Climate Change Balmain-Rozelle
PO Box 890
Rozelle NSW 2039
w: climatechangebr.org
e: ccbalroz@gmail.com
ABN: 31 258 840 648

Submission from
Climate Change Balmain-Rozelle
to the
Climate Change Authority's updated advice to Government[1]
on policies to meet its
Paris Commitments

28/8/2019

Who we are

Climate Change Balmain-Rozelle [CCBR] is an independent community group in inner west Sydney, promoting local and national action to reduce fossil fuel use, increase the adoption of renewable energy, and head off catastrophic global warming.
We count over 1000 supporters.

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1 http://www.climatechangeauthority.gov.au/consultations

1. Achieving a Net Zero Emissions Economy in the Long Term

1.1. Stranded Assets

In aiming for a net-zero economy, shorter term policies may not lead to the most efficient overall path. Some electricity generators, for example, take years to build and ma y be economically justified only by a forty year productive life. The ideal infrastructure to achieve a 25% cut in emissions by 2030 may may not lie on the path to that for a 90% reduction by 2050.

If the free market cannot estimate whole-of-life return on investment on the basis of a more-or-less known emissions ramp down, it is unlikely to produce the optimum outcome. So today's government must set the expectations of industry in line with this long-term aim. Moreover, it must indicate that a future government may find it necessary to cut emissions faster; in this way, it removes the risk of compensation claims for assets that become stranded because of changing circumstances.

Given the clear message from the Intergovernmental Panel on Climate Change that coal has no future if we are to keep global warming below 1.5 degrees C, any form of subsidy or government guarantee for new coal plants would send the wrong message to industry. We urge the Authority to specifically rule this out in their advice to the Government.

Recommendations:

- Gazette an emissions trajectory all the way to, at least, a 90% cut by 2050
- Charge entities such as ARENA, CEFC and AEMC with planning and supporting technologies on that basis
- Let it be known that companies that invest further in fossil fuel assets do so at their own risk.

1.2. Coal Communities

Many communities around the country are largely dependent on the thermal coal industry. Most of this coal is exported.

These communities are already at risk from decline in international demand. Transitioning them away from coal needs to start in earnest now for that reason alone. Further, their dependence on coal makes it politically difficult to cut domestic coal use or restrict coal export to Paris-compliant countries.

Germany and Spain offer examples of orderly transition plans. Key components are:

- continuous negotiation with unions, industries, communities, scientists and environmental NGOs
- selectively accelerated plant and mine closures to avoid coincidental clusters
- enabling a mix of employment pathways:
    - retraining and relocation packages, particularly to the new energy industry sites

- short term local work in remediation and decommissioning
- new industry suited to the locality.

A good start would be for the Government to sign the Silesia Declaration[2].

Recommendations:

- Commence transition plans for coal communities
- Consult with all stakeholders and study overseas experiences
- Use early retirement to stagger the closures
- Sign the Silesia Declaration as promulgated at COP24.

1.3. Emissions-Intensive Trade-Exposed Industries

Ultimately, all emissions-intensive activities and products need to bear a suitable impost. Avoiding consequences for exporters that disadvantage them internationally will require international agreements. The Australian Government should take the lead.

Meanwhile, assistance to such industries must not be so as to weaken the incentive to become less emissions intensive.

Recommendations:

- No compensation for emissions beyond those corresponding to international best practice for the given product
- To the extent that the entity brings emissions below what had been international best practice, thereby setting the new standard, compensation could continue at a diminishing rate for some period to reward the improvement.

2. Sectoral and Economy-wide Policies

2.1. Electricity Sector

2.1.a) Government Interference and Oversight

It is not the Government's role to mandate solutions to issues, such as more baseload as the solution to grid reliability. It is generally preferable that the Government define the issue and provide funding to assist, leaving the choice of solution to the expert bodies and the market.

See also .

2.1.b) AEMC Rules

That said, some such bodies, perhaps influenced by industry incumbents, can be slower to adapt than others and may need a nudge in the right direction. Some of the rules

2 https://cop24.gov.pl/fileadmin/user_upload/Solidarity_and_Just_Transition_Silesia_Declaration_2_.pdf

regarding power generation come to mind, such as

- the 5-minute rule[3]
- demand response[4]
- allowing a colocated variable source and storage to be considered a single entity[5]
- independently rewarding the various ancillary services[22].

> ***Recommendations***:
>
> - Advise the AEMC to pay as much heed to the new industries and independent experts as to the incumbents, and adapt more rapidly to the technological revolution.

2.1.c) Pollution

Existing fossil fuel power stations are permitted certain levels of pollution. A steady stream of reports finds more and more health harms attributable to such pollution, particularly from coal. In 2009, the Australian Academy of Technological Sciences and Engineering arrived at a public cost (excluding climate consequences) of $13/MWh[6]. In the ensuing 10 years, population densities have increased and international evidence of the number and extents of harms has mounted.

There is no logic to allowing power stations a level of pollution scot free.

> ***Recommendations***:
>
> - All pollution from generators should be subject to a charge approximating the public cost.

2.1.d) Resilience to the Changing Climate

Given the decades long nature of investments in power generation, the consequences of a warming environment must be considered.

- Thermal power stations find it increasingly difficult to cope. Australian coal and gas power stations already experience more outages in the heat of summer
- Hydropower is subject to the vagaries of rainfall. Climate predictions are for heavier downpours but longer and more severe droughts in between
- PV also underperforms in the heat, but typically only loses 10% of peak output even at 50C. Some technologies do even better
- The long term predictions of wind will also be relevant, but climate models might not yet be sufficiently certain. One study claims the Australian wind resource will gain[7].

3 https://reneweconomy.com.au/regulators-report-points-to-outrageous-gaming-of-south-australia-energy-market-77433/
4 https://reneweconomy.com.au/whos-afraid-of-demand-response-71616/
5 https://reneweconomy.com.au/why-battery-storage-in-australia-is-unable-to-back-up-wind-and-solar-40322/
6 https://apo.org.au/sites/default/files/resource-files/2009/03/apo-nid4196-1189331.pdf
7 https://www.theguardian.com/environment/2017/dec/11/global-warming-will-weaken-wind-power-study-predicts

Recommendations:

- In evaluating the reliability of power sources, the likely impacts of a warming climate should be considered.

2.2. Fossil Fuel Subsidies

The IMF estimates Australia spends $29bn annually subsidising fossil fuels[8].

Recommendations:

- All fossil fuel subsidies should be ramped down as swiftly as feasible, transition assistance being provided to adversely affected communities..

2.3. Gas

To boost Australian gas supplies, the Federal Government has put pressure on States to lift moratoria[9] on fracking for unconventional gas. Fugitive emissions above 3%, combined with the emissions from use of the fuel, make it as damaging to the climate over 100 years as the use of coal , it is essential that the actual level of emissions be well understood and policed. With a 20 year view of the damage, the fugitive emissions threshold drops to 0.6%.

Unfortunately, there are wide discrepancies amongst the many attempts to assess this level, both in Australia and, in respect of shale gas, in the US. A key reason is that the bulk of fugitive emissions often comes from a very few sources[10]. Thus, a very high level of vigilance would be required by government authorities, with no trust whatsoever being placed on industry.

Recommendations:

- Desist from pushing States to allow fracking, until such time as continuous, comprehensive and independent monitoring can be arranged.

2.4. Emissions Reduction Fund/Climate Solutions Fund

Prospect

At reducing Australia's emissions, Direct Action and its subsequent incarnations have never been a great success and now appear to have stalled. The total has only grown 2% in the last two years.

Permanence

8 https://reneweconomy.com.au/global-fossil-fuel-subsidies-reach-5-2-trillion-and-29-billion-in-australia-91592/
9 https://www.abc.net.au/news/2018-11-14/gst-fracking-government-morrison-moratorium/10497850
10 https://energy.unimelb.edu.au/__data/assets/pdf_file/0019/2136223/MEI-Review-of-Methane-Emissions-26-October-2016.pdf

The bulk of reductions contracted under the ERF relate to vegetation[8].

If a plantation under this scheme is undisturbed for 25 years, the ERF treats it as 80% of that amount of carbon having been sequestered permanently[11]. (A 5% margin is subtracted from that, leaving an assessment of 75%.)

This surprising generosity appears to be a consequence of using a discount rate of about 6%. To achieve actual permanent sequestration the ERF would need to pay an amount X, say, every 25 years. Discounting at 6% p.a., the total in today's dollars is

$$\Sigma_n X(1-0.06)^{25n}=X/0.79$$

However, that assumes X is constant: no inflation and no increased need to sequester carbon. The discount rate set by the US Federal Reserve tracks nearly one percentage point below the recent inflation rate at the time, so the real discount rate (i.e. after subtracting inflation) is under 1%. Using this, 25 years of sequestration should only be credited as 20%-5%=15% of permanent; 100 years as 60%-5%=55% instead of 100%-5%=95%.

Additionality

As the Climate Change Authority has noted[12],

> "*it can be virtually impossible for governments, regulators or indeed anyone outside the firm concerned, to quantify what would have otherwise happened.*"

For vegetation, this relates to that which would have been planted anyway, though perhaps for a noncomplying period, and perhaps more so to preservation of vegetation that likely would not have been cleared. How the CCA nonetheless arrived at the conclusion that additionality rates for the CFI were "reasonably high" remains obscure***[13].***

Safeguard Mechanism

The ERF is a waste of time and money if the safeguard mechanism is not enforced. It appears the goalposts have been moved to accommodate emitters on multiple occasions[14]. Only this month, the Clean Energy Regulator had occasion to declare a crackdown on compliance[15].

Recommendations:

- Terminate the ERF/CSF for new projects, redirecting the funds to more successful schemes such as ARENA and CEFC
- Improve scrutiny of existing projects
- Where possible, rescind the decisions to raise baselines.

2.5. Transport

Electric Vehicles

11 http://www.cleanenergyregulator.gov.au/ERF/Choosing-a-project-type/Opportunities-for-the-land-sector/Permanence-obligations
12 http://www.climatechangeauthority.gov.au/sites/prod.climatechangeauthority.gov.au/files/files/CCA-CFI-Review-published.pdf
13 https://reneweconomy.com.au/erf-review-fails-to-douse-doubts-over-coalition-key-climate-policy-95653/
14 https://www.theguardian.com/environment/2019/aug/13/coal-mine-increases-greenhouse-gas-emissions-without-penalty-foi-reveals
15 https://reneweconomy.com.au/safeguards-mechanism-in-regulator-sights-in-emissions-reporting-crackdown-78013/

A looming challenge for electricity networks is the adoption of electric vehicles[16]. This is to be welcomed for many reasons:

- a reduction in directly harmful emissions
- less noise pollution
- in conjunction with the switch to renewable energy, a reduction of greenhouse gas emissions,
- reduced dependence on oil imports and reduced need for oil reserves.

For the benefit of public health, grid efficiency, emissions reduction and balance of trade, steps should be taken to encourage the uptake of EVs, bringing it more into line with the potential growth of PV.

To reap these benefits, it is essential that EV charging is substantially aligned with PV output. This will involve, *inter alia*, engaging with those bodies which set tariff periods.

Recommendations: ***Charging infrastructure***

While some of these actions are matters for local and state government, the Federal government may have a role in coordination and encouragement.

- Level 2 charging
  - At Transport Hubs

    While EVs are still relatively rare, only a few clusters of car spots need be equipped with chargers. The cost of the energy and infrastructure would be covered by a small premium charged on using those parking places, thereby discouraging their occupancy by ICE vehicles.

    Consideration should also be given to installing roofs with PV panels, providing shade for the cars and contributing to the power.
  - At Public and Private City Carparks

    While commuting all the way by car is not to be encouraged, Australian cities have not done well at cutting congestion. It is likely to remain a fact of life for some time yet. Accepting this, City authorities could mandate/subsidise a minimum level of provision of charging points.
  - Demand Response

    Ideally, these level 2 charge points would be sensitive to signals from the grid. Some guarantee would need to be made to the drivers that, say, 10kWh will be delivered within 6 hours.

16 In this document, this refers to Battery Electric Vehicles (BEVs), not HEVs or PHEVs

- Level 3 charging on Highways
    - While the bulk of the journeys are urban, a national network of fast charging stations, 100km apart at most, will be needed to encourage owners to go fully EV.

Recommendations: Incentives to accelerate EV uptake

- California's ZEV (Zero Emissions Vehicle) and China's NEV (New Energy Vehicle) schemes promote EVs by setting a minimum ratio of EV to ICE sales for each manufacturer. This is analogous to Australia's LRET scheme for renewable energy. We recommend such schemes as they have the merit of automatically becoming neutral if falling costs make them unnecessary.
- Retain the advantage that EVs have of not paying fuel excise or equivalent; sheet home the cost of road maintenance to the vehicles that contribute the great bulk of the wear: trucks and buses; redefine the fuel excise that applies to private cars as a pollution tax in respect of harmful emissions. This could be set according to the vehicle's engine characteristics.
- Preference EVs for Government fleet purchases

Recommendations: FCAS, Demand Response and EV2G

- As with grid-scale batteries, a fair market in FCAS and a broader Demand Response market (see) would stimulate the provision of charging points that supply these services
- For public charge points, some standardisation of contracts would assist driver comprehension and trust.

For supporting analysis of the above see on page 14.

3. Supporting Innovation, Finance and New Industries

Established new technologies

The CEFC provides excellent support for existing new industries already. The Government should continue to support it and maintain an arm's length relationship in respect of the distinct technologies and projects. That is, the Government can identify problems, such as overall grid reliability, but should leave it to the CEFC, perhaps in consultation with such as AEMO, to identify the mix of solutions – low emissions generation technologies, storage technologies, transport technologies, ... - to be funded.

In particular, the Government must resist the temptation for arbitrary direct support of specific projects, such as Snowy 2.0 and enhanced interconnections, without a long term, transparent strategy coordinated with the States and based on science and engineering.

These interventions disrupt the business cases for rival solutions that may otherwise be commercially sounder. This is not to say that enhanced interconnection is inappropriate, merely that it should compete fairly and transparently with all alternatives.

Boom and bust cycles are a common problem in new industries as too many step into a niche at once; arbitrary Government backing makes the problem worse.

Recommendations:

- Don't pick winners; set the long term goal and let the expert authorities and the market fill in the details
- Negotiate with the States for a system that allows fair and

Emerging technologies

Technologies requiring further research and trials are another matter.

Some domains of industry and commerce are poorly served by existing low carbon technologies. Developing solutions for these justifies, and likely requires, support that is more direct.

In particular, a hydrogen economy has the potential to cut emissions in[17]:

- long distance transport (shipping, aviation, longhaul tucks, non-electric rail)
- iron and steel production
- ammonia production
- exportable energy

Recommendations:

- Restore the funding to ARENA that was wastefully diverted to the CSF, and increase it further.

4. International Context

4.1. International Units

In principle, the use of international units to meet Australia's emission reduction targets seems reasonable – greenhouse gas emissions reduced in any part of the world are a valid contribution to the global emissions task we face. These international units could be generated by a variety of activities, such as renewable energy efficiency programs; methane or natural gas recovery; or sequestration on land through afforestation or reafforestation; or sequestration of blue carbon in aquatic systems such as mangroves or sea grass if such are available in an international scheme.

While in some cases it may be cost-effective to offset emissions in Australia by purchase of international units, we have concerns about the validity of the trading schemes, particularly the additionality, compliance and longevity of carbon farming. As we note in

17 https://www.g20karuizawa.go.jp/assets/pdf/The%20future%20of%20Hydrogen.pdf

above, the carbon market in Australia is heavily exposed to biological sequestration, particularly low upfront cost forest regeneration projects[18] – with this as standard practice in Australia, it is unlikely that many truly transformative projects are being adopted as a result of international market trading.

International units may also be derived from afforestation, reforestation or an avoidance of deforestation, all of which are difficult to satisfactorily determine. In a poorly designed scheme, or a fraudulently administered one, we may actually see a negative impact: for example, if Brazil clears its rainforests now, will it become eligible to sell units for reafforestation in the future, thus profiting from release of carbon?

We therefore urge the need for extreme rigor in assessing these aspects before allowing the purchase of international units to become part of our response to reducing emissions. We further note that, for well-administered schemes, we can expect in future the price of such units to rise, as the low hanging fruit is taken up by others.

Finally, we believe that Australia should be rigorous in searching out abatement measures at home and ensuring that international units do not "let us off the hook"' by avoiding or postponing reductions we can make ourselves.

Recommendations:

- Reject purchase of international units, unless rigorous analysis shows they adequately address additionality, compliance and longevity concerns, especially in vegetation projects.

4.2. Carryover Credits from Earlier Periods

We submit unequivocally that Australia should retire all carry-over credits from the Kyoto Protocol. Not one gram of CO2 or other greenhouse gas will be saved by relying on this accounting method when we need to make real reductions urgently. Yet currently the government plans to claim about 370 million tonnes of carbon-dioxide equivalent by this method.

Australia's special treatment in the first phase of the Kyoto Protocol meant that exceeding our targets was possible on paper, even while our emissions have continued to rise since 2013.

Countries such as New Zealand, Britain, Germany, Sweden, Denmark, the Netherlands, France and the EU as a whole have ruled out relying on such carryover credits. We find it morally reprehensible that Australia should instead align itself with Russia and the Ukraine in "gaming the system". By insisting upon claiming these credits to make its (already weak) reductions target, Australia not only fails to make the contribution that we owe, as one of the highest per capita emission producers in the world; we set an example that undermines the whole Paris agreement as others are encouraged to follow suit.

18 https://research.csiro.au/digiscape/evolving-australian-carbon-markets/

Recommendations:

- Retire all carry-over credits from the Kyoto Protocol.

4.3. Australia's Relationships with its Pacific Neighbours

While we acknowledge that this is a political issue rather than a technical one, we are concerned that Australia's standing in the Pacific is reduced by its failure to plan for a transition from coal, both as a domestic power source and as an export industry.

A loss of credibility in the Pacific, where island nations face an existential threat from rising sea levels, has negative strategic implications for Australia.

Recommendations:

- Accelerate our emissions reduction so that we lead in our region and amongst developed nations.

Appendix on Electric Vehicles

Uptake Forecasts

The AEMO's Integrated System Plan (July 2018) foresees little relevance of EVs in its 20 year horizon[19]. Yet between September 2017 and March 2018 the AEMO had doubled its prediction of EV uptake, reaching up to 30TWh/y of demand – 15% of current grid demand - by 2038[20].

Given the rapid pace of technological advance and the repeated failure of forecasters to appreciate it, even this upper limit foreseen by AEMO is likely too conservative.

Illustration 1 shows ARENA's 2018 forecast under three intervention scenarios[21].

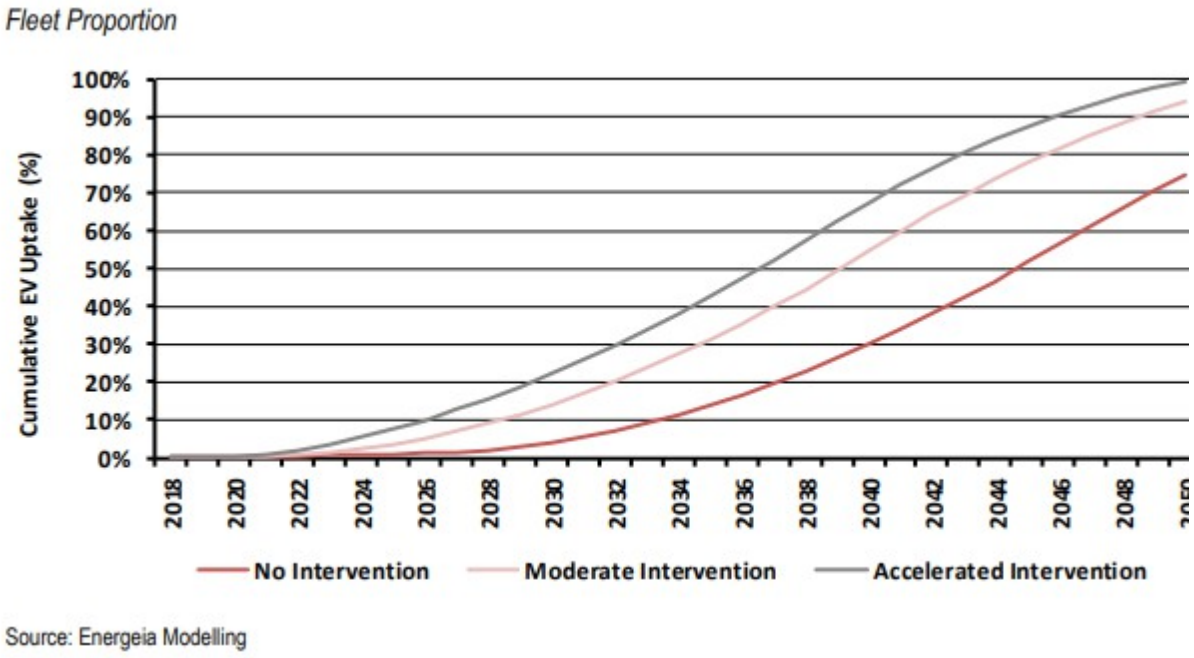


Illustration 1: ARENA's EV uptake forecast scenarios

The Moderate Intervention scenario reaches 50% penetration in 2039, also around 25-30TWh/y. However, it is underpinned by an estimate that 28% of new sales would be BEV/PHEV in 2026. That looks conservative in view of Illustration 2 and 3 on page 8.

Demand Profile

Photovoltaic solar power has become the cheapest option for new electricity generation[22], with its lead predicted to grow for decades yet, undercutting not only new but even incumbent coal and gas generators[23]. Its main limitation, of course, is its daily output profile. While storage can help match demand, that adds to the cost.

19 https://www.aemo.com.au/-/media/Files/Electricity/NEM/Planning_and_Forecasting/ISP/2018/Integrated-System-Plan-2018_final.pdf
20 https://reneweconomy.com.au/aemo-just-doubled-forecast-ev-uptake-australia-66789/
21 https://arena.gov.au/assets/2018/06/australian-ev-market-study-report.pdf
22 https://reneweconomy.com.au/csiro-aemo-study-says-wind-solar-and-storage-clearly-cheaper-than-coal-45724/
23 https://about.bnef.com/new-energy-outlook/

A key question is how EVs may affect the demand profile. The simplest way to recharge a private EV is overnight, while it is garaged at home, but that would exacerbate the profile mismatch.

Charging rate

An important part of the equation is the speed at which EVs can be recharged[24]. Three broad levels of charging technology exist.

Level	Volts	kW	Charge rate[25], km/h	Effective speed[26], km/h	Charger cost, AUD	Added vehicle price, AUD
1	120/240 AC	1.4	7 to 14	7 to 12	-	-
2	240 AC	3.3 to 6.6	18 to 50	15 to 33	1,300[27]	-
3	500 DC	50-150	200 to 400	66 to 80	25,000-50,000	1000

Table 1: EV charging technologies

For journeys so long as to require a full recharge along the way, level 3 is the only realistic option. But for daily commutes of up to 100km round-trip, level 2 affords an off-road full recharge in under 6 hours. That fits well with PV supply peaking 9am-3pm.

For Australia in 2016, private vehicles drove 133bn km in urban trips, 75% of their total mileage[28].

Commuting

For those commuting entirely by public transport, the car can be left at home Monday to Friday, where it can recharge during peak PV output – from their own rooftop or via the grid.

For those needing to drive, either to reach public transport or all the way to their place of work, the challenge is to enable recharging while the car is parked. This could be done with level 2 charge points throughout the carpark, using grid power at off-peak rate (since PV will make daytime power cheap), optionally supplemented by solar panels on the roof of the carpark or on neighbouring office blocks.

Most Australian commuters travel less than 20km to work; the average is 16km[29]. The electricity used for the round trip would be around 6kWh. With PV bringing grid power during the day down to 10¢/kWh retail, each car would be refuelled for 60¢ a day. A further 40¢ would cover the investment in the charging unit. This cost could be rolled into the all-day parking fee.

Grid firmness

24 https://www.evse.com.au/difference-between-levels-of-chargers
25 Range added per unit of time spent charging
26 Assumes long journey, driving speed of 100kph, finishing with same charge as starting. Computed as (charge rate x drive speed)/(charge rate + drive speed)
27 https://www.ohmhomenow.com/electric-vehicles/ev-charging-station-cost/
28 http://www.abs.gov.au/ausstats/Subscriber.nsf/LookupAttach/9208.0Data+Cubes-22.03.171/$File/92080DO001_1231201610.xls
29 http://www.abs.gov.au/ausstats/abs@.nsf/Lookup/by%20Subject/2071.0.55.001~2016~Main%20Features~Commuting%20Distance%20for%20Australia~1

In the normal course of market operation, cheap PV generation displaces conventional baseload - coal and gas. But a grid dominated by such renewables is less able to cope with network failures; if an interconnector trips, PV and wind do not naturally ramp up to cope. Large turbines can use their inertia ("synchronicity") to supply a little more.

As a result, SA introduced a cap on renewables supply to ensure enough gas powered plant was operational too. This is already leading to some curtailment of PV and wind[30].

This problem is being addressed by equipping grid-scale renewables with "synchronous condensers" (essentially flywheels), but this adds somewhat to the cost[31].

"Smart" EV charging can help to solve this. The charging infrastructure could respond to signals from the network and instantly cut demand on request[32]. Thus, the presence of a significant demand for EV charging allows a greater fraction of *other* demand to be met by renewables.

The NEM rewards Frequency Control and Ancillary Services (FCAS) that help to stabilise the grid. The level of reward is based on the FCAS supplied by traditional synchronous generators. A higher reward is appropriate for the lightning response that batteries and Demand Response (DR) offer[33,34]. A carpark could earn revenue merely by backing off demand.

Domestic charging could do likewise, but the charging units might be less sophisticated, or the householder insufficiently motivated to enable the feature.

EV2G can go further, feeding back into the grid temporarily.

Electric Vehicle to Grid (EV2G)

Potentially, electric vehicles can also provide a distributed storage service to the grid, providing an income to the vehicle owner and allowing a greater penetration of renewable energy into the grid. While there are technical difficulties for the car battery and the network, and contractual difficulties for the driver and the power retailer, it is becoming a reality[35].

At this stage, the only recommendation we can make is to plan ahead for how to take advantage of this technology as and when it develops.

Lifetime Cost of EVs

At the lower end of today's market, EVs can cost more than double the equivalent Internal Combustion Engine (ICE) car in Australia. Table 2 compares vehicles of similar niche from the same manufacturer, but ignores maintenance costs[36].

Make and model	*Renault Clio Zen*	*Renault Zoe Life*
Engine	ICE	EV

30 https://reneweconomy.com.au/wind-and-solar-curtailment-jumps-as-renewables-reach-record-levels-76368/
31 https://reneweconomy.com.au/siemens-to-deliver-australias-first-solar-farm-synchronous-condenser-29609/
32 https://cleantechnica.com/2018/02/24/current-ev-charging-equipment-market-innovation-trends-part-2/
33 https://reneweconomy.com.au/inside-the-tesla-big-battery-how-it-made-money-and-cut-prices-15167/
34 https://www.smh.com.au/business/the-economy/tesla-claims-it-s-being-shortchanged-for-providing-power-too-quickly-20180321-p4z5hw.html
35 https://thedriven.io/2018/10/24/nissan-says-new-leaf-will-be-both-a-car-and-a-power-station/
36 Mostly, EVs require less maintenance, but at present that is outweighed by the cost of battery replacement.

Make and model	*Renault Clio Zen*	*Renault Zoe Life*
Price (Aus)	$20,000	$48,000
Fuel for 100km	6.6L	10kWh
Fuel price	$1.30/L	~14c/kWh
$/100km	$8.70	$1.40

Table 2: Example comparison of ICE and EV costs

Even at a zero discount rate, the price difference of $28,000 would only be recovered after 380,000km - more than 20 years of average driving. The battery would need replacing in about ten.

The high price owes most to the lithium and cobalt content of the batteries, raising the concern that increasing demand will push the price higher. But that has not stopped the battery price falling 70% from 2010 to 2017, and the technology race is far from over.

EVs are predicted to be cheaper to buy than ICE by 2025[37,38].

Illustration 2 combines several analyses from 2015-2017[39].

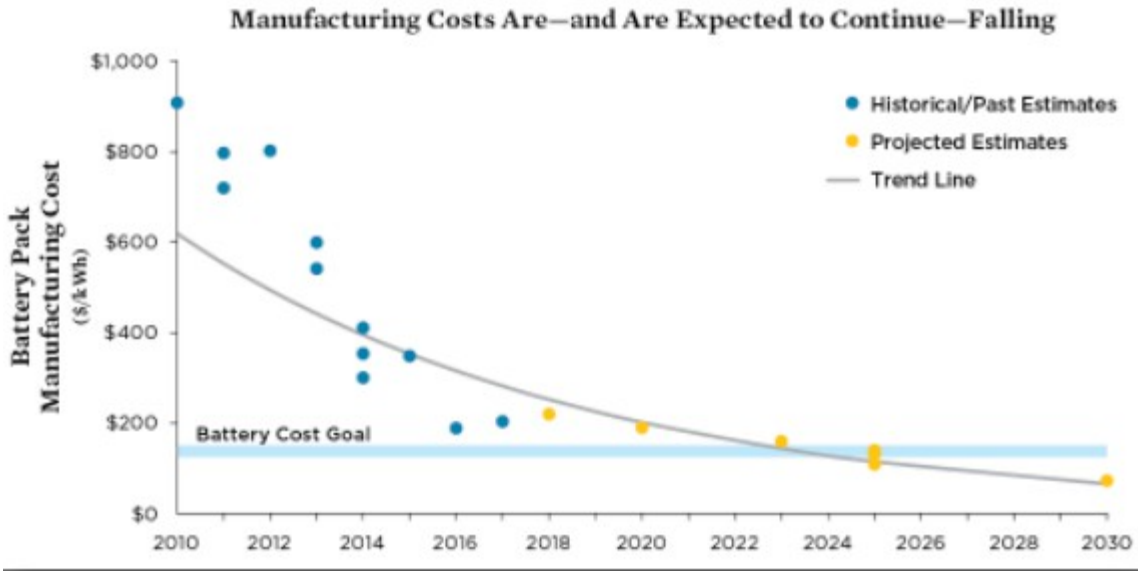


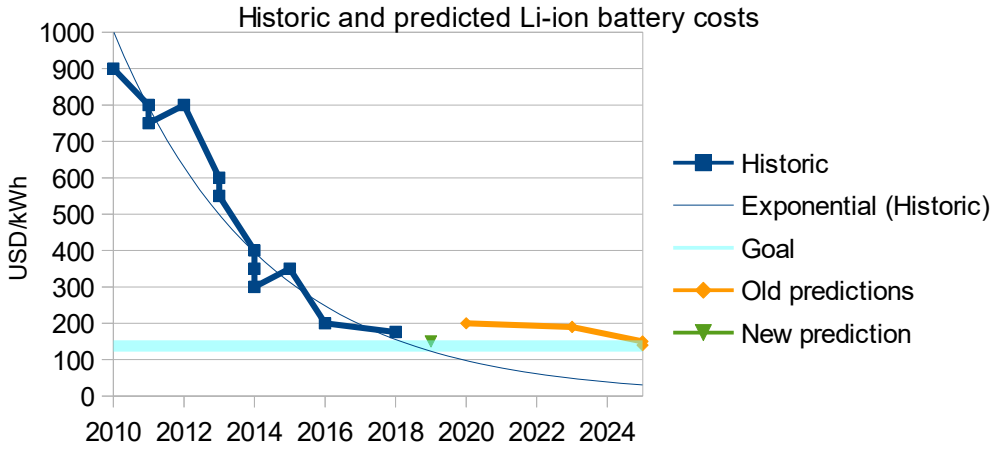
Illustration 2: Historic and predicted battery costs. "Goal" is car lifetime cost parity.

But that is already out of date. By end of 2018, EV battery production costs had fallen under USD180/kWh and are predicted to beat USD150 in 2019[40]. Moreover, the trend line in Illustration 2 is not a good fit to the historical data.

Including the new data and applying a negative exponential fit produces Illustration 3.

37 https://www.ucsusa.org/clean-vehicles/electric-vehicles/electric-cars-battery-life-materials-cost
38 https://arena.gov.au/assets/2018/06/australian-ev-market-study-report.pdf
39 https://www.ucsusa.org/sites/default/files/attach/2017/09/cv-factsheets-ev-incentives.pdf
40 https://about.bnef.com/blog/transition-energy-transport-10-predictions-2019/

Illustration 3: Historical and projected EV battery costs as at Jan 2019



This implies lifetime cost parity will be achieved around 2020, opening the floodgates for a transition to EVs. BITRE (August 2019) predicts that 50% of new cars in Australia will be electric in 2035[41]. At an average annual replacement of 10%, the curve implies 26% fleet penetration. But without suitable planning now, there may be a shortage of charging infrastructure, a mismatch with electricity generation, and an incumbent fleet of still-new ICE vehicles of rapidly declining value.

Range Anxiety

While this submission centres on urban driving, drivers will not want to need an ICE or hybrid on hand for longer journeys, or to have to rent one for the occasion. Even for a driver who never undertakes such, it would be a psychological barrier. A fast-charging highway network will also be needed.

Within urban areas, while EV charge points remain rarer than conventional fuel stations, mobile apps showing nearby points will be essential. These are starting to appear[42].

Location, location

Since the primary location of the electricity demand for EVs will be in the cities and suburbs, that may be the optimal place to produce the extra power. If EV adoption lags the general shift to renewables, the resulting balance between grid-scale and suburban rooftop PV may be suboptimal. This suggests benefits of a continuing SRES scheme.

Matching Demand to Supply

1. Time of Day

   Scenarios that recharge EVs from grid power reach optimum when the growth of PV has reclassified the 9am-3pm[43] period (10am-4pm in summer) as off-peak.

2. Volume

   Australian electricity consumption is 260TWh/y[44], and that of petrol and Diesel

41 https://www.bitre.gov.au/publications/2019/files/bitre-report-151.pdf
42 https://www.theverge.com/2018/10/16/17983986/google-maps-electric-car-charging-tesla-superchargers
43 Increased interconnectivity may extend this, with SA, WA supplying PV into the Eastern evening.
44 https://www.energy.gov.au/sites/default/files/australian_energy_update_2018.pdf#page27

vehicles is 32GL/y[45]. At the 10kWh/6.6L equivalence in Table 2, full conversion to electric[46] of today's transport would add 48TWh/y[47] to demand, about 20%.

At average output of 4kWh per nominal kW PV per day, that is 33GW of PV panels; we are at 10GW now[48].

3. Trajectory

   While market forces will eventually bring these changes about, the adoption of EVs will likely lag behind. Until that catches up, PV generation risks being curtailed for lack of midday demand. This will in turn delay the roll-out of PV.

4. Potential Emissions Savings

   Electrifying the bulk of transport, and that mostly recharged from PV, Australia's emissions would fall by 80MtCO2e/y, about 14%.

Maintaining PV momentum through EV growth

The present roll-out of PV in Australia is about 3.5GW/y[49]. After Liddell's retirement in 2023 (2GW), no further coal power plants in the NEM are planned to retire before 2035[50].

With no increased demand for power, the rapid growth of PV is unlikely to continue beyond another few years. To maintain momentum, it would be good to have at least 1GW/y demand for EVs by 2023. That implies 3% of the road fleet.

The average age of a car on Australian roads is ten years[51]. Thus, ideally, 30% of new cars should be electric by 2023.

How much incentive will be required depends on the rate of decline in battery costs. Illustration 1 Implies substantial incentives will be required, Illustration 2 suggests modest intervention, while Illustration 3 implies none at all, beyond removal of the various other barriers.

More Total Demand, lower Power Prices

The growth of domestic PV has cut demand. In the fixed tariff that most consumers use, a large portion of the per-kWh charge actually funds the network. The reduced demand is forcing up the prices as the grid cost gets shared across a declining energy demand[52].

Adding a significant electricity demand for EVs will help sustain total demand and hold power prices down. California[53] has found that state-funded EV chargers have had a net economic benefit for the wider public.

Road Funding

Currently, EVs avoid the fuel excise. Much is made of the contribution of fuel excise

45 http://www.abs.gov.au/ausstats/abs@.nsf/mf/9208.0/
46 Which may include shifting some from road to rail
47 This makes no allowance for transport growth
48 https://reneweconomy.com.au/seven-australian-solar-facts-to-make-your-jaw-drop-30669/
49 https://reneweconomy.com.au/booming-solar-market-triples-in-2018-set-to-deliver-hazelwood-liddell-by-2020-2020/
50 https://www.aph.gov.au/Parliamentary_Business/Committees/Senate/Environment_and_Communications/Coal_fired_power_stations/Final%20Report/c02
51 https://www.caradvice.com.au/574207/australia-average-vehicle-age-is-10-1-years/
52 https://reneweconomy.com.au/rooftop-solar-takes-another-big-bite-out-of-origin-electricity-sales-31732
53 https://cleantechnica.com/2019/02/01/utility-funded-ev-charging-networks-benefit-all-rate-payers/

to road maintenance, but since over 90% of road damage results from HGVs this should really be considered just another source of government revenue. A continuing excise on petrol and Diesel, but not on road use by EVs, is easily justified by the direct health harms from noxious gases and particulates. Road maintenance should either be considered a public good or mostly funded from use by buses and trucks (which would incidentally create a level playing field for railways).

Glossary

AEMC	Australian Energy Market Commission	Sets the rules for the NEM, *inter alia*
AEMO	Australian Electricity Market Operator	Operates both the NEM and its WA equivalent
ARENA	Australian Renewable Energy Agency	
BITRE	Bureau of Infrastructure, Transport and Regional Economics	
BEV	Battery Electric Vehicle	i.e. Pure electric, no ICE
CCA	Climate Change Authority	
CEFC	Clean Energy Finance Corporation	
CER	Clean Energy Regulator	
CFI	Carbon Farming Initiative	Subsumed under Climate Solutions Fund
CSF	Climate Solutions Fund	
DR	Demand Response	An arrangement whereby electricity consumers can be rewarded for cutting demand at critical times.
ERF	Emissions Reduction Fund	Subsumed under Climate Solutions Fund
EV	Electric Vehicle	(in this document, BEV unless otherwise stated)
EV2G	EV to Grid	Using the battery of a parked EV as a source of power to the grid
FCAS	Frequency Control Ancillary Services	Some of the stabilising services that generators and storage can supply to the grid
GL, GJ, GW, GWh	Giga-litre, -joule, -watt, -watt-hour	= 1,000 ML, MJ, MW, MWh
ICE	Internal Combustion Engine	Burns ULP, Diesel or LPG
LRET	Large scale Renewable Energy Target	Requires a proportion of power generated to be from large scale renewables
MJ	Megajoule	1kWh=3.6MJ
ML	Megalitre	= 1,000,000 Litres
MW, MWh	Mega-watt, -watt-hour	= 1,000 kW, kWh
NEM	National Electricity Market	The wholesale spot market for electric power that connects all states and territories except WA and NT
PHEV	Plug-in Hybrid EV	Can operate as either ICE or BEV
PV	Photovoltaic	
SRES	Small scale Renewable Energy Scheme	Subsidises small scale renewables, e.g. PV installations up to 100kW
TJ, TW, TWh	Tera-joule, -watt, -watt-hour	= 1,000 GJ, GW, GWh

Cosignatories

The following organisations also endorse this submission

Sutherland Shire Environment Centre

Climate Action Monaro

Lithgow Environment Group Inc.

Climate Action Burwood-Canada Bay