Exemplary Advances

2020 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.

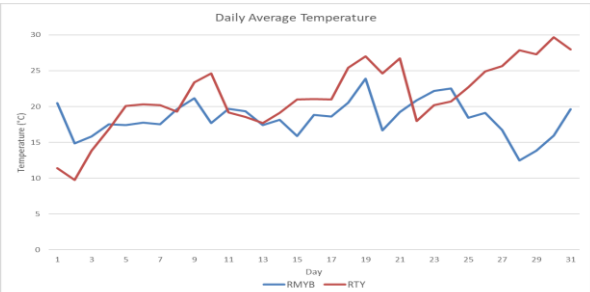
Exemplary Weather and Energy (EWE) Index[i] - December 2019

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

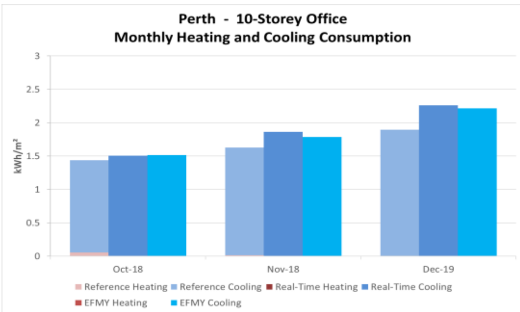
2019 December	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	N.A.	21%	N.A.	19%	N.A.	-3.8%
3-Storey	N.A.	23%	N.A.	23%	N.A.	-4.3%
Supermarket	N.A.	57%	N.A.	28%	N.A.	-2%
Solar PV	8.3%		2.7%		9.6%	

The Exemplary Real Time Year weather files (RTYs) and 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 warmer than average weather in December. The mean maximum and mean average temperatures were higher by 5.8°C and 3.1°C respectively. Only the mean minimum was lower by 2.7°C. It was sunnier as well. Cooling consumptions of all the three commercial buildings were higher than the averages. The 10-Storey office North facing zone had over 37% higher cooling consumption than the norm. South facing zones also had close to 37% higher cooling consumption. East and West facing zones had relatively lesser increase in cooling consumption but both perimeter zones had over 25% higher cooling due to the warmer and sunnier weather. The solar PV array had an energy yield of 8.3% higher.



Perth had warmer than average weather in December as well. The mean average and maximum temperatures were both higher by 2.1°C and the mean minimum was higher by 2.3°C. All three commercial building models had cooling consumptions higher than their averages. The 10-Storey office West and North facing zones had around 22% to 25% higher cooling consumption respectively. The East facing zone had relatively higher increase in cooling consumption - close to 28% higher than the norm - due to the generally warmer air temperature in the morning. It was sunnier and, therefore, the solar PV array had an energy yield of 2.7% higher in this weather.



Sydney had slightly cooler than average weather in December. The mean average and maximum temperatures were lower by 0.4°C and 1.2°C respectively. Only the mean minimum was higher by 0.7°C. The cooling consumptions of all three building models were lower than the norm. The cooling consumption of the 10-storey office South facing zone was over 7% lower due primarily to the cooler air temperatures. Both the East and North facing zones also had lower cooling consumption by 9.3% and 5.9% respectively due to the cooler and cloudier weather in the morning. Only the West facing zone had higher cooling consumption due to the sunnier weather in the afternoon. The solar PV array had an energy yield of 9.6% higher in this weather.

Enhancements to the EWE Index

Earlier editions of the Exemplary Weather and Energy Index compared energy consumption in the immediate past month with that of the Reference Meteorological Year (RMY), an indicative climate data set of 8,760 hours prepared by concatenating the 12 most indicative calendar months. Their indicativeness is tuned to their application through the weightings given to the pertinent weather elements to give RMY-A (solar given 50% weighting), RMY-B (solar given 33% weighting) and RMY-C (solar given only 17% weighting).

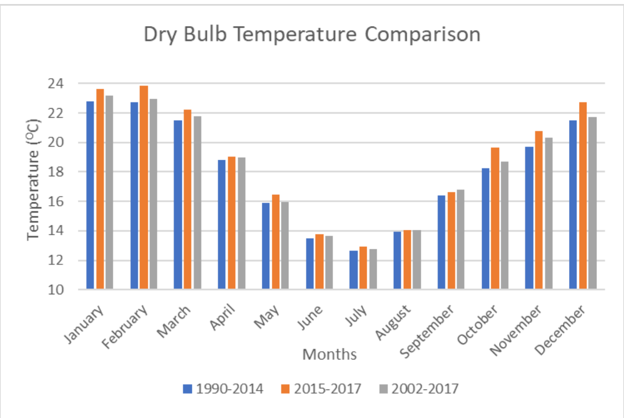
The EWE Index is now also calculated in comparison with the Ersatz Future Meteorological Year (EFMY) for 2050 and graphically compared with those relevant monthly values. Our EFMYs are generated in accordance with *"Future climate data for 100 prospective Australian solar energy sites"* Report by John M Clarke, Craig Heady and Dr Leanne Webb, CSIRO Marine and Atmospheric Research, September 2014.

New Intern - Nihal Abdul Hameed

Our Team has grown with the joining of Nihal as an Intern with us. He is currently a first-year postgraduate student at the Australian National University (ANU) specializing in Renewable Energy. A Mechanical Engineer by profession, he has done his bachelors from the National Institute of Technology, Calicut, in the southern state of Kerala, India. He has worked previously in the Building Services Engineering domain before he took up his Master's program at ANU. His interest in Renewable Energy and willingness to explore innovative approaches in engineering will be valued greatly here at Exemplary.

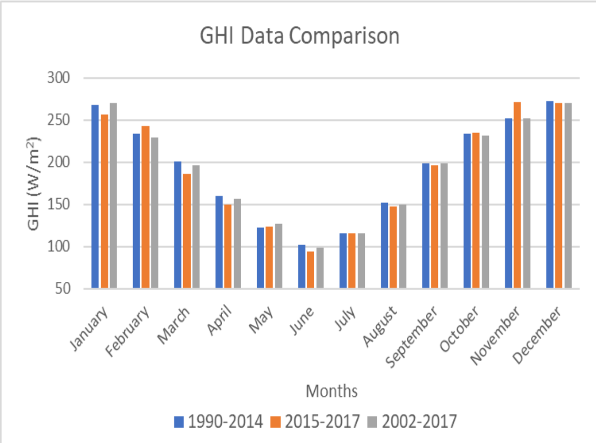
Temporal Analysis of Weather Data - Sydney

Exemplary has prepared updates to its set of 201 Australian sites most recently published for the quarter century of 1990-2014. Especially in the context of a changing climate, we are routinely processing data from subsequent years and comparing this with the prior decades. Most recently, this has been done for the three years 2015-2017 and the change analysed through the increments over time of the five key weather elements. For completeness, we have also compared the potential new climate data season of 2002-2017 (the most recent available 15 year data sets – long enough to smooth out the perturbations of the ~11 year Sunspot Cycle.



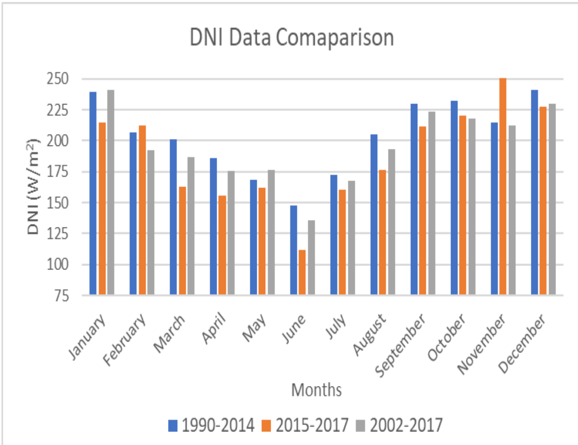
This Temporal Analysis has been carried out for the eight capital cities plus Alice Springs NT (Arid) and Cabramurra NSW (Alpine) so as to cover the gamut of the Climate Zones in the Building Code of Australia (BCA) - now part of the National Construction Code (NCC).

Looking into the RMY months comparison, the addition of the 2015-2017 batch of data resulted in many changes to RMY months – each selected to be indicative of the expanded 28 years of data. In addition, the extreme years where the solar radiation is only just less than 10% of the years (P10) and only just less than 90% of the years (P90) had most months change, one of which was to new data: January 2015.



RMY-A had 5 selected months change, two of which were to new years, being June 2015 and December 2015. Interestingly, RMY-A for both batches had no months from the 1990s. RMY-B had only 1 month change and RMY-C had only 2 months change.

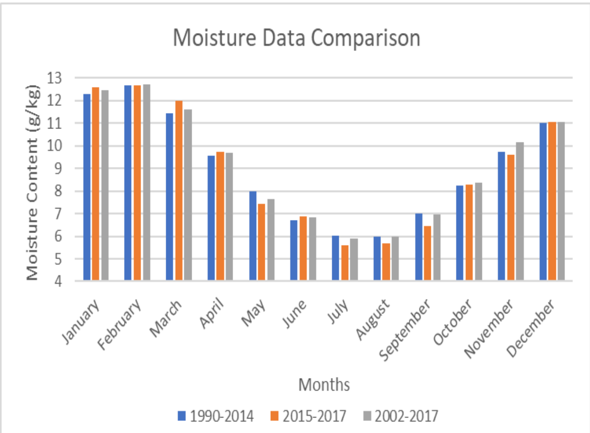
Comparing the new months for RMY-A, four out of five months changed to more recent years, except for May which changed from 2005 to 2000. The new months had very small decreases to mean dry-bulb temperature and moisture and a small decrease to wind speed of 2.72%. Global Horizontal Irradiation (GHI) increased slightly by 0.61% while Direct Normal Irradiation (DNI) decreased by 2.27%.

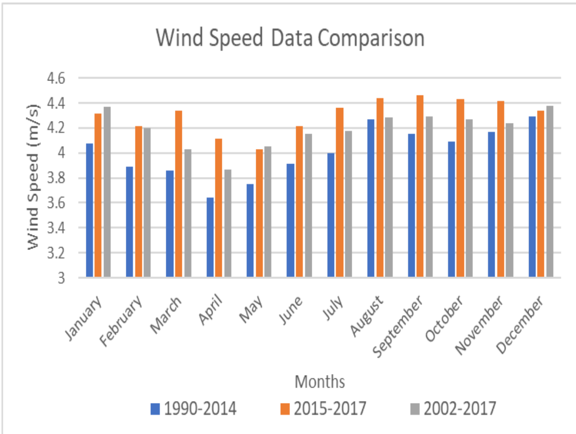


Comparing the data during the period of 1990-2014 with that of 2015-2017 (the data of the latest three years), an increase was noticed in mean temperature by 0.69 degrees, a decrease in moisture by 0.59%, an increase in wind speed by 7.38%, and a decrease of GHI and DNI by 1.08% and 7.47% respectively.

Comparing 1990-2014 with 2002-2017 (the most recent 15 years, the minimum record length to define climate) showed an increase in mean temperature of 0.28 degrees, a decrease in moisture of 0.62%, an increase in wind speed of 4.55%, and a decrease to GHI and DNI of 0.7% and 3.75% respectively.

Nihal prepared this month-wise graphical comparison of weather data of these three time periods.





Further to this temporal analysis of weather data for central **Sydney** between the widely-used current set of data (1990-2014) with the recently developed new batch of weather data (1990-2017), each issue of ***"Exemplary Advances"*** will see a similar comparison for each of the other nine sites around our country to assist readers to consider the need to update the weather and climate data they use for their simulations and other analyses. Look out for them in past and future editions of ***"Exemplary Advances".***

[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.