The Sun is a harsh mistress: taking Australian energy advantage seriously

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I'm here today to challenge you, and myself, to get serious about building Australia's energy advantage.

There is a lot of talk about our energy future. Some is nonsense. Some is better informed, but kept far too soft and fuzzy to avoid hard conversations.

Today I want to avoid fuzziness as much as possible.

Australia has the potential to build a significant comparative advantage in low cost, highly scalable and clean energy from the wind and, especially, the sun.

That could translate into large economic benefits, supporting tremendous value creation by clean energy-intensive industries that meet the needs of a net zero emissions world.

But the Sun is a harsh mistress. If we want to build that advantage we need to work for it very, very hard.

We need to know our path and walk it.

We need to be a place where you can build big things and build them well.

And we need to make energy advantage our top priority.

If we don't do those things we will abandon advantage and ultimately lose our energy intensive industries.

Defining terms

Let's start by defining our terms. 'Energy advantage' is more than 'energy adequacy'.

Adequacy is when you can meet the energy needs of your economy and society cleanly, reliably and at a cost that is acceptable, even if it may be globally mediocre.

Advantage is when you can supply energy cleanly, scalably and cheaply enough by world standards to make staying in Australia a no-brainer for existing industries, and coming to Australia obvious to new energy intensive activities.

In Analect XVI Confucius says “Good government obtains, when those who are near are made happy, and those who are far off are attracted.” And that is a good test for an energy system too.

Should we go for energy advantage? It's a real question!

Energy adequacy would be enough for much of our economy. While many businesses are trade exposed, most are not energy intensive. What those low-intensity businesses need from energy is business continuity. While they will certainly notice if the cost of achieving that is high, they will spend management time on even higher priorities like their customers, suppliers, workplace relations and their banks.

Households would be annoyed if energy costs failed to fall, and social equity needs constant attention, yet life would go on.

Just maintaining energy adequacy will be a handful amidst a vast technological transition to high reliance on variable renewables. It is clearly doable, though not easy.

Achieving advantage will be even harder, as I’ll explore in a minute. There are two big reasons to go for it though.

First, without globally competitive energy costs we will struggle to hold on to energy intensive industries that are important to our economy and to national resilience and security. Steel, aluminium, chemicals and more would have no compelling reason to be here if we are at best indistinguishable on energy costs.

Second, if we can deliver globally competitive energy costs we can grow new globally significant industries. We could turn a high share of our iron ore output into green iron using green hydrogen, boosting the value of our exports while helping decarbonise our region. Hydrogen could be an input to other key products as well, particularly ammonia. And processing critical minerals could add both value and security to global supply chains.

We really need to find new economic strings to our bow given the strong expectation that our existing exports of coal and gas will decline over the next few decades as our trade partners go through the energy transitions they have pledged to pursue.

Of course we can use other tools to try to hang on to existing industries and attract new ones. The Future Made In Australia tax credits and other measures are an important incubator. However we will have a much easier task, at a much lower and shorter Budget cost, if we actually achieve energy advantage.

I think the case for pursuing advantage is strong. But of course there is a third possibility – 'energy failure', with high prices, high emissions, and low reliability. An Australia where crumbling coal power stations limp on, leaning on gas at ever higher fuel prices, where we can't get new transmission built to unlock renewables or keep an energy or climate policy for more than three years at a time.

Energy failure is absolutely possible. Nobody should be relaxed about it. But that's a topic for another speech. Today I'm focussing on where success lies and what it demands of us.

Pathways to advantage

There are a lot of energy resources and technologies that may be relevant to achieving energy adequacy. There are very few that are a plausible basis for energy advantage, however.

That is because energy advantage requires ultra-cheap power. Think of hydrogen electrolysis. In my beloved dodgy spreadsheet for the levelized cost of hydrogen, a lot of things have to go right to deliver the famous H2 under $2 per kilo. If electrolyser costs fall 80% while maximising their efficiency no matter how intermittently they run, what more do they need?

If they run half the time to match lightly firmed renewables, the hydrogen industry can afford to pay twenty dollars per megawatt hour. All-in!

If they run nearly all the time off a completely firm source, hydrogen electrolysis can stretch to paying thirty dollars a megawatt hour.

Maybe $2 per kilo isn't the be-all end-all. Maybe electrolyser costs can come down more than 80%. Maybe other efficiencies can be found. But dirt cheap power is clearly foundational. What can deliver that?

Wind and especially solar are plausible if we can build them big and well and dedicate them to industrial needs. They're relevant because both technologies have achieved incredible cost reductions with growing global deployment, and because Australia has a better combination of quality resources, large land area and low risk premium than most other places in the world. The world needs a lot of new megawatt hours to decarbonise, and Australian renewables *could* be among the

cheapest most scalable available to supply them. There are serious complications, which I will come to.

Other options are not likely to be relevant to energy advantage.

I was just referring to the industrial use of dedicated large scale renewables, where the end use pays the full underlying cost of providing that clean energy. Some people are instead excited about the potential industrial use of free excess energy that would otherwise be spilled by the grid. There is certainly scope to create big value with flexible demand. But the quantities of electricity required for a world-scale green iron or green ammonia sector are so large that they cannot possibly be supplied for free by generation that makes its real money off other demand. A transition-relevant superpower industry will have to pay what its power needs cost.

A similar story applies to distributed and consumer energy resources. Rooftop solar, embedded batteries in cars and buildings, smart appliances are all terrific if managed well. They're crucial to the future of our existing energy system. They are also never going to supply the volume of energy or the cost of services that truly ambitious green industries require.

Large scale energy storage is also great and different forms of it, including chemical batteries and thermal batteries, will be transformative for many industries. However the economics of green hydrogen require the absolute cheapest electricity going. The cost of any flexibility is going to be very carefully balanced against the cost of underutilised electrolysers.

Offshore wind has many people excited. I think it is going to be a transformative technology internationally, and it could be an important contributor to energy adequacy for non-energy intensive activities in Australia. The higher capacity factor and lower correlation of offshore wind have a significant system value. Nonetheless I do not think it can play much role in supporting those industries that need energy advantage, for two reasons.

- The less important reason is that offshore wind is significantly more expensive than onshore wind and solar. The absolute cost will decline with experience and innovation, as we have seen in Northern Europe despite the challenges of the last two years. The relative gap will remain substantial, though.
- The bigger reason is that *anybody with a coastline can build offshore wind*. Australia has no special advantage. If floating offshore wind fulfils its promise, which is very plausible, that is a great thing for the world and for nations like Japan that would move from energy scarcity to domestic security and abundance at a mediocre but manageable cost. France just held Europe's first floating offshore wind capacity auction and the winning bids averaged 86 Euro per megawatt hour, or about $135 Australian dollars. That's exciting! For

> Australia, though, that ramps up the pressure to deliver significantly lower electricity costs. If the customers we hope for have options at home that are very okay, we have to be *terrific*.

Nuclear energy also has some people excited. Sadly it is a similar story to offshore wind, only more so. Nuclear is very reliable, clean and safe. It already plays a role in energy adequacy in some countries and it will keep doing so.

The economics look very bad in Australia; capital costs are very high on paper, and they have been far higher than that in Western countries that hadn't built nuclear in a long time. At those prices, nuclear could not compete with renewables as cheap bulk energy or with gas peakers as cheap flexible backup capacity.

Now capital costs *might* fall far enough in future to make nuclear a relevant contender for energy adequacy, and particularly for the provision of the last five per cent or so of annual energy in a system that is mostly renewable. We should keep an open mind about that. The flat ban on nuclear electricity makes little sense. Equally, halting transmission deployment in the hope that future cheap nuclear will make it unnecessary would also make little sense.

In any case there is no prospect of Australian energy *advantage* in nuclear. If capital costs fall they will fall globally. We have no leg up. Our uranium mining is lovely but irrelevant, both because we don't process it into fuel and because fuel costs are a very minor part of the cost of nuclear. Japan can generate nuclear energy as cheaply as Australia, and most likely cheaper.

What about natural gas? Gas peakers are extremely useful as a source of backup because they are so cheap to build. They are high emissions and high cost when running, but if they rarely run they are a fine source of energy adequacy. Peakers are an insurance policy with low premiums and a high deductible. Their role will narrow as batteries improve and pumped hydro projects are finally completed, but gas backup looks likely to be with us for a long while yet.

The most energy intensive industries, though, will want the least reliance on gas peakers that they can possibly manage, for both cost and emissions reasons. The Federal Government is doing its best to keep a lid on gas prices with the Gas Code and openness to new supply, but the delivered cost of any new gas resources to customers in New South Wales and Victoria is going to be high by all historic standards except the great spike of 2022.

The situation is even worse for baseload gas generation in combined cycle turbines. CCGT runs more efficiently than a peaker, but the fuel cost is still extremely high at any plausible Eastern Australian gas price. Even for supply adequacy, CCGT would be mediocre on emissions and bad on price.

Repowering peakers with hydrogen or biomethane could also be handy for adequacy, but the fuel cost means energy intensive activities will want to minimise their reliance as far as possible.

So our path to energy advantage looks narrow. Even if we are content with energy adequacy we have a lot to do, including a lot of transmission, renewables and backup peakers to build. But if we are going for The Full Ross Garnaut we have to be serious about it.

Getting serious

Superpower success requires Australian energy to be clean, scalable and cheap. Cheap! CHEAP.

Delivering renewables cleanly and ethically is essential, but we have no long-term monopoly on cleanliness nor morality. We can offer diversity for those customers looking to reduce exposure to China, but it turns out that many countries are not China.

There is no viable alternative to being cheap in the delivery of renewable energy.

- The costs of large scale renewables depend on:
- The quality of the resource;
- The costs of the kit;
- The costs of construction;
- The costs of finance; and
- The costs of time, uncertainty and money to navigate approvals processes and sustain social license.

We have to be as good as we can on all fronts. What can we do?

The quality and scale of Australia's **solar and wind resources** is a very big boost. But it can be outweighed if we don't get the other factors right.

The **cost of the kit** is primarily determined by global advances. Faster global deployment of wind and solar will mean deeper declines in the cost of additional units. That's wonderful and we will see a heck of a lot of deployment. There is a local cost component too; we can cut that as we build greater familiarity, experience and supply chains.

We should think very carefully about the role of local supply chains in the cost of clean energy deployment. We need to make sure that we are competitive on cost even when we pursue additional objectives like resilience and security.

The Solar SunShot program looms large here. It's not a crazy idea to build up a local photovoltaic supply chain if we are going to wind up installing a terawatt plus of solar over the next few decades. It is however a complicated, nuanced story.

We will need delicate management of the China relationship, given that part of the SunShot motive is reduced dependence on imported Chinese solar, yet that can only be delivered through deeper economic partnership with Chinese solar businesses operating in Australia.

And while substantial financial support will be needed to start with, a local PV industry must aspire and be driven to compete on cost through innovation, avoided transport, and a level playing field on carbon.

The **cost of construction** also needs to be competitive, and we've seen big headaches recently with blowouts in the delivery cost for many new energy projects. On the other hand what matters here is comparative advantage, and inflation has been a problem in many economies.

Paul Graham and Lisa Havas at CSIRO took a look last year at how Australia compares to other regions on capital costs for renewables and how delivered industrial energy costs flow from that. The capital costs came from International Energy Agency data published in 2020, and a deeper and more current update would be good. However at first blush we do not look too bad on capital costs!

We've built solar, onshore wind at moderate cost relative to other advanced economies, though China was nearly 20% cheaper. For offshore wind we have no experience and look about twice as expensive as Western Europe. Applied to strong resources, and assuming no relative shifts as global technology costs fall, that would see Australia deliver the third cheapest power in the world behind China and India.

So there is no basis for despair. Equally there's no room for complacency. The better we can do on delivered project costs, the more competitive we will be in energy intensive industries. Others will also be trying to do better.

What does better look like?

Of course we should maintain good pay and conditions in the energy construction workforce. We also need to maximise productivity to get terawatts deployed competitively. Automation, AI and assistive robotics are wind in our blades. We need to strengthen our skills pipeline while ensuring jobs and requirements are structured to be deliverable with the minimum qualifications necessary for quality and safety.

We need to standardise designs and practices for key components and infrastructure. Transmission project cost estimates blew out as companies with no recent

experience of building major lines started getting real world quotes. Now we need to squeeze efficiencies wherever we can, and standardisation of inputs will enable greater competition and learning.

Most of all, we need to agree that construction work is an enabler of energy advantage, not an end in itself. We have no jobs problem. We have the challenge of delivering huge infrastructure with the people we can throw at the task.

The **cost of finance** has already had a lot of attention yet more is left to do.

Rewiring The Nation specifically reduces the cost of transmission through cheaper debt. Great, if we can get the go-ahead to build it!

The Capacity Investment Scheme and the NSW Electricity Infrastructure Roadmap aim to reduce energy projects' cost of debt by taking on some of the market risks they face while leaving enough commercial skin in the game to keep proponents focussed on market needs. They are very helpful mechanisms for the messy present reality of our electricity systems.

However these schemes are still premised on the belief that the wholesale energy market will ultimately pay most or all of projects' costs. It is not at all clear that will stay true as the energy-only market is dominated by resources with a zero short run marginal cost.

The 2030 energy market redesign process has to go much better than the NEM2025 process did. The emerging market and policy design needs to provide a credible basis for efficient investment in both the bulk clean energy we need and the various forms of flexibility we require, including from gas peakers. A carbon signal to those peakers would be very helpful to calm stakeholders and drive uptake of clean fuels as and where that makes sense.

There are other factors that affect the cost of finance and need attention. The overall credibility and continuity of energy and climate policy really matter. If we are at risk of fundamental turmoil and backsliding, energy project finance is going to be significantly more expensive and advantage will slip away.

And broader macroeconomic settings are a big deal too. If we can moderate inflation enough to allow lower interest rates that would be a big reduction in new energy costs. Our domestic savings rate, the extent and mix of local investment, and our openness to foreign investment also matter for the cost of getting things built.

Social license and approvals are now the biggest barrier to achieving even energy adequacy and we have to improve our performance to achieve advantage. There is absolutely no path to deliver new energy or support energy intensive industries

without building big things. And every one of those big things has the potential to annoy someone. Slow or unpredictable processes and intractable opposition to development can add hugely to the cost of energy for everyone.

We are not going to make it easier to build than it is in China, and frankly nor should we. But if we choose to we can absolutely compete with the United States, Europe and elsewhere on the quality of approvals and attitudes to development.

We need approvals processes that are predictable, including through pre-evaluation of whole regions for suitability for key activities and presumptive approvals where individual projects are within expected parameters. We could commit to time limits on decision making and moderate opportunities for interventions and appeals. We need to make the information requirements more manageable for proponents and decision makers, whether through better focussing our asks or applying machine learning to the process. We need to compress and align the layers of decision making.

State and Federal approvals are both important. The Federal Government is funding swifter approvals through the recent Budget, and their deals with the States to allocate CIS capacity appear to involve a push for regulatory easing. That is good, but there is also a national process to reform the EPBC which is apparently stalled until after the election. It is very important to revive it and fulfil the vision of streamlining national approvals by enabling States to apply nationally agreed standards.

That takes more than decisions by government. It takes a shift in priorities among stakeholders. There are many issues at play in EPBC reform, but one massive factor is the fight over fossil export projects. The environment movement wants every possible tool on the table to slow and stop those coal and gas projects. I would say that demand side transition in customer economies is a more important focus, but never mind that. What everyone needs to grapple with is that stopping bad things does not make good things happen. Stasis does not deliver improvement. The status quo is high emissions.

Approvals are important, but so are attitudes. Australia needs to be a place that builds. Conventional landholders, traditional owners and communities need to be worked with and reap rewards from hosting projects. Real concerns deserve real respect. But in the end we need to build – or every community will suffer lost opportunity, higher energy prices and reduced reliability. NIMBY energy is politically powerful, but you can't run an economy on it.

Priorities

What I've laid out is not a small agenda. As I said at the start, the Sun is a harsh mistress. Squeezing cost out of new energy infrastructure, building it efficiently,

further lowering finance costs, and lowering the hurdle to get new things built will take a lot of discipline and the broadest political and community support we can muster.

Energy advantage is there to be had and the rewards for Australia are large if we succeed: preserving and growing industries that can support a resilient and prosperous nation and a clean and growing world. But if we want that we have to prioritise it amidst the constant clash of competing values and issues.

We can’t do everything or please everyone. Choosing energy advantage is a challenge that all of us will face every day.

Thank you.