Exemplary Advances

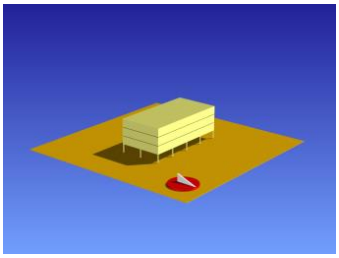
2020 July ***"Exemplary Advances"*** is the newsletter for Exemplary Energy Partners, Canberra. Feel free to forward it to friends and colleagues. Click here to subscribe or unsubscribe. Feedback is most welcome.

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

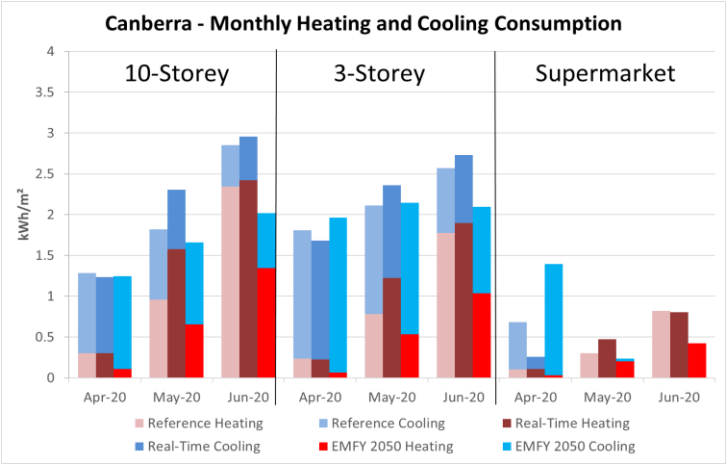
Exemplary Weather and Energy (EWE) Index[i] - June 2020

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

2020 June	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	3.4%	5.0%	-61.5%	17.3%	-32.6%	5.1%
3-Storey	6.8%	5.6%	-62.4%	23.7%	-32.1%	5.1%
Supermarket	-2.1%	N.A.	-65.6%	234.4%	-49.9%	N.A.
Solar PV	6.7%		-11.4%		5.1%	



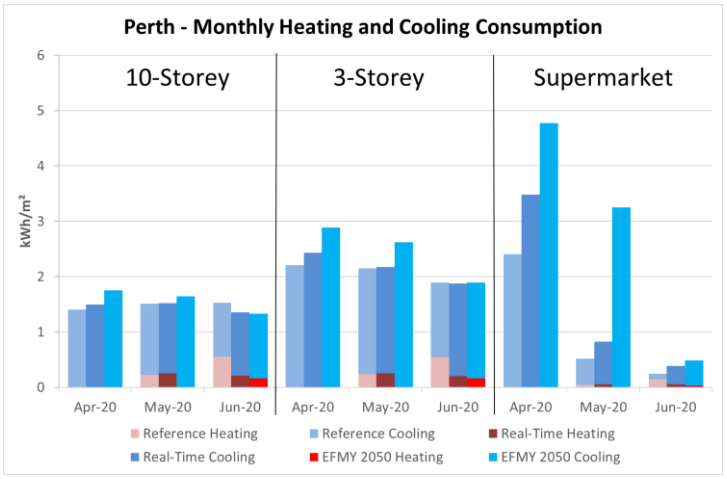
The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring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



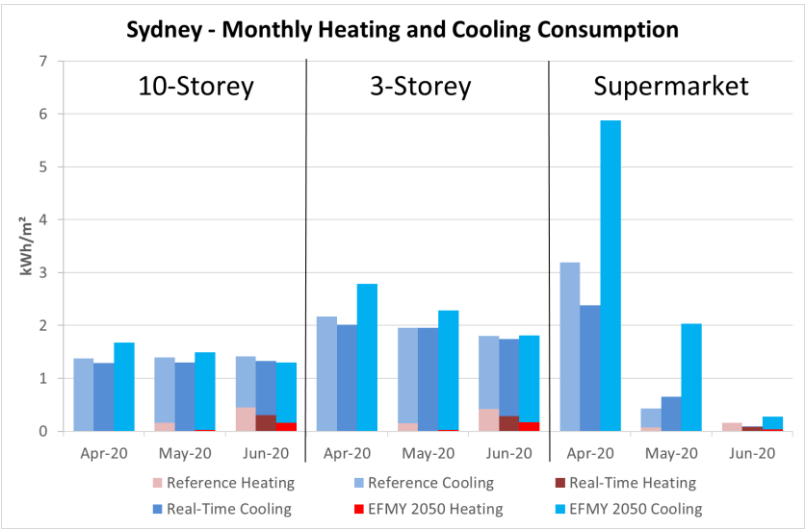
Canberra had a slightly cooler than average June. The mean average was lower than the average by 0.3°C while the mean maximum and mean minimum temperatures were higher than the averages by 0.1°C and 0.3°C respectively. It was overall sunnier, the solar PV array had an energy yield of 6.7% higher than the average. The two office building models had higher than average heating and also cooling consumptions. The data shows that this was due to the generally cooler than average morning but warmer during the day. The supermarket model, on the other hand, had less than average heating consumption (no cooling) as it was overall cooler in the evening, at night and also in the early morning (the time when the supermarket operates while the offices are still closed). The heating energy consumption of the 10-storey office East facing zones were 14.5% higher than the averages due to the generally colder morning. North and West facing zones also had around 12.5% to 5.6% higher heating. The temperature at the hour when heating consumption was at its peak was 0.5°C, which was 4.5°C warmer than the average. The peak heating consumption of the 10-storey office model, however, was 0.1.% higher than the average due to the high wind speed. 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 80% less heating consumption than the RTY, and the supermarket would require 11% more heating consumption than the RTY in June.

Perth had a warmer than average June. The mean average, mean maximum and mean minimum temperatures were higher than the averages by 2.6°C, 2.8°C and 2.2°C respectively. All three

commercial building models were therefore had higher than average cooling consumption. The supermarket had comparatively higher than average cooling consumption than the 2 office models due to the warmer evening, night and early in the morning. The solar PV array had an energy yield of 11.4% less due to the warmer weather and lower than average wind speeds which reduced the modules' efficiency. The 10-storey office East facing zones had close to 70% higher than averages cooling energy due to the warmer and generally sunnier weather during the morning. The South facing zones also had close to 70% higher cooling energy due primarily to the warmer air temperatures. At the hour of peak cooling, the air temperature was at 24.2°C which was 1.6°C higher than the average. Also, the global horizontal radiation was 42.2% higher than the average. Therefore, the peak cooling consumption of the 10-storey office model was 1.6% higher than the average due this 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 2-3% higher cooling consumption and the supermarket would have 28% higher cooling consumption than for the June just gone.



Sydney had a warmer than average June. The mean average, mean maximum and mean minimum temperatures were 1.0°C, 0.7°C and 1.2°C higher than the averages. The heating consumption of all the commercial building models were lower than the average. The 10-storey office North, East, South and West facing zones all had heating consumption lower than the averages by around 30%. It was sunnier, therefore, the solar PV array had an energy yield of 5.1% higher. The temperature at the hour of peak heating was 9°C which was 2.8°C higher than the average. Also, the wind speed was around 46% lower, hence the peak heating consumption of the 10-storey office model was 41.0% lower than the average due to the warmer and less windy condition at the hour of peak. When comparing our EFMY 2050 simulation results with the results for the June just gone, it is projected that the two office models would have around 72%-85% less heating consumption, and, the supermarket would have 20% lower heating consumption than the June 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.

Precipitation (Rainfall) Data Added to Weather and Climate Files

The availability of sub-daily rainfall event data is important for a wide range of engineering and modelling work in the built environment sector. While daily precipitation data are usually available, unfortunately, long series of recorded rainfall with hourly temporal resolution do not exist for all locations. The impetus for this work is to produce the input files for an anticipated version of NatHERS software used for modelling the energy performance of dwellings. This will allow accurate prediction of condensation issues for enhanced building healthiness and durability. In their study *'Local Climate Models for Hygrothermal Building Component Simulations'*, **Tanaka** and **Zirkelbach** (2016) note that "concerning the hygrothermal performance evaluation of building components, the local climate influence can be crucial". Accordingly, updated energy modelling input files incorporating precipitation data will also allow demonstration of full compliance with the new National Construction Code condensation requirements (NCC 2019).

Exemplary teamed with DeltaQ and Northrop for DISER Job

DeltaQ, led by engineer **Grace Foo** (pictured), has undertaken a research project entitled *Climate Change – Impact on Building Design and Energy* on behalf of the Department of Industry, Science, Energy and Resources (DISER) to better understand the impact of climate change on commercial building energy consumption and any HVAC and building design changes. Simulation expertise for the project came from Northrop's **Michael Smith** while the Ersatz Future Meteorological Years (EFMYs) and climate change expertise were provided by **Trevor Lee** of Exemplary. The report from this research, submitted at the end of June, will inform the Department and the Australian Building Codes Board (ABCB), if changes to the 2019 National Construction Code Section J (NCC Section J) or other regulation mechanisms are required to ensure future building resilience. *"Exemplary Advances"* will provide a summary of the results as soon as the report is made public.

Passive Ventilation to Decarbonise Commercial Buildings in Australia

Jack Wardale, a doctoral candidate in engineering for sustainable development at Cambridge University, UK, has partnered with Exemplary Energy to work on his dissertation project on prospects to shift to solutions involving passive ventilation to decarbonise commercial buildings in Australia. As for the DISER study cited above, the Ersatz Future Meteorological Year files (EFMY) donated by Exemplary for the years 2030 and 2050 will be utilised by Jack for his analysis which includes generating a building energy simulation model for the Australian locations of Melbourne, Sydney and Brisbane. Exemplary, being a strong promoter of research, is looking forward to Jack's final dissertation (which will be presented orally as well as through a poster which will be virtually available) and trusting it to be a valuable contribution to improving the energy performance of commercial buildings in Australia.

SolarShare 1.3 MW Majura Valley community solar farm

Canberra will soon welcome Australia's largest community solar farm. The 1.3 MW Majura Valley community solar farm developed by SolarShare is proposed to be designed and installed in between the new Majura bypass and the old Majura road by EPHO. More than 400 community members which constitute SolarShare will co-own the solar farm which is expected to power more than 250 Canberran homes. **Axel La Toison**, the senior project manager of EPHO, said that the project is undergoing its detailed design phase using tracking bifacial solar PV panels and is expected to commence construction

in August. Before Christmas this year the farm is programmed to be generating clean energy, which can abate around 1,600 tonnes of CO_2 per year over its 20 year planned life. Exemplary Energy is an investor in SolarShare and our **Nihal Hameed** and **Trevor Lee** are now assisting them with forecasting the solar farm energy output based on the climate data in recent years and applying Ersatz Future Meteorological Years (EFMYs) for the two decades centred on 2030. When in operation, we will also provide target outputs for the system using our Real Time Year weather files (RTYs) for inclusion in our Exemplary Weather and Energy (EWE) Index each month.

Heating and Cooling Costs of High and Low Performing Homes

The residential electricity price (GST inclusive) that commenced on 1 July 2020 is a reduction of 1.99% (increased by 0.83% last financial year) from 25.245 cents/kWh to 24.742[1] cents/kWh. However, the price of gas remained unchanged[2] at 3.4720[3] cents/MJ (11.9% increase in last financial year).

Canberra is located in a heating dominated climate where the amount of energy used for heating is 70%-80% of the total energy consumed for space conditioning and gas is the most common fuel for heating at home. The reduced in electricity but maintained gas price will marginally lower the annual energy cost. Using our 200 m² single storey house model as an example, a dwelling with lower NatHERS star rating that is fitted with a less efficient gas furnace and air conditioner, the total annual energy cost would reduce by about 0.40%. Using a more efficient heating and cooling appliance, the reduction in cost would only reduce by 0.63%. Visit our interactive matrix to see the cost implications of the full range of house sizes and star ratings and the full range of heater/cooler efficiency ratings.

Using the same house example but with electric heating and cooling system (i.e. reverse cycle air conditioners) the total annual energy cost could reduce by just less than 2.0% for a less efficient air conditioner or a higher efficiency system as the decrease in electricity this financial year is not significant. However, using electricity as the only power source to heat/cool a dwelling could cost up to 113% more than using electric only for cooling together with gas heating.

Asia Pacific Solar Research Conference – APSRC Melbourne 2020

Exemplary has offered three papers for consideration at this year's APSRC at the end of November:

1. Updating Australia's Reference Meteorological Years (RMYs) with the addition of Hourly Precipitation Data
2. Effect of Energy Efficiency Rating (EER) of Dwellings on Sale Prices in the ACT 1999-2020
3. Verification of ClimateCypher Climate Data Outputs with System Advisor Model (SAM)

More details will be provided in future editions of "Exemplary Advances".

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[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.

[1] Electricity price from ActewAGL, as viewed on 2020/06/24:
https://www.actewagl.com.au/-/media/files/pricing/act-electricity-schedule-of-charges-2020.pdf?rev=85abd6b0b46f418c83261f812081ec90&hash=B86AF56FA3F70121F0209763411162B2

[2] The price of gas is calculated from the average usage rates (cent per day, GST inclusive) of the followings: first 41.0959MJ/day (3.9413 cent), next 442.1918MJ/day (3.3761 cent) and next 1489.3151MJ/day (3.0985 cent).

[3] Gas price from ActewAGL, as viewed on 2020/06/24:
https://www.actewagl.com.au/-/media/files/pricing/act-gas-prices-2020.pdf?rev=d646f448cf3146a4adf906a81149c14d&hash=8CCAD099E12F971B92499AA68B4A6259