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Current and Future Impacts of Climate Change on Housing, Buildings and Infrastructure – Impact submission
Committee Secretary
Senate Standing Committees on Environment and Communications
PO Box 6100
Parliament House
Canberra ACT 2600

23 August 2017

Dear Sir / Madam,

Current and Future Impacts of Climate Change on Housing, Buildings and Infrastructure

Sustainable Business Australia (SBA) welcomes the opportunity to make this submission to the Australian Government. Specifically, we wish to highlight how the Government can translate the important SBA / WBCSD international engagement work into domestic climate policy sphere so as to efficiently, effectively and equitably transition the Australian economy on a low carbon pathway.

Business is leading the transition to a low-carbon economy. SBA, through its partnership with the World Business Council for Sustainable Development (WBCSD) is harnessing the power of collaboration to implement solutions at scale.

Business will be the key implementation partner for governments around the world as they strive to hit their NDC targets to reduce greenhouse gas emissions.

And businesses can go further and faster, when we work together with Government and the Community.

We would welcome the opportunity to examine further how SBA, through its global Partner, the World Business Council for Sustainable Development, and its 200 leading companies, could engage with the Government's future policy direction on this important issue.

Yours faithfully,

Andrew Petersen
CEO
Sustainable Business Australia I wbcsd Australian network partner

Current and Future Impacts of Climate Change on Housing, Buildings and Infrastructure

SBA Submission
23 August 2017

A Post Paris Agreement Pathway

Following the leadership of the Australian Government at COP21 in Paris, including the personal leadership of the Prime Minister, SBA welcomes swift adoption of the Paris Agreement by the Australia Government in 2016. The Government must now continue the pathway to emissions reduction and find the means to enable greater emissions reduction ambition.

This implementation must now be accelerated by sound policy signals, effective economic mechanisms, in concert with strong leadership, action and solutions from business. We as Australia's leading forward thinking and responsible action business peak body must and will continue the collaboration that brought the Paris Agreement into being.

We can only fulfil its ambitions and achieve the scale of transformation that is urgently needed by working together with our nation's policymakers.

Specifically, we see the implementation being a call to policymakers and business as follows:

- Sound policies – including national emission reduction plans and associated policies and regulations that will be strengthened and improved over time:

  SBA, part of the World Business Council for Sustainable Development[1] (WBCSD) Global Network[2], will be facilitating dialogues between business and policy-makers at the national level to strengthen the Nationally Determined Contributions and provide input to UNFCCC on best practices, harmonized rules and timelines to promote a race-to-the-top.

- Effective economic mechanisms such as global, robust and meaningful carbon pricing, removal of fossil fuel subsidies and provision of additional sources of climate funding:

  SBA, through its relationship with the WBCSD, is contributing lessons learned on the most effective carbon pricing mechanisms and their linkages that will facilitate the transition towards a low carbon future.

- Strong business leadership through global and local partnerships to accelerate structural transformation, technological change and innovation, as well as ambitious action at the company level:

  WBCSD members are already taking the lead by scaling up solutions through the Low Carbon Technology Partnerships initiative (www.lctpi.wbcsd.org) to maximize the business opportunities and minimize the risks created by climate change. Addressing climate change is also key to achieving the Sustainable Development Goals.

SBA will soon be announcing the introduction of the LCTPi platform into Australia, with work to commence later in 2017. For further information on the LCTPi and SBA's broader business engagement on climate action please see Appendix 1.

Government & Business collaboration to achieve the 2020 – 2030 implementation challenge

Collaborative initiatives on climate action are vital as they represent a variety of views from the sectors and geographies.

SBA's collaboration, as the Australian Network Partner of the WBCSD and as a partner to the A2EP EXP, has been

[1] http://www.wbcsd.org
[2] http://www.wbcsd.org/Overview/Global-Network/Regions/Oceania/Australia/Sustainable-Business-Australia-SBA

involved in a number of voluntary initiatives (LCTPi) and research projects Australian Alliance for Energy Productivity (2xEP); as well as 'on the ground' lead project work for the Low-Income Energy Efficiency Program – Our Green Project[3], enables us to provide key insights into global and national issues on the Australia's Climate Change Policies landscape.

Business is the key implementation partner for governments, including Australia, as they strive to hit their NDC targets to reduce greenhouse gas emissions.

SBA considers the pathway for an effective transition to meeting 2050 targets to be broadly outlined with following key steps.

Unlock the potential of Australia's NDC to drive low-carbon solutions and innovation

1. Review and strengthen Australia's NDC to take it to its highest level of ambition:
   - Increase emission reduction targets within the next 2 years to ensure an aggregate effect matching the Paris Agreement goal of staying well below 2°C or 1.5°C. This aligns with Recommendation 9 of the Climate Change Authority 2014 Report[4] on reducing Australia's greenhouse gas emissions; It recommends beyond 2020, Australia should continue to reduce emissions within a trajectory range bounded by the paths to 40 and 60 per cent below 2000 levels in 2030.
   - Ensure a wider sectoral scope including:
     - Energy-related targets and energy transition timelines to scale up renewable energy sources and improve energy efficiency within the next 4 years (See Energy Systems)
     - Roadmap to decarbonize the transport system (See Transport)
     - Plans to enhance climate smart agriculture and reforestation See Land Use
     - Plans for low carbon cities and energy-efficient buildings See Cities
     - Plans to develop and deploy technologies for carbon sequestration
     - Adaptation plans to enhance resilience and contribute to Sustainable Development Goals
   - Engage with business to design and implement NDCs that remove barriers to innovation and technological transfer; and drive deep system transformation and structural change across developed and developing economies, [including leveraging the Industry Growth Centre Initiative (focusing on Advanced Manufacturing, Food and Agribusiness, Mining Equipment, Technology and Services, and Oil, Gas and Energy Resources) to purpose them to include advising on overall sector strategy, sector definition, skills issues, and long-term opportunities for low carbon growth for Australia].

2. Set up a transparent and harmonized UNFCCC review mechanism to promote a race-to-the top at the global level:
   - Agree on standardized timelines for all NDCs in line with the five-year review cycle starting in 2020, using the same baseline;
   - Include business in the discussions on the use of standardized methods for accounting, reporting and verification;
   - Share best practice guidelines on high-performing NDCs to increase the successful implementation of other NDCs.

Scale up financial resources to invest in a low-carbon future

1. Scale up public and private investment
   - Design climate finance roadmaps, to supplement those established by ARENA and the CEFC.
   - Facilitate private sector engagement on the GCF Board and at the country level to leverage and amplify the level of private capital flows.
2. Implement meaningful carbon pricing mechanisms (Article 6)
   - Ensure robust and complementary carbon pricing mechanisms (such as carbon tax, market based

[3] http://www.sba.asn.au/sba/i-ogh.asp
[4] http://www.climatechangeauthority.gov.au/files/files/Target-Progress Review/Targets%20and%20Progress%20Review%20Final%20Report.pdf

mechanisms, standards or a combination of these and other appropriate mechanisms) to redirect investments towards low carbon solutions;
- Ensure coherent regulations between national and regional carbon markets and alignment between the various systems with clear global rules aiming for global coverage in order to prevent economic distortions and carbon leakage;
- Set up global market-based mechanisms in the international aviation and maritime sectors.
- Allow the purchase of international units to acquit Australia's liability

3. Set clear timelines for the removal of fossil fuel subsidies

On the next few pages we outline Cross-Cutting and Sectoral Recommendations that we consider would further opportunities for increased business engagement on a more comprehensive national climate change policy framework.

Cross-cutting Recommendations

On Employment, Innovation and Investment

Climate change is one of the most significant market failures ever seen[5]. The LCTPi drives a need for technology, construction and expertise, which adds value to the economy and supports business locally; this is in line with Number 8 of the Sustainable Development Goals. Similarly, limiting global warming to below 2 degrees will have substantial economic benefits in the long-term.

If it is successful in meeting its ambition, the LCTPi could help overcome market barriers and failures to create new investment opportunities and channel finance towards the low carbon economy. It could help to channel $5-10 trillion of business opportunities between now and 2030[6] and support 20-45 million person-years of employment (see Image 1). This expenditure will then ripple through the economy, potentially supporting 15-35 million jobs in the wider economy each year. These investment-driven business opportunities are equivalent to 0.2-0.5% of projected global GDP over the time period (2016-2030)[7].

A 2015 Report[8] written in conjunction by the WBCSD and PricewaterhouseCoopers (PwC) explains the methodology behind the job and investment impact analysis of the LCTPi (see Image 2). The methodology is based on multi-regional input-output modelling, which describes how different industries in the economy and in different countries relate to each other.

On this basis, the report estimates how activity in one sector stimulates activity elsewhere in the economy and the world. The Input-Output tables show how much a typical business in each supplier's sector requires to produce one unit of output. Equally, it shows what inputs are required from other sectors to produce one unit of its own output. In this way, the report estimates the input requirements through the entire supply chain for a given amount of expenditure in a given sector and country, and estimates the total value of production stimulated.

This process of one company stimulating economic activity in other companies is referred to as the multiplier effect. Statistics on employment in each sector were used to estimate the total employment associated with investment expenditure. For this, socio-economic accounts were used from the World Input-Output Database to help ensure consistency. Finally, the report derives the average output per head by sector and apply this to the total production value stimulated in each sector in the supply chain. In this way, it estimates the indirect employment supported by investment expenditure into a low carbon future.

On Trade

The Environmental Goods Agreement (EGA) is a trade agreement being negotiated by 18 participants representing 46 members of the World Trade Organization (WTO), focusing on reducing tariffs on products that benefit the environment. These products include solar panels, wind turbines, and energy efficiency, as well as air pollution, waste and water management technologies. Once concluded, the EGA will also play a role in helping to implement the Paris Agreement on climate change and the UN Sustainable Development Goals.

The Australian Government announced in January 2014 that Australia would join a number of other members of the WTO to negotiate an agreement to remove tariffs on a range of environmental goods. The global market for environmental goods was estimated to be worth US$1 trillion when negotiations were launched in 2014, and is expected to expand to around US$3 trillion by 2020. Australia's exports of environmental goods in 2014-15 were estimated at $1.5 billion, and imports at $8.7 billion.

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[5] Stern Review (2007). Available at: http://webarchive.nationalarchives.gov.uk/+/http:/www.hm-treasury.gov.uk/media/4/3/Executive_Summary. pdf (accessed 10-04-2017]

[6] 'Business opportunities' here are measured by to the gross amount of investment required to meet the LCTPi's ambitions.

[7] http://www.pwc.com/gx/en/issues/economy/the-world-in-2050.html (accessed 10-04-17)

[8] http://lctpi.wbcsd.org/wp-content/uploads/2015/11/LCTPi-PWC-Impact-Analysis.pdf

In addition to Australia, WTO members currently participating in these negotiations are Canada, China, Costa Rica, the European Union and its 28 member states, Hong Kong, Iceland, Israel, Japan, Korea, New Zealand, Norway, Singapore, Switzerland, Chinese Taipei, Turkey and the United States.

Since its inception in 1991, SBA has been advocating for the elimination of tariffs and barriers on environmental goods and applauds Australia for making the negotiation of an international agreement eliminating barriers to trade in environmental goods at the WTO a priority.

SBA considers this agreement can have a significant economic benefit, as well as simultaneously improve the ability of economies to address climate change and as well as other environmental challenges. In particular it will advance Australia's cost-effective deployment of such technologies to achieve its 2030 target.

Recommendations:

- Scaling up sustainable business solutions requires a stable, predictable and transparent policy and regulatory environment to enable companies to invest with confidence in low carbon technologies, skills and solutions on the long term;

- Adopting the Financial Stability Board Task Force on Climate Related Financial Disclosure recommendations, to set up policy frameworks and reporting requirements that drive corporate change and better financial reporting on climate risks and opportunities;

- Business also needs some consistent market structures and economic incentives that allow a leveled-off playing field across low carbon technologies, sectors, regions and countries. This includes putting a meaningful price on carbon and removing fossil fuel subsidies as they create a distortion of the economic price; and

- Governments also have a key role to play to unlock the potential of innovative business solutions by investing in large Research & Development programs and providing the right economic incentives for new technologies to go from the step of radical change to incremental change.

Specific responses to the matters identified

a. Recent and projected changes in sea level rises, and storm surge intensity

Scientists have already identified changes in heat-wave patterns due to climate change, and are confident that sea level rise, movements in locations and intensity of storms and rainfall, and increasingly intense droughts will also occur[9]

b. Recent and projected changes in temperature and precipitation

The volume of rainfall from extreme rain events has increased since the 1970s, and scientists can say with high certainty that extreme rainfall events in most parts of the country will become more intense.[10] Australian rainfall varies greatly from one year to the next and from one decade to the next, and is strongly influenced by phenomena such as El Niño and La Niña. Despite this large natural variability, underlying longer-term trends are evident in some regions.[11] There has been significant drying across southern Australia... for the southeast of the continent, rainfall for the period 1996 to 2015 has decreased by around 11 per cent since national rainfall records began in 1900. Over southwest Western Australia, rainfall since 1970 [is] around 19 per cent less than the long-term average.[12]

Why? Associated with a trend towards higher mean sea level pressure in the region. There has been a reduction in the number of cold fronts impacting the southwest and a decrease in the incidence and intensity of weather systems known as 'cut-off lows' in the southeast. A recent attribution study, led by CSIRO, shows that the extremely high pressures across southeast Australia in August 2014 were more likely to occur due to global warming. Southeast Australia had below-average rainfall in sixteen of the last twenty April–October periods since 1997.[13] Since the 1970s, there has been increased rainfall across northern Australia.[14] There is mixed evidence for changes in heavy rainfall over Australia.[15]

c. Recent and projected changes in extreme weather, including heatwaves, bushfires, floods, and cyclones

In Australia, the most obvious change has been an increase in the occurrence of record-breaking heat.[16] Extreme temperature events that occur over large areas of the continent are also increasing in frequency. In this instance, extreme days are defined as those above the 99th percentile of each month from the years 1910–2015. In 2013 there were 28 days over this threshold. This compares to the period prior to 1950 when more than half the years had no extreme days.[17] There has been an increase in extreme fire weather, and a longer fire season, across large parts of Australia since the 1970s.[18]

d. Recent and projected changes in natural coastal defence systems including coral reefs, kelp and mangrove forests

The Intergovernmental Panel for Climate Change predicts that by 2035 the average sea surface temperature will be warmer than any previously recorded, and by 2100 sea temperatures off north-eastern Australia could be at least 2.5 degrees Celsius warmer than the present average. Rising sea temperatures are not expected to be uniform across the Great Barrier Reef. Rather, the number, size and duration of warm pools (or hot spots) are all expected to increase.[19] The rise in temperature over the past 30 years have meant corals on the Great Barrier

[9] https://www.google.com/url?q=http://www.climateinstitute.org.au/verve/_resources/TCI-There-goes-the-neighbourhood-FINAL-30052016.pdf&sa=D&ust=1497317636960000&usg=AFQjCNH51SHfzZEtHPjF4Hz0Vy30Etldtw, p. 1
[10] ibid., p. 10
[11] http://www.bom.gov.au/state-of-the-climate/State-of-the-Climate-2016.pdf, p. 9
[12] ibid. p. 9
[13] ibid., p. 10
[14] ibid.
[15] ibid.
[16] ibid., p. 6
[17] ibid., p. 7
[18] ibid., p. 8
[19] http://www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/how-climate-change-can-affect-the-reef/rising-sea-temperatures

Reef are now at their 'normal' state of thermal thresholds. This means when temperatures increase again, particularly during summer months, corals will exceed these thresholds and move to a state of thermal stress.[20] Climate change has already impacted coral reefs in the Great Barrier Reef as corals are highly vulnerable to its potential effects. As the backbone of the Great Barrier Reef ecosystem, corals play a critical role. The climate change results in sea level rise, rising temperature, change in rainfall which damage the coral reef. The tropical cyclones and ocean acidification reduce the resilience of coral reefs. [21]

e. The impact of these changes on the vulnerability of infrastructure in coastal areas

The most commonly cited analysis, published in 2009, estimated the value at risk from coastal erosion and inundation related to sea level rise at up to $74 billion – but this almost certainly understates current exposure values. [22]

f. The impact of these changes on water supply and sewage treatment systems

Climate change has negative impact on the water supply and its quality. Rivers are the main source of water supply and the higher rainfall will result in higher stream flow and less rainfall will result in lower stream flow. The groundwater is also getting affected by this as the level of the groundwater is decreasing.[23] Water quality will be highly affected by the high temperature of the surface area. Algal blooms will occur frequently in warmer water. In Australia, algal blooms hit hardest in the continent's southeast corner - New South Wales, Victoria, south-east Queensland, and the south-east corner of South Australia - where conditions are wetter and human populations are higher. But besides undesirable tastes, odors and unsightly scums, there can be serious human impacts if algal blooms reach important waterways.[24] Higher temperature increases the microbial activities and bacterial and fungal population. Poor sanitation results in air borne diseases which is the result of climate change.[25]

g. The impact of these changes on transportation, including railways, roads and airports

There have been some recent illustrations, both in Australia and elsewhere, of the damage to road infrastructure that might result from physical phenomena that have been associated with climate change. For example, Cyclone Ului, which hit northern Queensland in March 2010, resulted in damage to the road network by exposing the road bed. In addition, trees and power lines that were felled as a result of the cyclone hindered road access. These consequences were exacerbated by subsequent flooding.[26] Similarly, rail networks located in hot climate zones are most likely to suffer from train delays resulting from heat-affected swollen rail tracks.[27] The intense heat experienced in Melbourne during the 2008 – 2009 summer illustrates the consequences of climate change for rail infrastructure. Soaring temperatures caused the Melbourne metropolitan railway network to swell which, in turn, resulted in significant disruptions to passenger train services for extended periods of time.[28] The impact of climate change on airport infrastructure has received limited attention. But, increased rainfall and storm events, bushfires can cause damage to terminals, reduced airlift, and reduced visibility respectively.[29]

h. The impact of these changes on energy infrastructure, including generators and transmission and distribution lines

Heatwaves, which may have limited effects on properties and buildings but considerable implications for public policy through planning, building codes and electricity demand. It is expected that, energy utilization will grow due to demographic and socio-economic issues.

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[20] http://www.gbrmpa.gov.au/managing-the-reef/threats-to-the-reef/climate-change/what-does-this-mean-for-species/corals
[21] https://coastadapt.com.au/sites/default/files/factsheets/T312_7_Coastal_Tourism.pdf p.6
[22] http://www.climateinstitute.org.au/verve/_resources/TCI-There-goes-the-neighbourhood-FINAL-300516.pdf
[23] Climate change adaptation in sea sector p. 38,39
[24] http://www.australiangeographic.com.au/topics/science-environment/2012/04/algal-blooms-a-colourful-danger/
[25] Climate change adaptation in sea sector p. 42
[26] Climate Change and the Transport Sector: Are we travelling in the right direction? P.5
[27] ibid p.9
[28] ibid p.11
[29] ibid p.18

On the other hand, average and peak energy demands are also associated to climatic circumstances. Increased air-conditioner uses are increasing the peak energy demand. The possibility of line outages and blackouts is increasing with time. If the average temperature increases by 2 °C, peak demand increases by 4% in Brisbane and 10% in Adelaide, but reduces by 1% in Melbourne and Sydney. To allow increases in peak demand for climate-related by 2030 about 10% of the existing asset levels may be necessary.

Climate change is affecting energy infrastructure in Australia. These changes cause a great impact on power stations, electricity transmission and distribution networks, oil and gas product storage and transport facilities, and off-shore oil and gas production. [30]

i. The impact of these changes on health, education and social services infrastructure, including hospitals, schools and aged care

The ratio of summer to winter deaths in Australia has increased from 0.71 to 0.86 between 1968 and 2006. 374 excess deaths during the 2009 Victorian heatwave, which represented a 62% increase in all-cause mortality, and a 34-fold increase of cases with direct heat related conditions. In South Australia, heatwaves were associated with a 7.3% increase in mental health admissions.[31] The impact of heat on work performance in 2013/2014 alone was estimated to cost the Australian economy US $6.2 billion, representing 0.33 to 0.46% of Australia's GDP. [32]

By the end of the century, a 1.1m sea level rise is expected to place $266 billions of coastal infrastructure at risk, including 258 police, fire and ambulance stations as well as 75 hospitals and health services.[33] The most elderly people groups will disproportionately feel the overwhelmingly negative health impacts of climate change. In 2030, this change is expected to substantial additional deaths, including: 38,000 because of heat exposure in elderly people.[34] There are various heat related impacts which can cause food-and-water borne diseases.

By 2050 there it estimated to be between 205,000 and 335,000 additional cases of bacterial gastroenteritis in Australia each year, and between 239,000 and 870,000 new cases by 2100.[35] Between 2030 and 2050, climate change is expected to cause approximately 250 000 additional deaths per year, from malnutrition, malaria, diarrhea and heat stress.[36]

j. The impact of these changes on private and public housing

There can be a high risk of housing and building collapse due to the climate change effects. More storms, heatwaves reduce the building lifetime. Mangroves are the natural protection wall but it's reduction can cause damage to houses. Coastal erosion alone is estimated to pose a threat to Australian property worth up to $63 billion in 2008 and $88 billion in 2015. A case study conducted shows that in Townsville almost 4,400 houses would be potentially inundated by 2100 due to sea level rise. [37]

k. The impact of these changes on public recreation and tourism facilities

CSIRO principal research scientist Kevin Hennessy used climate change modelling to predict what may be in store by 2020, 2050 and 2070 for some of Australia's top tourism destinations: Kakadu, Cairns, the Blue Mountains and the Victorian Alps. Kakadu and Cairns would see more severe cyclones, while there would be an increased fire danger in the Blue Mountains. And in the Victorian Alps, modelling showed snow cover by 2050 could decrease by up to 80 per cent from current levels. Less snow also meant less skiing, and reef tourism would be impacted if coral bleaching became an annual event by 2020.[38]

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[30] http://www.sciencedirect.com/science/article/pii/S1877705813005286#
[31] https://ama.com.au/position-statement/ama-position-statement-climate-change-and-human-health-2004-revised-2015
[32] ibid point 4.4.1
[33] ibid point 4.2.5
[34] ibid point 3.2
[35] ibid point 4.2.2
[36] http://www.who.int/mediacentre/factsheets/fs266/en/

[37] http://www.climateinstitute.org.au/verve/_resources/TCI-There-goes-the-neighbourhood-FINAL-300516.pdf
[38] http://www.smh.com.au//breaking-news-national/climate-change-will-impact-tourism-20090817-en18.html

l. The impact on financing and insurance arrangements for housing, buildings and infrastructure

In Australia, people are living in the buildings and houses which are near to coastlines and in bushland area, which are prone to flood and bushfire respectively. Escalating weather risk events may cause insurers to lose money through making multiple localised payouts on claims, then raise premiums or decline to insure. This can domino and can negatively impact banks and mortgage investors.

While only a small proportion of Australian housing might be ultimately at risk of falling value due to climate change, it should be remembered that a "contagion" effect has been observed in other markets where sudden repricing of risk occurred, particularly where there is limited information available about the extent of risk throughout the market. Relatively low levels of outright losses on subprime mortgages precipitated the financial crisis. Climate change has terrible implications for both insurers, as specialists in risk, and their customers – and by extension, for society at large. In a worst-case scenario, an insurer collapsing due to unforeseen natural disaster losses would obviously result in devastating social costs, in addition to the obvious financial ones. [39]

m. The adequacy of current state and Commonwealth policies to assess, plan and implement adaptation plans and improved resilience of infrastructure

The final report of the Productivity Commission's Inquiry into Natural Disaster Funding Arrangements has highlighted the need for changes to land use planning and urban design to improve resilience and manage the risks of climate change. The Commission has recommended several ways in which the availability of natural hazards data could be improved, including governments at all levels sharing natural hazard data that is already held, and potentially partnering with private sector providers to collect data where gaps exist. The Commission also recommended that insurers share expertise and information such as claims data to inform land use planning decisions, and that governments undertake land use planning and mitigation to reduce risk exposure and vulnerability.[40]

[39] http://www.climateinstitute.org.au/verve/_resources/TCI-There-goes-the-neighbourhood-FINAL-300516.pdf
[40] http://www.thefifthestate.com.au/innovation/design/national-guidelines-for-planning-resilient-communities-released/83986

Sectoral Recommendations

Energy Systems, including Renewable sources of energy

Climate and energy systems are linked. The end goal, as articulated by the Paris Agreement, must be established before working backwards can identify orderly steps. This requires a process to develop a long-term target, with specific rationale from a business perspective so that Australia knows the exact goal and the steps required to get there.

Australia can maximize competitive advantage by harnessing natural resource capital to become the low cost renewable energy producer in the Southern hemisphere.

In order to maximize competitive advantage, business needs to understand the scenarios that will occur on the road to the 2050 goals, and where the comparative advantage lies. A clear organizational pathway is the start of a benchmark to measure scenarios against.

At the end of 2015, 23.7% of power was coming from renewable sources of energy, and investment in renewables continues to gather pace. In 2016, wind and solar PV constituted 78.4% of new capacity in the EU, in the US almost two- thirds of new capacity was renewable, and in China combined new capacity in wind and solar reached 52 GW and was roughly equal to the new capacity in coal and gas. Over the last seven years alone, solar PV costs have come down 85%, meaning it already out does fossil fuel generation capacity in many regions of the world.

The International Energy Agency (IEA) calculates that renewables penetration could reach 26-27% globally by 2020, depending on what policies governments achieve between now and then. But the world is moving to a low carbon power sector faster than anyone, thought possible.

Already, more global capacity for renewable power is being added each year than coal, natural gas and oil combined, and in 2015 the sector overtook coal in terms of cumulative installed capacity. By 2020, demand for coal and oil will have peaked.

Most governments and investors increasingly realize that there is no room for new coal-fired power plants in the emissions budget implied by the Paris Agreement temperature limits. Governments also recognize reliance on coal (and gas) exposes their economy to price volatility on the global coal markets and decreases energy security.

These considerations, combined with increasing cost competitiveness of renewables, means that investment in new fossil fuel generation capacity is slackening off. Not only are new coal power plants struggling to secure investment, the retirement process for existing coal plants is also well underway: 249 US coal plants have been retired since 2010, and China has recently cancelled over 100 plants that were planned or under construction. With concerted effort to accelerate these trends, we can ensure that no new coal plants are built beyond 2020 and that all existing plants are in the process of being retired. This is in line with what millions of citizens around the world want, as evidenced by the growing calls for better air quality, for example in Asian megacities.

The 2014 WBCSD report Building a Resilient Power Sector as part of the resilience project demonstrated that electric utilities and their stakeholders can benefit from pooling learning, exchanging best practices, sharing resources and encouraging mutual aid. Businesses with global supply chains face many diverse, unpredictable and interconnected risks. Climate unpredictability coupled with complexity in modern supply chains means it is challenging to estimate risks. The approach described in Resilience in Global Supply Chains[41] provides guidance to companies to deal with stresses and to manage shocks and build resilience.

The long-term targets of Australia must be aligned with the Paris Agreement to enable an economy wide approach.

[41] http://wbcsdpublications.org/project/building-resilience-in-global-supply-chains/

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In order to maximize competitive advantage, business needs to understand the scenarios that will occur on the road to the 2050 goals, and where the comparative advantage lies. A clear organizational pathway is the start of a benchmark to measure scenarios against.

Australia requires higher levels of investment in the energy and industry sectors to spark a higher rate of change and remain competitive. With a clear rate of change, the nature and amount of support required for a renewable energy transition can be understood.

All forms of carbon capture and sequestration must be increased including conversion into products, underground storage and natural carbon sinks. Increased use of gas must only occur if strong action is taken to avoid methane leakages.

Recommendations

In addition to the general policy asks listed above, we believe that Australia's public 2020 – 2030 climate and energy policies should promote:

- A dedicated use of revenues from carbon pricing mechanisms for investing in renewable energy and other low carbon initiatives;
- A level playing field between renewable and conventional technologies, addressing issues such as subsidies to fossil fuels, discriminatory market rules in some markets, systemic bias in financial regulation and unfavorable administrative requirements;
- The development of operational and market frameworks to harness and value the full potential of renewable generation and facilitate the deployment of new business models;
- A better planning of and investment in transmission and distribution infrastructure with consideration for the growing penetration of distributed renewable energy;
- All forms of carbon capture and sequestration must be increased including conversion into products, underground storage and natural carbon sinks. Increased use of gas must only occur if strong action is taken to avoid methane leakages.

More specifically, Australia's climate and energy policies should address these 3 priorities:

1. Finance:
    - Facilitating the significant scaling up of green bond finance through a commitment to robust verification and transparency as well as de-risking our project pipelines;
    - Removing systemic bias and ensuring that they do not systemically disincentives investment in clean energy infrastructure;
    - Making a "smart" use of limited public funds, as the targeted use of these public funds can help to scale-up private sector investment.
2. Corporate Renewable Power Purchase Agreements (PPAs):
    - Creating an enabling environment for the development of Corporate Renewable PPAs will allow businesses and consumers to buy power directly from independent power producers.
    - Working with corporate renewable energy buyers to scale up renewable energy procurement will increase direct demand for renewable energy and boost the market of renewable sources of energy.
    - This will require the removal of any prohibitions for entering third-party PPAs.
    - It is essential to combine this with renewable incentives that cost-effectively support the development of renewable electricity projects (where necessary) and establish guarantees of origin or other similar certificate systems to show that renewable power is available for corporate buyers at a sensible cost.
3. Micro grids:
    - Scaling-up micro grid projects in developing countries is key to the achievement of Sustainable Development Goal No.7 to promote sustainable energy access for all, particularly for rural and remote Australians.
    - Promoting sustainable electrification of remote areas can be done via accelerated deployment of low carbon micro grids.

- Integrating the energy production and consumption of micro grids into the well interconnected electricity market at local, national and regional level;
- Developing innovative finance instruments to support the startup of micro grids.

Industry

Industry plays a major role by developing new low carbon technologies and mainstreaming climate action through supply chain operations. We focus here on two major sectors: cement and chemicals.

Recommendations: Cement

Global work carried out by the WBCSD's Cement LCTPi highlights the needs for predictable and objective long-term policies that ensure a level-playing field, enable huge CAPEX investments for which appropriate financial mechanisms and incentives are strongly encouraged. International cooperation should also be strengthened to gather reliable, industry level energy and emissions data. This includes supporting effective policy development, tracking performance, identifying regional & national performance gaps and best practice benchmarking.

It is also important to increase the use of alternative fuels, for which Australia's climate change policies should facilitate understanding of stakeholders and public on their role in GHG emission reduction. This includes the Australian Government introducing industrial ecology frameworks and promoting a recycling-based society and rewarding investments in energy efficiency in relation to their societal benefits. Regulatory frameworks should support the development of national processes that encourage the use of alternative fuels.

Efforts to mitigate climate change should be accompanied by a concerted strategy to build adaptation and resilience to climate change. This should include a revision of existing standards, strengthening of building codes and inclusion of resiliency criteria in the development of infrastructure. Enabling policies and international collaboration for the deployment of carbon capture storage & use technologies should also be promoted.

Recommendations: Chemicals

The barriers for deploying low-carbon technologies in the Chemicals sector remain. However, in 2016 the WBCSD's Chemicals LCTPi companies and partners have worked to further investigate the barriers and enablers specific to breakthrough technologies, as well as engage along the value chain further strengthen and align on common approaches to measuring and communicating on sustainability performance.

To facilitate the market reach of these technologies the Australian Government and business must overcome information gaps on new product solutions and work on universally accepted criteria that consider the whole life cycle of a product. This may, for instance, involve developing common standards for specific products or value chains (e.g. sustainable buildings, biofuels, transportation). It could also involve strengthening platforms for knowledge sharing.

Risk sharing is important in technologies that are at their earlier stages of development. Sharing upfront costs of breakthrough technologies and low-carbon solutions through collaborative financing mechanisms, public-private partnerships and steady protection of intellectual property. This may require supportive regulatory frameworks that allow the development of innovative business models (e.g. capturing OPEX as well as CAPEX). Particularly at early stages of technology readiness levels, upfront costs may necessitate access to novel financing mechanisms for appropriate risk sharing.

Finally, we must find ways to address the skills gap, by building more capacity and understanding of how Australia's low-carbon solutions can be incorporated and received in areas such as buildings, the automotive industry, food and packaging.

Whilst the importance of these barriers varies from technology to technology and from value chain to value chain, there is a general lack of alignment of multi-stakeholder priorities as an overarching barrier and a cause for the existence of other barriers. To stimulate the uptake of sustainability offerings, it is essential to develop a common understanding between the various stakeholders involved at each value chain level, and to implement actions and policies to make not just individual sectors but entire value chains more sustainable.

Cities

Energy Efficiency in Buildings

National and sub-national governments have an important role to play in helping the building sector achieve higher levels of energy efficiency and sustainability. By developing action plans jointly with the private sector, they also gain necessary insights and support on how the building sector can contribute significantly to their intended nationally determined contributions to climate change mitigation (NDCs).

Through 2017 and beyond, the WBCSD's LCTPi-Energy Efficiency in Building (EEB) members will continue to identify opportunities to advocate for long-term policy frameworks on energy efficiency in buildings.

The Australian Government and local governments should continue to refine and deliver national/local strategies that provide a clear policy framework on how to achieve an energy-efficient building stock. This includes the adoption, strengthening and enforcement of building energy codes and setting and maintaining incentive schemes linked to actual energy performance and improvements.

All actors involved should help create an energy-aware culture among building professionals and citizens. They should promote transparency on energy consumption for residential and commercial buildings (through e.g. energy audits, benchmarking, labelling).

Recommendations: Energy Efficiency in Buildings

The Australian Government should promote and co-ordinate climate policies to enable business and civil society actions that:

- Adopt energy-efficiency targets and building energy codes
    - Renovate existing buildings to meet these targets
    - Apply new requirements for new buildings
- Develop financial incentives & innovative instruments
    - Continue and accelerate subsidization of energy auditing of buildings;
    - Cut taxes on renovation/ insulation work/ heating & cooling;
        - Facilitate access to low interest rate loans (eg: PACE, USA)
- Design local action plans with all key stakeholders to best fit the specific local context.

Low Carbon Cities

The A2SE 2xEP initiative (the Initiative) notes that the built environment can make a major contribution to the general aim of doubling Australia's energy productivity by 2030. An appropriate and practical 2030 energy productivity target could focus investment by the sector and individual operators on economically efficient opportunities.

A2SE proposes to consult with a diverse range of stakeholders about what this target, should be, the optimal pathways to follow for different sub-sectors to reach the agreed voluntary target, as well as how improvement in the energy productivity of the built environment could be tracked. Consultation will canvass collaborative action that the industry could take to support a significant improvement in energy productivity and recommend actions required by governments to reduce or remove barriers to achieving such a target.

Recommendations: Strategies the Initiative have identified to improve productivity in the sector:[42]

1. Strategy area 1: 'Traditional' energy management – improving energy efficiency through better management of energy use, including the implementation of innovative technologies, demand management strategies, best practice data-management and benchmarking energy management. Structure of the economy and stage of economic development to facilitate energy-productivity decision making. Geographic size and features, as well as climate (and weather variability) Demographics / Social Factors Government Policy & Planning frameworks Energy Market Dynamics Energy Productivity Growth Factors directly

[42] http://www.2xep.org.au/files/sectors/2xEP_Built_Environment_OverviewV1_20150831_Summary.pdf

impacting energy input Output dimensions ($ or other perceived value) e.g. Energy market policy, including price determinations regulation, including minimum standards Investment incentives e.g.: Energy price sensitivity, renewable / Fuel mix and primary.

2. Strategy area 2: Systems optimization – focusing on precinct scale energy-related aspects of the built environment as a system, including integrated urban infrastructure planning and design to optimize asset utilization. These changes may be implemented for reasons of broader productivity improvement such as urban regeneration, but greater value can be realized by adding a deliberate focus on energy productivity.

3. Strategy area 3: Business model transformation – focusing on the energy-related aspects of fundamental longer-term change in industry norms. This relates to, amongst other factors, the way space is utilized for buildings and infrastructure (e.g. energy supply), the approach to design and building material use, as well as the design and operation of equipment and infrastructure.

4. Strategy area 4: Value creation or preservation – a focus on quantitative, as well as qualitative aspects of the built environment from the perspective of individual property owners and society in general.

Long-term emission pathway recommendations

A long-term vision for the Australian emission landscape, including emission targets are important to provide direction for strategic policy decisions, build confidence in policy direction and remove barriers to investment decisions. Without a clear trajectory for the future of national emissions, investment decisions could be delayed. A long-term target will also ensure Australia is acting in line with the Paris Agreement, which carries the expectation for countries to announce 2050 emission plans by 2020.

Recommendations

SBA considers there to be various benefits from Australia setting a long-term emission target, outlined as follows:

- Set a 2050 target;
  - Providing a clear understanding of the goal to business, government and regulation committees so they can formulate individual and sectoral-specific steps to get there
  - Defining this target based on other developed countries as well as the Australian circumstances
  - Based on the scientific understanding of Australian and global emissions and what is economically, socially and biologically viable
  - Disclosure reports on setting of targets should include the methods used in calculating the reduction target
- Boards strive to achieve more ambitious targets, although hard to meet, prevent falling significantly short by aiming for lower goal.

- Use the 2050 target to work backwards in establishing the strategic process to get there;
  - Long-term ambitious signals need to be broken down into digestible steps that business can take
  - Broad 2050 targets must have tangible impacts that public and individuals can envision
- Submit a mid-century strategy before 2020;
  - To ensure Australia is on track to the 2020 commitments and beyond
  - This would benefit from public consultation
- Review and update the long-term targets to ensure they are consistently in line with the Paris Agreement.
  - This could include a review process that occurs repeatedly both before and after the 2020 reports
  - Reviews must build upon existing targets, and take into account new developments in the sectors explained above.

Appendix 1

About the LCTPi (www.lctpi.wbcsd.org)

The LCTPi supports businesses that want to be in pole position for success in a low-carbon future. It provides a collaborative platform for private and public stakeholders to discuss solutions to accelerate low-carbon technology development, and scale up the deployment of business solutions, to a level and speed that are consistent with limiting global warming to below 2°C. At COP21 in Paris in December, the LCTPi announced the launch of key public-private technology partnerships as well as company and sector actions to implement the solutions.

How it works – LCTPi:

- Identify focus areas that have technology and solutions with potential
- Establish an engagement process to get specific companies around each focus area
- Form working groups around each focus area with strong business leadership
- Ensure a shared, ambitious and realistic vision
- Determine which barriers can be dealt with most quickly
- Find potential new partners to unlock specific solutions
- Create joint action plans with partners to deliver solutions

Over 170 companies and 70 partners have already joined the LCTPi. No other business-led initiative has the size, scale and potential impact of LCTPi. 102 companies have made public endorsements of LCTPi and are ready to move to implementation. Over 1500 business representatives and policy makers have contributed to shaping the solutions in international dialogues conducted in key emerging markets over 2015 and 2016. We are tracking the progress of LCTPi and we will present the results at every COP.

About SBA's 2017 Climate Action Agenda

1. The Low Carbon Technology Partnerships initiative – Australia (LCTPi - Australia)
    - Companies can join one of the 8 LCTPi groups: renewable energy; low carbon transport fuels; low carbon freight; cement; chemicals; energy efficiency in buildings; forests and climate smart agriculture.
    - Governments will be able to partner with SBA on the overall Initiative or in one of the groups;
    - Companies will share best practices and collaborate on meaningful solutions through national, regional and global LCTPi dialogues and platforms.

2. Invest in new technologies, skills development and low-carbon solutions
    - Redirect investments to low carbon solutions compatible with the 2ºC trajectory
    - Develop organizational capacity to implement new technologies and business models for low carbon solutions
    - Take advantage of internal carbon pricing as a greater incentive to invest into low-carbon solutions and as a risk management tool to screen the viability of projects.
    - SBA is supporting the work being done in this area by the Investor Group on Climate Change (www.igcc.org.au)

3. "Walk the talk" and set up corporate targets / disclosure to drive change at the company level
    - Adopt science-based target methodologies to understand how you can reduce emissions at the company level; using learning by doing approach, starting with scope 1 and 2 emissions and with selected business units or countries.
    - Develop action plans to enhance adaptation and resilience throughout the supply chain and contribute to SDGs.
    - SBA is supporting the work being done in this area by CDP (www.cdp.org), and the We Mean Business Coalition

Image 1: Economic and business contribution of the LCTPI
http://lctpi.wbcsd.org/wp-content/uploads/2015/11/LCTPi-PWC-Impact-Analysis.pdf

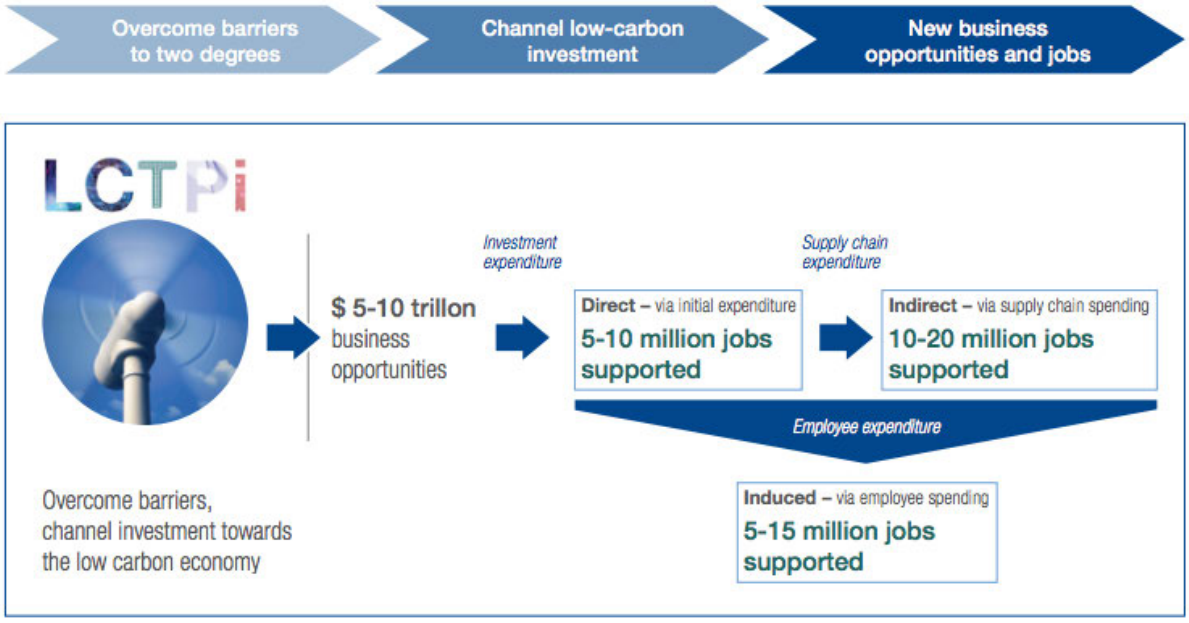

Image 2: Economic and business contributions of the LCTPi
http://lctpi.wbcsd.org/wp-content/uploads/2015/11/LCTPi-PWC-Impact-Analysis.pdf

ANALYSIS STEP	KEY TASKS	OUTPUT
Understand the nature and scale of ambition	• Review documents on working group ambitions. • Discuss findings amongst WBCSD and member company representatives.	**Business opportunities provided by the low carbon investment that the LCTPi could unlock**
Develop investment assumptions	• Identify relevant third party estimates of capital investment requirements. • Adjust data to make it more representative of LCTPi ambitions, avoid double counting between focus areas, and ensure consistent scope. • Identify third party data to inform assumptions about where investment is likely to occur and their possible cost structure. • WBCSD agreement on investment assumptions.	
Develop global input-output model	• Gather input-output tables and socio-economic data on jobs and wages from the World Input-Output Database • Gather economic data on inflation and exchange rates from the IMF and World Bank. • Create economic model using input-output, economic and socio-economic data. • Generate employment multipliers.	**Employment supported by the low carbon investment that the LCTPi could unlock**
Estimate employment supported by required investment	• Apply employment multipliers to national and sectoral investment assumptions. • Aggregate employment estimates to a global level.	

About SBA

SBA was established in Australia in 1991, and is the peak body for support and advocacy for sustainable business activities in Australia. In 2014 SBA was appointed Australia's Global Partner for World Business Council for Sustainable Development (WBCSD) and in 2015 SBA was appointed the Australian Community Leader by the Global Reporting Initiative (GRI).

SBA's members include leading Australian businesses, from all sectors, which share a commitment to economic, environmental and social development. SBA represents member companies, public sector enterprises and institutions, BINGOs and community organisations, which in turn represent 100,000 + Australian employees. www.sba.asn.au.

About WBCSD

The World Business Council for Sustainable Development is committed to galvanising the global business community to create a sustainable future for business, society and the environment. The WBCSD provides a forum for its 200 member companies to scale up business solutions that change the status quo. www.wbcsd.org