

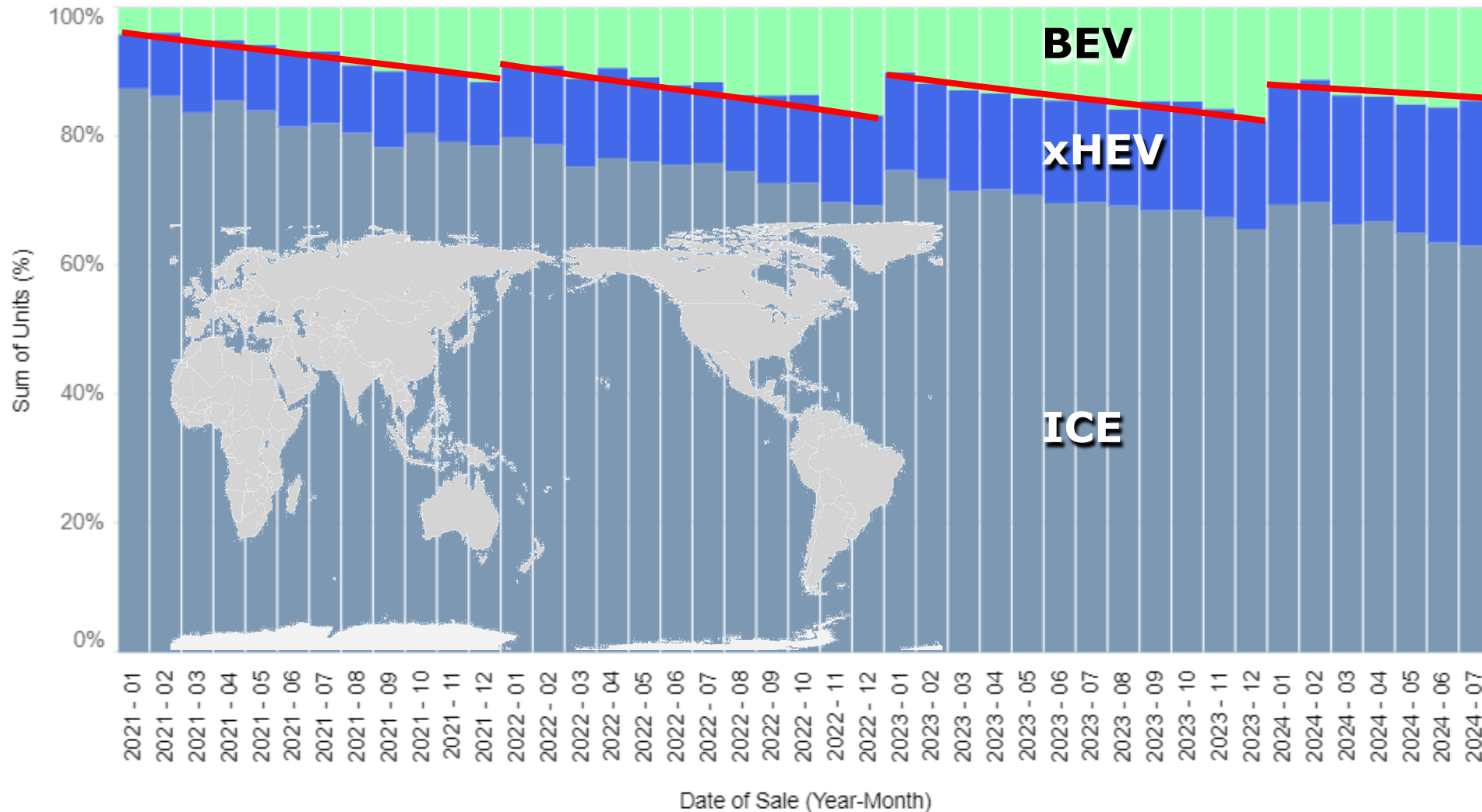
Potential Impacts of Consumer Trends on Future Powertrain Technology

2024 Waseda University - AVL Japan Joint Symposium

G. Fraidl

Global Passenger Car Sales - Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24

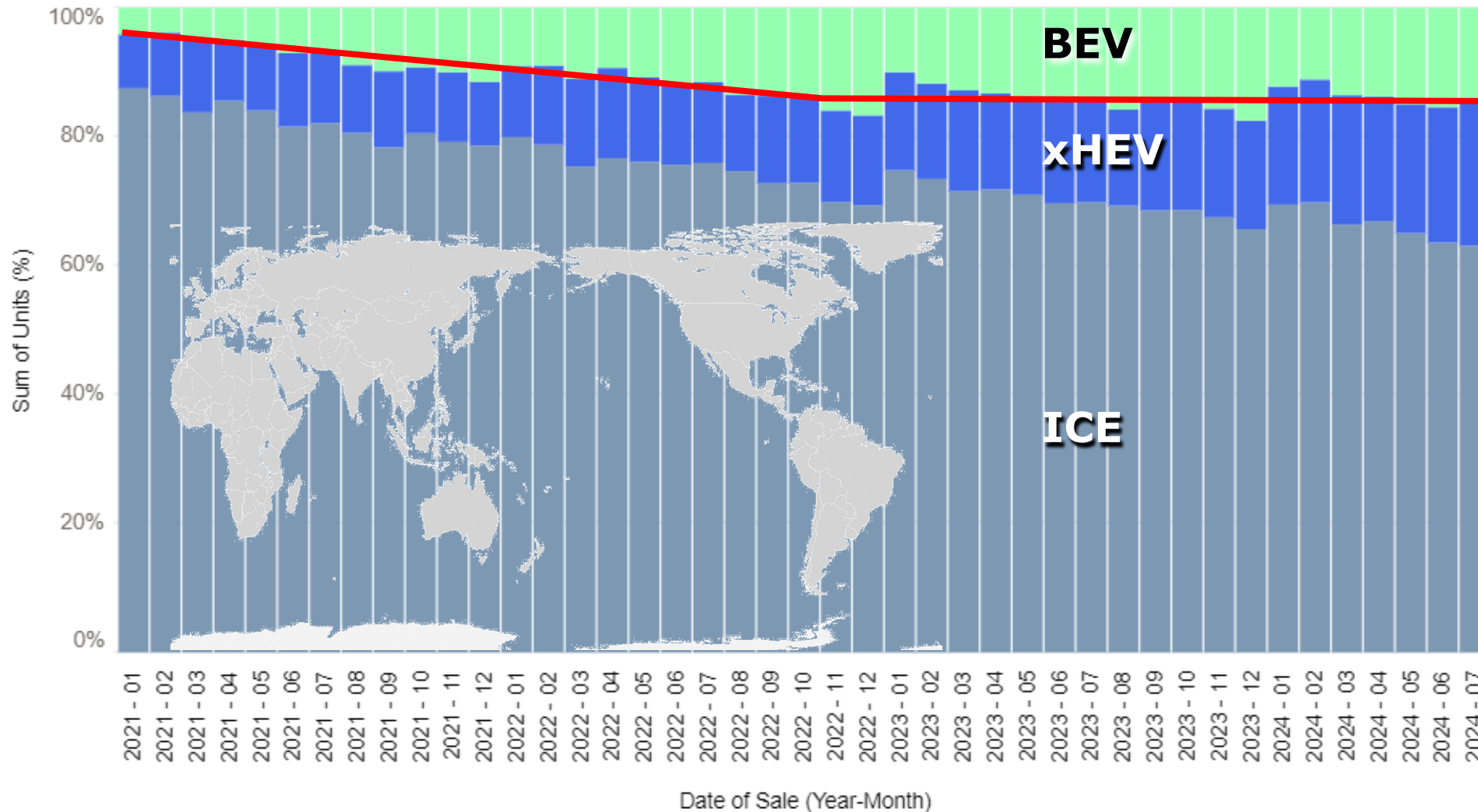


**BEV July 2024
14,4%**

**Global BEV share:
"Discontinuous
growth"**

Global Passenger Car Sales - Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24

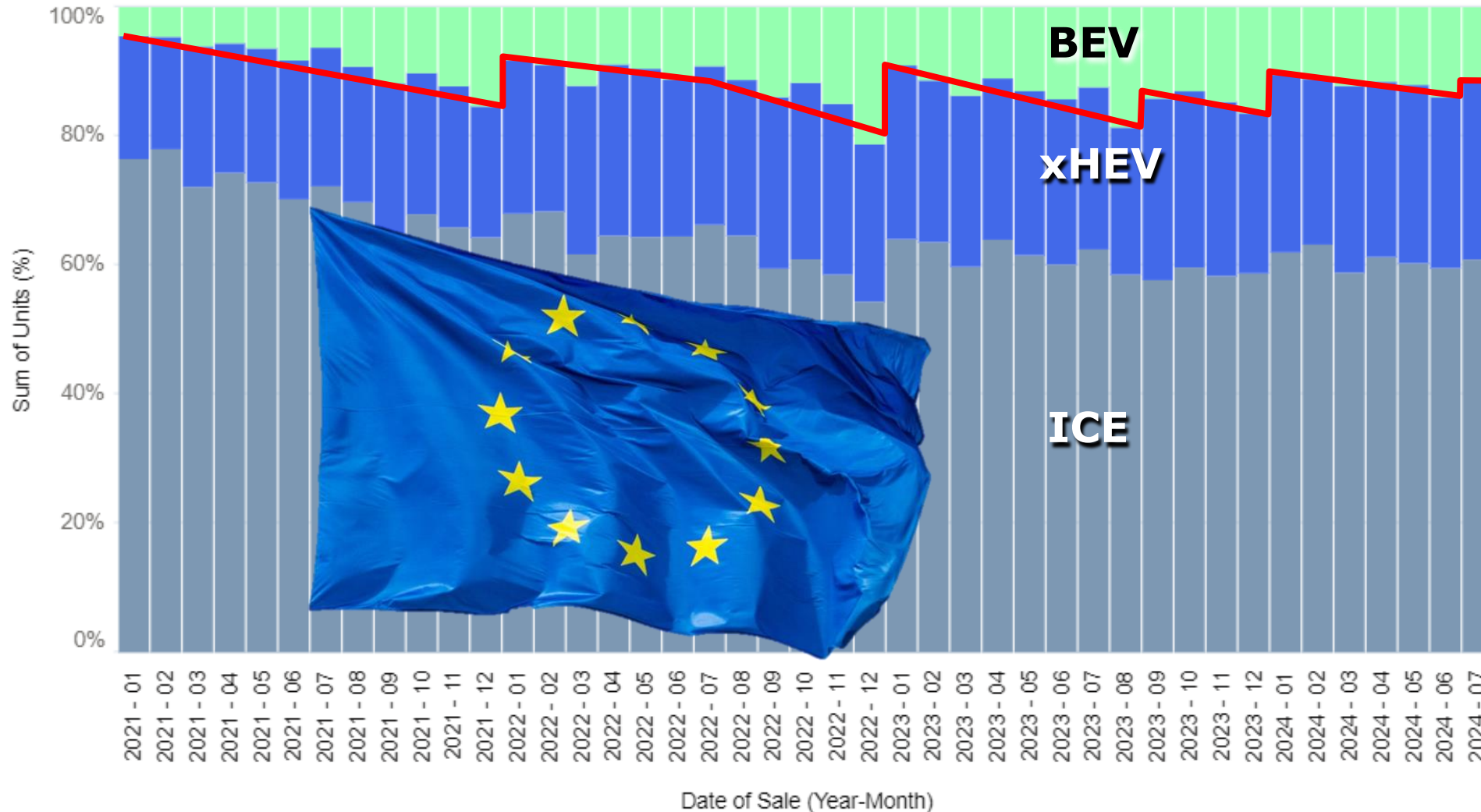


**BEV July 2024
14,4%**

**Global BEV share:
In total: now still
on a 2022 level**

Europe Passenger Car Sales - Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24

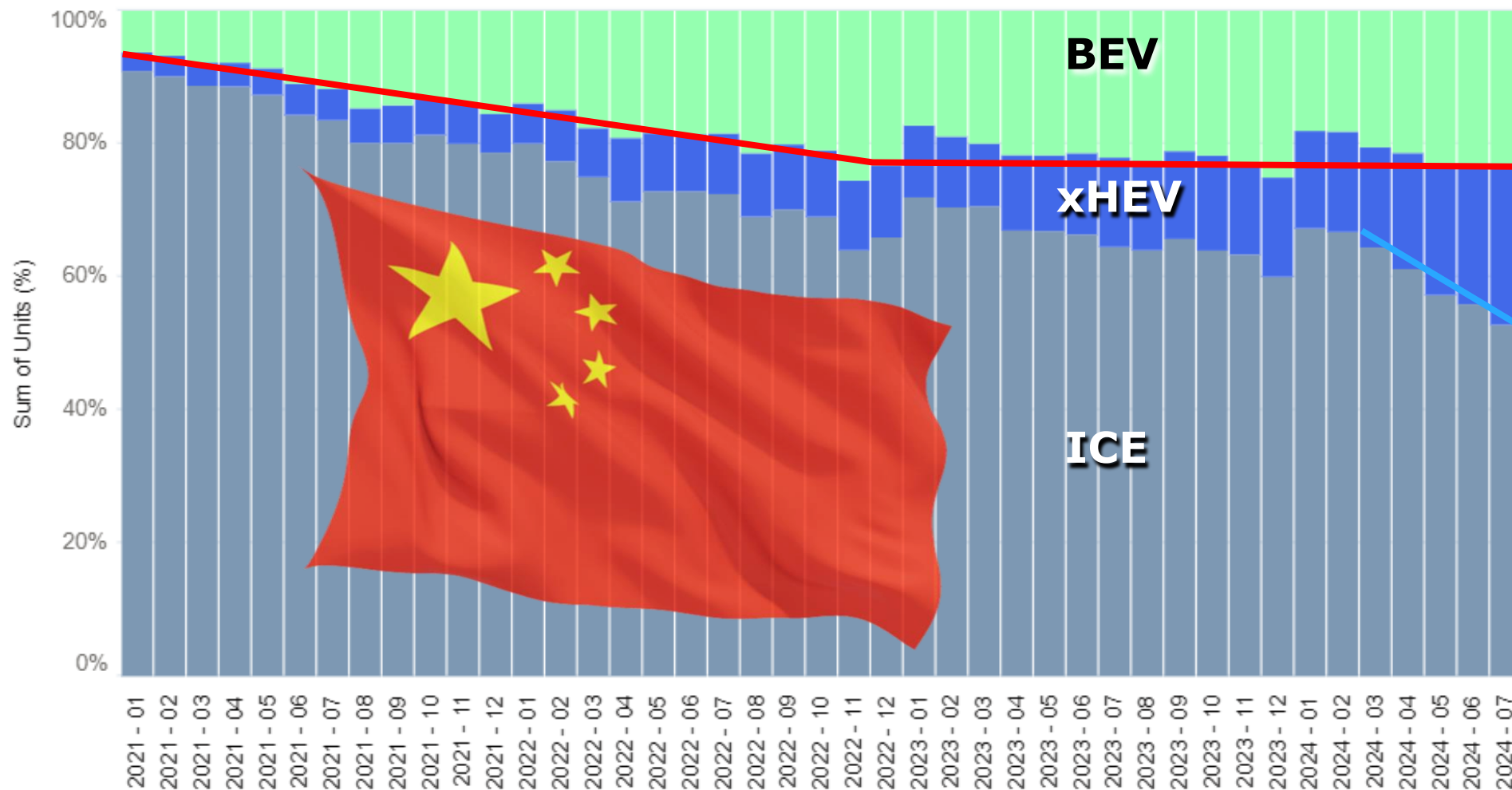


**BEV July 2024
11,1%**

**Europe BEV
share:
Strongly influen-
ced by changes in
incentivations,
2024 lower sales
than 2023**

China Passenger Car Sales – Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24



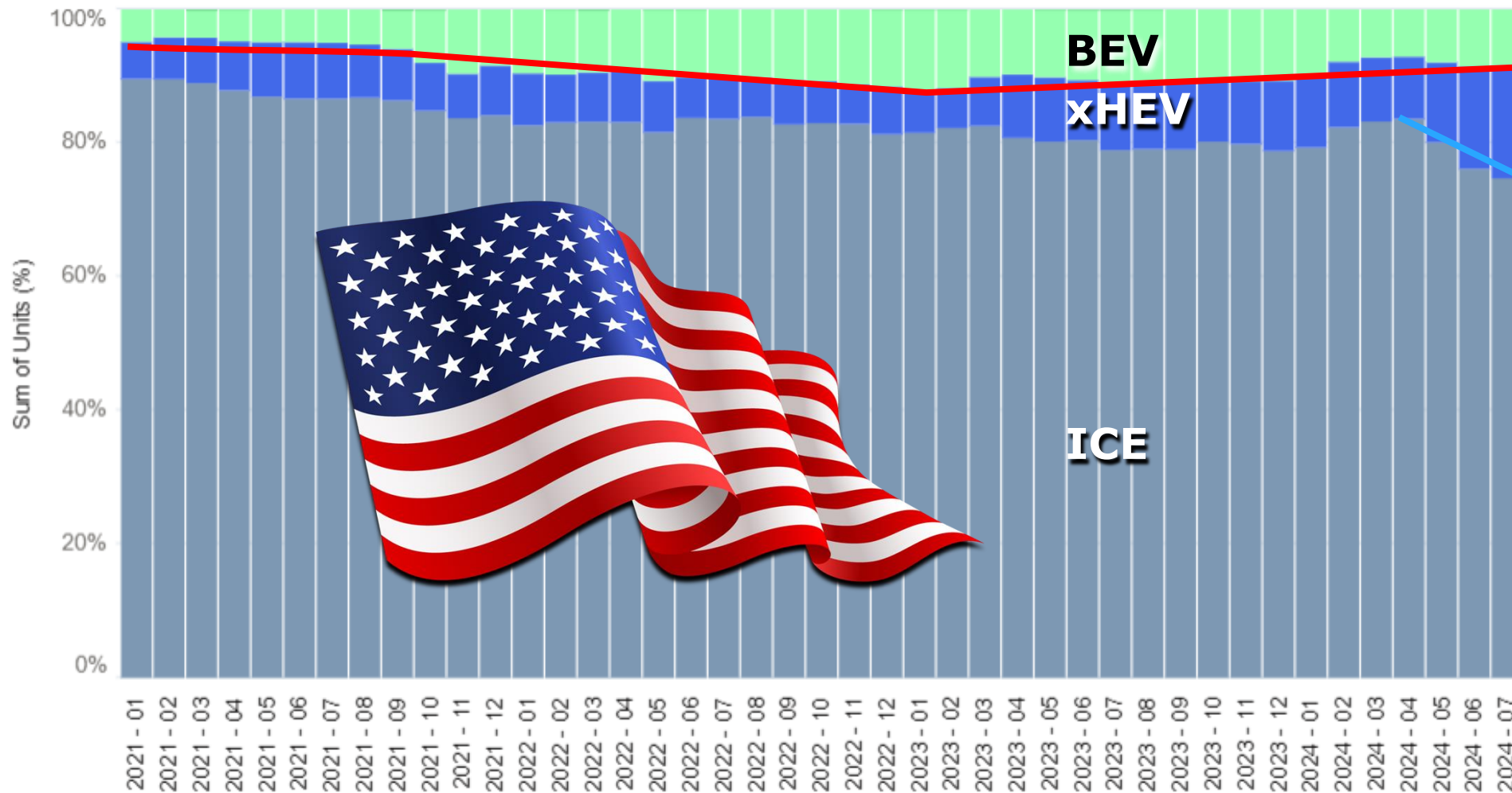
**BEV July 2024
23,6%**

**China BEV share:
Stabilizing on end
2022 level**

**NEV growth Q2
2024 primarily
from PHEV and
REX**

US Passenger Car Sales - Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24



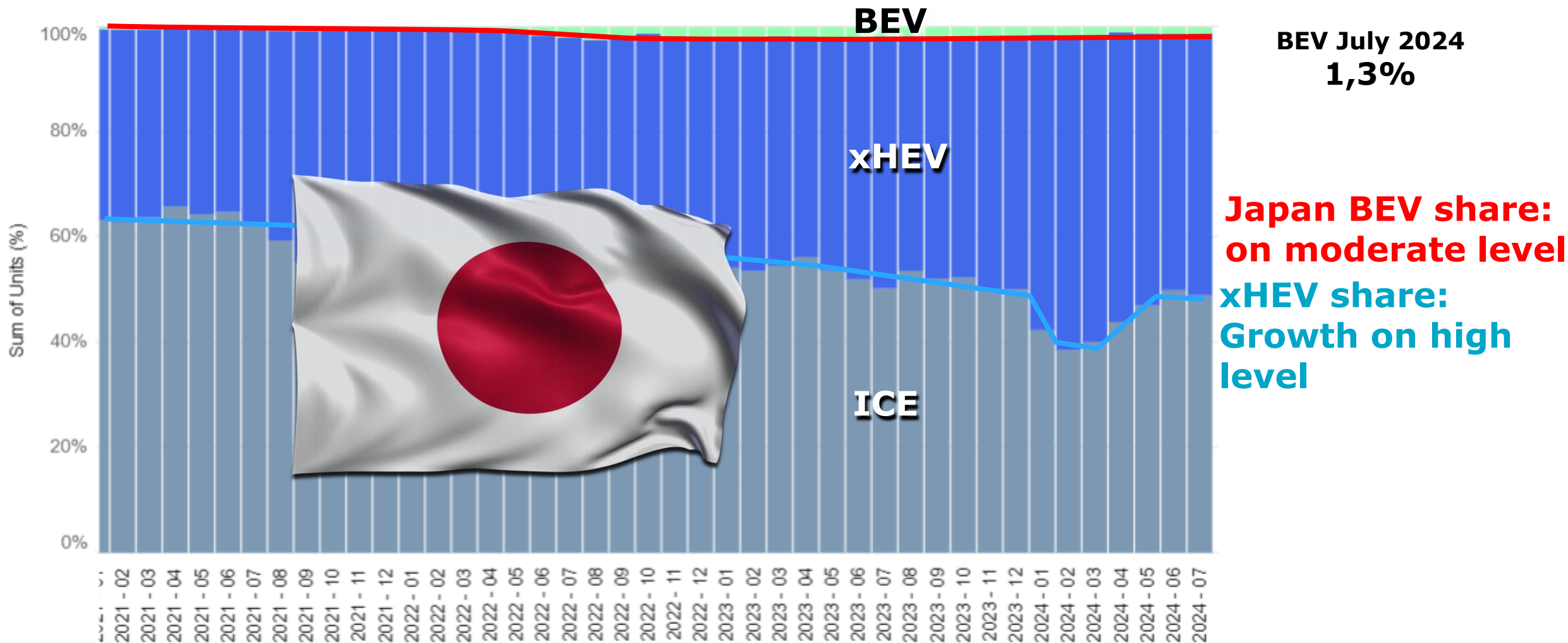
**BEV July 2024
8,5%**

**US BEV share:
Even slightly
declining since
begin 2023**

**In Q2 2024 clear
growth of xHEV**

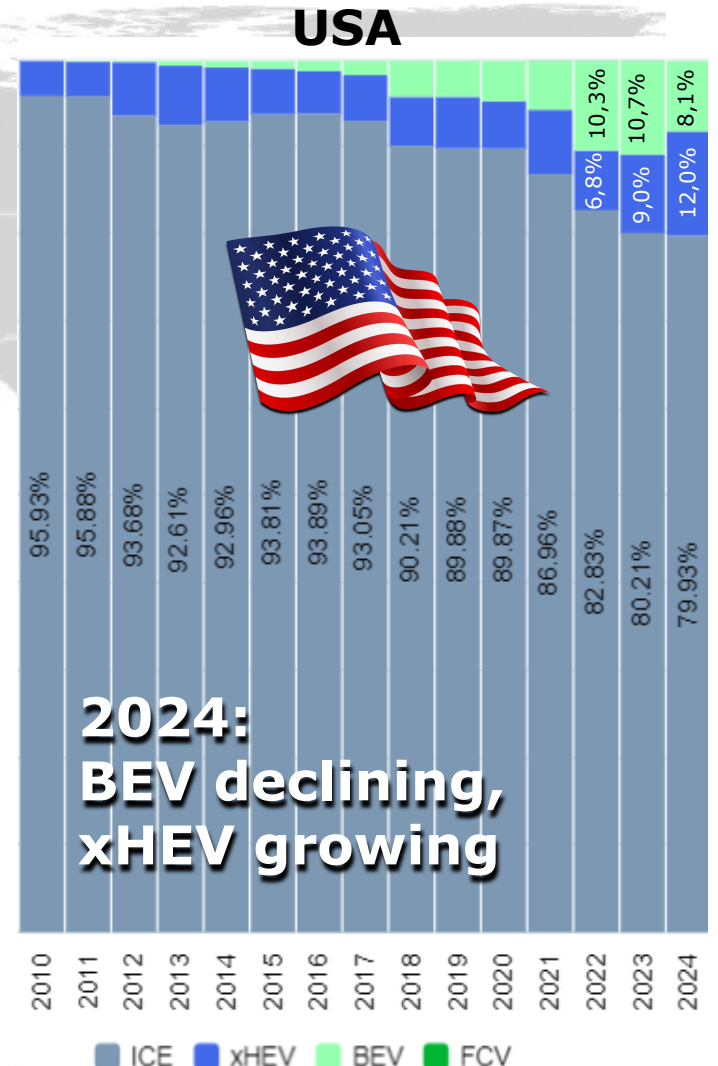
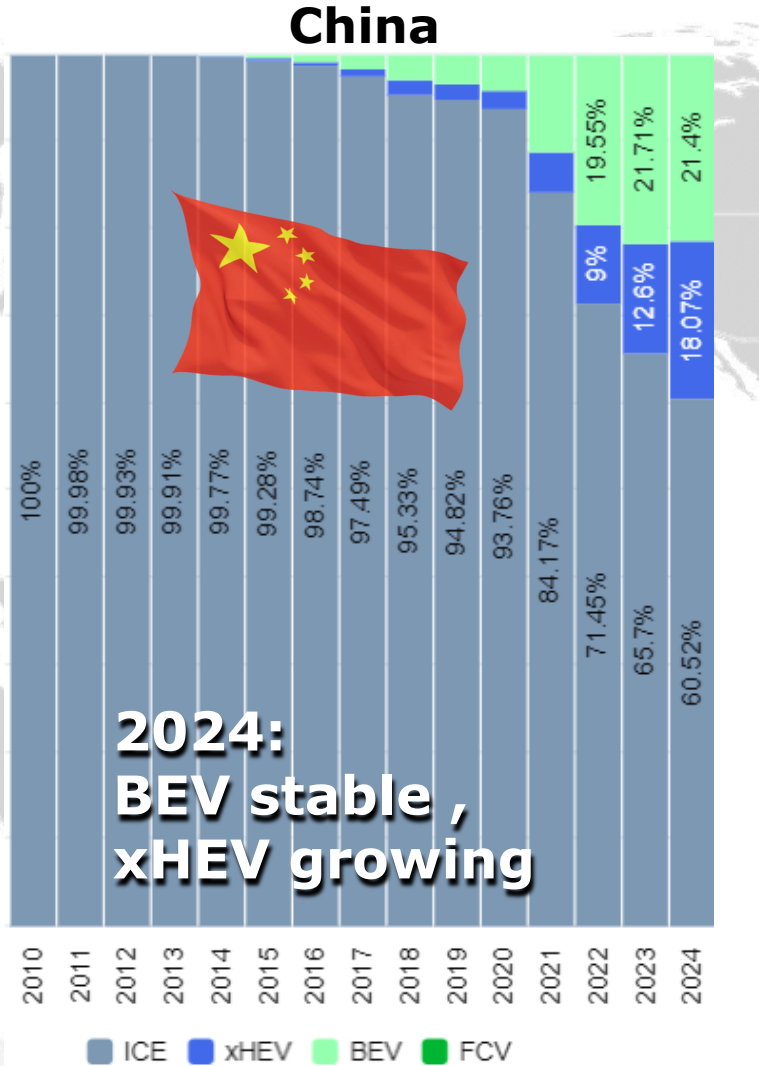
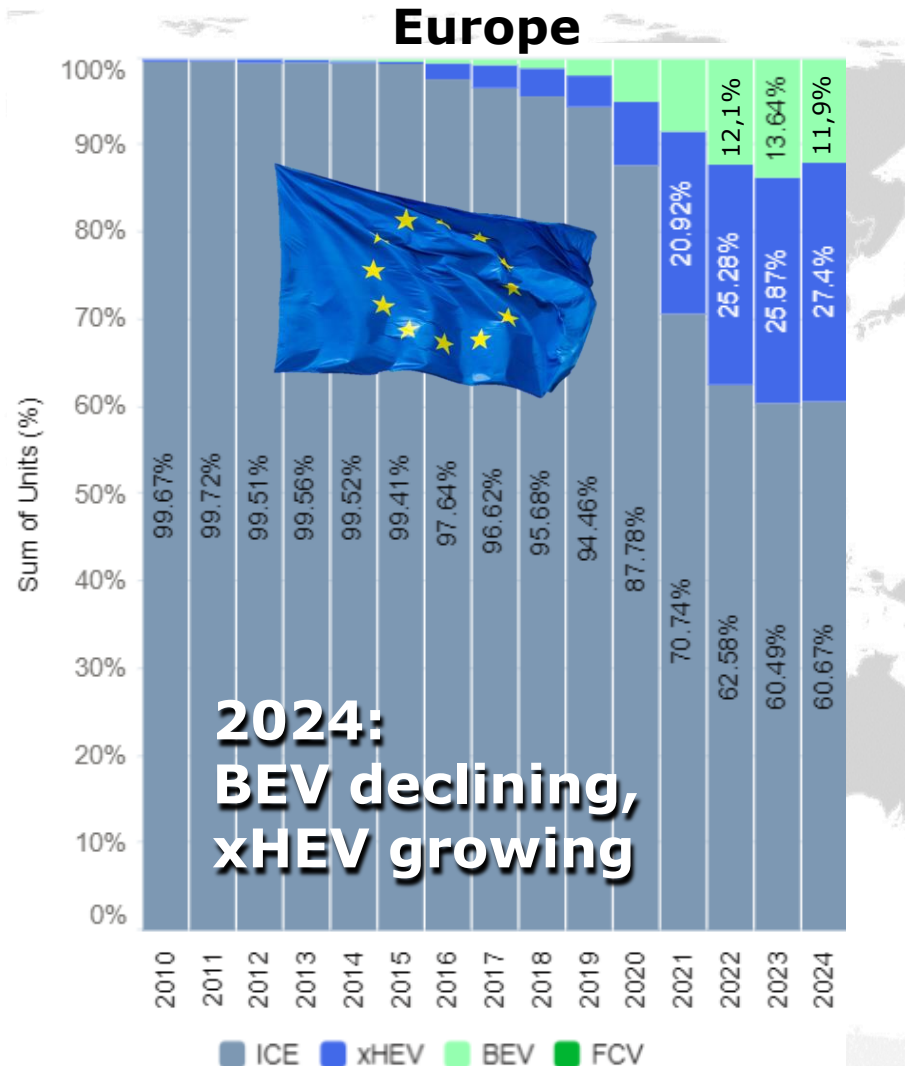
JAPAN Passenger Car Sales - Monthly^{*)}

^{*)}<3,5 to. Source Marklines 08/24



Regional Passenger Car Sales - Yearly^{*)}

^{*)}<3,5 to, Source: Marklines 08/24
Data 2024: 01-07



Flashlight on PassCar Regional Trends^{*)}

Status August 2024



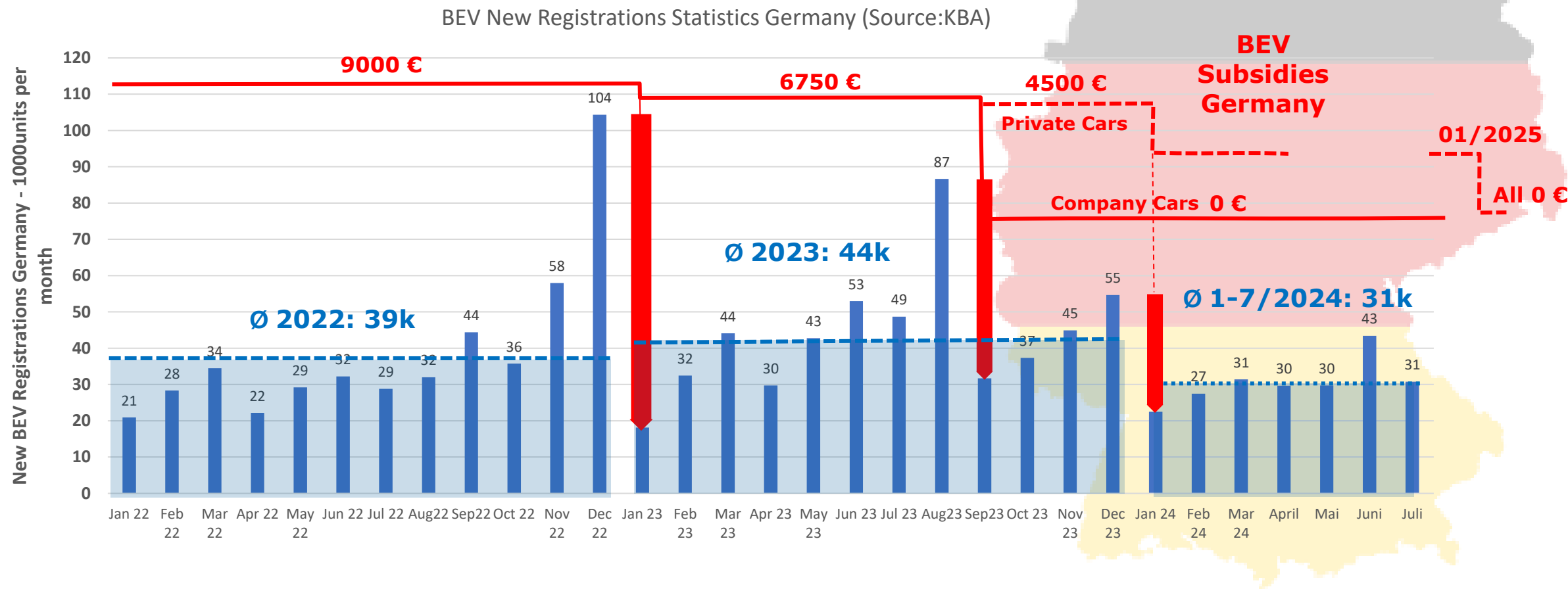
- **Reduction of BEV Subsidies & other hurdles → lower BEV sales growth → new interest on XHEV**



^{*)} European Perspective

BEV Monthly Sales & BEV Subsidies - Germany

Reduction of BEV subsidies → lower sales volumes → fleet CO₂ 2025 compliance endangered



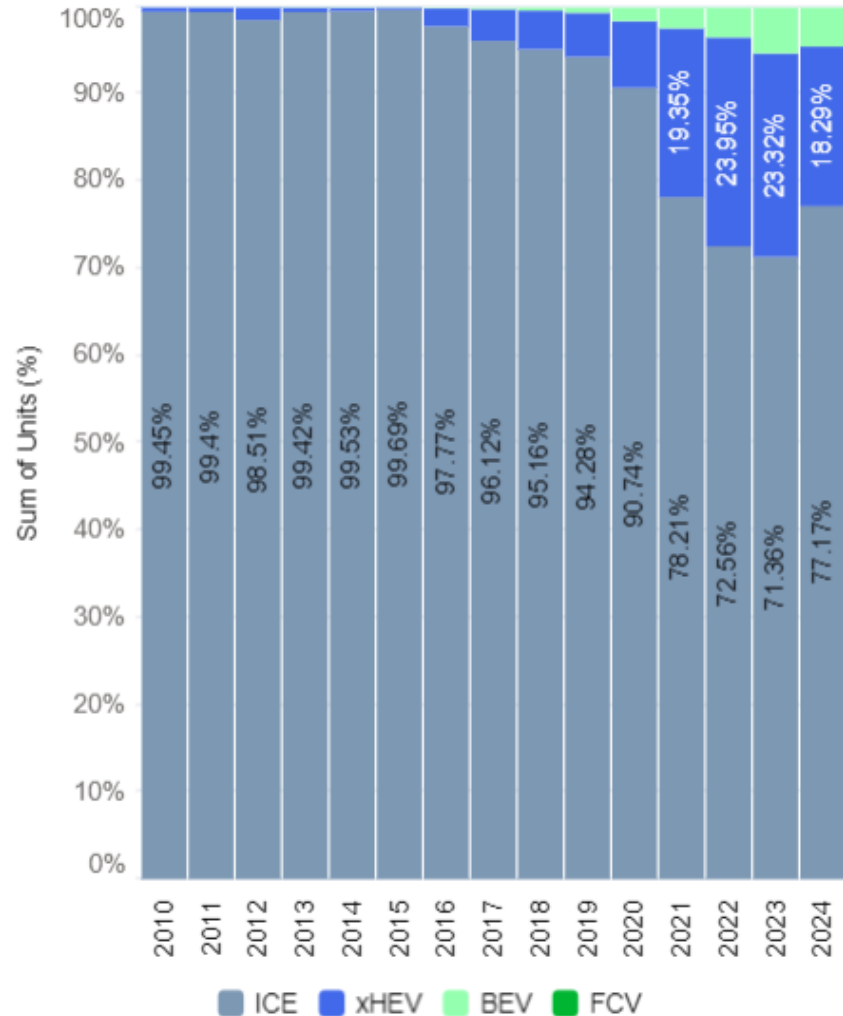
BEV sales significantly influenced by incentivization's

Regional Passenger Car Sales - Yearly^{*)}

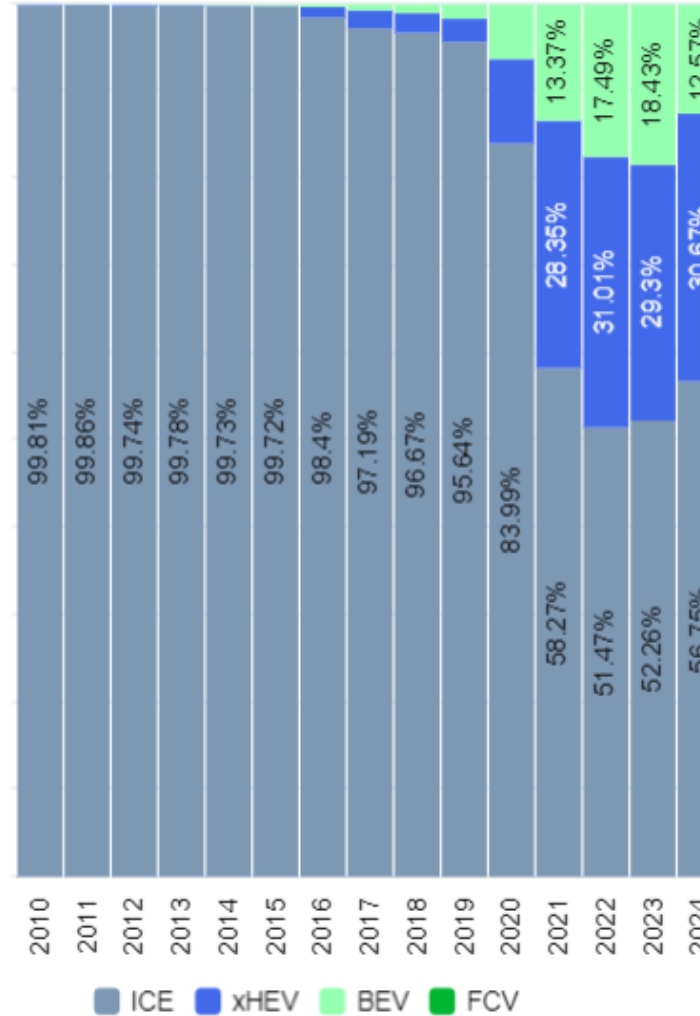
08/24

*) <3,5 to, Source: Marklines

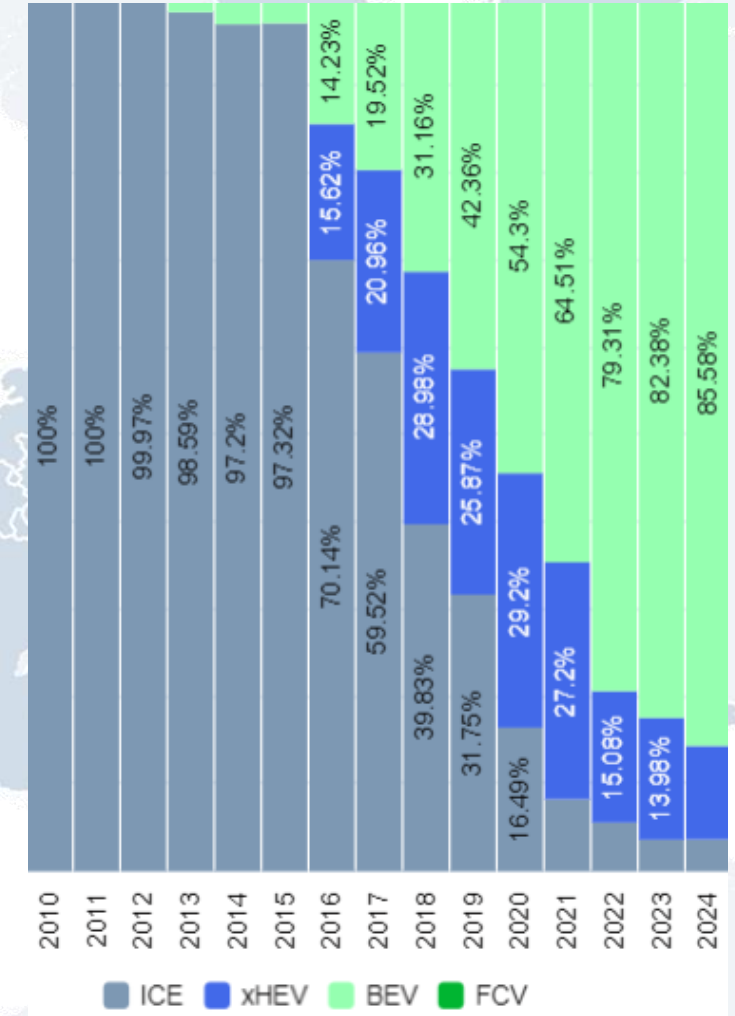
Spain



Germany



Norway



Flashlight on PassCar Regional Trends^{*)}

Status August 2024



- **Reduction of BEV Subsidies & other hurdles → lower BEV sales growth → new interest on XHEV**
- **Fleet CO₂ compliance 2025 becomes dominating short-term issue**



^{*)} European Perspective

Flashlight on PassCar Regional Trends^{*)}

Status August 2024



- Reduction of BEV Subsidies & other hurdles → lower BEV sales growth → new interest on XHEV
- Fleet CO₂ compliance 2025 becomes dominating short-term issue
- ICE Sales stop 2035 still under discussion
- Raise of import tax for Chinese cars proposed → risk of Trade War

**“Dogmatic”
Electrification**

^{*)} European Perspective

Flashlight on PassCar Regional Trends^{*)}

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Electrification

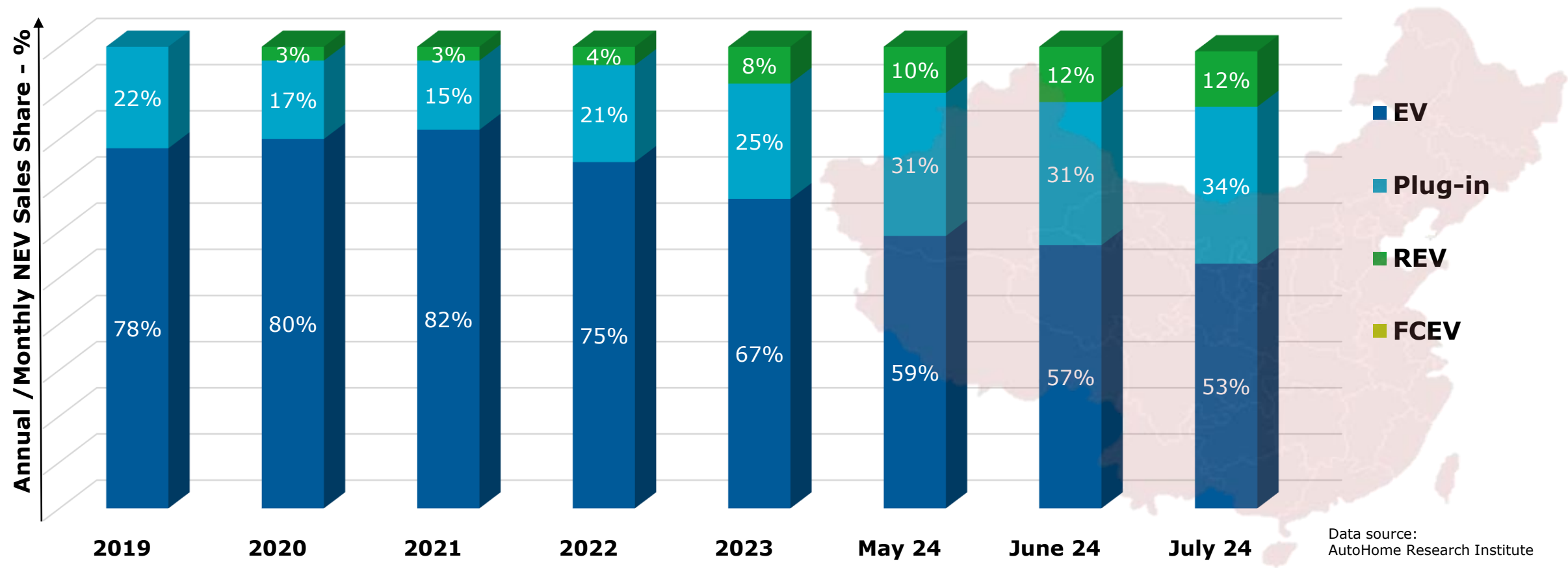


- **Focus on electrification, however proceeding with**
→ **NEV = BEV+PHEV/REX**



^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,

CHINA : Sales Volume Ratio of New Energy Vehicles



CHINA: Clear trends towards PHEV and Range Extender

Flashlight on PassCar Regional Trends^{*)}

Status August 2024

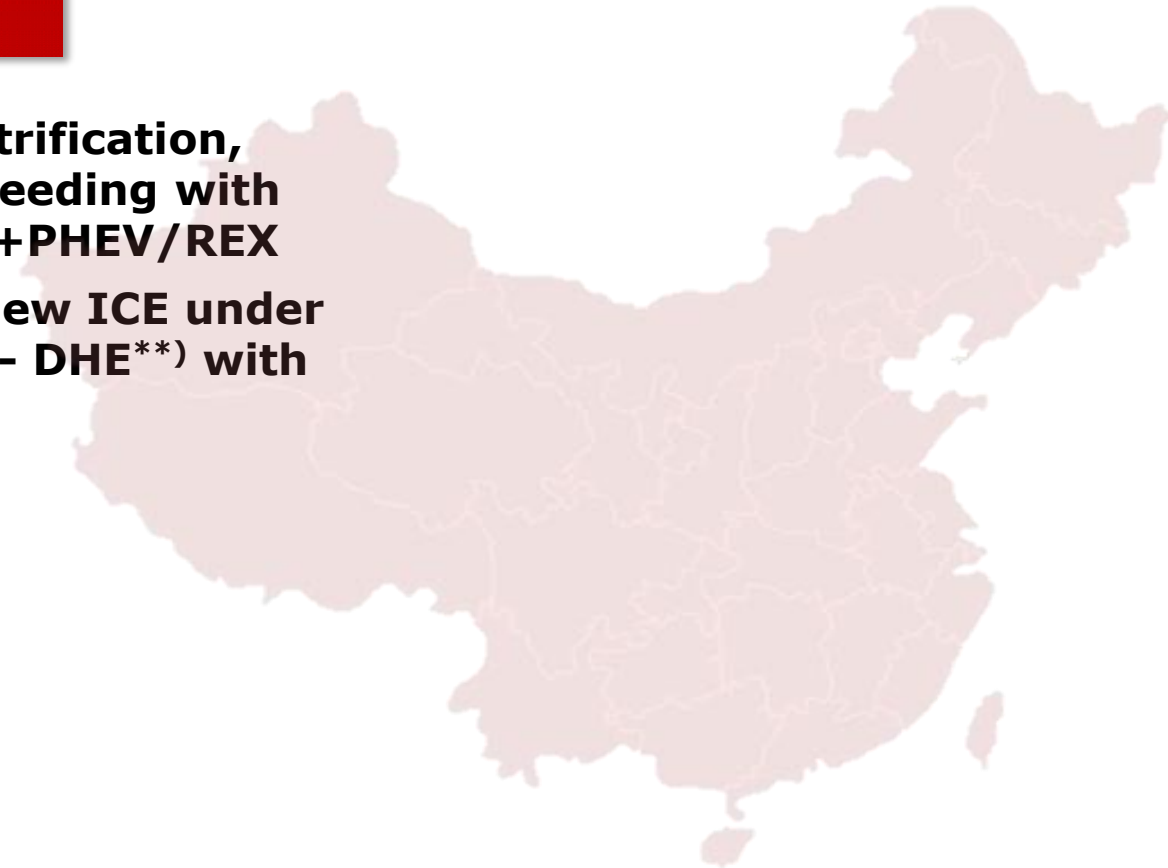


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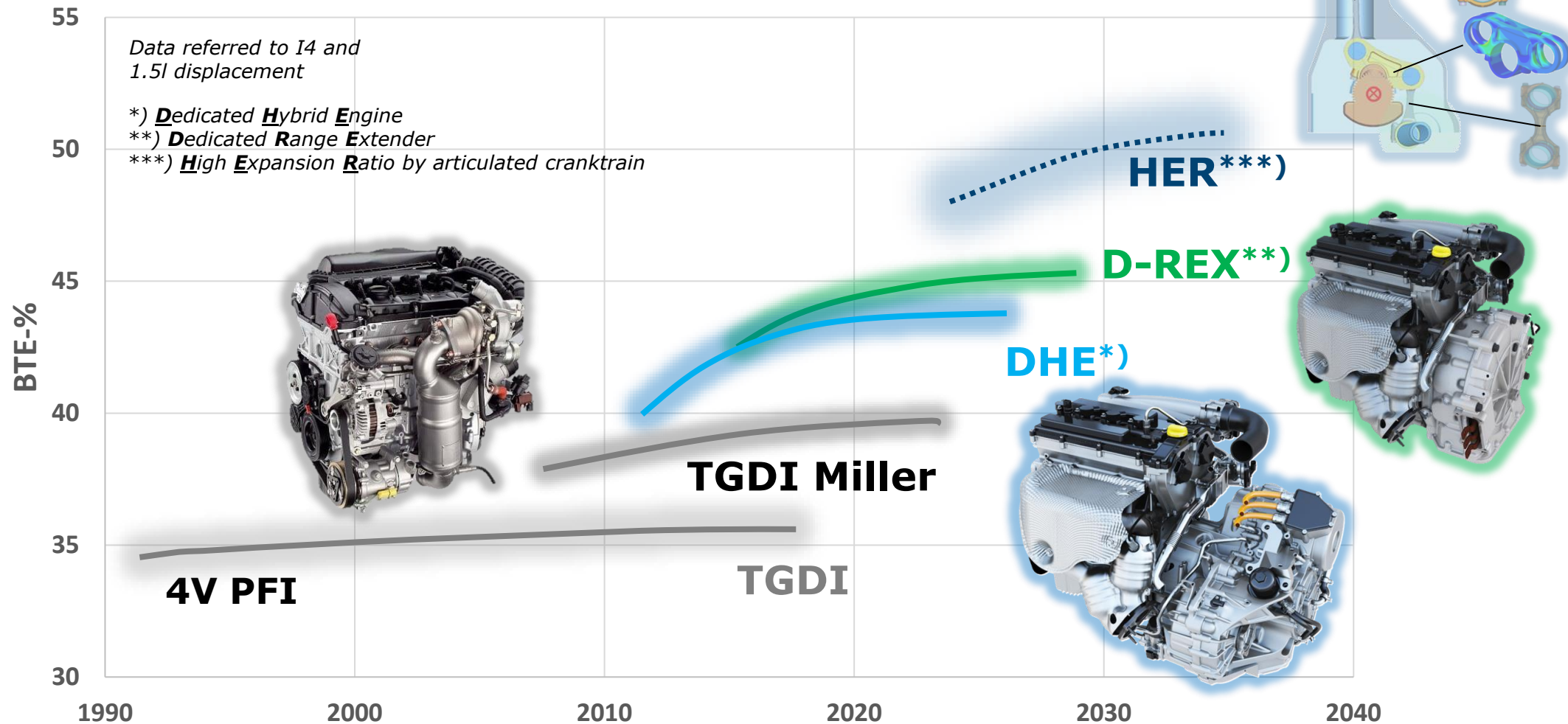


- Focus on electrification, however proceeding with → NEV = BEV+PHEV/REX
- Still various new ICE under development - DHE^{**)} with BTE > 43%



^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,

The Evolution of ICE Efficiency (Gasoline)



Flashlight on PassCar Regional Trends^{*)}

Status August 2024



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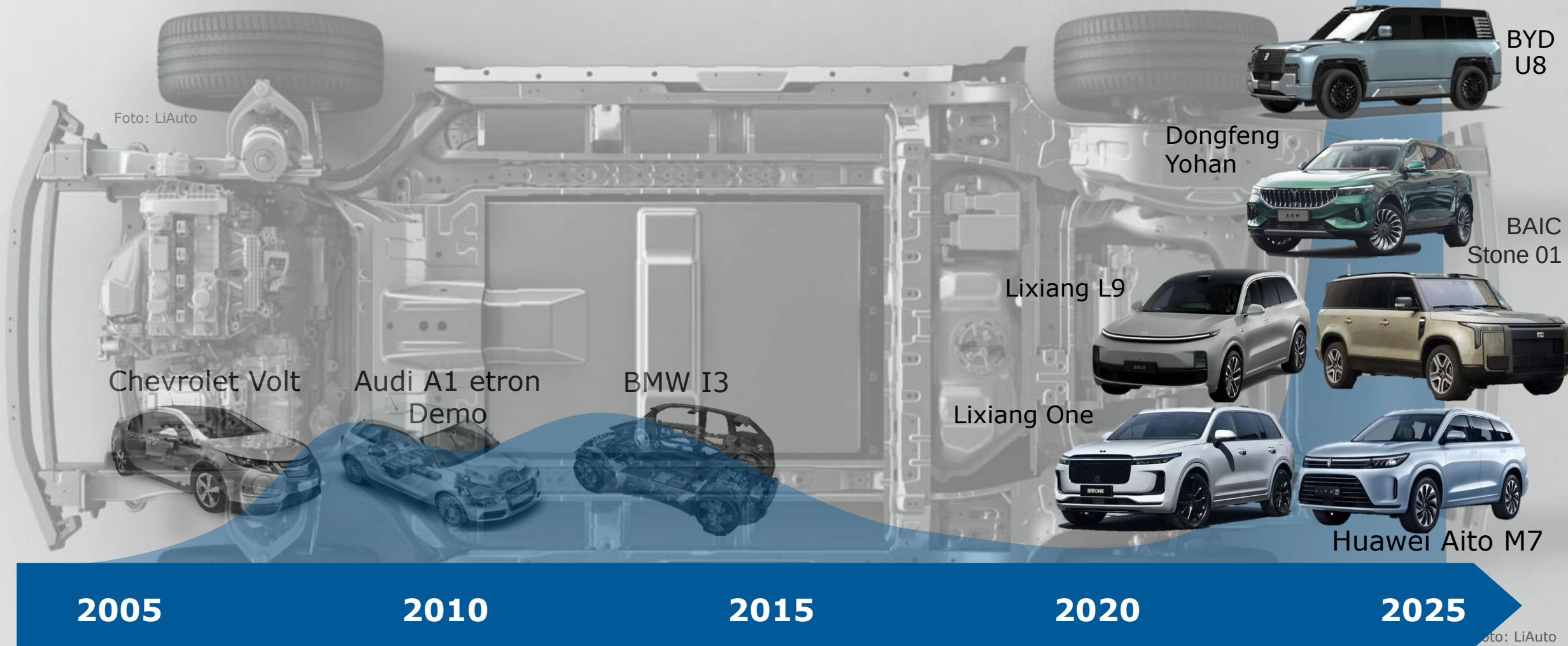
“Dogmatic”
Electrification



- **Focus on electrification, however proceeding with → NEV = BEV+PHEV/REX**
- **Still various new ICE under development - DHE^{**) with BTE > 43%}**
- **Strong hype for Range Extender**

^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,

Renaissance of Range Extender



New focus of REX applications with (large) SUV's especially in China, US expected to follow

Range Extender Platform

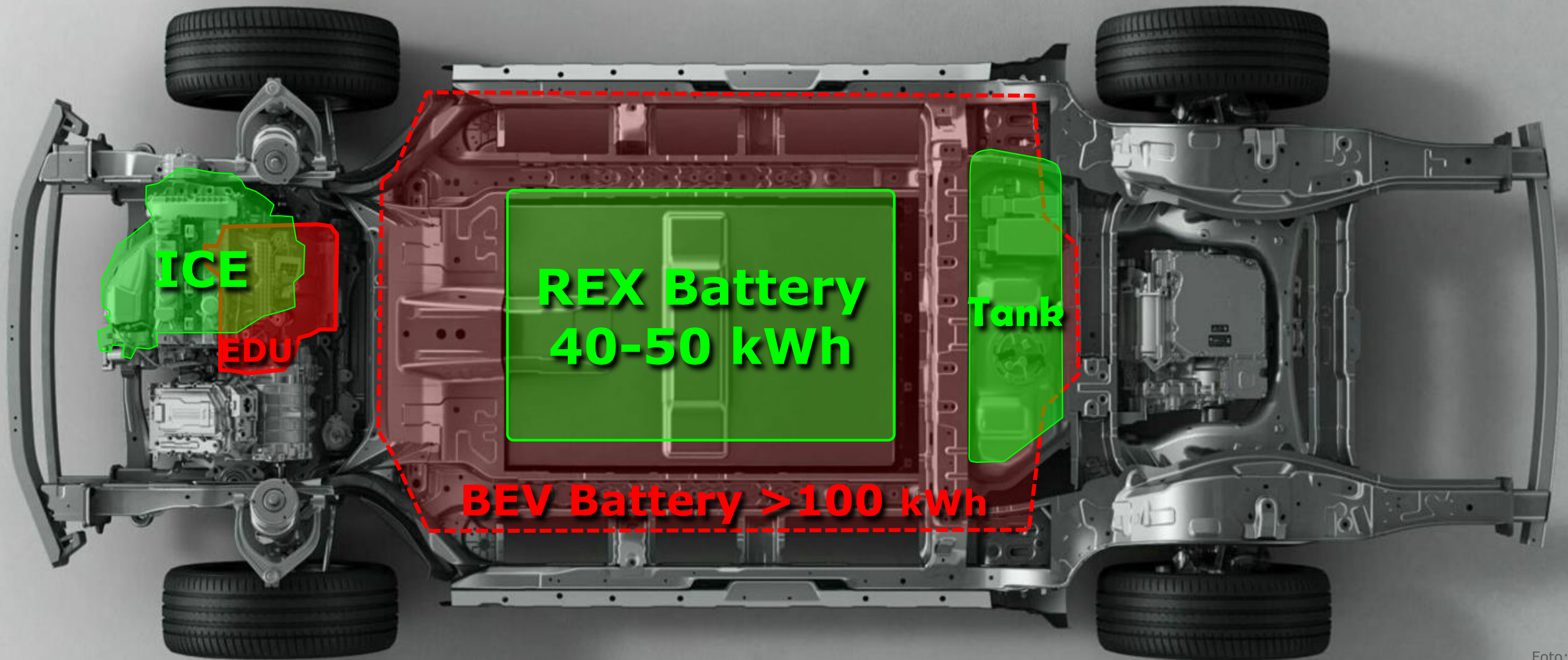


Foto: LiAuto

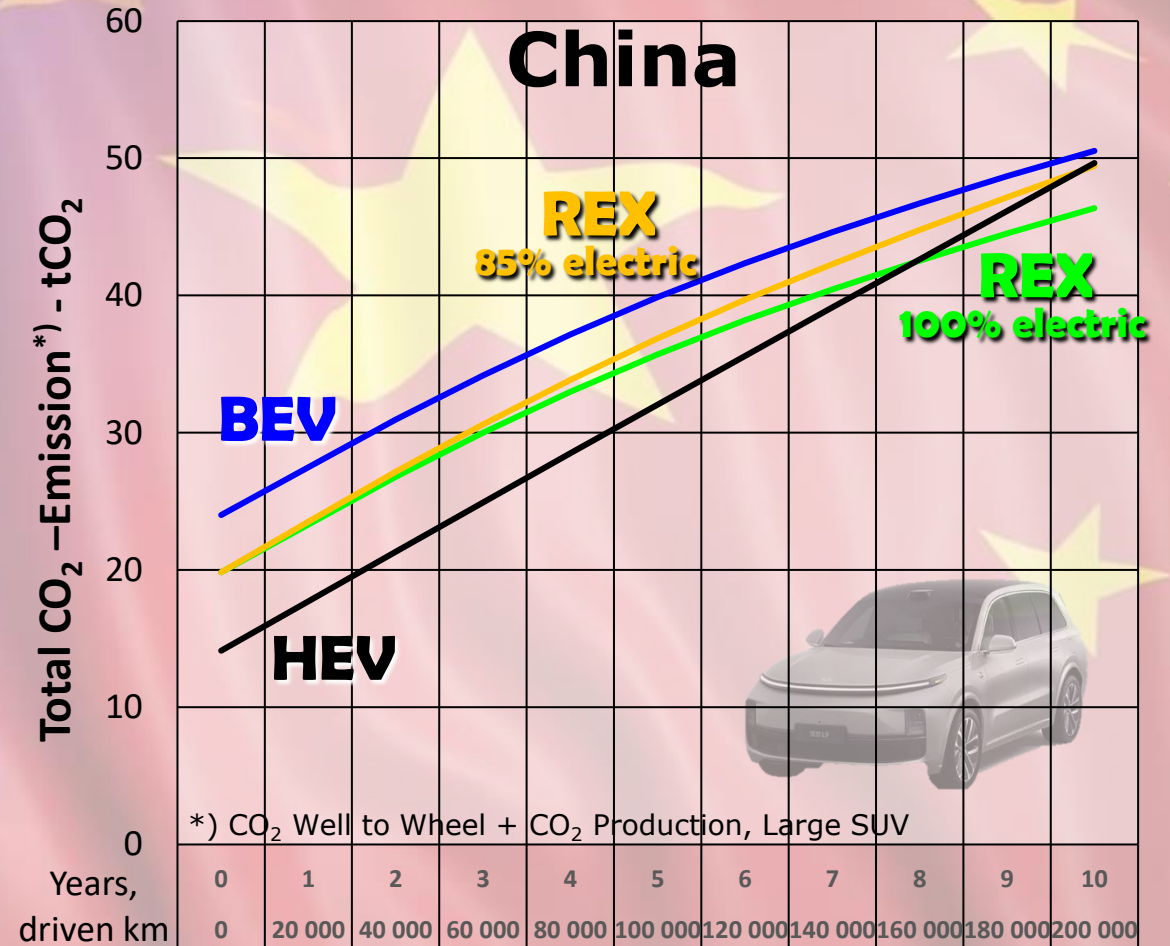
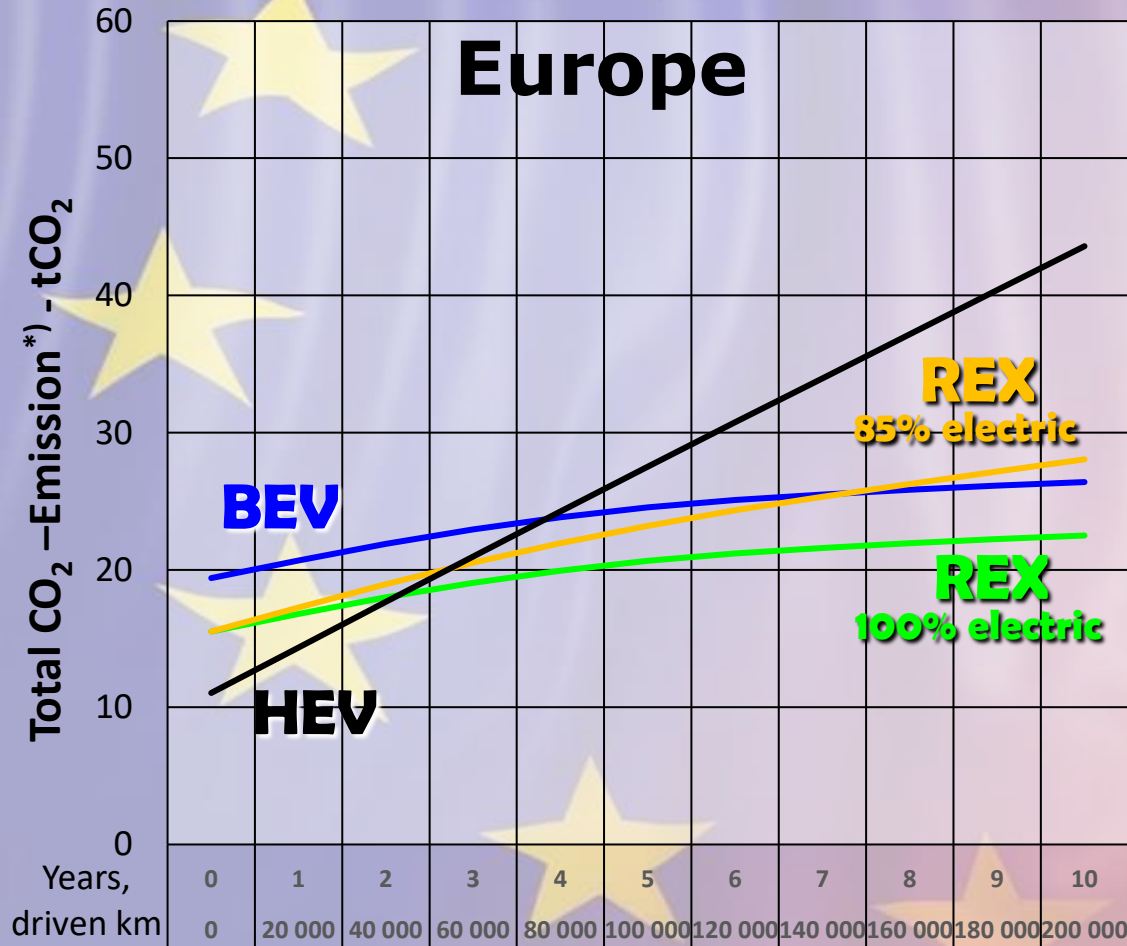
ICE integration as key challenge

Typical Range Extender Applications US vs. China



**In China NVH determines the engine size,
for US Pickup Trucks the long-range towing capability**

CO₂ Emission^{*)} - BEV vs. HEV vs. Range Extender



With adequate charging, Range Extender offers attractive Lifecycle CO₂

Flashlight on PassCar Regional Trends^{*)}

Status August 2024



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Electrification



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- **Strong hype for Range Extender**
- **Local OEM´s focus on export to compensate local price war**

“Pragmatic”
Electrification

^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,

Flashlight on PassCar Regional Trends^{*)}

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Electrification

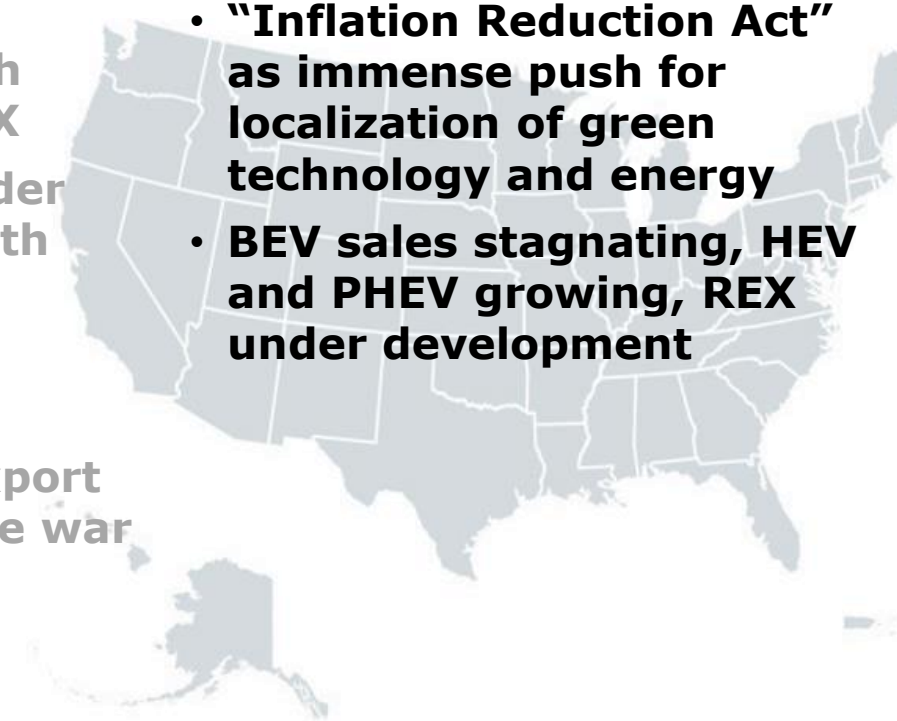


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Electrification



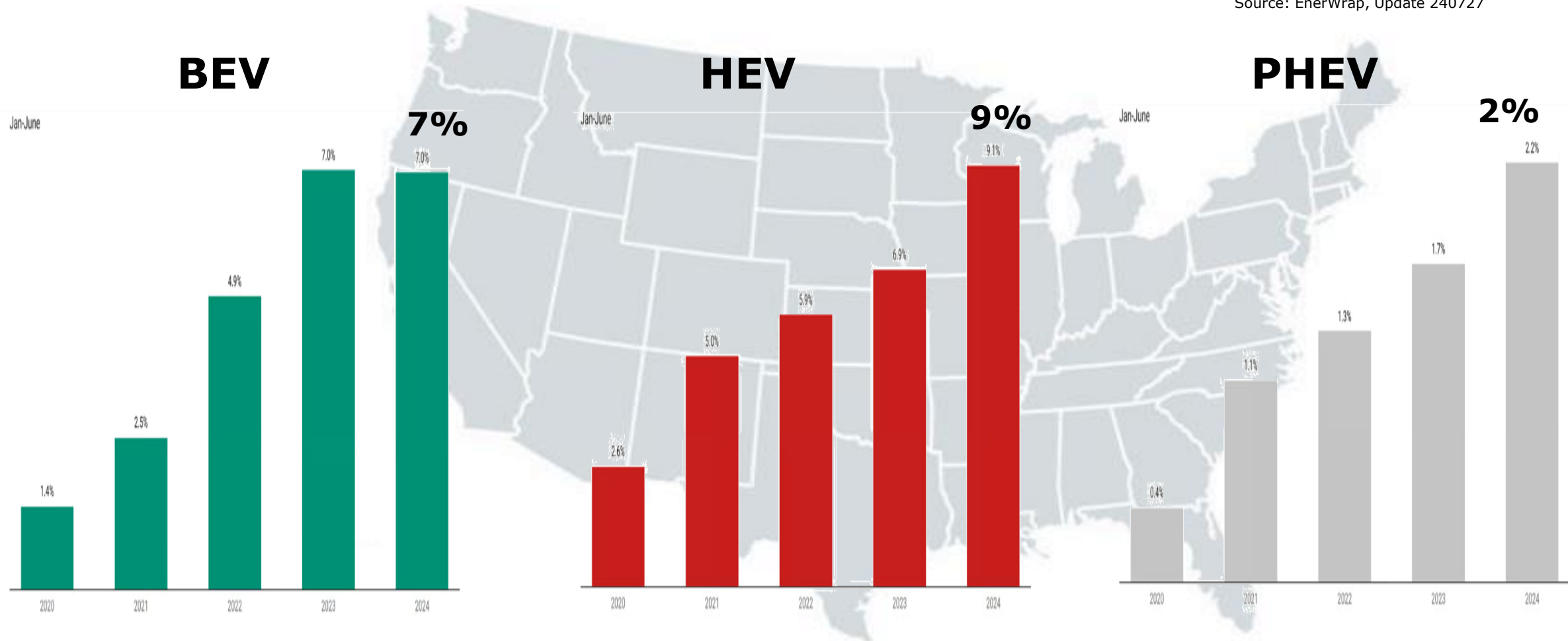
- **“Inflation Reduction Act” as immense push for localization of green technology and energy**
- **BEV sales stagnating, HEV and PHEV growing, REX under development**



^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,

US : Sales Volumes BEV, PHEV and HEV, Jan-June

Source: EnerWrap, Update 240727



US: BEV stagnating, HEV and PHEV growing

Flashlight on PassCar Regional Trends^{*)}

Status August 2024



- Reduction of BEV Subsidies & other hurdles → lower BEV sales growth → new interest on XHEV
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“Dogmatic”
Electrification



- Focus on electrification, however proceeding with → NEV = BEV+PHEV/REX
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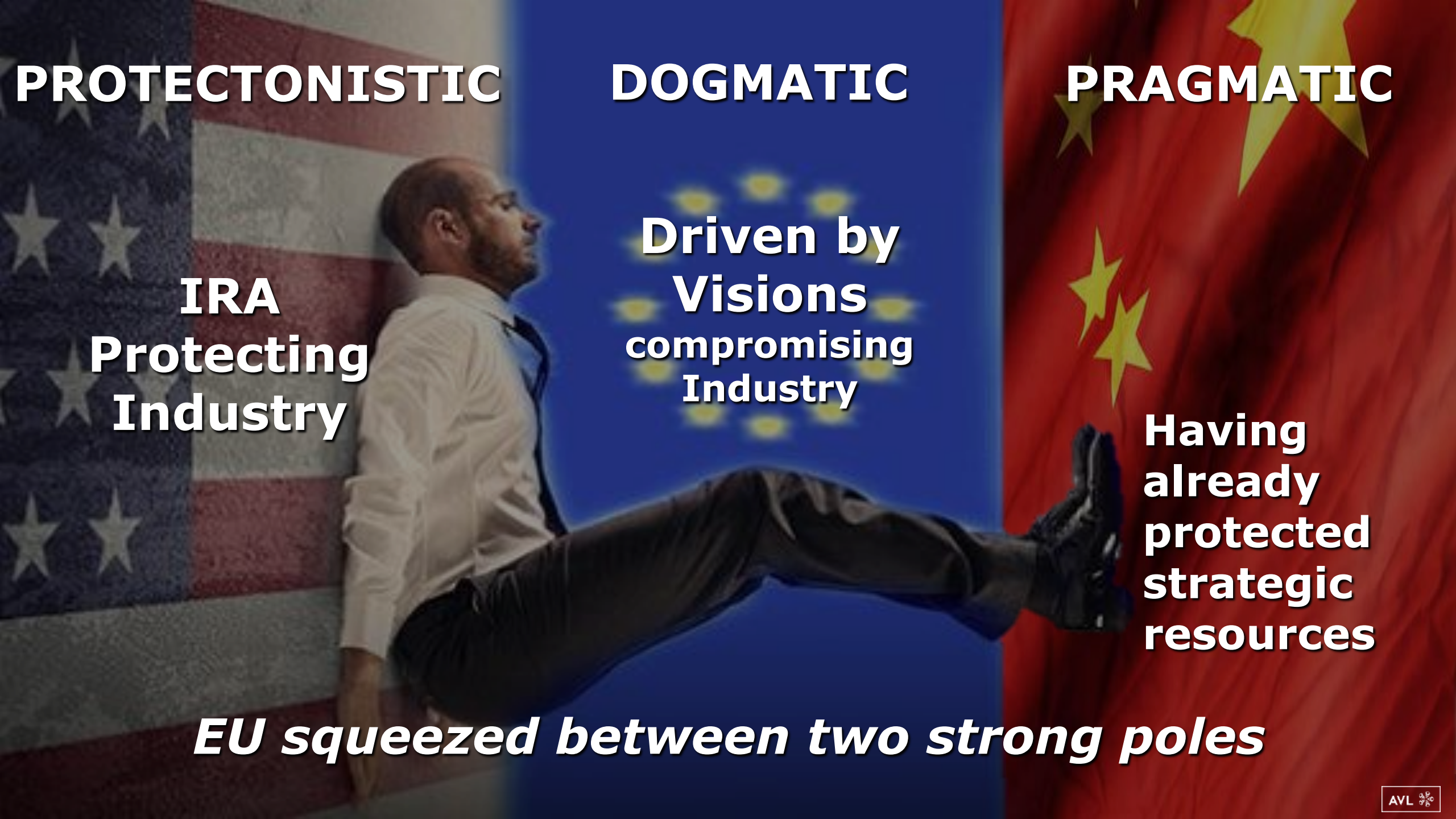


- **“Inflation Reduction Act”** as immense push for localization of green technology and energy
- **BEV sales stagnating, HEV and PHEV growing, REX under development**
- **Future trend will be determined by election in fall**

“Protective&Opportunistic”
Electrification

Different political priorities – Europe on economically risky path

^{*)} European Perspective, ^{**)} Dedicated Hybrid Engines,



PROTECTONISTIC

DOGMATIC

PRAGMATIC

**IRA
Protecting
Industry**

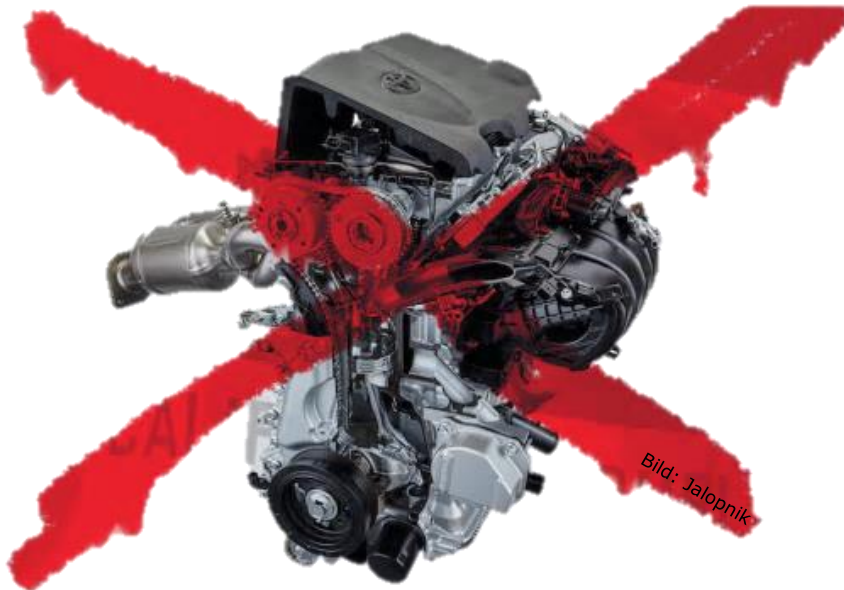
**Driven by
Visions
compromising
Industry**

**Having
already
protected
strategic
resources**

EU squeezed between two strong poles

Europe 's Automotive Key Question

**ICE Sales
Stop 2035 ?**



Again ?

Potential Game Changers (ICE Sales Stop 2035)

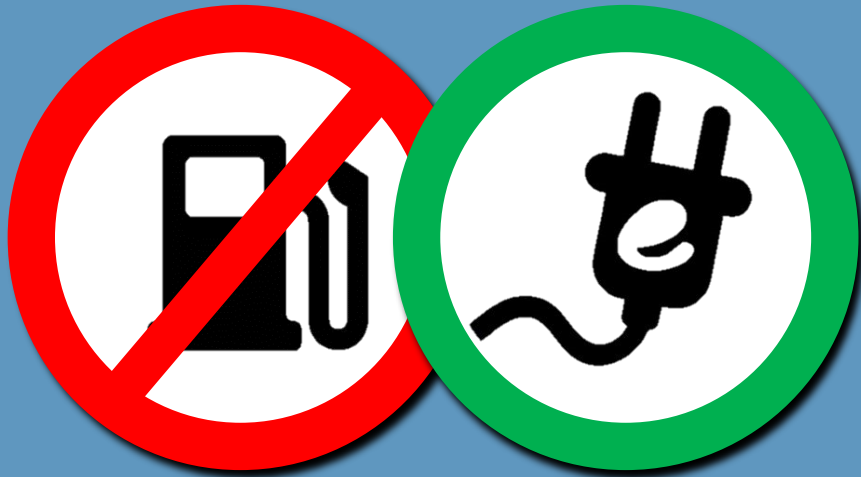


REVIEW
CO₂ STANDARDS
2026

Must we expect offset between technical truth and political reality ?

Potential Technology Scenarios

Passenger Cars & Light Commercial Vehicles



**Ice Sales Stop
2035**

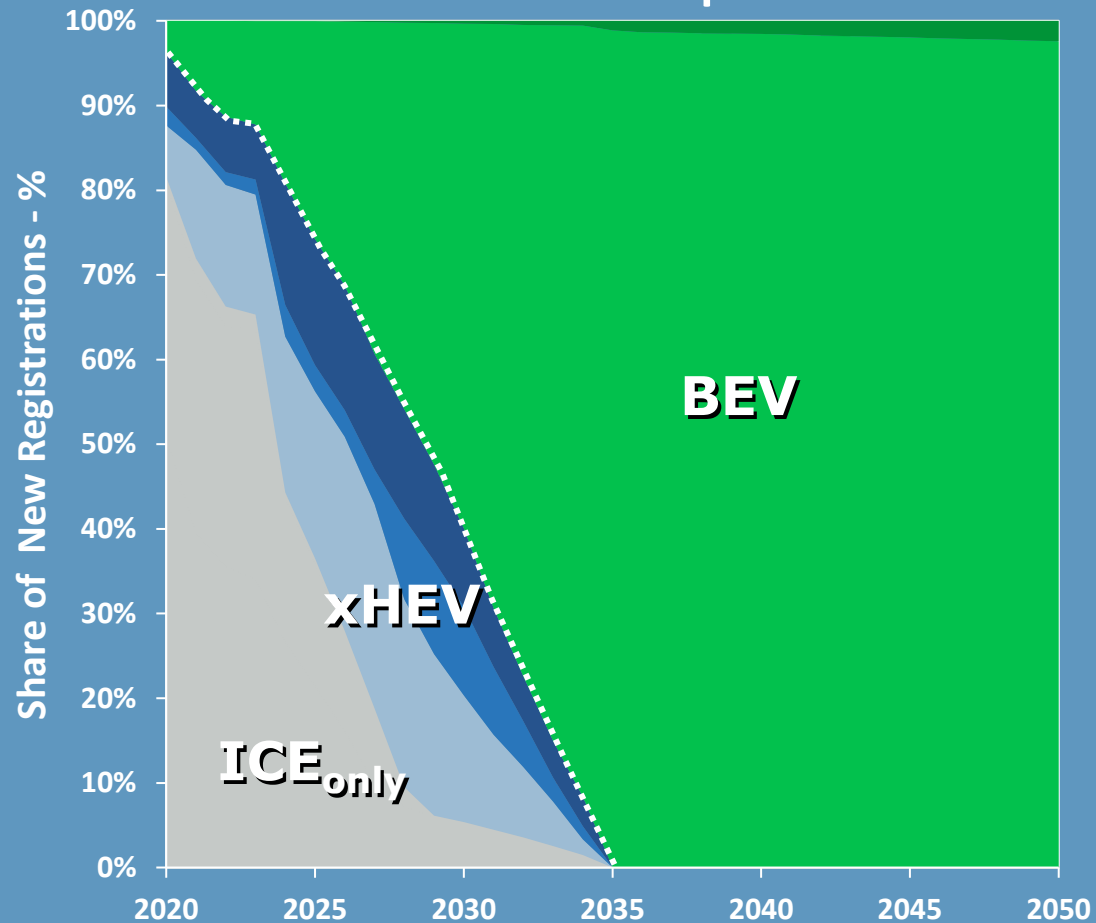


Technology Open

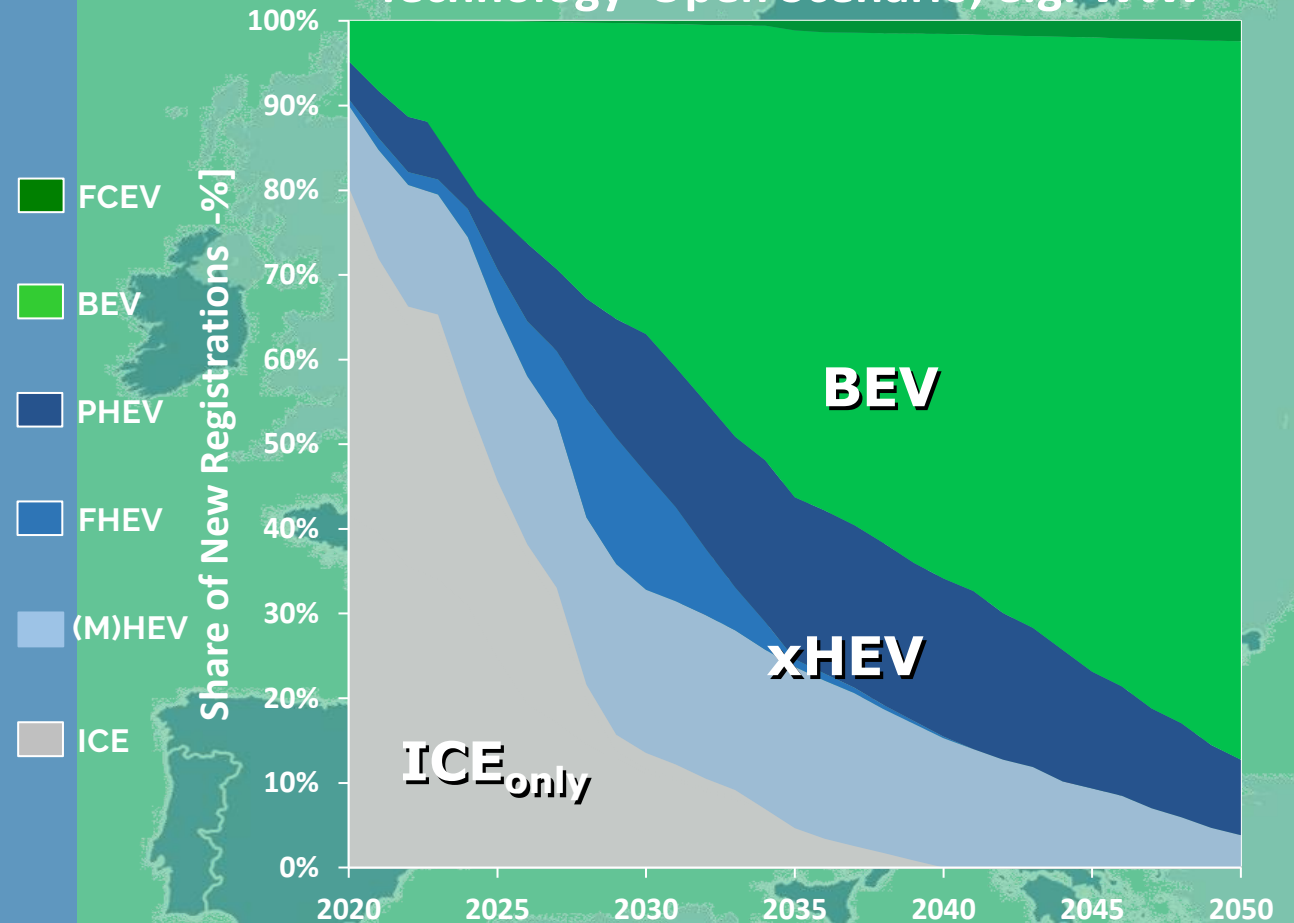
Potential Technology Scenarios

Passenger Cars & Light Commercial Vehicles

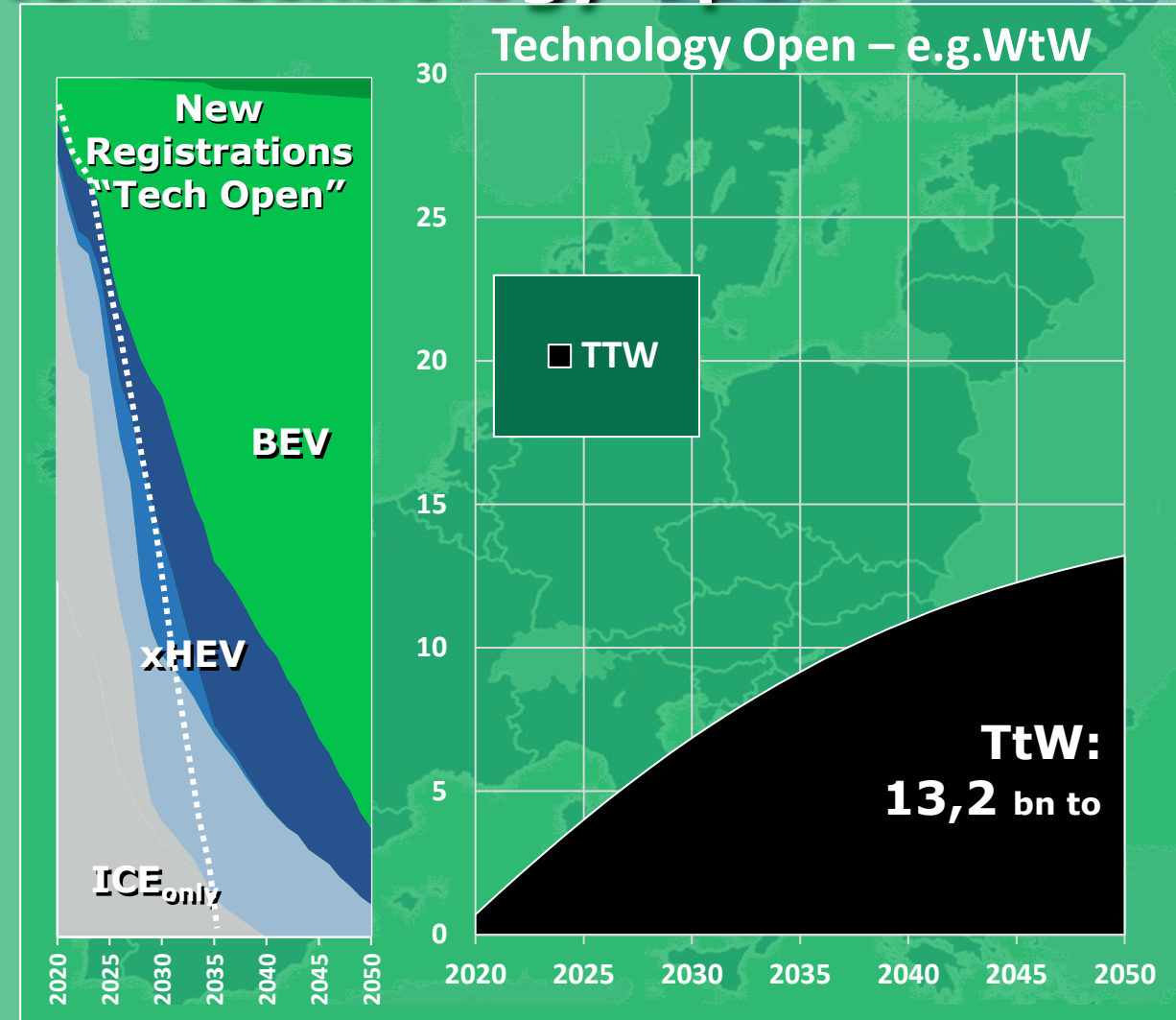
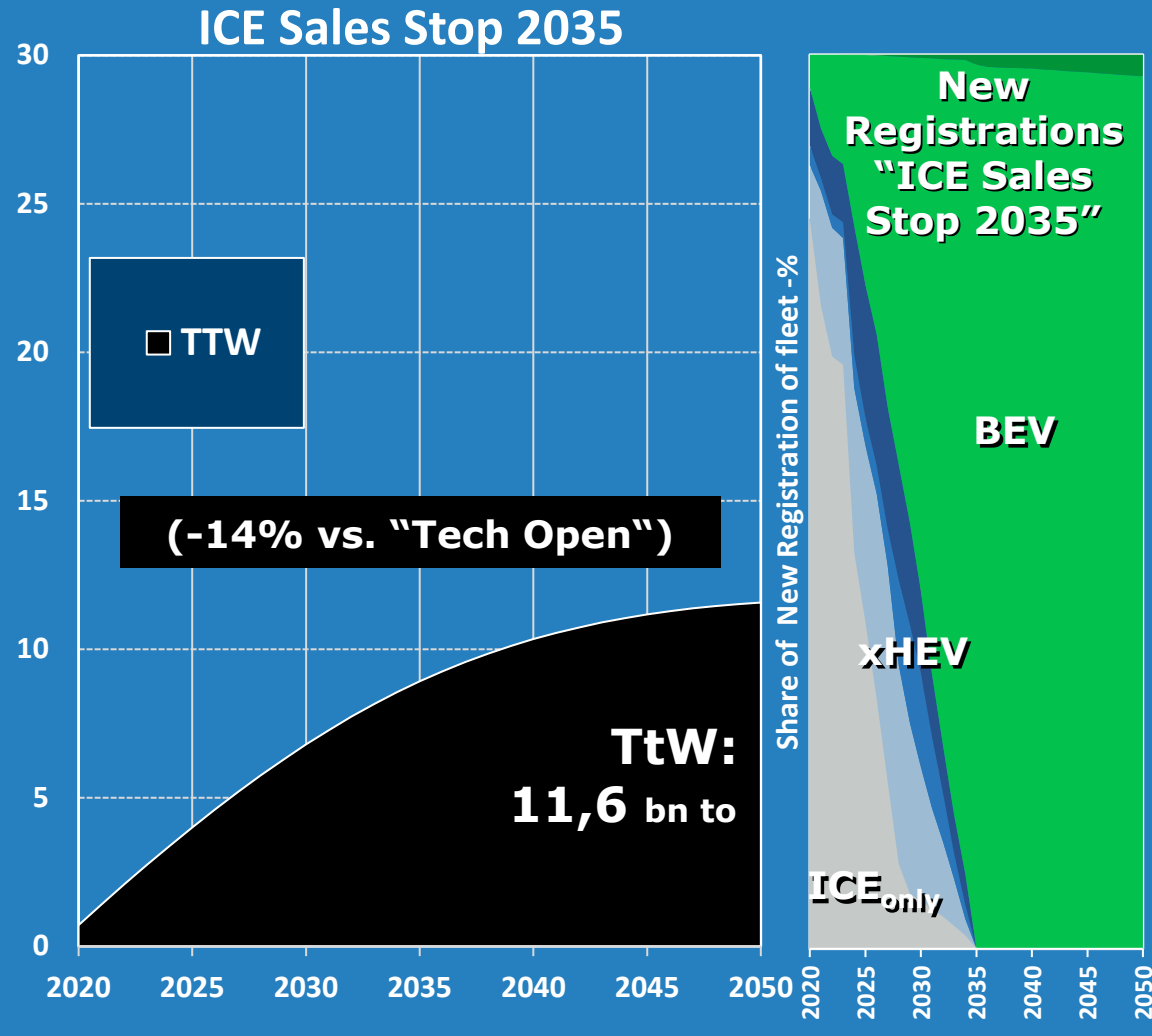
ICE Sales Stop 2035



Technology Open Scenario, e.g. WtW

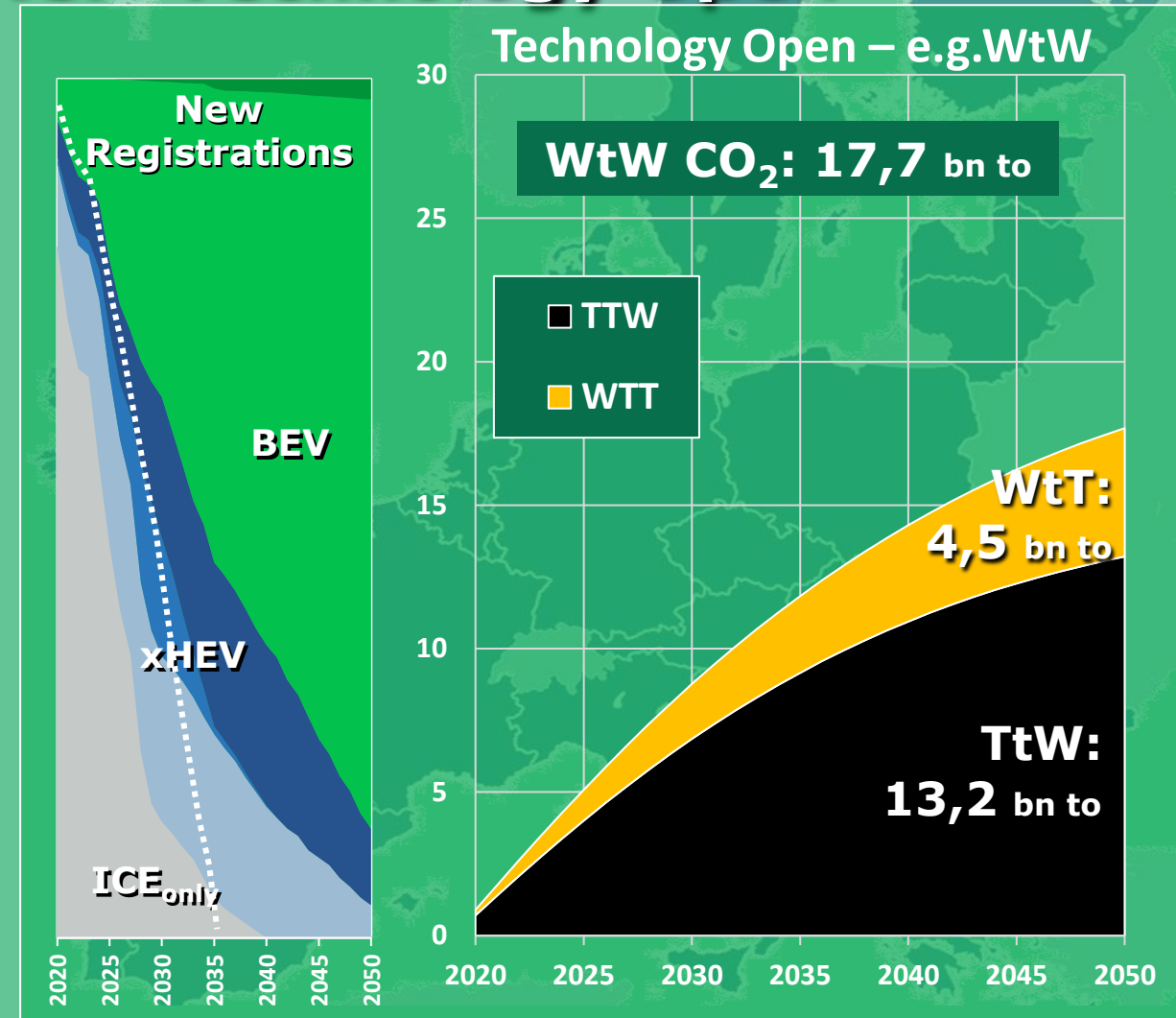
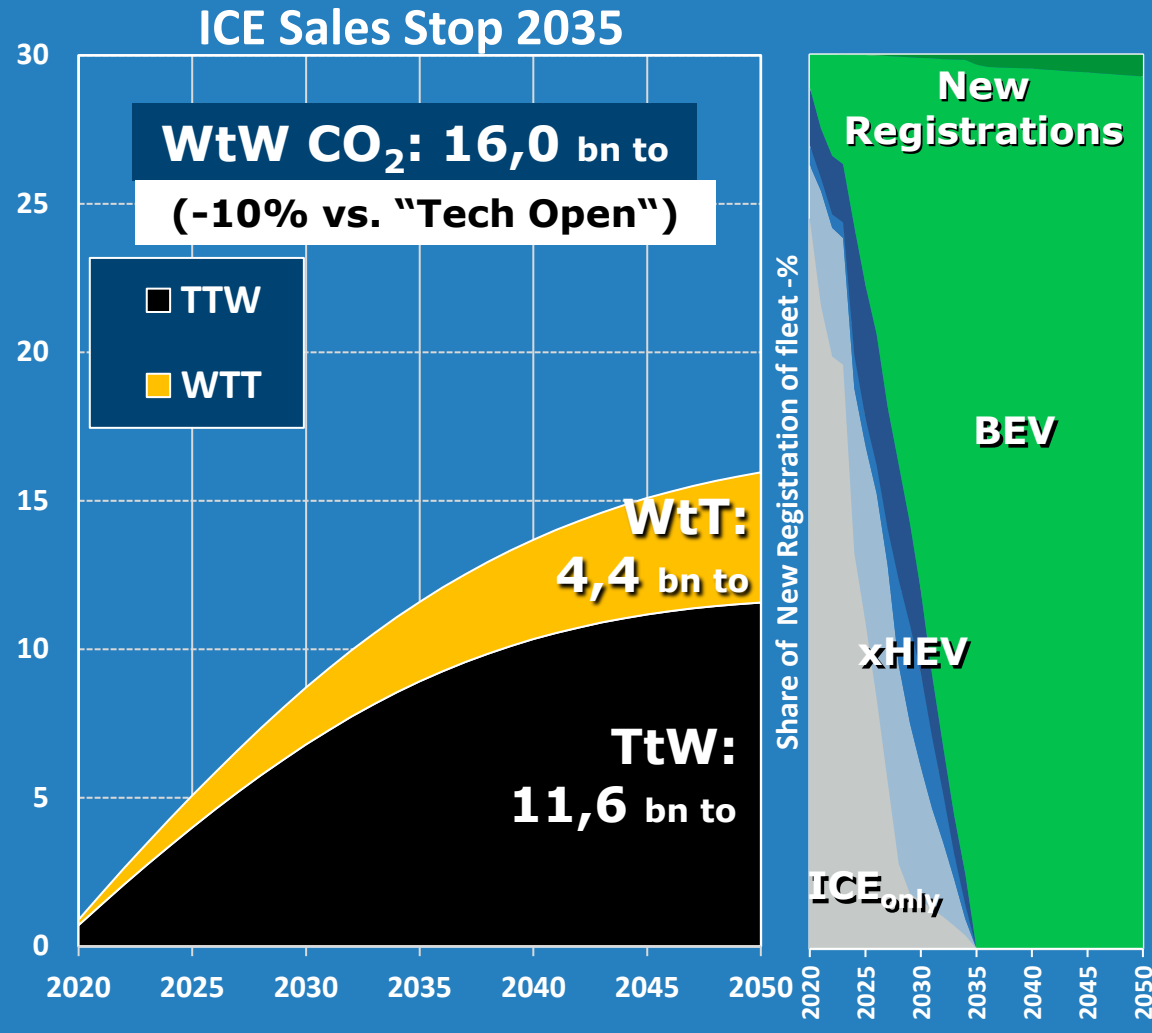


European PassCar & LCV Fleet Cumulative TtW CO₂ "ICE Sales Stop 2035" vs. "Technology Open"



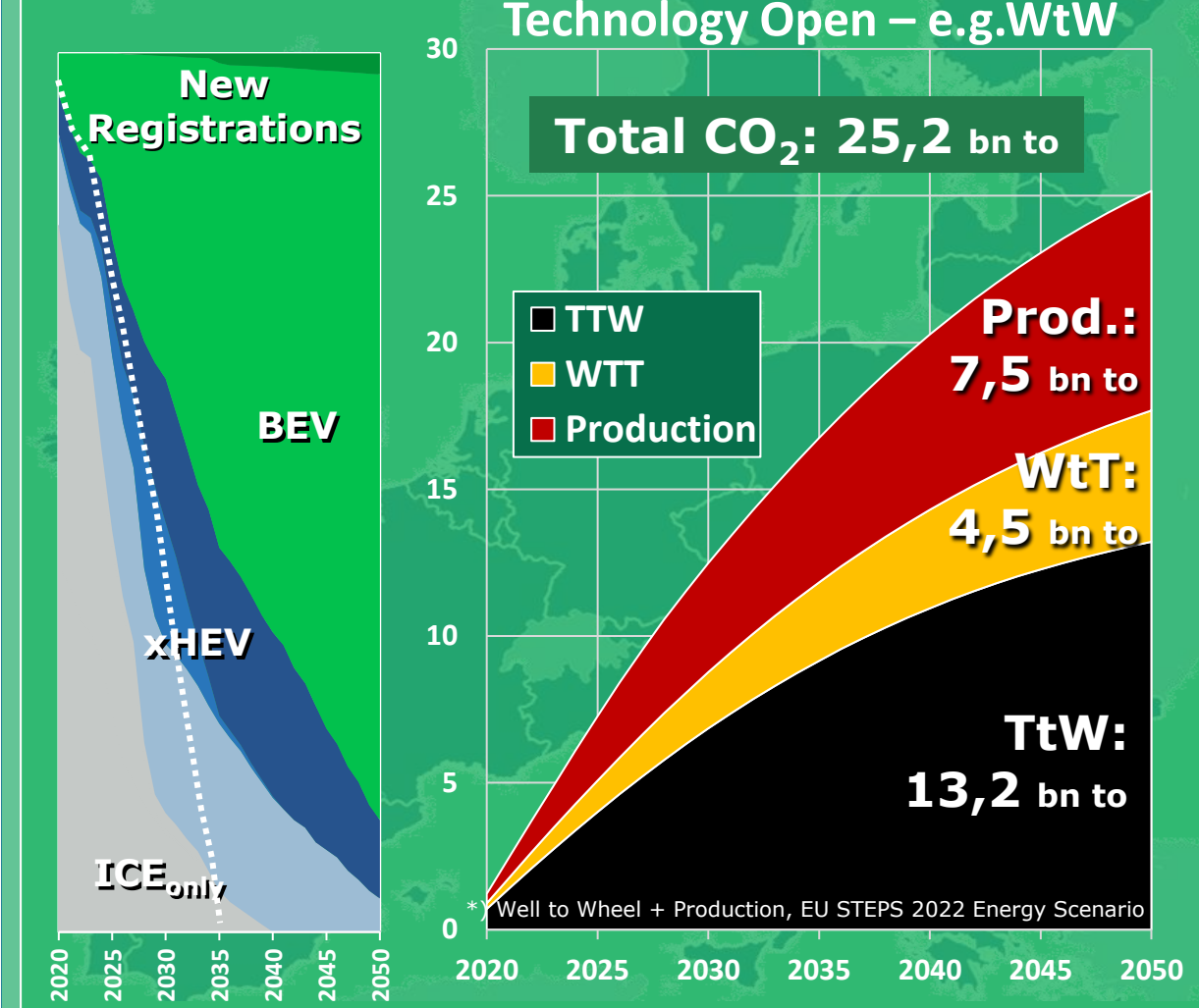
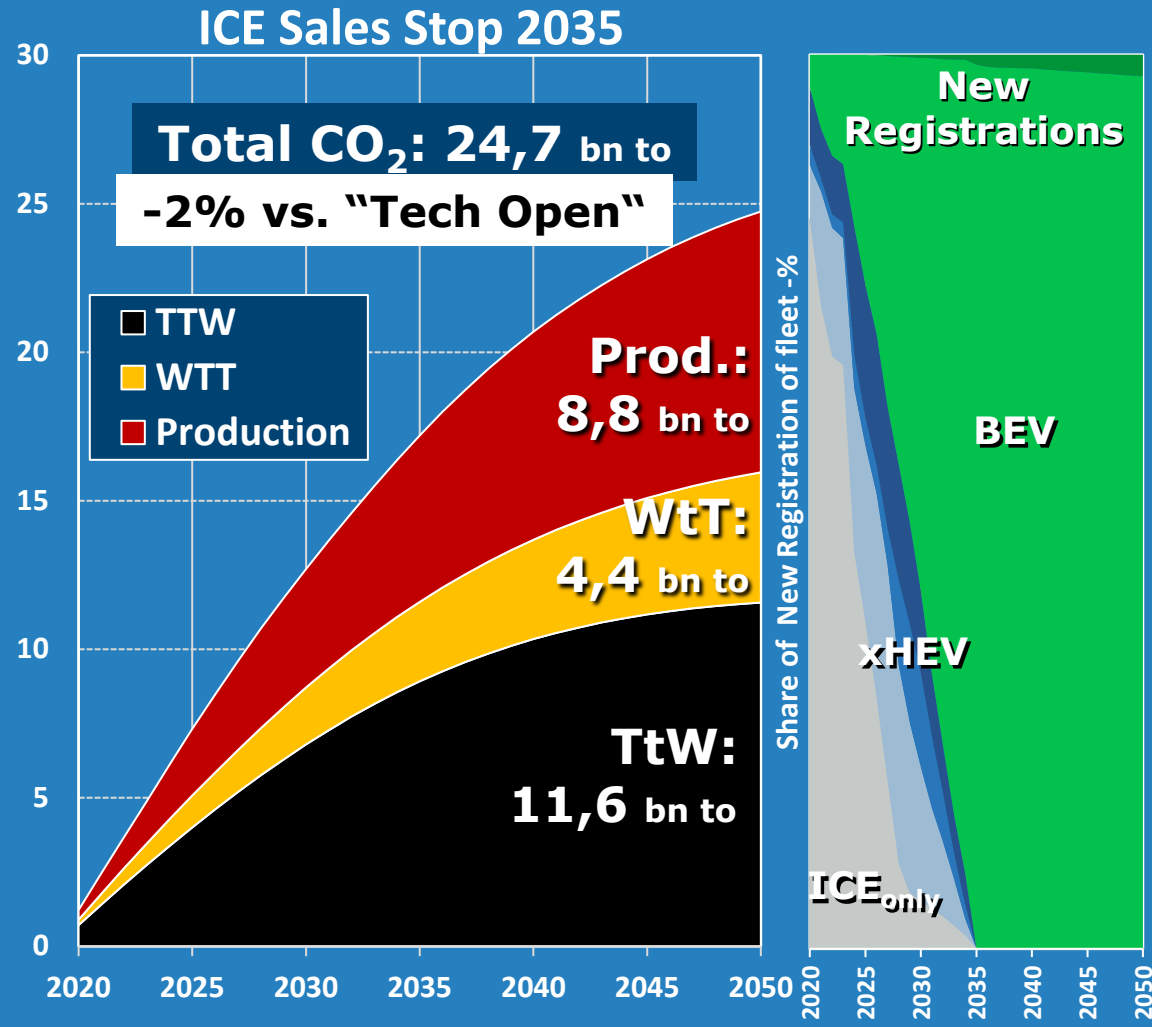
Compared to a "Technology Open Tech Scenario", a "ICE Sales Stop 2035" provides 14 % Tank to Wheel CO₂ Benefit

European PassCar & LCV Fleet Cumulative WtW CO₂ "ICE Sales Stop 2035" vs. "Technology Open"



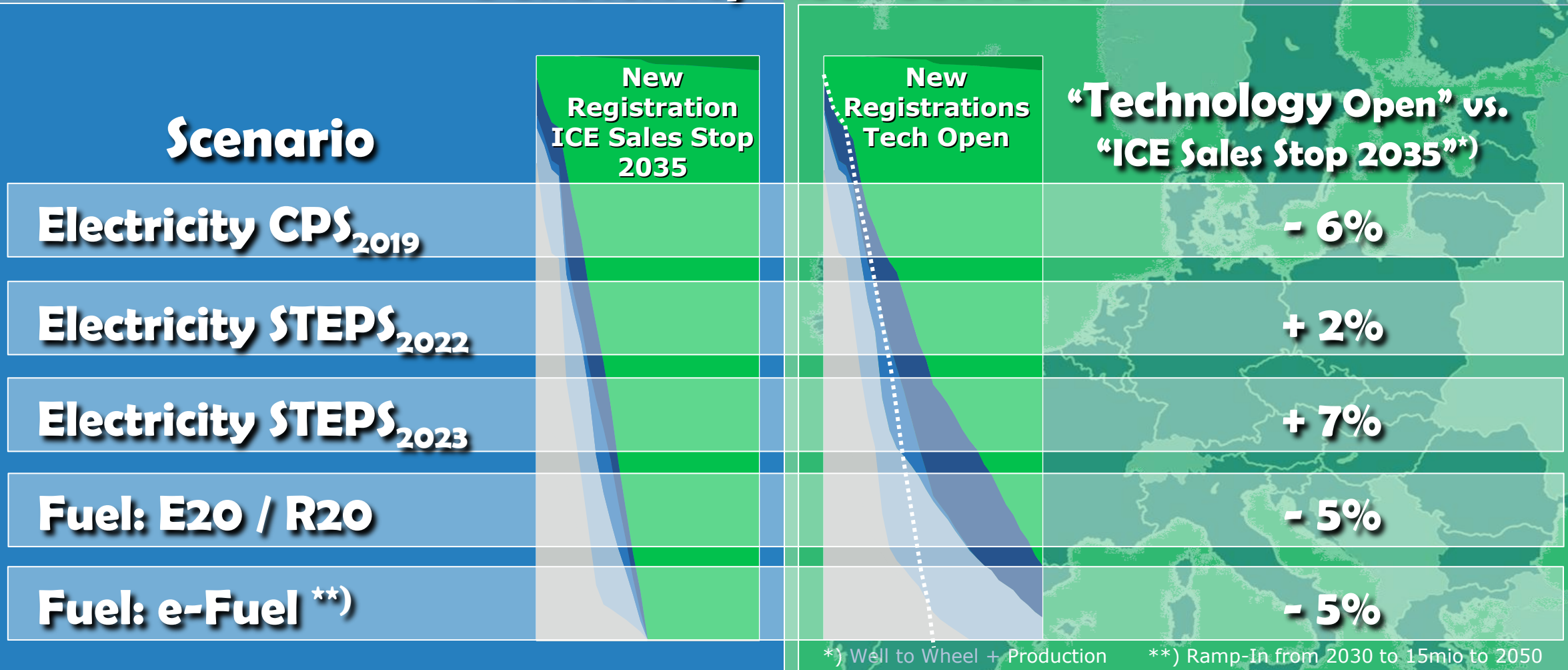
Compared to a "Technology Open Tech Scenario", a "ICE Sales Stop 2035" provides 10 % Well to Wheel CO₂ Benefit

European PassCar & LCV Fleet Cumulative Total CO₂ *) "ICE Sales Stop 2035" vs. "Technology Open"



Compared to a "Technology Open Tech Scenario", a "ICE Sales Stop 2035" provides just a 2% CO₂ *) Benefit

European PassCar & LCV Fleet Cumulative Total CO₂^{*)} Sensitivity Assessment



Considering most likely energy & fuel scenarios, there is no scientific argumentation for an “ICE Sales Stop 2035”

Some Thoughts

- *Long term, BEV will become the dominant Passenger Car powertrain technology. However, the market penetration must be adapted to economic realities*
- *Considering most likely energy & fuel scenarios, there is no scientific argumentation for an "ICE Sales Stop 2035" in Europe*
- *Also customers current buying behaviour does not follow political wishes → effect of "ICE Sales Stop 2035" questionable*
- *If we want a cost-effective CO₂ reduction, we must quickly move to Lifecycle CO₂, at least to Well to Wheel CO₂ assessment*

ありがとうございます

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