



DER and EV Forecasting

AEMO
Forecasting
Reference Group

26 March 2019

Confidential

Agenda

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Section	Topic	Start Time	Finish Time	Duration
1.	Our Approach to Modelling	3:40pm	3:45pm	5 mins
2.	Preliminary Results – Neutral Scenario	3:45pm	3:50pm	5 mins
3.	Benchmarking Forecast Outcomes	3:50pm	3:55pm	5 mins



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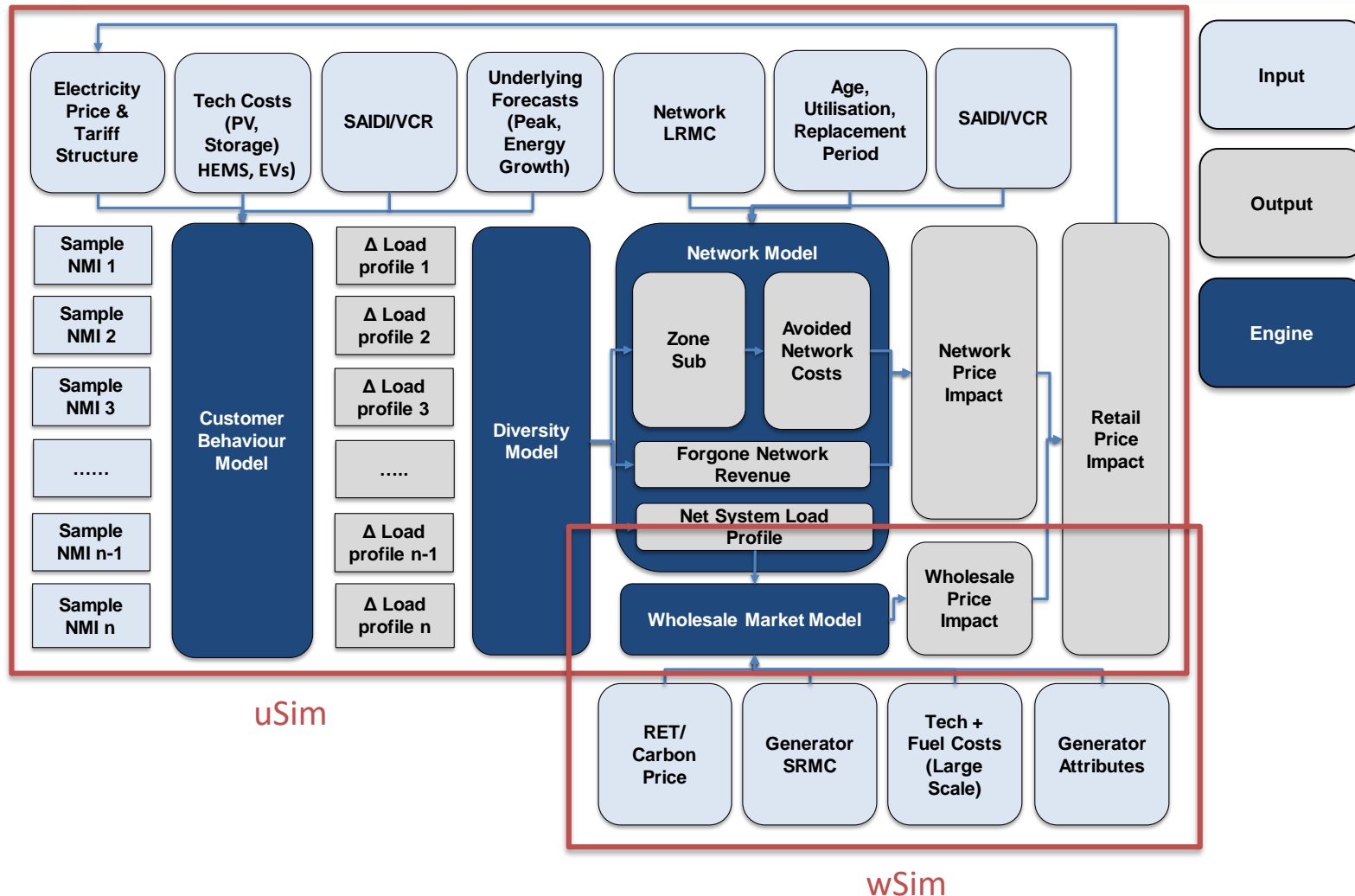


Inputs and Assumptions

Forecasting
Methodology and
Key Inputs by
Scenario



DER Uptake and Operation Modelling - uSim Simulation Platform

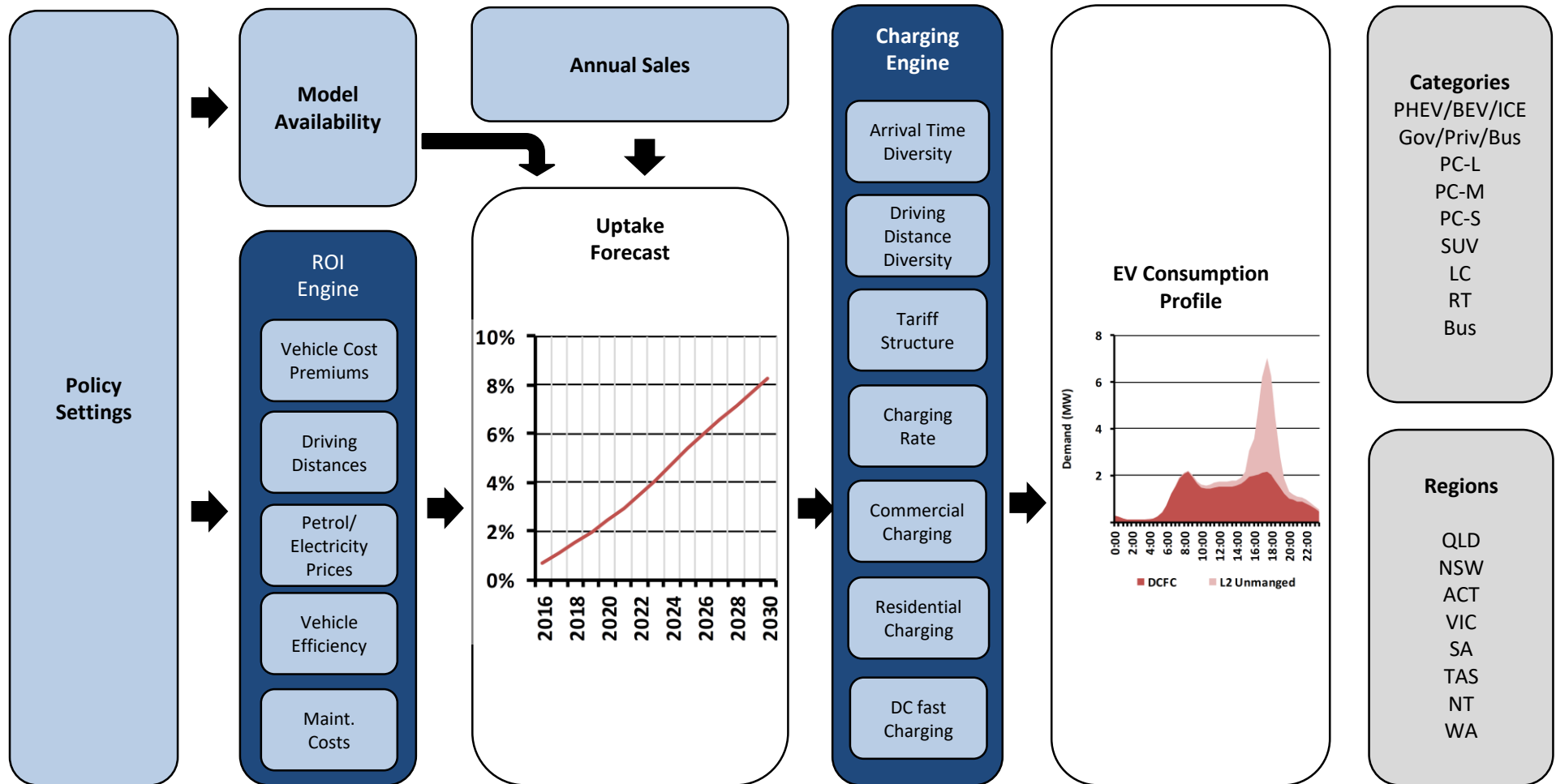


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EV Uptake and Impact Modelling - evSim

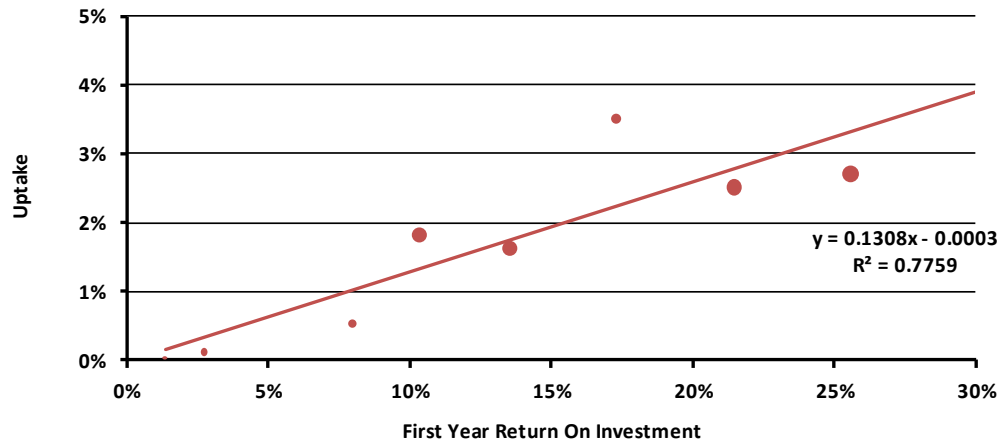
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Key Forecasting Drivers

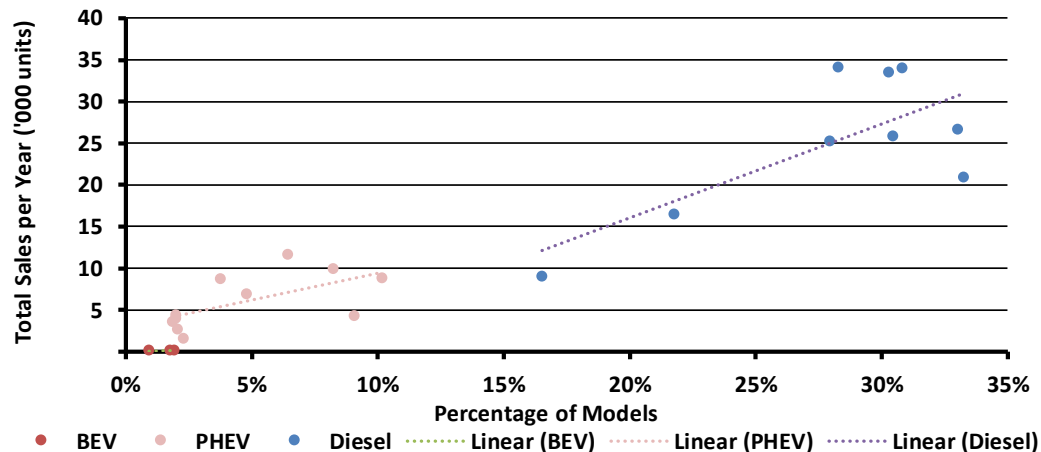
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Uptake vs. 1st Year Return on Investment



Source: Energeia Analysis

New Technology Adoption vs. Availability



Source: Energeia Analysis

- Energeia's DER (small-scale solar and storage) forecasts are based on agent-based modelling approach:
 - Technology uptake is driven by first year return on investment (ROI)
 - Technology cost declines over time drive increasing uptake
- Non-scheduled PV forecasts are based on regression approaches
- Energeia's EV uptake model is driven by two parameters:
 - First year ROI = (EV Premium + ICE O&M) / O&M savings
 - Model Availability % = Percentage of ICE models in an EV option



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Energeia DER Modelling Settings by Scenario

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Energeia DER Model Drivers		Planning Scenarios (1 st Priority Deliverables)			DER Sensitivities (2 nd Priority Deliverables)		
		Slow change	Neutral (26%)	Fast change	Low DER	Neutral (45%)	High DER
Growth Drivers	Population Growth	AEMO Slow Change	AEMO Neutral	AEMO Fast Change	AEMO Neutral	AEMO Neutral	AEMO Neutral
	Peak Demand Growth						
	Energy Growth						
Technology Costs	Solar PV Costs split by inverter, solar PV and install per kW	Weak	Neutral	Strong	Weak	Neutral	Strong
	Non Scheduled Solar PV Costs split by inverter Solar PV and Install per kW						
	Battery Storage Costs split by inverter, storage and install per kWh						
Prices	Retail price forecasts by state and class	AEMO (26%)	AEMO (26%)	AEMO (45%)	AEMO (45%)	AEMO (45%)	AEMO (45%)
	VWA RRP price forecast by state						
Tariff Structures	Current and future residential tariff structures, opt-in or opt-out years, default tariff switch year	Opt-in Tariffs	Opt-in Tariffs	Opt-out Tariffs	Opt-in Tariffs	Opt-in Tariffs	Opt-out Tariffs
	Current and future commercial tariff structures, opt-in or opt-out years, default tariff switch year						
	DSO/VPP Orchestration Year and Availability ¹	Weak Adoption (2027)	Neutral Adoption (2024)	Strong Adoption (2021)	Weak Adoption (2027)	Neutral Adoption (2024)	Strong Adoption (2021)
Rebates and Incentives	Solar PV Rebates over time by state	No Rebates	No Rebates	STC Rebates Continue	No Rebates	STC Rebates Continue	STC Rebates Continue
	Storage rebates over time by state ²			\$500/kWh		\$500/kWh	\$500/kWh

1. Timing for battery storage aggregation based on the Network Transformation Roadmap (2017) Energy Networks Australia
2. Storage rebates assume current SA battery rebate up to \$6,000 per unit is rolled out to other states, (e.g. reduces the installed cost of a 14kWh Tesla Powerwall II from ~\$12,000 to \$6,000)







Legend			
	Emissions		Neutral Setting
	Energy System Change		Low Settings
	DER Take-Up		High Settings

Energeia EV Modelling Settings by Scenario

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Energeia EV Model Drivers		Planning Scenarios (1 st Priority Deliverables)			DER Sensitivities (2 nd Priority Deliverables)		
		Slow change	Neutral (26%)	Fast change	Low DER	Neutral (45%)	High DER
Growth Drivers	Population Growth	AEMO Slow Change	AEMO Neutral	AEMO Fast Change	AEMO Neutral	AEMO Neutral	AEMO Neutral
Technology Costs	EV Cost premiums by Vehicle Type	Weak EV Parity (7 years)	Neutral EV Parity (5 years)	Strong EV Parity (3 years)	Weak EV Parity (7 years)	Neutral EV Parity (5 years)	Strong EV Parity (3 years)
Prices	Retail price forecasts by state and class	AEMO (26%)	AEMO (26%)	AEMO (45%)	AEMO (45%)	AEMO (45%)	AEMO (45%)
Tariff Structures	Current and future EV managed/unmanaged charging structures, opt-in or opt-out years ¹	Slow Transition (7 years)	Neutral Transition (5 years)	Fast Transition (3 years)	Slow Transition (7 years)	Neutral Transition (5 years)	Fast Transition (3 years)
Rebates and Incentives	EV rebates over time by state ²	No Rebates	No Rebates	\$3,000	No Rebates	\$3,000	\$3,000

1. Transition to managed EV charging coincides with the decline in EV price premium
2. EV rebates assumed to be implemented from the 'Moderate Intervention' Scenario in 'Australian Electric Vehicle Market Study' (2018) Clean Energy Finance Corporation (Equivalent to a \$3,000 reduction in sticker price)

Legend	
	Emissions
	Energy System Change
	DER Take-Up
	Neutral Setting
	Low Settings
	High Settings



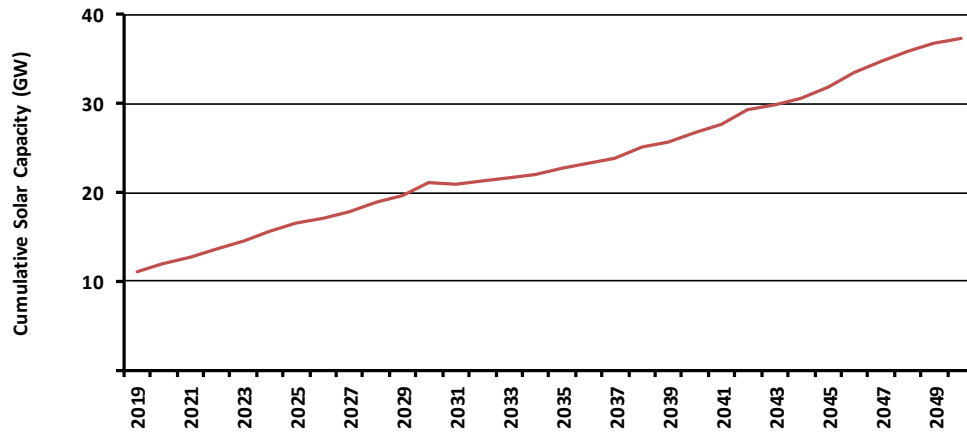
Forecasts

Preliminary Results
and Benchmarking
to Past Forecasts



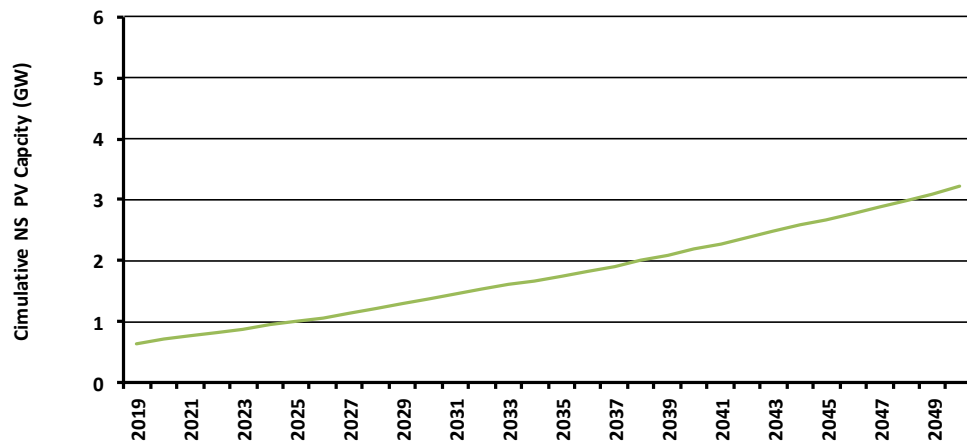
Preliminary Draft Results

Small-scale Rooftop Solar PV Uptake



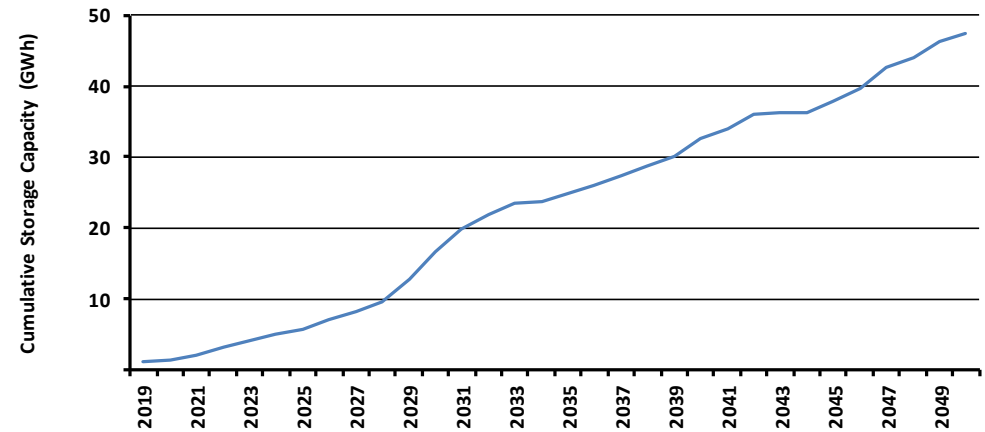
Source: Energeia Analysis

Non-Scheduled PV Uptake



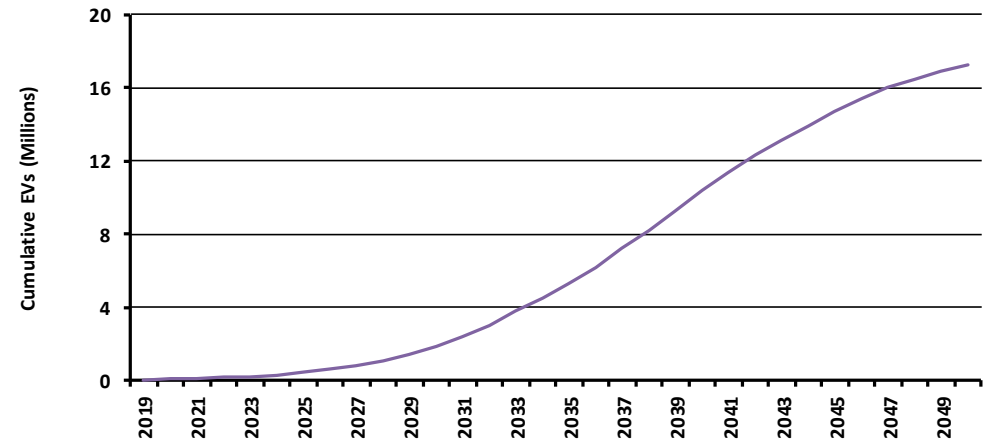
Source: Energeia Analysis

Small-scale Battery Energy Storage Uptake



Source: Energeia Analysis

Electric Vehicle Uptake

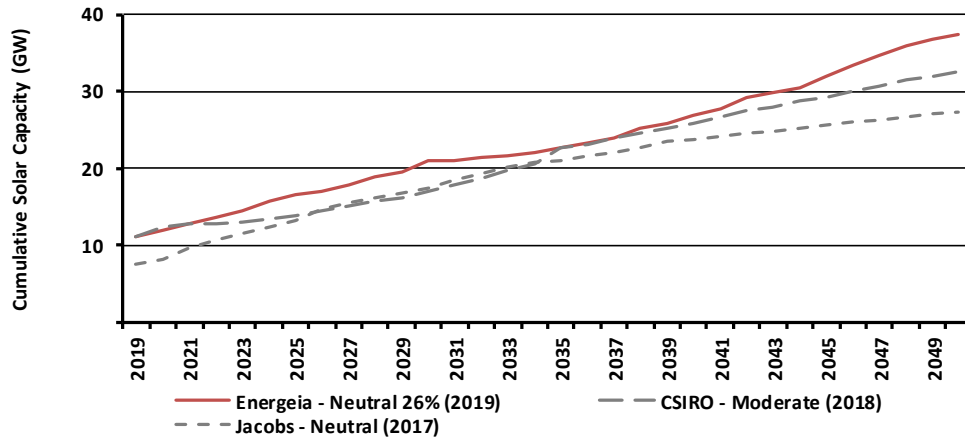


Source: Energeia Analysis

Comparisons to other Public Domain Forecasts

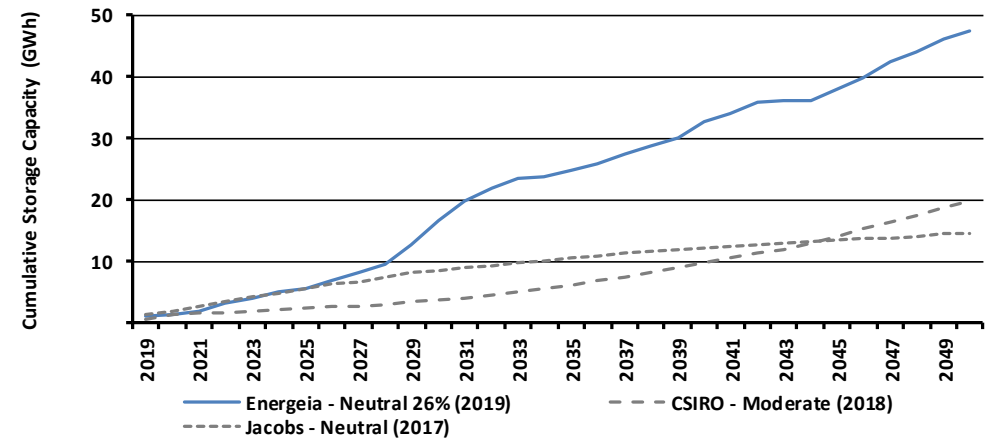
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Small-scale Rooftop Solar PV Uptake



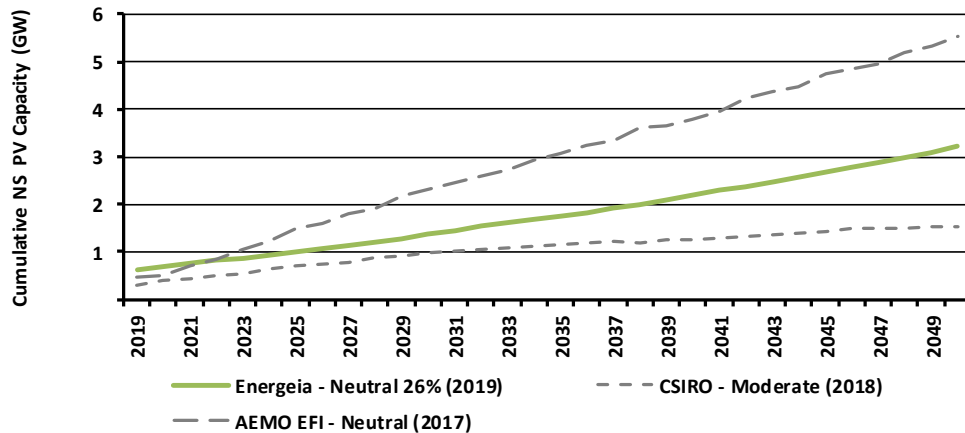
Source: CSIRO (2018), Jacobs (2017), ENA NTR (2016)

Small-scale Battery Energy Storage Uptake



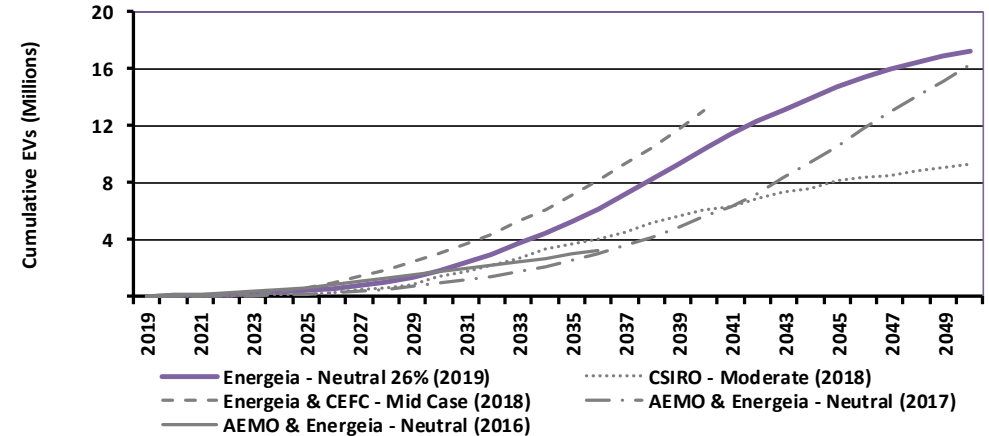
Source: CSIRO (2018), Jacobs (2017), ENA NTR (2016)

Non-Scheduled PV Uptake



Source: CSIRO (2018), AEMO EFI (2017)

Electric Vehicle Uptake



Source: CSIRO (2018), CEFC (2018), AEMO (2017), AEMO (2016);

Note: AEMO & Energeia forecasts exclude NT

Thank You



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Forecasting Methodology – Key Inputs

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ID	Category	Information/Data Required	Date Requested
1	Population Growth	Population growth by state and class (res/bus), and/or dwelling growth by state and class	Population and dwelling types will impact on new connections growth
2	Energy Growth	Residential and commercial consumption growth by state and class	Energy growth will effect self generation of DER
3	Peak Growth	Residential and commercial peak demand growth by state and class	Peak growth will affect peak avoidance by DER
4	Retail Price Forecasts	Residential and commercial retail price forecasts by state and class	Retail electricity prices shift the attractiveness of DER and EVs
5	Wholesale RRP Forecasts	Volume Weighted Average price forecast by state	Wholesale electricity prices shift the attractiveness of DER and EVs
6	Wholesale RRP Forecasts	Feed-in-Tariff (FiT) price forecast by state	FiT prices shift the attractiveness of DER
7	DER Cost	BTM Solar PV costs split by inverter, solar PV and install per kW	BTM Solar PV, inverter and install costs impact uptake decision
8	DER Cost	Battery Storage costs split by inverter, storage and install per kWh	Battery storage, inverter and install costs impact uptake decision
9	DER Cost	Non-scheduled Solar PV costs split by inverter, solar PV and install per kW	NSPV costs will shift attractiveness of uptake over time
10	EV Cost	EV Cost premiums by vehicle type	Cost premium to build and EV vs ICE will affect EV take up
11	Retail Tariff Structures	Current and future residential tariff structures, opt-in or opt-out years, default tariff switch year	Tariff churn impacts on the level of DER uptake and the load profile impacts
12	Retail Tariff Structures	Current and future commercial tariff structures, opt-in or opt-out years, default tariff switch year	Tariff churn impacts on the level of DER uptake and the load profile impacts
13	Retail Tariff Structures	Current and future EV managed/unmanaged charging structures, opt-in or opt-out years	Change in tariff structures will impact EV charging loads
14	Retail Tariff Structures	DSO/VPP orchestration year and availability (% of systems)	Change in DSO policy will change charge/discharge load profiles
15	Policy	Solar PV Rebates over time by state	Change in solar rebates will impact PV adoption
16	Policy	Storage rebates over time by state	Change in storage rebates will impact PV adoption
17	Policy	EV rebates over time by state	Change in EV rebates will impact PV adoption
18	DER Adoption	Current Solar PV adoption by state	Baseline of current Solar PV adoption
19	DER Adoption	Current Storage adoption by state	Baseline of current Storage adoption
20	EV Adoption	Current EV adoption by state	Baseline of current EV adoption