



ClearVue^{PV}

INVESTOR PRESENTATION
CLEARVUE TECHNOLOGIES LIMITED

Presented by: Victor Rosenberg, Executive Chairman – 19 & 21 March 2019

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Introduction



At ClearVue, we offer a powerful renewable energy solution that incorporates solar energy generation into transparent glass. ClearVue Technologies Limited (ASX: CPV) operates in the Building Integrated Photovoltaic (BIPV) sector which involves the integration of solar technology into building materials, specifically glass and building surfaces to produce localised renewable energy.

ClearVue's glass technology represents an untapped opportunity to use one of the worlds most used building materials for energy generation – clear GLASS

Our Mission & Motivation

- Our mission is to capture the energy that surrounds us through the use of innovative building materials. We believe that the future of energy is localised generation – energy generated where it is needed
- We are driven by green building goals and believe that our technology can assist building owners and developers achieve their own green and sustainability goals - including Net Zero buildings and even carbon negative buildings in some cases.



ClearVue Highlights



- ❑ Smart building technology that uses ultra clear glass to convert sunlight into energy
- ❑ Global market opportunity
- ❑ Patented technology – 34 granted patents and 39 patent applications throughout the World
- ❑ Australian Government support – \$1.6m grant from the Australian Federal Government to build a grid-independent greenhouse in early 2019

Key Targets:	Key Specifications:
❑ Agriculture and Horticulture	❑ Ultra clear - up to 70% transparency (VLT/AVT)
❑ Commercial and Residential	❑ Power generating - 30 W/m ² peak power (anticipated ≈ 50 W/m ² possible through ongoing R&D)
❑ Public Amenities	❑ Insulating - U-factor 1.26 W/(m ² °K)

Corporate Snapshot



- ❑ ClearVue secured \$5m through IPO and listed on the ASX on 25 May 2018
- ❑ High % of company shares are escrowed for 24 months – 39,026,956 million in total
- ❑ Tight free float with top 20 holding 60.5%

ASX Code: CPV (as at 8 Feb 2019)	
Ordinary Shares	97,730,300
Options	63,148,024
Performance Shares	13,000,000
Market Capitalisation (Share price \$0.35)	\$34 million
GICS Classification	Capital goods

Board and Management

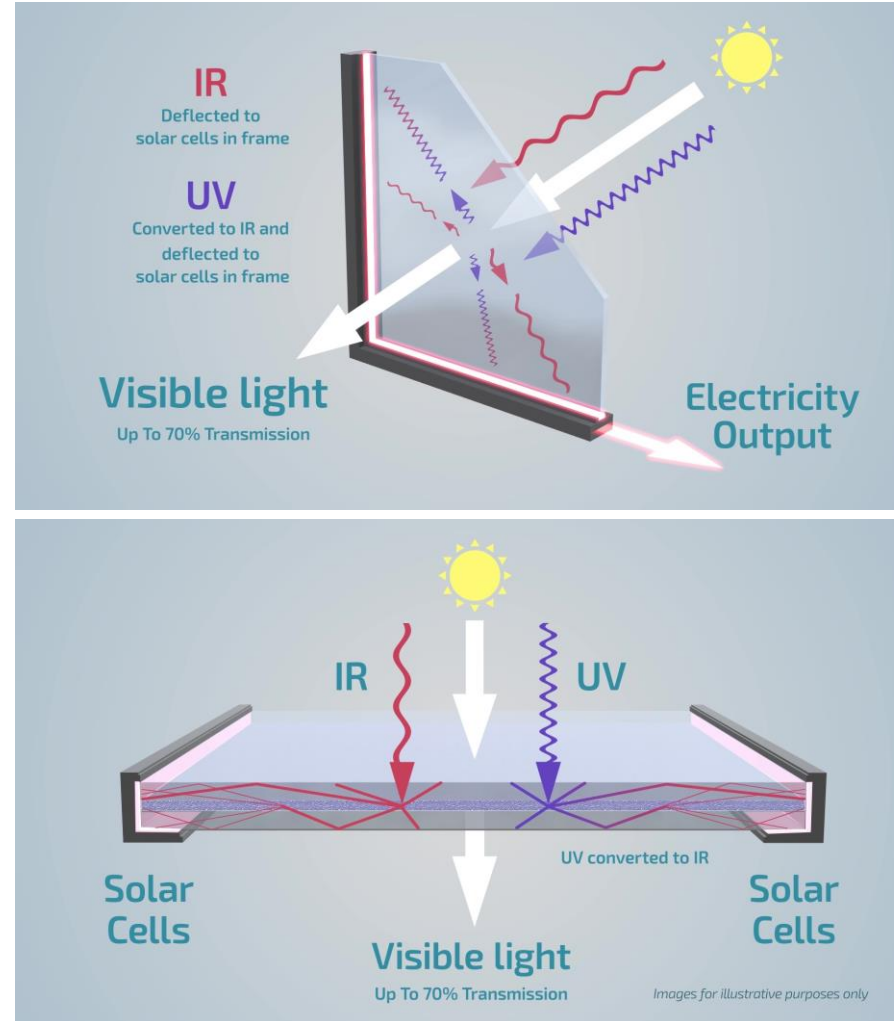


Victor Rosenberg	Jamie Lyford	Brett Tucker / Deborah Ho	Sean Rosenberg	Stuart Carmichael	Ivan Wu
Executive Chairman	General Counsel & Corporate Officer / Director	Joint Company Secretaries	Non-Executive Director	Non-Executive Director	Non-Executive Director
Serial Entrepreneur. Globally recognised for his contributions to glass industry. Extensive business experience in senior management and sales.	IP and licensing lawyer with over 20 years experience. Previously worked in BHP, IT company ATOS and ran Western Australian Government Innovation Centre	Company Secretaries to a number of ASX listed and private companies and has been involved in numerous public corporate transactions and acquisitions. Both are Chartered Accountants with a strong corporate and compliance background.	Member of the Institute of Chartered Accountants with over 10 years professional experience in finance, auditing and accounting of listed corporations	Member of the Institute of Chartered Accountants with over 20 years accounting and corporate finance experience. Currently Non-Executive Chairman of Schrole Limited (ASX:SCL) and Serpentine Limited (ASX:S3R) and Non-executive Director of De.mem Limited (ASX:DEM)	Corporate adviser to various private & ASX listed companies with over 20 years of corporate and commercial experience in the IT, resource and gas industries

ClearVue's Technology

An overview of ClearVue's technology

- ❑ Visible light (VIS) passes through the glass
- ❑ Micro & nano particles interact with Ultra Violet (UV) radiation which is down-converted to longer wavelengths and scattered along with Infrared (IR) light to the edges of glass
- ❑ IR is collected by PhotoVoltaic (PV) cells - Produces electricity
- ❑ Reduces heat and blocks damaging UV and IR radiation
- ❑ Insulation properties reduce heating and cooling costs
- ❑ ClearVue has extensive IP protection on its technology and products



Video: Technology and Product Opportunities Explained

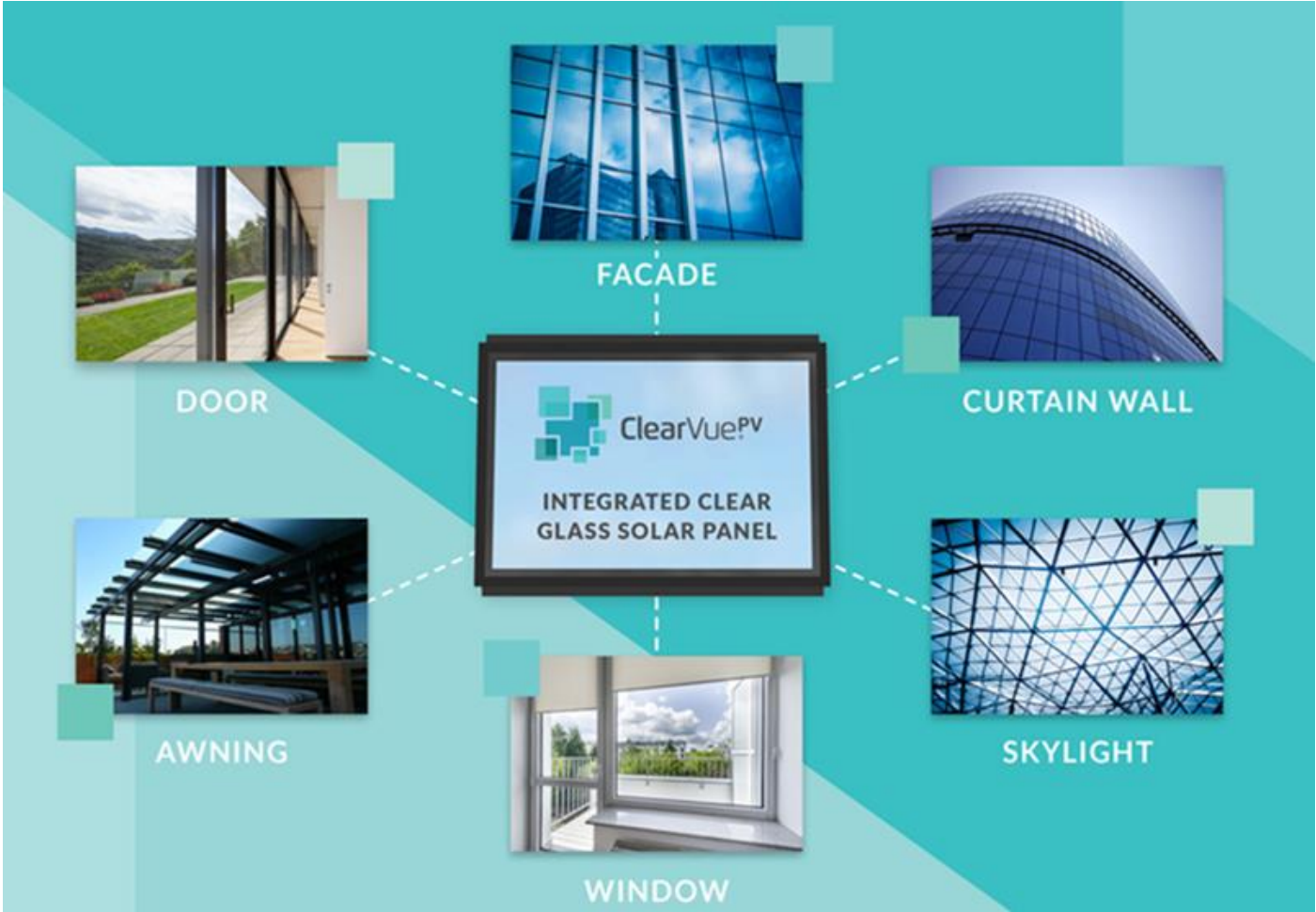


Click on blank
screen on left to
play video.

OR play from:

<http://www.clearvuepv.com/products-solutions/technology/>

Product Opportunities



ClearVue's Research Partners

Edith Cowan University

ClearVue has partnered with Edith Cowan University (ECU) in Perth Western Australia since 2011 to develop the core IP that can convert a pane of glass into a luminescent solar concentrator (LSC). ClearVue has entered into an exclusive agreement for contracted R&D for the development of ClearVue's core technologies.

ECU is also working on a new research project to develop all-inorganic micropatterned clear thin film solar cells onto glass which we hope to integrate into the exiting products and as a new stand alone technology.



Nanyang Technological University

ClearVue has signed a collaboration agreement for with Nanyang Technology University (NTU) (Singapore) and Singapore HJJ Alliance for Research and Enterprise Ltd research to explore printing of solar PV amongst other things.

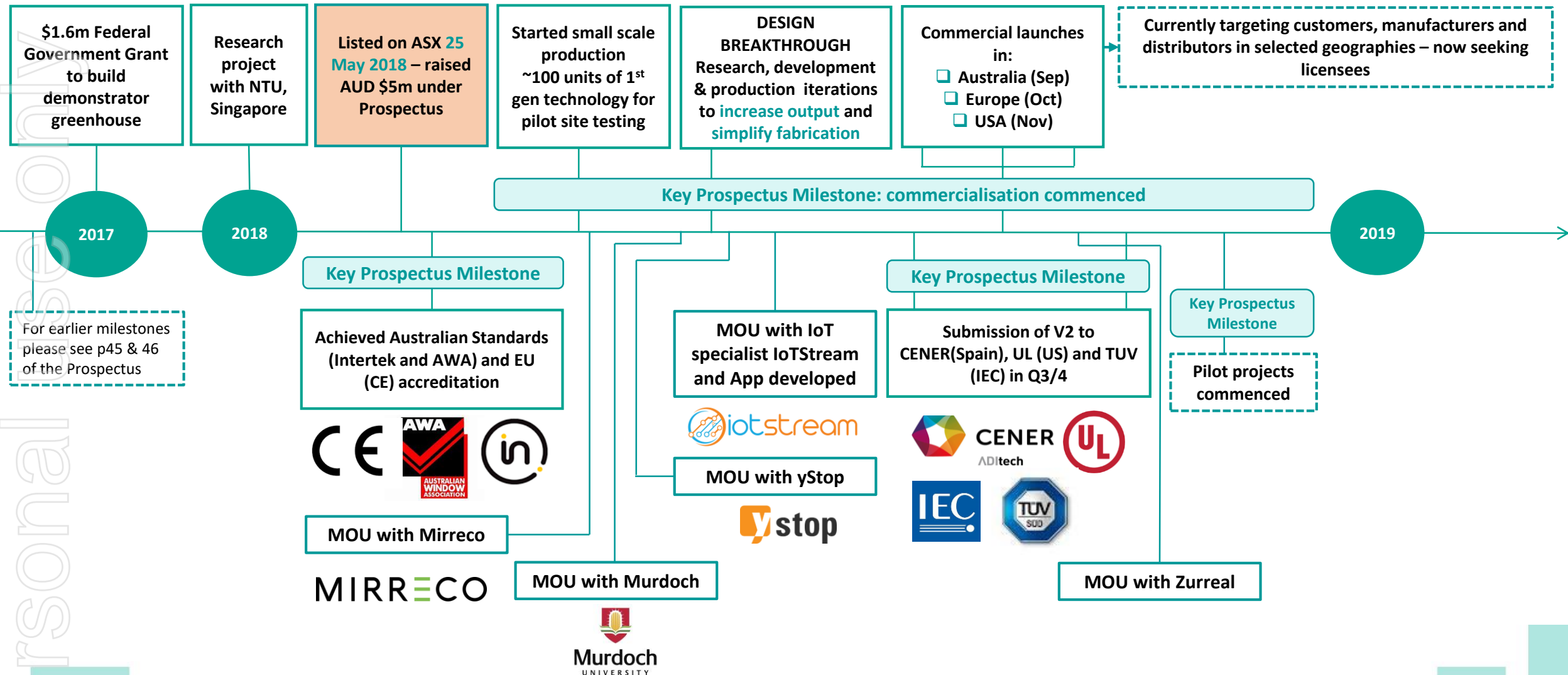


University of New South Wales

ClearVue has signed a Research Agreement with the World reknowned UNSW School of Photovoltaic and Renewable Energy Engineering to explore the use of quantum dots in combination with ClearVue's existing LSC technology or as a stand-alone for new applications.



Company Milestones



Product Launches



Greenbuild - Nov 2018
Chicago

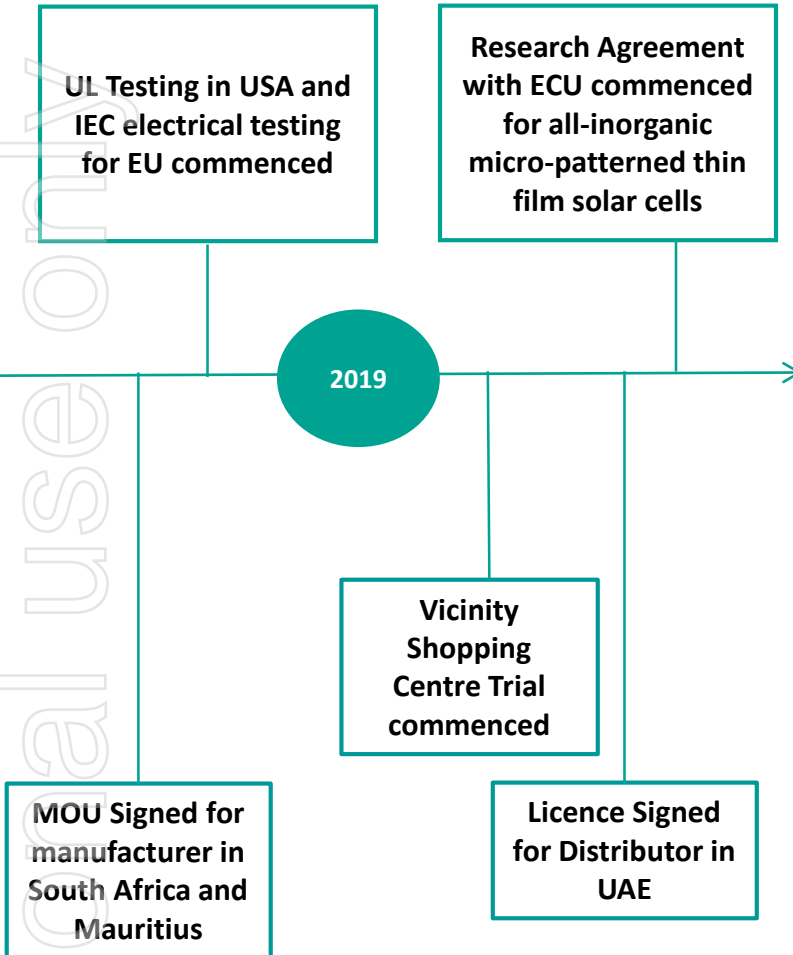


Glasstec – Oct 2018
Dusseldorf

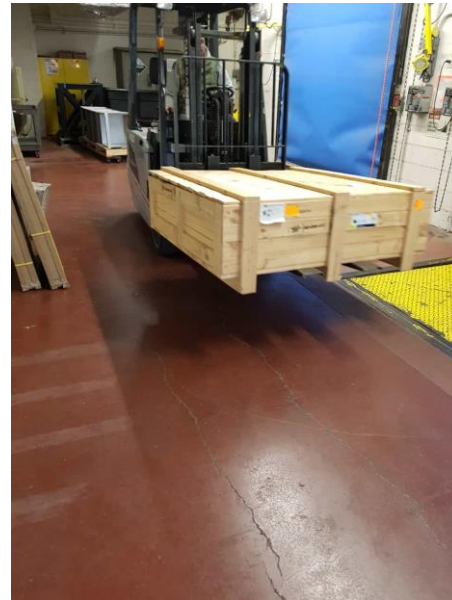


Upcoming Milestones

- ❑ Complete various demonstration projects
- ❑ Incorporate ClearVue's technology into a commercial building
- ❑ Complete and achieve **IEC** and **UL** accreditations by end Q2 2019
- ❑ Continue and complete commercialisation steps during 2019
- ❑ Continue discussions throughout 2019 with potential licensees
- ❑ Continue R&D and product development work
- ❑ On Track for sales commencing latter half of 2019



UL Testing for US Market commenced Q4

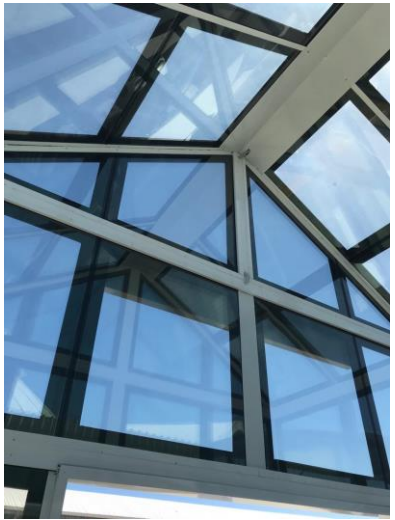


Video: Pilot Project – Vicinity Centres' (ASX: VCX) Shopping Centre at Warwick Grove WA



Personal use only

Video: Pilot Project – Vicinity Centres' (ASX: VCX) Shopping Centre at Warwick Grove WA



Small Home Applications

Mirreco's hemp based eco mini-home project on track to commence construction near Fremantle WA at Landcorp's Knutsford Precinct (<https://www.knutsford.com.au/>) in June/July 2019

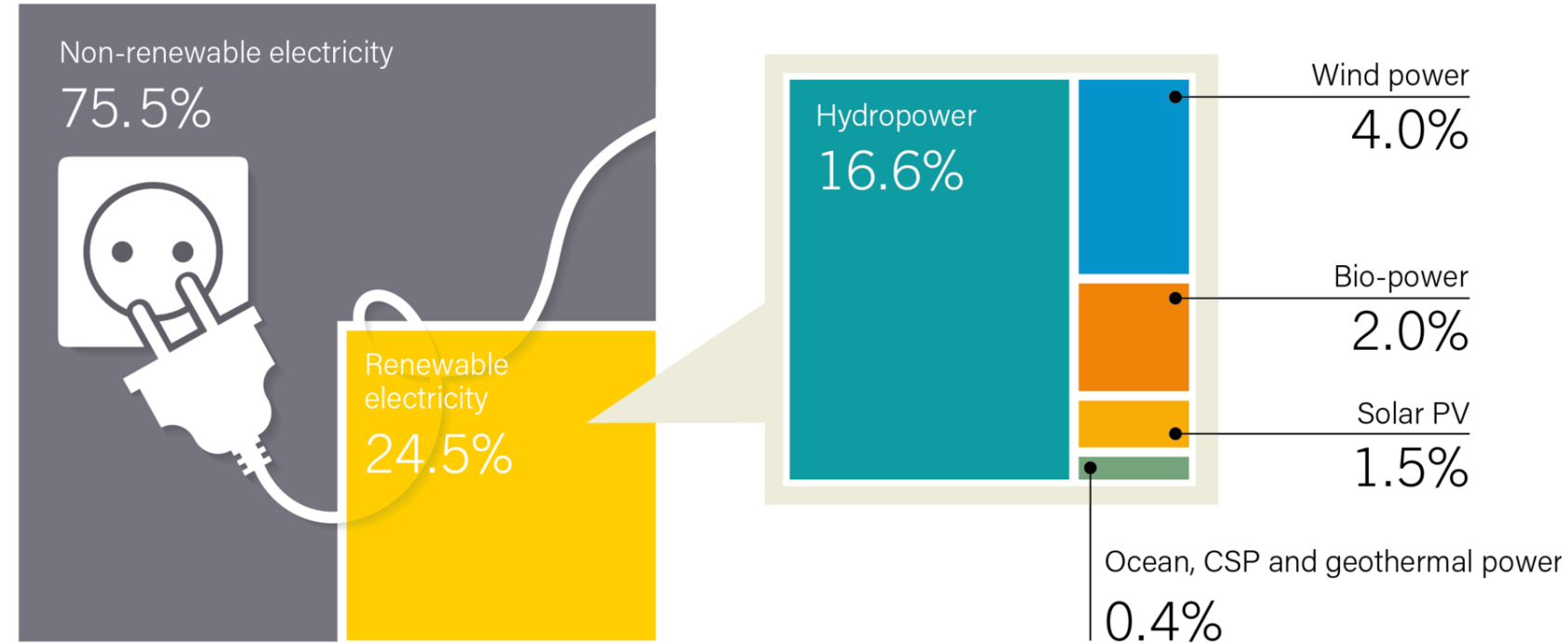


Worldwide Energy Generation

The sun's potential for power generation far exceeds that of all other renewable energy sources. However, solar power barely registers in the world's renewable energy portfolio with only 23,322 terawatt-hours (TWh) of a potential **≈750,000 TWh** available from solar*.

Presently solar generation accounts for only a fraction of a percent of total electrical output – much less than hydropower or wind energy, which until recently have been cheaper to produce.

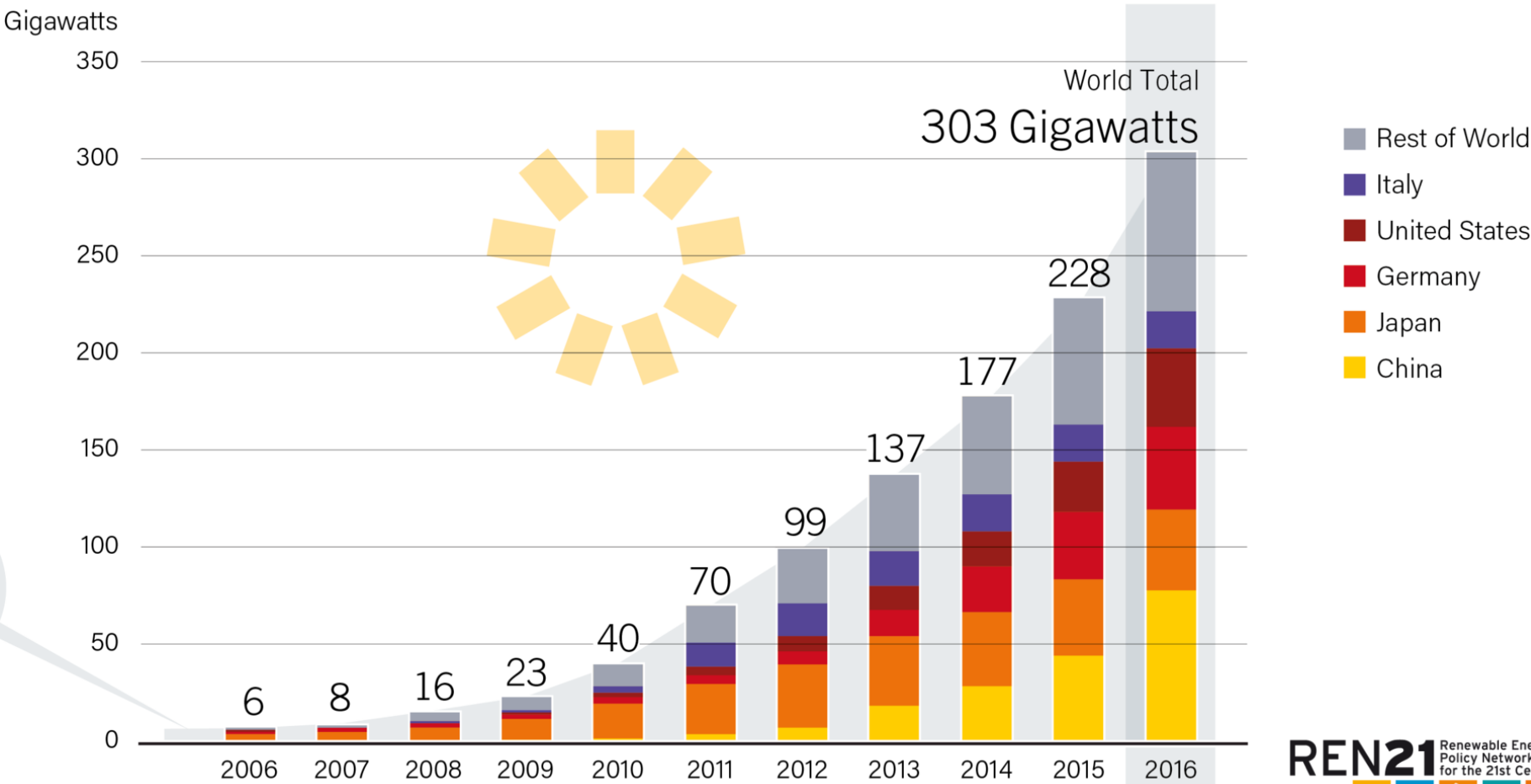
Estimated Renewable Energy Share of Global Electricity Production, End of 2016#



* As at 2008 see: https://en.wikipedia.org/wiki/Electricity_generation#Production_by_country

Source see: REN21 Renewables 2017 Global Status Report

Solar PV Global Capacity*



*by country and region 2006 – 2016 – Source see: REN21 *Renewables 2017 Global Status Report*

Market Opportunity

Traditional Roof Solar and PV Array Opportunity

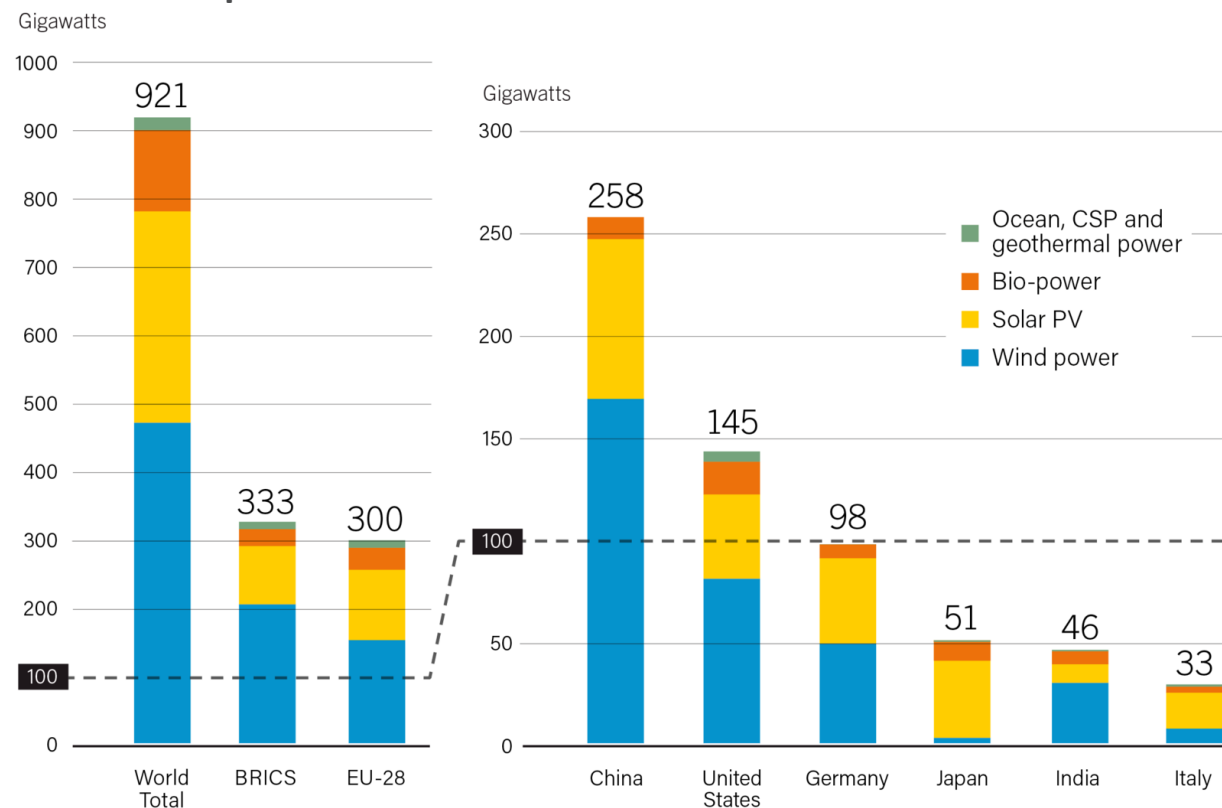
- Worldwide growth of traditional photovoltaics has averaged 40% per year from 2000 to 2013
- Total installed PV capacity reached **303 GW at the end of 2016** with China having the most cumulative installations (78 GW)
- According to the latest “Global Solar Demand Monitor” from GTM Research, installations in 2018 will reach 82.5 gigawatts#. After that, annual installations are predicted to exceed 100 gigawatts each year until at least 2022.

All of these figures (and the stats on earlier slides) largely ignore the impact of BIPV!

#(originally forecast at 104 gigawatts but downgraded due to reduced activity in China)

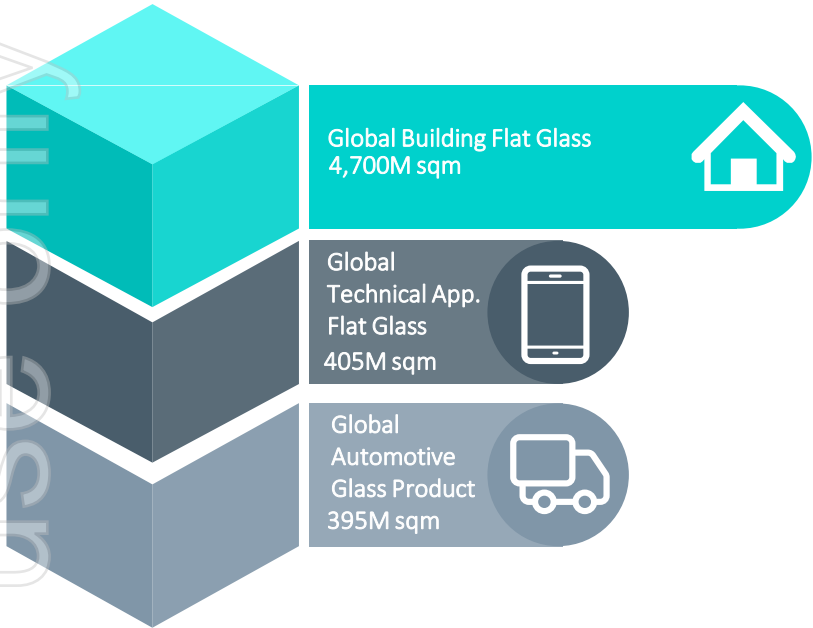
* BRICS – the emerging national economies of Brazil, Russia, India, China and South Africa.

Renewable Power Capacities in World, BRICS*, EU-28 and Top 6 Countries - 2016



Market Opportunity

Global Glass Market



Global Glass Market Suppliers



- ❑ Total Glass Market Size 5,500 sqm pa in 2011 (NSG Group and the Flat Glass Industry Report 2011).
- ❑ The construction glass industry is predicted to reach **USD \$111 Billion** by 2020 (Technavio)
- ❑ Global green building expected to double by 2018 (World Green Building Council)

ClearVue's Opportunity

Market Drivers

US\$310 Billion

investment into clean energy in 2014+ 16%



5,500 million

square metres of glass produced each year

€ \$23 Billion

Value of the flat glass market



37%

increase in global energy demand

Sources:

United Nations, Climate Spectator, NanoMarkets

Forbes - china-leads-the-world-in-renewable-energy-investment report July 2012

<http://www.climatespectator.com.au/news/uk-track-hit-2020-green-energy-targets-decc>

http://www.rechargenews.com/business_area/politics/article323311.ece

The Building Integrated Photovoltaics Opportunity

- ❑ Global market for building-integrated photovoltaic (**BIPV**) technologies was USD **\$2.4 billion** in **2016**
- ❑ Market to grow to USD **\$4.3 billion** by **2021** (with a compound annual growth rate (CAGR) of 12.2% for the period 2016 to 2021).

Source:

<https://www.bccresearch.com/market-research/energy-and-resources/building-integrated-photovoltaics-markets-report-egy072C.html>

ClearVue's Business Model



ClearVue will derive revenues from:

- ❑ **Direct sales** (initially) – by sale and supply of the Company's assembled products direct to distributors and licensed channel partners worldwide. The company will also continue to sell technology/product components to its licensees;
- ❑ **Licences** - the Company intends to charge a fee to manufacturers and distributors for the right to manufacture or distribute and sell the ClearVue product; and
- ❑ **Royalty payments** - the Company intends to charge a flat royalty fee per sqm of ClearVue glass/technology sold by a manufacturer or distributor business, with the rate to be determined.



Commercial & Residential Applications



large market opportunity – at the moment demand for BIPV solutions is limited by product characteristics
- no high energy performing and architecturally accepted transparent colourless products except from ClearVue

- ❑ By 2025 there will be more than 29 mega cities with 10 million plus people*
- ❑ Buildings can be a significant source of their own energy needs
- ❑ Insulation properties reduce heating and cooling costs
- ❑ Building owners obtain a faster payback from energy generating structures
- ❑ Skylights are the fastest new window market globally

* Source: UN Report on World Urbanisation & World Energy Outlook Report 2014



Public Amenities & Agriculture



Free energy in public places, e.g. libraries, or charge your mobile phone at a bus stop

Provide energy in developing countries in public buildings such as schools without large plots of adjacent land needed for solar arrays

Awnings, Atriums, Skylights, Road barriers

Waste management services and water purification

Powering IoT sensors and building electronics

Food and food security is a global multi billion dollar industry. Key markets are China, Europe and USA.

Technology presents opportunity for self powering greenhouses



Indicative Power Performance Modelling – Commercial Building

Assumptions Used for Reference Model:

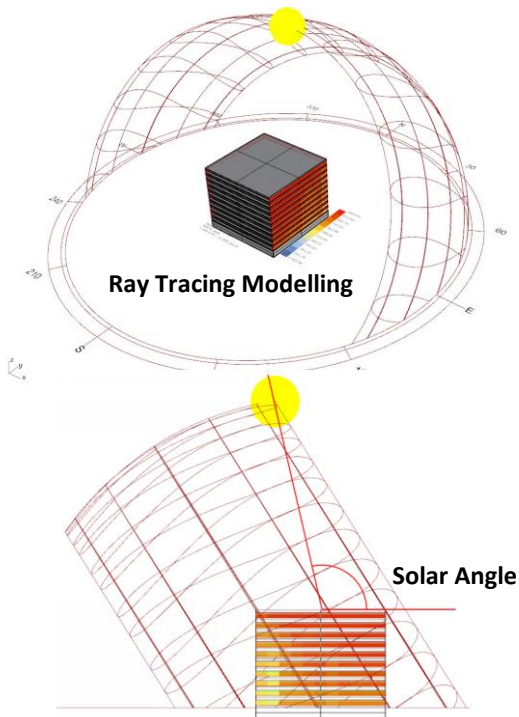
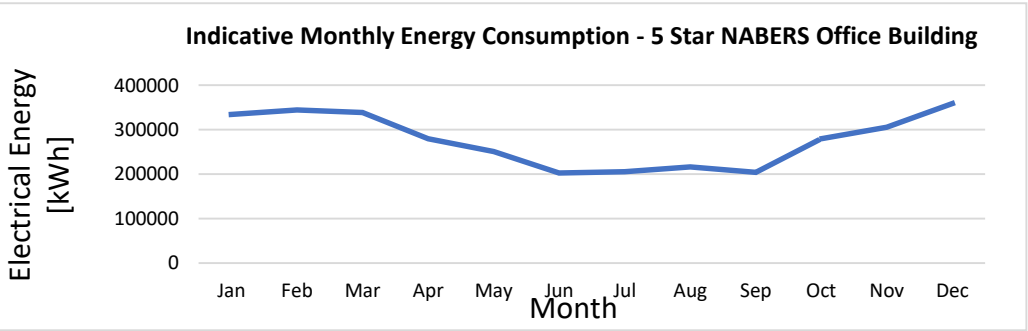
- Modern 5 star NABERS office building of 25,000m² of lettable area
- North, West and East facades with ClearVue glazing (only) – other configurations considered
- 2.1x1.2m CV PV panel used – compatible with standard spandrel type facades
- Analysis against industry standard electricity consumption for real world cost-benefit
- System proportional energy use taken from previous ARUP CBD high-rise offices projects
- ClearVue electrical generation can be mapped against different building systems

ClearVue Window Properties:

- Centre of pane performance of SGHC of 0.41 and U-Value 1.26
- PV strip (not including the window) efficiency of 16.7%
- Nominal window total efficiency of approximately 3.3%
- Total efficiency is dependant on angle of incidence of sunlight – ARUP conducting further work required to establish full angular dependency for added modelling detail

Angular Dependency	
Angle [°]	Approximate Power [W]
0	32.22
15	32.98
25	29.21
80	48.4*

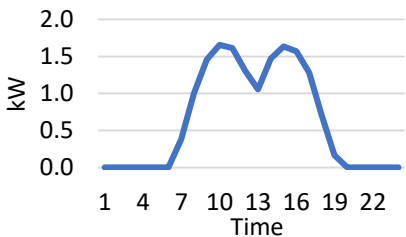
*Calculated from other data - TBC



In the reference model:

- **ClearVue generates 3,980 kWh/year per floor**
- The tenancy lighting for the typical floor uses 35,000 kWh/year per floor
- **ClearVue can supply 10-20% of the lighting power via window-generated renewable energy**
- **Model ignores 40% energy savings made through ClearVue's triple glazing and low-e**
- further/other opportunities:
 - IOT sensors, building automation systems, electrochromic switchable glass, actuators and automated blinds
 - ICT, communications and network gear, UPS
 - dedicated green charging zones for electric bikes and phones etc.

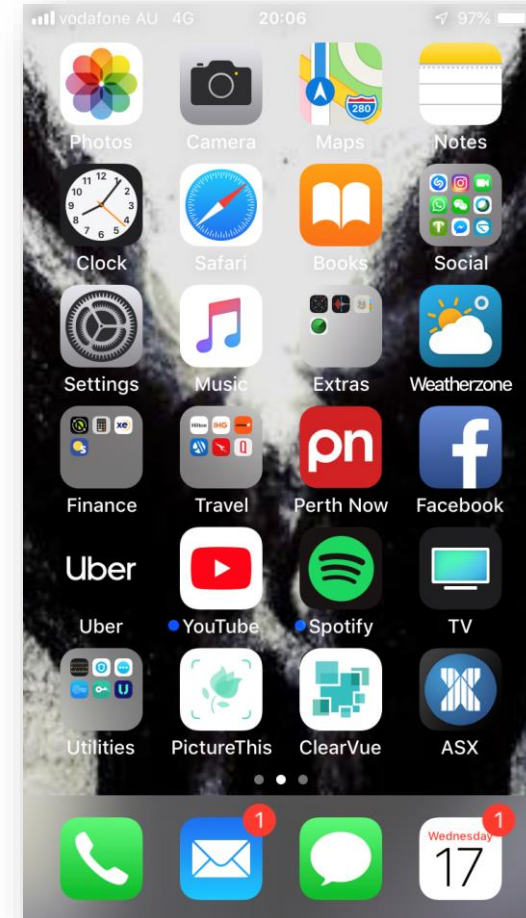
ClearVue Window System - Hourly Performance For a Typical Floor



Office LED Lighting

Smart Window Solutions

(Monitoring, sensors/sensing and IoT integrations)



Photographs of actual Apps developed for ClearVue with IoT partner IoTStream (www.iotstream.io)

Smart City Integration

Industry experts estimate that smart cities will demonstrate impressive increases in efficiency: using many of the concepts in the image and on the next slide, cities can expect to improve energy efficiency by 30% in 20 years.

Simultaneously, it's estimated that the broad market for smart city products and services will be worth [\\$2.57 trillion](#) by 2025 (growing at 18.4% per year on average) (PR Newswire).



Smart City Integration - Opportunities



Smart city solutions will fall into six broad categories:

1. Infrastructure

Smart lighting is one of the most important solutions that will be implemented in citywide infrastructure. While smart lighting sounds trivial it is worth noting that lighting alone consumes a whopping 19% of the World's total electricity.

2. Buildings

Heating, energy usage, lighting, and ventilation will be managed and optimized by technology. ClearVue PV panels will be integrated into building fabric, replacing traditional materials.

3. Utilities

Smart grids (used for energy consumption monitoring and management), water leakage detection, and water potability monitoring are just some smart city aspects on the utilities side. Any low powered monitors can be powered by ClearVue PV locally.

4. Transport

Intelligent, adaptive fast lanes and slow lanes (cycling, walking) will be implemented, while charging stations through the city will power EVs.

5. Environment

Air pollution control, renewable energy, and waste management solutions will make for greener cities. Rooftop gardens or side vegetation will be integrated into building designs, to help with insulation, provide oxygen, and absorb CO2.

6. Connectivity

There will be citywide Wi-Fi for public use, while real-time updates will provide citizens information on traffic congestion, parking spaces, and other city amenities. ClearVue PV when integrated into public buildings, glass walkways, road barriers, bus stops etc. will provide localised grid-independent power for city wide WiFi and 5G networks.

Summary



- ❑ ClearVue has a breakthrough Building Integrated Photovoltaic (BIPV) technology protected by a strong global patent portfolio;
- ❑ ClearVue has a strong management team and Board focussed on global successful commercialisation of the ClearVue technology and product
- ❑ ClearVue has completed Australian standards (Intertek) certification testing completed and EU certification (CE) for its glazing with additional product certification commenced for US market (UL) and for EU (IEC);
- ❑ ClearVue has a strong innovation pipeline and roadmap with ongoing research projects with 3 universities aimed at improving product power performance and expanding product applications;
- ❑ ClearVue have had successful major product launches at 3 trade shows completed during 2018 in Australia, Europe (Germany) and the United States. ClearVue is exhibiting this week (20 and 21 March) in Darling Harbour at Total Facilities Management conference (<https://totalfacilities.com.au/>);
- ❑ Listed in Frankfurt (and Stuttgart) in February 2019
- ❑ Pilot projects commenced:
 - ❑ Vicinity trial commenced at Warwick Grove Shopping Centre WA
 - ❑ Mirreco hemp based eco mini-home project on track to commence construction near Fremantle WA at Landcorp's Knutsford Precinct (<https://www.knutsford.com.au/>) around June/July 2019
 - ❑ CRC-P funded Greenhouse project – construction anticipated to commence around June/July 2019; research project already well underway
- ❑ Licensing discussions commenced (Worldwide) flowing from the trade shows:
 - ❑ MOU signed for South Africa and Mauritius (licence under negotiation);
 - ❑ Licence signed for Middle East

Questions?

Thank you for your attention – any questions?



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