Exemplary Advances

2020 May ***"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.

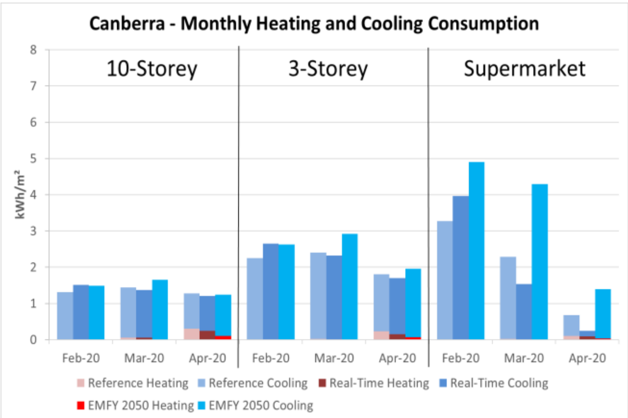
Exemplary Weather and Energy (EWE) Index[i] - April 2020

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

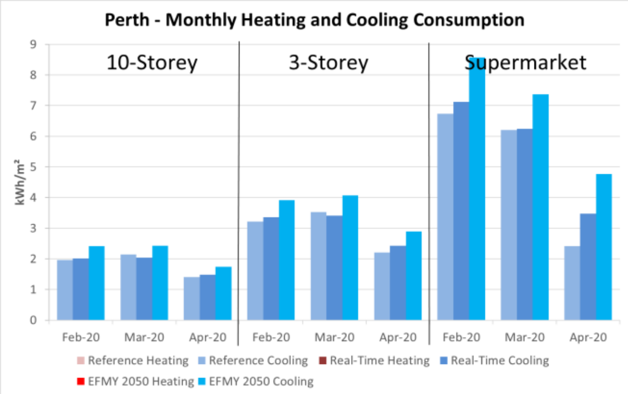
2020 April	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	-20%	-1.4%	-	5.8%	-	-7.9%
3-Storey	-33%	-1.7%	-	10.0%	-	-9.3%
Supermarket	-12%	-72.5%	-	44.5%	-	-30.6%
Solar PV	-9.0%		-3.5%		16.0%	

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.

Canberra had an overall cooler than average April. The mean average and mean maximum temperatures were 0.2°C and 2.3°C lower. Only the mean minimum temperature was 1.9°C higher. All three commercial building models had lower than average cooling consumptions. The heating consumptions were also lower than the average. The data shows that it is due to the generally cooler weather during the day (resulting in lower cooling consumptions) and, warmer weather during the morning (less heating was required during the cool morning). It was overall cloudier as well. Therefore, the solar PV array had an energy yield of 9.0% lower than the average. The cooling energy consumption of the 10-storey office North facing zones were 6.5% higher than the averages due to the cooler but sunnier weather in the afternoon. The temperature at the hour when cooling consumption was at its peak was 21.5°C, which was 3.9°C lower than the average. The peak cooling consumption of the 10-storey office model therefore was 12.1% lower than the average. When comparing the simulation results using our EFMY 2050 climate data with the RTY, it is projected that the two office building models would have over 15%-19% higher cooling consumption and the supermarket, operating for much longer daily hours, would have 88% higher cooling consumption than the RTY – a very substantial difference.

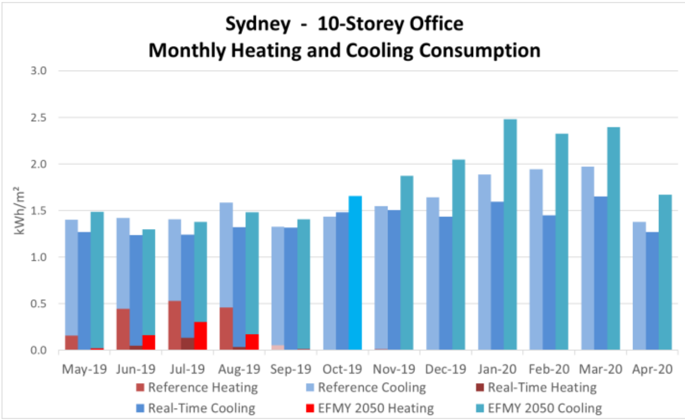


Perth had a warmer than average April. The mean average, mean maximum and mean minimum temperatures were higher than the averages by 0.7°C, 1.1°C and 0.7°C respectively. All three commercial building models had higher than average cooling consumptions. The supermarket had comparatively higher than average cooling consumption than the 2 office models due to the generally even warmer weather during the evening and night (the time when the supermarket operates while the offices are still closed). Despite the sunnier weather, the solar PV array had an energy yield of 3.5%

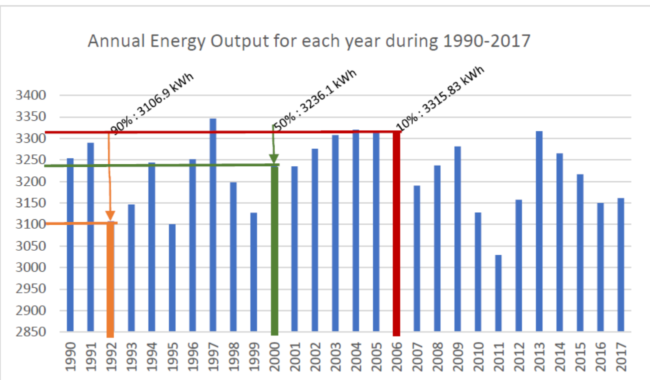


lower due to the warmer weather and lower than average wind speeds which reduced the modules' efficiency. The 10-storey office North and East facing zones had 12.8% - 18.0% higher cooling consumption than the norm. Southern zones had close to 11% higher cooling due primarily to the warmer air temperature. The air temperature was at 38.6°C at the hour of peak cooling, which was 5.0°C higher than the average. Also, the global horizontal radiation was 14.5% higher than the average. Therefore, the peak cooling consumption of the 10-storey office model was 3.5% higher than the average due to the warmer and sunnier weather during the hour of peak load. 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 15%-16% higher cooling consumption and the supermarket would have 27% higher cooling consumption than for the April just gone.

Sydney had a cooler than average April. The mean average and mean maximum temperature were 0.2°C and 0.8°C lower and the mean minimum temperature was about the same as the average. The cooling consumption of all the commercial building models were lower than the averages and the lower Relative Humidity (RH%) was also a contributing factor (8.1 percentage points lower). The 10-storey office East, North and West facing zones all had lower cooling consumptions than the averages by around 10%-14%. It was overall sunnier and therefore the solar PV array had an energy yield of 16.0% higher. The temperature at the hour of peak cooling was 21.8°C which was 3.7°C lower than the average. Also, the global horizontal radiation was 26.9% less than the average. Therefore, the peak cooling consumption of the 10-storey office model was 17.1% lower than the average due to the cooler and cloudier weather at the hour of peak. When comparing our EFMY 2050 simulation results with the results for the April just gone, it is projected that the two office models would have around 24%-30% higher cooling consumption, and, the supermarket would have 62% higher cooling consumption than the April of the RTY.

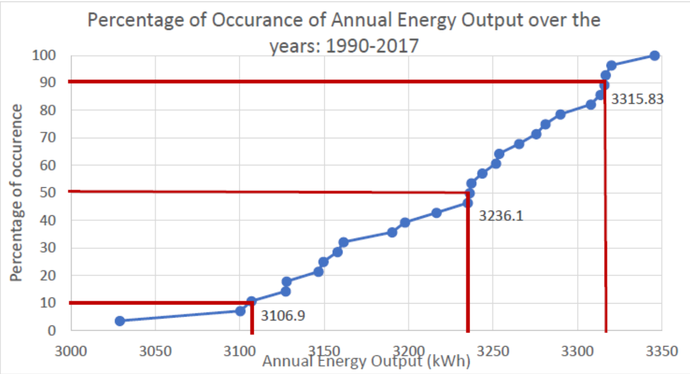


Extreme Climatic Years – P10 and P90 Years Explained



Designers and developers (and the financiers that back them) have need of "extreme year" climate files to establish the highest and lowest likely output from a renewable energy installation. Ignoring global warming which is dealt with in the EFMY files, these extreme years can be established by the serial simulation of an indicative system over the full period of weather years that we have available. In our case, we used the domestic scale solar PV system designed for us by GSES and simulated it in the software developed by the US National Renewable Energy Laboratories (NREL) called System Advisor Model (SAM) Because the solar irradiation data for most places in Australia dates from the publication by the Bureau of Meteorology (BoM) of data estimated from satellite observations from 1990, we have used that as our base year for 30 years of weather data. The graph above shows the results in chronological order with the 10th, 50th and 90th percentile years indicated (ranging from sunniest to cloudiest). Note that the vertical scale has been chosen to exaggerate the difference between years. The graph below shows them ordered by output. Here the horizontal axis has been selected to exaggerate the year to year differences.

P10 and P90 represent the reasonably expected range – 80% of all years will fall within that space. So P90 means 90% of the estimates exceed the P90 estimate and designers are confident that the first year of production will exceed that in 90% of the time. The P50 is the median year and will closely match the output simulated using one of our Reference Meteorological Years (RMYs) which are indicative of the long term mean.



P10 and P90 climate files are available for purchase from Exemplary.

Delays to Solar Radiation Data for 2019

Regular readers might recall that Dr Ian Grant, the scientist at the Bureau of Meteorology (BoM) who processed the satellite data into estimated gridded solar irradiation data, died late last year (see "*Exemplary Advances*" 2019 December). Sadly the BoM has yet to restore that service to the renewable energy and building simulation community. The Australian PhotoVoltaic Institute (APVI) is working with other interested groups and the BoM to restore that service as soon as possible. We hope to provide an update on their progress in the next edition.

Home buyers and renters prepared to pay more for high EER

Do houses sell for more if they have a green energy rating? The majority of the 27 relevant international primary academic publications reviewed for this project agree that a price premium does exist for more energy efficient homes, typically in the order of 5% to 10%.

There are two ways of looking at potential price effects. Firstly, by comparing rated versus not rated residences, and secondly, by comparing a higher rated residence with a lower rated one. To generalise, previous research studies based in the EU looked at high vs. low rated dwellings, and studies in Japan, Singapore and the USA looked at rated vs. non-rated dwellings. In both cases, a price premium was found.

The literature study was prepared by the University of Wollongong's Sustainable Buildings Research Centre (SBRC) as partners in the CRC for Low Carbon Living (CRCLCL).

For more detail see builtbetter.org/node/8139 or bit.ly/2uT7X3x.

Additionally, **Exemplary's** own work in this field was last reported on page 4 in our April 2020 edition of *"Exemplary Advances"*.

---

[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.