



Centre for Sustainability
Kā Rakahau o Te Ao Tūroa



The Potential for uptake of Electric Vehicles in New Zealand

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GREEN Grid

Why EVs?

Personal benefits*

- **Cheaper to run** – equivalent to paying around 30 cents per litre for petrol. *
- **Charge up at home** – can be charged anywhere there is a power point. *
- **More efficient** - convert up to 90% of energy from their batteries into driving. This compares to 20% - 30% for a petrol or diesel vehicle. *
- **More predictable price** - not vulnerable to fluctuating fuel prices

Local benefits

- **Pollution-free driving** - no exhaust emissions. *

National benefits

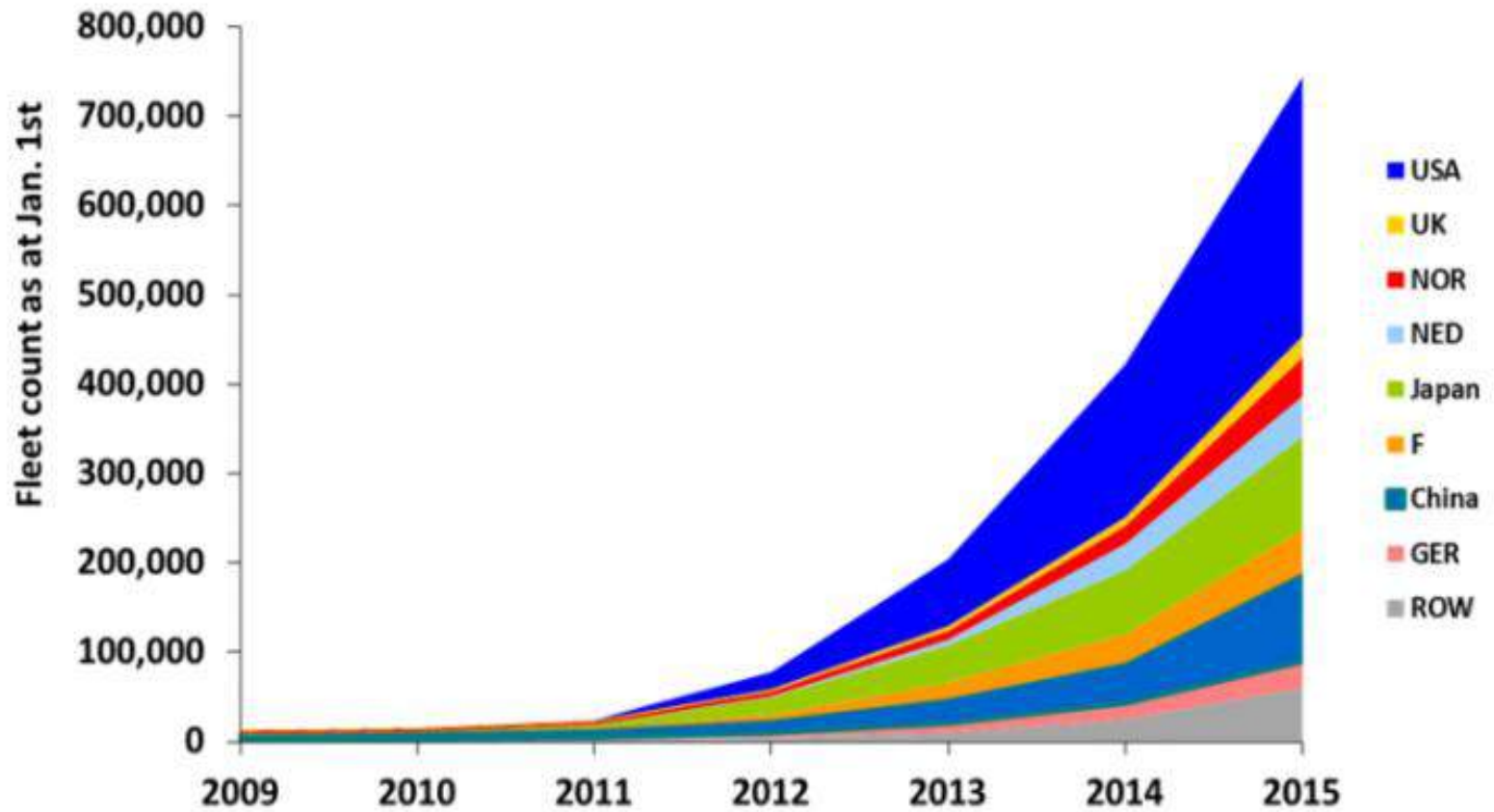
- **Uses homegrown fuel** – stimulate NZ's electricity sector
- **80% reduction in CO2 emissions in New Zealand** – due to renewable generation. *
- **Energy security** - reduction in oil imports and less exposure to global oil price variability

*EECA Energywise

<https://www.energywise.govt.nz/on-the-road/electric-vehicles/>

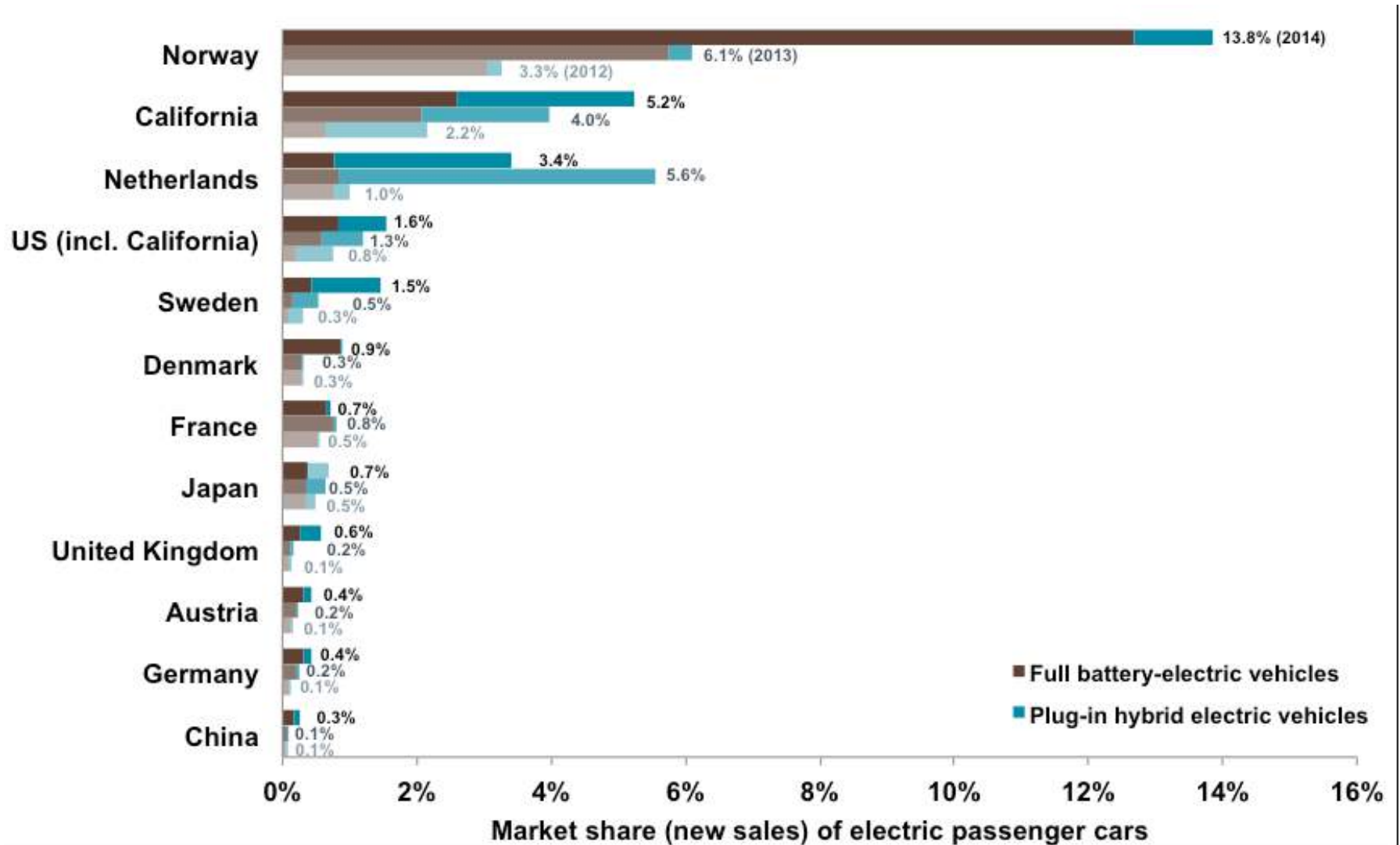
Global uptake of EVs

Number Of Electric Passenger Cars In The World

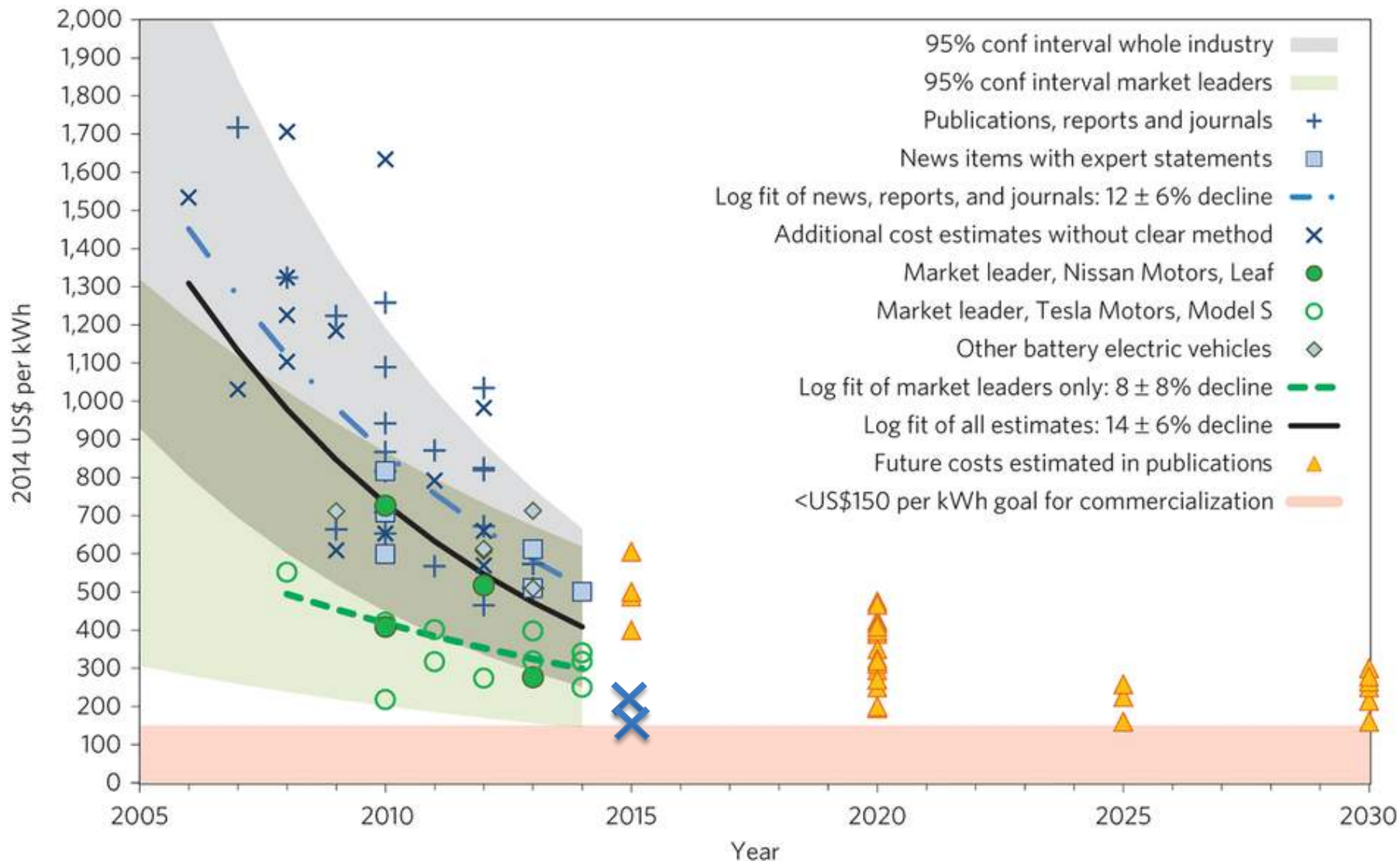


SOURCE: Centre for Solar Energy and Hydrogen Research

Market share growth 2012-2014



Battery costs

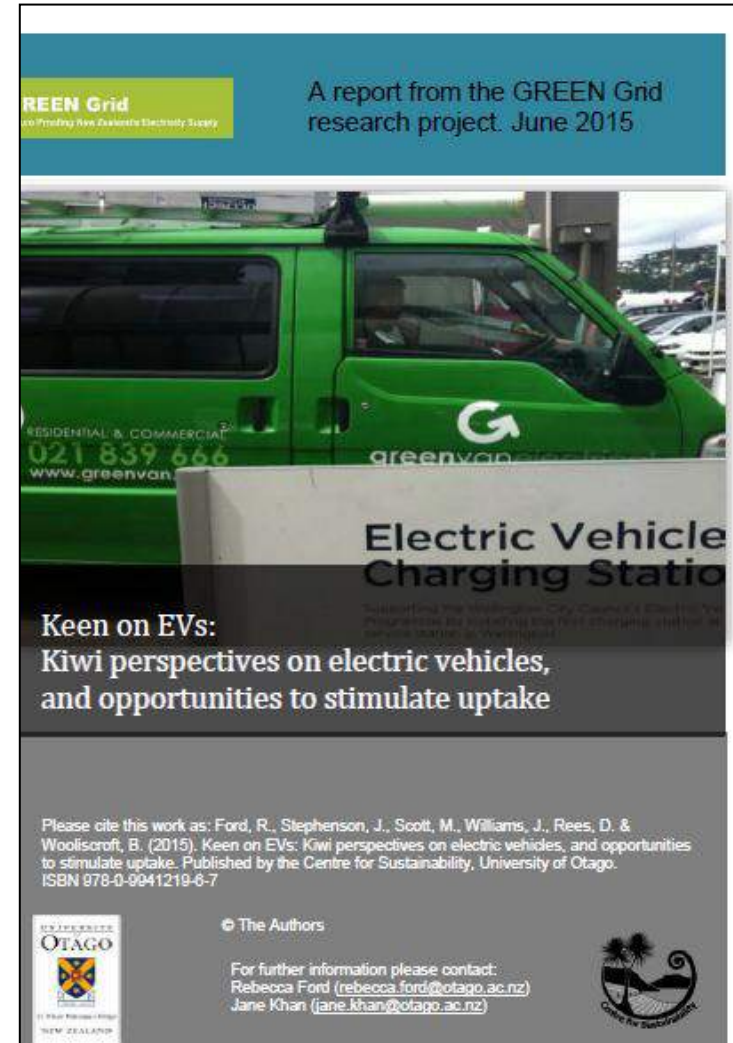


Source: B. Nykvist & M Nilsson, Nature Climate Change, 2015

Are Kiwis Keen on EVs?

Rebecca Ford, Janet Stephenson,
David Rees, Michelle Scott, Ben
Wooliscroft, John Williams.

Methods: interviews, surveys,
choice modelling, system dynamics
modelling, Delphi study.

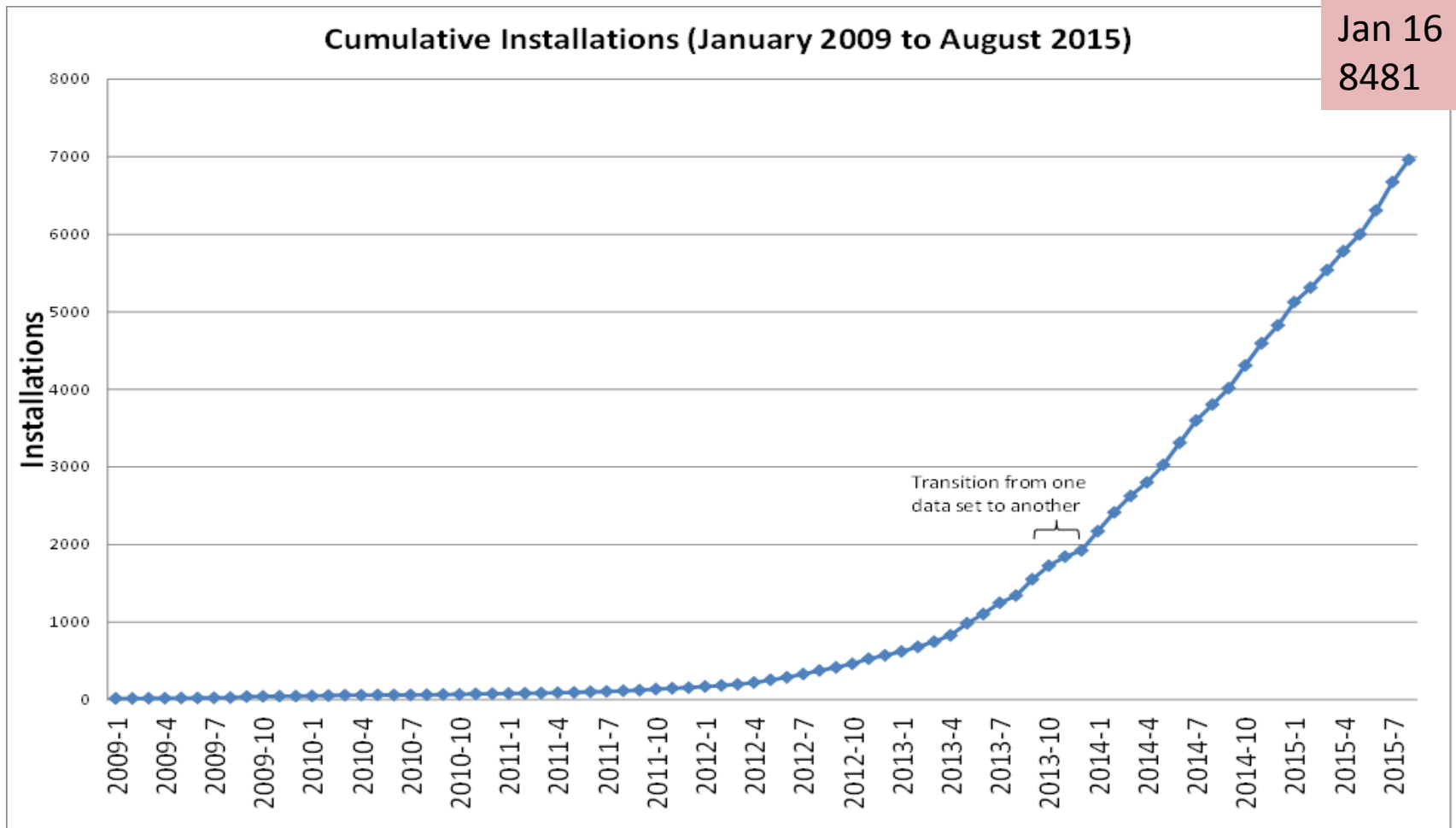


Who is interested in EV?

Most Kiwis!

- No correlations with age, income, region, number of people in household, employment status
- Education: a very weak positive correlation
- Ecological values; efficient drivers: a weak positive correlation
- Interest in photovoltaics (PV): a moderate positive correlation

Cumulative installations of PV (residential and commercial)



Miller et al., 2015 & Electricity Authority 2016

Interviews:

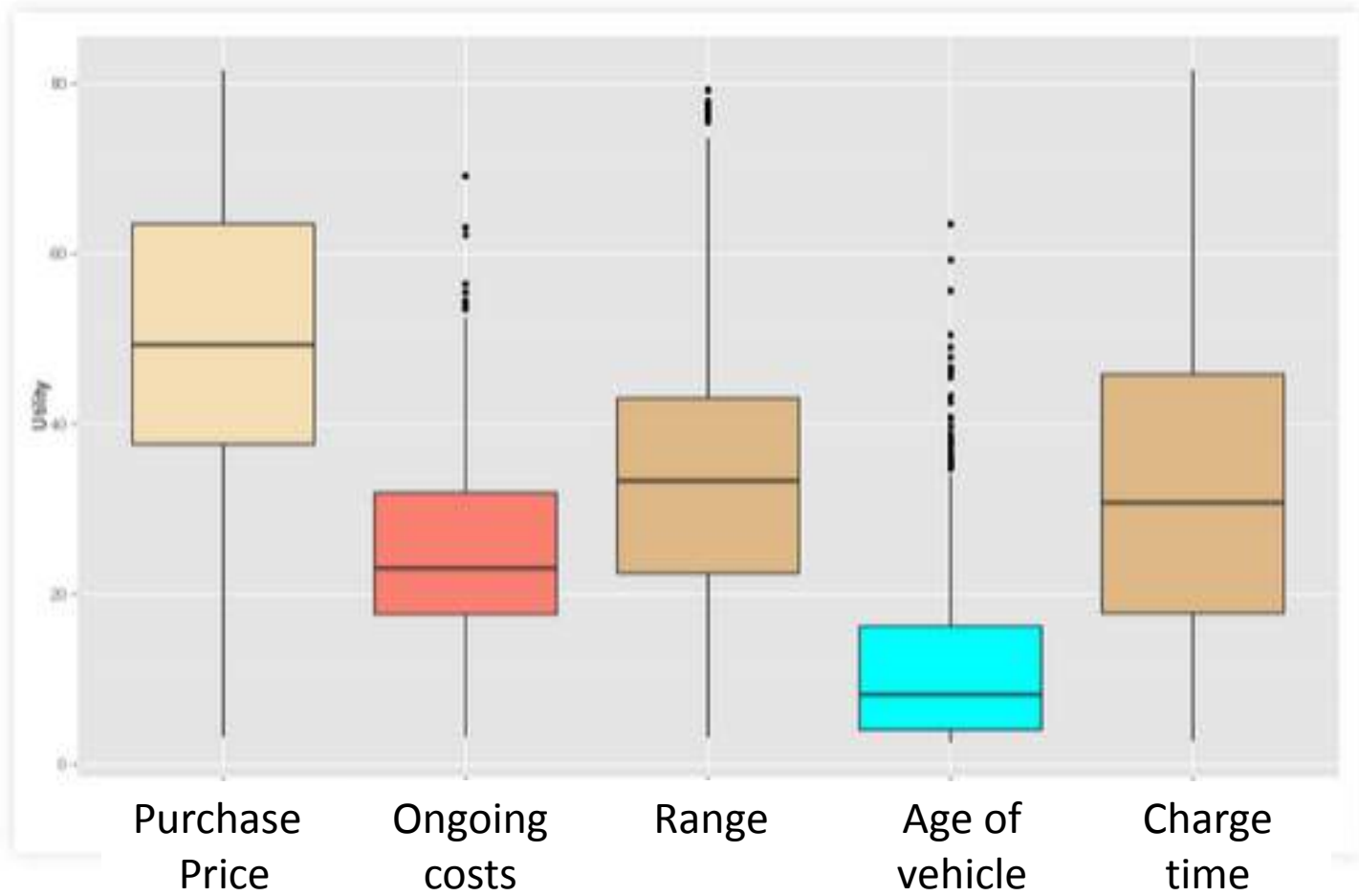
Motivations

- Environmental concern
- Efficiency
- Low running costs
- Performance
- Novelty
- Synergy with solar

Barriers

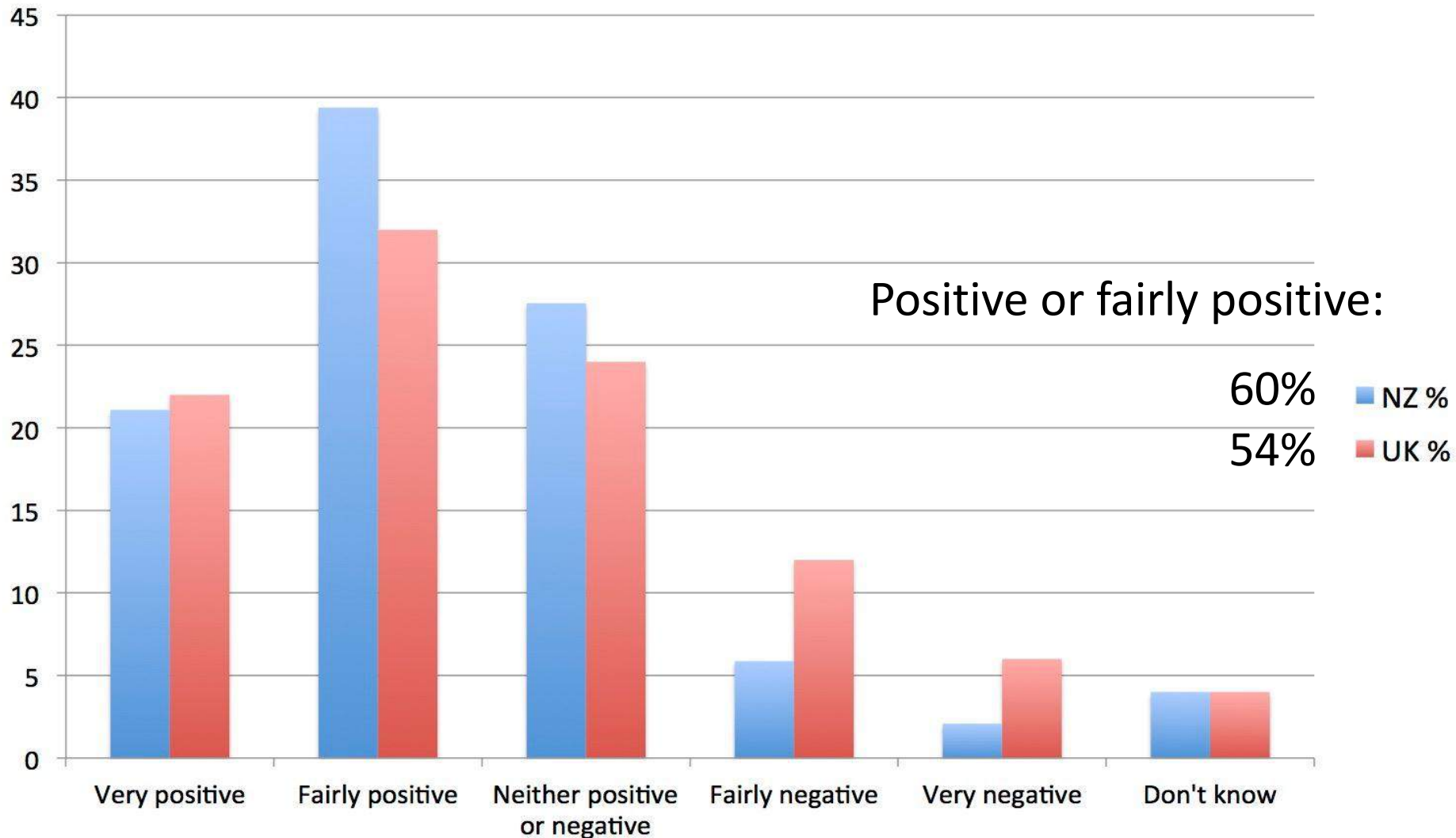
- Upfront cost
- Concern about range / lack of charging stations
- Anticipated changes in costs and technologies
- Lack of incentives

Relative importance of attributes



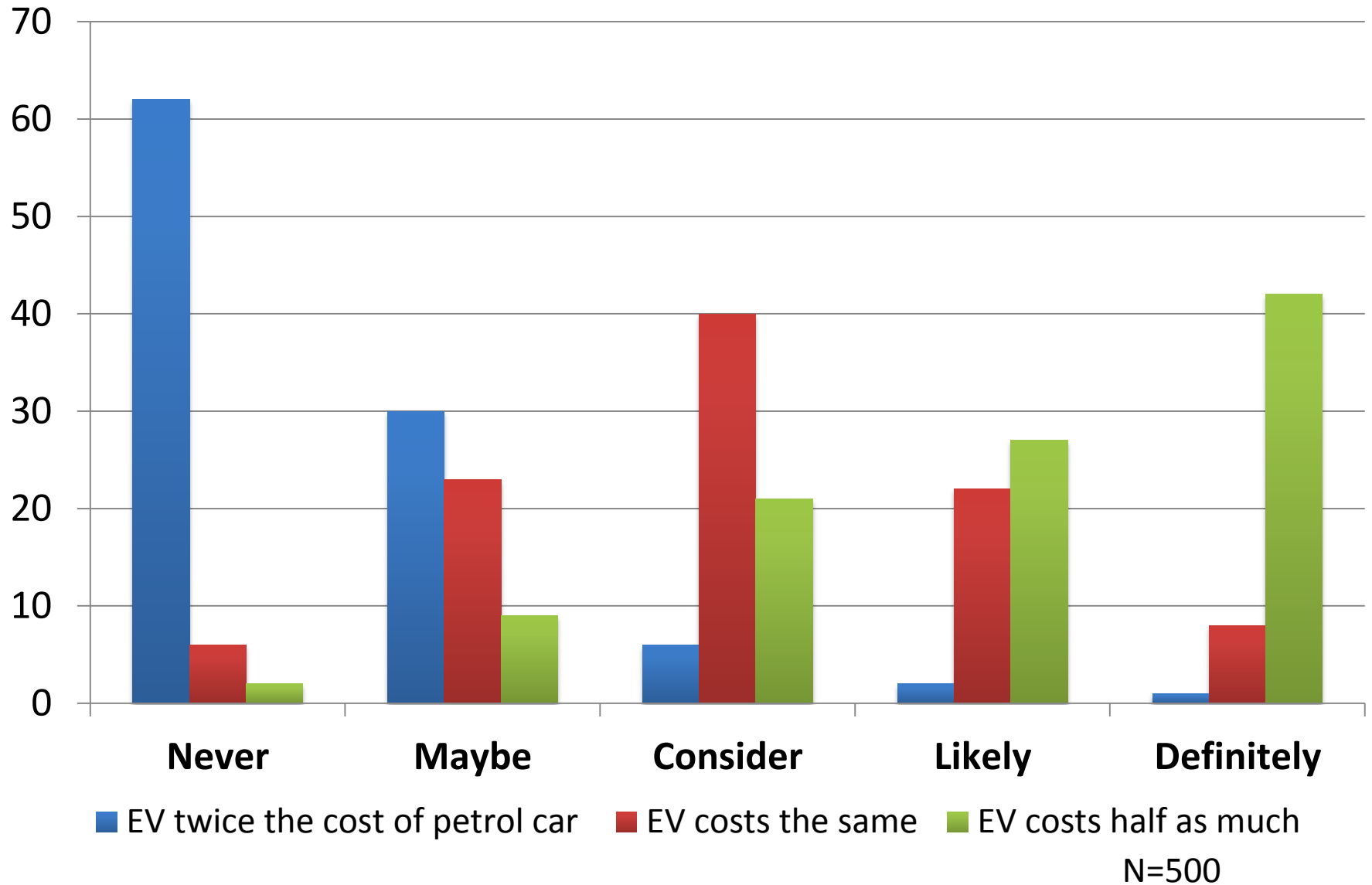
N=500

Percentage of people who feel positive about driving an EV (compared to the UK)



N=2270

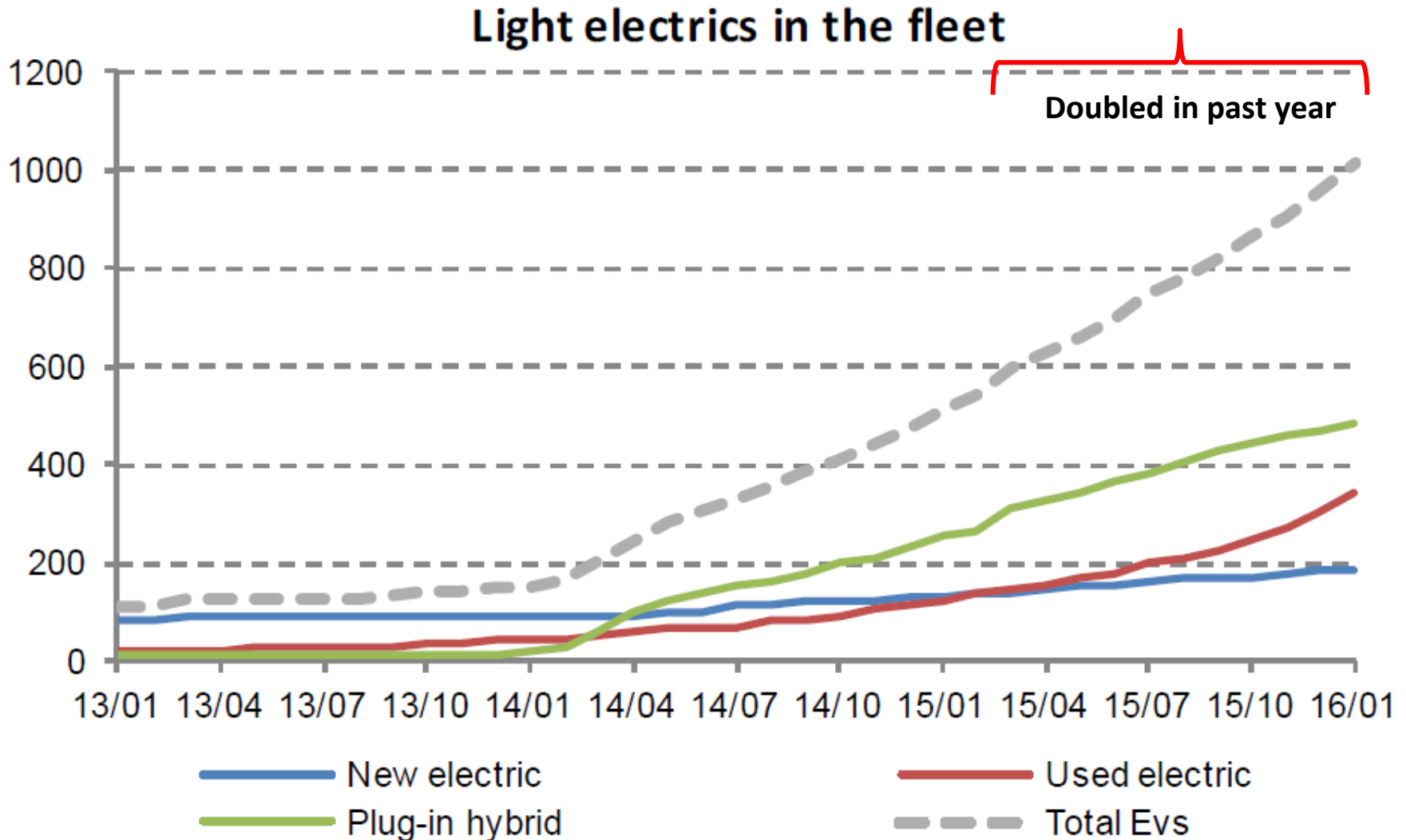
Likelihood to purchase an EV under different upfront cost scenarios



Readiness to purchase EV (2013)

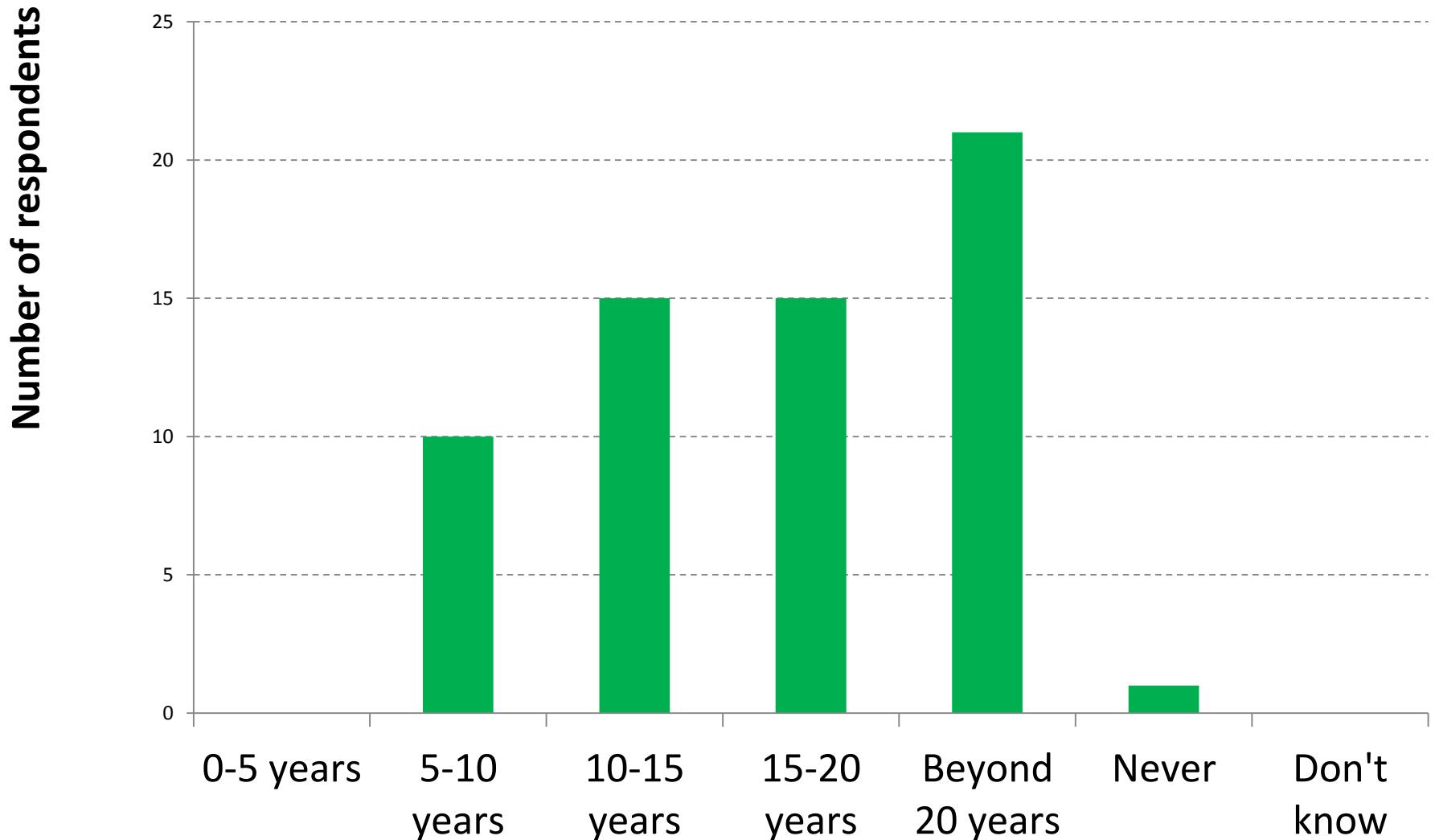
(n=500)	% of survey respondents
I've never considered purchase	38%
I've thought about it but rejected the idea	27%
I'm still thinking about it	28%
I'm almost ready to buy	3.5%
I'm ready to buy	2%
I already have one	0.5% = 6%

EV uptake in New Zealand (to Jan 2016)

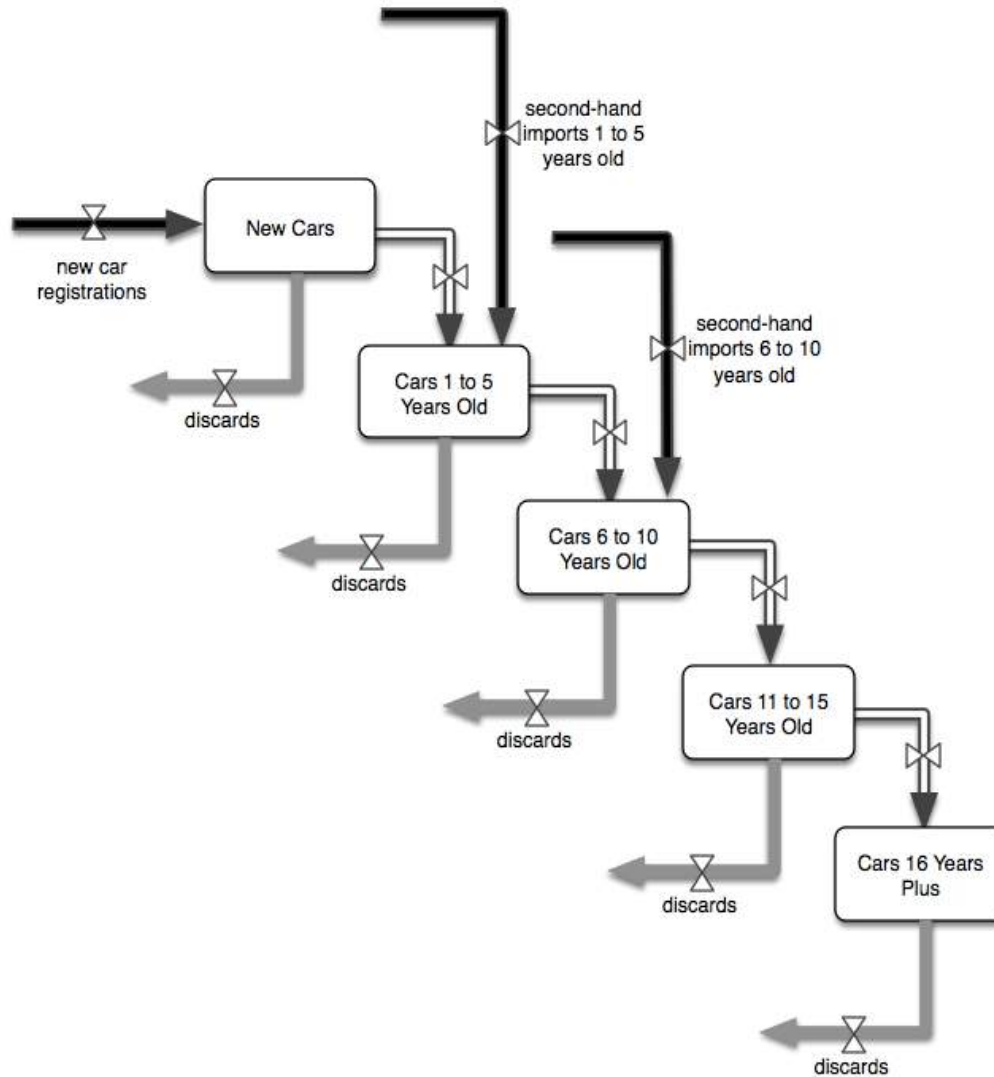


<http://www.transport.govt.nz/research/newzealandvehiclefleetstatistics/>

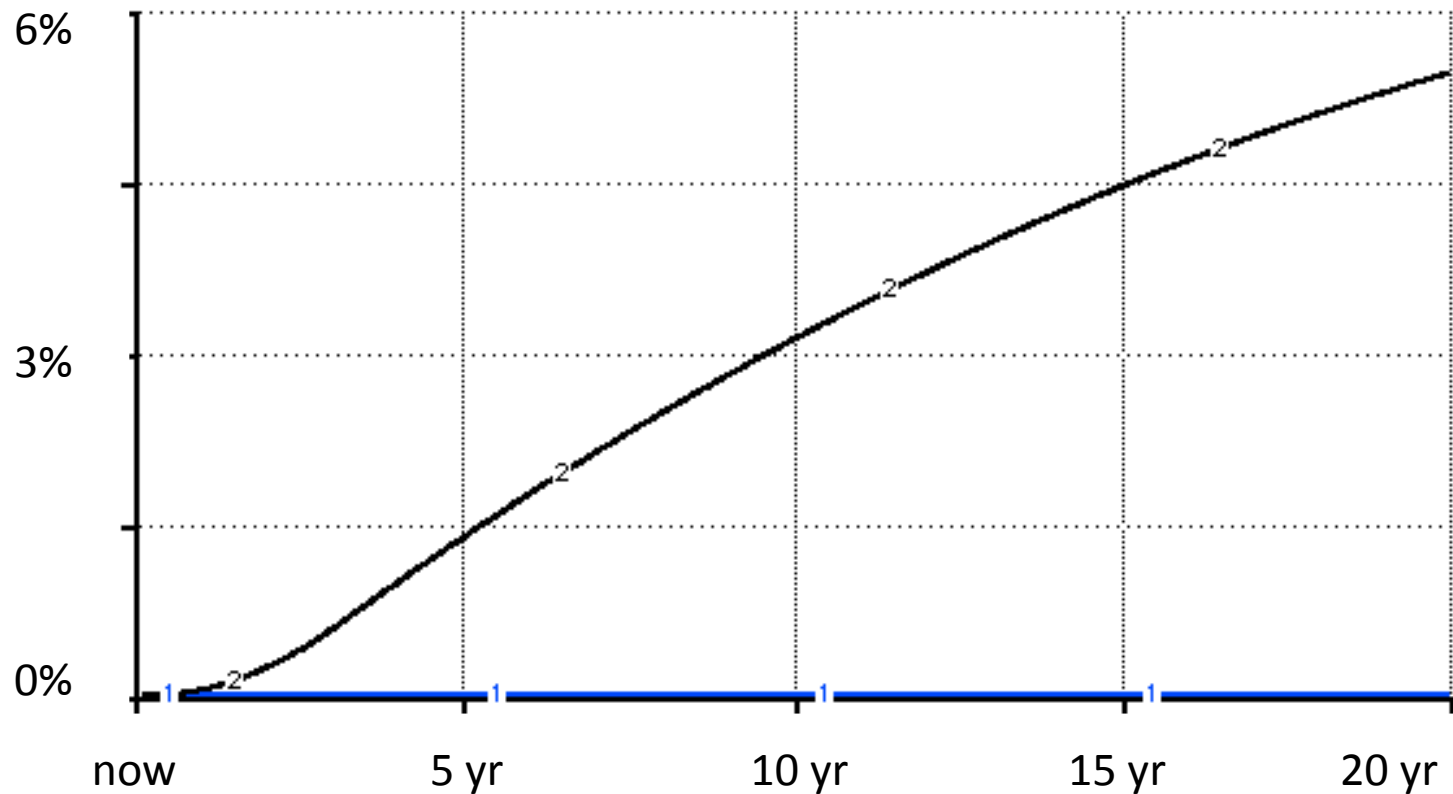
When might electric vehicles make up 20% of New Zealand's private vehicle fleet?



System dynamics modelling



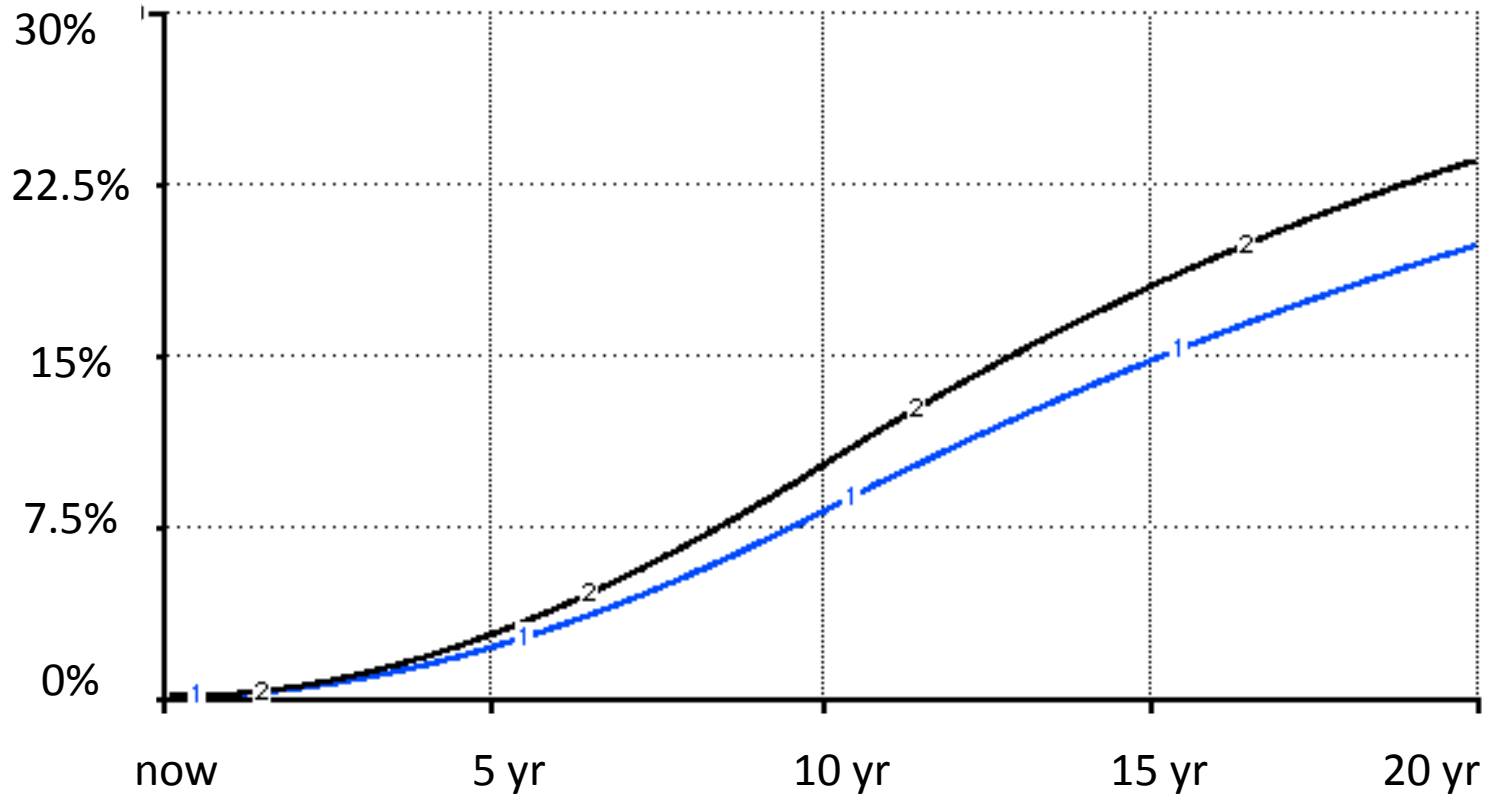
Percent of EVs in the light vehicle fleet- optimistic, no interventions



Assumptions: Price parity is achieved within 2 years. This increases current sales of EVs tenfold. EVs make up 20 per cent of fleet **purchases** within three years.

<http://energycultures.org/green-grid-project/energy-system-innovations/electric-vehicles/>

Getting EVs to 20% of the light vehicle fleet



Assumptions:

Run 1 (Blue line): Within a 10 year timeframe, EVs rise to 40% of fleet purchases, 35% of privately registered vehicles under 5 years of age, and 20% of privately registered vehicles 6 years or older.

Run 2 (Black line): same uptake assumptions combined with tougher emission standards, resulting in a 50% increase in the discard rate of older ICEs.

Thinking outside the square...



Kiwi car culture

We own lots of cars

We hang on to them for a long time

We're happy with second-hand cars

We're keen on EVs if they cost less than ICEs

Retrofits?

Retrofits are reasonably straightforward

Good fit with car culture?



Questions if EV retrofits were to grow ...

- What level of interest do individuals and businesses have?
- At what cost?
- What types of vehicles?
- What business models?
- Collaborations, partnerships?
- Opportunities for NZ?
- Markets beyond NZ?

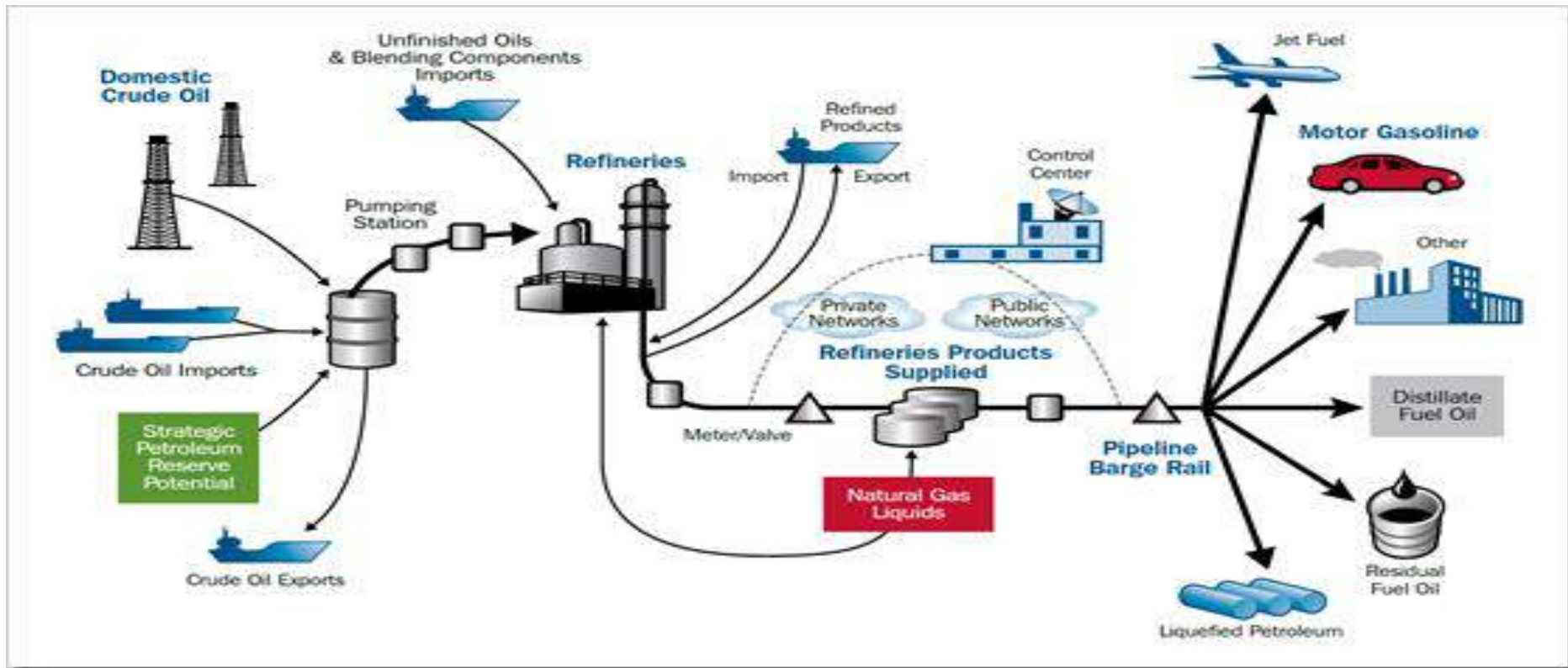


EVs relationship with the grid

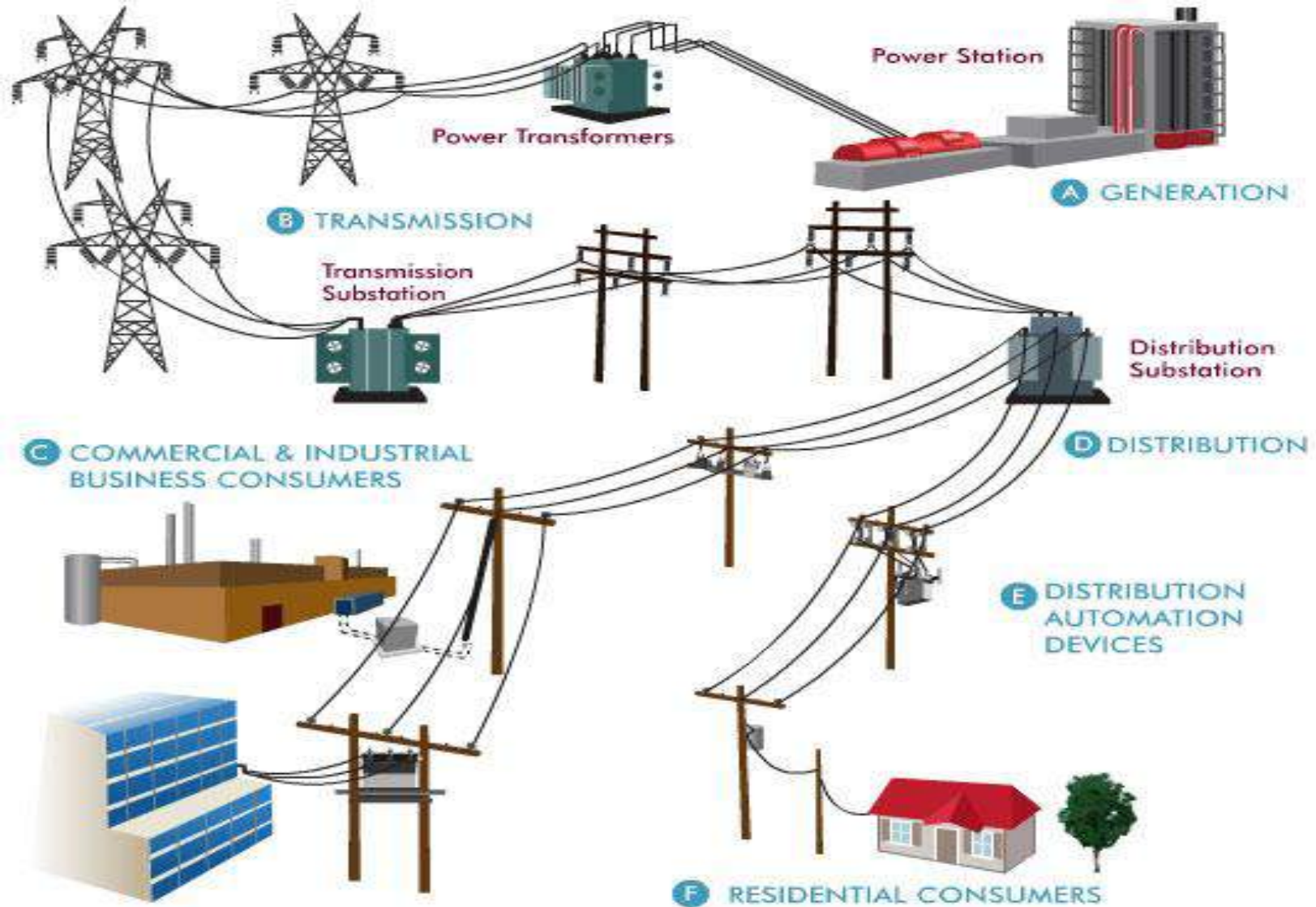
- Grow demand, with time of drawdown critical
- Storage of surplus from PV or other DG
- Smart tools for optimal charging regimes and optimal demand response
- Part of micro-grids



Regime of transport fuels provision

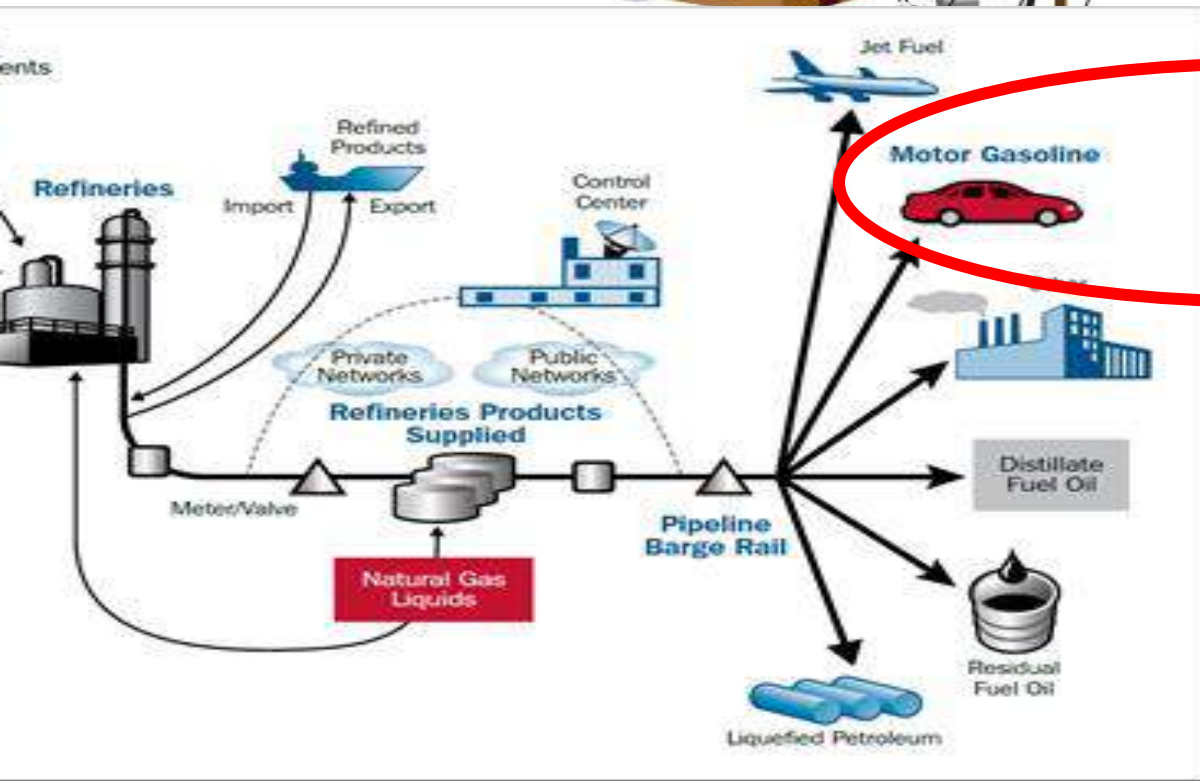


Regime of electricity provision



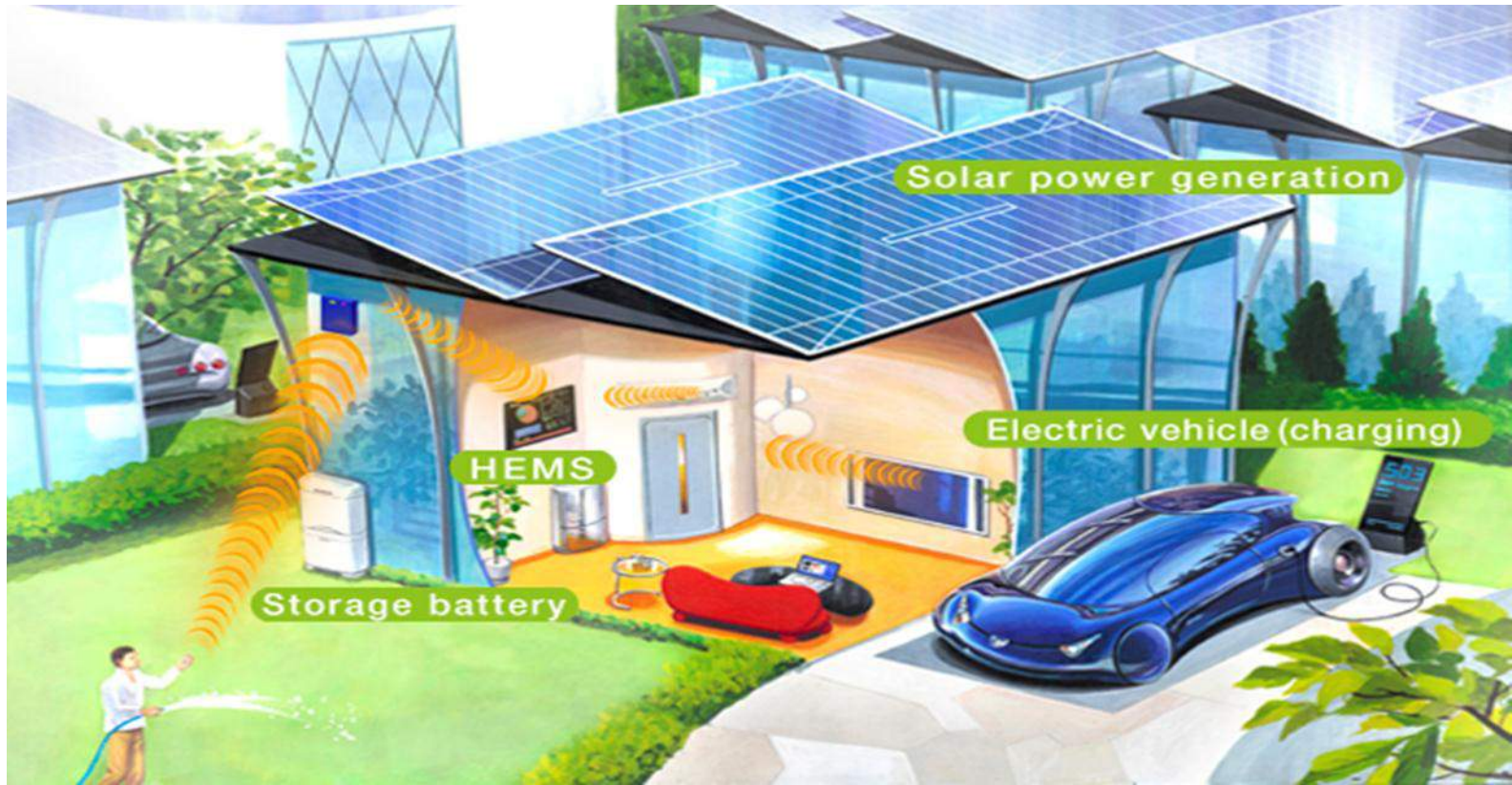


Converging regimes



Transforms role of homes/businesses

Convergence of distributed energy & mobility



Background papers and links

Link to the System Dynamics EV model

http://netsimapp.cloudapp.net/netsims/david.rees/evfleetmodel_betaversion/index.html

Electric Vehicle System Dynamics Model. David Rees. Epecentre Powertalk Dec 2015, p5-6

<http://www.epecentre.ac.nz/news/index.shtml>

New Zealand's future transport system: drivers of change. Stephenson, J., Hopkins, D., & McCarthy, A. (2014). <http://hdl.handle.net/10523/5399>

National Household Survey of Energy and Transportation. Wooliscroft, B. (2015).

<https://ourarchive.otago.ac.nz/handle/10523/5634>

Keen on EVs: Kiwi perspectives on electric vehicles, and opportunities to stimulate uptake.

Ford, R., Stephenson, J., Scott, M., Williams, J., Rees, D. & Wooliscroft, B. (2015).

<http://hdl.handle.net/10523/5730>

See also www.energycultures.org for further reports and academic papers



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