Forecasting Reference Group Minutes

Forum:	21 September 2022 FRG (#8a)
Date:	Wednesday 21 September 2022
Time:	2:00pm – 4:30pm AEST

Attendees:

Name	Organisation	Name	Organisation
Ben Skinner	AEC	Julian Fairhall	ERAWA
Andrew Turley	AEMO	Raymond Lobo	ERAWA
Anula Abeygunawardana	AEMO	Tyson Self	ERAWA
Ben Jones	AEMO	Kerina Heath	Ergon
Bianca Christison	AEMO	Jill Cainey	Erne Energy
Daniel Collins	AEMO	Mark Grenning	EUAA
Debborah Marsh	AEMO	Jo DeSilva	EWOSA
Grace Liu	AEMO	Cam Potter	FMGL
Helen Wang	AEMO	Greg McIntosh	FMGL
John Liang	AEMO	Tristan Edis	GEM
Jose Viada	AEMO	Alanna Gibson	GLNG
Leslie Lay	AEMO	Christina Sutherland	GLNG
Levi Rosenbaum	AEMO	Ren Kim	GLNG
Maggie Du	AEMO	Kate Farns	Hydro Tasmania
Magnus Hindsberger	AEMO	Eddy Buckovic	iiNet
Natasha Sinclair	AEMO	Jim Crosthwaite	Individual
Nick Zhang	AEMO	Matt Bowen	Jackson McDonald
Oliver Derum	AEMO	Penny Ling	Metro Power
Reinzy Colle	AEMO	Vlasta Barac	Metro Power
Sandy Ng	AEMO	Hesham Farhani	Molyneux Advisors
Sayani Gupta	AEMO	Richard Hickling	Mott MacDonald
Sreeparna Saha	AEMO	Chris Cook	NOPTA
Toby Price	AEMO	Craig Memery	PIAC
Monami Das Gupta	AER	Aaron O'Brien	Powercor
Paul Bresloff-Barry	Agora Retail	Ben M	Powerlink
Nick Eaton	ALCOA	Jennifer Brownie	QEUN
Tim Harris	ATCO	Linda Yu	QLD EPW
Christiaan Zuur	CEC	Manh Pham	QTC
Jacob Hyslop	CEC	Bret Harper	REPUTEX
Chathurika Mediwaththe	CSIRO	Andrew Manson	SA DEM
David Green	CSIRO	Marino Bolzon	SA DEM
James Foster	CSIRO	Matthew Hill	SAPN
Luke Reedman	CSIRO	Daniel Yanes	Shell
Paul Graham	CSIRO	Ron Logan	Shell
Jay Gordon	CWC	Tao Liang Lee	Shell
Michael Li	CWC	Noel John Sligar	Sligar and Associates
Mythili Murugesan	CWC	Joe Hemingway	Stanwell
Wei Sue	CWC	Jill Trinh	Synergy
Glen Whitehead	DISER	Sharon Raymond	TAS Treasury
Lucienne	DISER	Herath Samarakoon	TasNetworks
Zakieh Khorshidi	DISER	Arindam Sen	TransGrid
Caroline Valente	ECA	Mohammad Abdullah	TransGrid
Alex Driscoll	EDGE2020	Sujeewa Vithana	United Energy
Dor Son Tan	ENA	Damien Moyse	VIC DELWP
Lawrence Irlam	Energy Australia	Taryn Gale	VIC DELWP
Shoaib Amjad	Energy Australia	Will Clarke	VIC DELWP
Benson Heng	Energy Queensland	Noelle Leonard	WA JTSI
Erdem Oz	ERAWA	Luke Petersen	Western Power

Disclaimer

This document provides an overview of the main points of discussion on the agenda for the 21 September Forecasting Reference Group meeting, including CSIRO and ClimateWorks Centre's' draft 2022 Multi-sector modelling.

Readers, please note that:

- This document is a summary only and is not a complete record of discussion at the forum.
- For presentation purposes, some points have been grouped together by theme and do not necessarily appear in the order they were discussed.
- The views expressed at the forum and reflected here are not necessarily those of AEMO.

1 Welcome and Introductions

Daniel Collins (AEMO) welcomed everyone and covered the following:

- Draft FRG Minutes will be distributed when ready
- Correspondence is available via Energy.forecasting@aemo.com.au.

2 Presentation 1 – Draft 2022 Multi-sector modelling forecasts – CSIRO and ClimateWorks Centre (CWC)

Debborah Marsh (AEMO) presented AEMO's Forecasting Approach, explaining how different forecasting components interact in AEMO's modelling.

Luke Reedman (CSIRO) and Jay Gordon (CWC) presented CSIRO and CWC's Multi-sector modelling. The presentation provided an overview of the modelling approach and draft 2022 modelling results, focusing on what has changed since the 2021 forecasts[1].

Key topics raised by stakeholders during this session included:

- Ron Logan (Shell): Which IPCC carbon budgets[2] were used? Was a straight line reduction to the 43% target considered?
  - CSIRO/CWC: The 2018 (used in 2021) and 2021 (used in 2022) IPCC reports used the same carbon budgets: *Hydrogen Export* is a 50% chance of reaching 1.5 degrees. *Step Change* and *Exploring Alternatives* have a 67% chance of reaching 1.8 degrees. *Progressive Change* has no specific IPCC carbon budget, but has the 2030 43% economy-wide target.
- Craig Memery (PIAC): Do carbon budgets include CO2 equivalent greenhouse gasses?
  - CSIRO/CWC: Yes. Nitrous oxide, methane and others are included too.
- Damien Moyse (DELWP): Does the model compare the value of biomethane vs hydrogen in gas networks? Biomethane was more cost effective than hydrogen in DELWP's analysis.

[1] 2021 Multi-sector modelling report available under "supporting material for 2021" at: https://aemo.com.au/en/energy-systems/major-publications/integrated-system-plan-isp/2022-integrated-system-plan-isp/current-inputs-assumptions-and-scenarios
[2] See https://www.ipcc.ch/

- CSIRO/CWC: The “up to 10% blend” is an upper bound for hydrogen blending. The model determines the level of hydrogen, and compares it to other technologies, including electrification and biomethane. Only *Exploring Alternatives* has a lower bound, of 7.5%.

- Craig Memery (PIAC): It is unlikely that all appliances can use a 10% hydrogen blend. What are the cost and technology assumptions for hydrogen in gas networks and for user appliances? Assumptions should be based on merit and plausibility rather than state policy aspirations.
  - CSIRO/CWC: These forecasts take into consideration aspirational state targets. Hydrogen switching and infrastructure upgrade costs are not available, so are not modelled.
  - Damien Moyse (DELWP): Blending policies are highly uncertain.
- Damien Moyse (DELWP): How do long term capacity Energy Efficiency (EE) and electrification uptake limits work? What is the rationale for them?
  - CSIRO/CWC: Yearly installation and long term penetration limits are in place to prevent the model electrifying everything at the most efficient time since this is not realistic.
- Damien Moyse (DELWP): Why does *Progressive Change* not have a carbon budget? Why are budgets varied across scenarios?
  - CSIRO/CWC: *Progressive Change* explores how the legislated 43% target could be achieved without a specific carbon budget.
  - AEMO: The scenarios explore a range of potential budgets and targets. From *Progressive Change’s* with no budget constraint to *Hydrogen Export’s* more aggressive carbon budget to reflect a 1.5 degrees’ equivalent pathway.
- Matt Bowen (Jackson McDonald): Why is land use sequestration area so high?
  - CSIRO/CWC: The volume of land sequestration reflects DISER data which is mainly on-farm plantings, among other options. Therefore, the area figures presented do not reflect area removed from production. The lower 3 scenarios have less than 1 Mha before 2040, only reaching 4.4-4.8 Mha after 2050.
- Craig Memery (PIAC): Drastic upswings need to consider whether industry can plausibly deliver changes in a short time period. Can land sequestration change so much in 10 years?
  - CSIRO/CWC: The rate of sequestration uptake at the end of *Progressive Change* is a known issue in the current draft results. A staged approach will be considered further before the simulations are completed.
- Cameron Potter (FMGL): Why does only *Hydrogen Export* not reduce emissions in 2030?
  - CSIRO/CWC will look into Renewable Energy Zones and industry growth constraints.
- Cameron Potter (FMGL): Direct Air Capture (DAC) would be cheapest and most attractive in a low hydrogen economy. Why is this not reflected in *Hydrogen Export* emissions results?
  - CSIRO/CWC: *Hydrogen Export* relies on earlier sequestration investment than other scenarios, when DAC is not available at reasonable cost/scale. Therefore, it relies more heavily on land sequestration.

- Joe Hemmingway: How is power sector emissions as a proportion of national emissions reductions allocated? And how are inputs different from AEMO's forecasting models?
  - CSIRO/CWC: The AUSTimes model determines each sector's emission reduction share. The draft results, showing the power sector decarbonising sooner than other sectors. The electricity sector component of the model is a capacity outlook model, with closures and lowest cost replacements. It applies consistent inputs to AEMO's broader assumptions, but AEMO's ISP models are more detailed.
- Cameron Potter (FMGL): Is all hydrogen consumption assumed to be grid-connected? Why does it rise steeply from 2030? FFI believe things can change very quickly, but significant infrastructure upgrades are required.
  - CSIRO/CWC: Only Grid connected hydrogen is forecast. The abrupt increase is due to export assumptions.
- Damien Moyse (DELWP): Are buildings broken down to new and existing for EE?
  - CSIRO/CWC: Residential buildings are split into new or existing, but not commercial.
- Cameron Potter (FMGL): Why are commercial buildings relatively more efficient in the NEM than in WA?
  - CSIRO/CWC: NEM and WA have the same cost opportunities, but commercial building forecasts may be different. Industry growth in WA may outweigh NEM proportions.
- Craig Memery (PIAC): Why does the fuel share of biomethane in WA increase so much from 2024? This would require significant infrastructure and supply change updates.
  - CSIRO/CWC: This is a bug in the current draft simulation, where delivery charges were not included.
- Damien Moyse (DELWP): How can gas still remain a fuel source in 2050? The cost of carbon offset would be higher than hydrogen costs?
  - CSIRO/CWC: Offsets are not allocated to specific sectors; remaining gas means another sector has negative emissions. The 2050 offset cost is less than $300/tCO2-e, the extreme end of DISER's cost curve (See slide 10). This draft forecast will change with other factors.
- Cameron Potter (FMGL): Why is the wind/solar split much lower in *Hydrogen Export*?
  - CSIRO/CWC: Wind expansion is more limited than solar. Hydrogen production costs are also cheapest from solar.
- Cameron Potter (FMGL): *Hydrogen Export* should have less battery output since battery storage increases the cost for hydrogen production.
  - CSIRO/CWC: Change in industrial growth and the significant increase in power generation allows room for batteries. With more granular time sequential modelling, there would be less battery output. This reflects the coarseness of the time resolution in AusTIMES. Time sequential modelling (at the hourly temporal resolution) provides a more realistic representation of both pumped hydro and grid-scale battery operation as there is limited

foresight which can influence how the batteries charged and discharged, which cannot be captured in AusTIMES.

- Cameron Potter (FMGL): If the model allows for up to 100% hydrogen penetration in pipelines, how can *Hydrogen Export* still have natural gas in 2050?
  - AEMO: The transition to 100% hydrogen will be begin in isolated regions, allowing for appliance and pipeline repurposing, and potential new hydrogen pipelines. Therefore, when some regions reach 100% hydrogen, others will still be at 10%.
- Damien Moyse (DELWP): Why does steam methane reforming (SMR) without CCS appear later than SMR with CCS and continue to 2050 even though it would be higher cost?
  - Cameron Potter (FMGL): A strict carbon budget could create this. But if a carbon budget is in place, why would SMR without CCS be used at all if direct gas use has lower emissions?
  - CSIRO/CWC: This will be investigated further. A carbon budget, delayed emissions and electrification limits may be causing this in the current draft result.
- Caroline Valente (ECA): Other CWC modelling[3] has more EE opportunity for residential than to commercial buildings. Why does this model imply that commercial buildings become more efficient?
  - CSIRO/CWC: Decarbonisation Futures[3] focused on a range of exploratory building EE opportunities, while AEMO scenarios only includes more mature EE technologies. Building energy intensity is included in this model, but NatHERS ratings[4] are not.
- Jo DeSilva (EWOSA): What is the guarantee that hydrogen will be reserved for domestic use?
  - CSIRO/CWC: This is built into the range of scenario decarbonisation narratives. The model includes both export and domestic hydrogen opportunities.

3 Other business

- Ron Logan (Shell): When will responses to questions raised today be published?
  - AEMO: Insights on preliminary results will inform reporting for the draft 2023 IASR, for publication in December.
- Joe Hemmingway: When will demand traces from all ESOO scenarios be published? (Action 1)
  - AEMO: The ESOO model is published with regional demand traces (for P10 and P50 forecasts) for the ESOO Central scenario (*Step Change*) only. Other scenarios, and particularly sub-regional traces, are only available with the 2022 ISP, and are not available for the 2022 ESOO dataset.

4 Meeting close

The next FRG meeting will be held on Wednesday 28 September 2022, presenting draft DER forecasts from CSIRO and GEM, and CSIRO's draft Electric Vehicle forecasts.

[3] See https://www.climateworkscentre.org/resource/decarbonisation-futures-solutions-actions-and-benchmarks-for-a-net-zero-emissions-australia/
[4] See https://www.nathers.gov.au/

Forecasting Reference Group (FRG) Actions Items

Table 1 FRG Action Items (at 25 October 2022)

Item	Date Raised	Topic	Responsible	Closing details	Status
1	21/9/2022	Respond to demand traces email	AEMO	AEMO responded to Joe Hemmingway's email with further clarification about demand traces.	**CLOSED**