Australia's National Science Agency

Electric vehicle projections 2023

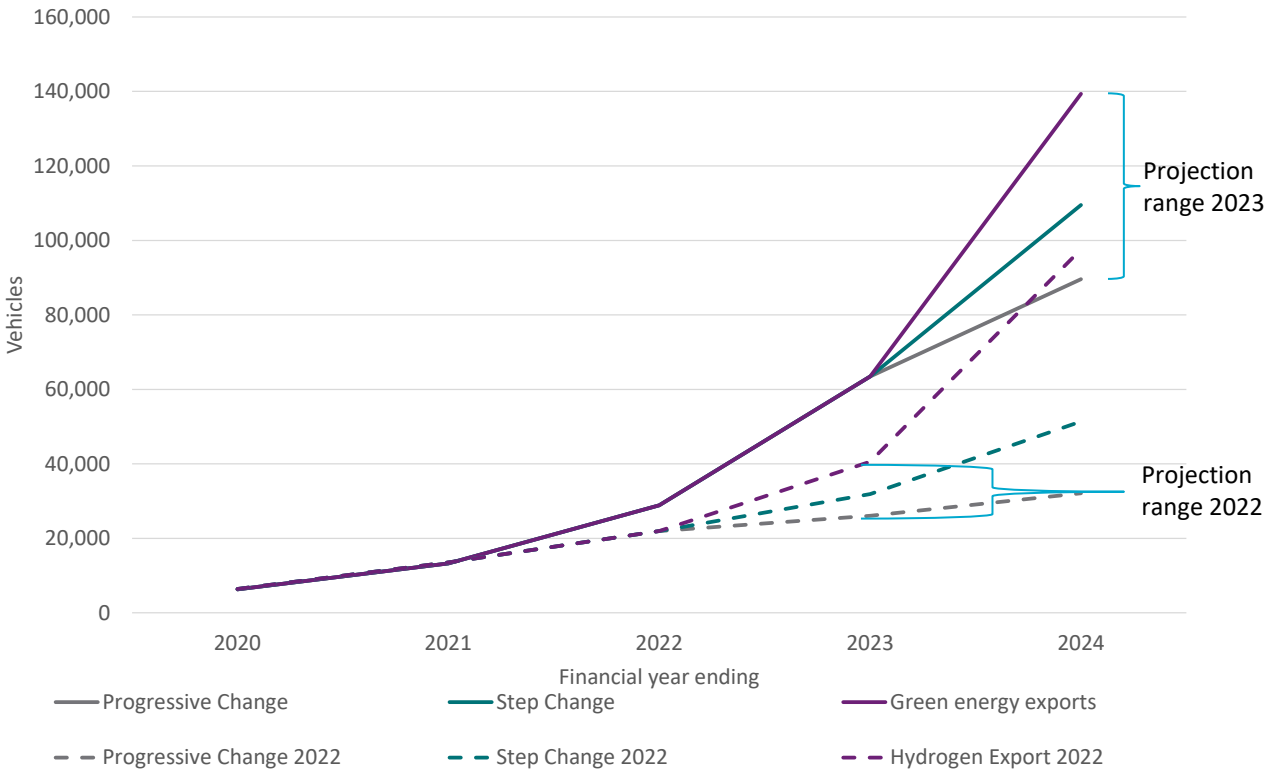
October 2023

Paul Graham

Key updates relative to 2022

Item	Impact
Population and GDP projections	Slightly lower overall
Historical EV sales	Faster than expected. Short term forecast range adjusted to recognise higher potential growth
Historical road transport statistics	• Vehicle sales are steady • Vehicle passenger travel is persistently lower – WFH, telepresence for business. • More confidence in predicting vehicles growth which will be higher.
Working through implications of potential fuel efficiency standards	New policy makes sales targets more important in the projections method
Working through feedback on profiles	More explicit charger assumptions and subsequent adjustments to profile shares

Short term sales projection



2023-24 forecasted range is 90,000 to 140,000.

September quarter annualised rate is around 118,000

2021-22 was uncertain in previous projection but base year 2022-23 is now firm historical due to change in method at FCAI statistics

FCAI is Federal Chamber of Automotive Industries

Fuel efficiency standards

- Australian fuel standards to be clarified by end 2023
- US proposal could lead to 60% EV sales by 2030 in US
- EU standards similar and define an ICE ban 2035
- Australia is coming from a higher vehicle emissions starting point
- State targets are for 50% EV sales share by 2030
- Propose +/-15% range for now. Narrow to +/-10% when more policy detail is known

	Progressive Change	Step Change	Green Energy Exports
2030 outcome	35% new vehicle sales	50% new vehicle sales	65% new vehicle sales

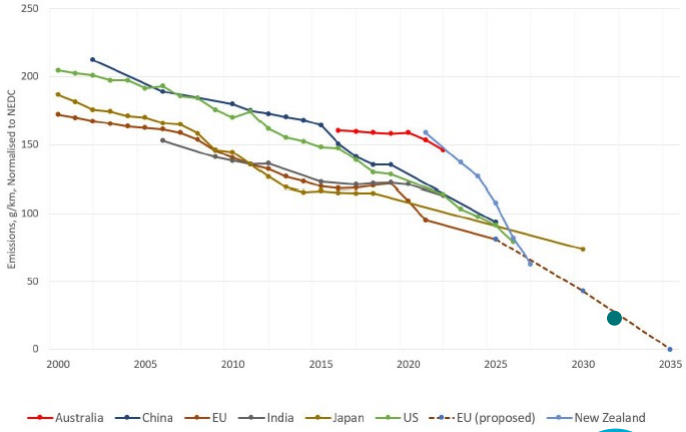
US EPA

Table 80—Fleet BEV Penetration Rates, by Body Style, Under the Proposed Standards

	2027 (%)	2028 (%)	2029 (%)	2030 (%)	2031 (%)	2032 (%)
Sedans	45	53	61	69	73	78
Crossovers/SUVs	38	46	56	59	61	62
Pickups	11	23	37	45	55	68
Total	36	45	55	60	63	67

Table 81—Fleet BEV Penetration Rates, by Body Style, Under the No Action Case

	2027 (%)	2028 (%)	2029 (%)	2030 (%)	2031 (%)	2032 (%)
Sedans	39	41	45	46	44	43
Crossovers/SUVs	26	32	37	40	39	39
Pickups	7	16	24	29	31	33
Total	27	32	37	40	40	39



- Current US EPA proposal is 45g/km by 2032

Chargers

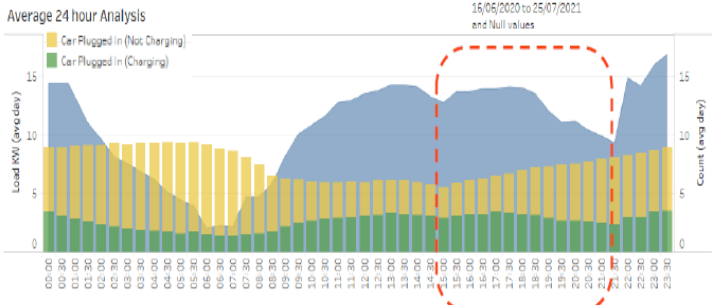
	AC/DC	Power	Effort required	Recharge time per empty vehicle
Level 1	AC	2.4 to 3.6kW	Standard power point	Days
Level 2	AC	7.2 to 22kW	Electrician installs dedicated power point and extra phases if necessary	Overnight
Fast (also level 3 and 4)	DC	25 to 100s of kW	Above plus large distribution connection	Minutes to an hour

Charger shares: current and 2050

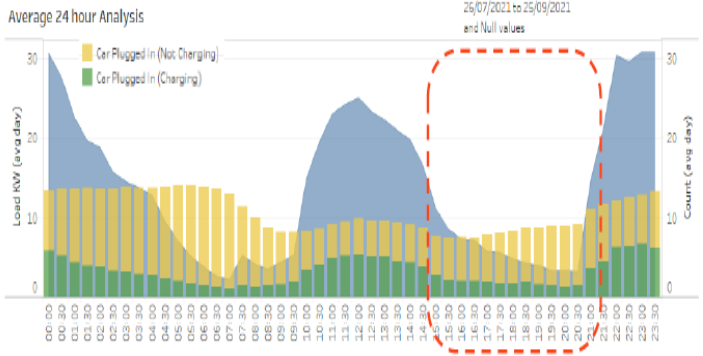
- Trials indicate Level 1 charging is currently common although trial results differ
- Assumed that there will need to be more workplace and public charging to accommodate households with difficult at-home charging circumstances
- Level 1 is too slow for recovering charge after a long trip even if home charging is convenient – additional driver of Level 2 and public fast over time
- These changes will occur sooner the faster EV uptake across the scenarios

Vehicle type	Charger type	Current (estimated)	Progressive change	Step change	Green energy exports
Passenger	Home - L1	68%	46%	41%	36%
	Home - L2	23%	31%	27%	24%
	Work - L2	5%	10%	15%	20%
	Public - L2	1%	4%	5%	6%
	Public - Fast	4%	10%	12%	14%
LCV	Home - L1	38%	17%	14%	12%
	Home - L2	13%	25%	22%	18%
	Work - L2	48%	55%	60%	65%
	Public - Fast	2%	3%	4%	5%
Truck/bus	Work - L2	29%	24%	19%	14%
	Work - Fast	69%	73%	77%	81%
	Public - Fast	2%	3%	4%	5%

Trial profiles

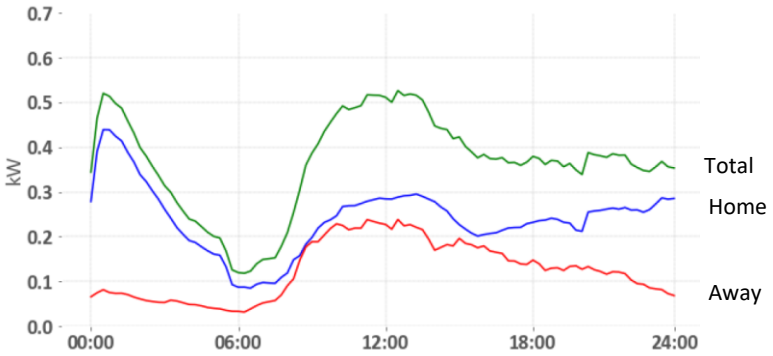


Before TOU incentive

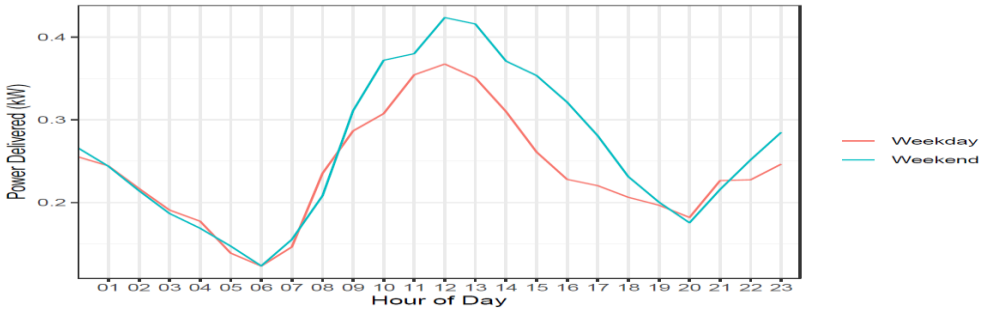


After TOU incentive

Midnight off-peak TOU incentive



Tariff incentives not stated



Key learnings from trials:

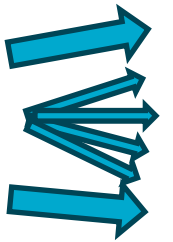
- Tariffs play a major role in reducing evening peak period charging.
- Midday charging is a feature and reflects rooftop solar and public charging

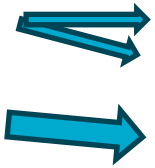
AER forecast TOU take up will increase

Sources: Energex and Ergon Energy Network (2022a, 2022b), Origin Energy (2021, 2022) and Philip et al. (2022)

Linking charger to charging profiles

	Tariffs	Opportunities / constraints	Charger
Households	Flat tariff common but TOU growing	Workplace, city or shop parking, home solar, in-car timer	Level 1 Level 2 Fast
	Dynamic price	Fast communication, plugged in, charge to spare, market arrangements	Bi-directional charger
Business	TOU is common	Workplace, city or shop parking, high daytime vehicle duty cycle	Level 2 Fast





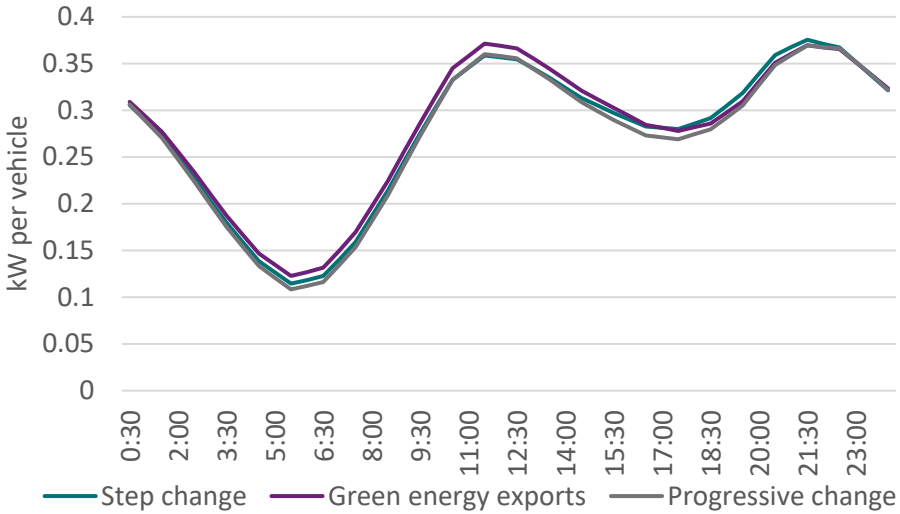
Profile types
Passenger - Unscheduled home charging, flat tariff
Passenger - TOU tariff with no day incentives other than use of home solar
Passenger - TOU tariff including day charging incentives (an emerging tariff type)
Passenger - Public L2 and fast charge
Vehicle to X
LCV, trucks & buses - Overnight due to day use of vehicle
LCV, trucks & buses - Daytime oriented allowing for vehicles parked at workplace
LCV, trucks & buses - public fast charge

Charge profile shares: current and 2050

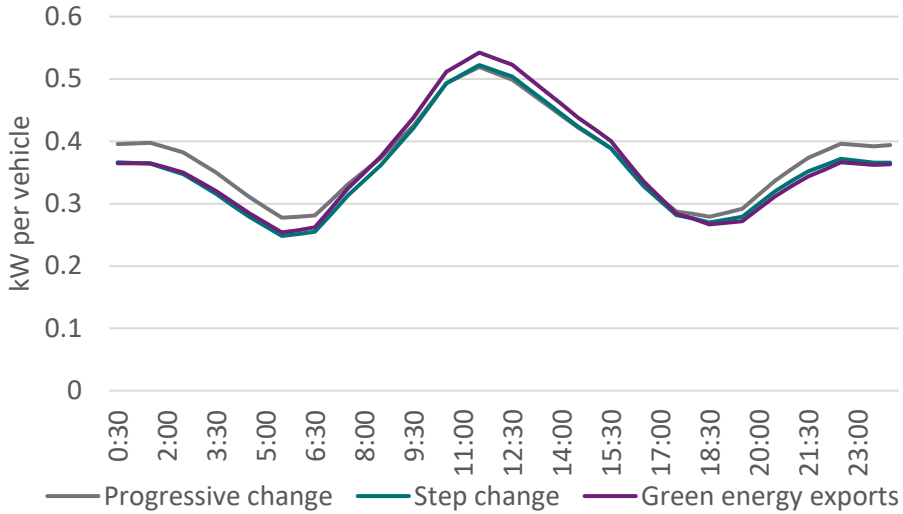
	Current	Progressive change	Step change	Green energy exports	To 2030	2030 to 2050
Passenger - Unscheduled home charging, flat tariff	70%	49%	44%	38%	⇩	⇩
Passenger - TOU tariff with no day incentives other than use of home solar	23%	4%	3%	2%	⇧	⇩
Passenger - Vehicle to home/grid (dynamic system-controlled charging)	0%	18%	24%	30%	⇨	⇧
Passenger - Public L2 and fast charge	5%	14%	17%	20%	⇧	⇧
Passenger - TOU tariff including day charging incentives	1%	16%	13%	9%	⇧	⇧
LCV - Overnight due to day use of vehicle	80%	73%	72%	70%	⇧	⇩
LCV - Daytime oriented allowing for vehicles parked at workplace	18%	24%	24%	25%	⇧	⇧
LCV - public fast charge	2%	3%	4%	5%	⇧	⇧
Trucks & buses - Overnight due to day use of vehicle	88%	80%	78%	76%	⇧	⇩
Trucks & buses - Daytime oriented allowing for vehicles parked at workplace	10%	17%	18%	19%	⇧	⇧
Trucks & buses - public fast charge	2%	3%	4%	5%	⇧	⇧

Outcome of charging assumptions: all vehicles

2030



2050



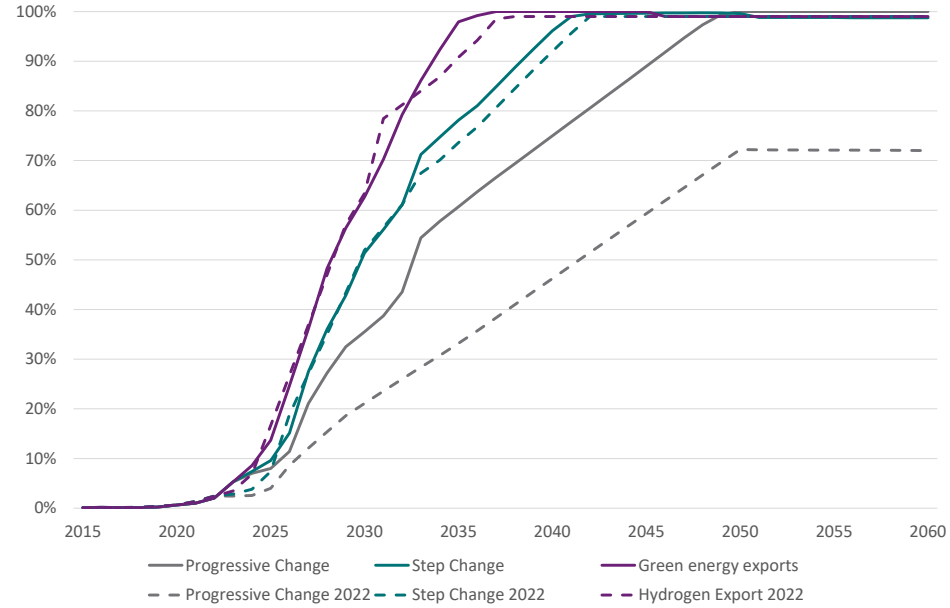
Increase in daytime charging over time

Decrease in peak period charging as TOU and then dynamic control adoption increase

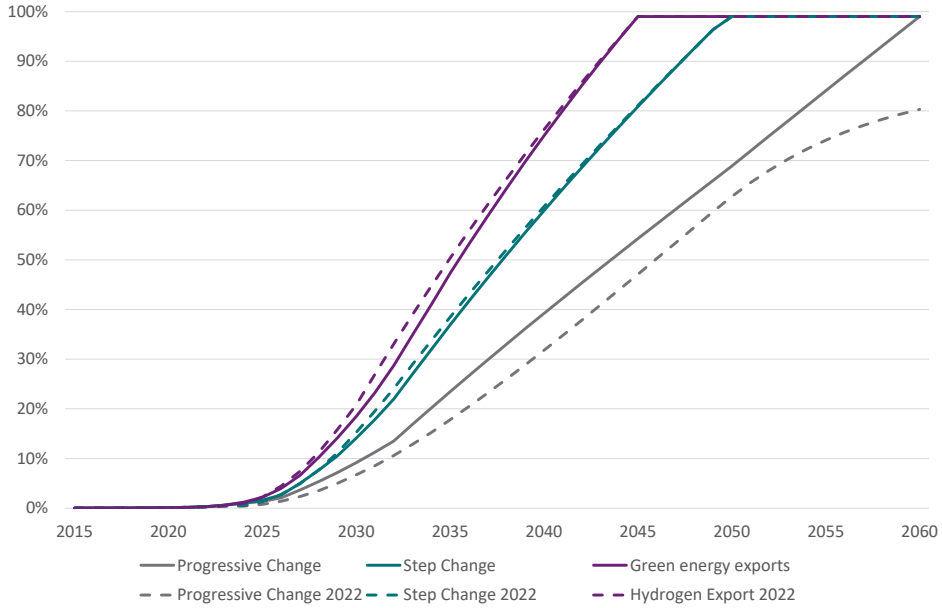
Charge per vehicle increases over time as trucks and buses electrify

Preliminary results: sales and fleet share

Sales share



Fleet share

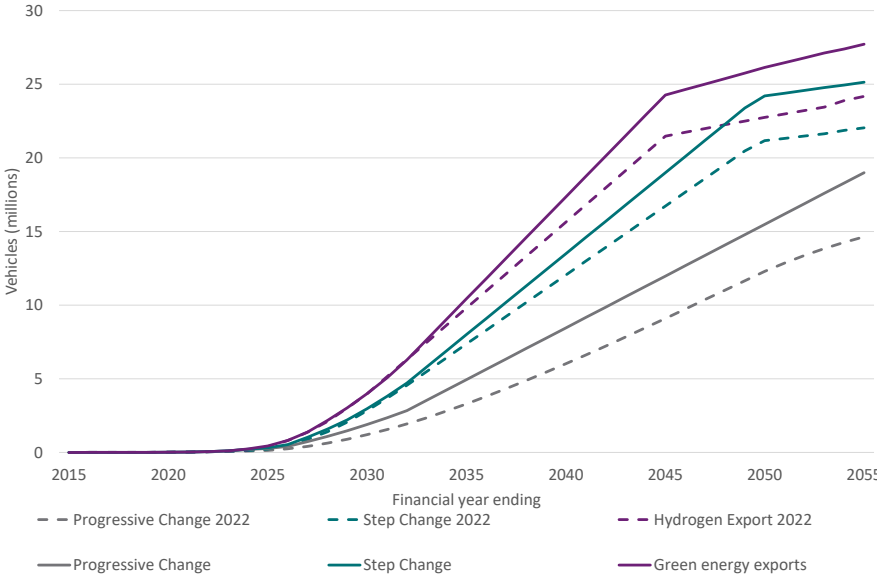


Progressive change 2022 sales rate is no longer plausible given recent strong growth and likely introduction of fuel efficiency standard. Volatility before 2030 reflects approach of cost parity in 2035

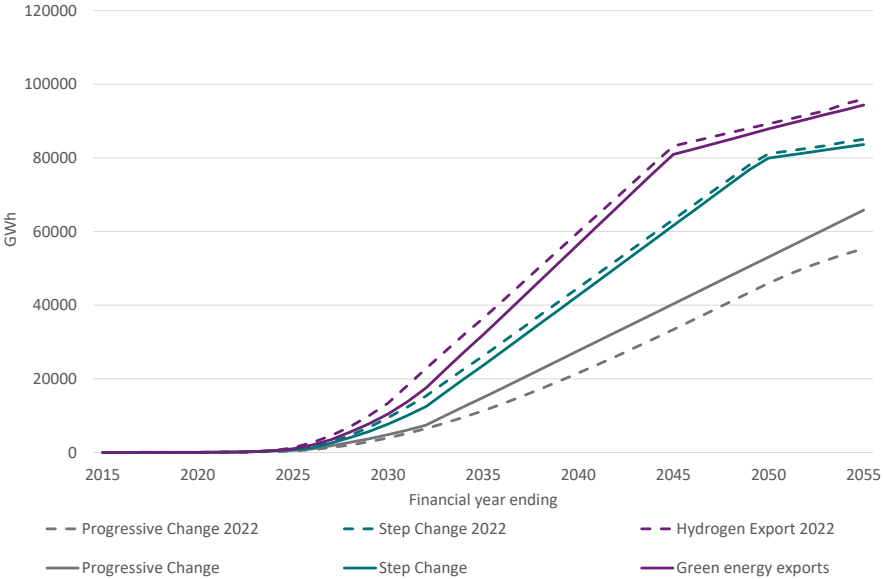
Preliminary results: number and consumption

NEM

Number of vehicles



Electricity consumption



Knee in 2045 and 2050 reflects end of period of accelerated scrapping of ICEs.

Higher number of vehicles compared to 2022 is offset by lower kms travelled per vehicle such that consumption changes relative to 2022 are small.

Thank you

Energy
Paul Graham
Chief Economist Energy

+61 2 4960 6061
paul.graham@csiro.au

Method appendix for information

Overview of CSIRO's EV model

Inputs

Inputs and Assumptions e.g. Historical EV sales, fuel efficiency, market changes, scenario settings.

Short-term Model

Long-term Model
(Consumer Adoption & Transport demand Model)

Outputs

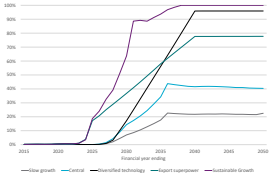
1) Uptake and Sales of EVs

2) Proportion of Vehicles

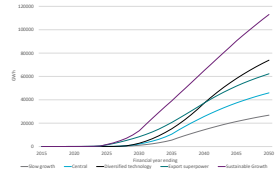
3) Operational forecasts

4) EV Consumption forecasts

EV sales share



EV consumption



Short and long term models

Next 12 months

Regression analysis

2024-25 to majority EV sales

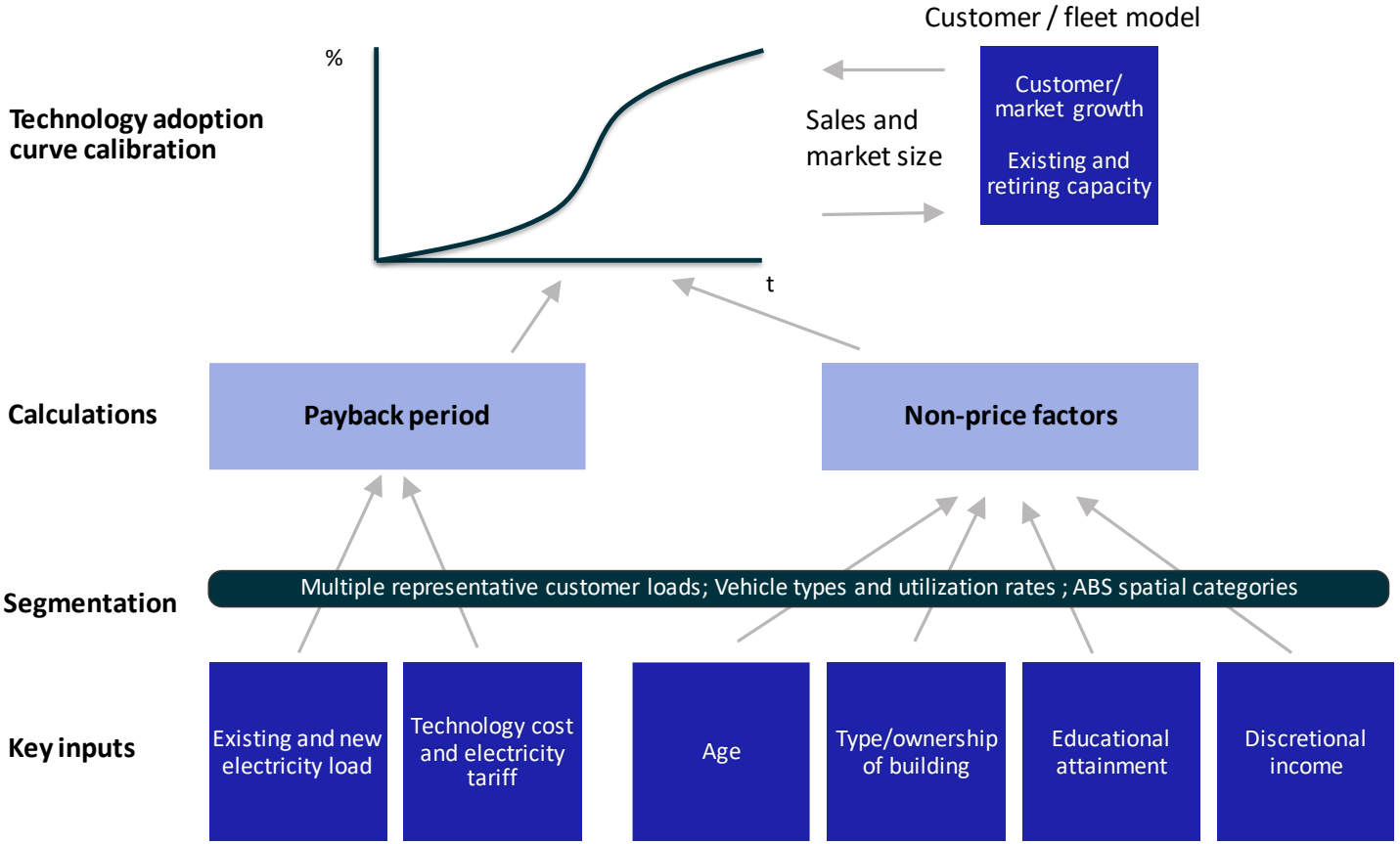
Consumer technology adoption model

Majority EV sales to end of projection

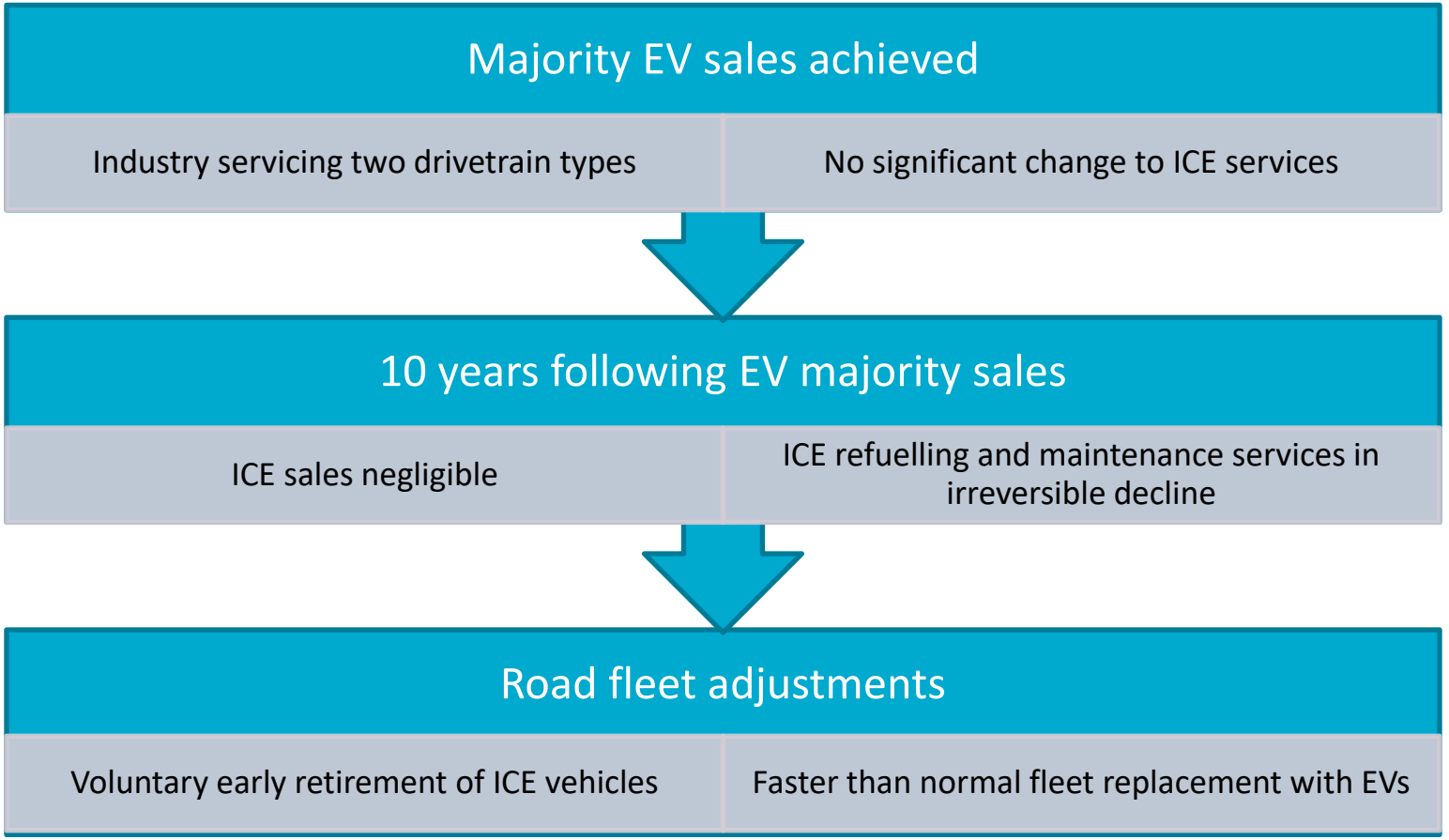
Market retirement model

Transport demand model

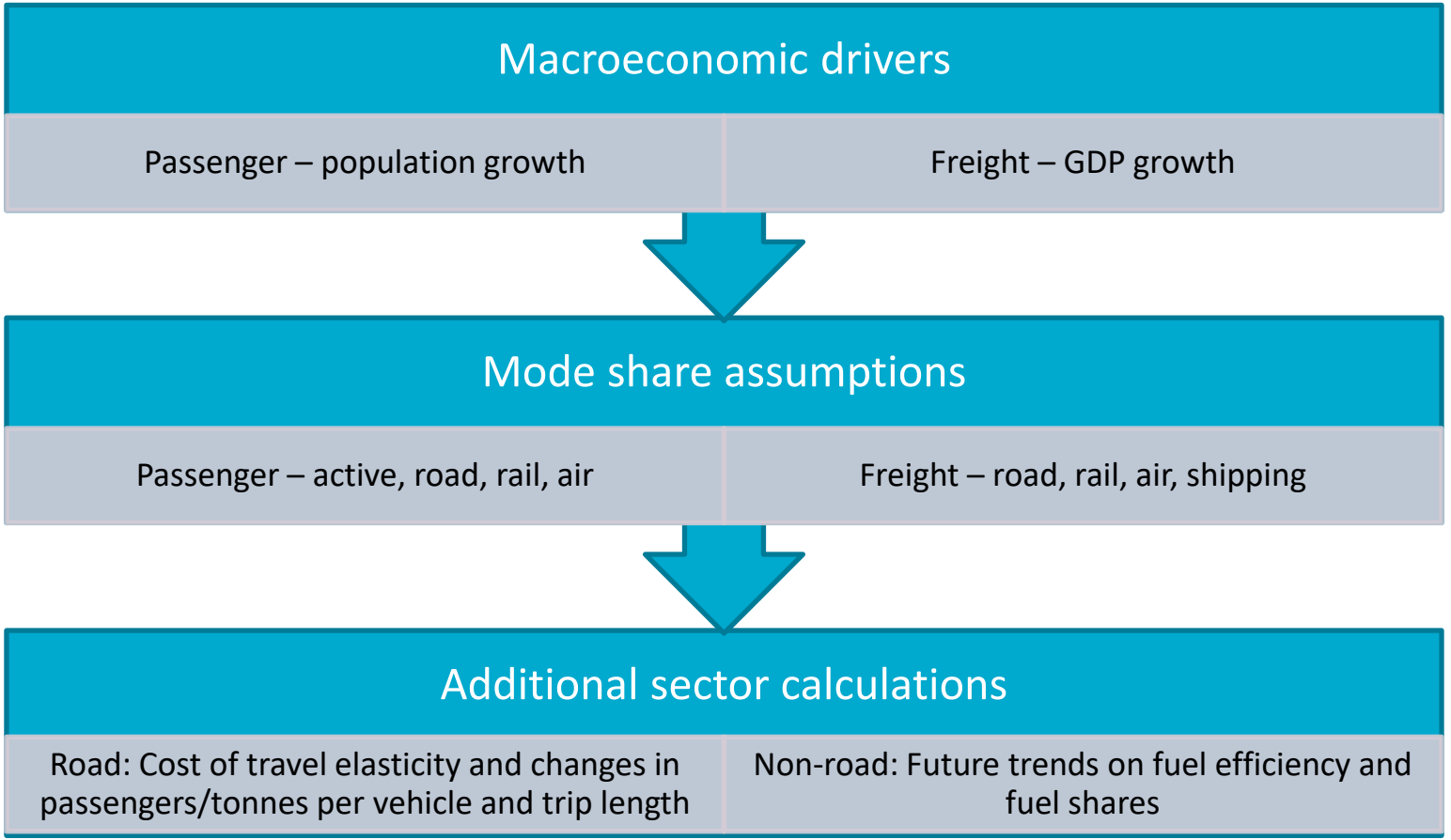
Consumer adoption model



Market retirement model



Transport demand model



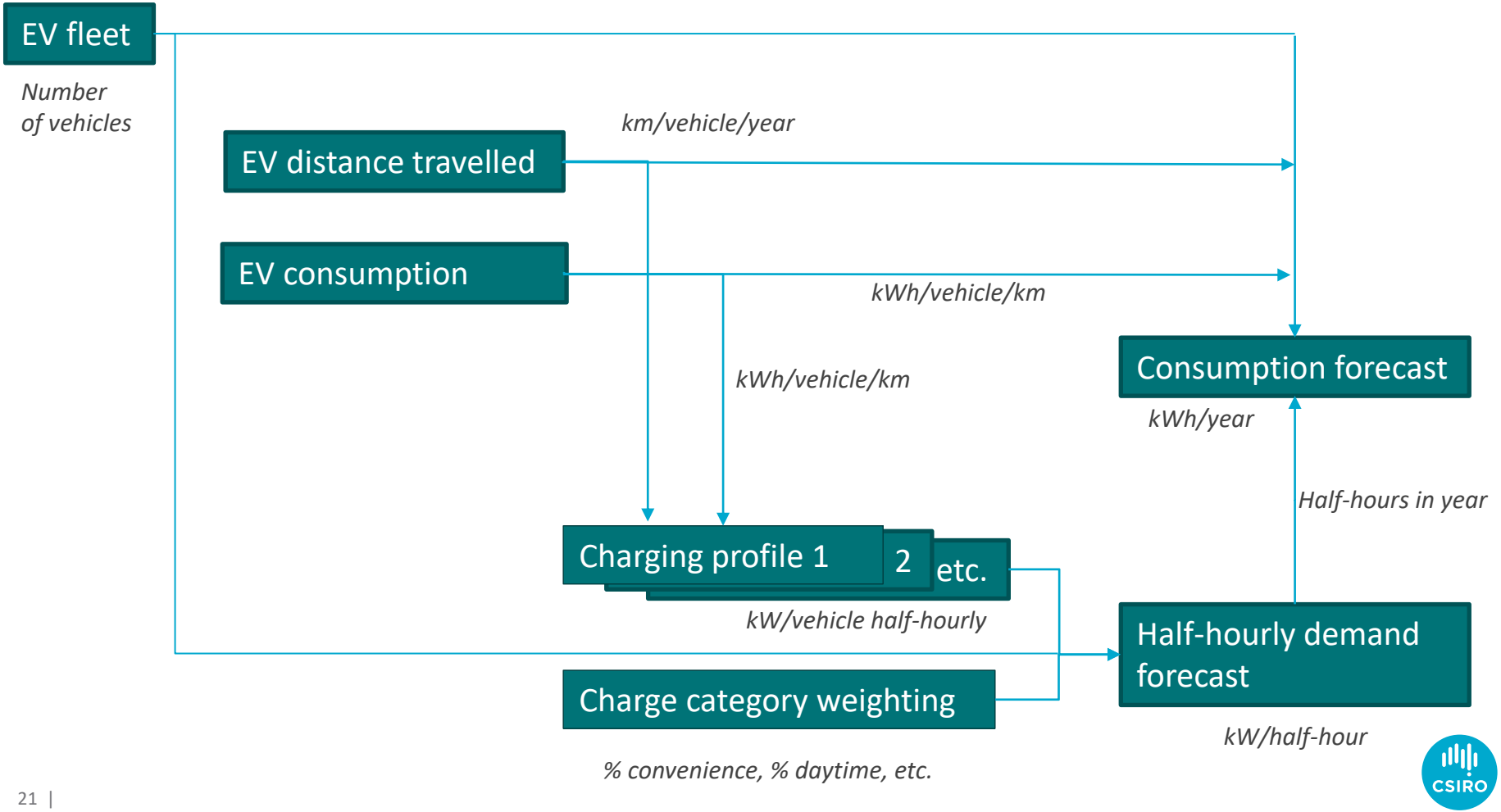
Total EV consumption calculations

Key outputs:

- Vehicle sales and subsequent number of vehicles by mode and type (monthly)
- EV electricity consumption (half hour to monthly)

- Monthly electricity consumption = Vehicles × km/month × kWh/km
- Half-hourly electricity consumption =
  ChargeProfileShare × ChargeProfiles × Vehicles

Subject to changes in vehicle efficiency and average travel distance


EV fleet
Number of vehicles
km/vehicle/year
EV distance travelled
EV consumption
kWh/vehicle/km
kWh/vehicle/km
Consumption forecast
kWh/year
Half-hours in year
Charging profile 1
2
etc.
kW/vehicle half-hourly
Half-hourly demand forecast
Charge category weighting
kW/half-hour
% convenience, % daytime, etc.