Exemplary Advances

2021 June ***"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.

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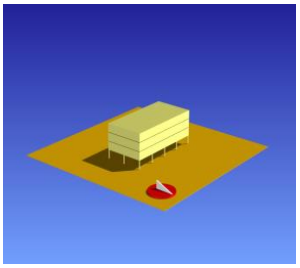
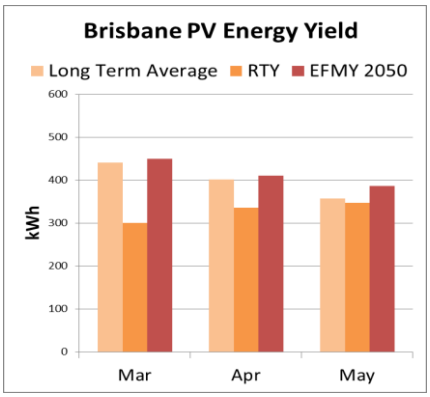
Exemplary Weather and Energy (EWE) Index[i] - May 2021

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

2021 May	Brisbane		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	-	-20%	-30%	-3%	-34%	-1%
3-Storey	-	-24.5%	-41%	-0.11%	-27%	0.34%
Supermarket	-	-8%	-24%	141%	-84%	31%
Solar PV	-2.8%		-2.1%		-16.5%	



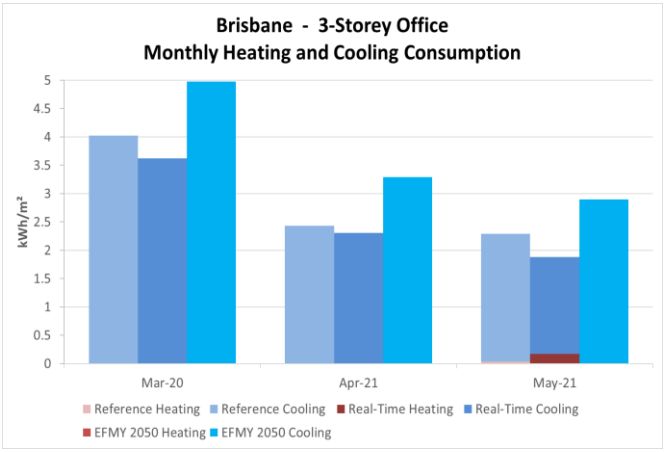
The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring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



Brisbane had a cooler but more humid May than the average. The mean average, the mean maximum and the mean minimum were lower than the averages by 4.0°C, 4.8°C and 4.4°C respectively. The average Relative Humidity (RH) and minimum RH in May was more than average by 14.8% and 47% respectively (2021 May RH minus long term average May RH). The maximum RH was the same as the average. The solar irradiation received in the mornings were lower than average while in the afternoon, it was higher than average. The wind speeds were generally lower than average. So the solar PV simulation results showed a lower output by 2.8%.

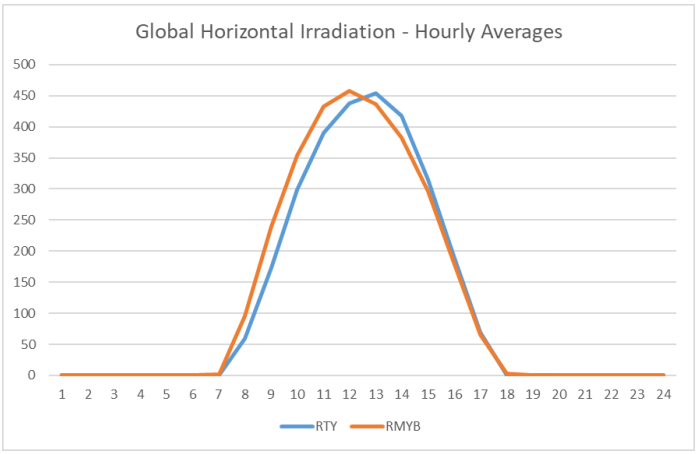
The cooling energy consumptions of all the commercial buildings were lower than average; the office buildings had a cooling consumption 20-25% lower than the average. All the zones in the 10 storey

office building had a lower than average cooling energy consumption. The east facing zones had the highest negative deviation of 29% from the average while north facing zones had the lowest negative deviation of 17%. This was due to the time of day variation in solar irradiation cited above.



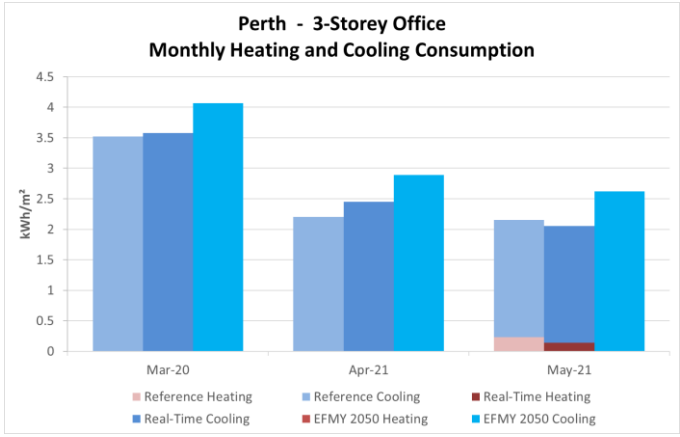
When comparing our EFMY 2050 simulation results with the results for May, it is projected that the two office models would have around 34-41% higher cooling consumption, and the supermarket would have about 60% higher cooling consumption than for the May just gone. The solar PV energy output for May when compared with the EFMY 2050 energy output showed 10.2% higher energy output projected in 2050.

Canberra had no data for May. 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.



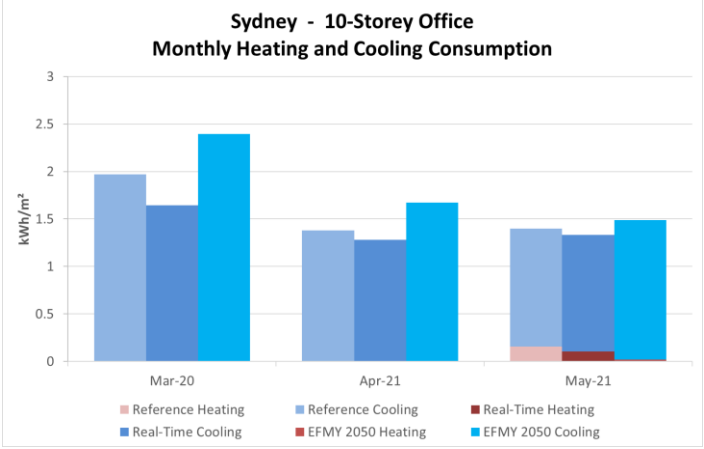
Perth had a warmer and more humid May than average. The mean average, mean minimum and the mean maximum were higher than the averages by 1.1°C, 1.5°C and 1.3°C respectively. Average and minimum relative humidity (RH) in May was higher than long term average respectively by 2% and 8% while the maximum RH was lower by 3% (2021 May RH minus long term average May RH). Perth generally received lower than average solar irradiation especially from late mornings til the end of the day. Therefore the solar PV output was lower than average by 16.5%.

The wind speeds were higher than average especially from late mornings til late evenings. Both the office buildings had a lower than average cooling energy consumption in the range of 1-3% while the supermarket had a significantly higher than average cooling consumption. In case of heating energy consumption, all the commercial buildings had lower than average consumptions; the office buildings had lower consumption in the range of 30-40% while the supermarket was lower than average by 24%. The east facing zones of the 10-storey building had a higher than average cooling energy due to higher temperatures in the morning hours. In the case of the north facing zones the generally lower solar irradiation in the afternoons led to a lower than average heating energy consumption by 12%. Due to higher than average humidity levels and warmer days, the latent heat of cooling was 0.84% higher than average and the



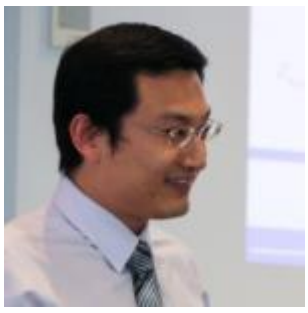
sensible heat of cooling was 2.3% higher than average.

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 25% higher cooling consumption and the supermarket would have 65% higher cooling consumption than this May. The solar PV energy output for May when compared with the EFMY 2050 energy output showed that this May's PV output was 16.8% lower than projected in 2050.



Sydney had a warmer but less humid May than the average. The mean average, the mean maximum and the mean minimum were higher than the averages by 1.2°C, 0.1°C and 1.4°C respectively. The average Relative Humidity (RH), minimum RH and maximum RH in April was lower than average by 12.3%, 8% and 5% respectively (2021 May RH minus long term average May RH). The solar irradiation received in Sydney was generally lower on a typical day in May except for few hours in the afternoons so the solar PV simulation results showed a 2.1% decrease. The wind speeds were higher than average but only in the afternoons. The heating energy consumptions of all the commercial buildings were lower than average while the cooling energies of office buildings were found to be close to the long term averages. The supermarket had higher than average cooling consumption of 31%. All the zones in the 10 storey office building except the east facing zones had higher than average cooling energy consumptions (and a lower than average heating consumption). This was due to the lower than average solar insolation in the morning hours which led to 22% higher heating energy consumption in the east zones. Due to lower humidity levels, the latent cooling for the 10 storey building was 0.26% lower than average but due to generally higher than average temperatures the sensible cooling was 1.3% higher than average. When comparing our EFMY 2050 simulation results with the results for May, it is projected that the two office models would have around 16-20% higher cooling consumptions, and the supermarket would have about 77% higher cooling consumption than for the May just gone. The solar PV energy output for this May was 1.19% lower than the projected output in 2050.

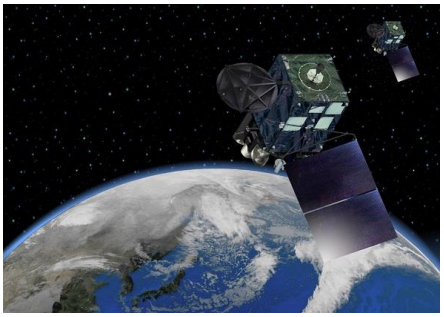
Brisbane added to the Exemplary Weather and Energy Index Service



As readers were informed in our May edition, Exemplary Energy is now able to procure solar irradiation data for Brisbane from the Queensland University of Technology (QUT) while sourcing the non-solar weather data from the BoM, we are now able to produce RTYs for Brisbane. The real time solar data used for Brisbane is sourced courtesy of Dr Aaron Liu, Queensland University of Technology (QUT), from the Davis™ weather station atop the Centre for Children's Health Research at the Queensland Children's Hospital (QCH). This monthly-generated RTY will be used for our EWE Index reporting from this issue onwards. Like the other cities being reported from before, the RTY data is compared with Reference Meteorological Year (RMY) data and Ersatz Future Meteorological Year (EFMY) data for 2050. The RMY for Brisbane was generated for the 29-year period 1990-2018. These RTYs can also be purchased and applied to analyse the energy performance of specific commercial buildings like offices and supermarkets so as to understand the

impact of the weather on the cooling and heating systems of such buildings for their ongoing review of operational energy effectiveness.

Satellite-derived Solar Irradiation Data available again soon



The Bureau of Meteorology (BoM) has advised that they expect to launch the real-time solar irradiation products on Tuesday 13th July. The system is proceeding through the final testing and sign-off stages as we write. The products will be available through the Bureau's registered user File Transfer Protocol (FTP) service. The BoM believes that these data streams are best suited to real-time operational applications rather than research. The BoM will send a notice to its emailing list when the new system is ready.

For research, the BoM plans to make the historical data available through its National Computational Infrastructure (NCI). Production and quality control of ~5 years of data at 2 km and 10 min resolution (all from the Himawari satellite, see "Exemplary Advances" 2016 August) takes a sizeable amount of supercomputer time. This processing is well underway and should be finished by the end of August. Once they're 'up-to-date', the gridded observations data will be made available through NCI with a ~3 month lag. Again, they will provide more information closer to that data being available and we will let you know through **"Exemplary Advances"**.

DISER Weather Files for the "Summer from Hell"

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).

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

Canberra and Sydney files were readily supplied form 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) 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 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 Enerefficient's **Hongsen Zhang** and DeltaQ when it is published by DISER in a few months from now.

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

There is at last a formal update on the saga of the Bureau of Meteorology's gridded solar data derived from satellite observations which has for too long been 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-Boulder ,Wagga Wagga	8	omitted

Those wishing to purchase this data should contact Exemplary Energy for a prompt quotation.

New Sources of Real Time Weather Data

Exemplary Energy is currently negotiating with 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 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.

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

Australasian Solar Conference 35 year Archive now Web Published

From an initiating suggestion by UNSW SPREE **Prof Alistair Sproul**, the Australian PhotoVoltaic Institute (APVI) has teamed up with Exemplary Energy to make the long term archive of solar energy collaborations and conferences in Australasia searchable on the web. Exemplary's archive of 1980s and 1990s paper proceedings along with their preceding annual Progress Reports 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 and a half 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.

As APVI Chair, **Dr Chris Fell** (CSIRO, Newcastle) reported to members recently, *"A while ago APVI member **Trevor Lee** generously donated hard copies of all the old ISES/ANZSES conference proceedings (1974-2009). Many thanks to Trevor - your devotion to collecting and storing these is everyone's gain,*

and an amazing opportunity to preserve what might have been lost for the industry. Our team led by ***Annie Ngo*** *(IT Power, Adelaide, pictured) has now completed the long process of scanning and uploading these to our website. The PDFs are searchable (thank goodness) so these are not just a great walk down memory lane, but also a genuine scientific resource."*

Readers can find the proceedings at - Historical conference proceedings

Energy Democracy - Central West NSW renewable energy co-operative

Exemplary Energy has invested in another community solar farm, this time near Orange, NSW, 250 km west of Sydney. Residents of New South Wales (or ACT) can join the Energy Democracy Central West NSW co-operative and access cheaper solar power. Energy Democracy are now raising capital for a 5 MW town-scale solar park with 5 MWh battery storage is being developed at 643 Mitchell Highway, Orange.

Parcels of shares in the co-operative equivalent to 2.5 kW of solar PV panels and 2.5 kWh of battery storage are available for just $4,995, thanks to a $3.5M grant from the New South Wales government's Regional Community Energy Fund. 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.

Exemplary Star v Star matrix updated for increased efficiency & prices

Each year, at this time, Exemplary Energy updates its "10 Star Challenge" web page to account for changing domestic prices for natural gas and electricity. For reasons of historical continuity we did not update the matrix to allow for the substantial re-calibration of heater and cooler appliance efficiency star ratings when it first applied to new products rated from 2018. This new Seasonal Energy Efficiency Ratio (SEER values)are based on the standard for *Performance of electrical appliances - Air conditioners and heat pumps* (AS/NZS 3823.4:2014 Amendment 1). That scale of SEERs runs to 10 stars but above 6 stars the scale represents a more theoretical potential rather than market availability. Anyway, the 6 star appliances used to offer Coefficients of Performance (COPs) of better than 3.1 at standard test conditions but now they provide SEERs of better than 7.5 – i.e. averaged over a season, 1 kW of electricity will deliver 7.7 kW of heat to (or from) the room.

All Electric

Reverse Cycle Air Conditioner Energy Rating Stars

Home Energy Rating Stars (EER)

Stars	1	2	3	4	5	6	7	8	9
1	$4,648	$3,210	$2,271	$1,665	$1,261	$961	$700	$448	$207
2	$3,407	$2,353	$1,665	$1,221	$924	$704	$513	$328	$152
3	$2,694	$1,861	$1,316	$965	$731	$557	$406	$260	$120
4	$2,231	$1,541	$1,090	$799	$605	$461	$336	$215	$99
5	$1,907	$1,317	$932	$683	$517	$394	$287	$184	$85
6	$1,666	$1,151	$814	$597	$452	$344	$251	$161	$74

Annual Energy Costs for a 200m² single storey home

The page shows matrices for two optional system types: 1) gas heating with electric air conditioning and 2) heat pump heating and cooling (often called reverse cycle air conditioning). Each matrix is responsive to user selection of house size between 75 and 500 m² (default of 200 m² shown below). And each has an indicative comparison of running costs of any associated duct systems of a range of insulation rated values.

Currently the matrices are set for Canberra prices as they were originally devised for the Master Builders Association (MBA) of the ACT but they are readily converted to the prices and climates of other cities. Promoters interested in this potential in their market should contact Exemplary Energy to discuss how to bring that potential to fruit.

Huge boost for wind, solar and storage is "transformational"

By Giles Parkinson

The New South Wales transmission company TransGrid has committed to spending $1.82 billion on the 900 km critical new transmission link to South Australia after the Clean Energy Finance Corporation (CEFC) stepped in to solve its financing issues with its biggest ever single financing facility.

The commitment by TransGrid to Project EnergyConnect means that the "transformational" link – designed to support South Australia's accelerated transition to 100 per cent renewables, and unlock billions of dollars of new wind, solar and storage projects in three states – will go ahead.

Read more here.

UNSW researcher wins top international solar technology gong

UNSW Engineering Professor **Thorsten Trupke** this month won the prestigious IEEE William Cherry Award. Prof. Trupke is a world-leading semiconductor scientist at UNSW's School of Photovoltaic & Renewable Energy Engineering (SPREE). He has made significant contributions to the field of photovoltaics and solar cell technology through his pioneering research breakthroughs and their subsequent translation to industry.

He invented photoluminescence (PL) imaging, a world-first technology that can identify hidden faults and defects affecting the performance of solar cells and silicon wafers. The technology measures the quality of silicon wafers, solar cells and of entire panels, typically in one second or less. Comparable assessments previously took several hours to complete. Read more here.

[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.