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Vehicle weight: Emissions & Weight Based Simulation Modelling of **V**ehicle **R**egistration **T**ax

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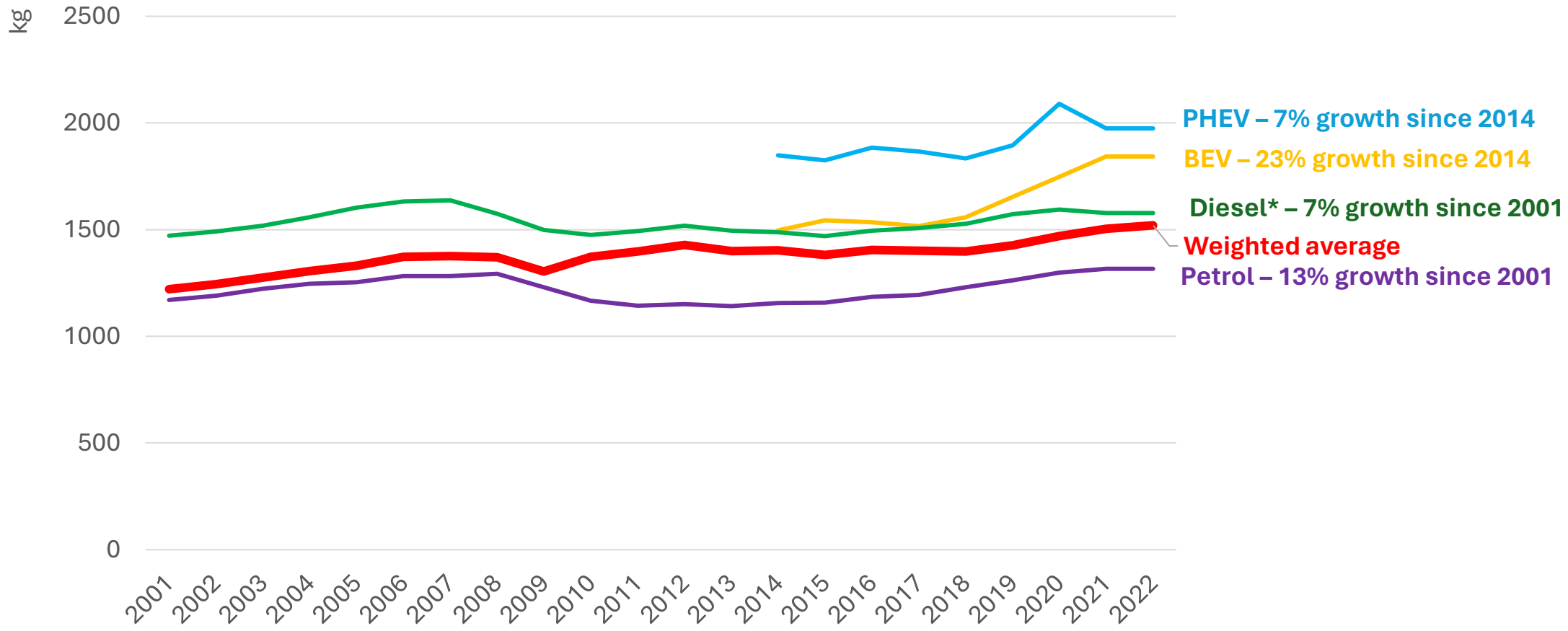
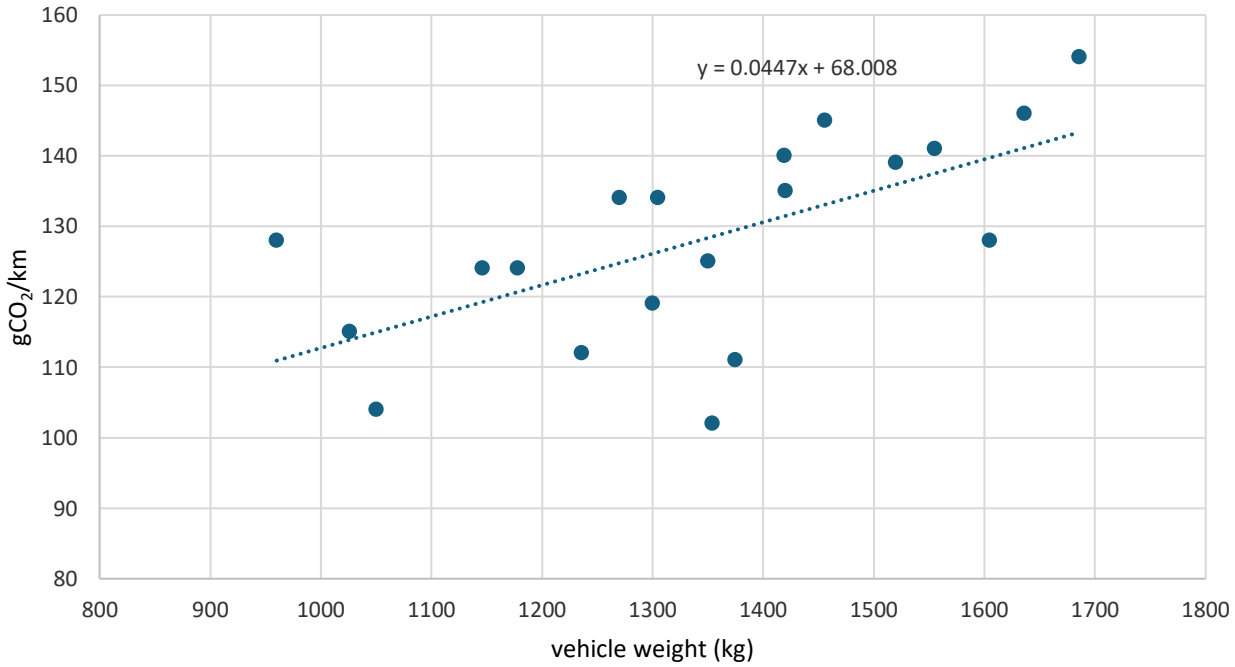
New vehicles are 330 kg heavier since 2001

27% increase in mass in new passenger cars has been driven by **increased weight of individual car models**, a shift in car sales towards **heavier vehicle categories**, and **towards plug-in and battery EVs**



Average mass of new passenger cars in Ireland by fuel and engine type.
Source: ICCT European Vehicle Market Statistics, based on EEA data. Vehicle sales data from CSO (TEA17, TEA27)

Increased weight is slowing decarbonisation



Relationship between vehicle CO2 intensity (gCO2/km) and weight (kg) for top-selling car models in 2021

Greater weight: More fuel

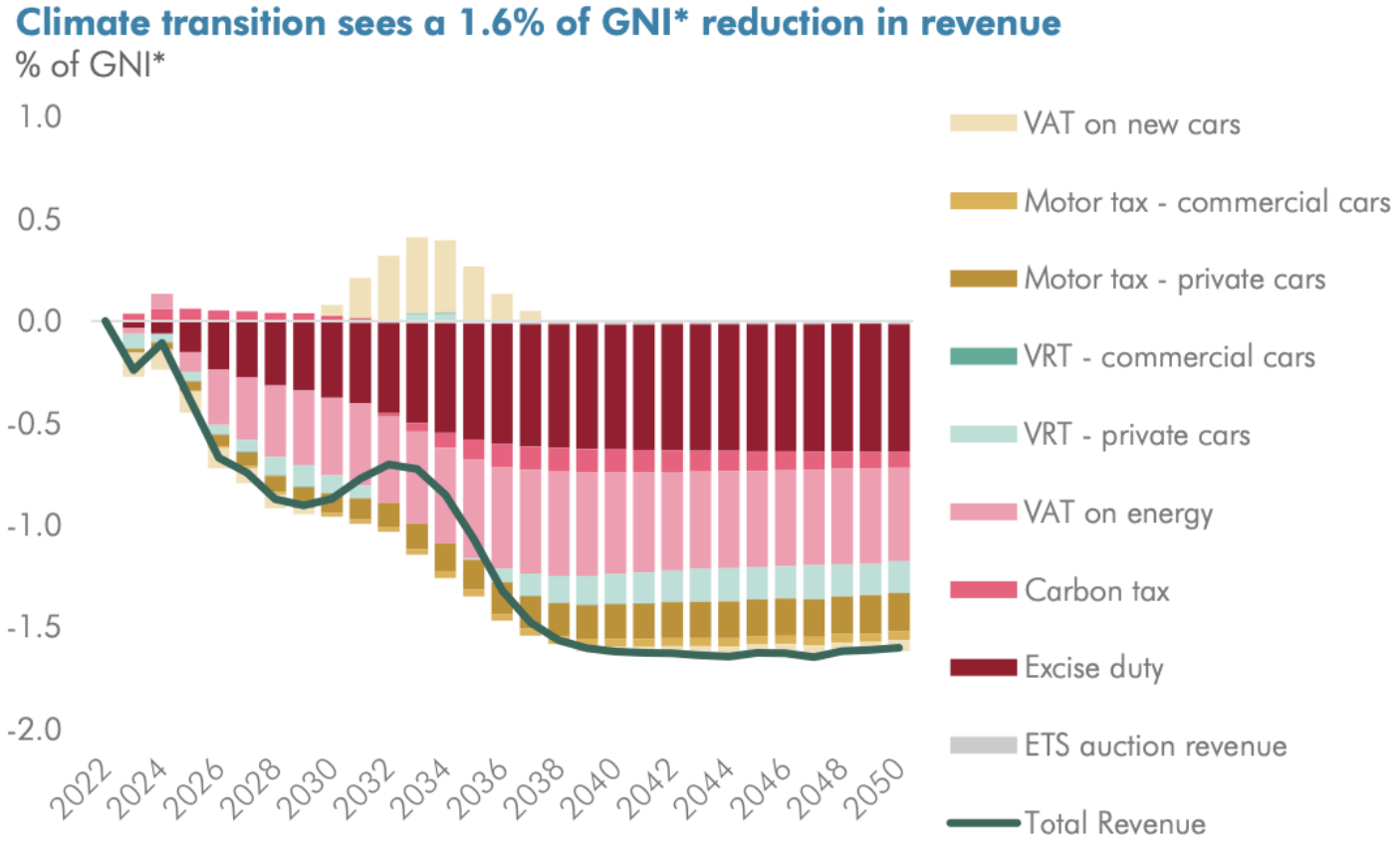
- The CO_2 intensity of 1,500 kg cars (2022 average) is 11% higher than 1,200 kg (2001 average)
- Assuming 300k car lifetime, this burns 1,500l extra fuel, with associated cost and pollution, an additional 3.5 tonnes of CO_2

Greater weight: More dangerous

- Greater weight, size and bonnet height causes more harm to vulnerable road users in a collision

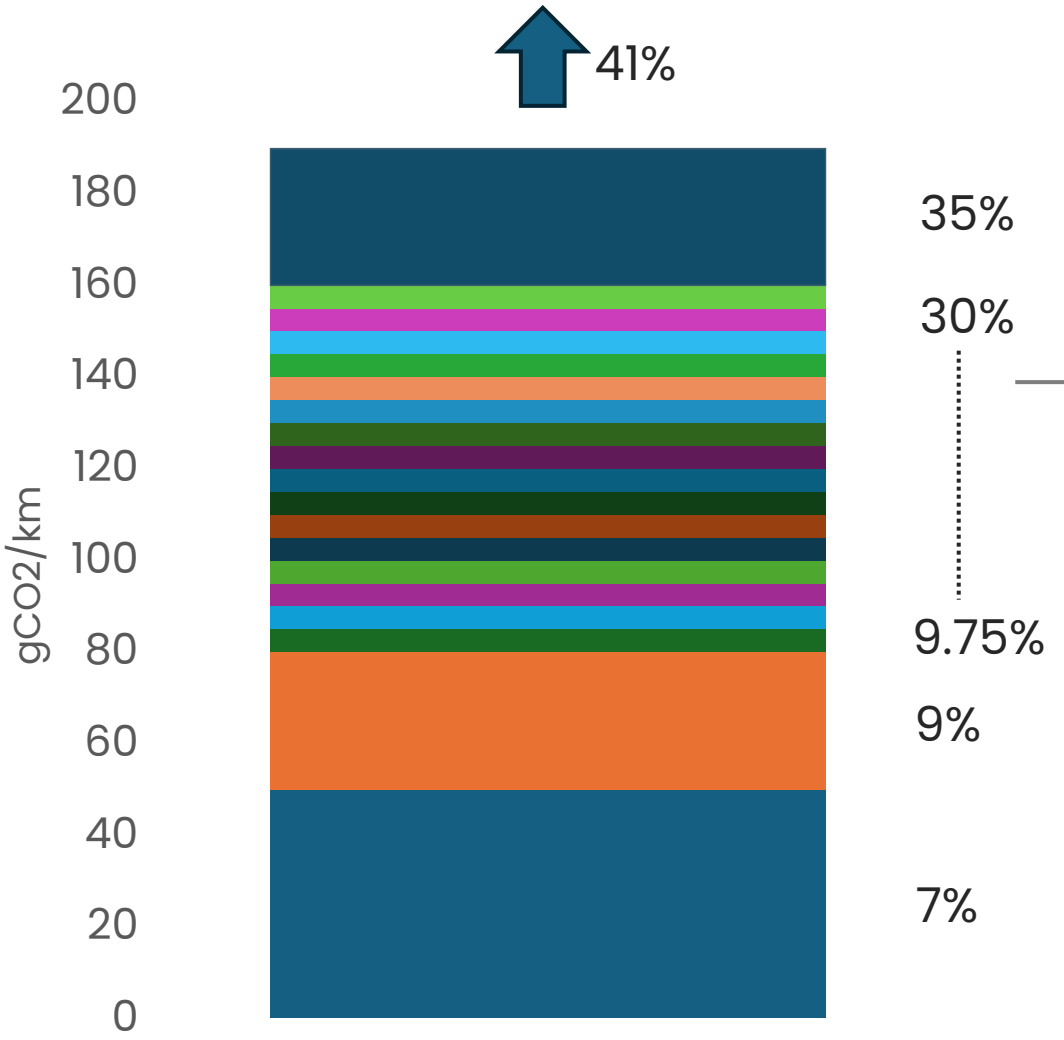
Fiscal impacts of energy transition

Assuming unchanged tax rates, meeting climate targets could see tax revenues declining by 0.9% (€2.5bn) annually by 2030



Casey & Carroll (2023), What climate change means for Ireland's public finances. Irish Fiscal Advisory Council

How is VRT calculated?



35%

30%

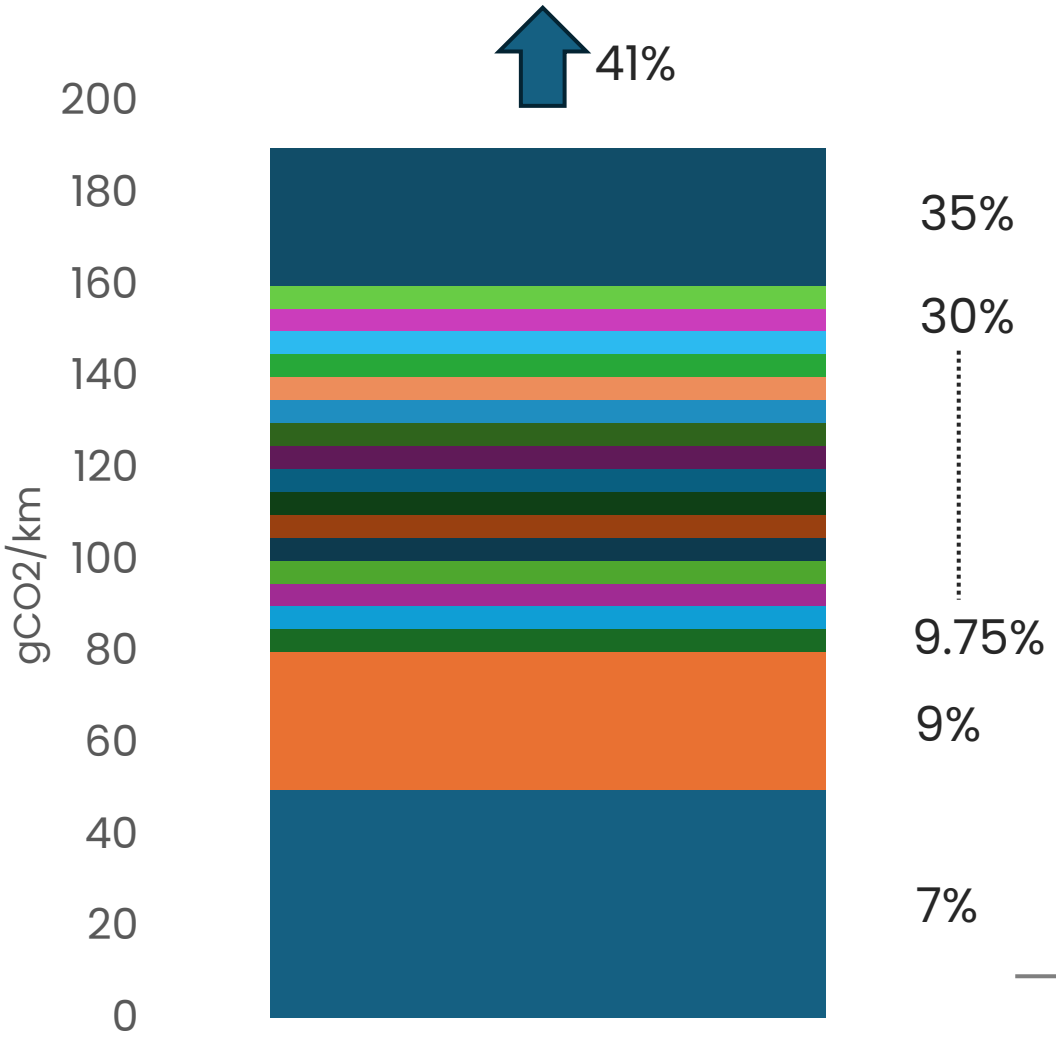
140 gCO2/km
25 VAT (%)
7500 VAT (€)
1552 kg

9.75%

9%

7%

How is VRT calculated?



35%

30%

9.75%

9%

7%

0	gCO2/km
7	VAT (%)
0	VAT (€)
1805	kg

— VRT relief applied

NOx mg/km VRT Marginal Brackets

min	max	(€) per mg/km
0	40	5
41	80	15
81		25

How is VRT calculated?

Battery Electric Vehicles (BEVs)

OMSP & Relief

	<€40,000	between	>€50,000
Rate~7%	€2,800	$€5{,}000 - \frac{\text{OMSP} - €40{,}000}{2}$	€3500(+)
Relief	Up to €5000	€0.5 - €4999.5	none
VRT	€0	€0 - €3,499	€3500(+)

NOx mg/km VRT Marginal Brackets

min	max	(€) per mg/km
0	40	5
41	80	15
81		25

0	gCO2/km	
7	VAT (%)	
0	VAT (€)	— VRT relief applied
1805	kg	

What can this new VRT simulation do?

Simulate current CO2/NOx VRT system

Simulate marginal weight-based taxation system

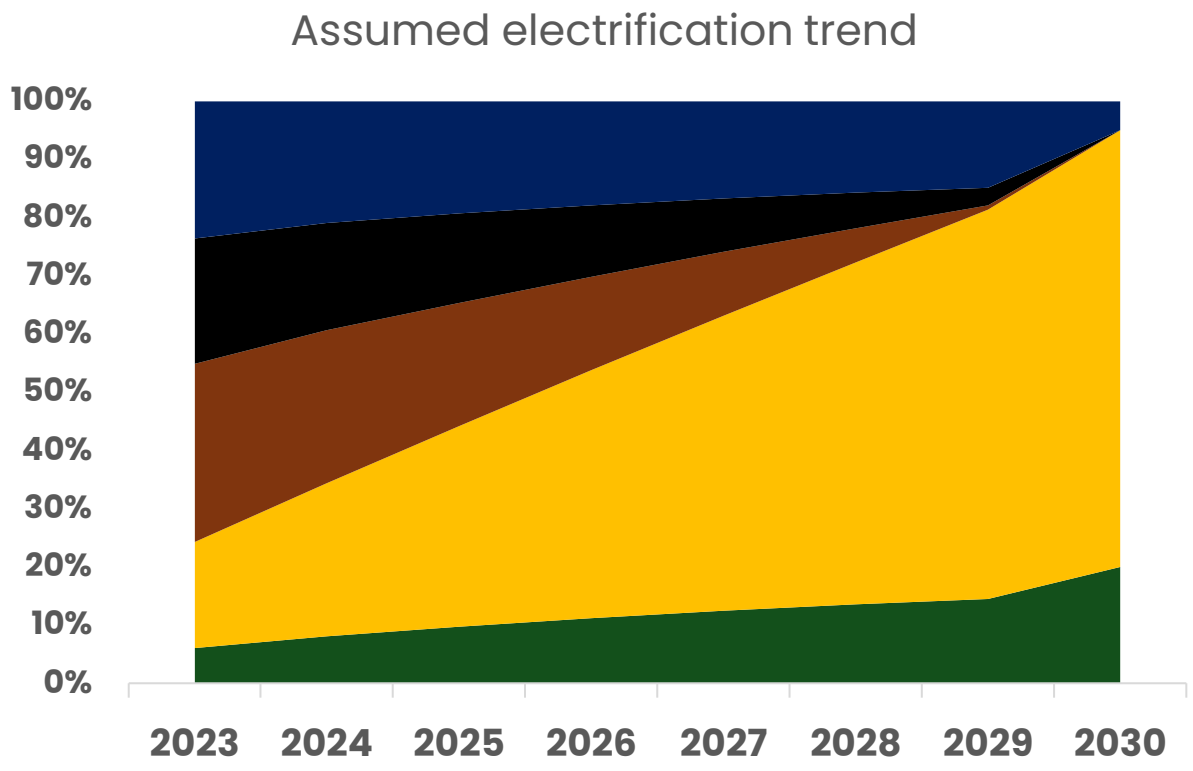
Evaluate the impact on revenue/emissions under current electrification trends under different schemes

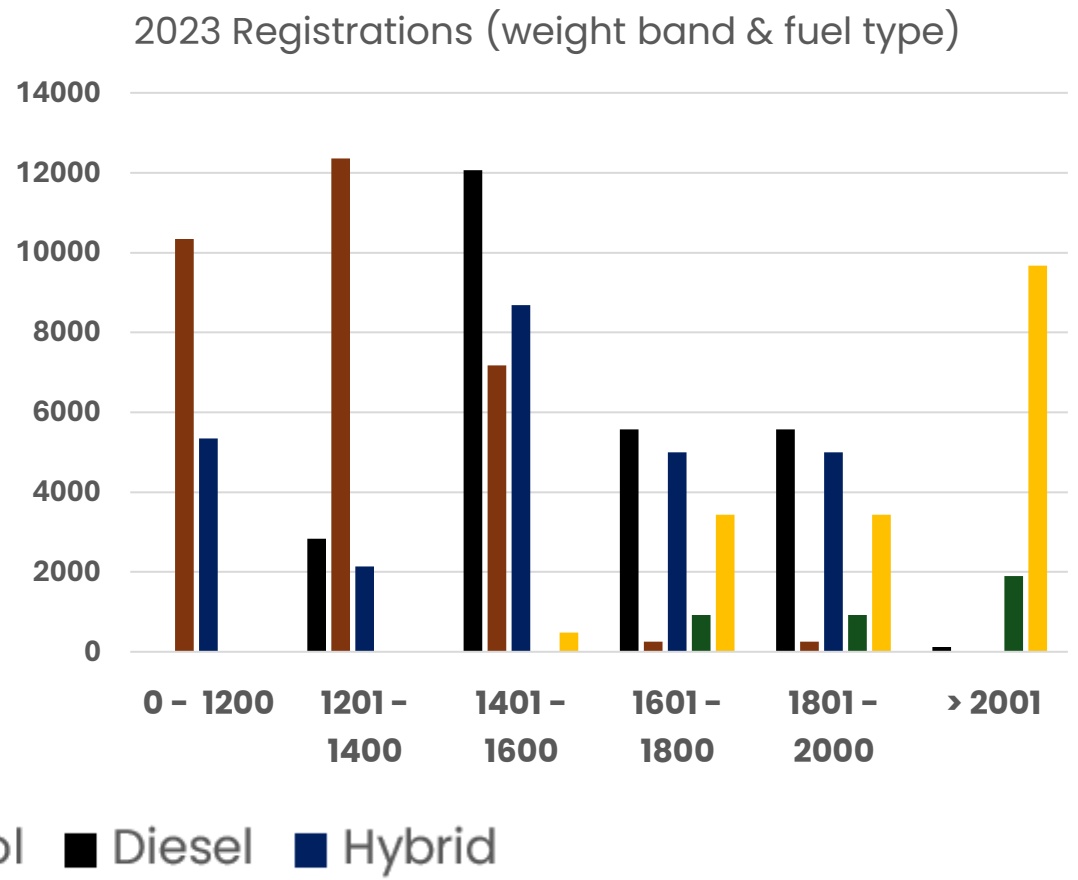
INPUTS

- All NEW vehicle registrations (2023) ~ 81% completed to date
  - Make/Model/Fuel type
- Vehicle: Weight (kg), emissions (g/km), NOx (mg/km), Value (€)
- Assumed Depreciation
- Flexible Marginal weight bands/ rates
- VRT Exemption rules (by fuel type)
- New Vehicle Registrations by fuel type (2024 – 2030)

Assumptions and state of play

- We can expect that if all new vehicles are Hybrid, Plug-in hybrids (PHEV) or Electric (BEV) by 2030 then emissions and revenue from VRT will fall …

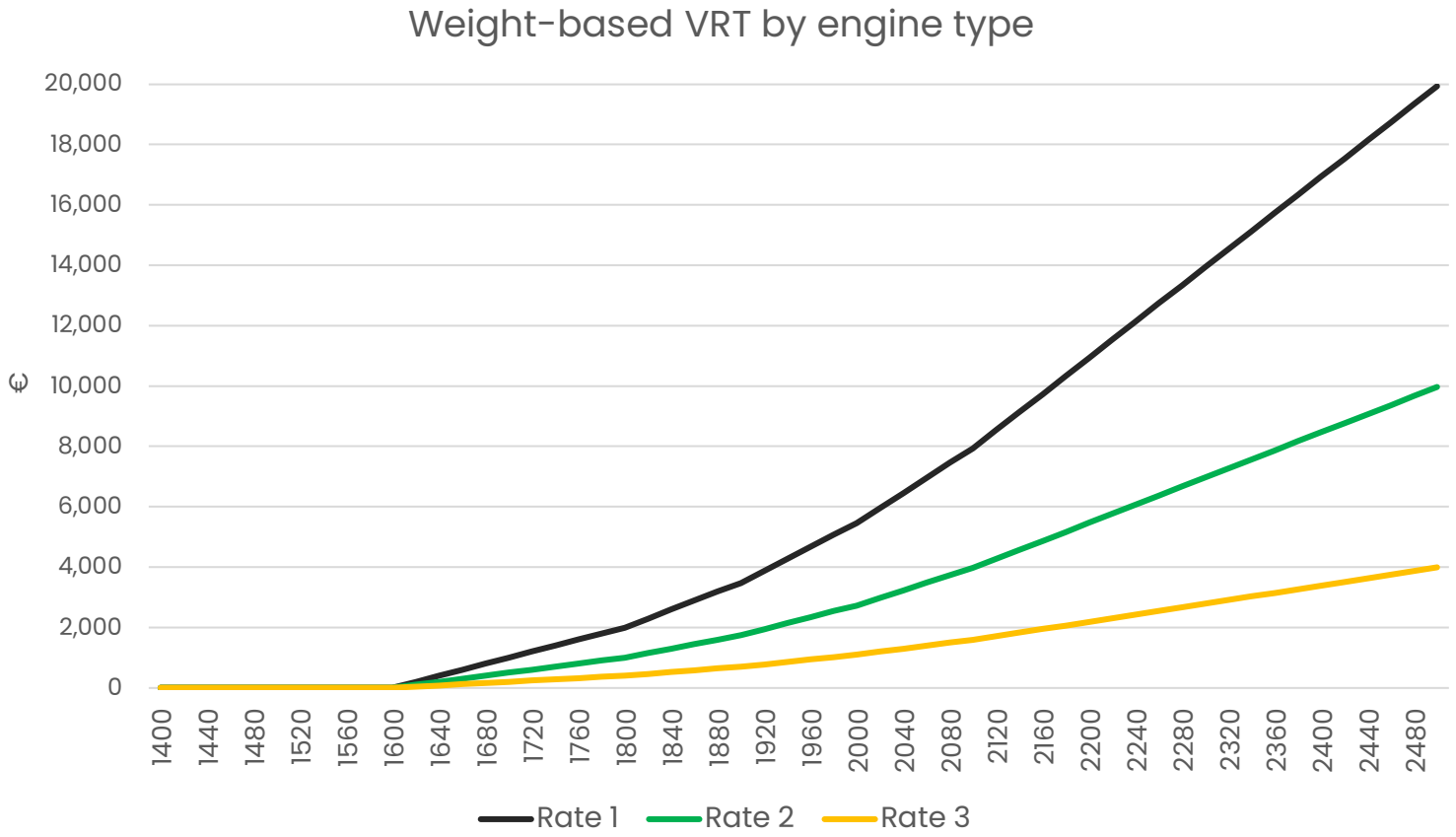




Assumptions and state of play

- We can expect that if all new vehicles are Hybrid, Plug-in hybrids (PHEV) or Electric (BEV) by 2030 then emissions and revenue from VRT will fall …

Weight based Tax bands (marginal €/kg)				
min (kg)	max (kg)	Rate 1 (€)	Rate 2 (€)	Rate 3 (€)
0	1599	0	0	0
1600	1799	10	5	2
1800	1899	15	7.5	3
1900	1999	20	10	4
2000	2099	25	12.5	5
2100		30	15	6



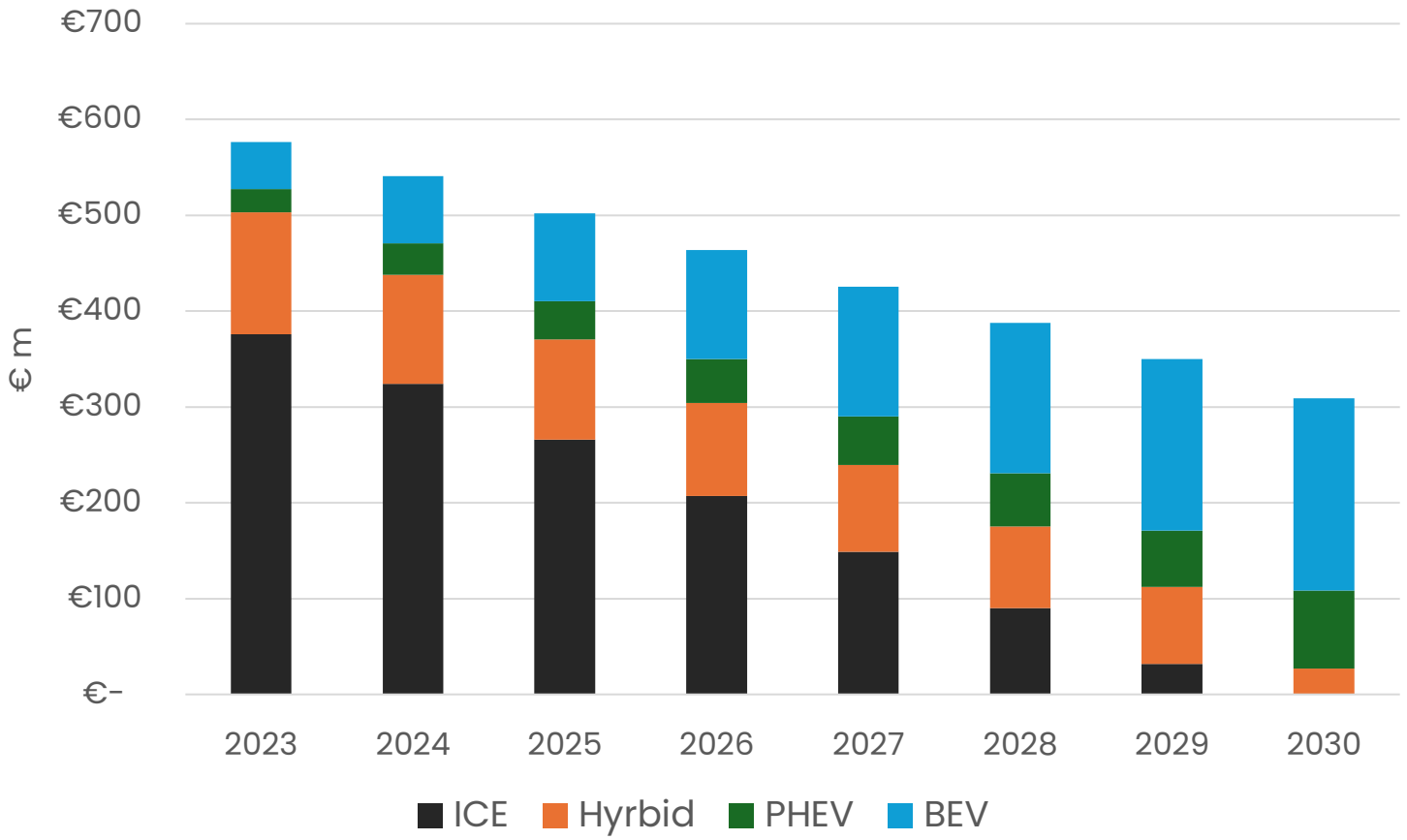
Scenarios

- All else being equal! - Scenarios assume that:
  - electrification trend continues
  - vehicle choice remains the same within engine types

- Allows us to explore 3 scenarios:
  1. What is the expected change in revenue if there is no change to VRT?
  2. What would be the impact of introducing weight-based tax immediately across all fuel types?
  3. Is there a phased introduction of the weight-based tax that maintains VRT while electrification trend continues?

Results (scenario 1)

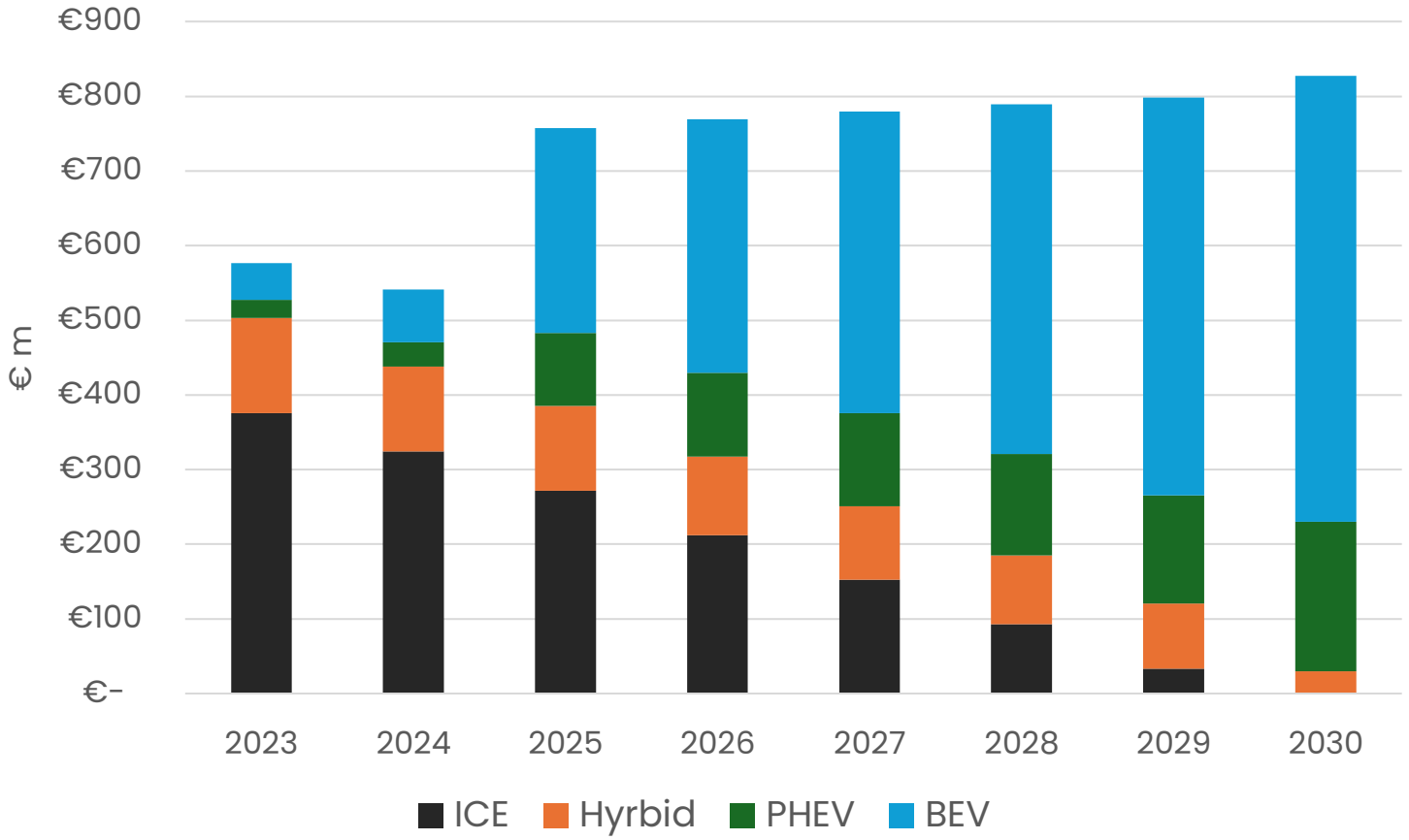
Description: electrification trend continues but no change in tax system



- Revenue falls by ~ €38 M each year (46% reduction by 2030 or 267 M less than 2023)
- Cumulative emissions from new vehicles rise to ~0.8 MtCO2 by 2030

Results (scenario 2)

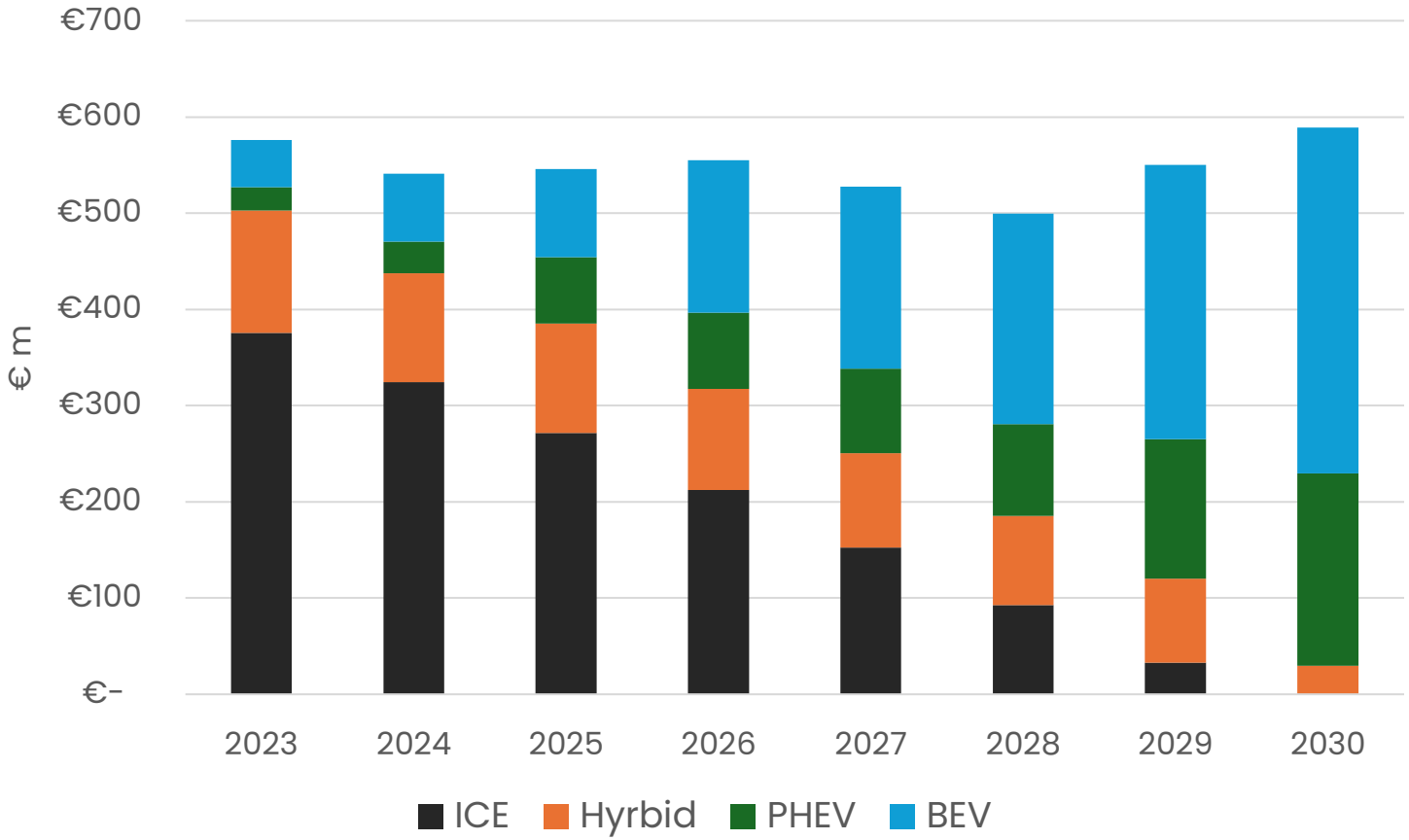
Description: electrification trend continues but new marginal weight-based taxation system is put in place. Introduced immediately (2025) and Rate 1 applied to all engine types. French weight bands applied.



- Revenue increases each year (44% increase by 2030 or 251 M more than 2023)
- PHEVs and BEVs disproportionally effected

Results (scenario 3)

Description: electrification trend continues but new marginal weight-based taxation system is put in place. Phased introduction from 2025, Rate 1 applied to ICE & Hybrids, Rate 2 applied to PHEVs, Rate 3 applied to BEVs. French weight bands applied.



- Revenue fluctuates each year (2% increase by 2030 or 13 M more than 2023)
- Even distribution of revenue collection across engine types

In practice … BEVs

	VW ID 3	VW ID 4	VW ID 5
			
Base Weight (kg)	1,805	2,156	2,193
Price (€)	€45,791	€55,280	€61,567
Current VRT (€)	€0	€3,637	€4,052
WB_VRT (s 1)	€2,065	€13,247	€14,757
WB_VRT (s 2)	€1,922	€4,050	€6,193

In practice … ICE/Hybrid/PHEV

TUCSON (Diesel)

TUCSON (Hybrid)

TUCSON (PHEV)

Base Weight (kg)	1,552	1,710	1,946
Price (€)	€43,559	€45,295	€47,674
Current VRT (€)	€8,389	€6,668	€3,312
WB_VRT (s 1)	€8,389	€7,768	€7,707
WB_VRT (s 2)	€8,389	€7,768	€5,509

Conclusions

- There is a compelling argument to include weight in the calculation of VRT for both fossil fuelled and electric vehicles
  - Fill revenue gap from energy transition
  - Incentivize lighter and more fuel efficient cars, to help fill the gap in carbon budgets
  - Reverse road safety threat as a result of “car bloat”
- For carbon budgets, speed is of the essence
  - To have an impact on carbon budgets, measures should be introduced quickly and send a strong signal
  - Meeting carbon budgets requires much more rapid vehicle electrification, but EV sales have fallen: **Major threat** to carbon budgets
- The rationale for introducing weight-based VRT component to EVs is strong
  - However, care needed to avoid unintended consequence, e.g., pushing buyers from EVs to ICEs or PHEVs
  - PHEVs are likely to emit 3x more CO2 than suggested by vehicle testing
- Car market may be undergoing significant disruption: era of low-cost EVs from China may be here
  - To maintain constant VRT intake, weight thresholds should be kept under review
- Other ways to disincentivize larger vehicles
  - Make CO2 base more progressive
  - Send forward signal to current new car market: flag to buyers that increased costs/limitations on used

Thank you

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