



UNDERSTAND | ADAPT | TRANSITION

Advancing Climate Action in Queensland

Making the transition to a low carbon future



Message from the Premier and the Minister

In 2015 we experienced the hottest year on Earth since record-keeping began. This was followed by confirmation that February 2016 was the hottest month ever recorded.

Indeed 14 of the 15 hottest years on record have occurred since 2001; March 2016 was the 373rd consecutive month to be warmer than the 20th century average.

The fact that the planet is getting warmer is no longer a point of debate on the world stage.

At the 21st United Nations Framework Convention on Climate Change (UNFCCC) Conference of Parties (COP21) climate conference in December 2015, nearly 200 nations, including Australia and our key trading partners, signed the Paris Agreement. For the first time, the international community has accepted unanimously that climate change is real and that concerted action to reduce carbon pollution is required from all nations.

The agreement commits the world to limiting any increase in global temperature to “well below 2°C” while “pursuing efforts to keep warming to 1.5°C”.

To achieve this goal, global carbon pollution will need to reach net zero around the middle of this century.

The good news is that we have solutions that can build a cleaner, more sustainable and prosperous Queensland. New technology is changing how energy is produced: we can create jobs and increase living standards in Australia and globally while decreasing carbon emissions at the same time.

Here in Australia, other state and local governments already have committed to achieving net zero carbon pollution by 2050. Many in the Australian business sector are calling for strong and immediate action, with leading companies making their own commitments to limit carbon pollution.

Queensland was once a national leader in action to reduce carbon pollution. The former LNP government systematically dismantled the forward-looking climate policies of previous governments, leaving Queensland unprepared at a time when other state governments in Australia and governments around the world are rapidly implementing policies that embrace the transition to a clean energy economy. This reckless approach and lack of a strategy has left Queensland on a dangerous upwards emission trajectory at the very time we need to be reducing our emissions.

It's time to get Queensland back on track, ready to face the challenges and embrace the opportunities of the future. We will develop our own strategy to prepare Queensland for the future, to manage the transition to a low-carbon world and make sure our fair share of the jobs and industries of the future are built here in Queensland for our children.

Developing this transition strategy is one element of a three-part program of work the Queensland Government is undertaking in response to our changing climate. The warming climate directly impacts Queensland in many ways—from hotter days to rising sea levels and more frequent and intense extreme events like storms, floods and droughts.

The Queensland Government is working with leading science bodies to develop a detailed understanding of how global warming will affect Queensland in the future under different warming scenarios.

This research supports the new Queensland Climate Adaptation Strategy, which is being developed in partnership with a wide range of sectors to address the risks to our economy, infrastructure, environment and communities from current and future climate impacts.

With advances in technology, and global trends driving increased innovation and investment, any number of actions can be taken to put Queensland firmly on the path towards a clean energy future where we can be proud of the legacy we create.

This discussion paper provides some of the best examples of work being done by governments, businesses and individuals in Australia and elsewhere to illustrate what is possible. We urge all Queenslanders to have your say on the direction and opportunities we should pursue to build a cleaner, more sustainable and prosperous Queensland.

Annastacia Palaszczuk
Premier of Queensland and
Minister for the Arts

Dr Steven Miles MP
Minister for Environment and Heritage Protection and
Minister for National Parks and the Great Barrier Reef



UNDERSTAND

Develop a comprehensive understanding of how climate change will affect Queensland



ADAPT

Work to reduce the risk of current and future climate change impacts on Queensland



TRANSITION

Do our fair share to reduce greenhouse gas emissions, and create the low-carbon economy jobs of the future in Queensland

“Understanding and adapting to climate change is part of this government’s broader Advance Queensland agenda: harnessing innovation to strengthen and diversify the economy and create the new jobs of the future, beyond the mining boom.”



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Purpose

Queensland was once a national leader in promoting a low carbon future.

The former Office of Climate Change (OCC) established in 2008 had an extensive program and budget. In 2010-11, the OCC had a budget of more than \$50 million and about 60 staff. This included the Queensland Climate Change Fund of \$30 million annually, and the Queensland Climate Change Centre of Excellence which provided dedicated scientific advice to the government.

However since 2012, the state-level policies and programs that worked towards the goal of a low carbon future have been dismantled. Queensland's emissions are on a dangerous upwards trajectory and the state is unprepared for the transition to a clean energy economy that is gaining pace elsewhere around the world.

Queensland now lags behind other Australian states, such as Victoria and South Australia. It's time to re-start the conversation about how we build on our existing strengths, exploit our natural competitive advantages and transition to a cleaner energy, low carbon future that will benefit our families, our children and future generations.

Overall, economies that recognise that the global, low carbon transition is both inevitable and already underway, and plan accordingly, are better positioned to realise the opportunities presented and reap the benefits of early action. Conversely, those that ignore this issue and fail to plan for the transition will be forced to make abrupt and painful changes in the future. It makes sense to plan ahead now and to encourage new industries and jobs that will ensure the most successful transition possible.

We've already begun to rebuild, with a bold renewable energy program, new vegetation protection laws before Parliament, and initiatives like Advance Queensland and the Biofutures 10-Year Roadmap. But there's more we can do.

This paper includes a number of policy and direction-setting questions for the community to consider when responding to the issues raised. **Your feedback and ideas will help shape the transition strategy for Queensland in an increasingly low carbon global economy.**





International context

In December 2015, the international community unanimously adopted an ambitious agreement to decarbonise the global economy and to limit the impact of climate change. The UNFCCC COP21 Paris Agreement commits 195 nations to hold the increase in global average temperature to “well below” 2°C above pre-industrial levels and to pursue efforts to limit the temperature increase to 1.5°C above pre-industrial levels.

International action

The Paris Agreement sets the world on a path towards a low carbon, low pollution, clean energy future and requires global emissions to peak in the near future before reaching net zero emissions in the second half of this century. Countries around the world are already acting to reduce emissions. To date, 188 nations—accounting for almost 99 per cent of global emissions—have submitted post-2020 reduction targets. In order to hold nations accountable, these targets will be reviewed every five years and adjusted based on the best available science.

In addition to emissions reduction targets, many nations are taking concrete action to decarbonise their economies. For example:

- The United States (US) is seeking to implement tough new emissions standards for power plants and the oil and gas sector as well as comprehensive energy and vehicle efficiency standards.
- Almost 40 countries and more than 26 subnational governments price carbon (WB 2015). The European Union has operated an emissions trading system since 2005. The world’s largest polluter, China, is operating pilot emissions trading schemes in seven provinces and will introduce a national scheme in 2017.
- China now leads the world in solar and wind energy. Government policies have driven a decline in coal-fired electricity production and massive growth in renewable energy.
- India has launched an international solar alliance with the objective of bridging the divide between government, industry and research organisations to increase investment in solar power. Already, 120 countries have signed up to the alliance (UNFCCC Newsroom 2015).
- The African Union and the African Development Bank have committed to producing 300 gigawatts (GW) of renewable energy by 2030, more than double Africa’s current power capacity and roughly six times more than Australia’s power capacity (AU 2015).

Subnational action

State and regional governments around the world are also playing increasingly influential roles in driving the transition to a low carbon economy. These governments are taking action in the areas of energy, environment, transport, planning and land use.

Internationally they are using their authority to lead the way by:

- developing innovative climate and energy policies
- setting the standard for global action by committing to 100 per cent renewable energy
- investing in clean technology infrastructure and start-up companies
- linking emissions trading systems
- developing new financing mechanisms
- making clear and meaningful commitments to emissions reductions
- ending deforestation and achieving net increases in tree cover.

State governments play a valuable role in sharing information between jurisdictions, and encouraging national governments to design equitable and cost-effective policy settings.

Local governments also play a particularly important role. With responsibilities spanning planning and development, environmental management, waste, transportation, roads and more, local governments are on the frontline in dealing with the impacts of climate change. They also play a lead role in involving the community directly in efforts to address and mitigate climate change, and can make a substantial impact in reducing carbon pollution as large energy consumers in their own right.

Ultimately, all levels of governments must take an active role in facilitating the transition to a low carbon economy.

HOW STATE AND REGIONAL GOVERNMENTS CAN DRIVE CHANGE: THE UNDER 2 MOU

The Subnational Global Climate Leadership Memorandum of Understanding is a good example of how actions by state and regional governments can drive global change. Known as the Under 2 MOU, in reference to the goal of limiting warming to below 2°C, the signatories share the goals of limiting greenhouse gas emissions to 2 tonnes per capita, or 80-95 per cent below 1990 levels, by 2050.

This agreement has been signed by more than 120 jurisdictions around the world, representing 720 million people and about US\$20 trillion in Gross Domestic Product (GDP)—almost a quarter of the global economy.

South Australia became the first Australian state to sign the Under 2 MOU during the Paris climate talks in December 2015.

(Read the full Under 2 MOU here: <http://under2mou.org/>)

INDUSTRY—FORGING AHEAD

Industry has a key role to play in this transition and many companies have proven they are up for the task. Carbon pricing is finding support in the international business and international transport sectors with more than 1,000 businesses participating in the Carbon Pricing Leadership Coalition (CPL 2015). International aviation and shipping are both investigating sectoral, market-based carbon pricing options.

A growing number of companies are taking action in advance of governments changing market conditions. Individual companies such as Coca-Cola and Pfizer have already implemented their own internal emissions reduction targets. These companies are positioning themselves for a future they recognise as inevitable.

Peak industry bodies such as the Business Council of Australia, the Australian Industry Group and the Australian Energy Council have signed on to the Australian Climate Roundtable. This broad-based coalition of organisations advocates for “Australia to play its fair part in global efforts to avoid 2°C and the serious economic, social and environmental impacts that unconstrained climate change would have on Australia” (ACR 2015).



Origin Energy was the first company in Australia to adopt all seven of the ‘We Mean Business’ coalition commitments on climate change. These commitments include using 100 per cent renewable energy for its office facilities. Origin’s strategy of combining a focus on gas-fired generation with owned and contracted renewable energy helps meet their 4.2 million customers’ demand for cleaner electricity (see www.wemeanbusinesscoalition.org).



Virgin Australia is committed to reducing its emissions and impact on the environment through a combined approach of fuel efficiency, sustainable aviation biofuel development and carbon offsetting in line with agreed global industry targets. The airline is currently investigating options to procure locally produced aviation biofuel in conjunction with alliance partner Air New Zealand.



Sony has committed to reduce greenhouse gas emissions from operations by 42 per cent below fiscal year 2000 levels by fiscal year 2020, with a long-term vision of reducing its environmental footprint to zero by 2050. This requires a 90 per cent reduction in greenhouse gas emissions by 2050 on 2008 levels.



Coca-Cola Enterprises Inc has committed to reduce absolute greenhouse gas emissions from core business operations by 50 per cent by 2020, using a 2007 base-year, and to reduce the greenhouse gas emissions from drinks production by 33 per cent in that timeframe.



Westpac has set resource efficiency and emissions targets since 1996. All Westpac operations will be carbon neutral over the period 2013 to 2017.



QANTAS is targeting a 1.5 per cent average improvement per annum in fuel efficiency per revenue tonne out to 2020. Beyond 2020, the company is targeting ‘carbon neutral growth’ and aims to reduce net emissions by 50 per cent by 2050 compared to 2005 levels.



Rio Tinto has set quantified emissions intensity reduction goals and is aiming for substantial decarbonisation of its business by 2050.

National context

The Australian Government has set a target of reducing carbon emissions by 26-28 per cent below 2005 levels by 2030. This is comparatively low when measured against the commitments of other advanced economies such as the US, Germany and the United Kingdom.

The national targets are also well short of those recommended by the independent Climate Change Authority (CCA), which the Queensland Government has resolved to support. The CCA recommends emissions reduction in the range of 45-63 per cent on 2005 levels by 2030.

The Australian Government's Emissions Reduction Fund is also widely acknowledged by economists to be an expensive and ineffective way to secure abatement, and any abatement derived through the fund is more than outweighed by emissions growth elsewhere in the economy.

Even the Safeguard Mechanism, which is intended to keep net emissions from large facilities at or below baseline levels, has been forecast by carbon market analysts Reputex as likely to lead to an increase in emissions covered by the scheme by 20 per cent by 2030, unless the rules are tightened.

The Australian Government's discontinuation of capital grants for new clean energy projects under the Australian Renewable Energy Agency and its stated intention to abolish the Climate Change Authority, raises serious questions about its commitment to effective climate policy.

Given Australia's low national targets and lack of national policy settings to cap and reduce emissions, it is likely that we will come under increasing international pressure to strengthen our climate change commitments, and introduce new policy mechanisms to achieve these targets, in the near future. Inaction may also lead to broader implications for Australia and Queensland's trade relationships and our reputation for clean and green food production.

The risk for the national and Queensland economies is that, in the absence of coherent national leadership, it will be difficult to achieve the 2030 target and there will be delays in making the necessary structural adjustments to the economy. Australia will be faced with the challenge at a later date to more rapidly de-carbonise at greater economic cost than if it had acted earlier, and will have missed the opportunity to lead the creation of clean energy jobs of the future.

2030 Targets—implied reductions in total emissions, 2005-2030 (Climate Change Authority 2015)

Change from 2005



Note: Japan's efforts to reduce emissions were dealt a blow by the Fukushima disaster—closure of all its nuclear power plants increased its reliance on fossil fuels. Change, except for Norway, is CCA calculation. China committed to peak its emissions around 2030, and to reduce emissions intensity by 60-65 per cent on 2005 levels by 2030; the range shown is an indicative estimate based on projected growth in China's real GDP. Korea has committed to reduce its emissions by 37 per cent from business as usual levels by 2030; the range shown is an estimate based on its 2005 emissions including and excluding the land sector. The US figure is a linear extrapolation from its 2020 target through its 2025 target; the UK figure is a linear extrapolation from its 2020 target through the mid-point of its 2023-27 budget.

Sources: Royal Norwegian Embassy; Historical emissions: Australia 2014-15 Projections (DoE 2015); China and Korea: (WRI 2014); Remaining countries: (UNFCCC Secretariat 2014a); includes land sector. China GDP: OECD (2014).

FIGURE 1 (DOTE 2013)

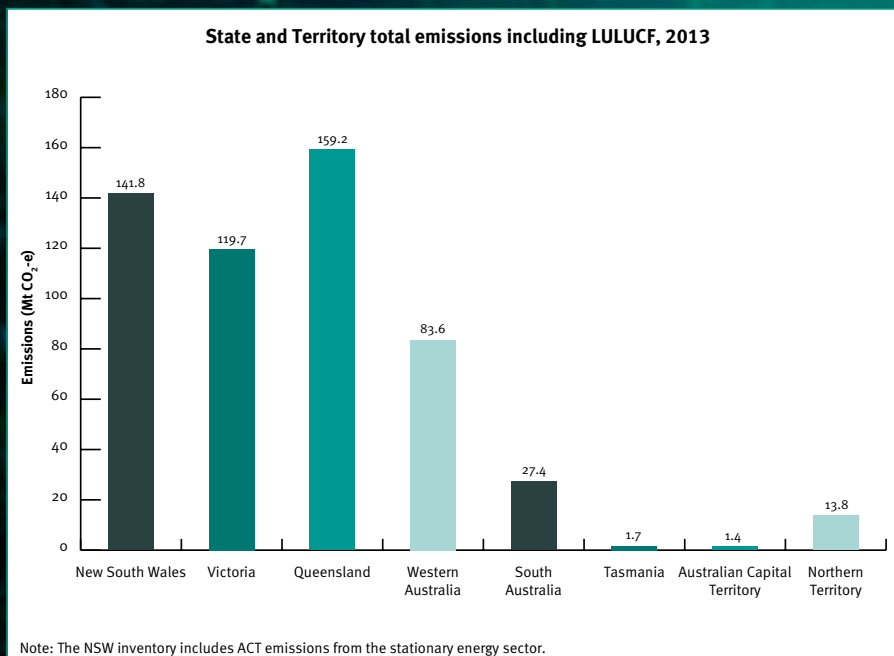
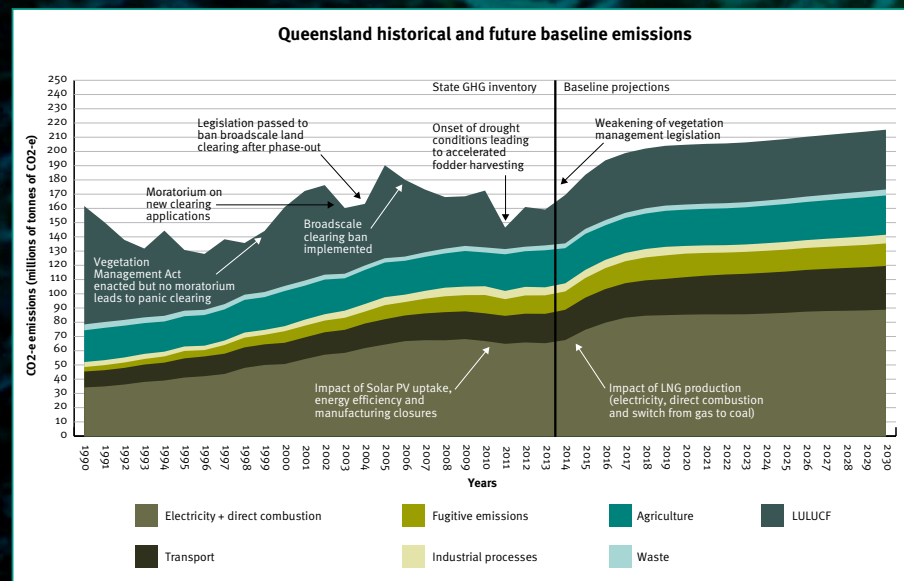


FIGURE 2





Queensland context

Queensland's carbon pollution—now and in the future

Currently Queensland's economy is emissions-intensive which means that it produces high levels of greenhouse gas emissions compared to other economies, on both a per person and per dollar gross state product basis. This is due to Queensland's significant reliance on coal-fired electricity generation, large mining and processing sectors, and higher levels of tree clearing than any other state or territory in Australia. The transport sector also generates significant emissions, a consequence of our large land area.

Latest data from the National Greenhouse Gas Inventory puts Queensland's greenhouse gas emissions at around 160 million tonnes of carbon dioxide equivalent per year (Mt CO₂-e), representing just under 30 per cent of total national emissions.

Without action, Queensland Government modelling indicates our total emissions will continue to significantly increase from 159.2 Mt CO₂-e in 2013, to 215.3 Mt CO₂-e in 2030, an increase of 35 per cent.

The business as usual (BAU) modelling shows that the lack of a strategy since 2012 has put Queensland's emissions on a dangerous upwards trajectory at the very time when international agreements require our emissions to be reducing.

The Australian Government aims to reduce emissions by 26–28 per cent on 2005 levels by 2030. Based on these projections, Queensland's emissions will increase 13 per cent over the same period (or 34 per cent by 2030 on 2000 levels).

Queensland's previous 'good news' stories—such as declining emissions from electricity generation and land clearing—have been reversed, and will continue to go backwards if new measures are not introduced to tackle our emissions.

(For more information: www.qld.gov.au/environment/climate/mitigating-effects/)

LAND CLEARING IN QUEENSLAND

In 2006, the then Queensland Government enacted legislation to end broadscale tree clearing. This was followed in 2009 by the introduction of protections for high value regrowth. These measures ensured Australia met its Kyoto targets for reducing carbon pollution.

In 2013, the incumbent government rolled back that legislation and presided over a dramatic escalation in land clearing rates.

The Statewide Landcover and Trees Study (SLATS) for 2012-2014 showed that the annual rate of clearing increased from 153,638 hectares per year to almost 300,000 hectares per year in financial year 2013-14.

While most other states were reducing land clearing, and even achieving net increases in forest cover, the Australian Government's accounting for 2013 land use change and forestry emissions figures reveal that 90 per cent of Australia's land use emissions occurred in Queensland.

SLATS data has shown land clearing in Queensland is now releasing more stored carbon into the planet's atmosphere than at any time in the past eight years—almost 36 million tonnes each year.

The Australian Government's Emissions Reductions Fund has used \$1.2 billion of taxpayer funds to buy back nearly 93 million tonnes of carbon that would otherwise have been emitted in coming years.

But at the current rate, land clearing in Queensland will rapidly wipe out the emissions reduction benefits derived from the fund.

The Queensland Government introduced legislation to Parliament in March 2016 to reinstate a responsible tree-clearing framework for Queensland. The bill is being considered by a parliamentary committee, with the committee's report due to Parliament by 30 June 2016.



Impacts of a changing climate

While Queensland is no stranger to volatile and harsh weather conditions, climate change is expected to amplify the frequency, distribution and severity of extreme weather events.

Increased average temperatures, more extremely hot days, more frequent and intense extreme events such as storms, cyclones, bushfires and droughts, and increased sea level and tides will change what it is like to live in Queensland.

Queensland's climate is already changing. Experts agree that the planet is now 1°C warmer on average than before the Industrial Revolution and there is a growing consensus that 1.5°C of warming may be already locked in by past greenhouse gas emissions and emissions projected to occur up to 2020. Our farmers, emergency responders, Queensland State Emergency Service (SES) volunteers and public health workers are speaking out about the impacts they can see already. And there is no more graphic visual representation of the impacts of our warming planet than the global mass coral 'bleaching' phenomenon that has severely affected the Great Barrier Reef in the summer of 2015-2016.

Without strong global climate change action, Australia will experience average warming of 4°C by the end of this century which will see average temperatures 3–5°C higher in coastal areas and 4–6°C higher inland (CCA 2014). Life will be substantially harder and many people, sectors of the community and the environment will suffer.

Even under a scenario where warming is kept to 2°C, the Commonwealth Scientific and Industrial Research Organisation (CSIRO) has found that Australia will still need to adapt to additional sea level rise, increased frequency and intensity of bushfires and floods, more frequent heatwaves and drought, increased water scarcity, and year-round higher temperatures.

This is one reason why it is in Queensland's interest to contribute to the global effort to limit warming to well below 2°C as set out in the Paris Agreement.





The impacts of a changing climate¹

The Queensland Government is investing \$3 million over three years to develop and implement a Queensland Climate Adaptation Strategy (Q-CAS) addressing ways to adapt to manage the risks to our economy, environment, infrastructure and communities from current and future climate impacts. Q-CAS is being developed in partnership with a wide range of sectors, with public consultation expected in mid-2016.

The Queensland Government also will provide \$12 million over the next three years, administered by the Local Government Association of Queensland, to help coastal communities plan and prepare for storm tide inundation, coastal erosion and rising sea levels from climate change.



Emergency services

- Increased likelihood of very high fire danger conditions
- Increased frequency and severity of cyclones and intense rainfall events
- Bushfire preparedness for increased risk as bushfire seasons lengthen
- State fire agencies increasingly needing to share personnel and other fire-fighting resources during peak demand periods.



Human health

- Increased frequency and/or intensity of extreme weather events, with immediate and ongoing risks to human health
- Heat-related mortality likely to increase with more Australians dying every year from extreme heat than from any other type of natural disaster
- Expansion further south of the geographic region suitable for transmission of mosquito-borne diseases.

¹Adapted from Climate Commission 2012



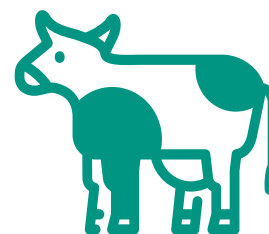
Biodiversity

- Heat and extreme weather events threaten the survival, breeding and regeneration cycles of many plants and animals
- Many of Queensland's species at increased risk of extinction
- Many of Queensland's iconic natural ecosystems such as the Great Barrier Reef and World Heritage tropical rainforests increasingly threatened.



Tourism and iconic ecosystems

- Tourism, a key industry for Queensland employing 230,000 people either directly or indirectly, relies on unique local attractions including the Great Barrier Reef, RAMSAR listed Moreton Bay and World Heritage tropical and sub-tropical rainforests
- Higher temperatures and changing rainfall will place increasing pressure on Queensland's rainforests towards the end of the century
- Higher sea surface temperatures and more acidic oceans threaten the Great Barrier Reef
- Tourism values of iconic beaches (e.g. Gold Coast beaches) and coastal ecosystems are impacted by sea level rise which contributes to beach erosion, damage to property and infrastructure and eventual coastal retreat.



Agriculture

- Heat stress for livestock and plants
- Some fruit and vegetable crops unable to be grown in their current locations due to less chilling and maturing time
- Salinity related to rising sea levels adversely affecting crops in coastal areas
- Potential increases in rainfall in the north increasing waterlogging in crops like sugar
- Reduced cereal production with increases in temperature or changes in rainfall.



Built environment

- Large sea-level rises could completely inundate some Torres Strait islands, forcing communities to relocate to islands with higher ground or to mainland Australia
- Increased risks of coastal flooding and beach erosion for many areas of the Queensland coast
- Moreton Bay, Mackay, Gold Coast, Sunshine Coast, Fraser Coast and Bundaberg local government areas are most at risk from increased frequencies of extreme sea level events
- Increasing natural disasters will threaten built environment assets, resulting in damage to essential public assets and the disruption of the community, essential services and the economy.

THE GREAT BARRIER REEF'S GREATEST THREAT

The Great Barrier Reef is precious. The world's largest coral reef is a unique national icon of global significance that supports nearly 69,000 jobs.

But the reef is in trouble—and climate change is its greatest long-term threat.

Most of the increased warmth from global warming is absorbed by the oceans. The oceans also absorb carbon dioxide, making them more acidic. This is fatal to corals.

At the same time, increased storm activity off the coast literally shears the reef to pieces, while the intensifying drought/flood cycle on land washes more sediment and pollution into the reef.

Coral reefs are the canaries in the coal mine of climate change. When live corals are stressed from overheating, they expel the microscopic algae that give them their unique, vibrant colours, leaving only a white skeleton.

In the summer of 2015-2016, strong El Nino conditions in the Pacific combined with increased ocean temperatures due to climate change caused a global mass coral bleaching event—only the third of its kind in history.

The Great Barrier Reef sustained severe bleaching, especially in the far northern sector between Cooktown and the tip of Cape York. Fortunately most popular tourist destinations were unaffected.

Protecting the Great Barrier Reef and the jobs it supports is a key priority for the Queensland Government. The government is investing heavily in measures that will improve the resilience of the Great Barrier Reef and its capacity to adapt and change in response to warming ocean temperatures, including:

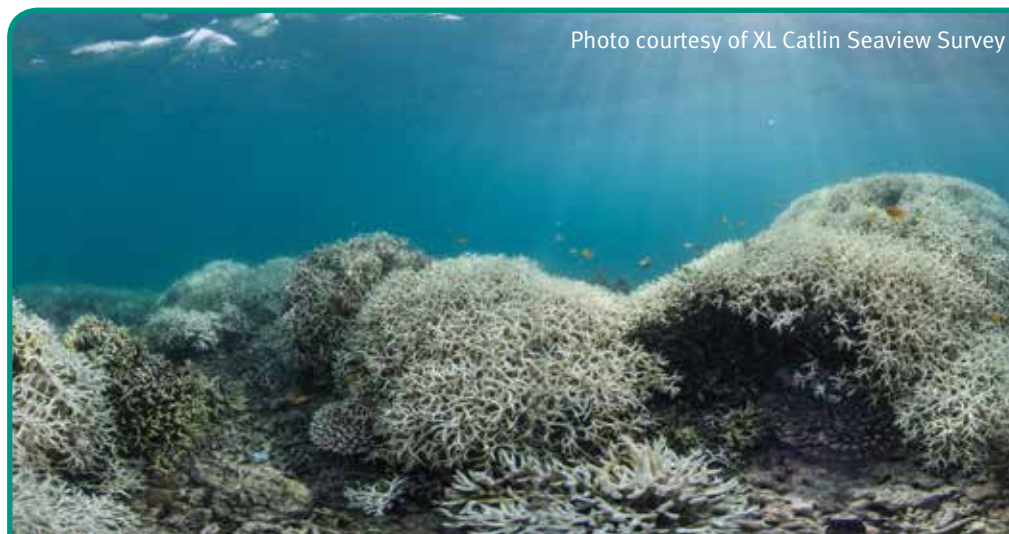
- investing an additional \$100 million over five years for reef water quality improvement measures
- establishing ambitious targets to reduce pollution affecting water quality in key reef catchments' water quality improvement targets
- appointing an expert taskforce led by the Chief Scientist to advise on improving water quality
- legislating a ban on dumping capital dredge spoil in the Reef World Heritage Area and strict limits on port development.

Photo courtesy of CoralWatch



Bleached anemones at Lizard Island, March 2016

Photo courtesy of XL Catlin Seaview Survey



Coral bleaching at Lizard Island, March 2016



QUEENSLAND'S FLOODS OF 2010-2011 WERE MADE WORSE BY CLIMATE CHANGE

Researchers have found that long-term warming of surrounding oceans helped make Queensland's floods of 2010-2011 far worse than they should have been (ARC Centre of Excellence for Climate System Science 2015).

Extremely warm sea surface temperatures around Australia during the summer of 2010-2011 led to 84 per cent above average rainfall levels in northeast Australia and the highest recorded soil moisture measurements since 1950.

The sustained and heavy rainfall over already saturated areas caused devastating floods across parts of south-east and central Queensland, claiming 35 lives and affecting more than 2.5 million people. More than 78 per cent of the state (an area bigger than France and Germany combined) was declared a disaster zone.

The World Bank estimated that the flood events of 2010-2011 and Severe Tropical Cyclone Yasi together caused in excess of \$20 billion (US\$15 billion) in damages and losses (WB and QRA 2011).



What are the opportunities?

Just as Queensland is uniquely vulnerable to the impacts of climate change, our state is uniquely positioned to take advantage of the opportunities presented by the transition to a clean energy, low carbon economy.

The Paris Agreement has galvanised governments, industries, investors and innovators around the growing opportunities of a clean economy. Global investment in clean energy now outstrips fossil fuel investments with a record US\$329 billion (AU\$465.72 billion) in global clean energy investment last year alone (BNEF 2016).

Technological and commercial advances, both domestically and internationally, are producing clean energy goods and services at increasingly competitive prices. Governments that foster the development of these new products, markets and business models are already reaping the benefits in terms of growth, revenue and employment opportunities.

Queensland is benefiting from significant research and investment in the bio-energy sector and growing investment in carbon forestry projects. Opportunities also exist in the large scale mining and manufacturing sector where Queensland can combine its manufacturing expertise, large resource base and renewable energy potential to produce low emissions products and resources.

In particular, our plentiful supply of renewable energy resources and technology—especially solar—gives Queensland the potential to be a net exporter of renewable energy to other states.

Acting now will position Queensland to attract new investment and employment opportunities, building the industries of the future here in our state.

Along with creating new jobs, the transition to a clean energy, low carbon economy also has the advantage of allowing households to better manage their own power and bills through solar PV and batteries.

It's important that as a state, we act early to develop our own transition strategy. This allows us to design a strategy that suits our local priorities, rather than having one imposed on us by external forces. Early action also means costs can be reduced and the risks of transition better managed. Putting transition off to a later time will mean making deep, rapid economic

changes down the track—ultimately costing far more and unfairly disadvantaging vulnerable sectors of our community.

Economic analyses, including modelling by the Australian Government's Treasury Department (2008), consistently find that early mitigation action is cheaper than delaying action. That is, delayed action poses a greater risk to the national and Queensland economies. The modelling finds that countries that defer action lock in emissions-intensive infrastructure for longer and face higher long-term costs when forced to make greater adjustments later.

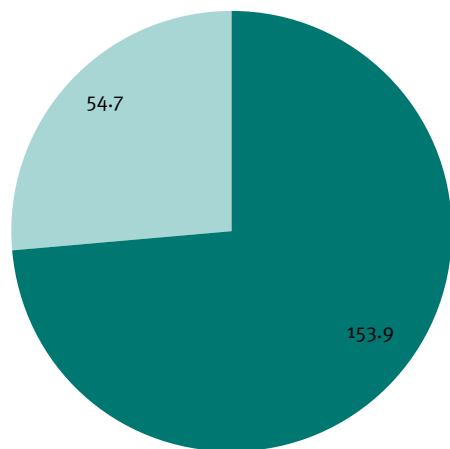
Photo courtesy of Sunelec





FIGURE 3

Queensland coal exports in 2013-14 (Mt)



Metallurgical

Thermal

What impact will the global move to low carbon energy sources have on our regional communities?

Queensland is a large exporter of coal which contributes significantly to the state's economy.

On 18 December 2015, the International Energy Agency (IEA) reported that global coal demand growth halted in 2014. A downward trend in 2015 is likely to be detected in the next assessment. The IEA has reported that the economic transformation in China and the adoption of low carbon policies worldwide—including the watershed Paris Agreement—is likely to continue to constrain global coal demand (IEA 2015).

To achieve net zero emissions, global demand for thermal coal used in power production must trend downwards over many decades.

However, during this global transition from coal to various forms of alternative energy for power generation, there will continue to be demand for coal for power generation and steel production.

Queensland produces some of the highest quality thermal and coking coal in the world which is mined within a strong workplace safety and environmental legislative framework. Due to the challenges of meeting the energy needs of developing nations, not supplying these markets with Queensland coal would not result in decreased coal usage and global carbon emissions in the short term: these countries would simply source coal from elsewhere. While Queensland is one of the world's largest suppliers of coal, its proved reserves represent less than five per cent of globally available resources.

Coal usage in destination countries will be included in their own carbon emission plans, and their own transition plans away from fossil fuels to renewables. The point of emissions is also the focus for carbon pricing and regulatory action by our trading partners. This will undoubtedly influence the export market in years to come. If Queensland is to make a real difference to global emissions, it will be through leading the way to a low carbon economy.

Metallurgical or coking coal makes up three-quarters of Queensland's coal exports by both volume and value. The demand for steel is unlikely to decline by as much as the demand for coal-fired energy because it is a key material in a large number of industries, even renewable energy. Wind turbines are primarily made from steel, with the emissions from their production more than offset by the clean energy they generate. The continued need for steel means that Queensland will continue to export metallurgical coal even as the world decarbonises.

Queensland has large amounts of viable land to undertake carbon sequestration projects providing many rural landowners with an important opportunity to diversify their incomes and benefit financially from the carbon market. Some Queensland landholders currently receive funding from the Australian Government's Emissions Reduction Fund (ERF) to undertake carbon sequestration projects.

The Queensland economy will continue to grow as the government works to reduce carbon emissions, and jobs will grow across a number of different sectors including renewable energy, tourism and mining.

CLEAN COAL TECHNOLOGIES

The extensiveness of coal as an energy source has long been expected to drive investment in clean coal technologies, including coal-fired power stations incorporating clean-coal low-emission technology and carbon capture and storage (CCS); however, these clean coal technologies have not yet proven to be effective on a commercially feasible scale. The widespread application of technologies like CCS depends heavily on technical maturity, accessible storage locations, cost, and the ability to transfer the technology to developing countries, regulatory aspects, environmental issues and public perception.

If CCS is to form part of the long-term mix of measures used to reduce carbon pollution, industry will need to demonstrate that it can work and be economically viable in an environment where proven renewable energy alternatives are becoming more and more cost effective.

What Queensland is already doing

The Queensland Government is already pursuing a range of strategies to tackle climate change and reduce the carbon pollution generated within our state, including:



CLIMATE ADAPTATION

- Developing a \$3 million Queensland Climate Adaptation Strategy (Q-CAS) in partnership with a wide range of sectors (public consultation is expected in mid-2016)
- Implementing a \$12 million coastal hazards adaptation program in partnership with the Local Government Association of Queensland.



RENEWABLE ENERGY

- Appointing a Renewable Energy Expert Panel to assess and establish a credible pathway to a 50 per cent renewable energy target by 2030
- Setting a target of one million solar rooftops or 3000 megawatts of solar PV in Queensland by 2020
- Instigating a public inquiry by Queensland Productivity Commission into fair price for solar energy
- The Solar 60 initiative supporting up to 60 megawatts of large scale solar generation
- Government-owned network operator Ergon Energy to buy 150 megawatts of renewable energy from suppliers in regional Queensland.



LAND SECTOR MANAGEMENT

- Reinstating responsible vegetation management framework to reduce carbon emissions from tree-clearing, with a bill currently before Parliament
- Promoting opportunities for Queensland landholders to participate in the national Emissions Reduction Fund.



TRANSPORT

- Developing a network of 'electric super highways' with fast-charging service stations for electric vehicles the length of Queensland
- Encouraging public transport as mode of choice in SEQ with new rail and ferry infrastructure, review of all bus and train service timetables in SEQ and SEQ Fare Review
- Supporting improved federal vehicle emissions standards
- Continuing work on Queensland Cycle Strategy to encourage greater use of cycle ways, leading to fewer cars on the road and reduced emissions
- Use of Managed Motorways technologies to reduce stop-start travel, leading to lower emissions.



BUILT ENVIRONMENT

- Reviewing State Planning Policy State Development Assessment Provisions and development assessment requirements to consider how climate change and renewable energy priorities can be advanced through the planning framework
- Identifying ways that renewable energy and energy efficiency can improve housing sustainability as part of the development of a new Queensland Housing Strategy
- Through the State Infrastructure Plan, working to ensure that Queensland's infrastructure is resilient and adaptive to climate change, contributes to reductions in greenhouse gas emissions and is considerate of the surrounding natural environment.
- New agency Building Queensland to provide independent, expert advice on major infrastructure projects, including examination of the social and environmental impacts
- All state government projects of greater than \$100 million in value to include a sustainability assessment (assessments will also be encouraged for projects worth less than \$100 million).



ENERGY EFFICIENCY

- Working to raise national emissions performance standards for appliances and buildings
- Investigating new policy options to improve energy efficiency in new and existing government buildings.



INNOVATION

- Driving innovation within traditional industries and creating the industries of the future with the Advance Queensland innovation and jobs plan
- Supporting research into the impact of climate change on the Great Barrier Reef to deliver tangible outcomes for change
- Helping industry connect with researchers to develop innovative ways to improve practices and reduce the environmental impacts of business.



QUEENSLAND—POWERED BY SUNSHINE

Queensland is a world leader in household solar generation.

With more than 450,000 households and small businesses already connected to solar, Queensland has the highest number of installations in Australia. The collective capacity of solar PV makes it the 2nd largest power station in Queensland.

This number continues to grow as solar PV is cheaper than grid-supplied electricity in many cases.

The Queensland Government's goal of **one million solar residential rooftops by 2020**, along with policies to facilitate more solar power generation in community and rental housing and large-scale solar installations, will consolidate our position as the Sunshine State.

Renewable energy in the pipeline

Private proponents are well-advanced in the development of a wide range of renewable energy projects, which will provide a major boost to employment during construction and operation.

The Queensland Government is working with proponents of 17 projects, offering an additional 1000 megawatts of installed energy generation valued at \$2.4 billion and offering up to 2,300 jobs during construction. These projects are spread across the State and feature a range of technologies including solar, wind and biomass.

As part of the Solar 60 program, the Queensland Government is collaborating with the Australian Renewable Energy Agency (ARENA) in its 200 megawatt auction for large scale solar generation. On 14 January 2016, ARENA shortlisted 22 Projects across Australia to participate in the second round of its program, including ten very competitive projects located in Queensland.

Ergon Energy is undertaking a tender process to contract up to 150 megawatts of large-scale renewable energy capacity in Queensland. This process will help Ergon Energy to meet its liabilities under the Federal Renewable Energy Target.

ADVANCE QUEENSLAND

The Advance Queensland initiative will position Queensland as a place where entrepreneurs, industry, universities and government work collaboratively to **turn great ideas into investable products and grow businesses that create the jobs and exports of the future.**

Examples around Australia have shown that an early transition to a low carbon economy maximises employment and investment opportunities, and that innovation is the key to this transition.

The Queensland Government has invested \$180 million over four years in the Advance Queensland program to create the knowledge-based jobs of the future. This includes the Advance Queensland Innovative Partnerships program, which offers grants of up to \$1.5 million to Queensland research organisations to undertake collaborative research projects with industry or small- to medium-sized enterprises addressing one of Queensland's science and research priorities, including clean energy and climate change.

This program will boost the productivity growth and competitiveness of existing industries and accelerate the development of emerging industries and technologies where Queensland could have comparative advantage in global markets—helping create jobs now, and jobs for the future.

(For more information: <http://advanceqld.initiatives.qld.gov.au>)



“Qantas and Virgin Australia support the Queensland Government’s commitment to develop an advanced bio-economy. Transitioning the industry from the production of first generation ethanol/biodiesel to a bio-economy producing advanced fuels, chemicals and polymers will require careful policy and planning.”

Joint presentation by Qantas and Virgin Australia to members of the Queensland Government.

BIOFUTURES

The Queensland Government is committed to stimulating an industrial biotechnology revolution in the state.

Queensland has the potential to become a leading producer of bioproducts and technologies, creating new markets for both technology developers and agricultural producers and providing significant regional development prospects for the state.

Legislation passed by the Queensland Parliament on 1 December 2015 introduced a biofuels mandate, requiring the fuel industry to meet targets for the sale of bio-based petrol such as E10 ethanol-blended petrol and bio-based diesel.

The biofuel mandate is a step towards growing our biofuel and bio-manufacturing industries: it provides certainty so the industry can invest, innovate and grow.

Queensland motorists will continue to have choice in the fuel market to purchase ethanol-blended petrol or other unleaded fuels to suit their engine.

Prescribed sustainability criteria will apply to the bio-based diesel and ethanol additives that may be counted toward the fuel and diesel mandates. Applying these criteria will reduce the likelihood of unintended environmental impacts resulting from an increased demand for feedstock, including the potential for increased use of fertiliser and runoff entering the Great Barrier Reef resulting from an expansion or increase in intensity of cane production.

(For more information: <http://www.statedevelopment.qld.gov.au/industry-development/biofutures.html>)



What more should Queensland be doing?

The Queensland Government is determined to properly manage the transition to a low-carbon economy and secure our fair share of the jobs and industries of the future.

While a well-designed national approach is likely to be the most effective and efficient way to drive down carbon pollution, the state government will play a key role as both a leader and a model user. Specifically, state-based action is needed to address gaps in national policy, take action in areas of state responsibility and to help Queensland businesses and communities adjust to and take advantage of national and international carbon measures. The state government also has a significant role to play as a polluter in its own right, and a purchaser of goods and services. This includes managing the energy and emissions of state-run buildings like schools and hospitals.

There are four main ways to reduce carbon pollution over the long-term while maintaining strong economic growth. Each can simultaneously deliver other benefits to individuals, communities, existing industries and the economy overall:

- Energy efficiency
 - » Being smarter about the use of energy and doing more with less
- Low carbon electricity
 - » Reducing the emissions associated with energy production and, over time, replacing existing fossil fuel based generation with home-grown renewable energy
- Electrification and fuel switching
 - » Switching the fuels used in cars, buildings and industries to cleaner options, including low carbon electricity and biofuels
- Non-energy emissions
 - » Storing carbon in our trees and in our soils, which offsets emissions created by other sectors while providing our rural and regional communities with an additional income stream.

These four ‘pillars of decarbonisation’ (ClimateWorks Australia and ANU 2014) present opportunities in a range of sectors including:

- energy and electricity
- housing, buildings and town planning
- transport
- waste management and recycling
- agriculture and land management
- training, trade and investment
- mining and resources.

The next section of the discussion paper canvasses examples of actions that Queensland could take in key sectors. Your ideas on what actions and opportunities Queensland should pursue will help shape our strategy for transitioning to a low carbon economy.



WHAT DO YOU THINK?

1. What should Queensland look like in 5, 10 or 30 years in a low carbon global economy?
2. What do you think are the benefits and costs of taking action to address climate change in Queensland?
3. What part should Queensland play in meeting global and national climate change commitments?
4. How should Queensland work with the Commonwealth, state and territory governments and local governments to reduce greenhouse gas emissions?
5. What kind of goals or targets should Queensland set in order to achieve this?
6. What could the Queensland Government do to further stimulate innovation and commercialisation of low emissions and clean technologies?
7. Should Queensland sign the 'Under 2 MOU'?

HITTING THE RIGHT TARGET: THE VALUE OF A LONG-TERM GOAL

Setting an emissions reduction goal has a number of important benefits. Interim targets and policies can be assessed against their capacity to contribute to the goal. This sends a clear signal to stakeholders and investors of what is expected and anticipated, reducing uncertainty and improving their capacity to make efficient decisions.

Setting an emissions reduction goal also helps discourage delaying actions to reduce emissions, which can lock in high carbon activities and result in a greater reliance down the track on technologies which are expensive, underdeveloped and potentially constrained in order to meet externally imposed targets or limits.

South Australia recently committed to a target of zero net emissions by 2050 and will embed the target in legislative and policy frameworks. Interim commitments include improving the energy efficiency of government buildings by 30 per cent from 2001 levels by 2020, 50 per cent renewable electricity by 2025² and the achievement of \$10 billion in low carbon investment by 2025.

Many states in the USA have set ambitious long-term goals and policy frameworks to implement them. California has committed to an emissions target of an 80 per cent reduction below 1990 levels by 2050. That state has also set an interim target of 40 per cent below 1990 levels by 2030 and strengthened a range of policies including its renewable energy target to 50 per cent by 2030.

² In 2009, South Australia set a target of 33 per cent renewable energy by 2020. The state went from having little renewable energy a decade ago to achieving its 33 per cent target in 2013-14. Subsequently, the target was increased to 50 per cent by 2025 (www.renewables.sa.gov.au).



Electricity and energy efficiency

Queensland's emissions from electricity generation are increasing; electricity prices have risen steeply too. We need to examine how we use energy and how we can manage a sustainable transition to clean energy sources.

Queensland has excellent renewable energy resources. It's a fast-growing industry with major growth potential. Plus, falling technology costs make renewable technology more economic for households and businesses.

Energy efficiency is another area that provides great opportunity to cut both costs and pollution at the same time.

As early as 2003, it was found energy consumption in the manufacturing, commercial and residential sectors could be reduced by as much as 30 per cent while delivering the same services by deploying existing cost-effective technology that recovered its costs within four years (EEGHWG 2003).

SHAKING UP THE ENERGY MIX

Among large industrial nations, Germany leads the way in reforming and decarbonising its energy generation system. This monumental transformation, known as the Energiewende, has accelerated further following the 2011 Fukushima nuclear incident. The proportion of electricity generation accounted for by renewable energy in Germany increased from 6 per cent in 2000 to 30 per cent in 2015. By the year 2025, 40–45 per cent of electricity consumed in Germany will be sourced from renewables; by 2035, that figure will be 55–60 per cent.

This energy transition also has opened up important new fields of business in Germany. New global markets have arisen in the wake of the expansion of renewable energy sources and efficient use of energy. German enterprises are also playing a major role both domestically and internationally in renewable energy development and creating many jobs in the process.

Photo courtesy of Sunelec



HAVE YOUR SAY:

RENEWABLE ENERGY EXPERT PANEL

The Queensland Government has a clear commitment to increasing the level of renewable energy in this state.

The government has established a Renewable Energy Expert Panel to undertake a public inquiry into a renewable energy target for Queensland. The Panel will assess and establish credible pathways to a 50 per cent renewable energy target in Queensland by 2030 and identify how to drive the development of a renewable energy economy for the state. The Panel will deliver its final report by the end of 2016.

Central to the inquiry is a broad public consultation process. Information about the Expert Panel inquiry and how to participate can be found on the Department of Energy and Water Supply website: www.dews.qld.gov.au/electricity/solar/solar-future/expert-panel



WHAT DO YOU THINK?

8. What are the opportunities for Queensland in transitioning to a clean energy future?
9. What are the major barriers in adopting clean energy technologies in Queensland?
10. What programs would you like to see put in place to encourage greater uptake of energy efficiency and clean energy?



THE TRANSFORMATIVE POTENTIAL OF BATTERIES

Energy storage is a critical enabling technology for a wide range of applications such as providing renewable energy storage (e.g. together with household or business solar PV systems), on- and off-grid remote power, telecommunications and peak demand management.

Much as for renewable energy, rapid cost reductions for energy storage are expected to drive wide-scale deployment, increased investment and job growth. Recent research estimates that global annual battery storage capacity will grow from:

- 0.36GW in 2014 to 14GW in 2023 for utility scale applications
- 0.17GW in 2014 to 12GW in 2024 for residential and commercial applications.

In 2001, two engineers in Brisbane began to develop a zinc-bromine flowing electrolyte battery system. Their technology offered the potential to overcome the limitations of existing energy storage systems by providing much lower cost, a longer life, less weight and a better match for time-shifting electricity use with a discharge time of three to eight hours. RedFlow Limited was formed soon after.

With mentoring support, funding and collaboration with the Queensland and federal governments, the University of Queensland and Ergon Energy, RedFlow was able to commercialise the battery. By late 2010, RedFlow's technology was being installed throughout Australia and New Zealand: in 2014, a manufacturing agreement with US giant Flextronics realised commercial production of RedFlow's unique 'flow battery'.

RedFlow continues to innovate: a companion Battery Management System that simplifies the installation and management of RedFlow batteries, essentially making them a 'plug and play' electricity storage device, was recently released. Brisbane-based RedFlow demonstrates the employment and investment benefits of supporting energy storage innovation in Queensland.



Built environment

Buildings consume a significant amount of electricity, accounting for emissions equivalent to the entire Queensland agricultural sector. They also represent some of the most well-proven, lowest-cost opportunities to reduce emissions, which is why building energy efficiency measures are often near the top of climate action plans for governments and businesses alike.

Beyond the bricks and mortar buildings themselves, how we shape urban form and develop our urban environments impacts directly on how much pollution is created from electricity use and transport, as well as the resilience of our cities and communities to the impacts of climate change. Put simply: there is as much to be gained from better arranging and connecting land uses as there is from improving the efficiency of buildings.

For example, residential journeys—connecting households with jobs and services—create a significant proportion of the emissions generated in the transport sector. The way we design and build our cities and neighbourhoods impacts directly on these emissions. By putting more housing closer to jobs and services, especially public transport transit, the need for private vehicle travel is reduced as is the length of trips.

Investing wisely in the right infrastructure—frequent and high quality transit and convenient pedestrian and cycle connections—will provide an attractive alternative to increasingly congested commuter trips by private vehicle. The neighbourhoods served by this infrastructure are places designed for people, not for cars, and provide the basis for more sustainable and low energy lifestyles.

These principles will underpin the approach to the South East Queensland Regional Plan and the State Infrastructure Plan. Together, these plans will shift South East Queensland towards a more sustainable urban form—compact, connected and more energy-efficient, reducing carbon emissions by putting more housing closer to jobs and services.

BUILDING SUSTAINABLE NEIGHBOURHOODS

Southeast False Creek in Vancouver, Canada is a leading example of how urban environments can be designed for sustainable living.

Southeast False Creek is designed as a mixed-use community with a total population of 11,000–13,000 people and a focus on residential housing. It features efficient energy solutions, high performance green buildings, and easy transit access.

The development includes the The Southeast False Creek Neighborhood Energy Utility which uses waste thermal energy captured from sewage to provide space heating and hot water to new buildings in Southeast False Creek.

This recycled energy eliminates more than 60 per cent of the greenhouse gas pollution associated with heating buildings. The utility is self-funded: it provides a return on investment to Vancouver taxpayers and affordable rates to customers.

(City of Vancouver 2016)

HOW CALIFORNIA SAVED \$74 BILLION OVER FOUR DECADES

California is a leader in efforts to improve the energy efficiency of buildings, with the California Energy Commission implementing advanced building codes and appliance standards, incentive programs, training and public awareness. The Energy Commission estimates that its energy efficiency building and appliance standards, which are updated every three years, have saved Californians more than \$74 billion in reduced electricity bills since 1977. Savings accumulate as newer, more efficient models replace older equipment and appliances and as new construction replaces older buildings.

Existing buildings are targeted through the 2015 Existing Buildings Energy Efficiency Action Plan. The plan includes strategies to improve energy codes for existing buildings, a benchmarking and disclosure program for large commercial buildings, and increasing financing options through access to reliable information and qualified service providers. California's approach recognises the pivotal role all play—building occupants and owners, architects, contractors, local building officials, equipment manufacturers and suppliers, and financing entities. For example, a principal strategy of the plan is to make information on efficiency project costs and savings readily available so that the value of efficiency upgrade projects is apparent.

(CEC 2016)

THE VICKER RIDGE: LUXURY LIVING THAT DOESN'T COST THE EARTH

Queensland homeowner Robert McVicker has built a contemporary family home in Logan Village with all the mod cons: big swimming pool with waterslide, multiple fridges, electric heated floor, home theatre, a clothes dryer for regular use—and even outdoor air conditioning!

But 'The Vicker Ridge' is more than an example of luxury living. It is also a remarkable example of meaningful sustainability, as the building produces more energy and water than it consumes.

Over the past two years (May 2014 to April 2016), The Vicker Ridge exported 112 per cent of the electrical energy imported by the building.

Over the past three years (May 2013 to April 2016), The Vicker Ridge treated all wastewater onsite and harvested 109 per cent of the building's water needs. It even still managed to harvest 108 per cent of its water needs in the 2014 calendar year, despite being one of the driest years on record in Queensland.

The home uses solar power production, smart building construction, design and energy efficiency devices to maintain energy efficiency. The home harvests rainwater and all wastewater is treated onsite without chemicals and reused, eliminating the need for external offsite facilities that use electricity to provide water supply and wastewater treatment.

The McVickers have no electricity bills, no municipal water service fees and no municipal sewerage fees.

The Vicker Ridge has won multiple awards, including the Built Environment Award at the prestigious 2015 Premier's Sustainability Awards.

WHAT DO YOU THINK?

11. What steps should Queensland take to improve energy efficiency in the built environment sector?
12. What are the main challenges to achieving successful, sustainable communities in Queensland? What types of innovations might address these challenges?



STOCKHOLM SHOWCASES ELECTRIC HYBRID BUSES

More and more cities around the world are using electrified bus traffic as a cost-efficient way of reducing the twin problems of poor air quality and carbon emissions.

Stockholm has recently deployed a number of fuel-efficient, and practically emission-free, electric hybrid buses to their public transport network. At least one entire route through the Swedish capital's centre is served entirely by electric hybrid buses.

The electric hybrid buses from Volvo operate quietly and free of emissions on renewable electricity for much of their journey, with the batteries quick-charged for only six minutes at the end of a route. As a complement, the buses also have a small diesel engine that is driven on biodiesel.

Compared with conventional buses, the electric hybrids provide considerable environmental gains. The total energy consumption on a city bus route of 10 kilometres is 60 per cent lower than a Euro 6 standard diesel bus, and carbon emissions are reduced by 90 per cent since the buses use a combination of renewable energy and biodiesel. The electric hybrid bus roll-out in Stockholm is a demonstration project by Volvo Buses, Stockholm Public Transport and Vattenfall; it is part-financed through the Zero Emission Urban Bus System project.

Electric hybrid buses have also been used in commercial service in Hamburg, Germany, since December 2014.

Closer to home, the Noosa Shire Council plans to commence a trial of electric buses in 2016.

PLUGGING INTO ELECTRIC VEHICLES

Electric vehicles (EVs) offer both a low emission transport solution and a zero-emission option when recharged from renewable energy only. Even when recharged from the existing grid, EVs are more carbon friendly than the average Queensland car³:

Average Queensland car	Battery only EV (Queensland grid)	Plug-in hybrid EV SUV	Battery only EV (renewable energy)
270gCO ₂ /km	160gCO ₂ /km	125gCO ₂ /km	0gCO ₂ /km

Switching even 2 per cent of Queensland's car fleet (with all EVs used being recharged from renewable energy) could generate significant savings—potentially avoiding up to 675,000tCO₂ for a single year compared with an average Queensland car.

EVs offer other benefits by: reducing urban air pollution; optimising electricity infrastructure; soaking up excess electricity generated by renewables or existing generators; and providing potential for household savings on energy spending on electricity and fuel.

The Queensland Government fleet has previously evaluated EVs, and is currently evaluating the Mitsubishi Outlander Plug-in Hybrid Electric Vehicle (PHEV). Greater use of these vehicles will assist the government to not only save money on fuel costs but also reduce its carbon footprint.

Queensland is also home to internationally recognised EV innovations. Tritium is a Brisbane based company exporting its EV fast-recharging and other EV technology around the world. Another example of home grown innovation is Ashburner Francis, an engineering consultancy located in East Brisbane, which has developed an integrated transport and energy solution by pairing a Mitsubishi Outlander PHEV with a 20kW Canadian Solar PV system. This integrated solution was financed via a 'clean-tech' funder over a seven-year period at \$0 up-front cost. After a year of operation, the firm saved more than 30 per cent in both electricity and fleet operating costs compared with a conventional hybrid sedan. Ashburner Francis is now investigating the feasibility of adding battery storage in order to take advantage of the solar energy they generate during weekends.

³ Assumptions: average kilometres travelled: 12,762 km; battery EV: 170w/km; PHEV: 134w/km; emissions intensity of Queensland electricity: 0.93kgCO₂-e/kWh; total car emissions in Queensland: 9,095,370tCO₂-e; average emissions per car: 3.542tCO₂-e

Transport

The transport sector is projected to experience one of the largest proportional growths in emissions for Queensland to 2030. This includes the emissions generated from cars, trains, trucks, buses, airplanes and boats.

While managing emissions in this sector is a particular challenge for a large and decentralised state like Queensland where long distance travel is common and often unavoidable, transport emission-busting technologies exist and are commercially available.

As existing towns and cities undergo maintenance and development opportunities, it makes sense to consider ways to reduce greenhouse emissions while improving the liveability of our communities and affordability of transport options.

Behavioural change is important too. For example, using public transport is at least twice as energy efficient as using a private vehicle travel.

Greater usage of the public transport system in Queensland would lead to fewer vehicles overall on Queensland roads, leading to reduced emissions from transport and will also reduce congestion.

Transition in the transport sector promises significant benefits beyond carbon pollution reduction—like cleaner air with less particulate pollution (a form of pollution associated with public health risks including increases in mortality and respiratory and cardiovascular morbidity [CAR 2015]).

The possibility for light rail, infrastructure for electric vehicles in city hubs, an extensive network of bikeways, and an increased usage of the public transport system could be a part of a new-look Queensland. The investment in such activities could be achieved through alternative funding methods such as value-sharing mechanisms.



WHAT DO YOU THINK?

13. What would an efficient, affordable, low emission transport system look like in 10 or 20 years?
14. What are the major barriers in shifting to lower carbon transport options in Queensland?
15. What strategies would you like to see put in place to encourage greater uptake of low emission transport options?
16. What strategies would be effective in encouraging greater patronage on public transport and fewer private vehicles on the road?
17. What could the Queensland Government do to support greater uptake of EVs?
18. How could the Queensland Government maximise the carbon reduction potential of EVs?



Waste

The waste sector contributes 3.4 per cent of Queensland's greenhouse gas emissions. This is largely from the release of methane which is produced when organic matter breaks down. Ever-advancing technology has demonstrated that waste processes provide the opportunity to create new jobs, deliver financial savings for industry and reduce pollution.

Industrial ecology and its focus on closed-loop systems that reduce waste of any sort—water, electricity and biological products—from flowing into the environment has a direct effect on greenhouse gas emissions.

Reducing the amount of materials discarded into landfill further reduces the amount of energy (and other resources such as water) used to replace materials we have discarded.

FINDING RENEWABLE ENERGY OUT OF WASTEWATER

Teys Australia is the second largest red meat processor and exporter in Australia, employing about 4,500 people, mainly in regional Australian communities. In a smart move towards producing and using more renewable energy onsite, Teys Australia has built state-of-the-art waste water treatment systems at its Beenleigh and Rockhampton facilities that greatly reduce reliance on fossil fuels and limited natural resources.

These systems reduce greenhouse gas emissions and capture biogas, a by-product of the anaerobic treatment of waste water, from large volume lagoons covered with an HDPE vinyl 'roof'.

The waste water treatment plants have been successful in using this Covered Anaerobic Lagoon (CAL) technology to capture the methane-rich biogas previously emitted to the atmosphere as a waste. All liquid waste from the facility is passed through the CALs. Biogas is used onsite as a substitute for natural gas and coal in boilers, with the potential to also be used for electricity generation onsite in the future.

Modelling indicates Teys Australia's \$31 million investment in the two Queensland projects reduces the towns' combined annual carbon dioxide emissions by 72,000 tonnes. This is equivalent to taking 24,000 cars off Queensland roads every year. Additionally it will deliver a combined reduction in natural gas and coal of 161,540 gigajoules (GJ).



GIVING NEW LIFE TO WASTE OIL

The \$65 million Northern Oil Refinery at Yarwun, near Gladstone, opened in March 2014 as the first facility in Queensland to recycle waste lubricating oil back into base lubricating oil for reuse. The joint venture between Southern Oil Refinery and J.J. Richards and Sons produces no waste and recycles waste oils that may otherwise have been burnt or landfilled.

The advanced plant is capable of processing 100 million litres of waste oil a year, meaning all of Queensland's annual waste lubricating oil production can be reprocessed in Gladstone. By keeping oil in productive use, the facility lowers carbon emissions, delivers improved oil security and supports a new industry and local jobs. These environmental and economic credentials earned the plant the Innovation in Sustainable Technologies Award at the 2015 Queensland Premier's Sustainability Awards.

In March 2016, the Queensland Government announced that a \$16 million advanced biofuels pilot plant will be built at the Yarwun plant. If successful, the Northern Oil Advanced Biofuels Pilot Plant will be expanded to a large commercial-scale refinery costing \$150 million and producing 200 million litres of advanced biofuel annually. This will be suitable for military, marine and aviation use.

Switching to biofuels instead of petrol, diesel or gas is an effective way to reduce emissions in the transportation sector, especially for vehicles where electrification is not yet an option.

Re-refining waste oil instead of burning it also keeps CO₂e emissions out of the atmosphere: Between March 2014 (when the refinery opened) and Christmas 2015, the Northern Oil Refinery reduced Australian CO₂-e emissions by more than 360,000 tonnes—the equivalent of taking almost 70,000 cars off the road.

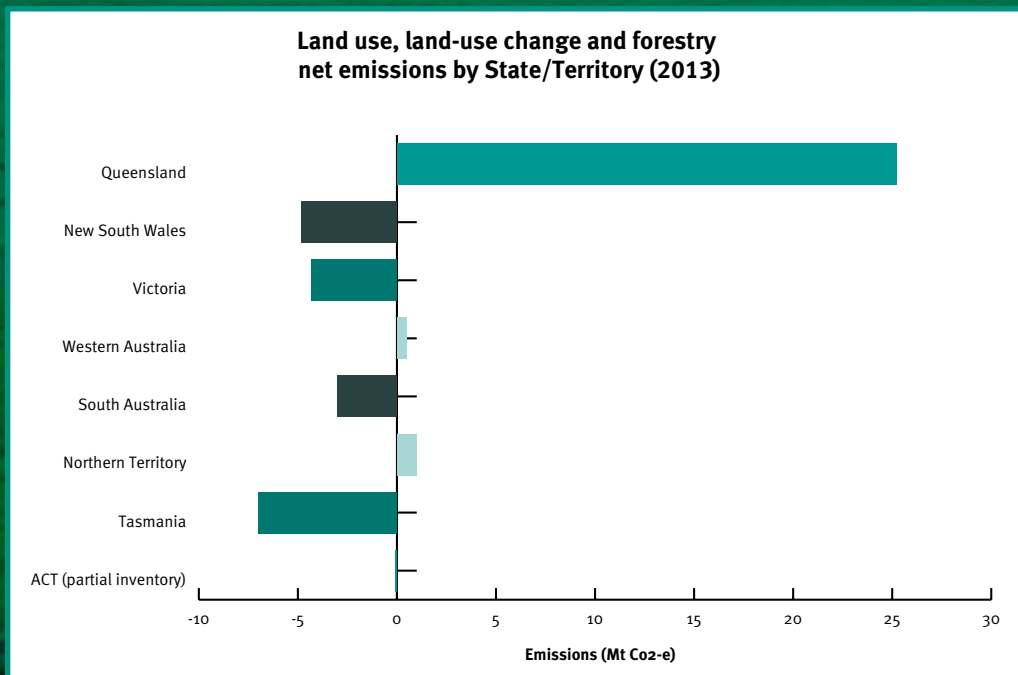
If all of Australia's collected waste oil was re-refined instead of burned, greenhouse gas emissions would be reduced by about 1 million tonnes per year.



WHAT DO YOU THINK?

19. What do you think the key waste priorities are in Queensland?

FIGURE 4



Land sector

Land use, land use change and forestry sector, including agricultural land use, plays an important role in storing carbon.

Queensland is responsible for 90 per cent of Australia's total land sector emissions. In all other jurisdictions except Western Australia and the Northern Territory, this sector acts as a 'carbon sink', meaning that activity in the sector actually removes more carbon from the atmosphere than it releases.

Reducing the amount of land-clearing in Queensland is an integral step in reducing our overall carbon emissions.

Avoiding further clearing, however, is only part of the equation: encouraging regrowth and afforestation, including of land already owned or held by the government, is equally important.

Carbon farming in some areas of Queensland shows the reality of a new industry that can provide a new source of income for land managers. The introduction of carbon offset requirements could create a new domestic or even international market that Queensland is perfectly positioned to exploit.

Reducing land-clearing and increasing afforestation comes with substantial co-benefits in addition to decreasing pollution: it helps improve biodiversity by protecting habitat for native wildlife; it helps reduce pollution runoff into waterways and the Great Barrier Reef; it also assists farmers be more resilient to the current and inevitable future impacts of climate change.

Our knowledge about the value of land and marine areas and their role in reducing climate change impacts has grown immensely. Plans to include blue carbon in national carbon accounting standards will present great opportunities and co-benefits for Queensland.

WHAT IS 'BLUE CARBON'?

'Blue carbon' refers to the storage and sequestration of carbon in the world's coastal ecosystems. Ecosystems such as mangroves, salt marshes and seagrasses store vast amounts of carbon, with much of this stored in the sediment beneath the vegetation. Queensland has extensive potential for blue carbon storage with large areas of wetlands and about half the mangrove forest area of Australia.

Scientists now understand the significance of blue carbon in combating climate change, with coastal ecosystems being capable of burying and storing carbon at rates better than terrestrial ecosystems such as tropical rainforests. Furthermore, unlike terrestrial ecosystems, which can reach soil carbon storage capacity within decades, blue carbon ecosystems can continue to deposit carbon for thousands of years. Unfortunately, coastal developments' destruction of these habitats results in the loss of this storage capacity and the release of vast amounts of stored carbon.

CARBON FARMING

Brock and Katrina run 1,200 cattle on 'Wallal' property, south of Charleville. Carbon farming has offered them the opportunity to diversify farm income in a region suffering from the impacts of fluctuating beef prices and drought. Brock and Katrina now have two contracts with the Australian Government to manage native forest regrowth on previously cleared land for the purposes of sequestering carbon. With minimal impact on grazing, the two contracts supply up to half the property's net profit, whilst saving Brock and Katrina years of work manually re-clearing regrowth.

'Wallal' is not the only property to benefit from the opportunities offered through carbon farming. More than 40 properties in Queensland's south-west region successfully secured contracts in the Australian Government's November 2015 Emissions Reduction Fund auction, injecting more than \$200 million of additional income into the region over the life of the projects. In carbon terms, this is equivalent to taking more than three million cars off the road for the entire year.

Queensland's vast land area offers significant opportunities to invest in carbon farming in the coming years—an investment that will deliver important financial, carbon reduction, biodiversity and landscape restoration benefits

Photo courtesy of the Aboriginal Carbon Fund



WHAT DO YOU THINK?

20. What are the key issues the Queensland Government should address with respect to land use and land use planning?
21. How can we provide some stability in the livelihood of our farmers, and support the potential for transition to new industries such as carbon farming?
22. What role do you think the Commonwealth, State and Territory Governments should play in securing terrestrial and marine blue carbon storage areas?



Resources

Under the international carbon pollution reduction arrangements, emissions are accounted for in the place where they are generated. This means, for example, the emissions generated from burning coal exported from Queensland are accounted for in the country where the coal is used.

However, Queensland remains accountable for the emissions generated in the process of mining and production, including emissions from the energy consumed and emissions from unintended leaks of gas and vapours that occur in the mining and production process (known as 'fugitive' emissions).

The shift to a low-carbon economy requires examination of how to reduce these emissions generated directly by the resources sector.



Photo courtesy of Australian Renewable Energy Agency

WHAT DO YOU THINK?

23. What strategies should Queensland pursue to support industry to reduce emissions generated in the process of mining and production?



RIO TINTO SWITCHES FROM DIESEL TO SOLAR IN WEIPA

Mining industry giants like Rio Tinto and BHP Billiton recognise the need for urgent action to reduce global greenhouse gas emissions and the economic reality of the global shift towards clean energy sources.

For these companies that both produce and consume energy, reducing the emissions of their own operations by increasing energy efficiency and switching from fossil-fuel intensive sources of energy are key planks in adapting to a low-carbon environment.

In September 2015, Rio Tinto switched on its commercial diesel displacement solar plant in Weipa, far northern Queensland. The 1.7MW solar PV array will generate electricity for Rio Tinto's Weipa bauxite mine, processing facilities and the township, cutting Rio Tinto's diesel use by around 600,000 litres a year.

This is the first stage of the project, which is planned to extend to 6.7MW and include battery storage in coming years.

The Australian Renewable Energy Agency, which provided \$3.5 million for the first stage of the project, hopes its success will create a precedent for industry by demonstrating the viability of solar PV for powering remote, off-grid sites such as mines (2015).

HAVE YOUR SAY:

Playing a part in the global effort to limit warming to well below 2°C is critical for the long-term viability of Queensland's economy, communities and industries.

We have work to do to make sure Queensland is on track to weather the impacts of both a changing climate and a changing global economy, and secure our fair share of the new industries and jobs that are rapidly emerging around Australia.

Your feedback and ideas on the topics raised in this discussion paper will help inform the development of our strategy for managing the transition to a low carbon future.

To respond to the 'What do you think' questions or provide any other feedback, please submit a written submission by emailing climatechange@ehp.qld.gov.au. You can also participate in the online survey at www.getinvolved.qld.gov.au.

Submissions close on 2 September 2016.

We'll be providing regular updates about the development of the climate transition strategy and other work being done by the Queensland Government to understand and adapt to the impacts of a changing climate for Queensland. You can keep up with the latest news and opportunities to be involved by liking the Department of Environment and Heritage Protection on Facebook, or signing up for email updates at www.qld.gov.au/environment/climate/climate-change





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(Footnotes)





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