TRACKING PROGRESS TOWARDS A LOW CARBON ECONOMY

4. BUILDINGS

Summary Report

July 2013

Full report available at www.climateworksaustralia.org/tracking-progress

Executive summary

Recent progress

The energy intensity of Australia's buildings has decreased by 3 per cent between 2002-03 and 2010-11, led by improvements in the operation of buildings, improved energy efficiency standards, more efficient appliances and distributed energy.

New commercial buildings: New building standards are estimated to have delivered about a 32 per cent reduction in emissions from office base buildings. This comprises heating, cooling, ventilation, common area lighting and elevators but only accounts for around 12 per cent of commercial building energy use. Lack of data prevents accurate estimates of recent changes in office tenancies and other commercial building types.

Existing commercial buildings: Energy intensity of the building stock overall has improved slightly (2 per cent) over the last 10 years, driven by a small number of market leaders and capture of 'low hanging fruit' in other buildings.

Other than in large offices, activity has been patchy and fragmented and often linked to government incentives and white certificate schemes.

Expanding the base of market leaders

Rating tools, predominantly Green Star and NABERS, have helped reduce the emissions intensity of commercial buildings.

The Green Star tool provides a framework for the design and construction of high performing buildings, with the lowest rating requiring best practices to be demonstrated. The tool provides a rating based on the building's design in a number of areas of environmental impact, focusing on minimising energy and emissions. On average, Green Star office buildings emit 45 per cent fewer emissions than new office buildings built to current efficiency standards.

The NABERS rating tool is predominantly used to assess the emissions intensity of building operations. Since its inception in 1998 participation has increased, with two thirds of Australia's commercial office building stock rated in 2011-12. Large institutional property owners have led the uptake of NABERS, using the tool to assess their premises and re-rate following building upgrades. In 2010 the proportion of buildings performing at or above best practice was so high that the NABERS scale was extended to 6 stars to diversify the market leaders.

Today, these tools are supporting significant improvements in high-end commercial offices, driven by competition for tenants. Penetration in other building types is increasing but still only a small proportion in most sub-sectors.

New residential buildings: The maximum allowable energy intensity for heating and cooling has decreased on average by 17 per cent since 2009-10 when building fabric standards were increased.

Existing residential buildings: Across the residential building stock as a whole there has been a slight (2 per cent) decrease in energy intensity, due mostly to improvements in appliance efficiency, hot water and lighting.

Distributed energy: The rapid uptake of small scale solar has contributed to slowing down demand for grid-supplied electricity from homes. More than one million Australian homes now have a solar PV system installed, representing a five-fold increase from 2008-09 to 2011-12. In 2012 Australia had the highest number of residential solar installations in the world. Commercial buildings have had strong uptake of co- and tri-generation, however no comprehensive dataset exists.

These activities, combined with a decrease in the emissions intensity of grid-supplied electricity[1], have helped to slow the growth in emissions resulting from additional new buildings, and increased ownership of

Standards as a tool to improve energy efficiency

In 2010, there were strong improvements in the energy efficiency standards for both residential and commercial buildings. These changes have helped to reduce the amount of heating and cooling required, improve lighting efficiency by reducing lighting power density, and eliminate new electric hot water heaters. States and territories choose whether to adopt the changes, which are set by the Australian Building Codes Board (ABCB).

The National Construction Code (NCC) now contains a range of energy efficiency requirements, including requirements relating to the building itself – such as glazing, insulation and draught proofing – as well as major energy using equipment such as heating and cooling systems, water heating and lighting.

However, there is some concern that there is insufficient post-construction verification to ensure compliance. Research by QUT (Queensland University of Technology) demonstrates that many homes are not performing as expected.

Minimum Energy Performance Standards (MEPS) are mandatory minimum standards that a range of appliances must meet in order to be sold in Australia. Appliances that are currently covered by MEPS include refrigerators, motors, water heaters, air-conditioners and a range of lighting products.

1 See report 2: Power in the *Tracking Progress* report series

The rise of solar photovoltaics (PV)

Solar PV panels have become extremely popular for Australian homes due to a number of factors:

- Declining technology costs mean the average 1.5 kW system now costs around a quarter of what a similar system would have cost in 2003[2].
- There are now greater financial benefits from the electricity generated, as a result of rising electricity prices, Small Scale Renewable Energy Certificates (SREC) and feed-in tariffs.

appliances. Between 2002-03 and 2010-11, commercial building floor space increased by about 17 per cent and the number of households by 12 per cent, but over the same period total emissions from buildings increased by only 8 per cent.

Outlook to 2020

Despite strong expected growth in the number of homes and commercial buildings, a continuation of recent trends in emissions reduction activities would drive 7 per cent reduction in buildings emissions between 2010-11 and 2019-20.

Without further activity to reduce emissions, building emissions would be expected to increase by almost 19 per cent to 2019-20, from 113 $MtCO_2e$ in 2010-11 to 135 $MtCO_2e$ in 2019-20. The rise would come mostly from an increase in the number of new homes and commercial floor space. Continuation of recent trends in emissions reduction activity would more than offset this growth, resulting in a net 7 per cent reduction in emissions between 2010-11 and 2019-20.

New commercial buildings: Buildings constructed between 2012-13 and 2019-20 will make up 23 per cent of all commercial floor space by 2019-20. These buildings will be constructed to meet NCC 2010 standards (to date no further increases to standards have been proposed). Current registrations of Green Star projects suggests that Green Star rated offices will represent 50 per cent of all new offices built between 2013 and 2017. A growing number of other buildings (e.g. education) are also using Green Star.

Existing commercial buildings: The energy intensity of the commercial building stock would improve by 3 per cent by 2019-20 if recent trends of 0.3 per cent annual improvement are sustained. Key factors that will influence the level of future activity include improved building monitoring and automation, upgrades to lighting and improvements to heating, cooling and ventilation systems. Flexible financing, government grants and white certificate incentives could drive further improvements.

2 At June 2013, the average price including installation across Australia from market data (Solar Choice 2013) was $3,700 whereas it was approximately $15,000 in 2003 (Watt 2012)

3 Further detail is presented in the full Buildings sector report, report 4 of the *Tracking Progress* series.

New residential buildings: Between 2011-12 and 2019-20 the number of households is expected to increase by 0.9 million. These homes will be constructed to meet NCC 2010 standards. Recent adoption of increased standards in NSW and Tasmania would provide an additional 8 per cent reduction in the maximum allowable energy intensity for heating and cooling from 2010-11. Further abatement could be realised by providing information on low emissions homes to home buyers and tenants.

Existing residential buildings: The strongest improvements in buildings could come from reduced residential elecricity demand. The latest national statistics are from 2010-11, and they show a slight increase in electricity use per household up until that year. More recent data[3] suggests this trend is reversing, due the 2010 building standard improvements and improved MEPS for refrigerators, televisions, stand-by power, computers and monitors.

Distributed energy: The uptake of distributed energy is expected to remain strong despite recent regulation changes including the removal of feed in tariffs, and amendments to NABERS regulations for co-generation. If current trends continue residential solar would more than triple by 2019-20. Commercial solar installations have taken longer to gain traction however the business case is becoming more attractive as electricity prices continue to rise and businesses focus on reducing emissions. Further uptake of co- and tri-generation is expected to be encouraged through Green Star ratings and the Greener Government Buildings program.

Building energy performance disclosure

Building energy performance disclosure schemes are aimed at providing prospective building purchasers and tenants with the information required to assess the energy performance, and therefore the probable energy costs of running a building.

The introduction of energy performance disclosure for large commercial buildings in 2010 has revealed both a growing group of market leaders and a large group of buildings that have been slow to act. Of all buildings assessed, 39 per cent exhibited better emissions intensity than new builds (at or above a 4 stars NABERS rating). However, 11 per cent of buildings had a rating of 0 star. These buildings consumed over twice as much energy per square metre as market leaders, which would lead to significant differences in energy bills.

The Australian Capital Territory's House Energy Rating Scheme requires building owners to obtain a rating which must be provided to prospective buyers or tenants when the building is being leased or sold. It is currently the only residential building disclosure scheme in Australia. Results from the scheme demonstrate that there have been financial benefits for home owners who improve the energy performance of their homes[3].

Background

About the *Tracking Progress* project

Tracking Progress is the first national index of Australia's progress towards a low carbon economy.

With increasing business and community focus on how best to transition to a low carbon future, it is critical to have a robust measurement and evaluation framework for low carbon activity.

In order to understand how Australia is progressing towards our national emissions reduction targets, a good understanding of this activity — and the factors that are supporting or impeding it — is required. Building this evidence is critical for achieving an efficient, least-cost transition while maintaining our economic growth, competitiveness and prosperity.

The reports that make up this project provide an assessment of activity occurring across the Australian economy that reduces or avoids greenhouse gas emissions, pulling together all the available information and data across key sectors. We have tracked and reported progress through our national progress report series covering Power, Industry, Buildings and Land-Use & Waste[4].

In addition we have produced a Special Report on factors influencing large industrial energy efficiency.

No other research provides a national aggregation of data on the underlying investments and activity that lead to future abatement. National measurements currently focus on actual emissions and energy use each year. This only reveals 'the tip of the iceberg' of abatement activity.

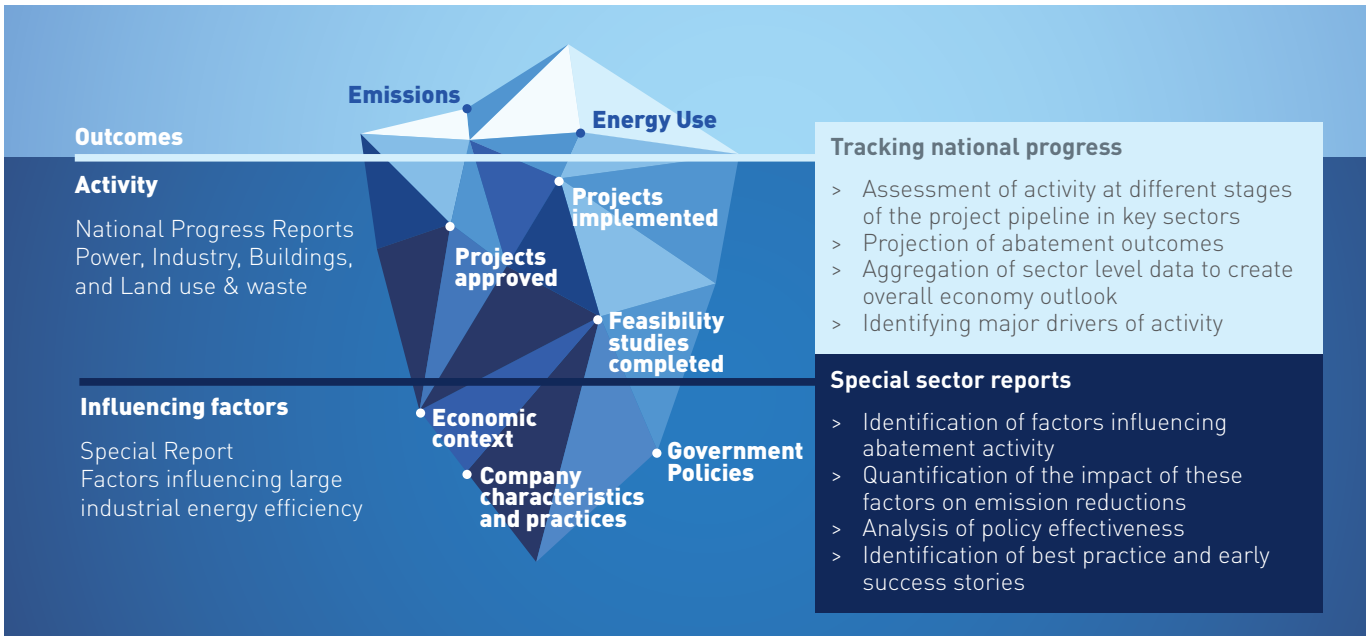
This series of reports reveals the hidden part of the story including:

LEVEL OF CURRENT ACTIVITY across key sectors of the economy. This includes activities that will deliver emissions savings in the future, some of which do not yet appear in national energy and emissions metrics but which are sufficiently advanced to make a known contribution to reducing future emissions.

FUTURE ABATEMENT that can be achieved if recent trends in abatement activity are sustained to 2019-20.

FACTORS INFLUENCING EMISSIONS REDUCTION ACTIVITY for large industrial energy efficiency — from broad economic influences to company specific factors — including an understanding of the common qualities of companies that achieve the most emissions reductions.

4 The Transport sector has not been assessed in the 2013 Tracking Progress report series but will be addressed in a future report series.



Description of the Buildings sector

This report investigates emissions reduction activity in the Buildings sector. It covers abatement from a reduction in energy use in residential and commercial buildings[5], as well as from increases in distributed energy in buildings — in particular co-generation and solar PV.

A Full report on progress in the Buildings sector — along with a National Progress report, reports on progress in Power, Industry and Land-use and Waste, and a Special Report on factors influencing large industrial energy efficiency — is available at www.climateworksaustralia.org/tracking-progress

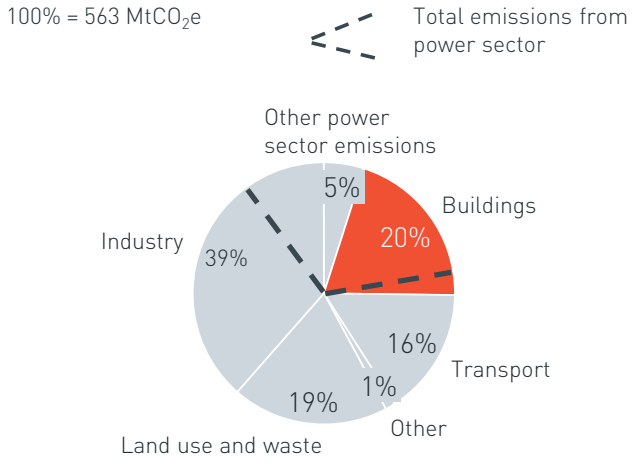
Emissions profile

In 2010-11, total emissions from the commercial and residential building sectors accounted for 113 $MtCO_2e$, or around 20 per cent of Australia's national emissions (see graph opposite).

Grid-supplied electricity consumption by buildings was responsible for 18 per cent of all emissions, and a further 2 per cent came from direct fuel combustion such as gas or wood for heating, hot water systems and cooking.

Increases in emissions from buildings are a result of growth in the number and size of buildings, and growth in the use of equipment and appliances. They can be offset by advances in building design, improvements to the efficiency of equipment and appliances, and opportunities to generate energy onsite from renewable sources or gas.

Breakdown of Australian emissions and sector coverage in 2010-11, % (DICCSRTE 2013)[6]



Breakdown of the sector's emissions

In 2010-11, residential buildings were responsible for slightly more than half of total emissions in the buildings sector (see graph opposite). About 84 per cent of residential emissions result from the consumption of grid-supplied electricity.

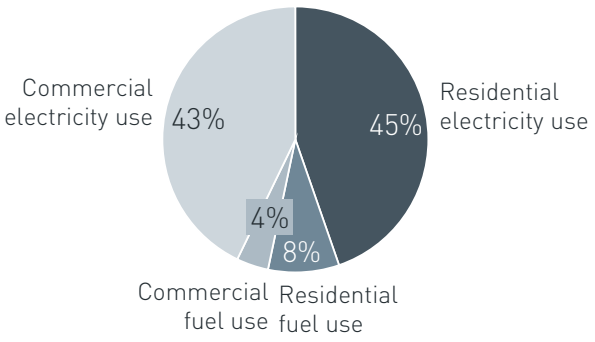
Commercial buildings contribute the remainder of the sector's emissions, with more than 90 per cent coming from consumption of grid-supplied electricity.

Commercial and residential buildings have different energy use profiles. Most energy in commercial buildings is consumed by heating, ventilation, air conditioning and lighting systems, while in residential buildings the main energy uses are appliances, water and space heating.

Australia has a varied climate and energy requirements for heating and cooling vary dramatically across the country.

The most populated urban areas of Sydney, Melbourne and Brisbane have relatively mild climates and require less energy for heating and cooling of buildings than some other areas of the country.

Breakdown of generation and emissions from buildings in 2010-11, % (DCCEE 2011, ESAA 2011, ClimateWorks team analysis)



5 Please note that the impact that these reductions may have on the grid-supplied electricity generation mix are considered in the Power report in this series.

6 A detailed bibliography is available in the full report for the Buildings sector at www.climateworksaustralia.org/tracking-progress

Index of Progress

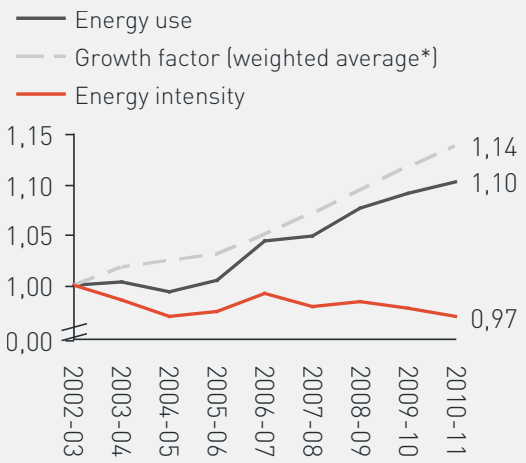
1. Overall sector

Recent progress

Slight improvement overall

Improvements in energy efficiency of new buildings and distributed energy mostly offset by additional buildings and increased use of electricity by electronics and space conditioning in homes

Change in energy and energy intensity, indices (BREE, ABS, COAG 2012, ClimateWorks team analysis)



What factors influenced the abatement activity?

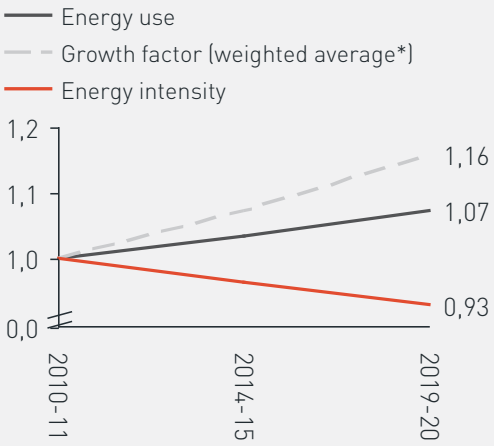
- Rating tools and regulations for buildings and appliances
- Emergence of market leaders
- New energy uses

Outlook to 2020

Current trends would deliver 30% of identified potential

Strong improvements in energy efficiency in homes and increases in solar PV uptake are expected if recent trends are sustained, but limited improvements expected overall in non-office commercial buildings

Change in energy and energy intensity, indices (BREE, ABS, COAG 2012, ClimateWorks team analysis)



What factors will influence abatement activity?

- Further increases in electricity prices
- Improved information
- New technologies
- Regulatory uncertainty

Change relative to historical levels & expectations

- No improvement or backwards
- Patchy or limited improvement
- Some improvement
- Moderate improvement
- Strong improvement

Legend

- Upside factors
- Downside factors

Share of potential identified in the Low Carbon Growth Plan (LCGP) that current trend would deliver

- No abatement captured
- Little abatement captured (1–25%)
- Some abatement captured (26–50%)
- Moderate abatement captured (51–75%)
- Significant abatement captured (>75%)

Legend

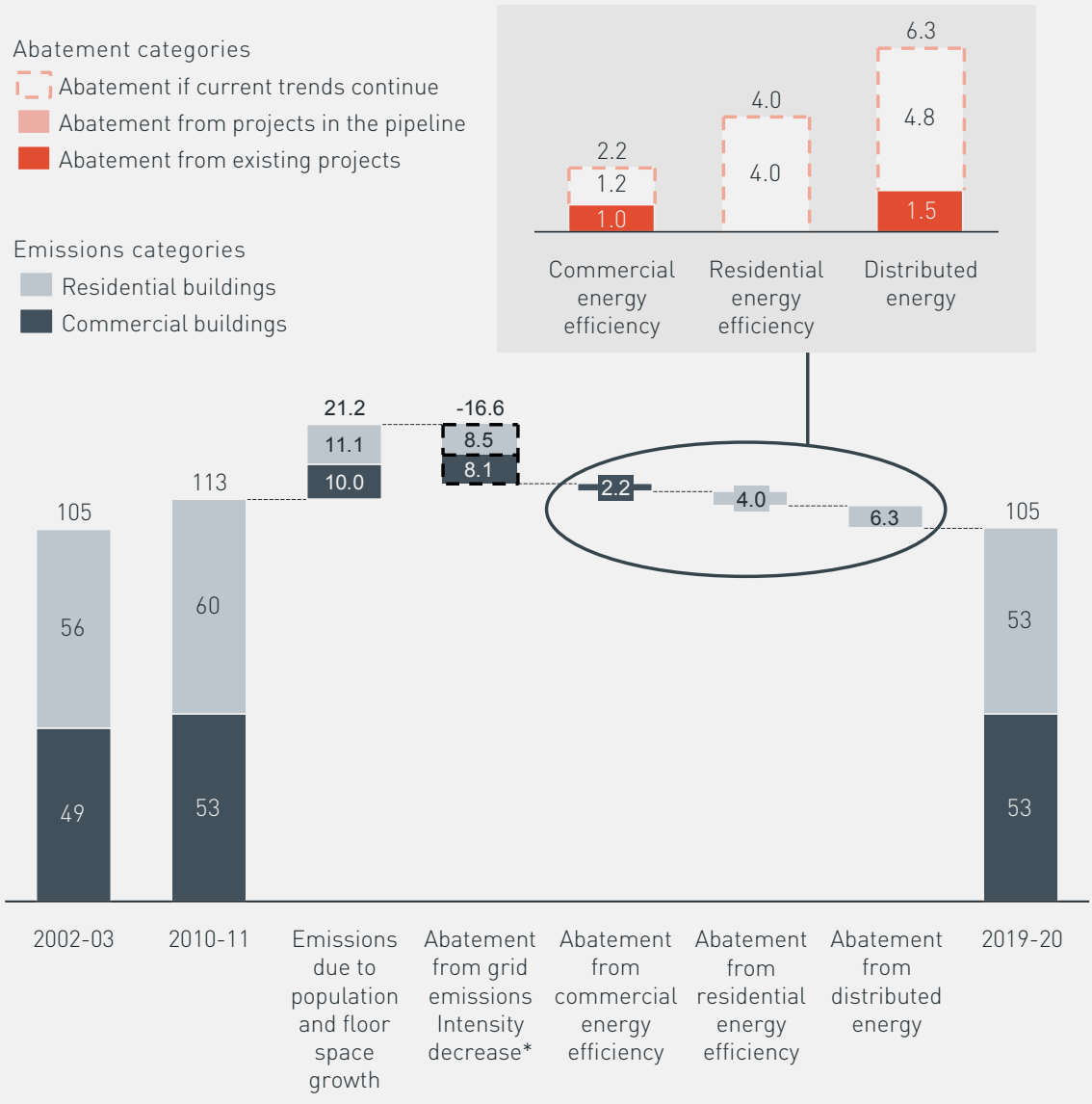
- Upside factors
- Downside factors

* Weighted average of commercial floor space and number of households indices.

Between 2002-03 and 2010-11, emissions from the Buildings sector grew by only 8 per cent despite higher growth rates in commercial floor space (17 per cent) and number of households (12 per cent). This was due to improvements in both energy efficiency of buildings and emissions intensity of grid-supplied electricity over the last decade.

If there is no further abatement activity beyond 2009-10, the sector's emissions would grow by 19 per cent by 2019-20, driven by increases in commercial floor space and number of households. Sustaining current abatement trends would more than compensate for this growth, leading to an overall decrease in emissions of 7 per cent by 2019-20. Energy efficiency improvements would contribute a total of 6.2 $MtCO_2e$; 2.2 $MtCO_2e$ from commercial buildings, and 4 $MtCO_2e$ from residential buildings, where recent data and modelling suggest that historical increases in electricity use per household are likely to reverse. Increases in distributed energy, in particular solar PV, would contribute an additional 6.3 $MtCO_2e$ through displacement of grid-supplied electricity. Reduction in grid emissions intensity by 2020 will further reduce buildng emissions by 16.6 $MtCO_2e$ by 2019-20.

Emissions in the Buildings sector, $MtCO_2e$ (DCCEE 2012, ClimateWorks team analysis)



* Abatement allocated to the power sector.

2. Index of progress for each abatement category

Recent progress

NEW COMMERCIAL BUILDINGS

How much activity is happening?

Strong improvement in new office base buildings, and likely improvements in remaining building types due to increased standards

Improvements in standards and emergence of market leaders

What are some key achievements?

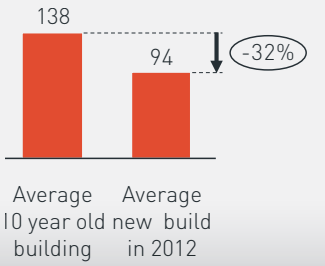
- New office base buildings are about 32% more efficient than the average 10 year old building
- Green Star offices represent over 31% of new office space built since 2003, emitting 46% less than offices built to meet 'minimum standards'

What factors influenced the activity?

- Competition in high end office market
- Strengthening of building standards
- Improvements in skills and technologies
- Split incentives
- Lack of actual data for non-office buildings

Key metric

Estimated emissions intensity of office base buildings, $kgCO_2e/m^2$*



EXISTING COMMERCIAL BUILDINGS

How much activity is happening?

Energy intensity per m^2 has decreased by an average 0.3% p.a.

Improvements are still limited to a small subset of buildings

What are some key achievements?

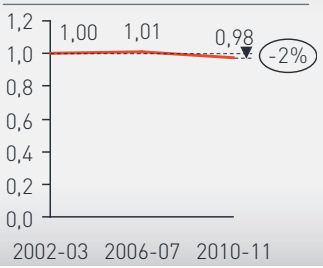
- Subsequent NABERS rating in 2011-12 showed average emissions reductions of 9% for over 620 buildings
- In 2011, 39% of offices reporting through the mandatory disclosure program had better ratings than standard new builds

What factors influenced the activity?

- Competition in high end office market
- Commercial Building Disclosure
- Grants & white certificate schemes
- Lack of data for many building types

Key metric

Average commercial energy intensity per m^2, index*



NEW RESIDENTIAL BUILDINGS

How much activity is happening?

Increased efficiency standards have decreased heating and cooling energy consumption of new homes by 17% since 2010

Strong improvement of standards

What are some key achievements?

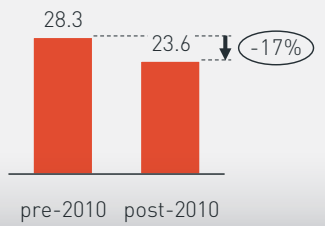
- Building fabric standard increased from 5* to 6* NatHERS in most states
- New lighting power density standards likely to reduce lighting energy use by about 30%.
- Ban of electric hot water heaters likely to reduce water heating emissions by almost 50%.

What factors influenced the activity?

- Strengthening of building standards
- Lack of verification that performance meets standards
- Split incentives resulting in little focus on efficiency measures during design

Key metric

Est. average energy intensity of heating and cooling for new dwellings across Australia, kWh/m^2*



EXISTING RESIDENTIAL BUILDINGS

How much activity is happening?

Energy use per household improved on average by 0.3% per annum driven in particular by improved appliance, water heating and lighting efficiency

Energy efficiency offset by larger houses and new energy uses

What are some key achievements?

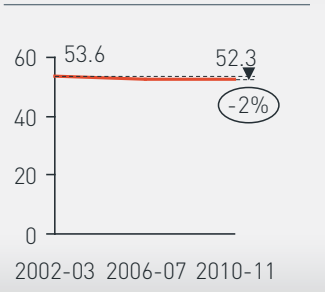
- Since 2003, 9% of hot water systems have been switched from electricity to solar
- Incandescent light bulbs have been banned and replaced by CFLs (80% more efficient, on average)

What factors influenced the activity?

- MEPS and Energy Star
- White certificate schemes and rebates
- Minimising energy bills to balance household budgets
- Increased ownership of IT, entertainment and air conditioning
- Information barriers

Key metric

Energy consumption per household (incl. solar), GJ*



DISTRIBUTED ENERGY

How much activity is happening?

Over 1 million small scale solar systems now installed, and co-generation is believed to have increased

Solar PV reached ~5% of residential electricity use in 2012

What are some key achievements?

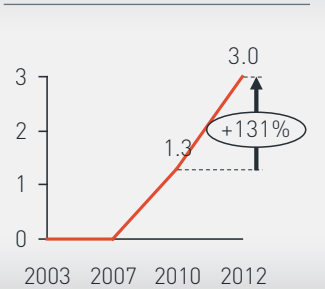
- Australia currently has over 1,000,000 homes with a solar PV system installed, more than any country in the world
- Industry participants report strong increases in co-/ tri-generation, however it cannot be accurately quantified due to a lack of data

What factors influenced the activity?

- Decreasing technology costs
- Renewable Energy Target
- Rising electricity prices
- Feed-in-tariffs

Key metric

Generation from Solar PV, TWh*



* Multiple data sources. See full Buildings report for details at www.climateworksaustralia.org/tracking-progress

Recent Progress

Change relative to historical levels & expectations

- No improvement
- Limited improvement
- Some improvement
- Moderate improvement
- Strong improvement
- Data unavailable

Outlook to 2020

Share of available potential current trend would deliver

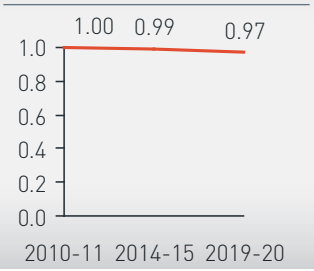
- No abatement captured
- 1–25%
- 26%–50%
- 51%–75%
- 76%+
- Data unavailable

Outlook to 2020

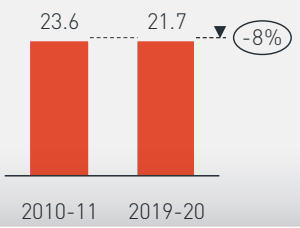
NEW COMMERCIAL BUILDINGS

How much activity could happen?	What's in the pipeline?	What factors will influence the activity?	Key metric
Expected improvements in small group of market leaders, but no data on other building types **Lack of data prevents quantification of future trends**	> Almost all office buildings under construction in major capital cities are Green Star registered > Increased penetration of high efficiency, low emissions projects in other commercial sub-sectors	◀▶ Continued demand for green buildings ◀▶ Increased standards ◀ Construction downturn may lead to less projects being completed compared to predictions	CANNOT BE ESTIMATED WITH EXISTING DATA

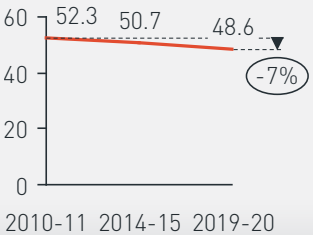
EXISTING COMMERCIAL BUILDINGS

How much activity could happen?	What's in the pipeline?	What factors will influence the activity?	Key metric
Energy intensity per square metre on trend to reduce by 3% by 2020 **Current trends would deliver 8% of potential**	> Flexible financing helping to overcome split incentives > Greener Government building program could deliver 1.2 $MtCO_2e$ abatement by 2019-20 > Green Star performance is first common operational performance tool	◀▶ Mandatory Disclosure ◀▶ Flexible financing ◀▶ Improved monitoring and automation ◀ Split incentives ◀ Information barriers	Average commercial energy intensity per m^2, index* 

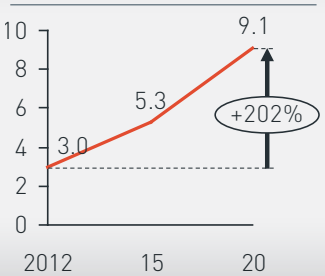
NEW RESIDENTIAL BUILDINGS

How much activity could happen?	What's in the pipeline?	What factors will influence the activity?	Key metric
Recent trends would deliver an estimated 8% reduction in the maximum allowable energy to heat and cool new homes **Current trends would deliver 15% of LCGP potential**	> Research pipeline indicates carbon neutral homes could be achieved at reasonable cost in mid term > Increase in sustainable precinct developments with commitments to efficient housing	◀▶ Increasing demand for sustainable homes ◀▶ International innovation and local trials ◀ Efficiency standards rolled back or under review ◀ Split incentives	Est. average energy intensity of heating and cooling for new dwellings across Australia, kWh/m^2* 

EXISTING RESIDENTIAL BUILDINGS

How much activity could happen?	What's in the pipeline?	What factors will influence the activity?	Key metric
Reversal of historic growth in residential electricity use expected from recent improvements in standards for new builds & appliances **Current trends would deliver nearly two thirds of LCGP potential**	> Rapid advancement of LED technology causing price drops and wider accessibility > Review of white certificate schemes to drive household efficiency activity	◀▶ Rising electricity costs ◀▶ Technology improvements ◀▶ Expansion of residential disclosure ◀▶ Smart metering ◀ Information barriers	Energy consumption per household (incl. solar), GJ* 

DISTRIBUTED ENERGY

How much activity could happen?	What's in the pipeline?	What factors will influence the activity?	Key metric
Solar PV could reach about 13% of residential building electricity use in 2020 **Expected to exceed LCGP potential**	> Current trends would lead to a three-fold increase of solar generation by 2020 > Government retrofit programs and precinct scale projects driving increased uptake > New technology to increase output from distributed energy and store excess electricity	◀▶ Rising electricity costs ◀▶ Decreased technology costs ◀▶ Drive to decrease building energy emissions intensity ◀ Grid connectivity ◀ Increased gas prices (for co- and tri-generation)	Estimated generation from Solar PV, TWh* 

3. What more could be done?

The commercial buildings sector has a lot of additional potential to reduce its emissions

Each sector has the potential to contribute additional emissions reductions by 2019-20. This potential was outlined in ClimateWorks' *Low Carbon Growth Plan for Australia*.

That research, published in 2010 and updated in 2011, provides an indication of the scale of emissions reduction potential available in Australia without changes to the business mix of our economy or to our lifestyles. It also provides details of the activities that can deliver these emissions reductions.

The *Low Carbon Growth Plan for Australia* found that there is enough abatement potential to achieve a 25 per cent emissions reduction target in Australia, using technologies and practices already available. However further policy or economic incentives would be required to drive the uptake of those activities.

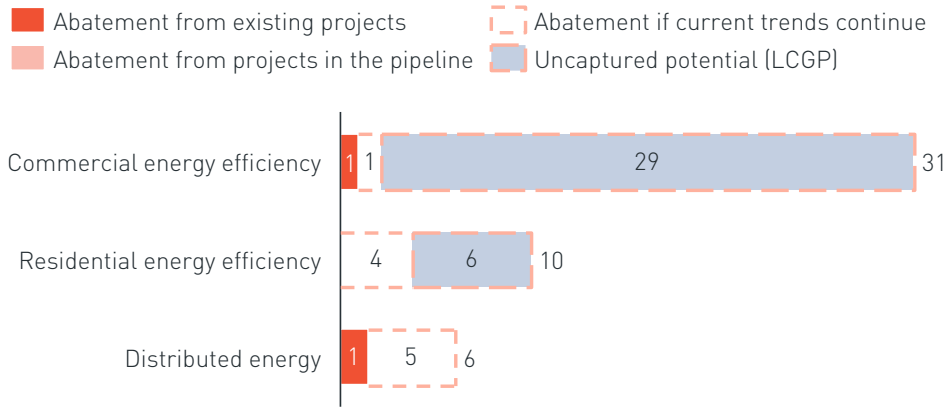
The graph above compares the abatement observed in the Buildings sector to date as shown in this *Tracking Progress* report series with the potential described in the *Low Carbon Growth Plan for Australia*, noting that total abatement figures per sector do not align exactly due to the different methodologies used for the two reports and changes in the economic context between 2011 and today[7].

In the Buildings sector, an additional 29 $MtCO_2e$ would be required in 2020 to meet the 25 per cent emissions reduction potential modelled in the *Low Carbon Growth Plan for Australia* (LCGP)[8] for this sector. Most of the additional potential comes from energy efficiency improvements in commercial buildings (29 $MtCO_2e$)[9].

In particular, the potential to improve the energy efficiency of existing buildings is mostly untapped. There is also some potential to reduce residential energy use further through increased energy efficiency, in particular through further improvements to the thermal efficiency of existing and new buildings.

If current trends are sustained, abatement activity in distributed energy would exceed the potential identified in the LCGP.

Relative share of emissions reduction potential in the Buildings sector, $MtCO_2e$ (ClimateWorks 2011, ClimateWorks team analysis)



7 The *Low Carbon Growth Plan for Australia* (LCGP) is used only as a benchmark indication of how much potential remains available. The numbers presented in this report differ from the numbers presented in the LCGP given that those two analyses have slightly different scopes: the LCGP assessed abatement potential above the Australian Government's business-as-usual emissions projection, whereas this Tracking Progress study reports on all abatement activity undertaken, including abatement that would have been regarded as part of business-as-usual by government projections. For example, installation of new renewable capacity to meet the Renewable Energy Target was included in the Government's business-as-usual projection, but has been included in our abatement calculation in this report. This means that the 'total potential' referenced in this report appears larger than what was reported in the LCGP

8 Please note that the impact of further electricity reductions on the power generation mix is explored in the Power sector report, with any further reduction in grid electricity demand likely to reduce fossil fuel generation.

9 The total uncaptured potential from commercial and residential buildings energy efficiency adds up to 35 $MtCO_2e$, however we have subtracted the abatement that can be achieved through distributed energy (which is additional to the opportunity identified in the LCGP) in order to estimate the total uncaptured potential for this sector.

Case studies

Bringing low emission homes into the mainstream

Positive Footprints is a Victorian-based company that designs and builds affordable low emission homes. The company has standard designs for 9 Star NatHERS rated homes which need only one third of the energy for heating and cooling of standard 6 star homes.

Common design features include passive solar design, a high degree of insulation, tight building fabric to prevent air leakage, excellent ventilation, reversible ceiling fans for cooling, high efficiency LED and compact fluorescent lighting, solar PV system, solar hot water with gas booster, and Green Switches to eliminate standby power when appliances are not in use. Penola house (above right) is one such example.

Greener Victorian Government Buildings

Buildings account for 70 per cent of the Victorian Government's energy use. The Department of Treasury and Finance initiated the Greener Government Buildings program to reduce emissions from government owned assets through the use of energy performance contracts.

As at July 2013, facilities representing 24 per cent of the Victorian Government's total energy use had projects implemented or in progress. These 33 projects are forecast to deliver a net financial benefit of over $400 million and a greenhouse gas savings representing 9 per cent of the Victorian Government's footprint. The 5 projects completed to date have delivered an average 36 per cent emissions reduction. Almost 50 per cent of projects include co- or tri-generation.

"Never before has the Victorian Government, or any property owner that I'm aware of, delivered such substantial energy and greenhouse gas savings, and such significant financial returns, at such low risk." Sam Burke, Program Manager.

Australia's first Zero Carbon Precinct

Barangaroo South is Australia's first large scale carbon neutral precinct. It is a mixed use redevelopment of the southern 7.5 hectares of a former container wharf in Sydney's CBD.

The project integrates sustainability into its design, including the adoption of a neighbourhood scale, shared infrastructure approach to services benefiting the wider Sydney community.

Design features include best practice design for buildings utilising Green Star, NABERS and BASIX rating tools, promotion of energy efficienct appliances, on-site solar generation, and investment in offsite renewable energy.

The site is predicted to contribute approximately 50,000 tonnes of CO_2e abatement annually, equivalent to taking more than 12,000 cars off the road. as well as generating more renewable energy than it uses.

CONTACT US

For further information about this project,
and to view all reports in the Tracking Progress series, visit

www.climateworksaustralia.org/tracking-progress

Or contact

Amandine Denis
HEAD OF RESEARCH
EMAIL amandine.denis@climateworksaustralia.org

Anna Skarbek
EXECUTIVE DIRECTOR
EMAIL anna.skarbek@climateworksaustralia.org

Climateworks Australia
Level 1, 31 Flinders Lane
Melbourne Victoria 3000
PHONE +61 3 9902 0741

This report was authored by Amandine Denis (Head of Research)
and Emma Lucia (Business Analyst)

With support from Eli Court (Project Manager), Shane Gladigau
(Project Officer), Meg Argyriou (Head of Engagement) and
Anna Skarbek (Executive Director)

A detailed bibliography is available in the full report for the Buildings sector
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