2023 Draft Energy Efficiency Forecasts

Forecasting Reference Group

29 March 2023

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Making the business case for sustainability

Materiality Criteria

- National Energy Rules, v156, NER 5.22.3b) specify that policies should be included in the forecasts where:
  - A commitment has been made in an international agreement to implement that policy
  - That policy has been enacted in legislation
  - There is a regulatory obligation in relation to that policy
  - There is material funding allocated to that policy in a budget of the relevant participating jurisdiction, or
  - The Ministerial Council of Energy (MCE) has advised AEMO to incorporate the policy.

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Measures Forecast

Measure	Residential	Commercial	Industrial
AEEI	☑	☑	☒
NCC energy performance requirements	☑	☑	n/a
GEMS (greenhouse and energy minimum standards/labelling)	☑	☑	☑
NSW Energy Savings Scheme (ESS)	☑	☑	☑
NABERS and Commercial Building Disclosure (CBD)		☑	
VIC Victorian Energy Upgrades (VEU)	☑	☑	☑
SA Retailer Energy Productivity Scheme (REPS)	☑	☑	☑
[POTENTIAL NEW] Minimum Energy Performance Standards for Existing Buildings/Rentals (MEPS)	☑	☑	n/a
[POTENTIAL NEW] Universal Mandatory Disclosure (UMD)	☑	☑	n/a
[POTENTIAL NEW] Industrial Assessments (IA)	n/a	n/a	☑
[POTENTIAL NEW] Safeguard Mechanism (SAFE)	n/a	n/a	☑

- Quantifying AEEI for industrial is not feasible with current data
- Similar measures to 2021 but:
  - In 2021, quantified a range of VIC budget measures, now mostly completed – likely to fail materiality test
  - Also Emissions Reduction Fund and Clean Energy Finance Corporation EE activities – also fail materiality test
  - UMD and Safeguard Mechanism are new this year

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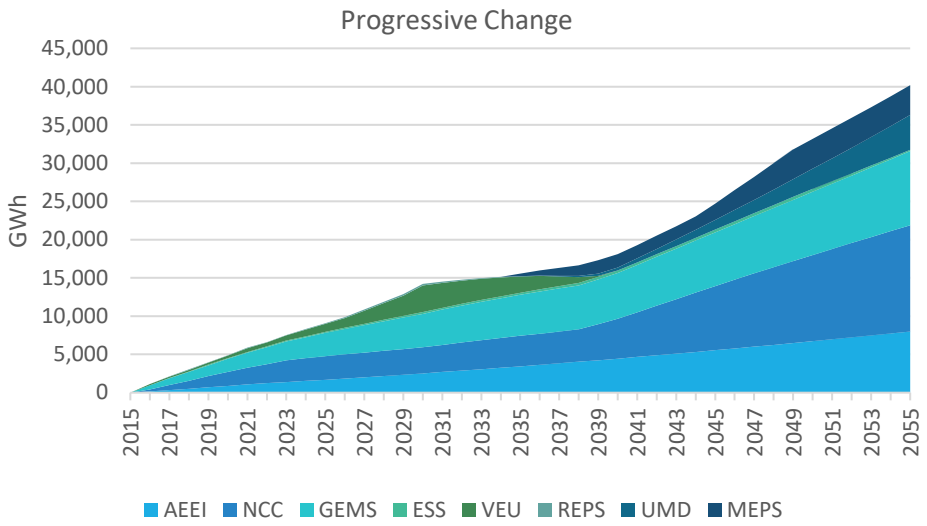
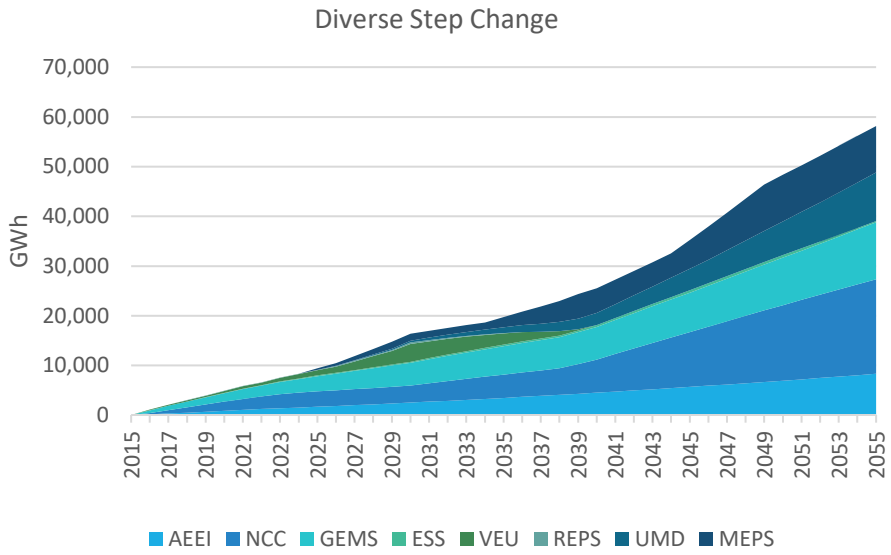
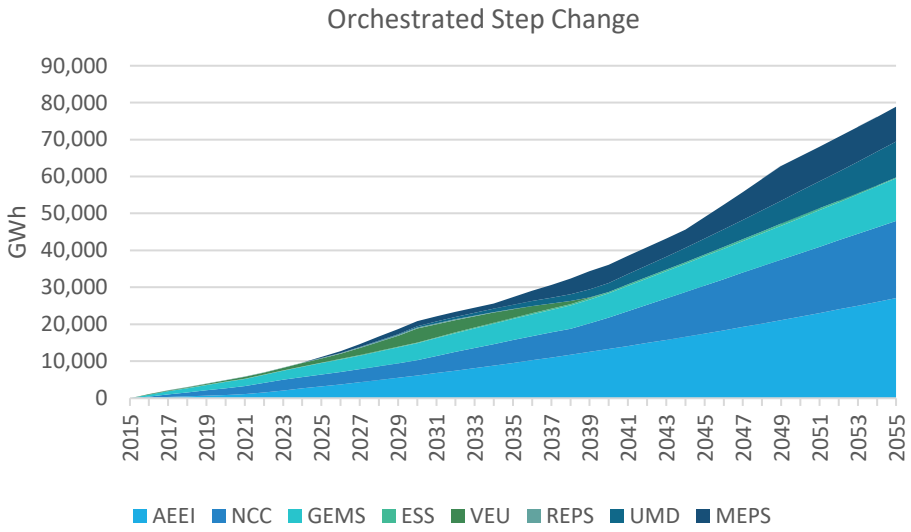
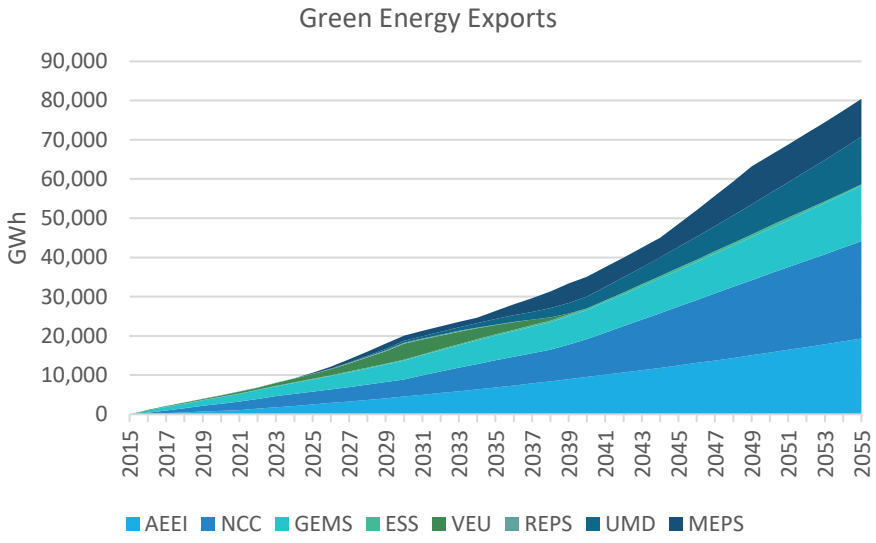
Residential Forecasts – Electricity



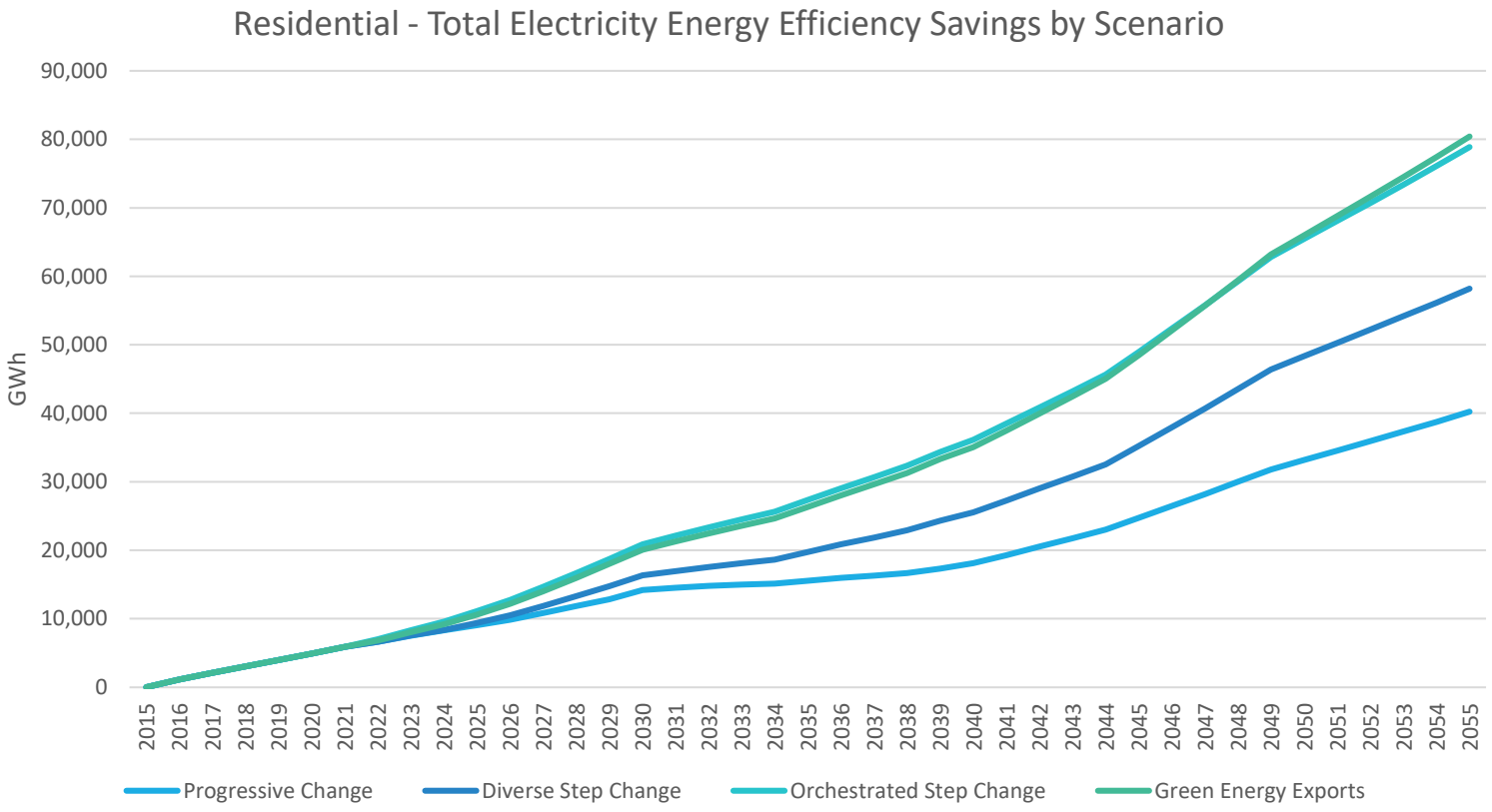






- Highest savings with Orch. Step Change/Green Energy Exports
  - Greater electrification, policy ambition, AEEI
  - Orch. Step Change highest AEEI (electrification), but GEE has higher growth – two effects tend to cancel each other out, with similar savings overall

Residential Forecasts – Electricity



- Flattening of energy savings post-2030 is due to assumption that VEU and REPS end in 2030, as per existing legislation
- Also, NCC2022 is expected to encourage electrification, which flattens electricity savings
- Minimum energy performance standards for rentals announced in VIC, ACT and likely to be expanded

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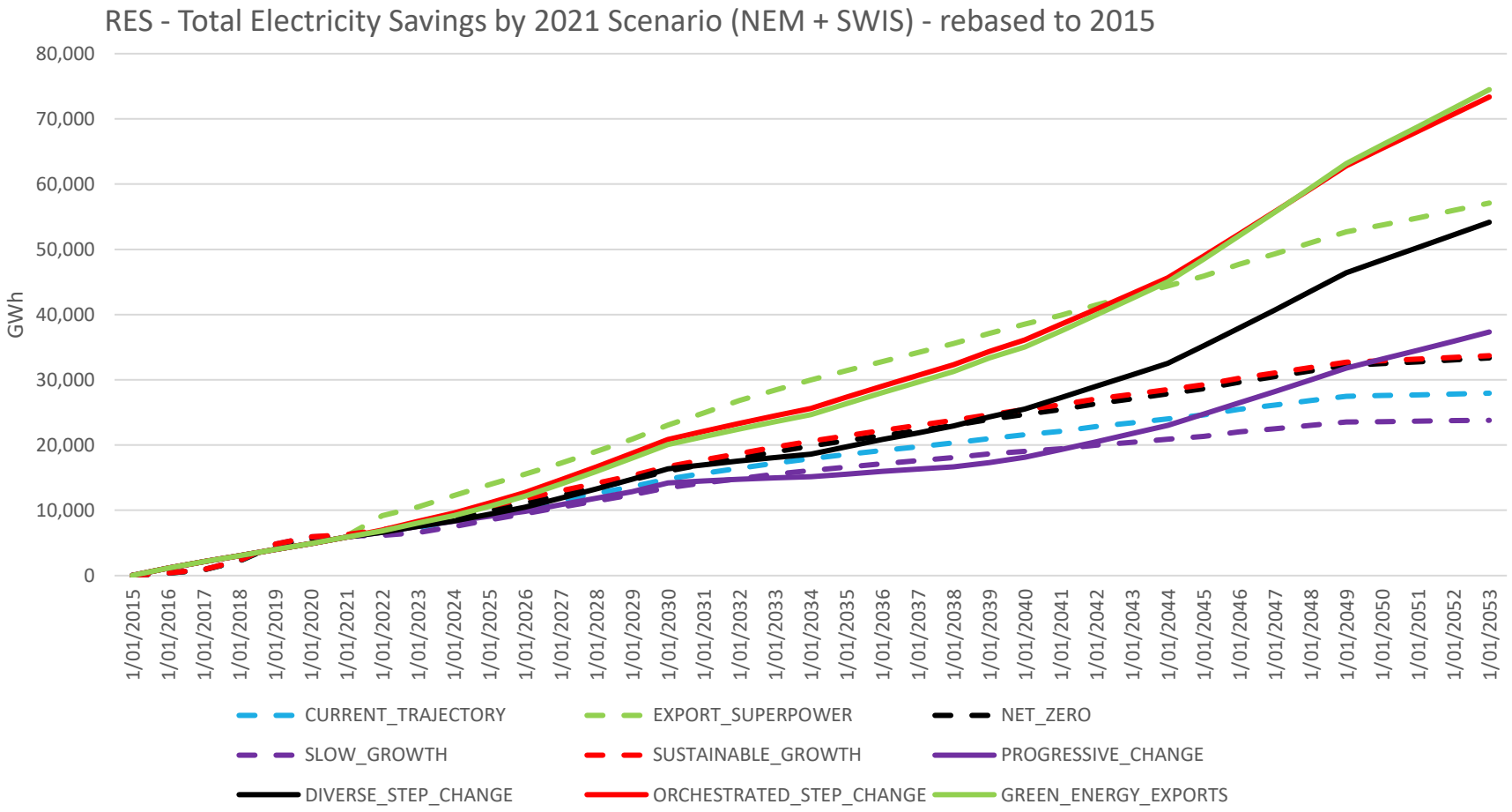
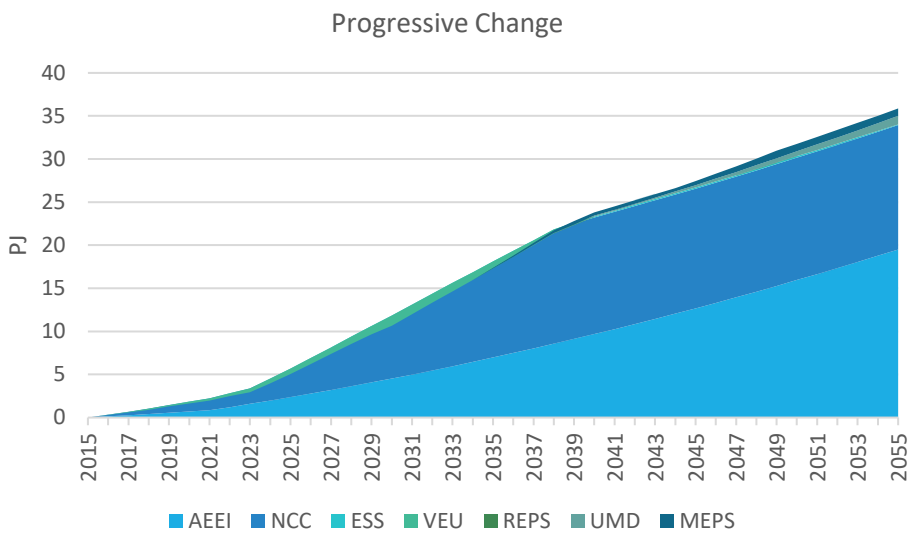
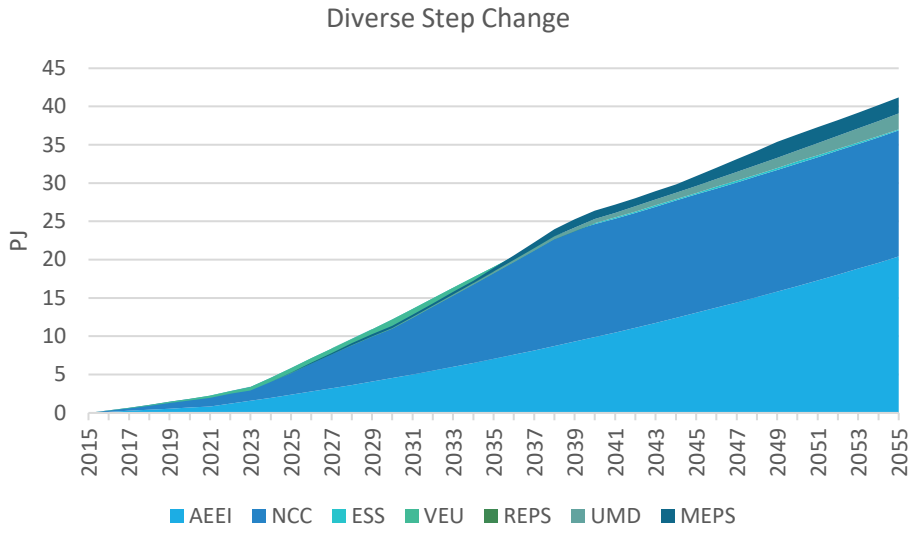
Residential Forecasts – Electricity

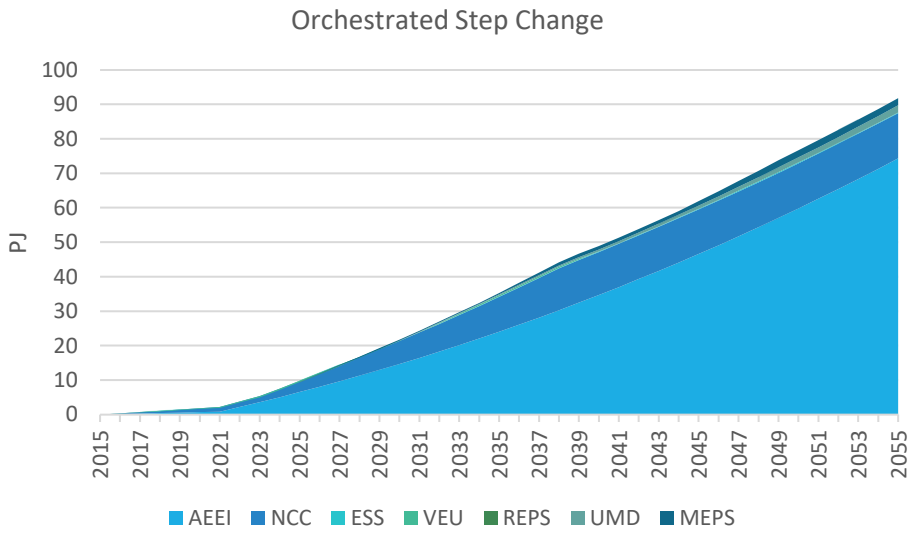


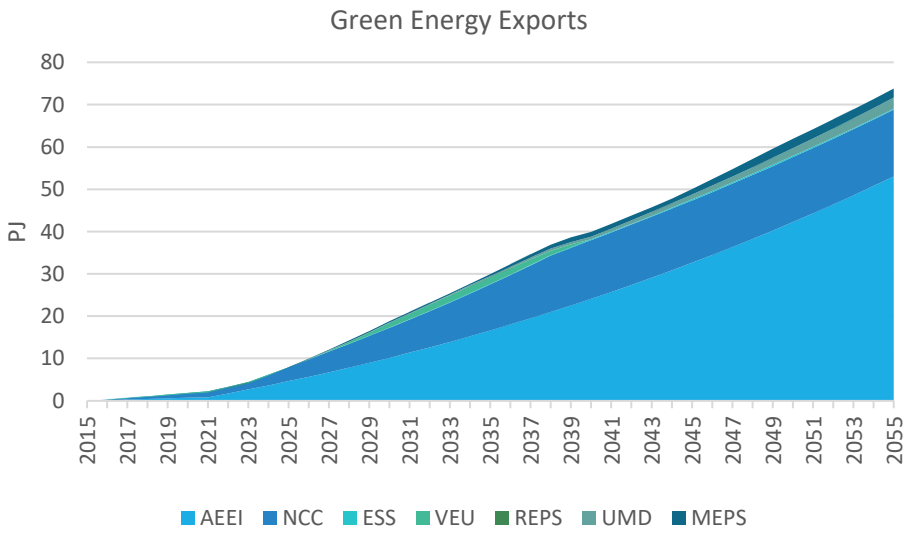
- Forecasts are similar through to mid-2040s
- NT not in scope in 2021
- Primary increase is due to potential new measures, MEPS for tenancies and universal mandatory disclosure
- NCC2022 impact delayed by a year, and whole-of-home elements not modelled in 2021
- Not modelling extension of ESS-style schemes to other jurisdictions in 2023

Residential Forecasts – Gas



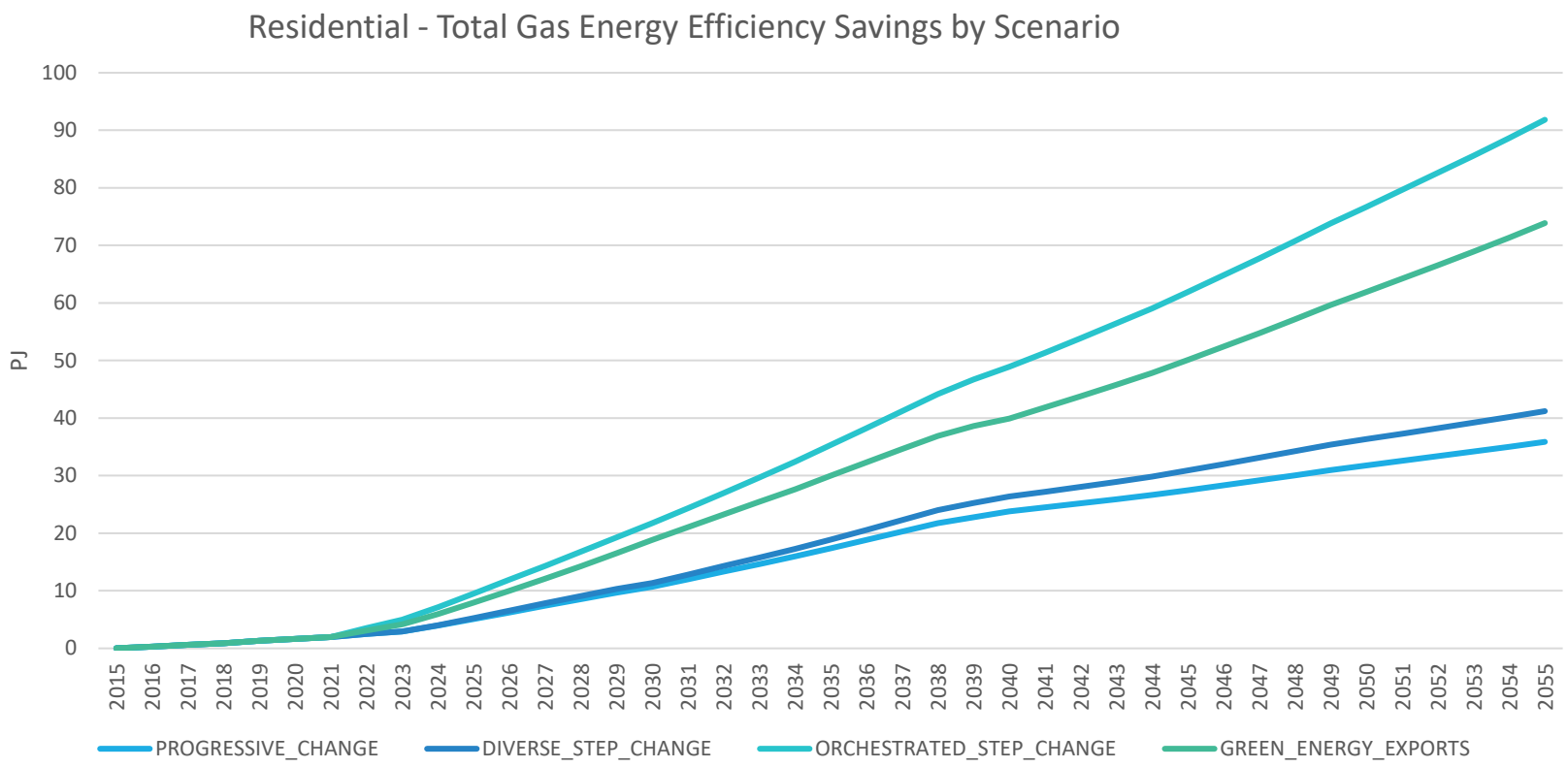






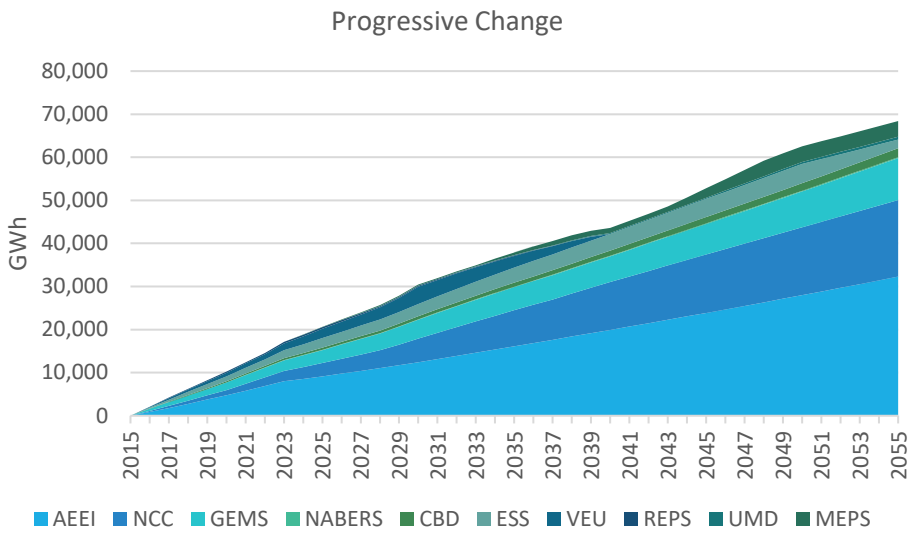
- Gas efficiency savings small overall – mainly indirect savings from better thermal envelopes, but diminishing returns with higher star ratings, and electrification to reduce gas use and opportunity for savings, particularly in VIC
- Highest market-led savings under Orch. Step Change (electrification), and highest policy-led savings under Diverse Step Change (low electrification)

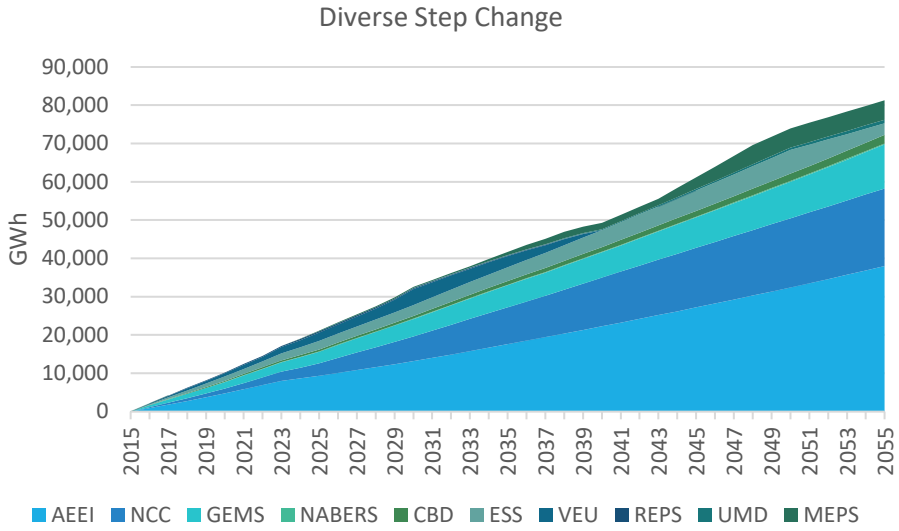
Residential Forecasts – Gas

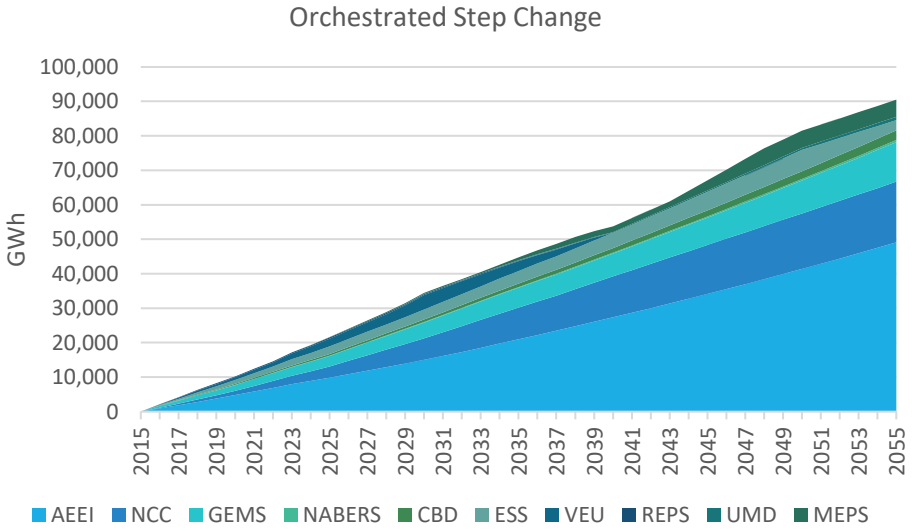


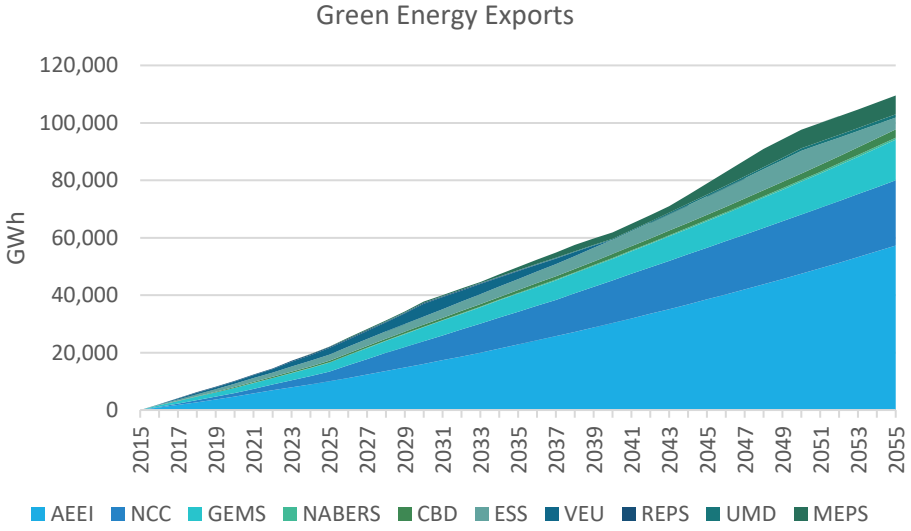
- VEU and REPS savings phased out by 2040
- NCC2022 encourages additional gas savings from FY2024

Commercial Forecasts – Electricity



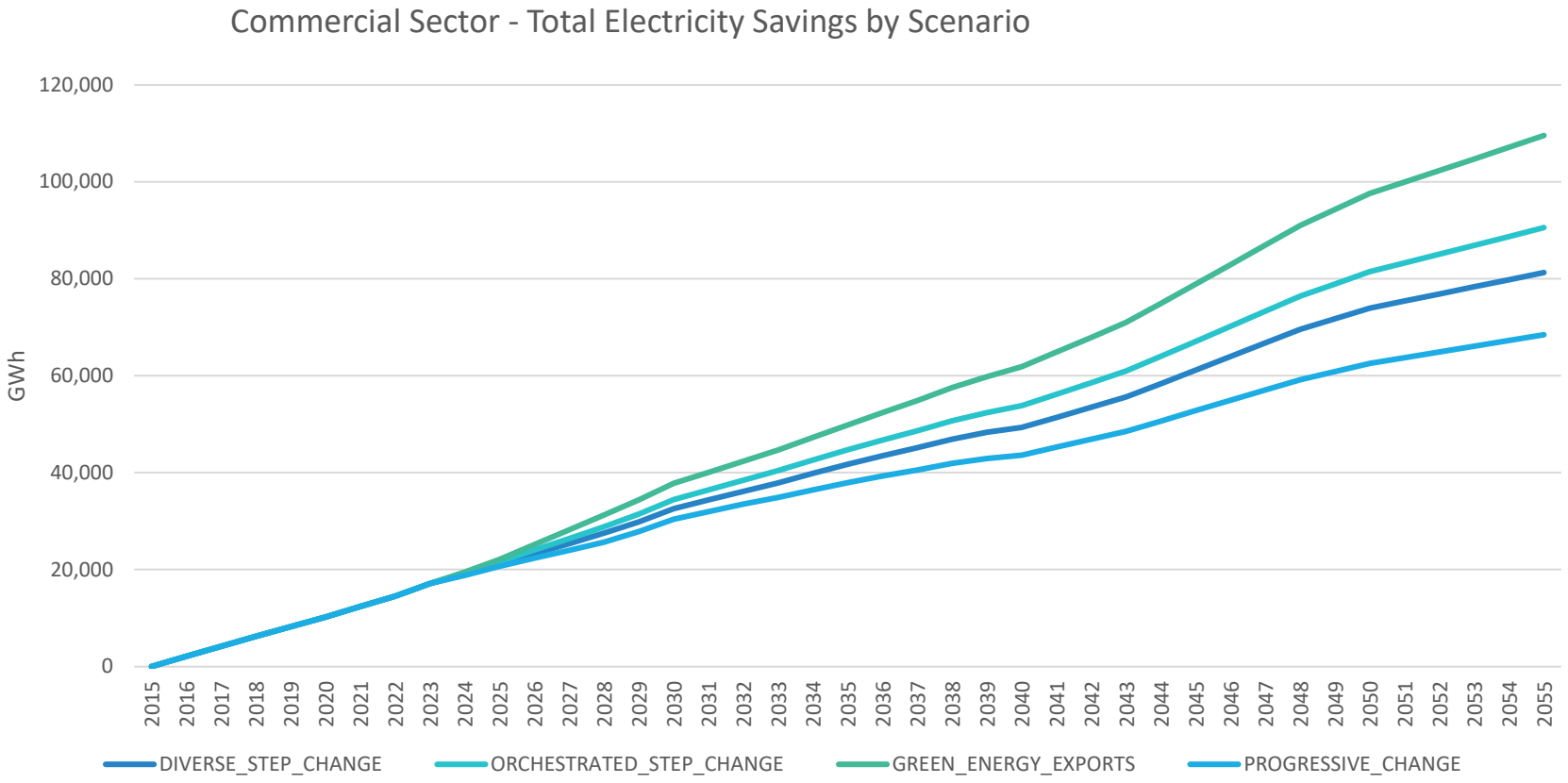






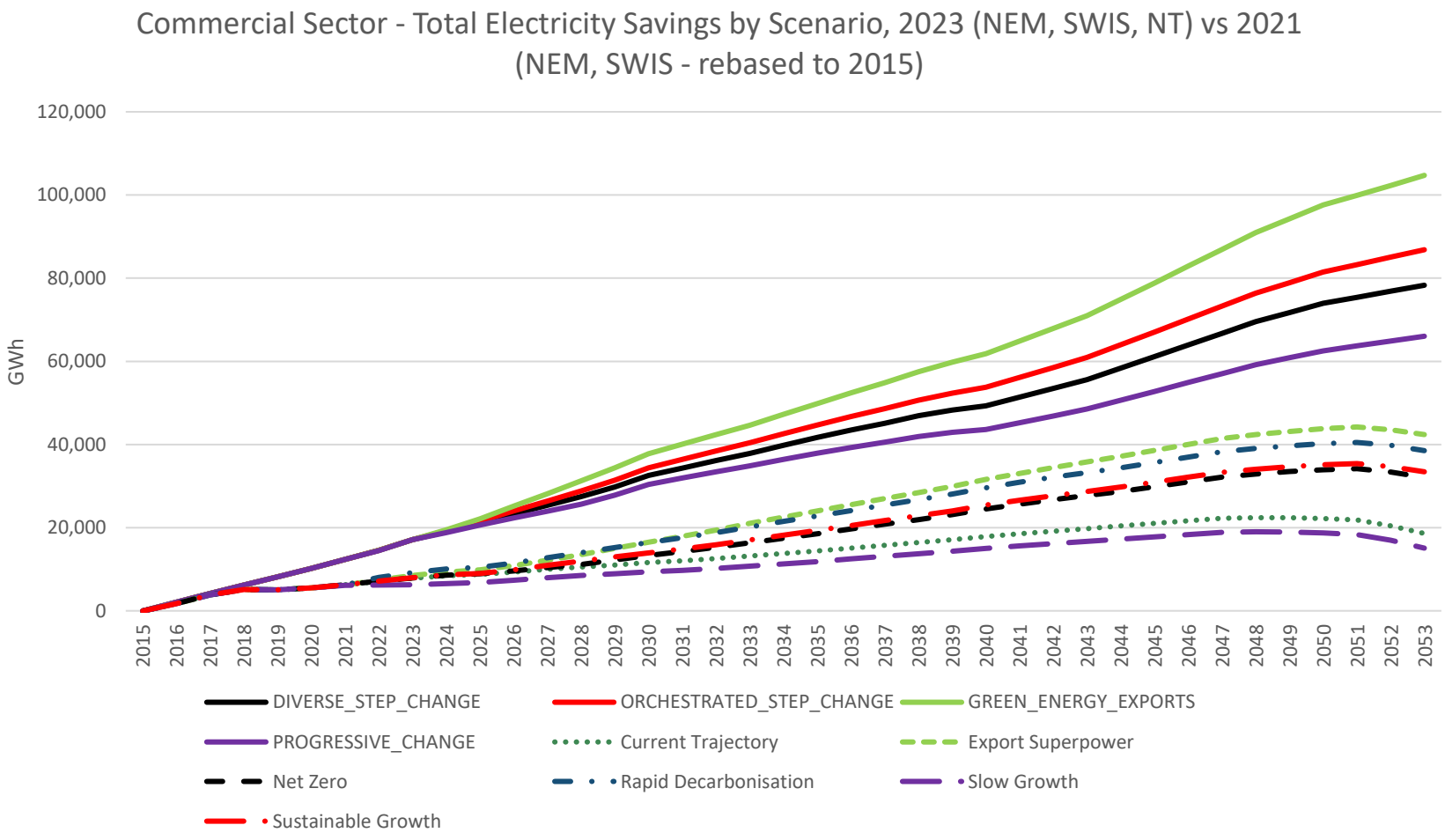
- Savings higher when economic growth, stock turnover and/or electrification are higher
- Step Change scenarios have the same policy assumptions, but electrification leads to greater AEEI in Orchestrated, but therefore lower policy-led savings (as these are measured additional to AEEI)

Commercial Forecasts – Electricity



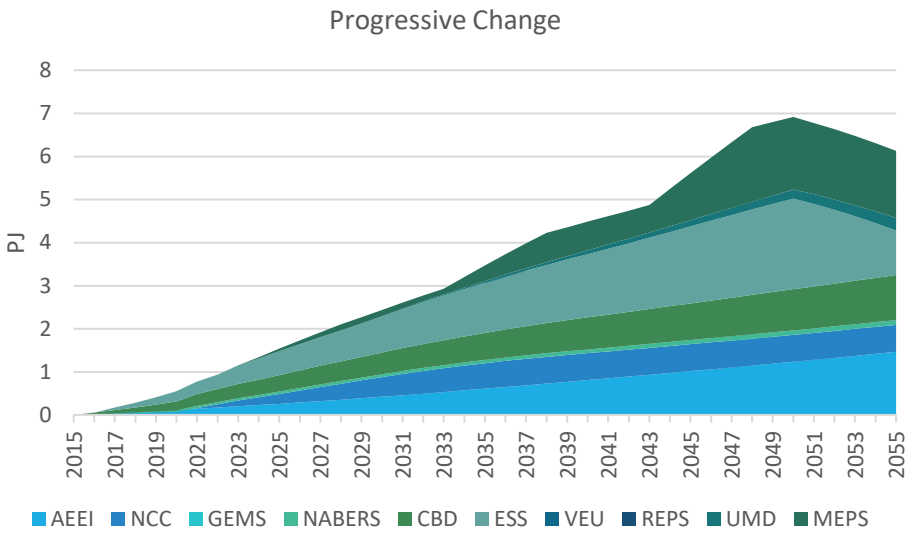
- REPS/VEU phased out by 2040
- Savings driven by AEEI – which, in turn, is significantly affected by electrification
  - also by stock turnover/growth rates, modest degree of differentiation in policy settings

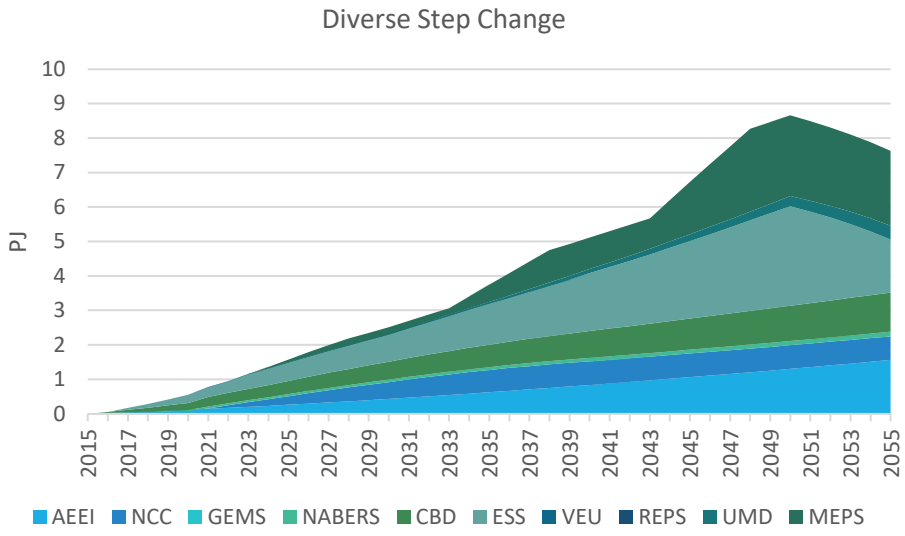
Commercial Forecasts – Electricity

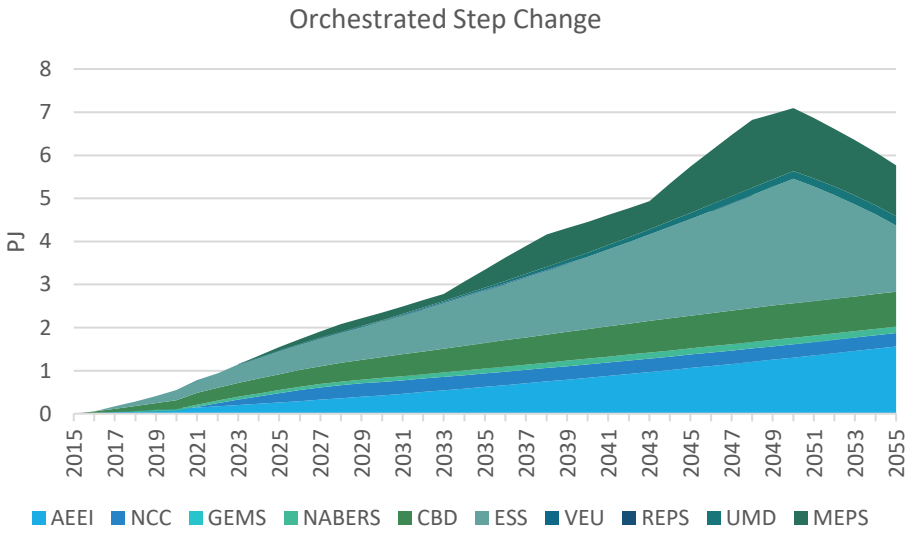


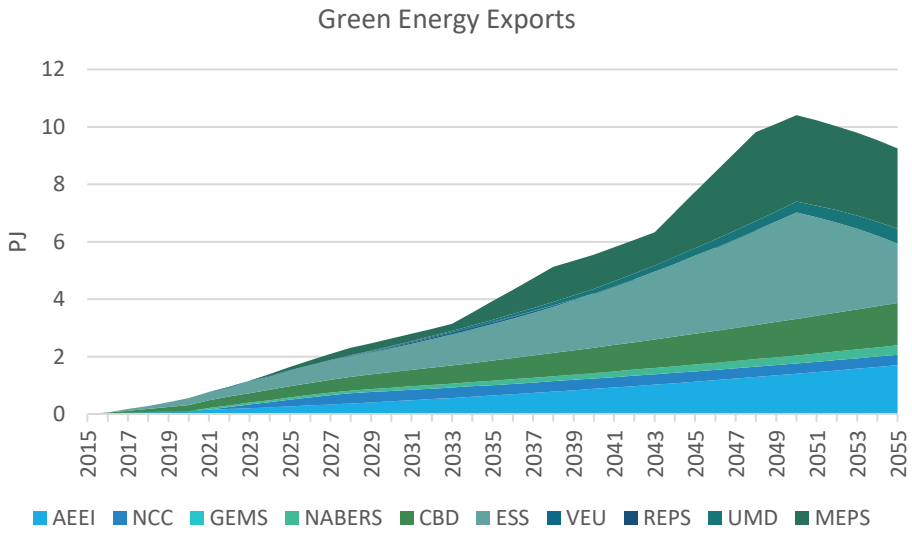
- Primary difference cf 2021 is AEEI, which was not forecast in 2021
- Other measures have very similar savings (rebased to 2015)
- NT not in scope in 2021

Commercial Forecasts – Gas



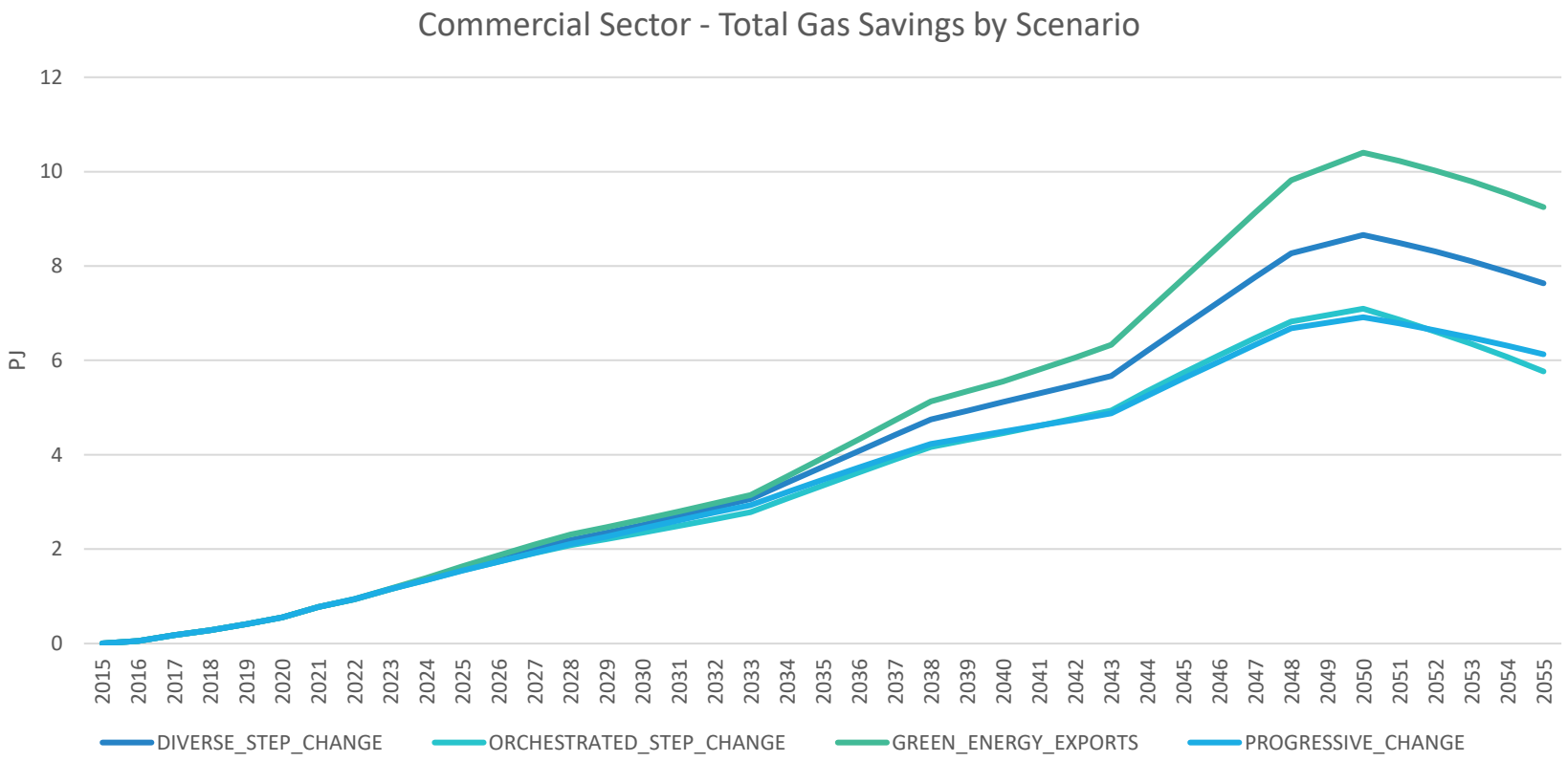






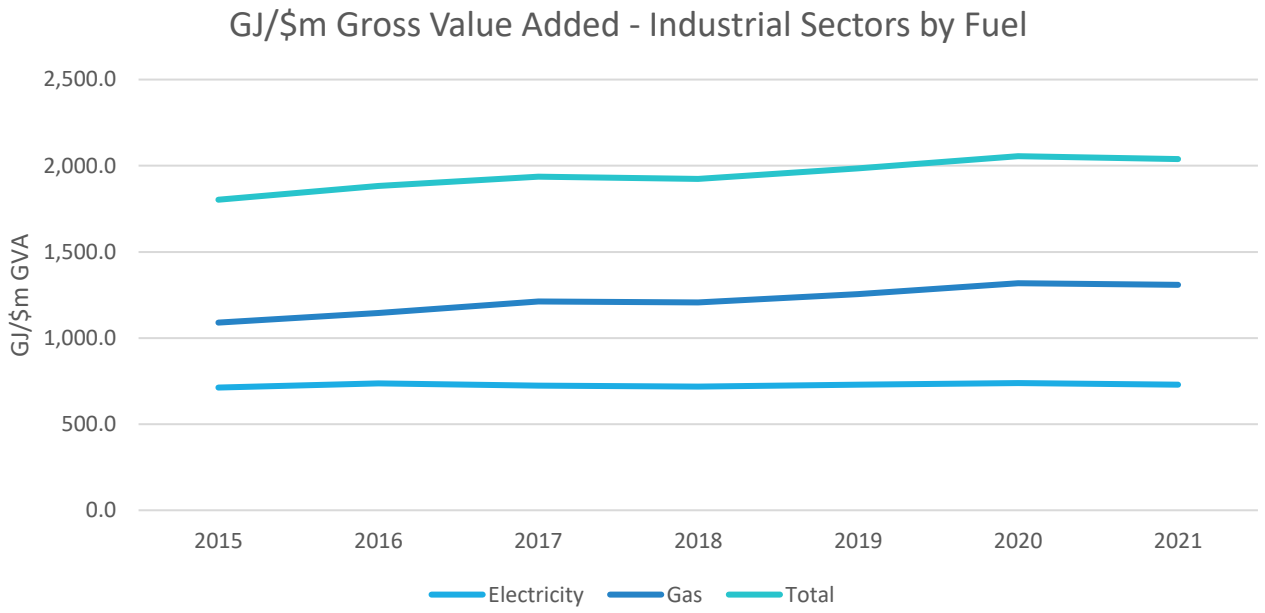
- Savings are small in all scenarios - gas is a relatively minor fuel in commercial
- Highest in Green Energy Exports – faster growth but less electrification (than Orch. Step Change), followed by Diverse Step Change (less electrification, but also less growth
- Savings drop off after 2050 – all state schemes assumed to have ended (ESS grows until then)

Commercial Forecasts – Gas



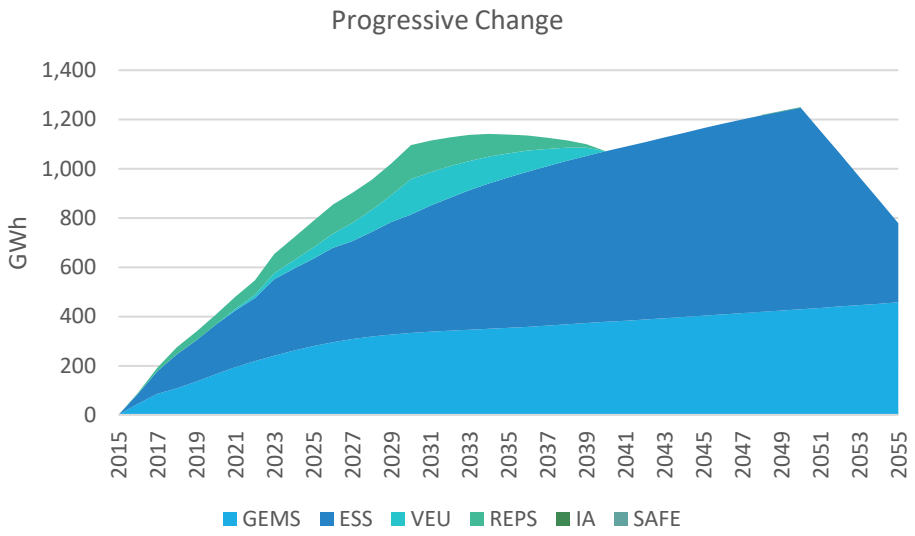
- Orchestrated Step Change and Progressive Change have similar trajectories for gas, but this is incidental
  - Progressive Change has higher gas use, but weaker policy settings and AEEI, whereas Orchestrated Step Change has less gas use, but stronger AEEI and policy settings, and these effects tend to cancel each other out

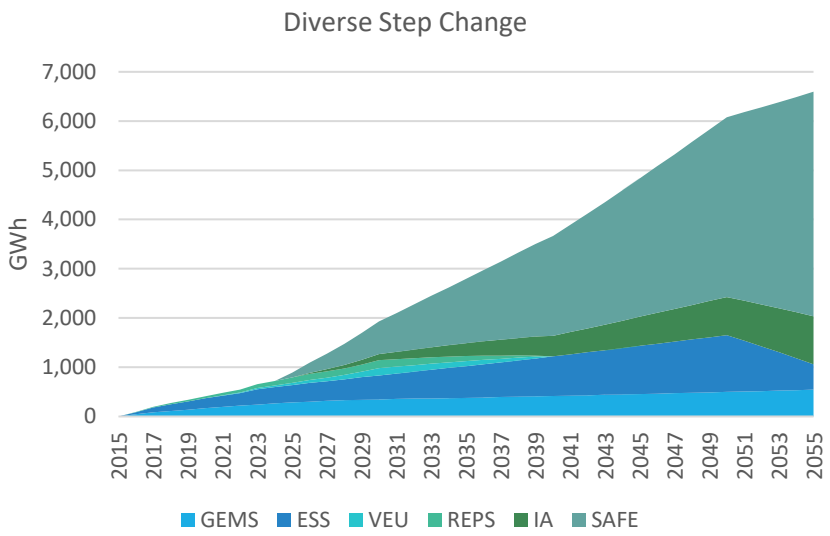
Industrial Sector - AEEI

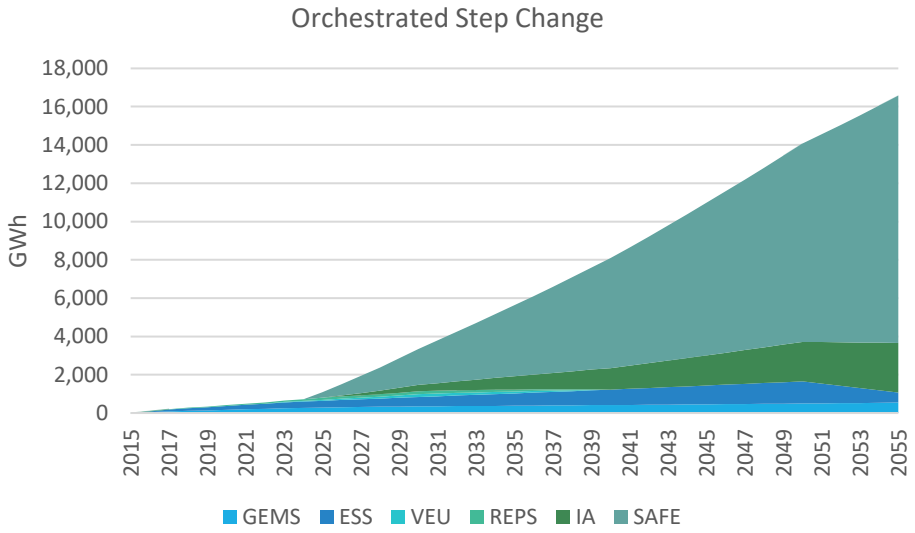


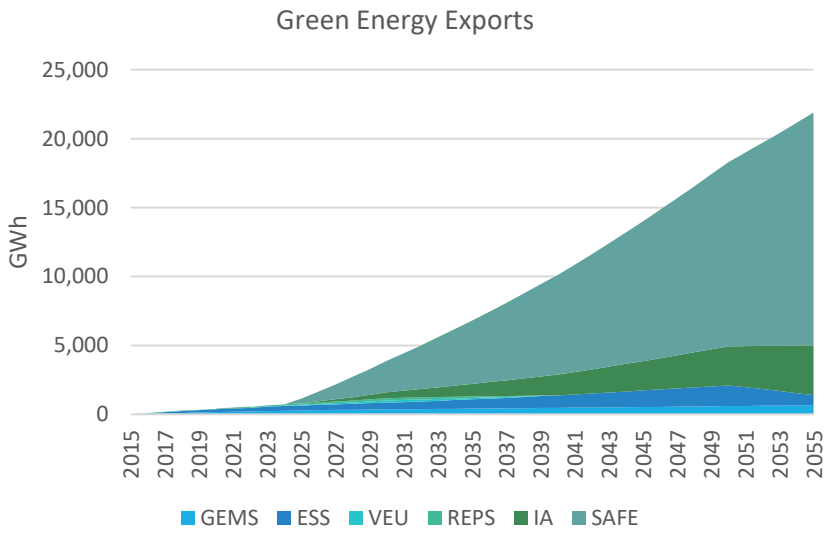
- $m GVA is often taken as a proxy for output, but many economic factors obscure underlying changes in physical output or productivity, particularly in the industrial sector
  - USD commodity prices, exchange rates, changing product mix, changing ore grades, weather (agriculture), etc
- However, this measure of energy intensity *increases* over time for both electricity (0.4%/year) and gas (3.1%/year), and in total by 2.1%/year
  - For comparison, average growth rate of (real) GVA was just 0.9%/year over the same period
  - The implication is that AEEI was negative over this period, but we would not call this based on proxy data, and AEEI is not quantified in forecasts

Industrial Forecasts – Electricity



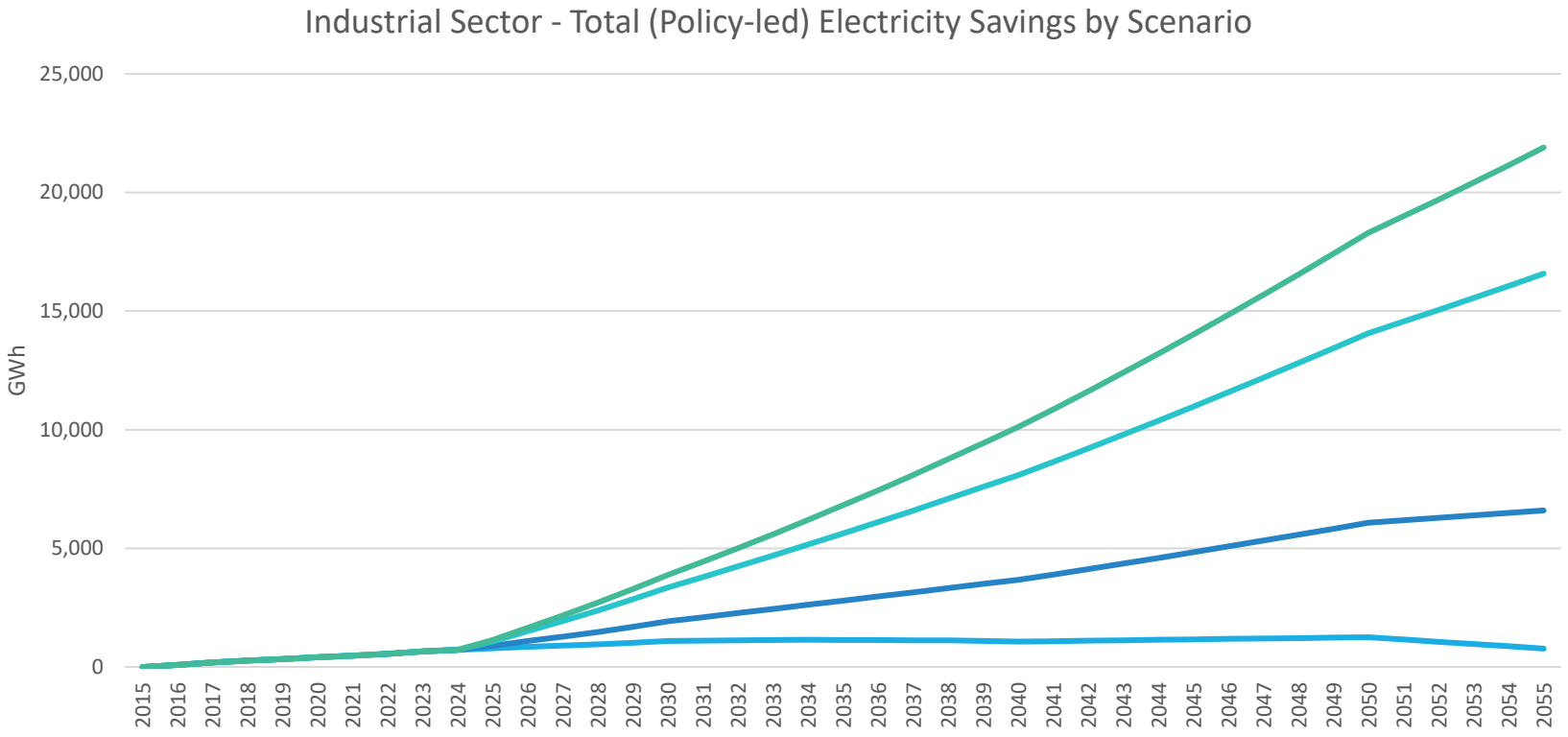






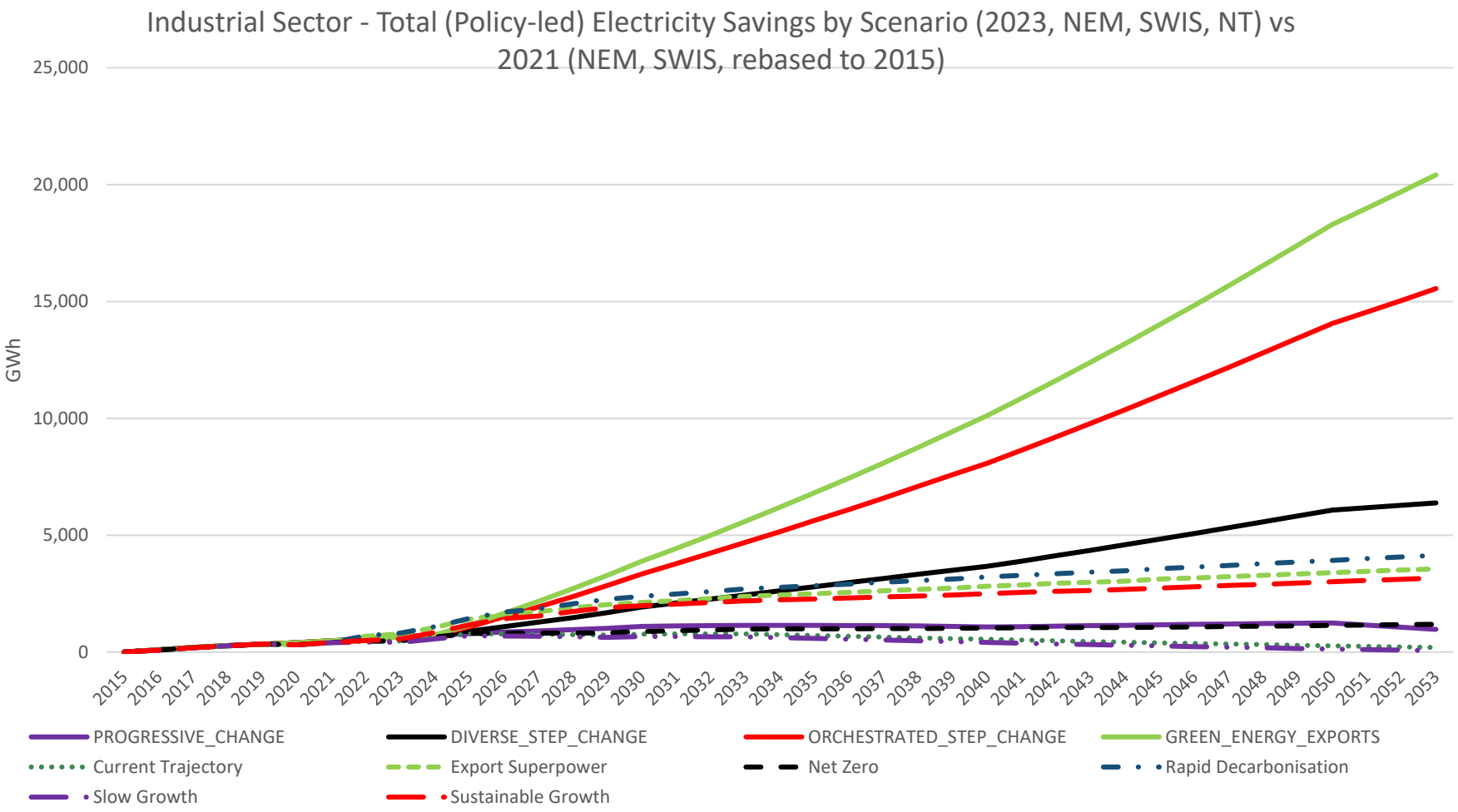
- Savings are very small in all scenarios if only existing measures are considered
- GEMS assumed to have higher ambition in Green Energy Exports and Step Changes
- The Safeguard Mechanism, and Industrial Assessments (potentially as an alternative), have very large EE potentials, but the former is still evolving

Industrial Forecasts – Electricity



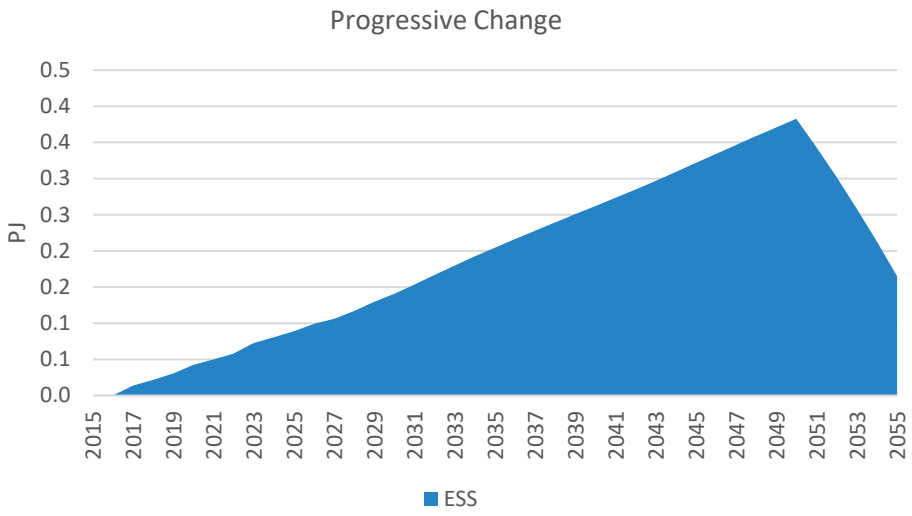
- Scenarios are differentiated on policy settings and electrification assumptions
  - Safeguard Mechanism and Industrial Assessments assumed not to occur under Progressive Change
  - Electrification is highest under Orchestrated Step Change, but manufacturing/ export sector growth most rapid under Green Energy Exports – two tend to offset each other in terms of efficiency outcomes
    - AEEI would be higher under Orchestrated Step Change, due to greater electrification, and lower under Green Energy Exports, where hydrogen is assumed

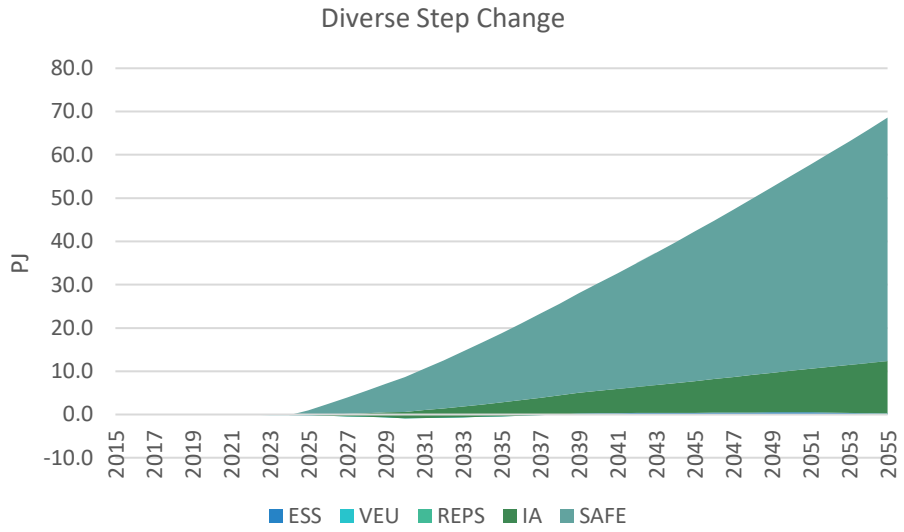
Industrial Forecasts – Electricity

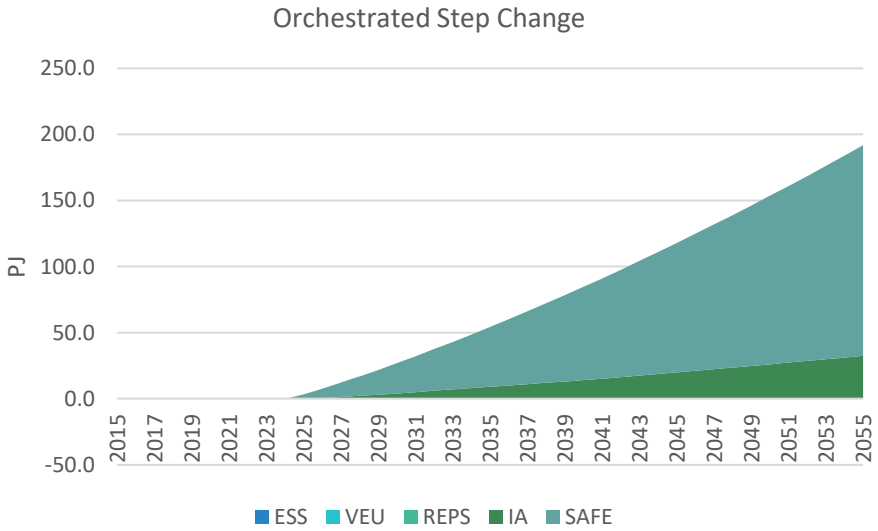


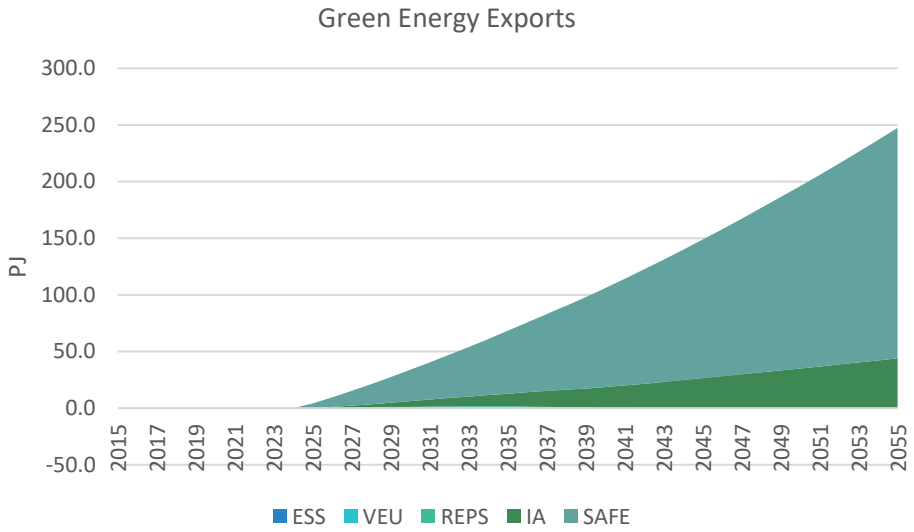
- Major difference in 2023 is the Safeguard Mechanism
  - Eg, in Green Energy Exports in 2053, it accounts for 15400 GWh of out 20400 GWh total
- GEMS is lower than in 2021, reflecting updated impact modelling from DCCEEW

Industrial Forecasts – Gas



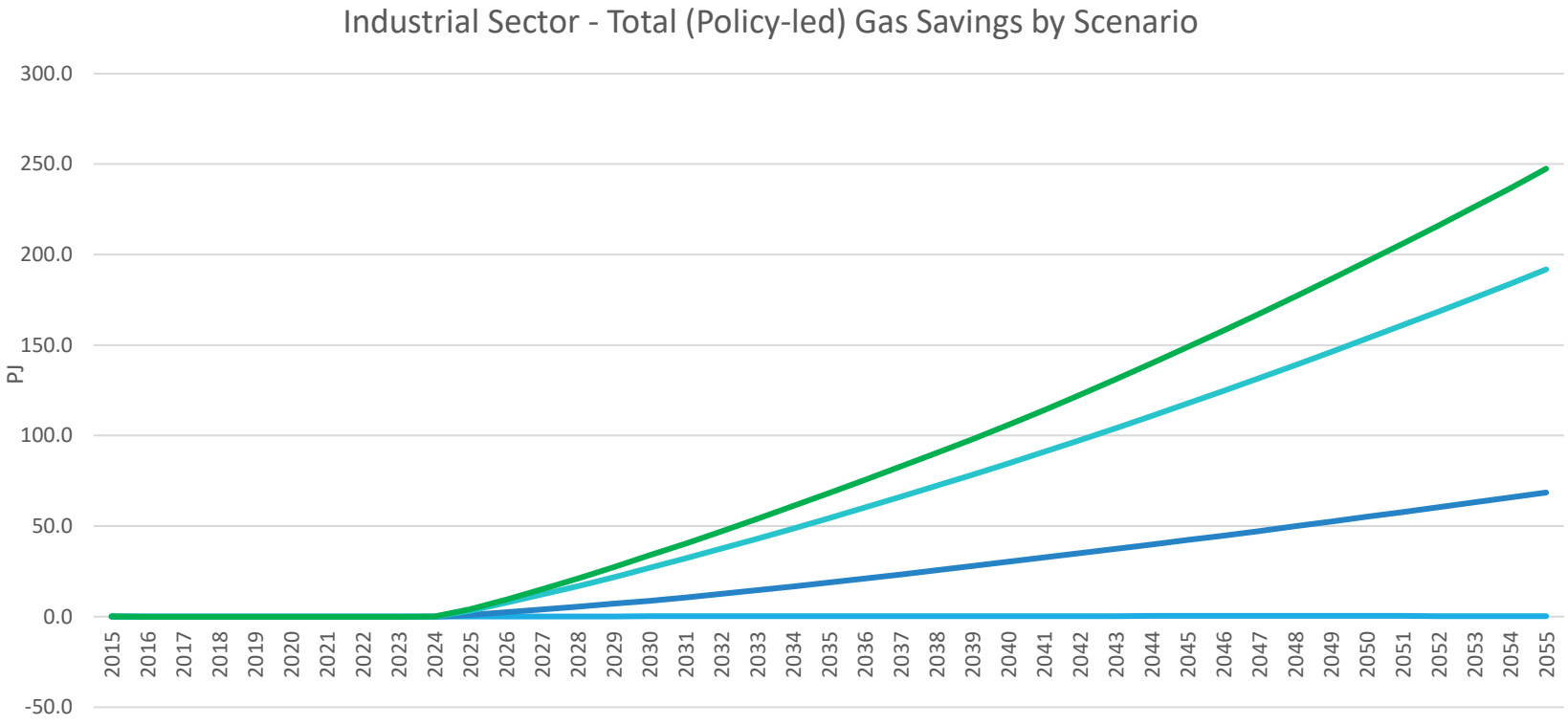






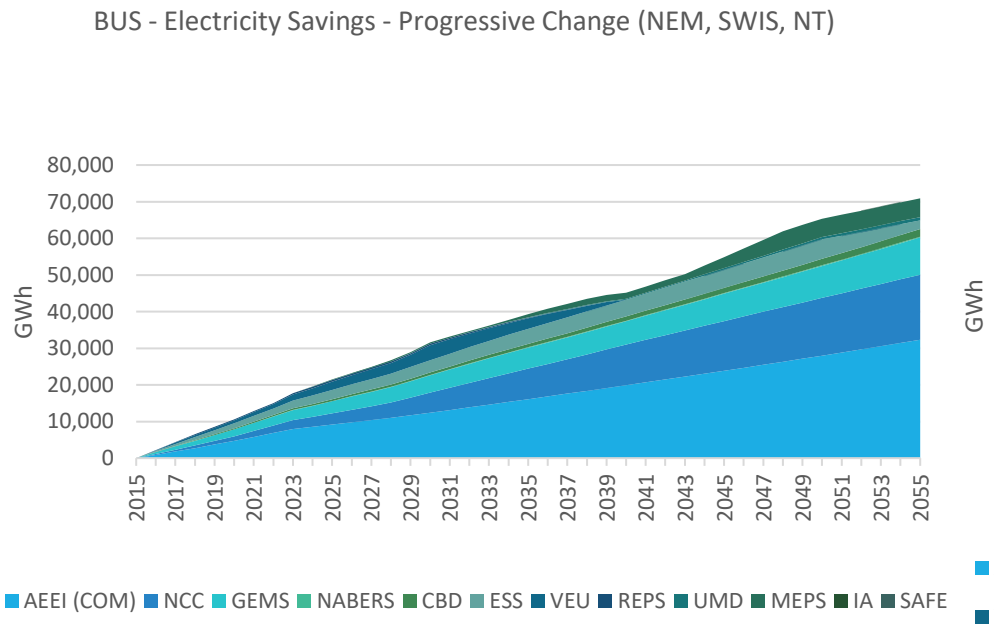
- Savings are very small in all scenarios if only existing measures are considered (minor negative gas savings can arise in VEU where activities encourage gas replacing electricity)
- Electricity/gas split of savings for SAFE and IA are based on average (industrial) fuel mix – but gas savings more likely through electrification than EE improvement
  - Would need to see details of the Safeguard Mechanism, and do much more extensive modelling, to accurately forecast its EE impact

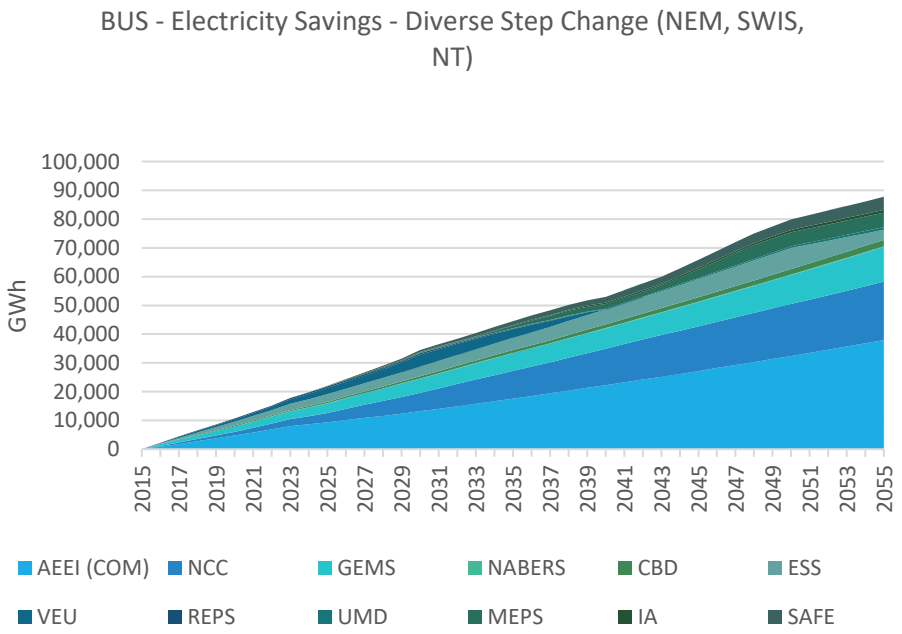
Industrial Forecasts – Gas

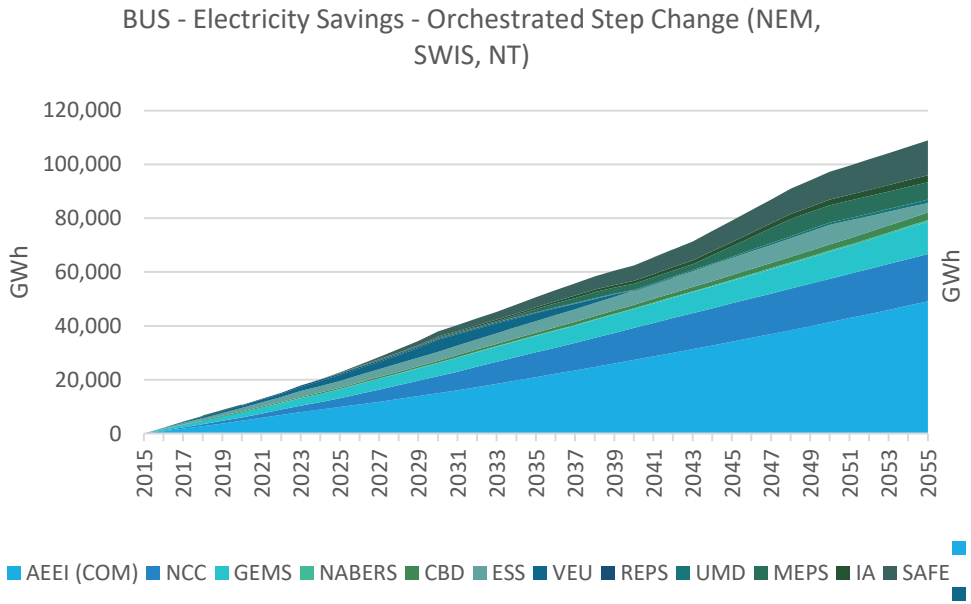


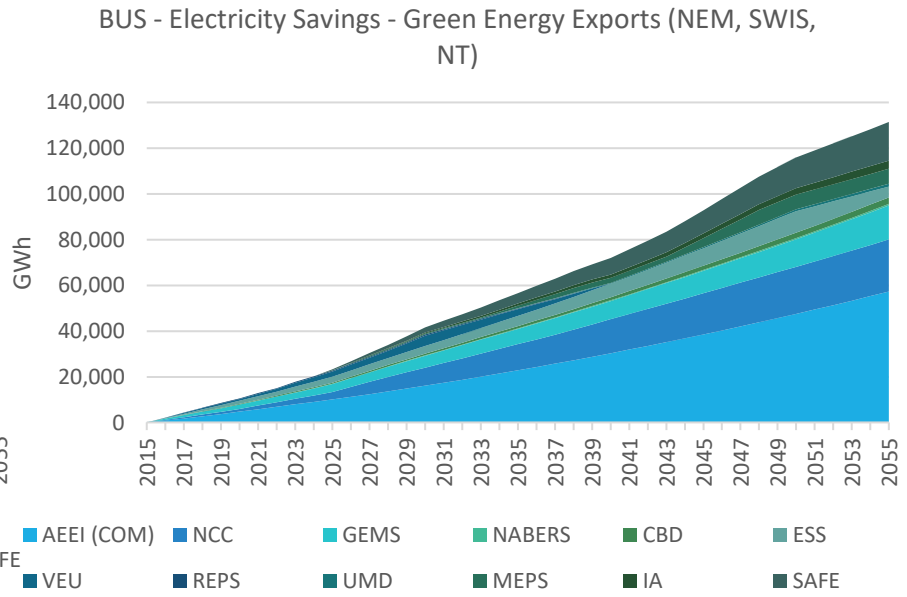
- As with electricity, scenarios are differentiated on policy settings and electrification assumptions
  - Safeguard Mechanism and Industrial Assessments assumed not to occur under Progressive Change
  - Electrification is highest under Orchestrated Step Change, but manufacturing/ export sector growth most rapid under Green Energy Exports – two tend to offset each other in terms of efficiency outcomes

Combined BUS Forecasts – Electricity









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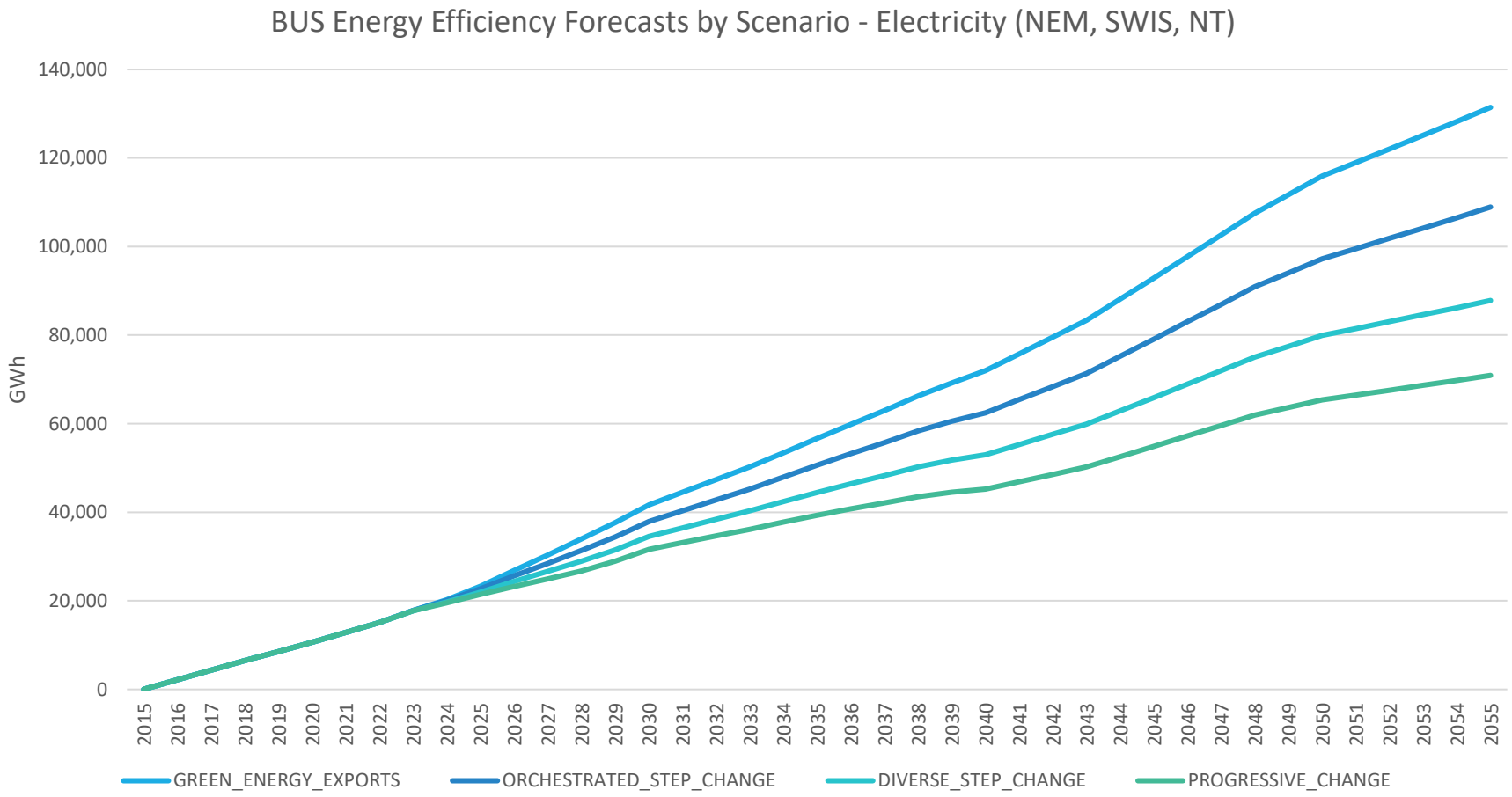
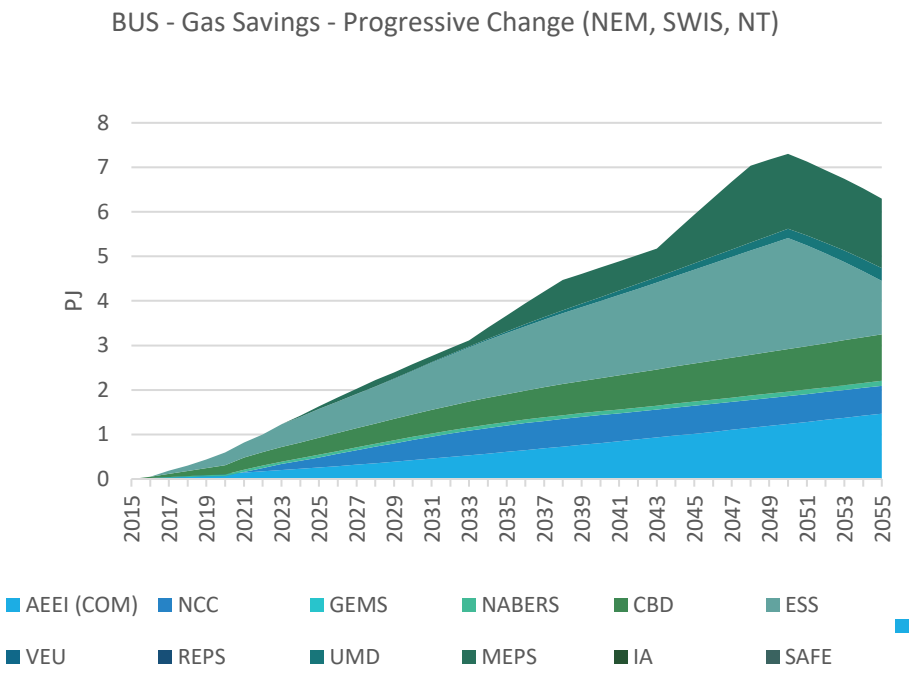
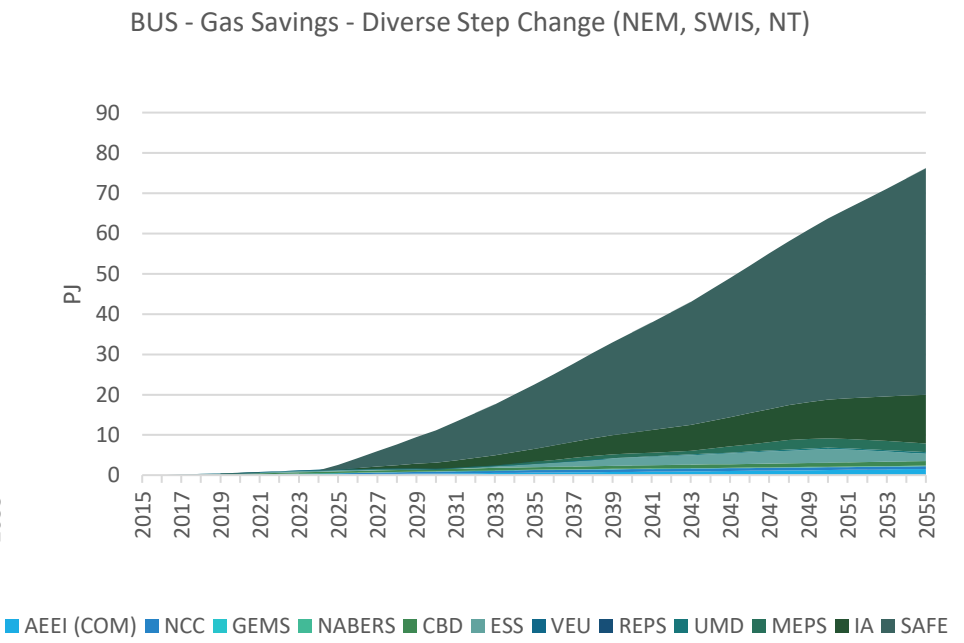
Combined BUS Forecasts – Electricity

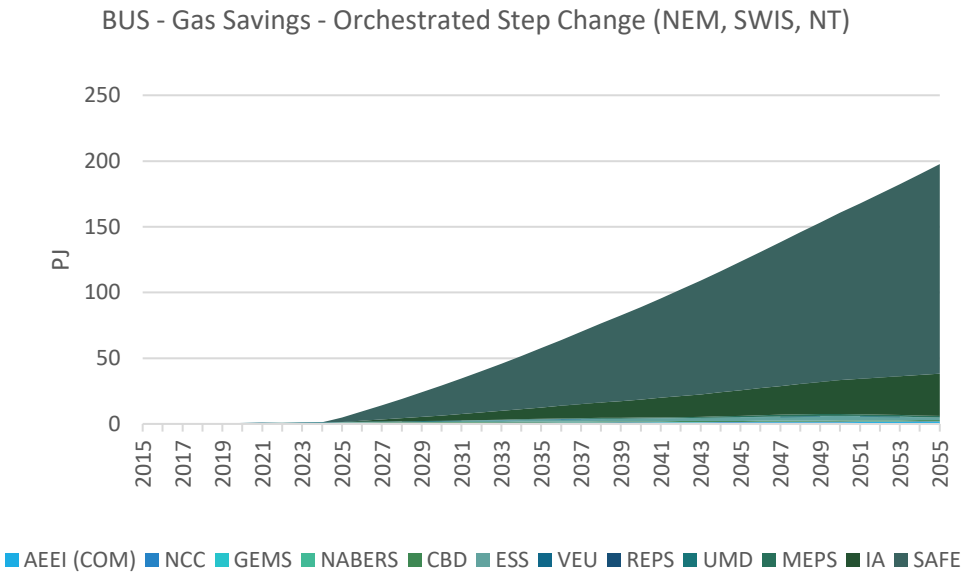


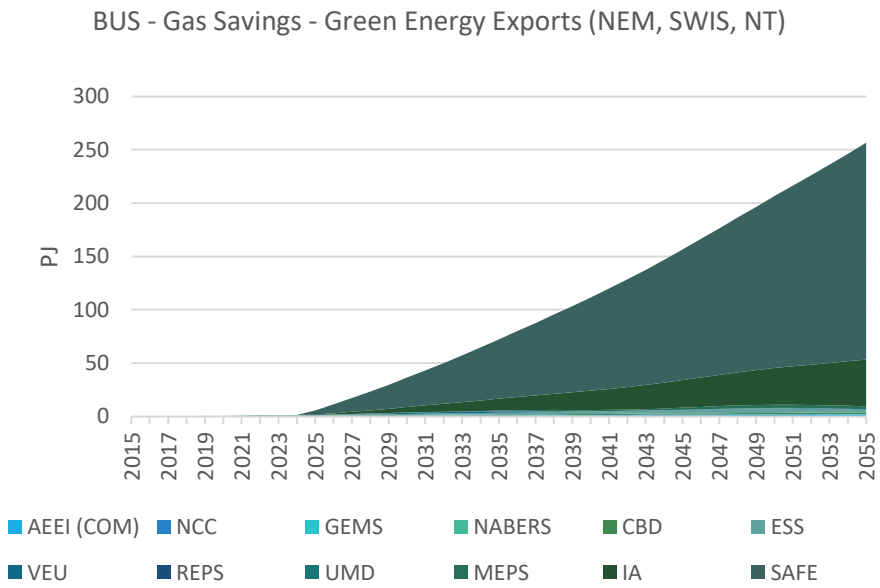
- COM represents the larger share of the savings, but largely attributable to AEEI, not estimated for IND

Combined BUS Forecasts – Gas

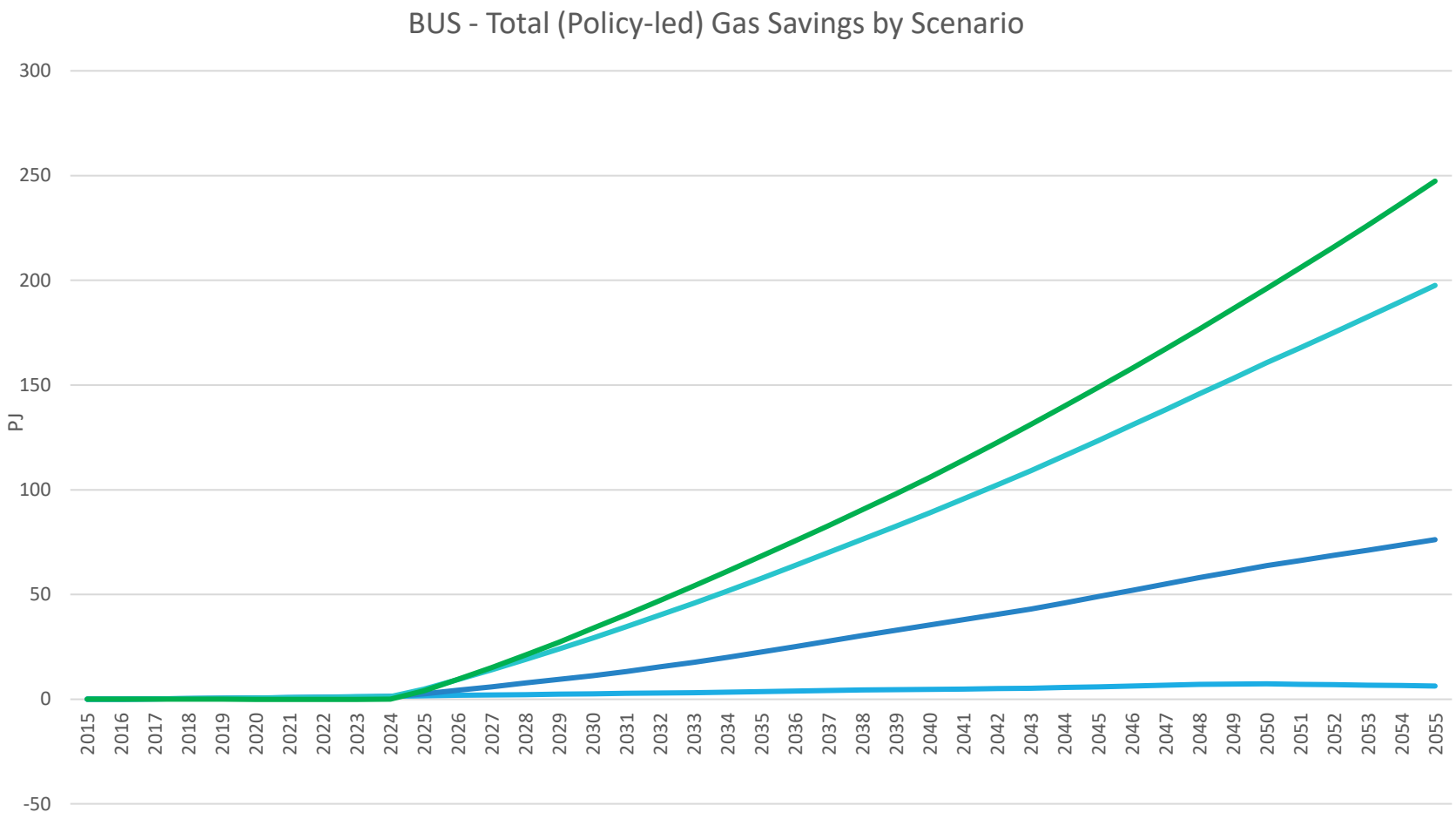






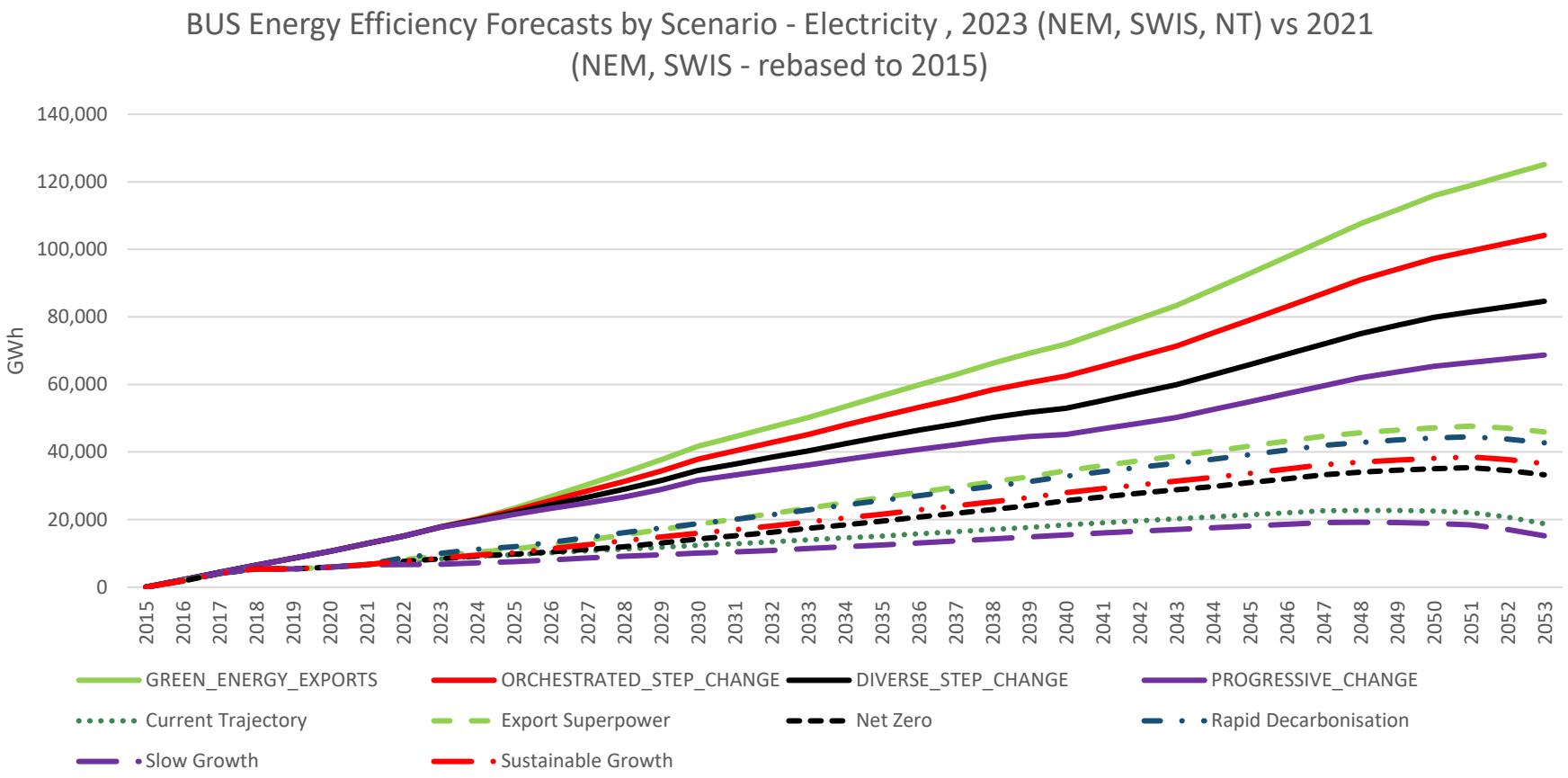


Combined BUS Forecasts – Gas



- For gas, savings are dominated by IND rather than COM, due to the assumed influence of the Safeguard Mechanism in particular

Combined BUS Forecasts – Electricity (2021 vs 2023)



- As noted for COM and IND, the key influences for 2023 are:
  - Inclusion of AEEI for COM in 2023 (not in 2021)
  - Inclusion of the Safeguard Mechanism for IND in 2023 (not in 2021)
- Other measures generally very similar to 2021
  - GEMS savings lower
  - REPS and VEU modelled as phasing out by 2040

Strategy. Policy. Research.

Contact

Philip Harrington, Principal Consultant

philip_harrington@strategypolicyresearch.com.au

0419 106 449

www.strategypolicyresearch.com.au

Additional Slides

- Note – for reference/questions only

Scope / Definitions

- Scope is limited to efficiency/intensity change
  - Excludes TOU, maximum demand, demand management considerations
  - Electrification is examined only where linked to energy efficiency change/policy
- Energy *efficiency* and energy *intensity* terms tend to be used interchangeably, however:
  - Energy *efficiency* (useful work/output per unit energy consumption) is best used for simple, specific processes (and carries normative connotations if used economy or sector-wide)
  - Energy *intensity* (energy consumption per unit useful work/output) is better for describing larger/more complex energy-using systems, and generally does not carry normative connotations
- The ACT is modelled as part of NSW Region

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Scope / Definitions

- References to WA in charts, etc, are to the SWIS only
  - references to the NT are to the whole of the NT
- Markets are divided into RES and BUS sectors, with the latter segmented into COM and IND
  - COM and IND may both contain Large Industrial Loads (LILs) and the rest (denoted SMEs), but most LILs are industrial
  - IND excludes Division D (power generation, etc) except water/sewage pumping, and includes Divs A (agriculture), B (mining), C (manufacturing), E (construction) and I (stationary electricity/gas only)
- Load segments are TOT, HEAT, BASE, COOL
- Underlying Consumption = Delivered Consumption (net transfers at the meter, ie, reduced by ‘exports’) + behind-the-meter generation

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Approach – Historical Period

1. Capture historical consumption data (primarily interested in underlying/total consumption)
2. Estimate stock turnover (RES and COM), including variations in future turnover by scenario
3. Derive total change in fuel intensities in the historical period by region, by combining the above two steps
4. Estimate policy-induced savings measure-by-measure (major measures only), drawing on program reporting and/or inputs from program managers (discounted for non-additionalities to market-led efficiency change and to other policy measures, as appropriate)
5. Derive market-led (or autonomous) energy intensity change by region/fuel as *total* energy intensity change *minus policy-led* energy intensity change
6. Reconcile and balance model for the historical period

Approach – Forecast Period

7. Forecast policy-led savings, with explicit policy assumptions per measure/scenario, linked to growth drivers by scenario (as appropriate), projecting non-additionalities in line with historical reconciliation (except where policy change is expected to change additionality)
   - Forecasts run to FY2055, so this includes potential future policy settings and/or models that do not exist today, in line with scenario narratives
8. Forecast market-led savings, differentiated by scenario in line with scenario narratives, linked to growth drivers

Approach

- This approach provides evidence-based total fuel intensity change over time (in the historical period) and ensures that total intensity change is neither over- nor under-estimated
  - However, the policy-led and (in particular) the market-led components must be estimated
- For the industrial sectors, there is no ready measure of physical output in the public domain, and energy consumption reporting is highly aggregated
  - We examine energy use/unit value-added as a proxy (at best) for total energy intensity change
  - Estimate policy-led savings measure-by-measure, as above
  - Data does not support analysis of market-led change (but, as noted later, it suggests that both electricity and gas intensity has been rising over time)

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Data Sources

- For residential, historical electricity consumption data is provided by AEMO (from 2017 in NEM states, 2015 for SWIS)
  - We use Australian Energy Statistics (AES) for NT, and backcast to 2015 (all states except SWIS) in line with AES trends
  - Gas consumption is from AES
    - AES discontinuity between 2014 and 2015 does not impact
- For commercial and industrial, historical fuel consumption data was not available from AEMO, so AES was used
- Residential stock turnover from new ABS data series (2016 – 2022) and from new Commercial Building Energy Consumption Baseline Study for non-res buildings
  - Housing stock growth linked to connection forecasts by scenario; and non-res stock growth linked to value-added – services by scenario
- AEMO data/assumptions re LIL/SME splits, splits by ANZSIC Code, and load splits, for consistency with other inputs
- Policy impact data from program reporting and additional inputs re GEMS, ESS

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