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A Greener Dragon? Climate Change Lessons and Opportunities for Cooperation between China and Australia

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Abstract

This paper examines the impact of climate change on Australia, and whether there are lessons and opportunities for cooperation from China's experience. It contends that Australia is seemingly out of alignment with the international community in addressing climate change, not least because Australia's mitigation actions have been constrained by economic reliance on coal exports, the domestic use of coal for energy production and the influence of vested mining interests on climate change policy.

This paper argues that Australia needs a strategy to communicate and demonstrate to the Australian public that mitigating and adapting to climate change is in Australia's national interest, particularly in relation to human and comprehensive security issues. It concludes that Australia can benefit from China's experience as a 'greener dragon', offering lessons for Australia on achieving climate change-related economic and energy reform, as well as sustainable development and cooperation opportunities.

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Introduction

In September 2014, US President Barack Obama remarked to a UN Climate Change Summit that:

> [F]or all the immediate challenges that we gather to address this week—terrorism, instability, inequality and disease—there's one issue that will define the contours of this century more dramatically than any other, and that is the urgent and growing threat of a changing climate…. We are the first generation to feel the impact of climate change and the last generation that can do something about it.[1]

The US, through its 2015 Clean Power Plan, has committed to curbing power plant carbon emissions by 32 per cent by 2030.[2] China has also declared, through its submission to the UN Framework Convention on Climate Change, that it will reduce carbon dioxide emissions by 60-65 per cent of GDP and increase forest stock volume by 4.5 billion cubic meters on the 2005 level.[3]

The commitments by China and the US are significant as they are the world's first and second largest green house gas (GHG) emitters. Neither country had previously committed significant action to the international GHG reduction framework, although both had made domestic economic and environmental adjustments.[4] However, it is widely recognised that the participation of China and the US is essential to achieving the UN-mandated target of reducing emissions to avoid what otherwise has been predicted to be irreversible 'tipping points', resulting in catastrophic changes to the climate system.[5] Their commitment also accords with the global priority being placed on mitigating climate change, including through the transformation of their economy and energy sectors.

China's commitment to climate change mitigation is an important economic issue for Australia. As China is Australia's largest trading partner, any adjustments China makes to its economy will impact the Australian economy.[6] China has been signalling the importance of the environment and climate to its economy since the release in 2001 of its 10th Five Year Plan (2001-05), in which it set targets for fuel consumption and energy conservation, and foreshadowed an expansion of forests as 'carbon sinks'.[7] This was followed in 2008 by a White Paper on Climate Change.[8] More recently, the 12th Five Year Plan set a target for the reduction of energy intensity and signalled an intention to price carbon by trialling an emissions trading scheme.

China is also undertaking macro-economic restructuring, reflecting an attitude shift toward a low carbon or 'green economy', focusing on energy efficiency, renewable energy, environmental sustainability and domestic innovation.[9] Some have suggested that these initiatives are linked to the legitimacy of the Chinese Communist Party, particularly since 2013 when air pollution in a number of urban centres became so bad that it constituted a threat to social stability.[10] Regardless, the initiatives have had a positive effect on emission reductions. China's actions are also consistent with Australia's other major trading partners in Asia, North America and Europe.[11]

This presents opportunities for Australia to leverage its trading relationships to work with trading partners in order to mitigate climate change as a threat to human security.[12] Climate change can threaten human security by slowing economic growth, making poverty reduction more difficult, and eroding food and water security.[13] Climate change impacts are also likely to result in human displacement and migration, particularly in the Indo-Pacific region.[14] As noted by the Climate Council of Australia in 2015, the Indo-Pacific region is:

> [O]ne of the world's most disaster prone [regions]; in 2014 over half of the world's 226 natural disasters occurred here…. [Moreover], Asia is also home to more than 90 per cent of the global population … [living in a region] that is exposed to tropical cyclones, with rising sea-levels magnifying the impact of storms.[15]

Extreme weather effects, water and food scarcity, and population migration also have broader security implications, leading climate change to be considered a 'threat multiplier', suggesting there is considerable potential for climate change to impact significantly on the national security of affected states.[16] However, climate change is also a transnational security issue. While effective state-level policies are critical, individual countries alone cannot remove the climate change threat—there has to be coordinated international action to reduce GHG emissions.

This is an important consideration for Australia, as it is the 13th largest GHG emitter and, according to Australia's Climate Change Authority—an independent statutory body—the highest GHG emitter on a per capita basis.[17] Yet Australia is seemingly out of alignment with the international community in addressing climate change. In particular, Australia's mitigation actions have been constrained by economic reliance on coal exports, the domestic use of coal for energy production and the influence of vested mining interests on climate change policy.[18]

The Climate Change Authority has recommended that Australia's emission reductions be 30 per cent below 2000 levels by 2025.[19] However, the Australian Government has committed only to a 26-28 per cent reduction below 2005 levels by 2030.[20] Australia's intended mitigation measures and timeframe have drawn international criticism, with the International Energy Agency, G20, EU, China, US, Switzerland and Brazil all criticising Australia for being out of alignment with international expectations.[21] This is more noticeable when a developing country such as China is taking more direct action than Australia to deal with climate change. It is compounded by the fact that Australia, as a leading supplier of uranium, does not use nuclear power—and that it is one of the hottest, driest continents but makes use of solar electricity for only 2 per cent of its energy needs.[22]

Australia's misalignment with the international community and its continuing reliance on coal places Australia's economy and infrastructure at risk, as well as impacting Australia's reputation. Although coal currently generates significant export revenue for Australia, the international move away from the use of coal, because of its impact on climate change, is resulting in a declining market.[23] These issues require a trade-off decision about positioning Australia's economy for the future, particularly when some alternative energy sources—such as a nuclear energy capability—would likely take up to 10 years to develop.[24]

As a developed economy endowed with natural resources, it is within Australia's capacity to undertake reform and increase GHG emission reductions. The constraints for Australia implementing mitigation actions are 'no longer technological or economic…. [t]hey are political, institutional and ideological [based on individual and cultural belief systems]'.[25] To overcome these constraints, Australia needs a coherent bipartisan strategy to mitigate climate change, offering a road map, change management plan and context narrative for the Australian public on the necessary changes to industry and the economy.[26] Such a strategy would also provide a pathway for government actions and the synchronising of policies required to adapt to the current and emerging effects of climate change.

This paper will contend that the development of such a strategy is in Australia's national interest, particularly in relation to human and comprehensive security issues. It will further contend that Australia can benefit from China's experience as a 'greener dragon', offering lessons for Australia on achieving climate change-related economic and energy reform, as well as sustainable development and cooperation opportunities.

In considering how Australia should respond to climate change and maximise its development opportunities, Part 1 of this paper will outline why climate change is a 'diabolical' policy issue and recommend a strategy to address this. It will outline China's strategy and approach, and draw out the key lessons for developing a climate change strategy. Part 2 will propose that Australia needs a climate change strategy based on an economic argument, and assert that there is strong popular support for government action on climate change. It will also propose the content of a climate change strategy and how this would be implemented, contending that the foundations of a strategy exist within the current policy framework, although they are not integrated and do not achieve a synergistic effect.

Part 3 will outline China's climate change policy initiatives and their relevance for an Australian climate change strategy. Part 4 will propose two major initiatives centred on Australia's energy mix and low carbon cities that would complement an Australian climate change strategy, as well as offering opportunities for cooperation and development with China. The paper will conclude that adjusting Australia's approach to climate change, and leveraging the trading relationship with China, presents a unique opportunity to transform Australia's economy, energy and infrastructure, and improve Australia's contribution to global GHG emission reductions.

Part 1: Climate Change is a Diabolical Policy Issue

A diabolical policy issue incorporates the characteristics of a 'wicked' policy problem. It also contains the characteristic of being long term, rather than immediate, implying that effective solutions are unlikely to be easily developed or implemented. While some wicked problems are purely domestic, the globalisation of modern society suggests that most can only be adequately resolved through international cooperation of unprecedented dimension and complexity.[27]

Climate change is certainly not a short-term issue. A number of mitigation actions, even if implemented immediately, would likely have minimal influence this century, not least because some GHG remain in the atmosphere for up to 120 years.[28] Governments must be prepared to mitigate and adapt to climate change over a long period. This requires the development of policies within an intergenerational framework, focusing on economic, social and environment areas.

Furthermore, climate change policies should have bipartisan support to ensure there is continuity throughout any change of government. As climate change impacts the economy, environment and human security, it is a comprehensive security issue and it is, therefore, in the national interest to mitigate and adapt to it.[29] Only a consistent and comprehensive government approach, underpinned by effective communication with the Australian public, will enable policy certainty and coordinated mitigation and adaptation action.

Developing an appropriate mechanism

A strategy provides a road map to deal with diabolical policy problems. According to Gerry Johnson and Kevan Scholes, a strategy is 'the direction and scope of an organisation over the long term … which achieves advantage for the organisation through its configuration of resources within a changing environment, to meet the needs of markets and to fulfil stakeholder expectations'.[30] Harry Yarger contends that a strategy can also be defined as 'the calculation of objectives, concepts and resources within acceptable bounds of risk to create more favourable outcomes than might otherwise exist by change or at the hands of others'.[31]

Taking these broad definitions into consideration, the key effect to be achieved from a climate change strategy would be an explanation of the vision and policy themes in order to gain business and public commitment to investments that mitigate and adapt to climate change. China's approach to a climate change strategy offers an example where there are some lessons that may be applicable for Australia.

China's climate change approach and strategy

China undertakes climate change mitigation and adaptation action through an authoritarian environmentalism approach and a 'green economy' strategy. Bruce Gilley defines authoritarian environmentalism as a 'non-participatory approach to public policy making and implementation in the face of severe environmental challenges'.[32]

China's approach reflects an appreciation that 'China's climate is complex and its ecological environment is fragile, which makes it very vulnerable to the adverse impacts of climate change'.[33] Climate change-related extreme weather events are projected to increasingly affect the heavily-populated coastal cities of Shanghai (22.3 million people) and Tianjin (11 million people), causing not only humanitarian disasters but also impacting China's industrial capacity and economy.[34] Additionally, an anticipated sea level rise of one metre would likely impact 'twelve

coastal provinces [that] account for 42 per cent of its population and 73 per cent of its GDP'.[35] China accordingly acknowledges the nexus of climate change with its future prosperity and economic growth, and has crafted an approach and strategy to align with China's context.

Economic development and the ongoing legitimacy of the Chinese Communist Party are the key drivers of China's strategy and approach to climate change. Economic development has enabled over 500 million people to be lifted out of poverty and food security to be achieved.[36] However, China's initial focus on economic development resulted in severe ecological and environmental damage.[37] The tipping point occurred in 2013, when citizen discontent and social protests over air quality in Beijing prompted media attention and forced the Government's commitment to improve air quality through reducing carbon emissions and improving energy intensity.[38] While economic development remains a key driver for political legitimacy, more recently this has been balanced by the requirement for ecological and environmental sustainability to achieve a mitigating effect on climate change.

Recognition of the nexus between climate change and human security, and the legitimacy of the Chinese Communist Party, resulted in China adapting its approach to climate change. China's approach has evolved from 'hard line' during the 1997 Kyoto Protocol negotiations to one where climate change adaptation and mitigation measures are considered as an economic opportunity for a green economy.[39] Evidence for this includes climate change receiving increased priority in China's Five Year Plans from 2006, as well as the growth of investment in clean energy, both signalling the transformation of China's economy to a green economy.

China's transformation to a green economy is also reflected in the Government's planned implementation of an emissions trading scheme in 2017, and that China became the world's leading exporter of solar and wind technology in 2009.[40] Consequently, it can be argued that China has constructed its strategy for climate change mitigation and adaptation by viewing climate change as an economic development opportunity, rather than an environmental issue. Such an approach is suited to China's strategic context. As a developing country, it is continuing to seek economic growth through dominating areas of a 'green market', while economic growth—along with ecological sustainability—is the narrative being utilised to maintain the legitimacy of the Chinese Communist Party. The effect of this approach positions China as a 'good international citizen', through making meaningful contributions to international norms.[41]

China has also prioritised climate change as an economic issue to address ecological degradation. This is reflected in the fact that the central policy-making body on climate change is the National Development and Reform Commission, which has broad administrative and planning control over the Chinese economy. Within the Commission, the primary body to execute climate change policy is the National Leading Committee on Climate Change, chaired by China's Premier. It coordinates actions across 20 ministries, ensuring climate change adaptation and mitigation actions are prioritised, coordinated, controlled and transformed to meet government requirements,[42] although local governments may modify policies and the method of implementation to accord with local economic priority issues.[43]

China also promulgates to domestic and international audiences its climate policy achievements and planning for future developments, primarily through the annual *China's Policies and Actions for Addressing Climate Change* report. Each report serves as an annual strategy, providing direction for provinces and businesses on future climate change mitigation and adaptation investments—in effect a roadmap and a vision for China's transition to a green economy. The 2014 report, for example, highlighted industry restructure, the focus of the economy on low carbon technology and bilateral arrangements.[44] It also outlined key policy focus areas, such as coal consumption targets, regulation measures and the dual treatment of mitigation and adaptation policy development.

China's approach and strategy provides key lessons for Australia. First, the Australian Government needs to set and communicate the climate change strategy and policy agenda in order to provide certainty for businesses and the public on investment opportunities. Second, the Government should communicate its achievements against the strategy, thereby providing transparency in its approach to climate change, as well as enabling learning and policy

adjustment to occur. Third, the Government should prioritise climate change policy implementation and achieve policy synergy through the establishment of a coordination body. Finally, climate change mitigation and adaptation action should be viewed as an economic opportunity rather than simply an environmental issue.

Clearly, however, there are a number of issues in reviewing China's approach and strategy and their applicability for Australia. First, the degrees of recognition of climate change vary between China and Australia, with the former having decided that specific measures must be adopted while the latter continues to have partisan policies. Second, China's political system allows it to adopt policies directly from the central leadership. In addition, the political system in China normally provides for a relatively stable governing cohort to stay in power for ten years, with no official opposition. In contrast, Australia has much shorter election cycles and a political culture wherein the opposition tends to oppose most government policies. Moreover, partisan positions lock parties to specific policies to the extent that once in power, they often find it difficult to reverse their earlier policy positions.

Similar to Australia, China's policies also are subject to trade-off decisions between sustaining economic growth and the need to address climate change.[45] However, it appears that China—having positioned itself as a green economy—is developing a market and market instruments to minimise the trade-off decision requirements, and is communicating this strategy to domestic and international audiences. Consequently, while the political systems and capacities may be different, the requirements and effects of a strategy remain applicable to both countries.[46] Therefore, a key initiative for Australia would be to develop and implement a climate change mitigation and adaptation strategy.

Part 2: An Australian Climate Change Strategy Initiative

This part of the paper will argue that Australia needs a climate change strategy to address what is a diabolical policy issue. It will highlight that the foundations for a strategy exist within the current policy environment, although they are not integrated or coherent and do not achieve policy synergies. It will also provide the economic argument for implementing climate change policies and illustrate that there is strong popular support for Australian Government action on climate change. Finally, it will propose the contents of an Australian climate change strategy and how this would be implemented.

The need for a climate change strategy

Because of the nature of the Australian electoral cycle, there are short-term electoral imperatives and sectional interests that diffuse policies, as well as impacting on long-term national security considerations. This has been particularly evident in Australia's approach to climate change since 2007. The lack of vision for a long-term strategy for climate change, and planning for mitigation and adaptation action, is also reflected in the Australian Government's *2015 Intergenerational Report*, which is a significant policy deficit in a report that is meant to be a 'social compact between generations ... to make choices today to build a strong and resilient economy … for future prosperity'.[47]

Furthermore, given Australia's vulnerability to climate change impacts—which increasingly include a reduction of average winter rainfall, an increase in extreme fire weather and droughts, and more intense cyclones—it could be assumed that there would be strong partisan support for climate change policies. [48] However, this is not the case; instead, 'climate action in Australia has been a polarising and highly political issue … [and] could be seen as inconsistent and lacking in direction'.[49] This is a contributing factor in Australia's misalignment with the international community's approach to climate change.

Additionally, the current political approach is the antithesis of what is required in dealing with climate change as a diabolical issue. Climate change necessitates a bipartisan approach—including a shared vision and coordinated policy framework—to ensure consistency of action over a long intergenerational period. A strategy initiative that considers these issues, along with

the economic argument, must be developed to ensure success in mitigating and adapting to climate change.

The economic argument

According to one recent study, the prospective economic impact of climate change in Australia has been estimated at $226 billion, which includes the cost of damage to infrastructure by extreme weather events and a sea level rise of 1.1 metres.[50] The damage to critical infrastructure (road, rail, ports and warehousing) is expected to be devastating. Moreover, the economic impact will likely worsen commensurately with Australia's projected population growth, and be exacerbated by the likelihood that close to 90 per cent of Australia's population will be residing in urban areas on or near the coast.

Droughts are anticipated to further impact the economy through an annual reduction of 1 per cent of GDP from 2020, while extreme heat will continue to impact the productivity of the Australian economy.[51] In 2013-14, for example, heatwaves caused an estimated productivity loss of $8 billion due to reduced labour capacity and disruption of electricity supplies. The impact of bushfires has already been realised, with insured losses averaging $160 million per year during the period 2003-13. Without a global reduction in GHG emissions, it is also estimated that Australia's agricultural exports will decline between 11 and 63 per cent by 2030 and between 15 and 79 per cent by 2050.

Based on these projections, Australia needs to take action to mitigate and adapt to climate change, as opposed to its current approach of expending funds in dealing with the current climate impacts. A climate change strategy would articulate a pathway for the transformation of the Australian economy and its infrastructure, as well as a cultural shift in the population (the ideological basis) regarding the need to mitigate climate change. The economic consequences of Australia not taking climate change mitigation and adaptation action will impact significantly on Australia's overall national security.

To date, Australia's limited actions are impacting bilateral investment opportunities and risk leaving Australian industry 'stranded' through continued investment in declining industries. For instance, China and the US have recently declared in a joint statement that they would reduce carbon emissions, commit to fuel efficiency standards and commit climate finance to assist developing countries transition to low carbon economies.[52] In the same statement, China also committed to launching an emissions trading scheme and using low carbon sources in the electricity grid. As China is Australia's largest trading partner, China's actions and transition to a green economy place Australia's economic and financial system at significant risk of stranded assets in a declining market.

A recent discussion paper by the Climate Institute of Australia outlines that the nature of climate regulatory risk is changing and that companies are now shadow carbon-pricing investments to determine their exposure to GHG emissions.[53] It also contends that investors are increasingly considering GHG emissions as part of their fiduciary responsibilities, such as superannuation funds screening fossil fuel investments.

The International Energy Agency has also warned that a transition away from fossil fuel needs to be orderly or could trigger a 'rushed exit', stranding approximately US$300 billion in fossil fuel production assets world-wide.[54] Australia's reliance on coal exposes the Australian economy to such a risk, with coal providing 64 per cent of Australia's energy mix and with Australia being the fourth largest coal producing country and the world's largest coal exporter.[55] Financial analysts have also highlighted a risk to Australian sovereign debt as a result of international macro-economic shifts away from coal, which would significantly impact Australia's export market, with a recent report arguing that:

> [The] Australian economy is more susceptible to a policy shock than other developed markets given the uncertainty surrounding its national climate change policy, which currently lags other developed markets, combined with the level of dependency of the Australian economy on carbon-intensive sectors.[56]

There is a strong argument, therefore, for Australia to commence transitioning from its reliance on coal for energy and export to avoid any negative impact to the Australian economy of a 'rushed exit' from coal.

Existing foundations

Australia already possesses a number of policy instruments, institutions, scientific evidence and Government-directed reports to provide the foundations for an Australian climate change strategy. These include the Garnaut Reviews of 2008 and 2011, the Climate Science Framework 2009, and the work of such organisations and departments as CSIRO, Climate Change Authority, Bureau of Meteorology, Department of Environment, Department of Industry, Innovation and Science, and Office of the Chief Economist.[57] However, although these key strategic information sources and programs exist, there is not a sustainable development climate change strategy that links the foundation assets to individual departmental initiatives or provides certainty for the community and economy.

Additionally, the dispersed and uncoordinated nature of Australia's response to climate change reduces the opportunities for synergy, diffuses policies and does not enable effective communication with the Australian public. For instance, the australian.gov.au website does not have an entry point for climate change information. To find initiatives and policies on climate change, an individual must review the websites of four government departments and four associated organisations/bureaus and authorities.[58] This contrasts with China's system, where there is a readily identifiable coordinating committee, chaired by the Premier, with clearly-articulated responsibilities for coordination and synchronisation.

Popular support

Notwithstanding the lack of a climate change strategy, a recent poll indicates that the majority of the Australian people support the need to mitigate and adapt to climate change, with 70 per cent of respondents agreeing that climate change is occurring, 57 per cent trusting the science on climate change and 59 per cent believing that the Government is underestimating its impact.[59] Significantly, 63 per cent were of the view that the Government should take more action, including such measures as supporting the growth in renewable energy and a move away from coal, the regulation of carbon pollution, and that polluters (not taxpayers) should be financially responsible for costs.

These findings were mirrored in a 2015 poll by the Lowy Institute, where 63 per cent of respondents thought the Government should commit to significant GHG reductions, while 43 per cent believed solar energy would be the primary source of electricity in 10 years, with 13 per cent believing it would be nuclear energy.[60] Based on these polls, it would seem that the population is favourably positioned for a cultural shift, warranting the implementation of a strategy that focuses on communicating government actions and the future plans necessary to transform Australia's economy, energy and infrastructure.

Contents of an Australian climate change strategy

Drawing on the lessons from China, this paper contends that Australia's climate change strategy should be framed in three parts. Part one should contain a strategic narrative explaining the vision, imperative and priority for the Australian public on climate change. This would effectively be the business case for undertaking climate change mitigation and adaptation action, and should be expressed as an opportunity to reform Australia's energy infrastructure and establish new markets.

The narrative should explain the link between climate change and the Australian economy, particularly acknowledging the trend of Australia's international trading partners away from coal. It should explain why Australia must participate globally in emission reductions and acknowledge that all countries need to take action to mitigate climate change. It should draw on Australian and international scientific evidence to outline the projected physical and economic impact and risks of climate change to geographical areas throughout Australia.

Part two of the strategy should illustrate the positive aspects of mitigation in terms of energy and infrastructure reform and ameliorating perceived business risks. The strategy should articulate the short-, medium- and long-term goals, as well as the innovation, research and policies that need to be implemented or developed for complementary mitigation and adaptation measures. It should highlight the key political commitment of avoiding investments that lock in future carbon developments.

There should also be a commitment to renewable technology, infrastructure, and research and development, as well as an educated debate on Australia's energy mix. This would include a discussion on utilising nuclear power and mandating that all federal government policies be reviewed to assess the impact and risk to mitigation and adaptation measures. The effect would be to provide certainty for businesses and the public to invest in climate change mitigation and adaptation actions, thus facilitating business opportunities.

Part three of the strategy should provide guidance on how the Commonwealth would support and complement the mitigation and adaptation actions of states and territories, building on the work of the Council of Australian Governments, which commenced in 1992 with a National Strategy for Ecologically Sustainable Development, followed by a National Strategy on Energy Efficiency in 2009.[61] Although the Council has developed a number of strategies for climate change-related issues, there is not an over-arching strategy or focus for transforming the economy that aligns the Commonwealth and Australia's states and territories, nor have there been any updates since 2009.

The effects of not developing and implementing a comprehensive strategy to reform Australia's economy can be assessed on an opportunity cost basis. Although economic reform would require investment in energy and infrastructure, it is generally agreed that this would outweigh the cost of 'stranded assets' and the risk to sovereign debt as the international economy transitions away from fossil fuels. Furthermore, without a change in Australia's GHG emissions reduction commitments, Australia's reputation in the international community will continue to degrade.

Strategy oversight

One option to ensure a heightened focus on sustainable development and emissions reduction/low carbon future would be to re-establish a Climate Change Department.[62] However, given current economic constraints, a more viable option would be for the Department of Industry, Innovation and Science to assume the responsibility for climate change policy coordination. The existing Clean Energy Regulator could be transferred to this department and a dedicated Climate Change Commission, internal to the Department, could be established to focus on coordination requirements and the synchronising of policy approaches and initiatives across the Australian Government.

Although this proposal would position the GHG emitting industry elements against climate change policy within the one department, it would allow for the contestability of policies and implementation in an economic framework of sustainable development, rather than an environmental framework. Under this proposal, the Department of Environment would retain the responsibility for environmental protection issues associated with economic development.

Developing an Australian climate change strategy as proposed in this paper would articulate the direction and priority of climate change within the Australian Government for business, public and the international community. It would enable a commitment to initiatives that would provide a transformation of the Australian economy, energy mix and infrastructure. China has undertaken a number of initiatives in these areas that provide an opportunity for Australia (and others) to learn from China's evolving approach, as well as potential areas for cooperation and development.

Part 3: 'A Greener Dragon' Actions and Their Relevance for Australia

Having established that climate change is a diabolical policy issue and that a strategy is needed to manage this issue, this part of the paper will outline China's policies and the opportunities for

cooperation and development for Australia. It will focus on the green economy, financial policy, infrastructure, and renewable energy. It will highlight that Australia can learn from China's policy initiatives and use climate change as the opportunity to transform the Australian economy and energy supply mix. It will contend that the 2014 Memorandum of Understanding on Climate Change between Australia and China, and the Comprehensive Strategic Partner Dialogue, are appropriate frameworks to collaborate on practical climate change outcomes.[63]

China's 'green economy'

The Chinese Government's report *China's Policies and Actions for Addressing Climate Change 2014* declares that 'pursuing green, low-carbon development and actively addressing climate change is not only necessary to advance our ecological progress and put our development on a sustainable path, but will also demonstrate to the world that China is a responsible country'.[64] This reflects China's strategy for developing a green economy, wherein 'green development is part of the policy approach to overcoming future risks and finding new robust sources of growth'.[65]

It is estimated that the changes to China's energy policy and infrastructure to achieve a green economy are likely to cost $US6.6 trillion.[66] A 2013 report by China and the World Bank forecast that the 'contribution of emerging green industries to China's GDP will be 15 per cent by 2020'.[67] The report assessed that China has the ability, capacity and human capital, as well as the renewable energy resources, necessary to innovate and develop into a green economy.[68] The report identified that implementation of the strategy is to be achieved through mandated fuel efficiency, an emissions trading scheme, low carbon cities, closure of coal plants, acceleration of energy-saving measures, development of a smart grid, and demonstrated support and growth in renewable energy.[69]

Although China is currently dependent on coal for approximately 80 per cent of its electricity, it intends to reduce its dependency to less than 40-50 per cent by 2050, reinforcing its commitment to diversify its energy sources towards a green economy.[70] This has particular relevance for Australia, as China is its largest trading partner, and any macro-economic changes will impact Australia's prosperity. Consequently, 'understanding China's growth is also profoundly important for Australia as we craft a national strategy to seize the opportunities it affords and avoid the risks it poses for us',[71] which will include the need for Australia to adapt its political and economic approach to retain access to China's significant market.

Financial considerations

China has adjusted its financial policy approach to GHG emissions and climate change mitigation actions to support a green economy and reduce GHG emissions. China has announced that it will implement an emissions trading scheme in 2017. China had previously signalled this intention in its 12th Five Year Plan through pilot schemes being conducted in seven significant economic regions, including Beijing, Tianjin, Shanghai, Chongqing and Shenzhen, as well as the Guangdong and Hubei regions.[72] When these regions are combined, they amount to the world's largest national carbon pricing (by volume) initiative.[73]

China's fiscal approach to GHG reductions supports the development of a green economy and is likely to present opportunities for the global carbon pricing system when it is implemented in 2017. A recent World Bank report states there are currently 40 nations and 20 cities pricing carbon; this is an expansion of 90 per cent since 2012.[74] The report also highlights that businesses are pricing carbon as part of a risk management strategy.

Given China's move to an emissions trading scheme and increased global participation in either an emissions trading scheme or carbon pricing system, Australia should reconsider a carbon pricing system to maximise opportunities in the international system and to provide a fiscal mechanism to support any climate change strategy. This would be controversial, given Australia's partisan history on climate change and carbon pricing—and is unlikely to occur in the short term. However, any climate change strategy should be underpinned by financial policy that provides incentives for business and consumer decisions to change behaviour, or taxes on carbon emissions for maintaining GHG emitting behaviours.[75]

Mitigation and adaptation infrastructure

Underpinning China's strategy is the dual priority placed on mitigation and adaptation actions to manage climate change. China has created the conditions for the development of low carbon cities.[76] It embarked on a program of closing inefficient power plants and set a target of 16 per cent energy intensity reduction in its 12th Five Year Plan; in 2011, it also declared that a national high speed rail covering 16,000 kilometres would be built by 2020.[77] The World Bank has determined that 'urban infrastructure and policies can influence lifestyle choices which in turn impact urban [GHG] emissions'.[78]

China has also commenced 'eco-city' developments with an emphasis on low carbon emissions through an integrated approach to smart land use, which includes preserving green space through promoting urban agriculture and vertical greening, and energy and resource efficiency.[79] This is significant as China expects to reach an urbanisation level of 51 per cent by 2015, making cities a key component of its plan to reduce energy intensity and GHG emissions. The actions that China has taken include cleaner energy systems, managing private vehicle demand and restricting private vehicle use to lower congestion and improve air quality, facilitating public transport, and walking and cycling modes to reduce emissions.

Furthermore, China's Government has curtailed local government land conversion from farming to urban development.[80] City adaptation measures include mapping risks, identifying vulnerable communities, emergency preparedness, flood plain management, improved drainage and water storage, and shore management to include safe routes.[81] These measures have proven particularly successful, with the US$3.15 billion spent on flood control averting estimated losses of US$12 billion.[82] The design, planning and technology to support the development of low carbon cities represents an opportunity for cooperation between China and Australia.

A key Chinese infrastructure investment has been the plan by the State Grid Corporation of China to implement 'smart' power grids by 2020. The Corporation provides electricity to over 1 billion people in China, however, supply is problematic due to the uneven distribution of resources and electricity consumption.[83] To enhance inter-regional transmission capacity, and integrate renewable energy, the smart grid vision aims to provide a coordinated, digitised and automated network, capable of supporting large-scale power transmission from multiple sources, utilising distributed generation and storage systems. To date, pilot projects have been implemented, demonstrating the viability of this research and development project.[84]

Australia also needs to upgrade its energy infrastructure to incorporate renewable energy, and conduct research on smart grid and infrastructure. So the smart grid concept provides an avenue of technology development and cooperation for the two countries. In particular, China is upgrading and enhancing nuclear plants, standardising market regulation of photovoltaic products, improving wind technology, using biological and geothermal energy for electricity production, and developing electric vehicles for application in the smart grid system.[85]

Renewable energy

The increased growth of renewable energy in China's energy mix is an important key to GHG reductions. China has reduced GHG emissions through reducing the amount of coal in the energy mix and increasing nuclear, hydro, gas and renewable, such as wind and solar.[86] In the past year, China increased hydropower by 12 per cent, LNG by 42 per cent and achieved new capacity in nuclear power generation and wind. Thermal coal imports declined 31 per cent as a function of low prices, reduced industrial activity, increased regulation and available hydropower—this is also reflected in a reduction of Australian coal exports to China by 23 per cent, worth A$635 million.[87]

China has also set renewable energy policies to include a system favouring renewable power generation (wind and solar, followed by hydro and biomass), while also requiring grid companies to improve transmitting technologies and enhance the integration capacity of renewables. The Central Government has also increased oversight of renewable energy development.[88]

Furthermore, China has 28 nuclear power reactors in operation and 23 under construction, and has become self-sufficient in reactor design and construction.[89]

China's use of renewable energy, albeit in different scales, mirrors that of Australia, where wind is the leading renewable technology. Australia's import of wind turbines from China potentially provides an opportunity for technology cooperation and development on improving efficiency and smoothing wind energy integration into electricity grid systems. China's upgrading and enhancement of its nuclear energy infrastructure may also have lessons for Australia in terms of the potential development (or at least the exploration) of a nuclear power capability.

While China and Australia have existing common areas for development, such as renewable energy integration, energy infrastructure development and carbon pricing, potential areas of cooperation clearly require a nuanced approach to effectively leverage the existing trading relationship. In particular, the relationship must take account of the different political approaches and objectives on climate change, and the different political systems.

Leveraging the China-Australia relationship

The China-Australia relationship has deepened over the last several decades, especially in the economic area, from one of dependency to interdependence, with China becoming Australia's largest export market in 2007. Despite differences in ideology and values, China regards the relationship as 'a stable and cooperative bilateral relationship'.[90] Indeed, President Xi Jinping has emphasised his Government's desire to 'expand bilateral cooperation to new areas, such as clean energy, the environment, financial services and infrastructure'.[91]

According to Jingdong Yuan, China wants to focus on economic ties with a strategic vision and considers that a successful relationship would be pragmatic, bipartisan, feasible and coherent in policy and engagement.[92] This reflects China seeking consistency of policy and policy implementation, which is a key lesson for Australia, particularly in climate change action. This further reinforces the requirement for Australia to develop and implement a bipartisan climate change strategy that views climate change as a sustainable development opportunity.

The traditional China-Australia economic relationship has been about resources, predominantly coal and uranium for energy security. However, China has recently prioritised clean energy, environment and infrastructure as areas for bilateral expansion. This presents opportunities for the development of further economic relationships, particularly in areas such as research and development for a green economy, and infrastructure mitigation and adaptation measures, including low carbon cities, smart grids and renewable energy sources, such as nuclear and wind technology.

As China and the US have made joint announcements on climate change measures, a strengthened Australia-China bilateral relationship on climate change would not necessarily challenge Australia's traditional security relationship with the US, particularly if based on the existing 2014 Memorandum of Understanding on Climate Change and the Comprehensive Strategic Partnership.[93]

The Memorandum of Understanding on Climate Change agrees that Australia and China will cooperate to 'deliver practical climate change outcomes … and encourages participation from business, industry and the scientific communities'.[94] The Comprehensive Strategic Partnership acknowledges China's and Australia's shared view of the economic importance of the relationship. Its aim is to take advantage of high-level dialogue between the Prime Minister of Australia and President of China to enhance dialogue and exchanges between the respective Governments and public sectors.[95] Both agreements would provide an effective framework for business, government and public sector dialogue and cooperation in areas of infrastructure, technology, innovation and energy efficiency.

Part 4: Australia's Policy Initiatives

This part of the paper proposes two key policy initiatives, containing micro initiatives, to complement an Australian climate change strategy. The initiatives also serve as potential areas for cooperation and development between China and Australia through leveraging the current trading relationship. The initiatives are themed on Australia's energy mix, and focus on a nuclear energy public discussion and low carbon cities.

The initiatives are key pragmatic programs that China is also implementing. Hence, cooperation through the Comprehensive Strategic Partner Dialogue and Memorandum of Understanding on Climate Change would enhance business opportunities for Australia. Each proposal will be reviewed against its potential contribution to Australia's national interest. An assessment will also be made on the political capital necessary to implement the initiative. Finally, it will outline which government department should be responsible for implementation and the resource implications, and the initiative's prospect of success.

The policy context

The Australian Government's *Australia's Energy Projections to 2049-50*, released in 2014, contends that coal and gas are expected to decline in Australia's energy mix consumption and, that in the absence of direct or indirect carbon pricing, coal power generation is projected to remain constant while renewable energy will increase to 22 per cent in 2020.[96] However, the report indicates that an investment in energy infrastructure should occur, both to replace ageing assets, as well as enabling the further integration of renewable energy. Consequently, for Australia to transition to a low carbon/green economy, a long-term restructure in the energy sector is required, including significant investment in technology, infrastructure and the energy mix.

The Australian Government's *Energy White Paper 2015* also noted the requirement for the refurbishment of infrastructure and decommissioning of coal-fired power stations that are beyond original design life.[97] The White Paper acknowledged the growth and benefits of nuclear energy, including that it is affordable, reliable and with significant environmental benefits over the existing use of coal. Indeed, Australia has 31 per cent of the world's supply of uranium; it also mines and exports uranium fuel for foreign reactor programs and has a nuclear research and medicine sector and a regulatory body. There would seem merit, therefore, in Australia harnessing this endowment as an option to transition the energy infrastructure and existing power resources to nuclear.

However, while Australia has a significant endowment in relation to uranium, paradoxically Australian law (the *Environment Protection and Biodiversity Conservation Act 1999* and the *Australian Radiation Protection and Nuclear Safety Act 1998*) prevents the construction or operation of nuclear plants. Yet nuclear energy, along with hydropower, provides viable base load energy that is cleaner than GHG emitting coal-fired power.[98] It seems logical, therefore, that Australia should investigate nuclear energy as a potential source of low carbon energy, including legislative amendment to facilitate the transition to a low carbon and green economy.

Initiative 1 – Discuss, investigate and educate on nuclear energy

The South Australia Government has recognised the potential of nuclear energy and has established a Royal Commission to determine the feasibility of South Australia undertaking an expansion of mining uranium, the further processing of uranium, nuclear energy electricity generation and the management, storage and disposal of waste.[99] The use of nuclear energy for electricity generation is consistent with global actions, with 437 nuclear reactors in operation in over 30 nations, including 110 reactors in operation in Asia, with 68 under construction in China, Russia, India and South Korea.[100]

Therefore, it would be in Australia's national interest to investigate nuclear energy as a means to ensure energy security in a green economy. The mechanism to commence this would be to

leverage South Australia's Royal Commission and recommence the nuclear energy discussion in Australia. By leveraging the current Royal Commission, the Federal Government would burden-share investigative resources, while media attention and political capital could be diffused between state and federal jurisdictions in what would be an emotive discussion, noting any move to nuclear requires federal legislation amendment.

Leveraging the Royal Commission would require regular communication on its progress via social media and other traditional forms such as television and radio, as well as transparency through publishing the report as soon as practical. The financial costs of reporting progress are considered minimal and would be borne by the Department of Industry, Innovation and Science. This is also considered consistent with the aim of a climate change strategy. Furthermore, to progress a nuclear energy industry in Australia, investment in community consultation and education should commence to ensure public acceptance. This could occur through the Department of Industry, Innovation and Science sponsoring conferences and information seminars in capital and major regional cities, as well as at select universities.

Furthermore, Australian nuclear education and development of human capital could occur through the sponsorship of nuclear physics and engineering studies in collaboration with the Australian Nuclear Science and Technology Organisation. Investment in human capital is considered a priority for any nuclear energy capability, as it is generally recognised that a skilled workforce would take approximately 10 years to develop. Hence, grants of say five postgraduate positions per year over 10 years, costing approximately A$4 million in total, would seem an effective and relatively low cost means of contributing to the development of the necessary workforce.[101]

Given China's experience with nuclear energy, as well as synergies with the uranium trading relationship, a discussion on nuclear energy for Australia provides an opportunity for cooperation with China under the 2006 Australia-China *Cooperation in Peaceful Uses Nuclear Energy Agreement*.[102] This would provide an element of transparency on policy, technologies, the regulatory program and a comparison on the electricity sources, risks and costs. Discussion on nuclear energy could take place under the Memorandum of Understanding on Climate Change (or a separate clean energy framework) and could also occur through dialogue between universities.

Cooperation could also focus on new technologies, such as the breeder reactor that utilises thorium instead of plutonium. This energy combination would be more acceptable to the Australian public and with the US security alliance, as it cannot be enriched to make nuclear weapons and hence precludes weapon technology. Yet it is an area for cooperation on an energy technology that potentially delivers 80 times more energy than would normally be obtained. This type of reactor would prolong Australia's reserves of both uranium and thorium, and provide Australian energy security from within its own factor endowments. Nuclear energy also provides consistent base load power that would facilitate the transition away from Australia's current reliance on coal.[103]

While a joint Australia-China conference on the subject of energy would not be considered controversial and would likely be successful in terms of discussion and sharing of technology, it is anticipated that cooperation on a new technology such as the uranium/thorium breeder reactor could draw criticism. There is also risk it may be perceived poorly in relation to Australia's alliance with the US. Consequently, any move in relation to technology and nuclear reactor cooperation should be mitigated through transparency measures such as invitations to participate as observers in any conference.

In summary, the initiative of recommencing a nuclear energy discussion in Australia would need to be supported by the continued development of human capital to ensure a capable nuclear energy workforce that could be utilised in the future. As part of the nuclear energy discussion, there would also be opportunities for development and cooperation with China on new technologies such as the breeder reactor.

Initiative 2 – Low carbon cities

Low carbon cities are important for Australia's mitigation and adaptation policy implementation, not least because they provide a dual policy effect. To illustrate this point, 89 per cent of Australia's population lives in urban areas and, of this, the majority lives in just 20 cities. Australia's urban population is projected to increase to 92 per cent by 2050. Cities are responsible for large energy use and related GHG emissions.[104] However, the largely-urbanised population is also susceptible to serious disruption to societal functioning due to the impact of weather on urban infrastructure, such as the disruption of electricity supplies in heatwaves and water shortages or restrictions during droughts.

Furthermore, Australia's six cities with the highest population growth are on the Queensland coast. Consequently, adaptation measures for extreme weather, tidal surge and sea level rises should be included in urban planning.[105] However, the population concentration also enables the implementation of public transport to reduce GHG emissions, increased use of energy efficient buildings and the concentrated use of renewable technology. Cities also provide for a large concentrated population under local government legislation, facilitating their engagement via local politicians and through community-based programs.

The Commonwealth, through the Council of Australian Governments, should continue to drive consistent and common green city planning designs and building codes that ensure energy efficiency as well as adaptation measures. This initiative would be managed by the Department of Infrastructure and Regional Development and reported through the previously-recommended coordinating function of the Department of Industry, Innovation and Science/Climate Change Coordinating Commission.

Resourcing this initiative would be consistent with the current shared funding arrangements between federal, state and territory jurisdictions for key infrastructure development. While there may be some resistance about federal government direction in state and local government infrastructure development, joint financing and key design principles would still enable state/local government flexibility. It is in the national interest to ensure the sustainability of key concentrated population nodes for economic development. Therefore, it is likely that this initiative would receive support and would not require the expenditure of a significant amount of political capital.

City planning and design, incorporating public transport, are important aspects to achieve the dual challenge of climate change mitigation and adaptation. In relation to transport, efficient public transport systems would reduce vehicle travel, while car electrification could be supported through designated power-charging centres and mandatory fleet low emission standards. Mitigation efforts could be concentrated in the urban planning design of new buildings (orientation) that incorporate heating and cooling efficiency, lighting efficiency through solar, and wind and solar photovoltaic electricity generation. City design could also include innovative mechanisms for adaptation purposes, such as the capture and recycle of water run-off, and reducing the piped water requirements to support cities, as well as vertical farming or utilising glass city buildings as greenhouses.

To maximise the use of renewable energy, particularly wind and solar which Australia is endowed with, reform of and research and development into the energy infrastructure, energy storage and smart grids are key to increasing their penetration in the electricity market. Hence, technological advances in energy infrastructure are a key to achieving low carbon cities. In a low carbon city construct, critical to the use of renewable energy is the concept of a micro grid and smart grid. A micro grid is the integration of electrical loads and generation that can be isolated from the national grid, to ensure uninterrupted supply and match electricity load generation with demand requirements.[106]

The smart grid concept is one that is digitised, automated and integrates the micro grids to maintain overall region supply; this ensures electricity reliability and security. It is conceivable that a building designed to be energy efficient, which generates power through either photovoltaic cells or wind turbines being incorporated into the structural design, could be a

micro grid that would feed a broader city or state smart grids. To mitigate renewable energy fluctuation, due to seasonal variation, energy storage systems need to be developed to cater for micro grid use.

While a number of technologies are available, such as super capacitors, flywheel energy storage systems, regenerative fuel cells (hydrogen) and battery storage, there are limited available capabilities that are cost effective.[107] Therefore, for Australia—as a country endowed with solar and wind energy—research and development in energy storage and connectivity with micro grids would provide effective electricity solutions for low carbon cities. As China has invested in 21 smart grid projects, there are likely to be lessons for Australia's development. Thus the low carbon city provides a number of avenues for development and cooperation.

In summary, this second initiative would enable cooperation across local, state and federal levels of government to facilitate key planning, design and building codes to ensure energy efficiency, as well as adaptation measures for climate change. This initiative could be further supported through technology developments in energy storage, micro grids and smart grids that would enable the increased use of renewable energy and provide effective electricity solutions for the projected concentrated demand in cities resulting from urbanisation. The initiative would support Australia's national interest by ensuring Australian cities are sustainable and remain key nodes for the economy.[108]

Both initiatives are likely to experience ideological and institutional barriers to implementation. In terms of ideological barriers, these are reflected in the partisan politics experienced in Australia in recent years in relation to climate change policies. However, this could be mitigated through consistent communication and a strategy initiative highlighting the benefits of reform. Indeed when private industry expresses the positive aspects of a reform argument, this should be highlighted. Private industry should be leveraged, along with media associations, to communicate the strategy and benefits of mitigating and adapting to climate change.

An example was in December 2014, when Rio Tinto declared nuclear energy 'should not be summarily precluded from Australia's future energy mix',[109] presenting a business interest in a nuclear conversation that could be used to stimulate further discussion and reform. Moreover, business investment would be encouraged when there are consistent policies that provide certainty for investment decisions, which a strategy would provide.

Institutional barriers likely to be experienced include Australia's federal structure, wherein states are responsible for infrastructure decisions and energy supply. Consequently, the federal government would need to work with the states through the Council of Australian Governments to achieve policy implementation. Again, a strategy would provide guidance, prioritisation of resources and financial incentives to assist the states in implementing the initiatives. Indeed, Commonwealth resources could be leveraged to provide cooperation and business opportunities for states and territories to pursue with China.

Although the cost and availability of Commonwealth funds, linked to the economic growth of Australia, remain a risk to implementing the above initiatives, particularly any nuclear capability and research and development for technological solutions, they are not considered barriers to implementation. The initiatives present opportunities for foreign investment or public/private funding partnerships that could be utilised to mitigate initial high capital costs.

However, there is a risk that due to high capital costs, the above initiatives may not be implemented as priority policies. When viewed through this prism, cost could be considered a barrier; this circumstance is considered likely to occur if a national climate change strategy is not developed. Consequently, it is contended that a national climate change strategy, as proposed in this paper, would provide the key foundation initiative to enable the implementation of a nuclear energy industry in Australia, as well as low carbon city initiatives.

Conclusion

It has been argued in this paper that climate change is a diabolical security policy problem, wherein Australia's national security is impacted by the social, economic, intergenerational and transnational nature of climate change. To date, Australia's mitigation and adaptation measures have been subject to short-term approaches, partisan politics, and are diffused across a number of Commonwealth departments, resulting in a loss of policy priority.

Although Australia has the relevant scientific expertise, economic and energy reports that highlight its vulnerability to climate change impacts, there is no coherent strategy to tie policies and outcomes to a single vision and policy framework. Consequently, policy development and implementation synergy have not been achieved. This paper has argued that the problem needs to be addressed through a consistent, coordinated and comprehensive approach, including the development of a climate change strategy.

The paper has also highlighted that China's transition to a green economy has realised improved ecological circumstances, as well as business opportunities, that have resulted in China becoming a leading exporter in renewable energy. The lessons from China's approach to climate change include dual priorities for mitigation and adaptation policies, and a centrally-coordinated strategy. These lessons are applicable to Australia, despite the differences in political circumstances and available resources.

Like China, any Australian strategy should be viewed through a sustainable development prism, as well as an environmental one, thus viewing climate change as an economic opportunity, rather than as a threat. Establishing a climate change coordinating commission, within the Department of Industry, Innovation and Science, would place the contest of climate change strategy and policy ideas in an economic framework rather than an environmental framework, as currently occurs. The coordinating commission would be responsible for the climate change strategy, as well as providing policy coordination and delivering a policy development and implementation synchronisation effect.

While its climate change policies have been subject to partisan politics, the majority of Australia's population is supportive of the Federal Government taking increased action on climate change, including investment in renewable energy, and seems open to a conversation about nuclear energy. Such popular sentiment presents the opportunity to develop and implement a climate change strategy in a supportive environment. However, the key to any strategy would be the ability for the government-of-the-day to effectively communicate the strategy, vision and goals to the public and businesses to enable certainty for business investment decisions in government initiatives.

The paper has contended that the economic argument remains fundamental to undertaking climate change mitigation and adaptation measures. The ability to communicate the current costs of climate change impacts and the opportunity costs associated with any decision not to reform the economy, energy and infrastructure, would enable trade-off decisions to be made and supported. In particular, these include the assessment that Australia needs to diversify its reliance on coal for domestic energy needs and as an export commodity due to the economic impact on Australia's comprehensive security.

It has also been argued that coal presents as a sovereign debt risk to the Australian economy, particularly as China, being Australia's largest trading partner, has committed to GHG reductions and a green economy. Furthermore, China's actions in establishing a fiscal policy to support the green economy through an emissions trading scheme are consistent with Australia's other trading partners. Therefore, rather than China's transition to a 'greener dragon' being considered a threat, the paper has argued that it should be viewed as an opportunity to leverage the established trading relationship and cooperate to develop business opportunities, such as nuclear power technology, smart grids, micro grids and renewable energy. The framework for such cooperation could be the existing Comprehensive Strategic Partnership dialogue and the Memorandum of Understanding on Climate Change.

The paper has suggested that the initiatives to be implemented should centre on Australia's energy mix, as this is considered most impacted by any transition to a green economy, as well as representing an opportunity to diversify away from the current reliance on coal. The first proposed initiative is that Australia should commence a discussion and investigate nuclear energy as a major source of its energy security. The opportunity to achieve this could be through the current Royal Commission being undertaken by South Australia into such issues as the expansion of mining and processing uranium, nuclear energy for electricity generation, and the management, storage and disposal of nuclear waste.

It has been argued that this initiative would leverage community debates, new information and analysis. It would also diffuse any emotive arguments across Commonwealth and state governments. The nuclear discussion initiative could be supported through government-sponsored nuclear energy conferences at various universities and the development of human capital to ensure a robust nuclear energy capability. Furthermore, the nuclear discussion would present opportunities for cooperation with China on new technologies such as a breeder reactor that maximises Australia's factor endowment with uranium and thorium.

A nuclear energy capability takes up to 10 years to implement. Therefore, it has been argued that Australia should be considering this initiative now to ensure that it is viable for implementation prior to any energy security emergency that may arise. Although Australia has historically and politically been opposed to nuclear energy, its factor endowment, as well as nuclear energy technology improvements, warrant debate and legislative amendment, especially now that large businesses such as Rio Tinto are also supporting nuclear energy as a viable alternative to coal.

The second key initiative proposed in this paper relates to the development of low carbon cities. This would provide the opportunity for a dual focus on mitigation and adaptation measures for climate change, particularly in Australia where there is a high level of urbanisation. This initiative focuses on the Commonwealth Government cooperating with the states and territories through the Council of Australian Governments to implement common green city planning designs and building codes.

It also would encourage increased use of renewable energy, focusing on solar and wind. It would require investment in innovation of electricity grids, such as smart grids and micro grids, as well as battery storage to improve the penetration of renewable energy in the market. It has also been argued that low carbon cities would provide opportunities for cooperative development with China, particularly given China's investment in 21 projects relating to the development of a 'smart grid'.

Both of the proposed initiatives are considered capital intensive and therefore would require public private partnerships or foreign direct investment to enable them to occur. Both initiatives are considered necessary for Australia's future economic and energy security within the context of climate change mitigation and adaptation measures. Action taken in relation to energy and infrastructure reform to improve the uptake of renewable energy would also improve Australia's reputation in the international community. However, the initiatives are long term and would, therefore, likely be subject to institutional and ideological barriers. Consequently, it has been argued that commitment, understanding and acceptance of a climate change strategy would provide the pathway to mitigate these barriers, particularly when strong economic benefits can be argued in any trade-off decisions.

While the initiatives are long term in nature, they would need to be fully implemented by 2030 for positive effects to be evident by 2100. Key players in the international community have demonstrated their commitment to mitigate climate change—and have articulated their concerns about Australia's limited progress to date. Australia needs to take action to avoid being out of alignment with the international community, otherwise it risks its economy through sovereign debt, stranded assets and loss of international reputation.

The initiatives proposed in this paper are considered pragmatic and feasible, and consistent with the Australian Government's recent commitment to innovation. If implemented, they would

provide business opportunities, ensure that Australia maintains its energy security and that Australia's cities remain sustainable.

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