

CSIRO Australian

National Outlook

Economic activity, resource use, environmental performance and living standards, 1970–2050

November 2015

Slide pack of all figures in the main report and the chart overview

NATIONAL OUTLOOK 2015

www.csiro.au



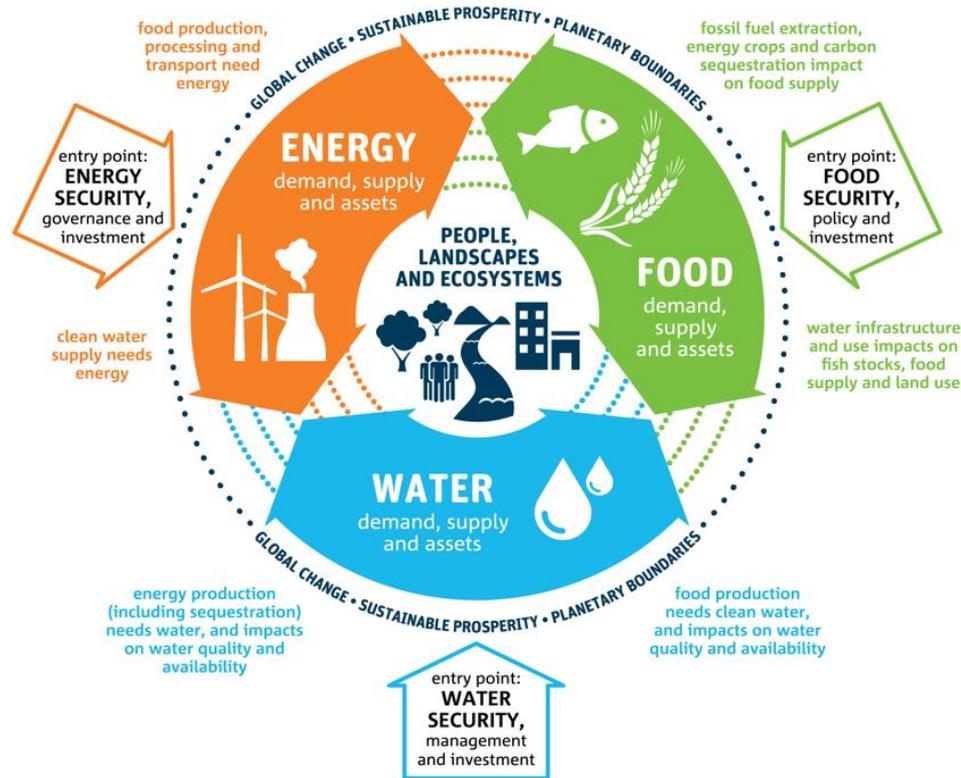
Helping to navigate Australia's future

NATIONAL OUTLOOK 2015
www.csiro.au



Exploring the “Water-Energy-Food nexus”

FIGURE 1 ELEMENTS OF THE WATER-ENERGY-FOOD NEXUS, AND KEY NEXUS LINK AGES

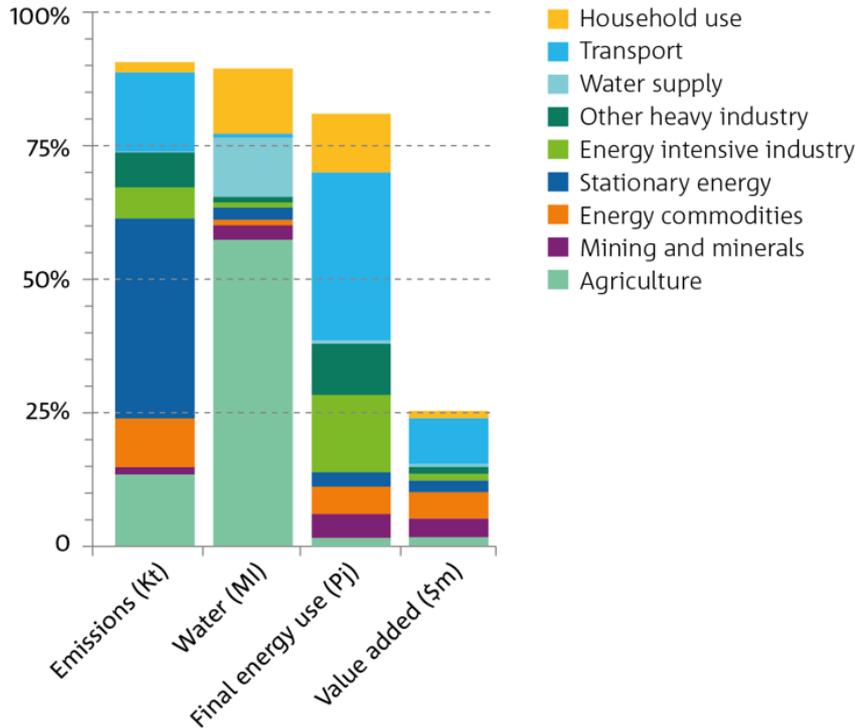


The *National Outlook* is a new initiative, which is intended to contribute to the evidence base and understanding required for Australia to navigate the complex and often intertwined challenges involved in achieving sustainable prosperity.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Purpose and scope of the *National Outlook* report

FIGURE 2 CONTRIBUTION OF MATERIAL INTENSIVE SECTORS TO AUSTRALIAN GREENHOUSE GAS EMISSIONS, WATER USE, ENERGY USE, AND VALUE ADDED, 2012

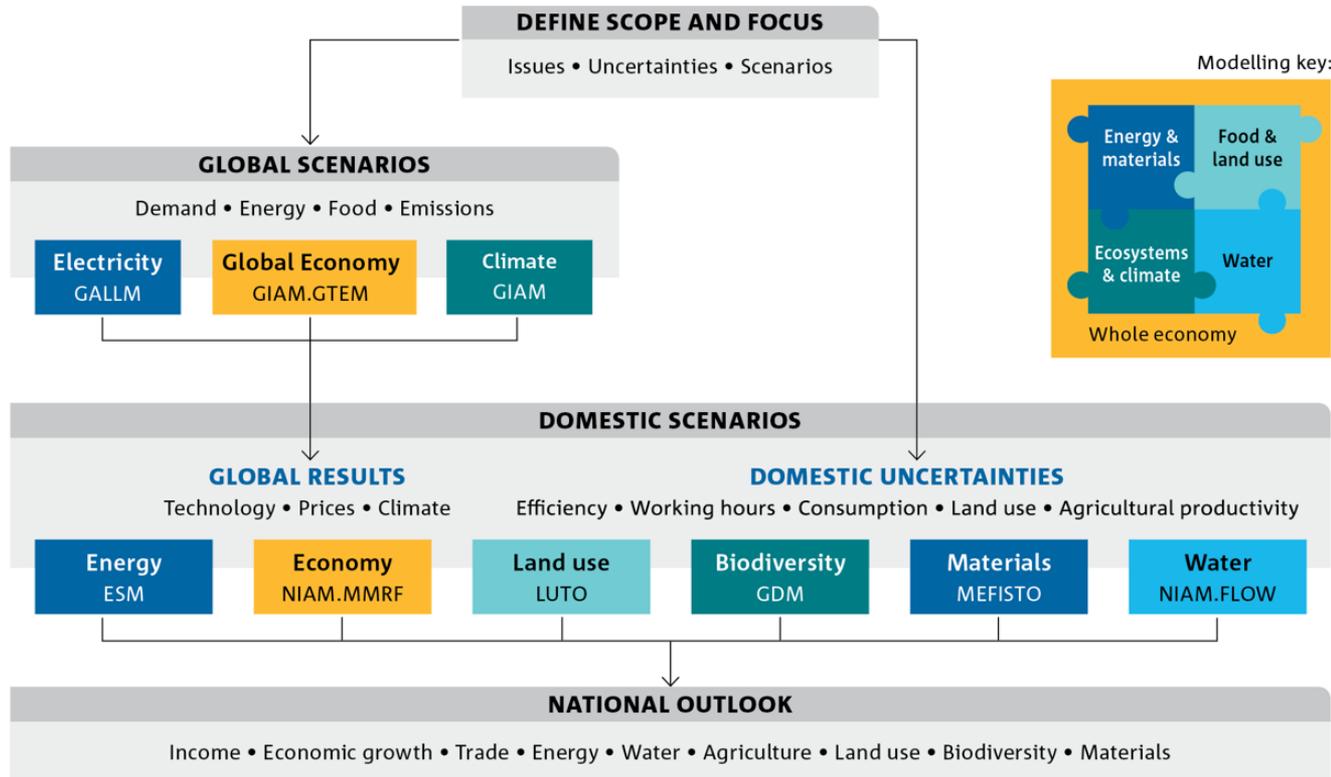


The analysis explores the prospects for Australia's materials- and energy-intensive industries, which account for one quarter of economic value and employment, and around three quarters of our use of energy, water, and materials.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Our analytical framework

FIGURE 3 OVERVIEW OF THE NATIONAL OUTLOOK ANALYTICAL FRAMEWORK, AND PROJECT FLOW

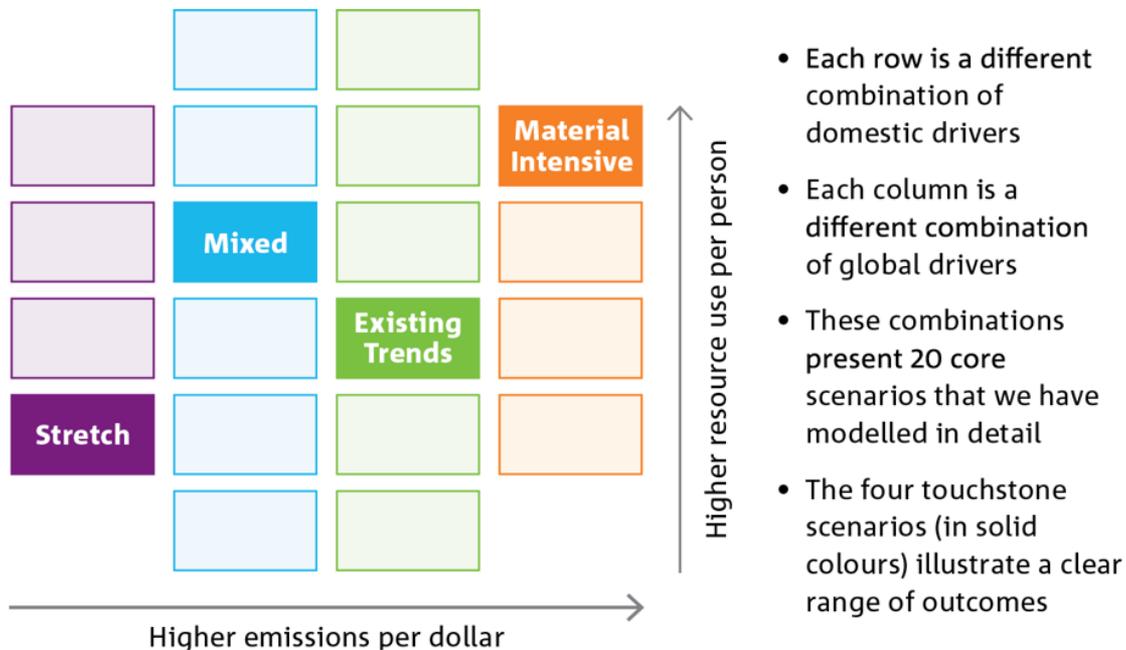


The *National Outlook* is the most integrated and evidence-based national scenario assessment of these issues yet attempted. The analysis uses nine linked models to explore global and national trends and uncertainties.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Issues and scenarios explored

FIGURE 4 OVERVIEW OF THE NATIONAL OUTLOOK SCENARIOS



The analysis for the *National Outlook* adopts a scenario based approach to explore multiple uncertainties.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

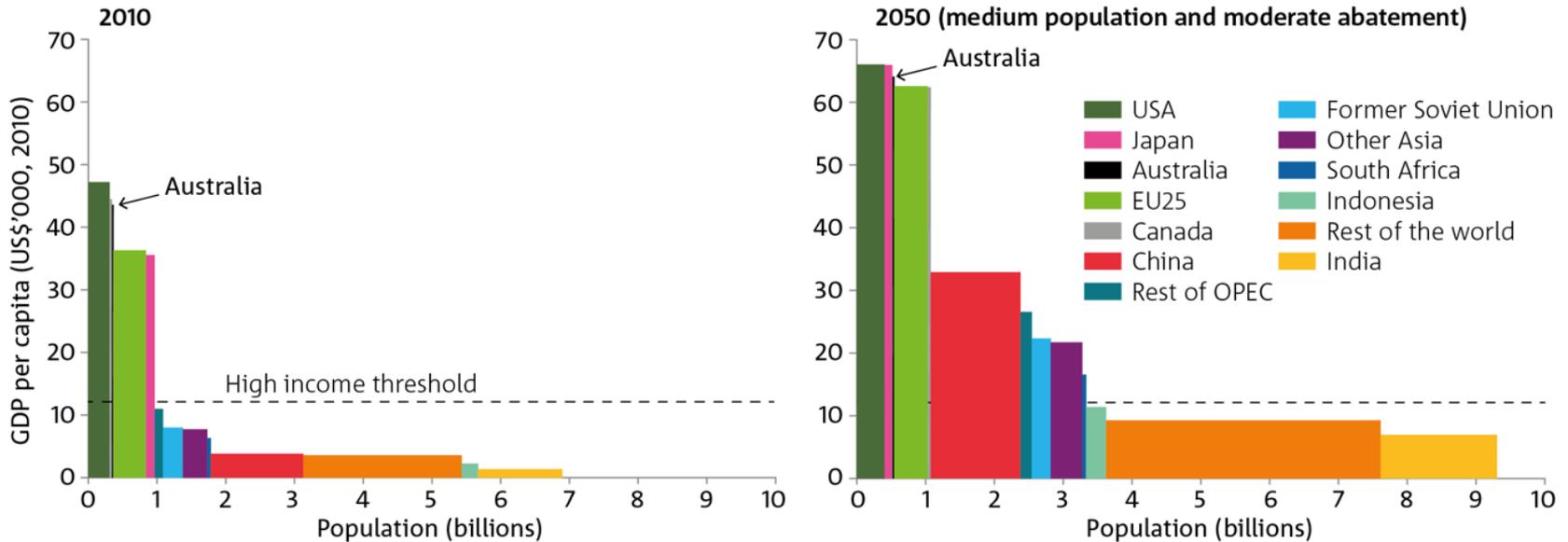
Australia's choices will shape our prosperity

NATIONAL OUTLOOK 2015
www.csiro.au



Projected global demand for our exports trebles to 2050

FIGURE 5 THREE BILLION PEOPLE LIVE IN HIGH INCOME NATIONS BY 2050, UP FROM ONE BILLION TODAY



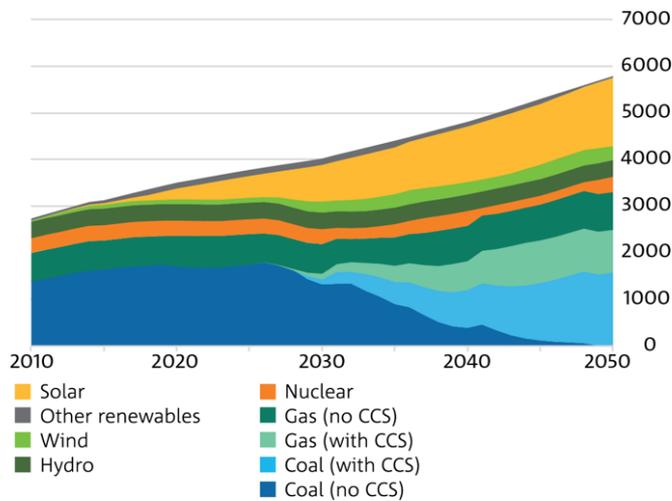
Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

By 2050 the world economy is projected to grow to be around three times larger than it is today, with average global income per person more than doubling from 2010 to 2050 across all scenarios.

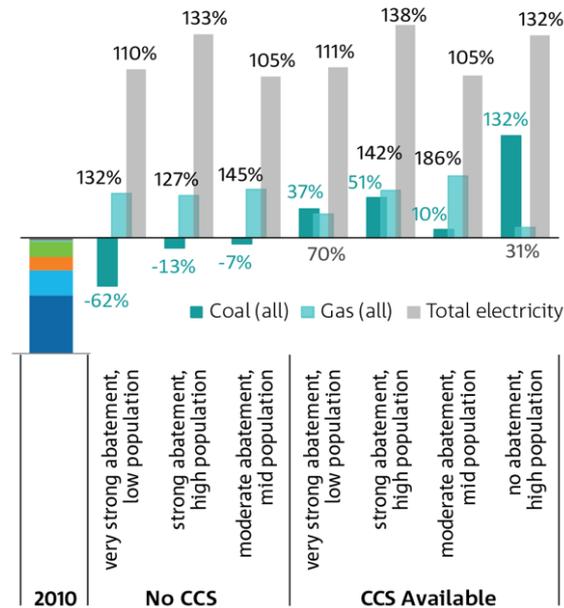
Demand for our minerals and energy-intensive exports will be strong, but prospects for specific commodities are uncertain

FIGURE 6 GLOBAL ENERGY DEMAND GROWS, BUT PROSPECTS FOR SPECIFIC ENERGY RESOURCES ARE UNCERTAIN

Global electricity generation (GWyr) by energy source
moderate abatement and medium population (M2) with CCS



Change in coal, gas, and total electricity
generation from 2010 to 2050 (GWyr)

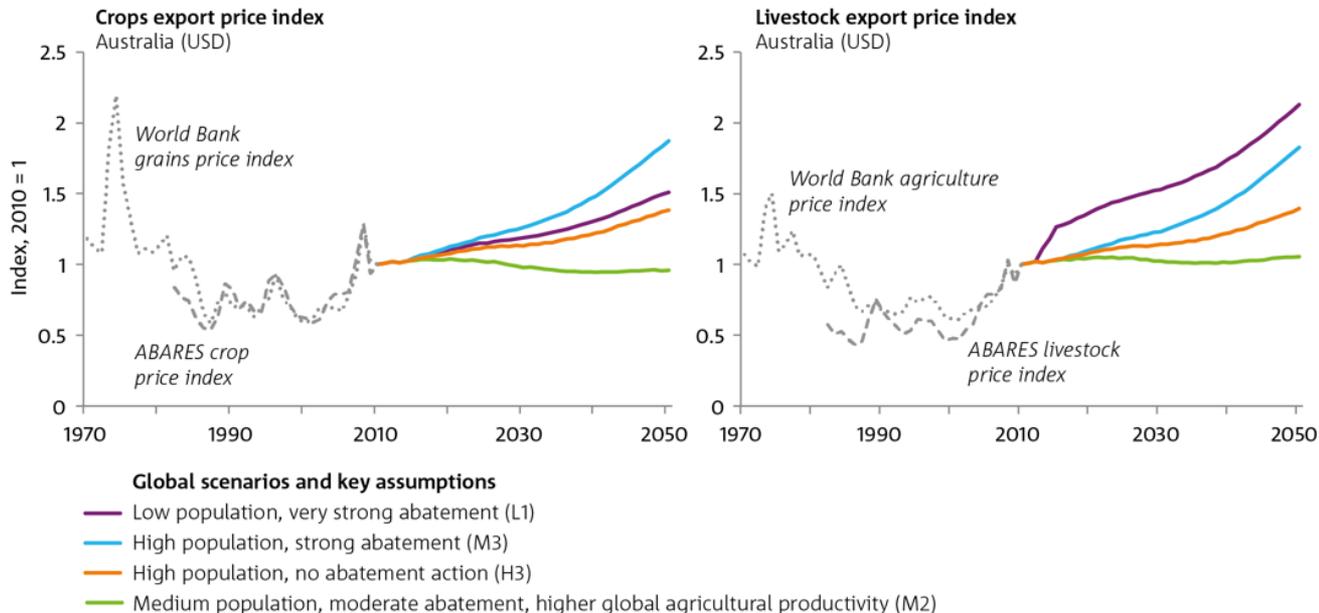


The outlook for coal and gas is uncertain. The global outlook for fossil fuel based electricity generation ranges from a small decline to a doubling from current levels, with larger differences for coal.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Agricultural prices are projected to trend upwards

FIGURE 7 GLOBAL AGRICULTURAL PRICES COULD TREND UP, REVERSING THE LONG TERM TREND

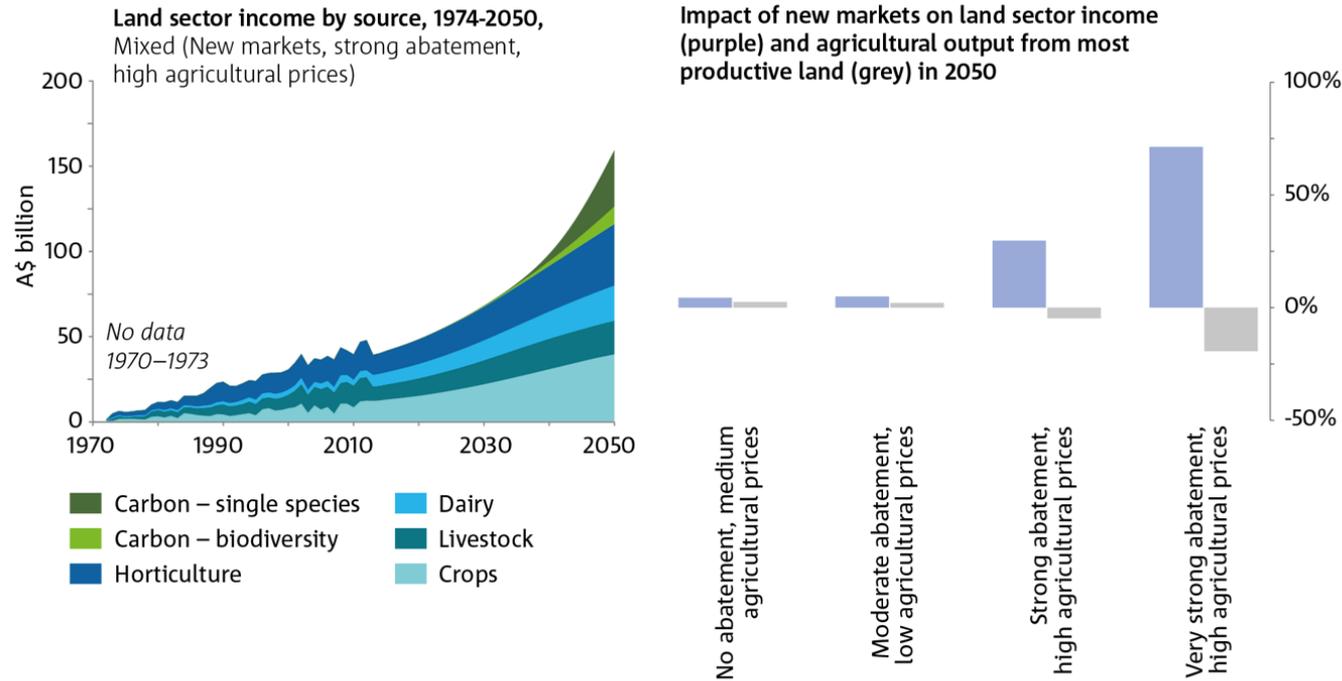


Looking ahead, an upward trend in agricultural prices is likely as global supply falls behind the growth in global demand.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

... and we can increase agricultural output

FIGURE 8 NEW MARKETS BOOST AND DIVERSIFY LAND SECTOR INCOMES, PARTICULARLY FROM OUR LESS-PRODUCTIVE LAND



Australian agricultural output volumes (and incomes) are projected to rise by at least 50% by 2050, with productivity improvements in line with long-term trends. New land markets increase land sector incomes.

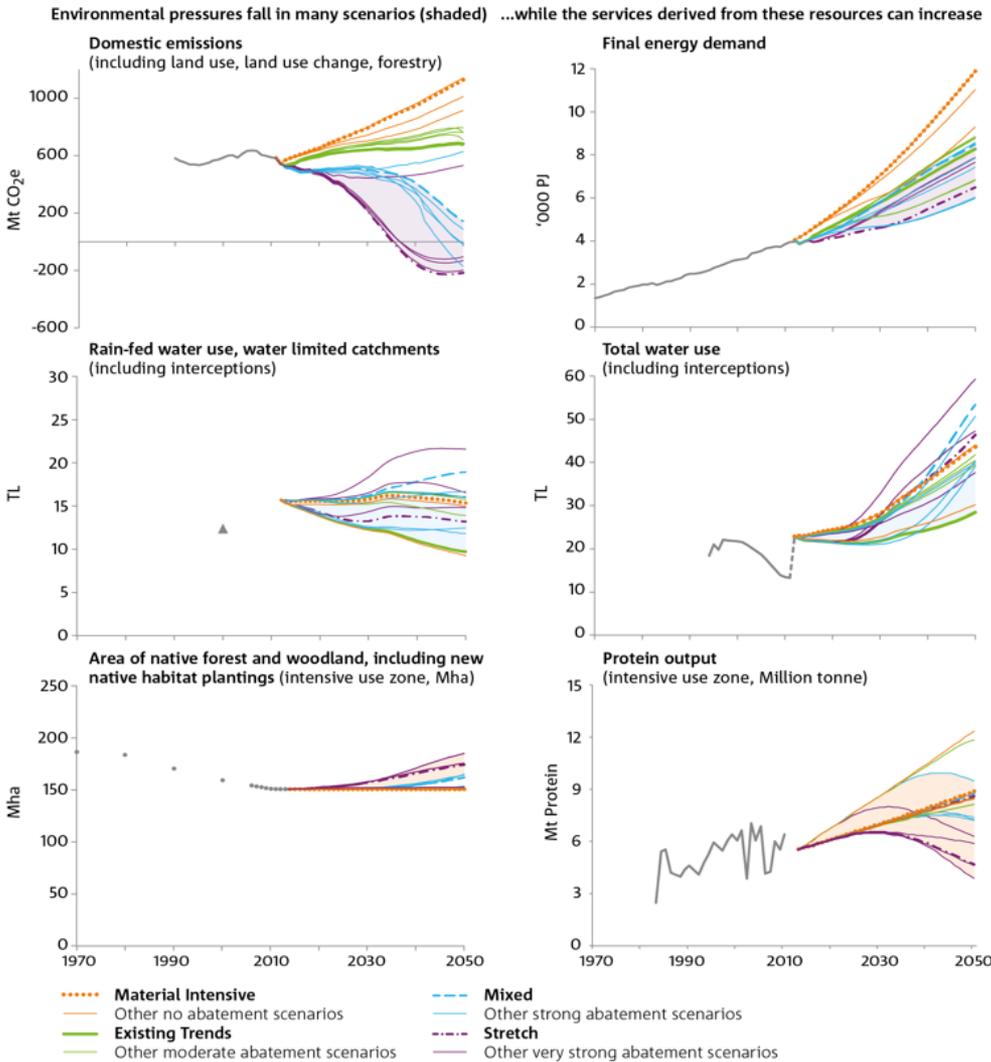
Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Sustainability and economic growth can be partners not competitors

NATIONAL OUTLOOK 2015
www.csiro.au



FIGURE 9 ENERGY, WATER AND AGRICULTURAL OUTPUT INCREASES, WHILE PRESSURES DECLINE



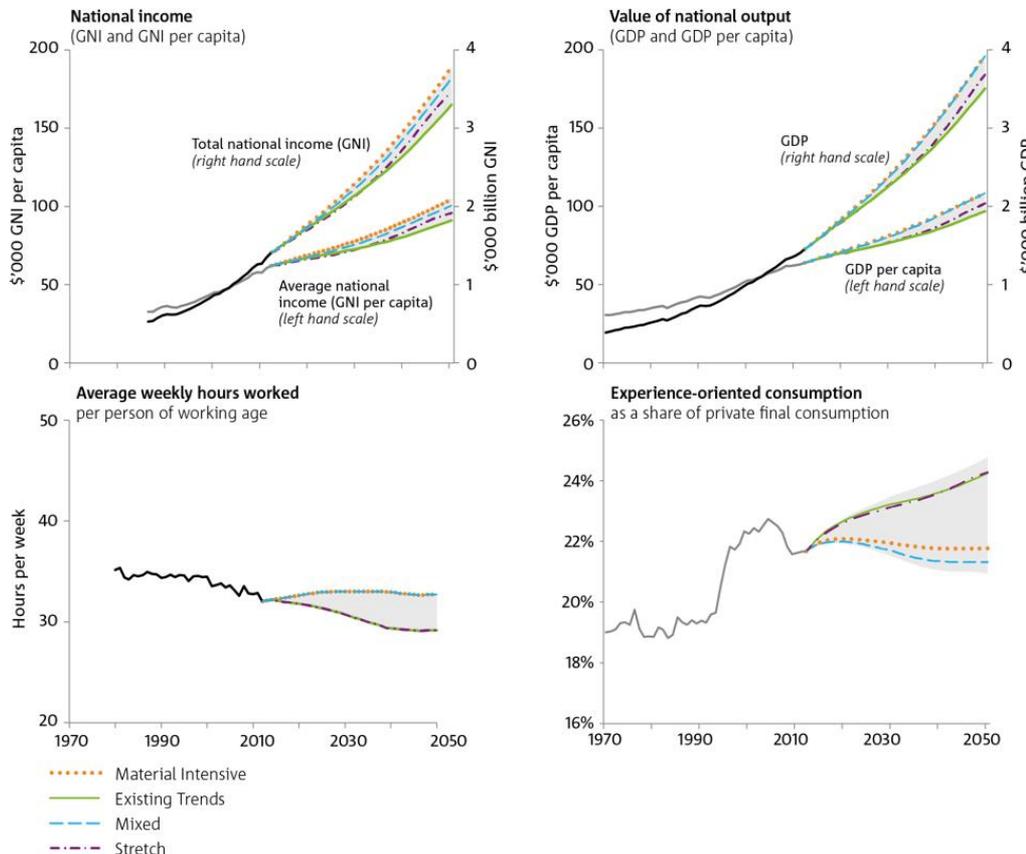
Energy, water and food

We find Australia can continue to enjoy strong trend growth in national income, while reducing pressures on natural resources and ecosystems.

Source: Hatfield-Dodds, Schandl et al. (2015) *Nature* doi:10.1038/nature16065

Australian average income projected to rise in line with historical trends

FIGURE 10 AVERAGE INCOME INCREASES BY 12 TO 15% PER DECADE OVER THE FOUR DECADES TO 2050, EVEN WITH DECLINING WORKING HOURS, AND THE VALUE OF ECONOMIC ACTIVITY INCREASES TEN-FOLD FROM 1970 TO 2050

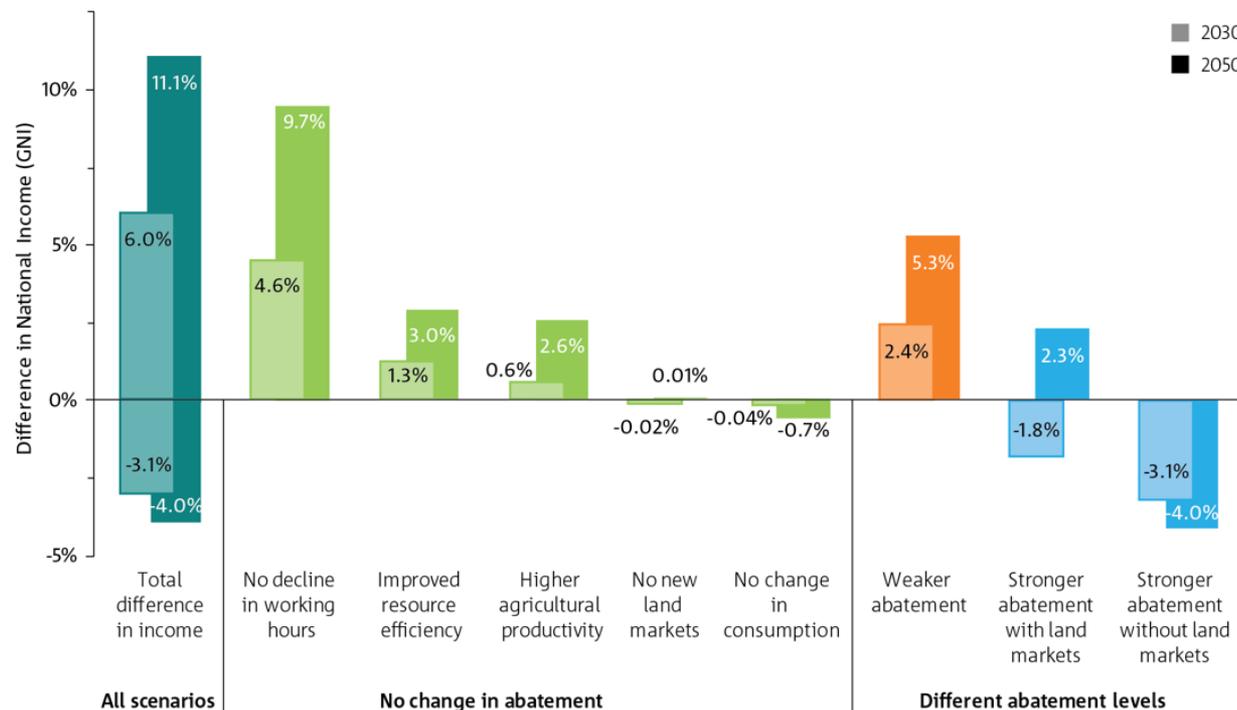


We project that the total value of Australian economic activity will increase by a factor of ten over the 80 years to 2050.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Scenario drivers help boost national income

FIGURE 11 THE IMPLICATIONS OF DIFFERENT SCENARIO DRIVERS ON NATIONAL INCOME IN 2030 AND 2050

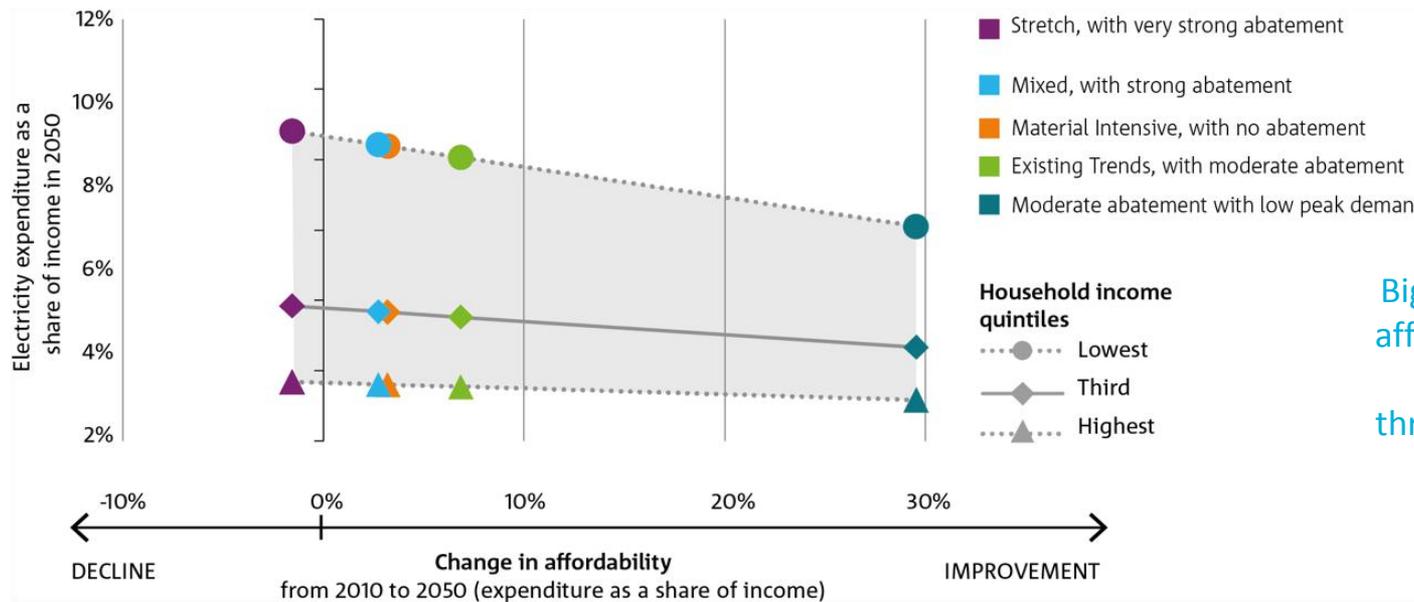


Average income per person is projected to increase by 12 to 15% above inflation per decade, with choices about working hours making up two-thirds of the differences in income.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Energy and transport affordability can be maintained or improved

FIGURE 12 ENERGY EFFICIENCY CAN MAINTAIN AFFORDABILITY OF ELECTRICITY IN THE FACE OF HIGHER PRICES – BUT THE BIGGEST GAINS COME FROM REDUCING NETWORK AND DISTRIBUTION COSTS

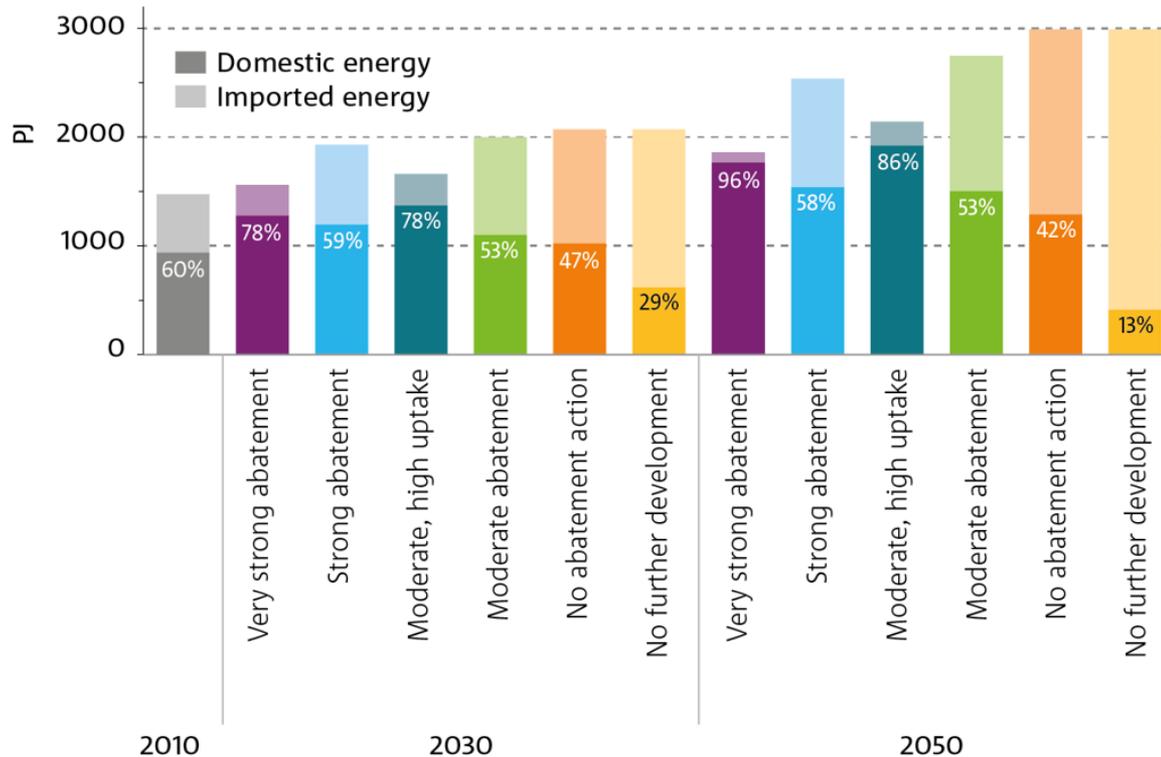


Big improvements in the affordability of electricity could be achieved through better managing peak demand, and associated network infrastructure costs.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Electric vehicles and biofuels

FIGURE 13 ELECTRIC VEHICLES AND BIOFUELS COULD REVERSE DECLINE IN TRANSPORT ENERGY SELF-SUFFICIENCY

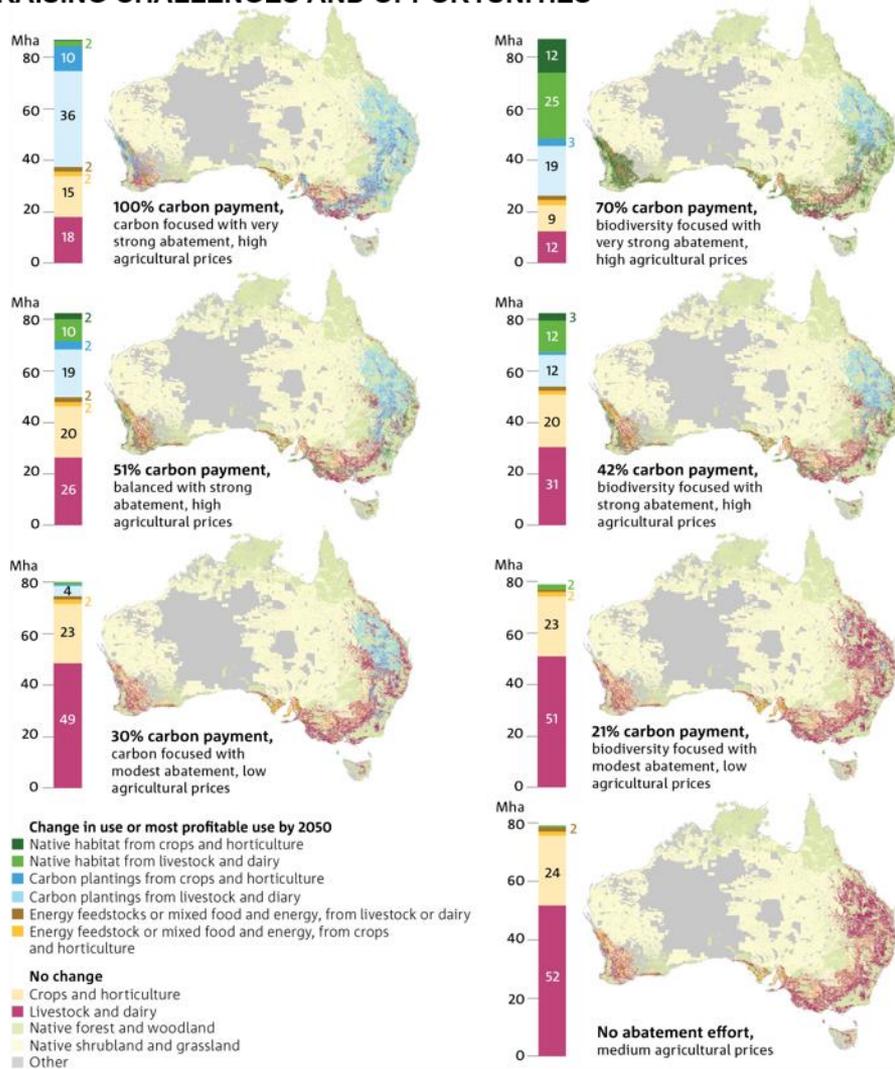


Uptake of electric vehicles and biofuels could reverse mounting transport imports, reduce costs, improve air quality, and reduce greenhouse gases.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Decisions we make as a society matter – and will shape Australia's future more than the decisions we make as businesses or individuals

FIGURE 14 PROFITABLE RURAL LAND USE COULD SHIFT DRAMATICALLY, RAISING CHALLENGES AND OPPORTUNITIES



Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

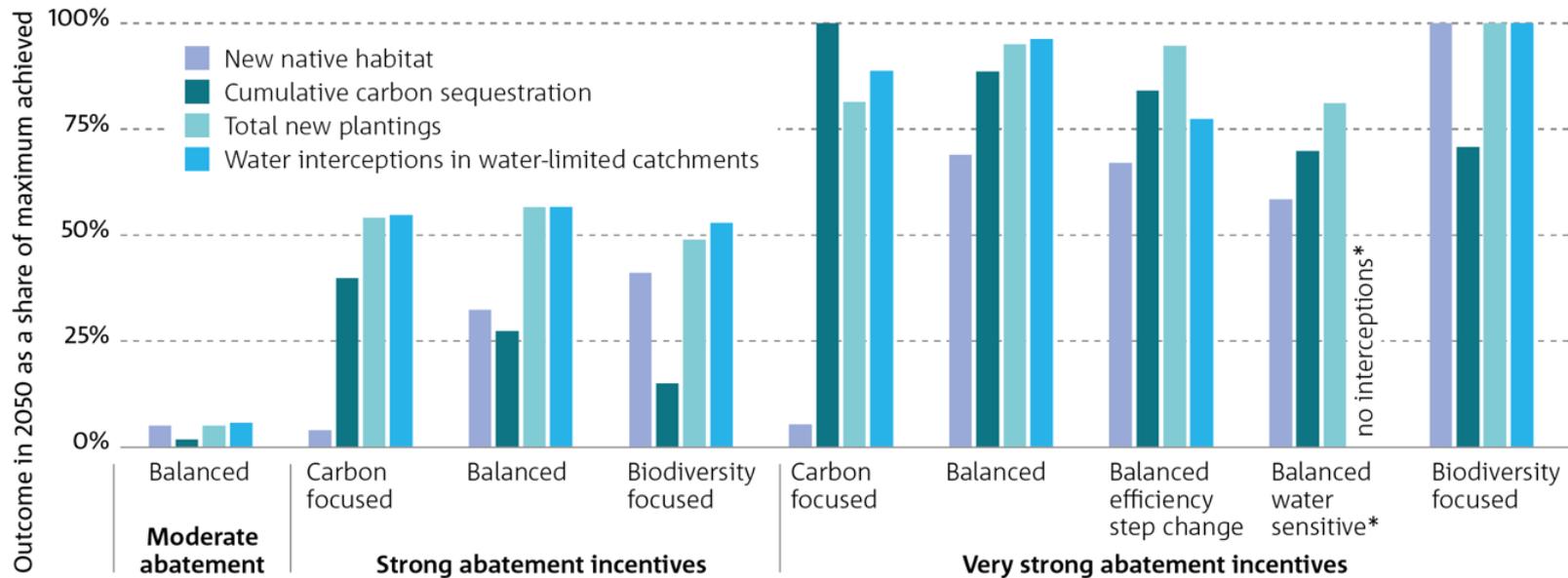
Meeting the water-energy-food nexus will produce challenges and opportunities for rural land use and communities

We can transform and enrich our economy and regional communities by meeting national and global food, fibre, energy, carbon sequestration, and conservation needs through new land sector markets, if we manage these transitions well.

Policies and institutions are central to unlocking benefits, and managing trade-offs and risks

FIGURE 15 POLICY SETTINGS AND CHOICES DRIVE DIFFERENT OUTCOMES FOR CARBON, NATIVE HABITAT, AND WATER – EVEN WITH THE SAME LEVEL OF ABATEMENT INCENTIVE

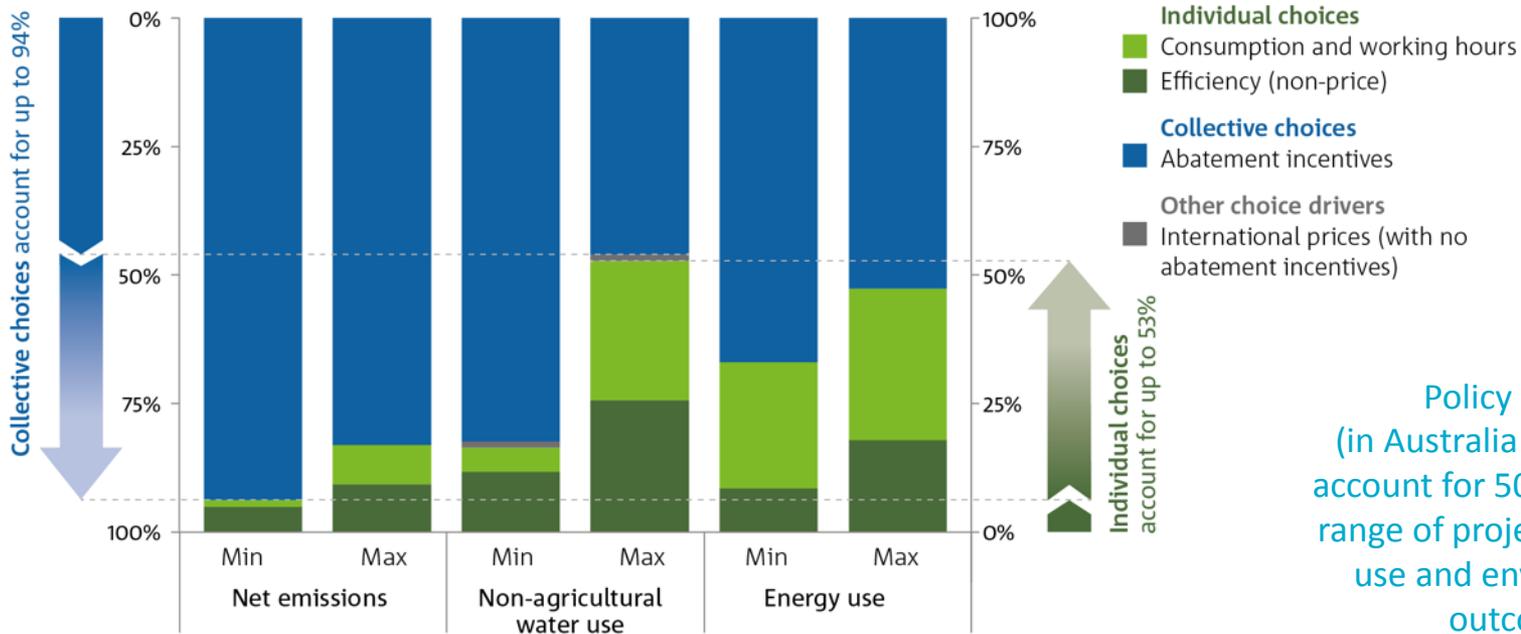
Native habitat, carbon sequestration and water interceptions from new plantings



Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Calculating the contribution of different choices

FIGURE 16 COLLECTIVE CHOICES ACCOUNT FOR THE MAJORITY OF PROJECTED DIFFERENCES IN RESOURCE USE AND ENVIRONMENTAL PRESSURES IN 2050

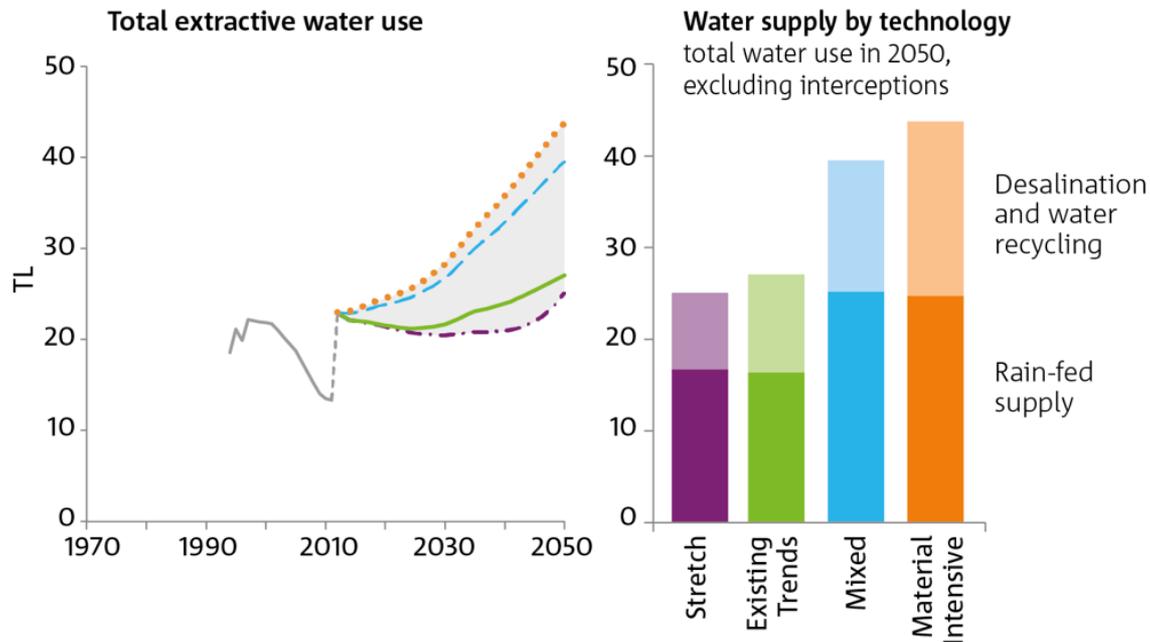


Policy choices
(in Australia and globally)
account for 50 to 90% of the
range of projected resource
use and environmental
outcomes.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Rising water demand can be met, while enhancing water security

FIGURE 17 NON-TRADITIONAL SUPPLY OPTIONS PLAY A SIGNIFICANT ROLE IN MEETING FUTURE WATER DEMAND

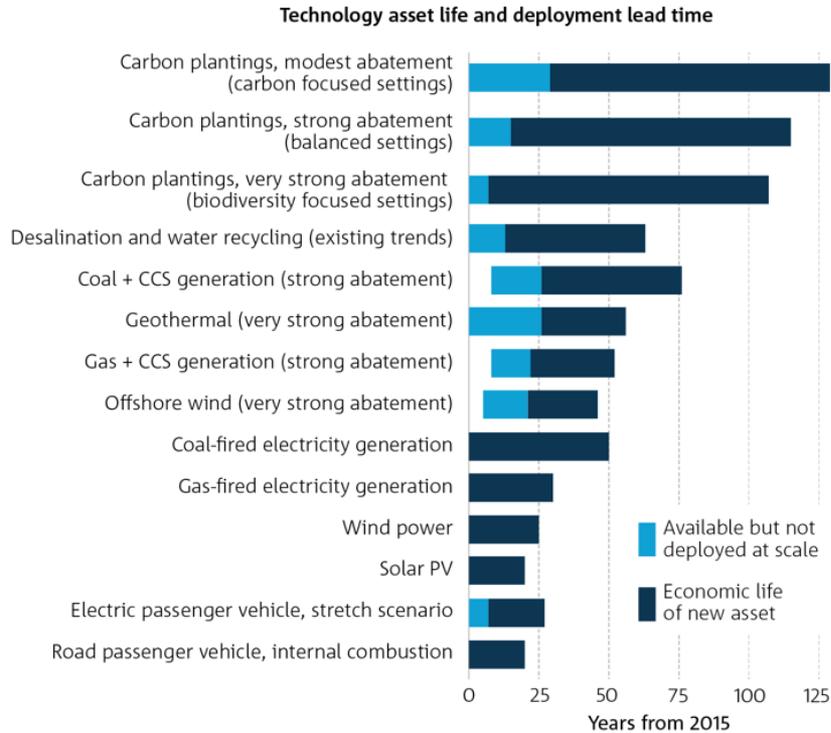


Projected increases in water demand need not lead to increased pressure on water-limited catchments.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Technology is crucial to achieving sustainable prosperity

FIGURE 18 **TRANSITION TIME FRAMES ARE SHAPED BY INVESTMENT DECISION CONTEXT AND THE LIFE CYCLE OF DIFFERENT ASSETS**

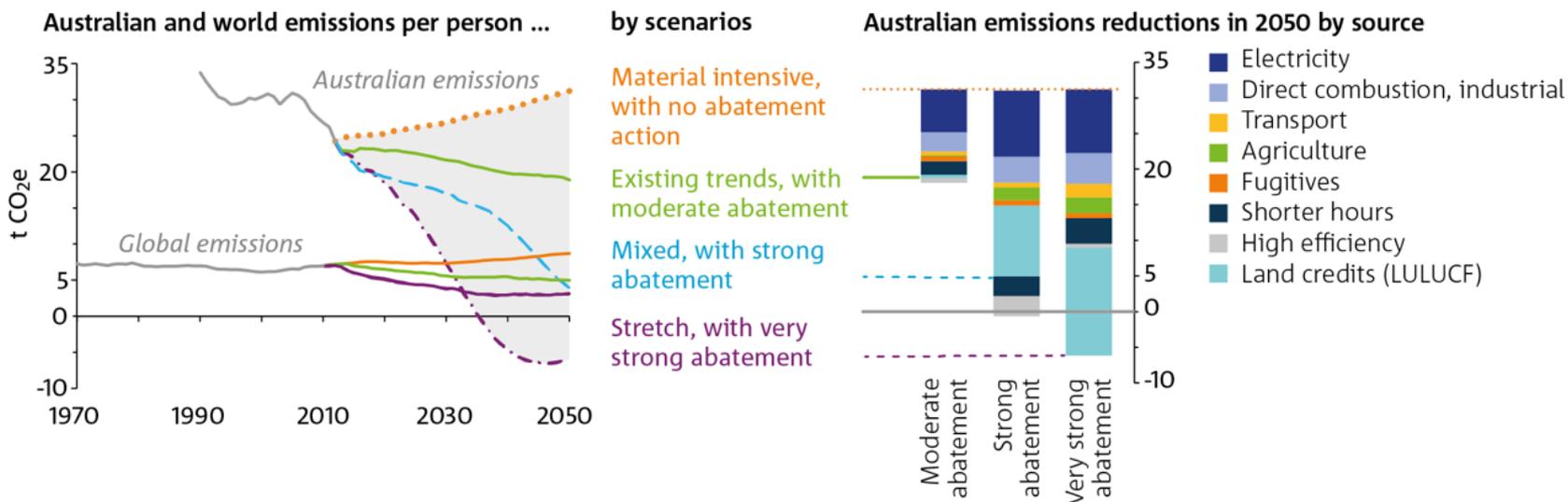


Policy settings and market factors will drive the deployment of a portfolio of technologies for energy, water, transport, agriculture and other industries, and to support continuing innovation.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

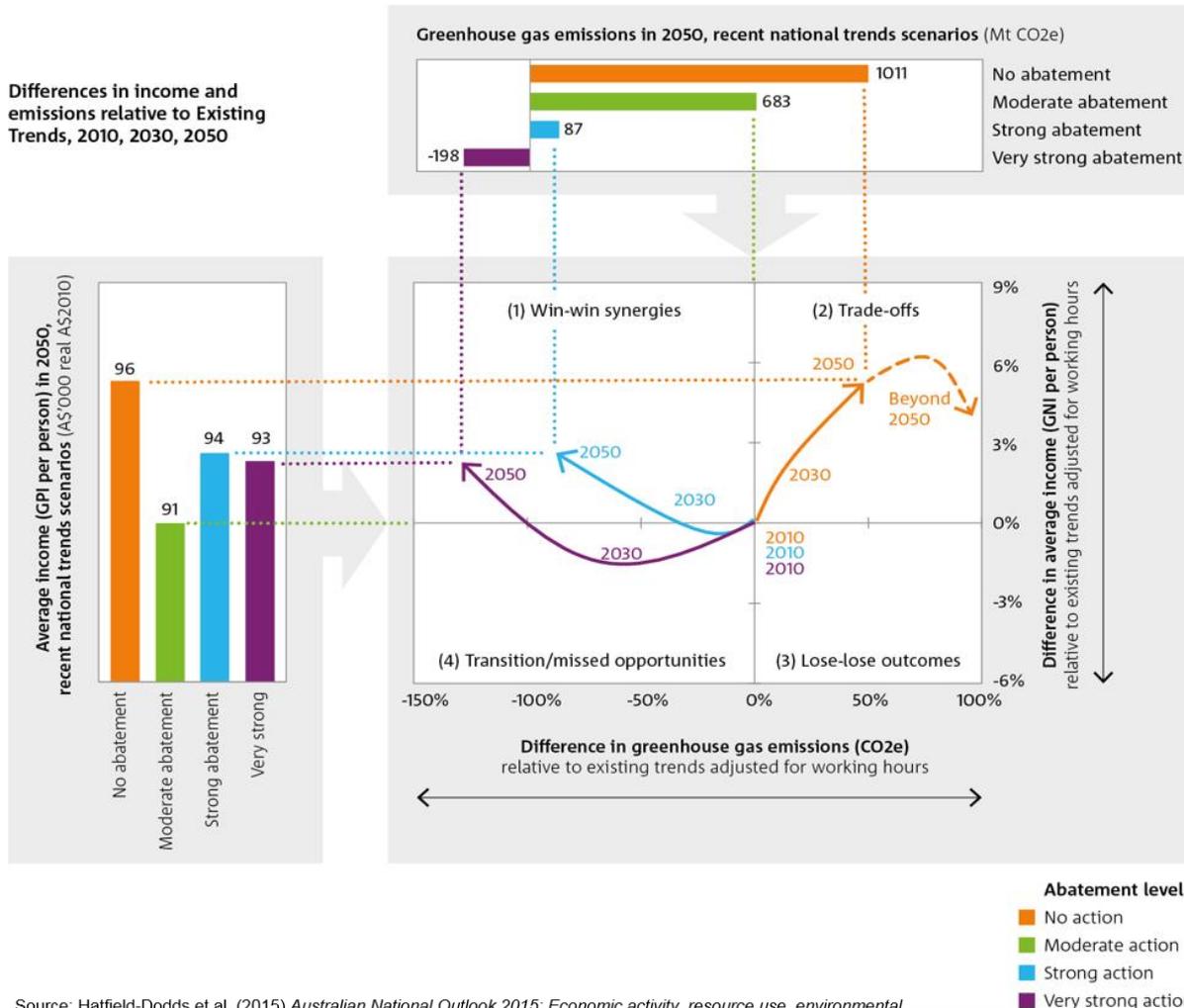
We can reduce our greenhouse gas emissions significantly through actions across all major sources, while maintaining strong economic growth

FIGURE 19 AUSTRALIAN PER CAPITA EMISSIONS CAN FALL BELOW THE GLOBAL AVERAGE, WITH CONTRIBUTIONS FROM ALL SECTORS



Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

FIGURE 20 STRONGER GLOBAL ACTION TO REDUCE GREENHOUSE GAS EMISSIONS PROVIDES WIN-WIN ECONOMIC AND ENVIRONMENTAL OUTCOMES BEFORE 2050



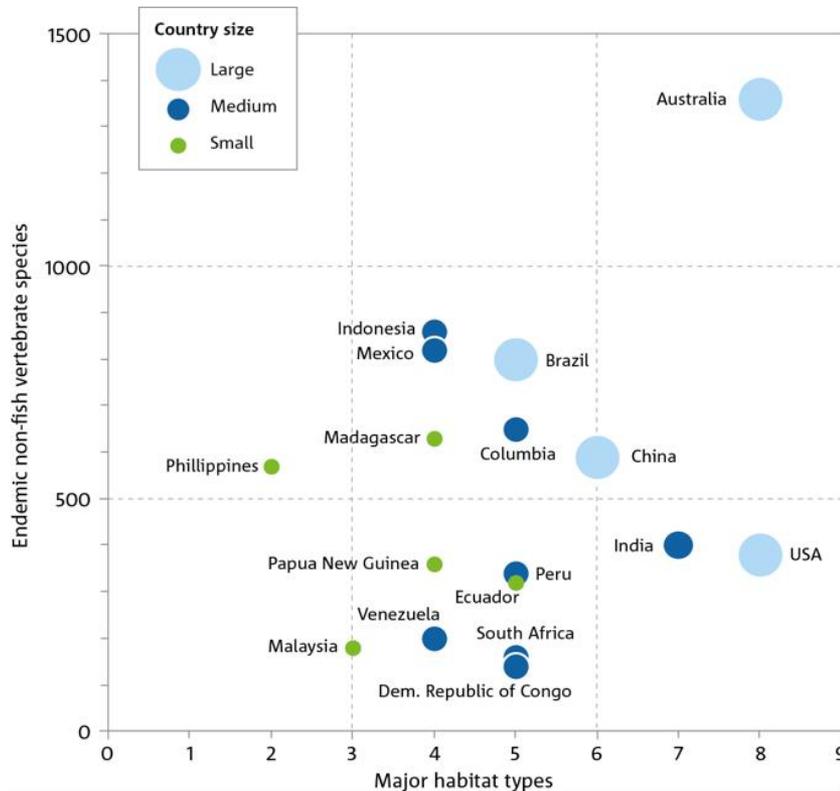
Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

We can reduce our greenhouse gas emissions significantly through actions across all major sources, while maintaining strong economic growth

Shifting from current global efforts to stronger global emissions reductions could yield economic and environmental benefits for Australia. Weaker global emissions reductions are projected to boost near term economic performance, but would risk damaging assets that underpin our long term wellbeing and economic security.

Abatement incentives can be harnessed to restore Australia's globally significant ecosystems

FIGURE 21 AUSTRALIA HAS GLOBALLY DISTINCTIVE BIODIVERSITY

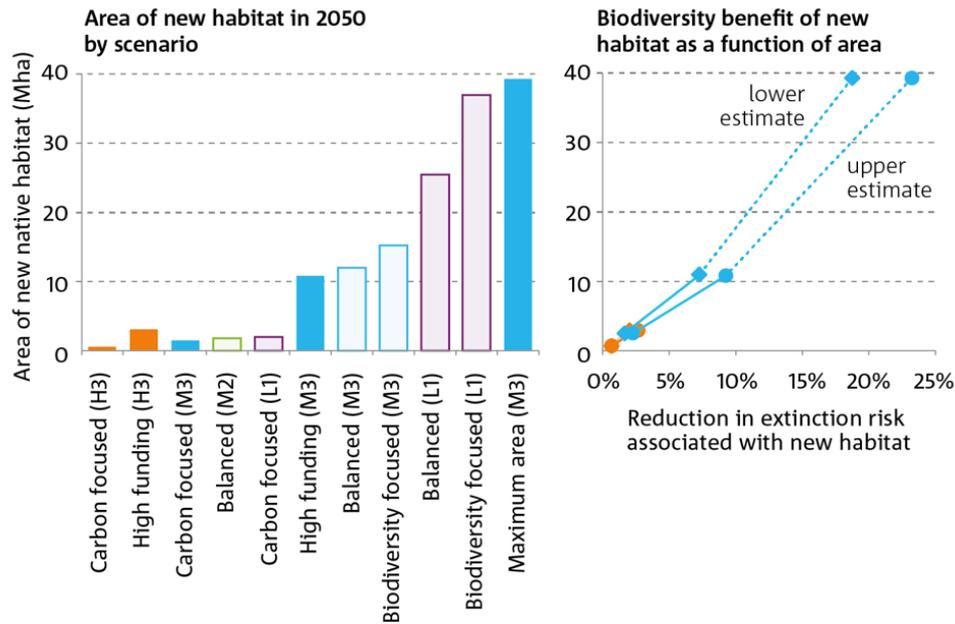


Australia's ecosystems are unique and globally significant. Providing incentives for restoring native habitat as well as carbon sequestration could significantly reduce the impacts of climate change on Australia's unique ecosystems and native species.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Carbon payments can be harnessed to protect our biodiversity

FIGURE 22 RESTORING NATIVE HABITAT COULD SIGNIFICANTLY REDUCE THE IMPACTS OF CLIMATE CHANGE



Biodiversity benefits – including reductions in extinction risk – are broadly proportional to the area of new native habitat restored.

Abatement effort and temperature in 2100

- No abatement action (H3) (6°C)
 - Strong abatement (M3) (3°C)
 - Moderate abatement (M2) (3°C)
 - Strong abatement (M3) (3°C)
 - Very strong abatement (L1) (2°C)
- Solid colour scenarios assessed for biodiversity benefit*

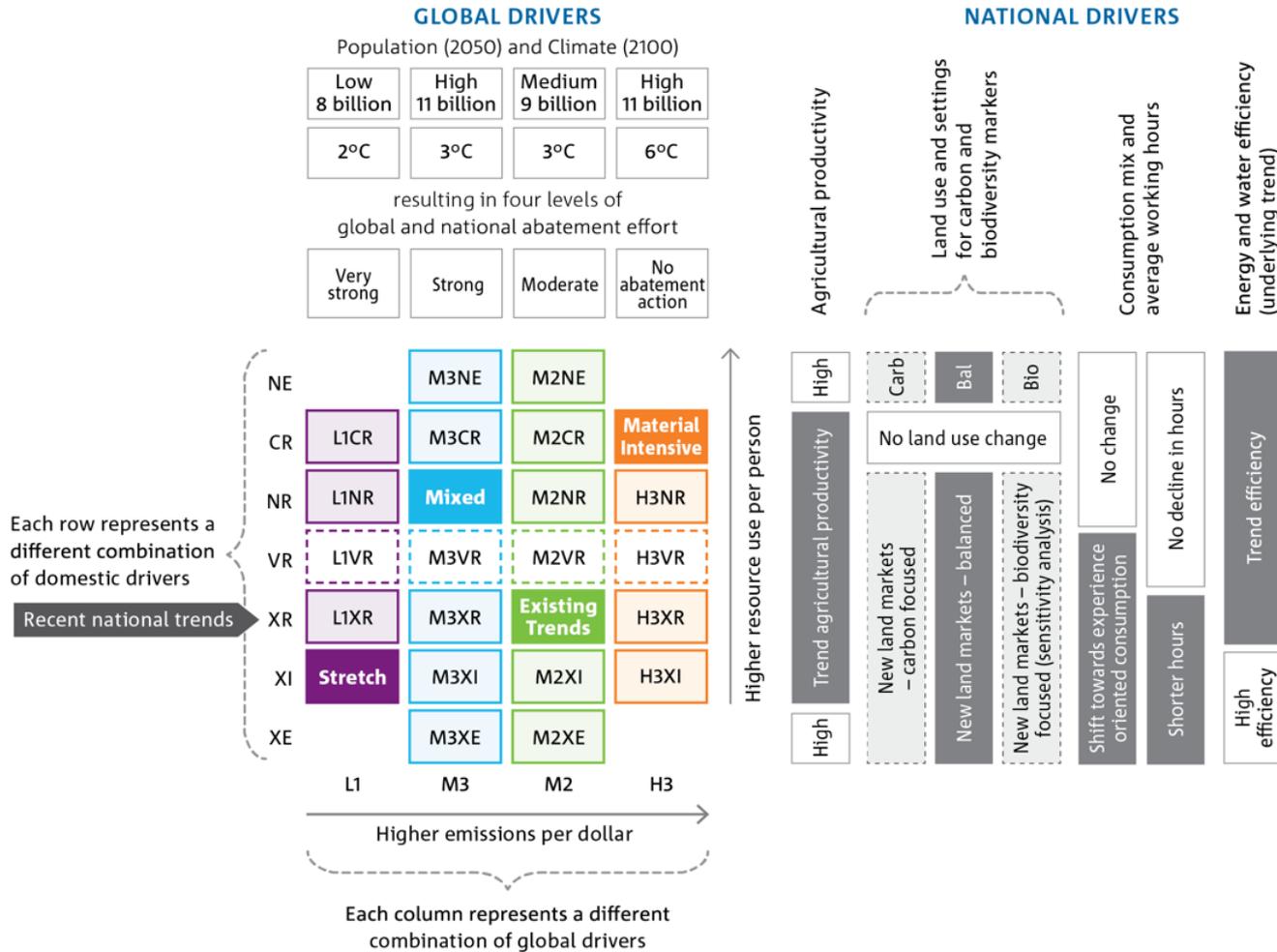
Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Appendix A: Our analytical framework

NATIONAL OUTLOOK 2015
www.csiro.au



FIGURE 23 THE SET OF NATIONAL OUTLOOK SCENARIOS, IN RELATION TO GLOBAL AND NATIONAL DRIVERS



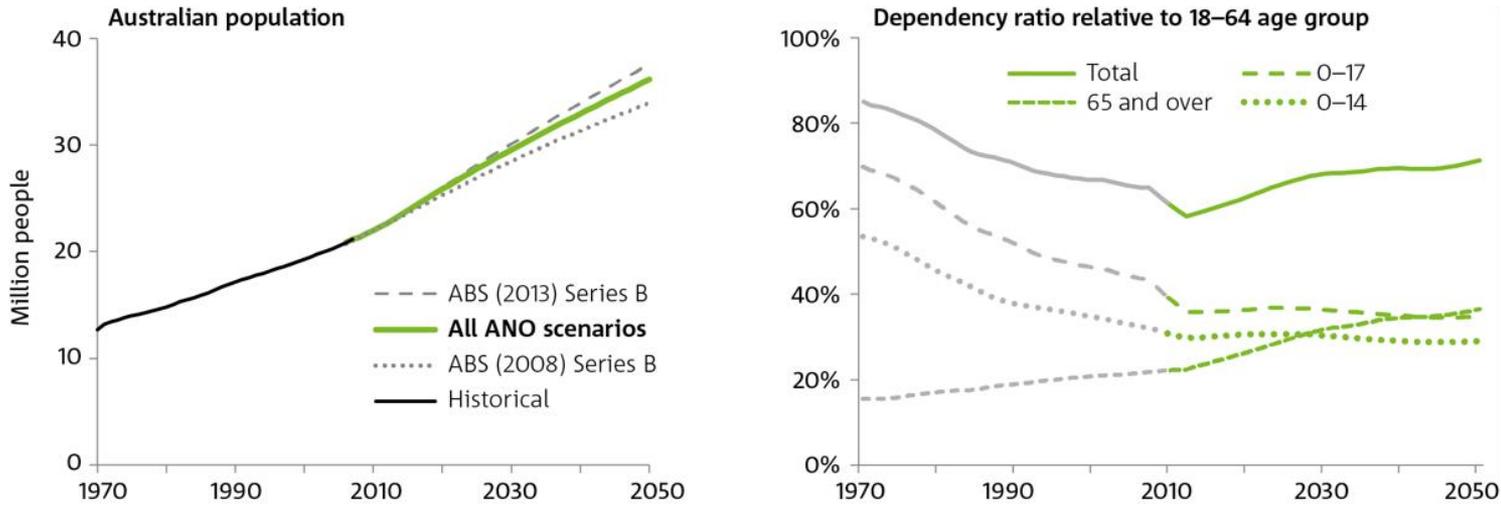
Scenario definitions and assumptions

The *National Outlook* focuses on modelling 20 core scenarios, supplemented by targeted sensitivity analysis. Though not exhaustive, this set covers a wide range of plausible socio-economic and biophysical outcomes, and allows us to assess the effects of each scenario driver.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Population assumptions

FIGURE 24 AUSTRALIAN POPULATION AND DEPENDENCY RATIOS, 1970-2050 (ALL SCENARIOS)

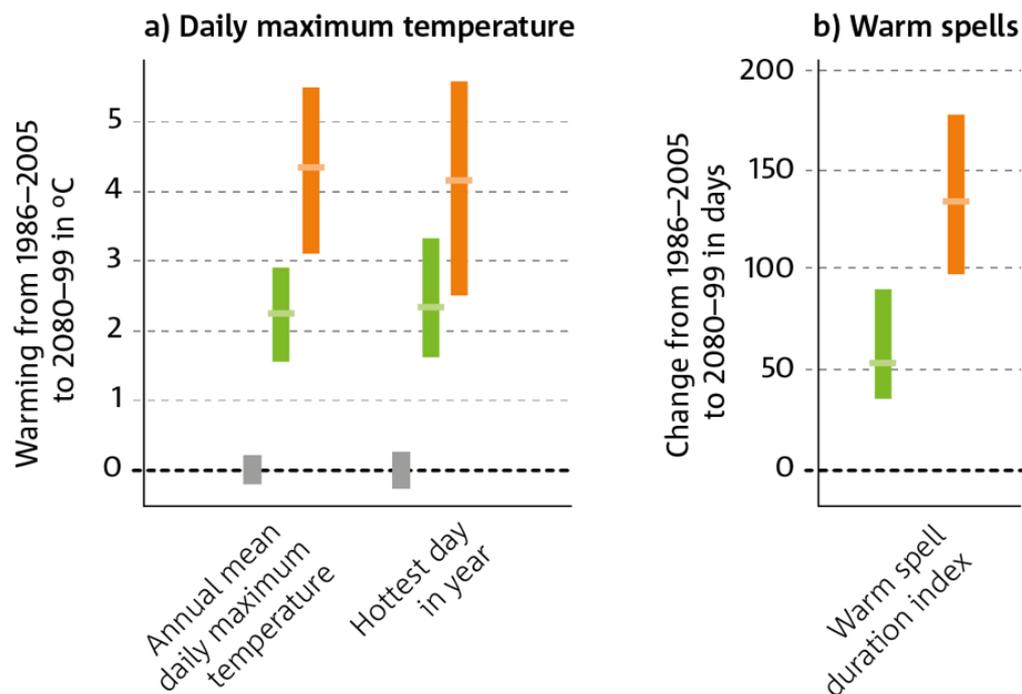


Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Total population increases from 22 million people today to 36 million in 2050. This is an increase of 64% over four decades, a little slower than the 76% increase experienced from 1970 to 2010.

Changes in climate variability – the intensity and frequency of droughts, floods, storms – will have impacts for agriculture

FIGURE 25 EXTREME HEAT EVENTS ARE PROJECTED TO BECOME MUCH MORE COMMON

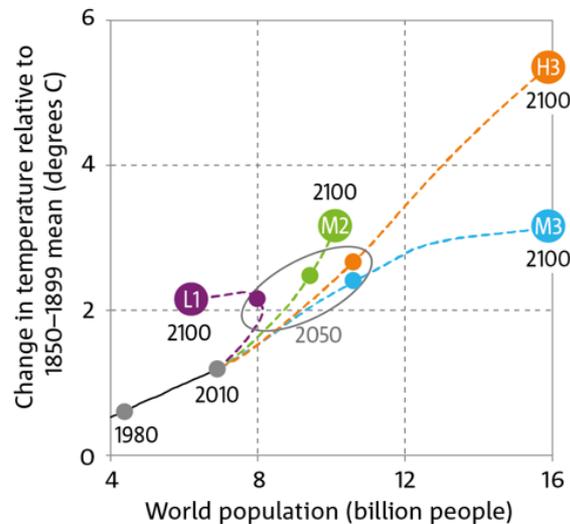
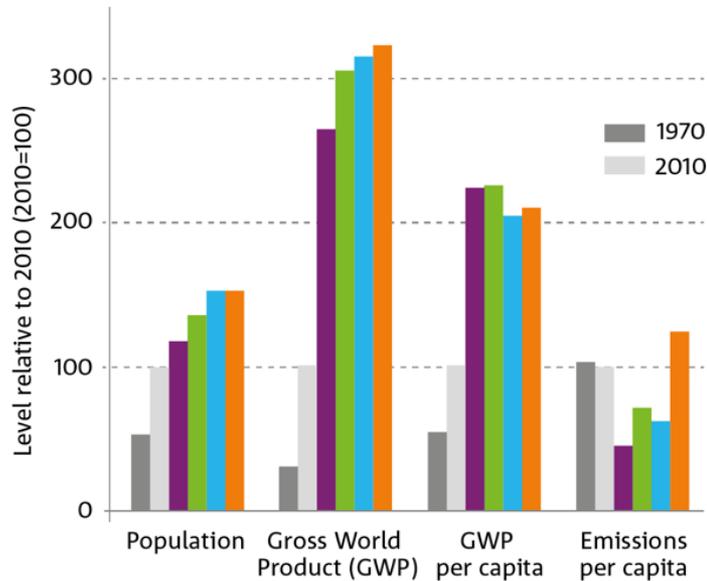


The impacts of changed frequency and severity of extreme weather and climate events may be very significant, and may outweigh the benefits of productivity improvements in some regions.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Key results for the global context scenarios

FIGURE 26 KEY INDICATORS FOR THE FOUR GLOBAL CONTEXT SCENARIOS, 1970, 2010, 2050, OR 1980-2100

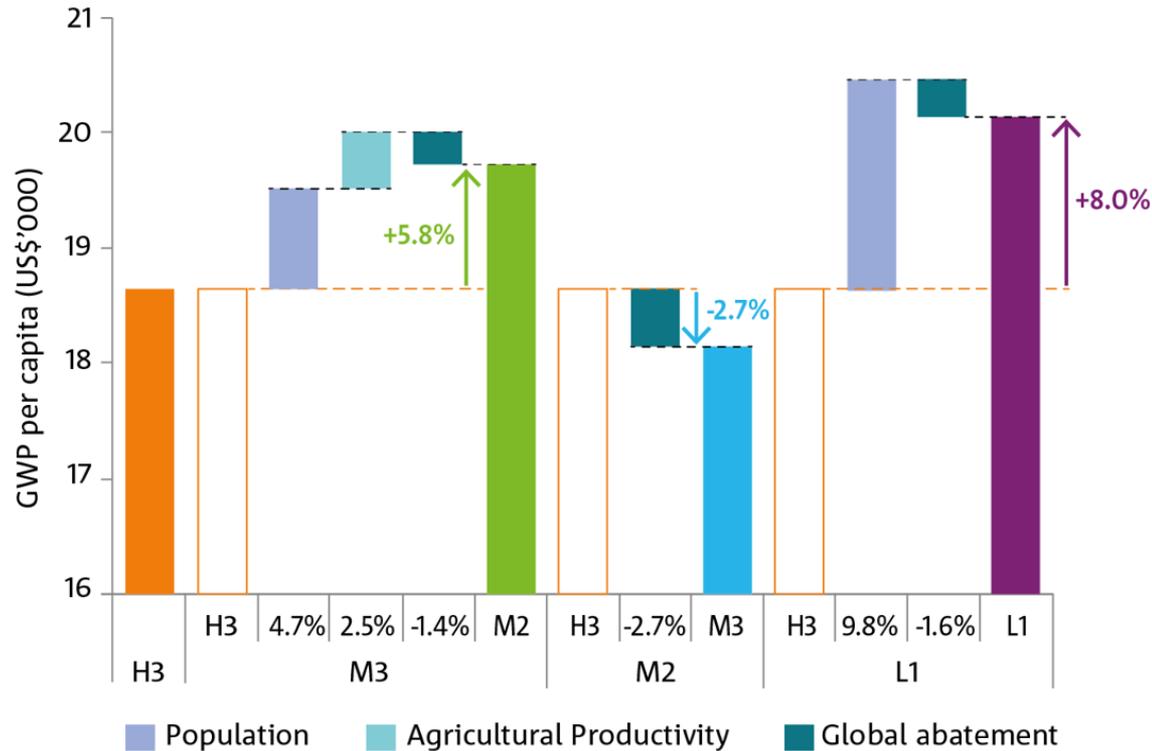


The different levels of global abatement effort have a significant impact on per capita emissions in 2050, but the full climate implications – and impacts – of the different emissions trajectories do not occur until later in the century.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

Abatement impacts offset by population growth

FIGURE 27 IMPACT OF POPULATION, AGRICULTURAL PRODUCTIVITY AND ABATEMENT INCENTIVES ON GLOBAL GDP PER CAPITA, RELATIVE TO THE SCENARIO WITH HIGH POPULATION AND NO GLOBAL ABATEMENT, 2050



Average global income in 2050 varies by 8% across the different global context scenarios, with differences in population growth accounting for most of this difference.

Source: Hatfield-Dodds et al. (2015) *Australian National Outlook 2015: Economic activity, resource use, environmental performance and living standards, 1970-2050*.

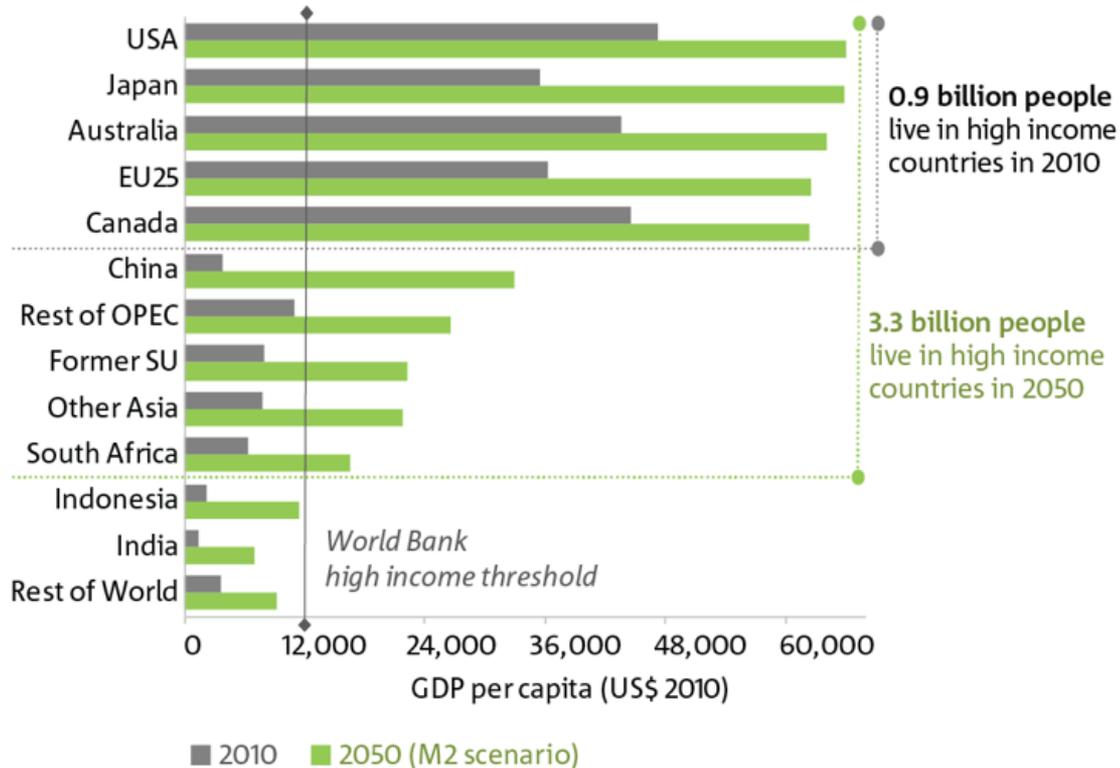
Additional figures from the Chart Overview

NATIONAL OUTLOOK 2015
www.csiro.au



Growth and living standards

A3. PER CAPITA INCOME BY WORLD REGIONS, 2010 AND 2050

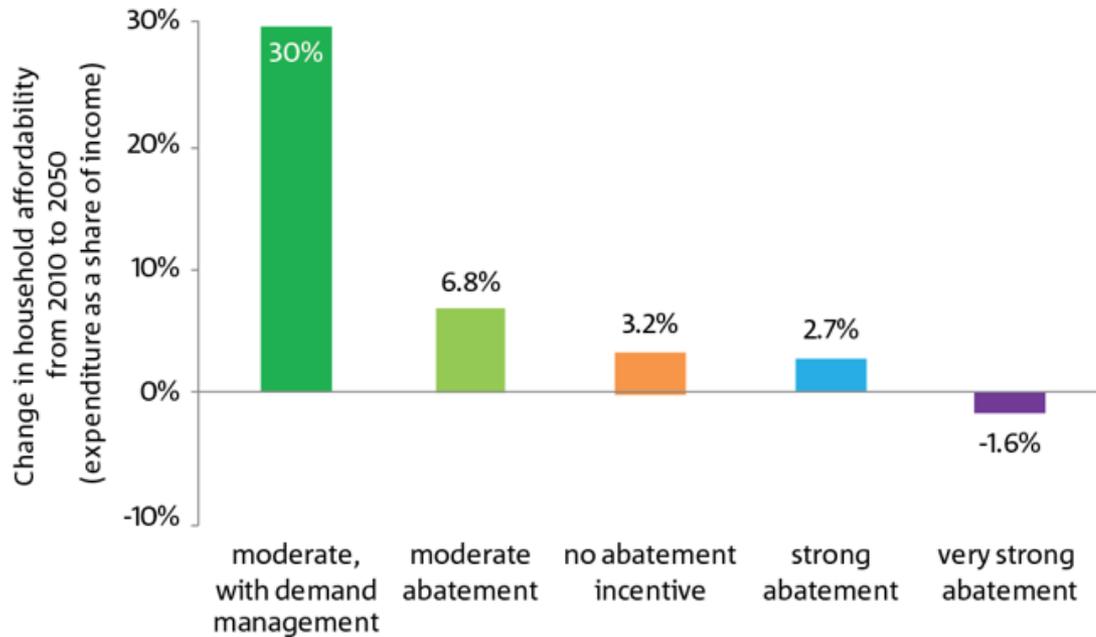


As the number of people in high income countries triples to 2050, so does the demand for Australian exports.

Source: CSIRO (2015) *Australian National Outlook 2015 – Chart Overview: Economic activity Living standards, resource use, environmental performance and living standards, 1970–2050*. CSIRO, Canberra.

Energy and resources

D1. CHANGE IN ELECTRICITY AFFORDABILITY TO 2050

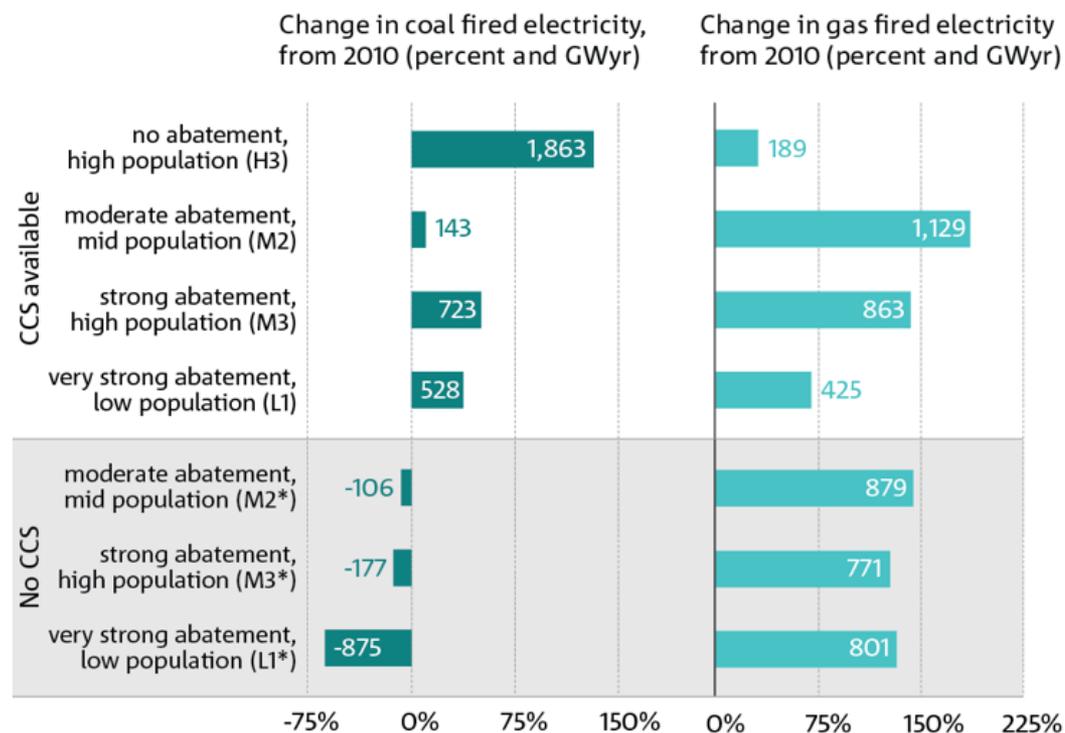


Affordability is not sensitive to carbon intensity, but could improve by 30% with better management of peak demand.

Source: CSIRO (2015) *Australian National Outlook 2015 – Chart Overview: Economic activity Living standards, resource use, environmental performance and living standards, 1970–2050*. CSIRO, Canberra.

Energy and resources

D3. CHANGE IN GLOBAL COAL AND GAS FIRED ELECTRICITY BY 2050



Carbon capture and storage (CCS) may allow coal-fired power to grow even with very strong global abatement.

Source: CSIRO (2015) *Australian National Outlook 2015 – Chart Overview: Economic activity Living standards, resource use, environmental performance and living standards, 1970–2050*. CSIRO, Canberra.

Contact details:

CONTACT US

t 1300 363 400
+61 3 9545 2176
e enquiries@csiro.au
w www.csiro.au

AT CSIRO WE SHAPE THE FUTURE

We do this by using science to solve real issues. Our research makes a difference to industry, people and the planet.

As Australia's national science agency we've been pushing the edge of what's possible for over 85 years. Today we have more than 5,000 talented people working out of 50-plus centres in Australia and internationally. Our people work closely with industry and communities to leave a lasting legacy. Collectively, our innovation and excellence places us in the top 10 applied research agencies in the world.

WE ASK, WE SEEK AND WE SOLVE

FOR FURTHER INFORMATION

Land and Water
Steve Hatfield-Dodds
t +61 2 6246 5597
e steve.hatfield-dodds@csiro.au
w www.csiro.au/nationaloutlook
www.csiro.au/landandwater

The screenshot shows the CSIRO National Outlook publications page. At the top, there is a navigation bar with links for HOME, ABOUT, CAREERS, EVENTS, LOCATIONS, CONTACT, and a search box. Below the navigation bar is the CSIRO logo and a secondary navigation bar with links for Our research, Do business, Education, Publications, and News. The main content area features a large image of Australia on a globe. Below the image, the text reads: "Research / Major Initiatives / National Outlook" followed by "National Outlook publications" in a large font. Underneath, it states: "Reports, summaries and scientific papers produced as part of the Australian National Outlook 2015." There are three main sections: "Australian National Outlook" with a link to "National Outlook 2015 overview" and "National Outlook publications"; "Main reports >" with the text "The major reports that make up Australian National Outlook 2015."; and "Key science papers >" with the text "Reporting National Outlook results and analysis." Below these is "Foundation science papers >" with the text "Documenting the National Outlook modelling capacity." On the left side, there is an "ENQUIRIES" section with the text "Have an enquiry about this page?" and a link to "Contact us". At the bottom of the page, there is a footer with three columns: "About us" (text: "At CSIRO we shape the future. We do this by using science to solve real issues. Our research makes a difference to industry, people, and the planet. We ask, we seek, we solve. We are CSIRO. More about us"), "Access to information" (links: "Freedom of Information >", "FOI Disclosure Log >", "Information Publication Scheme >", "Public Interest Disclosure scheme >"), and "Connect with us" (social media icons for Twitter, Facebook, YouTube, LinkedIn, and Google+, a "Subscribe to our monthly newsletter" section with a "Your email" input field and a "Subscribe" button, and a "Copyright Legal notice and disclaimer Your privacy Accessibility Sitemap Contact us" footer).

www.csiro.au/nationaloutlook

NATIONAL OUTLOOK 2015
www.csiro.au

