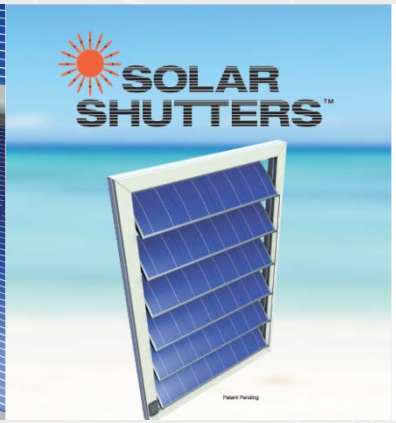
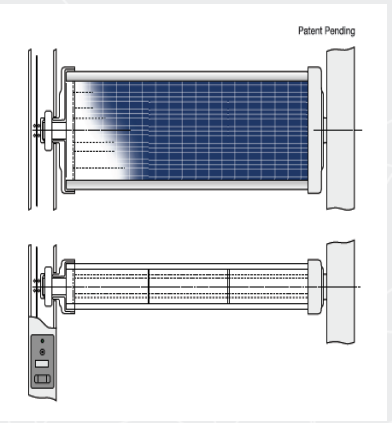
The Market Intelligence Co.

Innovative Technologies Pty Ltd

Solar Shutters™





Desk Research into Solar Energy in Australia to determine the potential for Solar Shutters™.

May 2016

The Market Intelligence Co.

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www.market-intelligence.com.au

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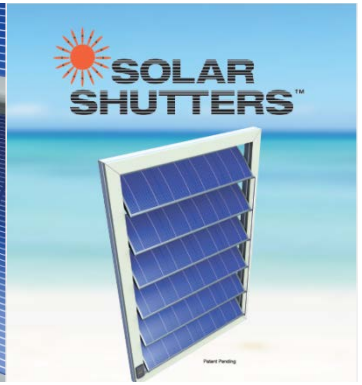

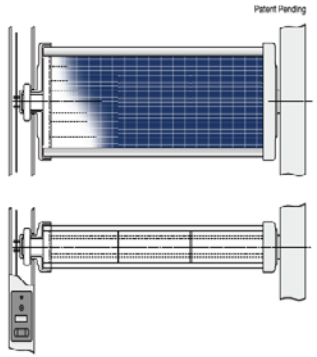

Research Background

- The Market Intelligence Co. (TMIC) was commissioned by Innovative Technologies to conduct desk research on the status of solar energy in Australia to assist in determining the potential for its Solar Shutters™.
- Solar Shutters™ have been developed to deliver renewable solar generated electricity, in particular to business offices and residential apartments that do not have rooftops to support traditional solar panels.
- We reviewed published material from a variety of sources, including:
  - Clean Energy Council
  - Clean Energy Regulator
  - AMEC
  - Australian Bureau of Statistics
  - Media publications (incl. transcripts of interviews and speeches)
  - Academic and industry journals and magazines.
- The desk research and analysis was conducted in May 2016.

Research Objectives

- The research objective was to provide Innovative Technologies with:

An understanding of the Solar Energy Market in Australia to assist Innovative Technologies in determining the potential uptake of its Solar Shutters™.

- Specifically by gaining an understanding of:
  - o The solar roof panel uptake over the last 5 years.
  - o The approximate number of residential apartments/units, business offices, high rise buildings (that currently have no access to utilising solar roof panels).
  - o The cost of electricity over time and potential savings by generating solar renewable electricity.
  - o The outlook for the Tesla Powerwall.*

*Innovative Technologies has indicated that the Solar Shutters™ technology is compatible with the Tesla Powerwall but this has not been independently verified by TMIC.

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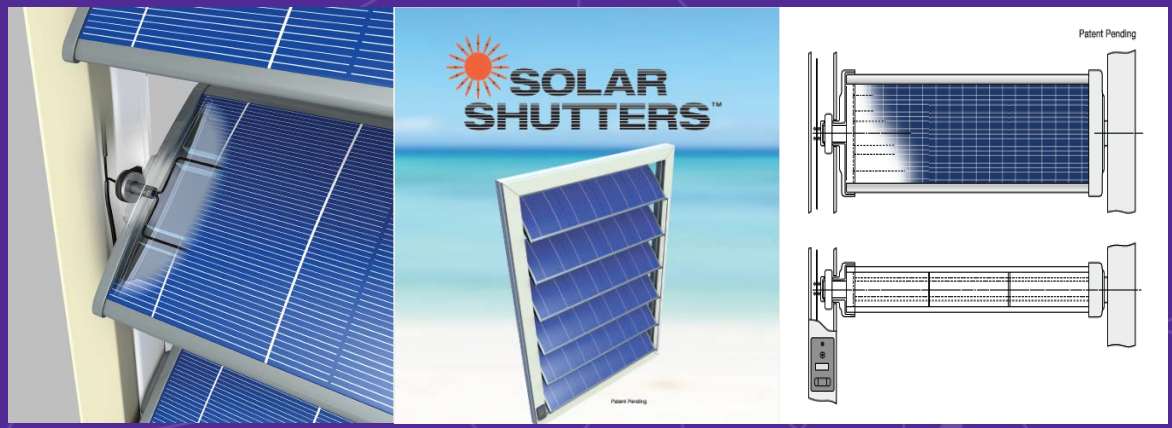
Executive Summary



Executive Summary

About Solar Shutters™

- Solar Shutters™ has been developed in Australia by Mark Jack Lyons and his Australian Company 'Innovative Technologies Pty Ltd' who has successfully commercialised numerous IT related business ventures.

  Business references can be viewed at the company website: www.innotech.mobi under the 'About' heading, and in collaboration with his father's Australian Research and Development company Gremarol Pty Limited, who has successfully developed a ballistic polymer material called 'Matrix Armor Protection' details can be viewed at the website: www.matrixarmorprotection.net

- "Solar Shutters™ is the latest development in Renewable Solar Energy Technology which provides a uniquely practical method of delivering Solar generated electricity to Business Offices and Residential Apartments who do not have rooftops to support traditional Solar Panels."

- Traditional curtains and blinds used in residential homes and business offices have always been used to keep the sunlight out of the room.

- Solar Shutters™ capture this sunlight and convert it into Renewable Solar Energy that can be used to power home and office lights, home appliances, televisions, and business equipment such as computers and printers.

(Source: Innovative Technologies Pty Ltd; this has not been independently verified by TMIC.)

Executive Summary cont'd

About Solar Shutters™ cont'd

- Solar Shutters™ will be manufactured in a range of different sizes and decorative framing such as different wood stain finishes for residential home and different colours or marble and metallic effects for business offices.
- "Solar Shutters™ offer a uniquely powerful and practical Renewable Solar Energy solution providing Off-grid power and reducing grid and peak electricity costs as well as presenting Businesses with a tax deductable expense."
- "Solar Shutters™ therefore represents the potential to supply millions of Business Offices and Residential Apartments with huge Global License and Franchise Potential."
- Patent protection for the Solar Shutters™ product, designs and technology have been filed in Australia and South Africa. Other Global Patents will be filed for Global Commercialisation at the appropriate times.
- **The desk research findings support that the energy efficiency market and its associated products/equipment is growing, suggesting that there is potential for the Solar Shutters™ product and technology in Australia.**

(Source: Innovative Technologies Pty Ltd; this has not been independently verified by TMIC.)

Executive Summary cont'd

Desk Research Findings

Small-scale solar energy and storage systems are expected to experience significant growth over the next few years.

Solar Roof Panels

- Nearly 10% of household electricity is delivered by rooftop solar systems.
- There are over 1.5 million small-scale solar PV systems in Australia; current average system size is around 5kW.
- Nearly 1 in 5 households have solar PV panel systems – conversely, over 4 in 5 households currently do not have rooftop solar PV.

High Rise Buildings

- **Solar Shutters™ are specifically designed and configured to be utilised in high rise residential and commercial buildings.**
- Government priority to improve energy efficiency in mid-tier commercial buildings. It is estimated that there are up to 80k mid-tier commercial high-rise buildings in Australia.
- Residential high-rise dwelling approvals have increased significantly in recent years (around 72,000 in 2015), up from around 280k such dwellings in 2011. This trend is expected to continue.

Executive Summary cont'd

Desk Research Findings cont'd

Cost of Electricity and Potential Savings

- Electricity prices are governed by state/regional jurisdictions.
- Average national electricity prices increase by 1.1% per annum.
- Cost savings by installing solar PV panel systems in the commercial sector averaged around $4.3k per installation in 2014.
- Rebates for feeding back into the grid are being wound back; future cost savings to be driven by behind-the-meter consumption.

Tesla Powerwall Outlook

- **The Solar Shutter™ products and technology are designed to be compatible with the Tesla Powerwall product and utilisation, thereby offering high rise residential and commercial buildings the Tesla Powerwall with solar powered recharge capability.**
- The energy storage market is expected to expand exponentially.
- Tesla views Australia as a top priority market; Tesla Powerwall installations commenced in January 2016.
- Current payback period is too long for most residential applications, but cost of storage systems is expected to halve in the next 5 years.

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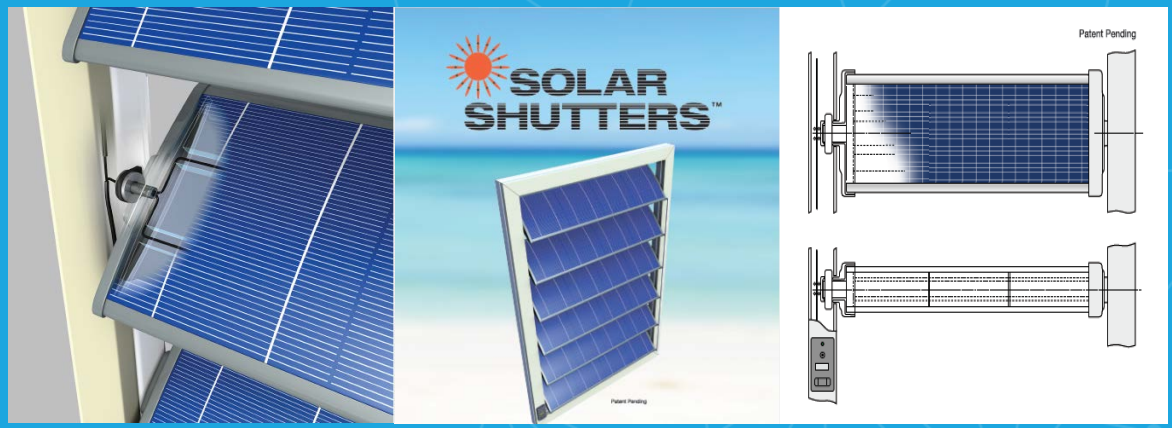
Desk Research Findings



Overview of Renewable Energy in Australia

- The objectives of the Renewable Energy (Electricity) Act 2000 are[1]:
  - To encourage the additional generation of electricity from renewable sources.
  - To reduce emissions of greenhouse gases in the electricity sector.
  - To ensure that renewable energy sources are ecologically sustainable.

  This is done through the issuing of certificates for the generation of electricity using eligible renewable energy sources and requiring certain purchasers (called liable entities) to surrender a specified number of certificates for the electricity that they acquire during a year. [1]
- The Federal Government has committed to a 23% Renewable Energy Target (RET) by 2020.[2]

  This means an additional 33,000 gigawatt hours in renewable energy by 2020. Separately, small-scale solar PV systems are expected to supply about 12,000 gigawatt hours.[3]

  (Note: there will be a Federal Election on 2 July, 2016. The Australian Labour Party (ALP) which is currently in opposition, recently announced an increased focus on renewable energy should they win the election.)
- 4 States/Territories have renewable energy targets in place, ie. ACT, South Australia, Queensland and Victoria. For example, the QLD Government has set a target of 1 million solar roof tops in Queensland by 2020.[4]

[1] Australian Government, Federal Register of Legislation, www.legisation.gov.au.
[2] The Australian Financial review (28 May, 2016)
[3] The Courier Mail (11 May, 2016)
[4] http:www.esdnews.com.au (24 & 25 May, 2016)

Overview of Renewable Energy in Australia cont'd

- **Renewable energy** provided **13.47%** of Australia's electricity in 2014, split by renewable technology as[1]:

Technology	Generation (GWh)	% of Total Generation
Hydro	14,555	6.19%
Wind	9,777	4.16%
Household and Commercial Solar (<100kW)	4,834	2.06%
Bio Energy	2,400	1.02%
Large-scale Solar	118	0.05%
Other Renewable (eg. Geothermal, Marine)	0.54	<0.01%
Total Renewable	**31,684**	**13.47%**

This has **increased** to 5.0TWh and **2.6%** by **April 2016**, or nearly **10% of household** electricity use.[2]

Tasmania has the highest penetration of renewable energy (95%, mainly Hydro) followed by SA (40%). NSW has the lowest penetration (6%).[1]

[1] Clean Energy Australia Report 2014, Clean Energy Council.

2 http://reneweconomy.com.au/2016/rooftop-solar-now-accounts-for-2-6-of-Australia-Demand (11 May, 2016)

Solar Roof Panel Uptake in Australia

- The table below lists all small-scale solar photovoltaic (PV) panel systems that have had certificates validly created against them as of 1 April, 2016, including new installations, upgrades to existing systems and stand-alone (off-grid systems):[1]

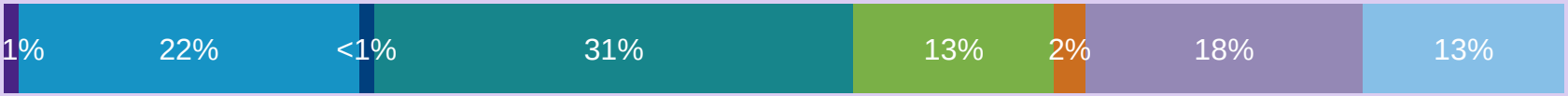
Year	2010	2011	2012	2013	2014	2015	2016	Total
No. Of Solar Panel Systems	198,208	360,745	343,320	200,407	180,137	138,955*	20,989*	1,527,864*

Period of peak rebate tariffs which have subsequently been decreased

The combined rated output of these small-scale solar installation is 4,809,062 kWh.

Over 1.5 million installations to date. Current average system size = 5kW

- The current breakdown of small scale solar installations by state:



QLD has the most solar roof panel systems, followed by NSW and VIC.

* The 2015 and 2016 figures will continue to rise due to how the data is collated, ie. a 12-month creation period for registered persons to create small-scale technology certificates.

[1] Clean Energy Regulator, http://www.cleanenergyregulator.gov.au/RET

Solar Roof Panel Uptake in Australia cont'd

- Although QLD counts the highest number of small-scale solar PV panel systems overall, based on the number of households in each state, penetration is highest in SA (nearly 1 in 3 households), followed by QLD and WA.

State	ACT	NSW	NT	QLD	SA	TAS	VIC	WA	Total Australia
No. Of Installations[1] (2016)	16,655	331,378	5,334	470,953	194,927	26,660	282,295	199,662	1,527,864
No. Of Households[2] (in '000, 2011)	139.1	2,689.5	70.7	1,679.0	660.5	207.5	2,098.8	874.1	8,420.0
Estimated No. Of Installations per Household	0.12	0.12	0.08	**0.28**	**0.30**	0.13	0.13	**0.23**	0.18

- We estimate that nearly 1 in 5 Australian households (18%) have small-scale solar PV panel systems.
- Around two-third of all households in Australia are located in a capital city. Melbourne (VIC) is projected to have the largest numeric increase in households, reaching 2.5 million by 2036, followed by Sydney (NSW) reaching 2.4 to 2.5 million by 2036.[2]

[1] Clean Energy Regulator, http://www.cleanenergyregulator.gov.au/RET
[2] Australian Bureau of Statistics, http://www.abs.gov.au

Solar Roof Panel Uptake in Australia cont'd

- At the end of 2014, more than 15,000 businesses had installed a solar power system.[1]

  The types of businesses include retail stores, accommodation providers, fast food restaurants, chicken and dairy farms, breweries, wineries, office buildings, etc.[1]

- Solar PV uptake has been driven by significant cost reductions in solar technology cost, coupled with rising residential electricity prices and generous government incentives. The nett result is an increase from around 150 MW at the start of 2010 to over 4,500 MW in 2015.[2,]

- Small-scale solar systems supplied 5 terawatt hours (TWh) of electricity in the year to April 2016, out of a total of around 185.9 TWh (or 2.6%).[3]

- The average solar power system size has been growing to around 5.0kW in mid 2015.[2]

- State support schemes for solar (in the form of rebates for feeding into the grid) have been wound back. Households therefore, aim to be more self-sufficient with their system which also opens the door for storage devices.[1]

[1] Clean Energy Australia Report 2014, Clean Energy Council.
[2] AEMC, 2015 Residential Electricity Price Trends Report, December 2015.
[3] http://reneweconomy.com.au/2016/rooftop-solar-now-accounts-for-2-6-of-Australia-Demand (11 May, 2016)

High Rise Buildings in Australia

- High-rise buildings are defined as being **four storeys or higher**.

- There were **281,204** occupied private **dwellings in high rise** buildings in 2011.[1]
- Over **72,000 high rise dwelling approvals (**for individual flats/units) in a 12-month period – accounting for nearly a third of total residential dwelling approvals in 2015. [2,1]
- A further **increase** in residential high rise is expected.

- It is estimated that there are up to **2,500 premium/A-grade** commercial office buildings in Australia.[4]
- In addition, up to **80,000 mid-tier buildings (est.)**, which are the focus of the national **energy productivity improvement program.**[3]

[1] Australian Bureau of Statistics, 2011 Census of Population and Housing, www.abs.gov.au. Note: the next Census will be published in 2017.
[2] http://www.businessinsider.com.au (2 November, 2015)
[3] Mid-tier commercial office buildings in Australia: A national pathway to improve energy productivity.
[4] Ernst & Young: Mid-tier commercial office buildings in Australia.

High Rise Buildings in Australia cont'd

- The **Green Building Council Australia** (GBCA) was established in 2002 to develop a **sustainable** property industry in Australia.

  It promotes green building practices, technologies, design practices and processes, hoping to integrate green practices into building construction and operation. GBCA operates a national environmental rating system for buildings – Green Star.[1]

- According to GBCA's CEO, **23% of CBD office stock** is now **Green Star-rated** and the industry has been extremely effective at tackling the energy efficiency of premium and A-grade building stock.[2]

- **However, a large portion of the market has lagged behind** due to a range of barriers, split incentives, lack of skills and expertise. [2]

- **Mid-tier buildings** are commonly defined as the B, C and D-grade buildings, usually found in the capital city CBDs and fringe areas, suburban centres and some regional towns.[2]

- In 2015 Australia had up to 52 million square metres of mid-tier building stock.[2]

"Improving the energy efficiency of buildings is widely regarded as one of the most cost-effective opportunities to cut greenhouse gas emissions. The mid-tier office sector presents huge opportunities, and our industry can be an example for energy efficiency and greenhouse gas emissions reduction around the world." (Katy Dean, GBCA)

[1] http://www.gbca.org.au
[2] https://www.gbca.org.au/news (18 November, 2015)

High Rise Buildings in Australia cont'd

Residential

- In 2009/10, 11% of the 8.4 million households living in private dwellings, were living in flats, units or apartments (including but not limited to high rise buildings).[1]
- Higher density housing was more common in capital cities, particularly in Sydney where 23% of households were living in flats, units or apartments in 2009/10.[1]
- The 2011 Census found **281,204 occupied flats, units and apartments in 4 or more storey blocks**. This equates to **3.5%** of the total occupied dwellings, up from around 2% in 2001. (Note: Including low rise, the total for occupied flats, units and apartments amounted to just over 1 million dwellings, up from around 900,000 in 20109/10.)[1]
- The **high-rise unit approvals** sector has been a key driver of the lift in overall dwelling approvals over recent years – averaging around **6,000 per month**.[3]
- This is more than double the approvals for high-rise units in 2010/11 (31,496) and nearly four times those in 2009/10 (18,567).[1]
- As city populations grow, we can expect to see more high-rises over the next 5 to 10 years.[2]

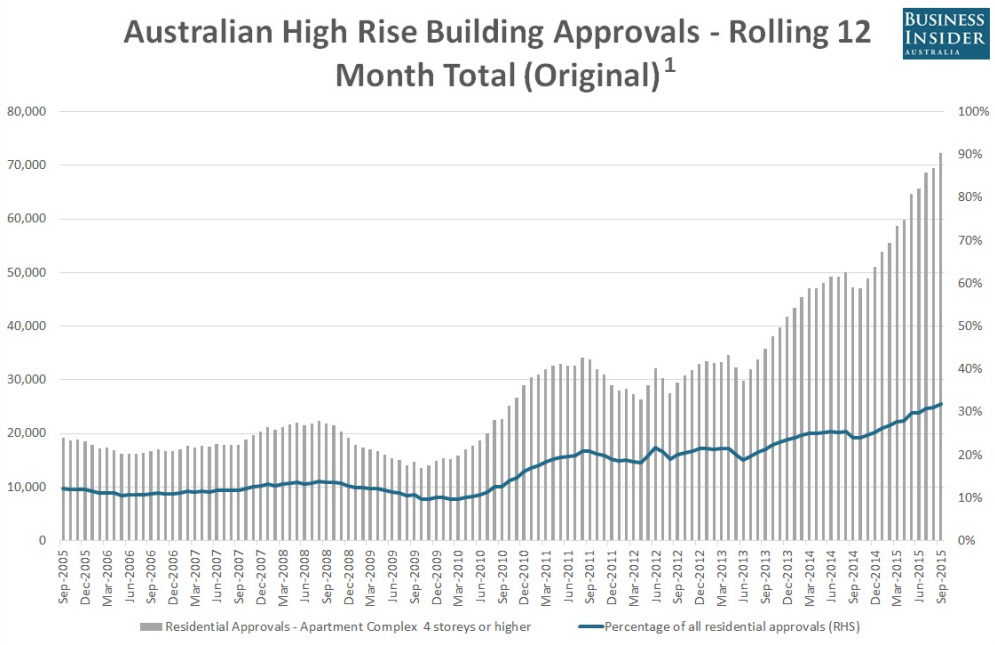
While the number of townhouses and low-rise development approvals have been on the decline since 2010, **developers of high-rise apartments** have stepped into the breach with the **number of approvals skyrocketing**.[4]

1 Australian Bureau of Statistics, ABS Year Book Australia 2012 and 2011 Census of Population and Housing, www.abs.gov.au
2 http://www.domain.com.au/advice/the-rise-of-highrises/ (24 November, 2014)
3 http://blog.corelogic.com (5 April, 2016)
4 Http://www.afr.com/personal-finance/apartmetnt-investments-heaven-or-hell (19 February, 2016)

High Rise Buildings in Australia cont'd

Residential cont'd

- In 2015, nearly one third of Australian residential dwelling approvals (72,260) were for high-rise apartments (in complexes four storeys or higher). Approvals in high-rise complexes grew by 25,026 (or 53%) compared to the previous year.[1]



[1] http://www.businessinsider.com.au (2 November, 2015)

High Rise Buildings in Australia cont'd

Commercial

- The "pathway document" for the **mid-tier commercial office building project** which was commissioned by the Australian Government Department of Industry Innovation and Science, states[1]:
  - Improving energy productivity has been identified as one of three key themes in the Australian Government's Energy White Paper, which sets out Australia's policy approach to energy over the coming years. Improving building performance is widely regarded as one of the most cost-effective opportunities to deliver energy and greenhouse gas emissions reductions.
  - Many premium and A-grade buildings have already undertaken energy efficiency upgrades and either have, or are moving towards, Green Star certification and high (4star+) NABERS Energy ratings. The rest of the commercial office building sector – the B,C and D-grade assets (generally referred to as mid-tier) have lacked significantly in implementing energy retrofits and have lower NABERS Energy ratings (average of 2.4 stars), if at all.
  - Mid-tier buildings are usually found in the capital city CBDs and fringe areas, suburban centres and some regional towns.
  - It is estimated that there could be as much as 64 million square metres of commercial office space in Australia. Whilst the top-tier premium and A-grade buildings make up around 12.7 million square metres (or around 20%), the rest of this space could be classified as mid-tier (around 52 million square metres or around 80%).
  - Extrapolating findings from a report on retrofitting office buildings in Victoria, indicates that there could be up to **80,000 mid-tier buildings** across the country.

[1] Mid-tier commercial office buildings in Australia: A national pathway to improve energy productivity.

High Rise Buildings in Australia cont'd

Commercial cont'd

- According to Ernst & Young, there is no one single or authoritative Australia-wide source that can be referenced in order to answer key questions such as:
  - How many commercial buildings are there in Australia?
  - How many square metres of commercial buildings are there?
  - What is the break-down by size, age, location, ownership, PCA-grade, energy intensity or other key parameters

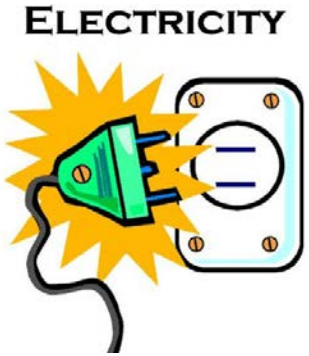
  For example, the PCA's Office Market Report includes approximately 4,500 buildings (totalling nearly 25 million square metres of NLA) located in the 8 capital cities and 17 major towns across the country. Of this, about half, or 12.3 million square metres is mid-tier B, C, and D-grade stock.

  However, we know that there is additional, mostly mid-tier office stock located in many other suburban and regional towns, not included in these figures. In addition, the PCA's Office Market Report does not capture buildings if they are sub-1000 square meters in the CBDs, and sub-500 square metres in the 17 major towns.[1]

[1] Ernst & Young: Mid-tier commercial office buildings in Australia.

Cost of Electricity

Key Indicators - National Average* Consumer[1]



28.72c / kWh at the national weighted average consumption level (2014/2015, excl. GST)

+1.1%
Electricity prices increase at a rate of 1.1% per annum (2013 to 2018(f))

$1,507
Average total annual bill (2014/2015, excl. GST)

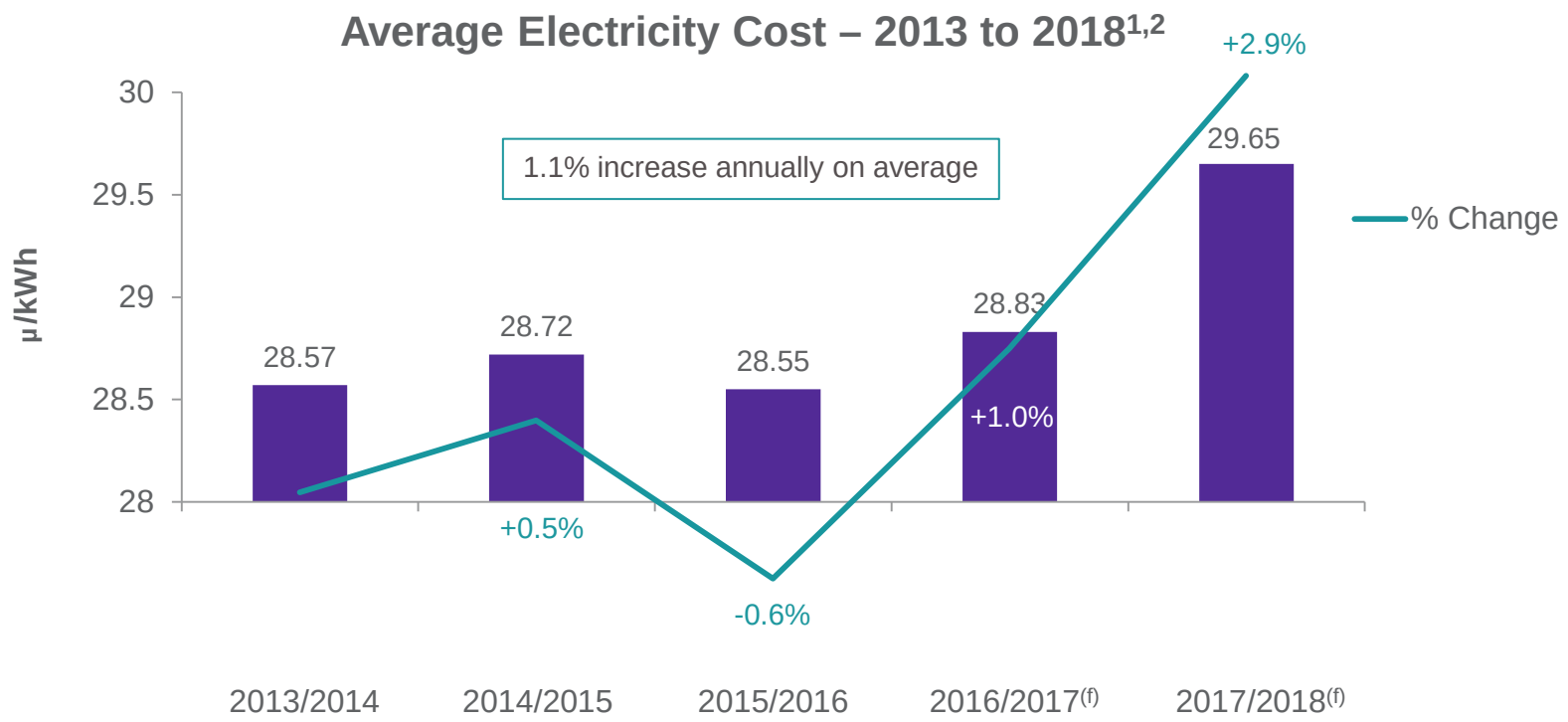
5,248 kW
national weighted average annual consumption (2014/2015)

*Jurisdiction on electricity in Australia is at a ***state or regional*** level. The Australian Energy Market Commission (AEMC) is required to produce a national level summary where the jurisdictional estimates are weighted to determine nationally indicative prices and cost components. (Note: these **national figures are therefore indicative only.**)

[1] AEMC, 2015 Residential Electricity Price Trends Report, December 2015.

Cost of Electricity cont'd

- The cost of electricity is driven by regulated network costs, competitive market costs and environmental costs.



[1] AEMC, 2015 Residential Electricity Price Trends Report, December 2015.
[2] AEMC, 2014 Residential Electricity Price Trends Report, December 2014.

Cost of Electricity cont'd

By State/Jurisdiction

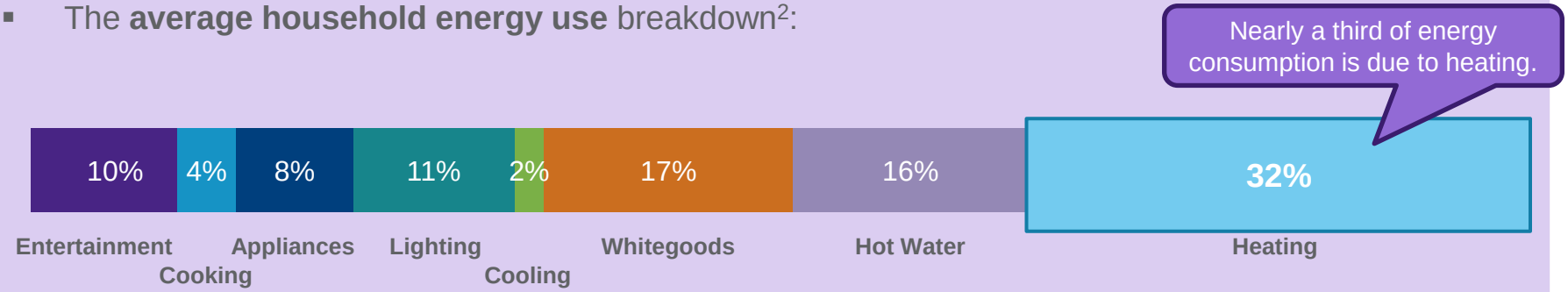
	Expected Increase/Decrease in Residential Electricity Market Offer Prices*[1]			
	2015/2016	2016/2017	2017/2018	Average p.a.
NSW	-3.6%	+1.6%	+2.5%	+0.2%
VIC	+1.5%	-2.6%	+1.1%	-
SA	-7.2%	+6.8%	+3.4%	+0.8%
WA**	n.a.	n.a.	n.a.	+6.2%
SE QLD***	+3.3%	-0.6%	+4.2%	+2.3%

Largest average annual increase expected in WA, followed by South East Queensland.

* For the representative consumer in that jurisdiction.
** Subsidised by the WA Govt – currently under review.
*** SE QLD (South East Queensland) is the biggest jurisdiction in QLD and includes Brisbane and the Gold Coast.
[1] AEMC, 2015 Residential Electricity Price Trends Report, December 2015.

Cost of Electricity cont'd

- The national weighted average consumption level is **5,248kW per year** (in 2014/2015)[1].
- The **average household energy use** breakdown[2]:



- The cost of energy has consistently rated as the top concern for Australian consumers. Almost two thirds of Australians want to be self-sufficient in meeting their energy needs.[3]

  However, Australians' concerns about electricity costs are somewhat tempered by their habits and daily routines. Standby power consumption still accounts for 5.9% of Australia's residential electricity consumption, adding $93 per annum to the average household's electricity bill.[4]

- **Commercial buildings** account for about **10%** of the nation's overall energy consumption and **commercial office buildings** for approximately **2.5%**.[5]

1 AEMC, 2015 Residential Electricity Price Trends Report, December 2015
2 Clean Energy Australia Report 2014, Clean Energy Council.
3 Australian Broadcasting Commission (ABC) News: The Tesla Powerwall and what it means for Australia's energy market. (2 February, 2016)
4 Sydney Morning Herald, http://www.smh.com.au (22 May, 2016)
5 Mid-tier commercial office buildings in Australia: A national pathway to improve energy productivity.

Potential Cost Savings by Generating Solar Energy

- **Government incentives** in the form of small-scale technology certificates (STCs) to install solar systems **fluctuate** depending on how many people are installing.[1]

  Households are currently eligible to receive up to $5,168* off the upfront price of a 6.6kW system or $3,914* for a 5kW system. The highest possible value of the incentives is **capped** by the Government **at $5,440*.**

- **State support schemes** for solar (in the form of rebates for feeding into the grid) are being wound back, meaning people are now more focused on installing systems that cover the electricity they use themselves. [2]

- For example in NSW ...

  Some 146,000 households signed up for the NSW solar bonus scheme, which offered homeowners 60 cents or 20 cents feed-in tariffs per kilowatt hour for the solar energy they put back in the grid. [3]

  This scheme will end on 31 December 2016, meaning tariff rates will drop to around 6 cents, which is less than the amount homeowners are charged for accessing electricity from the grid. [3]

When there are a lot of people installing solar, the value of the incentive falls; when there are a few, it rises.[1]

NSW homeowner Dr Kwan estimates he will go from being paid $1,292 each quarter to having to pay $475 when the scheme ends.[3]

* Based on a calculation for STC zone 3 (eg. Sydney, Brisbane, Perth) at STC price of $38/kW.

[1] Solar Market Newsletter (21 May 2016)

[2] Clean Energy Australia Report 2014, Clean Energy Council.

[3] http://www.smh.com.au/business/consumer-affairs/what-households-need-to-do-before-the-end-of-the-solar-bonus-scheme (29 May, 2016)

Potential Cost Savings by Generating Solar Energy cont'd

- However, the owner of a Tesla Powerwall fitted to his existing solar system, anticipates a **saving of up to $1,500** on electricity annually.[1]
- At the end of 2014, more than **15,000 businesses** had installed a solar power system, **saving more than $64 million** on their power bill each year.[2]
- Initiatives to reduce energy costs include[2]:
  - ***Storage*** – the biggest barrier to the wider adoption of storage has been the price of both household units and large-scale technology.
  - Innovative funding models where the solar companies offer to carry much of the risk and deliver a guaranteed return to commercial clients.
  - Solar power purchase agreements (PPAs) where a third party installs a solar system on the roof of a home or business and then supplies that customer with the electricity it produces (at a lower price than the rates offered by electricity retailers).

Therefore, on average, **cost savings** by generating solar energy add up to **$4,267** per solar power installation per year in the **commercial** sector.

Most estimates put the current share of behind-the-meter consumption – the output from rooftop solar which is consumed within households or businesses without ever being exported back into the grid – at below 50%. (Hugh Saddler, Pitt & Sherry)[3]

[1] Daily Telegraph, www.dailytelegraph.com.au/ (10 May, 2016)
[2] Clean Energy Australia Report 2014, Clean Energy Council.
[3] http://reneweconomy.com.au/2016/rooftop-solar-now-accounts-for-2-6-of-Australia-demand (11 May, 2016)

Outlook for Energy Storage

- According to GTM Research, **Australia's energy storage** market is expected to expand by a staggering 37-fold between 2015 and 2020 to an **annual installation rate of 244 megawat**ts.[1]
- Bloomberg New Energy also forecasts 33 gigawatts of battery storage in Australia by 2040 and 37 gigawatts of rooftop solar power.[1]
- The Grattan Institute estimates costs would need to fall by two-thirds to make buying a battery worthwhile, although with payback periods of seven to 10 years for some households, it already makes sense for some. Morgan Stanley calculates the home battery market in Australia could reach $24 billion.[2]
- According to IHS Technology, around 30,000 Australian households will have solar plus battery systems operating in the next 2 years.[3]
- The Australian battery storage market is expected **to increase more than 10-fold this year**, growing from fewer than 500 installations in 2015 to **more than 5,000 by the end of 2016.** This increase places Australia in the top 5 markets for distributed energy storage in 2016.[3]
- Between 2016 and 2018, behind-the-meter residential and commercial storage installations are expected to double each year, exceeding 200MW of installed power capable of storing 250MWh of electricity, compared to less than 3MW at the end of last year.[3]

"Storage has the potential to revolutionise the Australian Energy sector. It allows consumers to more fully manage their energy use, complement their onsite renewable energy generation, help with the management of peak demand and fundamentally change the role of networks and the traditional energy system." (2014 Clean Energy Australia Report)

[1] Benzinga.com; Tesla enters the Australian battery market (18 February, 2016)
[2] Australian Financial Review: Tesla Powerwall buoys grid operators. (23 December, 2015)
[3] www.esdnews.com.au (March, 2016)

Outlook for the Tesla Powerwall

- According to Innovative Technologies, the Solar Shutters™ technology is compatible with the Tesla Powerwall.

  The current residential product model for the Tesla Powerwall is to be connected and recharged by solar roof panels. Due to their nature, this option is not applicable to residential and commercial high rise buildings. The Solar Shutters™ are designed to make this option possible.

- The first installation of the Tesla Powerwall in Australia occurred in January 2016 in Sydney.[1]
- The Powerwall is a 7 kWh lithium-ion-battery system that stores electricity generated from rooftop solar panels (or PV panels) during the day so that electricity can be used at night during the peak-usage times.[2]
- Powerwall residential systems are available to Australian residents via dealers including CSR Bradford, Origin Energy, Imply Energy, Sun Edison Australia and Natural Solar.[3]
- The Managing Director of Natural Solar states that "Natural Solar has witnessed and unprecedented amount of customer interest in Tesla in recent months."[3]

Australia ranks alongside North America and Germany among Tesla's three priority markets for Powerwall not only because of the popularity of solar panels but also increasing energy prices, and state feed-in tariffs, which, while declining, will help drive uptake of home battery storage. (Heath Walker, Tesla Australia)[2]

[1] http://ecogeneration.com.au/news
[2] Australian Broadcasting Commission (ABC) News: The Tesla Powerwall and what it means for Australia's energy market. (2 February, 2016)
[3] Benzinga.com; Tesla enters the Australian battery market (18 February, 2016)

Outlook for the Tesla Powerwall cont'd

- The CEO of Solar Analytics estimates that installation rates will surge ten-fold in 2016 to around 40,000. NSW is expected to be the biggest market initially, particularly when households lose their premium feed in tariff at the end of this year. Steve Blume, from the Australian Energy Council, says 60,000 households may choose battery storage in the first year after losing the premium tariffs.[1]
- The efficiency of the battery is 92 per cent, so although it has a 7kWh capacity, the Powerwall's working capacity is more like 6.4kWh. Tesla also has a 10kWh weekly cycle version intended for back-up applications, but it is the 7kWh version you will see in most home installations.[2]
- The Tesla Powerwall typically comes with a 10-year warranty period.
- One of the Australian providers of the Powerwall, Natural Solar, says that there are only two inverters currently on the market which are compatible with the Powerwall, so most existing solar panel owners will need to obtain a new inverter.[2]
- For those who do not already have solar panels, the Powerwall can be purchased as part of a complete system that includes solar panels and an inverter.[2]
- A solar array large enough to power both the home and charge the Powerwall is required – for most homes that would mean at least a 4kWh array.[2]
- For those who already have solar panels, the Powerwall and a compatible inverter will cost between $12,000 and $12,500 depending on the inverter chosen.[2]

[1] http://reneweconomy.com.au/2016
[2] Australian Broadcasting Commission (ABC) News: The Tesla Powerwall and what it means for Australia's energy market. (2 February, 2016)

Outlook for the Tesla Powerwall cont'd

- The first household to have the Powerwall fitted to an existing solar roof panel system paid about $10,000 and is anticipating a saving of up to $1,500 on electricity annually.[1]
- Energy companies are selling **Powerwall packages** for **between $13,990 and $16,500** (GST inclusive) and with consideration to rebates for small-scale technology certificates (STCs).[2]
- Although depending on energy needs and the number of people living in a household, a 7kWh battery is unlikely to be enough to make most households independent of the electricity grid. It is possible to install two or more battery units to increase the storage capacity.[2]
- Almost two-thirds of Australians want to be self-sufficient in meeting their energy needs and while battery systems will not give complete independence for most consumers, it does offer a bit more control.[2]
- As more and more households adopt them, **it is expected that prices of battery storage systems will halve again within the next five years**.[2]
- Solar panels have also gotten cheaper, with the Climate Council reporting a 75 per cent drop in price over the past five years.[2]
- With the global market for solar panels and battery storage expected to grow ten-fold by 2020, the demand for battery systems like the Powerwall should have flow-on effects on prices as economies of scale kick in.[2]

(Note: There are a number of other brands of battery storage systems in the Australian market, including Redflow and Sonnen, whilst Panasonic, LG and Sunverge are said to be launching battery sales in Australia.)

[1] Daily Telegraph, www.dailytelegraph.com.au/ (10 May, 2016)
[2] Australian Broadcasting Commission (ABC) News: The Tesla Powerwall and what it means for Australia's energy market. (2 February, 2016)

Some Other Technology Developments

- A team from the University of NSW (UNSW), led by Professor Martin Green and Dr. Mark Keevers, has pushed **sunlight-to-electricity conversion** efficiency to **34.5%** - establishing a new world record for unfocused sunlight.[1]
- Another UNSW team, led by Dr. Xiaojing Hao of the Australian Centre for Advanced Photovoltaics at the UNSW School of Photovoltaic and Renewable Energy Engineering, have achieved the world's highest efficiency rating (7.6% efficiency in a 1cm^2 area) for a full-sized **thin-film solar cell** (for facades, roofs and windows), using a thin-film technology known as CZTS. Unlike its thin-film competitors, CTZS cells are made from abundant and non-toxic materials.[2]
- Chinese scientists have created new solar panel technology that transforms the **power of rain** into electricity, according to Australia Network News.[3]

CZTS's cheapness, benign environmental profile and abundant elements may be the trigger that finally brings architects and builders onboard to using thin-film solar panels more widely in buildings. (Dr. Hao, UNSW)[2]

[1] http://www.zmescience.com/ecology/renewable-energy-ecology (May 2016)
[2] http://wwww.esdnews.com.au/zero-energy-building-a-step-closer-with-solar-breakthrough (3 May, 2016)
[3] http://wwww.esdnews.com.au/new-solar-panel-turns-rain-into-power (13 April, 2016)

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