Exemplary Advances

2021 January ***"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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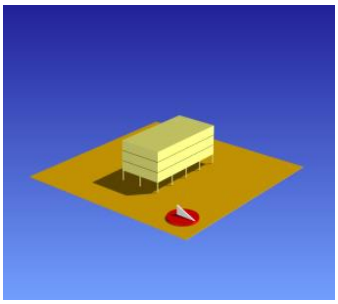
Exemplary Weather and Energy (EWE) Index[i] - December 2020

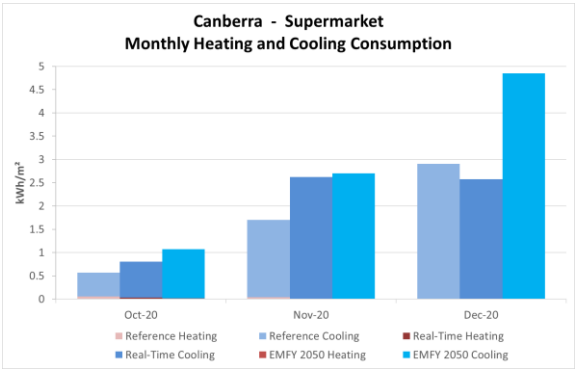
Monthly tabulation and commentary relative to the climatic norm – the Reference Meteorological Years

2020 December	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	N.A.	-3%	N.A.	5%	N.A.	-9%
3-Storey	N.A.	-2%	N.A.	6%	N.A.	-10%
Supermarket	N.A.	-11%	N.A.	10%	N.A.	-14%
Solar PV	12.5%		7.8%		12.8%	
PV Farm	8.8%		N.A.		N.A.	

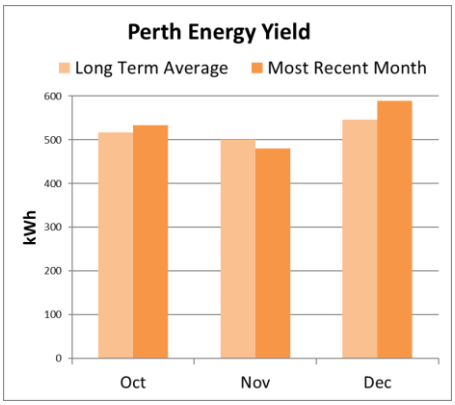


The Exemplary Real Time Year weather files (RTYs) the current Reference Meteorological Year files (RMYs) and the Ersatz Future Meteorological Years (EFMYs) used for these monthly simulations are available for purchase to allow clients to simulate their own designs for energy budgeting and monitoring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

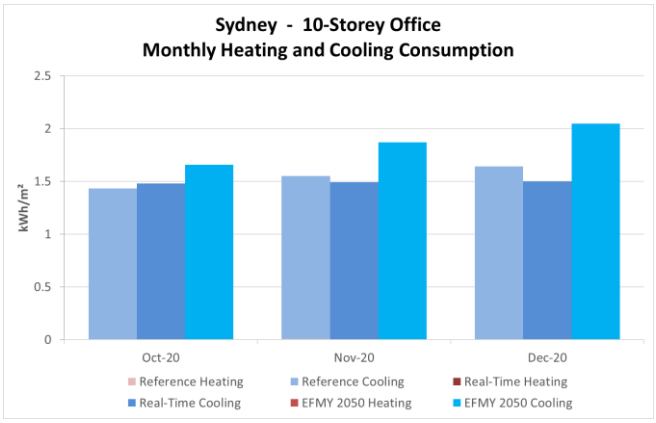
Canberra had a slightly cooler than average December. The mean average and mean maximum were found to be 0.4°C, and mean minimum was coincidentally equal to the average mean minimum. It was usually sunnier than the average after 12 noon and the wind speeds generally were lower than average. However, a 12.5% increase in the solar PV model can be attributed to the post noon increase in solar irradiation and the generally lower than average temperatures seen in last December. All the commercial building models had lower than average cooling consumptions with the office buildings having a lower cooling consumption by 2-3%. The east facing zone of the 10-storey office building had around 6.7% less cooling energy consumption than average (the lowest of all the zones) when compared to 0.6% higher than average in the west facing zone due to lower than average solar irradiation in mornings and also lower temperatures in the mornings. The temperature at the hour when cooling consumption was at its peak was 33.4°C, which was 11.1°C higher than the average and hence the cooling energy consumption at the time of peak load was 1.9% higher than 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 both have around 15-17% higher cooling consumption than the RTY, and the supermarket would require around 47% more cooling consumption than the RTY in December.



Perth had a warmer than average December. The mean average, mean maximum, and mean minimum temperatures were higher than the averages by 1.0°C, 0.7°C and 1.5°C respectively. Generally Perth received higher than average solar irradiation throughout the daytime on a typical December day. Also the winds speeds recorded in the early afternoons were above the average. The combination of the above two factors has led to generating 7.8% higher energy output than average from solar PV model. All three commercial building models had higher than average cooling consumption with the office building in the range of 4-6% while the supermarket had 11% higher than usual. The 10-storey office east facing zone had 13.1% higher than average cooling energy consumption while all other zones had only 4-7% increase in cooling energy consumption due to high solar irradiation and lower wind speeds in the morning. At the hour of peak cooling, the air temperature was at 35.1°C which was about 2°C higher than the average. Therefore the peak cooling consumption of the 10-storey office model was 13.7% higher than the 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 10% higher cooling consumption and the supermarket would have 17% higher cooling consumption than this December.



Sydney experienced a cooler than average December. The mean average, mean maximum, and mean minimum temperatures were lower than the long-term averages by 0.8°C, 1.4°C and 0.1°C. It was generally sunnier in the afternoons and the wind speeds were higher than average during the daytime hours in Sydney, the combination resulting in the solar PV array output being higher than average by 12.8%. The cooling consumptions of all the commercial building models were lower than the average by 9-14%. The west facing zone of the 10 storey office building saw least reduction of 6.7% in cooling energy consumption when compared to the average while other zones saw much higher reduction in cooling consumption ranging between 14-16%; the reason being the higher than average solar irradiation incident on the building in the afternoon hours. Overall the 10 storey office building had a 9% decrease in the cooling energy consumption in December. During the hour of peak cooling of the 10-storey office building model, the temperature was 29.3°C which was 0.7°C lower than the long term average. The peak cooling energy consumption was therefore simulated to be 14.3% lower than the average. When comparing our EFMY 2050 simulation results with the results for December 2020, it is projected that the two office models would have around 27-31% higher cooling consumption, and, the supermarket would have about 40% higher cooling consumption than for the December just gone.

Delays to Solar Radiation Data for 2019 and 2020

We will continue to keep you informed of developments in this field, although nothing has been announced over the festive season. The hiatus since July 2019 has meant an embarrassing delay to the production of up to date weather files for over two years now. The full one-page statement from the Bureau of Meteorology released in November last year is available here for reference in the interim.

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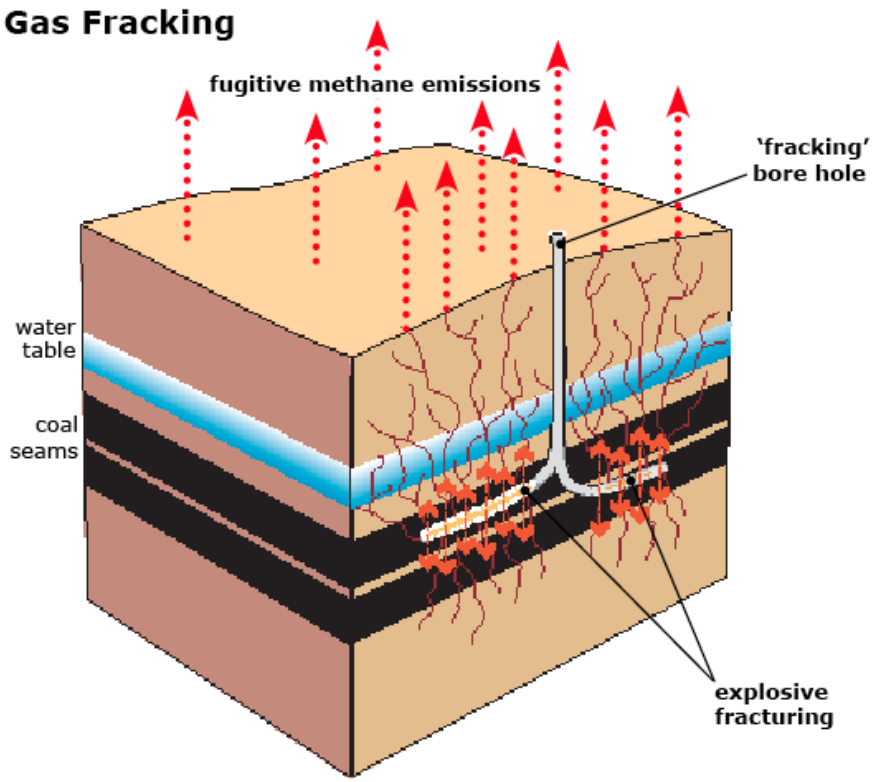
Community Energy for Goulburn – Solar PV Farm Investment

Exemplary Energy confirms its investment in another community owned solar farm: this one in Goulburn, NSW. The Co-op was formed in mid 2020 by a local community association, Community Energy for Goulburn Inc (CE4G) established in late 2014 to build the community owned solar farm. Details of the proposal were included in our November 2020 edition.

They are still raising the last of the investor finance of $1.9M with a minimum Investment of $400 with initial preference going to residents of Goulburn Mulwaree and adjoining local government areas (LGAs) but **investment is now open** to residents of the rest of NSW and the ACT.

The peril of high atmospheric methane levels

by Dr Andrew Glikson, Earth and Climate scientist, Geospectral Research, Canberra



It is hard to think of a more Orwellian expression than that describing the increase in toxic atmospheric methane gas as "gas-led recovery."

Several of the large mass extinctions of species in the geological past are attributed to an increase in atmospheric methane (CH_4), raising the temperature of the atmosphere and depriving the oceans from oxygen. Nowadays a serious danger to the atmosphere and for the life support systems ensues from the accelerated release of methane from melting Arctic permafrost, leaks from ocean sediments and from bogs, triggered by global warming. As if this was not dangerous enough, now methane is extracted as coal-seam-gas (CSG) by fracking (hydraulic fracturing) of coal and oil shale in the US, Canada, Australia and elsewhere.

Methane-bearing formations, located about 300-1000m underground, are fracked using a mixture of water, sand, chemicals and explosives injected into the rock at high pressure, triggering significant amounts of methane leaks into the overlying formations and escaping into the atmosphere *(Figure 1. Schematic illustration of coal-seam-gas fracking (R. Morrison, by permission, above)*.

CSG is made primarily of about 95-97% methane, which possesses a radiative greenhouse potential close to X80 times that of carbon dioxide (CO_2). The radiative greenhouse effect of 1 kg methane is equivalent to releasing 84 kg of CO_2 and decreases to 20 and 34 times stronger than CO_2 over a 100-year period. Read more.

Enhanced accuracy of ClimateCypher's P10 and P90 years

By Trevor Lee, Naman Jain and Nihal Hameed

We at Exemplary Energy have enhanced our in-house software, ClimateCypher, by fine tuning its capability of selecting the months for concatenating into P00, P10, P90 and P100 years for a user-selected period - generally several decades.

P10 and P90 values are defined as the values which are expected to occur or be exceeded 10% and 90% of the time in a long term dataset. ClimateCypher produces climate data of a period of years and also the RMY (Reference Meteorological Years) used as the single synthesised year representative of a set of years. By this new function, ClimateCypher will now also produce a set of four 12 month synthetic years: the least sunny, the 10%ile least sunny, the 90%ile most sunny and the sunniest.

For more information go to 2020 APSRC "Verification of ClimateCypher Climate Data Outputs with System Advisor Model (SAM)" by **Nihal Hameed** et al.

South Australia achieves 100% solar and lowest prices in Australia

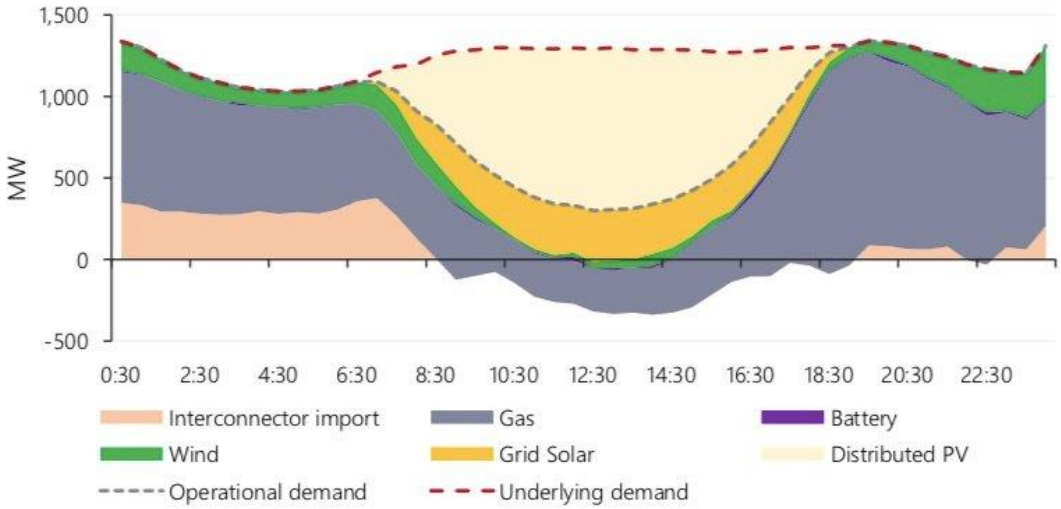
by Giles Parkinson

South Australia – maligned by conservatives over the world-leading share of wind and solar in its grid – now boasts the cheapest wholesale electricity prices in the country, even as it reaches "world first" levels of 100 per cent solar power.

The Australian Energy Market Operator, in its latest Quarterly Energy Dynamics report, confirms that South Australia – as first reported exclusively by Reneweconomy three months ago – served all of its electricity demand for more than an hour shortly after mid-day on October 11 through rooftop and utility scale solar.

Figure 7 SA solar (grid and distributed) meets 100% of South Australia's demand for the first time

South Australia operational demand by time of day – 11 October 2020



AEMO says this is a world-first in a grid of this size, and occurred in a December quarter when South Australia posted the lowest wholesale electricity prices in the country – thanks to the growing share of wind and solar and the increase in rooftop solar PV which is reducing grid demand. Read more.

[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.