GRATTAN Institute

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# Target support for technologies: building a bridge to a low-emissions, lowest-cost future

## Response to the 'Technology Investment Roadmap' Discussion Paper

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# 1 Summary

Governments should development a continuous framework or "bridge" to support research, development and deployment of technologies that have the potential to deliver emissions reductions at lowest cost. Support should also be provided to technologies that are necessary to enable these primary technologies in areas such as electricity reliability or security.

The bridge should cover all stages from research, development, and commercial deployment. The role of government is to address early-mover technology and climate-change policy risks. In doing so, support should be targeted to the nature and readiness of the technology.

Governments should fund basic research through universities and CSIRO using well-established criteria.

Governments should fund investment incentive programs such as capital grants where such funding has the potential to materially accelerate cost reductions.

Governments should prioritise market reforms where their absence is a barrier to commercial deployment of relative mature technologies. At this stage, the private sector can then fund the large-scale investment needed and Governments should not invest directly or indirectly in technology support.

In the absence of some form of emissions constraint or carbon price, mechanisms such as reverse auctions, tradable green certificates or green mandates may be an effective, if less efficient, alternative.  It will be necessary to ensure that all sectors that materially contribute to emissions are addressed.

# 2 Introduction

This submission is made by Tony Wood of the Grattan Institute. It responds to the Discussion Paper released by the Department of Industry, Science, Energy and Resources in May 2020 examining opportunities for governments to investment in and support the development and deployment of technologies that will deliver a low-emissions future at lowest cost..

Grattan Institute is an independent think-tank focused on Australian domestic public policy. It aims to improve policy outcomes by engaging with both decision-makers and the community.

It is understood that the Department and the supporting Reference Panel are seeking responses to issues and questions raised in the Discussion Paper. The outcome result will be input to the first Low Emission Technology Statement later this year. It will also provide advice to the Minister for Energy and Emissions Reduction to contribute to the national emissions reduction strategy, recommended by the Finkel Review[1] and confirmed by the Government.

The underlying rationale for the Technology Strategy and Roadmap is an objective to deliver emissions reduction at lowest cost and a premise that some form of support for technology development and deployment will be necessary to achieve that objective.

A low-emissions economy will be characterised by a different mix of technologies from those in place today. That mix is likely to arise from most, if not all, of the technologies known today.

This submission seeks to differentiate the respective roles of governments and industry in supporting the development and deployment of those technologies that will contribute to the above objective. The emphasis is on how to apply public and private investment and other support mechanisms to a range of technologies and other innovations at different positions along the innovation pathway. While innovation can occur from research through development and to deployment, the nature of that innovation evolves as should the respective roles of government and industry.

Mapping technology and other emission reduction technologies across the innovation pathway and the mechanisms available for government support forms the recommendations of this submission.

[1] https://www.energy.gov.au/sites/default/files/independent-review-future-nem-blueprint-for-the-future-2017.pdf

# 3 Principles for government actions

Governments have a role in supporting research, development, and deployment of technologies. All three are critical to achieving lowest cost emissions reduction, yet they are qualitatively different. The key determinant is risk: where it arises, how it is reduced or transferred, and how it is priced. The outcome will be inefficient if there is misalignment between risk exposure and risk management or between risk and reward.

At the research stage of the innovation pathway, the risks are highest while the required investment is lowest. These factors tend to reverse along the pathway as do the relative weights being carried by government and private sector investment.

The role for governments in research can be played through universities or agencies such as CSIRO and both need robust grant programs to deliver and manage public funding with appropriate tracking and milestones. Part of this process is to differentiate between situations where Australia might play a leading role in the basic or translational research and those where the research is best done elsewhere and the role for Australian governments is to support demonstration or deployment in the Australian context.

Governments also have a well-established role in supporting early-stage technology development. There are several reasons why this is so[2]:

- Early investors face higher costs than followers. Finance costs are higher for technologies that are not well understood. Importantly, many of the challenges are local, that is, specific to building projects in Australia. New infrastructure, technical expertise, supply chains and regulatory frameworks all must be developed, imposing delays and costs on early movers.

- Unlike consumer electronics, for example, low-emissions energy or energy-intensive commodities provide the same service to their consumers as emissions-intensive electricity. Innovations do not earn more, and expensive intellectual property may not be defensible.

- Early movers cannot bank the full value of projected higher long-term revenues for a low emissions commodity because government policy on climate change and energy is inherently unreliable. The Grattan report *No easy choices: which way to Australia's energy future?* [3]analysed these difficulties in detail.

The role for governments at the development stage is demonstrated in the establishment and operation of the Australian Renewable Energy Agency (ARENA). The basic idea is to provide a push to get the technology moving down the cost curve and to stop pushing when momentum is achieved, or the technology fails to gain acceptable momentum.

[2] https://grattan.edu.au/wp-content/uploads/2014/04/Building_the_bridge_report.pdf
[3] https://grattan.edu.au/wp-content/uploads/2014/04/124_energy_no_easy_choices.pdf

Low-emissions technologies will be deployed when they are cost-competitive with existing technologies. The role for governments in technology deployment should be to address market failures and remove barriers such as outdated regulations. The most obvious example is climate change and the best Australian success story is the Renewable Energy Target (RET) in deploying solar and wind technologies. The objective of this industry policy was to achieve commercial scale with these technologies. It was successful despite the technologies being more expensive than incumbents. The cost gap was addressed by imposing a liability on energy retailers. The cost was modest as documented by the Climate Change Authority[4] and the Warburton Review[5].

The key issue for achieving the primary objective is to deploy limited government funding in the most cost-effective way to the areas where government should take the lead role.

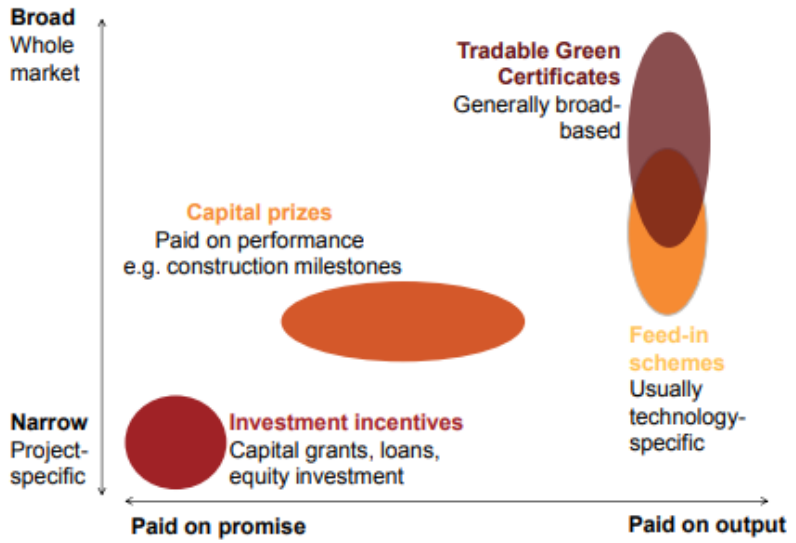
## 3.1 Applying government funding

Governments have, at their disposal, several approaches to low-emissions technology development:

- Investment incentives such as capital grants, low-cost debt or equity, or underwriting market or technology risk.
- Direct revenue support such as the Climate Solutions Fund, Contracts-for-difference, or feed-in tariff schemes.
- Tradable green certificate revenue support market mechanisms such as the RET or green mandates.

The relationship between these approaches is illustrated in Figure 1 below.

**Figure 1: Difference in technology support instruments**




We published a detailed assessment of these alternatives in our 2012 report, *Building the bridge.*

Finally, regulation can be appropriate where there are difficult market failures such as information asymmetry that impede deployment via markets.

[4] http://climatechangeauthority.gov.au/2014-renewable-energy-target-review

[5] file:///C:/Users/Tony/Downloads/sub450c_Clean%20Energy%20Council.pdf

### 3.2 Deploying private funding

In a market economy such as Australia the expectation is for the private sector to provide the brunt of investment, particularly at the deployment stage.

At this stage, the appropriate role for governments is not through investment, direct or indirect. Well-designed and regulated markets will be the most effective and efficient way to deliver deployment funding at the scale required. Government funding is likely to be counterproductive since it will compete with private investment at best and deter private investment at worst. The role of the Clean Energy Finance Corporation (CEFC) is sometimes an example of the former, while Snowy Hydro 2.0, VRET, QRE and the Commonwealth's UNGI proposal are examples of the latter.

If governments do provide funding support to mature technologies, vested interests will seek to secure government support for their technology or commercial interest.

Markets do not naturally value the external cost of climate change. The widely accepted lowest cost way to address this market failure is through some form of emissions constraint or carbon price. Such a first-best approach is currently not supported at the level of Australia's federal government or opposition. This means that alternative mechanisms to drive down costs, usually focused more narrowly, must be considered. Such mechanisms will usually incur a cost to either consumers or taxpayers. The cost will represent an implicit carbon price. A well-designed mechanism will contribute to that cost reducing with experience and scale.

### 3.3 Guidance from government

In the Discussion Paper and separately stated by the Minister, the government has indicated some positions that may underpin and/or constrain the range of actions to be considered.

- Government-funding support across the technology innovation chain may be direct from government such as the ERF/CSF or via agencies such as ARENA and the CEFC or research institutions such as CSIRO and universities.
- The overwhelming bulk of funding for technology deployment is expected to come from the private sector.
- The government expects that private sector funding will be via voluntary incentive schemes such as the Climate Solutions Fund or grant schemes. This contrasts with any form of imposed liabilities, taxes or emissions constraints that could be interpreted as taxes. This would therefore exclude deployment mechanisms such as the Renewable Energy Target or imposed baseline reductions under the Safeguards Mechanism.
- There is little prospect in the next few years for an economy-wide emissions reduction policy. Sector specific deployment mechanisms, with future flexibility, will therefore be required. And even if there was an economy-wide mechanism, targeted support would still be required for development of early-stage technologies.
- The paper indicates that the objective is to have no economic cost arising from emissions reduction. Strictly imposed, that may be unachievable in cases where

emissions reduction may always add cost to emitting activities. This submission treats this as a desired outcome while assuming the practical objective is lowest cost.

### 3.4 A framework for consideration

The technology roadmap will add real value if it provides an assessment of the market failures and barriers that prevent or diminish development and deployment of technologies that meet minimum criteria. These priority technologies or innovations should be matched against the tools and mechanisms available to governments. We undertook a detailed assessment of tools and mechanisms in our 2012 report, *Building the bridge: a practical plan for a low-cost, low-emissions future.*

Mapping the technologies against high level characterisation criteria and the relevant mechanisms should provide the basis for a plan that supports the role of technology in Australia's long-term emissions reduction strategy. Appendix A is a suggestion as to what such a framework might look like.

# 4 Issues arising from the Discussion Paper

The Discussion paper seeks input in 6 areas:

## 4.1 Challenges, trends, and competitive advantage

In setting technology priorities, the biggest challenge will be tracking and responding to the emergence of and rate of change in demand for low-emission technologies globally and to understand the potential and barriers for technologies that might qualify for priority support. In addition, there is a need to differentiate between those technologies where Australia will be a taker and those where we could be a maker. Australia companies are global leaders in resource extraction and logistics while the size of our domestic markets and the nature of our high wage economy means we rarely are the best place to add value to those resources.

There is an emerging opportunity that is based on a change in those economics based on globally competitive renewable energy and where greater value could be added in Australia[6]. The challenge will be to cultivate and maximise Australia's capability to capture that opportunity.

## 4.2 Shortlist for priority investment

The discussion paper seeks to identify a shortlist of technologies for inclusion in the first Low Emissions Technology Statement based on short, medium, and long-term impact. It is understood that the Reference Panel will assess impact on four criteria: abatement potential, opportunity for Australia, comparative advantage, and readiness. The discussion paper suggests that these technologies could be the focus of technology investments.

This framework is unlikely to provide a path to a clear plan for action across the technology innovation pathway. For example, large-scale solar and wind electricity generation have high abatement potential as illustrated in the discussion paper. Yet, commercial success and barriers to deployment for these technologies lie almost entirely in the areas of market structure and regulation.

Energy storage technologies are also large scale and well-developed. Yet they are enabling technologies with high potential for indirect abatement impact, where deployment will again be best served through addressing market and regulatory issues.

Electrolysers to produce renewable hydrogen also represent an enabling technology with significant impact potential. In this case, there are technology development challenges where investment incentives would be appropriate.

[6] https://grattan.edu.au/wp-content/uploads/2020/05/2020-06-Start-with-steel.pdf

Appendix A suggests a framework that could integrate these issues of priority and investment.

There are technologies with modest abatement potential but where that potential is material within a specific sector. Examples include sub-sets of transport, industry, and agriculture. A prioritisation based solely on the above criteria will miss such sectors, a gap that will need to be addressed if the long-term objective is to be realised. The problem arises partly from the absence of an economy-wide emissions constraint or policy. Yet the early-mover technology barrier remains. This suggests a further overlay should be applied to the core framework to ensure all sectors are covered.

### 4.3 Goals for leveraging private sector investment

Private sector investment will flow when the risks and rewards are aligned with the return expectations of the private sector. Different investment vehicles such as infrastructure funds and venture capital firms will be seeking different balances of the two. It would useful to understand these differences across the relevant sectors. If private sector investment is being sought at the earlier stages of the innovation chain, then structures such as the Low Emissions Technology Development Fund and Flagship programs might be considered.

### 4.4 Broader issues for adoption at scale

In cases such as electricity, there is a considerable range of market factors that need to be addressed and, fortunately, are mostly in hand. In general, the broader issues will tend to be situational. For example, CCS will need to consider community and other licence-to-operate issues, while large-scale manufacturing plants will require attention to planning approvals and a different set of community engagement questions.

### 4.5 Deepening trade, markets, and global supply chains

Australia must continue to an active and strong supporter of global trade in a world that may be turning in the other direction. There have been proposals in that direction already suggested for our post-pandemic economy. In addition to the issue of low-cost renewable energy, our geographic position will be an advantage in this century.

### 4.6 Economic stretch goals

Quantitative stretch goals, including those that are purely economic, can be useful. But they can also be misleading or unhelpful. Even where the technology can directly lead to reduced emissions such as solar energy generation, a simple economic stretch target of $/MWh LCOE needs to be framed in a systemic sense such that issues of resource adequacy and transmission are considered. LCOE is an appropriate metric for specific technologies. Yet, as was well framed in the Finkel Review and the original concept of the National Energy Guarantee, the role of enabling technologies must be part of the overall technology investment framework.

A further level of complexity is added when the impact is indirect, and some form of surrogate metric is all that can be applied. The cost of an enabling technology will be one metric in most cases. However, its contribution to the core technology, e.g., electricity reliability or security will be just as important if not more so. This is not an argument against economic stretch goals and there is much that can be done to make them valuable tools.

# 5 Assessing the impact of technology support

The assessment of technology support is its impact on the outcome: Is Australia on track to meets its core objective of reducing emissions at lowest cost while protecting other social, environmental and consumer issues such as the reliability and security of electricity supply?

Impact assessment criteria for each technology area will be situational, both to the technology at a point in time and over time. They should be set, as much as possible, as part of any funding arrangement.

These criteria should include, but are not limited to:

- Key metrics, including and milestones.
- Changes in status including technical or commercial readiness
- Risks of potential adverse or unintended consequences
- Opportunities from unexpectedly positive developments
- Changes in over-arching policies, particularly on climate change

The annual Low Emissions Technology Statement should include a progress report against both high level and specific criteria. This statement should extend to new factors such as the emergence of alternative/superior technologies. Decisions to cease ongoing support for technologies where progress against metrics or milestones is less than agreed must be rigorous.

# 6 Appendix A: Indicative technology support framework

| Issue/technology | Impact | Readiness | Barriers | Mechanism |
|---|---|---|---|---|
| Large-scale solar<br><br>Large-scale wind | High; direct | Technically and commercially advanced | Markets and regulation | Market reforms |
| Pumped hydro | Indirect | Technically and commercially | Markets and regulations | Market reforms; Grant funding in specific circumstances |
| Large-scale batteries | Indirect | Technically OK; Needs development | Cost and market | Grant funding |
| CST | Small; direct | Technically needs some development for high temperature heat | Cost | Grant funding |
| Gas for firming | Indirect | Technically and commercially | Markets and regulation | Market reforms |
| Next generation solar PV | | Undeveloped | Technology and cost | Leave for universities or CSIRO to build a case |
| Soil carbon | Moderate; direct | Technically and commercially understood; monitoring needs work | Cost with no demand | Revenue support |
| Alternative cements | Moderate; direct | Needs technical development | Technology | Research funding |

| | | | | |
|---|---|---|---|---|
| EV charging infrastructure | Indirect | Technically advanced; | Alignment with vehicle supply and demand; tariffs and metering | Tariff reform; metering roll-out |
| Electrolysers | Indirect | Technically progressed; needs development | Cost | Investment incentives |
| Hydrogen DRI | Moderate; direct | Technically progressed; needs development | Cost | Investment incentives |
| Geological CO2 sequestration | Moderate; direct | Technically developed | Cost; storage | Regulation |
| DER integration | Indirect | Technically advanced; needs development | Cost; regulation | Pilot funding; regulatory reforms |
| SMRs | Large; direct | Technically immature; needs development | Illegal; societal barriers; cost | Watching brief for Australia |
| Biofuels | Moderate; direct | Technically mature; needs development in specific applications | Cost; fuel availability | Green fuel mandate; possibly pilot plant funding |