

# A Low-Emissions Technology Roadmap for Australia: Panel Discussion on the Government's Discussion Paper

## EPIA Webinar Transcript: 11 June 2020

This is an edited transcript of a panel discussion held under the Chatham House Rule.

The three panellists were: Grant King, a well-known businessman in Australia, former CEO of Origin Energy and member of the Ministerial Reference Group for the Roadmap process, Professor Chris Greig of Princeton University and Rodger Whitby, CEO of the St Baker Energy Innovation Fund.

### The purposes of the Technology Roadmap

The Government has commenced work on what it calls a 'bottom-up' Technology Roadmap. It has two purposes in mind: the first to encourage private sector investment in low emissions energy technologies; the second to help the Government prepare for the Glasgow Climate Change Conference.

The Roadmap will form the cornerstone of Australia's long-term emissions reduction strategy and will complement other strategies including the National Hydrogen Strategy. The strategy will straddle the period up to the point of reducing global emissions to zero by 2050.

EPIA supports the Roadmap process because, as the discussion paper says, "*technology will underpin the long-term emissions required in Australia and globally*".

### Costs

The discussion paper provides only a very shallow survey of costs, relying mainly on the 2018 GenCost report of CSIRO and AEMO.

### Categories

The paper groups low emissions technologies into 11 categories, starting with electricity supply, with around 30% of total emissions:

1. Electricity supply
2. Process heating
3. Mining and industrial equipment
4. Feedstocks
5. Transport
6. Residential built environment
7. Commercial built environment
8. Capture of future emissions
9. Energy from waste
10. Agriculture and land use
11. Negative emissions technologies.

The Government intends to issue an Annual Clean Energy Statement. It has invited submissions by 21 June 2020. In EPIA's view, this deadline is unrealistic.

In 2016, EPIA suggested that a process of public and private sector collaboration was vital but would not happen by itself - collaboration required the public and private sectors to work very differently. A mechanism was needed to orchestrate collaboration. This is why EPIA is supportive of the Roadmap process.

### **Three key points about the Roadmap process: (1<sup>st</sup>) it is 'whole of economy'**

The discussion paper is not a draft of the ultimate Roadmap. Its purpose is to prompt submissions and discussion.

It is also a whole of economy process, not confined related to a particular sector. Australia may have concentrated in the past on sectors that were thought easy, like energy, missing abatement opportunities in harder-to-abate sectors, like transport and agriculture.

Consultation by the Department over the last 2 weeks has been helpful in understanding the challenge of producing a roadmap and the great breadth of issues that interest people.

The important go-forward dates are Q3 this year which may produce the first Low Emissions Technology Statement. This is part of a process designed to allow the Government to formulate what to submit to the COP 26 Meeting.

The Roadmap process is part of a much broader strategy.

There has already been a roll-out of some elements of the strategy, like the national hydrogen strategy. The electric vehicle strategy will be rolled out shortly. The AEMO Integrated System Plan (ISP) is another important piece of work. So is the National Energy Productivity Audit.

The recent Emissions Reduction Fund (ERF) review (the King Review) may be seen as a 'process improvement step'. The Technology Roadmap again is about creating an enduring process; it is not about fixing a position at a particular point in time view, but establishing an enduring process for driving investment in technology and clearly private sector investment in technology.

The Ministerial Reference Panel will not produce the report. It will be produced by the Government, the Department or the Minister. The positive side of that is that the Minister has to own the recommendations. We won't have to go through a process of the Government accepting or rejecting the report. It will be a Government report.

The Ministerial Reference Panel has been active in contributing to the thought process around the Roadmap. An 8-step process is set out in the discussion paper. We are around steps 3-4 in that process which is about the strategy for identifying priority technologies.

There are 140 different technologies in the current list. Everyone might make up the list differently. This is a first attempt by the Department to catalogue low-emissions technologies. The hard work, yet to be done, is to create a list that is coherent in terms of understanding how technology goes through the innovation cycle and into commercialisation. We may be only a third of the way through the thought process.

This is therefore just a list: the Reference Panel and the Departmental taskforce will be using well-understood techniques like the technology readiness and commercial readiness indicators as a framework for looking at where each of those technologies might be up to and deciding where support might be encouraged.

## **2<sup>nd</sup> key point: filtering the technologies for prioritisation**

The 2<sup>nd</sup> key point about the filtering process relates to prioritisation. The Government has identified four filters, which will be used to filter the listed technologies: (1) whether they have abatement potential, (2) whether they have large-scale abatement potential, (3) whether those technologies provide large-scale economic opportunity for Australia, and (4) whether Australia has comparative advantage in that area and has technological readiness. That's not to say it will only be four filters. There may be other filters used to sort through the technologies and these should certainly be included in submissions.

Being a process that is supposed to endure for 20-30-40 years, or certainly 20-30 years, it's important to understand that the process will evolve. Technologies that we might consider to be down the track will not be lost sight of.

## **3<sup>rd</sup> key point: stretch goals or targets**

An important part of the process is setting what people call stretch goals or targets. The one that is talked about at the moment is 'H2 under \$2'. Whether that is AUD or USD, there is debate about that, but it is merely a way of expressing how those targets are met. In other areas, there might be targets around cost per megawatt amp in respect of battery storage, or cost of carbon sequestration, or cost of manufacturing of green steel. With soil carbon, we may need new measurement processes for it to have any chance of unlocking the potential for negative abatement. We may also need better measures for sequestration, biosequestration or geosequestration.

There is a desire to not only establish priorities for technologies but to set targets for those technologies.

## **Private sector investment**

There is also a desire to conduct the review in a way that creates significant private sector investment. We won't get there without significant private sector investment. At the best of times, government funding is limited.

## **Cost effectiveness of Government expenditure**

Where, in the innovation cycle, or conveyor belt, or however you want to think of that innovation process, is the most cost-effective way for governments to spend money?

## **'Enabling technologies'**

A key question is about 'enabling technologies'. There is a real risk of losing perspective. To consider a practical example, Australia got very excited about solar and wind. We put a lot of solar and wind into the power system but we don't necessarily have the technology to control and run transmission and distribution systems with high levels of renewables in a safe and reliable way. So we got part of the technology into the picture but not the whole of it. We need to develop greater insight into enabling technologies, what we must get right, and often the small things that we must get right, in order to make a big impact.

## **Timetable**

The Government's timetable is to produce the First Annual Clean Energy Statement by the end of the third quarter this year. The timetable appears very short but the process was kicked off before COVID and lost momentum because of COVID. If submissions miss the 21

June submission deadline, they are surely not going to be rejected. We are engaged in a process that is enhanced by valuable contributions and it is hard to imagine that a valuable contribution will be ignored.

### **The 'Rapid Switch' project/ transition bottlenecks**

Rapid Switch is a relatively new initiative spearheaded by Princeton University but which is led and executed at a local level by universities in India, China, Europe and Australia (through UQ). It is Chris Greig's focus for the next 5 to 10 years. The essential aim is to develop a deeper understanding of viable pathways to achieve zero emissions futures and explore how fast we can expect to decarbonise the whole of any economy.

Rapid Switch is differentiated from most energy transitions research by a pragmatic acknowledgement of the scale and pace of the change involved in these transitions and a recognition that levels of ambitions and capabilities that execute a rapid transition vary dramatically between countries and between sectors. Where most model pathways present a technology roadmap that delivers, for an overall system, the lowest overall system cost based on the available assumptions, these models typically imply a planning regime that is both foresight rich and provides for seamless integration across sectors.

That is a nice concept from an academic perspective, but it doesn't really reflect the real world in which investors make decisions, that is, under uncertainty about future policies and technology costs that exist both locally and between countries. That uncertainty is deepened by a range of what I call bottlenecks, barriers, constraints, and unintended consequences that can emerge which could delay or slow or even stop a transition. They can be technological, for example, integrating very high levels of wind and solar into the electricity grids, they could be social, for example, community opposition to carbon sequestration or high voltage transmission, they can be financial, like stranding of incumbent carbon-intensive assets or political, like a prohibition on nuclear power or unconventional gas extraction.

Experience tells us that, the faster we try and execute a transition, the greater the likelihood that we are going to confront bottlenecks and the greater their severity. These bottlenecks, like ambition and capability, will vary in their influence across locations, sectors and time; so they are very difficult to model. This calls for region-specific and sector-specific deep dives and really intense engagement with local stakeholders as we go through these transitions.

### **The Findings of Princeton's Net Zero America Project**

Professor Greig described the main findings of Princeton's Net Zero America Project, explaining that it was a response to a growing number of politically driven pronouncements to take the US economy to net zero emissions by 2050 or in some cases even sooner - the earliest version was 2030. No-one making these announcements seemed to know what it would take or what such a transition would look like.

Multiple scenarios were developed to get to net zero economy-wide, with varying assumptions and levels of things like net induced electrification, varying contributions of renewable energy and the supply side, varying levels of energy productivity and transition period.

The first main finding was that every scenario involved sustaining unprecedented rates of one technology or another, that is, several times the historical annual deployment rate seen anywhere in the world. That could involve hundreds of gigawatts of wind and solar being

installed year on year for three decades, along with a 10-fold increase in long distance transmission and with massive investment in batteries and very low-capacity factor flexible resources to allow us to balance supply and demand in a renewable dominated system or, in a renewable constrained scenario, with tens of gigawatts of new nuclear capacity being added along with gigatonne levels, billion-tonne levels of carbon sequestration.

The other main finding is that all scenarios are capital-intensive, and all involve very significant social change and physical impacts on landscapes and resources. The plant and infrastructure site structure will be immense. Planning is very sensitive to stakeholder engagement. All scenarios will test industrial capacity and supply chains and will result in stranding of some asset classes.

Over the current decade, we may need to underpin more 'pathway optionality' for different technologies to compete and evolve in later decades.

Professor Greig advanced four high-level recommendations to Government:

- 1 Recognise uncertainty and facilitate pathway optionality, which will mean keeping multiple scenarios alive;
- 2 Engage deeply with a broad range of stakeholders including industry, the research community, NGOs and local communities (which to some extent has been happening);
- 3 Deepen research and development collaboration between industry and universities, which may have declined in Australia over time; and
- 4 Undertake more applied research to anticipate and resolve most critical transition bottlenecks.

### **Venture capital**

Discussants heard from Rodger Whitby of the St Baker Energy Innovation Fund, an early-stage venture capital fund whose main investment themes are energy and e-mobility.

The Fund has invested heavily in: Tritium Ltd, who are developing and manufacturing electric vehicle ultra-fast chargers; EVIE Networks who are building a network of ultra-fast chargers down the East Coast of Australia to create a backbone of charging infrastructure; an emerging electricity retailer focused on household solar, a battery materials company called Novonix, who are building/developing synthetic graphite for anodes and cathode materials.

### **Transport sector**

The discussion paper identifies the transport sector as responsible for nearly 20% of Australia's emissions, second in line after power generation. Certainly if electric vehicles are powered by renewable energy, or even as the grid becomes less and less intense in its emissions, electric vehicles deliver those emission savings.

### **Electric vehicles**

The emissions savings of an electric vehicle improve over time as the grid becomes less emissions-intensive, whereas an internal combustion engine is only as good as it was the day it rolled off the production line.

For electrification of the passenger fleets there are possibly three major challenges:

1. How do we provide the public charging infrastructure for EV: this would be ultra-fast stations between cities, within cities and in the workplace.
2. The speed with which we can replace internal combustion vehicles with EV.
3. How do we integrate these new technologies into the overall electricity generation and distribution complex? If we integrate them to the grid poorly, they will be a little like the rapid expansion of solar where it is challenging to the grid.

So three really key challenges for electric vehicles. A lot of money is required. It is going to require bold and brave decisions from both public and private money.

The key to this exercise is to work out where Government support for that investment fits in.

### **Nuclear energy**

The subject that more and more frequently comes up is the development of modern nuclear technologies, such as small modular reactors. There are two new SMR units now operating at the same location in Russia, there are several under development in Argentina and China and there are more in advanced stage licencing. It is valid to ask why the Roadmap only starts to monitor and consider development of small modular reactors in the long term 2030-2050? Surely this should start now?

Issues to consider with nuclear should include the cost of spent fuel storage and the cost of site remediation. These issues could be dealt with by regulation rather than legislative prohibition, which could be repealed now.

### **Cement manufacture**

An Australian company CALIX is now working in Europe, with financial assistance from the EU which they won under competitive conditions, working with cement manufacturers to remove CO<sub>2</sub> from flue gases from cement production.

### **A systems approach**

In moving to net zero, we need to make progress across the board and not just in particular sectors. The UK is looking at a cost-cutting, whole of system, engineering approach.

With a systems approach, you mix technologies. Technologies are not to be viewed in isolation. The mixture is determined by whatever is most suited to the development of a particular place or region or market. The way you go about measuring them is not according to their stand-alone characteristics but in the context of a system as a whole.

### **Novel ways of sponsoring innovation**

The EU are introducing The Future and Emerging Technologies Innovation Launchpad. It is allocating grants of EU100,000 per project, to support short actions which are focused on non-scientific aspects and on turning early stage pathfinder results into genuine innovation with socioeconomic impacts. Applications are open until 14/10/20. There is no actual cost reporting required, no timesheets required, and no audits required.

The CEFC is a key funding source for innovation in renewable energy and CCUS. However, it is a finance corporation and it looks for a return. Should there be another mechanism with the required hundreds of millions, if not billions, in backing to flexibly fund the higher risk, early stage innovation that is required to meet the Roadmap aspirations?

Does Australia need an additional vehicle or program to sponsor innovation? We already have ARENA which is focused on renewables. Do we need a Low Emissions Technology Agency to sponsor innovation in non-renewable technologies, such as hydrogen and nuclear.

### **Non-financial ways of driving innovation**

The Government is interested in identifying the most cost-effective way of deploying government funds.

As suggested by the Grattan Institute, the Government might also consider policies and regulations to drive private sector investment. Also how is the Government to be deterred from actions that create barriers to private sector investment, such as investment into pumped hydro and underwriting new generation.

### **Mobilisation of a massive amount of private sector capital**

The Government cannot spend enough money by itself to get us through the challenge.

There has to be a mobilisation of a massive amount of private sector capital, that has to be the way we think about it.

This means the Government must address all barriers and encourage the private sector to make the decisions about where will it risk capital with the prospect of some benefit occurring. This means more than just money. The Government doesn't understand commercial imperatives.

The Government has to get out of saying it is going to do a bunch of things as though it is a market player. It has to let the private sector move in.

### **Regulatory obstacles**

The Government has to look at regulations, it has to get rid of regulatory prohibitions and it has to reform institutional barriers that are not in regulations but where bureaucratic processes do not allow some things to get through.

The ERF process has many barriers which must be addressed. These were identified in the ERF report. A well-understood example relates to sequestered carbon. At present we cannot map the way through that process and get a method approved for sequestered carbon. We will be able to in the future.

### **Voluntary carbon markets**

We may be able to create fungible carbon credits for exceeding emissions reduction requirements. Economic value could be created by improving technologies and processes that are market based. If we can then expand voluntary markets there will be funding for these things if we establish a new market in trading carbon and emissions. We would need to establish a way that allows the market to value carbon and trade it and bring the enormous amount of investment that can arise by making deep cuts in carbon emissions.

### **De-risking early stage investment**

The private sector won't mobilise capital fast enough for a mid-century net-zero target unless the government really steps in with significant capital and other activities to de-risk early stage investments.

It will require a large amount of government capital as well if we want to achieve a rapid transition. The transition is going to be enormously challenging, much more challenging than any of us actually understand.

### **Keeping all options open**

The huge uncertainties around costs and performance, and how certain technologies will play out in this transition, across all the sectors, make it essential to preserve all options. Not locking ourselves into particular pathways is critical.

We have to enable CCS. We ought to enable nuclear. Renewables will play a very significant role, perhaps a dominant role, but will need to be supported by lots of flexible resources. The market is going to have to evolve in order to incentivise flexible low-utilisation resources.

### **Risk sharing**

Government's role in helping to fund some of these early stage developments is absolutely critical to share the risk with early stage investors. This has worked quite successfully in solar and wind.

### **Finally, on the Technology Roadmap**

To reduce emissions, the Government has recognised there are some deep and crucially important issues that need to be addressed from a scientific, engineering and technical point of view, keeping away from politics as much as possible.

This may be the beginning of a new conversation. We must all contribute what we can.

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*This is an edited version of discussion at an EPIA webinar held on 11 June 2020 in which 200 delegates from eight countries participated. It has been provided to the Australian Department of Industry, Science, Energy and Resources as a contribution to the Department's Low-Emissions Technology Roadmap discussion paper.*

*A list of additional questions raised but not answered during the webinar is available from the secretariat.*

*The Institute would be happy to receive any additional questions and comments from industry and the wider community.*

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