Exemplary Advances

2021 July ***"Exemplary Advances"*** is the newsletter for Exemplary Energy Partners, Canberra. Feel free to forward it to friends and colleagues. Click here to subscribe or unsubscribe. Feedback is most welcome.

Past editions of ***"Exemplary Advances"*** are available on our website.

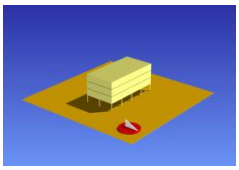
In this issue:

Exemplary Weather and Energy (EWE) Index[i] - June 2021

Monthly tabulation and commentary relative to the climatic norm – the Reference Meteorological Years

2021 June	Weather Index (monthly means)[1]						Weather and Energy Index (%)						
	Temperature (°C)			Rel. Humidity (%)			10-Storey		3-Storey		Supermarket		Solar PV
	Min	Avg	Max	Min	Avg	Max	Heat	Cool	Heat	Cool	Heat	Cool	
Brisbane	-4.3	-4.4	-3.6	+52.0	+15.8	-3.0	+60.1	-24.8	+71.5	-30.6	+22.5	-100	-8.3
Canberra	+2.2	+0.2	-1.2	+5.0	-6.0	-7.0	+14.1	-21.2	+11.6	-20.8	-16.6	-	-5.3
Perth	-1.0	-0.3	+0.3	+3.0	+4.0	-3.0	+11.8	-3.5	+7.1	-1.7	+4.6	-100	+8.9
Sydney	+1.6	+1.1	+0.4	+3.0	-12.9	-15.0	-37.1	+8.8	-35.4	+10.0	-43.2	-	+8.2

The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring rather than rely on analogy with the performance of these archetypical buildings and systems.



Brisbane had a cooler but more humid June than the average. The solar irradiation received in the mornings was lower than average. The wind speeds were also generally lower than average. Accordingly, the solar PV simulation results showed an 8.3% lower output than average. The cooling energy consumptions of both the commercial office buildings were lower than average. The heating consumption of all the buildings were higher than average. The east facing zone of the 10 storey building had 37% lower than average cooling consumption and 35% higher than average heating need. This was due to lower than average solar insolation and outside temperatures in the morning hours.

[1] 2021 June Temperature/Relative Humidity minus long term average June Temperature/Relative Humidity

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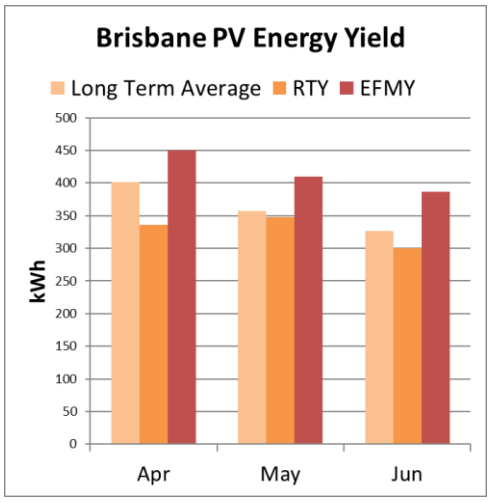
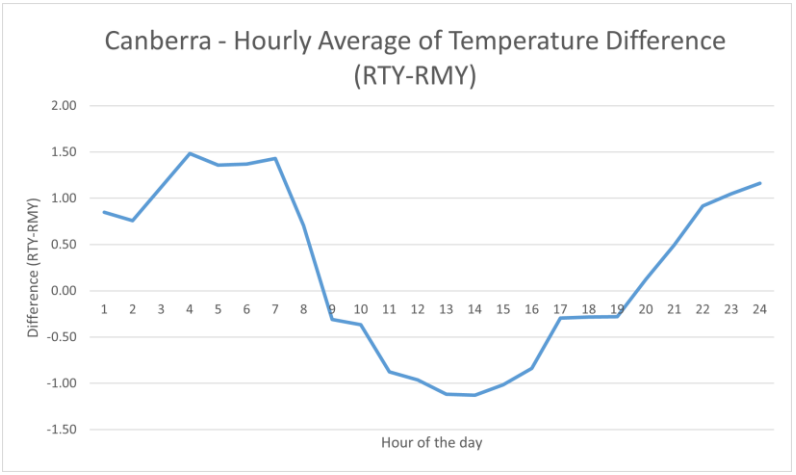
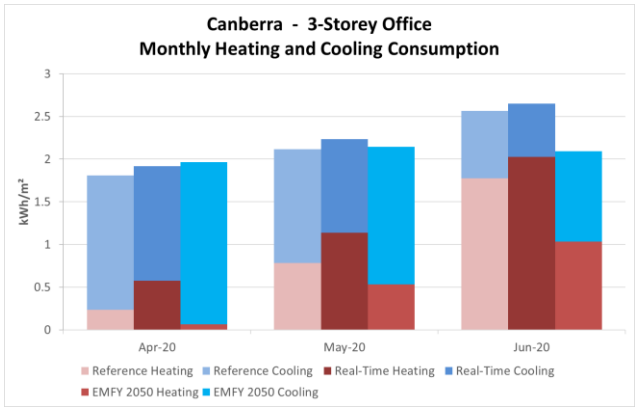


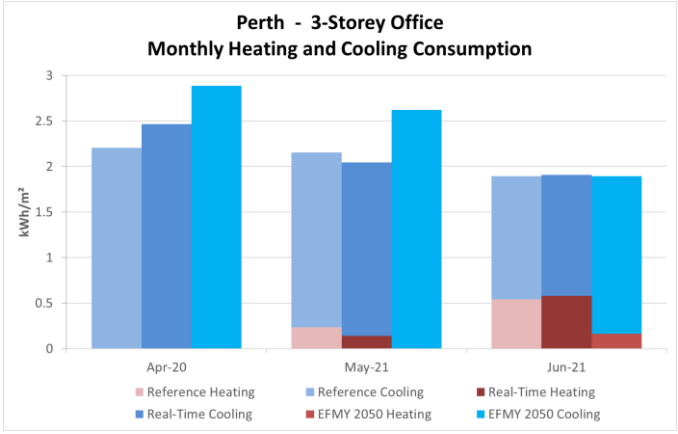
When comparing our EFMY 2050 simulation results with the results for June, it is projected that the two office models would have around 36-45% higher cooling consumption, and the supermarket would have about 28% higher cooling consumption than for the June just gone. The solar PV energy output for June when compared with the EFMY 2050 energy output showed 7.3% lower energy output projected in 2050.



Canberra had slightly warmer but less humid weather than average in June. The solar irradiation was found to be lower than average especially in the mornings. This led to the solar PV output being lower by 5.3%. All the office buildings had a lower than average cooling energy consumption and a higher than average heating energy consumption as the temperatures were lower during the afternoon time. The supermarket had a lower than average heating energy consumption. For the 10 storey office building, all the zones had a higher than average heating energy consumption. Due to lower solar irradiation in the morning and afternoon, the east and north facing zones required much higher heating than usual which led to heating energy consumption being higher in the range of 37-42%. The heating consumption for south and west facing zones were higher by only 4-6%. When comparing our EFMY 2050 simulation results with the results for June, it is projected that the two office models would have around 40% higher cooling consumptions. The solar PV energy output for June when compared with the EFMY 2050 energy output showed that this June's PV output was 4.9% lower than projected for 2050.



Perth had a cooler but more humid June than average. Perth generally received lower than average solar irradiation in the afternoons while it was higher in the morning hours. The winds speeds were higher in the afternoons. The combined effect has led to the solar PV output being higher than average by 8.9%. Both the office buildings had a lower than average cooling energy consumption in the range of 2-3%. In case of heating energy consumption, all the commercial buildings had higher than average consumptions in the range of 5-12%. All the zones of the 10 storey office building had a lower than average cooling energy consumption. In the case of heating energy consumption, all zones except east facing zones had a lower than average consumption.



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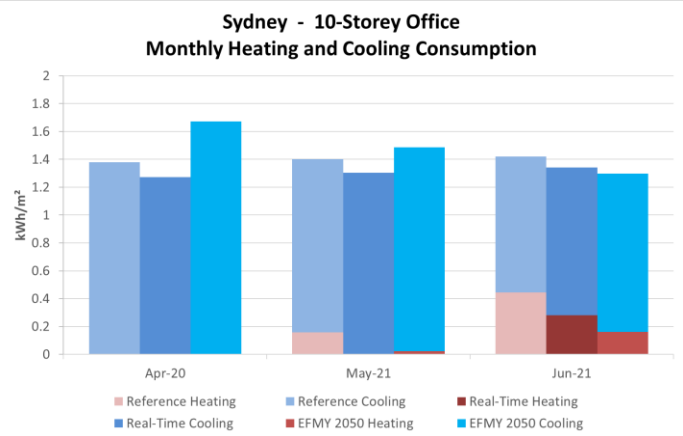
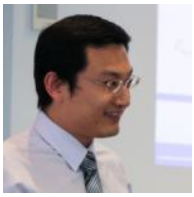
The temperatures in the morning hours were lower than average, thereby leading to higher heating requirements in the east zone. When comparing the simulation results using our EFMY 2050 climate data with the current climate, it is projected that the two office building models would have around 19-23% higher cooling consumption than this June. The solar PV energy output for June when compared with the EFMY 2050 energy output showed that this June's PV output was 1.6% lower than projected in 2050.



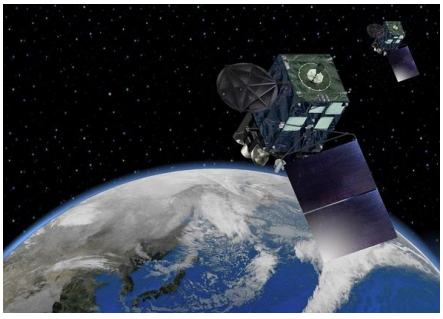
Sydney had a warmer but less humid June than the average. The solar irradiation received in Sydney was higher than average in the afternoons. Also the wind speeds were higher than average in the afternoons. This led to 8.2% increase in the PV output simulation than average. The heating energy consumptions of all the commercial buildings were lower than average while the cooling energies of office buildings were found to be higher than the long term averages. All the zones in the 10 storey office building had higher than average cooling energy consumptions (and a lower than average heating consumption) in the range of 33-36%. The east facing zone recorded the highest deviation of cooling energy consumption of 25% from the average as the solar irradiation in the morning hours were lower than average while the north and west facing zones had 9-17% higher consumption. When comparing our EFMY 2050 simulation results with the results for June, it is projected that the two office models would have around 10% higher cooling consumptions. The solar PV energy output for this June was 3.5% lower than the projected output in 2050.

Brisbane added to the EWE Index Service – challenge and solution



Exemplary Energy is procuring weather data for Brisbane from the Queensland University of Technology (QUT). This data is provided by Dr Aaron Liu of QUT and is measured from the Davis™ weather station atop the Centre for Children's Health Research at the Queensland Children's Hospital (QCH). The challenge with this data and our solution were reported in our June edition.

Real-Time Solar Irradiation Data for All Capital Cities – Update



As mentioned in our June Edition, the Bureau of Meteorology (BoM) had initially planned to launch their real-time solar irradiation products by Tuesday 13th July. However, the release of this service has been delayed due to the financial year bottleneck at their IT department. Our liaison with the Bureau has informed us that they are currently working on making the service available through the registered user File Transfer Protocol (FTP) service. We have also been informed that customers can expect notifications early next month about the launch of this service.

We at Exemplary are currently preparing ourselves to tap into this new source of data in order to expand the capabilities of our free public service the 'Exemplary Weather and Energy (EWE) index' and the sales of 'Real-Time Year (RTY)' data sets for all the 8 capital cities. We plan to give an update on this matter and the services we would be providing based on this data in the next edition.

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New Team Member – David Ferrari (BEng, BSc, PhD)

Dr Dave Ferrari is an engineer with a long-held interest in the energy transition, having spent the best part of two decades working in government, industry and academia to address the challenges of that transition and support urgently needed change. He first worked with Exemplary as an undergraduate intern in 2003 and now makes a welcome return.

He recently completed two years with the United Nations Economic and Social Committee for Asia and the Pacific (UN ESCAP), providing research and advice to member States on policies and programs to achieve Sustainable Development Goal 7 (SDG 7) on energy and the Paris Agreement commitments to mitigating climate change. This included supporting the development and piloting of ESCAP's National Expert SDG Tool for Energy Planning (NEXSTEP), providing secretariat support in the delivery of intergovernmental meetings and working groups, and authoring a range of reports or publications on power grid connectivity, energy system policies and planning, and progress towards SDG 7.

Prior to joining the UN, Dave spent ten years working with the Victorian Government on the development and delivery of energy efficiency, renewable energy and waste programs. He managed a series of high-profile and high risk programs for Sustainability Victoria (SV) and contributed to the development of Victoria's renewable energy policy as a member of the Project Control Board before taking a role with the Essential Services Commission to lead the administration of technical components of Victoria's flagship white certificate program.

He has worked in R&D, developing a high temperature solar thermal collectors to deliver industrial process heat, managed a NATA-certified laboratory assessing the compliance of water heating, air conditioning and building products to Australian Standards and regulations, and worked with the Australian Bureau of Meteorology (BoM) developing forecasting tools for the Australian Wind Energy Forecasting Systems (AWEFS).

In 2009 he was awarded a PhD in Engineering from the Australian National University for his work on free-form geometric feature recognition for knowledge management. He also holds a Bachelor of Engineering (Sustainable Energy Systems), Bachelor of Science (Mathematics) and is a Certified Measurement and Verification Professional (CMVP).

Australia's de-facto Carbon Price at record high

Michael Mazengarb

Australia's de-factor carbon price – a voluntary market for carbon offsets – continues to show signs of life, with spot prices reaching new highs as big companies look to boost their climate credentials, even in the absence of strong federal policy.

The spot price of Australian Carbon Credit Units (ACCUs) recently passed $20 per tonne for the first time since the abolition of the Gillard government's carbon price in 2014.

And, according to leading carbon market analyst firm RepuTex, it could more than double in value, reaching as high as $50 per tonne by the end of the decade. Read More

XMYs Available - Extreme Meteorological Years

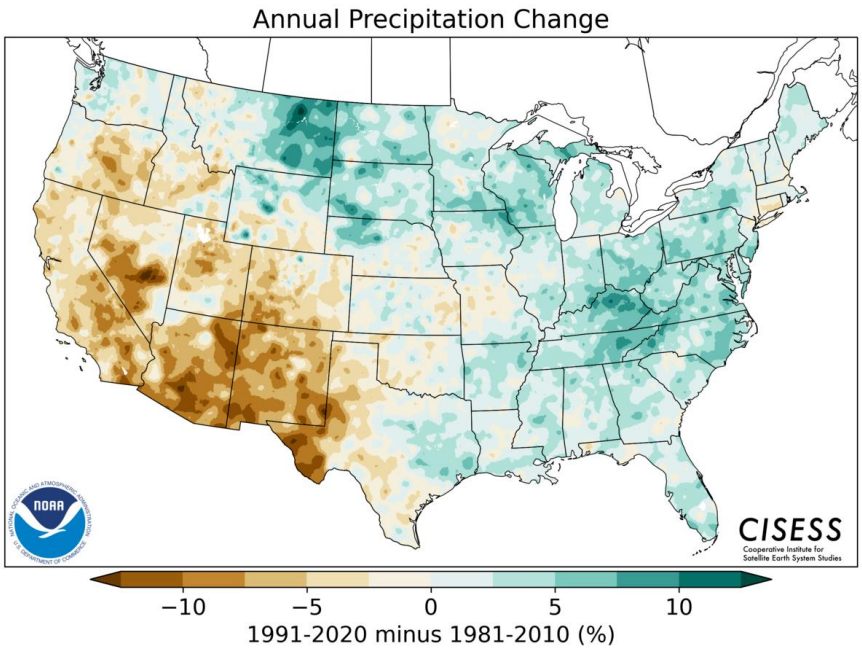
Readers may recall Exemplary's undertaking of enhancing the in house software "ClimateCypher" to produce P01, P10, P90 and P99 months based on the climate zone of the location in the January issue this year and our presentation about this in the Asia Pacific Solar Research Conference was also reported. We have started to implement this in producing the eXtreme Meteorological Year (XMY) data for various locations in Australia. Exemplary had started producing these XMY data files for locations in each climate zone. These locations include Darwin, Brisbane, Alice Springs, Wagga Wagga, Adelaide, Melbourne, and Canberra. Apart from these locations which represent places in each Climate Zone of Australia, this service is also available for locations like Broome, Cape Grim, Geraldton, Kalgoorlie, Learmonth and Townsville at the moment. These XMY data as the name suggests take into consideration the extreme case weather scenarios and would be beneficial while modelling engineering problems like energy performance simulation of buildings and predicting the output of solar farms especially in the advent of global warming.

Please contact us to give you a prompt quote for the XMY files of any of the above location or to discuss the prospects of producing the XMY data of the location of your interest.

U.S. Climate Normals

The U.S. Climate Normals are large suite of data products provided by National Center for Environmental Information (NCEI). The data furnish information about typical climate conditions for various locations across the United States. The Climate Normals data would be a useful tool for comparison of present weather with the one in the future. These data re calculated for a uniform 30 year period (1991-2020) and include the annual, seasonal, monthly, daily and hourly averages and statistics of temperature, precipitation and other weather elements. A 15 year (2006-2020) Normals data is also available for use from NCEI.

NCEI generates these data every 10 years and the above mentioned 30 years and 15 year normal data for 1990-2020 and 2006-2020 are the latest in the series. An example of application of these normal data are shown in image where the present Normals data is compared with the just previous normal data (1981-2010) for annual precipitation. Similarly such comparison would be beneficial in making day to day life decisions as well as important economic and political recommendations. In order to access the Normals data and to know more, please visit the NCEI US Climate Normals website.



Our Bureau of Meteorology is currently working on updating Australian climate averages products to the 1991-2020 3-decade period (broader than solar data).

Monash team lifts solar and wind generation forecast accuracy 45%

by Sophie Vorath

A research collaboration between Monash University's Grid Innovation Hub and Palisade Energy has been able to utilise machine learning technology to enhance the predicting capacity of renewable energy generation forecasts. The forecasting algorithms obtain data from the Supervisory Control And Data Acquisition (SCADA) system set up in generators and this $1 million project achieved 45% more accuracy when tested on the 130 MW Waterloo wind farm in South Australia and the 11 MW Ross River solar farm in Queensland.

In the past, due to the natural variation in the weather, renewable generators faced challenges to accurately forecast their short term generation levels, which had led to problems related to grid stability and project economics. With this machine learning model, it is expected to overcome this challenge and pave way for lowering of renewable energy prices. Read more

Techno-Economic Analysis of PV-CSP Hybrid Power Plant – Update

As mentioned in our April edition, our interns (at right, Chithral, Naman, and Nihal) along with three colleagues had endeavoured on a group research project as part of their Master's degrees. We at Exemplary are proud to announce that their project was a success and they were invited to present the results of their finding at the capstone project event which was held in ANU on 20th of July.

Their project aimed at conducting a techno-economic analysis of PV (Photovoltaic) - CSP (Concentrated Solar Power) hybrid power plants in the Australian context. They worked under the supervision of Associate Professor Dr. John Pye (extreme left in the picture), a senior lecturer and researcher at the Solar Thermal Group at ANU. This project was also co-supervised by Armando Fontalvo Lascano, a PhD scholar, and the research fellow, Dr. Ye Wang.

They used Modelica to build mathematical models of the two technologies. These models were then varied in ratios(PV:CSP) of 0:1, 0.25:0.75, 0.5:0.5, 0.75:0.25 and 1:0 with respect to 4 total rated plant capacities of 125, 150, 175 and 200 MW in order to fulfil a baseload of 100 MW. It was found that a 200 MW rated power plant with a PV to CSP ratio of 0.25:0.75 is the most economical option due to thermal storage which comes with CSP. This thermal storage enables the option of taking advantage of the higher electricity prices that occur in the early morning and evening while PV helps to satisfy the load during the day. For more information please refer to our April edition of Exemplary Advances.

Community based Solar Farms –Update – a Bureaucratic Hurdle

Exemplary Energy has invested in another community solar farm, this time near Orange, NSW, 250 km west of Sydney. Residents of New South Wales (or ACT) can join the Energy Democracy Central West NSW co-operative and access cheaper

solar power. Energy Democracy are now raising capital for a 5 MW town-scale solar park with 5 MWh battery storage is being developed at 643 Mitchell Highway, Orange.

Parcels of shares in the co-operative equivalent to 2.5 kW of solar PV panels and 2.5 kWh of battery storage are available for just $4,995, thanks to a $3.5M grant from the New South Wales government's Regional Community Energy Fund. Readers interested to invest should contact the co-op even if they don't live in NSW. Energy Democracy is planning similar projects in Horsham VIC, Mallala SA and Wairarapa NZ.

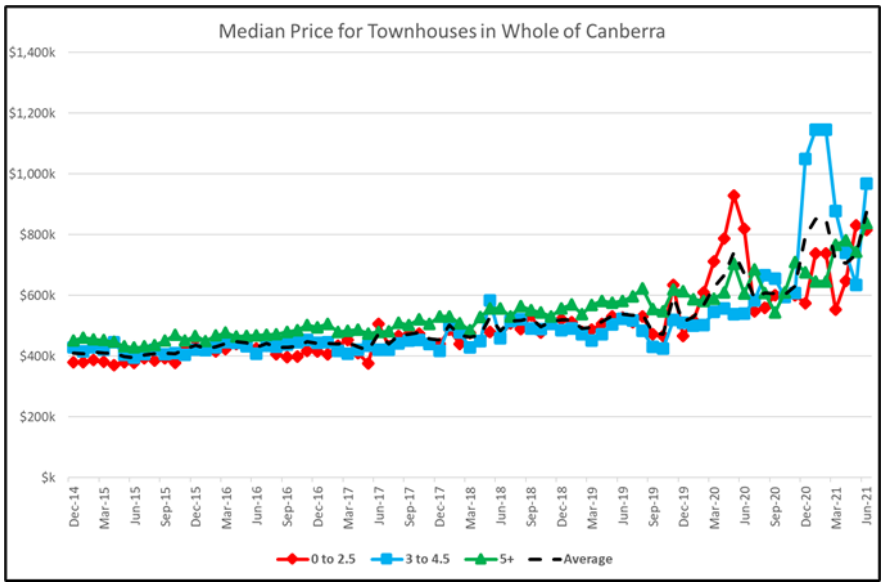
When the Orange Community Renewable Energy Park submitted the original Development Application (DA), Orange City Council ruled that the solar park/farm should have an operational life of 35 years based on their internal assessments, which is what the Co-operative had planned and hoped for. However, Western Regional Planning Panel (WRRP) imposed an operational life of 25 years.

A modification application s4.55(2) to extend the operational period of the Orange Community Renewable Energy Park to 35 years has been sent to Orange Council to make a recommendation in agreement, after which the WRRP will make a ruling.

Home Energy Efficiency Ratings – Price varies with EER

A regular monthly report © by Exemplary Energy Partners.

The residential property of Canberra generally had an increase in median advertised sale price in June when compared to our May data record. Houses and townhouses respectively had 13.4% and 15.9% increase in median advertised price compared to previous month's record. Apartments/units on the other hand recorded a 12.4% decrease in median advertised price. The property that had the largest median advertised price increase was 3-4.5 star townhouses with a 34.5% increase, from $633,900 to $969,000. Apartments/units with 3-4.5 star rating, on the other hand, had the largest median advertised price decrease this month at 29.9% from $611,800 to $470,800.



Rating (Sale of Premises) Act in April 1999, Exemplary Energy Partners has tracked the relationship between EER and the advertised asking price of Canberra dwellings. Readers interested in the EER(SOP) Act and its successors and their effect on the Canberra housing market should access our $/EER-star paper at the APSRC in December 2020.

As well as for the whole of Canberra, $/EER indices are tracked separately for the three dwelling types and the five suburban areas: Belconnen, Gungahlin, Inner North, Inner South, Woden/Weston Creek and Tuggeranong.

China Launches Emissions Trading Scheme: the World's Largest

by John Treadgold

The core aim of emissions trading is to put a price on carbon. It recognises the detrimental effects of pollution, and it seeks to put a monetary price on it. The theory goes that this will make emissions-intensive goods less competitive, incentivising those produced with cleaner technology.

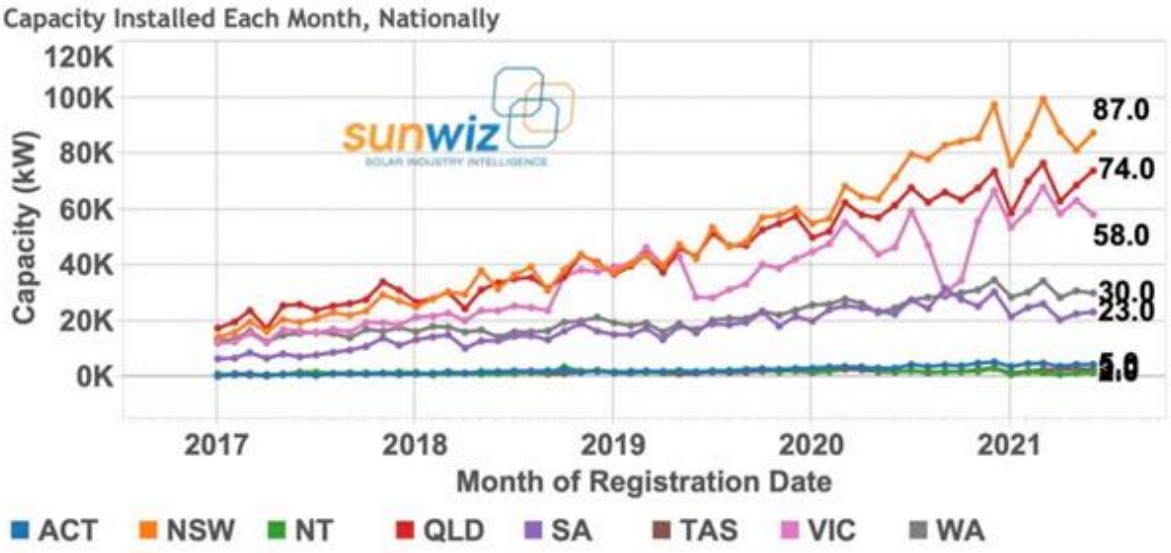
The Chinese scheme will assign companies a quota of carbon emissions. They can either use their carbon allocation to cover their pollution, but if they are able to reduce their emissions, they can sell surplus allowances to companies that face a high cost of abatement.

At launch the scheme will cover only the electricity generation sector, although this alone captures 2,000 companies and a reported 4 billion tonnes of carbon emissions per year. According to state sources, this is 40% of the country's emissions, and highlights the outsized contribution of electricity generation on total emissions. Read More

Rooftop solar systems are getting bigger, and now average 8.7kW

by Giles Parkinson

The total amount of small scale (under the capacity of 100 kW) rooftop solar on Australian homes have grown to a total of 14.8 GW. This statistics was published by SunWiz, an industry statistician. A 2% rise of installed capacity over May, which accounts for 282 MW, was commissioned in June which led to this record jump to an average PV system size of 8.7 kW in June.



As it had been in the past two years, NSW had the highest rooftop solar capacity in Australia; 87 MW of solar panels was installed in NSW. Queensland had the second highest installations of 74 MW. Warwick Johnston, the director of SunWiz, stated that all states saw a dramatic increase in installation of 15-100 kW range, especially Victoria which was strong in the 30-100 kW market. Read more

[i] Exemplary publishes the EWE for three archetypical buildings and a residential solar PV system each month; applying the RTYs to EnergyPlus models developed using DesignBuilder for a 10-storey office, a 3-storey office and a single level supermarket as well as an SAM model of a typical 3 kW_{peak} solar PV system designed by GSES. All values are % increase/decrease of energy demand/output relative to climatically typical weather. Especially during the mild seasons, large % changes can occur from small absolute differences. RTYs are available for purchase for your own simulations.