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INERTIAL CONTROL AND TASMANIAN HYDROPOWER

GIVAR meeting Yokohama

Donald Vaughan– 21 June 2018

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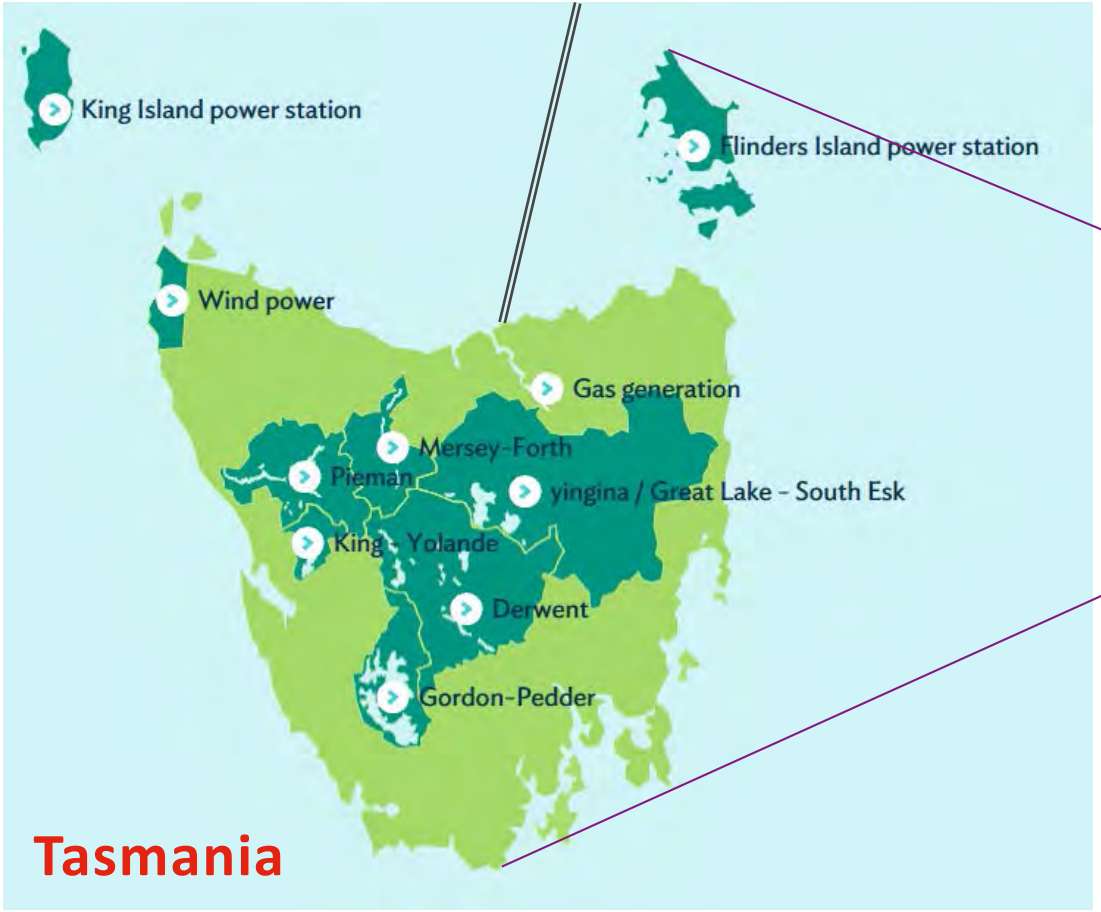

King Island power station
Flinders Island power station
Wind power
Gas generation
Mersey-Forth
Pieman
yingina / Great Lake - South Esk
King - Yolande
Derwent
Gordon-Pedder
Tasmania

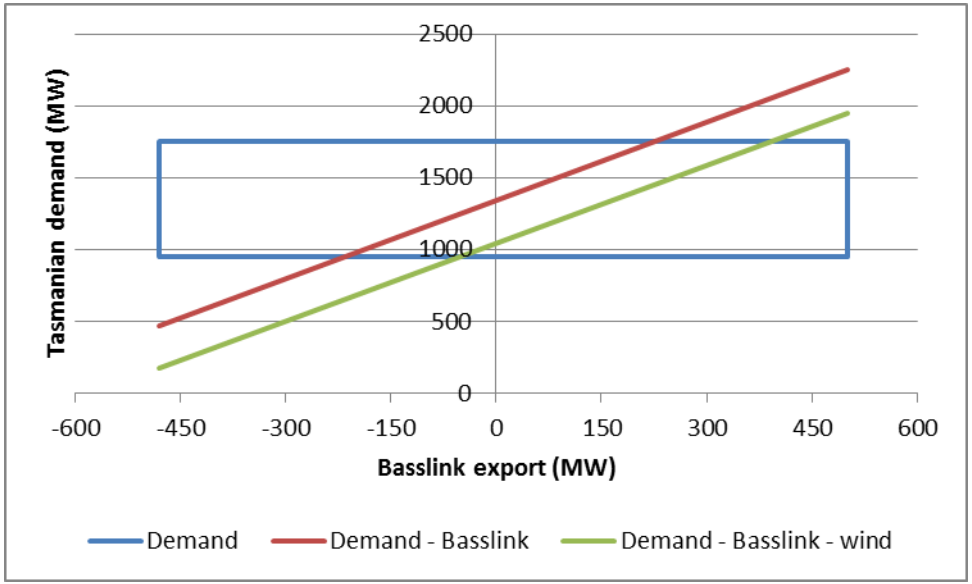

AUSTRALIA
Brisbane
Sydney
Adelaide
Melbourne
Hobart
NEW ZEALAND

OVERVIEW OF PRESENTATION

- Tasmanian context
- Review of requirements
- Actions
- Other considerations
- Future view

CONTEXT

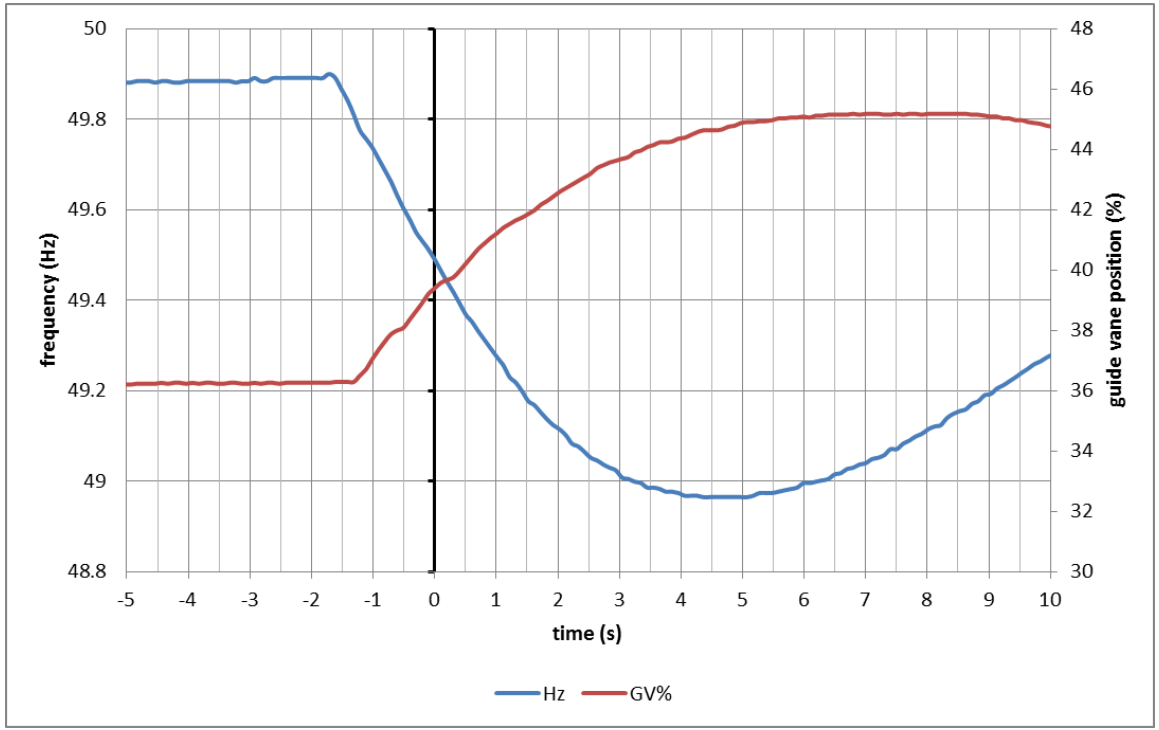
- Variable demand, HVDC link and wind aka “the squeeze” or displacement of synchronous generation
- Large contingency size
- Slow(ish) hydro governor response
- Market impacts



Context 1: squeezing out of synchronous generation

CONTEXT 2: LARGE CONTINGENCY SIZE

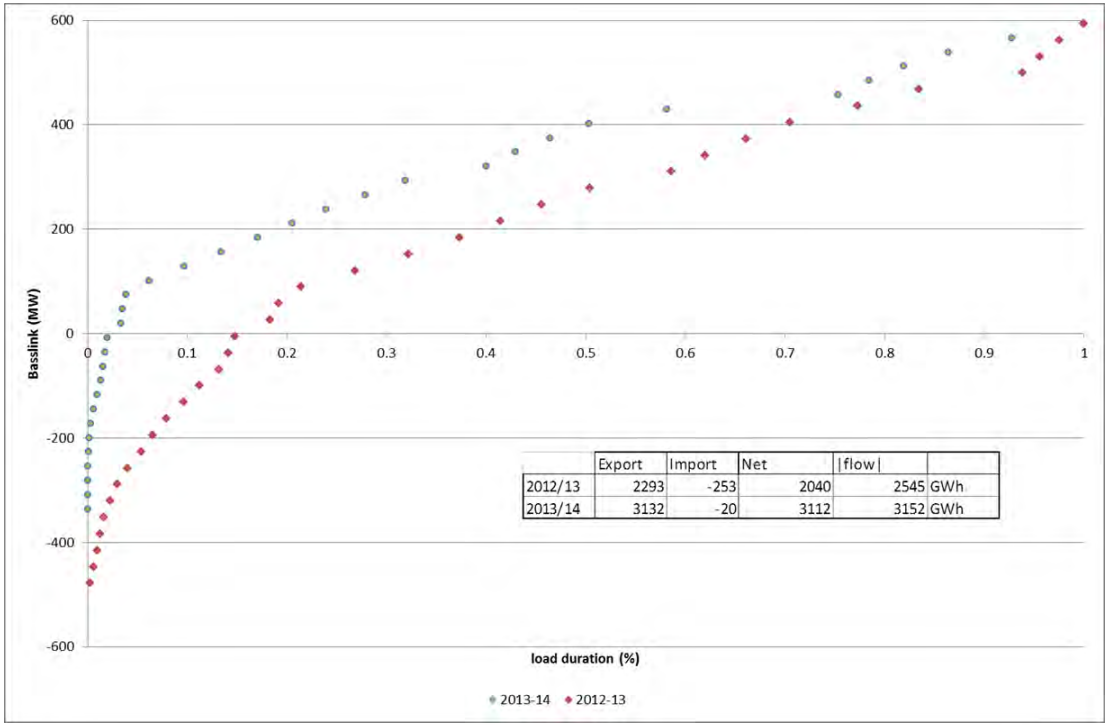
- Minimum demand: 950 MW
- Largest load: 180 MW
- Largest generator: 144 MW
- Largest event: 500 MW (Basslink)



Context 3: sluggish hydro governor response

CONTEXT 4: MARKET IMPACTS

- There's more wind potential
- There's more inter-connector capacity
- Lack of inertia is constraining growth



	Export	Import	Net	|flow|	
2012/13	2293	-253	2040	2545	GWh
2013/14	3132	-20	3112	3152	GWh

REQUIREMENTS

What do we need?

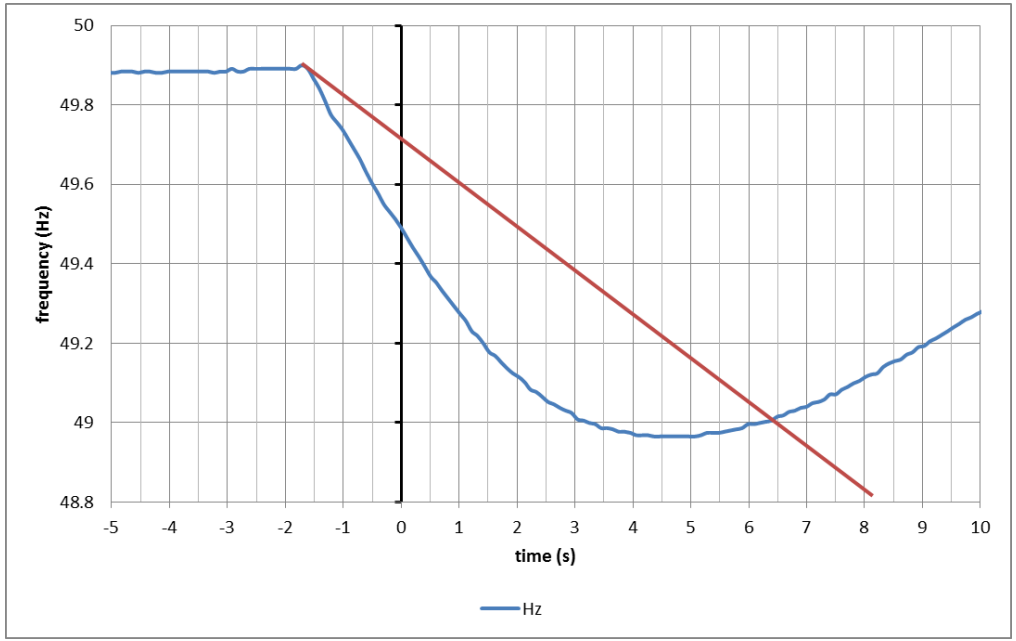
- Is there a trade-off between inertia and governor response?
- What's the minimum inertia we need?
- How do we get that inertia dispatched efficiently?

TRADE-OFF BETWEEN INERTIA AND FREQUENCY RESPONSE

- We need less fast governor response for more inertia

BUT

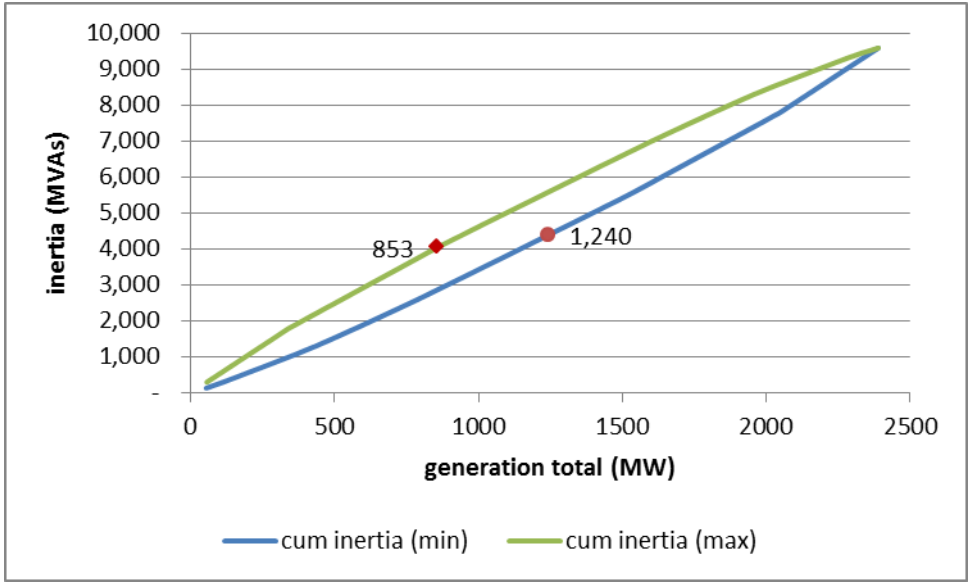
- By adding inertia we tend to get more governor response anyway!
- Inertia only buys time but it is crucial



MINIMUM INERTIA

A maximum |ROCOF| of 3 Hz/s

- For the Basslink event:
  - 500 MW
    - » 4000 MWs of inertia
- Somewhere between 800 – 1200 MW of hydro generation required to meet inertia requirement
- >> than the power requirement at low demand



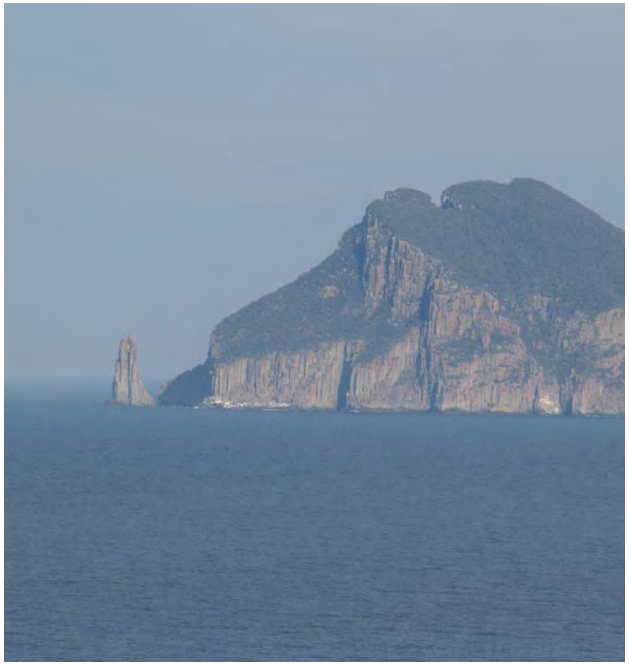
EFFICIENT PROVISION OF INERTIA

- Synchronous condensers
  - Where hydro machines are capable of this mode can be very good inertia sources

BUT

Basslink has a NO-GO zone of +/-50 MW

  - Need for inertia becomes need for frequency support



ACTIONS

Tail water depression

fast conversion from SC to generator mode

- Governor re-tuning
- Industrial customers to provide load response

Governor retuning and switched tuning

Modify governor gains when frequency events occur to get faster initial response

Find other sources of frequency response

Industrial customers provide load response

Batteries and/or super capacitors

NEW CHALLENGES – WHAT'S NEXT?

Inertia and synthetic inertia

Where's the limit?

How compatible are the two?

Can synthetic inertia work efficiently on it's own?

Regulation of frequency

As variability grows so does the challenge of regulating to 50 Hz.

Market based responses

As new independent players enter the market, how are costs of inertia and the other ancillary services shared?

QUESTIONS

Thank you for your time

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