



UNCLASSIFIED



Projections of Electric Vehicle Fleet Size

Method description for the Draft EDGS 2015

Projections of electric vehicle fleet size

Introduction

There is considerable uncertainty about projections for electricity demand relating to transport. For the Electricity Demand and Generation Scenarios (EDGS) we are mainly interested in the demand for electricity from electric vehicles (EVs). Electric vehicles include both battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs). This document provides a description of the method used to project the number of electric vehicles and the associated electricity demand used for the draft EDGS 2015.

MBIE is looking to improve its method of modelling electric vehicles and welcomes feedback.

The Vehicle Fleet Model input assumptions

The vehicle fleet is modelled by the Ministry of Transport (MoT) using their Vehicle Fleet Model (VFM). However, MBIE provides MoT with key assumptions in order for them to produce results for our different scenarios.

We provided MoT with the following input assumptions:

- National GDP, total household numbers, total population, retail diesel price, retail petrol price.
- Uptake of electric vehicles, broken down into proportion of Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV). This is used in the fleet projection determination.

The VFM provides output for light private vehicle and light commercial vehicles at the vehicle fuel type level. The outputs are:

- Number of vehicles
- Kilometres travelled
- Fuel use

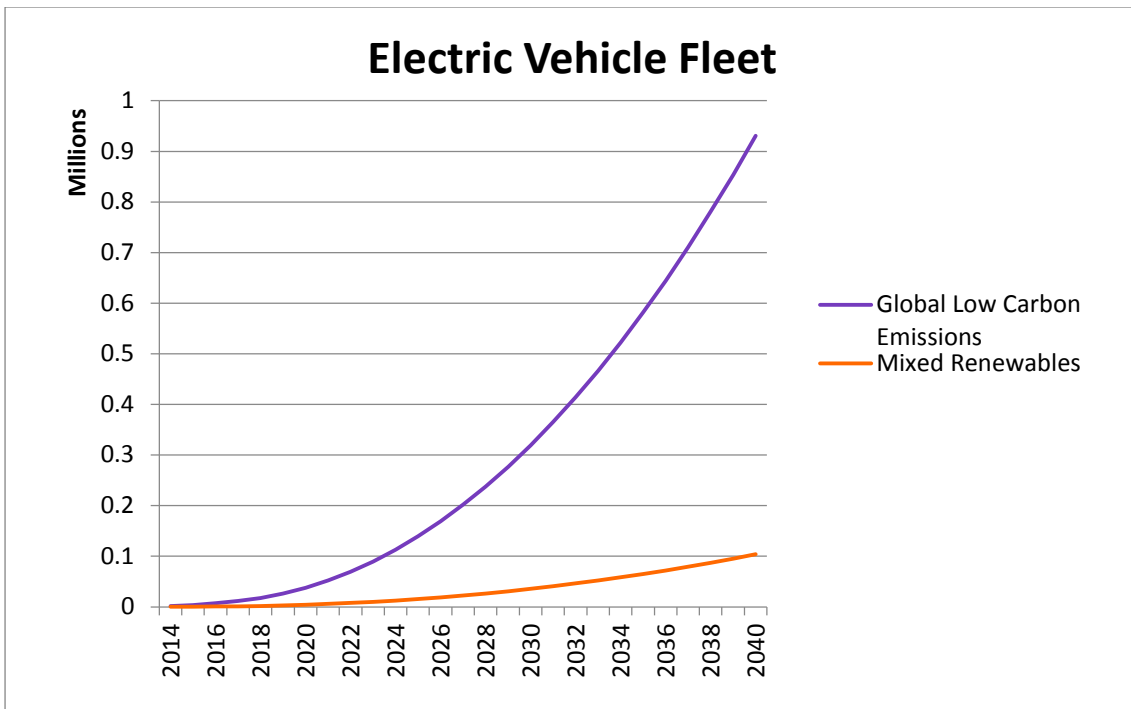
Method for determining electric vehicle uptake assumptions

We use a medium projected uptake of electric vehicles and a high projected uptake. We recognise that EVs can enter the vehicle fleet either as new or used vehicles. The projections are informed by the IEA publications as referenced in Table 1 below.

Table 1: Input assumptions for VFM

Year	NZ new vehicles that are electric ¹		Type of electric vehicle ²	
	Medium Uptake	High Uptake	BEV	PHEV
2015	0.5%	3.4%	36%	64%
2020	1.4%	11.5%	29%	71%
2025	2.3%	19.6%	26%	74%
2030	3.1%	27.7%	26%	74%
2035	4.0%	35.8%	28%	72%
2040	4.9%	43.8%	34%	66%

For the medium and high EV uptake projections we assume that the percentage of new electric vehicles entering the fleet each year increases linearly until it reaches 4.9% and 43.8% (respectively) in 2040. With these input assumptions, the VFM results give around 108,000 electric vehicles on the road by 2040 in the medium uptake case. The percentage of used vehicles entering the fleet that are electric is the same as for new vehicles, but with a five year lag.



MBIE has used a vehicle cost model to inform our base case electric vehicle uptake. Table 2 shows the capital cost data used. The relative difference in cost between the Battery Electric Vehicle (BEV)

¹ IEA, Energy Technological Perspectives, 2012

² IEA, Technological Roadmap - electric vehicles and plug in hybrids, 2011

and Gasoline Internal Combustion Engine (ICE) is the important for the determination of uptake rate. The model works out the difference in Net Present Value (NPV) between BEVs and ICEs taking into account a discounted cash flow analysis of capital costs and operating costs. The exogenous assumptions are: discount rate, lifetime, exchange rate, road user charges, electricity price, depreciation rate, and petrol price. An income demographic model is then applied to determine the number of purchases of electric vehicles. This allows for the fact that some consumers are prepared to pay a premium over ICEs to purchase EVs. Given the outputs from the NPV model the consumer percentage prepared to pay a premium for an EV is initially around 3.5%, rising to 5.5% in the 2030s before reaching 9.5% in the 2040s.

Table 2: IEA ETP 2012 New Policies cost data (USD)

	BEV	Gasoline ICE
2015	\$ 35,161	\$ 27,742
2020	\$ 34,272	\$ 28,166
2030	\$ 34,195	\$ 28,766
2040	\$ 34,398	\$ 29,788
2050	\$ 34,138	\$ 30,532

Method for modelling electricity demand

The VFM fuel use outputs are used to calculate fuel demand for all vehicle types except in the case of electric vehicles. Fuel use for electric vehicles is projected outside the VFM. To calculate electricity demand for electric vehicles a constant fuel efficiency of 0.17 kWh per kilometre travelled was assumed for electric vehicles.

