2024 WEM ESOO – WA Forecasting Reference Group (FRG) Meeting

22 March 2024

AEMO

We acknowledge the Traditional Owners of country throughout Australia and recognise their continuing connection to land, waters and culture.

We pay respect to Elders past and present.

AEMO Competition Law – Meeting Protocol

AEMO is committed to complying with all applicable laws, including the Competition and Consumer Act 2010 (CCA). In any dealings with AEMO regarding proposed reforms or other initiatives, all participants agree to adhere to the CCA at all times and to comply with this Protocol. Participants must arrange for their representatives to be briefed on competition law risks and obligations.

Participants in AEMO discussions must:

- Ensure that discussions are limited to the matters contemplated by the agenda for the discussion.
- Make independent and unilateral decisions about their commercial positions and approach in relation to the matters under discussion with AEMO.
- Immediately and clearly raise an objection with AEMO or the Chair of the meeting if a matter is discussed that the participant is concerned may give rise to competition law risks or a breach of this Protocol.

Participants in AEMO meetings must not discuss or agree on the following topics:

- Which customers they will supply or market to.
- The price or other terms at which Participants will supply.
- Bids or tenders, including the nature of a bid that a Participant. intends to make or whether the Participant will participate in the bid
- Which suppliers Participants will acquire from (or the price or other terms on which they acquire goods or services).
- Refusing to supply a person or company access to any products, services or inputs they require.

Under no circumstances must Participants share Competitively Sensitive Information. Competitively Sensitive Information means confidential information relating to a Participant which if disclosed to a competitor could affect its current or future commercial strategies, such as pricing information, customer terms and conditions, supply terms and conditions, sales, marketing or procurement strategies, product development, margins, costs, capacity or production planning.

AEMO Forum and Meeting Expectations

This charter explains expectations regarding participation and behaviour in the AEMO's stakeholder forums.

Meeting Expectations

All participants will:

- Respect the diversity of the group.
- Speak one at a time – refrain from interrupting others.
- Share the oxygen – ensure that all attendees who wish to have an opportunity to speak are afforded a chance to do so.
- Maintain a respectful stance towards all participants.
- Listen to others' points of view and try to understand others' interests.
- Share information openly, promptly, and respectfully.
- If requested to do so, hold questions to the end of each presentation.
- Remain flexible and open-minded, and actively listen and participate in meetings.
- Abide by COVID-Safe workplace guidelines, if attending a meeting on AEMO's premises.

Roles and Responsibilities

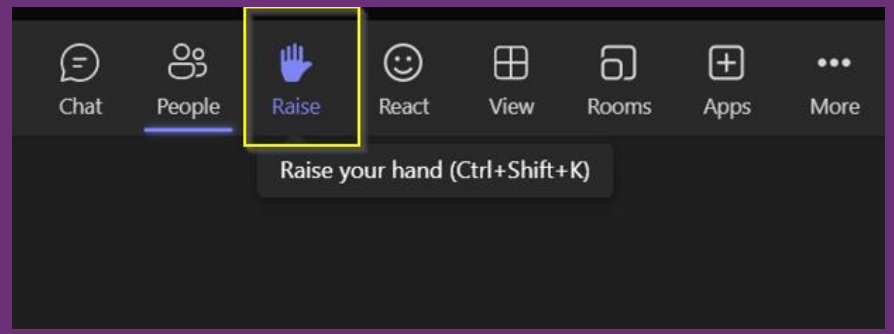
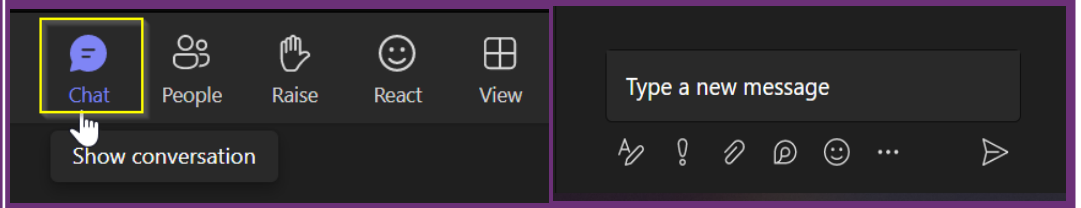
Forum stakeholders agree to:

- Be specific and fact-based in their feedback on a specific workstream or emerging issue;
- Review and provide feedback on papers and reports;
- Relay information to their colleagues or constituents after each meeting and gather information/feedback from their colleagues or constituents, as practicable, before each meeting;
- Maintain a focus on solutions or outcomes that benefit all energy consumers.

AEMO agrees to:

- Provide technical expertise in a manner that is considerate of the audience and their level of expertise;
- Assist participants in understanding issues enough to represent their views;
- Provide all participants the opportunity to voice their views.

Interacting in TEAMS

Raise hand – request to join discussion	Chat function – share comments, ask a question, or raise discussion point
	
Click the Raise hand icon to contribute to the current discussion. Please unmute when you're welcomed to join. When finished, please lower your hand by clicking the icon again and mute your microphone.	Click the Chat icon to go to the Meeting chat interface. Type your message and send. Please note that your message can be viewed by everyone attending the meeting. Please standby while AEMO either writes a response or queues for discussion.

Please state your name and organisation when you start speaking.

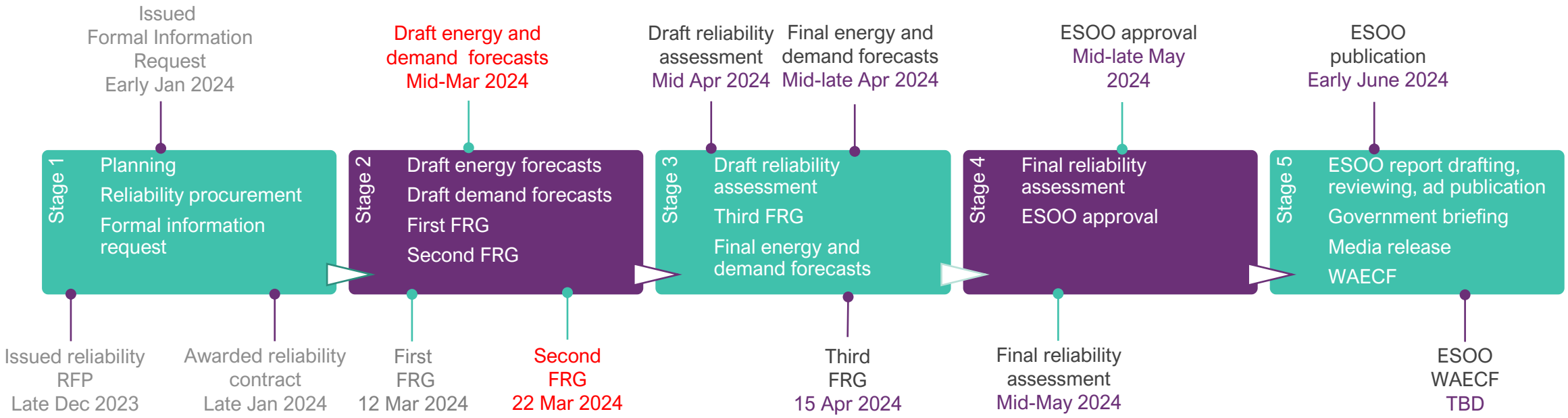
Meeting agenda (22 March 2024)

#	TIME (AWST)	TOPIC	PAPERS	RESPONSIBLE	ACTION
1.	10:30am – 10:35am	Welcome and introduction	Welcome slides	WA Future System & Design (AEMO)	**Note**
2.	10:35am – 11:55am Presentation: 40 – 50 mins Discussion: 30 mins	Draft energy and demand forecasts	Presentation 1	Energy Forecasting Demand Forecasting (AEMO)	**Inform Consult**
3.	11:55am – 12:00pm	Next steps	None	WA Future System & Design (AEMO)	**Inform**
4.	12:00pm	Meeting close	None	WA Future System & Design (AEMO)	**Note**

- *Please be aware that this meeting will be recorded for the purpose of creating minutes.*
- *To make the most of our time, we'll ask the presenters to finish their presentations before taking any questions.*
- *If you have any questions after the session, you're welcome to email them to us at WA.FutureSystemDesign@aemo.com.au . Please ensure that they reach us by **COB Tuesday, 26 March, 2024**.*

ESOO timeline overview (current step)

The 2024 WEM ESOO forecasts the Reserve Capacity Target (RCT) for each Capacity Year between 2024-25 and 2033-34, and, specifically, determines the Reserve Capacity Requirement (RCR) – the amount of capacity to be procured through the RCM – for the 2024 Reserve Capacity Cycle (2026-27).



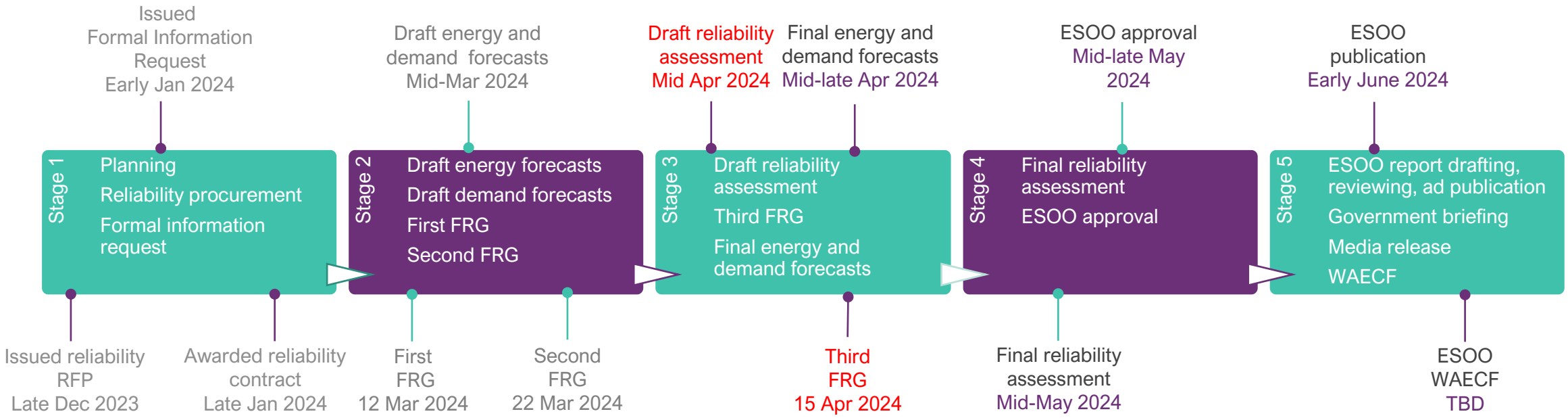
Note: the timeline is updated as of 22 March 2024.

Key dates:

- Tuesday, 12 March: First FRG – reliability assessment assumptions and methodology.
- **Friday, 22 March: Second FRG – draft energy and demand forecasts.**
- Monday, 15 April: Third FRG – draft reliability assessment results.
- Monday, 10 June 2024: ESOO publication deadline.

ESOO timeline overview (next step)

The 2024 WEM ESOO forecasts the Reserve Capacity Target (RCT) for each Capacity Year between 2024-25 and 2033-34, and, specifically, determines the Reserve Capacity Requirement (RCR) – the amount of capacity to be procured through the RCM – for the 2024 Reserve Capacity Cycle (2026-27).



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For more information visit

aemo.com.au

Any comments or feedback can be sent to
WAElectricityforum@aemo.com.au or *WA.FutureSystemDesign@aemo.com.au*

WEM scenario settings

WEM scenarios

- The 2024 WEM ESOO considers three scenarios, consistent with WEM Rules 4.5.10(a)
- Scenarios have been adopted from AEMO's 2023 Input, Assumptions and Scenarios Report (IASR)
- These scenarios are consistent with the 2023 WEM ESOO as follows:

WEM scenario	2023 & 2024 WEM ESOO
Low demand growth	Progressive Change
Expected demand growth	Step Change
High demand growth	Green Energy Exports

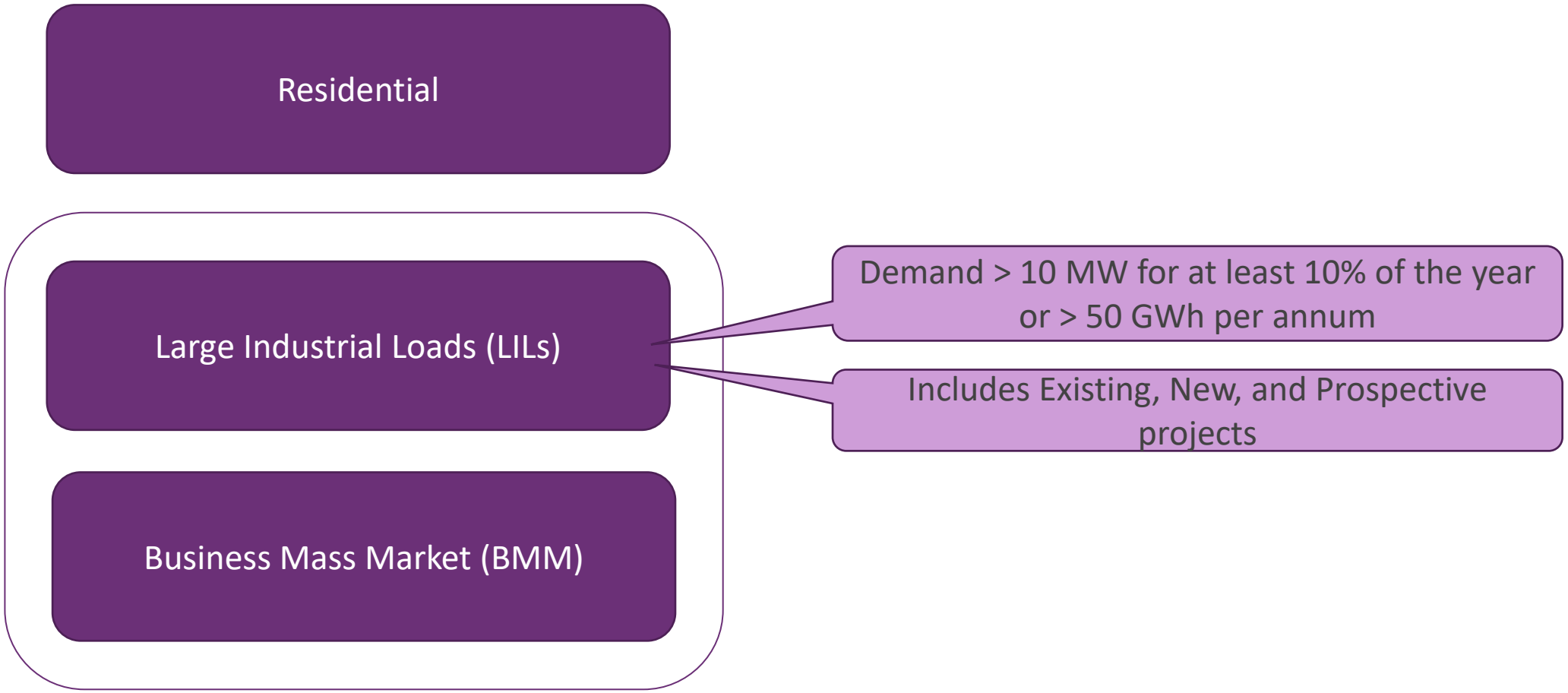
WEM scenarios

- ***Low scenario*** adopts the ***Progressive Change*** IASR scenario which features slower economic growth and only modest technology cost change.
- ***Expected scenario*** adopts the ***Step Change*** IASR scenario which features higher consumer energy resources investment and strong electrification.
- ***High scenario*** adopts the ***Green Energy Exports*** IASR scenario which reflects very strong decarbonisation activities and strong electrification, higher economic growth, and global demand for green energy exports such as green hydrogen and green steel.
- All three scenarios target at least 43% emissions reductions by 2030.

Draft consumption forecasts

Presented by Jieyang Chong, Lin Han and Jay Stein
Energy Forecasting

Consumption sectors



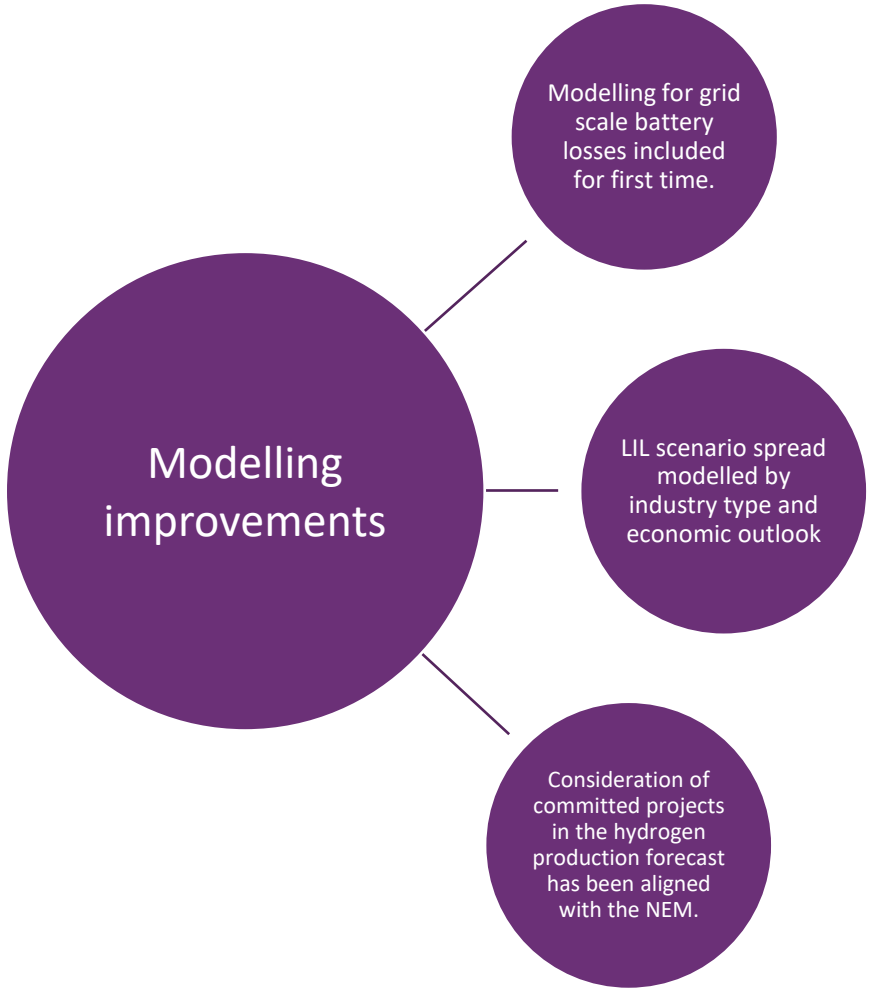
Refer to Forecasting Approach – Electricity Demand Forecasting Methodology for modelling approach

Updated model inputs

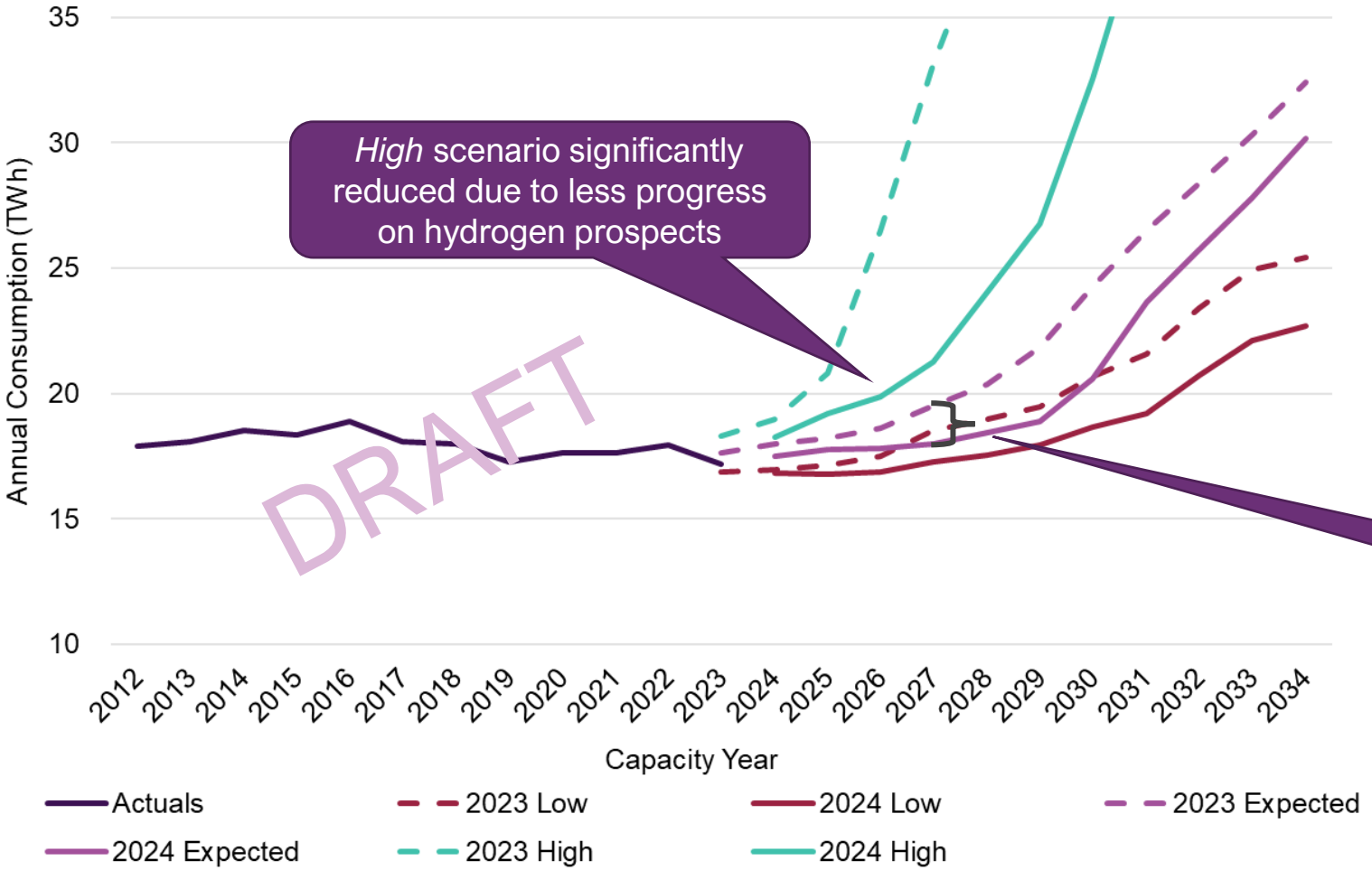
- Energy efficiency forecasts – developed by Strategy. Policy. Research
- Updated CER forecasts* – Distributed PV, EV, Battery forecasts developed by CSIRO & Green Energy Markets
- Economic forecasts – developed by Deloitte Access Economics
- Western Power provides AEMO with connection level estimates and commencement dates for LILs
- AEMO has directly surveyed 31 LILs to determine future site level forecasts and decarbonisation plans

*Refer to Draft 2024 Forecasting Assumptions Update for further information on CER forecast updates

AEMO continues to refine our forecasting approach



SWIS Operational Forecast (sent-out)

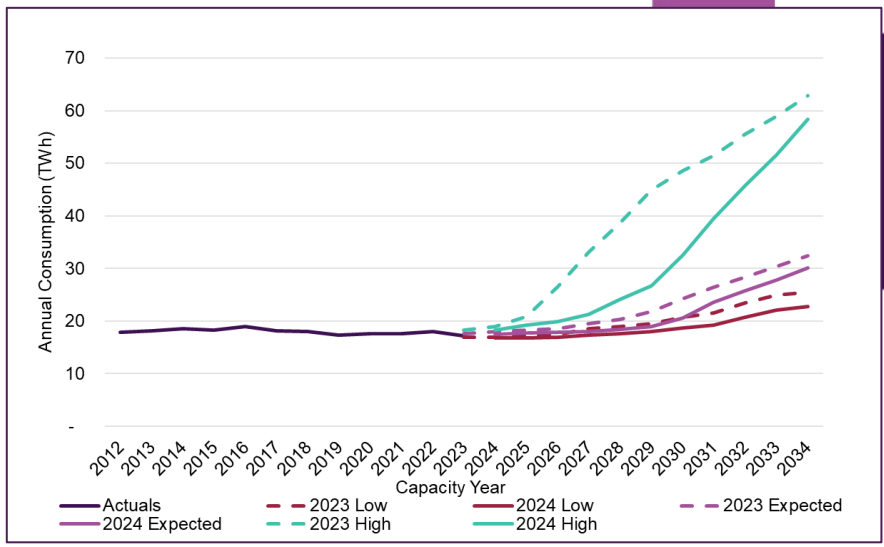


High scenario significantly reduced due to less progress on hydrogen prospects

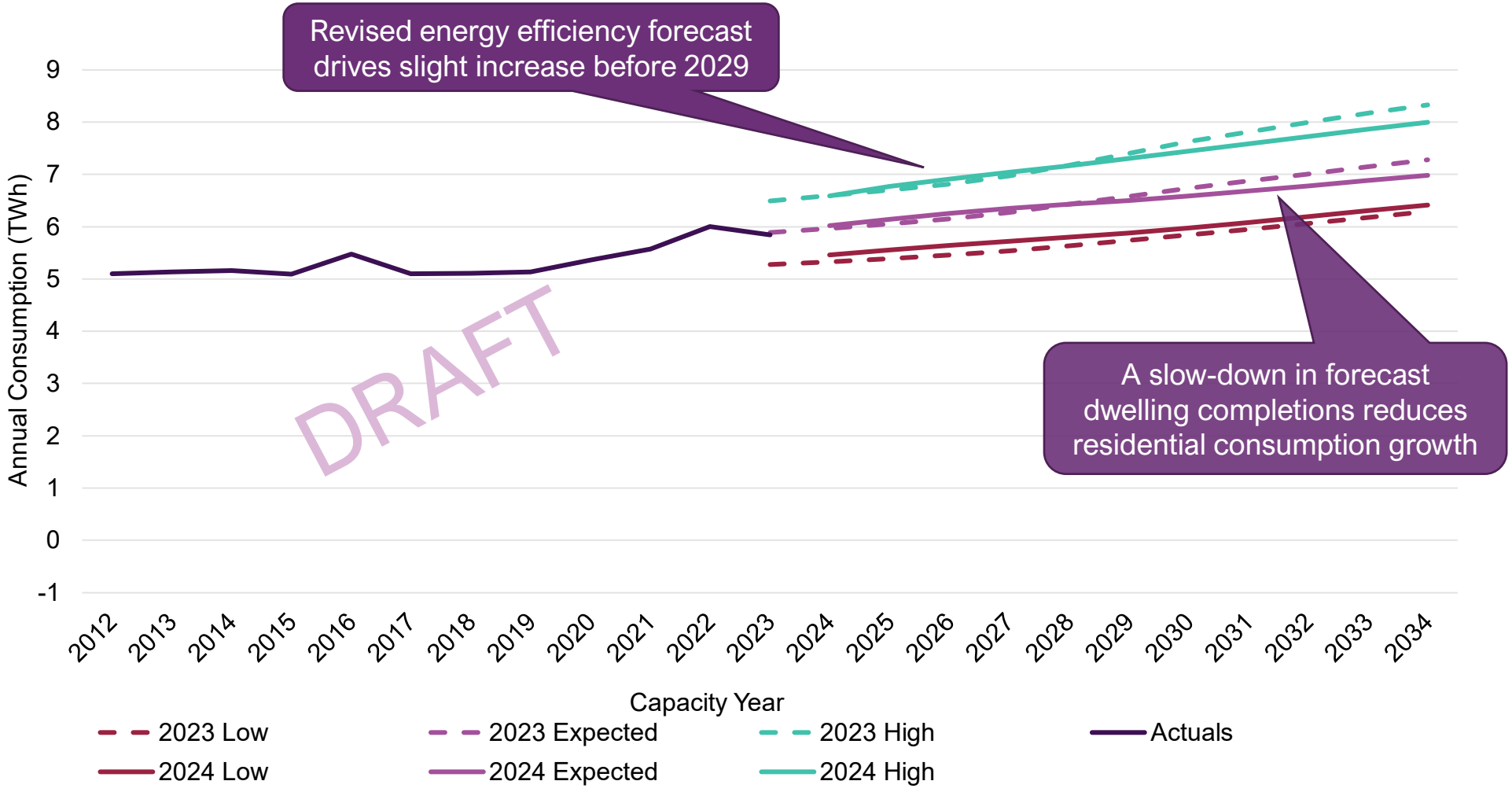
DRAFT

Expected scenario 1.5 TWh lower in 2026-27 (RCT year) due to lower LIL forecast and increased capacity of residential installed PV.

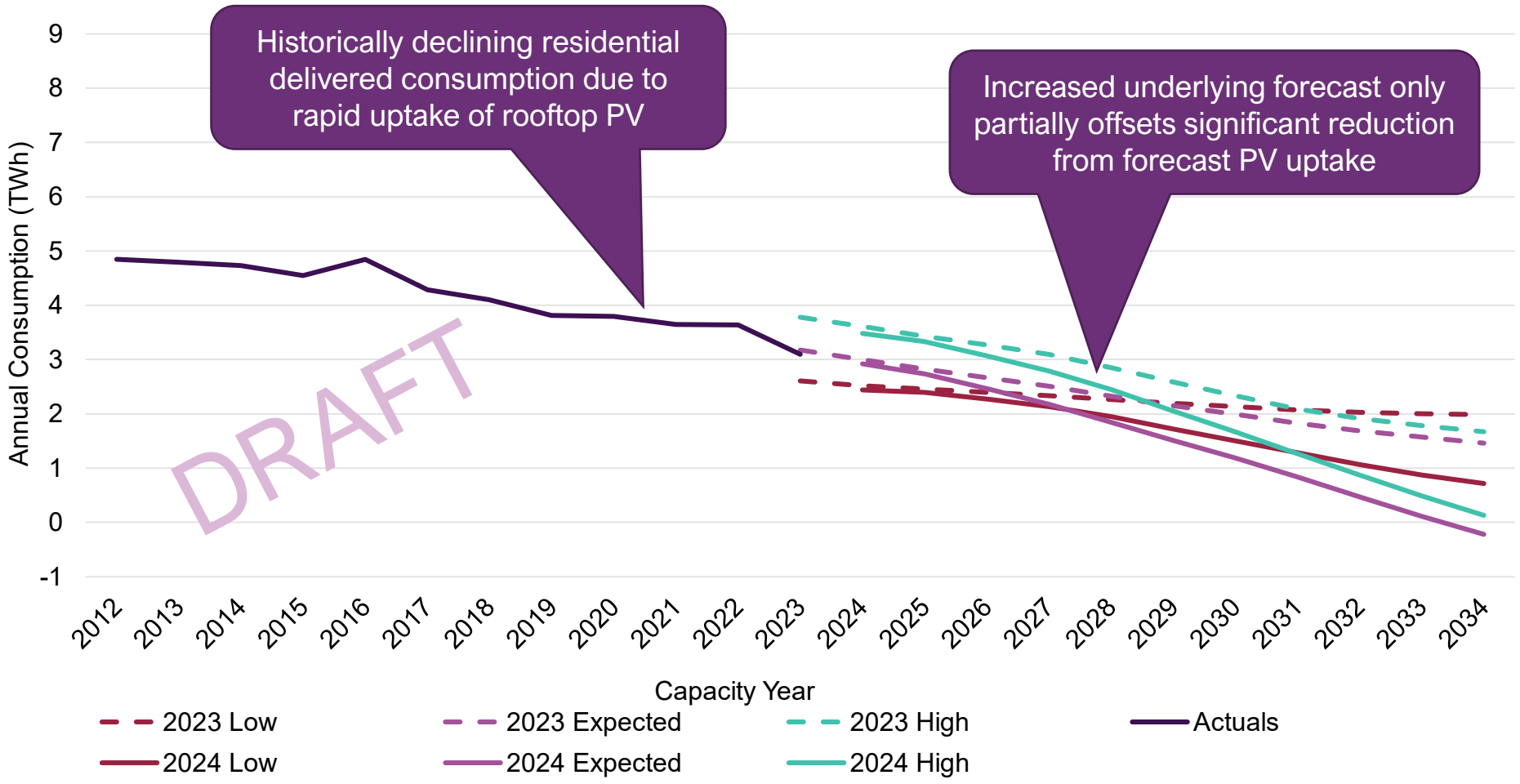
Chart resized to show full *High* scenario



Residential
Underlying

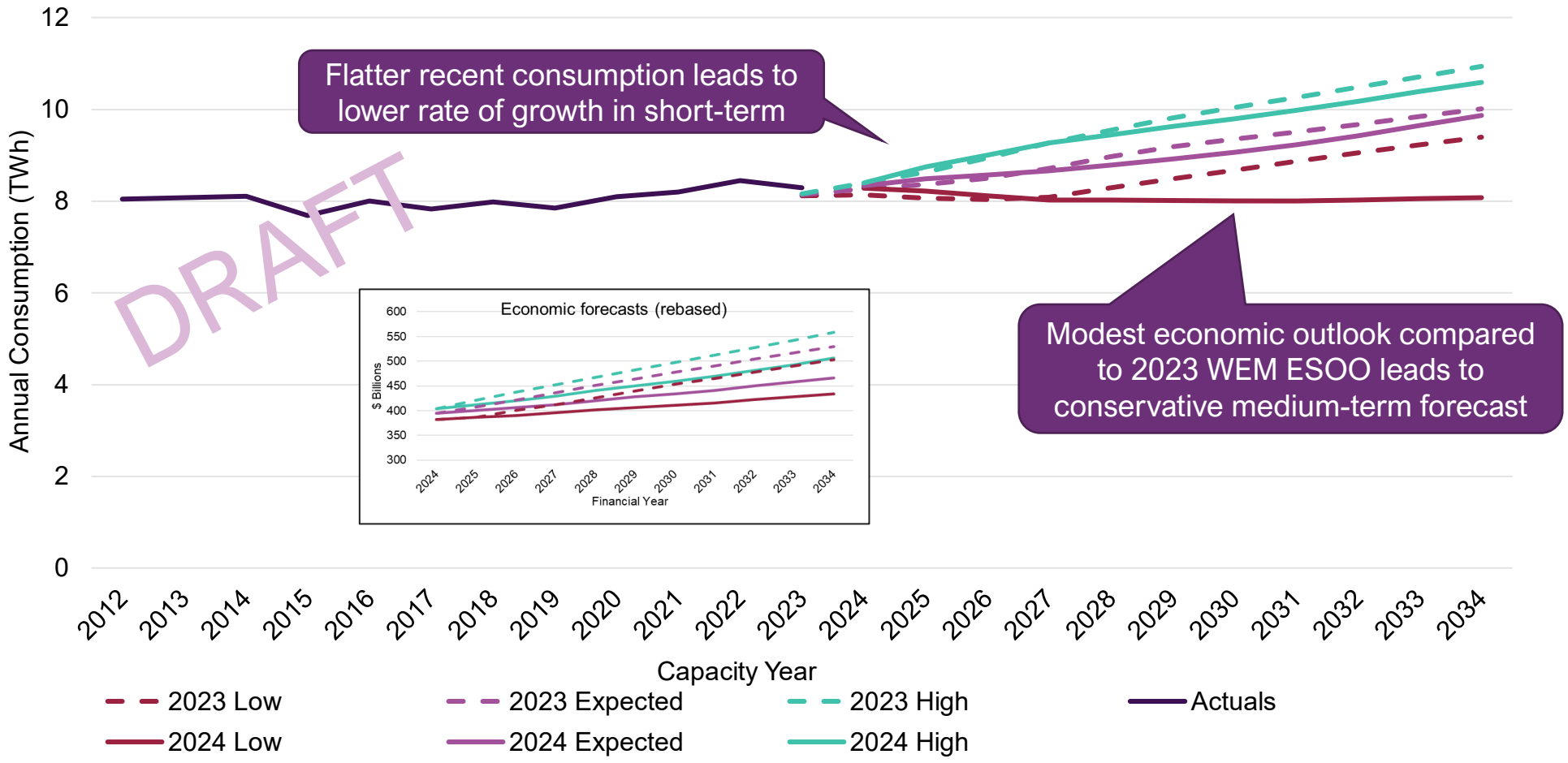


Residential
Delivered



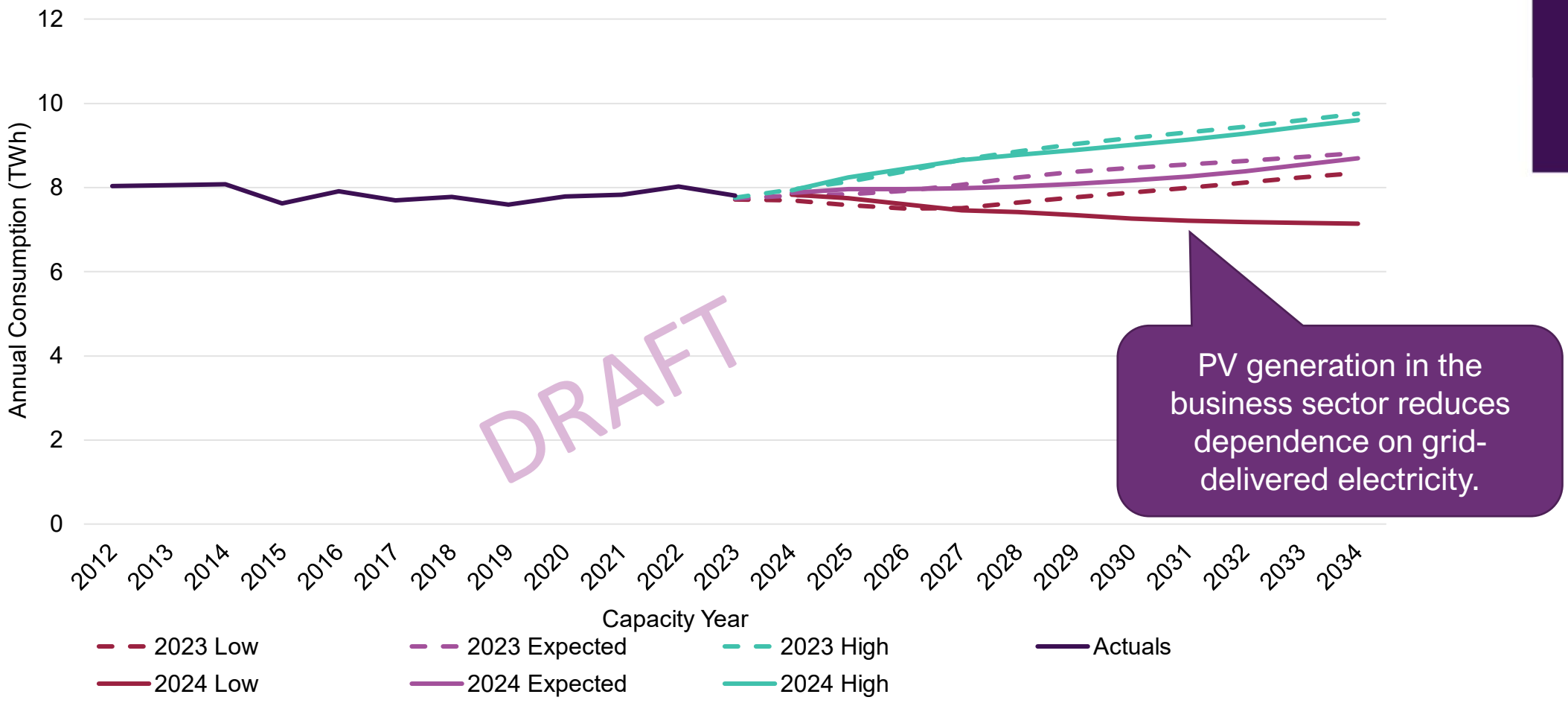
Business Mass Market

Underlying

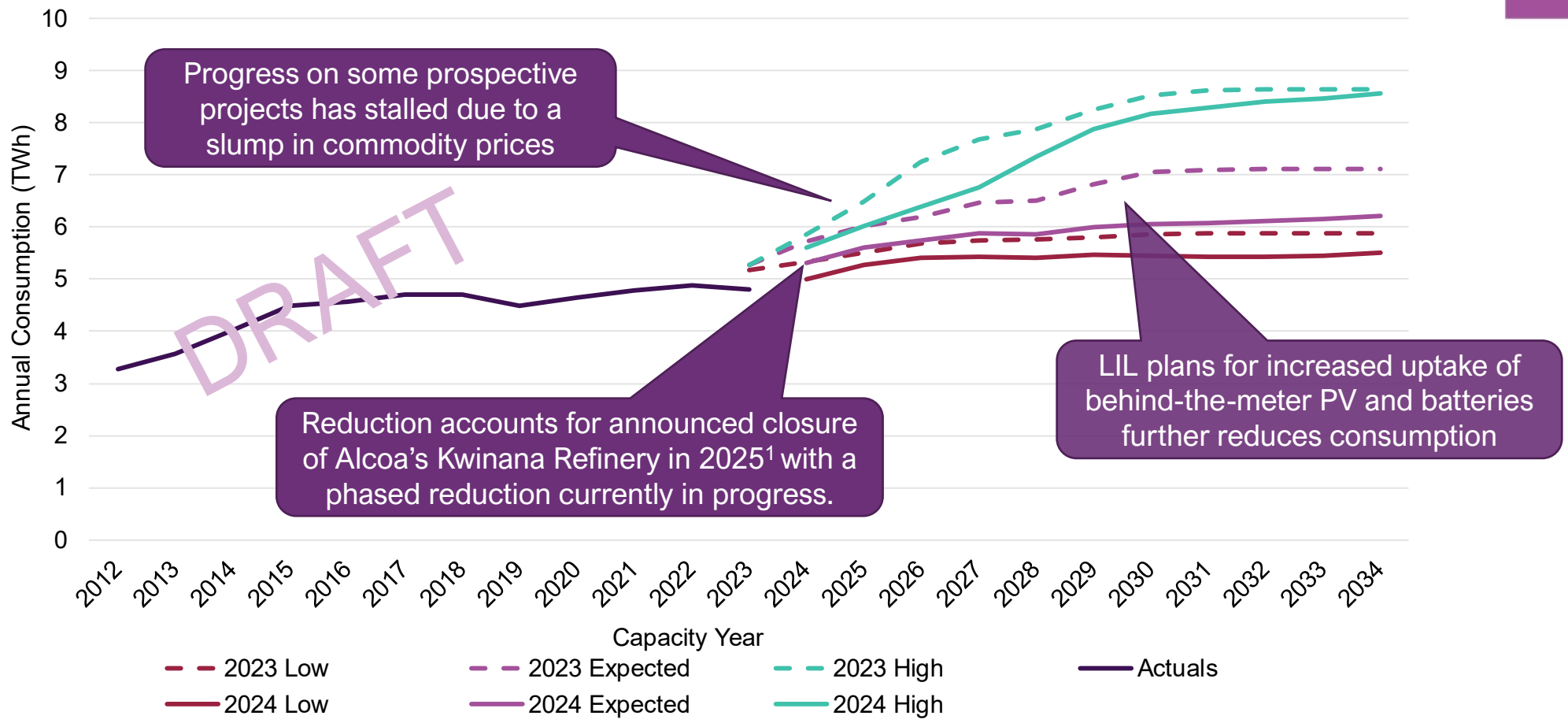


Business Mass Market

Delivered

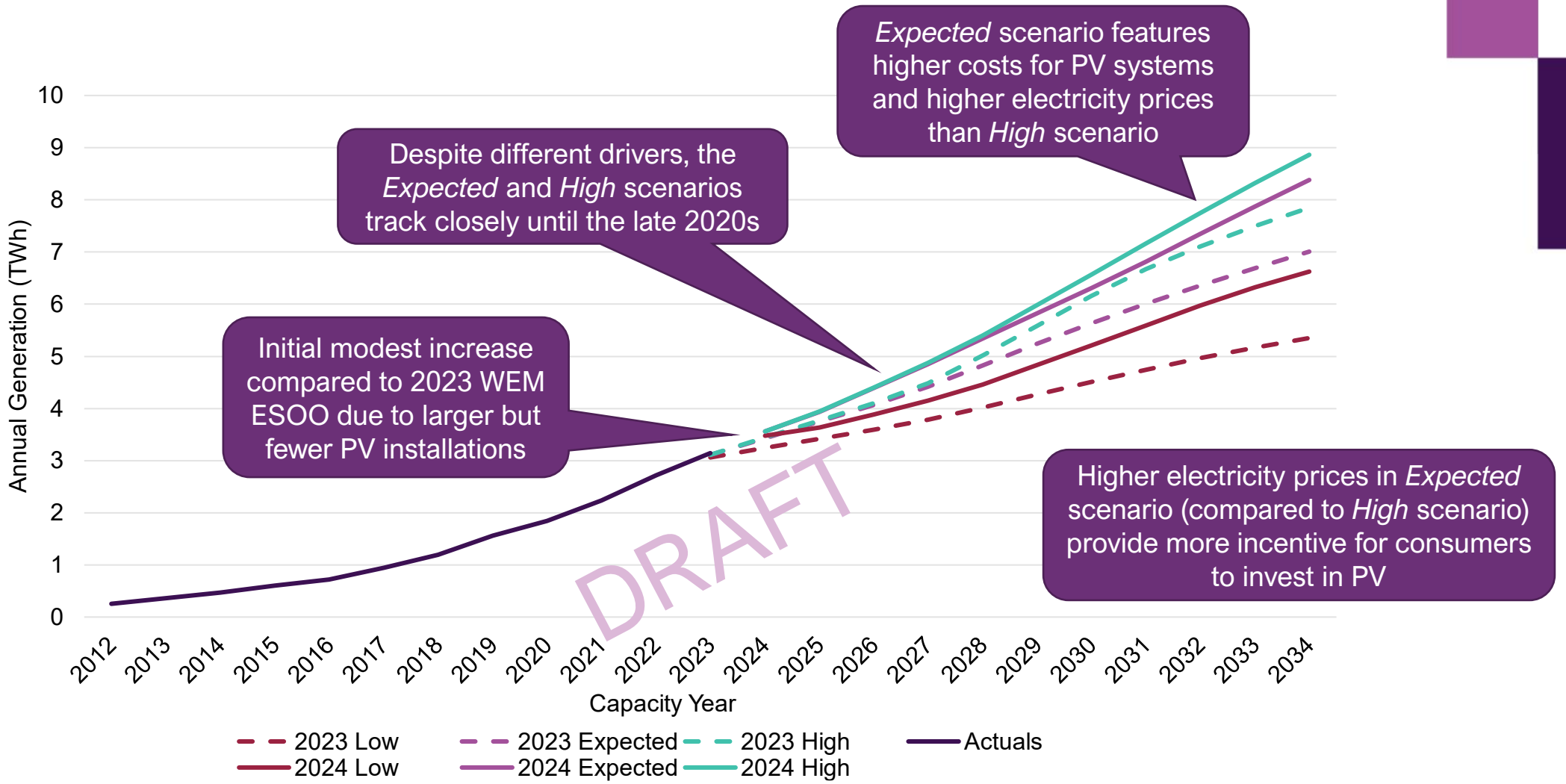


Large Industrial Loads



[1] Refer to https://news.alcoa.com/press-releases/press-release-details/2024/Alcoa-announces-curtailment-of-Kwinana-Alumina-Refinery-in-Western-Australia/default.aspx

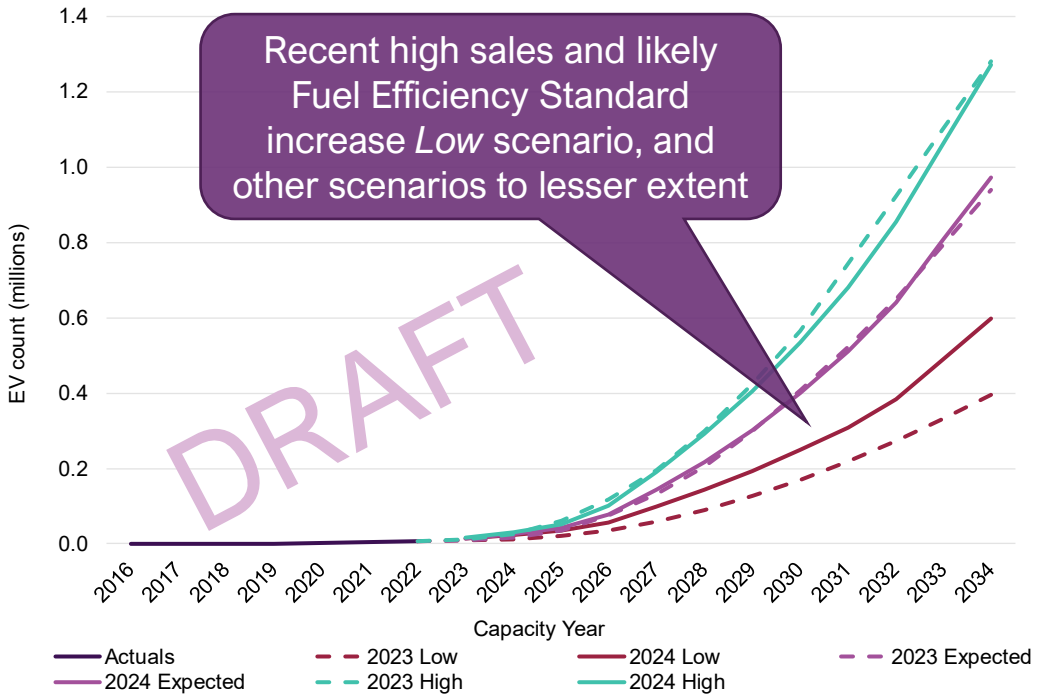
Rooftop PV Generation Forecast



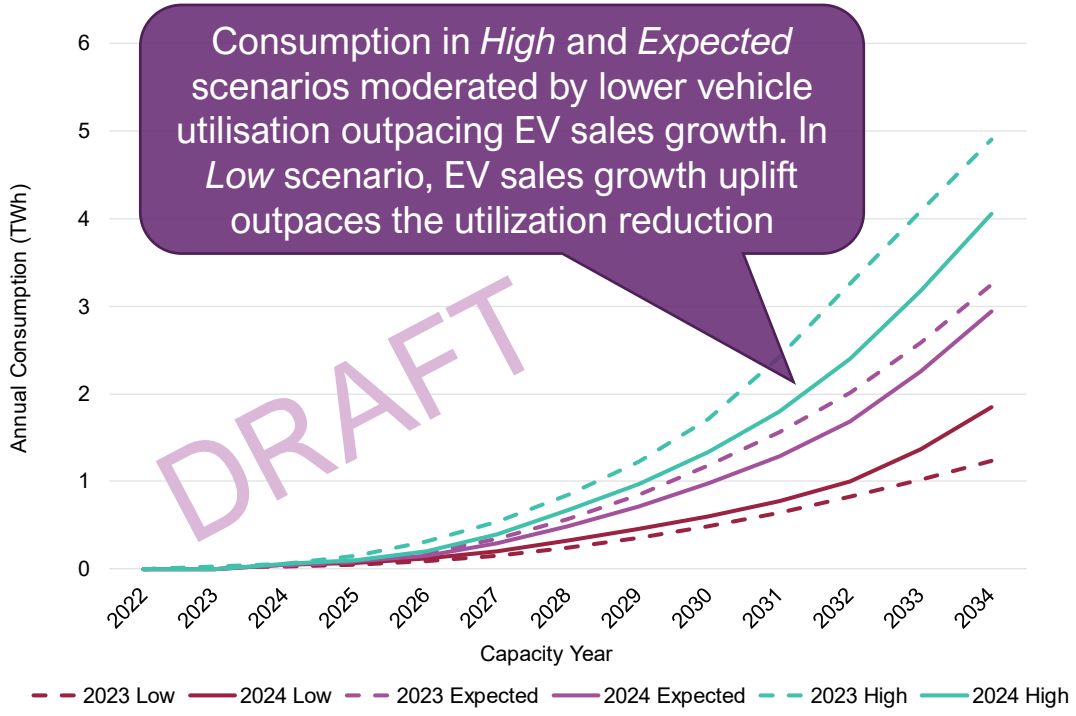
*Refer to Draft 2024 Forecasting Assumptions Update for further information

EV Forecast

EV Numbers



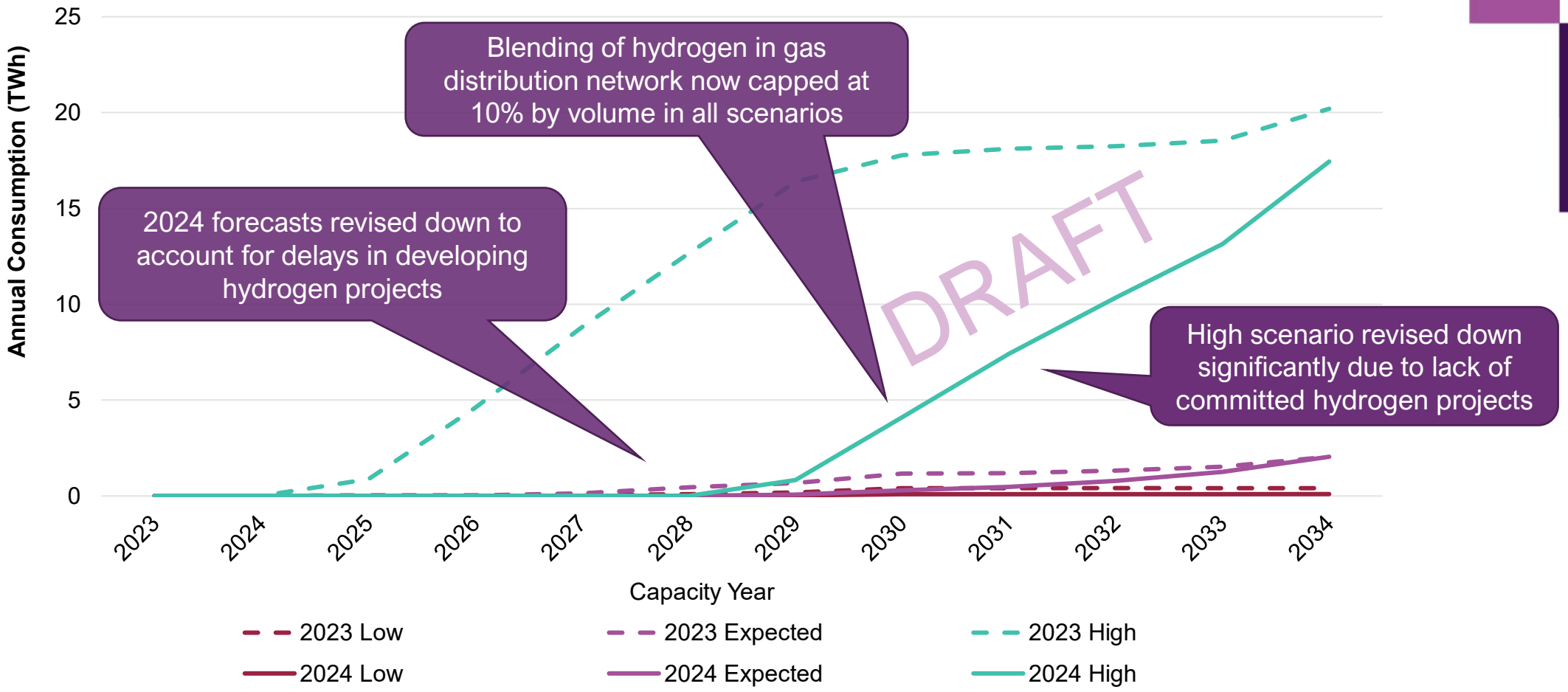
Consumption



Note: CSIRO are currently revising down their forecasts in response to feedback on the Draft 2024 Forecasting Assumptions Update. This will be reflected in the final 2024 WEM ESOO forecast.

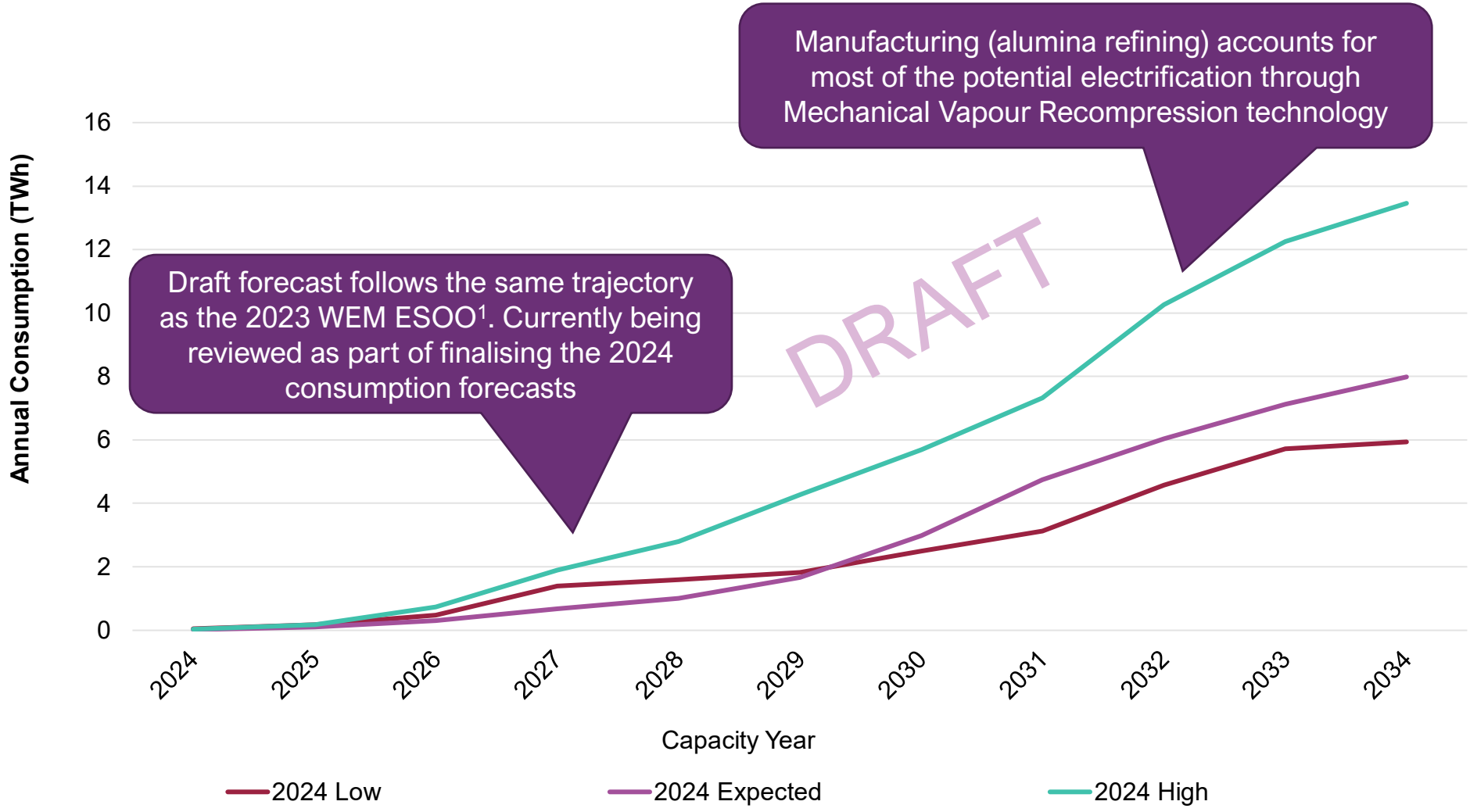
*Refer to Draft 2024 Forecasting Assumptions Update for further information

Hydrogen Production Forecast



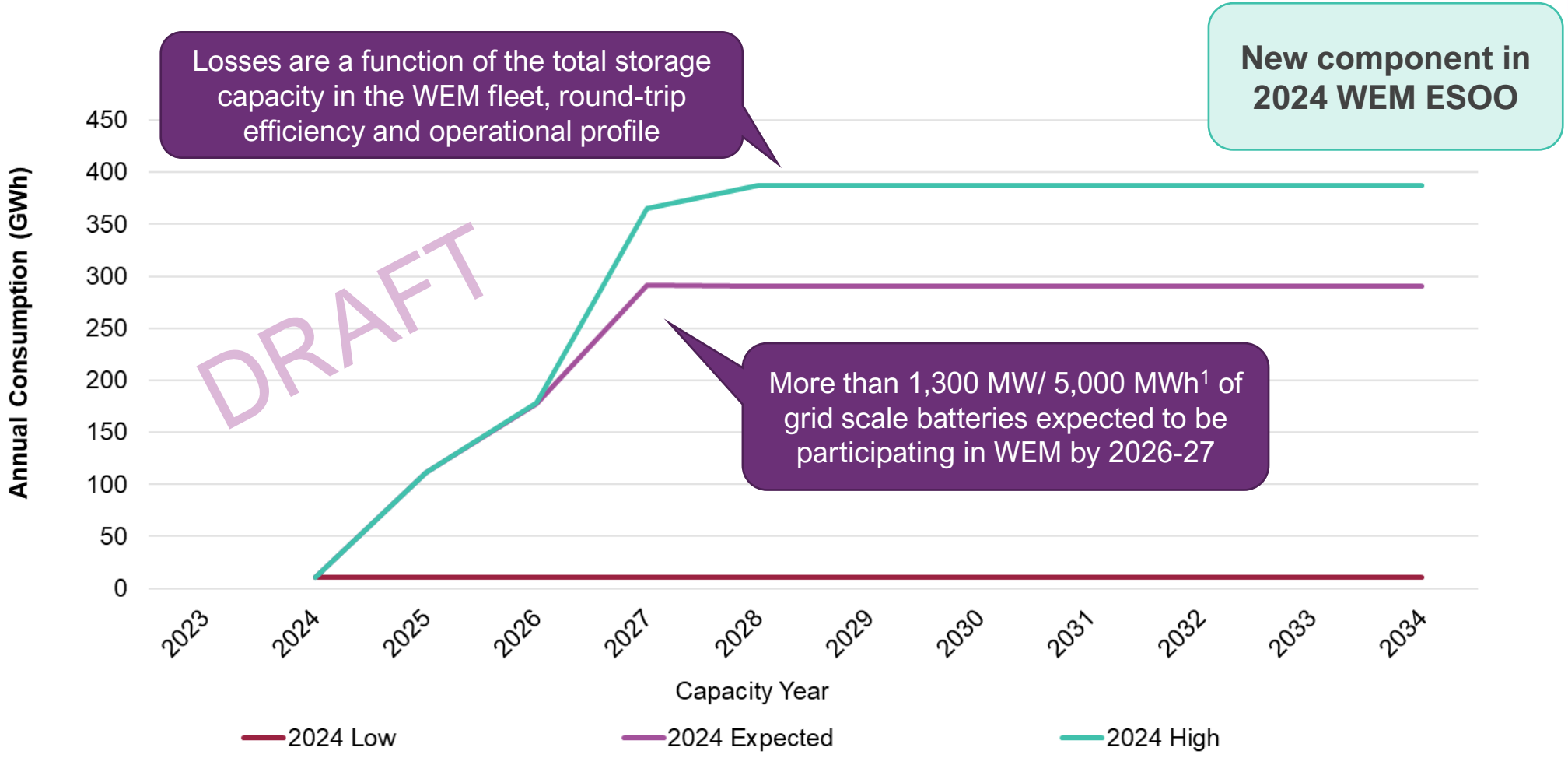
Hydrogen production forecast reflects electricity consumed to run electrolysers to produce 'green hydrogen'

Electrification Forecast



[1] Based on CSIRO and ClimateWorks 2022 Multi-sector energy modelling. Refer to report for further information

Grid Scale Battery Losses Forecast



AEMO will finalise the integration of grid-scale battery losses into Operational Consumption for the Final 2024 WEM ESOO forecast

[1] Battery forecasts are sourced from AEMO and are key inputs into the Reliability Assessment

AEMO is seeking feedback on grid scale battery loss assumptions

New component in 2024 WEM ESOO

Round trip efficiency

AEMO currently models grid scale batteries with **85% round trip efficiency** across all scenarios.

Battery operations

AEMO currently models grid scale batteries as operating **one full cycle** per day across all scenarios.

AEMO welcomes stakeholder feedback on the above battery loss assumptions

Maximum and minimum demand draft forecasts

Summary of draft maximum and minimum demand forecasts for 2024 WEM ESOO

Presented by Leo Ma and Nick Cimdins

Demand Forecasting

Overview

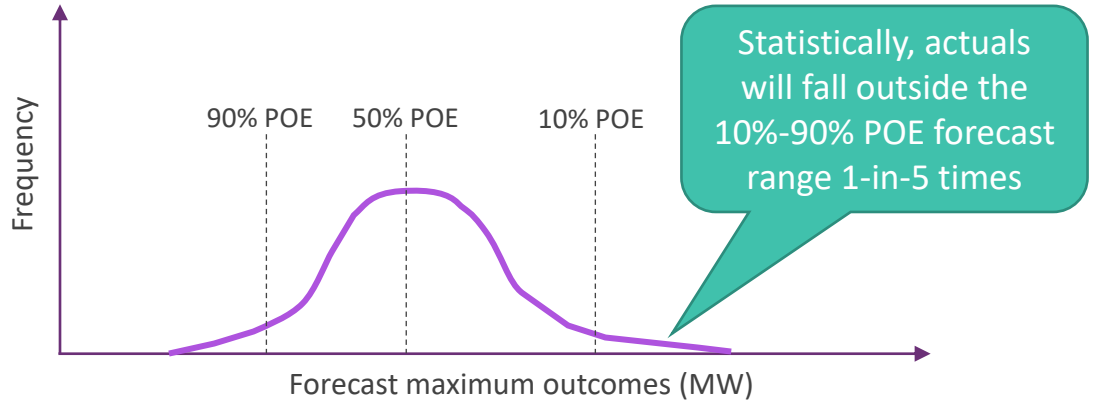
- Maximum and minimum demand forecast definitions
- 2023 WEM ESOO demand forecast performance
- Updates to demand forecasting methodology*:
  - Improvement in model prediction accuracy
  - Discontinue the use of GEV model to rebase the starting point of forecast
  - Post-model adjustment due to extreme weather in 2024
- Draft forecasts
  - Summer max
  - Winter max
  - Annual min

*Refer to Forecasting Approach - Electricity Demand Forecasting Methodology for further information.

Maximum and minimum demand forecasts

Maximum demand is highly dependent on weather (among other things). As the weather outcomes vary year-on-year, a probabilistic model is used and the maximum demand forecast is given as the 10%, 50% and 90% probability of exceedance (POE) values.

- The 10% POE forecast represent a forecast value that only will be exceeded across the season with a probability of 10% or one out of every 10 years.
- Similarly, the 90% POE forecast represent a forecast value that only will be exceeded across the season with a probability of 90%.



AEMO's maximum and minimum demand forecasts represents forecast demand in the absence of:

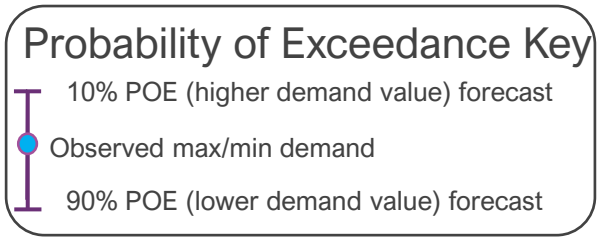
- Unserved energy as result of directed load shedding or significant network outages.
- Demand side participation including any under procured through the Reserve Capacity Mechanism and Supplementary Reserve Capacity.
- Calls for voluntary reduction in demand.

Any such atypical reduction in demand should be considered when comparing with the forecast.

Responses from large loads to the Individual Reserve Capacity Requirement is accounted for in the large industrial load forecast.

2023 WEM ESOO: Forecast accuracy summary

	Winter Maximum	Annual Minimum	Summer Maximum 2023	Summer Maximum 2024
Trading Interval	Monday, 2023-06-26 18:00	Monday, 2023-09-25 12:30	Thursday, 2023-03-02 16:00	Monday, 2024-02-19 17:30
Temperature (°C)*	10.1	19.8	31.6	35.1
Daily max temperature (°C)	14.4	20.6	36.9	42.3
Daily min temperature (°C)	4.1	9.7	23.9	27.5
Operational sent out (OPSO) (MW)	3,657	600	3,682	4,315 (4,160 OPSO + 155 load reduction)**
Large Industrial Load (LIL) (MW)	547	485	502	303
10% POE (MW)	3,557	636	4,112	4,254
50% POE (MW)	3,395	585	3,847	4,003
90% POE (MW)	3,255	536	3,606	3,736



The winter of 2023 was not particularly cold, but the actual maximum demand was above 10% POE. The model had under-forecasting bias, which have been improved in ESOO 2024

The minimum demand occurred on a Monday, slightly lower than the second lowest day on a Sunday. Besides the mild weather and ample PV generation, the relatively low LIL is also a key driver

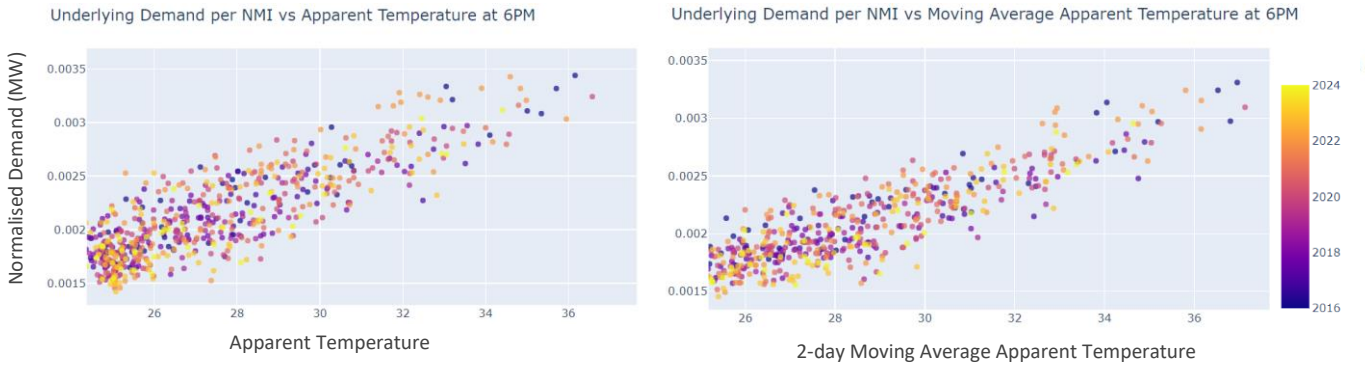
2023 summer was mild, with the daily maximum temperature on the day of max demand reaching only 36.9 °C. It fall near 90% POE

The estimated actual demand exceeded the 10% POE. This is expected because 2024 was extremely hot.

** Temperatures were recorded by Perth Metro Weather Station.*
4,160 MW was estimated based on non-loss adjusted sent out 30-mins SCADA data.* ***The load reduction value is an estimate, subject to change

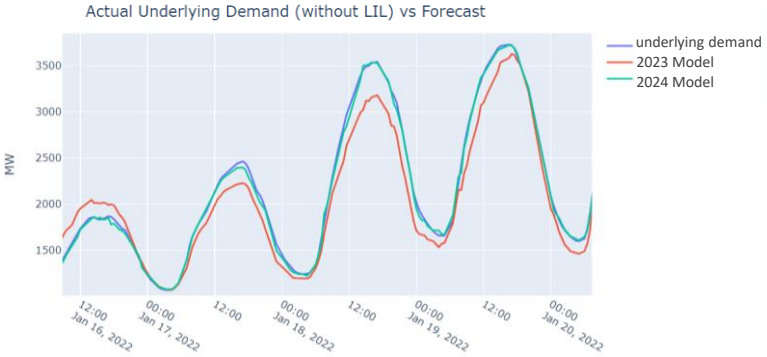
2024 WEM ESOO model change

1. Linear regression model is replaced with a more complex machine learning model
2. Added the apparent temperature, lag variables and heatwave variables

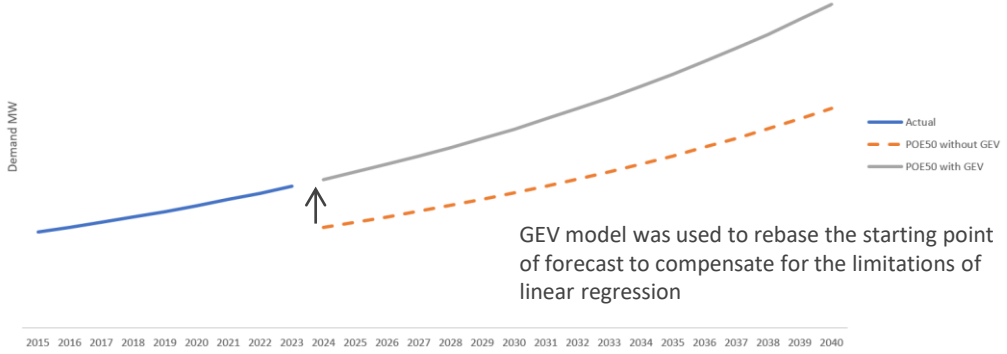


Overall test set prediction metric

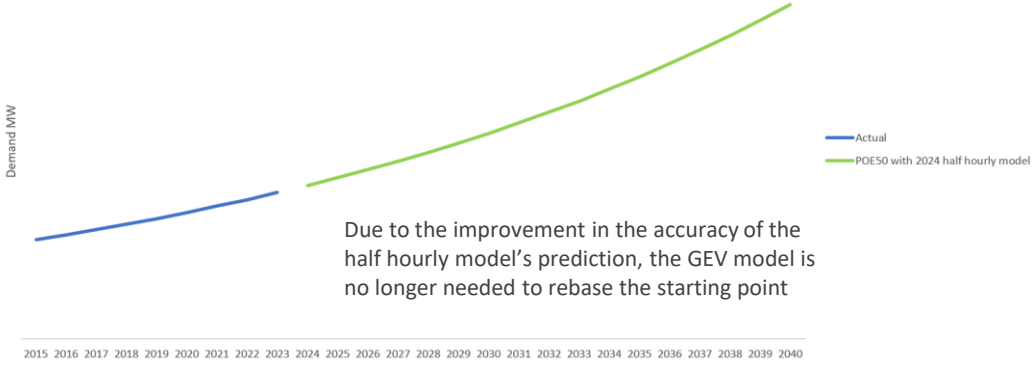
	MAPE	MAPE Top 10%	MAPE Bottom 10%
2023 Model	5.05%	6.48%	4.94%
2024 Model	2.17%	1.66%	1.64%



3. Discontinued GEV (Generalized Extreme Value) model



GEV model was used to rebase the starting point of forecast to compensate for the limitations of linear regression



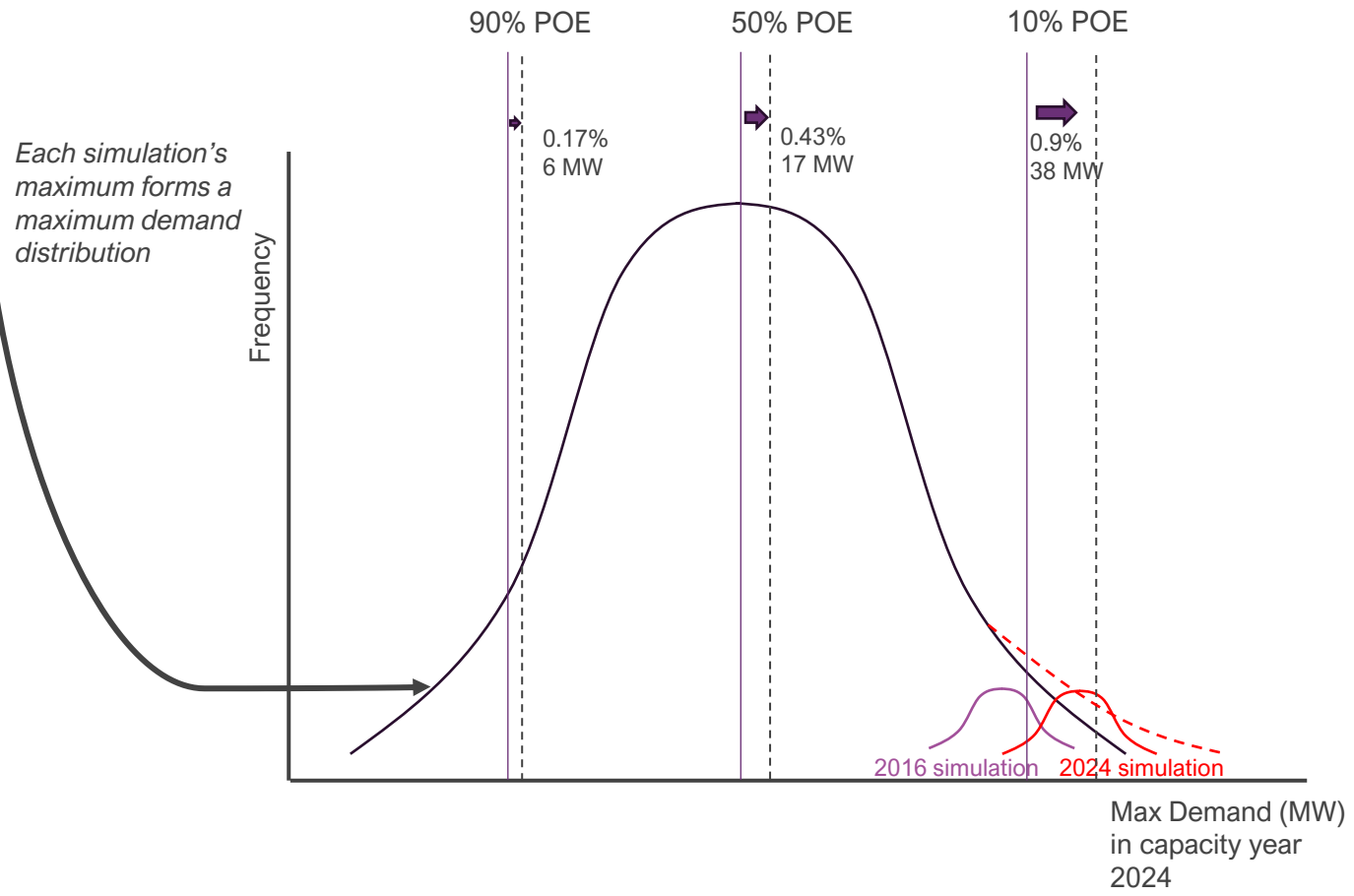
Due to the improvement in the accuracy of the half hourly model's prediction, the GEV model is no longer needed to rebase the starting point

2024 WEM ESOO Post-Model Adjustment

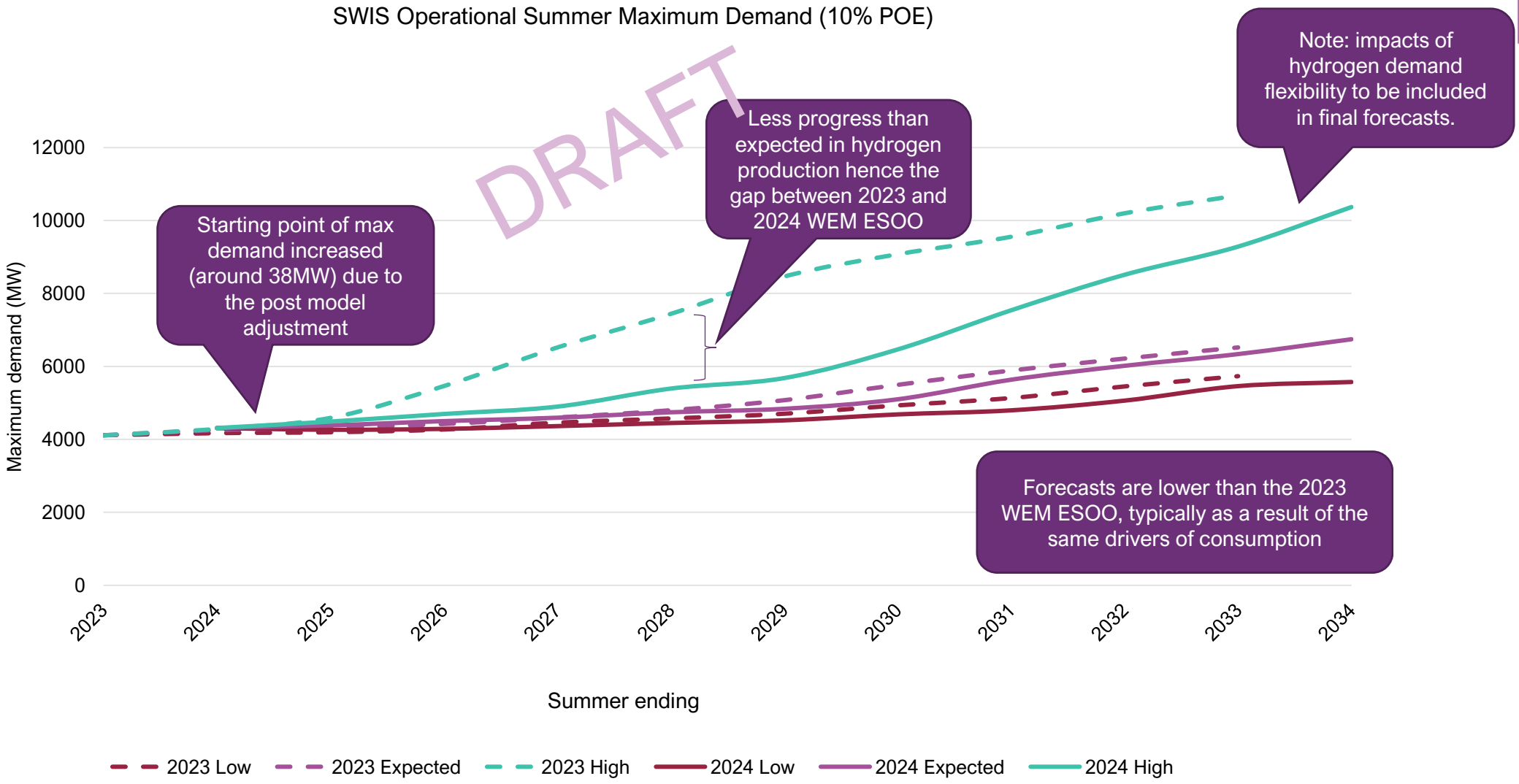
2024 WEM ESOO model is unable to incorporate data from 01/01/2024 due to lack of PV estimates from external consultant, alternative methodology has been developed to consider peak demand events in Summer 2023-24.

Number of Reference Year	15
Number of Dayshift	7
Number of Residual	30
Number of Total Simulations	3150

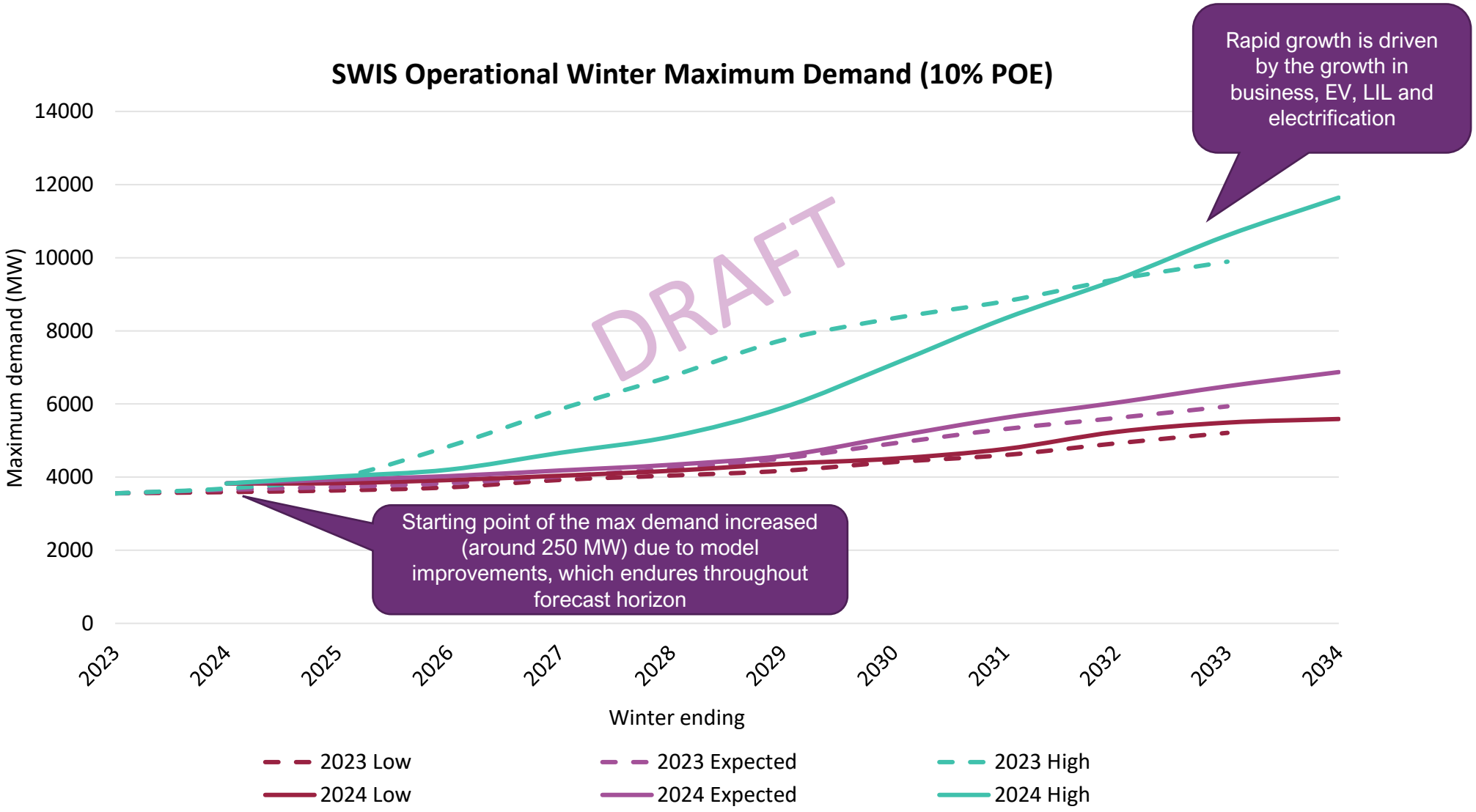
- Using a reference year with similar weather on peak demand day, shift and calibrate its distribution so that its median equals 2024 actual maximum demand, to approximate a 2024 distribution.
- Adding this newly created distribution back to the original distribution will elongate the right tail.
- After recalculating the POE, the increase in 10% POE will be greater than that of the 50% and 90%, as the 2024 simulation mainly impacts the extreme values on the right side of distribution.



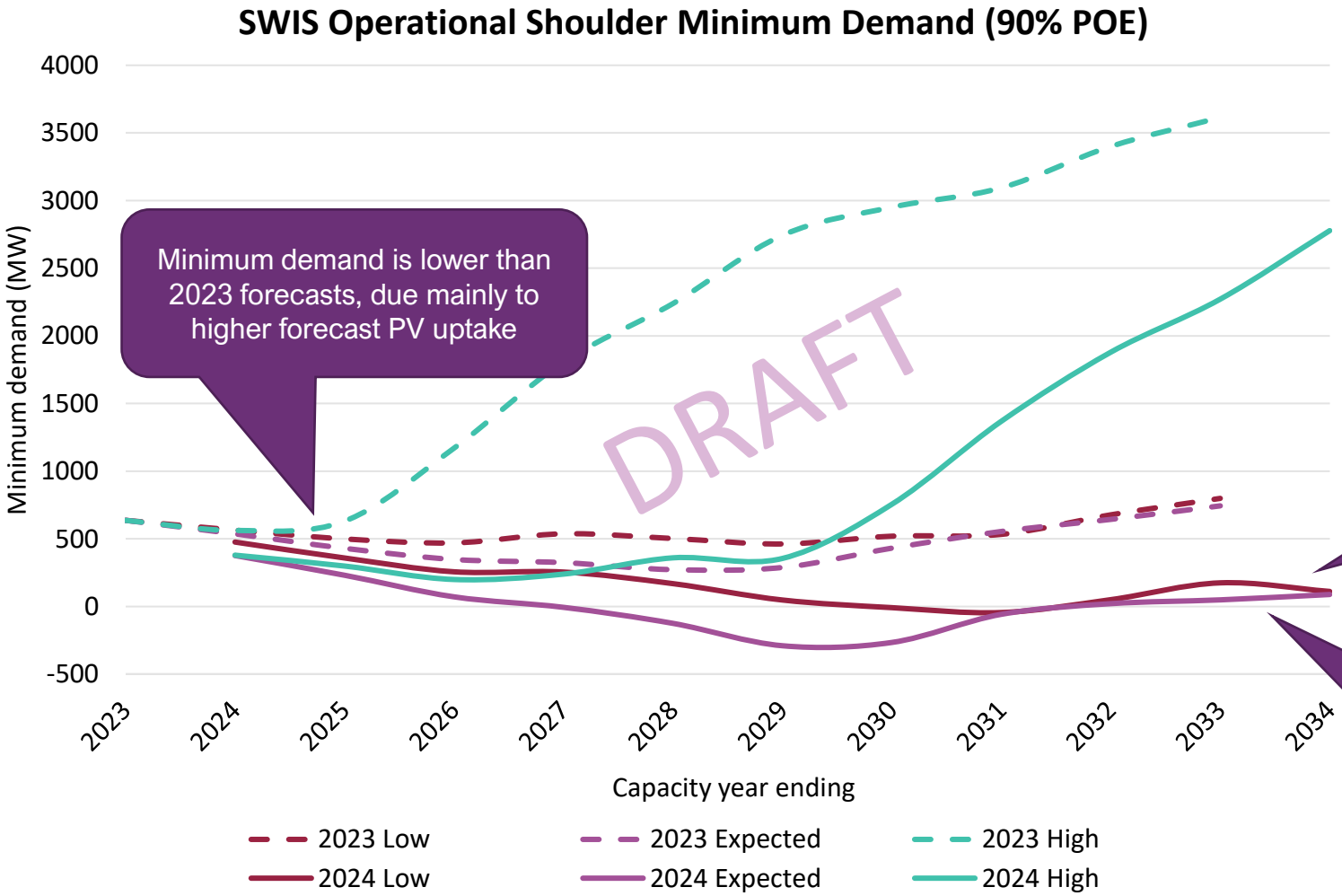
Draft maximum demand forecast: Summer



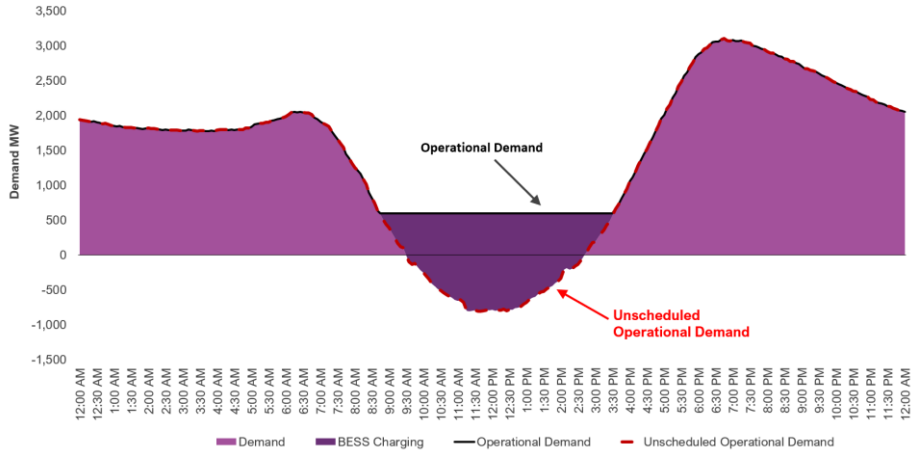
Draft maximum demand forecast: Winter



Draft minimum demand: Annual



Minimum demand is lower than 2023 forecasts, due mainly to higher forecast PV uptake



**This graph is just for illustration and shows a perfect battery charge to maintain 500 MW operational demand.*

Min demand increases after 2029 due to the rapid growth in underlying demand (EV, electrification)

Forecast demand below zero represents "unscheduled" demand, i.e. it does not include the impacts of charging utility scale storage or any services to add additional demand