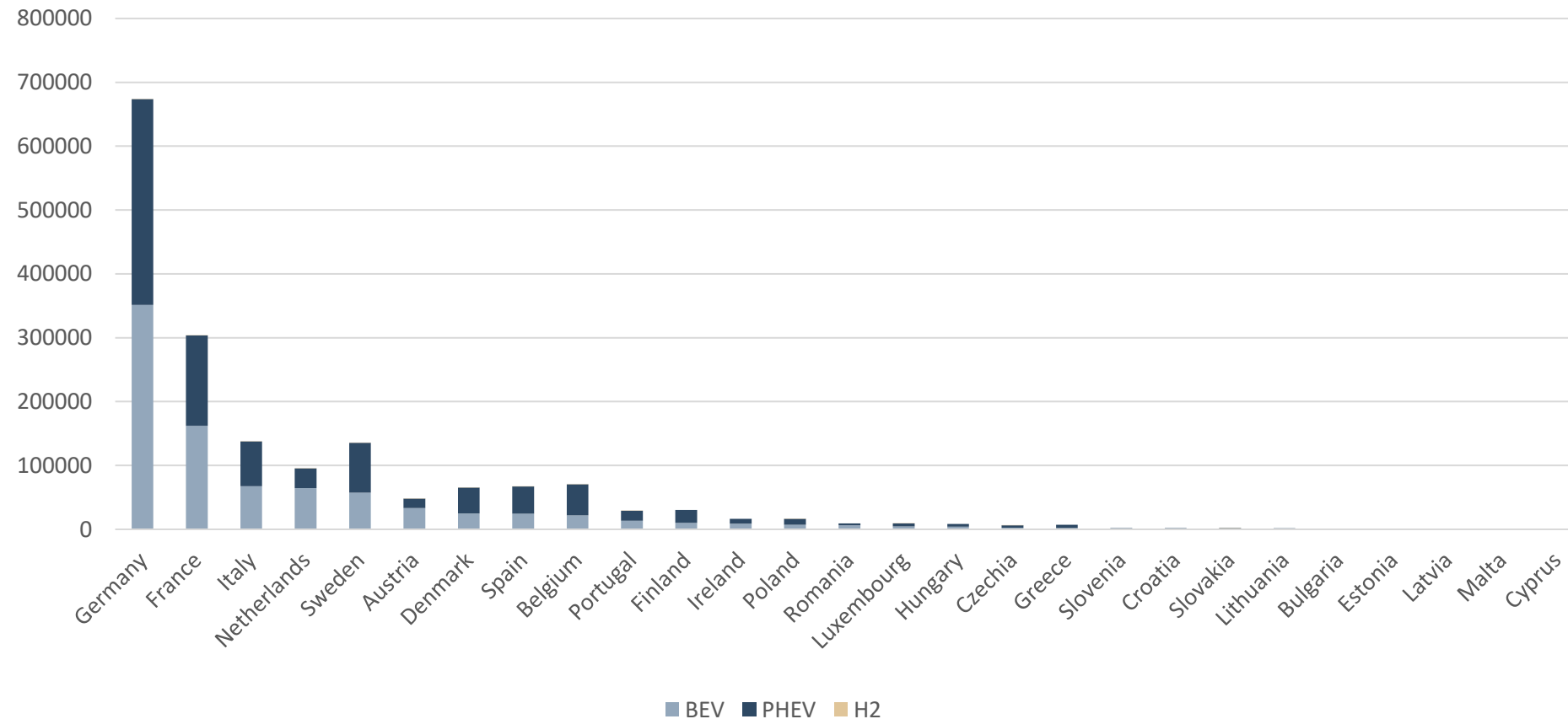
Source: LME, 2021



- ▶ Prices for cobalt have risen by a good 200 percent since March 2015 and have collapsed since Mai 2018. They now are on the level of before the price rally.
- ▶ Cobalt is mostly a by-product of nickel and copper production. Falling nickel and copper prices dampen cobalt production.
- ▶ Cobalt production and processing are under control of Chinese companies.

Germany counts for 40 percent of new registrations

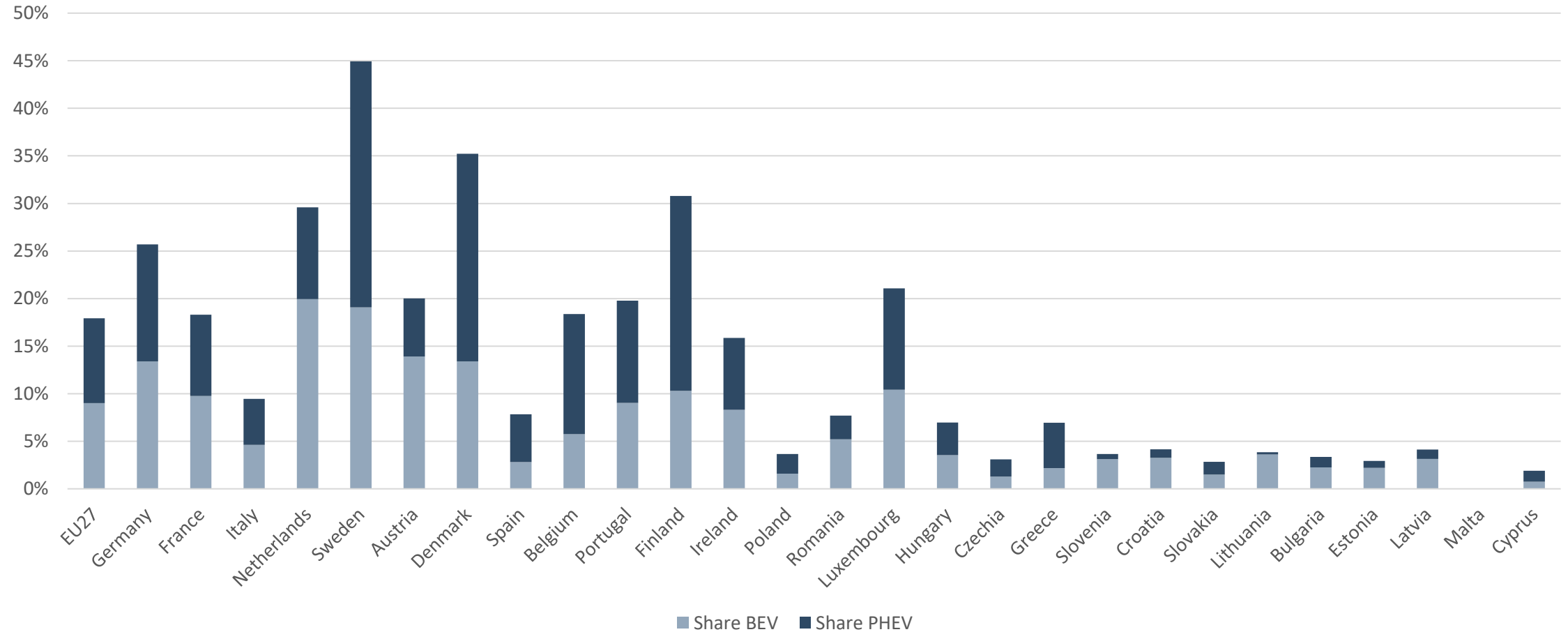
New registrations of electric cars in 2021 in the EU – number of units



Source: EAFO, 2022

Registrations of electric cars: Large regional differences

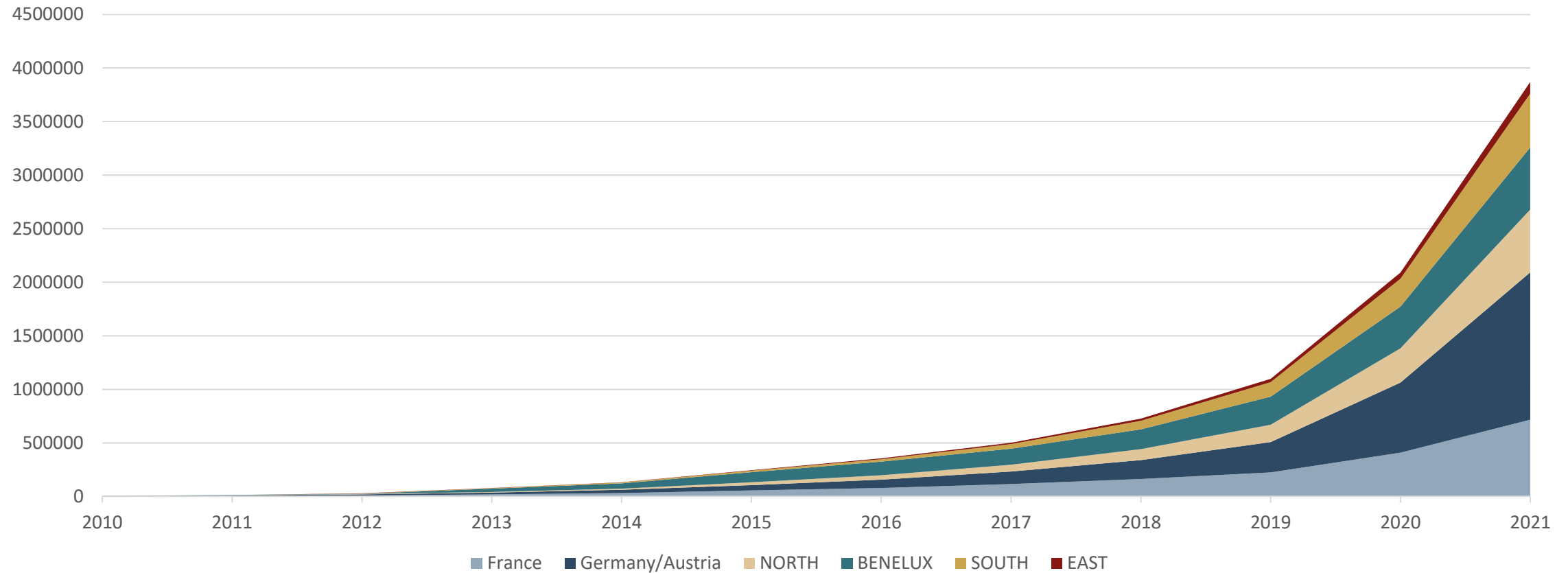
Market share of electric cars in EU 27 – indicated in percentage



Source: ACEA, 2022; EAFO, 2022

Electric vehicles are concentrated in a few countries

Fleet of electric passenger cars in the EU27 by region

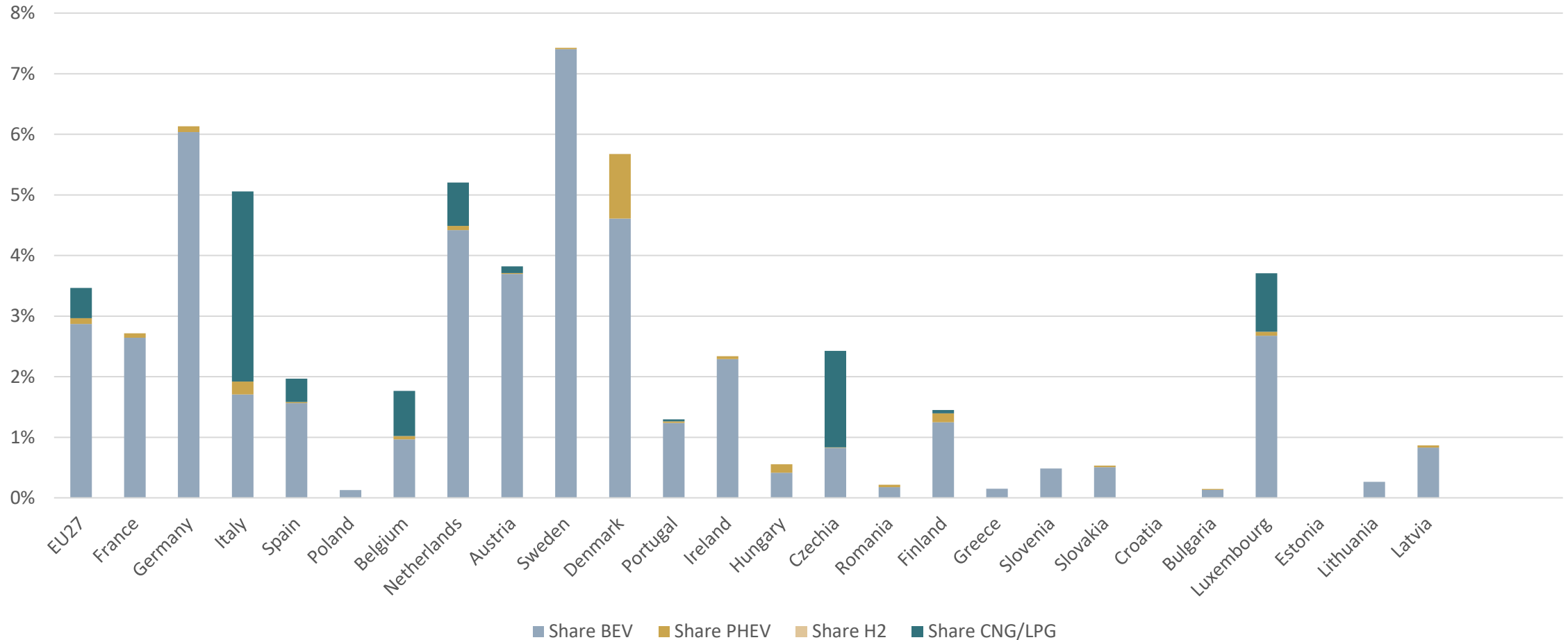


NORTH: Denmark, Finland, Ireland, Sweden; EAST: Bulgaria, Estonia, Croatia, Latvia, Lithuania, Poland, Romania, Slovakia, Slovenia, Czechia, Hungary; SOUTH: Greece, Italy, Malta, Portugal, Spain, Cyprus

Source: EAFO, 2022

Light Trucks: Alternative drives still at the beginning of the road

Market shares of Light Trucks with alternative drives in EU 27 – indicated in percentage of 2021

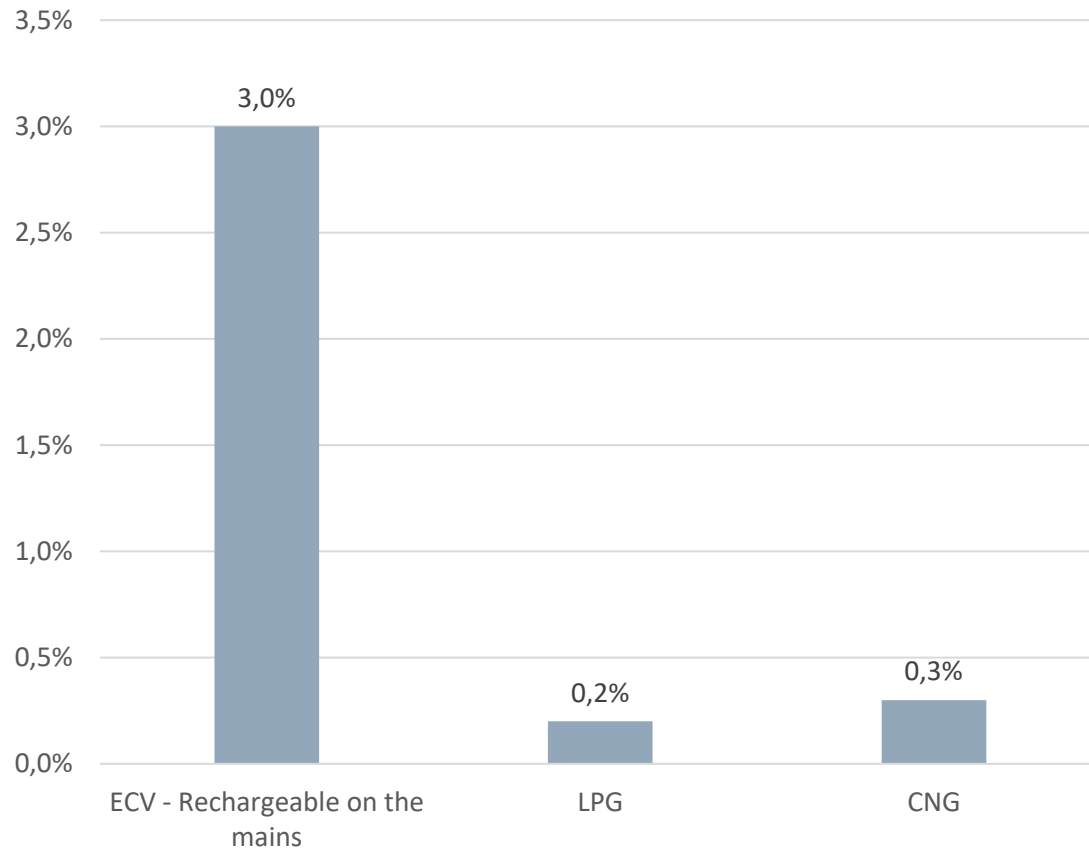


*No data for Malta, Cyprus
Source: ACEA, 2022; EAFO, 2022

Only a few vehicles on the road

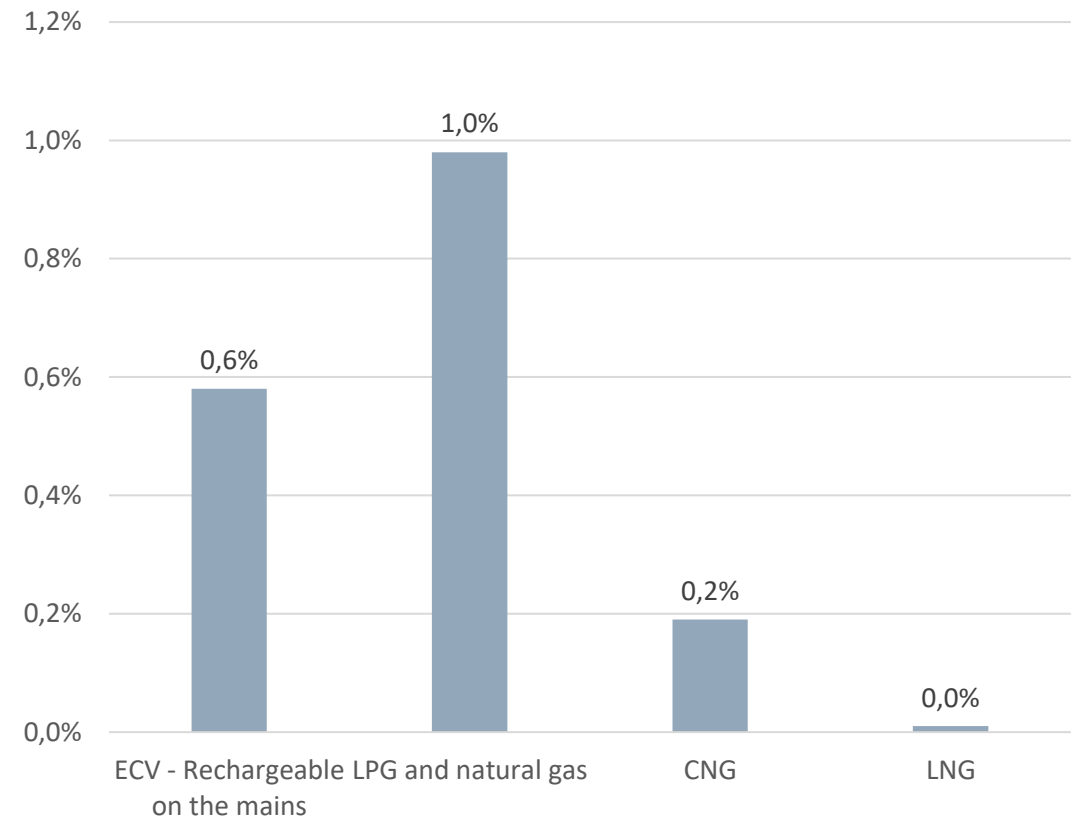
Only a fraction of the fleet has an alternative power train

Share of alternative drives in passenger car inventory in the year 2021



Only a fraction of the fleet has an alternative power train

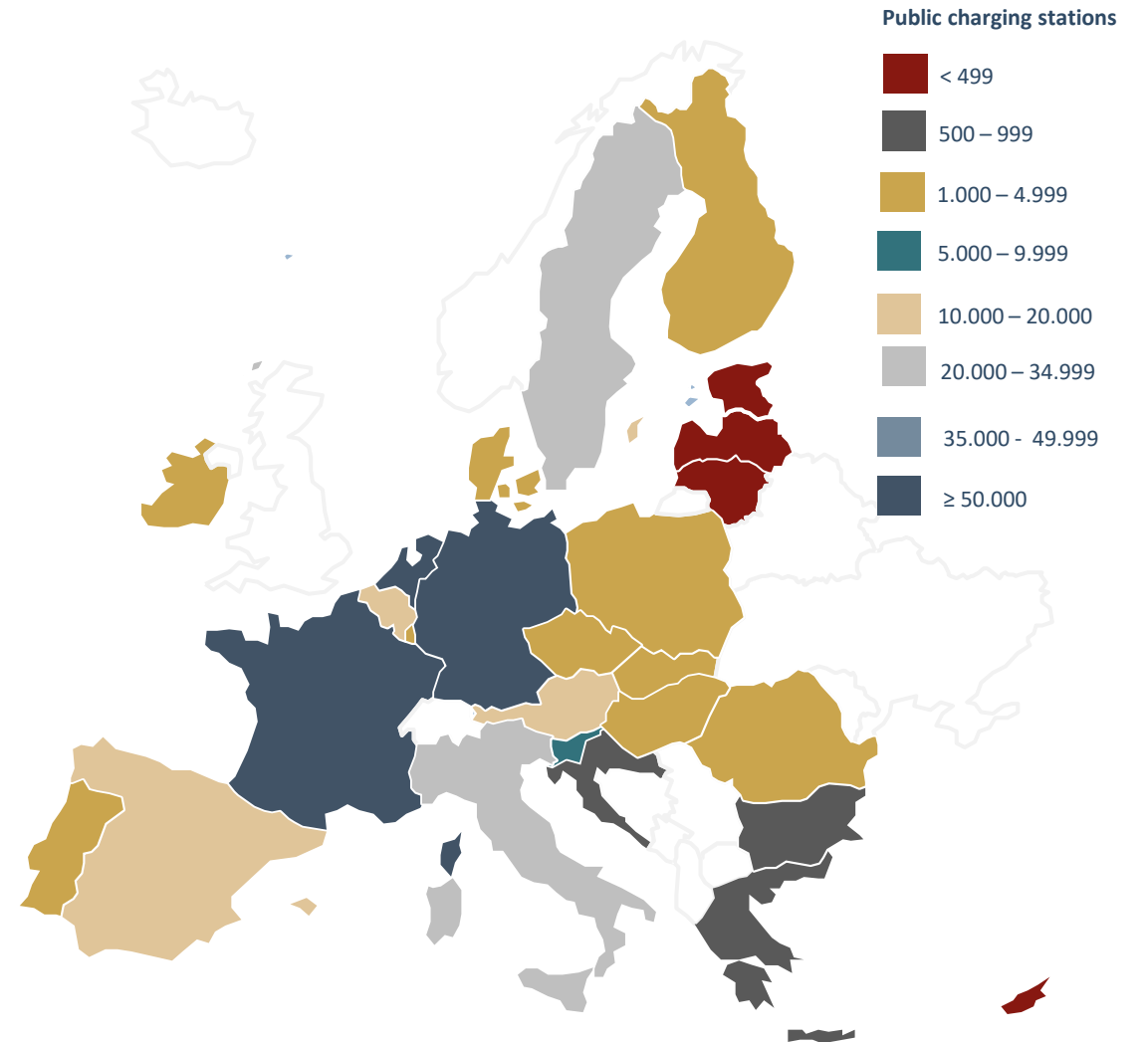
Share of alternative drives in light commercial vehicles in the year 2021



Source: EAFO, 2022

Charging infrastructure is concentrated in a few countries

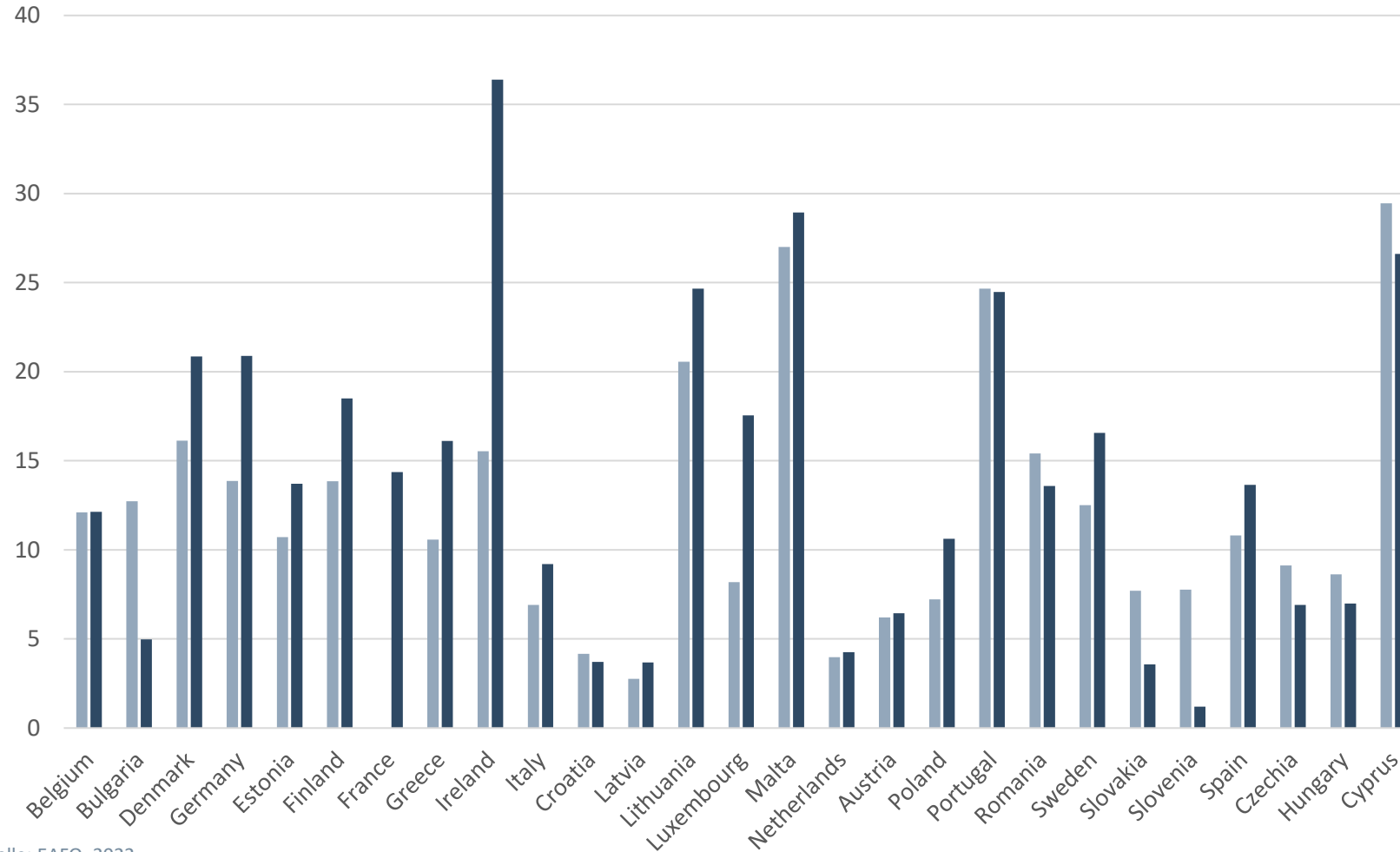
Land	Charging points 2021	Of which > 22 kW	Share in the EU < 22 kW	Share in the EU > 22 kW
EU27	338.191	39.117	100%	100%
Netherlands	91.739	4.219	27.13%	10.79%
Germany	62.711	10.752	18.54%	27.49%
France	54.653	4.858	16.16%	12.42%
Italy	26.860	3.692	7.94%	9.44%
Sweden	20.201	2.385	5.97%	6.10%
Austria	17.408	2.103	5.15%	5.38%
Belgium	14.982	836	4.43%	2.14%
Spain	12.434	3.020	3.68%	7.72%
Denmark	6.046	587	1.79%	1.50%
Slovenia	5.560	291	1.64%	0.74%
Finland	5.451	730	1.61%	1.87%
Portugal	3.917	993	1.16%	2.54%
Hungary	2.886	622	0.85%	1.59%
Poland	2.784	838	0.82%	2.14%
Czechia	2.299	800	0.68%	2.05%
Slovakia	1.624	401	0.48%	1.03%
Romania	1.240	450	0.37%	1.15%
Ireland	1.079	223	0.32%	0.57%
Luxembourg	1.044	20	0.31%	0.05%
Croatia	940	327	0.28%	0.84%
Bulgaria	683	221	0.20%	0.56%
Greece	629	23	0.19%	0.06%
Latvia	480	418	0.14%	1.07%
Estonia	198	155	0.06%	0.40%
Lithuania	181	153	0.05%	0.39%
Malta	100	0	0.03%	0.00%
Cyprus	62	0	0.02%	0.00%



Sources: EAFO, 2022

Public charging stations - a chicken-and-egg problem

So far, there are only a few BEVs per public charging point



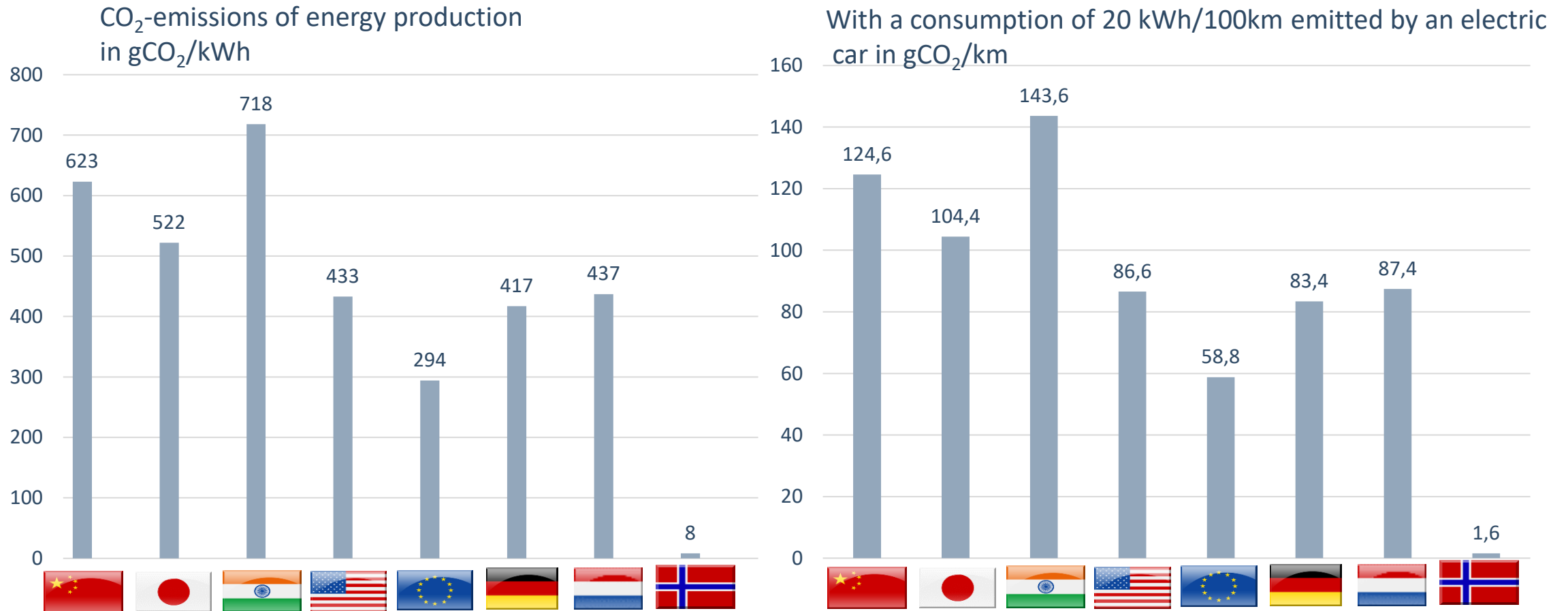
Quelle: EAFO, 2022



- A dense network of public charging points is needed for BEVs to spread on the mass market.
- However, with only a few charging processes per charging point, their operation is not economically viable.
- The situation is aggravated by the fact that today 80 percent of charging processes take place at non-public charging points.
- Problem: The lamppost parker needs the public network, but the current owner of a BEV usually does not.

Energy mix decides on climate friendliness

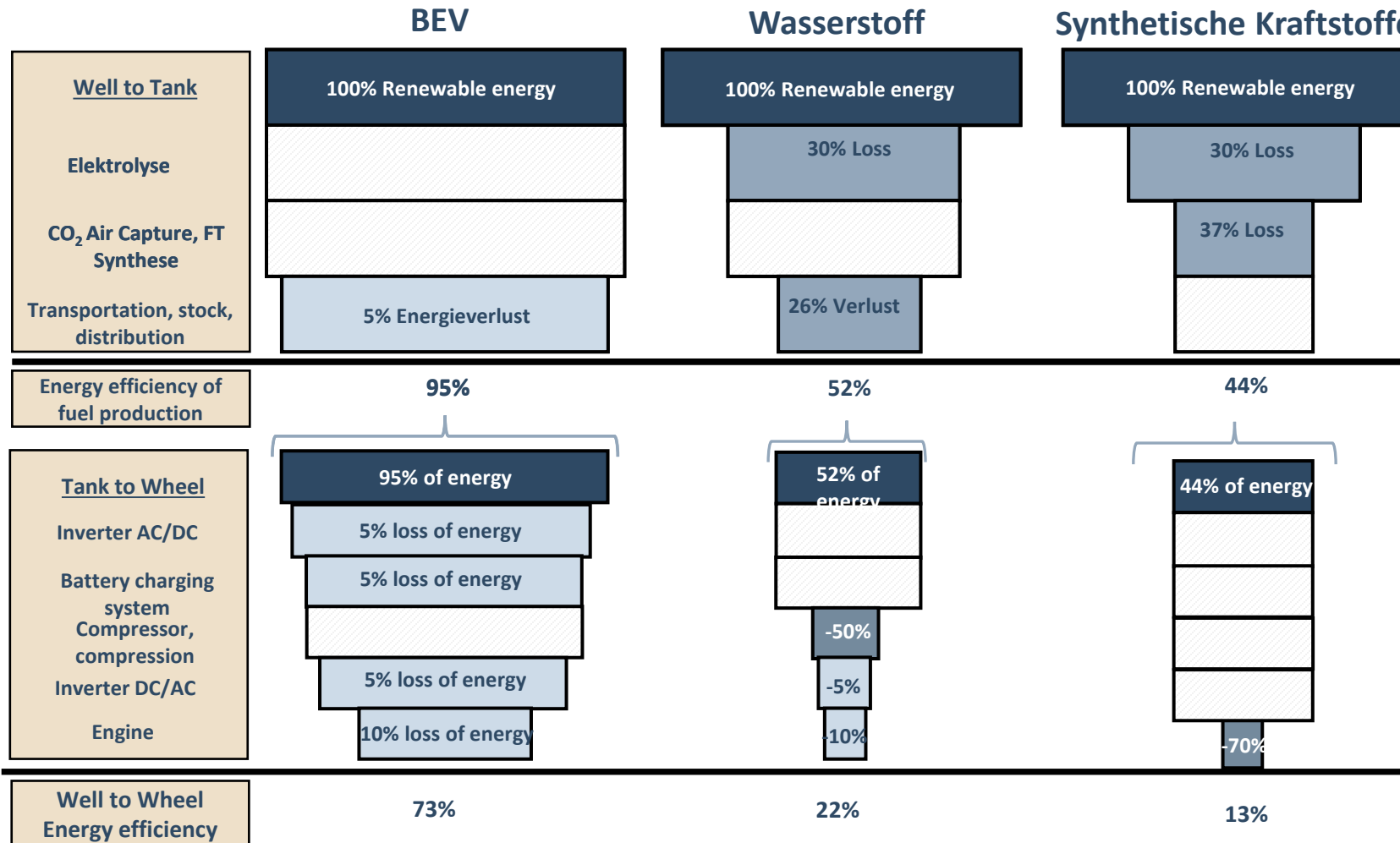
CO₂-emissions of energy production and electric cars



Source: IEA, CO₂-Emissions from Fuel Combustion, 2019, own calculations

Efficiency edge for BEV, but efficiency is not all

Energy efficiency in the Well to Wheel perspective by diverse energy storage systems



But:

- ▶ Technical efficiency is different from system efficiency.
- ▶ Hydrogen and synthetic fuels achieve higher weight- and volume-specific energy densities.
- ▶ Both are better suited for the indispensable energy import.
- ▶ Synthetic fuels can decarbonize vehicle stock.
- ▶ Even in the most optimistic scenarios, direct electrification is not sufficient to meet the climate targets in transportation.

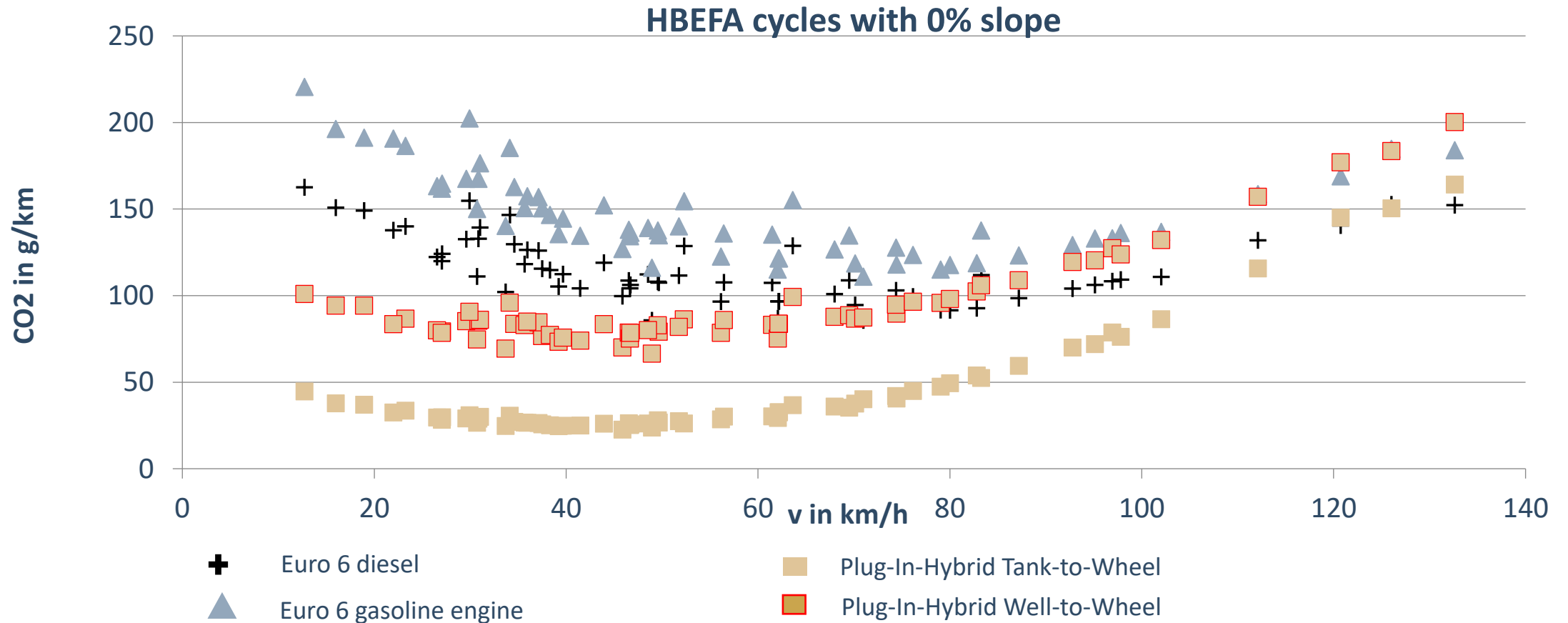
Conclusion

All alternatives will be needed to achieve the climate targets in transport.

Source: Transport & Environment, 2019

The speed makes the difference

CO₂-emissions of middle class passenger cars with different drive variants and driving speeds



Source: TU Graz, 2018