

School of Photovoltaic & Renewable Energy Engineering, UNSW Sydney, 15 May 2019

Can Labor close the greenhouse gap?



Dr Mark Diesendorf

Honorary Associate Professor
UNSW Sydney

Email: m.diesendorf@unsw.edu.au



Web: <https://research.unsw.edu.au/people/associate-professor-mark-diesendorf>



Current Level of 'Debate' from some Politicians

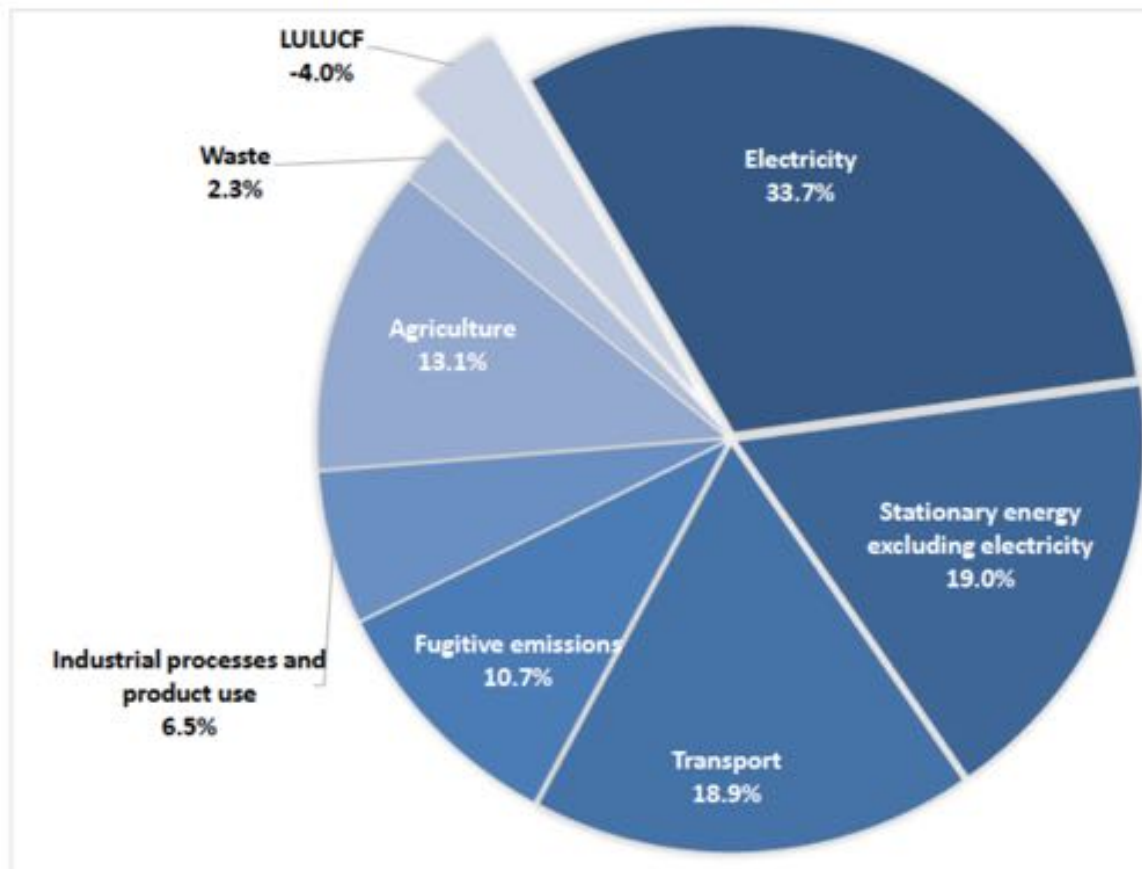
Oh yuck, look...



...a wind turbine

Australia's GHG Emissions by Sector, Year ending Sept 2018

Figure 4: Emissions contribution by sector, Australia, year to September 2018



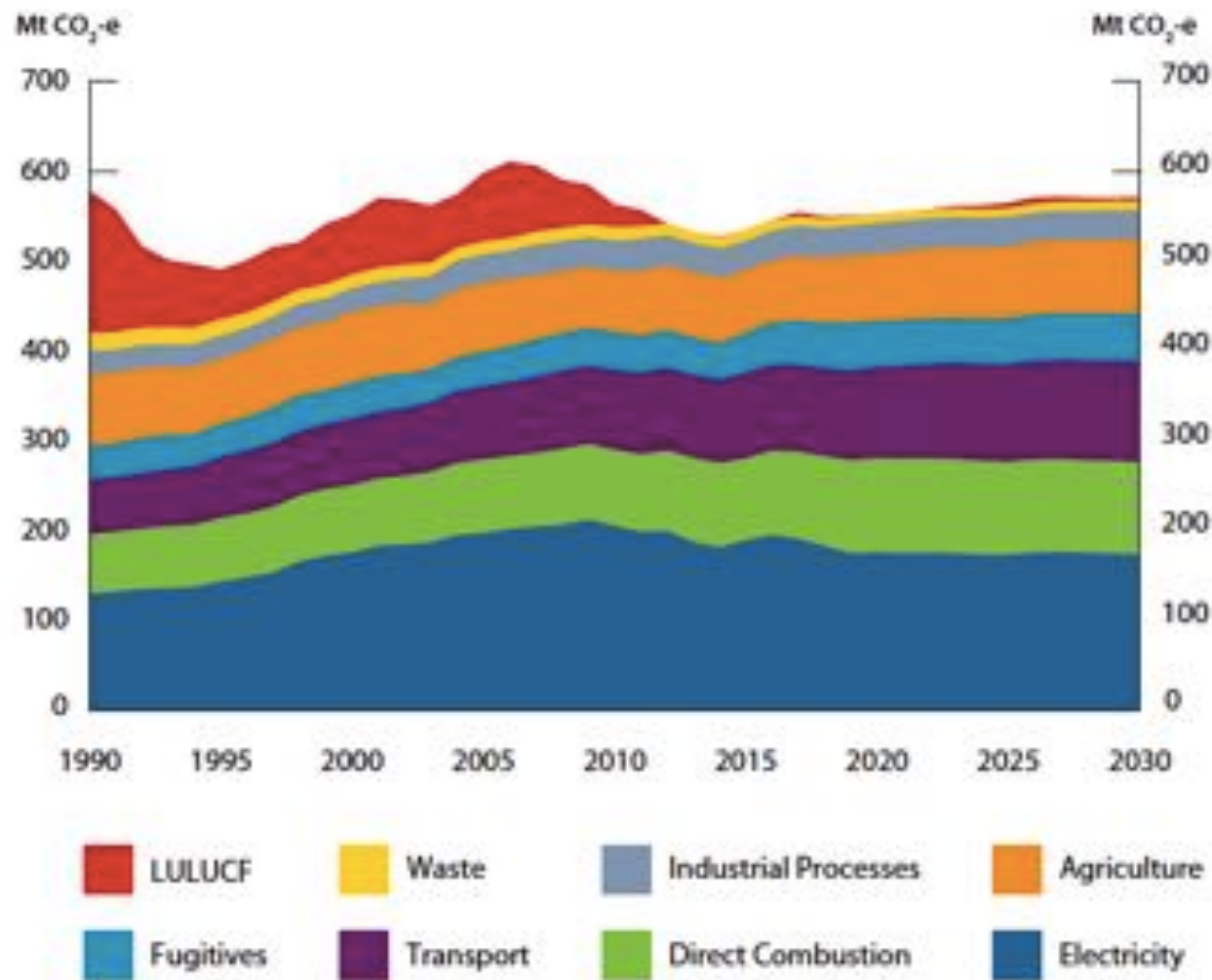
Source: Department of the Environment and Energy

- Although electricity is 34% now, it will provide most transport & heat in future
- All energy produces 82% of total emissions
- Most energy can be transitioned to renewable electricity
- Air and sea transport (4%) will need fuels produced from renewable energy
- Land sector, especially agriculture, is more difficult than energy sector

Total CO₂e emissions = 536 Mt; electricity share 34% = 182 Mt

Australia's GHG Emissions Trend & Projection

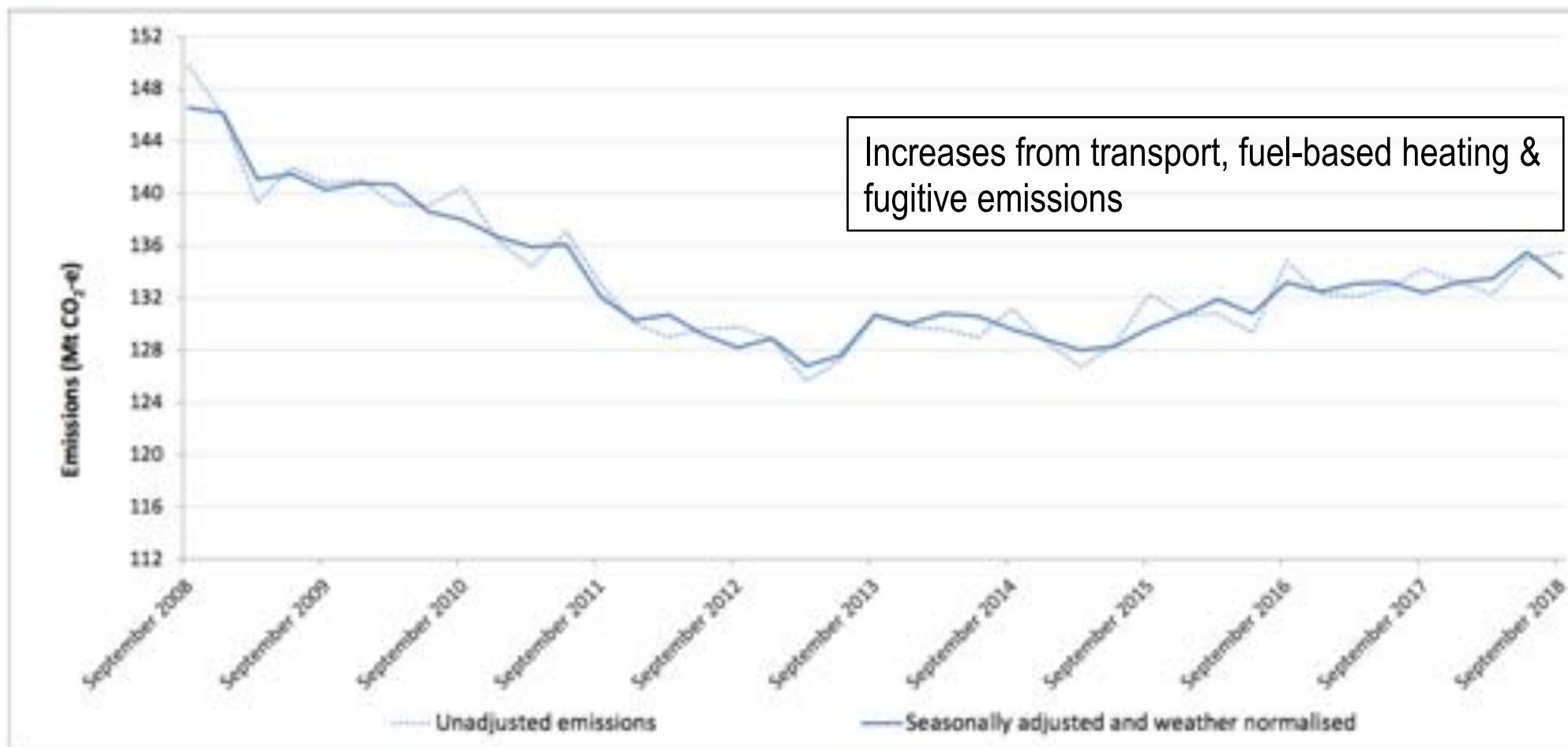
Figure 3 Australia's emissions, 1990 to 2030



- ★ Emissions were 605 Mt in 2005, then dropped when land clearing was reduced
- ★ Emissions in 2017: 536 Mt
- ★ Electricity emissions declining – detail follows
- ★ Non-electricity energy emissions have been increasing 2014-2018

Recent Total Australian Emissions Trending Up

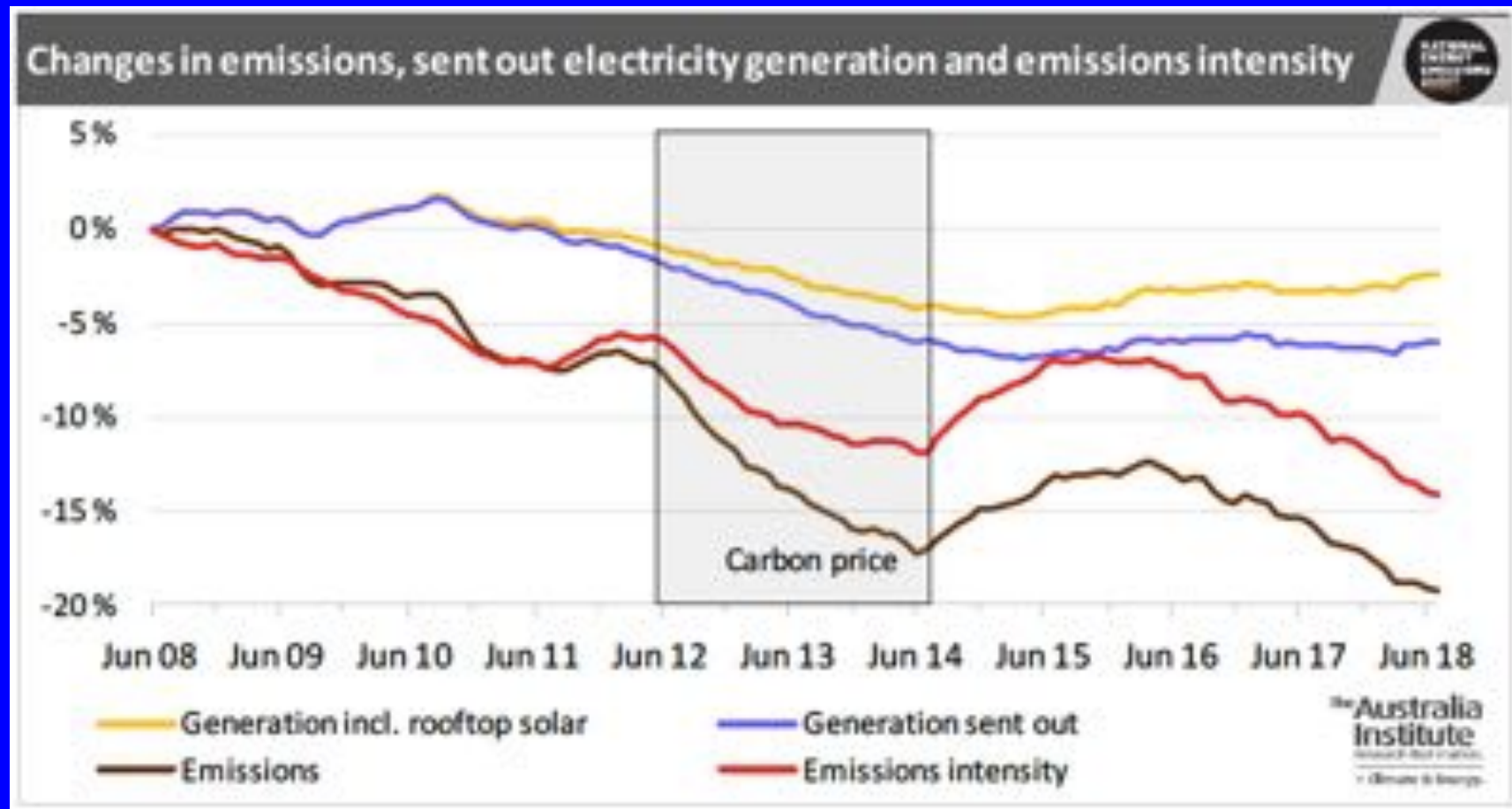
Figure 1: Emissions² by quarter, Australia 2008 to 2018



Source: Department of the Environment and Energy

Increasing non-electricity emissions are outweighing decreasing electricity emissions

Electricity Emissions Declining since mid-2016



Graph shows NEM trend. However, including WA, with declining demand & less coal, doesn't change qualitative result.

Australia's Exports of Fossil Fuels

Fuel	Fuel quantity p.a. (Mt)	Export value 2018-19	GHG Emissions from combustion (Mt/yr)
Coal	~380 Mt total comprising ~147 Mt coking + ~233 Mt thermal	\$66 B (coking \$41 B; thermal \$26 B)	406 + 419 = 825
LNG	70 Mt (2018); 80 Mt (2020 est.)	\$50 B	275?

Exports of GHG emissions: 1100 Mt = 44 t per person
 CO₂e emissions within Australia: 554 Mt = 22 t per person

Hence, Energy Goals to Cut Australia's Contribution to Global GHG Emissions should be

- ★ 100% renewable electricity ASAP
- ★ Electrify most transport & non-electrical heat; improve (electric) public transport & infrastructure for cycling & walking
- ★ Increase energy efficiency & conservation substantially
- ★ Replace coal & LNG exports with renewable energy exports

Goals for Australia's Non-Energy Emissions

(not discussed here)

- ★ Land use, agriculture & forestry (17% of emissions): R&D on animal feed; modify human diet; no logging of old-growth forests
- ★ Develop alternative industrial processes: e.g. for cement; iron & steel; (6.5% of emissions)

Longer term general strategies

- ★ Research and develop steady-state physical economy: i.e. one with low throughput and no growth in the use of energy, materials & land
- ★ Reduce population growth while maintaining multiculturalism and increasing refugee intake

Focusing on urgent actions in the Australian energy sector, we need targets and policies to achieve them

- ★ Targets for GHG emissions, renewable electricity (RElec), energy efficiency (EE) & renewable fuels



- ★ A wide range of policy instruments, including various economic instruments; laws, regulations & standards; institutional change; planning of cities, transport, key industries. Policy development needs consultation & negotiation



Targets of Major Parties: Federal

LNC

- ★ 26-28% reduction in annual GHG emissions below 2005 level by 2030
- ★ Actually 26%, to be partly attempted with Kyoto credits, an accounting device

ALP

- ★ 45% reduction in annual GHG emissions below 2005 level by 2030
- ★ 50% renewable electricity (RElec) by 2030 (we already have 19%)

Is 100% RElec by 2030 Sufficient to achieve ALP GH Target?

(Electricity is easiest energy supply mode to transition)



Bulk electricity
from variable
renewables



+



Total emissions in 2005 = 605 Mt; ALP target equivalent to 333 Mt

Total emissions in 2017 = 536 Mt

Assuming 100% RElec and no increase in non-electricity emissions 2017-2030 (contrary to current trend), then total emissions in 2030 = non-elec. emissions = $0.66 \times 536 \text{ MT} = 354 \text{ Mt}$

Even 100% RElec falls short of ALP's GH target of 333 Mt.

Even 100% RElec needs to be supplemented e.g. by energy efficiency and/or some electrification of transport and/or of gas heating.

ALP GH & RElec Targets: Back-of-Envelope

Item	Annual emissions (Mt)
Total GHG emissions in 2005	605
Less 45% reduction target for 2030	333
GHG emissions in 2018	536
Additional emissions reduction required 2018 to 2030: $\Delta = 536 - 333 = 203$ Mt	$\Delta = 203$
Currently 19% RElec, so 81% fossil elec emits 34% of 536 Mt = 182 Mt	182
Hence 50% RElec substitutes for an additional 31% of 182 Mt = 56 Mt	$\Delta = 56$
Gap remaining after 50% RElec: $\Delta = 203 - 56 = 147$ Mt	$\Delta = 147$

Assumptions

1. no increase in electricity generation by 2030 – unlikely given growth in EVs;
2. no change in total non-electricity emissions – present trend is increasing.

Options (not additive) for Closing the Gap of 147 MT/yr after 50% RElec achieved

Target option	Δ GHG emissions (Mt/yr)
Increase RElec target from 50% to 100%: $\Delta = \frac{1}{2} \times 182$ Mt	91
Increase RElec target from 50% to 81%: $\Delta = 56$ Mt	56
Improve overall efficient energy use by 20%: $0.2 \times 0.82 \times 536$ Mt	88
Improve overall effic. energy use by 15%: $0.15 \times 0.82 \times 536$ Mt	66
Electrify 1/2 land transport & charge with RElec: 6.5% of 536 Mt	35
Electrify one-quarter of non-elec heat: 4.75% of 536 Mt = 25 Mt	25
Halve fugitive emissions: 5.3% of 536 Mt	28
Halve non-energy industrial emissions: 3.25% of 536 Mt	17

Note:

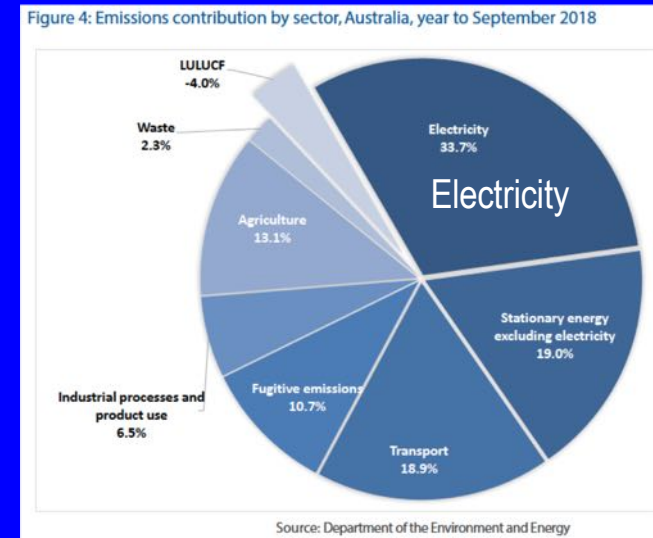
- Not all options are independent so we can't add rows; e.g. increasing RElec & improving EE will automatically cut fugitive emissions; electric transport emissions depend on %RElec
- Reducing FF **electricity** use by y MWh will reduce emissions from FF elec by 3y MWh.

Recommended Energy Goals to Cut Australia's Contribution to Global GHG Emissions

- ★ 100% renewable electricity ASAP (2030 at best)
- ★ Electrify 50% transport by 2035 and improve public transport, cycling & walking
- ★ Electrify 50% non-electrical heat by 2035
- ★ Increase energy efficiency & conservation by 20% by 2030
- ★ Replace coal & LNG exports with renewable energy exports by 2040

Results will go well beyond ALP's emission target, but not all are achievable by 2030.

We need to set these goals, and policies to achieve them, now.



Proposed Goals Vs Proposed Policies

Goal	Policies	Comment
100% RElec ASAP	<p>LNC: No target or +ve policies</p> <p>ALP: Target 50% RElec;</p> <ul style="list-style-type: none"> • additional \$10 billion for CEFC; rebate of \$2k for 100K household solar + battery systems; • \$5 billion for new & upgraded transmission & distribution lines; • solar schools; • review NEM & amend objective. <p>Greens: Target: 100% RElec ASAP; Grid Transformation Fund, incl. Renewable Energy Zones; increased funding for ARENA & CEFC for storage; timeline for phasing out coal power</p>	<p>ALP: Good policies but insufficient. Should increase target to 100%; add reverse auctions (to get them to NSW and WA). Most new CEFC funding should be allocated to storage; part of transmission funding should be allocated to creation of Renewable Energy Zones.</p> <p>Need Roadmap & policies for phasing out coal power stations</p>

Proposed Goals Vs Proposed Policies

Goal	Policies	Comment
Electrify 50% of transport and improve urban public transport	<p>LNC: No target or +ve policies</p> <p>ALP: 50% of new sales by 2030, facilitated by 20% rebate for business car fleets; 50% of new gov't fleet by 2025; vehicle emission standards based on weak US standards.</p> <p>Greens: Ban sale of ICE vehicles by 2030; fund fast charging stations; fund public transport, walking & cycling</p>	ALP should strengthen its target and support with stronger policies, e.g. fund fast charging stations in key locations

Proposed Goals Vs Proposed Policies

Goal	Policies	Comment
Electrify or solarise 50% of non-electric heat	LNC: No target or +ve policies ALP: No specific policies; possible impacts from Safeguard 2.0 baseline & credit ETS Greens: Carbon price	R & D needed; carbon price would be effective; failing that, incentives to switch from gas needed

Proposed Goals Vs Proposed Policies

Goal	Policies	Comment
<p>Increase overall energy efficiency (EE) substantially</p>	<p>LNC: Possible tiny impact from Emissions Reduction Fund</p> <p>ALP: Permit ARENA to fund energy efficiency; possible impacts from Safeguard 2.0 baseline & credit ETS</p> <p>Greens: National EE target: strengthen Building Code for new buildings; EE obligation on energy retailers</p>	<p>We need EE target & specific polices, e.g. strengthen Building Code of Australia and apply to new & existing buildings (with different standards); strengthen MEPS for appliances & equipment; with States, mandate energy audits & ratings and disclosure for sales and rental of buildings. Regulations for rental accommodation, roof colours, etc.</p>

Proposed Goals Vs Proposed Policies

Goal	Policies	Comment
Phase out exports of coal & LNG while phasing in renewable energy exports	<p>LNC: No policy</p> <p>ALP: No positive policy; negative policies are: \$1.5B for gas pipelines in northern Australia, which would encourage fracking; no opposition to Adani, but at least no funding for it.</p> <p>Greens: No new mines; roadmap to phase-out fossil fuel exports by 2030; Clean Energy Export Development Fund</p>	<p>No new coal mines or gas fields.</p> <p>Strategic planning, research, development and demonstration needed urgently, for exports of RE as hydrogen or ammonia (or possible via electricity transmission)</p>

Remaining Carbon Budgets for 2°C & 1.5°C

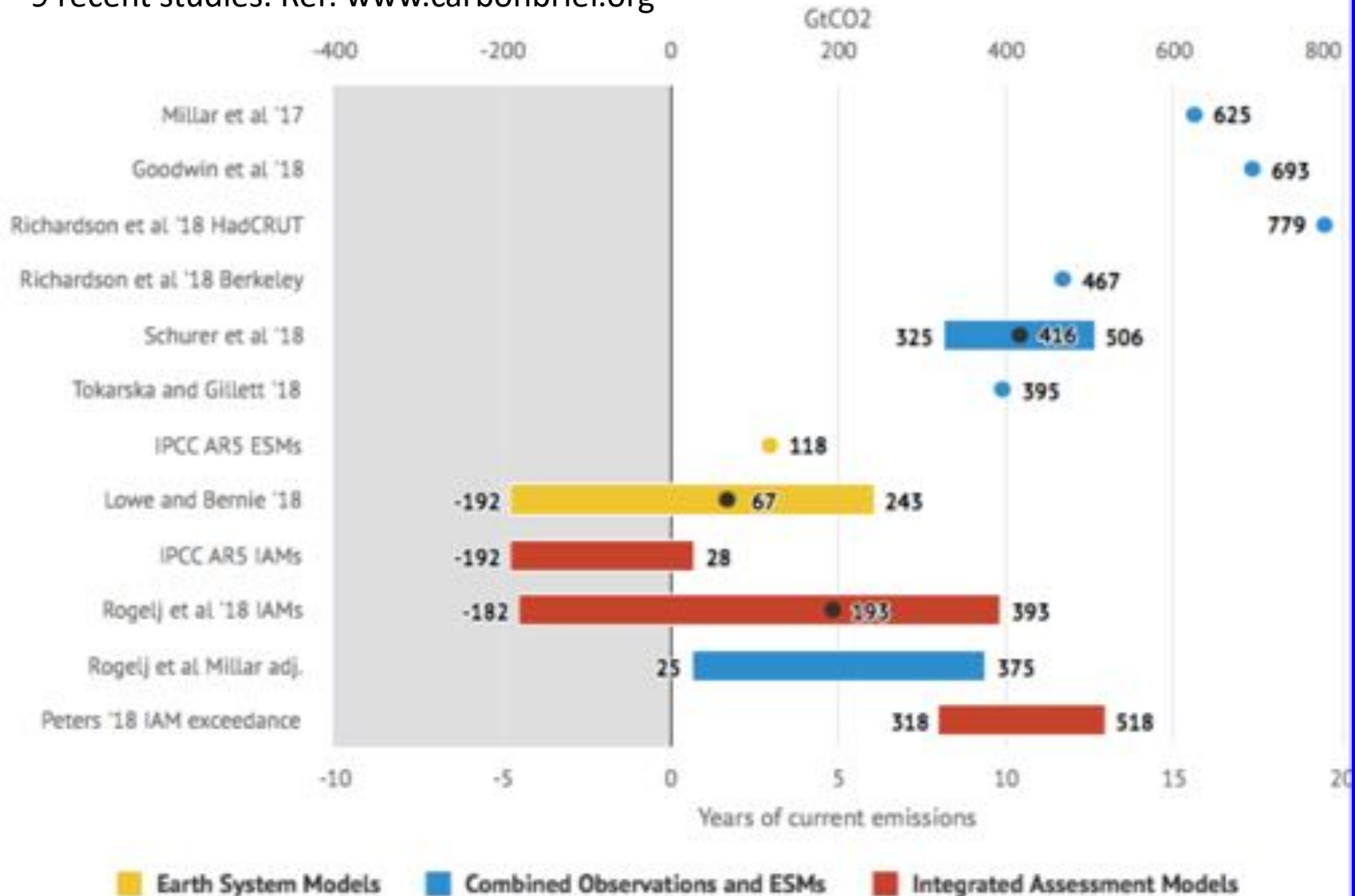
IPCC (2018) Special Report 15

- ★ Remaining CO2 budgets for 2°C & 1.5°C are 1170 Gt & 420 Gt, measured from 1/1/2018 (big uncertainties); annual global emissions 2017 = 36 Gt (CO2 only)
- ★ One way of calculating Australia's share is 'grandfathering' (i.e. based on current emissions share of 1.5% of global).
- ★ Then Australia's remaining CO2 budgets become 17.6 Gt & 6.3 Gt respectively, from 1/1/2018.
- ★ If, under Labor, annual emissions decline linearly from 536 Mt in 2018 to 333 Mt in 2030, then mean annual emissions over 2019 to 2030 = 435 Mt, and our carbon budgets would give us 40 & 14.5 years from 1/1/2018 to reach zero emissions, or **38.5 & 13 years from June 2019.**
- ★ But grandfathering gives us the most time and is unfair to other countries; equal per capita budget is fairer but gives us only 0.325% of global budget, or 3.8 Gt & 1.4 Gt from 1/1/2018, **leaving us 5.6 and 1.1 years respectively from June 2019.**

Global CO₂ Budget for 1.5°C from 1/1/2018

Remaining carbon budget for a 66% chance of less than 1.5C warming

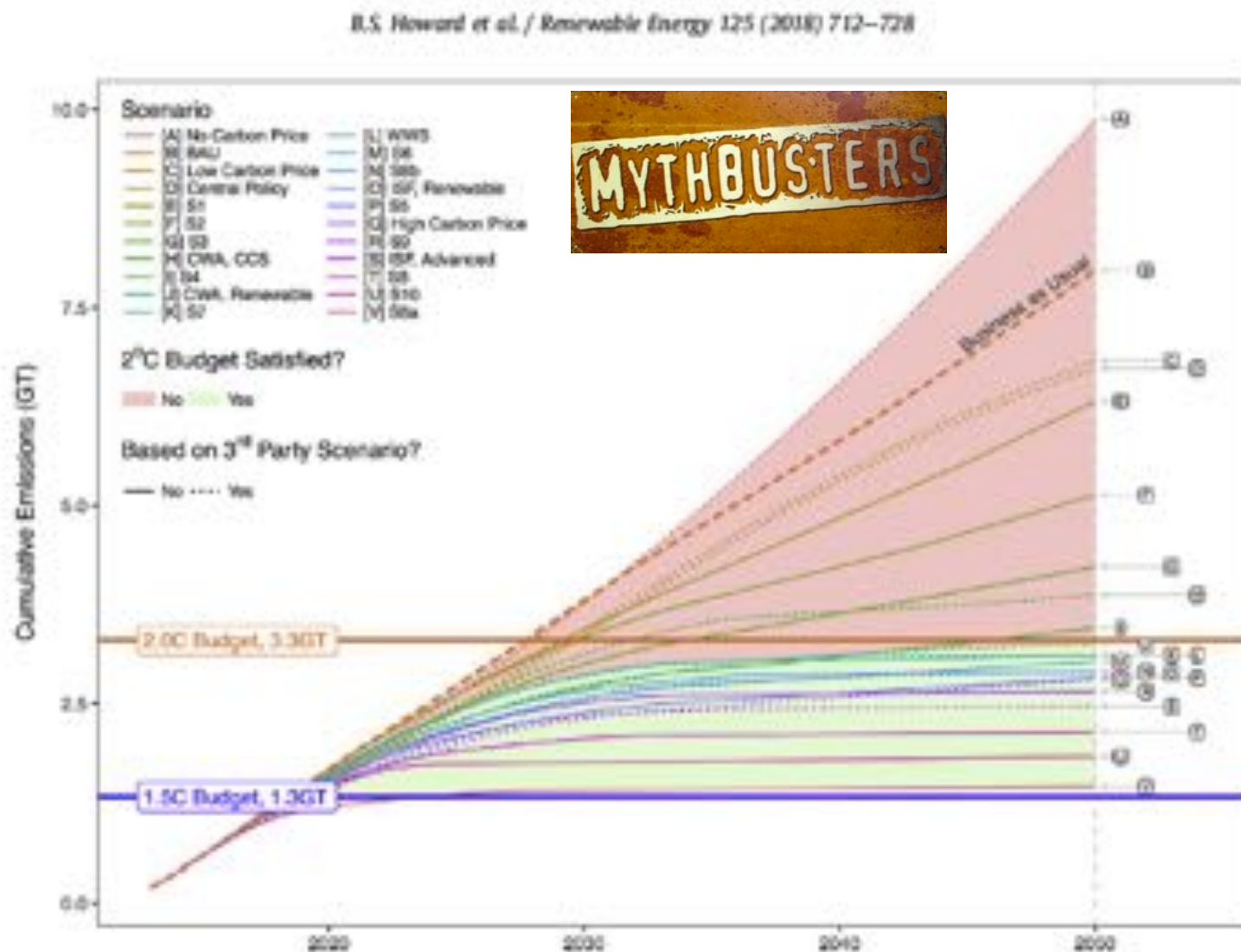
9 recent studies. Ref: www.carbonbrief.org



Are CO₂ Emissions from Transition an Impediment?

Cumulative life-cycle GHG Emissions, Australia 2011-2050, compared with Australia electricity industry's share of global carbon budget published pre-2018

Howard, Hamilton, Diesendorf, Wiedmann (2018)



- ★ Good news: Emissions during transition << emissions saved
- ★ Bad news: only one of 22 scenarios (almost) keeps Oz within 1.5C carbon budget for electricity
- ★ This scenario has 98% renewable electricity + high energy efficiency by 2030

100% RElec is feasible & affordable by early 2030s, possibly even by 2030;

100% renewable energy (including transport & heat) will take longer

ALP policies + states can achieve 50% RElec, but not its greenhouse target

Background info

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

More detailed policy discussion

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

