Exemplary Advances

2021 August ***"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.

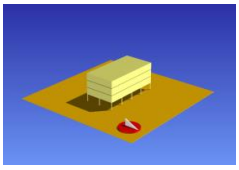
In this issue:

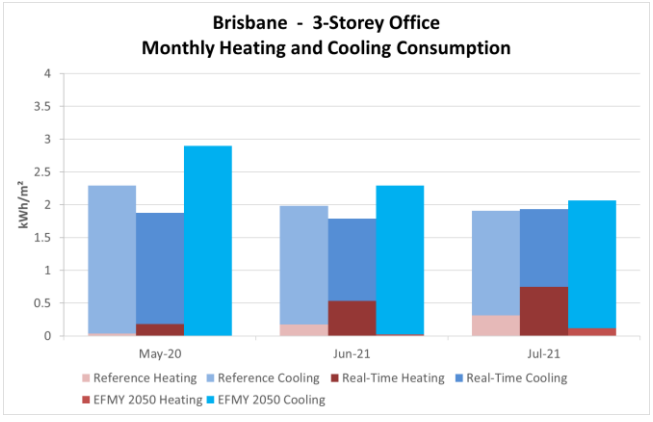
Exemplary Weather and Energy (EWE) Index[i] - July 2021

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

2021 July	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	-3.1	-3.3	-3.5	+48.0	+18.8	+1.0	+141	-21.0	+169	-25.7	+29.6	-100	-11.4
Canberra	+0.9	+0.1	-0.7	-4.0	+1.5	0.0	-6.7	+54.7	-14.2	+46.8	-16.6	-	-0.1
Perth	+4.0	+2.0	+0.4	+17.0	+4.2	-2.0	-56.5	-9.9	-56.9	-3.5	-45.8	-95.8	-11.2
Sydney	+1.8	+1.8	+0.2	-6.0	-19.4	-16.0	-43.1	+13.3	-43.7	+15.5	-37.1	-46.6	+3.9

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.

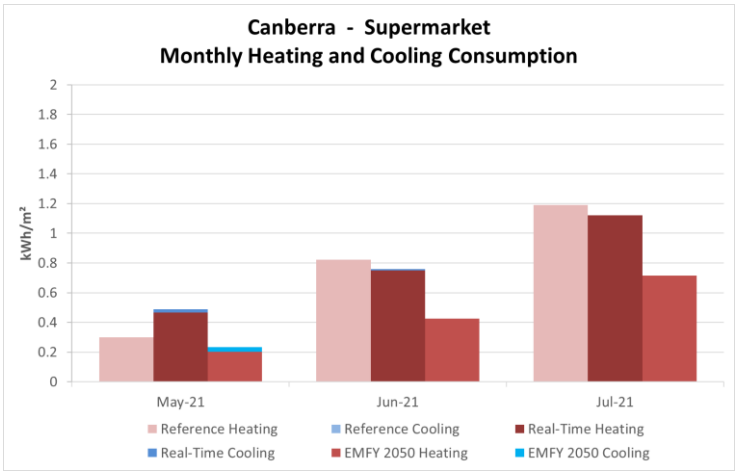




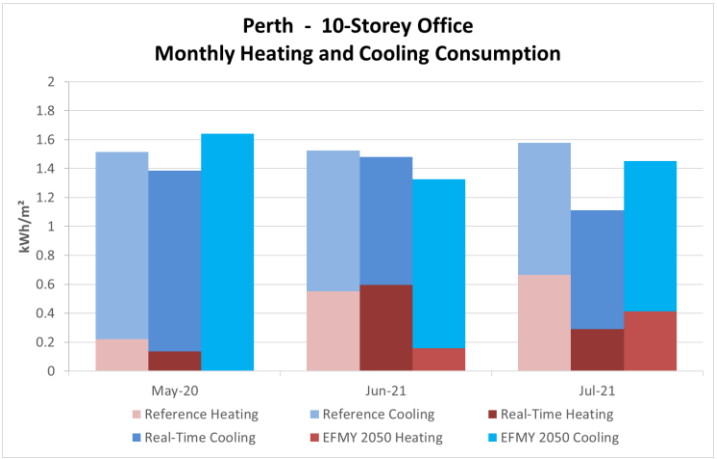
Brisbane had a cooler but more humid July than the average. The solar irradiation was lower than average especially in the mornings. The wind speeds were also generally lower than average. So the solar PV simulation results showed an 11.4% lower output than average. The cooling energy consumptions of all the commercial office buildings were lower than average. The heating consumptions of all the office buildings were higher than average by a large margin. This is due to the low solar irradiation supported by the lower temperatures experienced in the last month. The heating consumption of

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

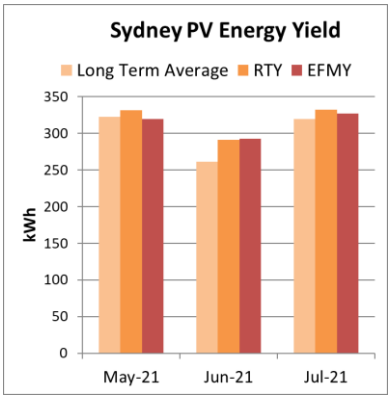
east facing zones of the 10 storey building was 74% higher than average. This is the largest deviation from the average heating consumption and is caused by the comparatively lower solar irradiation in the mornings. The north facing zone saw 38% higher heating consumption compared to average. When comparing our EFMY 2050 simulation results with the results for July, it is projected that the two office models would have around 30-39% higher cooling consumption. The solar PV energy output for July when compared with the EFMY 2050 energy output showed 17.4% lower energy output projected in 2050.



Canberra had slightly warmer and more humid weather than average in July. The solar irradiation was a little higher than average especially in the mornings and early afternoon. However, the solar PV output was lower by 0.1%. This may be due to higher than average temperatures in the morning hours. All the office buildings had a higher than average cooling energy consumption. The heating energy consumption was lower for all the commercial buildings. For the 10 storey office building, all the zones had a lower than average heating energy consumption. Due to higher solar irradiation and higher temperatures in the morning and afternoon, the east and north facing zones required much less heating energy when compared to other zones. These zones showed 18-20% lower heating energy while other zones showed only 6-8% lower heating energies. When comparing our EFMY 2050 simulation results with the results for July, it is projected that the two office models would have around 38-50% lower heating consumptions. The solar PV energy output for July when compared with the EFMY 2050 energy output showed that this July's was 7.3% higher than that projected in 2050.



Perth also had a warmer and more humid July than average. However, Perth generally received lower than average solar irradiation. The winds speeds were generally higher. All these led to the solar PV output being lower than average by 11.2%. All the commercial buildings had lower than average cooling and heating energy consumptions. The lower cooling during this warmer month could have been due to the lower solar irradiation and higher wind speeds. All the zones of the 10 storey office building had a lower than average heating energy consumption. In case of cooling energy consumption, the east and south facing zone had 13.5 and 61% higher consumption respectively while the north and west facing zone had 14-27% lower consumption. When comparing the simulation results using our EFMY 2050 climate data with the recent weather, it is projected that the two office building models would have around 18-21% higher cooling consumption than this July. The solar PV energy output for July when compared with the EFMY 2050 output showed this July's was 13.2% lower than that projected in 2050.



Sydney had a warmer but less humid July than the average. The solar irradiation received in Sydney was higher than average especially in the afternoons. Also the wind speeds were higher than average in the mornings. This led to 3.9% 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 higher than the long term averages. All the zones in the 10 storey office building had higher than average cooling energy consumptions. The east and south facing zone had higher cooling consumption when compared to the long term average. When comparing our EFMY 2050 simulation results with the results for July, it is projected that the two office models would have 7-8% higher cooling consumptions. The solar PV energy output for this July was 1.6% higher than the projected output in 2050.

BOM's New Real-Time Weather Data Service includes Solar

As mentioned in our July Edition, the Bureau of Meteorology's (BOM) long-awaited real-time solar irradiation product has finally been released on 4th August. It was initially planned to be launched on 13th July but was delayed due to a bottleneck at their IT department. This product is part of one of the many products in BOM's newly inaugurated Real-Time Data Service.

We at Exemplary are preparing ourselves to tap into this new source of real-time data. We will be using the newly launched real-time solar irradiation product to acquire hourly solar insolation. While for the surface weather data like temperature, wind speed and direction, humidity, etc we are planning to subscribe to one of the many real-time products provided by BOM in its new service to complement accessing its monthly subscription service for ground-based measurements.

That hourly solar insolation product derives data through the Heliosat-4 radiation model using observations from the advanced imager on-board the Himawari satellite. Heliosat-4 is also bias-corrected. These biases were analysed and corrected based on comparisons conducted for the calendar year of 2017 between the outputs by Heliosat-4 and BoM's 12 ground stations. While the surface weather data is sourced via BOM's ground Automated Weather Stations (AWSs).

This new source of data will allow us to geographically expand our 'Real-Time Year' (RTY) data set and enable us to provide the latest weather data to our clients. It will also allow expanding the capabilities of our free public service the 'Exemplary Weather and Energy (EWE) index'.

Access to BOM real-time data is available through the registered user File Transfer Protocol (FTP) service and we will establish access to this data by September or October this year.

Australian Climate Data Bank 2020 – 31 years distilled

With Exemplary being in the process of acquiring weather and solar data as reported in the previous article and also in previous editions, we are getting prepared for producing the weather files spanning 31 years from 1990 till 2020. They will be generated in the Australian Climate Data Bank (ACDB) format, which was introduced by CSIRO and BOM in the mid '80s, and would be made available for

about 250 Australian locations in TMY3 and EPW formats as well. This data along with Estsatz Future Meteorological Year (EFMY) data in the past has paved the way for various studies and policy updates such as hat undertaken by DeltaQ on the impact of climate change on building performance. And we expect that such studies would continue with the updated data files we will be producing soon.

A key addition that is proposed for the data is the inclusion of hourly precipitation data. This would be a valuable input for various engineering and modelling applications such as urban hydrological modelling, infrastructure designing, on-site rainwater use, etc. It would also be useful for any extension of the NatHERS software to include precipitation for dwelling performance modelling.

Asia Pacific Solar Research Conference – Sydney, 16-17 December

Exemplary Energy has submitted four extended abstracts in support of this year's APSRC and will expand on them in future editions.

1. Updating Australia's Reference Meteorological Years with the Addition of Hourly Precipitation Data
2. Verification of ClimateCypher Climate Data Outputs with System Advisor Model (SAM)
3. Extending Real-Time Year Weather Data Services with Bureau of Meteorology Data
4. Effect of Energy Efficiency Rating (EER) of Dwellings on Sale Prices in the ACT 1999-2021

eXtreme Meteorological Years (XMYs) now Available

The eXtreme Meteorological Year (XMY) data is an extension of the Typical Meteorological Year (TMY) data which contains selected extreme months with the insolation variables to form a set of four extreme representative years: P01, P10, P90 and P99 (sunniest to cloudiest cases respectively). The investigation done by Amin Moazami et al recommends the use of XMY data in addition to the RMY data for the accurate prediction of the range of future building energy performances. Exemplary is now capable of preparing these XMY data sets based on the weather data from 1990 to 2020 with our software, ClimateCypher, based on the iterative studies conducted and presented at the Asia Pacific Solar Research Conference (APSRC) last year (and a conclusive presentation of how the refining of the results was done will be presented to this year's conference). These data are now available for locations in the first seven climates of the National Construction Code (NCC). These locations are Darwin, Brisbane, Alice Springs, Wagga Wagga, Adelaide, Melbourne and Canberra. We have also produced the XMY data for Broome, Cape Grim, Geraldton, Kalgoorlie, Learmonth and Townsville. Please contact us if you are interested in acquiring the XMYs for any of the above locations or would like to discuss the XMY data creation for other locations of your interest.

New weather and climate files – 31 years (1990 to 2020)

As mentioned in our June edition, the Bureau of Meteorology's (BoM) gridded solar data derived from satellite observations has long been stuck at the end of July 2019 following the death of their key staff member Dr. Ian Grant in November that year.

However, we are glad to report that for research purposes BoM plans to make ~5 years' worth of historical gridded solar data derived from satellite observations available via their National Computational Infrastructure (NCI). This will allow us to produce and provide our clients with 31-year weather and climate data files for around 250 Australian locations.

This data will have a spatial resolution of 2 km and will be provided for 10 minute time intervals as well as in the pre-existing 5 km hourly values format. The production and quality control processing of this data takes a sizable amount of supercomputing time and is currently underway and could be finished as

early as the middle of next month. Once they're 'up-to-date', the gridded observations data will be made available through NCI with an ongoing ~3-month lag.

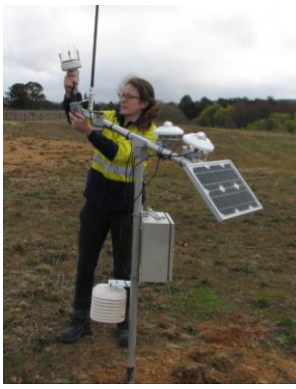
Community based Solar Farms – Regular Update

Exemplary Investments Pty Ltd is currently invested in three Community based Solar Farms.

SolarShare, Mount Majura ACT

This solar farm is fully operational having switched on for the autumnal equinox, 21 March 2021. No update has been provided by SolarShare this month. For details click here.

Community Energy for Goulburn NSW



CE4G has appointed Komo Energy as its design and develop partner and Exemplary has provided specially developed weather data specific to Goulburn to help optimise the design. The project is ~50% funded by the NSW Government and will comprise a 1.8 MW solar PV array combined with a commensurate on-site battery. The current COVID lockdown in regional NSW will inevitably delay the start of construction but this is not yet quantifiable but the Automatic Weather Station has already been installed. For details of CE4G, click here.

Energy Democracy for Orange NSW

This will be a 5 MW town-scale solar park with 5 MWh battery storage is being developed at 643 Mitchell Highway, Orange, with funding assistance of ~50% from the NSW Government. ED4O has appointed ITP Developments to bring the project into being and Exemplary has provided weather data specific to Orange to help optimise the design.

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.

'Green Steel' – ANU students modelling with Exemplary climate data

A team of engineering students at the Australian National University are using Exemplary's RMY climate data sets for Newman WA to model the energy infrastructure required for the production of 'green steel' using hydrogen. The hydrogen would be produced by electrolysis of desalinated seawater, using power provided from large-scale PV and wind farms located in the remote Pilbara region, where most of Australia's 900 megatonnes per year of iron ore is extracted. Using Ben Elliston's open-source National Electricity Market Optimiser (NEMO) tool, the amount of PV, wind, and importantly, energy storage, will be examined and a least-cost configuration determined. The cost of energy is expected to be a major constraint on the emergence of a future green steel industry. The Pilbara region, however, has some of the best solar energy resource in the world, and could provide Australia with a significant competitive advantage in that future industry.

Contact: Dr John Pye

Humans are Warming the Planet

The Intergovernmental Panel on Climate Change (IPCC) has recently published its sixth assessment report which has unequivocally stated that humans are the root cause for the observed warming of the atmosphere, lands and oceans. The IPCC finds Earth's global surface temperature warmed 1.09℃

between 1850-1900 and the last decade. This is 0.29℃ warmer than in the previous IPCC report in 2013. (It should be noted that 0.1℃ of the increase is due to data improvements.)

Out of the 1.09℃ average temperature increase, IPCC finds that 1.07℃ of it is due to greenhouse gases associated with human activities. In other words, pretty much all global warming is due to humans.

The IPCC says human activities have also affected global precipitation (rain and snow). Since 1950, total global precipitation has increased, but while some regions have become wetter, others have become drier.

The frequency and intensity of heavy precipitation events have increased over most land areas. This is because the warmer atmosphere is able to hold more moisture — about 7% more for each additional degree of temperature — which makes wet seasons and rainfall events wetter.

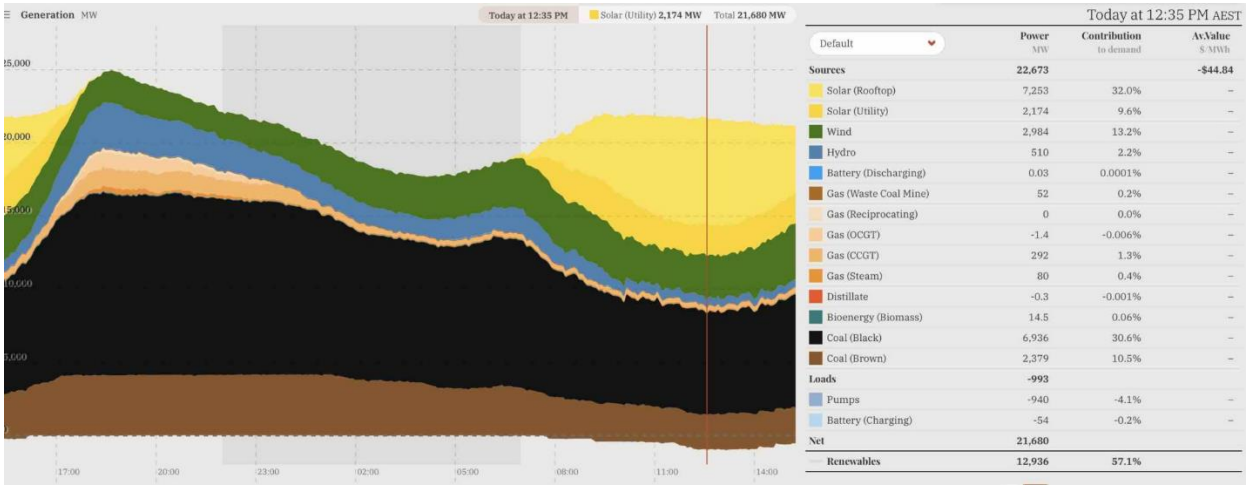
For more from the IPCC's sixth assessment report please use the following link.

Solar exceeds coal for first time on Australia's main grid

By Giles Parkinson

A record combined output of rooftop solar and large scale solar farms exceeded that of brown and black coal generation for the first time in Australia's main grid on Sunday 22nd August.

According to energy analyst Simon Holmes a Court, quoting the OpenNEM data feed he helped establish, solar exceeded the output of coal at 12.35pm on Sunday, delivering a combined 9,427MW, or 41.2 per cent of demand, compared to coal's combined 9,315MW, a combined 41.1 per cent.



It's a significant landmark, reinforcing the scale and pace of the energy transition that has forced Australia's two biggest utilities – AGL and Origin – to all but abandon the concept of coal generation as necessary "baseload" as they seek to adapt their legacy business models to wind, solar and storage technologies. 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.