2021 NEM
Draft Consumption Forecasts

29 May 2021 FRG Meeting

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www.Sli.do #FRG

Acknowledgement of Country

In the spirit of reconciliation, AEMO acknowledges the Traditional Custodians of country throughout Australia and their connections to land, sea and community. We pay our respect to their elders past and present and extend that respect to all Aboriginal and Torres Strait Islander peoples today.

Background and Purpose

- The purpose of today's presentation is to share and discuss the draft 2021 electricity consumption forecast, a key input of the 2021 ESOO
- Today's agenda includes:
  - Definitions
  - Modelling inputs and methodology
  - Outlook and key drivers
  - Sources of risks and variability
  - Discussion

Timing	Electricity Consumption Forecasts	Responsible
May 2020	Last time this was discussed at FRG	AEMO
Feb - May 2021	FRG discussions on various inputs	AEMO, Consultants & Participants
Today	**Discussion on 2021 forecasts**	**AEMO**
June FRG	Maximum and minimum demand Additional electrification from multi-sectoral modelling	
July 2021	ESOO Released	AEMO

This presentation does not include the impacts of Multi-sector electrification

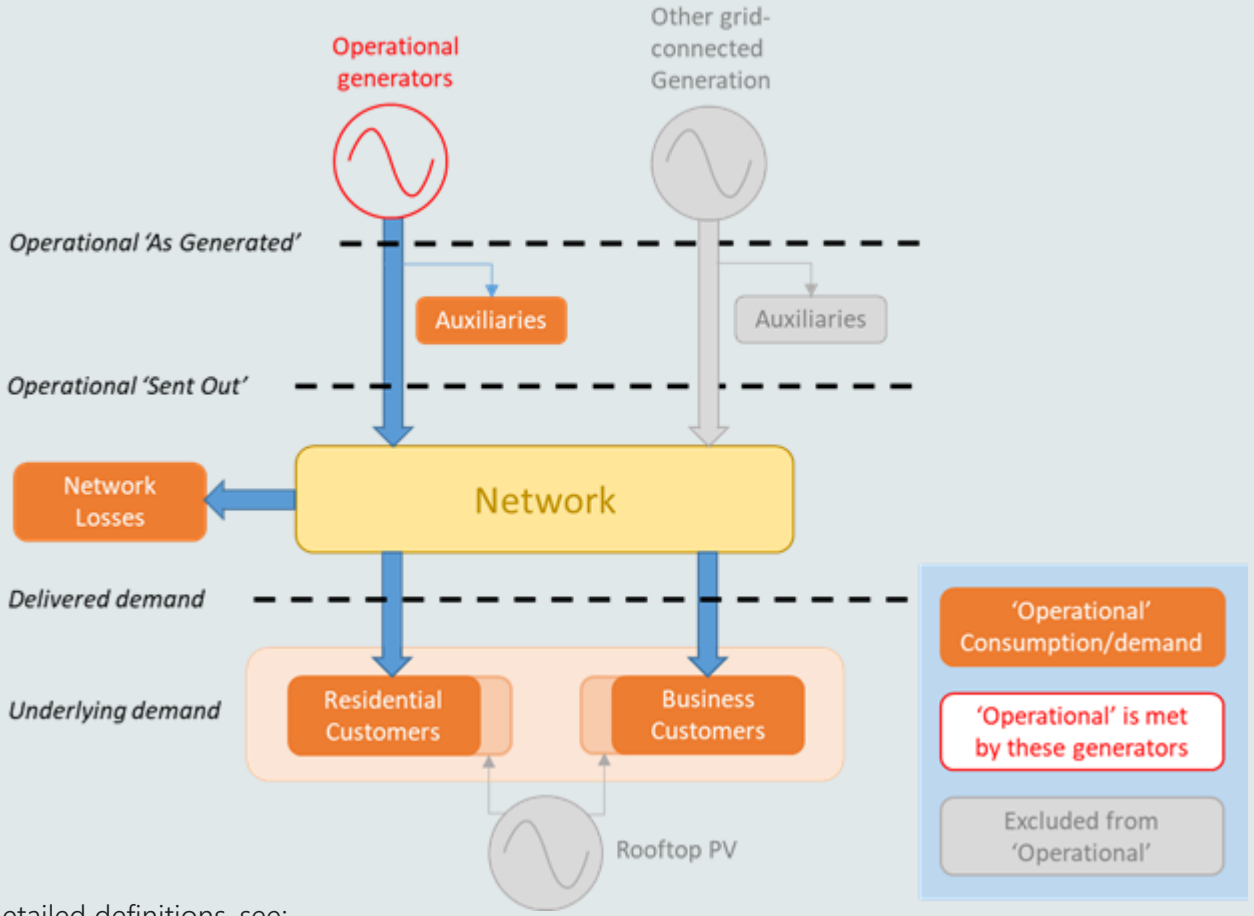
Understanding the language of forecasting electricity consumption

Key forecasting definitions in use today:

- **Underlying Demand:**
  - Underlying demand is the "power point" demand of consumers, irrespective of where that power is generated (from the grid or within the home).
- **Delivered Demand:**
  - Delivered demand is the demand that is met from the transmission grid, net of any distribution-generated energy such as rooftop PV
- **Operational Demand**
  - What is consumed by consumers, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

Key demand measurement points:

- **"Sent Out"**
  - Electricity supplied to the grid by scheduled, semi-scheduled and significant non-scheduled generators (excluding auxiliary loads)
- **"As Generated"**
  - As per Sent Out, but including auxiliary loads (that load which is used within a power station)



For detailed definitions, see: https://www.aemo.com.au/-/media/files/electricity/nem/security_and_reliability/dispatch/policy_and_process/2020/demand-terms-in-emms-data-model.pdf?la=en

To contribute, see: www.Sli.do Event code #FRG

AEMO scenario settings

Scenario	Slow Change (formerly Slow Growth)	Steady Progress (formerly Current Trajectory)	Net Zero 2050	Step Change (formerly Sustainable Growth)	Hydrogen Superpower (formerly Export Superpower)
Economic growth, population outlook and connections growth	Low	Moderate	Moderate	Moderate	High
Energy efficiency improvement	Low	Moderate	Moderate	High	High
DSP growth	Low	Moderate	Moderate	High	High
Distributed PV	Moderate, but elevated in the short term	Moderate	Moderate	High	High
Battery storage installed capacity	Low	Moderate	Moderate	High	High
Battery storage aggregation / VPP deployment	Low	Moderate	Moderate	High	High
Battery Electric Vehicle (BEV) uptake	Low	Moderate	Moderate	High	Moderate/High
BEV charging time switch to coordinated dynamic charging	Low	Moderate	Moderate	High	Moderate/High
Electrification of other sectors (expected outcome)	Low	Low/Moderate	Moderate	Moderate/High	High
Hydrogen consumption	Minimal	Minimal	Potential for domestic consumption	Potential for domestic consumption	Large NEM-connected export and domestic consumption

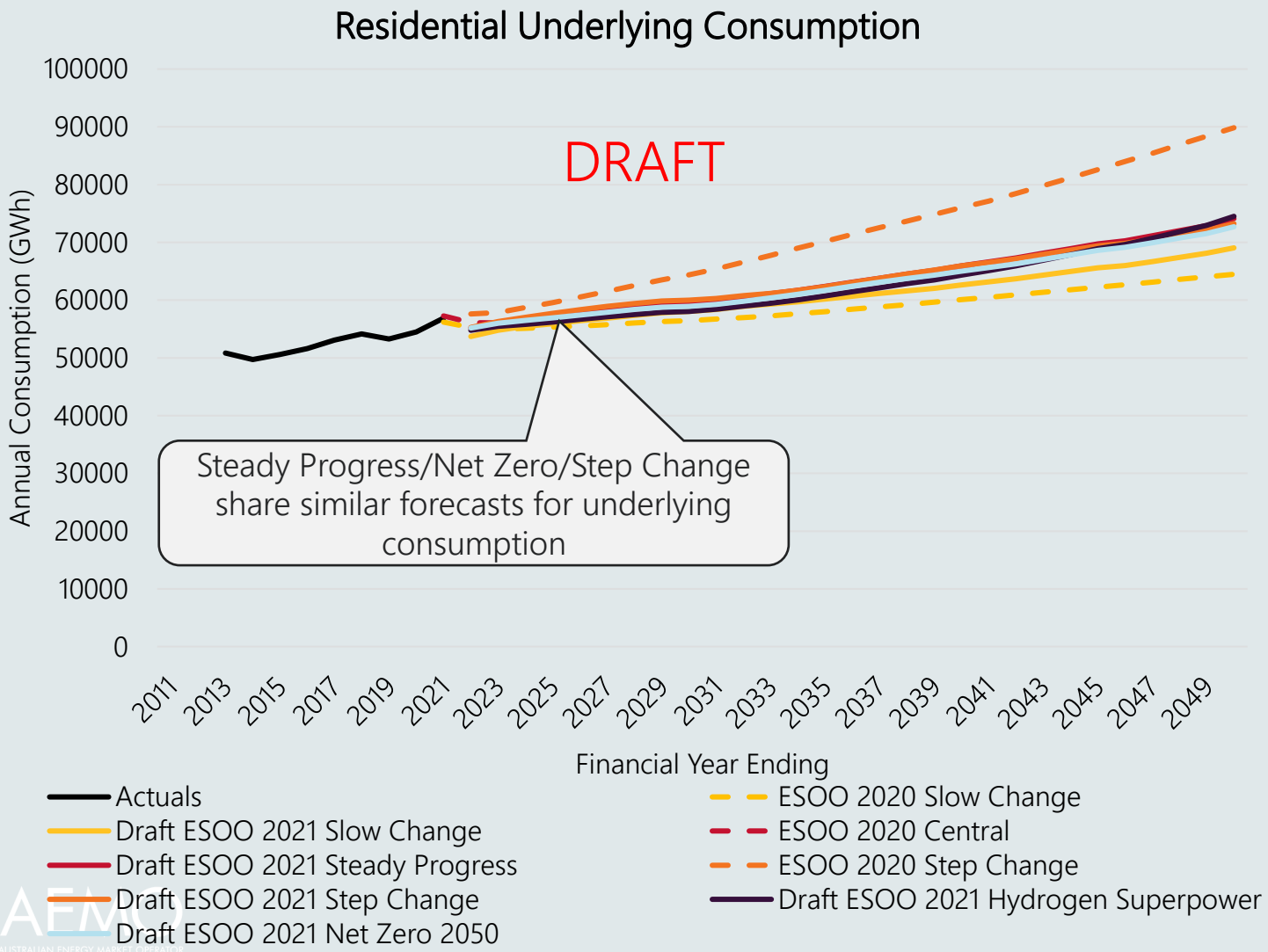
Forecast Input Status

Forecast Input Component	FRG Reference	Status
Connections	Presentation 1 31st March 2021	No Change. Presented again in Appendix.
Price Index	Presentation 1 31st March 2021	No Change. Presented again in Appendix.
Energy Efficiency	Presentation 3 28th April 2021	Finalised. Presented today.
Appliance Index	Presentation 2 5th May 2021	Updated. Incorporated in Residential forecast.
PV Generation	Presentation 1 and 2 28th April 2021	Complete. Presented today
GSP and Population	Presentation 1 24th February 2021	No change. Presented again in Appendix
LNG		Drafted. Presented today
Hydrogen Electricity Impact	Presentation 3 5th May 2021 (and June 2021 FRG)	Under development
Electrification	Presentation 3 5th May 2021 (and June 2021 FRG)	Under development
Large Industrial Load Outlook	Presentation 1 5th May 2021	Interviews wrapping up. Draft forecasts presented today.
EV	Presentation 2 28th April 2021	No change. Presented today

Today's forecast presentation will provide an overview of the impacts of all the consulted inputs except for electrification and hydrogen.

Forecasts

Residential: scenario spread reduces due to countervailing connections and energy efficiency drivers across scenarios



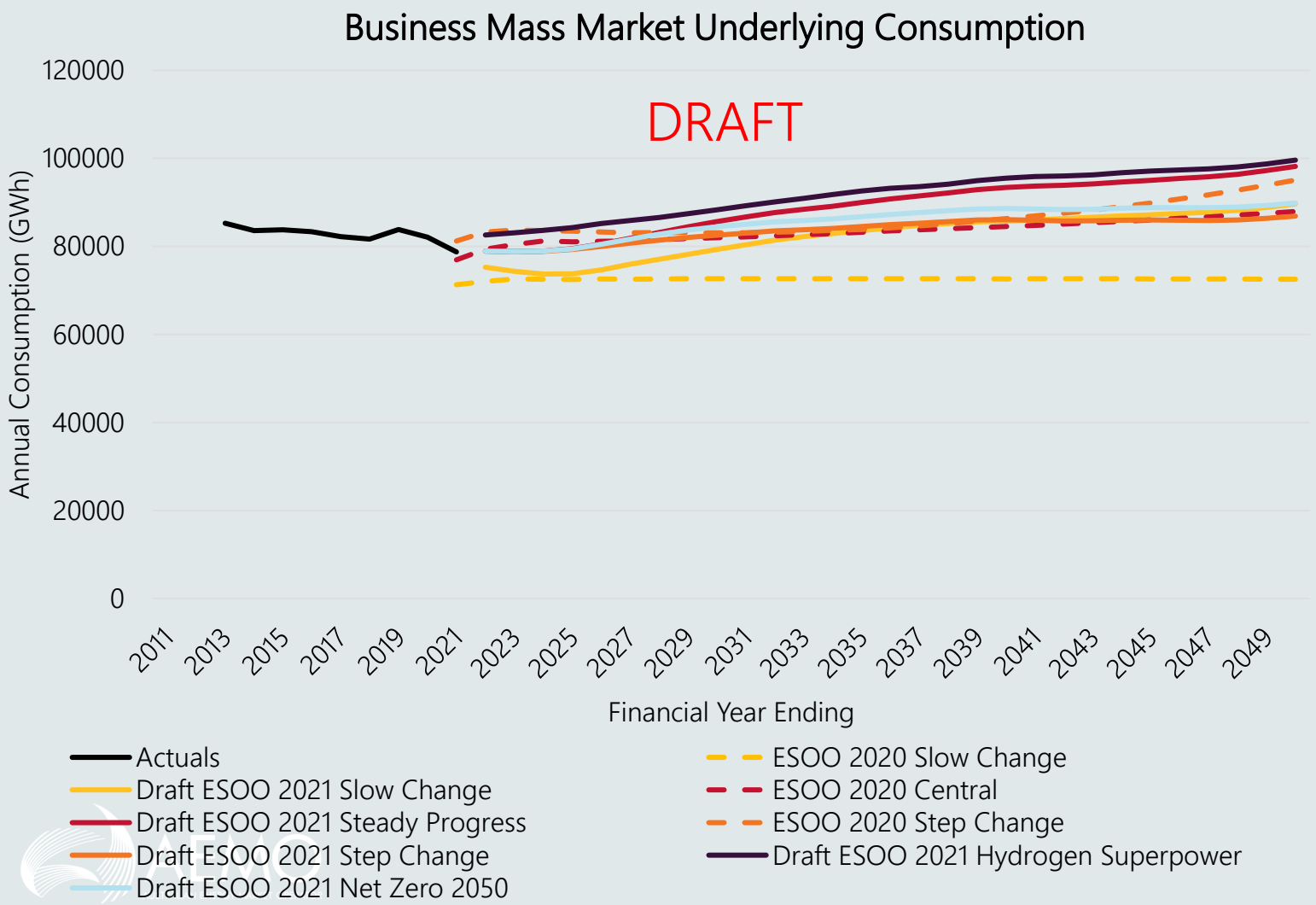
- The connections forecast is higher for Steady Progress/Net Zero/Step Change compared to the 2020 Central scenario and higher for the 2021 Slow Change compared to the 2020 Slow Change (see Appendix Slide 23).
- This year's energy efficiency impacts are the strongest in the 2021 Hydrogen Superpower scenario compared to the other scenarios with the 2021 Slow Change scenario having the lowest impact (see Appendix Slides 24-26).
- The net result is a decrease in dispersion, although the scenarios contain these different drivers.

Business Mass Market and Energy Usage

- In 2016 AEMO began reporting[1] that the Australian economy has been restructuring away from energy-intensive manufacturing and has been modelling business energy use by sector, in order to best capture and account for these changes.
- AEMO has continued to refine the sectorial splits with the 2020 ESOO forecast, separating out Business Mass Market (formally labelled SME) load from the large industrial loads from AEMO's non-residential meter data to better identify trends from smaller users of energy. From 2020, AEMO has applied an energy intensity based approach (GWh /$GSP) that measures the long term decline in energy usage, against economic activity in its forward projections to capture this structural shift.
- This long-term model is combined with a monthly time-series model to improve short-term accuracy.
- There remains an uncertainty as to the composition of the economy in 2050, and the effect it will have on the long-term energy intensity outlook.
- In 2021 AEMO engaged CSIRO/Climate Works to assist with understanding and capturing sectorial energy usage, including electrification, to further refine the long term energy intensity of the Australian Economy for each scenario.

1 Refer to page 5 of the 2016 *AEMO National Electricity Forecast Report* https://www.aemo.com.au/Electricity/National-Electricity-Market-NEM/Planning-and-forecasting/-/media/080A47DA86C04BE0AF93812A548F722E.ashx

Business Mass Market Forecast reflects updated Energy Efficiency and economic outlook

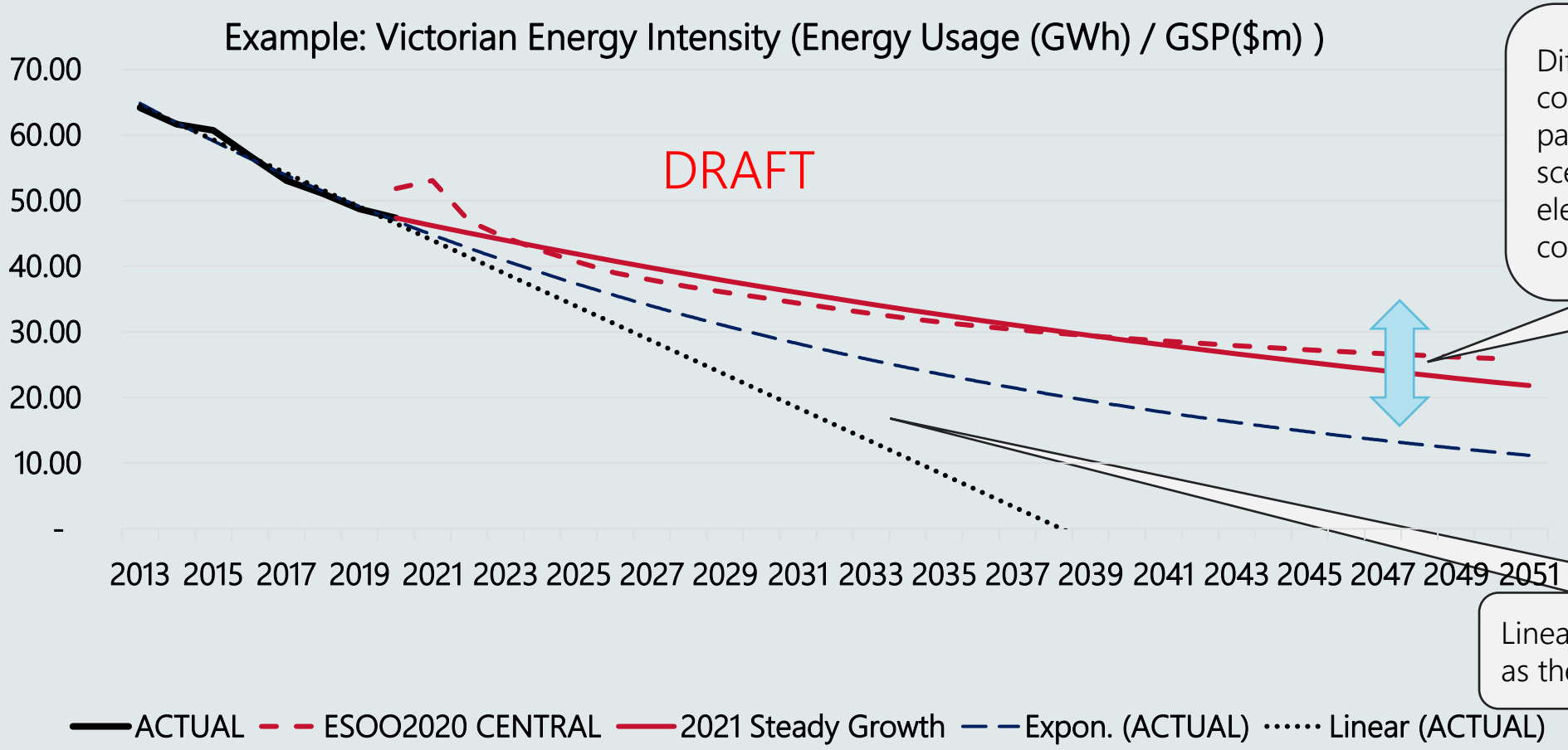


Since the 2020 ESOO:

- Lower energy efficiency (EE) forecast due to reduction in anticipated savings, electrification impact of EE policies, accounting for overlaps of savings between policies, and reconciliation of market-led and policy-driven EE.
- Long term economic forecasts are stronger and Covid-19 shock factors have been removed from all scenarios.
- Short term trend model updated to use monthly times-series data (from annual) improving short-term accuracy.
- Net effect is a slightly highere outlook for 2021 Steady Progress compared to the 2020 Central.

Long-term energy intensity assumptions may change across scenarios following insights from upcoming electrification forecasts

Business Mass Market: What other factors should AEMO consider for long term energy intensity?

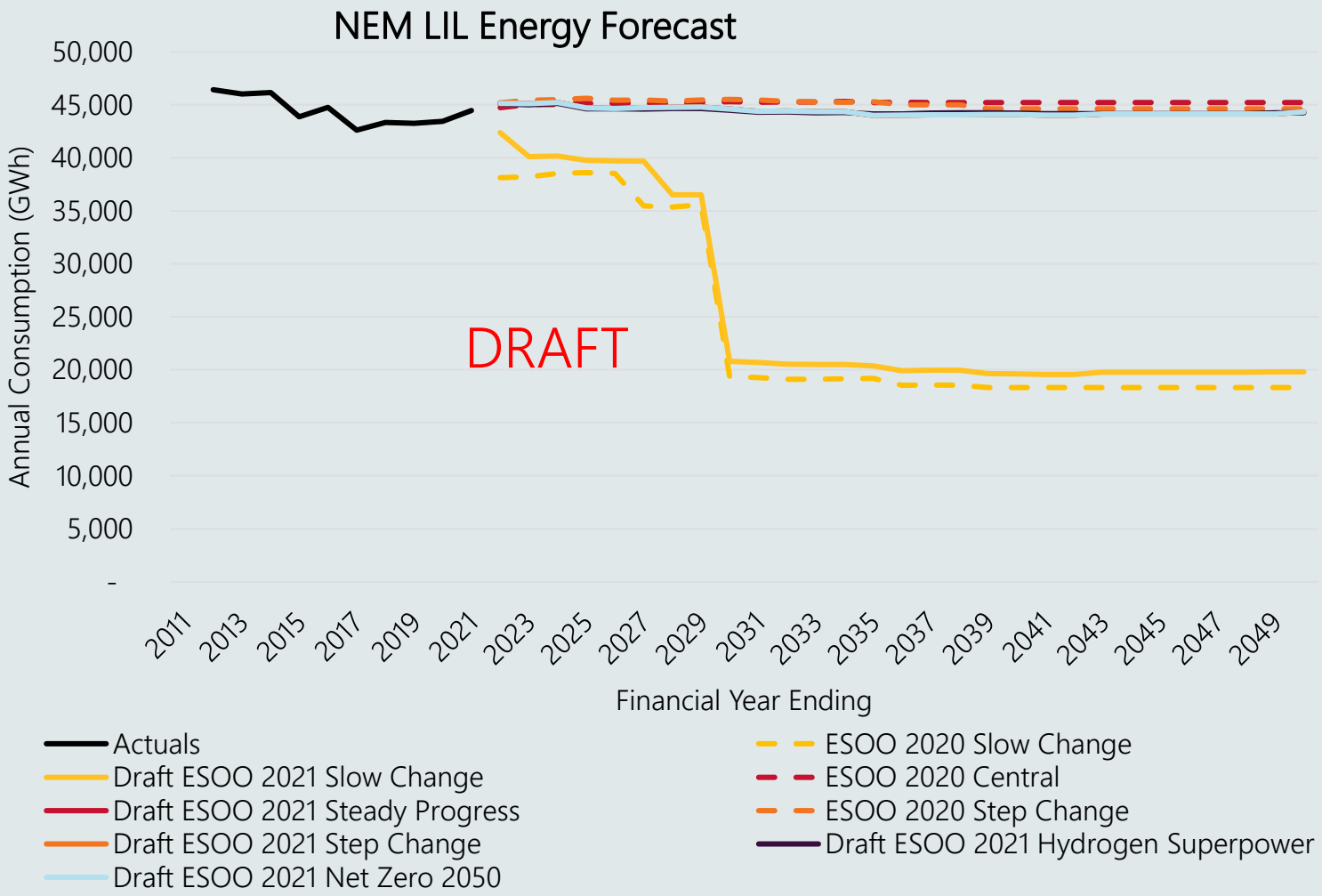


Different structural rate changes could alter the trajectory and pace of change, differing across scenarios depending on rates of electrification and sectorial composition.[1]

Linear decline unlikely over long term, as the structural changes stabilize

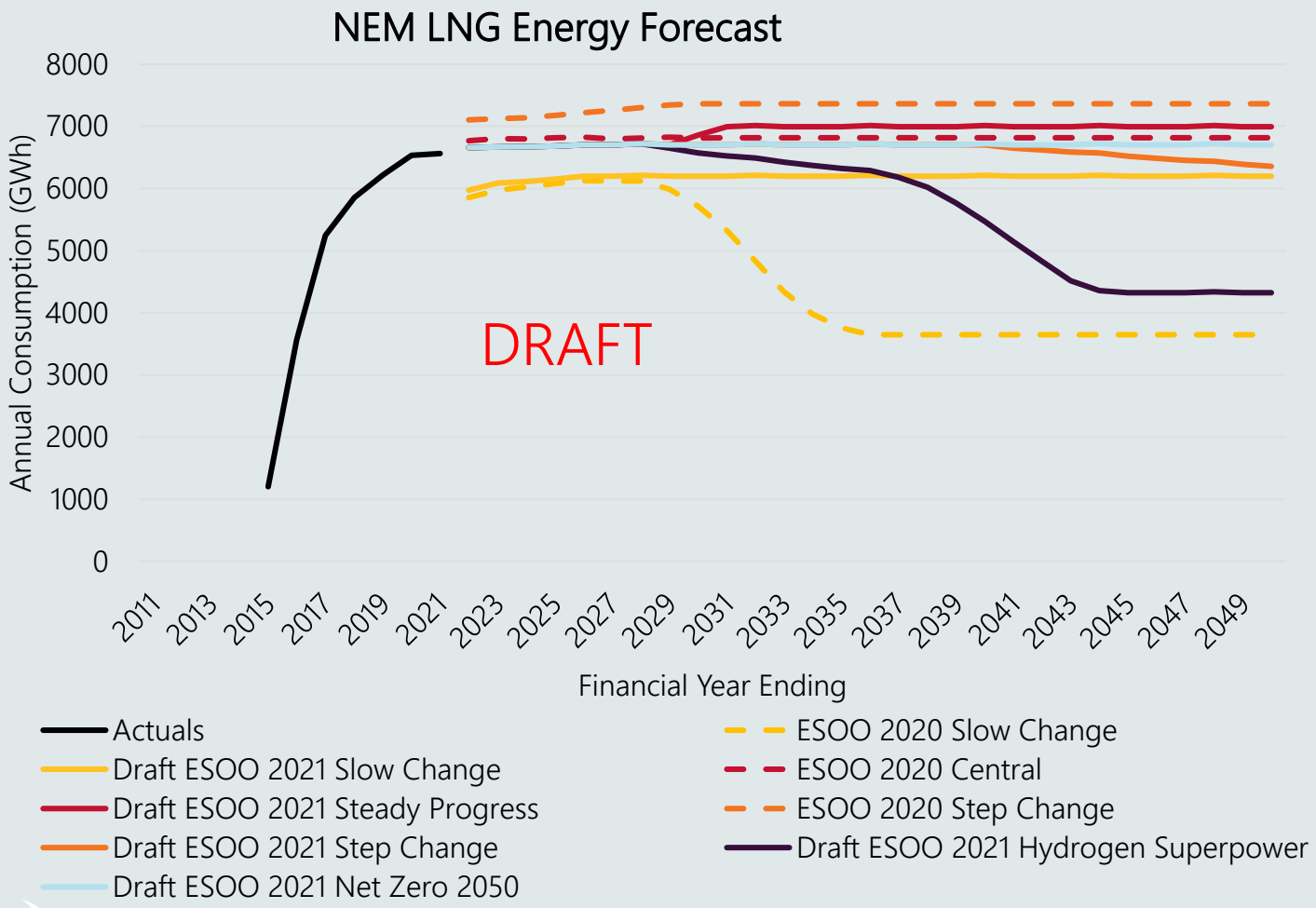
1 Refer to Mckinsey's article *Decoupling energy demand from economic growth* for a further discussion: https://www.mckinsey.com/industries/electric-power-and-natural-gas/our-insights/the-decoupling-of-gdp-and-energy-growth-a-ceo-guide

Large Industrial Load Forecast flat except for downside risk



- AEMO survey 166 different sites with loads that range from 10 to approximately 8000 GWh / year
- Sectors include metal production, metal and coal mining
- Forecast trajectory remains similar to the 2020 ESOO forecast for all scenarios, though slightly lower from small changes in operational outlook for several facilities
- Note: These forecasts exclude electrification assumptions.

LNG Forecast spread reflects a range of international market and policy factors

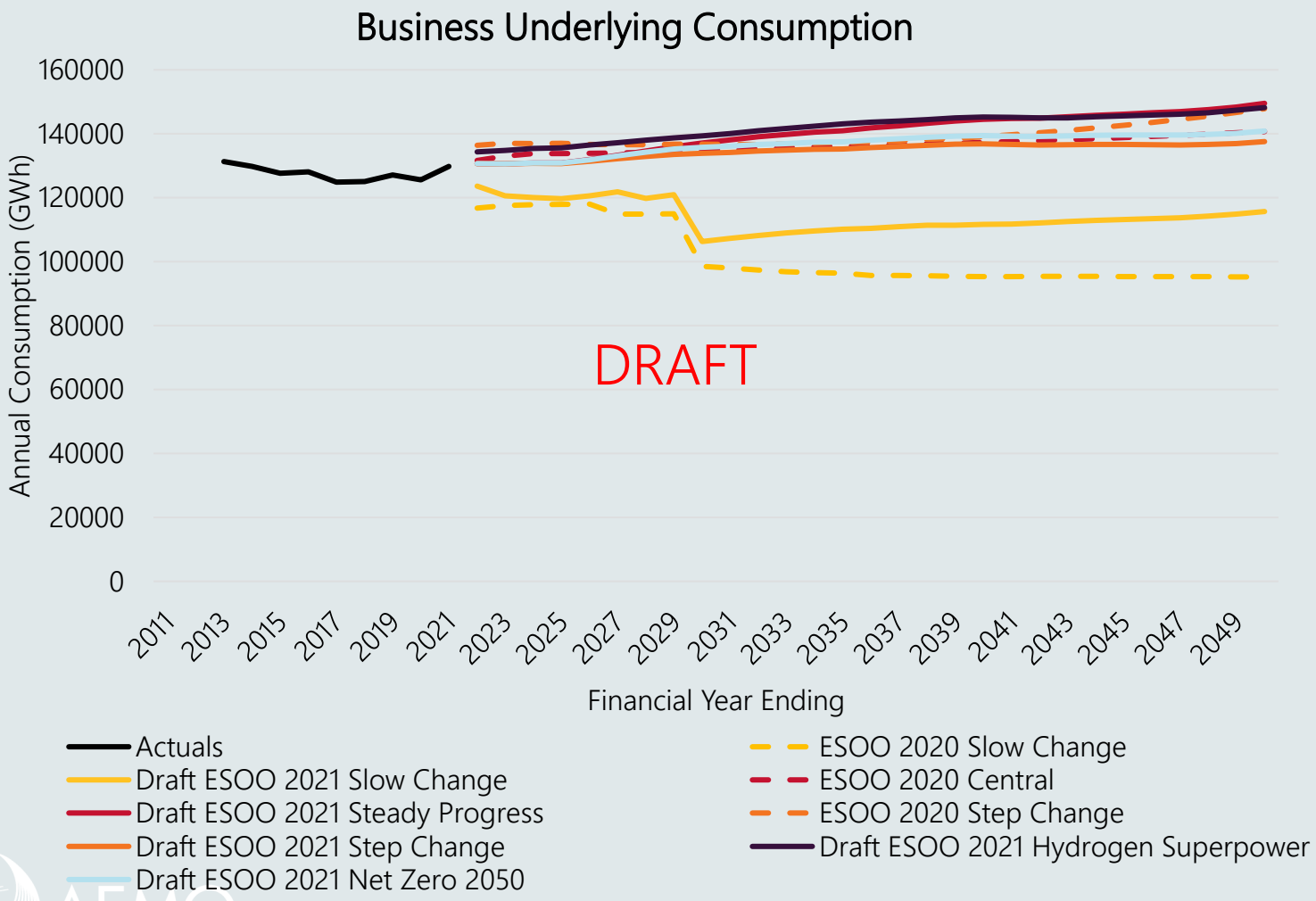


*Refer to the 2021 GSOO for more details https://aemo.com.au/-/media/files/gas/national_planning_and_forecasting/gsoo/2021/2021-gas-statement-of-opportunities.pdf?la=en

Highlights:

- Slow Change has a higher trajectory compared to the 2020 Slow Growth, with contracts now assumed to be renewed or replaced, which was not assumed in the 2020 ESOO*
- The Hydrogen Superpower scenario assumes that Hydrogen on an international scale increases in the mid 2030s, slowing LNG exports as Hydrogen exports increase.

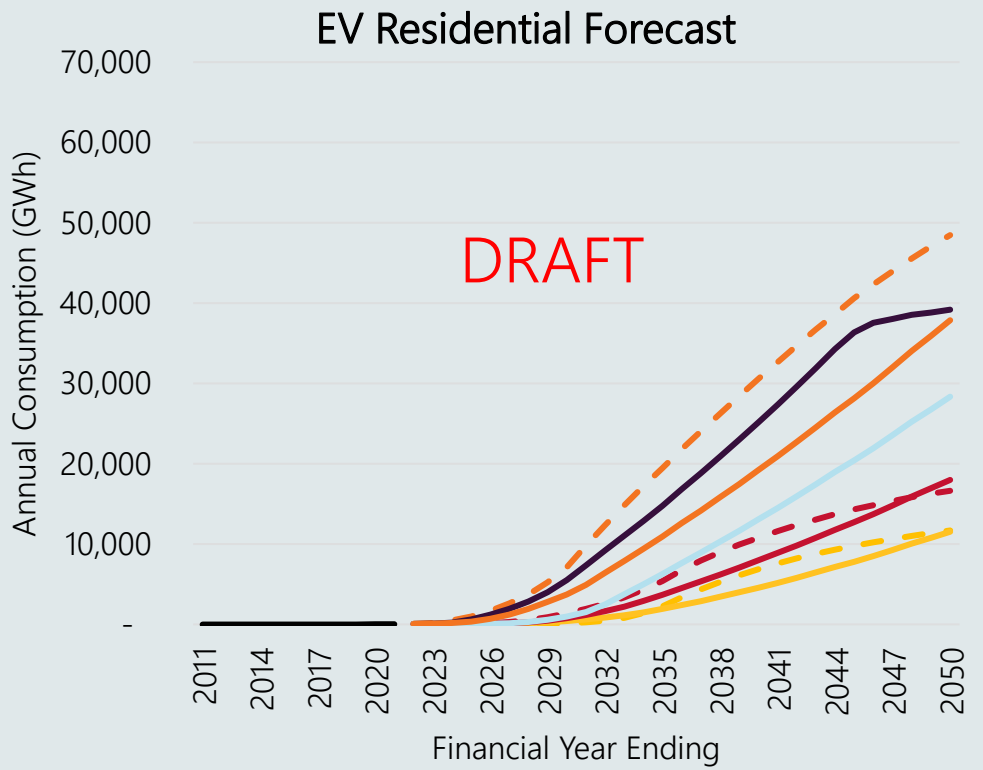
Business Total Forecast uptick reflects LNG, energy efficiency and economic updates

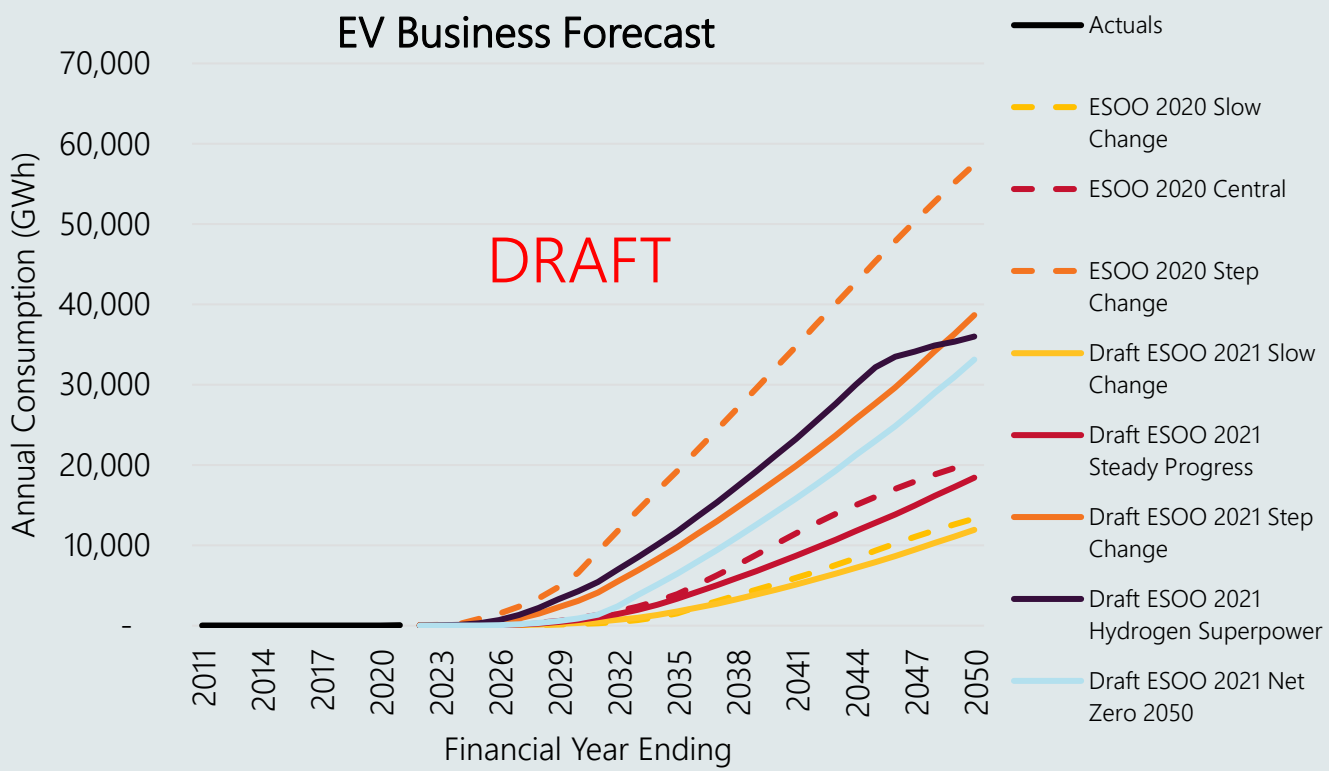


Main Updates:

- Forecast energy efficiency impacts lower across all scenarios than in 2020
- Separate Business Mass Market (BMM) model from LIL forecast
- Short term trend to long term economic model based on energy intensity (GWh/$)
- Large Industrial Loads (LIL) prospective forecast is higher for the 2021 Strong Electrification and Hydrogen Superpower scenarios

EV consumption forecast has moderated due to battery efficiency improvements, but vehicle numbers similar

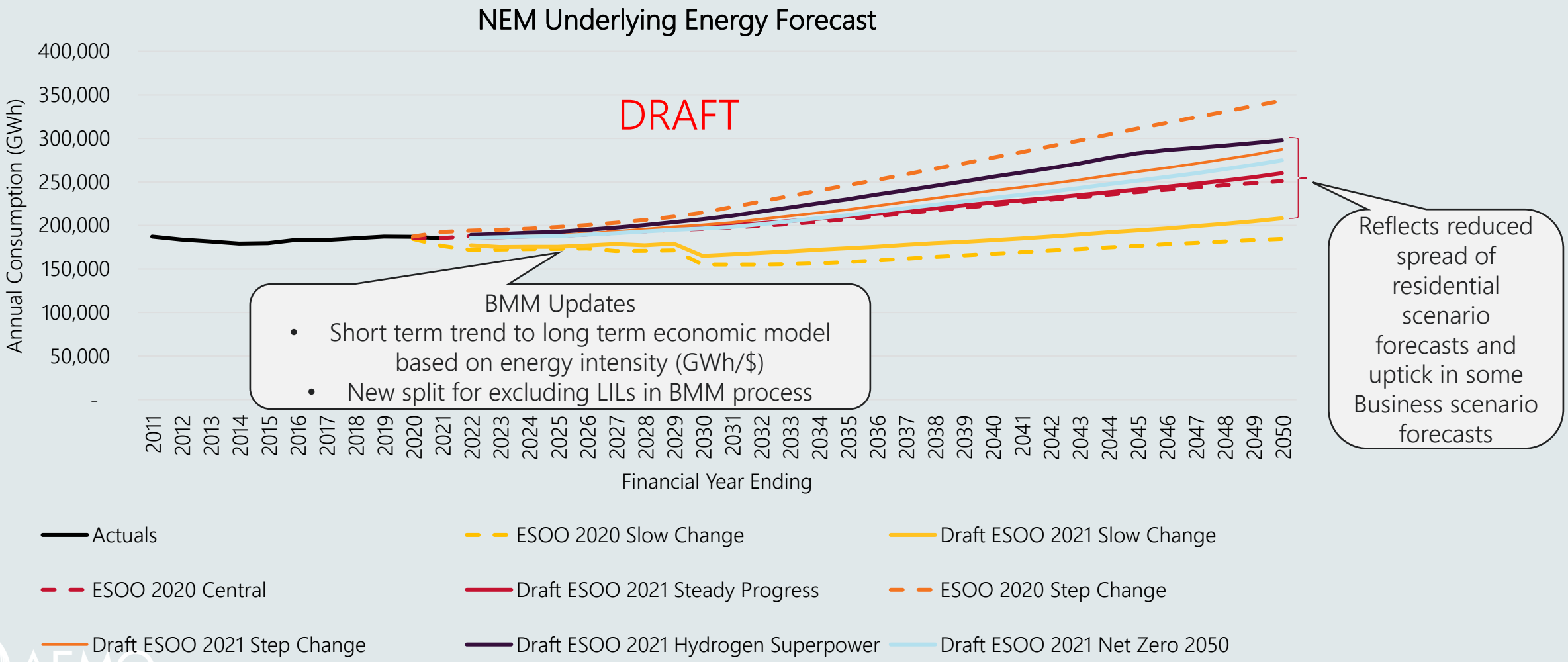




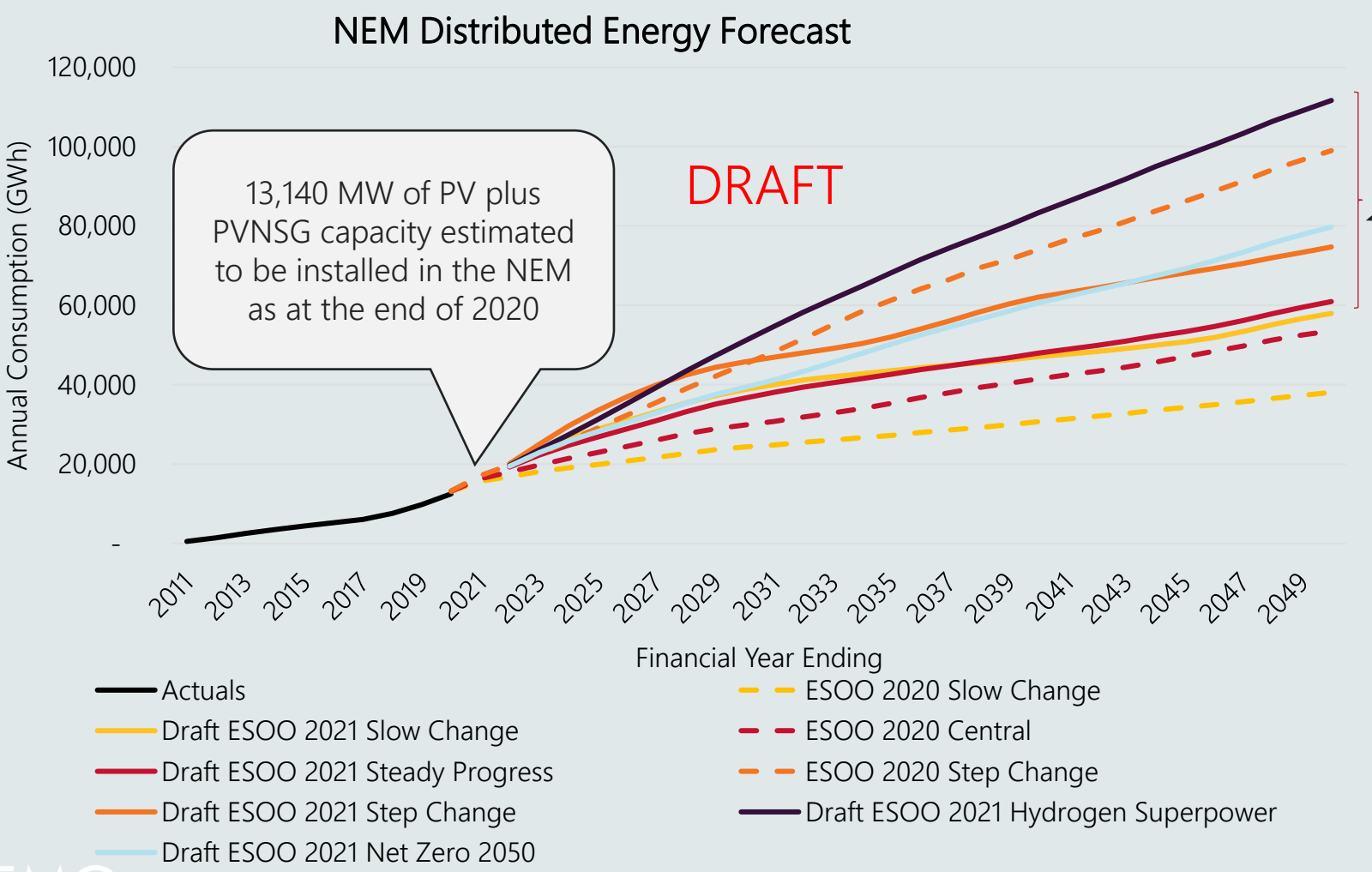
Main Updates:

- Similar to last year's forecast until 2030, with Hydrogen Superpower showing an inflection for the non-residential sector
- Post 2041 inflection showing the possible case of rapid growth if ICE vehicles are discontinued
- Although the vehicle numbers are similar, forecast is slightly lower than last year due to revised consumption estimates from the CSIRO that incorporate losses and changes in vehicle efficiency and an improvement by AEMO to calculate consumption from individual vehicle half hourly charge profiles

NEM Underlying forecast sums all component forecasts presented



Distributed PV generation forecast reflects ongoing consumer interest under all scenarios



Between 46,085 MW (Slow Change) and 81,100 MW (Hydrogen Superpower) of PV plus PVNSG projected to be installed by June 2050

Consultant Scenario Mapping:

- Hydrogen Superpower = GEM
- Step Change = CSIRO
- Net Zero 2050 = Average
- Steady Progress = Average
- Slow Change = CSIRO

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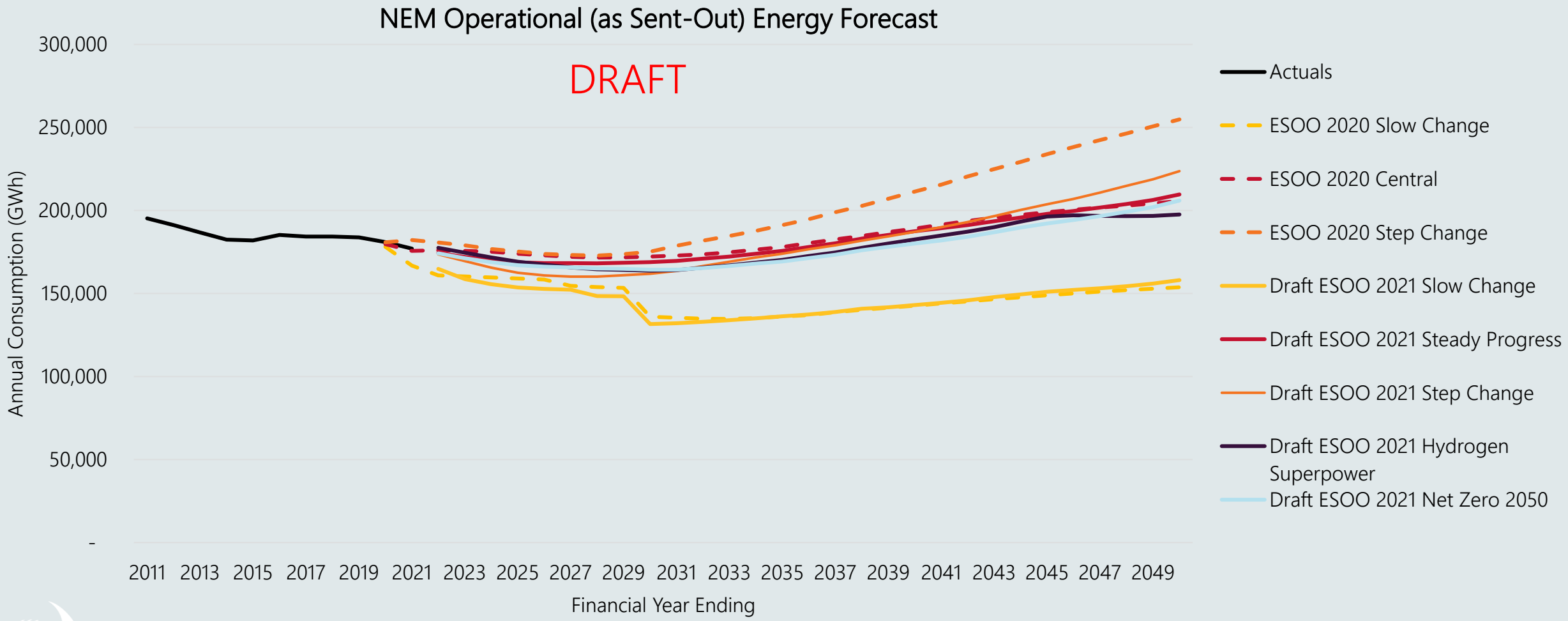
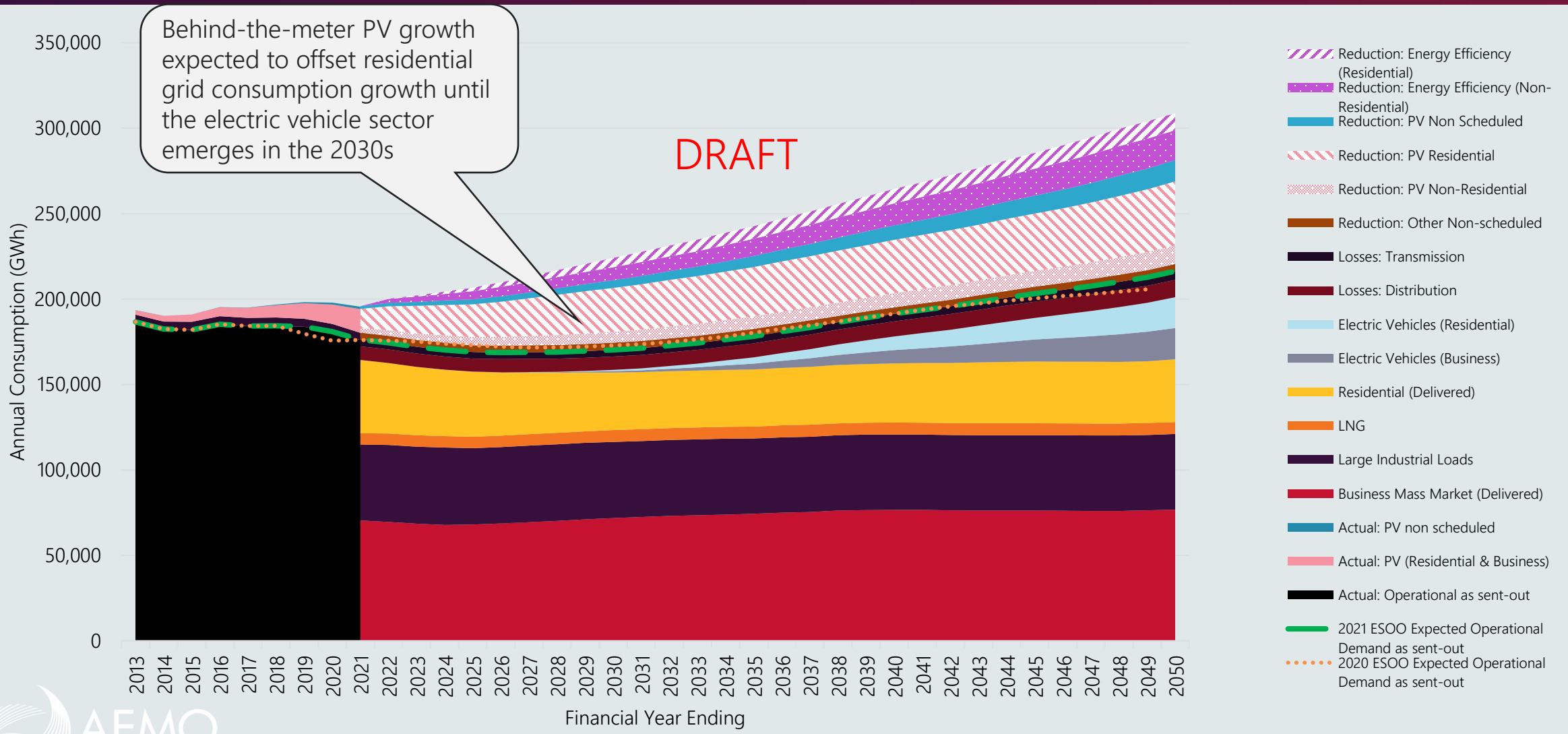
NEM Operational Forecast (sent out*): new PV roughly equals Business changes and EV load



* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

Full NEM Forecast by component (Steady Progress)



Influence of other sectors

- AEMO has engaged CSIRO to undertake multi-sectoral modelling to better understand the potential influences of other sectors.
- At this stage this work is still ongoing.
- The key outcomes of this work will inform adjustments to the demand that will vary across the scenarios:
  - Increased energy efficiency measures, underpinned by emissions objectives.
  - Increased electrification of other sectors, particularly gas and transport.
  - Increased electricity demand due to hydrogen uptake.
- Note: The work will also inform the emissions target for the electricity sector, although this will not directly affect the demand forecasts.

Stakeholder discussion

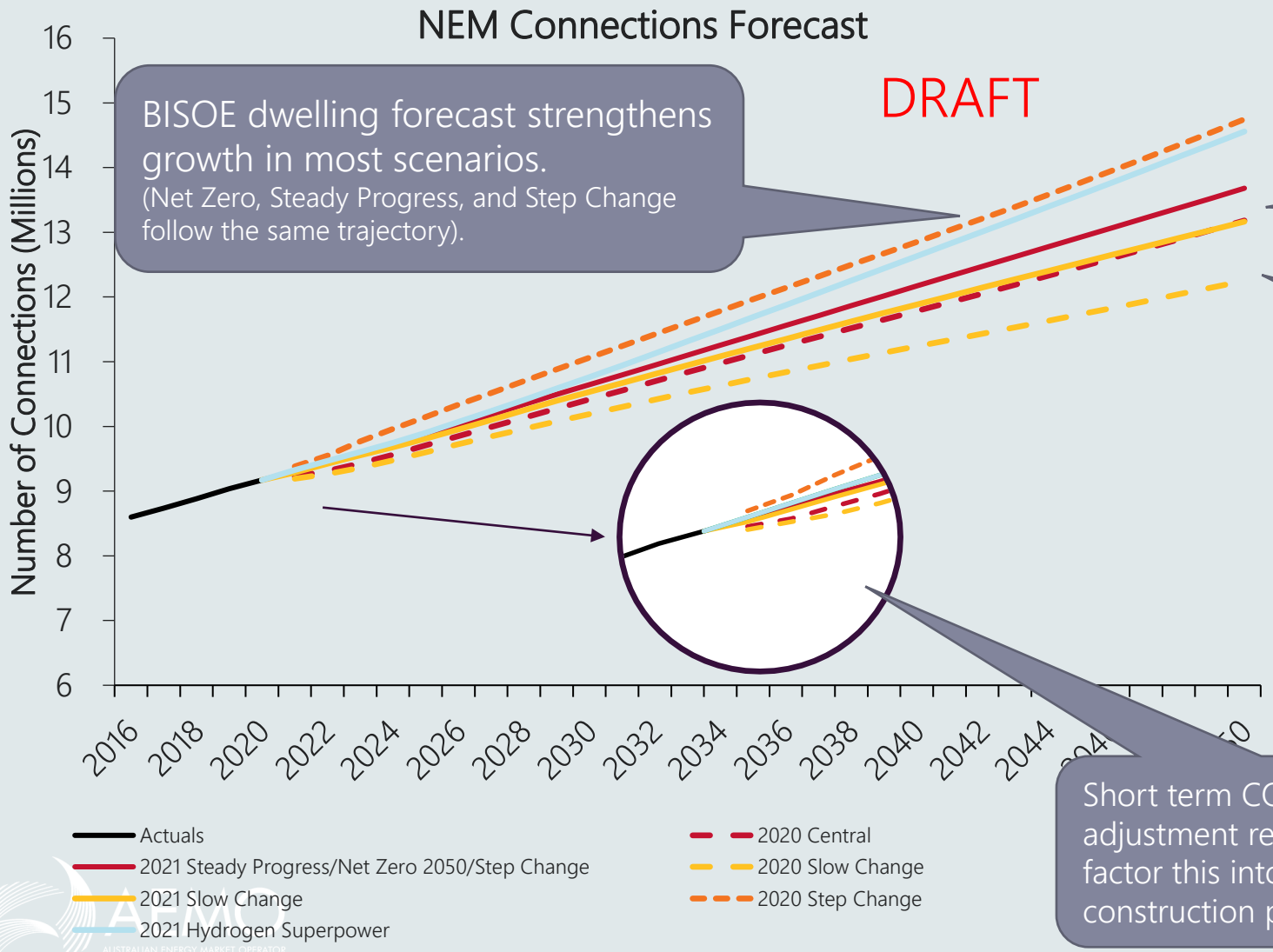
Do you think these forecast trends are reasonable?

Are there any others material impacts that we have not taken into consideration?

What other considerations should we include in the future?

Appendix: detailed results

2050 NEM Connections increase by 500,000 compared to 2020 forecasts



BISOE dwelling forecast strengthens growth in most scenarios.
(Net Zero, Steady Progress, and Step Change follow the same trajectory).

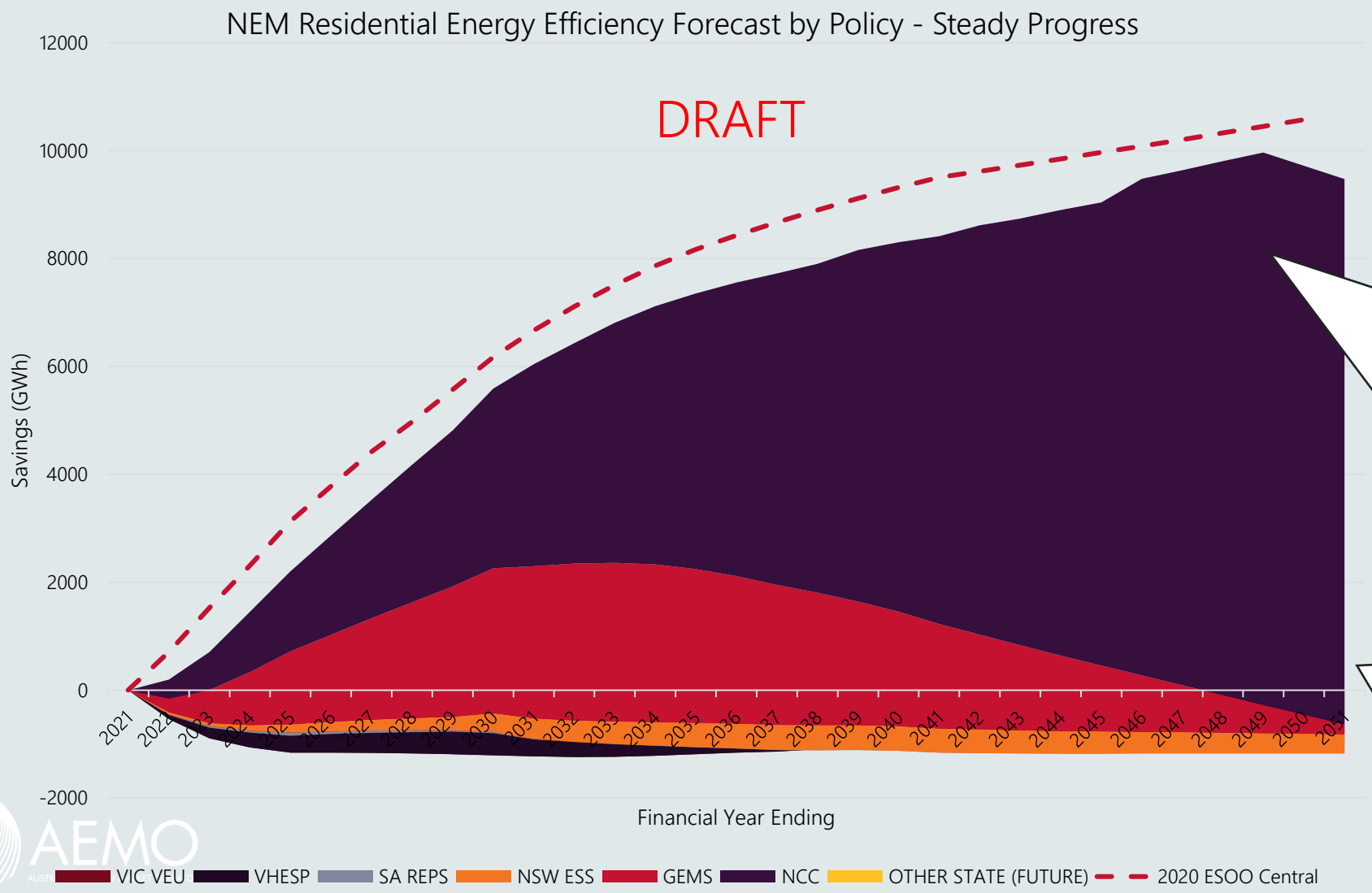
Lower long term dispersion: Incorporates BISOE advice on dwelling forecasts instead of AEMO applying a "dwelling construction index" to ABS household projections.

Growth rates follows a similar path to ABS household projections with the exception of Hydrogen Superpower which projects stronger growth beyond 2030 driven by BIS OE dwellings forecast.

Short term COVID downward adjustment removed as BISOE factor this into their housing construction projections.

BIS OE Long term population growth forecasts broadly align with the Australian Government's long term population outlook of approx. 1.3% YoY growth by 2030: https://population.gov.au/

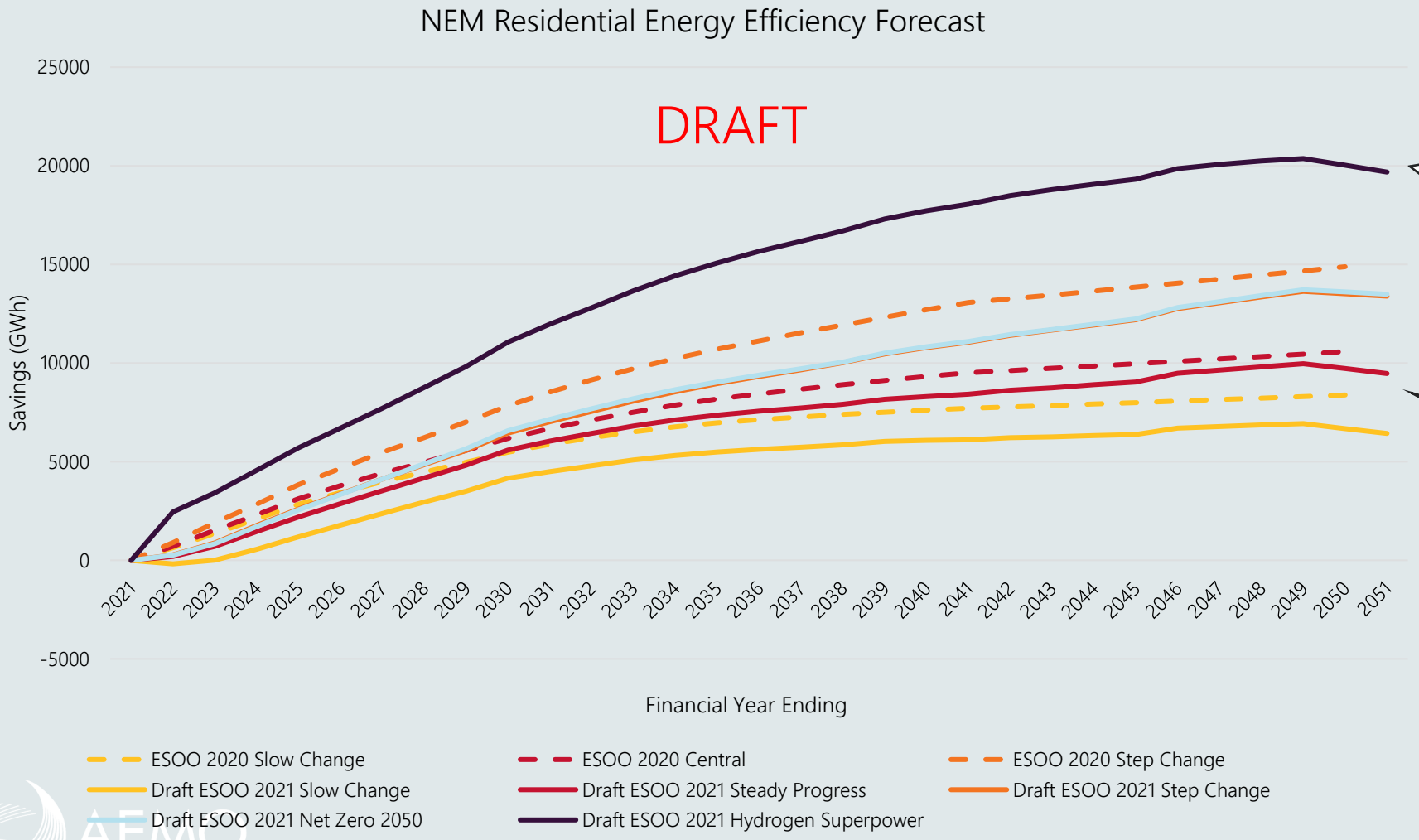
Energy Efficiency - Residential



National Construction Code estimated to make the biggest impact. Step up in savings reflects net effect of changes to dwelling types that have different energy efficiency potential. Fall in late 2040s reflects demolition of dwellings estimated to generate savings in earlier decades

Negative savings caused by electrification impact of some state schemes, contributing to a reduction in the energy efficiency forecast compared to the 2020 ESOO

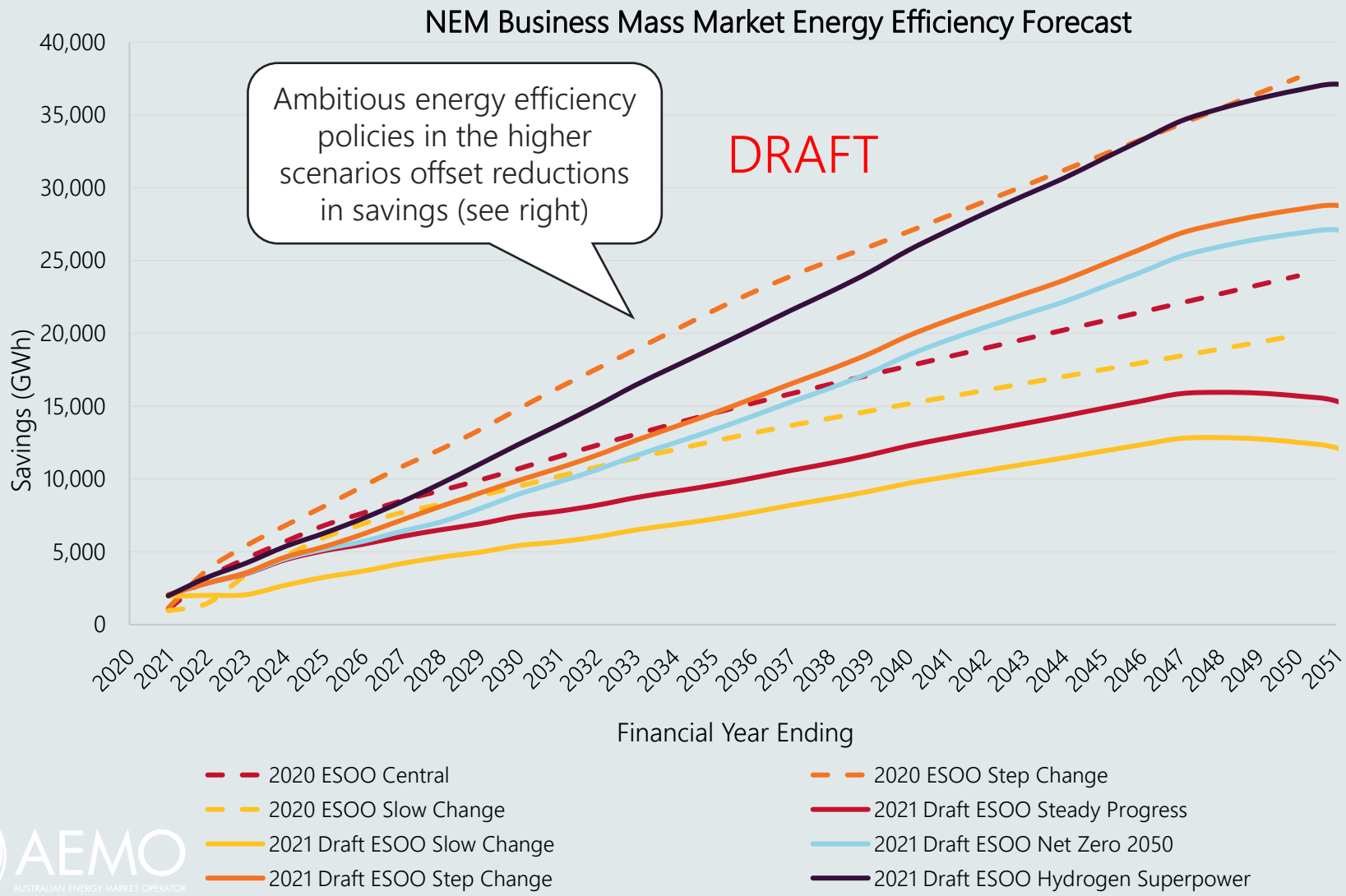
Energy Efficiency - Residential



More ambitious policy settings assumed for Hydrogen Superpower offset reductions observable in the other scenarios

Lower savings in 2021 compared to 2020 due to more discounting to avoid double counting, shifting savings from policy-induced to market-led energy efficiency, and increasing electrification from energy efficiency policies

Energy Efficiency – Business Mass Market



Higher discounting compared to 2020 to avoid double counting with GEMS and other policy measures

Savings also shifted from policy-induced to market-led or autonomous energy efficiency; AEMO does not include the latter in the forecasts

Electrification from state-based schemes and reduction in anticipated savings from Greenhouse and Energy Minimum Standards (GEMS) further reduce savings compared to 2020

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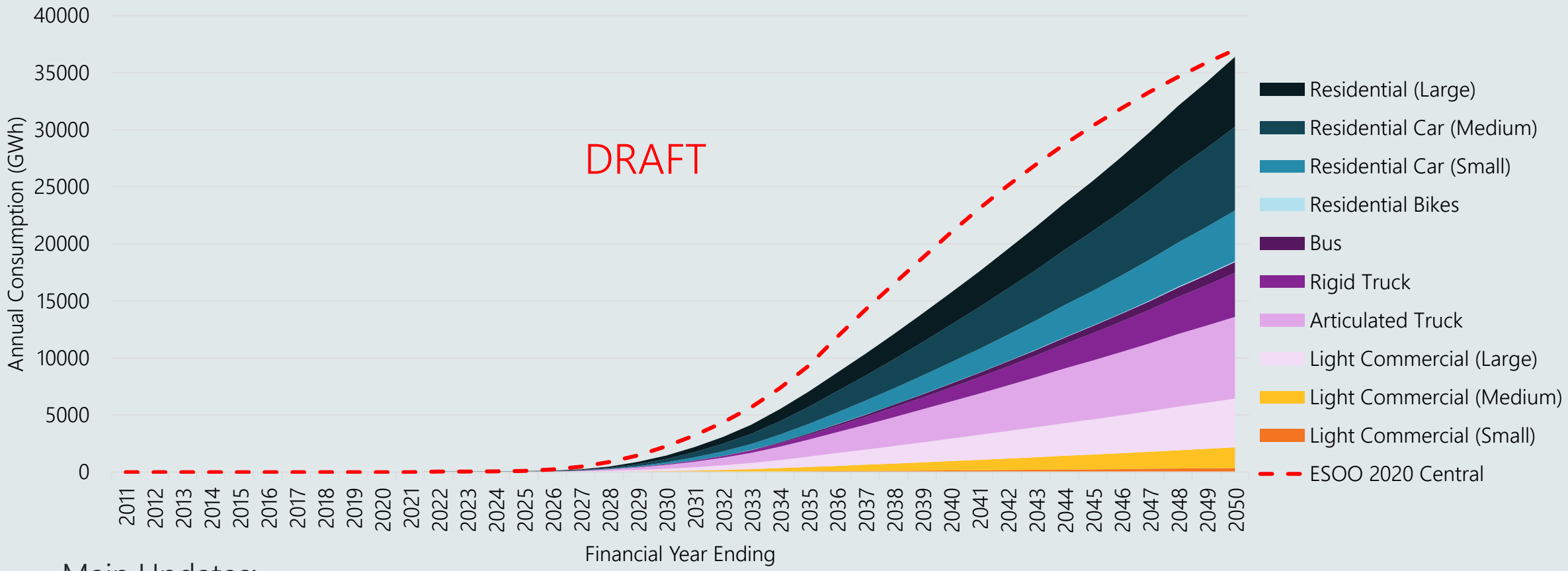
EV Forecast by Vehicle Type (Steady Progress)



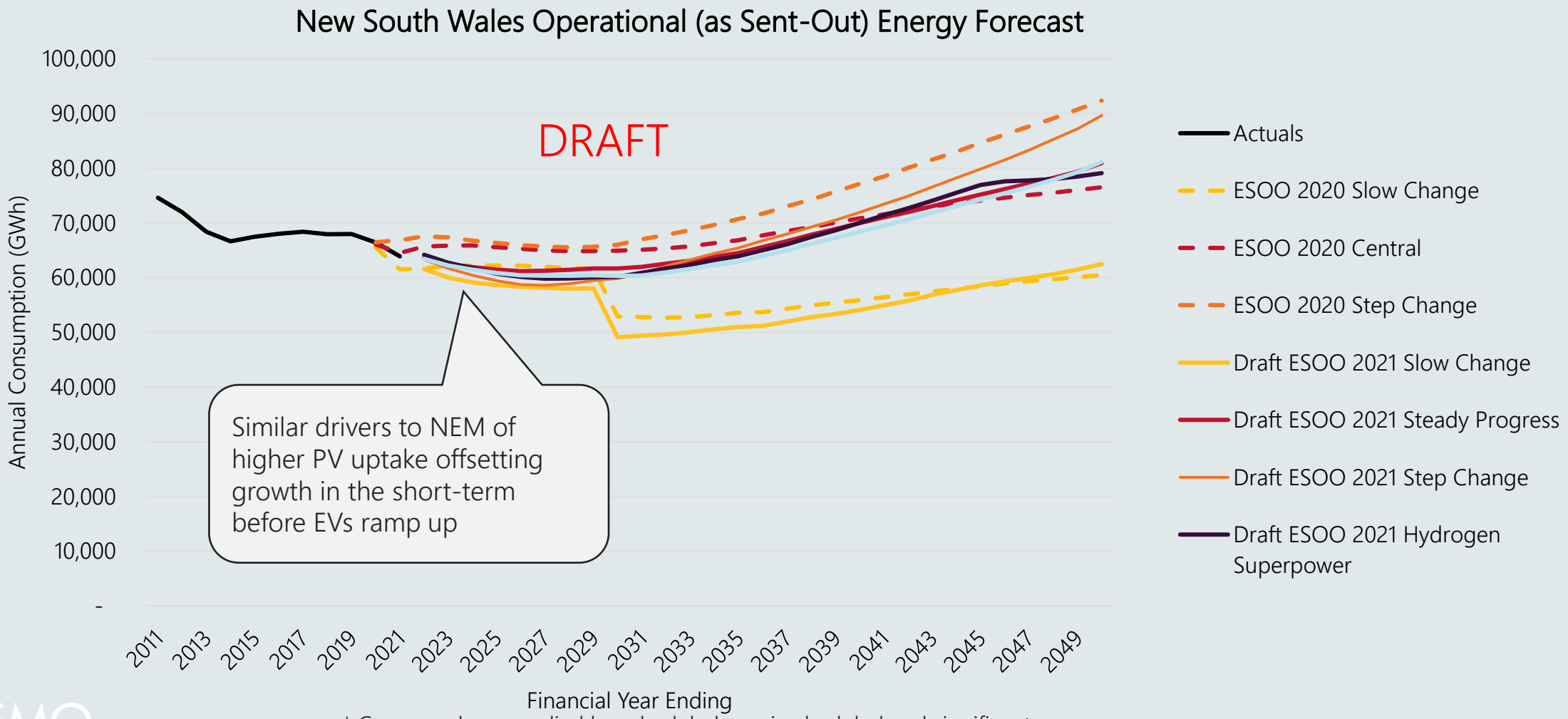
Main Updates:

- Whilst residential vehicles are expected to be more numerous, the larger consuming EV trucks mean that the consumption by residential and non-residential is approximately even.

Appendix: Regional Forecasts

Operational as Sent-Out

NSW Operational Forecast (sent out*)



* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

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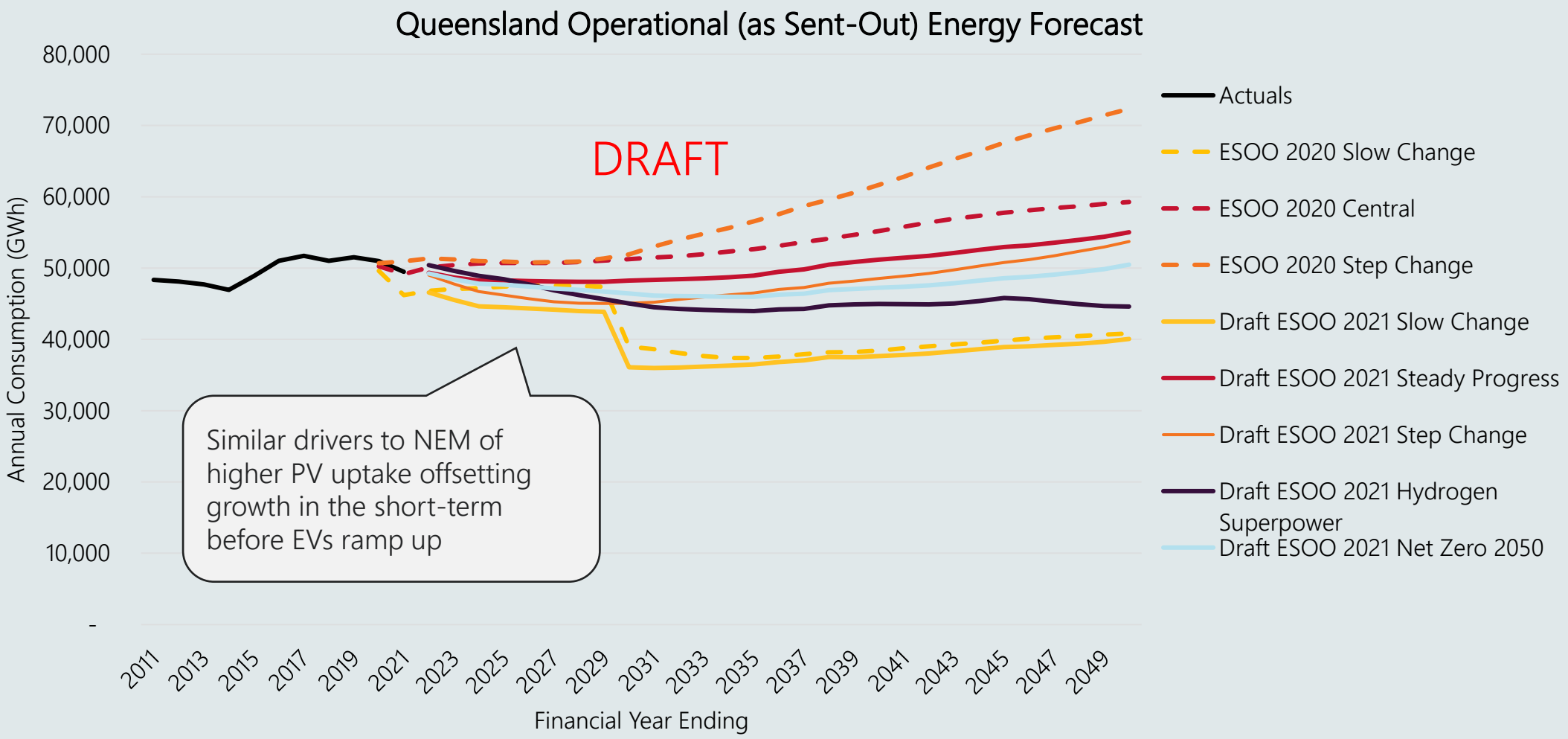
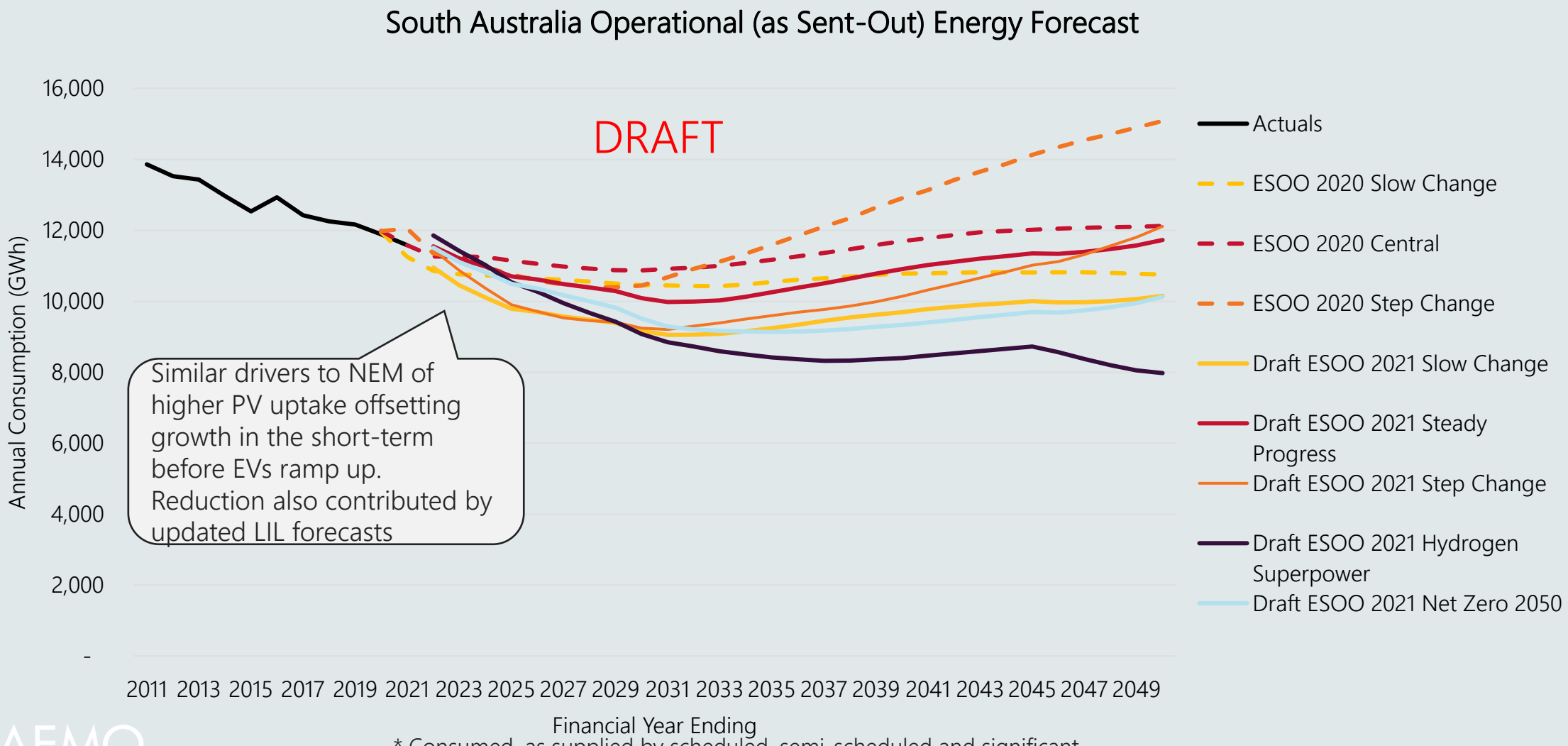
QLD Operational Forecast (sent out*)



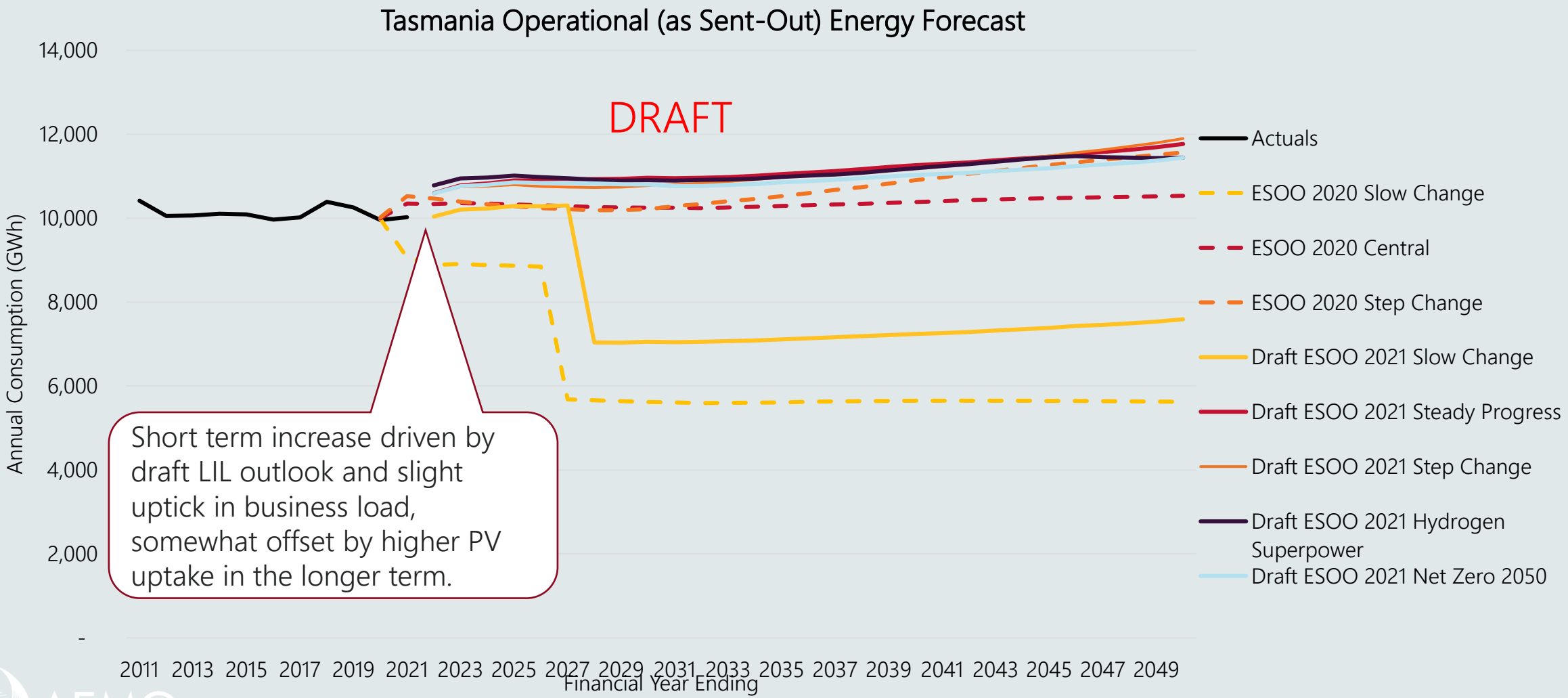
* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

SA Operational Forecast (sent out*)



* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

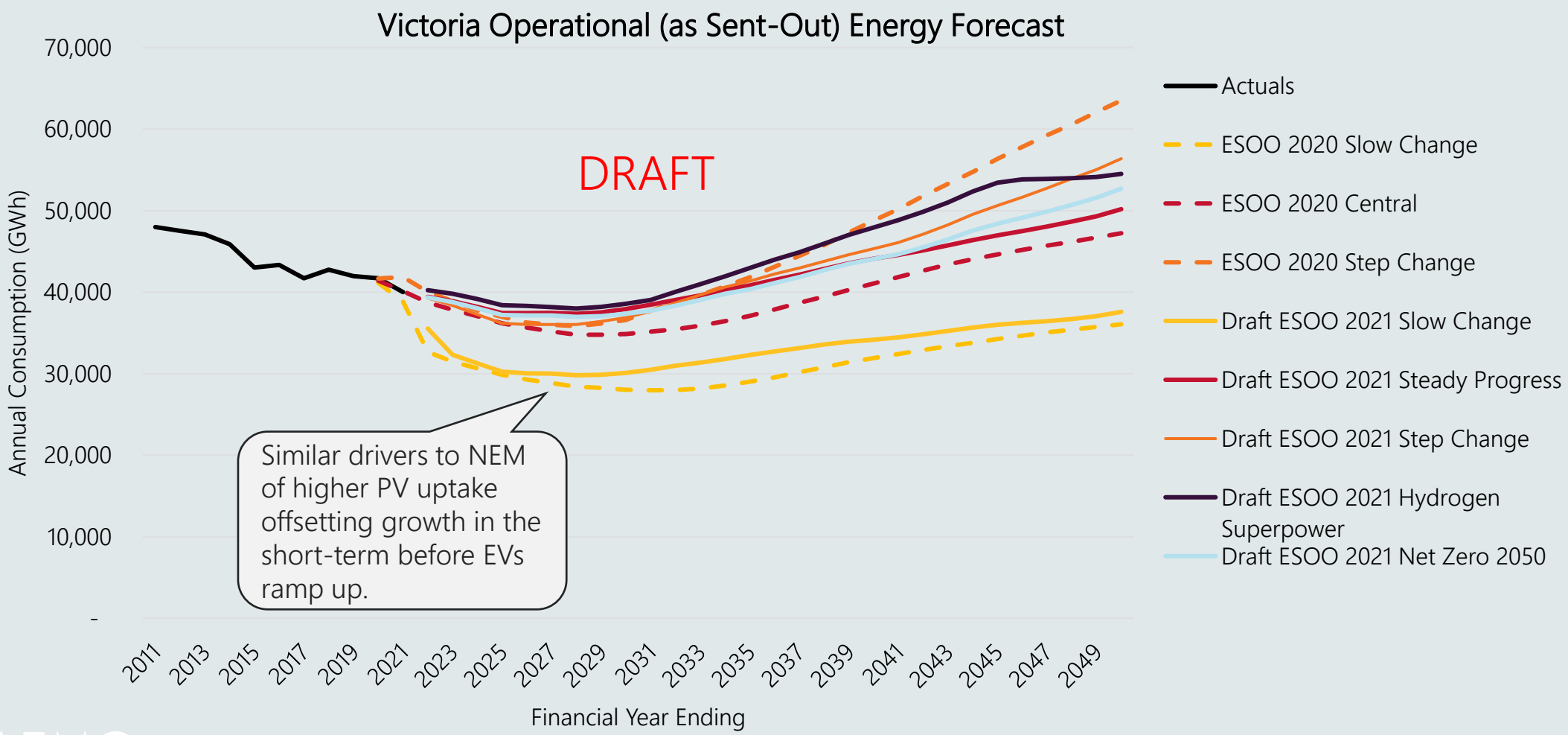
TAS Operational Forecast (sent out*)



Short term increase driven by draft LIL outlook and slight uptick in business load, somewhat offset by higher PV uptake in the longer term.

* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

VIC Operational Forecast (sent out*)



* Consumed, as supplied by scheduled, semi-scheduled and significant non-scheduled generating units >= 30MW (with some exceptions).

Appendix: Method overview

AEMO's Forecasting Methodology

Residential

Base year per connection
Baseload/ Heating/ Cooling

Forecast per connection
Baseload/ Heating/ Cooling

Adjusted forecast per connection

Adjusted total forecast

Underlying demand
Delivered demand

Scenario-specific adjustments

Forecast annual heating and cooling degree days

Energy efficiency forecast (base/heating/cooling)
Appliance uptake
Solar PV rebound effect
Climate change (heating/cooling)

Connections forecast

Electric Vehicle forecast
Solar PV
Battery loss

Refer to Electricity Demand Forecasting Methodology Information Paper

AEMO's Forecasting Methodology

Business Mass Market

Short term model

Trend model
Baseload/ Heating/ Cooling

Long term structural model

Base year
Baseload/ Heating/ Cooling

Forecast
Baseload/ Heating/ Cooling

Underlying demand

Delivered demand

Model transition

Year 1: 100% Short term model 0% Long term model
Year 5: 0% Short term model 100% Long term model

Scenario-specific adjustments

Gross State Product (GSP) forecast

Energy efficiency forecast (base/heating/cooling)
Commercial price forecast

Electric Vehicle forecast
Solar PV
Battery loss

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AEMO Forecasting methodology

Large Industrial Loads

Prepare list of industrial users to interview/survey

↓

Prepare survey template and interviews

↓

Review surveys and validate against meter data

↓

Produce forecast

↓

Delivered demand

Scenario-specific adjustments

Model Prospective loads or closure risks respectively for the higher economic and lower economic scenarios