

Technology Investment Roadmap Discussion Paper

Woodside Energy Submission

Introduction

Woodside Energy welcomes the opportunity to contribute to the Australian Government's **Technology Investment Roadmap Discussion Paper – A framework to accelerate low emissions technologies** (the Roadmap). Woodside supports the Australian Government's approach of accelerating new and emerging low emissions technologies to meet our climate change targets and believes these technologies can support Australia's growing economic prosperity.

At Woodside we are focused on:

1. Supplying natural gas and reducing our direct emissions to increase the contribution natural gas makes to achieving global net zero;
2. Investing in innovative technologies to supply lower and zero carbon energy; and
3. Developing capability and technologies to offset greenhouse emissions at scale.

We encourage Government to prioritise funding towards projects that move beyond studies and demonstrate scale, and to policy levers that assist in accelerating the economic viability of transition technologies to a lower emission future.

Response to roadmap questions

a) The challenges, global trends and competitive advantages that should be considered in setting Australia's technology priorities.

Australia has substantial competitive advantages to enable it to capitalise on a global transition to low emissions energy:

- Large companies that enable Australia to compete in the global energy market;
- Positioned near growing Asian energy markets where we are a known energy trading partner;
- Excellent natural gas and renewable resources; and
- Intellectual capital and a capability to innovate and manufacture.

However, we also have substantial competitive disadvantages:

- Competing nations that coordinate sovereign wealth funds, fiscal support and special economic zones; and corporate and diplomatic sales efforts (e.g. US, Germany, Saudi Arabia);
- Competing nations are prepared to take strong direct measures (e.g. EU Vehicle Emissions Limits) to crystallise change in the energy sector;
- A traditionally uncompetitive manufacturing sector; and
- A focus on research (feasibility studies) rather than technology deployment at scale.

Winning in this internationally competitive market requires:

- Strong fiscal and regulatory measures on both the supply-side and market demand-side;
- Significant public and private investment and risk sharing in technology development and deployment at scale; and
- Competing commercially and diplomatically to secure export markets.

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b) The shortlist of technologies that Australia could prioritise for achieving scale in deployment through its technology investments (see Figure 7).

Any low-emission technology roadmap must focus on large-scale, cost effective deployment of:

- Low-emission energy sources: solar, wind, hydro, natural gas and/or nuclear;
- Highly efficient transportation and storage: hydrogen, batteries, transmission;
- Offsets for hard-to-abate and transitioning sectors; and
- Digital technologies to enable integration of the above into systems.

We agree with the technology roadmap focus on “cross-cutting” technologies and applications that can facilitate a broad range of low emission technologies. For example technologies to produce hydrogen are attractive because they support multiple sectors and applications, including transport, electricity generation and industrial processes that are difficult to decarbonize, opening opportunities to decarbonise that are not available through renewable electrification alone.

For the particular technologies in which Woodside sees a commercially competitive proposition, we would prioritise as follows (drawing in the content of Figure 7 of the roadmap):

Electricity	Transport	Buildings (residential and commercial)
Short term: > Large scale PV and offshore wind > Remote area power systems including small scale LNG and hydrogen Medium term: > Concentrated Solar Thermal – for deployment in remote, cyclonic, dusty settings > Next generation PV Long-term: > Small modular nuclear reactors	Short term: > Hydrogen fuel cell vehicles, both light passenger and heavy, including re-fuelling infrastructure	
Industry – feedstocks, industrial processes	Industry – process heating	Agriculture and land use
Short term > Mixed gas (hydrogen blended into methane) distribution technology and standards > Bio-abatement technologies Medium term > Carbon utilisation (using carbon waste to create useful products)	Short term > CST for thermal reforming Medium to Long term > Hydrogen for green steel and like industries	Short term > Enhanced soil carbon and biosequestration
Fugitive emissions and waste	Hydrogen (cross-cutting)	Enabling technologies
Short term > Methane leak reduction technologies > National Standards on methane leakage Medium term > Enhanced wireless remote sensor technology to monitor emissions	Short term > Develop and manufacture electrolyzers Medium term > Liquid hydrogen storage tanks and containerized transport tanks	Short term > Digital technology enablers
Mining and industrial equipment	Negative emissions	

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c) Goals for leveraging private investment.

As the Roadmap notes (page 34) public funding of innovation is needed. The Roadmap identifies the need to fund basic research, and to substitute for venture capital given the thinness of Australia’s venture capital market.

As the Roadmap further notes, Government support for innovation can take a range of forms, and the different options have advantages for different stages of the technology life cycle. Woodside is largely agnostic between options (other than to argue that the scale of support needs to be increased materially to support the Roadmap). In Woodside’s view the main groups of options are below (with more detail on Woodside preferences in answer (d)):

Govt Investment Methodology	Examples	Woodside Commentary
Pre-competitive research	<ul style="list-style-type: none"> • University funding • Cooperative Research Centres 	Essential and supports directed research into fundamental scientific breakthroughs. Historically has been an over-balance of this in the total Government investment portfolio.
Supply side fiscal support	<ul style="list-style-type: none"> • Grants and loans • Tax Crediting 	Grants/loans require ‘picking winners’ but this can be minimized by having scaleable staged competitive processes. Tax crediting avoids the ‘picking winners’ risk and is differentially accessible based on corporate tax positions, prioritizing tax paying corporate entities.
Supply side industrial aggregation	<ul style="list-style-type: none"> • Hubs, special economic zones¹ • Infrastructure development 	Governments can stimulate common industries and collaboration by addressing common project risks such as industrial land, large infrastructure (eg. Ports), supply chain, utilities etc and this is best done in aggregated hubs or integrated initiatives.
Demand side mandates	<ul style="list-style-type: none"> • Fuel and appliance standards / content requirements • Emissions regulation 	Targets for hydrogen in natural gas networks or LNG use in remote minesites can also be backed by approvals conditions on the consuming project.
Demand side market development	<ul style="list-style-type: none"> • Public sector procurement • Consumer Subsidies 	The Commonwealth and State Governments have significant procurement power and can underpin nascent market demand and infrastructure rollout (eg converting bus and light vehicle purchases to hydrogen).

¹ **Low Emission Industries Special Economic Zones.** SEZs could be established to attract and facilitate investment including foreign, integrate local firms into global value chains, promote export-oriented growth and generate employment. The government could co-invest or provide incentives for industrial/manufacturing infrastructure for low emission industries, particularly renewable hydrogen hubs. The government could facilitate agreements with Australia’s FTA partners for co-investment/tariff relief for participating in the hubs. Examples of other nations adopting this approach include Shenzhen in China and Iskandar in Malaysia, both the United States and the United Kingdom have used Enterprise Zones.

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d) What broader issues, including infrastructure, skills, regulation or planning, need to be worked through to enable priority technologies to be adopted at scale in Australia while maintaining the support of local communities.

Scale

- We encourage Government to prioritise funding towards projects that move beyond studies and demonstrate scale, and to policy levers that assist in accelerating the economic viability of transition technologies to a lower emission future. This type of support is crucial to move Australia beyond feasibility studies and encourage projects of the scale required to have a material impact on Australia's future.

Infrastructure

- Lack of access to infrastructure, whilst not in itself a technology issue, can impede technology deployment. For example a low emissions export project may require access to conventional infrastructure such as a deepwater port in proximity to the renewable resources underpinning the project.
- Government could explicitly budget for an annual co-investment in low emissions energy infrastructure, recognising that the energy system we are endowed with today was largely a result of public investment that was subsequently privatised. Another way to provide efficient infrastructure access may be to develop low emissions special economic zones as a crucible to develop low-emissions industries.
- Government can also act as the market maker for low-emissions energy technologies by transitioning Government vehicle fleets to low emissions technology; consuming Government energy from low-emissions sources; and developing regulatory systems that encourage others to do the same. This can help build out infrastructure across the value chain.

Skills

- The University and VET sectors will need guidance from industry and the Government on priorities for skills requirements across the value chain, from renewable energy operators and vehicle maintainers to household hydrogen appliance installers.
- Woodside would also suggest the establishment of a national biosequestration institute, e.g. through a state agricultural college, and the creation of apprenticeships for biosequestration technicians and sequestration verifiers. Skillsets include planning, design, through to machinery automation and to plant science.

Regulation

- A regulatory gap-analysis is needed so that regulations and standards can be put in place ahead of the need to apply them to low emission energy projects. This may be critical to ensuring public confidence in new technologies.
- This regulatory system needs to be flexible and adaptive so that it does not stifle innovation. For example, where carbon offsets are intrinsic to the low emission technology (e.g. blue hydrogen), any verified offsetting methodology should be permissible rather than just CCS.
- Development of international carbon trading rules (most likely through Article 6 of the Paris Agreement) will take time to complete and should be prioritised to deliver an export trade framework that recognises, and adjusts for the emissions intensity of its exported products.

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Planning

- Local planning and land use regulation may need to be overhauled, for example to allow for large scale renewable energy; to re-purpose land to biosequestration; or to allow for distributed energy generation within a community setting.
- Energy system planning is also being overhauled to account for the growth in distributed energy and demand-side management. The Government should develop an energy infrastructure transition plan, based on a model that assumes a net-zero emissions system by 2050. This would reveal value levers and potential strategic technology and infrastructure investments; and reveal the impact of policy on the trajectory of change. With the right signals, industry can invest in those plans.

e) Where Australia, including its regional communities, is well placed to take advantage of future demand for low emissions technologies, and support global emissions reductions by helping to deepen trade, markets and global supply chains.

Australia's abundant natural gas, renewable resources, land mass, geoscience expertise and its longstanding international energy trading relationships and reputation all stand it in good stead to capitalize on low emissions technologies such as hydrogen and carbon capture, utilization, and storage. Many aspects of this advantage are in regional communities, which could benefit in the same way that they have benefitted from regional development driven by the oil, gas and mining sectors.

Suggestions for economic stretch goals that could help establish pathways for the cost-effective deployment of priority technologies.

- Increase Australia's R&D spend from 1.8% of GDP to the OECD average of 2.4% (2017 data²), with the increment dedicated to low emission technology. Ensure that this total spend is segmented across the RD&D life cycle so that the Government has a portfolio of investment from basic research and development to commercial scale deployment.
- Set a target for investments in new low emission capacity. For example, *Bloomberg New Energy Finance* cites investment in Australian zero carbon power capacity of US\$82bn by 2040 and cumulatively US\$105bn by 2050, in their *2019 New Energy Outlook*.
- Set clear targets for outcomes (similar to the H2 for \$2 goal) including volume of hydrogen in the natural gas network and quantum of carbon utilized and/or sequestered.

² <https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm>

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The Government is interested in partnering with industry, research institutions and others with relevant commercial or technical expertise to develop these economic stretch goals, which should be ambitious but achievable.

Woodside is a leading and innovative Australian energy company. We have the commercial and technical expertise, but more importantly, the scale to enable a transition.

We have recently committed \$40M to the Monash Energy Partnership, sponsored the CSIRO National Hydrogen R&D Strategy, established multiple hydrogen export consortia, and secured international government funding for feasibility studies to establish hydrogen export from Australia. We're one of the largest private investors in carbon farming, and are an emerging investor in international energy transformation efforts, and have invested in 100 refuelling stations in Korea.

Woodside welcomes the opportunity to work with the Federal government to help transition the Australian energy system in the national interest.