CLEAN ENERGY ROADMAP

INVESTING IN A SAFE CLIMATE FUTURE

The Greens' plan for getting to 100 per cent renewable energy

We're in a climate emergency and need to do more to encourage clean energy investment in Australia. While the old parties wax and wane on tackling global warming, pollution pricing and clean energy, the Greens have a plan to stand strong for a 100% renewable Australia.

The Greens helped build the foundations of the clean energy economy in Australia with the Clean Energy Act. Charging big companies to pollute, investing the money in clean energy and helping Australians save energy at home is working: energy pollution is down more than 7% already.

But we're in a climate emergency, and the old parties are still propping up fossil fuel companies with subsidies, Future Fund investments, and plans to massively expand coal exports.

The Greens know we need to do more to encourage clean energy investment in Australia. That means stability, certainty, and long-term vision.

The Greens support 100% renewable energy as quickly as we can achieve it. To get there, the Greens' Clean Energy Roadmap will:

- Increase the Renewable Energy Target (RET) to 90% by 2030. This will give investors and electricity network regulators the long-term policy certainty they need.
- Increase Clean Energy Finance Corporation (CEFC) funding to $30 billion over ten years, providing an injection of $3 billion per year, to drive commercialisation of emerging technology and help Australia catch-up with leading renewable energy nations.
- Improve national electricity transmission planning to cost effectively exploit our huge renewable energy resources.

IT'S POSSIBLE TODAY

Landmark research by the Australian Energy Market Operator (AEMO), as well as independent academics, has clearly shown that a clean energy Australia is possible. We can power Australia with the wind, sun, and water for a cost similar to replacing the ageing coal and gas plants that are nearing the end of their lives. Renewable energy is getting cheaper, while gas and coal plants will face increasing carbon pollutions costs.

It's better for the climate, our air and water, our health – and jobs. Renewables employ more people per unit of energy than polluting fossil fuels.

LONG-TERM VISION FOR CLEAN ENERGY

The RET needs to be extended, expanded and secured until we have 100% renewable energy in Australia.

Only the Greens have a plan to make Australia the best place in the world to build clean energy, by increasing the RET to 90% by 2030.

The RET is a successful, tripartisan policy that provides investment certainty and is helping investors build wind, solar and more. But it runs out in 2020, and Tony Abbott's Coalition has spent months pretending to support it while sending MPs out to extreme anti-wind rallies.

DRIVING THE TRANSFORMATION

The CEFC is a world-leading, independent group of experts tasked with commercialising emerging clean energy to benefit all Australians. The Greens have built the foundations by creating the CEFC, and it will start its investments on July 1 this year, building solar plants, wind farms and investing in energy efficiency in manufacturing.

But we need to take the next steps, or our pollution cuts won't be enough to avert the worst impacts of global warming.

That's why we plan to increase CEFC to $3 billion per year, for the next ten years. An overall investment of $30 billion for a cleaner future.

Printed and authorised by Senator Christine Milne, Parliament House Canberra ACT 2600.

PLANNING FOR 100% CLEAN ENERGY

Australia also needs to plan and roll-out an electricity transmission system that opens up massive investment and job opportunities in new areas with abundant sun, wind or geothermal resources. To build the right transmission links in the right place at the right time and at the right scale, the Greens will make the AEMO as a single, independent planning agency to administer a national transmission planning and reliability framework.

> OTHER PARTIES

Labor has never said no to a coal mine expansion or coal seam gas project, and plans to massively increase coal exports transported through the Great Barrier Reef, as does the Coalition. They also give billions of dollars each year to big mining companies to find and burn more fossil fuels; this tilts the field against clean energy and a safe climate.

Labor has no plan to increase the RET beyond 2020, which saps certainty from clean energy investors.

Tony Abbott and Greg Hunt claim to support the RET, but their MPs and advisers have called wind power a 'fraud' and called for the end of the RET at extreme anti-wind power rallies.

Mr Abbott has not answered the crucial question: will his government support the current RET for 41,000 GWh of clean energy by 2020?

Mr Abbott's Coalition has also stated it wants to abolish the CEFC and dishonour the contracts it signs with investors. This creates uncertainty for clean energy investors and will ensure a future switch to clean energy will be more expensive.

Only the Greens have a plan to make sure we make Australia the best place in the world to build clean energy.

> KEY POINTS OF THE GREENS' PLAN

1) We are in a global warming emergency. If we are a society that cares about leaving a safe climate for our children, and if Australia is to contribute fairly to the global challenge of limiting global warming to less than 2˚C, our electricity sector emissions must ultimately fall to zero.

2) The cheapest way to "decarbonize" the electricity sector is to plan the transition early and build the right energy infrastructure in the right place at the right time. The objective is to avoid wasting time and money on investments that don't adequately address climate change.

3) The debate is over, renewable energy is reliable. The argument that renewable energy is 'intermittent' and therefore unreliable has always been a gross over-simplification peddled by those with a vested interest in slowing renewable energy investment.

4) Carbon pricing is an essential long-term policy, but it is in Australia's interest to make strategic decisions about our energy future *now*. If we wait for carbon prices to be high enough to drive investment away from coal and gas to renewables, we risk investing in generation and transmission assets that become increasingly uncompetitive, and under-investing in renewable energy. Eventually, as carbon prices rise the emissions trading scheme will displace the RET as the driver of renewable energy investment, but in the meantime it is in the national interest to have a 90% renewable energy target for 2030.

5) According to a recently published analysis by the AEMO, relying on 100% renewable energy is technically achievable. It can be achieved with a range of technologies in myriad ways. Other academic studies have reached the same conclusion.

6) Achieving 100% renewable energy by 2030 is projected to increase electricity prices by an amount similar to business as usual if there is at least some global action on climate change. A 90% RET by 2030 is a technically easier stepping stone on the path to 100% renewables.

7) The CEFC seeks to overcome the range of financial barriers to commercialising and deploying cleaner energy technologies. If we are to roll out renewable energy fast, the CEFC needs the capacity for greater investment. The Greens will increase the guaranteed funding for the CEFC from $10 billion over five years to $30 billion over ten. This would increase spending from an average of $2 billion each year, to $3 billion each year.

8) To improve the coordination and planning of grid infrastructure, the Greens believe that the AEMO should be established as a single, independent planning agency to administer a national transmission planning and reliability framework.

9) The budgetary impact of the Greens' plan to extend and increase the finance mandate of the CEFC will be based on the same accounting principles applied by the Treasury and the Department of Finance and Deregulation: *If an entity in the general government sector is undertaking investments to achieve a return, then they do not impact on the budget bottom line.*

> WE NEED RENEWABLE ENERGY URGENTLY

We are in a climate emergency and the world needs to decarbonise very quickly. As was recently reiterated by the Climate Commission, if we are to retain a 75% chance of constraining warming to 2˚C, (in itself a dangerously high temperature increase), then globally we can emit no more than 1,000 billion tonnes of CO2 between 2000 and 2050. In the first 13 years, which is 26% of the period, we've already used up nearly 40% of that "global budget". If we continue at this rate, and that seems pretty certain until at least 2020, then our allowable emissions budget will have been depleted by 2028.

If we are a society that cares about leaving a safe climate for our children, and if Australia is to contribute fairly to the global challenge of limiting global warming to less than 2˚C, our long-term carbon budget is going to be tight and emissions from the electricity sector must ultimately fall to zero. Nuclear energy is too dangerous and too slow to build, carbon capture and storage is not ready and very unlikely to ever prove cost-competitive. A 100% reliance on renewable energy is therefore necessary and inevitable, it is just a question of when.

> THE DEBATE IS OVER, RENEWABLE ENERGY IS RELIABLE

The argument that renewable energy is 'intermittent' and therefore unreliable has always been a gross over-simplification peddled by those with a vested interest in slowing investment renewable energy. Some types of renewable energy have variable output, such as solar PV and wind, but many others such as hydro, geothermal, biomass and solar thermal with storage can be dispatched reliably.

The AEMO's draft report on achieving 100% renewable energy shows that by using a range of renewable energy options Australia can maintain existing electricity supply reliability standards.[1] Similar results have been published in the peer-reviewed journal Energy Policy by a research group at University of New South Wales.[2]

> THE RENEWABLE ENERGY TARGET IS AN ESSENTIAL COMPLEMENT TO CARBON PRICING

The RET is an essential complementary policy supporting carbon pricing. The fact that we still have tri-partisan support for the policy (although there is a risk the Coalition will reduce the target) is an implicit acknowledgement by all political parties that the existing carbon pricing mechanism is in its formative stages and not yet driving the desirable level of investment in renewable energy. It is worth noting that many nations are still making greater progress with energy efficiency and renewable energy policies than they are with carbon pricing.

While the rest of the world prevaricates about appropriate emission targets we can get on with the job of transitioning efficiently to renewable energy. In the longer term, once global carbon prices have started to rise, the unnecessary compensation to coal-fired power stations has run its course and the necessary transmission links have been built, renewables will become the cheapest way of generating electricity. As carbon prices rise the cost of complying with the RET laws will fall, ultimately to zero.

> OVERCOMING BARRIERS TO COMMERCIALISING EMERGING TECHNOLOGIES

The Greens are proud of their role in establishing the CEFC, which seeks to overcome financial barriers to commercialising and deploying cleaner energy technologies. These include the current global financial conditions, the complex nature of Australia's electricity markets, the high up-front cost of renewable energy, the preference of investment institutions for listed assets and a limited track record of returns in Australia. The creation of the CEFC recognises that the private sector needs encouragement if it is to invest at the levels required.

The CEFC as it is legislated, with funding of $10 billion over five years, is a very good start. However, a 90% renewable energy target for 2030 justifies greater funding.

To support the higher 2030 RET the Greens will increase the guaranteed funding for the CEFC from $10 billion over five years to $30 billion over ten. This would increase spending from an average of $2 billion each year, to $3 billion each year.

The CEFC Act requires at least half of the expenditure, that is $15 billion under the Greens' plan, to be directed towards supporting renewable energy. This level of funding is still small compared to the total level of investment required to achieve high levels of renewable energy. Even with an extended mandate the CEFC would not be competing with traditional lending institutions, and would retain its role of supporting emerging 'near to commercial' technologies.

[1] http://www.climatechange.gov.au/reducing-carbon/aemo-report-100-renewable-electricity-scenarios

[2] Elliston, B., MacGill, I. & Diesendorf, M. (2013) 'Least cost 100% renewable electricity scenarios in the Australian National Electricity Market', *Energy Policy*.

> BUILDING THE RIGHT INFRASTUCTURE, IN THE RIGHT PLACE, AT THE RIGHT TIME

It will be much cheaper to anticipate a 100% renewable future and build appropriately sized grid infrastructure to support it, than to continue with incremental additions to generation and grid capacity. For example, some of the scenarios in the AEMO 100% renewable energy study project significant geothermal generation in the Cooper Basin. It would be an expensive mistake to build a low capacity transmission line to any new renewable energy zone if ultimately a high capacity line proved desirable to exploit the full potential.

Other significant advantages of long-term planning include:

- Avoiding investment in non-renewable generators that would ultimately become stranded assets.
- Allowing time for the public sector institutions (including AEMO) that will be responsible for planning and regulating the transition to build required capacity. The AEMO's renewable study is just a first step and more detailed work is required.
- Allowing time for the firms that will construct and operate the generation and transmission infrastructure to build capacity to plan and compete effectively.

The AEMO should administer a national transmission planning and reliability framework. A national transmission system which can support high energy-flows between states will be crucial to maintain a secure electricity supply as renewable energy grows; for example, to transfer surplus power from states with lower demand, such as South Australia and Tasmania, when the wind is blowing or from solar power stations in Queensland and NSW on hot days.

In practice, the National Energy Market is a group of inter-linked state markets which the AEMO, Australian Energy Market Commission and the Productivity Commission have noted creates a potential bias against inter-connection between regions.

The Standing Council on Energy and Resources should direct the Australian Energy Market Commission to examine rule changes and other reforms required to establish the AEMO as a single, independent planning agency to administer a national transmission planning and reliability framework.

Currently, AEMO publishes a National Transmission Network Development Plan each year to support the development of nationally efficient transmission planning. This extends out about 25 years, however, AEMO constrains itself to only modelling the impact of "existing policies". Its analysis is also limited to cost-benefit analysis at the margin, which does not address transmission needs on timescales of two or more decades. In the future AEMO's planning should include a range of high penetration renewable energy scenarios, up to and including 100%, and address strategies that span decades.

The Clean Energy Finance Corporation

The CEFC's investment objectives are to catalyse and leverage an increased flow of funds for the commercialisation and deployment of Australian-based renewable energy, low emissions and energy efficiency technologies, thus preparing and positioning the Australian economy and industry for a carbon constrained world.

It is an independent statutory authority with a board comprised of experts in areas such as banking, finance, economics and energy markets to ensure a robust and rigorous organisation.

When making its investment decisions it will apply a commercial filter, applying private sector skills and disciplines to investment selection. Having a public policy purpose, the corporation has different financial risk and return requirements and when making investment decisions will take into account any positive externalities, such as improved health due to less air pollution. For a given financial return, it may take on higher risk and, for a given level of risk, due to positive externalities, may accept a lower financial return.

The CEFC has an investment mandate which requires it to focus on projects beyond the research and development stage, that have a positive rate of return and that have the capacity to repay capital. This approach will ensure the corporation invests responsibly and manages risk to achieve a targeted rate of return and ultimately be financially self-sufficient.

> IF IT'S NO MORE EXPENSIVE THAN BUSINESS-AS-USUAL, WHY WAIT ANY LONGER?

Two studies indicate that reaching 100% renewable energy by 2030 would increase electricity prices by an amount similar to business as usual, assuming there is at least some global action on climate change. While renewable energy is relatively expensive now, the cost is falling, and at the same time carbon pricing will increase the cost of electricity from coal and gas-fired power stations.

a) The AEMO 100% renewable energy study

While the AEMO 100% renewable energy study estimates potential increases in wholesale electricity prices, it fails to analyse the increased costs of a business-as-usual scenario addressing climate change as a comparison. Other studies, however, have made such projections. In the graph below it is apparent that wholesale electricity prices projected by AEMO for renewable energy are similar to projections published by Treasury and only slightly above CSIRO projections for electricity prices if we are to reduce carbon pollution.

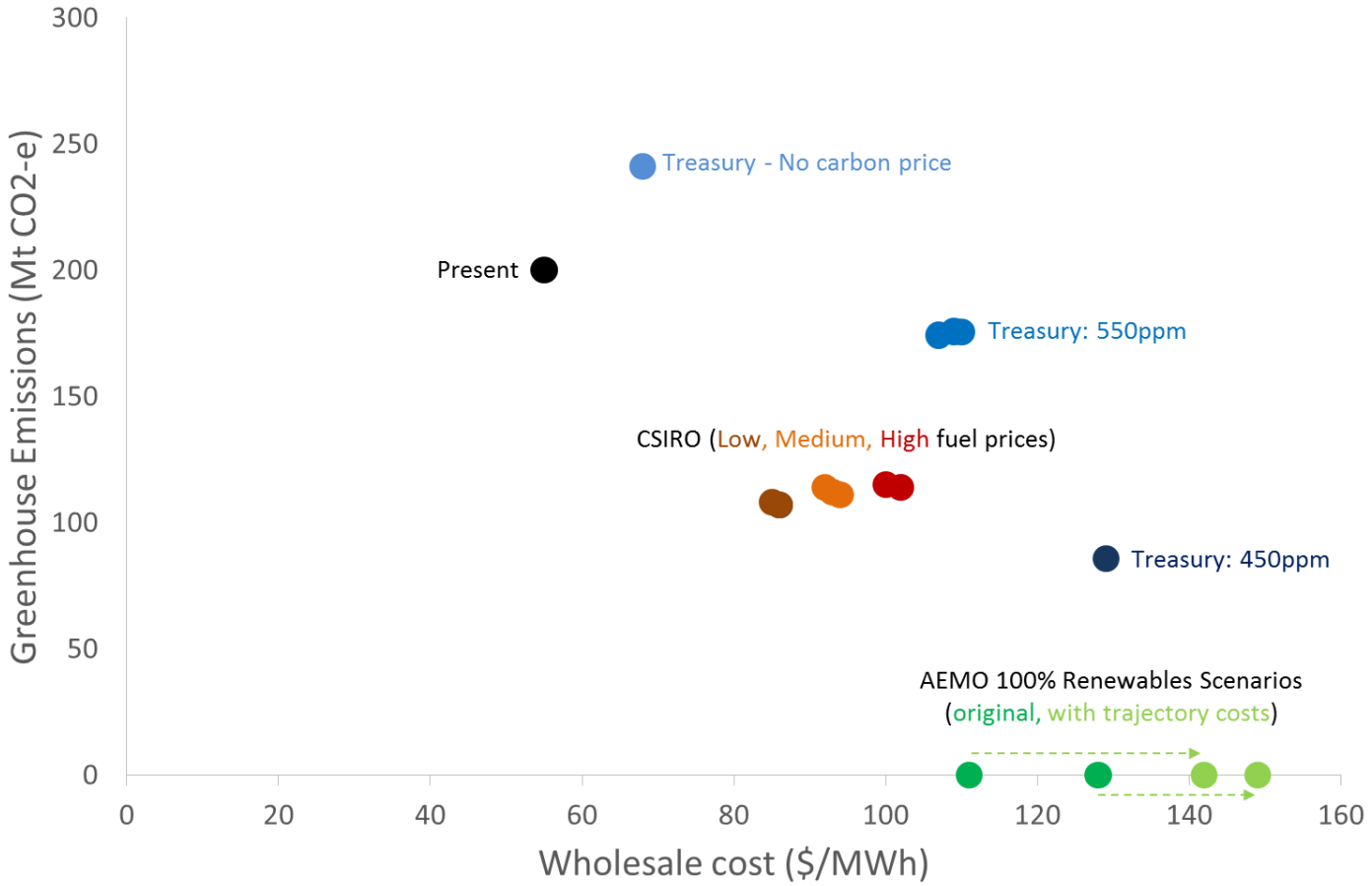
Regardless of the scenario, it is apparent that the 100% renewable energy scenario is unlikely to add substantially to electricity prices, while bringing substantial benefits associated with a much higher reliance on renewable energy.

The graph was produced by Riesz *et al*[3] from the Centre for Energy and Environmental Markets at the University of NSW. It compares the projected wholesale electricity prices for the year 2030 from a range of studies.

In reading this graph, note that $100/MWh is equivalent to 10c/kWh. For example, the graph shows the present wholesale cost of electricity to be around $50/MWh, which is the same as 5c/kWh. The average current residential retail rates are generally in the range 25–30c/kWh.

Riesz *et al* note that the largest source of error in the AEMO study was that capital costs were based entirely on 2030 technology capital costs estimates, rather than the costs that would have occurred when the technology was actually built, progressively over successive years. Their study attempts to correct that simplification. In the graph the dark green points show the AEMO results and the light green points add the estimated 'trajectory costs'.

Even with the inclusion of the 'trajectory costs' that AEMO ignored, the increases in wholesale electricity prices for 2030 are only 1–2c/kWh higher than the price forecast by Treasury if the world takes action to constrain global warming to 2˚C.



For comparison, 1–2c/kWh is much less than electricity price increases in recent years and the 5.4c/kWh national average increases in retail costs forecast by the Australian Energy Market Commission for the period 2011–12 to 2014–15.

b) Independent analysis from the Centre for Energy and Environmental Markets at the University of New South Wales

A similar study by Ben Elliston et al[4] from the University of NSW, which compared the cost of supplying the National Electricity Market with 100% renewable electricity with a 'replacement' scenario where fossil-fuelled power stations in the National Electricity Market are replaced with modern fossil substitutes at projected 2030 costs, concluded:

> *At moderate carbon prices, which appear required to address climate change, 100% renewable electricity would be cheaper on an annual basis than the replacement scenario.*

Like the AEMO study, this simplifies the analysis by assuming that all investment occurs in 2030. It understates the cost of the renewables scenario because by 2030 costs are projected to have fallen more than the cost of their fossil fuel alternative. On the other hand, the study uses Treasury projections for carbon prices to meet a 550ppm target, which is a lax target if the internationally agreed objective of constraining global warming to 2˚C is to be achieved. More stringent targets, such as a concentration target of 450ppm, would result in significantly higher global carbon prices and improve the relative competitiveness of renewable energy.

These studies demonstrate that a 90% RET by 2030 is not only necessary but achievable and provides the clear pathway to 100% renewable energy soon.

> MODELLING THE BENEFITS

The modelling conducted by AEMO to date needs to be developed further, building upon the work it has already completed by analysing a wider range of the costs and benefits of renewable energy.

Benefits of renewable energy to be included in modelling:

- Reduced health costs due to less toxic air pollution (eg SOx, NOx and soot).
- The avoidance of future stranded generation assets.
- Improved energy security and reduced exposure to international gas prices.
- Greater levels of energy sector employment.
- Reduced water consumption by coal-fired generators.
- Updated assumptions about renewable energy costs (particularly regarding solar thermal costs) that are regarded as too high by industry experts. (It is worth noting that some renewable energy prices have dropped considerably since the Treasury modelling was undertaken two years ago).

Costs AEMO identified that should be further considered:

- ''Trajectory costs".
- Land costs, noting that most of the land that is needed for wind farms or the transmission grid can remain available for agriculture and other uses.
- Stranded assets, noting that even in the absence of emission mitigation policies, the age of existing generators means that by 2030 approximately 98% of the value of coal generators and 86% of gas generators will have been fully depreciated.

> BUDGET IMPACTS

The budgetary impact of the Greens' plan to extend and increase the finance mandate of the CEFC will be based on the same accounting principles applied by the Treasury and the Department of Finance and Deregulation when they costed the existing CEFC funding arrangements. As explained by the Department of Finance and Deregulation:[5]

> *If an entity in the general government sector is undertaking investments to achieve a return, then they do not impact on the budget bottom line according to the accounting standards. So the extent to which the Clean Energy Finance Corporation is undertaking investments, and that's the Government's policy, then the majority of its activities will not impact on the budget bottom line.*

[3] Dr Jenny Riesz, Ben Elliston, Assoc. Prof Iain MacGill, Assoc. Prof Mark Diesendorf (2013). Submission on 100 per cent Renewables Study – Draft Modelling Outcomes Report. Centre for Energy and Environmental Markets University of NSW.

[4] Elliston, B., MacGill, I. & Diesendorf, M. (2013) 'Least cost 100% renewable electricity scenarios in the Australian National Electricity Market', *Energy Policy*.

[5] Department of Finance and Deregulation Deputy Secretary Mr David Martine, Senate Estimate - Finance and Public Administration Legislation Committee, 18 October 2011.