Exemplary Advances

2021 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.

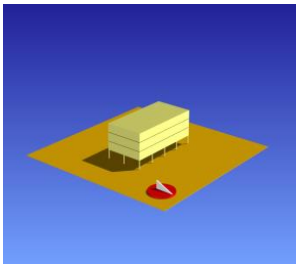
Past editions of ***"Exemplary Advances"*** are available on our website.

In this issue:

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

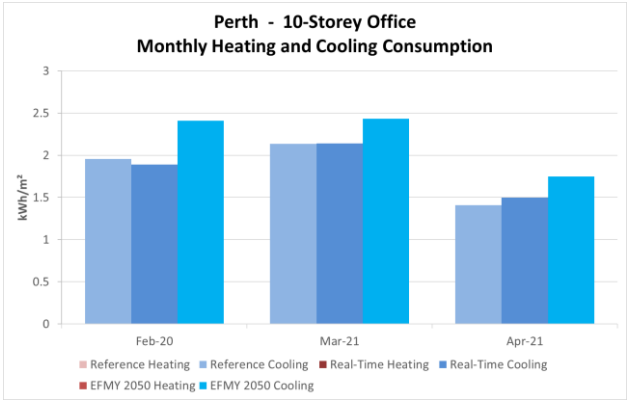
Monthly tabulation and commentary relative to the climatic norm – the Reference Meteorological Years

2021 April	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	N.A.	N.A.	-	6%	-	-9%
3-Storey	N.A.	N.A.	-	12%	-	-11%
Supermarket	N.A.	N.A.	-24%	60%	-80%	-41%
Solar PV	N.A.		-0.8%		2.8%	



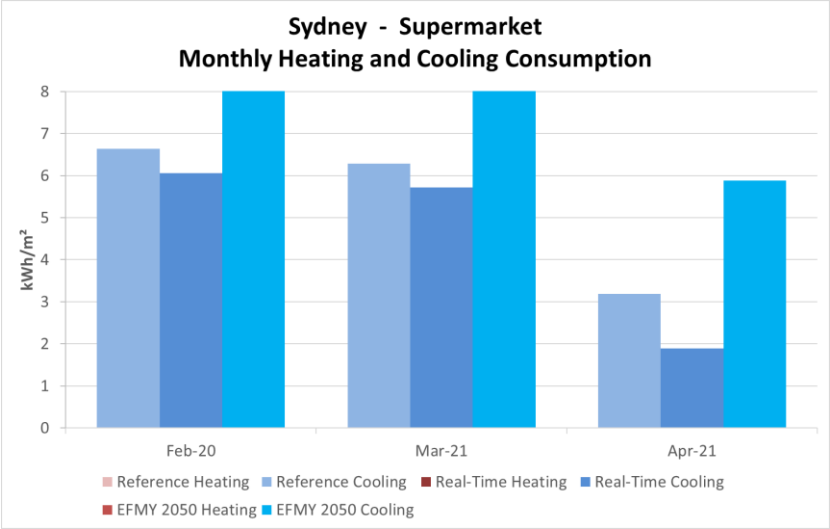
The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring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

Canberra had no data for April. The problem with CSIRO's weather station is being worked on but this much appreciated source of data over more than five years will not continue for long anyway. CSIRO has advised that the project that was funding the ongoing maintenance of the solar monitoring sites is being wound up, so there's now no official support to keep things running. See *New Sources of Real Time Weather Data* below.



Perth had a warmer and more humid April than average. The mean average, mean minimum and the mean maximum were higher than the averages by 0.8°C, 0.7°C and 1.9°C respectively. Average and minimum relative humidity (RH) in April was higher than long term average respectively by 6.3% and 15% while the maximum RH was lower by 4% (2021 Apr RH minus long term average Apr RH). Perth generally received higher than average solar irradiation in the mornings and early afternoons. However the solar PV

simulation showed an output 0.8% lower than the average. Perhaps the wind speeds were generally lower than average with the exception of afternoons and also the temperatures were higher than the average raising the PV temperature and thus reducing its efficiency. All three commercial building models had higher than average cooling consumption with the office buildings having the range of 6-12% while the supermarket was higher than average by 60%. Additionally, the heating consumption of the supermarket was 24% less than average. The east facing and north facing zones of the 10-storey office building showed a higher than average energy usage for cooling ranging from 20-21%; while the west and south facing zones had lower than average cooling energy consumption of 1.7% and 14.2% respectively. This is due to the higher than average solar irradiation in the morning hours and in the early afternoon hours. Due to higher than average humidity levels throughout a typical day, the latent heat of cooling was 0.84% higher than average while the sensible heat of cooling was 0.02% lower than average in Perth. 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 15% higher cooling consumption and the supermarket would have 19% higher cooling consumption than this April. The solar PV energy output for April when compared with the EFMY 2050 energy output showed that this April's PV output was 0.28 % higher than the projected output in 2050.



Sydney had a cooler and less humid April than the average. The mean average, the mean maximum and the mean minimum were lower than the averages by 0.7°C, 1.0°C and 0.7°C respectively. The average Relative Humidity (RH), minimum RH and maximum RH in April was lower than average by 9.9%, 5% and 1% respectively (2021 Mar RH minus long term average Mar RH). The solar irradiation received in Sydney was generally lower than the average value except for the early afternoon hours. But due to higher than average wind speeds almost throughout the daylight hours and generally lower than average temperatures, the solar PV array output was higher than average by 2.8%. The cooling consumptions of all the commercial building models were lower than the average and ranged between 9-12% in case of office buildings while the supermarket was lower by 41%. The heating consumption of the supermarket was 80% less than average. All the zones in the 10 storey office building had lower than average cooling consumption. Except for the north facing zone all the zones had cooling energy consumption lower than average by 15-19% while the cooling energy consumption for the north facing zone was lower than average by 12.4% due to higher than average solar insolation in the early afternoon hours. Due to higher than average humidity levels especially in the morning hours, the latent capacity for the 10 storey building was 1.3% higher than average but due to generally lower than average temperatures the sensible capacity was 0.3% lower than average. When comparing our EFMY 2050 simulation results with the results for April, it is projected that the two office models would have around 25-31% higher cooling consumption, and the supermarket would have about 68% higher cooling consumption than for the April just gone. The solar PV energy output for April when compared with the EFMY 2050 energy output showed 2.27% higher energy output when compared with the projected output in 2050.

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

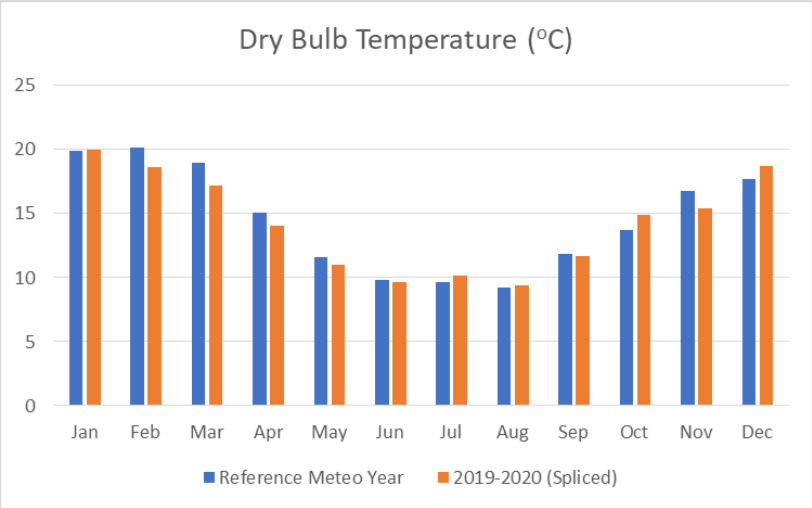
There is no formal update on the saga of the Bureau of Meteorology's gridded solar data derived from satellite observations which is still stuck at the end of July 2019. But the BoM's publication of data from its High Resolution solar monitoring ground-stations with minute-by-minute measurements is less behind. It is published to the end of July 2020. So Exemplary Energy is now able to produce **30** year weather and climate data files for the following locations.

NCC Climate Zone	Location	NCC Climate Zone	Location
1	Darwin, Broome, Learmonth, Townsville	5	Adelaide, Geraldton, Perth, Sydney
2	Brisbane, Rockhampton	6	Melbourne
3	Alice Springs, Longreach, Tennant Creek	7	Canberra, Cape Grim
4	Kalgoorlie, Wagga Wagga	8	omitted

Those wishing to purchase this data should contact Exemplary Energy for a prompt quotation. Currently data for **31** years is only available for Brisbane, Canberra, Perth and Sydney.

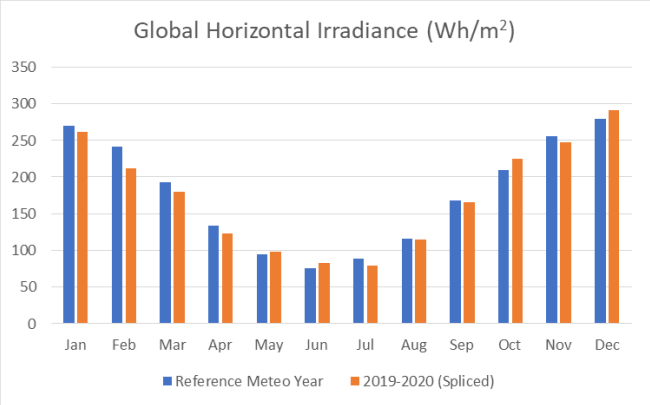
DISER Weather Files for the "Summer from Hell"

NCC Climate Zone	Location	NCC Climate Zone	Location
1	Darwin	5	Sydney
2	Brisbane	6	Melbourne
3	Alice Springs	7	Canberra
4	Wagga Wagga	8	omitted



The Commonwealth Department of Industry, Science, Energy and Resources (DISER) has commissioned Exemplary Energy to prepare weather files for the financial year 1 July 2019 to 30 June 2020 for stress testing of building designs by simulating them over the "Summer from Hell". The project covers seven of the eight Climate Zones in the National Construction Code (NCC).

Canberra and Sydney files were readily supplied from Exemplary's Real Time Year (RTY) service archives. In the absence of the Bureau's gridded solar data which is still stuck at the end of July 2019, Alice Springs, Darwin, Melbourne (Tullamarine, see graphs) and Wagga Wagga data sets were able to be generated with extra data from the Bureau of Meteorology (BoM) including its High Resolution solar monitoring ground-stations with minute-by-minute measurements. This required extra coding to aggregate the 1-minute data before input to our ClimateCypher software to produce TMY2 and EPW format weather files.



Climate Zone 2 was more problematic. Brisbane is its preferred indicative location but the BoM hi-res station was at Rockhampton – but, anyway, it had a significant instrument failure in the 12 months of interest and so was not a viable substitute. Fortunately, Dr Aaron Liu from Queensland University of Technology (QUT) has been able to supply us with data for the required 12 months. It too is in 1-minute time intervals but we are again able to aggregate that into half-hourly intervals for Climate Cypher.

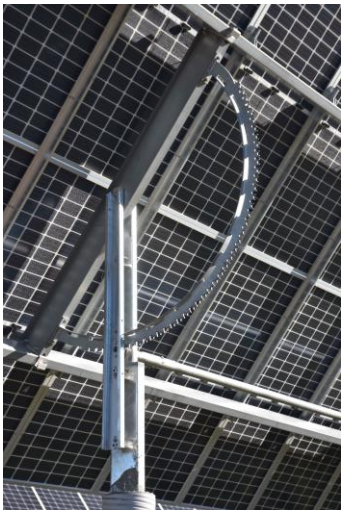
We look forward to directing you to the results of this work being undertaken by DeltaQ when it is published by DISER in a few months from now.

Australasian Solar Conference Archive to be Web Published

The Australian PhotoVoltaic Institute (APVI) has teamed up with Exemplary Energy to make the long term archive of solar energy conferences in Australasia searchable on the web. Exemplary's archive of 1980s and 1990s paper proceedings were scanned by Microsystems in Granville, NSW, to complement the CD proceedings of the 2000s to make all of that pioneering research more readily accessible. Microsytems' scanning software includes Optical Character Recognition (OCR) so that the first two decades are now much more accessible than they were in their hardcopy form as they are now searchable by key words in just the same way that the CD versions are.

"Exemplary Advances" will keep you informed of developments toward a formal launch before the end of this year.

New Sources of Real Time Weather Data



Exemplary Energy is currently negotiating with two new sources of real time weather data to allow the expansion of its Exemplary Weather and Energy (EWE) Index as a free public service and the sale of Real Time Year (RTY) data sets for these new locations to allow clients to simulate buildings and energy systems over actual recent durations.

For Brisbane, the QUT data source cited in the DISER article above could continue for ongoing use. For Canberra, the SolarShare community solar farm at Mount Majura in which Exemplary is a shareholder has an automatic weather station (AWS) which could be accessed in the event that the CSIRO's AWS remains unserviceable. The photographs are of the southern array of the SolarShare solar farm showing the single-axis sun tracking mechanism imported from Germany.

Those wishing to purchase this data should contact Exemplary Energy for a prompt quotation and confirmation of the time frame of delivery.

Australia is about to get its first proper carbon market

By Michael Mazengarb

Australia will soon have its first fully-fledged market for carbon permits, with the Clean Energy Regulator kick-starting work to establish a dedicated carbon trading exchange that will streamline and speed up trading of Australian carbon units.

The CER has issued an expression of interest for potential developers of an online exchange for emissions offsets, allowing offsets to be quickly traded. It is expected to support the emergence of new players into market for emissions reductions.

The dedicated exchange for government issued carbon units will accelerate the trading and transfer of emissions permits on a day to day basis, avoiding the need for traders to operate through often cumbersome emissions unit registries and is expected to significantly reduce transaction costs.

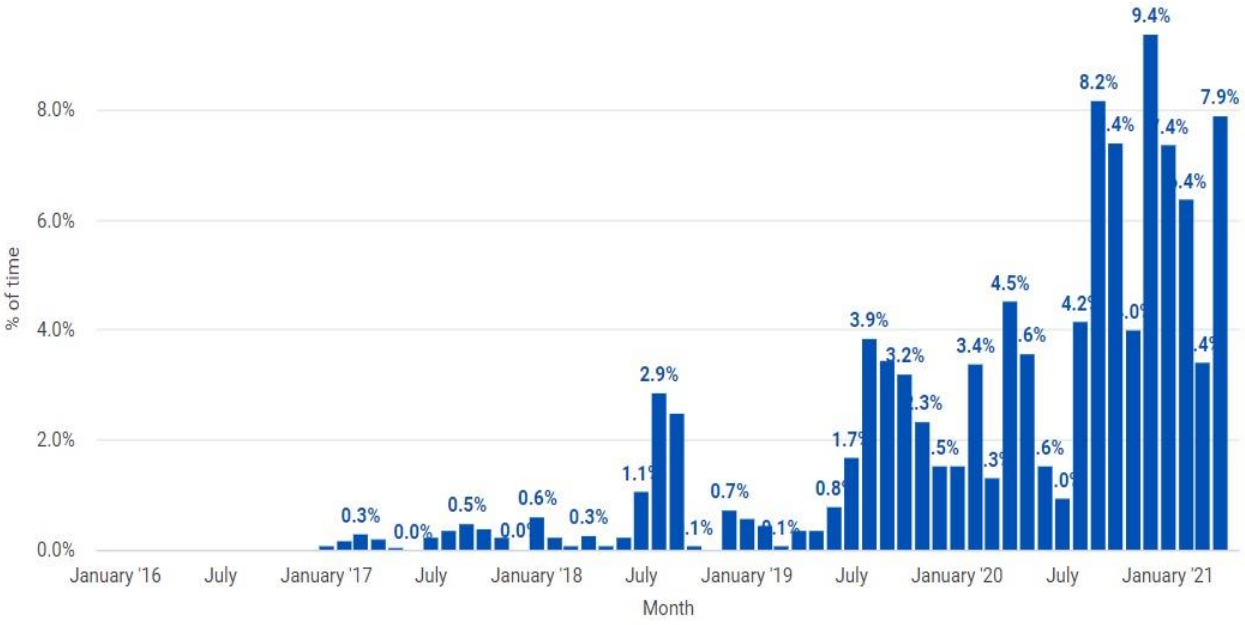
Read More.

Wind and solar farms seek to dodge negative prices and grid costs

By Matt Grover

In the Australian National Electricity Market (NEM), the energy transition from traditional generation to renewable resources is moving quickly, and new high-tech software tools are making wind and solar projects more competitive in the wholesale market and more attractive to investors.

In just the past two years, more than 35% of the NEM's grid-scale wind and solar farms have started using automated bidding software to optimise their market participation, respond to price signals, and improve financial returns.



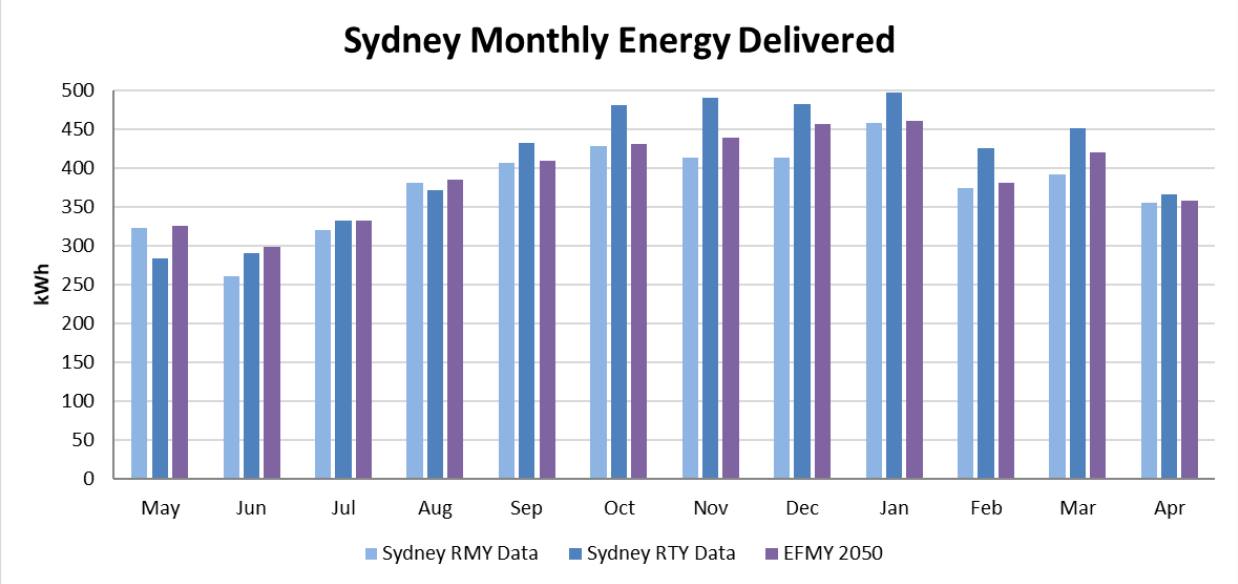
No longer content to be passive market participants, many wind and solar farms in the NEM have levelled-up their trading tools and capabilities to become active market participants – and become more profitable in the process, with some renewable assets increasing their annual net revenue by over 10% as a result.

Read More.

EFMY solar PV projected output now compared in EWE Index

Starting from this edition, Exemplary Energy is introducing the comparison of the monthly solar PV simulation output for the cities studied in the Exemplary Weather and Energy (EWE) Index analysis with the PV generation simulated with our EFMY (Ersatz Future Meteorological Year) file for the year 2050. Our EFMY files are developed predicting the future scenarios by combining the CSIRO climate projections with baseline data representative of baseline era climate. Since the new generation of PV plants have an expected lifetime of 25-30 years, this comparison will be beneficial in foreseeing how the solar PV plants will function in the predicted weather conditions of 2050 (although they will not be adjusted for PV efficiency degradation expected over that period).

Because Canberra RTY (Real Time Year) weather data is not available from CSIRO, this edition proceeds with the comparison only for Perth and Sydney. The following graph shows the PV energy outputs for Sydney with the RMY (Reference Meteorological Year), the RTY data and the EFMY 2050 data. Note that the output with EFMY 2050 data produces generally higher energy output than the baseline data due to the higher temperatures (the phenomenon of global warming) being of less impact on PV efficiency than an increase in insolation projected over that same time. Accordingly, it will be wise to design and finance new solar farms considering the projected future climate to cater to the world's generally increasing energy demands and a trend toward electrification.



[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.