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100% Renewables needs Policies

for Small, Medium and Large Scale Systems



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Solar PV: Small, Medium & Large Scale

Bega Valley 100% RElec: likely mix of small & medium scale



Module for solar lantern –
3rd world



Wharf Theatre, Sydney,
384 kW



Sydney Markets



102 MW, Nyngan NSW

Small-Scale Systems: Battery is Priority for PV

Note: small-scale wind has very limited potential in towns;
micro-hydro is also very limited geographically

Promised policies

- ★ **LNC NSW:** Interest-free loans for up to 300,000 residential solar-battery & battery systems over 10 years.
Comment: A modest policy for low-income home-earners. ✓
- ★ **ALP NSW:** Rebate up to \$2200 for for 2,000MW of rooftop solar PV.
Comment: If rebate can be applied to batteries ✓ ✓ ; otherwise 0
- ★ **ALP NSW:** Free TAFE courses for electrical trades & renewable energy. ✓
- ★ Key policy missing from LNC, ALP & NSW Greens: carrots & sticks for solar & batteries in rental accommodation



Medium-Scale Systems

Community, Local Government, Towns, Commercial & Microgrids



Hepburn wind farm



Sydney Convention Centre

- ★ Community owned projects were the foundation of the renaissance of renewable energy in Denmark & Germany
- ★ In Oz, small but expanding: 2 community wind farms operating and 80+ solar PV projects
- ★ Towns aiming for 100% RElec include Yackandandah Vic. & Tyalgum NSW
- ★ Several local governments going 100% renewable electricity for their own operations: e.g. City of Melbourne (RElec, mostly wind farm; achieved); Leichhardt (all energy, planned)

Innovation: Microgrid or Embedded Network



- ★ Single connection point to main grid (or none in a remote area)
- ★ Single daily connection charge spread across all customers
- ★ Could be ecovillage, whole town, shopping centre, apartment block, or caravan park
- ★ Community microgrid network owned by community, not the utility
- ★ Energy independence (partial or total)
- ★ Can sell electricity to distributor when grid electricity price is high, and buy from distributor when price is low → arbitrage

Innovation: Virtual Power Plant & Network

- ★ Individual houses & businesses with solar, some with batteries, are still individually connected physically to the main grid
- ★ But buying from and selling to the grid is centrally controlled by an aggregator enabling arbitrage – e.g. Reposit Power in Canberra; AGL in Adelaide
- ★ Benefits to members:
 - Energy independence (partial);
 - Increased solar self consumption and demand response;
 - Arbitrage;
 - Backup power
- ★ Services provided to grid & wholesale market include:
 - Can deliver peak-load capacity at short notice;
 - Can reduce solar/battery export to the grid at short notice;
 - Frequency control;
 - Voltage support;
 - Power factor correction;
 - Negative price avoidance

Policies for Medium-Scale Renewables

★ Existing or promised policies:

- LNC NSW has modest support for community RE projects via seeding grants & information ✓
- ALP NSW: 0
- ALP federal: \$99M over 4 years for Community Power Network ✓ ✓

★ Policies still needed: (Mey, Diesendorf & Macgill 2016)

- Simplify grid connection process
- For projects > 100kW, simplify registration as generator & obtaining retail licence
- Set fair feed-in tariffs
- Set fair fees for using distribution network over short distances
- In particular, facilitate Local Electricity Trading: a RElec generator assigns its exported generation to nearby customers according to time-of-use
- Permit peer-to-peer electricity trading, including households to sell electricity to neighbours at 230V



D

CST with thermal storage

Large-Scale RElec: Australia has Diversity of Sources and Siting



Wind, Albany, WA



PV solar tiles



Seawater pumped hydro

D



Hot rock geothermal (demo)



Bioenergy, Qld

D

D denotes 'dispatchable', i.e. can supply power on demand



D

Conventional hydro



Wave power (demo)

Reliable 100% Renewable Electricity Systems

- ★ Electricity from wind and solar PV is now much cheaper than from new coal or gas power stations, for both residential and large-scale systems
- ★ So a 100% RElec system for NSW and for the whole National Electricity Market will be mostly wind and PV
- ★ To be *reliable*, system must have some storage to balance variations in wind and PV
- ★ *Dispatchable* RElec has storage: e.g. conventional hydro & pumped hydro with dams; CST with thermal storage; gas turbine with fuel storage; battery
- ★ Storage capacity is more expensive than equivalent wind and PV capacity, so policies are still needed to encourage its use, both on large and small scales



Achieving Reliability in Large-Scale RElec

Reliability is a property of the system, not individual generators!

- ★ Variable RElec balanced with flexible, dispatchable RElec technologies & (optional) other forms of storage
- ★ Diversity of RElec technologies
- ★ Geographic diversity of wind and solar
- ★ Smart demand management/response
- ★ Key transmission links
- ★ No need for baseload power stations



Policies Needed for Transmission

New key transmission lines and upgrades

Top priority, urgent:

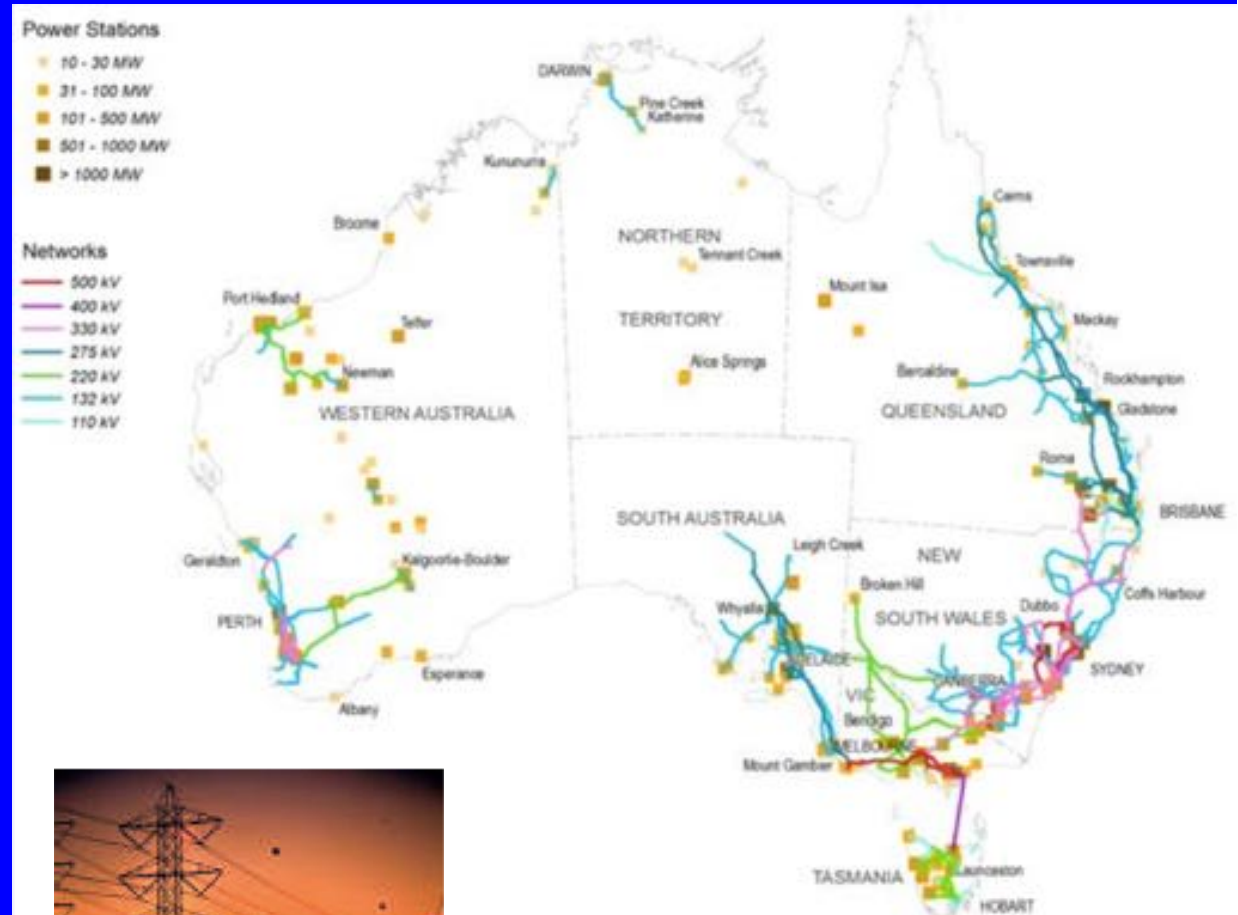
- ★ Upgrade northern NSW to Hunter region
- ★ Upgrade Qld-NSW link
- ★ Upgrades in N-W Vic

Medium priority:

- ★ New SA-NSW direct link
- ★ New Basslink

Questionable

- ★ Snowy Hydro 2.0 & its links into NSW & Vic; in its early years, pumping will be done mainly by coal power stations



Renewable Energy Zones

Places for multiple renewable electricity generators with single transmission link to main grid

Locations chosen on basis of:

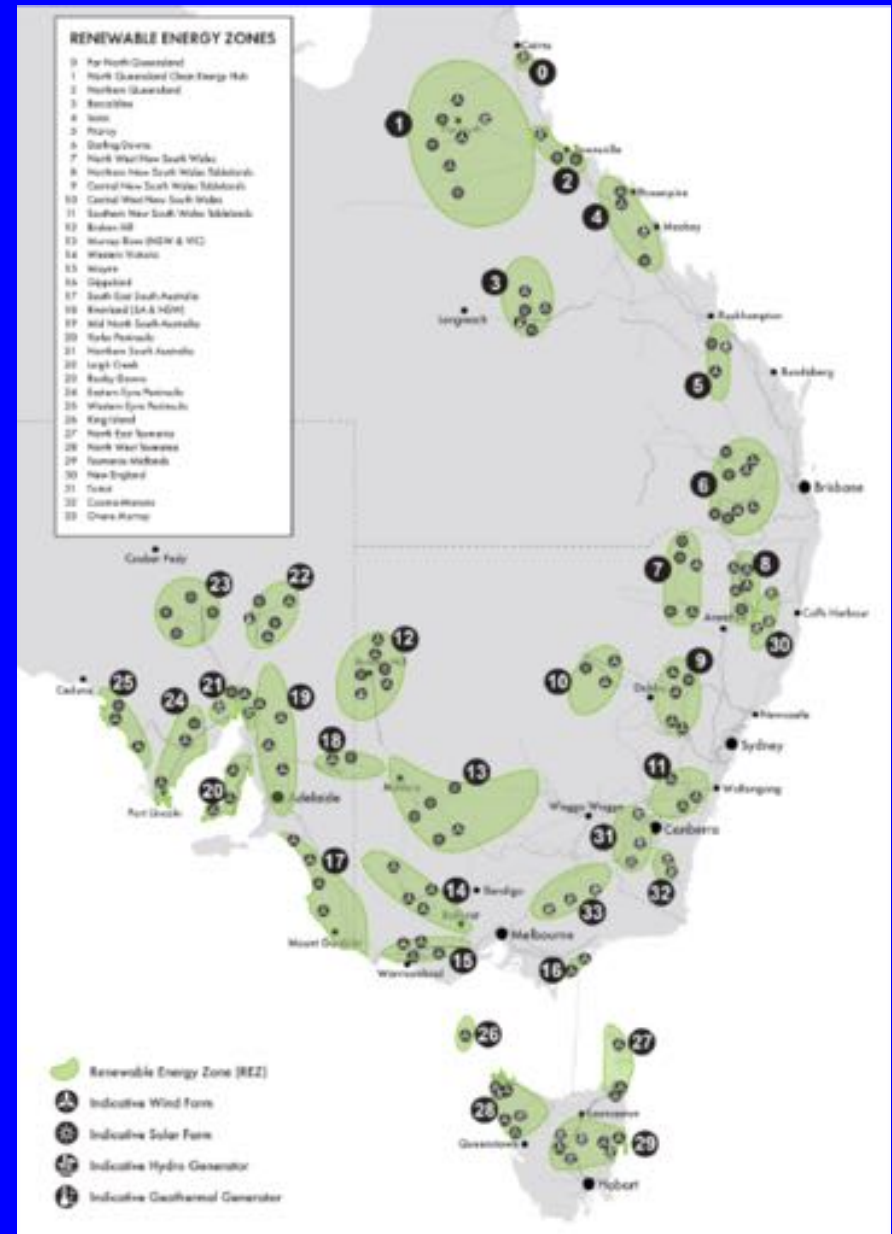
- Renewable energy resources;
- Location of existing transmission lines;
- Potential for multiple generators to share a new transmission line

Potential REZs in Tumut, Monaro & Northern Tablelands regions

Social acceptability and economic impacts must be addressed too.

Does the local community share in the design and benefits?

Who pays for new transmission lines?
Are they essential infrastructure?



Source: AEMO 2018. Integrated System Plan

Policies, Existing & Announced, for Large-Scale RElec

- ★ **LNC NSW:** \$55M to support the commercialisation of new large-scale projects that use emerging, dispatchable technology.
Comment: Tiny funding is just a token. ✓
- ★ **ALP NSW:** RElec target of 50% by 2030. ✓ ✓,
backed up by 4000 MW by reverse auction in first term. ✓ ✓ ✓
- ★ **LNC federal:** No policy of substance. 0
- ★ **ALP federal:**
 - RElec target 50% by 2030. ✓✓ Step in the right direction, but falls short of science
 - \$5 billion for upgrading transmission & distribution infrastructure
 - Additional \$207M over 4 years to ARENA for CST. ✓ Should be for all storage
 - Making Clean Energy Finance Corp. technology neutral. Backward step. 0 or -
 - Revive the National Energy Guarantee. Backward step motivated by political point scoring. 0 or –

Comment: Federal ALP policies inadequate for achieving 50% target. However, strong state policies could together reach this national target.

Main Policies Needed for Large-Scale RElec

- ★ Set targets for dispatchable renewables & other forms of storage (Federal & state);
- ★ Expand funding of Clean Energy Finance Corporation (CEFC), creating a separate tranche of loans for dispatchable renewables & other storage (Federal)
- ★ Expand funding for the Australian Renewable Energy Agency (ARENA), for research, development & demonstration grants to novel dispatchable renewables & storage (Federal)
- ★ Reverse auctions with a tranche for large-scale dispatchable renewables (States & territories)
- ★ New and upgraded transmission links to overcome the bottlenecks and connecting Renewable Energy Zones (Federal & state)
- ★ Revised rules for National Electricity Market (Federal & state)
- ★ A carbon price would be valuable, but not supported by LNC or ALP

100% RElec is feasible & affordable for NSW & Australia

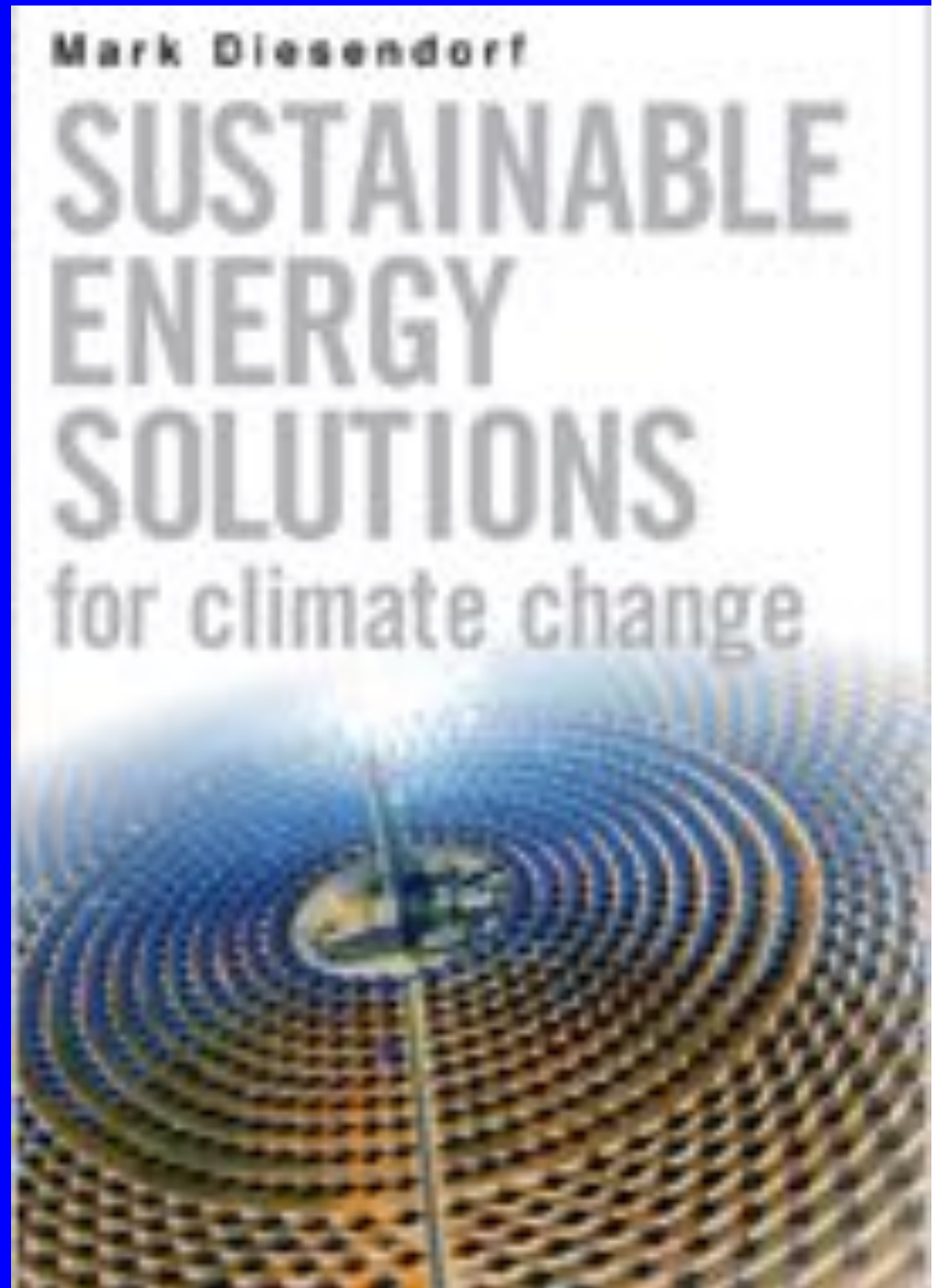
Further information

Background info

Mark Diesendorf 2014. *Sustainable Energy Solutions for Climate Change*, Routledge & UNSW Press

Policy discussion

Mark Diesendorf 2018. *Renewable Electricity Policy for Australia*. The Australia Institute



Supplementary Slides

Announced RElec Policies for NSW so far

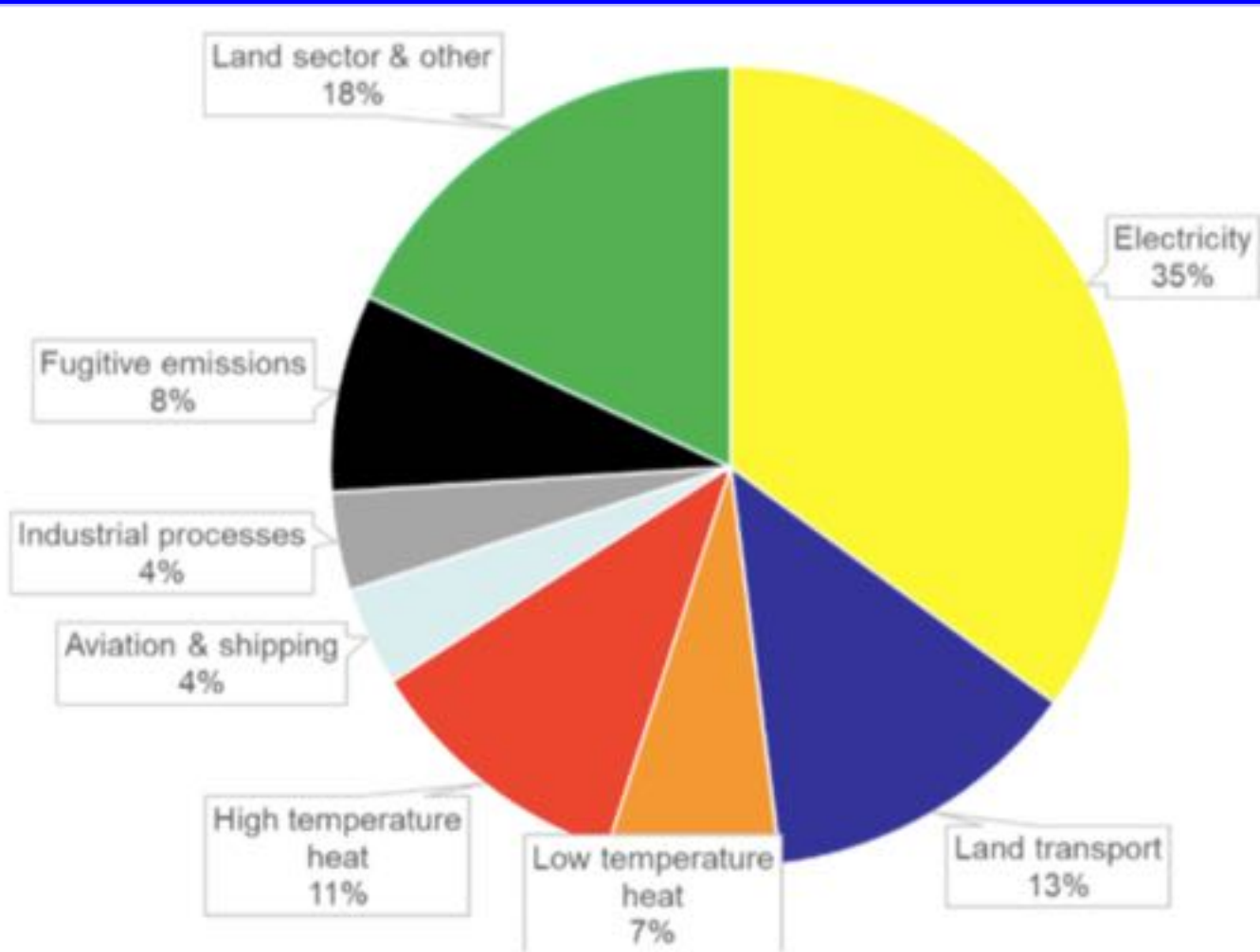
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Party	Policies
LNC	No RE target
√	Support for community RE projects via seeding grants & information
√	Established NSW RE Advocate to work with communities & industry
√	\$55M to support the commercialisation of new large-scale projects that use emerging, dispatchable technology.
√	Interest-free loans for 'up to' 300,00 residential solar-battery & battery systems over 10 years
ALP	
√ √	50% RElec by 2030
√ √ √	Additional 9GW RElec by 2030: 6GW by reverse auctions; 4GW in first term
√	1GW out of the 9GW by creating a state-owned RElec company
0	2GW out of the 9GW by supporting rooftop solar PV by rebate < \$2.2k
√	Free TAFE courses for electrical trades, RE and construction
√	These policies create a de facto NSW RElec target ~ 27% of electricity by 2030

Announced RElec Policies for NSW so far

Party	Policies
NSW Greens (summary)	
√ √ √	100% RElec + high energy efficiency by 2030
√ √	Support energy storage target
√ √	Support government effective policies to move towards that target
√ √	Oppose new emissions-intensive investments
√ √	Oppose expansion of coal mining & export
√ √	Phase out fossil fuels
√ √	Reform the NEM Specify how!
0	Needs policy on transmission & Renewable Energy Zones
Australian Greens	
√ √	Renewable Energy Zones across Australia, supported by \$2.4 billion fund Unofficial announcement by Adam Bandt MP?

Australia's GHG Emissions by Sector



- Although electricity is 35% now, it will provide most transport & heat in the future
- Energy provides over $\frac{3}{4}$ of total emissions
- Most energy can be transitioned to renewable electricity
- Air and sea transport will need fuels produced from renewable energy
- Land sector, especially agriculture, is more difficult than energy sector

Vested Interests are spreading False Myths about Renewable Electricity (RElec)

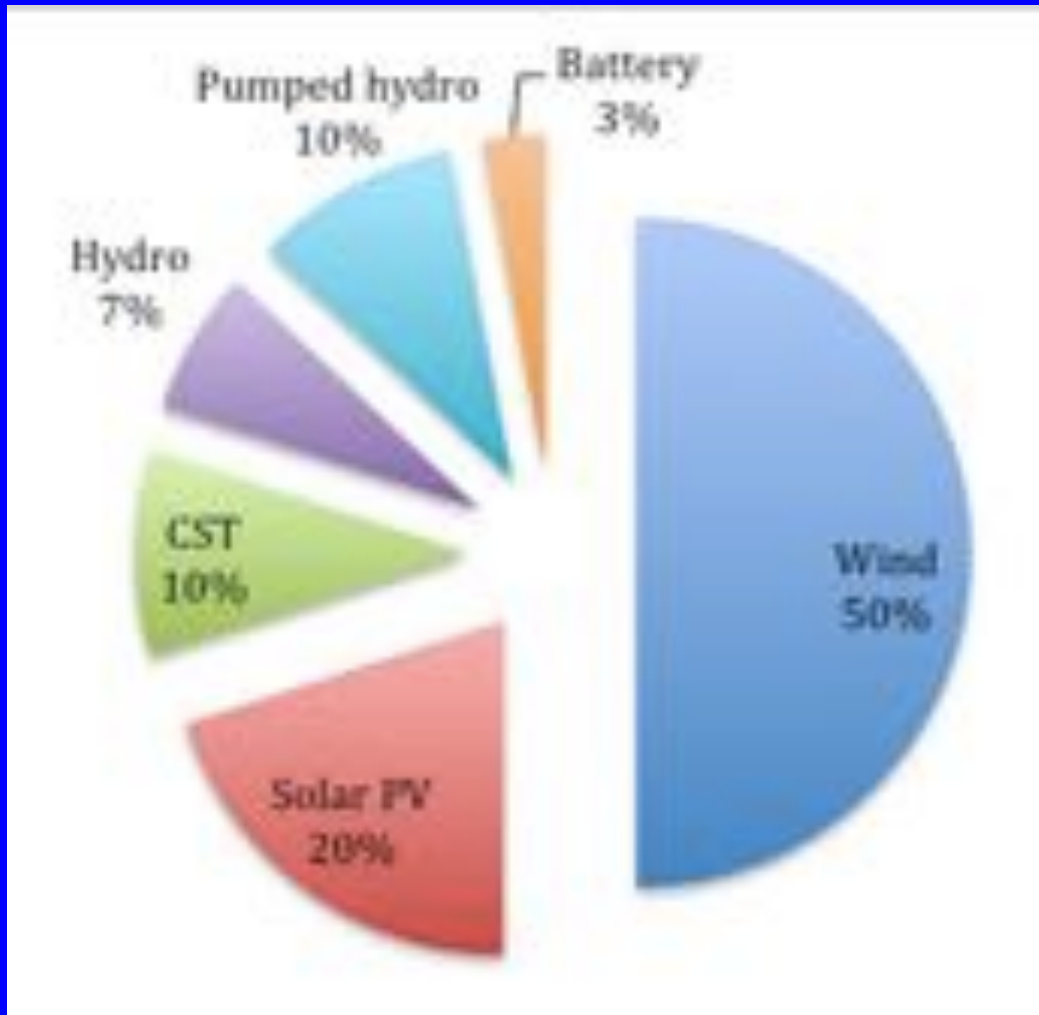
The Principal Myth (3 variants)

1. **Myth:** 'Base-load (operate 24/7) power stations, either coal or nuclear, are necessary for reliability, and RElec can't provide them'
2. **Myth:** 'Base-load power stations must run continuously as backup for variable renewables'
3. **Myth:** 'RElec is too variable to make the predominant contribution to grid electricity supply without vast amounts of expensive electrical storage'

These & other myths refuted by (1) practical experience;
(2) computer simulations balancing supply & demand every hour

A possible reliable 100% RElec mix for NSW or Australia:

Annual Electricity Generation by Source



A reliable system:
70% variable
renewables
+ 30% dispatchable
renewables & other
storage

Affordability Myth, “RE is responsible for high electricity prices”, is based on misleading half-truths

South Australia

- “South Australia has highest electricity prices in Australia”.
- True on average, but misleading, because SA had highest prices before it had renewables



Denmark

- “Denmark has one of highest electricity prices in Europe”:
- True but misleading, because price includes highest electricity tax in Europe, which goes into consolidated revenue



Both regions

- Fact: High proportion of RE **reduces** wholesale price of electricity – it’s the way the market works



Former Federal 'Policy': The National Energy Guarantee (NEG)

Poorly defined policy designed to placate this politician & his followers →

Would actually prolong coal power and slow the growth of RE

But rejected by the politician because it paid lip service to the climate threat
and no policy would placate Tony



The mythbusting 'honest government ad'
on its RE policy:

<https://www.youtube.com/watch?v=sitPeRITdNs>



We need effective, transparent policies!

Proposed Walcha Renewable Energy Zone



Wind 3400 MW



Solar 350-650 MW



Pumped hydro

- ✦ Energy needed due to closure of Liddell in 2022 and other coal stations subsequently
- ✦ 4000 MW of renewable energy, to be constructed in stages
- ✦ Wind & solar firmed by pumped hydro
- ✦ Local investment & employment in New England area
- ✦ Consultation with local community since 2004
- ✦ Benefit sharing with local community
- ✦ Needs increased transmission capacity

Policy Priority: Reverse Auctions for large-scale RElec

- ★ Purpose: to speed up installation of wind & solar farms and dispatchable renewables and further push down prices
- ★ Involves bids or tenders for specified requirements, with contract-for-difference
- ★ Provides a Power Purchase Agreement for investors
- ★ As in ACT, Vic & Qld
- ★ Profitable for state & territory gov'ts when wholesale price of electricity is greater than contracted price
- ★ Example of an inappropriate contract-for-difference: Hinkley C nuclear power station in the UK: contracted price = double wholesale price, increasing with inflation for 45 years!

Policy Priority: Reform NEM's market structure and rules

- ★ NEM (National Electricity Market) originally designed for system with large central power stations and one-way flow of electricity to consumers
- ★ Nowadays NEM is attempting to manage a system of many distributed consumers, millions of whom are also small-scale RElec generators → 2-way flows
- ★ NEM's objective doesn't mention climate change: yet electricity is responsible for 35% of Australia's greenhouse gas emissions
- ★ NEM doesn't include energy efficiency, which has huge potential for cutting both emissions & consumers' costs
- ★ Under existing rules, large generators can 'game' the market, pushing up electricity prices at the expense of consumers
- ★ With present market structure, when dominated by solar and wind, wholesale price will fall so low that it won't provide sufficient revenue for investment in new generation

Policy Summary: for a smooth transition of the electricity sector

- ★ Targets for greenhouse gas emissions, renewable electricity and energy efficiency – federal, state, territory & local governments
- ★ Faster implementation of key new transmission lines and upgrading of key old ones – state & federal governments
- ★ Incentives for dispatchable renewables & other forms of storage – federal gov't
- ★ Creation of Renewable Energy Zones – state and/or federal governments
- ★ Reverse auctions for large-scale renewable electricity – NSW, WA & NT still to go
- ★ Public review of National Electricity Market, including objective, structure and rules. How can it be made more relevant to 21st century? – federal & state gov'ts
- ★ Roadmap for phasing out coal power station & coal exports
- ★ Many other valuable but less urgent policies
- ★ Carbon price would be valuable, but not supported by either of major parties

Why a carbon price (preferably tax instead of ETS) would be valuable, if we got it

- ★ Sends message to investors that investment in new dirty coal-fired power stations is financially risky; encourages investors in RE
- ★ It's the only way to exert pressure to change on the whole economy. A carbon price applied 'upstream' (e.g. at coal-mine) to all the major greenhouse polluters flows 'downstream' to all economic transactions, affecting energy, materials, transport, buildings, land use, etc.
- ★ Gives message consistent with other policies
- ★ Compensates for at least part of the external (environmental, health and social) costs of fossil fuels
- ★ Raises revenue for a just transition and/or for infrastructure, or can be returned to people as a dividend

Why Carbon Pricing is Not Sufficient

Generally because of market failure; in particular...

- ★ Producers & consumers have incomplete information
- ★ EE limited by market failures such as split incentives between landlord & tenant
- ★ EE limited by transaction costs, absent appropriate institutions such as ESCOs
- ★ Market often fails to provide infrastructure (eg, transmission lines; railways)
- ★ Market often fails to fund R&D; incentives needed in Oz
- ★ Consumers who don't have access to alternatives must pay the price and continue to pollute
- ★ Market is short-term, based on marginal economics; inadequate for long-term planning and hence for initial dissemination of new technologies
- ★ Market, in particular cost-benefit calculations, doesn't handle risk and uncertainty well

None of these market failures is a logical argument against pricing being valuable.