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Projections of Solar Photo-Voltaic Uptake

Method description for the Draft EDGS 2015

Projections of Solar Photo-Voltaic Uptake

This document outlines our model for projecting uptake of Solar Photo-Voltaic (PV) in the residential and commercial sectors.

The model

There are three key parts to our model:

1. Financial model –a discounted cash flow (DCF) model used to calculate the cost of solar. The model has been split into three timeframes: 2012-2019, 2020-2034 and 2035 onwards.
2. Economic decision –the cost of solar is compared to low user tariffs from the Ministry’s Quarterly Survey of Domestic Electricity Prices (QSDEP) to determine if Solar PV is economic for a particular household. If it is less than the tariff in that region, solar is considered economic.
3. Uptake rates - An uptake rate for households is assumed based on the number of economic households. Commercial uptake is based on the installed capacity of households.

The discounted cash-flow model

A discounted cash-flow (DCF) model is used to determine the Long-run Marginal Cost (LRMC) of solar. This is by definition the price where the NPV=0.

The key assumptions for our discounted cash-flow model are outlined in the Table 1 below for the Mixed Renewables scenario. Capital costs, and operational and maintenance costs are based on International Energy Agency (IEA) data¹. In our Mixed Renewable scenario we use IEA New Policies costs for Solar PV Buildings in Europe, but make a downward adjustment to 2020 and 2035 costs to reflect estimated reductions in costs since 2012. In our Global Low Carbon Scenario we use the costs from the IEA 450 ppm scenario.

We assume that the household needs to borrow in order to pay for the upfront costs over a 25 year term at a debt servicing rate of 8% per annum. We also assume that the discount rate on future cash-flows is 8%.

The LRMC is then adjusted upward to take into account the revenue the household receives from selling generation back to the grid, to give an average required break-even price of solar. We assume a capacity factor of 13.5%, and that 90% of generation is consumed onsite. The buy-back rate is assumed to be 8c/kWh.

¹ <http://www.worldenergyoutlook.org/weomodel/investmentcosts/>

Figure 1: Financial model assumptions

Solar PV Cash Flow NPV Model for Long Run Marginal Cost				
Technical assumptions	2012	2020	2035	Unit
Include Panel Degradation	Yes	Yes	Yes	
Capacity	3	3	3	kW
Assumed Capacity Factor	14%	14%	14%	
Calculated Generation	3,548	3,548	3,548	kWh
% of generation consumed onsite	90%	90%	90%	
Financial assumptions				
Plant Cost Assumptions				
Capital Cost in NZD used in model	4144	3335	3052	NZD per kW
O&M Cost in NZD used in model	41	43	50	NZD per kW per year
Other Financial Assumptions				
Assumed retailer buy back rate (if not all consumed onsite)	8.00	8.00	8.00	c/kWh
Debt servicing rate	8%	8%	8%	
Debt term	25	25	25	years
Discount Rate	8%	8%	8%	
Results				
Average LRMC:	35.3	29.3	27.8	c/kWh
Average required variable offset price:	38.4	31.7	30.0	c/kWh

Determining where solar is economic

We compare the break-even price of solar from our DCF analysis to the tariff faced by consumers in each lines network. The tariff prices come from MBIE's Quarterly Survey of Domestic Electricity Prices². If the tariff price is higher than the cost of solar then solar is considered to be economic. We don't try and forecast electricity prices by lines area, and simply use the latest prices for all future periods. Prices are likely to increase over time, while solar costs are likely to fall over time. Because of this we are probably underestimating uptake to some extent.

Uptake rates

Using the number of households where solar is economic; we apply the following uptake rates to determine the installed capacity of household Solar PV. We assume the average household system is 3.8 kW, and this falls to 2.75 kW by 2050.

Group	Uptake rate
Existing households	15% of existing households where solar is economic
New households	30% of new households where solar is economic
Commercial uptake	18% of the household installed capacity

² More information about the QSDEP can be found on MBIE's website at the following address <http://www.med.govt.nz/sectors-industries/energy/energy-modelling/data/prices/electricity-prices>

Between 2014 and 2026, interpolation is carried out to smooth the line. From 2035 onwards we assume that the average growth rate between 2025 and 2035 continues out to 2050.

Figure 2: Solar PV installed capacity projection (MW) – central projection

