Deep dive

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Deep dive

- A short recap on the public forum
- Addressing themes from feedback received to date
- Questions from the floor

Recap

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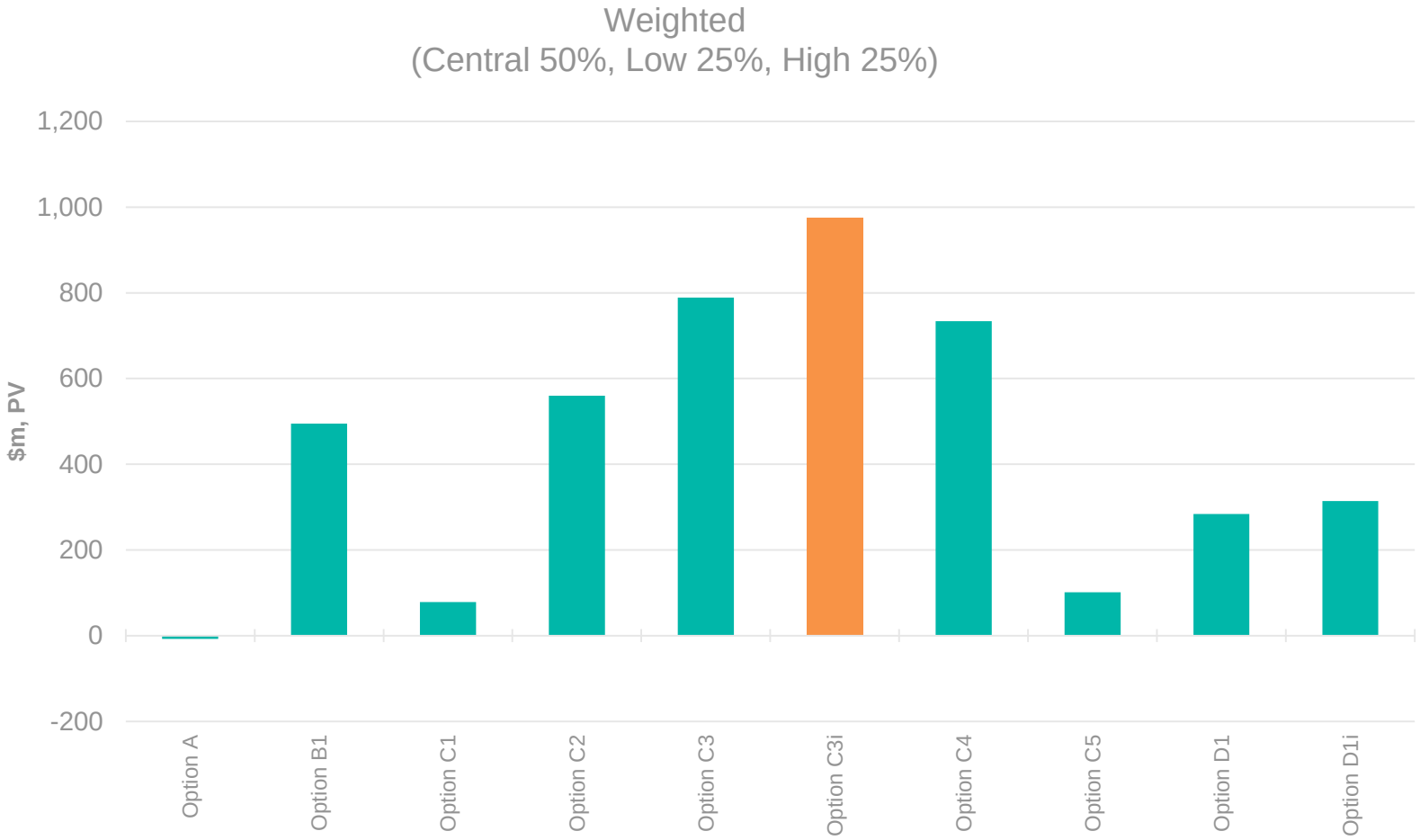
Options

Option	Description	Capital Cost ($2018 billion)
Option A	Non-interconnector[1]	$0.13 p.a.
Option B	Qld HVDC	$1.8
Option C1	NSW HVDC	$0.8
Option C2	NSW 275 kV	$1.0
Option C3	NSW 330 kV via Buronga	$1.4
Option C3i	**C3 + series compensation**	**$1.5** (NPV ~$0.9)
Option C4	NSW 330 kV Buronga by pass	$1.3
Option C5	NSW 500 kV	$2.9
Option D1	Victoria 275 kV	$1.2
Option D1i	D1 + series compensation	$1.2

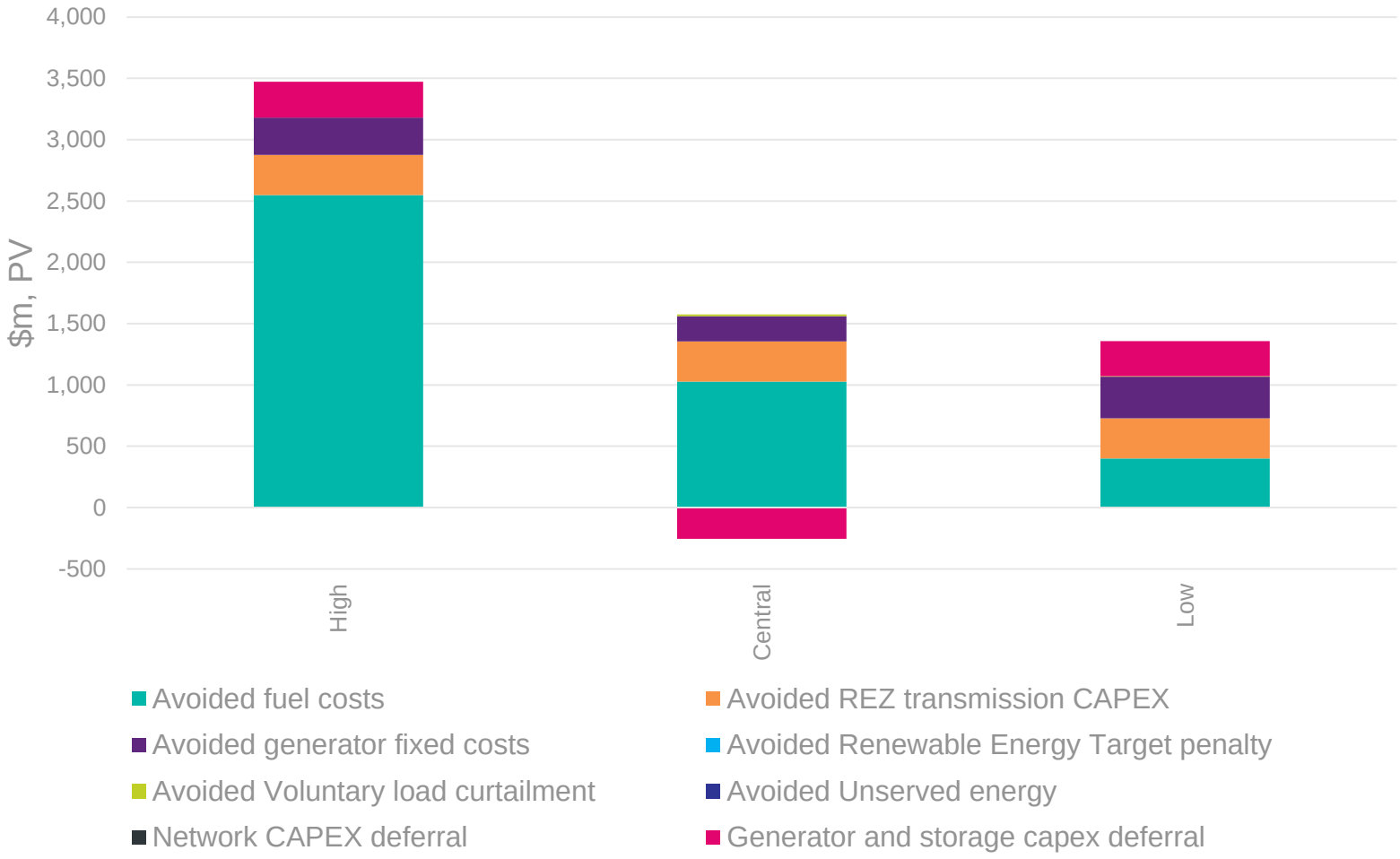
Scenarios

Variable	High	Central	Low
Weighting	25%	50%	25%
Electricity demand **(including impact from distributed energy resources)**	AEMO 2018 EFI **strong** demand forecasts plus potential SA mining load development of **345 MW**	AEMO 2018 EFI **Neutral** demand forecasts	AEMO 2018 EFI **Weak** demand forecasts
Gas prices – long term	**$11.87 GJ in Adelaide** ($1.68/GJ higher than the AEMO ISP strong forecast)	**$ 8.40/GJ** (AEMO 2017 GSOO Neutral forecast; $0.77 lower than AEMO ISP Neutral forecast)	**$7.40/GJ** ($0.62/GJ lower than the AEMO ISP weak forecast)
Emission reduction renewables policy – in addition to Renewable Energy Target (RET)	Emissions reduction around **45%** from 2005 by 2030 (Federal opposition policy)	Emissions reduction around **28%** from 2005 by 2030 (Federal Government policy)	**No** explicit emission reduction beyond current RET
Jurisdictional emissions targets	VRET 25% by 2020 and **40% by 2025** QRET **50% by 2030**	VRET 25% by 2020 and **40% by 2025** QRET **50% by 2030**	VRET 25% by 2020 and **40% by 2025** QRET **50% by 2030**
SA inertia requirement – RoCoF limit for non-credible loss of Heywood Interconnector	**1 Hz/s** (International standard)	**3 Hz/s** (current SA Government requirement)	**3 Hz/s** (current SA Government requirement)
Capital costs	**15%** higher than central scenario	AEMO **2016 NTNDP** with some updates from **2018 ISP**.	**15%** lower than central scenario

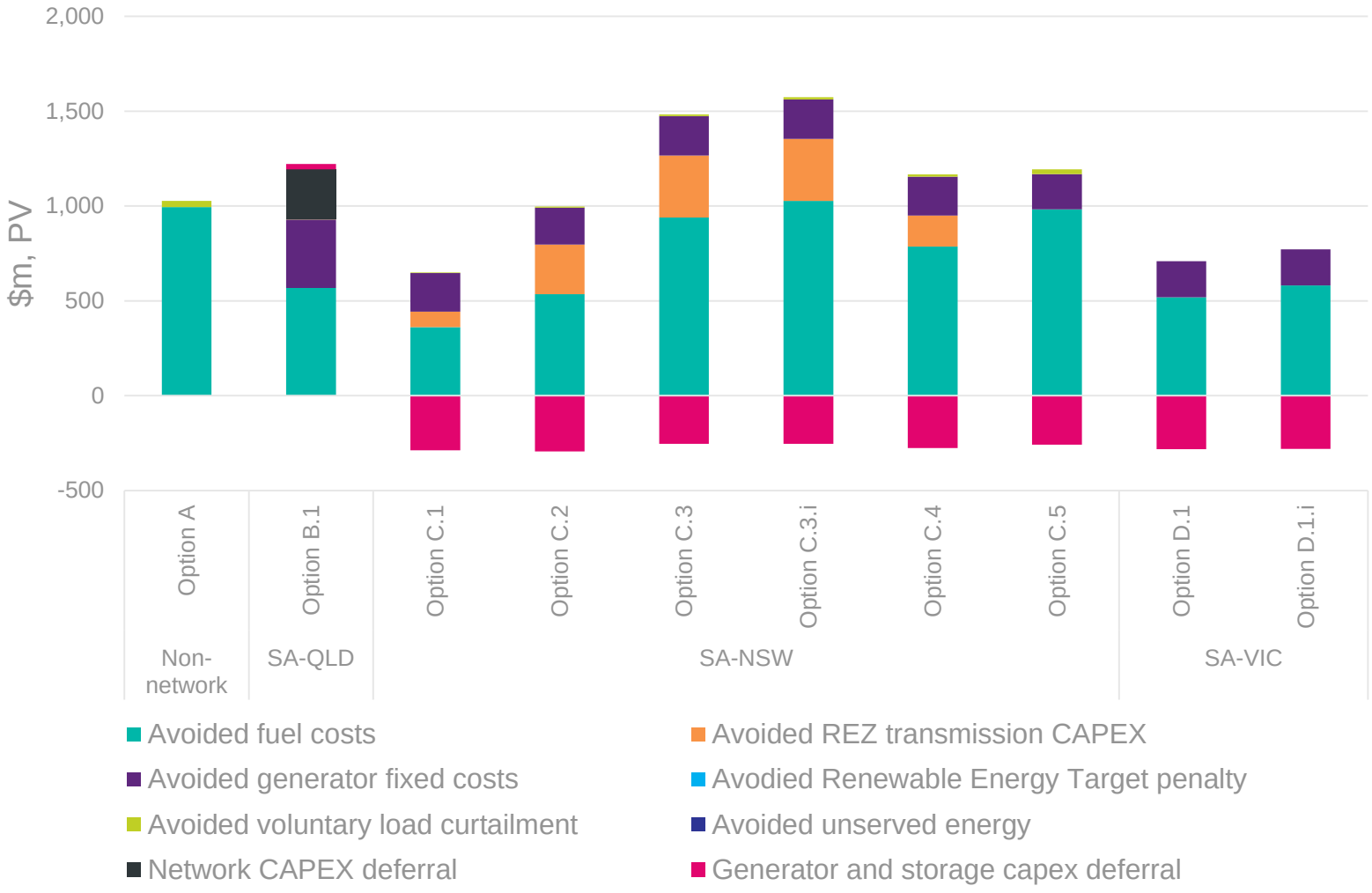
Weighted benefits



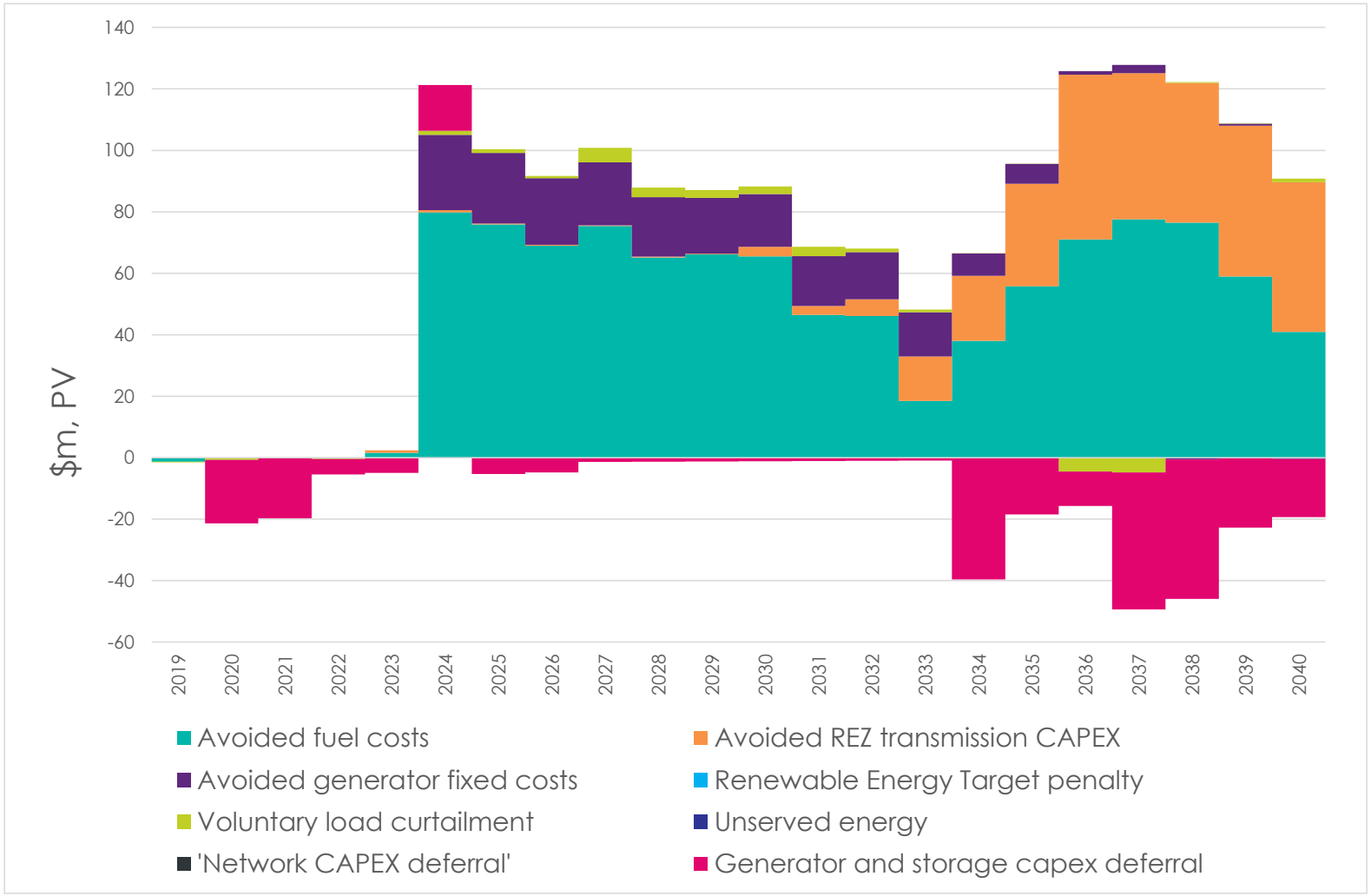
Preferred option – benefit category by scenario



Central scenario – gross market benefits



Preferred option – central time series



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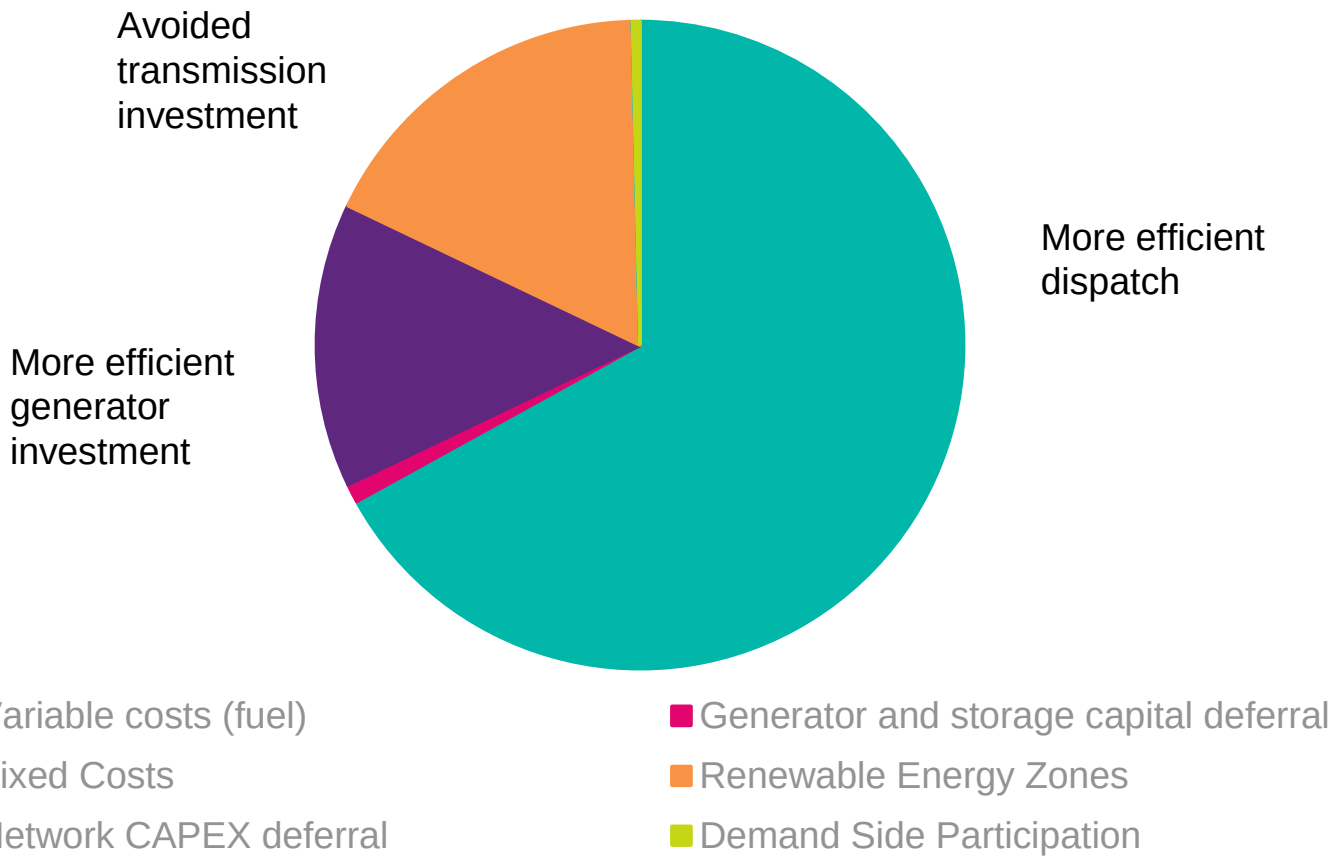
Preferred option benefit categories (weighted)



Feedback themes

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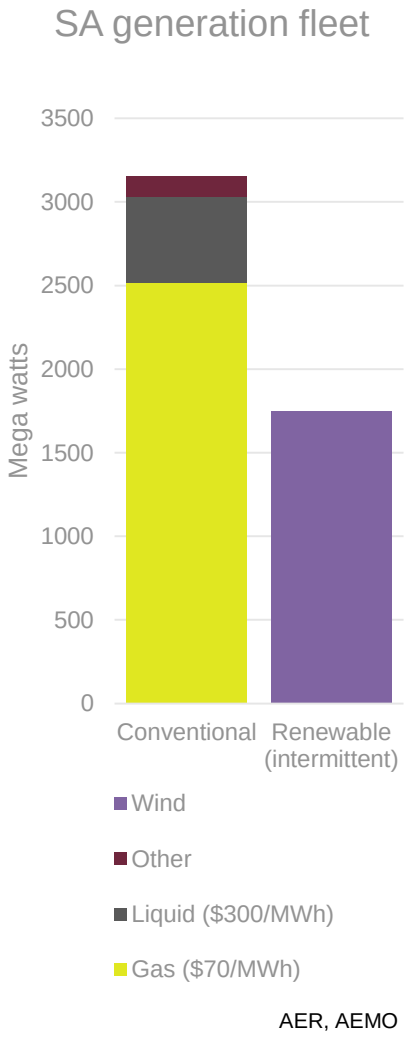
Themes

1. Gas market interaction
2. Transmission deferral benefits
3. System strength considerations
4. Non-interconnector options
5. Spotlight on Queensland option

1. Why is the gas price so important?

- SA's dispatchable fleet is dominated by gas generators
- RoCoF* constraint on Heywood Interconnector.
  - Interconnector limits are now influenced by gas generators (not just flows)
- Gas prices have increased
- Submissions advised testing a wide range of prices
  - We centered on AEMO's neutral forecast
- Energy Quest advice informed the gas price floor
- We tested AEMO's ISP scenario "Increased Role for Gas"

* Rate of Change of Frequency



AER, AEMO

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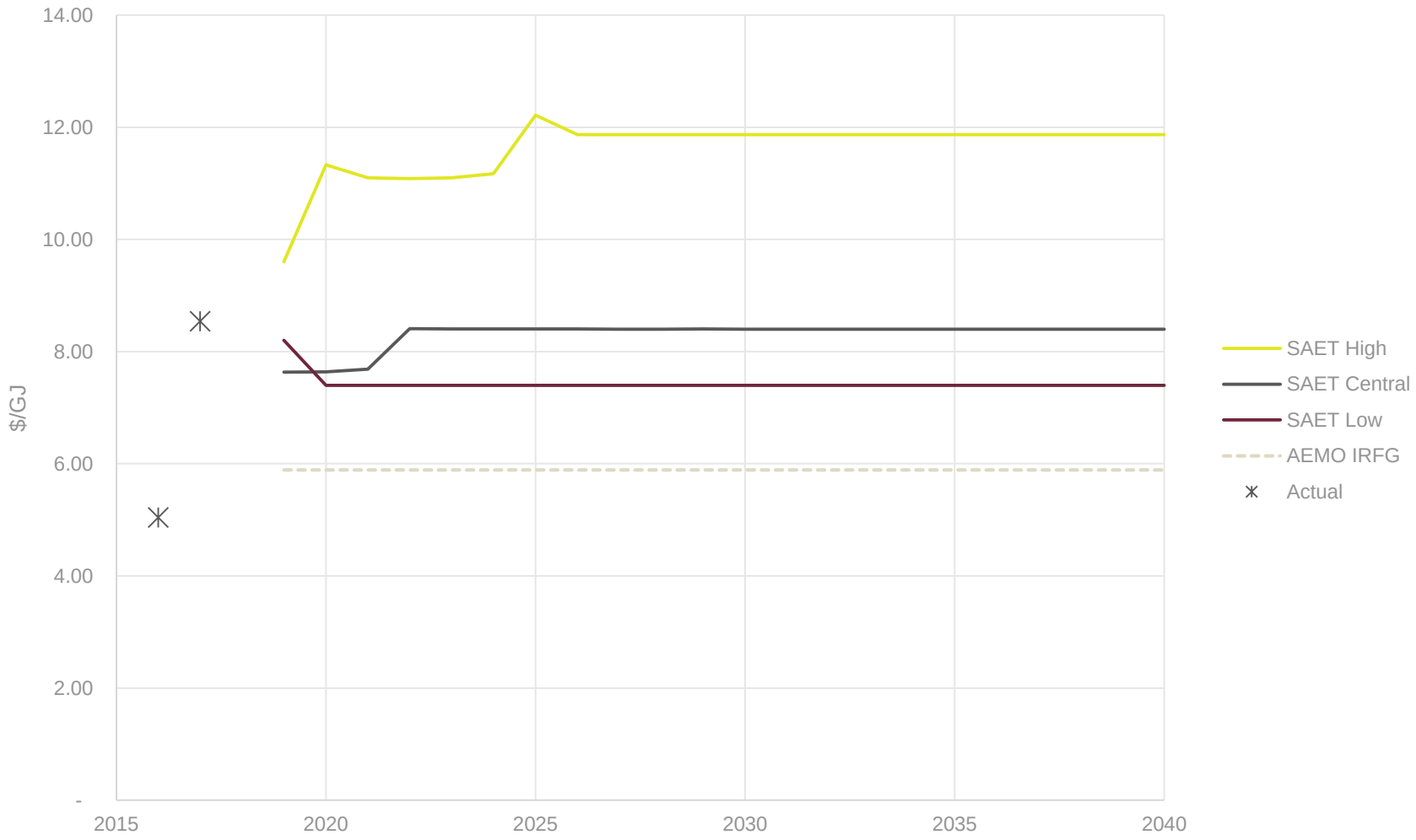
1. Gas prices – delivered to Torrens Island



2. Transmission deferral benefits

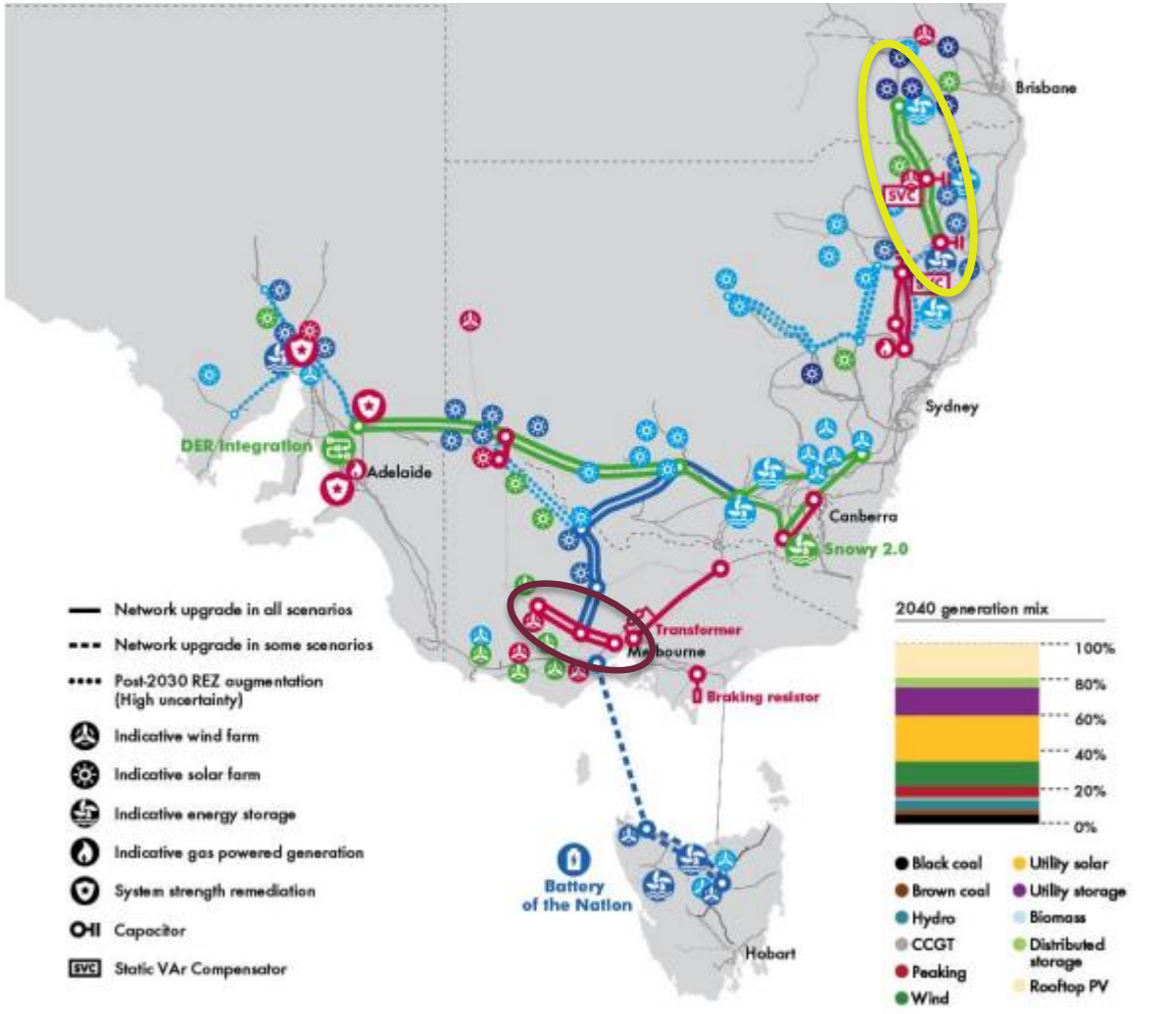
- RIT-T class of market benefit: “differences in timing of transmission investment”
  - Reduced capital expenditure on transmission investment otherwise required

- AEMO’s Integrated System Plan and SAET interaction
  - Group 1: Western Victorian Renewable Integration RIT-T
  - Group 2: Medium Qld to NSW augmentation (378 MW)
  - Group 3: Renewable Energy Zones – intra regional transmission development.

- Consistent with AER 2018 Draft RIT-T Guidelines

2. ISP and SAET interaction

- Group 1 – Red
  - Western Victoria Renewable Integration RIT-T
- Group 2 – Green
  - SA – NSW interconnector
  - Medium QNI Upgrade
- Group 3 – Blue
  - REZ Benefits



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3. System strength

- Current arrangement
  - Synchronous floor and low non-synchronous cap

    AEMO constrain on or direct synchronous generators to meet the minimum system strength requirement

    If the synchronous floor is met but not exceeded, a **low** cap is applied to non-synchronous generators
  - High non-synchronous cap

    If the synchronous floor is exceeded, a **high** cap is applied to non-synchronous generators
- Assumed base case
  - High non-synchronous cap
  - 2,400 MWs of inertia is provided by synchronous condensers influences Heywood Interconnector limits.

3. System strength

- Current direction arrangements costing ~ $50 - $60 million p.a.
- Separate solution to be delivered ASAP to address synchronous floor only

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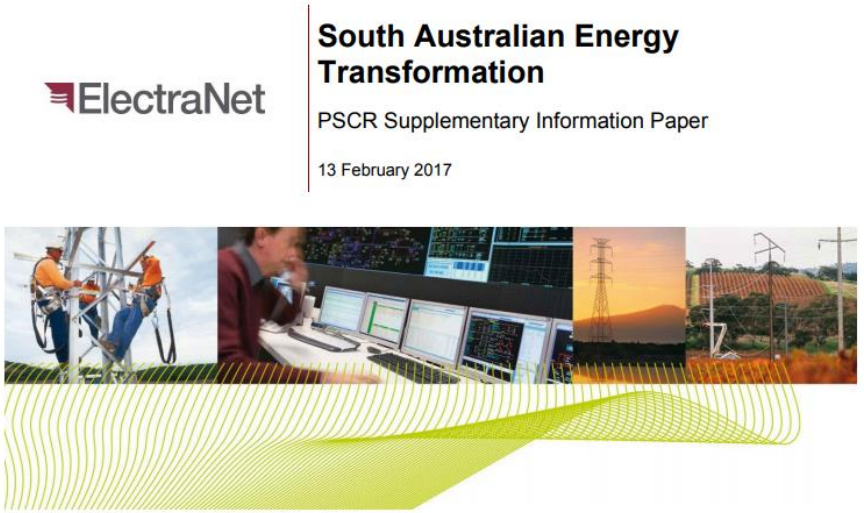
4. Non-interconnector option

- SAET Supplementary information paper
- Describes minimum and preferred system targets
  - ‘grid scale’ solutions to meet the identified need
- ElectraNet tested the benefits of many non-network combinations
- Entura advised on an optimized solution and assessed performance against the minimum and preferred system target



4. Non-interconnector option

- SAET total PV cost ~ $1.1B

The solution and publicly available information on capital costs >$1.5B

- 150 MW Solar thermal ~ $750m

  Renew Economy 9 May 2018

- 225 MW Pumped hydro ~ $410m

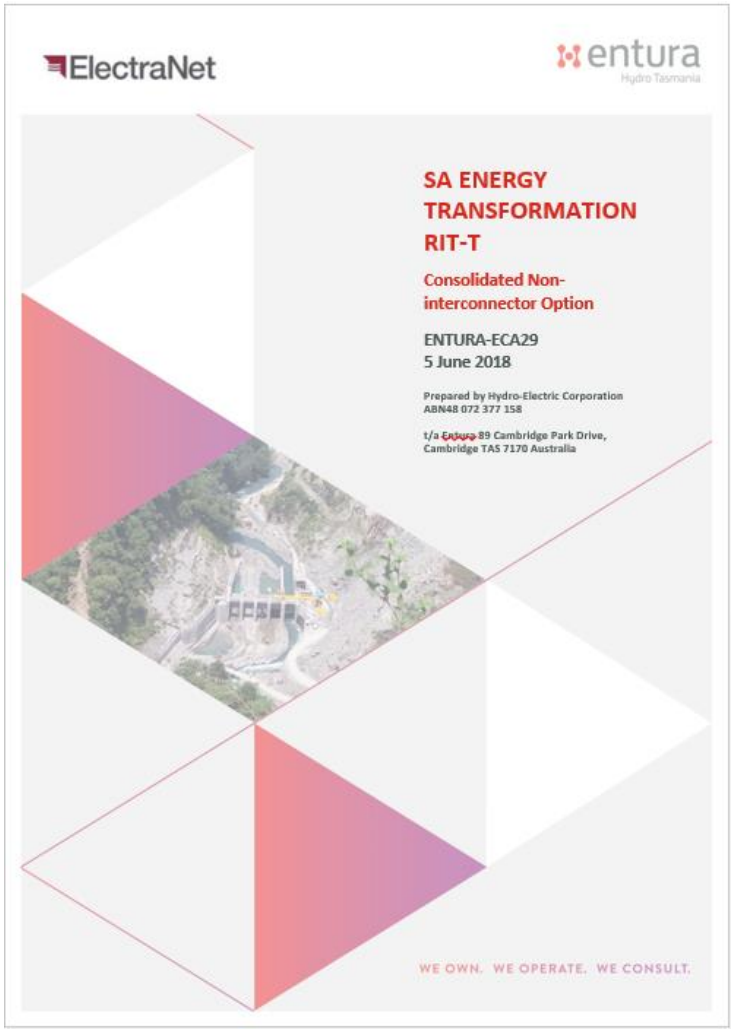
  Guardian Australia 8 February 2018

- 2 * 150 MW battery ~ $375M

  AEMO ISP assumptions ~ $1.25m / MW

- Network support agreement

  No publicly available equivalent



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5. Spotlight on Queensland option

- Capital Cost $1.79 B
- Capacity 750 MW in both directions
- Assumed to fully alleviate RoCoF in South Australia
  - Equivalent to AC options
- Cost benefit comparison HVDC vs AC solution ($273 million total)
  - Phase shifting transformers ($85 million)
  - Series compensation ($46 million)
  - Synchronous condensers (NSW) ($54 million)
  - SVC ($54 million)
  - Capacitors and reactors ($33.4 million)
- REZ 12 – Broken Hill
  - Build limit 100 MW
  - Penalty cost $660,000 per MW

Questions

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