

AGENDA – Forecasting Reference Group (FRG)

MEETING: #5
 DATE: Tuesday 27 March 2018
 TIME: 2.30 pm – 4.30 pm AEDT
 LOCATION: AEMO Melbourne Boardroom, AEMO Sydney Boardroom;
 AEMO Fraser Room; AEMO Coonawarra Room, AEMO Ningaloo Room

TELECONFERENCE: Dial: **1800 055 132** Meeting ID: **35825292**

CONTACT: Energy.forecasting@aemo.com.au

ITEM	TIME	TOPIC	PAPERS	RESPONSIBLE	ACTION
1.	2:30pm – 2:35pm	Welcome and Introductions	None	Nicola Falcon (Chair)	Note
2.	2:35pm – 2:45pm	Previous Minutes and Action Items	FPRG Minutes: 27 February 2018	Nicola Falcon (Chair)	Agree/ Discuss
3..	2:45pm – 3:15pm	Connection Point Forecast Updates <ul style="list-style-type: none"> • Timelines • Methodology and Improvements 	Paper 1	Linton Corbet (AEMO)	Discuss
4.	3:15pm – 4:15 pm	National Electricity Forecast 2018 – Assumptions and Methodology: <ul style="list-style-type: none"> • Connections and Economic Outlook • Consultancies Update: PV, Electric Vehicles, Batteries, Energy Efficiency • Summer Analytics Work on Price Methodology 	Paper 2	Daniel Guppy (AEMO) Greg Staib (AEMO)	Discuss
5.	4:15pm – 4:25pm	Other Business	None	All	Discuss
6.	4:25pm – 4:30pm	Meeting Close	Next meeting scheduled: Tuesday 24 April 2018	Chair	Note

DRAFT MINUTES – Forecasting Reference Group (FRG)

MEETING: #4

DATE: Tuesday 27 February 2018

CONTACT: Energy.Forecasting@aemo.com.au

ATTENDEES:

NAME	ORGANISATION	LOCATION
Magnus Hindsberger	AEMO	Brisbane
Daniel Guppy	AEMO	Melbourne
Greg Staib	AEMO	Melbourne
Jo Dean (Secretariat)	AEMO	Melbourne
Nicola Falcon	AEMO	Melbourne
Song Li	AEMO	Melbourne
Tania McIntyre (Chair)	AEMO	Melbourne
Dee Butler	AER	Adelaide
Justin Gardner	Ergon Energy	Brisbane
Connie Ganser	Stanwell	Brisbane
Nick Cimdins	AusNet Services	Melbourne
Ben Skinner	Australian Energy Council	Melbourne
Richard Paprzycki	Energy Australia	Melbourne
Maya Muthuswamy	Engie	Melbourne
Neil Gascoigne	Powercor Australia	Melbourne
Panos Priftakis	Snowy Hydro	Melbourne
David Moore	Planning NSW	Sydney
John Sligar	Sligar and Associates	Sydney
Jacqui Biro	AEMC	Teleconference
Ed White	Ausgrid	Teleconference
Jackie Bridge	AusNet Services	Teleconference
David Whitelaw	Dept. of Environment and Energy	Teleconference
Jakes Jacobs	Energy Skills Queensland	Teleconference
David Hock	Engie	Teleconference
Shane Bruner	Ergon Energy	Teleconference
Geoff Bongers	Gamma Energy Technology	Teleconference
David Moore	NSW Dept. of Industry	Teleconference
Keith Rulan	Powerlink	Teleconference
Jennifer Brownie	QLD Electricity Users Network	Teleconference
Herath Samarakoon	TasNetworks	Teleconference

1. Welcome and Introductions

Tania McIntyre (AEMO) welcomed the participants of the FRG to the second meeting of 2018.

2. Previous minutes and action items

Tania McIntyre (AEMO) ran through the Action Items from the January 2018 FPRG meeting. The meeting minutes were accepted and noted as final.

Updates on outstanding Action Items have been appended below.

3. Demand Forecast Updates

Nicola Falcon (AEMO) informed the FRG of the scheduled March 2018 release of the Gas Statement of Opportunities (GSOO) publication and the Gas Demand Forecast has been delayed. These will now be published in June 2018.

Nicola outlined the timelines of Publications:

- Demand and Gas Supply will be presented in one publication.
- The Electricity Demand Forecast is expected to be an August publication. The Demand and Electricity Statement of Opportunities (ESOO) will also be published in one paper.
- A Minor update on the electricity forecasts will be published in the coming month.
- Moving forward AEMO will publish minor updates on a more regular basis, when AEMO considers there has been a material change.

John Sligar (Sligar and Associates) requested that AEMO create a document for the website that lists the cut off, publication dates and locations of each publication on the website.

ACTION: 4.3.1: Nicola Falcon (AEMO) to explore the possibility of creating a one page document on the AEMO website outlining cut off and publication dates of each publication, noting that not all dates are known yet.

ACTION: 4.3.2: Jackie Biro (AEMC) to discuss the implications of timing changes with Nicola Falcon (AEMO) offline.

Any further feedback or queries can be directed to energy.forecasting@aemo.com.au

4. March Electricity Forecast Updates

Greg Staib (AEMO) spoke on the Annual Energy Forecast being released March 2018 on the AEMO Forecast Interface.

Most of the changes to these updates have been discussed in previous FRG meetings and the March release covers Liquefied Natural Gas (LNG), Electric Vehicle (EV), Coal Seam Gas (CSG) and light industrial load adjustments along with new calculations on historical demand. New Demand Side Participation (DSP) projections will also be published.

Greg presented on Neutral, Weak and Strong updates from 2017. Nick Cimdins (AusNet Service) queried what the proportion of the total fleet were represented as electric vehicles, Greg confirmed that in 2037 the neutral case of the fleet was at 20%, the strong case 10.5M is 50% of fleet with the weak being 6% of fleet. Greg commented forecasts show that there would be a rapid uptake post 2027 in the Strong.

Greg clarified that the forecast outlook for the grid operational demand was for the total electricity demand from operational generators.

Jacqui Biro (AEMC) commented that the 2024-25 forecast current update in the Neutral scenario is higher than the 2017 ES00. Greg advised that the assumptions on large industrial load are driving this in the short term. Greg informed the FRG that the process to capture large industrial load is done through a survey, media searches and via TNSP's when they come on line as well as internal modelling.

Justin Gardner (Ergon) queried whether AEMO will be able to forecast losses associated through small scale PV going back to the sent-out level if that demand was met by the large scheduled generators instead. Greg confirmed that is something AEMO are currently working on. As a rule of thumb, add 5% for losses to the forecast generation of Rooftop PV to achieve the equivalent generation required by a transmission connected generator to meet the same consumption at a distributed level.

Jennifer Brownie (QLD Electricity Users Network) queried the flat demand for business in Queensland and doesn't believe that the figures are accurate for the state and sought further information on the reduction for climate change and requested a graph by state on the Electric Vehicle numbers.

Action 4.4.1 Greg Staib (AEMO) to review the data interface for QLD data and confirm location of requested information with Jennifer Brownie (QLD Electricity Users Network).

ACTION 4.4.2 Greg Staib (AEMO) to forward to Jennifer Brownie data on EV in QLD.

5. Status of Current Work and Next Steps

Daniel Guppy (AEMO) informed the FRG on the summer analytics program adding that more detail on these topics would be covered in a future methodology workshop.

Daniel informed the FRG that the summer analytics was divided into two parts – heatwaves and climate change. The summer research project has completed its study on the impact of heatwaves on demand. We are currently researching how climate change will impact the maximum temperatures and change the frequency, length and intensity of heatwaves in the future.

The first stage of the maximum demand methodology aims to snapshot consumer behaviour in response to weather effects. The summer analytics study aimed to improve this stage with a focus on heatwaves. The study used data from the past five years to identify consumer behaviour related to heatwaves. This behaviour is then simulated through different weather events to present 17 counterfactuals and enable a review of the demand under these events. The second aspect of the summer analytics project is researching climate change to warm these 17 historical years to current and forecast temperatures.

AEMO has 24 models for any given region capturing every hour of the day. This is not seasonal data. The maximum demand was captured from 5pm – 6pm and minimum demand was 3am - 4am or, with solar PV, around noon.

Justin Gardner (Ergon Energy) confirmed that the maximum demand is net of battery discharge.

AEMO's research explored different heatwaves variables:

- Daily rolling average (1 - 3 days), a continuous variable that can be expressed as a cool wave or a heat wave

- Excess heat factor (EHF) – many publications recommend EHF as a means of capturing heatwaves
- Heatwave dummy variable
- Humidity was not included in the modelling, due to multicollinearity with heatwaves

AEMO's research found:

- The impact of a heatwave contributed 5% to overall demand.
- The Dummy and EHF models worked best in capturing the response to demand. The next electricity demand forecast update (in August) will implement further variables to capturing heatwaves.

Shane Brunner (Ergon Energy) queried whether any wind speed variable had been factored in. Daniel advised that the BOM identified different wind variables and that wind speed can change temperature observation, however to include this in the model created multicollinearity issues with temperature.

AEMO is currently looking at climate change and its impact on demand. To forecast demand, the simulation collected 17 years of data to ensure alternative weather conditions were represented. To capture climate change, the current approach is to lift temperatures up by 0.5°C per 20 years.

AEMO have met with climate scientists who have forecast out to 2100 and will be further researching the risk of climate change over the coming four weeks. This research will look at the impact of climate change on the frequency and intensity of heatwaves.

Forum members highlighted that other power system vulnerabilities include storms - dark cloud cover from thunder storms (impacting PV output) and large hail stones damaging equipment. It would be useful to understand the projected increased frequency of these events.

6. Demand Side Participation Forecast update, Approach and Results

Magnus Hindsberger (AEMO) presented an update on Demand Side Participation (DSP) advising the FRG that the present 2018 DSP Forecast will be published at the end of March 2018.

The methods have been evolving over time with Magnus explaining that the types of DSP AEMO are capturing in the forecasts are

- **Semi Regular** (Frequent): price driven, back-up generator, industrial loads.
- **Occasional** (Rare): Reliability driven, critical peak pricing programs, peak smart air conditioners.

The regular (daily) DSP consisting of tariff driven or timer based response is embedded into the maximum demand forecast.

The major change to the methodology is the exclusion of Reliability and Emergency Reserve Trader (RERT) and Australian Renewable Energy Agency (ARENA) DSP. Other changes include using the updated survey data, and revising the method to use meter data analysis for all DSP loads and not just industrial loads.

The revised method classifies DSP into three baseline types based on the metered consumption profile:

- Industrial load (flat)

- Daily load shape
- Irregular loads

The DSP response against those baselines is calculated by wholesale price levels or Lack of Reserve (LOR) conditions.

Magnus commented that the observed DSP outcomes highlights that it is - from a system level - a probabilistic resource that can produce a wide range of outcomes, depending on the position at the time of the controlling aggregators or retailers.

The DSP forecast is used by AEMO in Medium Term Projected Assessment of Medium Term Projected Assessment of System Adequacy (MT PASA), Electricity Statement of Opportunities (ESOO). It is not being used in short term processes such as Short Term Projected Assessment of System Adequacy (ST PASA).

Ben Skinner (AEC) commented that in his view, DSP should also be included in ST PASA assessments as it would give market participants a more true picture of supply adequacy.

Nicola Falcon (AEMO) asked if Network provider DSP should be included in the assessment:

- Ben Skinner (AEC) suggested that Network Providers should be included, if it is assumed that the network has installed the services in conditions that are likely to be correlated in peak demand circumstances.
- Ausnet Services flagged that there can be a large variation in the extent of any response to critical peak pricing programs, and this is an area that they are wanting to better understand.
- Powercor cautioned inclusion of all network provider DSP as some is used to manage local issues, not specifically to provide regional reliability support.

Jennifer Brownie (QLD Electricity Users Network) commented that in a webinar by the Energy Security Board, the Minerals Council stated that demand response is up to \$60,000 per MW hour which is much higher than what has just been presented. AEMO has excluded RERT and ARENDA DSP. Jennifer requested clarification from AEMO on this point. As this was raised by Minerals Council in a different forum, it would be more appropriate for QEUN to follow this up with them directly.

The next major update on DSP information is in April 2018 as part of the new DSP information guidelines process with a workshop for participants scheduled 6 March 2018.

Any further feedback or queries can be directed to energy.forecasting@aemo.com.au

7. Other Business

No new business was raised.

9. Meeting Close

The next Forecasting Reference Group meeting is scheduled for Tuesday 27 March 2018.

Forecasting Reference Group (FRG) Actions Items

Item	Date Raised	Topic	Action required	Responsible	By	Status
4.3.1	27 Feb 2018	Demand Forecast Updates	AEMO to explore feasibility of creating a one page document listing the release timings.	Nicola Falcon (AEMO)	Ongoing	Open
4.3.2	27 Feb 2018	Demand Forecast Updates	AEMC to discuss offline the implications of the minor reports on projects. <i>27/03 Update:</i> Nicola's details emailed over to Jackie on 20 March.	Jackie Biro (AEMC) Nicola Falcon (AEMO)	20 March 2018	Open
4.4.1	27 Feb 2018	March Electricity Forecast Updates	AEMO to review data interface for QLD data and confirm flat demand in business and the reduction in climate change. <i>27/03 Update:</i> Greg to add historical data to dynamic interface.	Greg Staib (AEMO) Jennifer Brownie (QLD Electricity Users Network).	09 March 2018	Open
4.4.2	27 Feb 2018	March Electricity Forecast Updates	A request to have the graphs presented state by state (QLD specifically). <i>27/03 Update:</i> This information will be available on the interface once it is published on 29 March 2018.	Greg Staib (AEMO) Jennifer Brownie (QLD Electricity Users Network).	09 March 2018	Open

3.1.1	30 Jan 2018	Generator Information	Sample of the 'questions table' in new portal to be distributed to FPRG.	Matt Marston (AEMO)	March 2018	Closed
3.1.2	30 Jan 2018	Generator Information	Tadipatri Prasad to discuss upcoming projects off line	Tadipatri Prasad (NSW Govt.) Nicola Falcon (AEMO)		Closed
5.1.1	30 Jan 2018	Integrated System Update	Discussion of ISP details to be held offline.	Nicola Falcon, Craig Price (AEMO) Craig Oakeshott (AER)	10 February 2018	Closed
1.4.1	19-Sep-17	Summer Analytics Program	Chat with Ausnet Services regarding the ARENA project with Solcast. GS Update – Spoke with Luke at Solcast – insights to be released in future. Commitment from Siro for 1 resource. <i>20/11 Update</i> – Yet to commence program. <i>30/01 Update</i> – Vivian Mai, Price and Consumer demand behaviour and Song Li, Climate/Heatwaves will present on in the coming months. <i>27/02 Update</i> – Song Li presented on Climate/Heatwaves.	Greg Staib (AEMO)	24-Oct-17	Open

Transmission Connection Point Forecasts 2018

Forecasting Reference Group – 27 March 2018

Timing and improvements

2018 Timing of publication

Tasmania (March)



New South Wales (July)



Queensland (July)



South Australia (August)



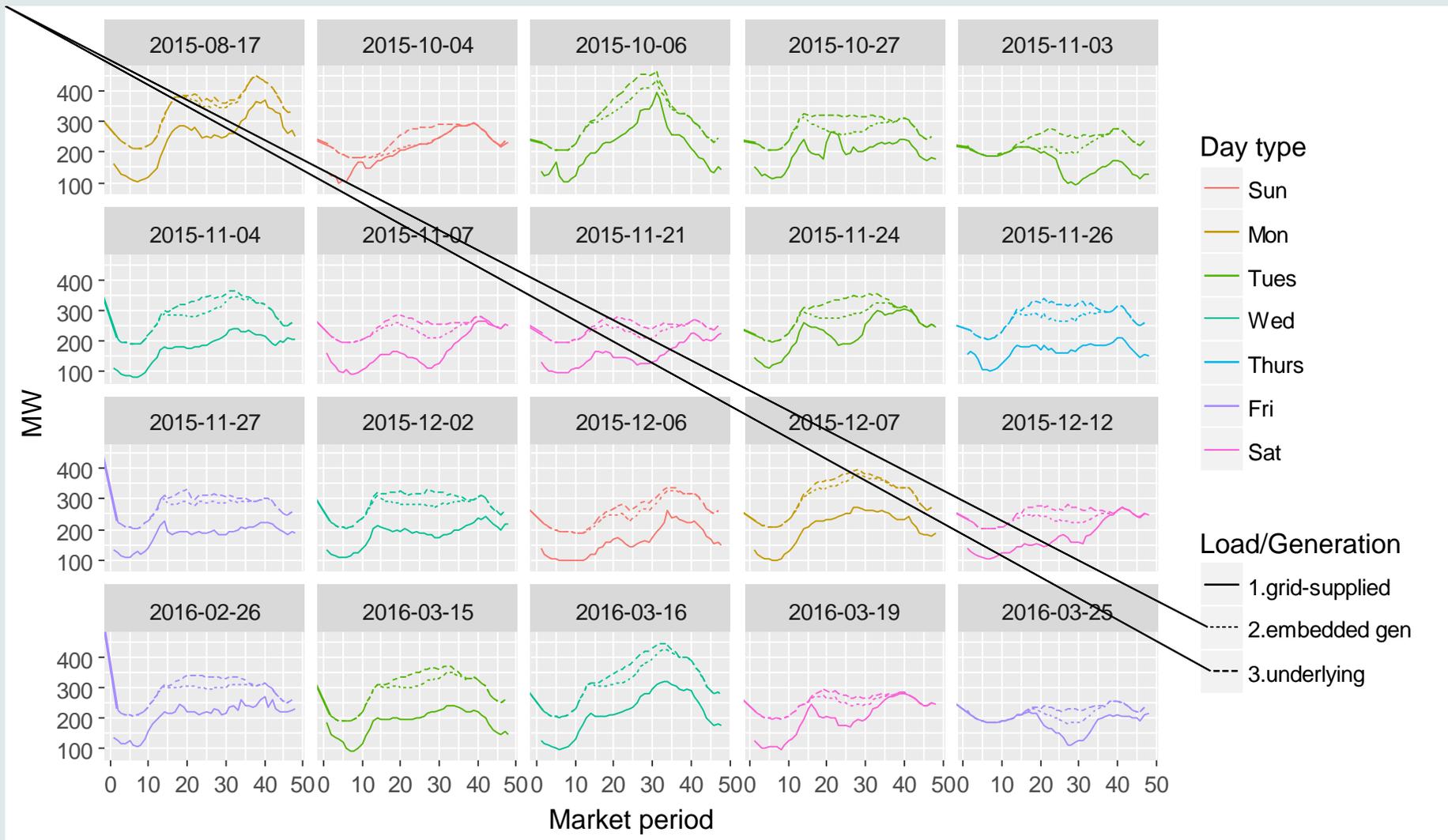
Victoria (September)

2018 Improvement work

- Key improvement planned: minimum demand forecast by connection point
 - Targeting a pilot study, with focus on Victoria:
 - Engage a consultant to propose and document a method, in consultation with AEMO and key stakeholders.
 - Depending on complexity of the method, explore implementing it by the end of 2018.
- Key considerations when assessing and forecasting minimum demand:
 - Intermittent embedded generation needs to be accounted-for (wind, thermal, solar...).
 - The timing of underlying demand and intermittent generation needs to be considered (half-hourly models instead of daily models).
 - Trending approach to drive forecasts may not be adequate – need to consider demand drivers (population, connections and agricultural, commercial & industrial sectors).
 - Forecasts of new generation should be attributed to connection points where possible. Sensitivity studies may play a role if uncertainty is large.
 - Data cleaning required to avoid poorly-specified models & correctly identify historical minima (outages, maintenance, load transfers and other structural breaks).
 - Impact of industrial load maintenance programs to be considered.

2018 Improvement work

Example of top 20 lowest days at a substation in Victoria in 2016-17





National Electricity Forecast 2018 – Assumptions and Methodology Discussion

Led by Greg Staib, AEMO Forecasting

Agenda

1. Purpose
2. Connections and Economic Outlook
3. Consultancy and Research Update:
 - PV, Electric Vehicles, Batteries,
 - Energy Efficiency
 - Summer Analytics Work Price Methodology

1. Purpose

2018 National Electricity Forecast

- As part of the NEM Electricity Statement of Opportunities, AEMO will update its forecast of NEM consumption and max/min demand.
- In preparation, AEMO is updating forecast drivers through a combination of internal research and consultancy work.
- The aim of this session is to:
 - present some preliminary forecast inputs,
 - the scope of proposed updates,
 - seek feedback on how these inputs should be considered in the electricity forecast.

2. Connections and Economic Outlook

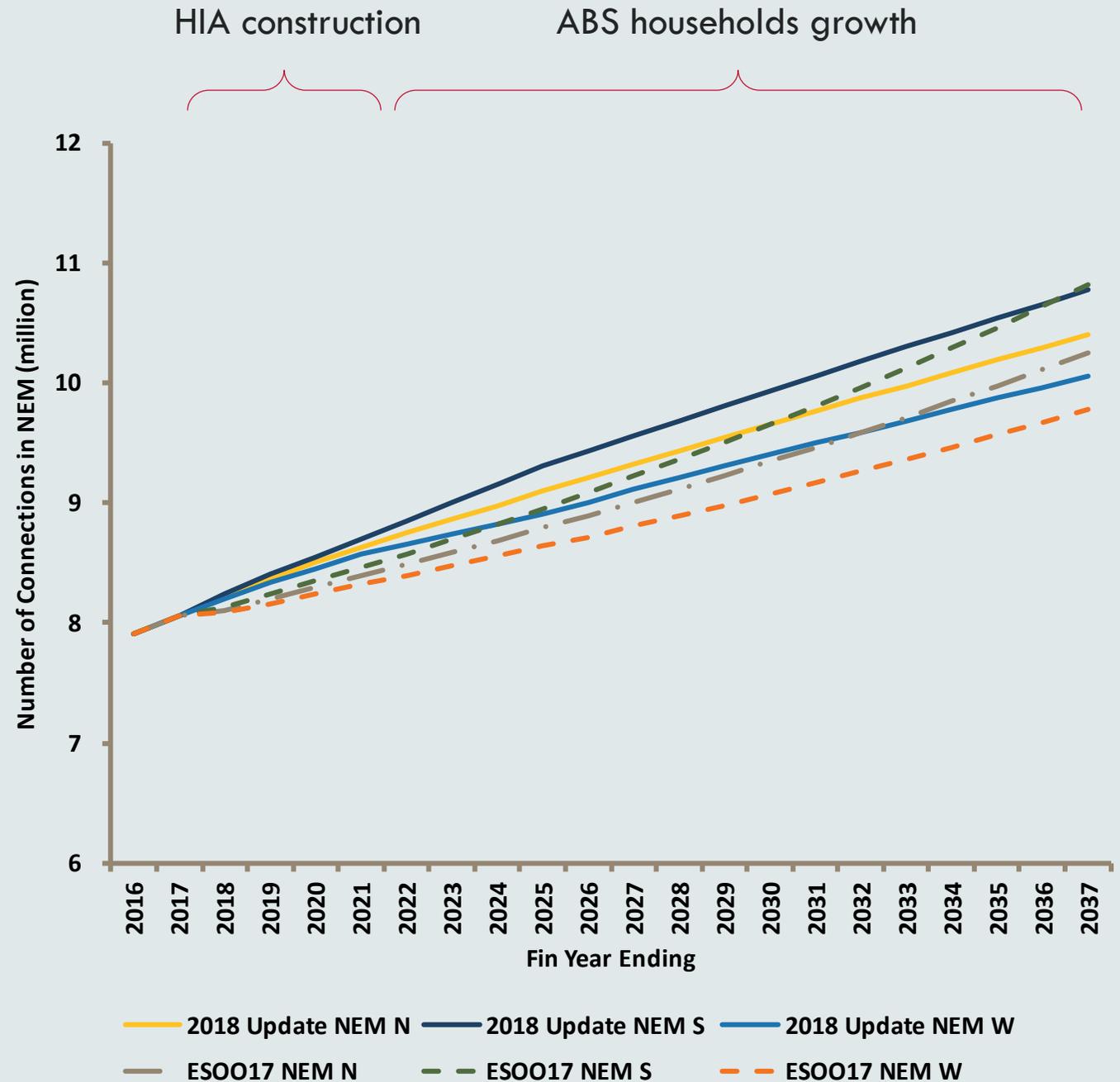
Connections

- The residential consumption model that AEMO uses requires a forecast of active residential electricity connections (dwellings)
- The electricity connections forecast considers:
 - Annual Housing Industry Association (HIA) research on short-term construction trends
 - ABS Population Forecasts (ABS Issue: 3222.0 - Population Projections, Australia, 2012)
 - ABS Household Forecasts (ABS Issue: 3236.0 - Household and Family Projections, 2015)
 - ABS 2016 Census results
 - AEMO National Meter Identifier (NMI) counts across all jurisdictions
- The spread of high, medium and low electricity connections follow the respective ABS scenarios A,B,C

Connections

Incorporating new construction data and census data show a higher short-term forecast than previous for all three scenarios:

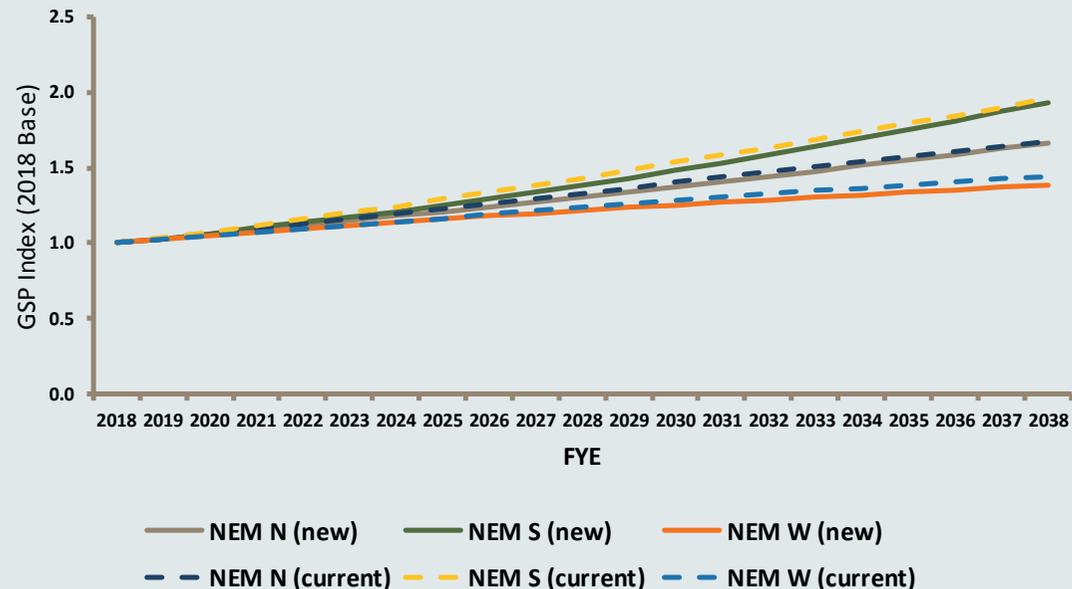
- Neutral (N)
- Strong (S)
- Weak (W)



Economic Forecast

AEMO have received an updated economic outlook from its economic consultant

- Long term economic forecasts are a key input into AEMO's electricity and gas demand forecasts for the business sector.
- Forecasts have been provided for AEMO's weak, neutral and strong scenarios
- The economic drivers AEMO considers are:
 - Gross State Product (affects manufacturing)
 - Household Disposable Income (affects services)



3. Consultancy and Research Update

Solar PV, battery storage and electric vehicles

- A key input into AEMO forecasting process is projected uptake of small-scale embedded technologies:
 - Solar PV
 - Battery storage
 - Electric vehicles
- AEMO has engaged CSIRO to provide forecasts for these technologies for the 2018 National Electricity Forecast
- Forecasts are due end of April 2018.
- Any other embedded technologies that should be considered?

Solar PV

- Solar PV forecast to consider segments:
 - Residential PV (<10 kW)
 - Commercial (>10 kW and <100 kW)
 - And Small-scale utility (>100 kW and <30 MW)
- Forecasts to include:
 - Projected number and capacity of installations over the next 20 years for low, medium and high trajectories
 - Forecast to be provided at the regional and subregional level
- What else should we consider?

Battery storage

- Battery storage forecast to include:
 - Behind-the-meter battery storage uptake of retrofit battery systems and new integrated rooftop PV and storage installations
 - Sectorial split by commercial and residential systems for low, medium and high uptakes
 - The forecasts are to include both kW (charge/discharge) and kWh (energy) storage capacity.
 - Forecast to be provided at the regional level.
 - Two half-hourly discharge / charging profiles to be provided:
 - Independent battery operations based on existing tariff structures/retail offers
 - Smart battery operations based on consideration for wider system/network/portfolio benefits
- **What else should we consider?**

Electric vehicles

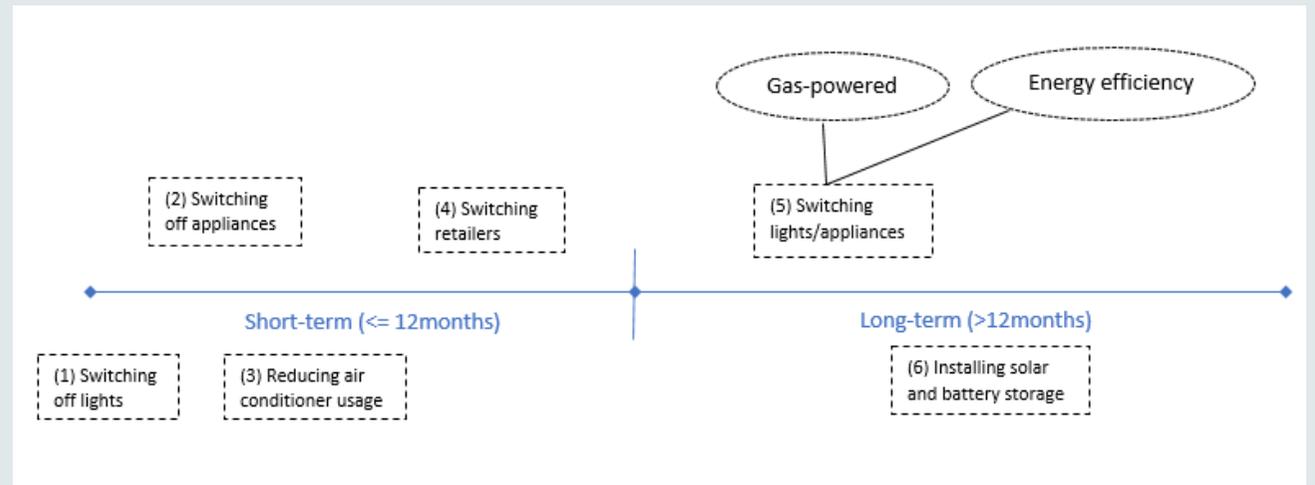
- Electric vehicle forecast to include:
 - Electric Vehicles (EV) uptake covering both Battery Electric Vehicle (BEV) and Plug-in Hybrid Electric Vehicle (PHEV).
 - Forecast of stock uptake and electricity consumption
 - Forecast to be provided at the regional level.
 - Forecasts to be split into two sectors: Residential vehicles vs commercial (fleet owners) uptake.
 - Two half-hourly charging profiles to be provided:
 - Charging based on current tariff uptake/incentives
 - EV charging based on consideration for wider system/network/portfolio benefits
- **What else can we consider?**

Energy Efficiency

- Energy Efficiency forecast contracted to *Strategy Policy Research Pty Ltd*
- This work will cover:
 - Gas and electricity energy efficiency forecasts for both appliances and buildings
 - Fuel switching – in particular gas-to-electricity
 - Segmented by residential and commercial sectors (excluding industrial/manufacturing)
 - Savings to be grouped into consumption type: heating, cooling, hot water and base load
- Estimate should focus on policy driven response as distinct from the effect on consumer purchasing decisions or behaviour from price changes (to avoid double counting)
- **What else should we consider?**

Price Methodology

- AEMO's forecasting process accounts for the impact of price changes arising from consumers adjusting behaviour (short term) or investment decisions (longer term) resulting in changes to consumption trends.

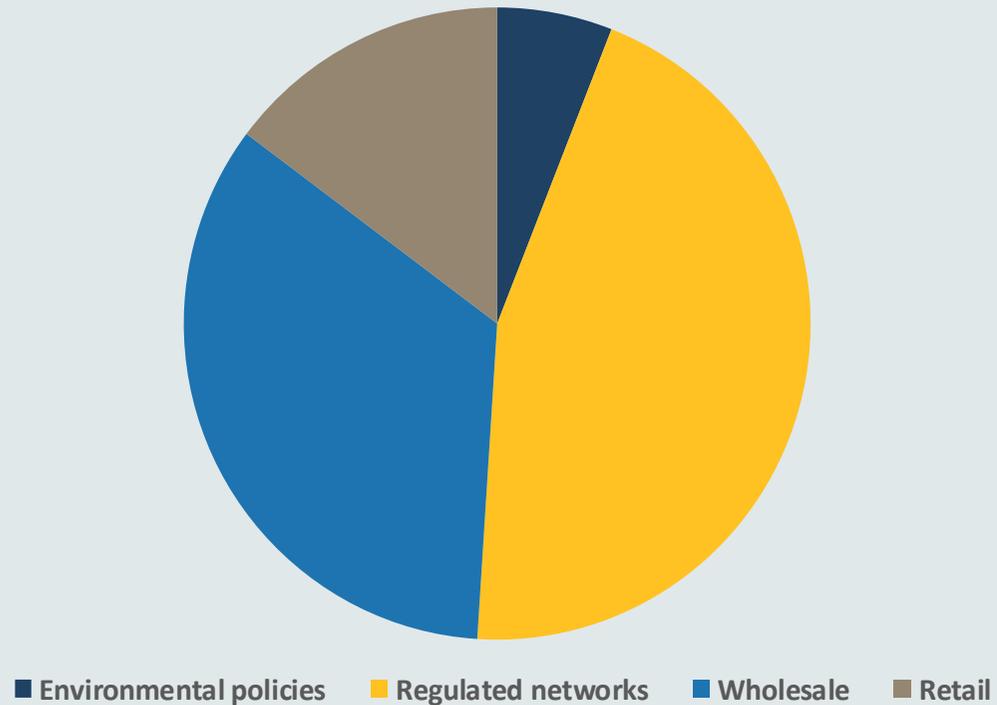


- Forecast prices are based on:
 - Wholesale price trajectories based on internal AEMO modelling.
 - Other components (retail, network, environmental) based on forecast values from AEMC's 2017 Residential Electricity Price Trends report.

Price Methodology

- Electricity bill components dominated by network and wholesale costs.

VIC Residential Bill Proportions (FYE2017)



Source: AEMC 2017 Residential Price Trends report