Exemplary Advances

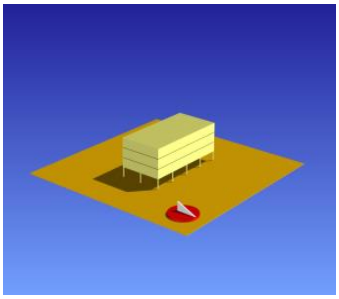
2020 October ***"Exemplary Advances"*** is the newsletter for Exemplary Energy Partners, Canberra. Feel free to forward it to friends and colleagues. Click here to subscribe or unsubscribe. Feedback is most welcome.

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

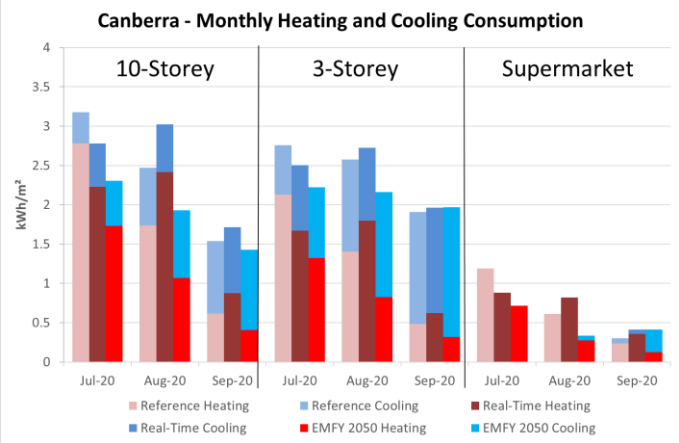
Exemplary Weather and Energy (EWE) Index[i] - September 2020

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

2020 September	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	42.2%	-8.6%	-75.8%	9.6%	-77.9%	0.8%
3-Storey	28.5%	-5.5%	-77.6%	15.4%	-72.8%	2.0%
Supermarket	50.4%	-12.6%	-55.1%	95.1%	-95.1%	75%
Solar PV	-0.5%		3.9%		3.4%	
PV Farm	-7.6%		N.A.		N.A.	

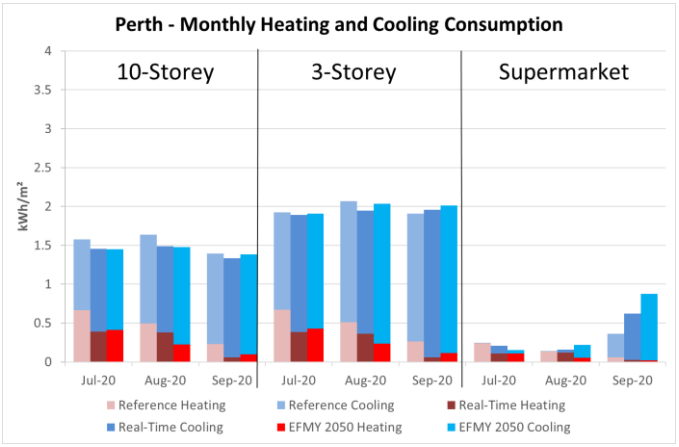


The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring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



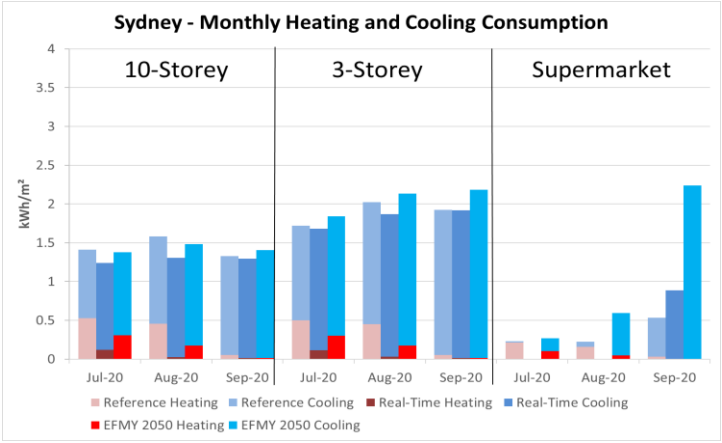
Canberra had a cooler than average September. The mean average and maximum temperatures were lower than the average by 0.9°C and 0.8°C respectively. The mean minimum was higher than average by 0.2°C. It was less sunny than the usual and also less windy which led to a 0.5% decrease in the solar PV array yield than the average. Due to lower than average temperatures, all the commercial building models had lower than average cooling consumptions and higher heating consumption. The east facing zone of the 10-storey office building had a 70% more heating energy consumption than average due to generally less sunny mornings in Canberra. All other zones also had a higher heating consumption than average but had a comparatively lower difference from average ranging from 20% to 40%. The temperature at the hour when heating consumption was at its peak was 3.9°C, which was 5.4°C lower than the average. Overall, the heating and cooling energy consumption of 10 storey office building was 28.5% higher and 5.5% lower respectively. When comparing the simulation results using our EFMY 2050 climate data with the RTY, it is projected that the two office building models would both have over 90% less heating consumption than the RTY, and the supermarket would require 40% less heating consumption than the RTY in September.

Perth had a warmer than average September. The mean average, mean maximum and mean minimum temperatures were higher than the averages by 2.0°C, 2.8°C and 1.4°C respectively. All three commercial building models therefore had lower than average heating consumption. A generally sunnier than average September produced a 3.9% higher solar PV array energy output than average.



The 10-storey office east facing and north facing zones had 92% and 83% lower than average heating energy consumption respectively due to the warmer, sunnier and less windy mornings and afternoons. The west facing and south facing zones also had over 70% less heating energy consumption due primarily to the warmer air temperatures. At the hour of peak heating, the air temperature was at 10.3°C which was about 1.8°C lower than the average. The peak heating consumption of the 10-storey office model was 71% lower than the average due to the slightly cooler temperature 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 over 40% higher cooling consumption and the supermarket would have 30% lower heating consumption than for the September just gone.

Sydney also had a warmer than average September. The mean average, mean maximum and mean minimum temperatures were 1.4°C, 1.1°C and 1.9°C higher than the averages. Due to sunny afternoons and higher than average wind speeds, the solar PV array output was higher than average by 3.4%. The heating consumption of all the commercial building models were lower than the average. The 10-storey office all zones except the east facing zone had over 70% less heating consumption and the only 30% less heating consumption than the averages for east facing zone due to the generally less sunny weather in the mornings and high wind speeds. During the hour of peak heating of the 10-storey office building model, the temperature was 10.3°C which was 1.1°C lower than the average. The peak heating energy consumption was therefore found to be 61% lower than the average. When comparing our EFMY 2050 simulation results with the results for July 2020, it is projected that the two office models would have around 8%-12% higher cooling consumption, and, the supermarket would have 60% higher cooling consumption than the September of the RTY.



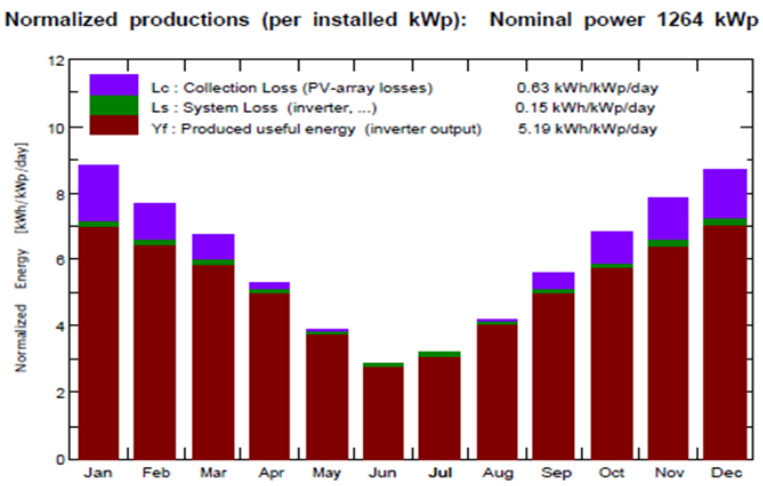
Delays to Solar Radiation Data for 2019

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, which has stalled with the data to the end of July, 2019, 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. As usual, we hope to provide an update on their progress in the next edition as there has been no progress over the past month.

Predicted Energy Outputs reporting for Majura Valley PV Farm

In the July edition of *"Exemplary Advances"*, we had informed readers about the Majura Valley community solar farm project in Canberra. As announced then, Exemplary is proud to provide the energy output projections from the solar farm using the System Advisor Model (SAM) and based on

recent weather data and also predicting the output for the two decade eras centred on: 2030 and 2050 based on our Ersatz Future Meteorological Years (EFMYs) predictions. The developer, SolarShare, is installing 1.3 MW of bi-facial solar panels on single-axis sun-tracking mounts. According to their engineering consultants, Epho Commercial, the farm is expected to export around 2391.8 MWh of energy into the grid in a typical year. This was calculated based on climate data which shows a yearly global irradiation of 1746.3 kWh/m^2 on the horizontal surface.



The simulation of the energy output using the EFMY data yielded an output prediction of 1807.64 MWh in 2030 and 1817.35 MWh in 2050. The output is drastically reduced in both of these scenarios, in spite of having a yearly Global Horizontal Irradiation (GHI) of 1782.1 kWh/m^2 and 1792.1 kWh/m^2 respectively for 2030 and 2050, because the high temperatures associated with global warming will affect the performance of the solar modules. The SolarShare output prediction is put forward assuming an average Canberra temperature of 13.34^{o}C while the EFMY data for 2030 and 2050 predicts a yearly average temperature of 14.44^{o}C and 15.52^{o}C respectively.

The output prediction using the Reference Meteorological Year (RMY) data which is representative data for the period from 1990 to 2017 produced a result of 2276.19 MWh which is 4.8% less than the energy output expected by SolarShare engineers.

The comparison of the yearly weather elements and the yearly energy output under different scenarios have been tabulated below:

Output Model	Weather Elements		Annual Energy output (MWh)
	Annual GHI (kWh/m^2)	Yearly Average Temperature (^{o}C)	
SolarShare Design	1746.3	13.34	2391.8
RMY	1765.6	12.93	2276.2
EFMY 2030	1782.1	14.44	1807.6
EFMY 2050	1792.1	15.52	1817.4

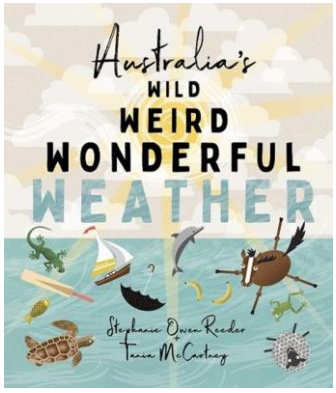
From this edition onwards, Exemplary will be calculating the monthly solar farm energy output based on the Real Time Year (RTY) data obtained from CSIRO measurements. This edition describes the energy output based on the RTY data from October 2019 to September 2020.

As seen from the above table if the Majura valley solar farm was operational, in September 2020, it was expected to produce 174.3 MWh as compared to the SolarShare design of 188.6 MWh.

Month	SolarShare Design			RTY Output			Difference between RTY and SolarShare Energy output (%)
	GHI (kWh/m^2)	Temp (°C)	Energy Output (MWh)	GHI (kWh/m^2)	Temp (°C)	Energy Output (MWh)	
Oct 19	172.1	13.4	226	265.2	14.7	251.7	11.37%
Nov 19	195.1	16.7	243.4	311.5	17.6	268.2	10.19%
Dec 19	218.7	19.19	276.1	315.6	21.5	275.7	-0.14%
Jan 20	219.8	20.9	273.5	263.3	22.5	227.4	-16.86%
Feb 20	172.4	20.0	227.8	239.4	20.6	192.4	-15.54%
Mar 20	165.9	17.6	229.9	205.0	16.9	193.7	-15.75%
Apr 20	124.4	13.1	188.7	148.0	13.0	141.7	-24.91%
May 20	95.3	9.2	147.6	123.6	8.4	125.0	-15.31%
Jun 20	66.9	6.8	107.1	104.6	6.7	101.7	-5.04%
Jul 20	77.4	5.8	123.4	110.1	6.5	113.2	-8.27%
Aug 20	104.3	7.3	159.6	138.7	6.3	143.9	-9.84%
Sep 19	134.0	10.5	188.6	183.3	9.8	174.3	-7.58%

Australia's Wild Weird Wonderful Weather

By Stephanie Owen Reeder and Tania McCartney (for children over 5 years old) $24.99



Did you know that, in 2009, a massive dust storm in Australia blew red dust and sand all the way to New Zealand, where it turned the glaciers pink? That, in 1899, Cyclone Mahina plucked dolphins out of the ocean in Far North Queensland and deposited them on cliff tops? That it snowed at Uluru in 1997?

In Australia's Wild Weird Wonderful Weather, readers are introduced to the wide range of weather in Australia, with bite-size pieces of information presented alongside graphic illustrations to entice young readers. Older readers will enjoy the detailed explanations about everything weather, from what causes certain phenomena to reading weather maps, exploring the climate of the past and preparing for the climate of the future.

For more details visit National Library of Australia (NLA).

[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.