GOVERNMENT OF WESTERN AUSTRALIA
Department of **Energy, Mines, Industry Regulation and Safety**
Energy Policy WA

Goldfields Regional Network

Concept Study

PoweringWA

Long-Term Solution

PoweringWA is investigating the potential development of a privately owned common-use electricity network from Kalgoorlie to Leinster via Leonora – the Goldfields Regional Network (GRN).

- Modelling suggests that a GRN is the optimal transmission outcome for the Goldfields region.
- The GRN would provide:
  - The Goldfields with access to more reliable low-emissions energy to support industry decarbonisation using high-quality and diverse wind resources.
  - An opportunity for a private sector-led solution.
- Three planning stages:
  - Stage 1: concept study
  - Stage 2: identify commercially viable options
  - Stage 3: identify regulatory and market arrangements.
- PoweringWA will engage meaningfully with all stakeholders in the region throughout all stages of the project.

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Key Drivers

The Energy Trilemma provides a framework to consider the key drivers and potential benefits for the GRN.
A successful GRN would deliver improvements to key stakeholders in each of these categories:

Energy Affordability

- A large-scale network comprised of renewable generation and storage, supported by gas, could deliver a lower cost of energy to operators.
- Gas and diesel generation is currently sized for the load of mining operations, including back-up requirements.
- Renewable energy solutions are currently limited by integration with gas and diesel generation and the operating life of mines.

Energy Security

- The Goldfields region represents over 600 MW of load (demand) that is predominantly supported by standalone generation at each location.
- Disbursed variable generation feeding into one network would allow for firm renewable power.
- The GRN would offer an additional point of supply to the City of Kalgoorlie-Boulder.

Energy Sustainability

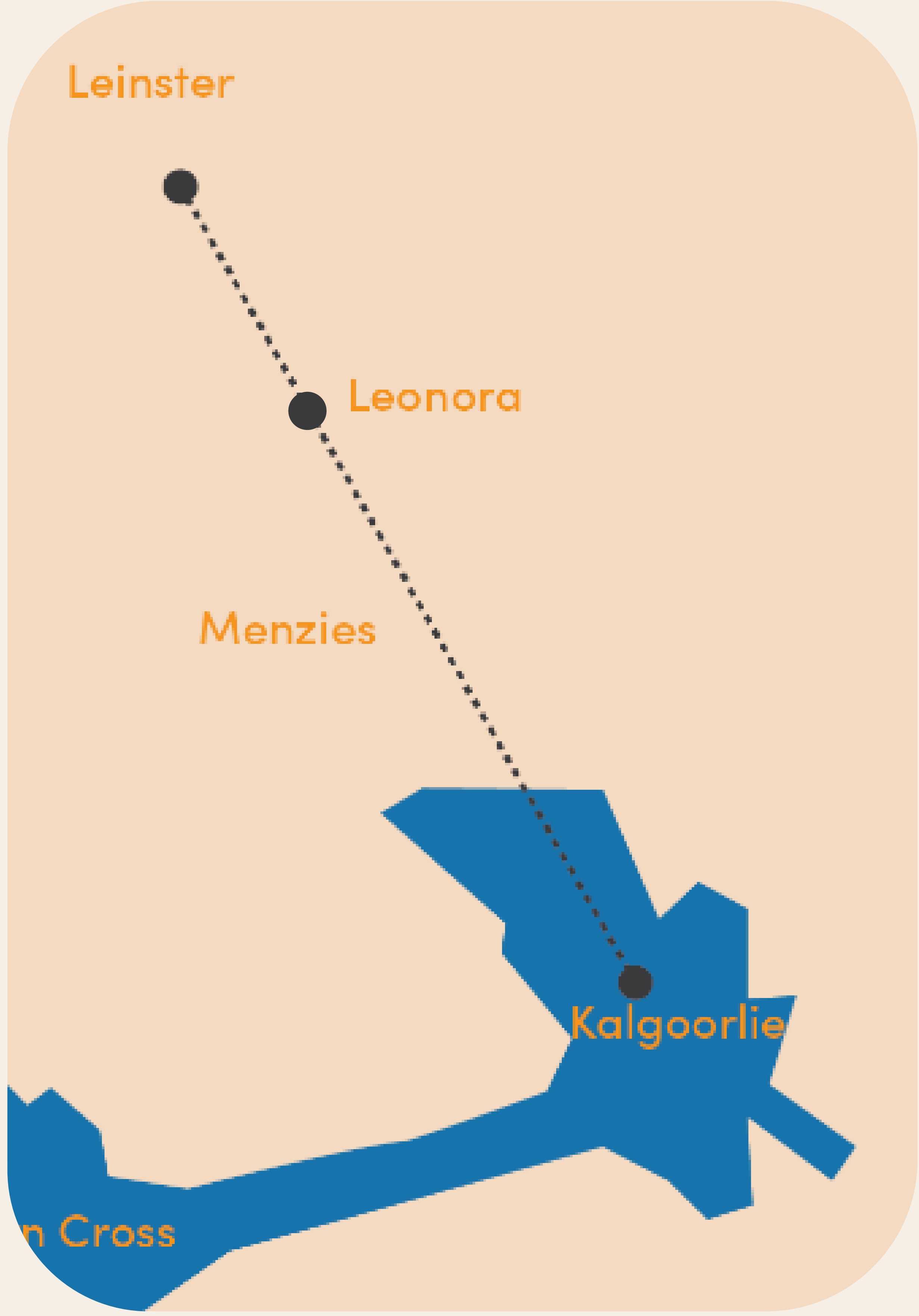
- The GRN would reduce the region's reliance on diesel and gas generation.
- Multiple locations across the Goldfields provide abundant renewable resources (solar and wind) for the development of large-scale renewables, subject to Government approvals.
- A network with significant renewable generation may fast track emissions reductions for facilities under the Commonwealth Safeguard Mechanism.

Concept Study for the Goldfields Regional Network (GRN)

PoweringWA has engaged EY and ResourcesWA to deliver a Concept Study for the GRN – an economic assessment of the viability of the GRN Project.

This slide pack presents preliminary outcomes from the Concept Study.

- Two main network scenarios were tested:
  - Standalone (the benchmark case with self-supply and no GRN)
  - A GRN that is connected to the SWIS
- Stocktake of current and future load (demand)
- Consideration of existing and future supply capacity and requirements
- Transmission infrastructure requirements and costs
- Levelised costs of electricity generated
- Impacts on reliability of supply and emissions



Methodology and Assumptions

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GRN Capacity Expansion Modelling and Analysis

Inputs and assumptions developed collaboratively between PoweringWA, ResourcesWA, EY and Stakeholders

Demand

Three demand scenarios:

- Committed
- Steady
- Electrification

Supply

Existing and probable capacity as well as build options (wind, solar, gas, battery)

Supply defined by location, capital cost (capex), fuel cost, operating and maintenance cost, plant life, emissions, renewable resource availability profiles, etc.

Network

Potential transmission network developments between nodes of the GRN, defined by capex and earliest available date

Capacity expansion modelling

EY's capacity expansion model (TSIRP)

- Used in previous capacity mix modelling in the SWIS (WOSP, SERS, SWISDA), Northern Territory, Mt Isa the NEM, NZEM and other remote power supply analysis
- The model identifies the **least-cost capacity mix** of generation, storage and transmission needed to meet demand over a long-term planning horizon ("central system planner" perspective)
- Includes **a set of defined constraints (**e.g., policy objectives and the power system technical envelope)
- Optimises both long-run investment decisions and short-run dispatch decisions to **minimise the total system cost** – that is, the sum of:
  - Capex on the new capacity buildout
  - Fixed operations and maintenance costs
  - Fuel and variable operations and maintenance costs
  - Costs associated with supply shortfall events (unserved energy, or USE)*

Results, analysis and insights

This Concept Study provides an **initial quantification** of:

- The scale of the network, generation and storage capacity (MW) needed to meet existing and new loads in the Goldfields
- The cost to supply the loads ($ billion, $/MWh).

The study **does not** include an in-depth assessment of power system security and reliability (PSSR).

* The USE value is based on an assumed Value of Customer Reliability (VCR), which represents the willingness of different customer types to pay for a reliable supply of electricity – assumed VCR = $81,550/MWh (further detail below)

Detailed Assumptions

	Methodology	Details

Demand	• The Committed demand scenario was developed from public disclosures on forecast mine life and industry feedback gathered through pre-forum meetings, supplemented by residential and commercial load data, where applicable
	• The other demand scenarios built upon the Committed demand scenario
	• Loads were aggregated into three demand regions:
	  ○ Kalgoorlie
	  ○ Leonora/Laverton
	  ○ Leinster
		• The Kalgoorlie demand region combines residential and small commercial loads as well as large industrial loads
		• The loads for the Leonora/Laverton and Leinster regions were industrial only
		• The modelling assessed the impact on the GRN due to:
		  ○ Nickel mining and production recommencement
		  ○ Fleet electrification
		  ○ Moderate load growth
		• The load growth assumption was based on 10-year average percentage change in WA gold production of ~1%
		• Load growth was applied to the flat-lined Committed demand post-2029

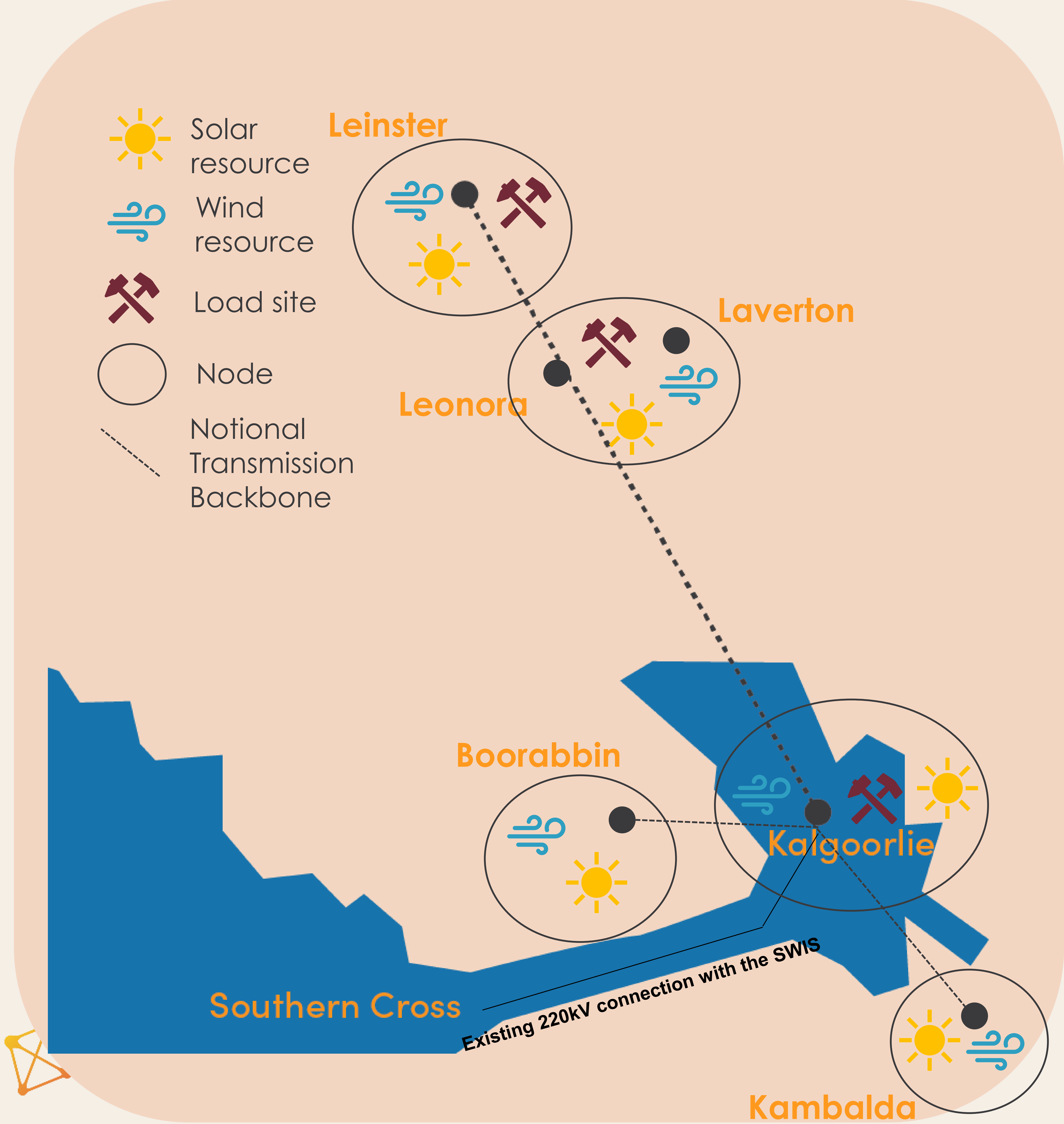
Existing and committed plant retirements and reliability	• Existing and committed supply capacity was based on an assessment of the current generation fleet • Retirements of existing plant was based on forecast end of asset life of thermal capacity in the region and gradual decarbonisation of facilities in the GRN geography	• Thermal generation retirements were considered on a case-by-case basis • Where appropriate existing assets were assumed to have asset lives between 7 to 10 years • All existing thermal capacity was assumed to be retired by 2043-44

Detailed Assumptions

	Methodology	Details
New supply candidates	• Site selection for new renewable supply informed by prior demand assessments (WOSP, SERS, SWISDA) • Candidate options refined in a series of consultations across the GRN Project team	• New solar PV and flexible gas available from 1/7/2026, limited to 500 MW per year until 1/7/2031 • New wind available from 1/7/2028, limited to 200 MW per year until 1/7/2031
Network	• Network costs and timing based on similar least-cost expansion modelling exercises undertaken for the SWIS (WOSP, SWIS Demand Assessment)	• No existing network between GRN nodes • Network build candidates for the backbone transmission line between nodes were available from 1/7/2033 (i.e., potential commencement date of the GRN • SWIS connection based on network transfer limits after East Enhancement* (190 MW of transfer capability from GRN to SWIS, 250 MW of transfer capability from SWIS to GRN) • SWIS modelled as a single node capable of importing from and exporting to the GRN
Gas constraint	• Daily gas limit based on regional pipeline limits	• Gas constraint of 148 TJ/day; 110 TJ/day south of Leinster
Capex	• Aligned to industry standard projections of capital costs for new generation capacity	• CSIRO GenCost 2023-24: Global Net Zero by 2050
Value of customer reliability (VCR)	• Based on 'Estimation of value of customer reliability for Western Power's network, Access Arrangement Information'** • Aligned to transmission-connected VCR for mines	• $81,550/MWh
Fuel costs	• Based on industry consultation and public data • Additional fuel transport costs overlaid for gas pipeline	• Assumed fuel cost of $9.00/GJ for natural gas • Assumed fuel cost of $28.72/GJ for diesel
Emissions constraint	• Not applied for the first feasibility assessment (the Concept Study prioritised the economic case for the GRN)	• No emissions constraint

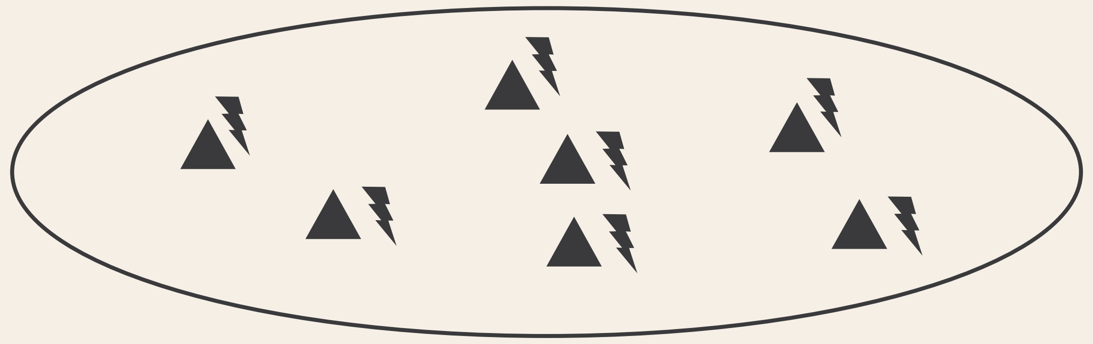
* In 2023, the WA Government committed $21 million to optimise existing transmission infrastructure in the eastern parts of the SWIS around Merredin
** 22. Attachment 6.4 - Estimation of value of customer reliability for Western Power's network.pdf

Goldfields Regional Network Nodes



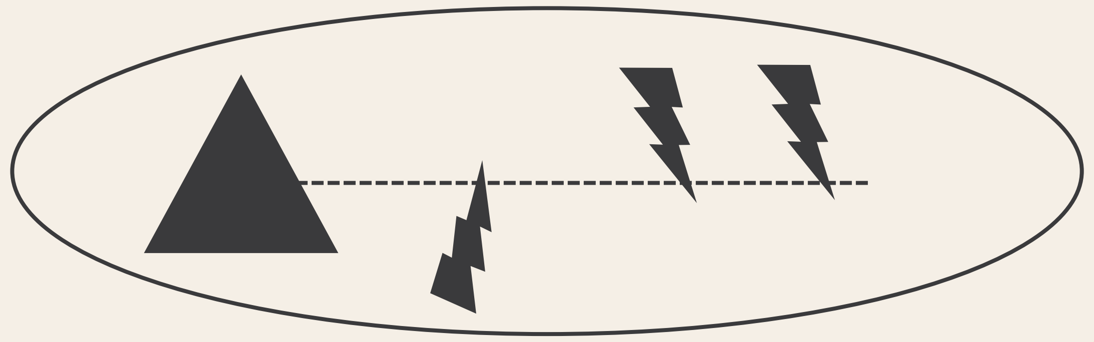
- An assessment of current loads in the Goldfields and public announcements regarding future load growth identified three demand regions:
  - Leinster (extending north to Mount Keith)
  - Leonora/Laverton (extending east to Sunrise Dam)
  - Kalgoorlie (extending south to St Ives)
- A supply-side assessment identified high-capacity factor wind resources at Leinster, Leonora, Boorabbin, Mount Burges, Kalgoorlie and Kambalda; and abundant solar PV resources throughout the region – this formed the basis of five nodes for the study
- Nodes are a modelling representation of aggregated demand and supply facilities (existing, committed and potential) in each region mapped to respective regions
- The GRN was modelled as a transmission network backbone to connect the modelled nodes – this configuration may be further refined in later stages of the GRN Project
- Intra-nodal connection between GRN transmission terminal stations and specific load sites (intra-nodal reticulation) was not explicitly modelled. The design and cost of intra-nodal reticulation has not been modelled in this feasibility assessment.
- **This design choice informed the approach to estimate the levelised cost of electricity generation (LCOEg) – see slides 30 to 32.**

In reality, standalone supply means multiple, individual loads with adjacent, on-site supply



No intra-nodal reticulation between sites

Modelling of nodes assumed aggregated loads and aggregated supply (by technology)



Intra-nodal reticulation between sites was assumed but not modelled explicitly

Demand Scenarios

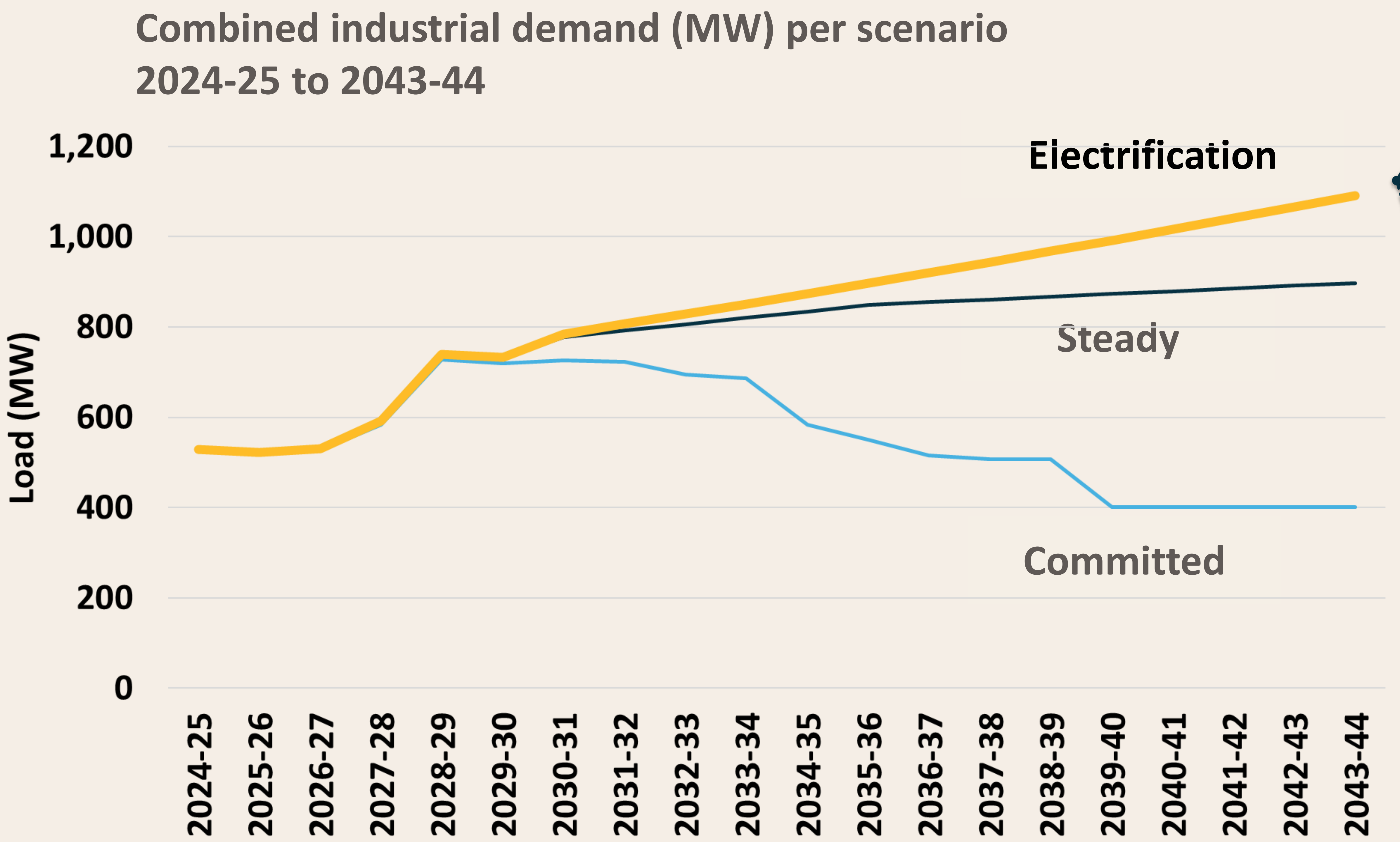
Three demand scenarios were modelled:

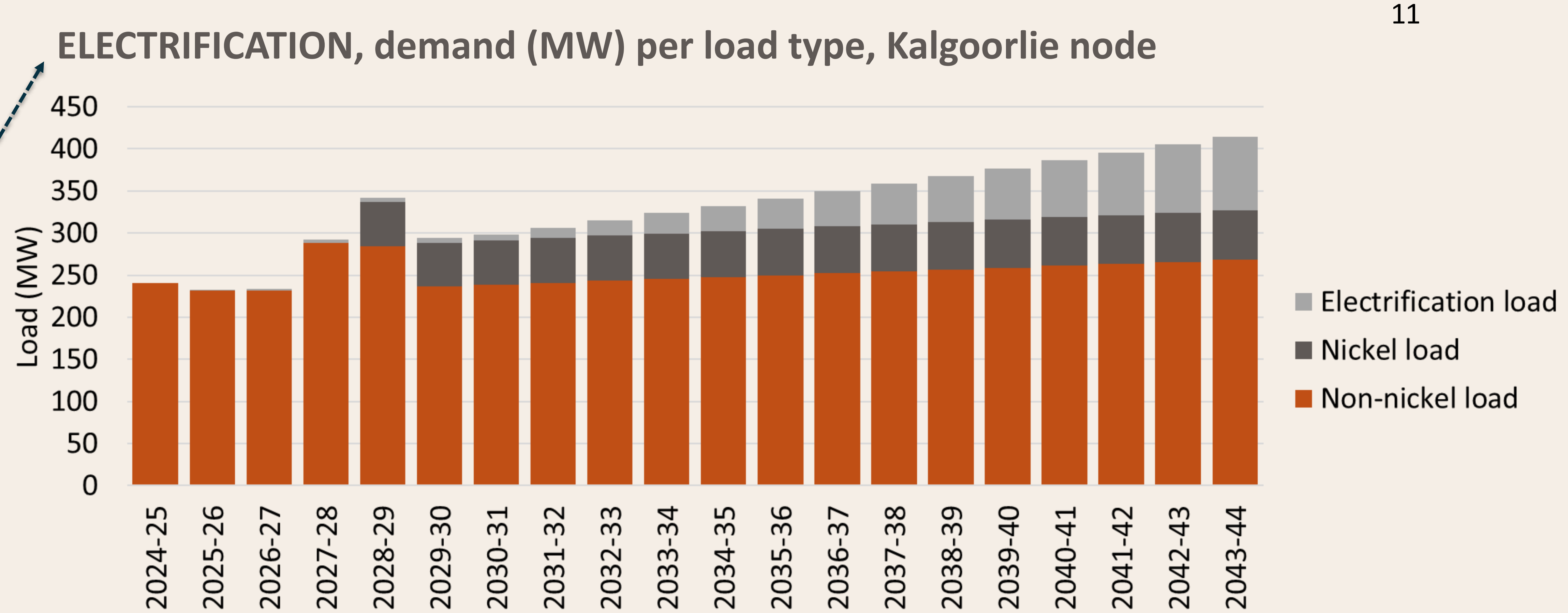
- Common assumptions – baseline demand to 2028-29 and recommencement of nickel
- Differing assumptions – load growth and electrification

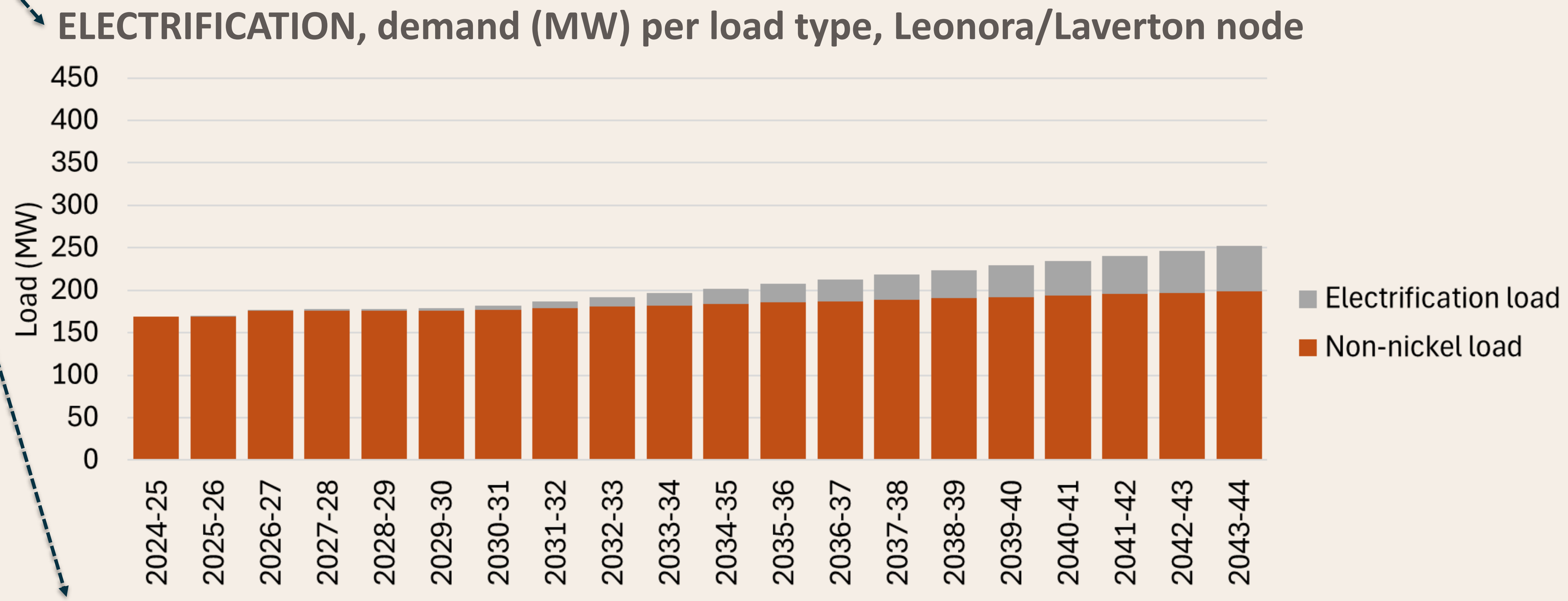
Scenario	Committed	Steady	Electrification
Base demand	• Current and announced loads based on publicly available industrial demand data and feedback from key stakeholders from pre-Forum workshops		
Nickel	• Assumed nickel demand recommences in 2028, following the review by Nickel West in 2027		
Load Growth	• None (i.e., demand declines as current mines reach end of life)	• Sufficient load growth to maintain demand at 2030 levels	• Load growth from 2030 based on average growth in WA gold production over the last 10 years (about 1% per annum).
Electrification	• No electrification	• 40% of total load (nickel and non-nickel) is available for electrification • Electrification of 1% p.a. until 2030-31 then 4.7% p.a. (reaching 30% in 2035-36) then 2% p.a.	• 40% of total load (nickel and non-nickel) is available for electrification • Electrification of 1% p.a. until 2030-31 then 4.7% p.a. thereafter to reach 100% in 2050-51

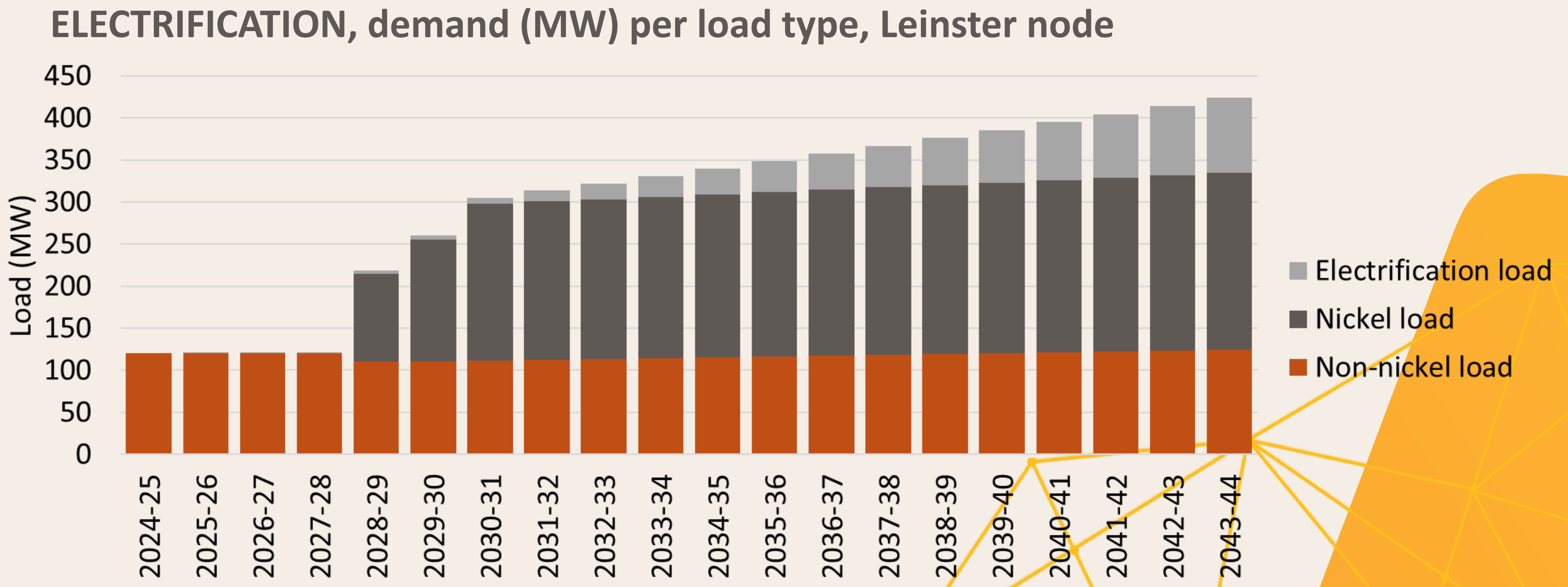
A delay to the nickel recommencement until the 2030s does not materially impact the results of the Concept Study because the GRN is not expected to be operational until 2033

Demand Scenario - Electrification





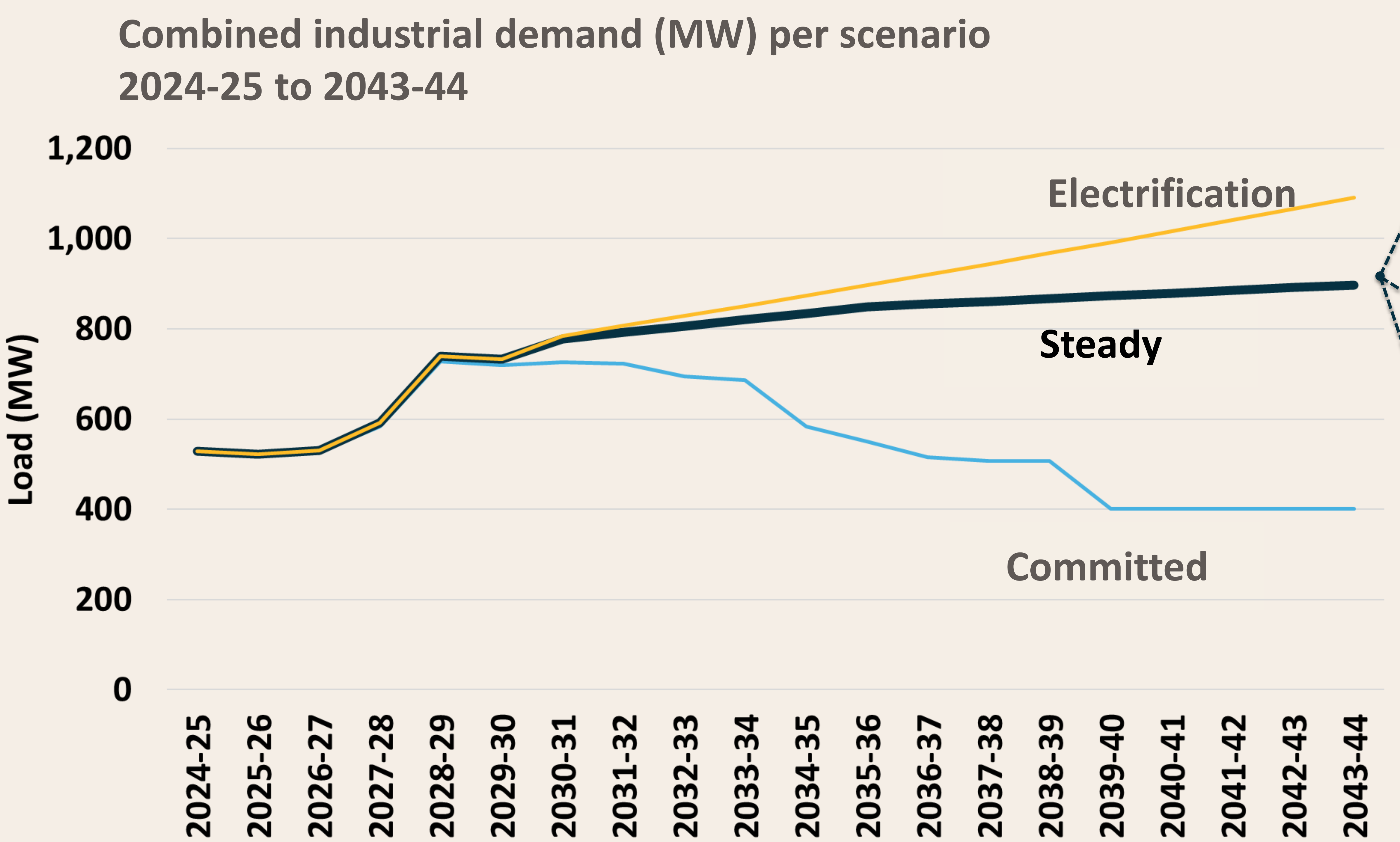


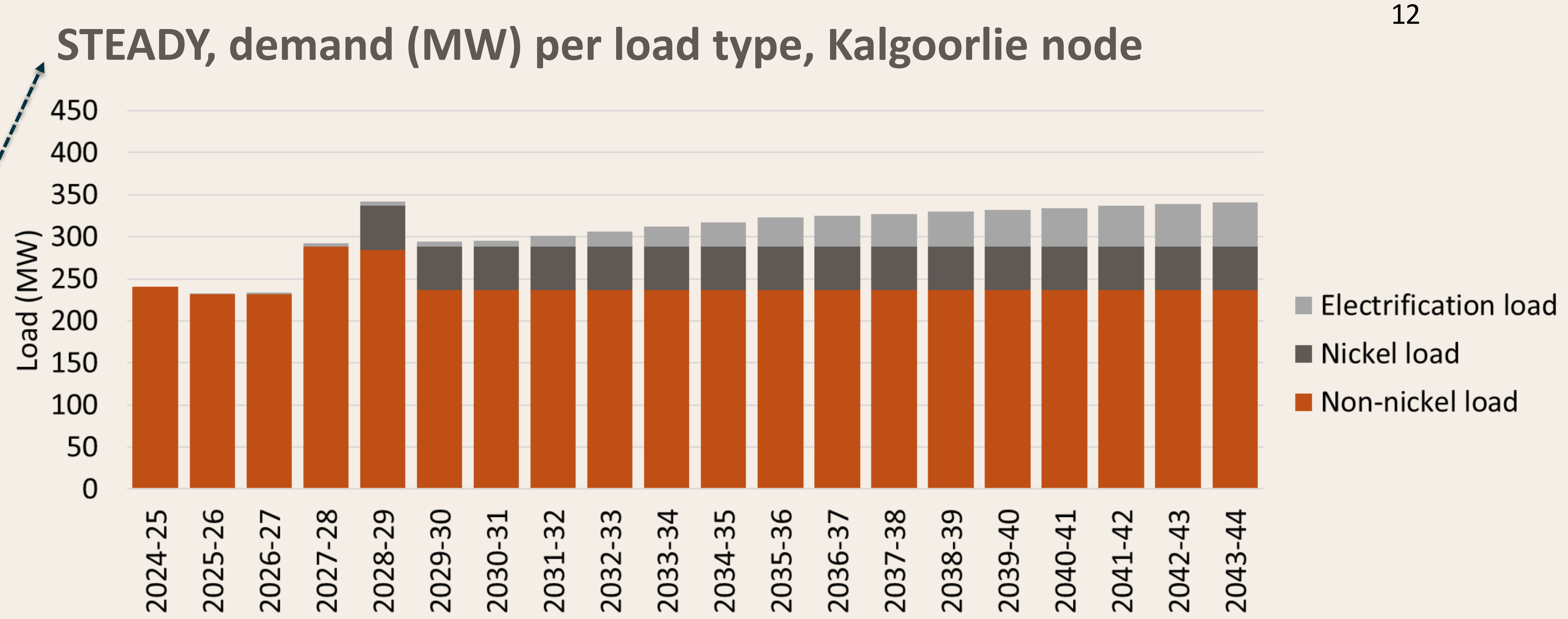


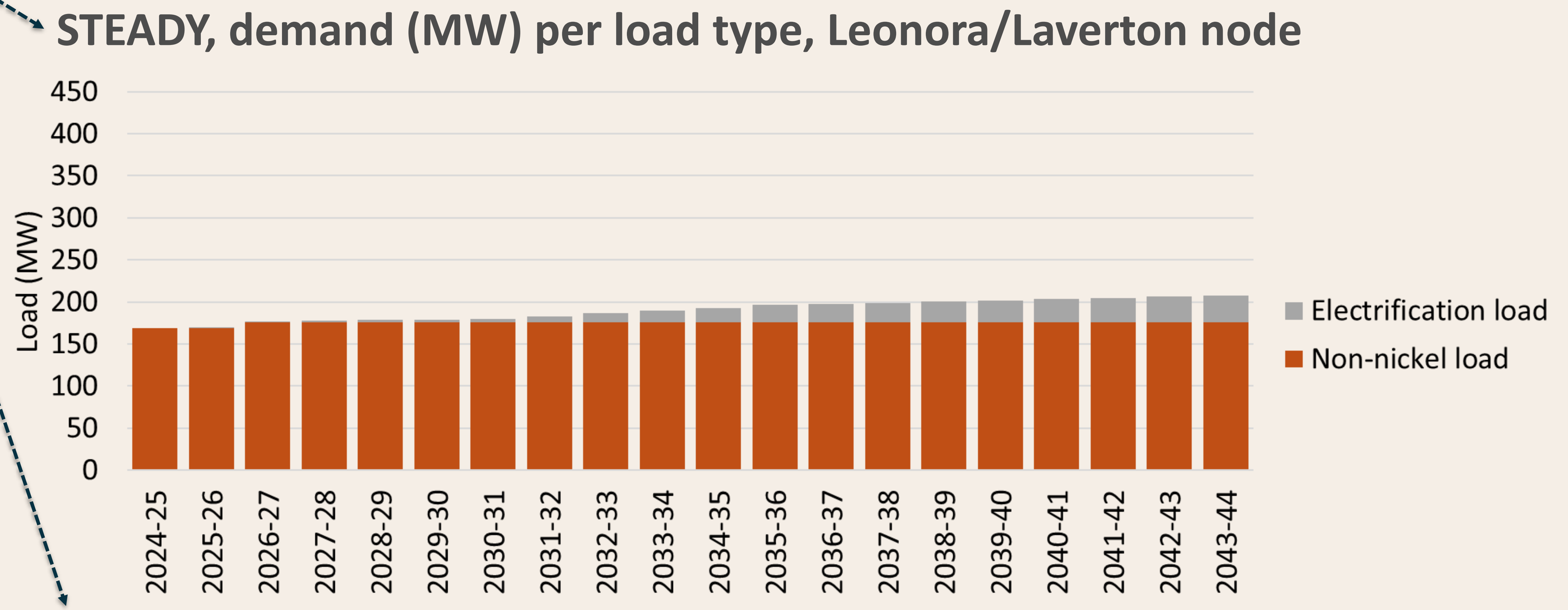
Industrial load by 2043-44:

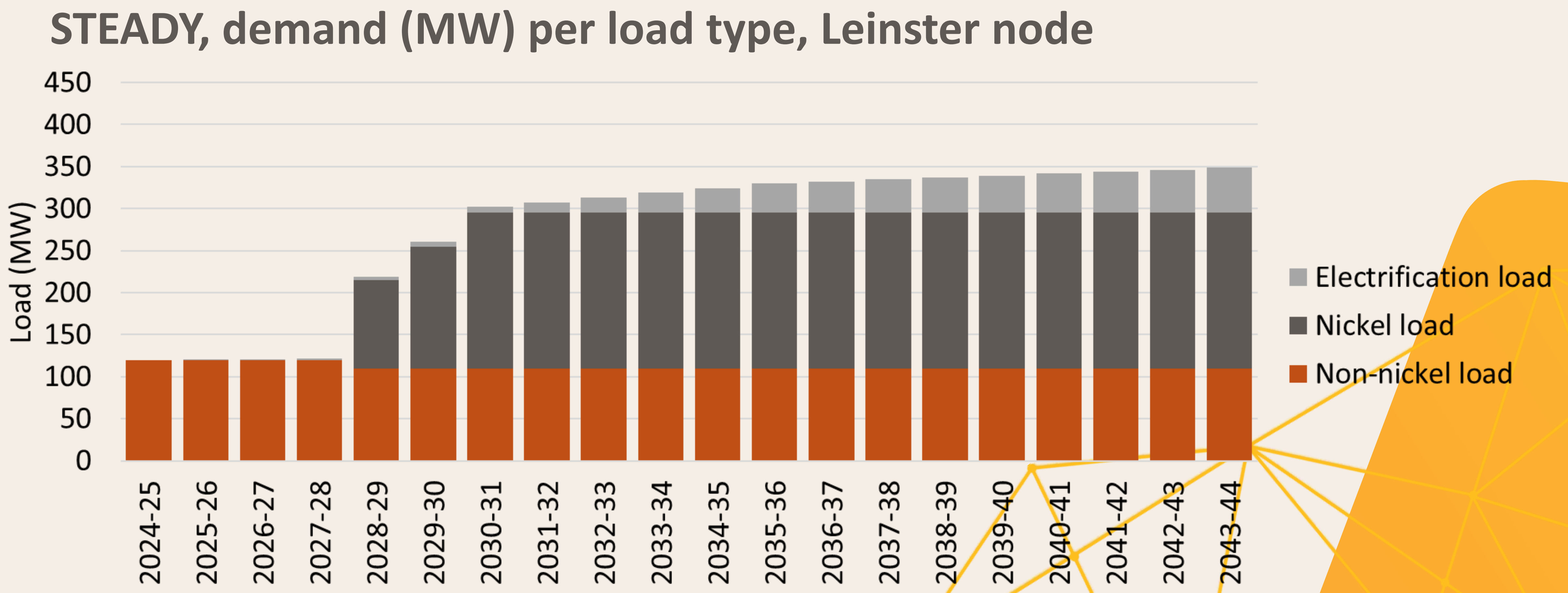
- **Kalgoorlie: 415 MW total**
  - 88 MW electrification, 59 MW nickel, 268 MW non-nickel
- **Leonora/Laverton: 252 MW total**
  - 53 MW electrification, 199 MW non-nickel
- **Leinster: 424 MW total**
  - 90 MW electrification, 210 MW nickel, 125 MW non-nickel

Demand Scenario - Steady





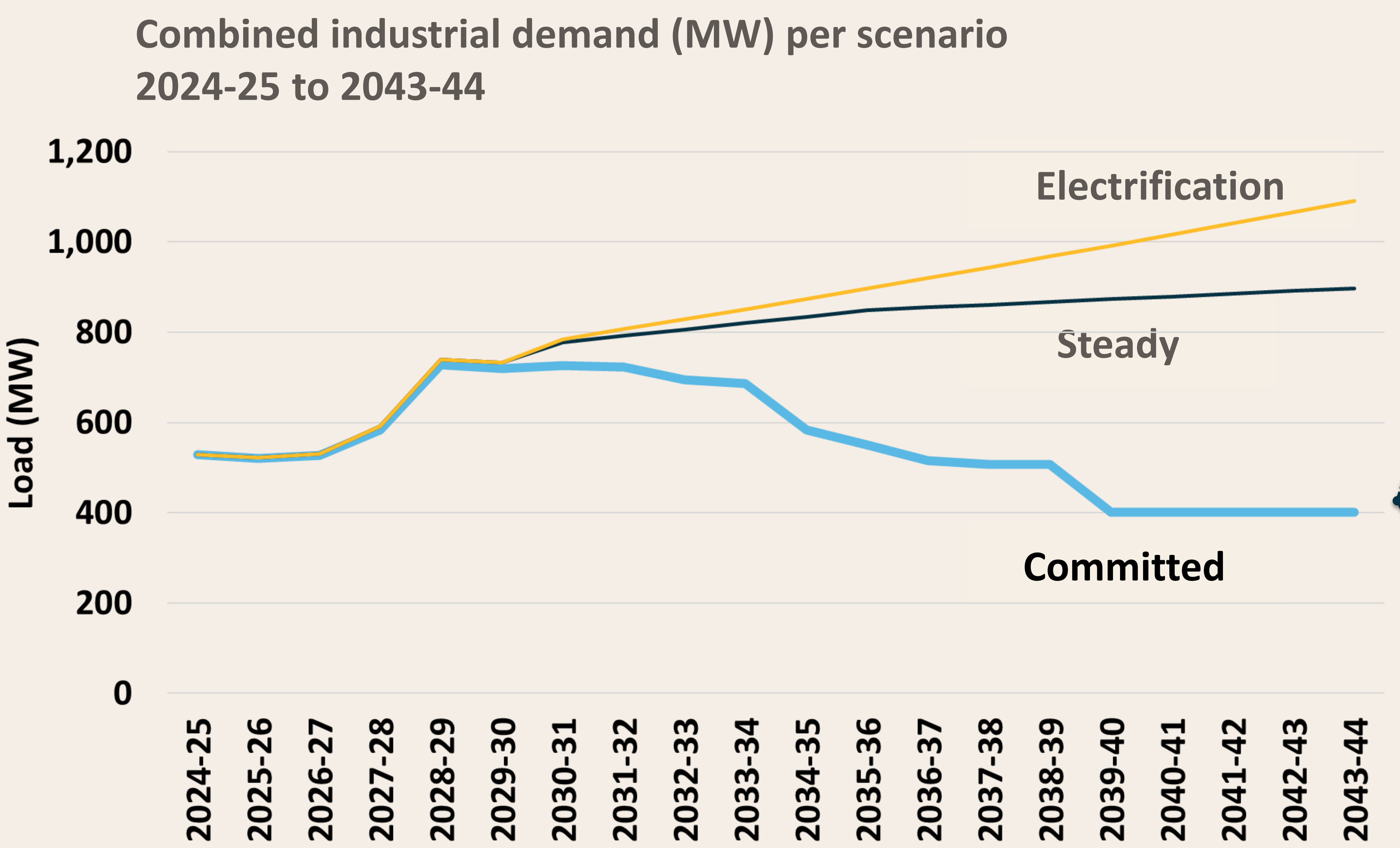


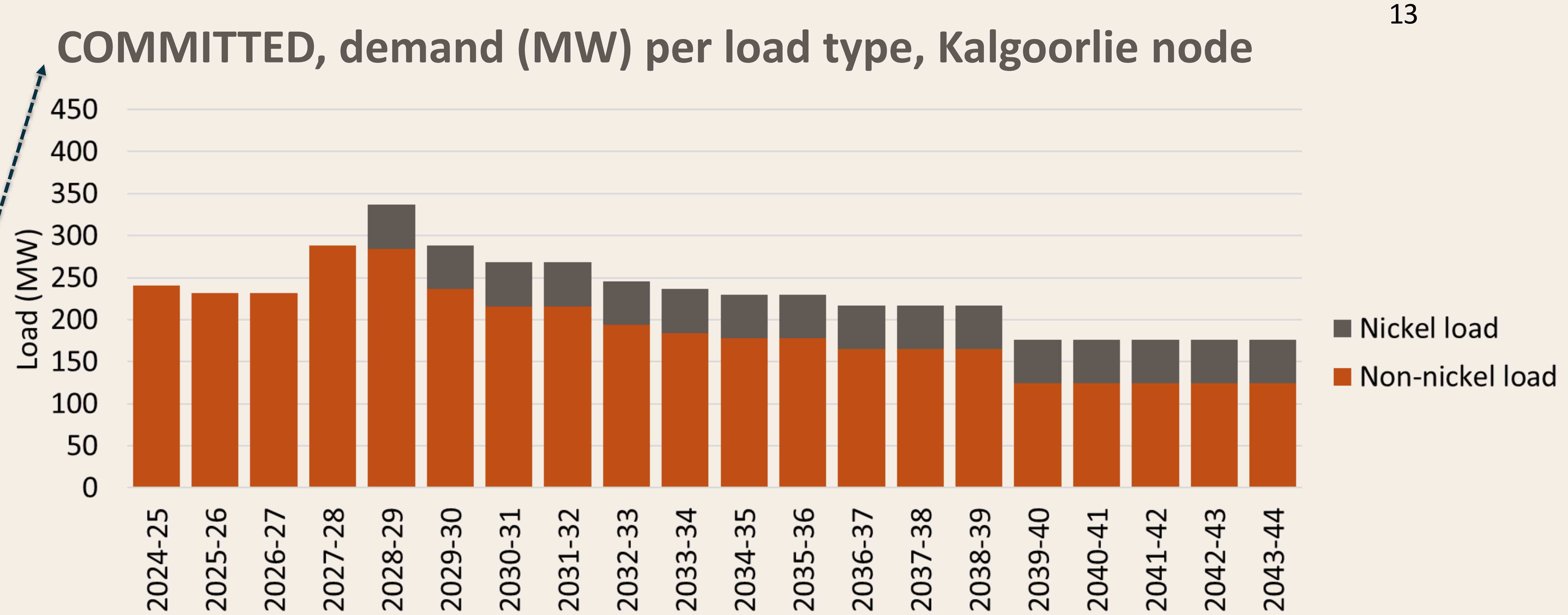


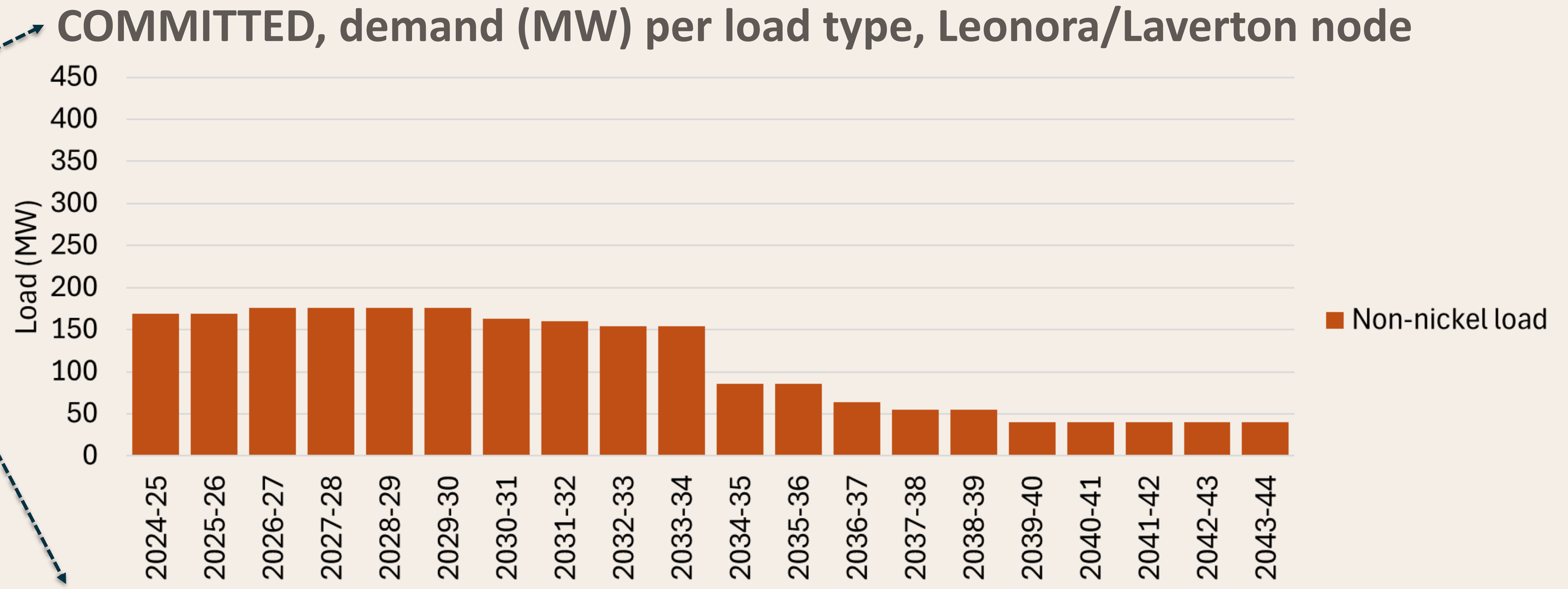
Industrial load by 2043-44:

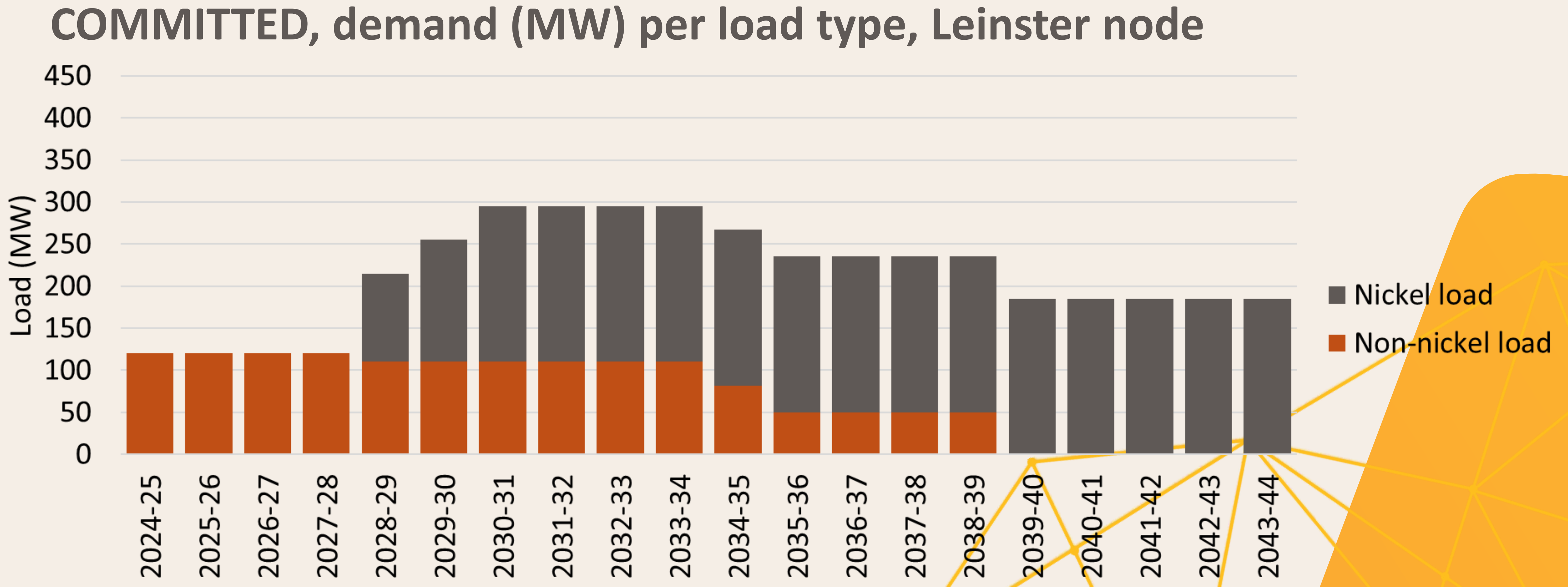
- **Kalgoorlie: 341 MW total**
  - 53 MW electrification, 52 MW nickel, 237 MW non-nickel
- **Leonora/Laverton: 207 MW total**
  - 32 MW electrification, 176 MW non-nickel
- **Leinster: 349 MW total**
  - 54 MW electrification, 185 MW nickel, 110 MW non-nickel

Demand Scenario - Committed





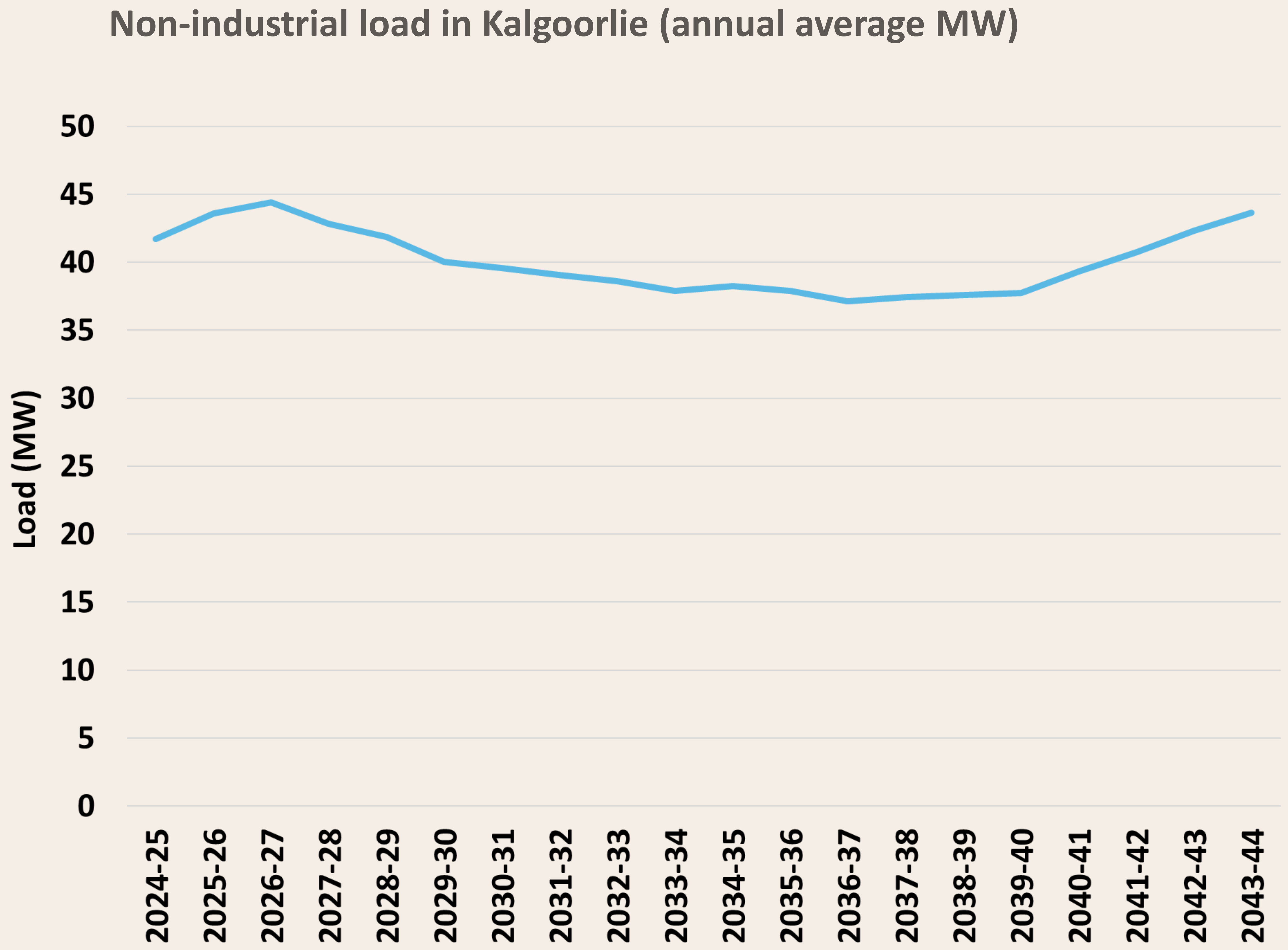




Industrial load by 2043-44:

- **Kalgoorlie: 176 MW total**
  - 52 MW nickel, 124 MW non-nickel
- **Leonora/Laverton: 40 MW total**
  - All non-nickel
- **Leinster: 185 MW total**
  - All nickel

Non-industrial demand



Non-industrial demand is consistent across all scenarios

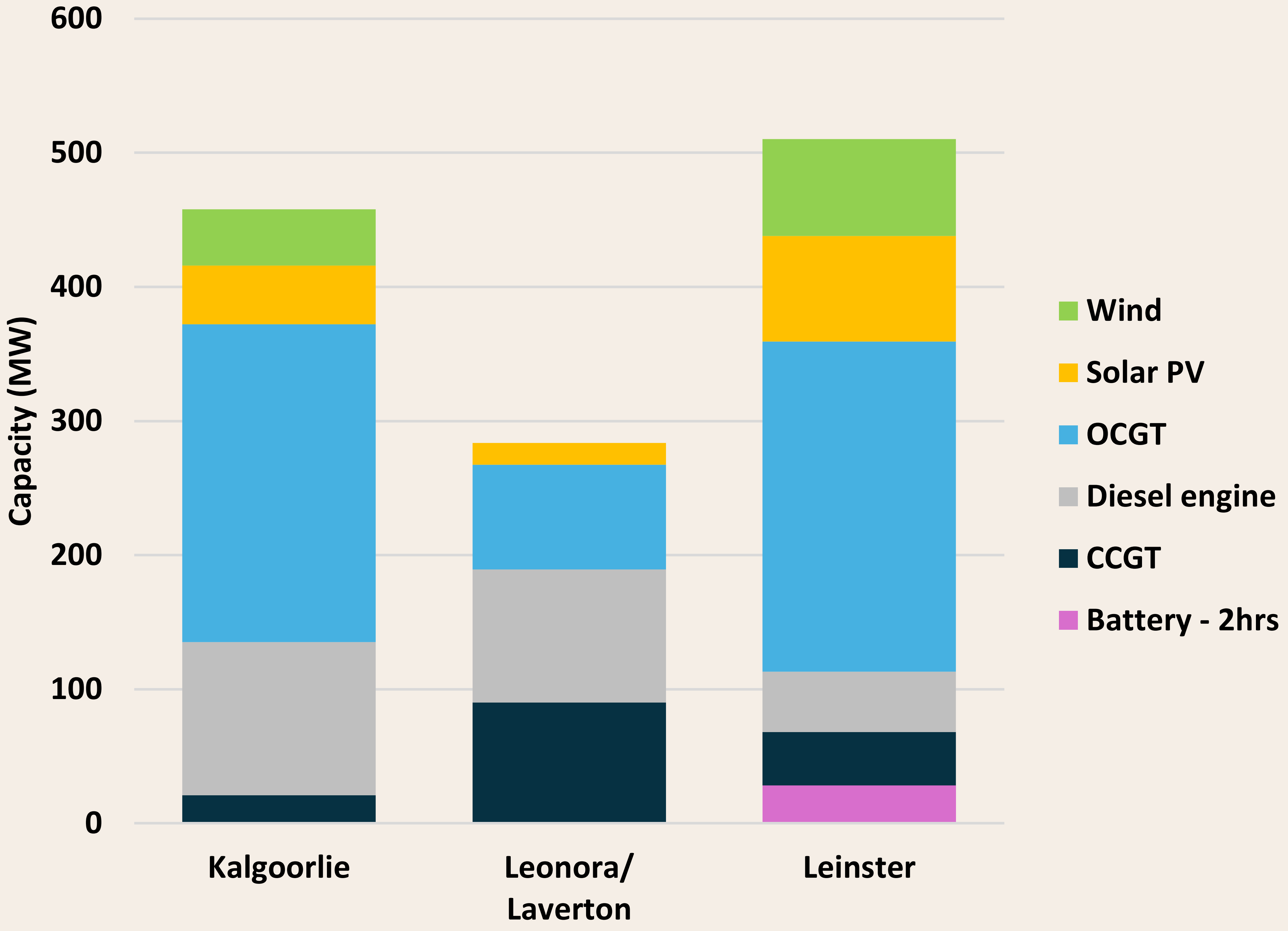
- Non-industrial (residential and small business) demand in Kalgoorlie is a small portion of the GRN demand
- Non-industrial demand assumptions reflect population growth, appliance uptake (including electric vehicles) and residential electrification, based on prior capacity expansion work (WOSP 2020, SWISDA)

Impact of rooftop PV on demand was captured through:

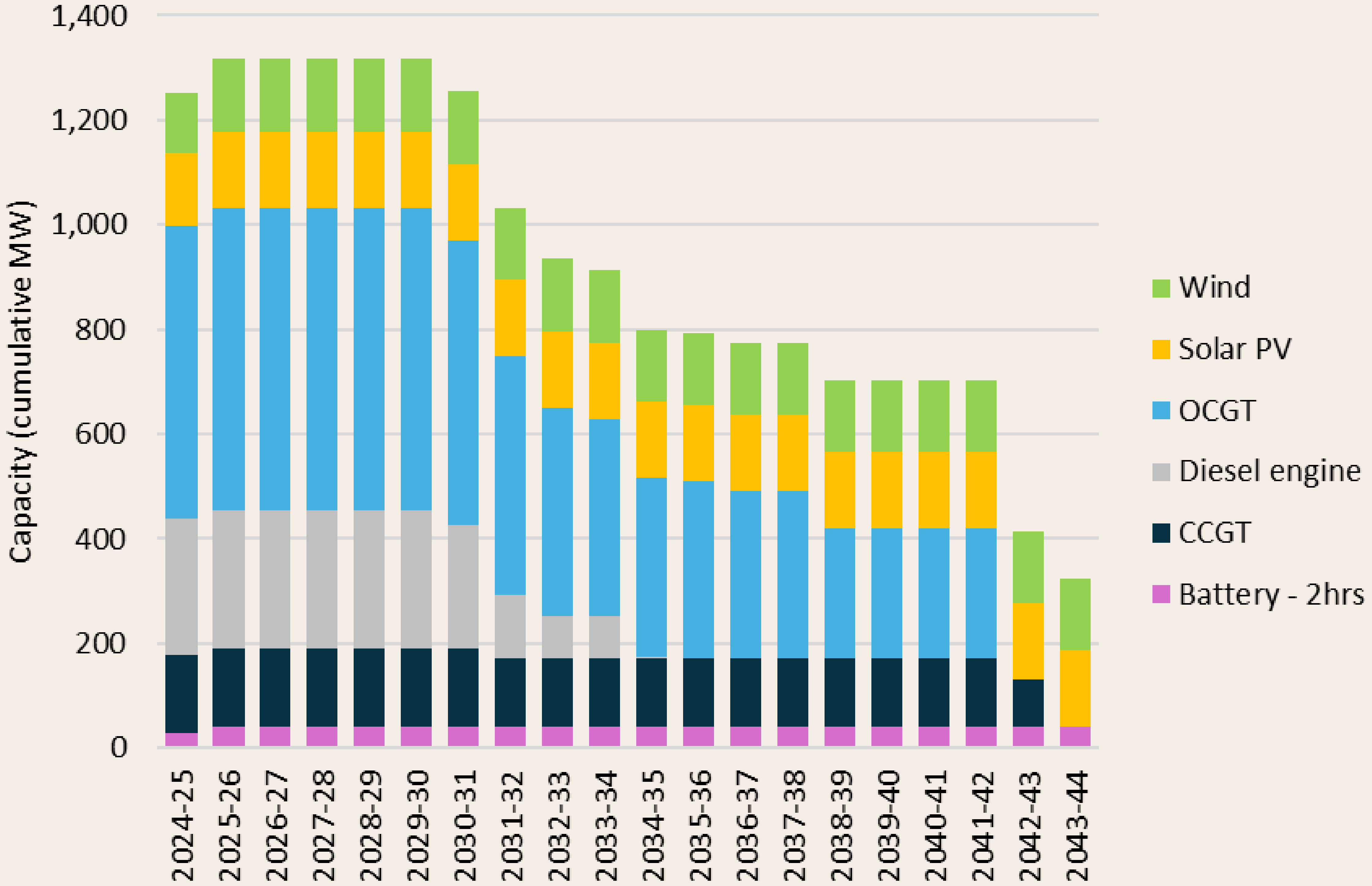
- EY’s modelling of future demand patterns captures intertemporal and interspatial patterns in electricity demand, wind and solar energy from several historical ‘reference years’
- A 'rolling reference year' was used to model non-industrial demand and the impact of rooftop PV
- Nine reference years (2010-11 to 2018-19) were applied end-to-end on a rolling basis over the study period
- This introduces variability in terms of the half-hourly demand, wind and solar profiles driven by the weather patterns in those years

Existing Generation and Storage

Existing and committed supply capacity (MW)



Assumed retirement schedule of existing facilities (MW)



- In 2024-25, it is estimated that just **15-20% of generation is from renewable sources**.
- Completion of the GRN in 2033-34 would **reduce the reliance on thermal generation** and signal opportunities for the **development** of **renewables**
- Existing supply assumptions (including the retirement schedule) are consistent across all demand scenarios

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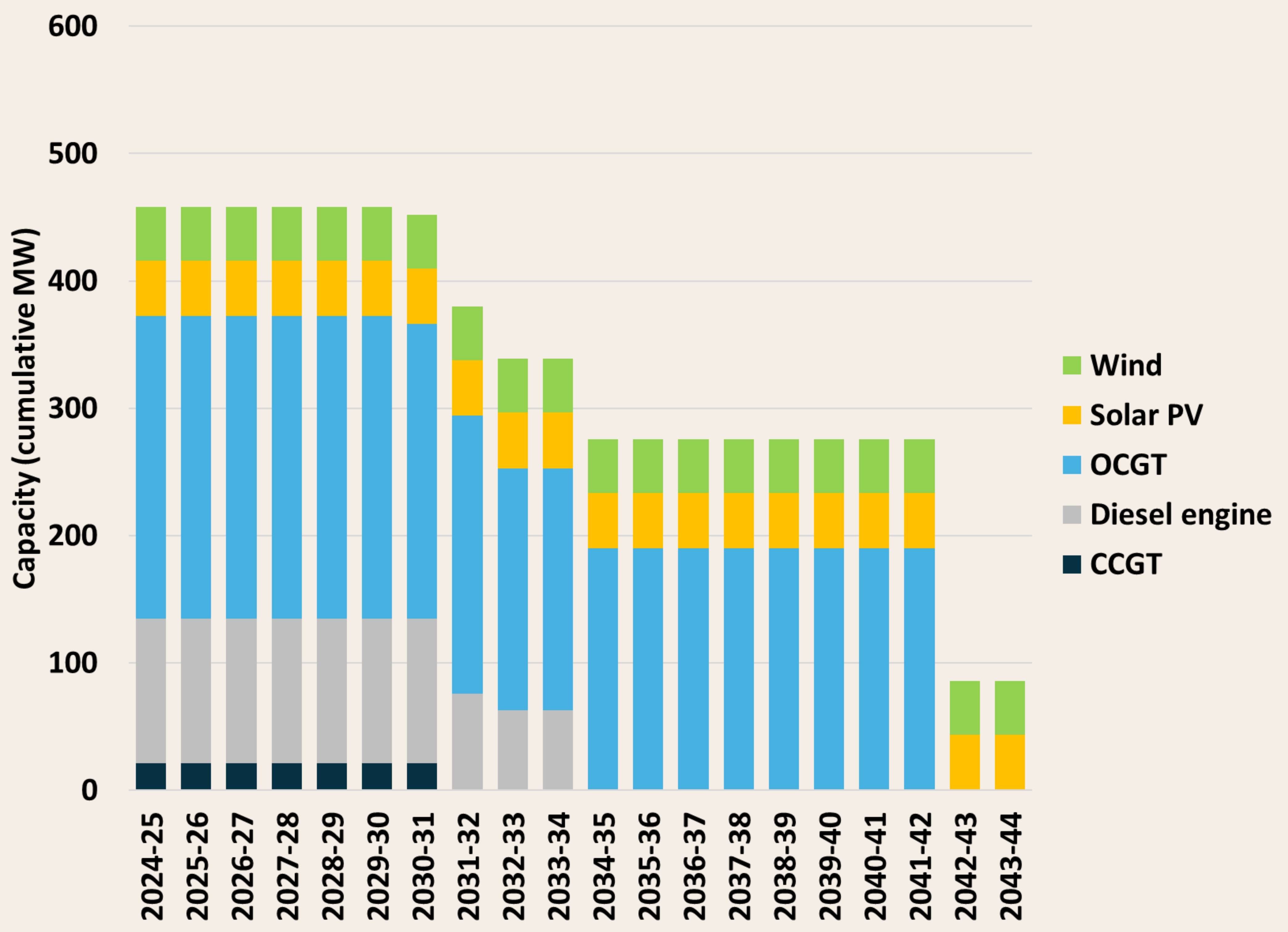
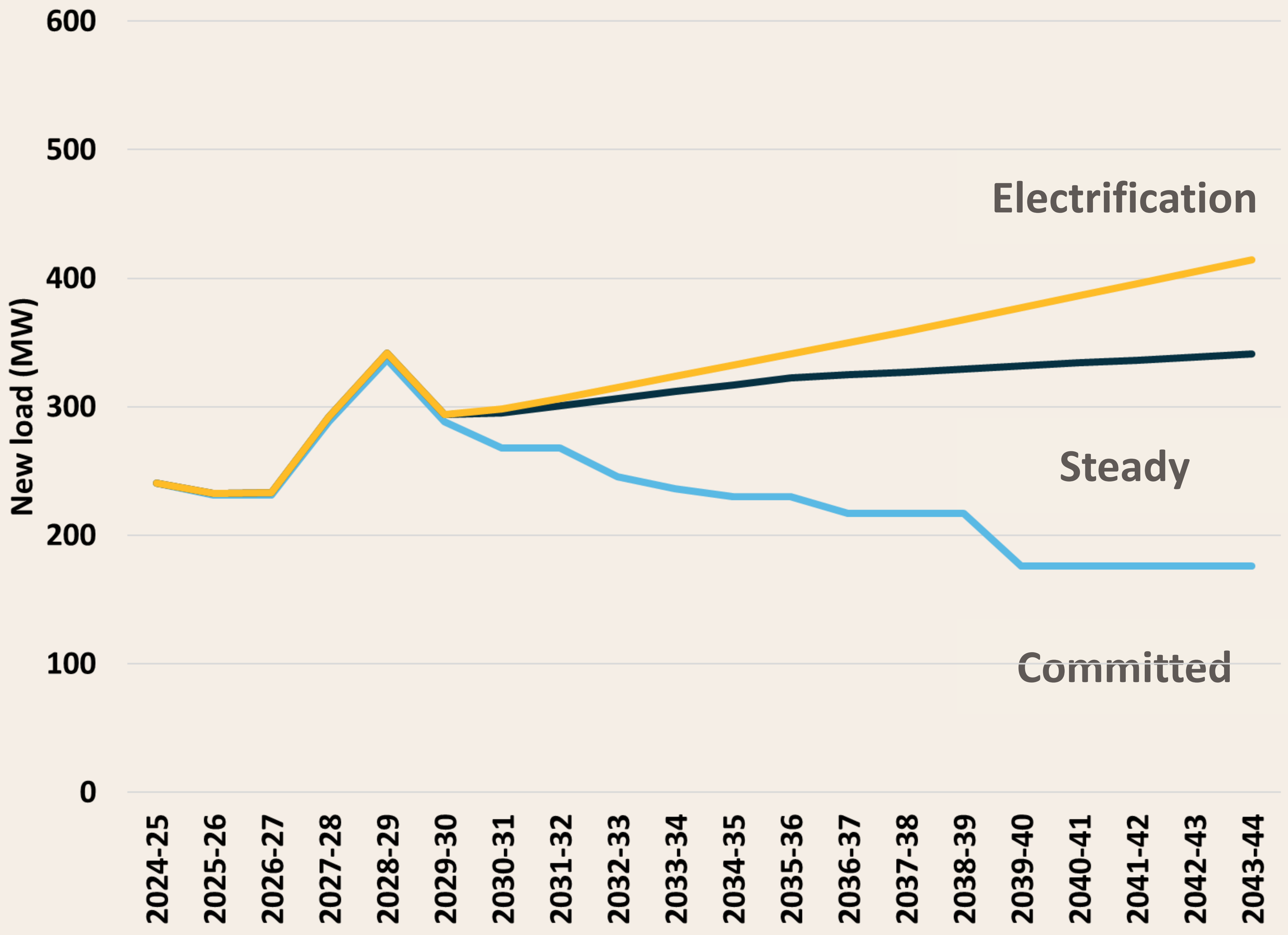
Existing Generation and Storage, and Industrial Demand - Kalgoorlie

Assumed retirement schedule of existing facilities (MW)

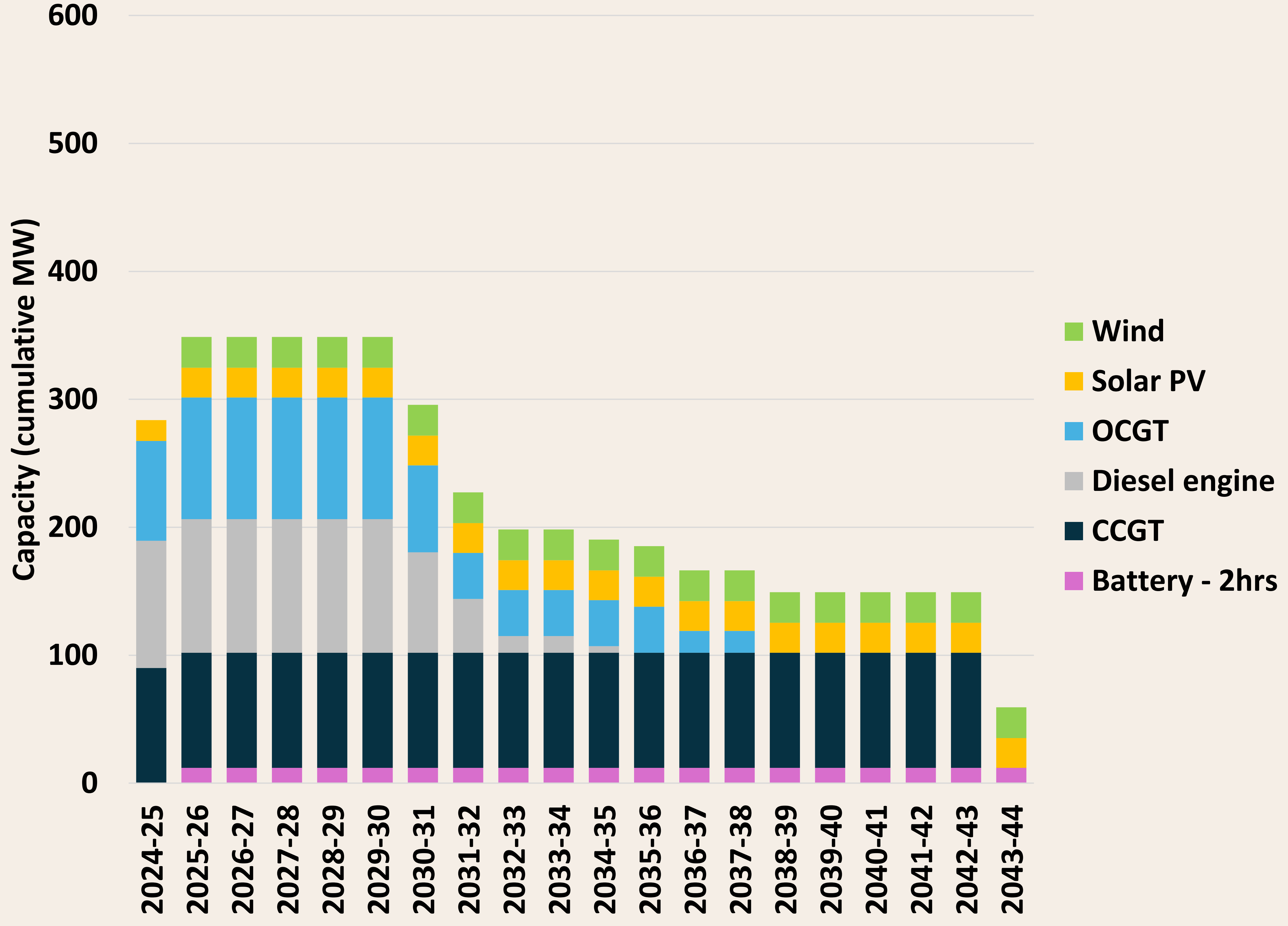


Combined industrial demand (MW)

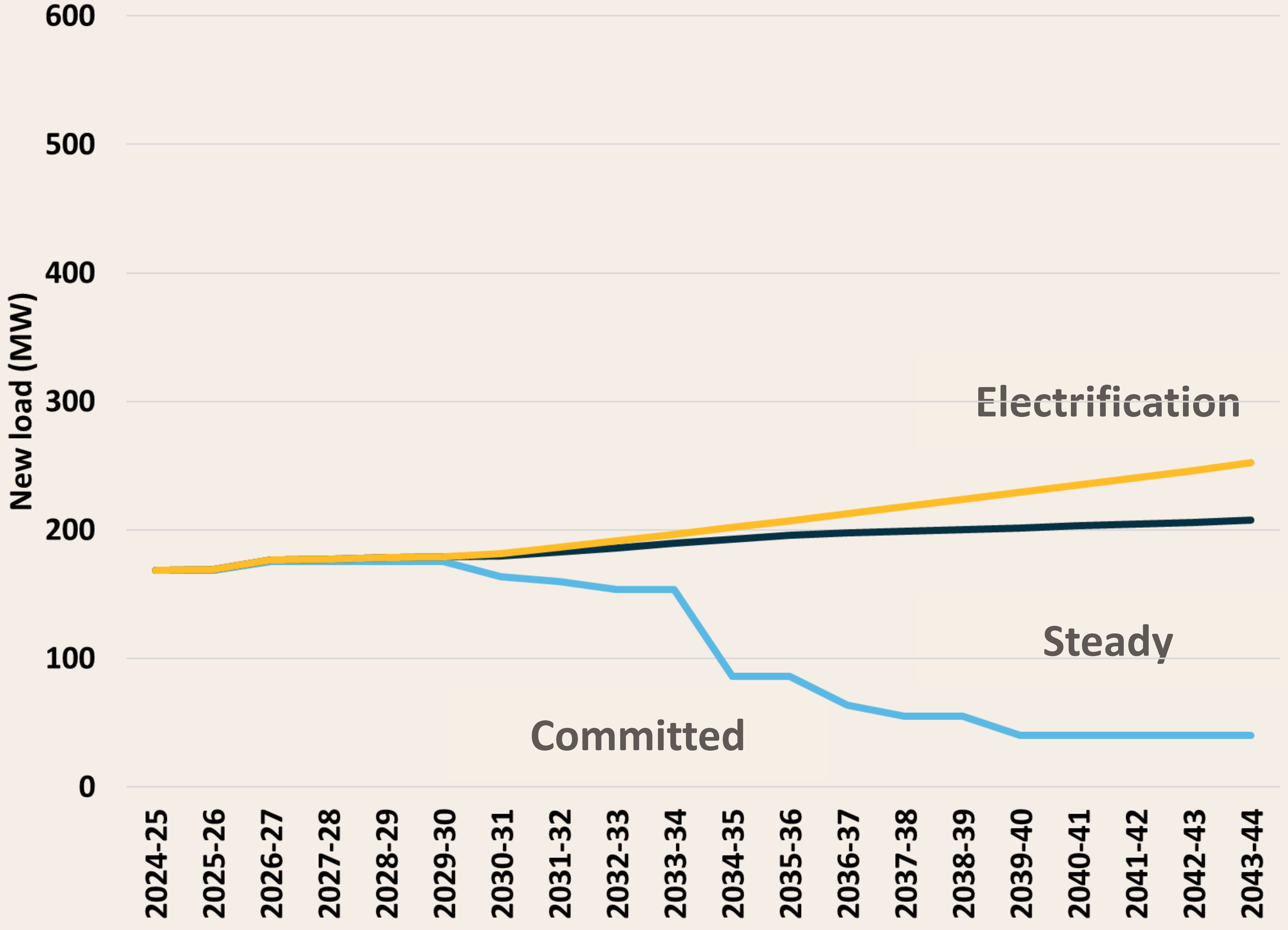


Existing Generation and Storage, and Industrial Demand - Leonora/Laverton

Assumed retirement schedule of existing facilities (MW)

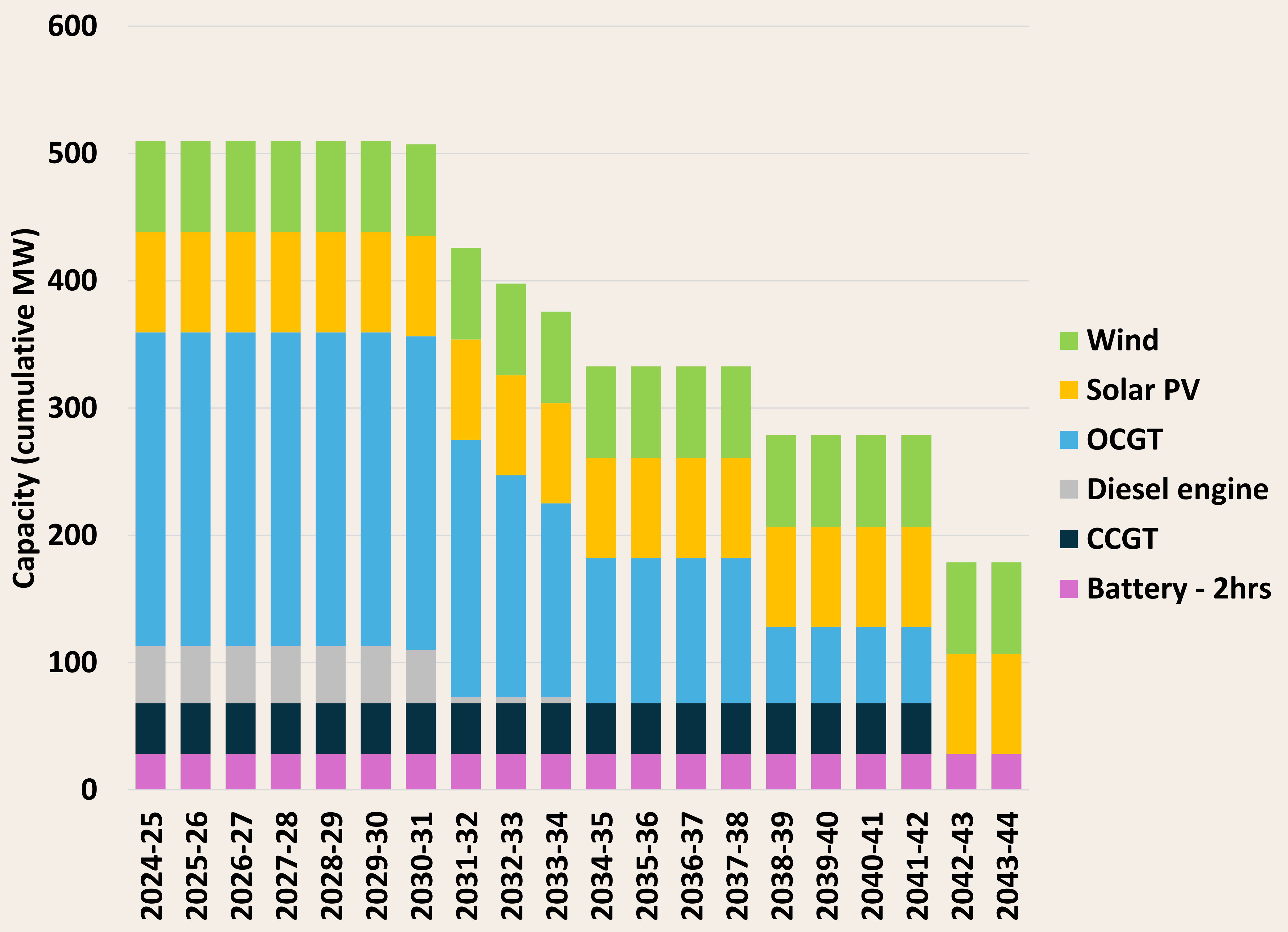


Combined industrial demand (MW)

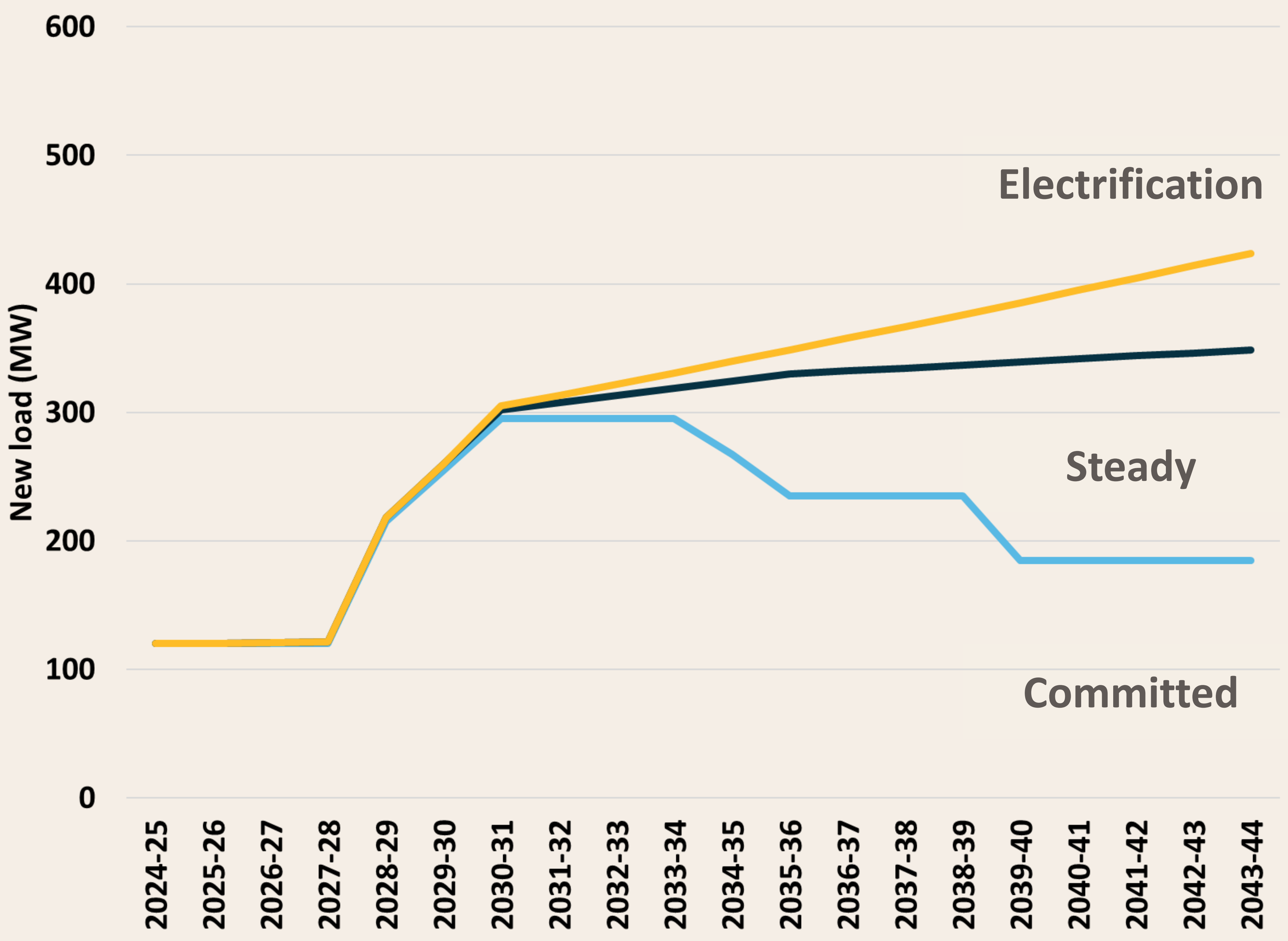


Existing Generation and Storage, and Industrial Demand - Leinster

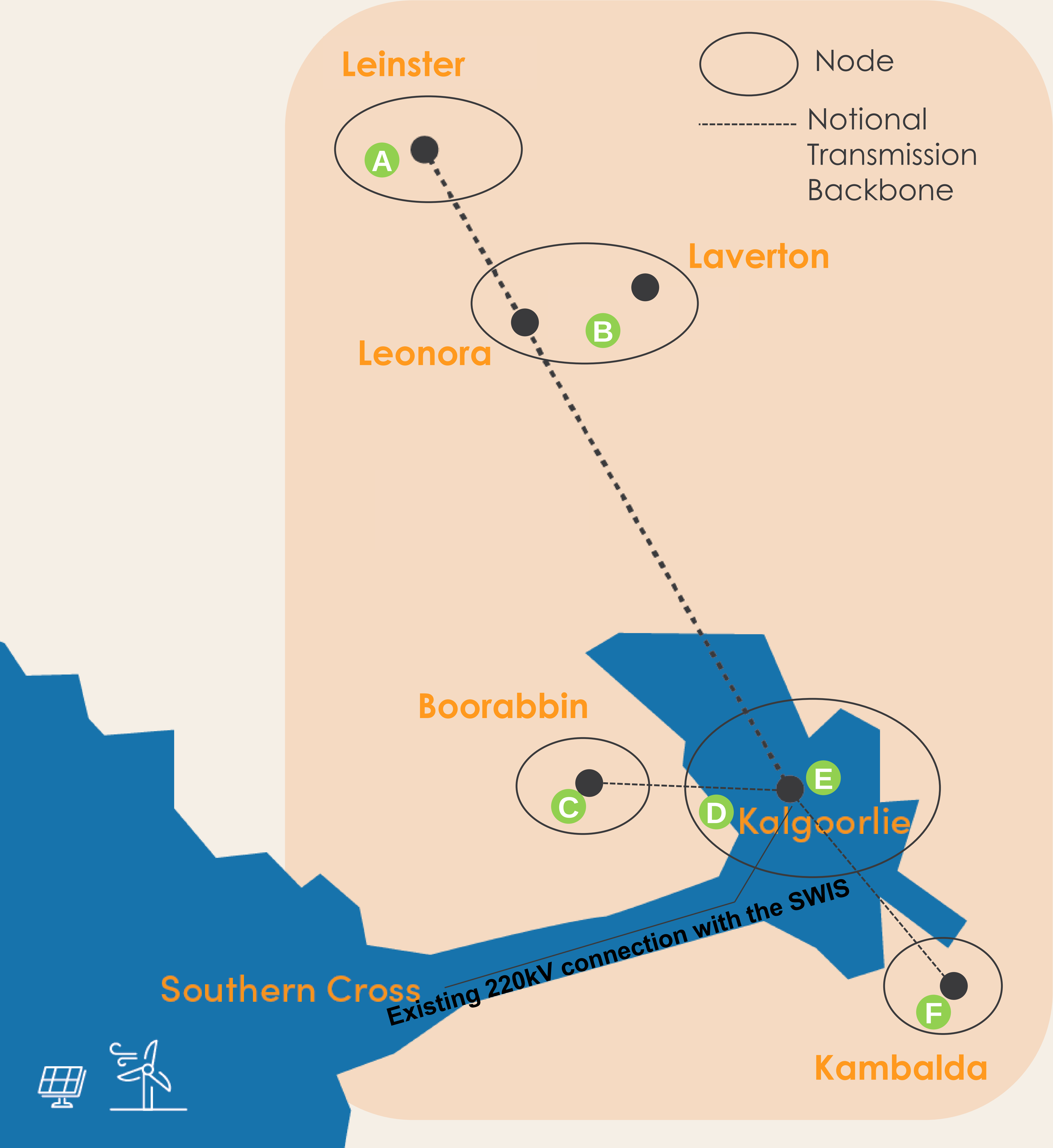
Assumed retirement schedule of existing facilities (MW)



Combined industrial demand (MW)



Assumptions on Potential Supply



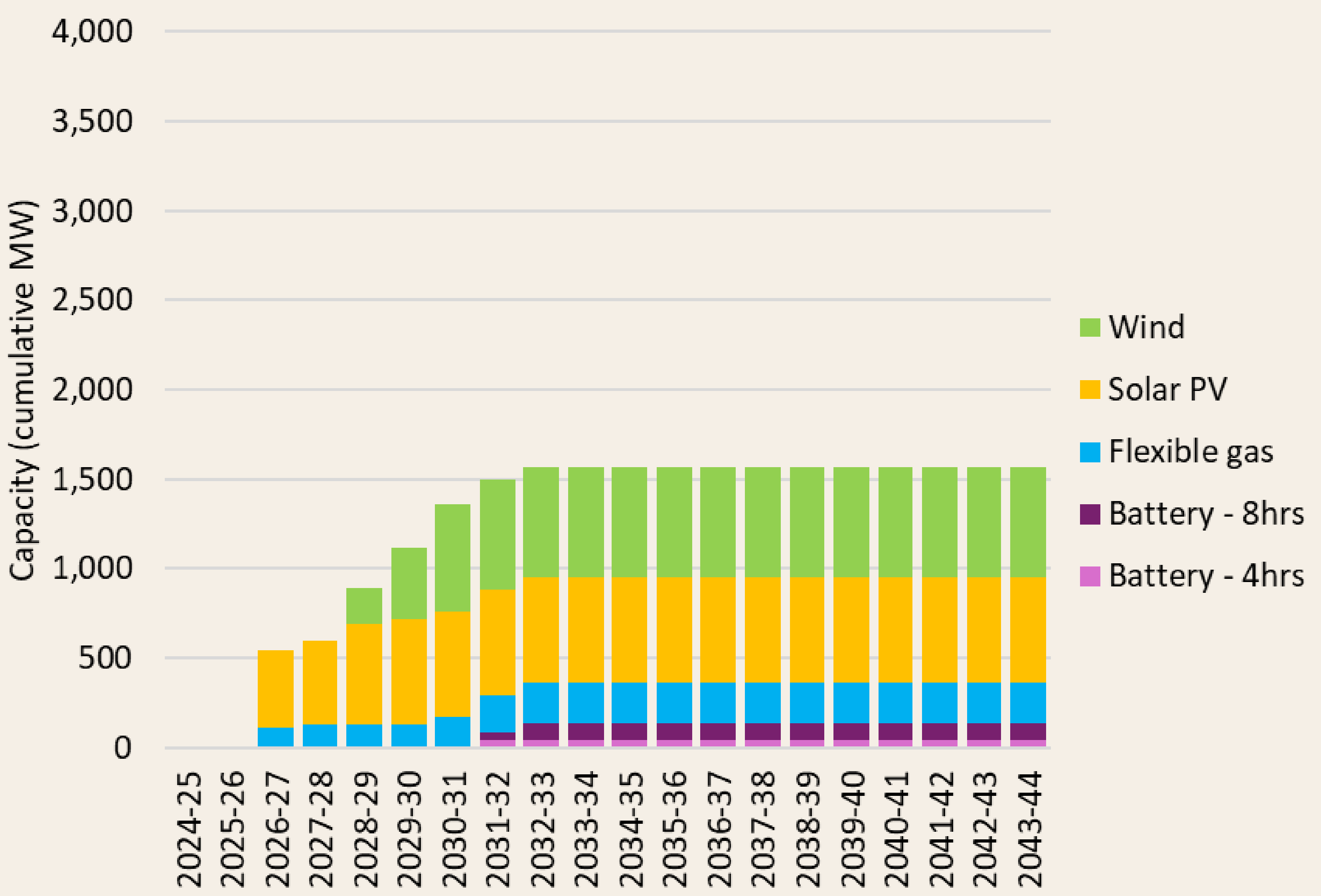
New generation locations	Indicative wind capacity factors	Indicative solar capacity factors
(A) Leinster	46%	30%
(B) Kookynie	40% and 43%	30%
(C) Wallaroo/Boorabbin	48%	30%
(D) Coolgardie/Mount Burges	31%	30%
(E) Kalgoorlie	37%	30%
(F) Kambalda West/Widgiemooltha	43%	30%

- The indicative supply sites were informed by prior capacity expansion work (WOSP 2020, SWISDA) and the GRN Project team's assessment
- Capacity factors were based on Global Wind Atlas and Global Solar Atlas
- Desktop assessment of land available for new supply capacity (tenure and area, informed by industry intelligence) was found to not be a limiting factor for build decisions – this will be explored further in future project stages

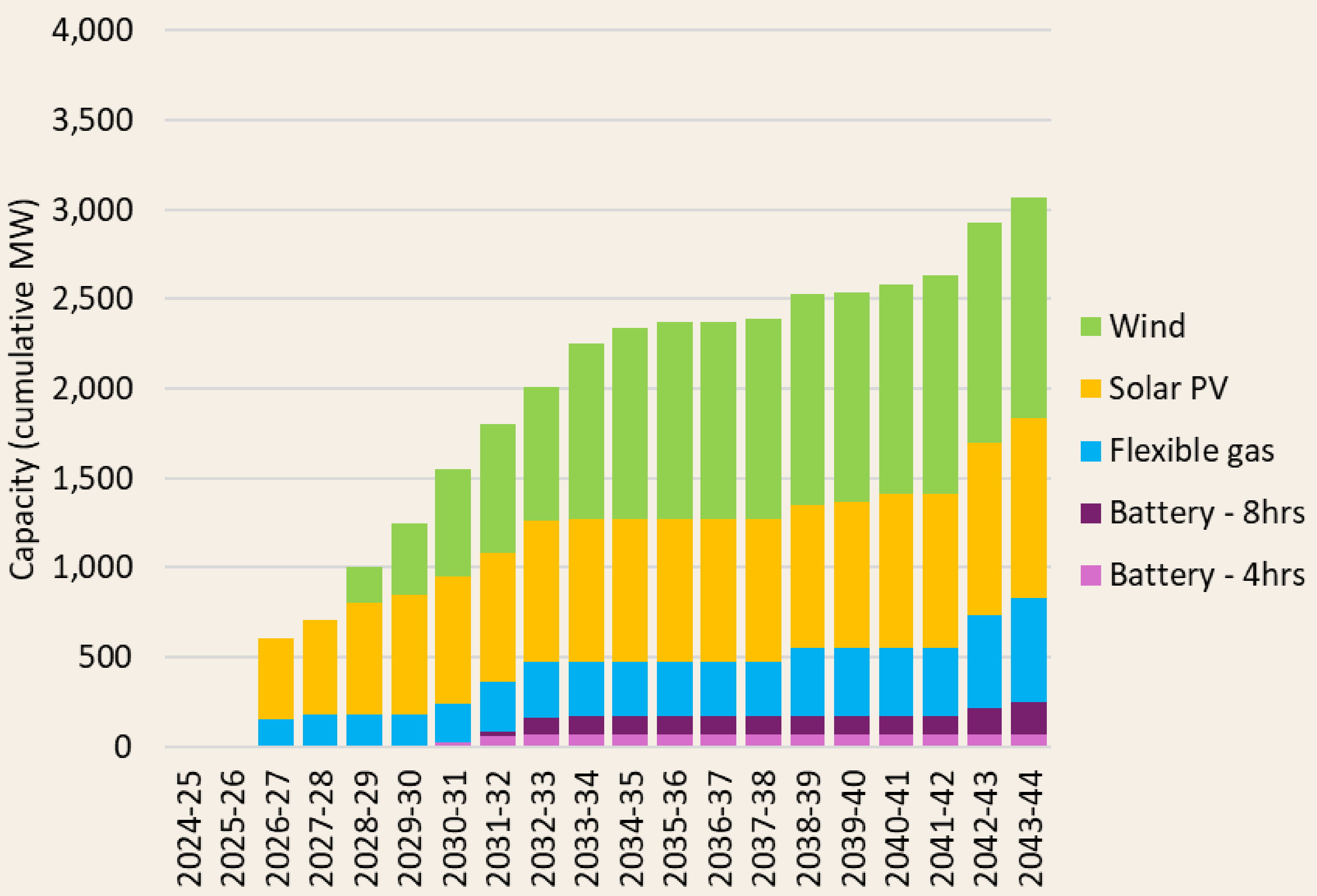
Outcomes

New Generation and Storage Requirements

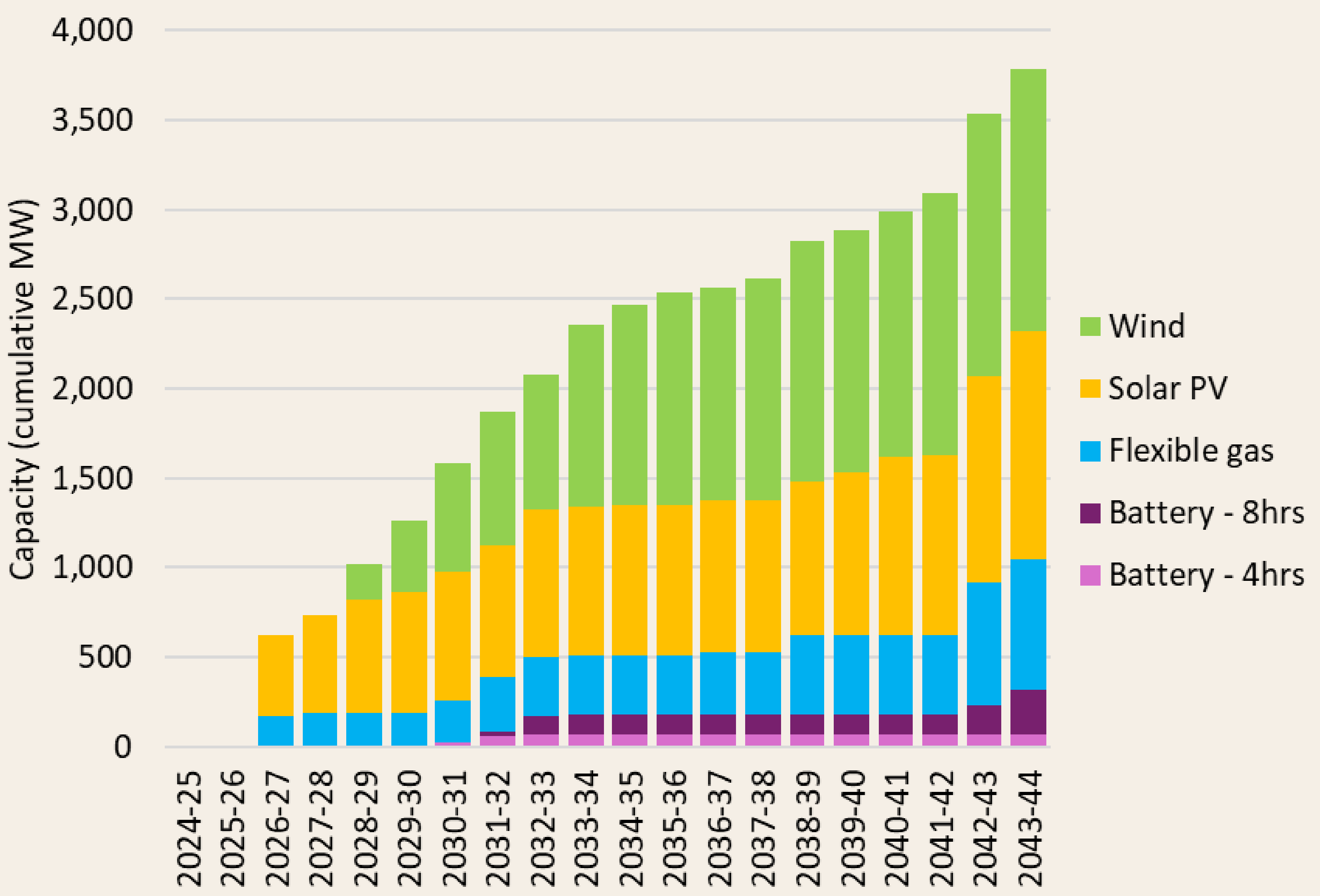
COMMITTED demand scenario (MW)



STEADY demand scenario (MW)



ELECTRIFICATION demand scenario (MW)



- The GRN would require significant **additional renewable generation**, supported by storage and firming gas
- The Steady and Electrification scenarios require **more than 2.5 GW of capacity**, representing a **significant opportunity for developers**

Long-term expansion of new generation and storage capacity is primarily driven by:

- Assumed **trajectories of electricity consumption** in each modelled demand scenario
- Assumed **retirements** of the existing thermal generation fleet (consistent across all cases)
- **Modelled build of the GRN network**, which allows access and sharing of electricity supply across GRN nodes

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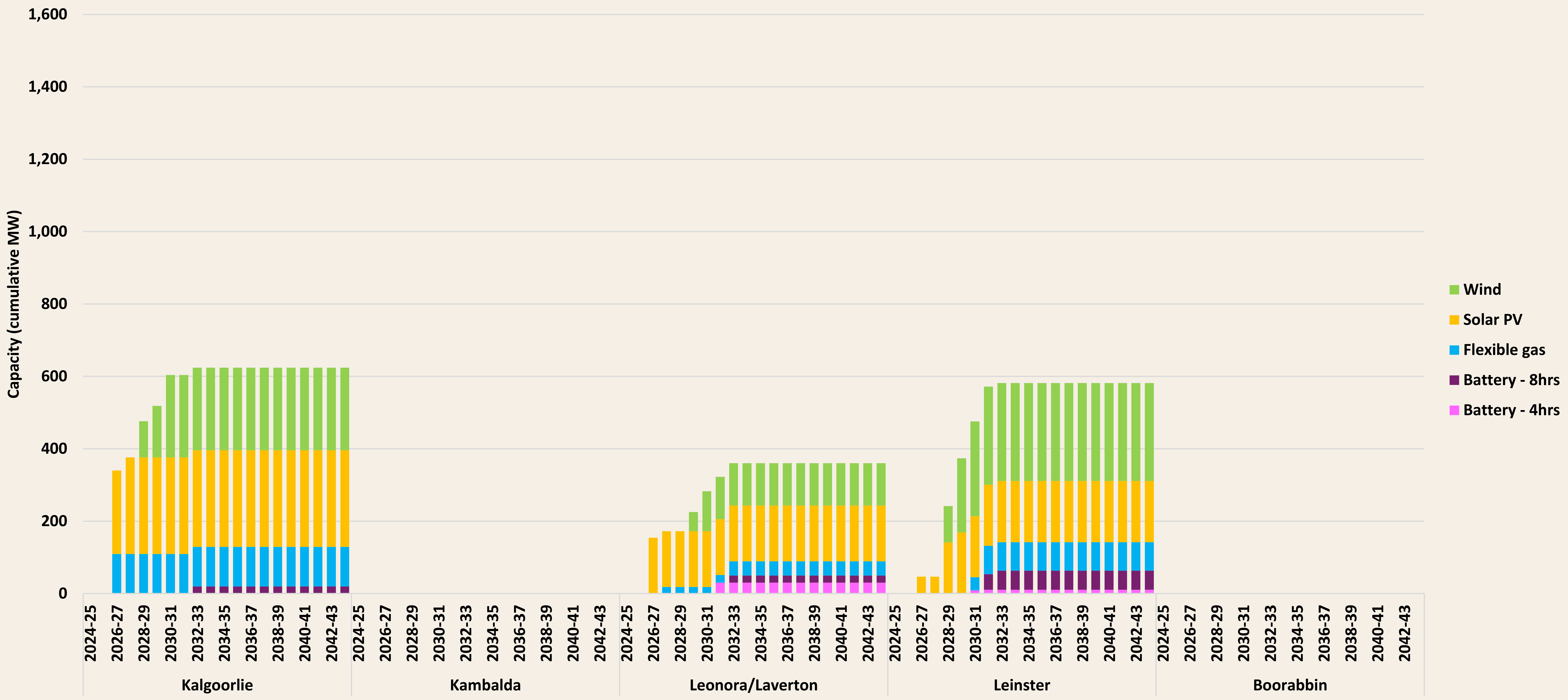
Detailed data provided in Appendix

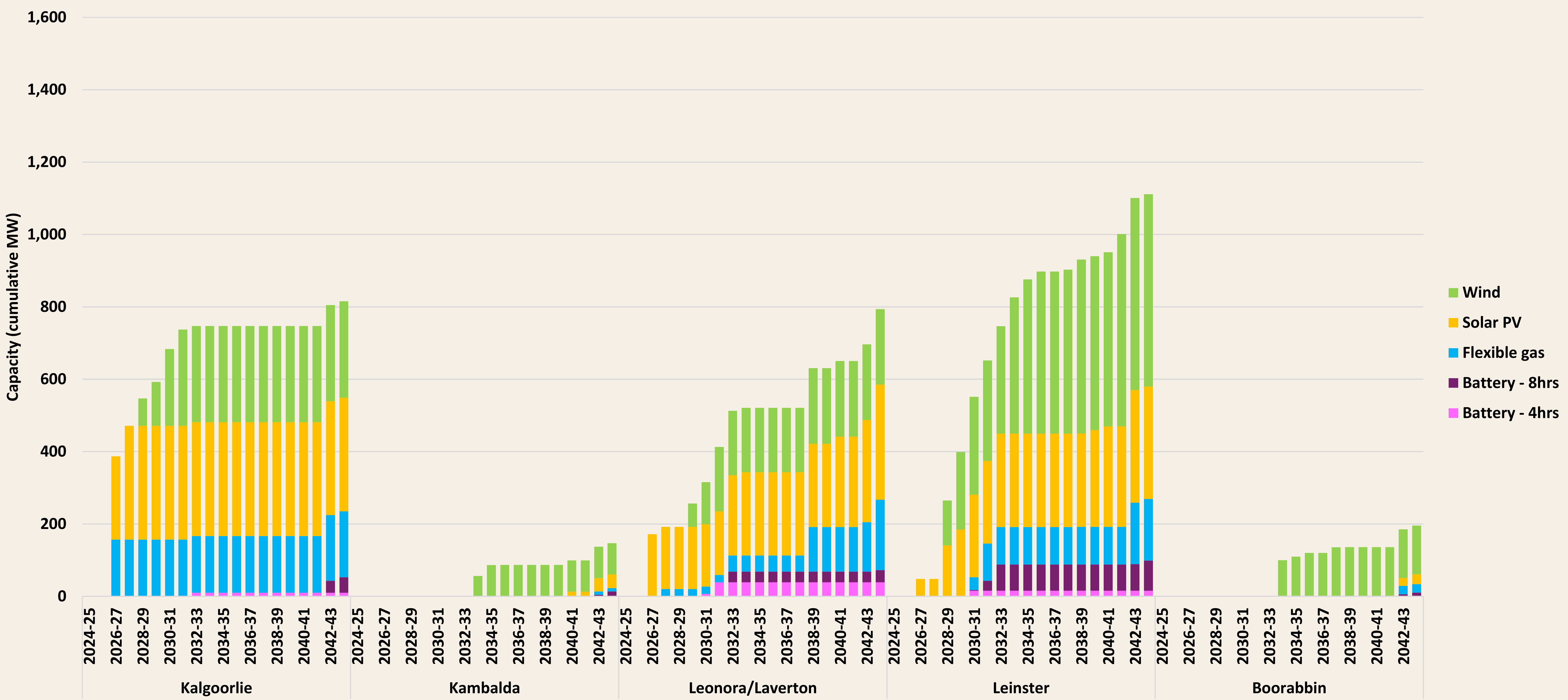
New Generation and Storage Requirements – COMMITTED scenario

Demand (MW) by Node



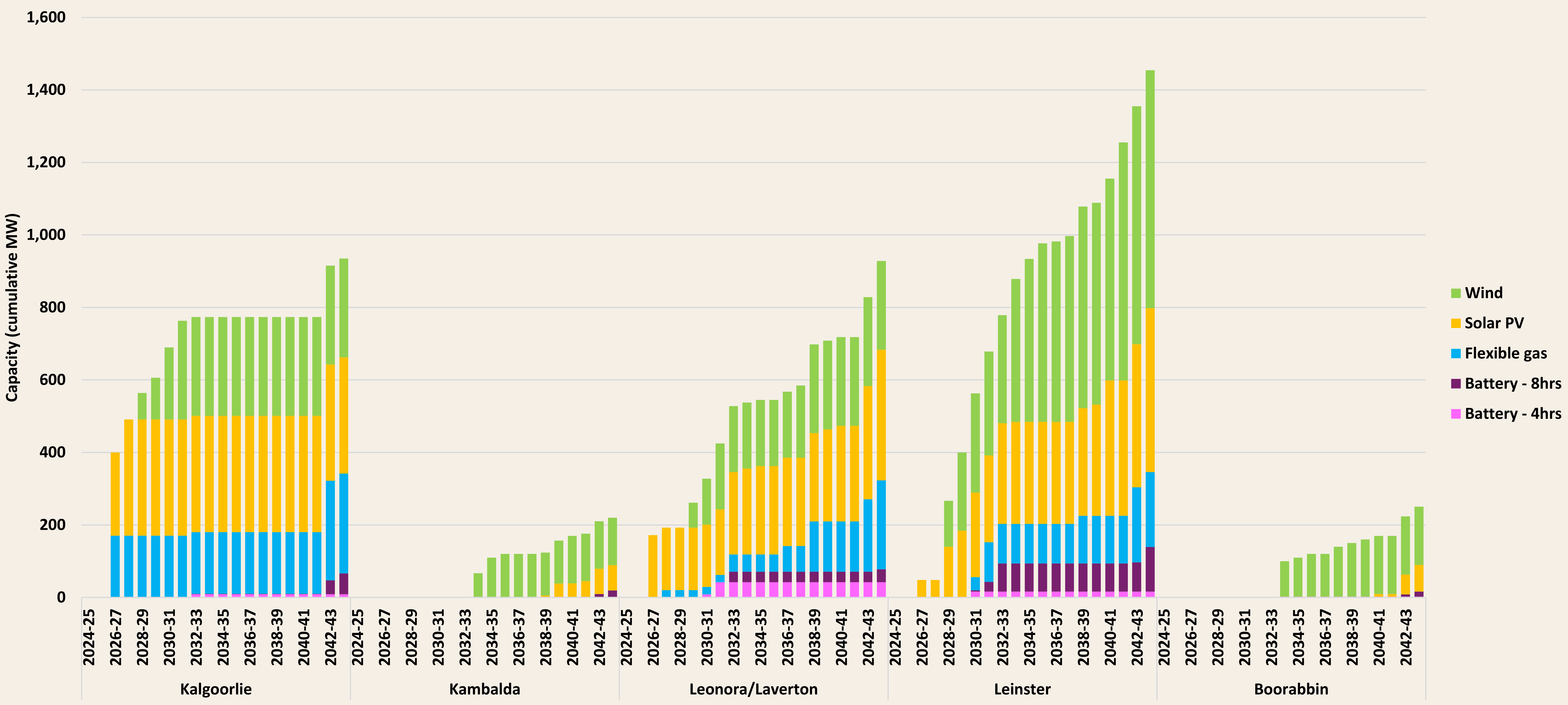
New Generation and Storage Requirements – STEADY Scenario

Demand (MW) by Node



New Generation and Storage Requirements – ELECTRIFICATION Scenario

Demand (MW) by Node



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Modelled Transmission Signals

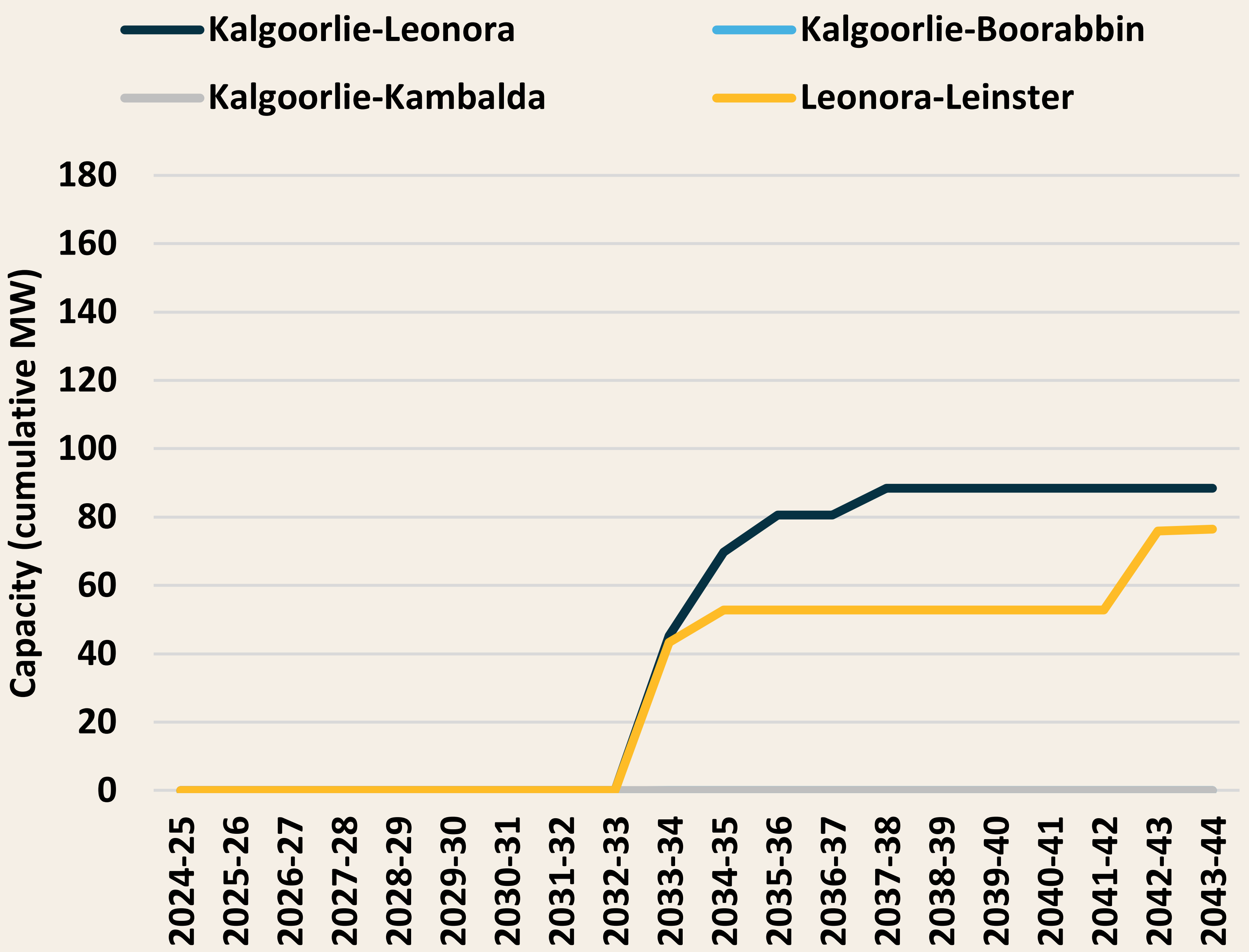
- Transmission signals were modelled using a least-cost capacity expansion approach based on linear optimisation
- The model allows network capacity to be built in small increments
- These increments are used as signals for the size of the network ‘building blocks’ that would be developed in reality
- Network signals are between 100 MW and 160 MW across the Steady and Electrification scenarios
- A double circuit network design is the preferred approach to ensure reliability and redundancy in the event of planned maintenance and unplanned network outages

- 132 kV is viewed as the appropriate configuration for the anticipated load carrying capability of the GRN network due to:
  - 220 kV or 330 kV architecture could provide the same or higher transfer capacity but would come at a much higher cost
  - 66 kV architecture would be a lower cost but would present design limitations given the distances in the GRN and would result in high network losses
  - Much of 66 kV architecture in the SWIS is approaching end of life and is being phased out
  - 132 kV is one of the primary voltages used for the SWIS, which helps with maintenance, spares and design

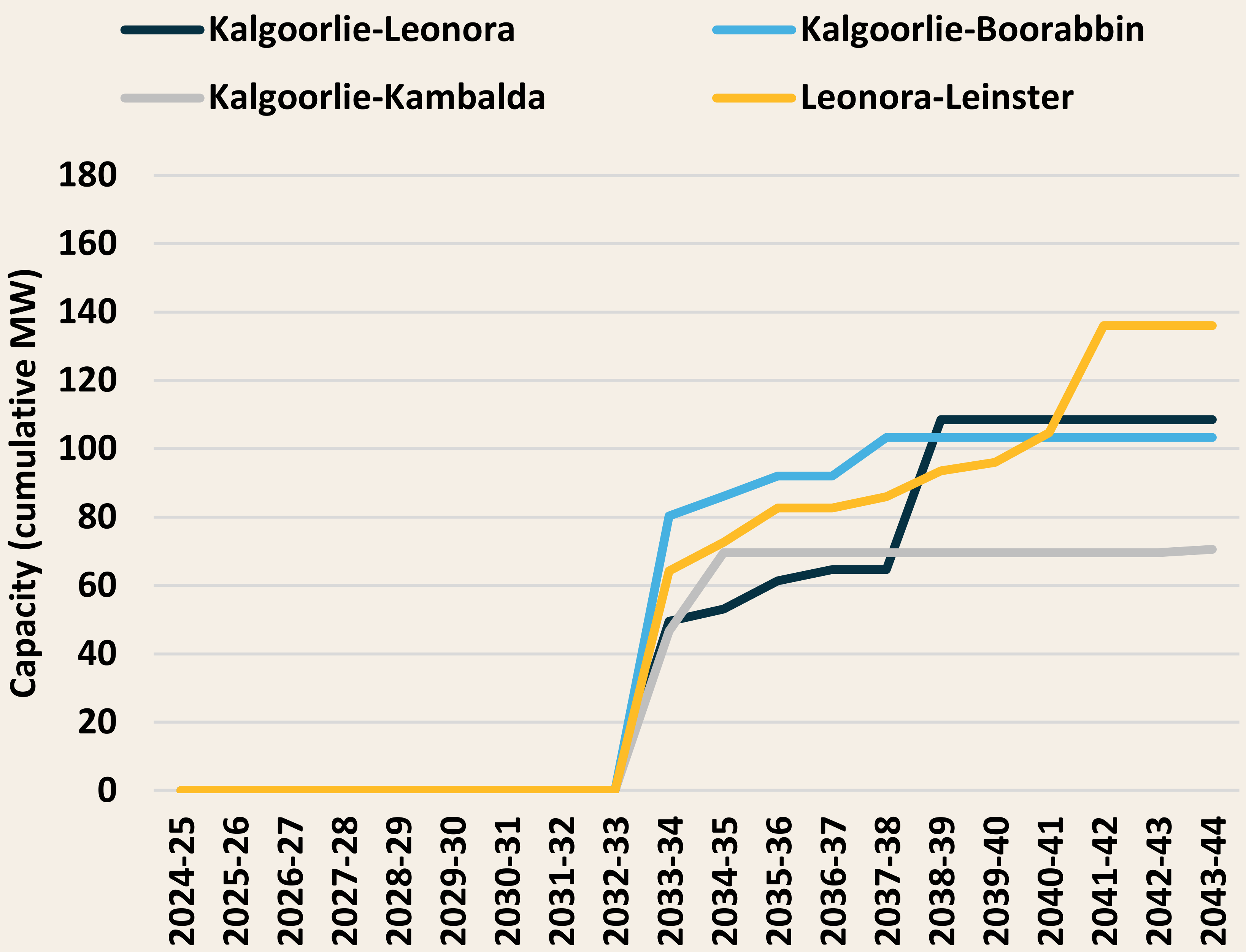
Modelled Transmission Signals

All demand scenarios signal that transmission infrastructure should be constructed from Kalgoorlie to Leinster, via Leonora.

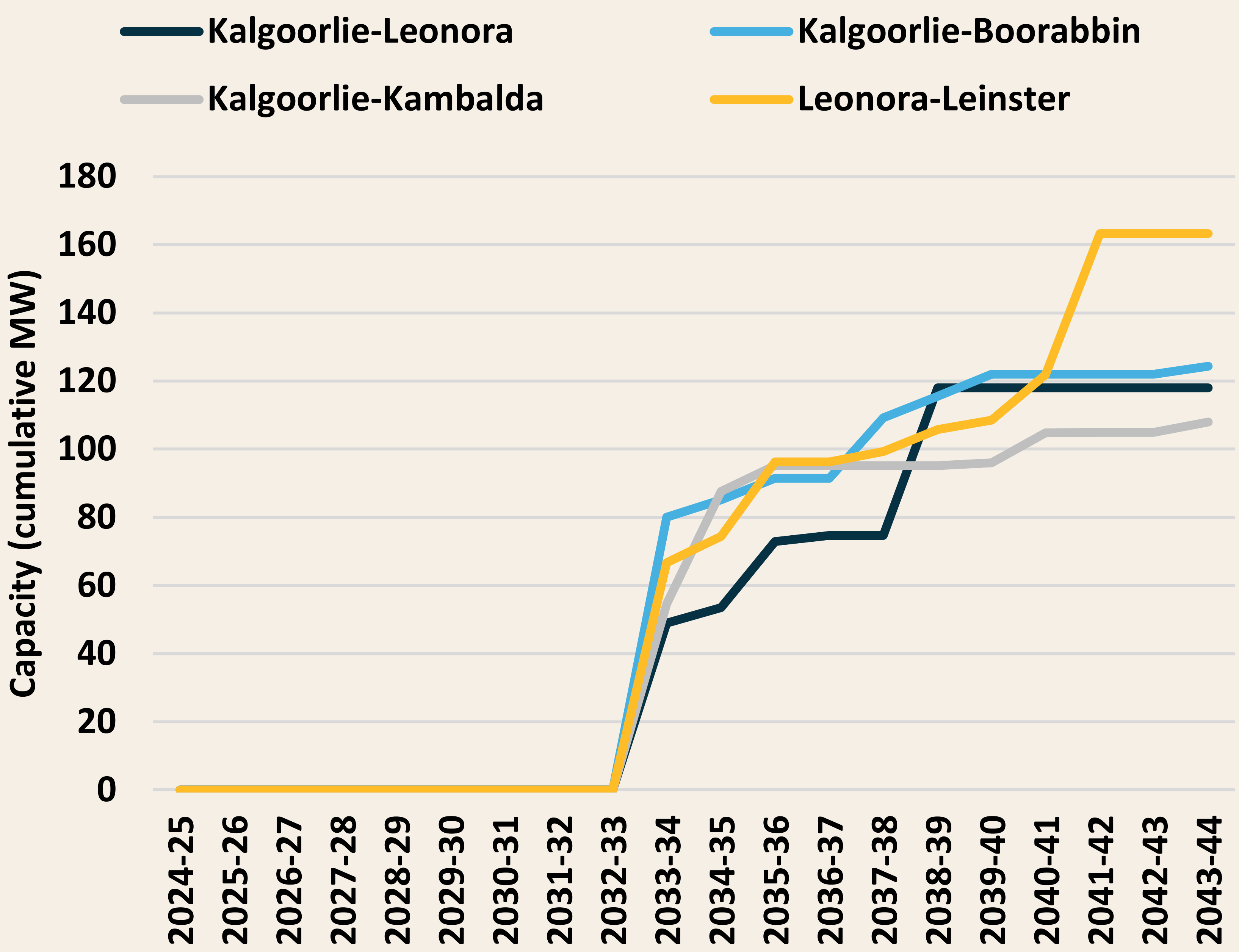
COMMITTED demand scenario (MW)



STEADY demand scenario (MW)



ELECTRIFICATION demand scenario (MW)



The Steady and Electrification scenarios identify:

- An opportunity to reduce total long-term cost of electricity by constructing transmission infrastructure west from Kalgoorlie to Boorabbin and south from Kalgoorlie to Kambalda to utilise wind resource in those areas, in addition to a line from Kalgoorlie to Leinster, via Leonora
- 150 MW transfer capacity for the backbone transmission would be satisfactory to service the projected demand

Transmission Building Blocks and Cost Assumptions

The transmission network configuration is based on a proposed 'N-1' level of security

Allows continuity of supply for both planned and unplanned outages on the transmission line circuits, transformers and connecting network elements

Assumption	Comments
Cost to build transmission line (double circuit): $1.3m/km	• EY analysis with reference to AEMO Transmission Costing Database and Western Power's SWIS costing assumptions
30% locational uplift to all costs	• Based on connection cost multiplier for Eastern Goldfields from recent network planning activities (WOSP 2020, SWISDA)
Capex per additional item of equipment	• EY analysis with reference to AEMO Transmission Costing Database and Western Power's SWIS costing assumptions
Additional equipment	• One terminal station for each of the Leinster, Leonora/Laverton, Boorabbin, and Kambalda nodes • Assumed that Kalgoorlie already has a terminal station • Two transformers for each terminal station achieve N-1 level of supply • Static VAR Compensators (SVCs) provide dynamic voltage support, assist in mitigating voltage stability risks and improve power transfer capability on very long lines
Intra-nodal reticulation assets	• Various high voltage (HV) and low voltage (LV) distribution network asset developments will be required to connect existing load/generation standalone facilities to the GRN – this has not been included in these cost estimates

Transmission Building Blocks and Cost – Steady and Electrification Demand Scenarios

Based on a double circuit 132 kV overhead line with 150 MW of load carrying capability per circuit.

Flow path	Distance (km)	Estimated Capex ($ millions)
Kalgoorlie–Leonora	230	389
Leonora–Leinster	130	220
Kalgoorlie–Boorabbin	120	203
Kalgoorlie–Kambalda	80	135
Total	**560**	**946**

Additional large equipment

Item	Capex per Item ($'m)	Estimated Capex ($ millions)
4 terminal stations	59	234
8 transformers	13	104
3 SVCs	39	117
Total	–	**455**

- All costs reflected in this slide (and all other slides in this pack) are estimates.
- The estimated costs have been informed by the assumptions outlined in slide 27 and are subject to further refinement informed by feedback from industry and as part of future GRN project stages.
- The intent of the GRN project is that a private developer would fund and construct the network, and that it would not be developed by the Government.

Transmission Building Blocks and Costs – Committed Demand Scenario

Based on a double circuit 132 kV overhead line with 150 MW of load carrying capability per circuit.

Flow path	Distance (km)	Estimated Capex ($ millions)
Kalgoorlie–Leonora	230	389
Leonora–Leinster	130	220
Kalgoorlie–Boorabbin	-	-
Kalgoorlie–Kambalda	-	-
Total	**360**	**608**

Additional large equipment

Item	Capex per Item ($'m)	Estimated Capex ($ millions)
2 terminal stations	59	117
4 transformers	13	52
2 SVCs	39	78
Total	**–**	**247**

- All costs reflected in this slide (and all other slides in this pack) are estimates.
- The estimated costs have been informed by the assumptions outlined in slide 27 and are subject to further refinement informed by feedback from industry and as part of future GRN project stages.
- The intent of the GRN project is that a private developer would fund and construct the network, and that it would not be developed by the Government.

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Levelised Cost of Electricity Generated (LCOEg) – Standalone Arrangement

The LCOEg metric allows comparability between the Standalone and GRN supply arrangements and to allow estimation of the GRN economic threshold

$$\text{LCOEg} = \frac{\text{Sum of costs associated with building and operating new generation fleet}}{\text{generation output of new generators less curtailed energy}}$$

	LCOEg numerator	LCOEg denominator
Included	• Cost of new entrant generator and storage facilities (capex*, fixed** and variable operating costs, fuel costs) • 20-year PPA term	• Sent-out generation output from new entrant facilities ○ 44% capacity factor for wind ○ 27% capacity factor for solar ○ Optimised system configuration ○ Idealised usage of dispatchable generation
Not included	• Regional uplift to capex • Gas transport costs • Life cycle replacement costs (thermal generation) • IPP margin • On-site network reticulation or substation costs • Costs associated with energy shortfalls (unserved energy)	• Curtailed energy

* Comparable to CSIRO GenCost 2023-24 Global Net Zero by 2050
** Does not consider full life cycle replacement costs of thermal generation
Note: a discount rate of 6% was applied.

Levelised Cost of Electricity Generated (LCOEg) – GRN Arrangements

The LCOEg metric allows comparability between the Standalone and GRN supply arrangements and to allow estimation of the GRN economic threshold

$$\text{LCOEg} = \frac{\text{Sum of costs associated with building and operating new generation fleet}}{\text{generation output of new generators less curtailed energy}}$$

	LCOEg Numerator	LCOEg Denominator
Included	• Cost of new entrant generator and storage facilities (capex,*, fixed and variable operating costs, fuel costs)	• Sent-out generation output from new entrant GRN generators
Not included	• Regional uplift to capex • New facility connection costs • Cost of occasionally importing electricity from the SWIS • Cost of generation from existing facilities in the GRN area • GRN transmission network backbone costs • Intra-nodal reticulation network costs (see slide 9) • Costs associated with energy shortfalls (unserved energy)	• Generation from storage facilities (storage is not inherently a generation source) • Generation output from existing facilities in the GRN area • Generation flows from the SWIS into GRN

* CSIRO GenCost 2023-24 Global Net Zero by 2050
Note: a discount rate of 6% was applied.

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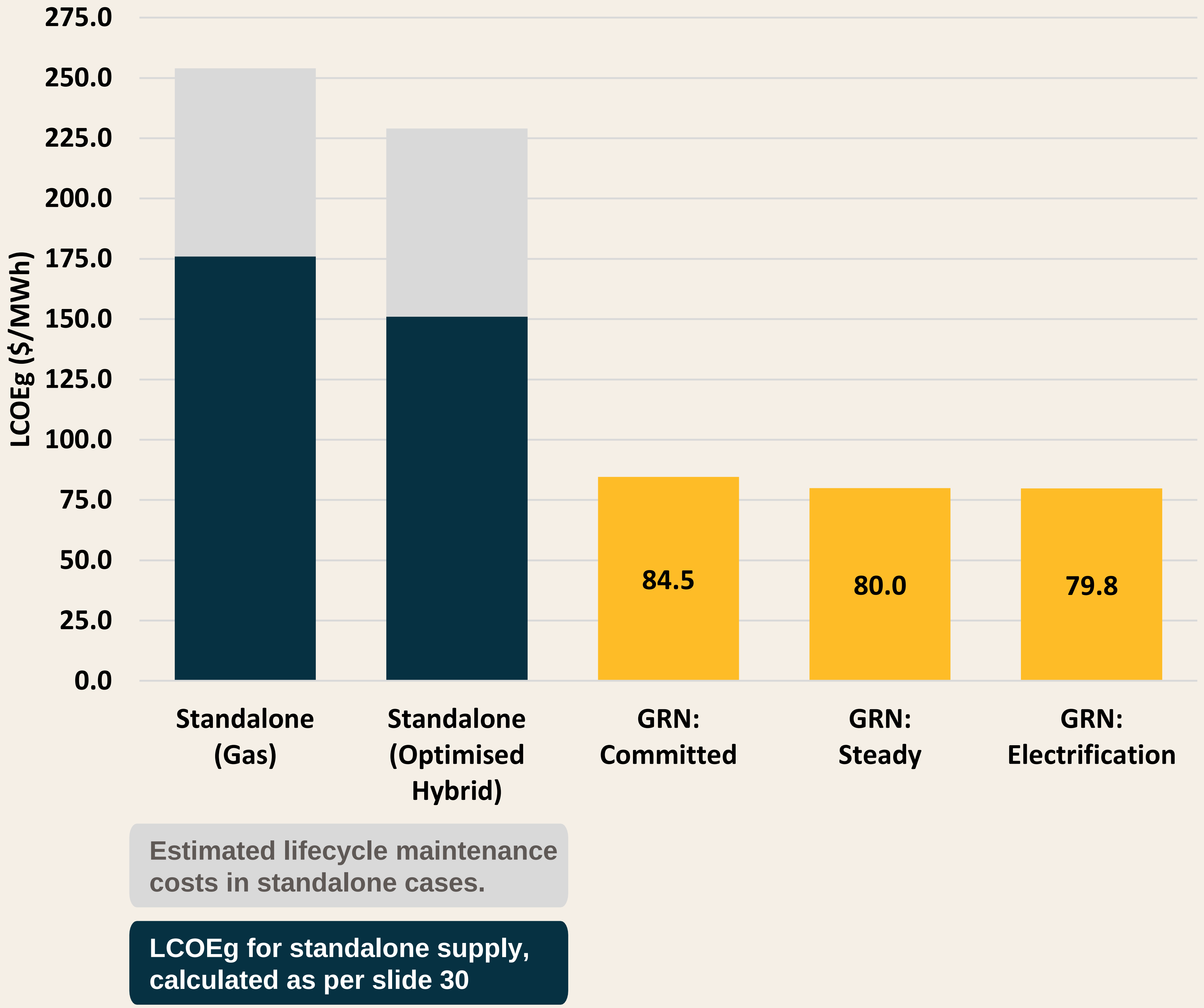
Modelling Outcomes and Potential Benefits

Levelised cost of electricity generated, LCOEg ($/MWh)



LCOEg outcomes indicate that the GRN is a more economic solution if the cost of transmission plus internal reticulation within the nodes is less than $60/MWh

- The Standalone cases show the LCOEg for a new gas-fired facility and for an optimised hybrid supply arrangement (gas, wind and solar) for a 20-year supply period
- The Standalone (optimised hybrid) LCOEg is the cost for the alternative scenario to indicate the viability of the GRN concept
- The standalone LCOEg would be higher if estimated lifecycle maintenance costs were added
- A high cost of unserved energy has been assumed to reflect industries' reliability requirements
- The SWIS reliability standard is met in all years and under all demand scenarios but at lower cost under the GRN
- By 2040 more than 80% of generation output would be delivered by renewable sources with the GRN, under the Steady demand scenario
- Emissions reductions are observed in all demand scenarios that assume the GRN is constructed

Standalone LCOEg reflects capex, VOM, fuel and FOM, where FOM includes costs of end-of-life maintenance to extend the running life of the asset

LCOEg for the GRN facilities assumes that no end-of-life costs are incurred to extend asset life; rather, the capacity expansion model was set up to incur capex on new capacity to replace assets where they come to end of life. Since capex on a brand new facility is typically higher than costs to replace certain, depleted parts of the plant, it is expected that the LCOE reflected here is a conservative estimate

Approach to the Initial GRN Tariff Assessment

The GRN tariff assessment was completed after the capacity expansion modelling, using the inputs from that model.

An assessment was done based on customers paying for access to the GRN through either:

- fully variable tariffs (i.e., based wholly on energy demand); or
- fully fixed charges (i.e., based on capacity).

A proportionate mix of volumetric and capacity-based tariff design may be more suitable for GRN stakeholders – this will be considered in future stages of the project.

	Assumptions fixed across all modelled tariff scenarios
GRN shared network cost estimate	• Consistent with the estimated costs outlined on slide 28.
Asset life	• 20 years (based on industry benchmarks)
Weighted average cost of capital (WACC)	• Two WACC values were considered: ○ 6.89% – regulatory rate of return instrument (sourced from the Australian Energy Regulator) ○ 10.00% – rate of return for a commercial investment
SWIS connection	• Power flows are occasionally imported from the SWIS

Initial GRN Tariff Assessment

Initial GRN tariff assessment is between $25/MWh and $47/MWh, which is less than the $60/MWh threshold from the LCOEg assessment.

This indicates that the GRN has the potential to deliver a lower cost supply solution than standalone supply arrangements, whilst enabling a high reliability and lower emissions electricity supply pathway.

WACC (%)	Depreciation (years)	Demand case	2033-34 required revenue ($ millions)	2033-34 volumetric tariff ($/MWh)	2033-34 capacity-based tariff ($'000/MW/p.a.)
6.98%	20	STEADY (with nickel)	$190.3	$26.0	$228.1
6.98%	20	STEADY (no nickel)	$190.3	$37.9	$331.6
6.98%	20	ELECTRIFICATION (with nickel)	$190.3	$24.9	$217.8
6.98%	20	ELECTRIFICATION (no nickel)	$190.3	$36.1	$316.6
10.00%	20	STEADY (with nickel)	$238.2	$32.6	$285.5
10.00%	20	STEADY (no nickel)	$238.2	$47.4	$415.2
10.00%	20	ELECTRIFICATION (with nickel)	$238.2	$31.1	$272.6
10.00%	20	ELECTRIFICATION (no nickel)	$238.2	$45.3	$396.4

Notes:

- The GRN commences operations in 2033-34 – see the assumptions on slides 7-8 and modelled signals on slide 26
- WACC is pre-tax real
- The indicated tariff would be either the volumetric tariff or the capacity-based tariff, not both
- The long-term outlook for tariffs will depend on depreciation, maintenance, escalation and customer demand variations over time

Reliability Outcomes

Under all modelled scenarios, least-cost expansion modelling indicates that unserved energy does not exceed the SWIS reliability standard* after the GRN is built

However, the capacity expansion modelling undertaken to date is not designed to test a wide range of power system reliability risks or potential power system security issues – these early outcomes require further analysis to verify

The objective of least-cost expansion modelling is to meet energy demand at lowest total system costs over a long-term planning horizon

This is achieved by incurring capital expenditure (a mix of new generation, energy storage and transmission capacity) and operating costs for all assets in the system to avoid the cost of experiencing unserved energy

The following components are approached differently in capacity expansion modelling than in a reliability assessment:

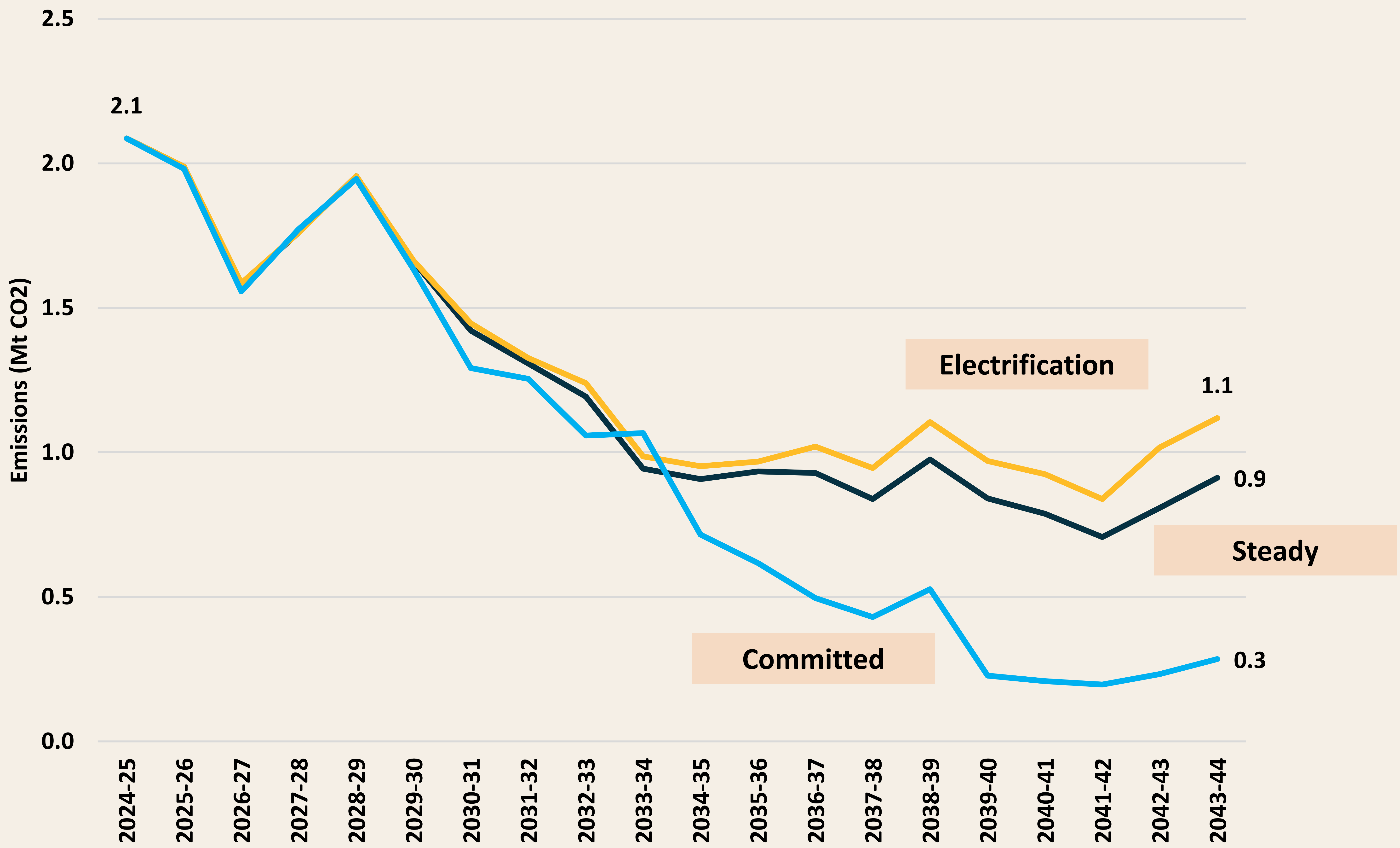
Outage rates	• The least-cost expansion modelling considers only one forced outage • A more detailed reliability assessment would consider many forced outage events (in the order of thousands) to capture a range of forced outage observations that could result in supply shortfalls
Weather reference years	• The least-cost expansion modelling applies weather reference years based on a rolling carousel • A reliability assessment (consistent with the 2024 WEM ESOO) approach considers 12 historical weather reference years for each modelled future year but has not been completed at this stage of the project
Custom GRN reliability needs	• The regulatory environment of the GRN is yet to be determined – the reliability planning criteria for the GRN may differ from the criterion on the WEM if the GRN is established under a different regulatory context than the WEM

A more detailed reliability modelling that captures the probabilistic nature of forced outages and weather events on reliability (akin to the 2024 WEM ESOO) will be explored at a later stage of the GRN Project

* Limb B of the SWIS reliability standard requires that expected unserved energy be no greater than 0.0002% of annual electricity consumption.

Emission Trajectories

Emissions for each demand scenario (Mt CO2)



- The emissions profile is largely consistent across Electrification and Steady scenarios, with a deeper drop in the Committed scenario due to a significant reduction in load
- Emissions are driven by new wind and solar displacing existing thermal generation and thermal retirements
- No emissions constraint was applied in the capacity expansion modelling – emissions outcomes are driven by the model's objective to minimise total system cost (TSC).

Goldfields Regional Network

Next Steps

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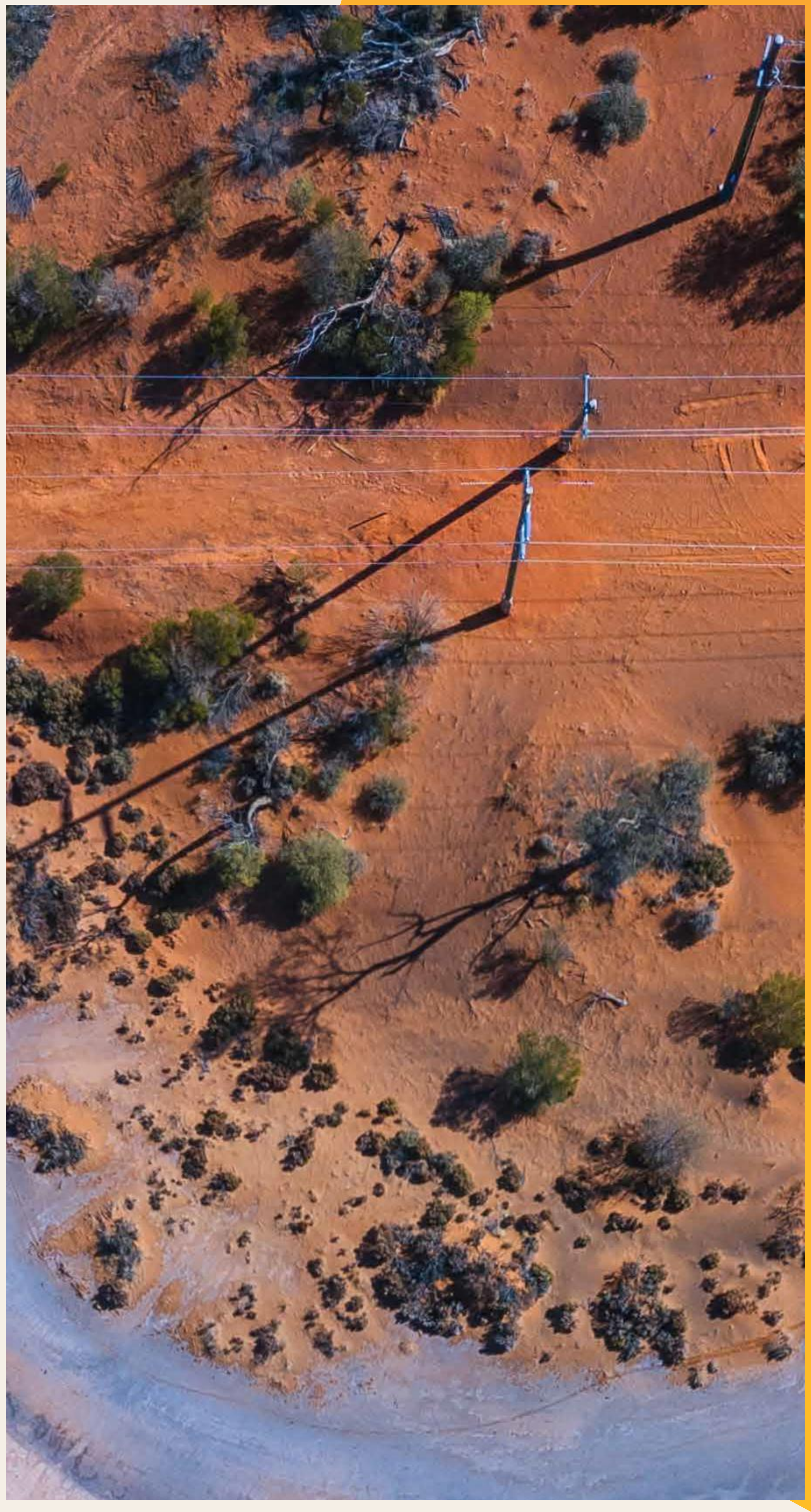
Next Steps

Preliminary Concept Study Results support the potential viability of the GRN project.

There is sufficient evidence to undertake the next steps:

1. Finalise the Stage 1 Concept study after incorporating industry feedback
2. Commence Stage 2 (commercial assessment)
   - Including a more detailed assessment of network tariffs, and security and reliability
3. Commence Stage 3 (regulatory and market assessments)
4. Establish working groups, including an Aboriginal engagement working group
5. Continue to meet with key stakeholders to inform project design

Recommendations will be made to the Government to undertake these steps and maintain project momentum



Upcoming Project Stages

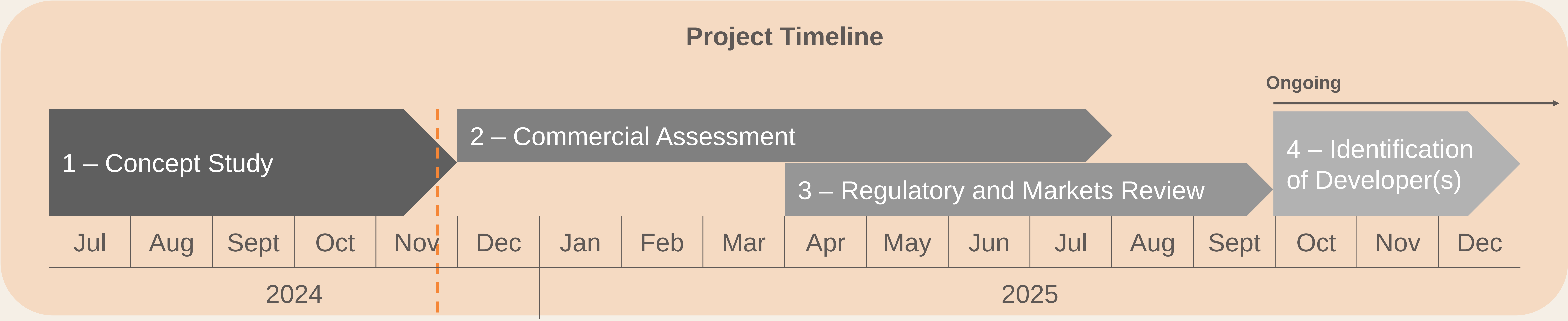
Stage 2 – Commercial Assessment

Assess, refine, and stress-test the outputs and data from Stage 1 to identify a range of commercial arrangements that would likely be acceptable to project developers, network operators and users of the GRN

This stage will include engagement with Aboriginal people in the region

Stage 3 – Regulatory and Markets Review

Identify and make recommendations on regulatory and market arrangements that could apply to the GRN, and an assessment of mechanisms available to recover costs associated with developing the GRN



Future Forums and Working Groups

Information relating to the GRN Forum will be published on PoweringWA's website:

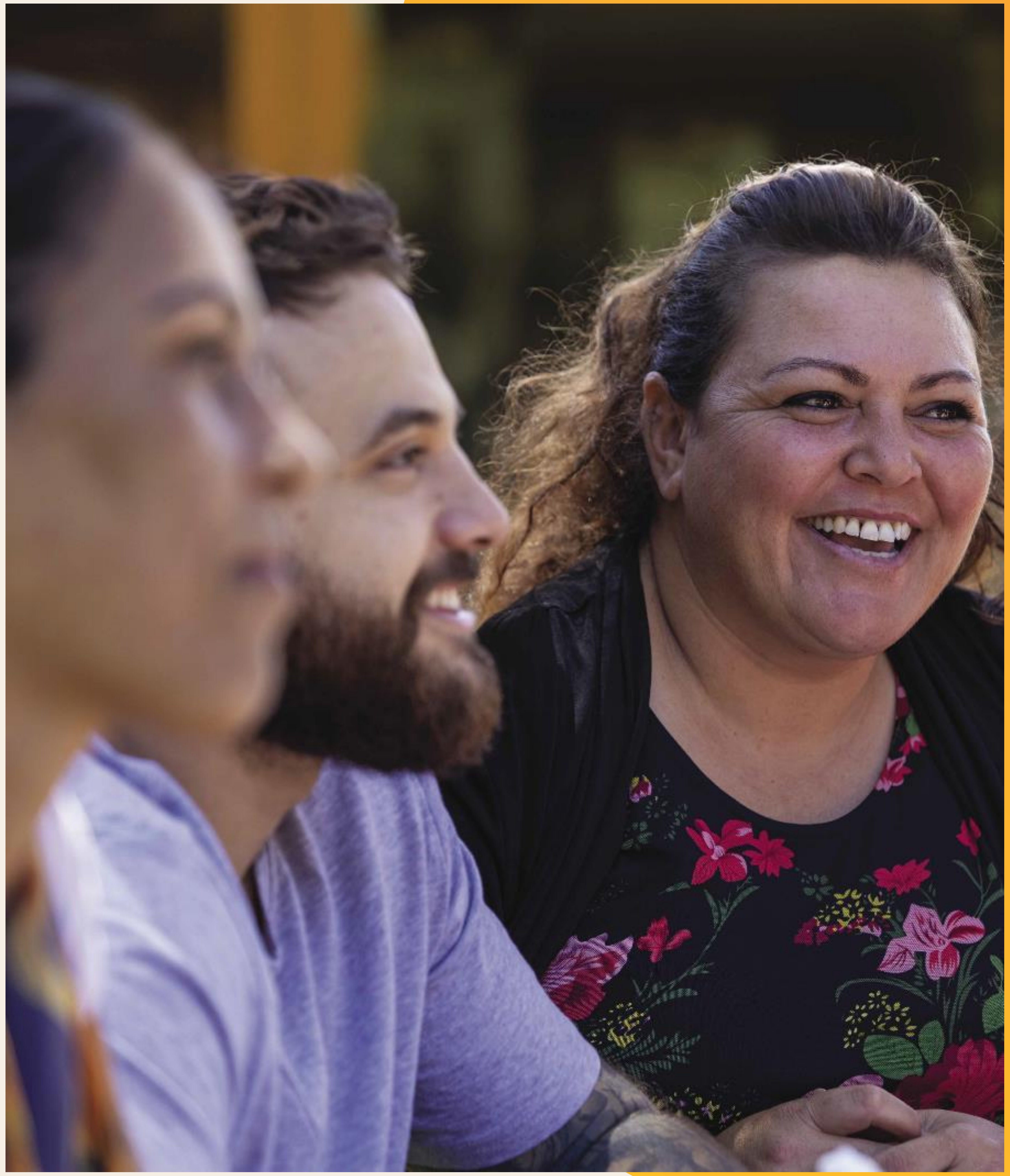
- Terms of References
- Meeting papers and minutes
- Presentations

The following Forum Working Groups are proposed:

- Industry and Commercial
- Aboriginal Engagement
- Regulatory and Market Arrangements

Stay tuned for future communications regarding establishment of the Working Groups and the next GRN Forum

For more information visit: **wa.gov.au/goldfieldsregionalnetwork**



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Appendix

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Modelled New Generation and Storage Build (MW)

COMMITTED demand scenario

Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0
2025-26	0	0	0	0	0
2026-27	0	0	109	432	0
2027-28	0	0	127	468	0
2028-29	0	0	127	563	200
2029-30	0	0	127	590	400
2030-31	9	0	164	590	600
2031-32	41	43	209	590	616
2032-33	41	92	227	590	616
2033-34	41	92	227	590	616
2034-35	41	92	227	590	616
2035-36	41	92	227	590	616
2036-37	41	92	227	590	616
2037-38	41	92	227	590	616
2038-39	41	92	227	590	616
2039-40	41	92	227	590	616
2040-41	41	92	227	590	616
2041-42	41	92	227	590	616
2042-43	41	92	227	590	616
2043-44	41	92	227	590	616

Modelled New Generation and Storage Build (MW)

STEADY demand scenario

Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0
2025-26	0	0	0	0	0
2026-27	0	0	157	450	0
2027-28	0	0	177	534	0
2028-29	0	0	177	627	200
2029-30	0	0	177	671	400
2030-31	23	2	213	714	600
2031-32	55	27	281	718	722
2032-33	65	102	305	794	741
2033-34	67	102	305	803	976
2034-35	67	102	305	803	1,066
2035-36	67	102	305	803	1,097
2036-37	67	102	305	803	1,097
2037-38	67	102	305	803	1,119
2038-39	67	102	384	803	1,177
2039-40	67	102	384	812	1,177
2040-41	67	102	384	855	1,177
2041-42	67	102	384	855	1,227
2042-43	67	144	521	966	1,227
2043-44	67	182	580	1,008	1,227

Modelled New Generation and Storage Build (MW)

ELECTRIFICATION demand scenario

Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0
2025-26	0	0	0	0	0
2026-27	0	0	170	450	0
2027-28	0	0	191	541	0
2028-29	0	0	191	633	200
2029-30	0	0	191	677	400
2030-31	25	4	227	726	600
2031-32	58	27	300	741	741
2032-33	67	108	327	825	753
2033-34	70	108	327	839	1,013
2034-35	70	108	327	846	1,121
2035-36	70	108	327	846	1,184
2036-37	70	108	350	846	1,189
2037-38	70	108	350	846	1,241
2038-39	70	108	441	865	1,340
2039-40	70	108	441	918	1,350
2040-41	70	108	441	1,003	1,365
2041-42	70	108	441	1,009	1,465
2042-43	70	163	682	1,153	1,465
2043-44	70	249	727	1,277	1,465

Modelled New Generation and Storage Build (MW): Nodal Breakdown

COMMITTED demand scenario

	Kalgoorlie					Kambalda					Leonora/Laverton					Leinster					Boorabbin				
Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026-27	0	0	109	231	0	0	0	0	0	0	0	0	0	154	0	0	0	0	47	0	0	0	0	0	0
2027-28	0	0	109	267	0	0	0	0	0	0	0	0	18	154	0	0	0	0	47	0	0	0	0	0	0
2028-29	0	0	109	267	100	0	0	0	0	0	0	0	18	154	0	0	0	0	142	100	0	0	0	0	0
2029-30	0	0	109	267	142	0	0	0	0	0	0	0	18	154	53	0	0	0	169	205	0	0	0	0	0
2030-31	0	0	109	267	228	0	0	0	0	0	0	0	18	154	110	9	0	36	169	262	0	0	0	0	0
2031-32	0	0	109	267	228	0	0	0	0	0	30	0	21	154	117	10	43	79	169	271	0	0	0	0	0
2032-33	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2033-34	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2034-35	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2035-36	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2036-37	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2037-38	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2038-39	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2039-40	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2040-41	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2041-42	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2042-43	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0
2043-44	0	20	109	267	228	0	0	0	0	0	30	19	39	154	117	10	53	79	169	271	0	0	0	0	0

Modelled New Generation and Storage Build (MW): Nodal Breakdown

STEADY demand scenario

	Kalgoorlie					Kambalda					Leonora/Laverton					Leinster					Boorabbin				
Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026-27	0	0	157	230	0	0	0	0	0	0	0	0	0	172	0	0	0	0	48	0	0	0	0	0	0
2027-28	0	0	157	314	0	0	0	0	0	0	0	0	20	172	0	0	0	0	48	0	0	0	0	0	0
2028-29	0	0	157	314	76	0	0	0	0	0	0	0	20	172	0	0	0	0	141	124	0	0	0	0	0
2029-30	0	0	157	314	121	0	0	0	0	0	0	0	20	172	64	0	0	0	185	215	0	0	0	0	0
2030-31	0	0	157	314	212	0	0	0	0	0	7	0	20	172	117	16	2	35	228	271	0	0	0	0	0
2031-32	0	0	157	314	266	0	0	0	0	0	39	0	20	176	178	16	27	103	228	278	0	0	0	0	0
2032-33	10	0	157	314	266	0	0	0	0	0	39	30	44	222	178	16	72	103	258	297	0	0	0	0	0
2033-34	10	0	157	314	266	0	0	0	0	56	39	30	44	230	178	16	72	103	258	377	1	0	0	0	99
2034-35	10	0	157	314	266	0	0	0	0	86	39	30	44	230	178	16	72	103	258	427	1	0	0	0	109
2035-36	10	0	157	314	266	0	0	0	0	87	39	30	44	230	178	16	72	103	258	448	1	0	0	0	119
2036-37	10	0	157	314	266	0	0	0	0	87	39	30	44	230	178	16	72	103	258	448	1	0	0	0	119
2037-38	10	0	157	314	266	0	0	0	0	87	39	30	44	230	178	16	72	103	258	454	1	0	0	0	134
2038-39	10	0	157	314	266	0	0	0	0	87	39	30	123	230	209	16	72	104	258	481	1	0	0	0	135
2039-40	10	0	157	314	266	0	0	0	0	87	39	30	123	230	209	16	72	104	267	481	1	0	0	0	135
2040-41	10	0	157	314	266	0	0	0	13	87	39	30	123	250	209	16	72	104	278	481	1	0	0	0	135
2041-42	10	0	157	314	266	0	0	0	13	87	39	30	123	250	209	16	72	104	278	531	1	0	0	0	135
2042-43	10	33	182	314	266	0	4	9	37	87	39	30	137	282	209	16	73	170	311	531	1	4	23	22	135
2043-44	10	43	182	314	266	0	13	9	37	87	39	34	195	318	209	16	83	170	311	531	1	9	23	27	135

Modelled New Generation and Storage Build (MW): Nodal Breakdown

ELECTRIFICATION demand scenario

	Kalgoorlie					Kambalda					Leonora/Laverton					Leinster					Boorabbin				
Financial Year	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind	Battery - 4hrs	Battery - 8hrs	Flexible gas	Solar PV	Wind
2024-25	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2025-26	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2026-27	0	0	170	230	0	0	0	0	0	0	0	0	0	172	0	0	0	0	48	0	0	0	0	0	0
2027-28	0	0	170	321	0	0	0	0	0	0	0	0	20	172	0	0	0	0	48	0	0	0	0	0	0
2028-29	0	0	170	321	73	0	0	0	0	0	0	0	20	172	0	0	0	0	140	127	0	0	0	0	0
2029-30	0	0	170	321	115	0	0	0	0	0	0	0	20	172	69	0	0	0	184	216	0	0	0	0	0
2030-31	0	0	170	321	199	0	0	0	0	0	8	0	20	172	127	16	4	36	233	274	0	0	0	0	0
2031-32	0	0	170	321	273	0	0	0	0	0	42	0	20	181	182	16	27	109	240	287	0	0	0	0	0
2032-33	9	1	170	321	273	0	0	0	0	0	42	29	48	227	182	16	78	109	278	298	0	0	0	0	0
2033-34	9	1	170	321	273	1	0	0	0	66	42	29	48	237	182	16	78	109	281	394	2	0	0	0	98
2034-35	9	1	170	321	273	1	0	0	0	109	42	29	48	244	182	16	78	109	281	449	2	0	0	0	108
2035-36	9	1	170	321	273	1	0	0	0	119	42	29	48	244	182	16	78	109	281	493	2	0	0	0	118
2036-37	9	1	170	321	273	1	0	0	0	119	42	29	71	244	182	16	78	109	281	498	2	0	0	0	118
2037-38	9	1	170	321	273	1	0	0	0	119	42	29	71	244	199	16	78	109	281	513	2	0	0	0	138
2038-39	9	1	170	321	273	1	0	0	4	119	42	29	139	244	245	16	78	132	297	556	2	0	0	0	148
2039-40	9	1	170	321	273	1	0	0	37	119	42	29	139	254	245	16	78	132	307	556	2	0	0	0	158
2040-41	9	1	170	321	273	1	0	0	38	131	42	29	139	264	245	16	78	132	373	556	2	0	0	7	161
2041-42	9	1	170	321	273	1	0	0	44	131	42	29	139	264	245	16	78	132	373	656	2	0	0	7	161
2042-43	9	38	275	321	273	1	8	0	70	131	42	29	200	313	245	16	81	207	395	656	2	7	0	55	161
2043-44	9	58	275	321	273	1	18	0	70	131	42	36	245	360	245	16	123	207	452	656	2	14	0	74	161