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Rapid, deep and cheap: eliminating 80% of emissions

Andrew Blakers

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http://re100.eng.anu.edu.au/

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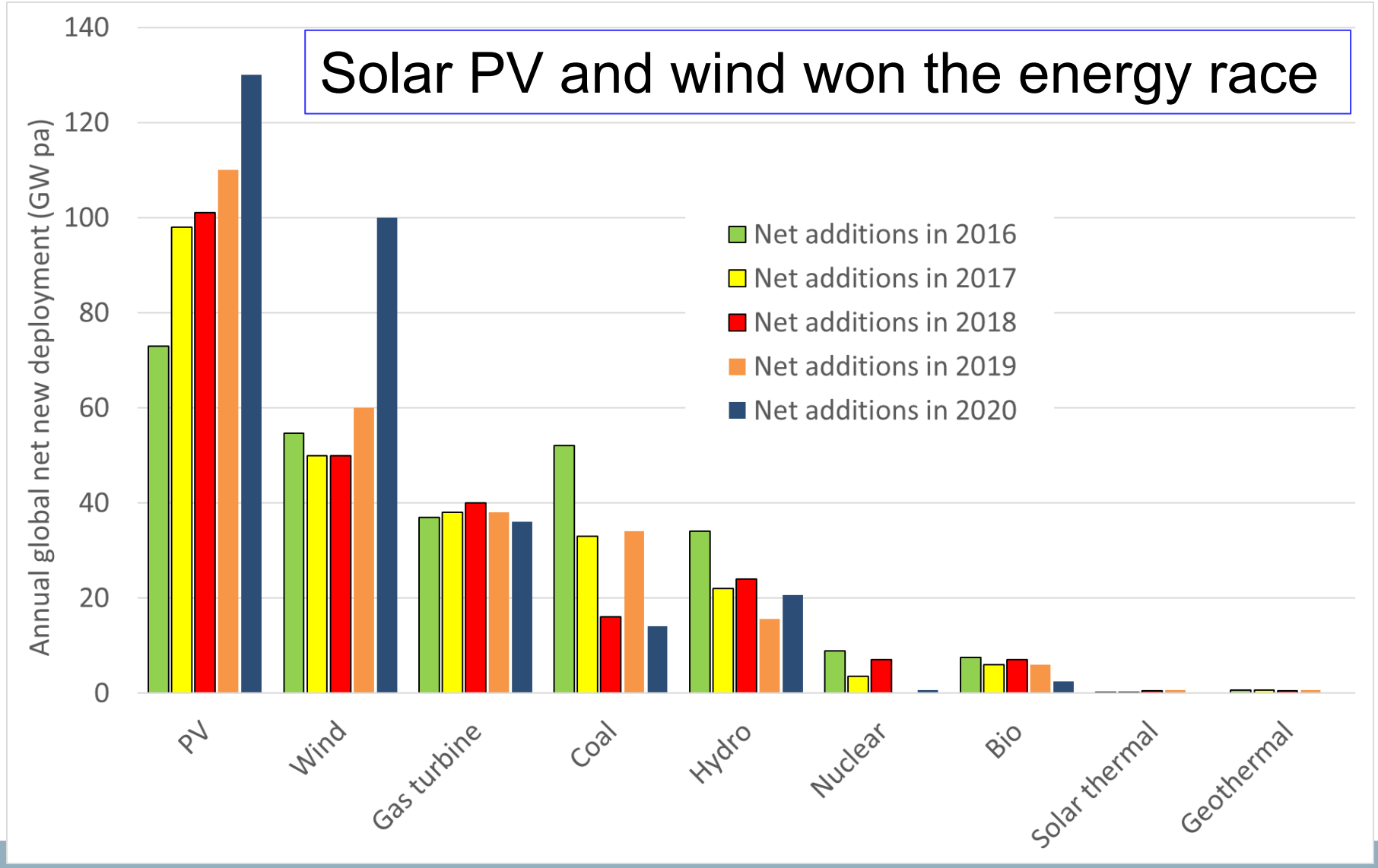
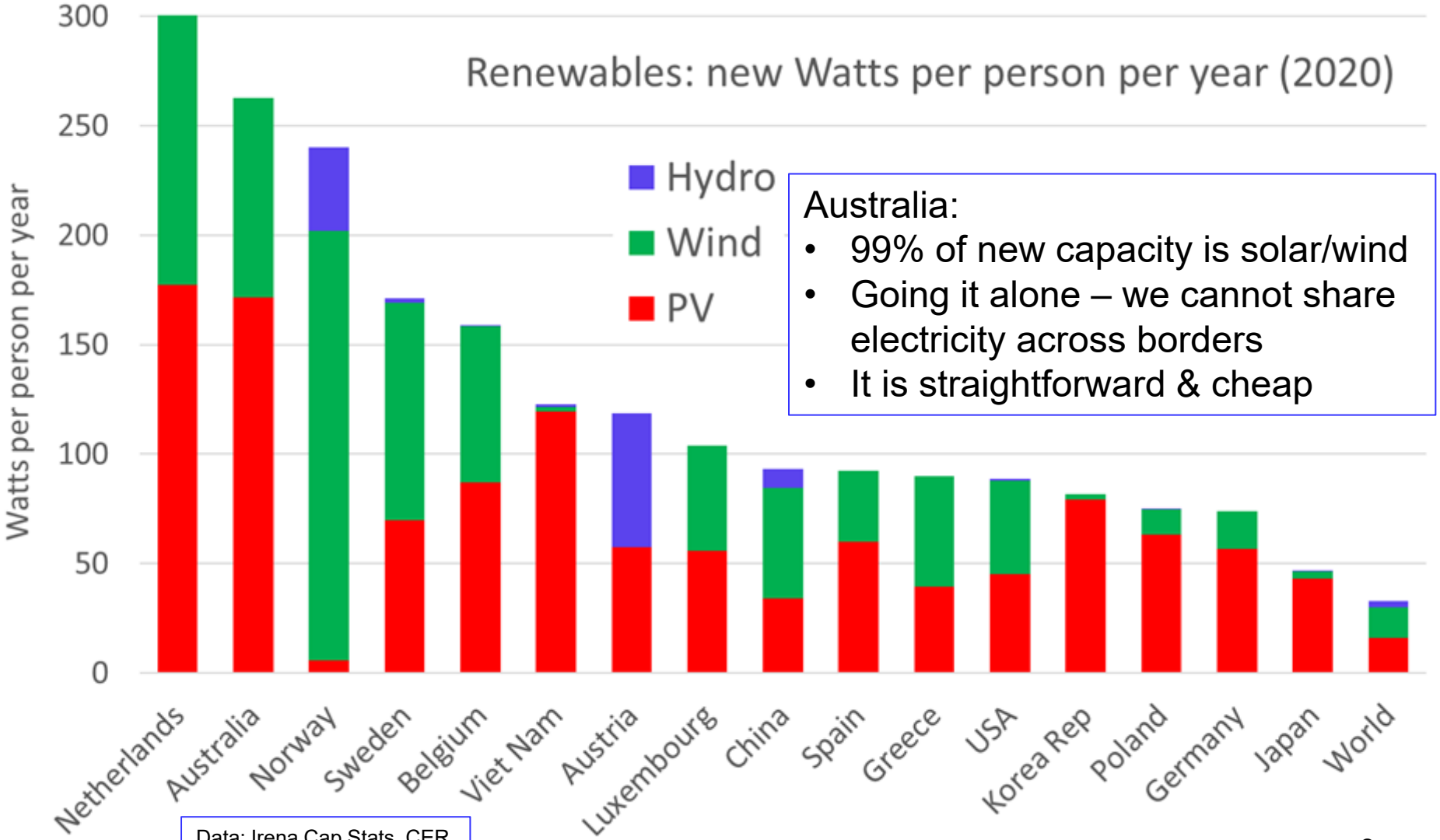
Global annual net new generation capacity



Renewables deployment speed per person



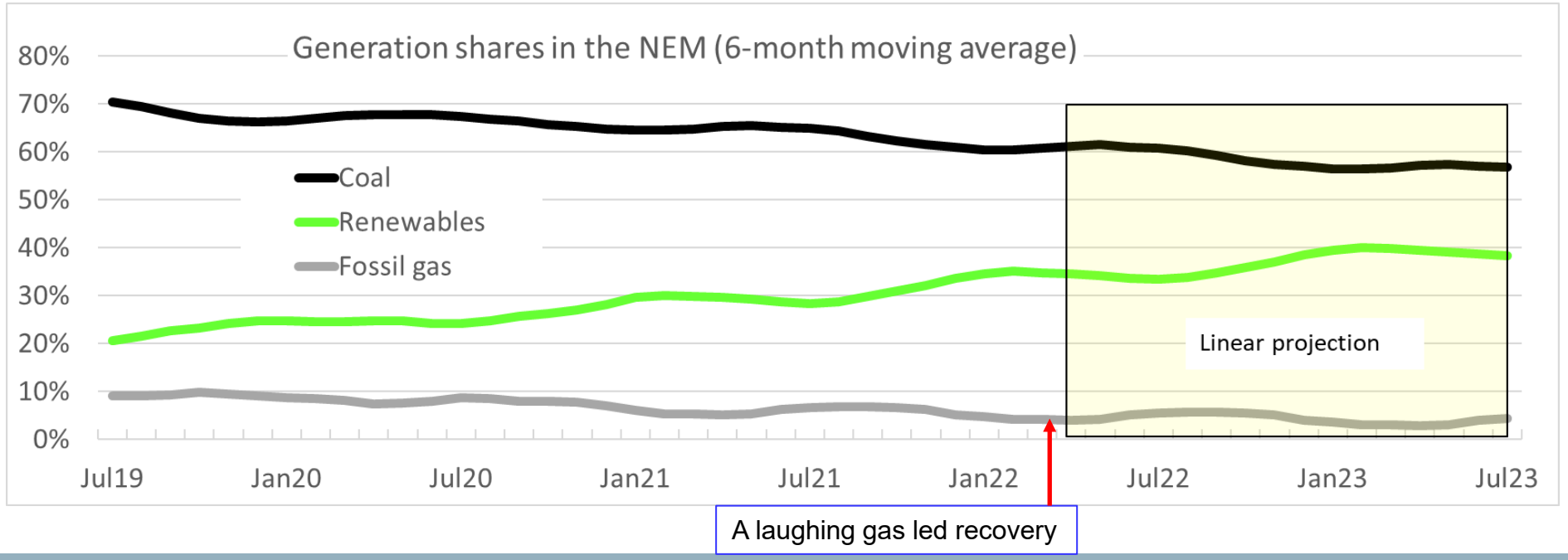
Australia:

- 99% of new capacity is solar/wind
- Going it alone – we cannot share electricity across borders
- It is straightforward & cheap

Data: Irena Cap Stats, CER

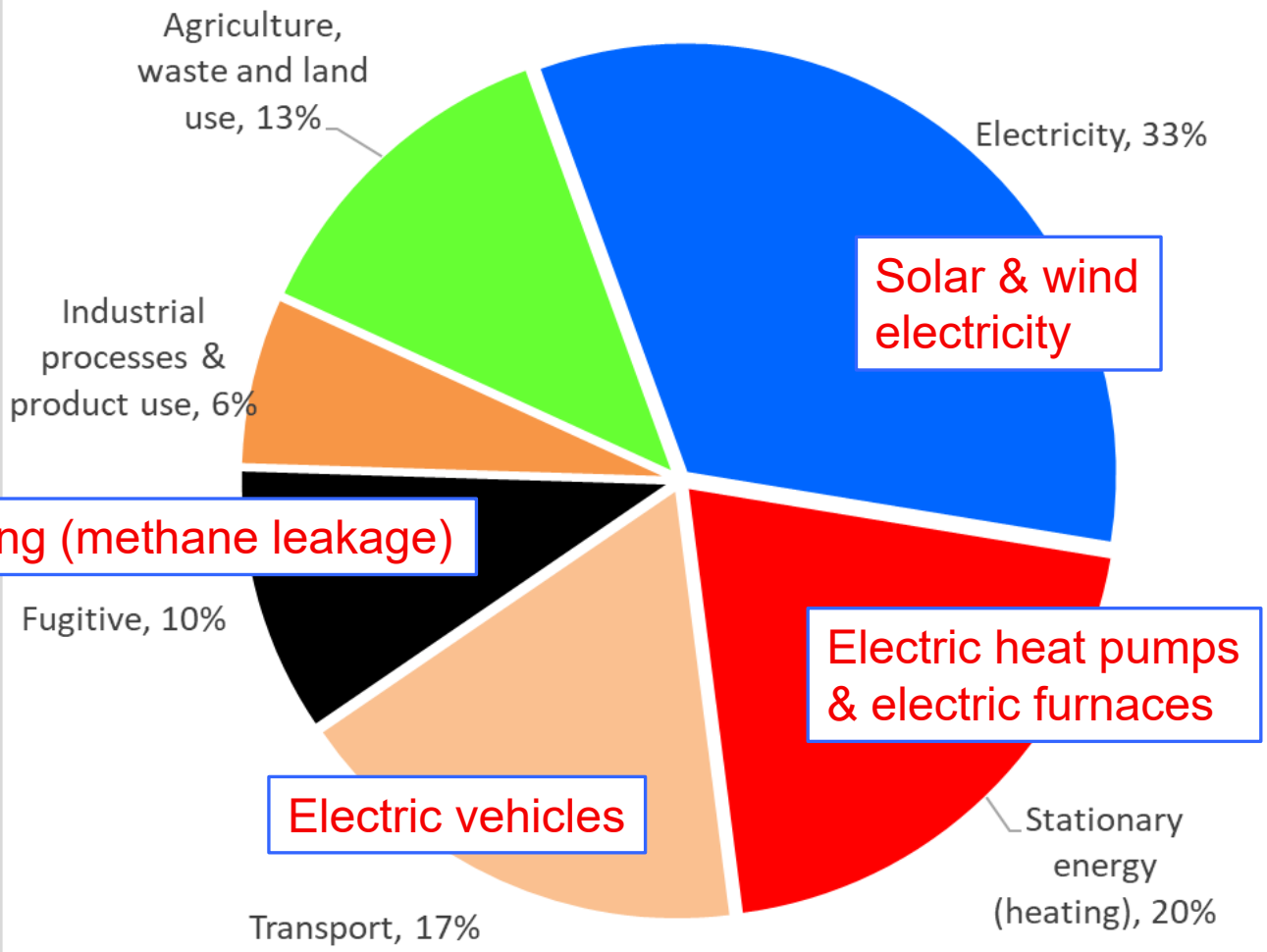
Milestones in the National Electricity Market

- Renewables at 36% (mostly solar & wind)
- Renewables tracking towards 50% in 2025
- South Australia: 70% solar & wind



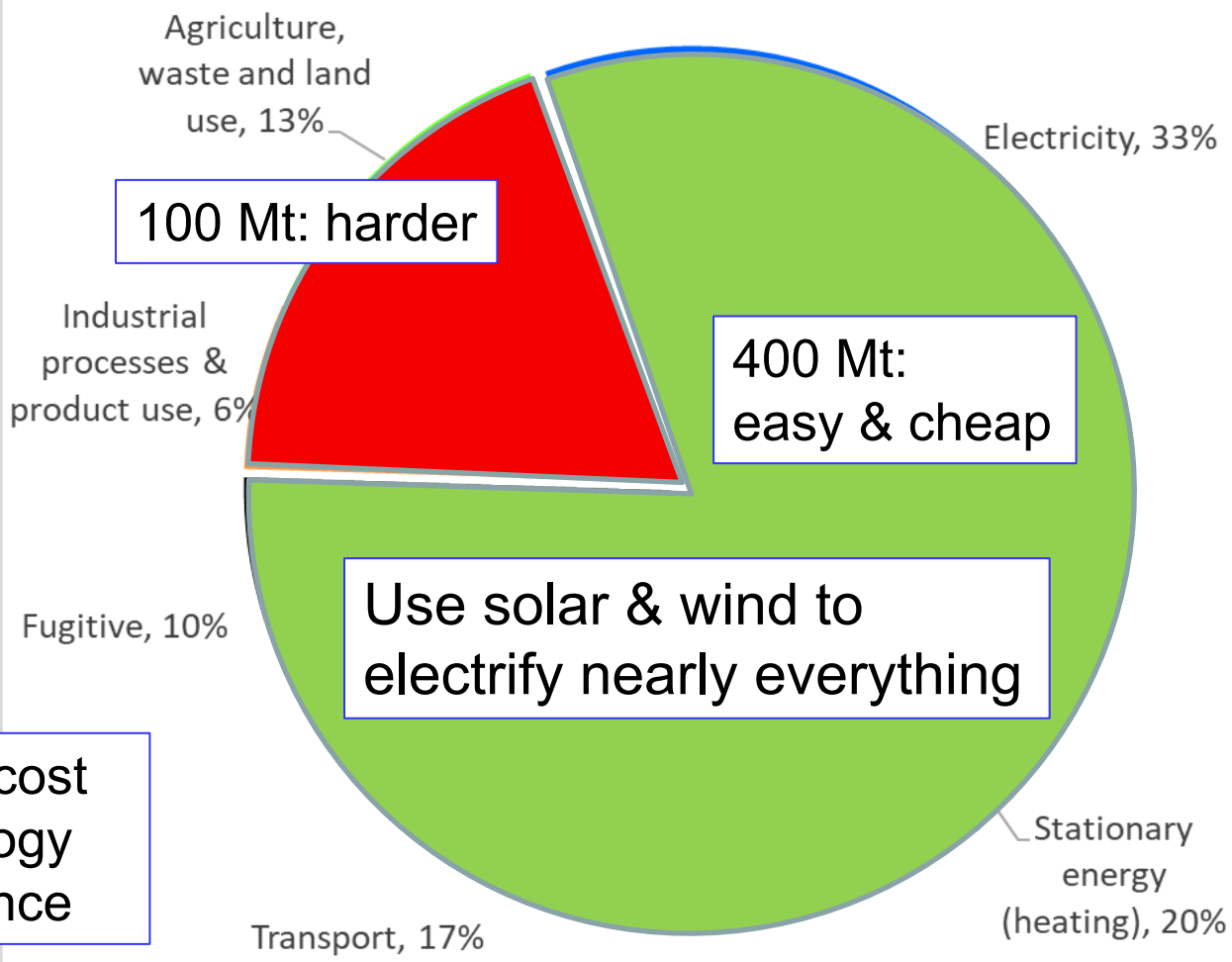
An 80% cure for Australian emissions

In 2020: 500 Megatonnes



An 80% cure for Australian emissions

500 Megatonnes (Mt) in 2020



- Low and falling cost
- No new technology
- Low inconvenience

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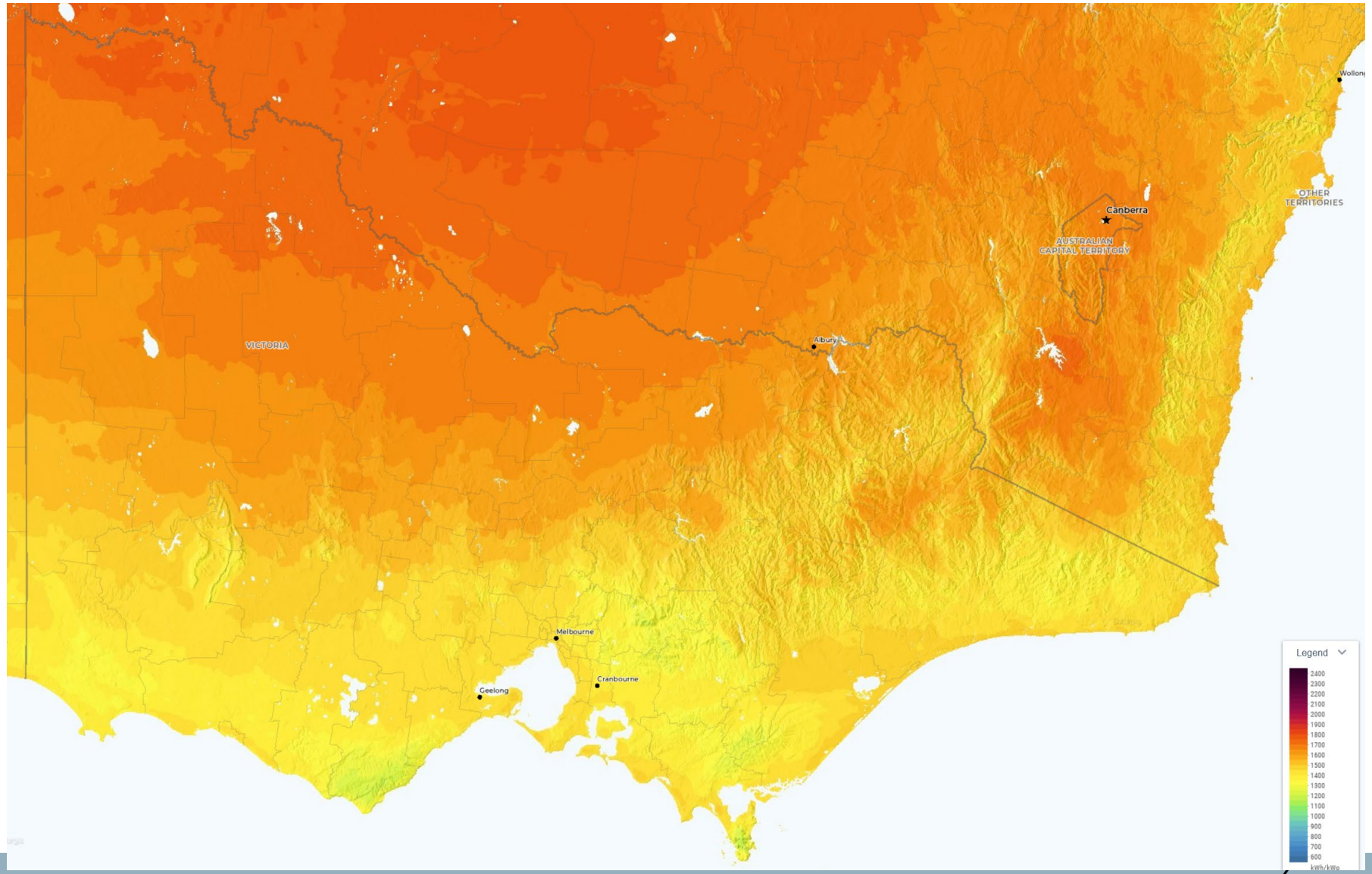
Global solar atlas - Victoria



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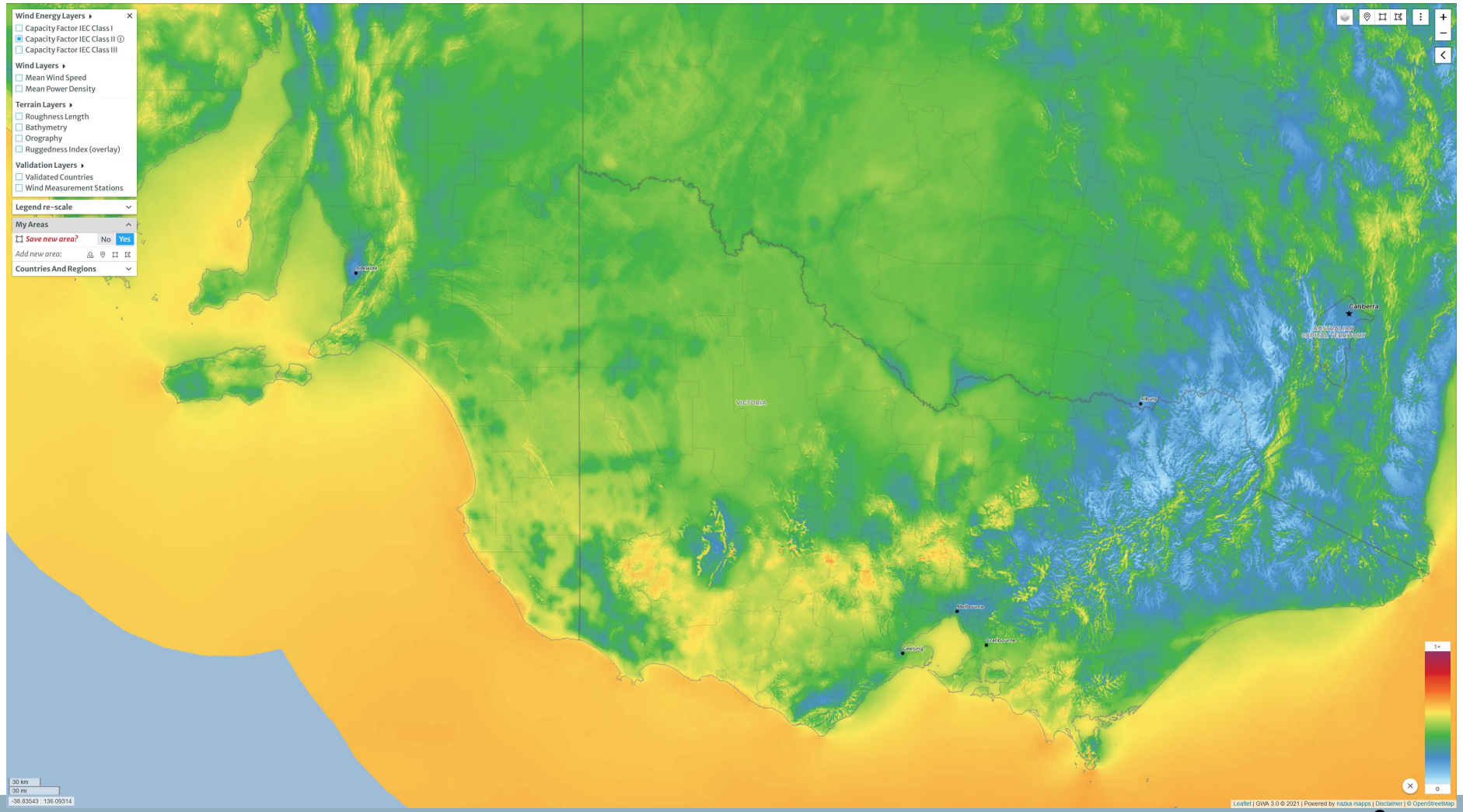
Global wind atlas - Victoria



Stabilize 100% renewable electricity

- Technical diversity
  - 90% PV and wind (+ existing hydro & biomass)
- Wide geographical dispersion (million km^2)
  - Hugely reduces storage by smoothing-out local weather
- Demand management
  - Shift loads from night to day, interruptible loads
- Mass storage
  - Pumped hydro: 97% of all storage
  - Advanced batteries

often blows at night

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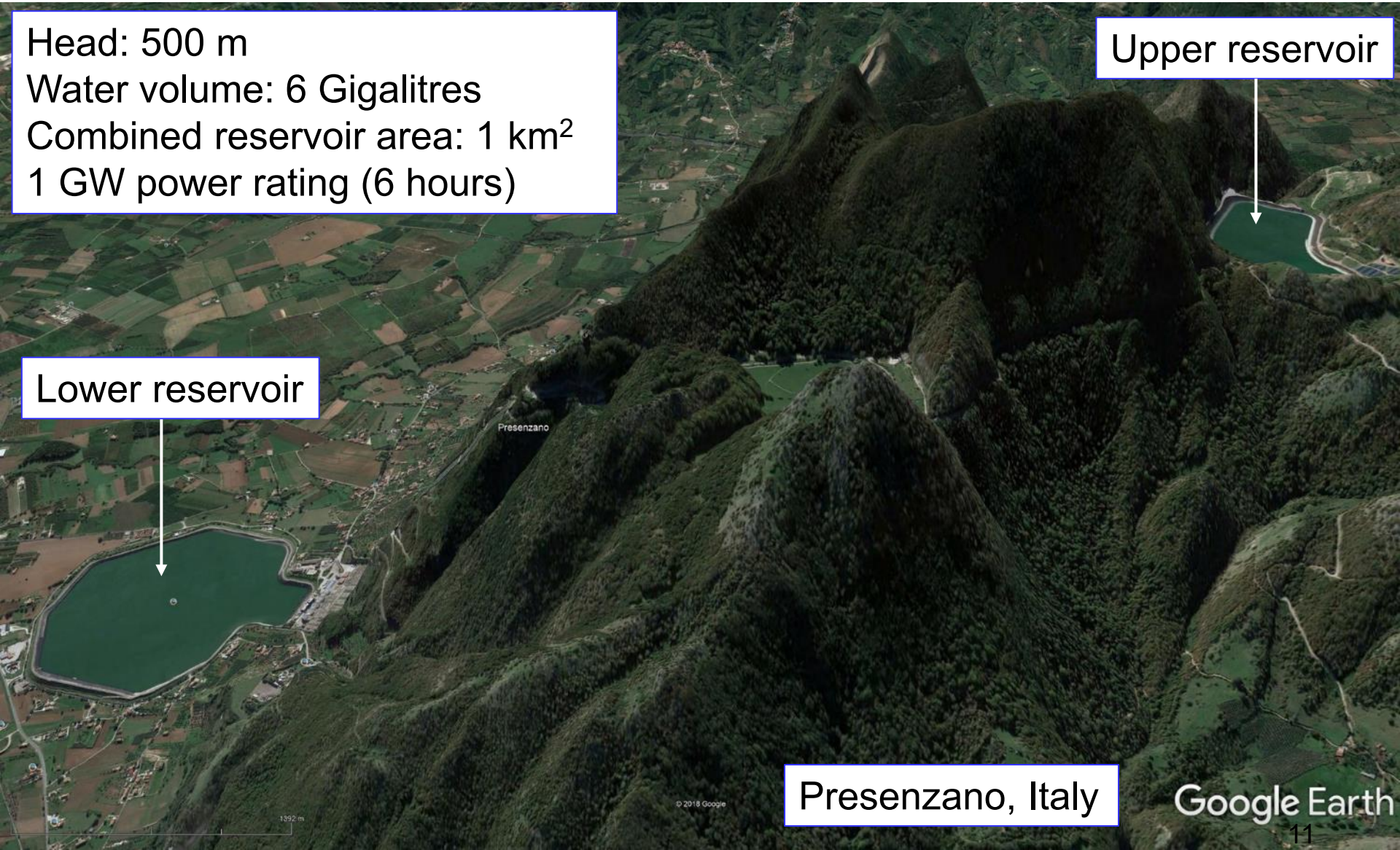
On-river pumped hydro storage: Tumut 3

Head: 151 m
Water volume: 6 Gigalitres
Combined reservoir area: 19 km^2
1.5 GW power rating

Off-river pumped hydro



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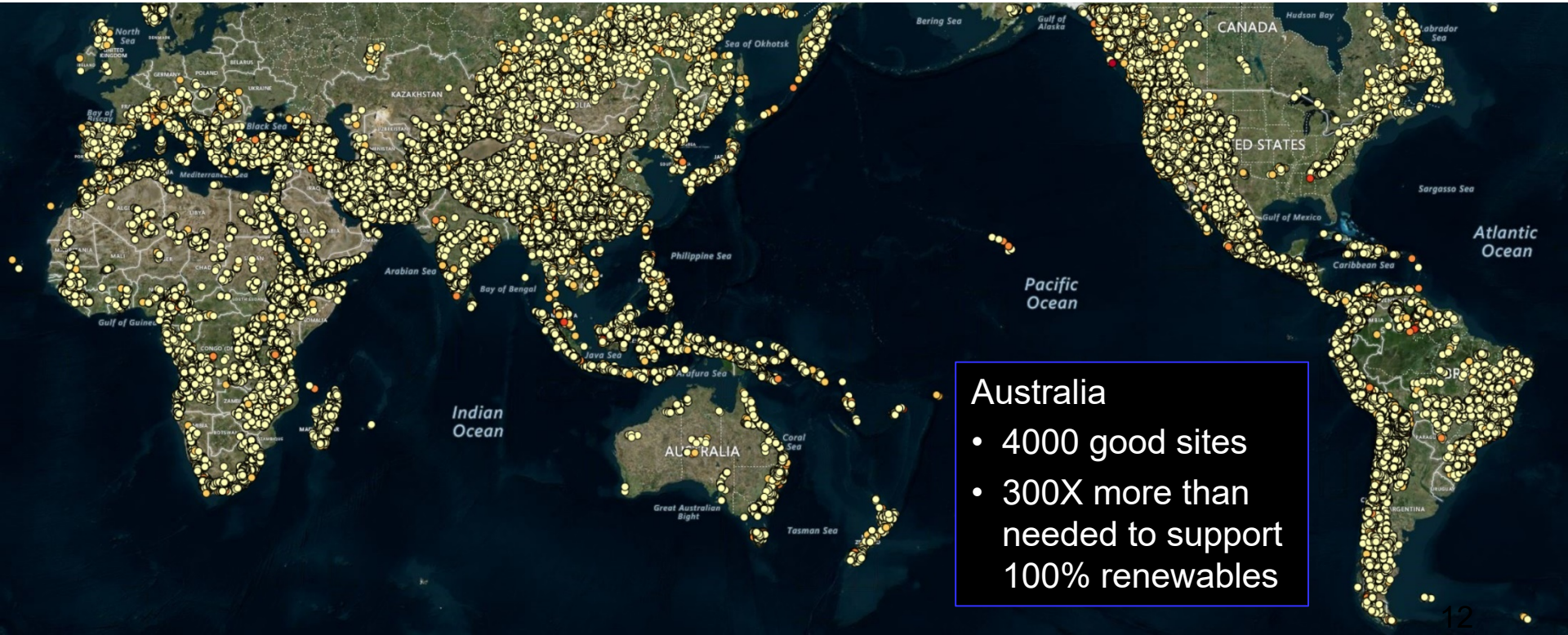
ANU's global off-river pumped hydro atlas

http://re100.eng.anu.edu.au/global/index.php

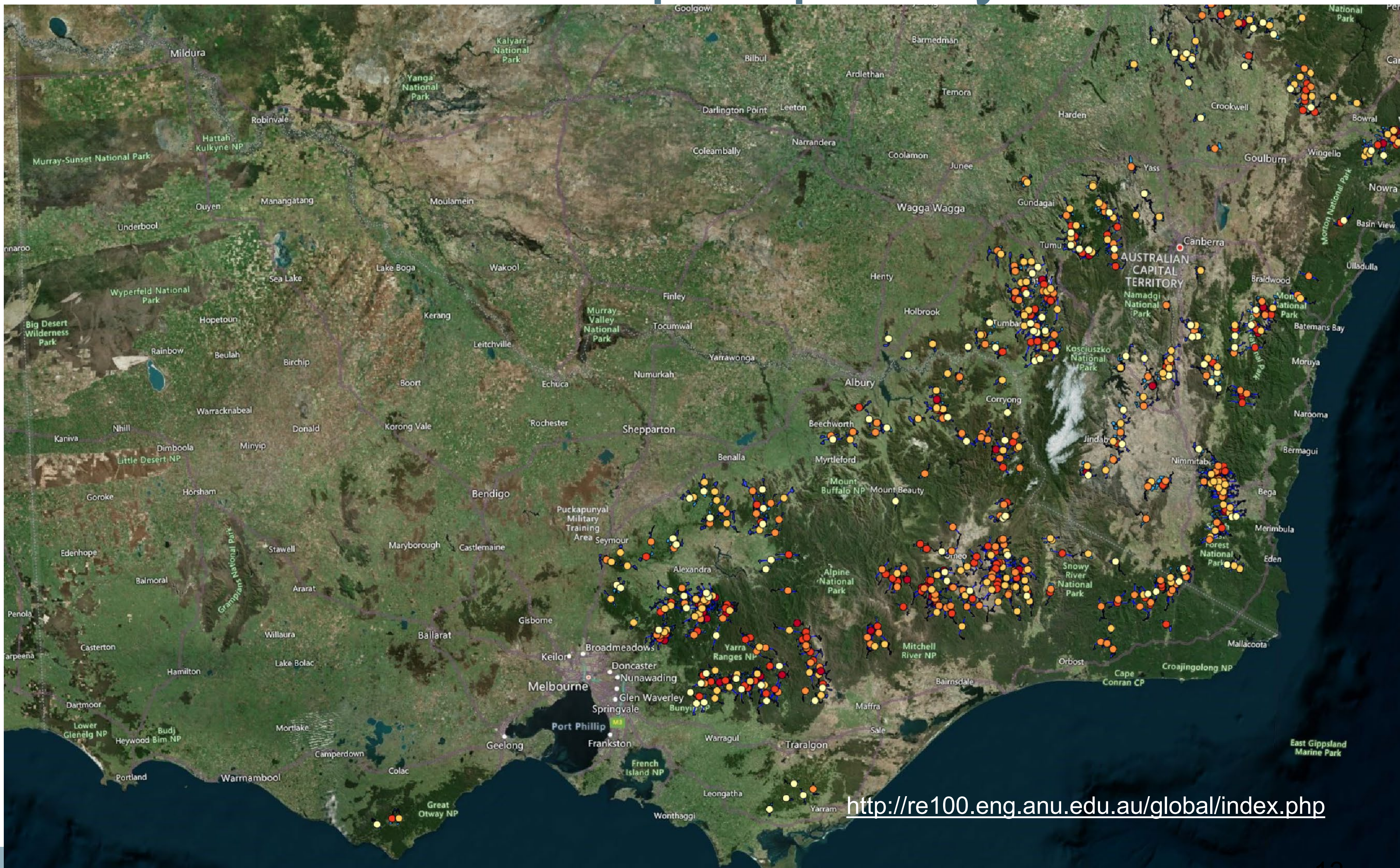
616,000 off-river sites (60°N to 56°S)

23 million Gigawatt-hours (1 million GW * 23 hours)

All outside national parks & urban areas

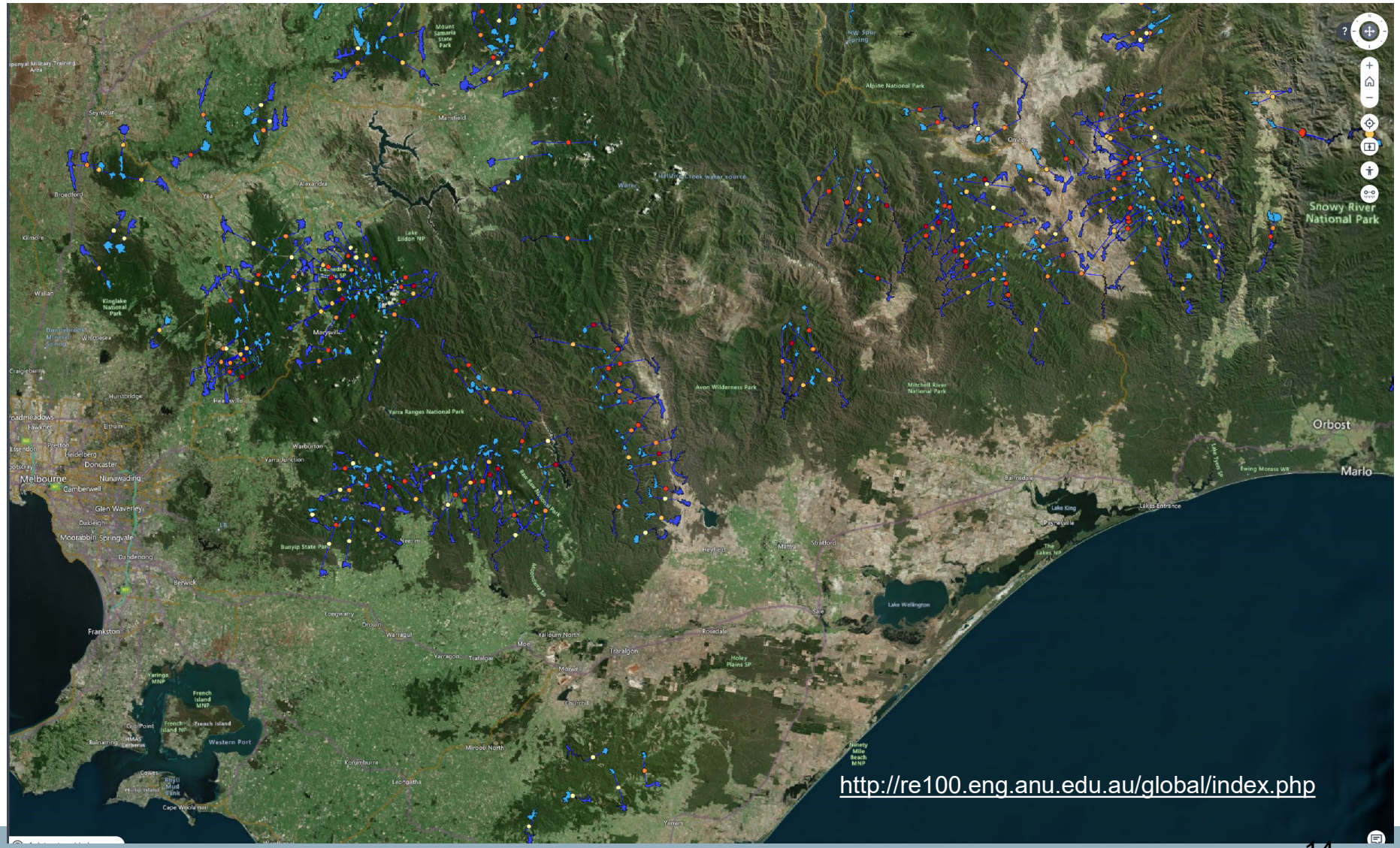


Victoria's off-river pumped hydro



http://re100.eng.anu.edu.au/global/index.php

Zooming in


Snowy River National Park
Orbost
Marlo
Melbourne
Frankston
http://re100.eng.anu.edu.au/global/index.php

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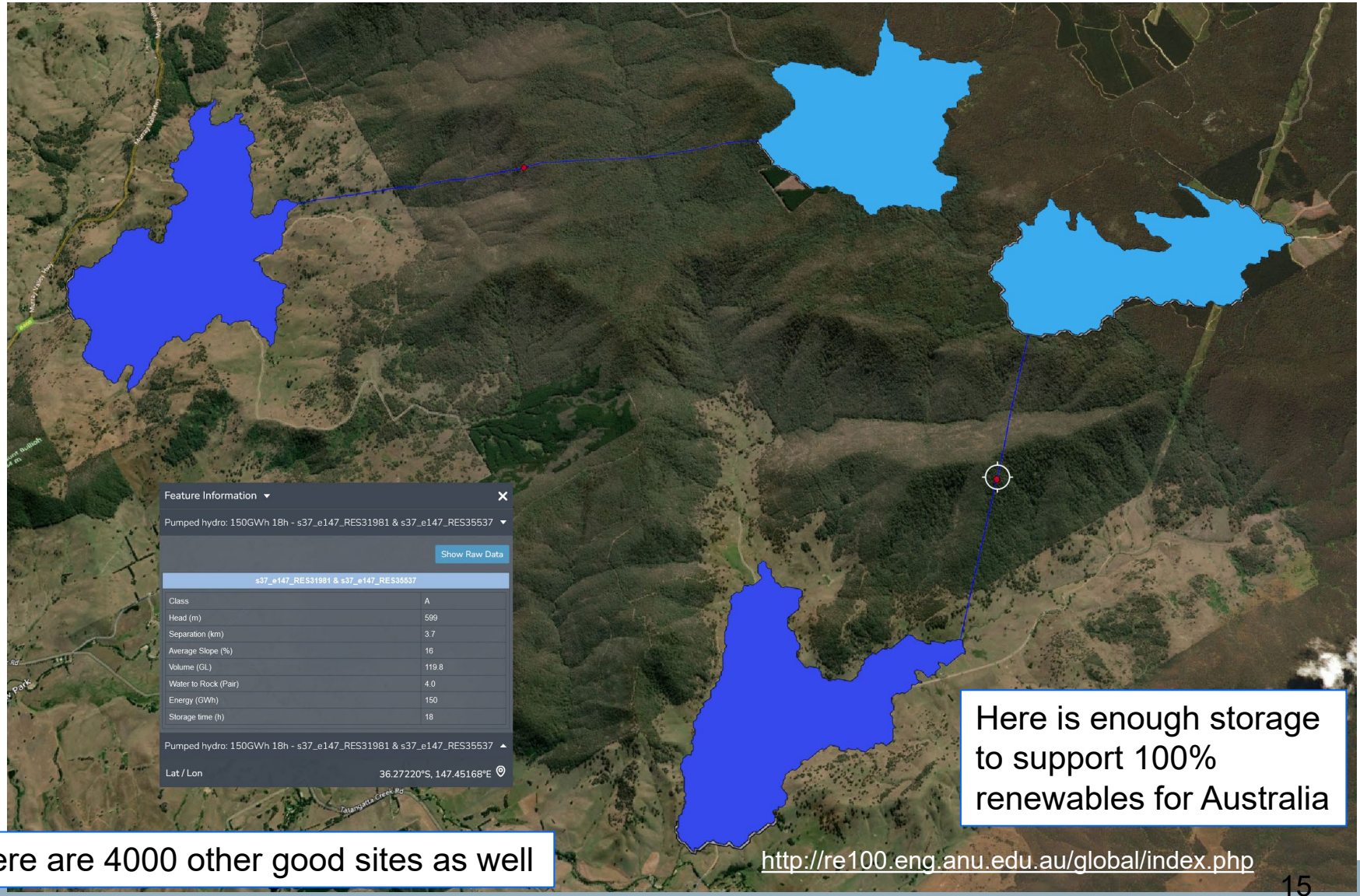
Off-river pumped hydro – Bullioh, 150 GWh storages



Here is enough storage to support 100% renewables for Australia

There are 4000 other good sites as well

http://re100.eng.anu.edu.au/global/index.php

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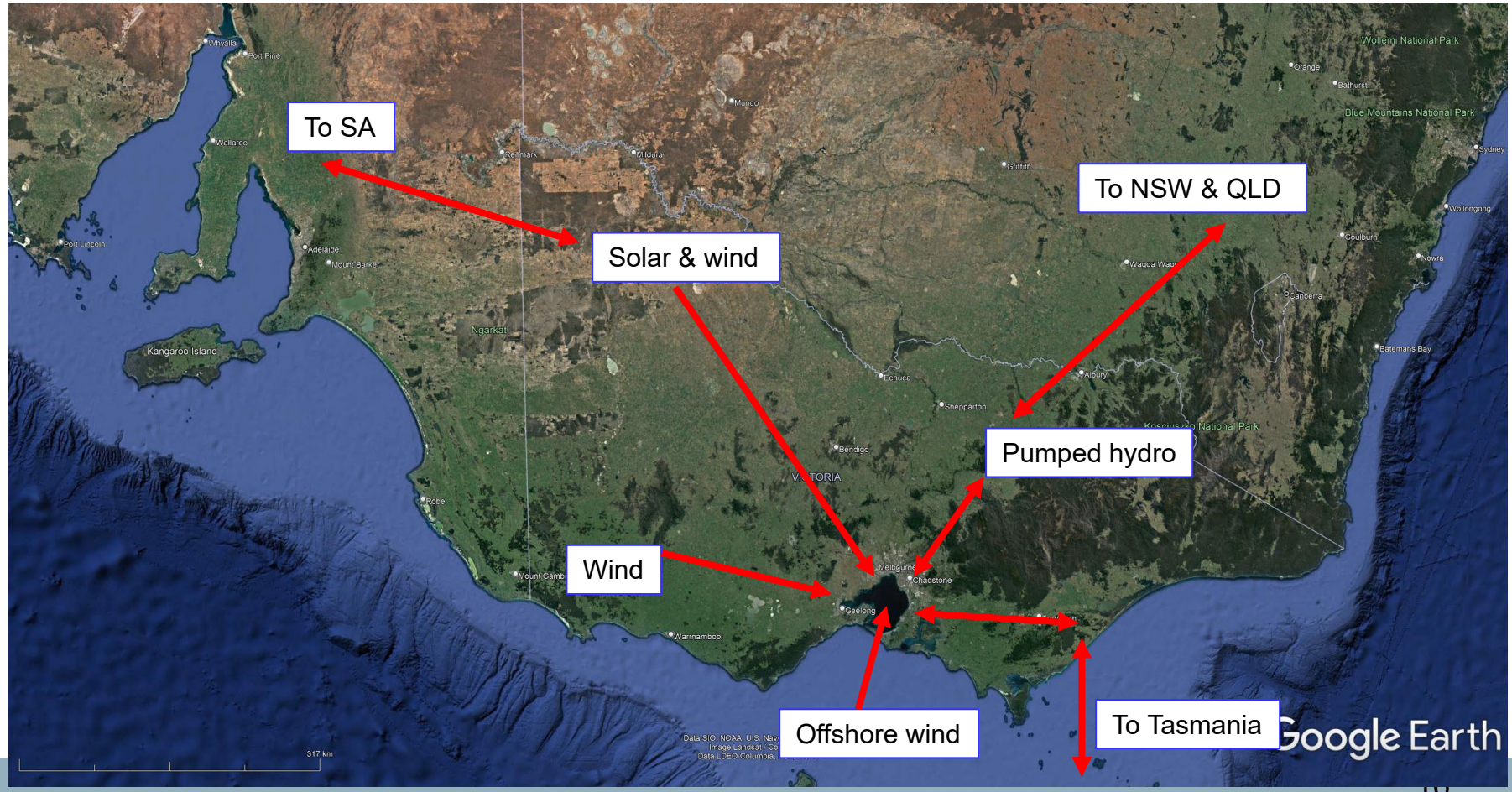
Lots more high voltage transmission

- Bring new solar & wind into Melbourne
- Interstate transmission reduces storage needs (smooths out local weather)



What can Victoria do?

1. Invest in much more transmission
   - Solar & wind eliminate coal generation
2. Invest in one or two pumped hydro systems
   - Pumped hydro & batteries take care of storage
3. Ban new sales of fossil gas water & air heaters
   - Push gas out
4. Strongly encourage electric vehicles
   - Push oil out
5. Electrify everything (doubled electricity production)
   - Enjoy lower energy prices and better energy security

- Mature, vast production runs
- Low environmental cost
- Nothing to invent – the cheapest energy in history
- And lots of room to further lower costs