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Building a Programme Evaluation Function for Policy Impact

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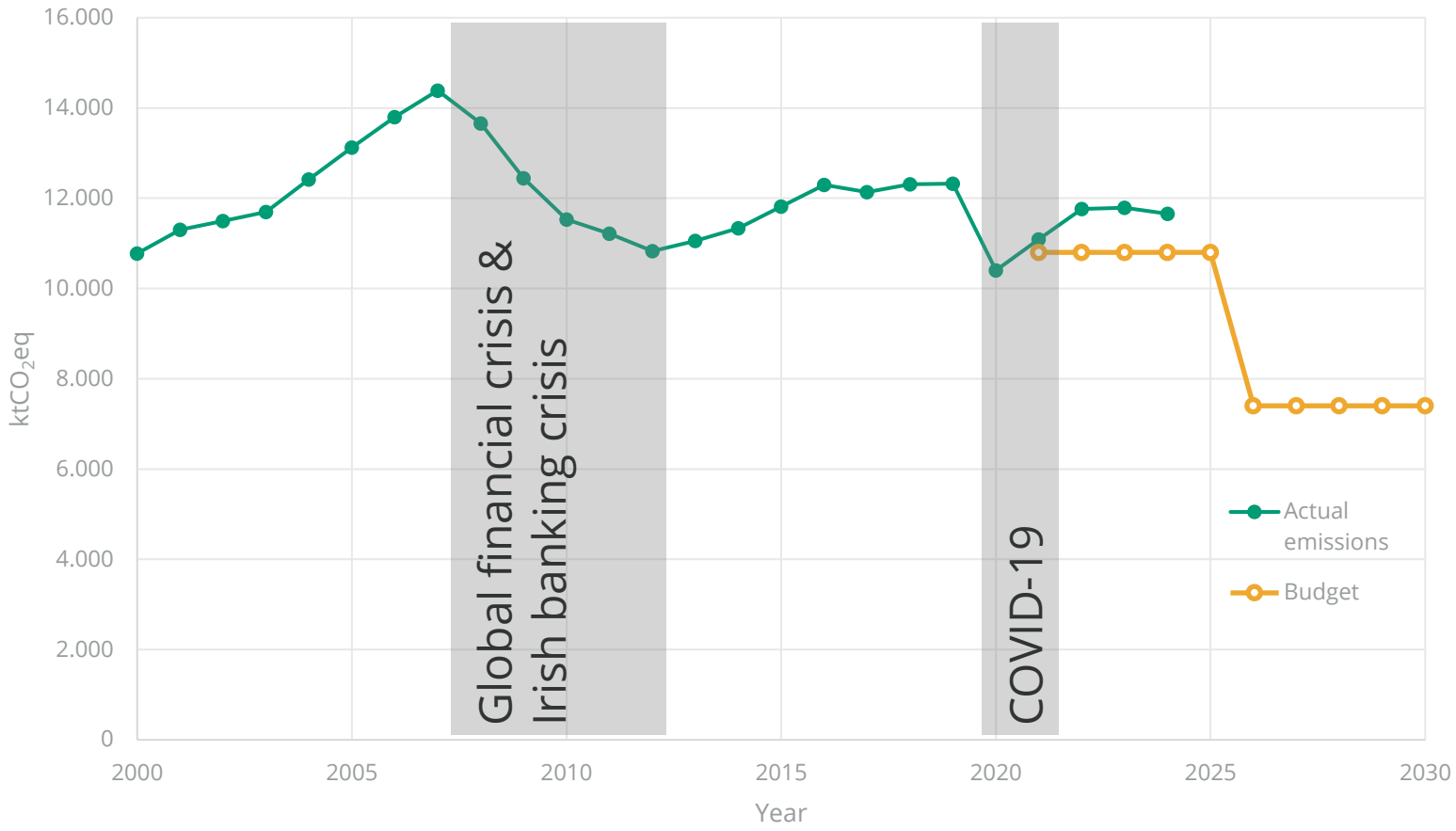
Outline

1. Background: Ireland's EV Grant programmes
2. Questions on programme impact
3. Data
4. Approach
5. Results
6. Conclusions and next steps

Ireland's historical Transport-related emissions



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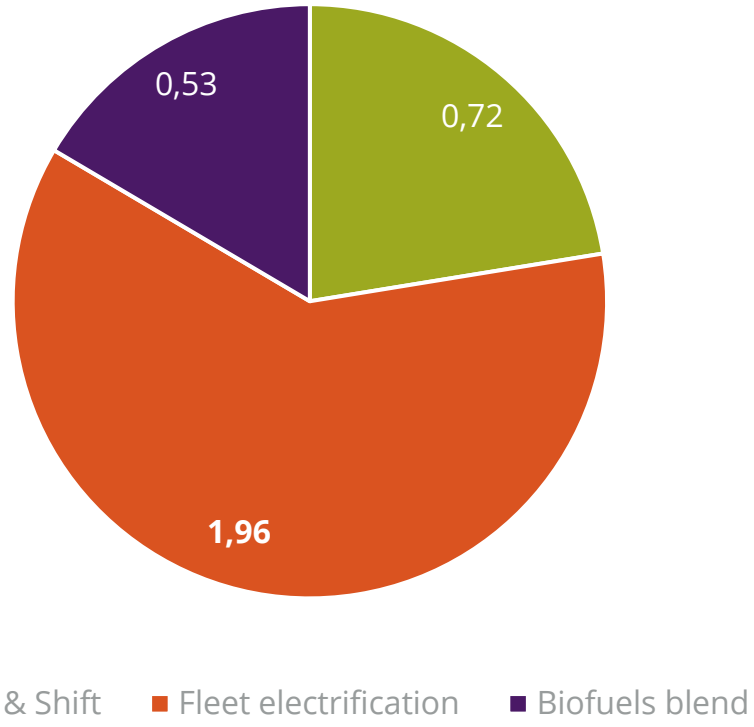
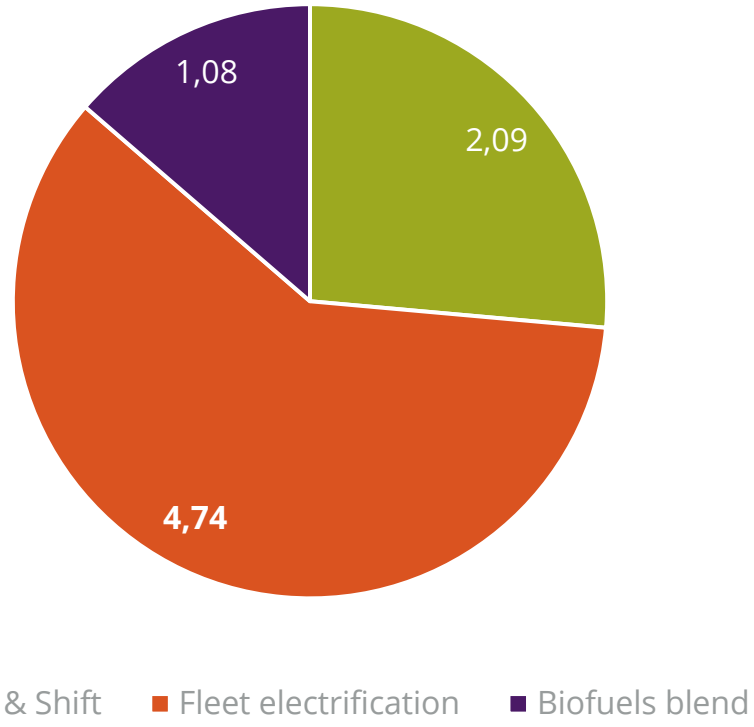
Ireland's strategy for decarbonising transport

2025 abatement targets, $MtCO_2eq$



2030 abatement targets, $MtCO_2eq$



Fleet electrification

	2025 Target	2030 Target
Passenger EVs	175,000	845,000
BEV share of total pass. veh.		30%
EV share of new pass. veh.		100%
Commercial Vans	20,000	95,000
EV share of total LGVs		20%
Low-Emission HGVs	700	3,500
ZE share of new HGVs		30%
Additional targets for public transport and rail transport		

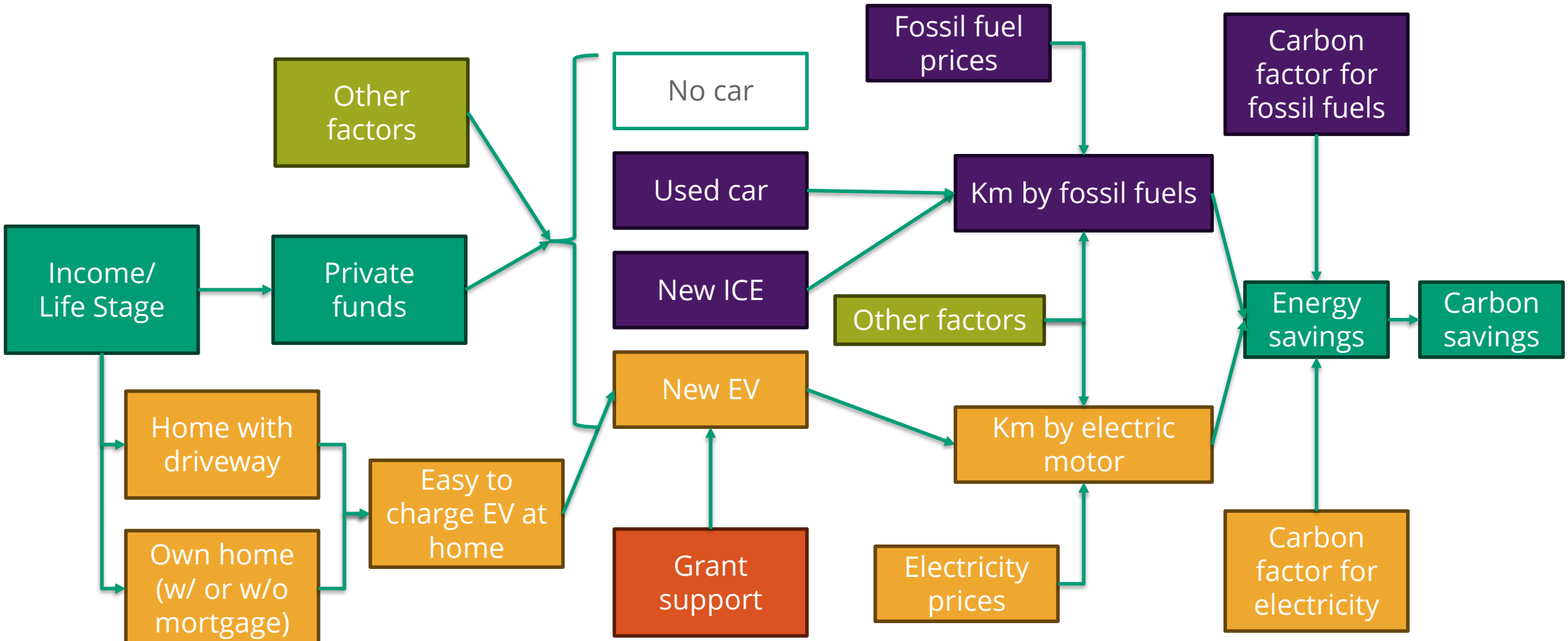
Current policies to incentivise Private EVs

Up to June 2023	Up to December 2023	Current Policies
€5000 grant toward new BEVs	…reduced to €3500	
€600 grant toward home charger		
Registration tax relief of €5000 for BEVs		
Motor tax at lowest band of €120 pa for BEVs (€170 for PHEVs)		
50% reduction in toll levels for BEVs (25% for PHEVs)		…discontinued
BEVs qualify for 0% Benefit-in-Kind rate up to €50k		

International evidence

- BEVs may be **more popular** among households who normally travel **shorter distances** by car, such as in urban areas (Mukherjee & Ryan 2020; Huwe & Gessner 2020)
- **Greater benefits** might be realised by uptake in **rural** areas (Newman et al 2014) due to:
- **Rebound** effects are possible due to:
  - Reduced **operating costs** (Sorrell 2007)
  - **Perception** of low environmental consequences of BEVs (Seebauer, 2018)
- **Negative rebound** also possible:
  - **Range** limitations of BEVs (Hasan & Simsekoglu, 2020)

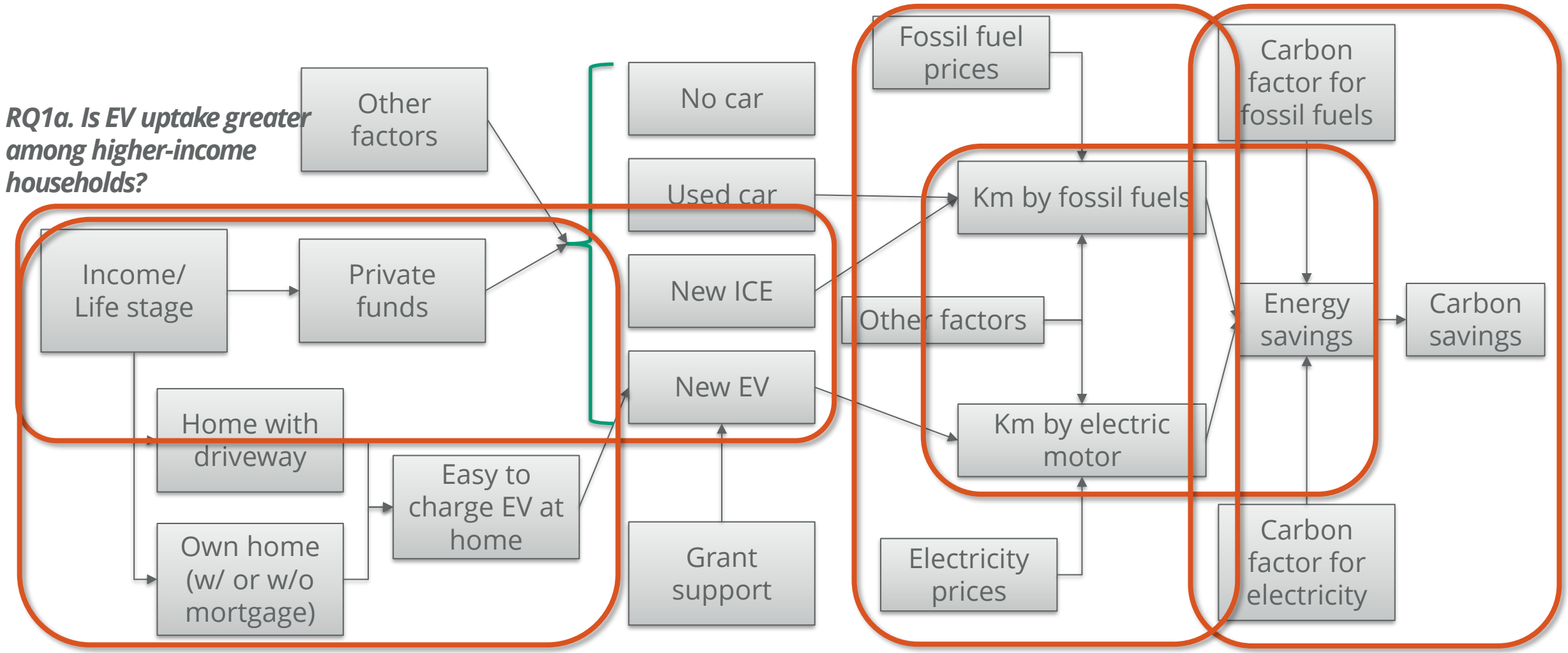
Conceptual framework



Research questions

RQ2a. Taking into account kilometres travelled, what are the energy savings achieved by EVs?
RQ2b. What might explain any difference in km/year?

RQ1a. Is EV uptake greater among higher-income households?



RQ1b. Is EV that difference in uptake due to related structural barriers (e.g. home charging) and/or affordability of new cars?

RQ2c. Taking into account carbon factors, what are the carbon savings achieved by EVs?

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Data:
EV and ICE user survey, January-February 2025

ICE cohort

- Target: ICE owners aged 18+
- Leads source: Consultant panel
- Sample size: n=1,010
- Sample details:
  - Nationally representative via consultant's online panel, with quotas and weighting applied to gender, age, social grade, and region as per latest Central Statistics Office projections.
- Filtered for "bought new": **218**

EV cohort

- Target: EV owners aged 18+
- Leads source: SEAI EV grant recipient list
- Sample size: n=**2,988**
- Sample details:
  - Sample taken from over 34,000 private EV grants awarded since 2021
  - Incentive raffle of €250 One4All voucher offered to participants, with details as per latest data protection regulation to protect the identify of the participants
  - Final data is not weighted, although survey invitations were managed to ensure a regional spread of respondents that reflected the total population of grant recipients

Data:
EV and ICE user survey, January-February 2025

Dependent variables

- Annual km travelled
  - Self-reported km per year
  - Odometer reading / years since registration
- Annual emissions, fuel consumption, electricity consumption
  - EEA database of emissions rates by make/model
- Annuel energy consumption
  - Emissions rates converted back to kWh using Carbon Factors for Ireland

Explanatory variables

- Region (NUTS3 – 8 in Ireland)
- Household members (1,…,5,6+)
- Residence has its own driveway (Yes/No)
- Household income (9 categories converted to midpoint values €/year)
- Settlement type (City, Commuter Belt, Small Town, Rural)
- Environmental attitudes (6 Likert scales converted to numbers and averaged)
- Years owned
- Vehicle category
- *Attached from EEA database:* WLTP-rated mass of chosen car

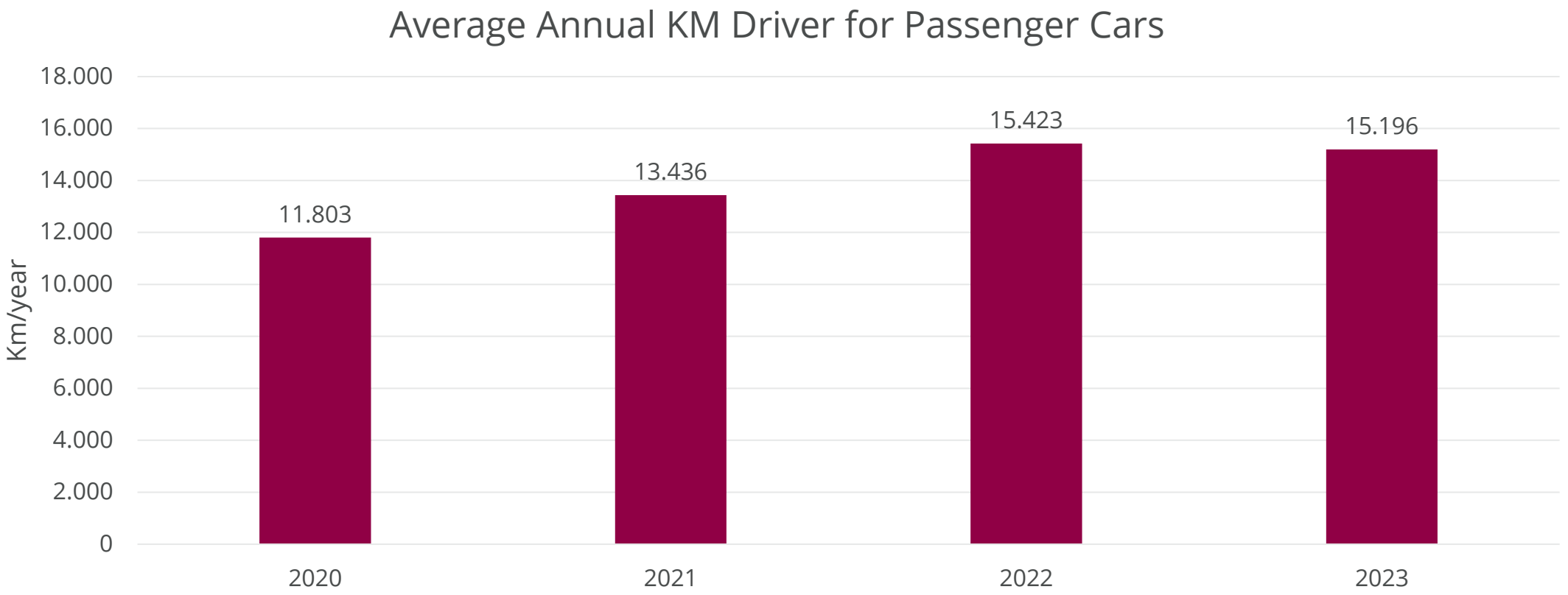
Sample

Filters:

- Only purchased as new
- 2nd to 98th quantiles of propensity score
- Bought 2020 or later

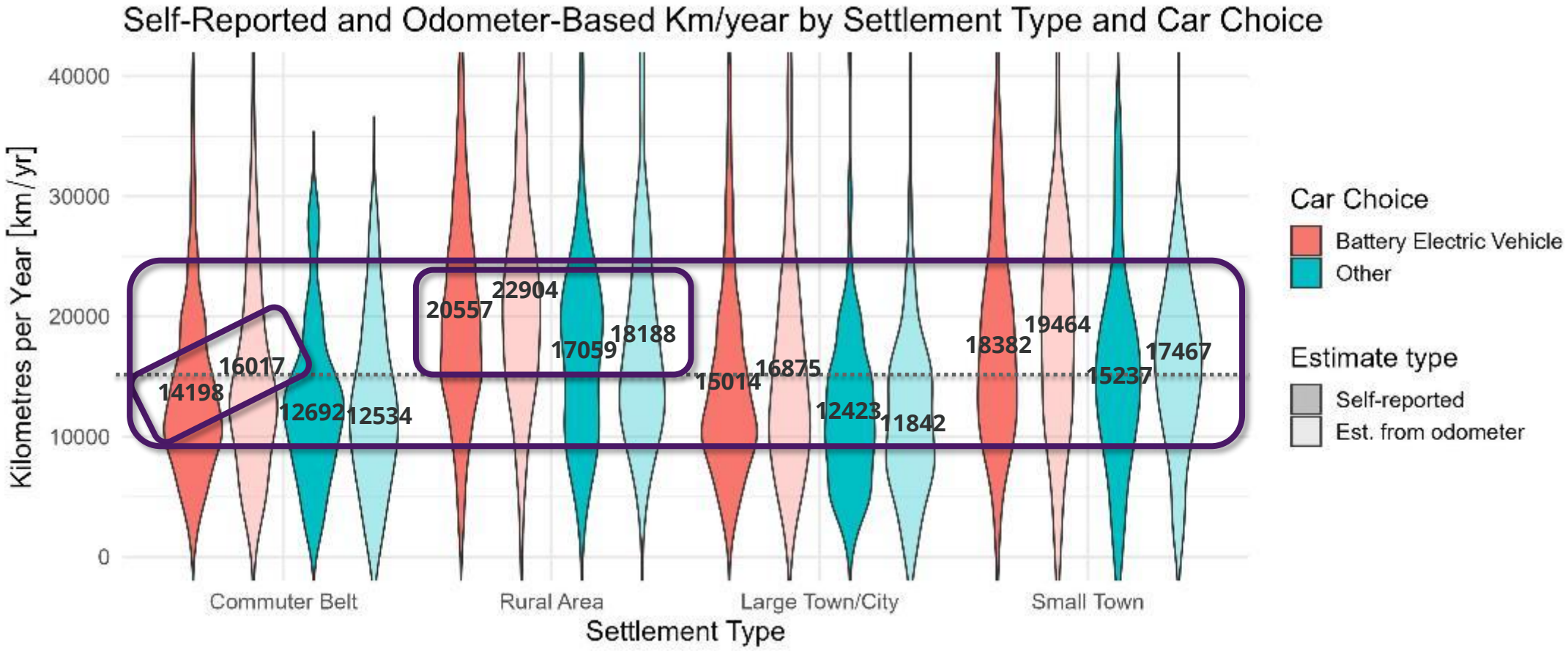
Settlement Type	ICE, HEV, PHEV	BEV
Commuter Belt	57	475
Rural Area	40	470
Large Town/City	107	708
Small Town	22	144

Ireland's National Statistics



(compare StreamSave: **13,740** km/year EU avg.;
Ireland's EEOS: **17,074** km/year)

What annual km was driven by the survey sample?



Approach:
Matching on Adjusted Propensity Scores

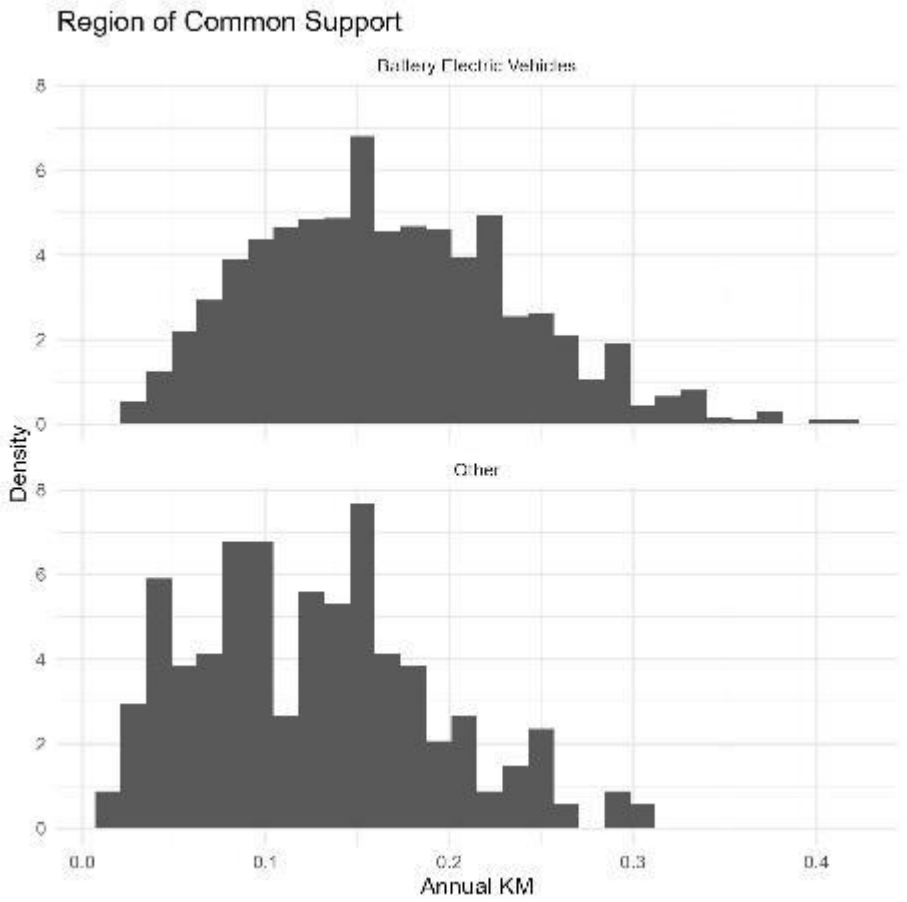
- Propensity Score:
  Pr(Choose BEV) a function of:
  - Region (NUTS3)
  - Attitudes
  - Household income
  - Having own driveway
- Adjusted for different sample sizes vs. population sizes
- Estimate Average Treatment Effect on the Treated (ATT) as:

  Model-predicted Annual KM for choice as made for BEV group (BEV)

  minus

  Model-predicted Annual KM *if* choice had been non-BEV instead

  Average over observations



Estimated model of Annual KM

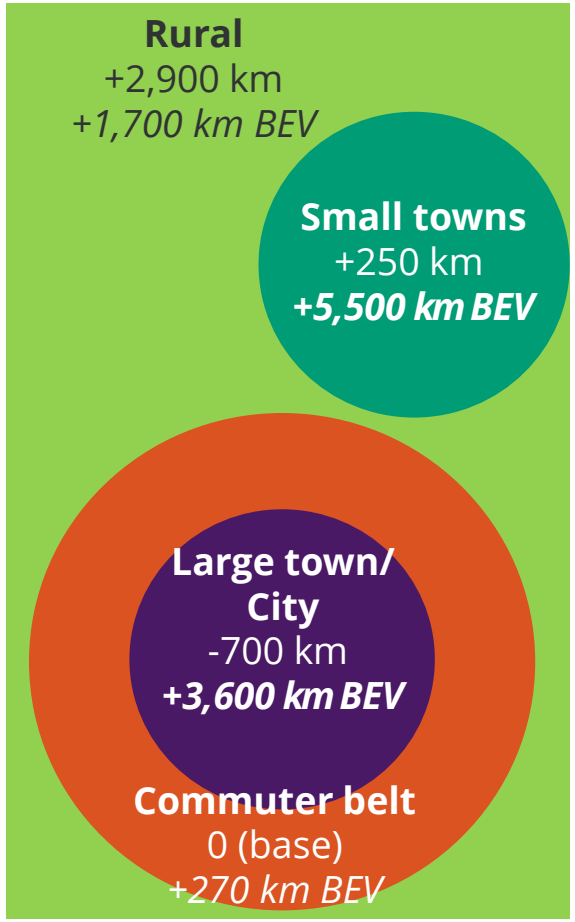
Model term		Estimate	Std. Error	t-value	Pr(>|t|)	
(Intercept)		8959	1373	6.524	8.77E-11	***
Battery Electric Vehicle		266	1298	0.205	0.8376	
Settlement Type	Commuter Belt					
	Rural Area	2924	2034	1.437	0.1508	
	Large Town/City	-720	1530	-0.471	0.6378	
	Small Town	259	2243	0.115	0.9082	
BEV * Settlement Type	Commuter Belt					
	Rural Area	1652	2101	0.786	0.4319	
	Large Town/City	3615	1625	2.225	0.0262	*
	Small Town	5462	2367	2.307	0.0212	*
Household Size		1358	161	8.422	< 2e-16	***
Attitude Score (ranges from -1 to 1)		-2246	583	-3.854	0.0001	***
Region	Dublin					
	Mid-East	1334	729	1.83	0.0674	.
	South-West	2204	650	3.389	0.0007	***
	Mid-West	6444	863	7.468	1.25E-13	***
	West	4248	857	4.955	7.87E-07	***
	Border	3723	1089	3.418	0.0006	***
	South-East	3036	880	3.45	0.0006	***
	Midland	5911	1098	5.382	8.28E-08	***

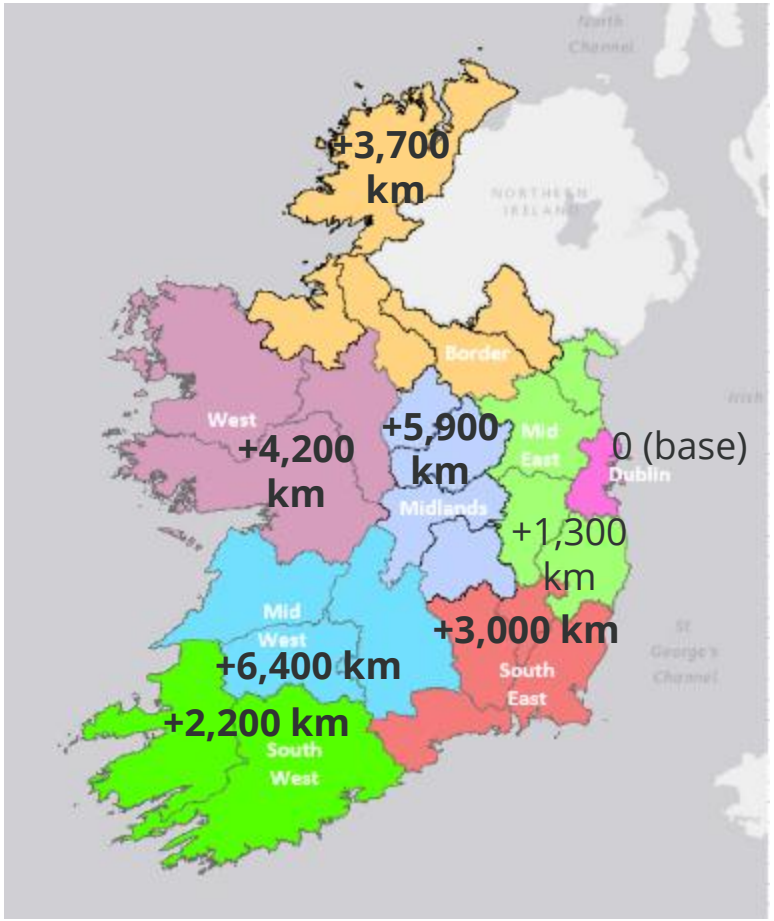
Estimated model of Annual KM

10,300 km
Non-BEV, 1 household member,
Neutral environmental attitudes,
Commuter belt in Co. Dublin

+1,400 km
for each household member

-2,200 km
for maximum environmental attitudes (+2,200 km for minimum)





Convert to kWh and CO2 per year

Battery Electric Vehicles

- Energy consumption

  Average over BEVs in sample: **0.163 kWh/km**

  (compare StreamSave and Ireland's EEOS: 0.124 kWh/km)

- Carbon emissions

  Emissions factor for electricity: **226.3 g/kWh**

  (compare StreamSave 133.3 g/kWh EU avg.)

  Average over BEVs in sample: **36.9 g/km**

Others

- Energy consumption

  Average fuel consumption: **3.0 L/100km**

  Energy content: **9.23/10.27 kWh/L** for Petrol/Diesel (StreamSave)

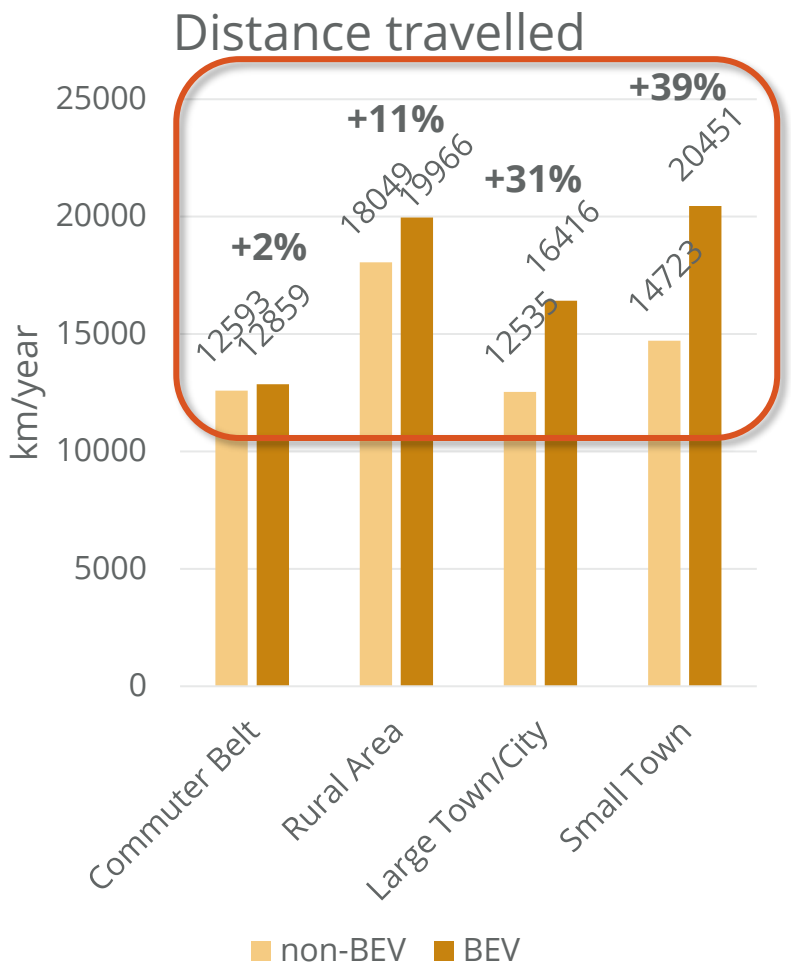
  Average energy consumption: **0.269 kWh/km**

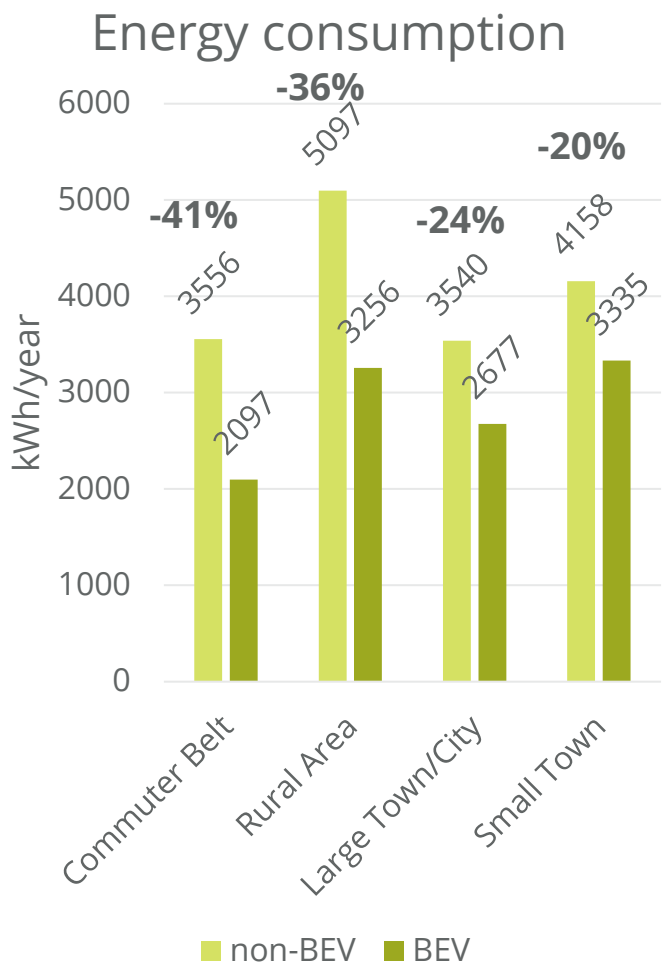
  (compare StreamSave and Ireland's EEOS: 0.313 kWh/km EU avg.)

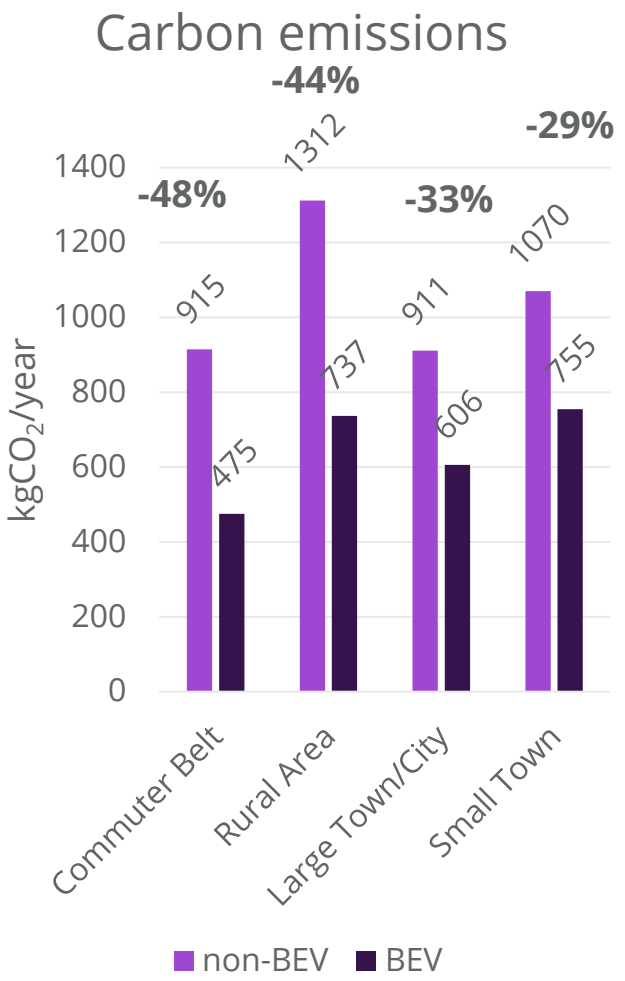
- Carbon emissions

  Average emissions (WLTP) in sample: **72.7 g/km**

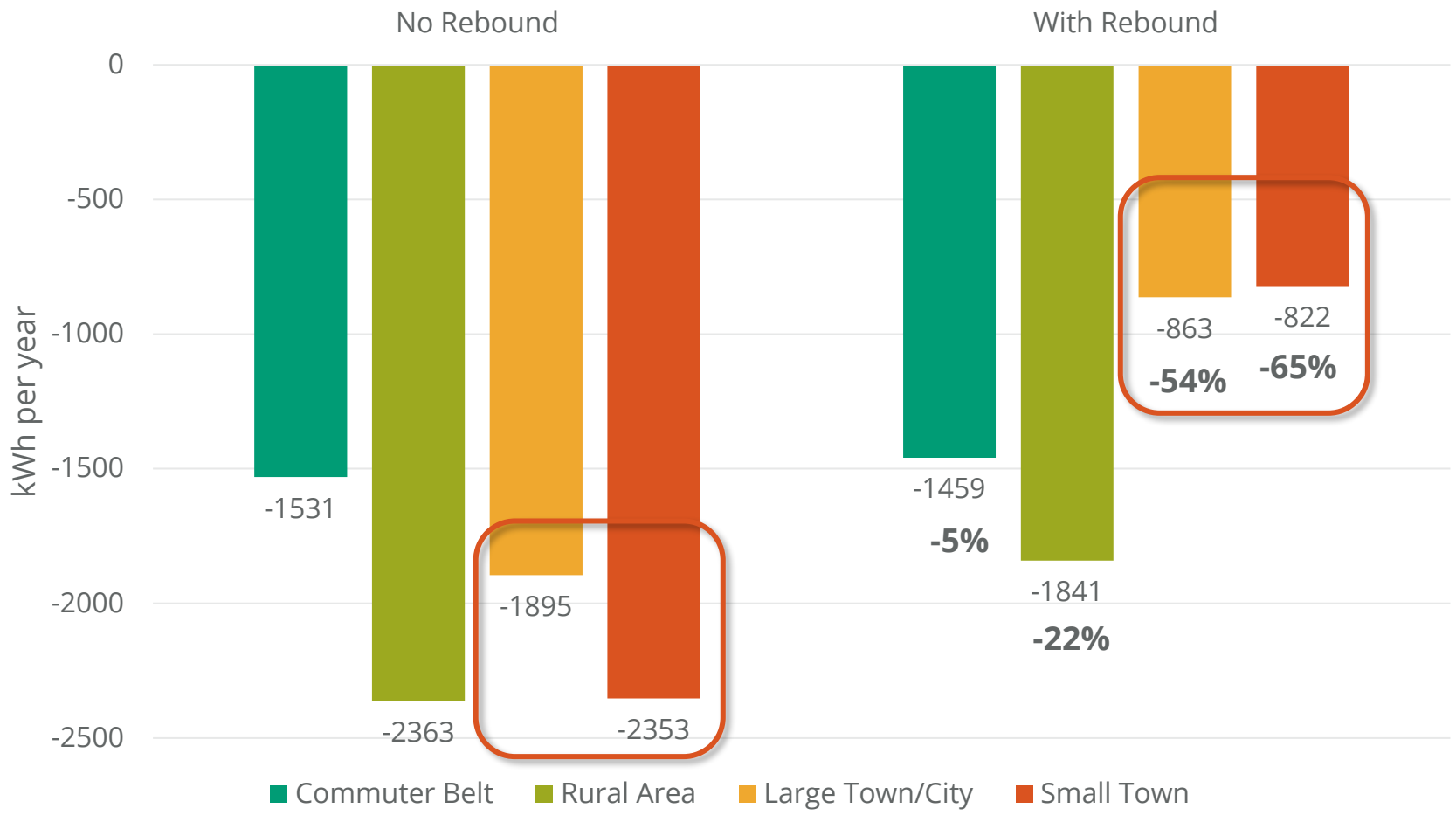
Predicted metrics with BEVs vs. with other vehicles



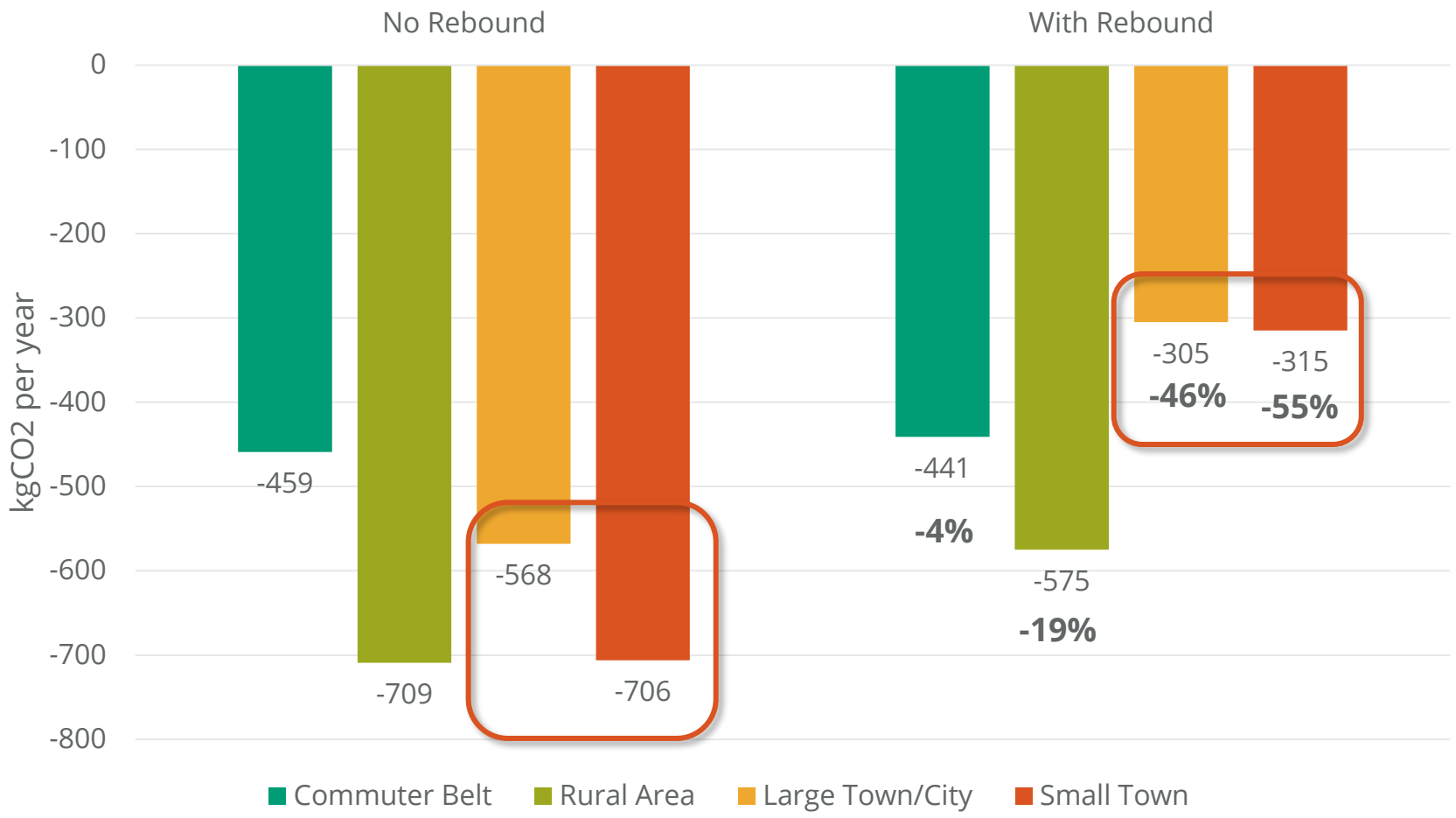




Effect of Rebound on BEV Energy Consumption



Effect of Rebound on BEV Carbon Emission Savings



Conclusions

- Distance travelled varies by various factors
  - Region, household size, attitudes
- Rebound effects evident for BEVs in certain Settlement Types
  - Small towns
  - Cities/large towns
- Energy and carbon savings overall less than SEAI normally assumes
  - Rebound effect
  - Higher BEV energy consumption
  - Lower non-BEV energy consumption
- Rebound effect reduces energy savings by -5% to -65%
- Without accounting for rebound:
  - Greatest savings in **rural** areas and **small** towns
  - Least savings in **commuter** belt
- When accounting for rebound:
  - Greatest savings in **rural** areas
  - Least savings in **large** towns/cities and in **small** towns

Next steps

- Examine current uptake in relation to impact by region
  - Is the uptake pattern raising or lowering the average effect?
- Examine potential effects of policy adjustments
  - “Settlement Type” is self-reported and not translatable to policy
- Considers spill-over and free-rider effects
  - No such effects currently assumed

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Thank you for listening

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