Exemplary Advances

2019 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.

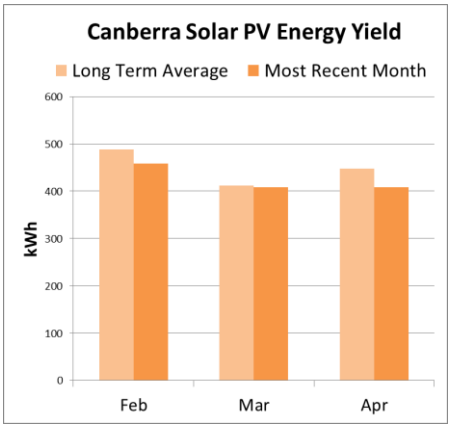
Exemplary Weather and Energy (EWE) Index[i] - April 2019

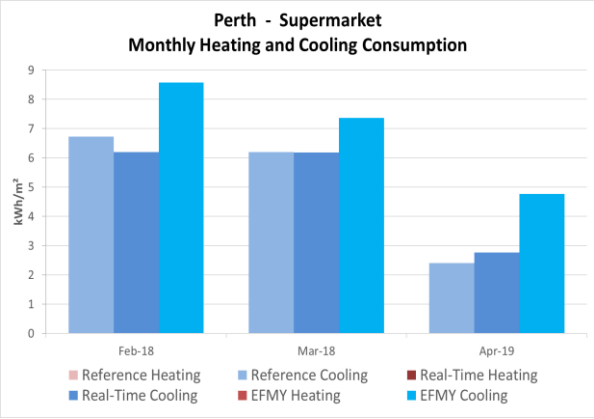
Monthly tabulation and commentary relative to the climatic norm – the Reference Meteorological Years

2019 April	Canberra		Perth		Sydney	
	Heat	Cool	Heat	Cool	Heat	Cool
10-Storey	-43%	7%	N.A.	-15%	N.A.	*-4%*
3-Storey	-53%	10%	N.A.	-12%	N.A.	*-4%*
Supermarket	-45%	9%	N.A.	14%	N.A.	*-3%*
Solar PV	12.7%		-26.0%		*0.0%*	

The Exemplary Real Time Year weather files (RTYs) 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.

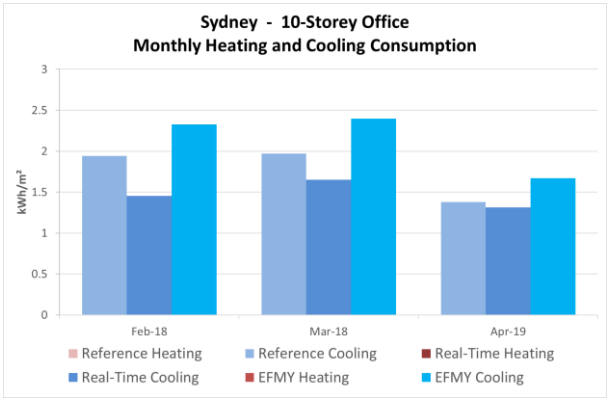
Canberra had warmer than average weather in April in terms of air temperature. Although the mean maximum temperature was lower by 0.1°C, the mean average and minimum temperatures were higher by 1.5°C and 0.6°C respectively. Therefore, the two office buildings and supermarket models had cooling consumptions higher than the averages. The cooling consumption of the 10-storey office North facing zones was over 32% above the norm. East and West facing zones also had over 25-29% higher cooling consumption because it was sunnier than the average. The solar PV array had an energy yield of 12.7% higher under this sunnier weather.





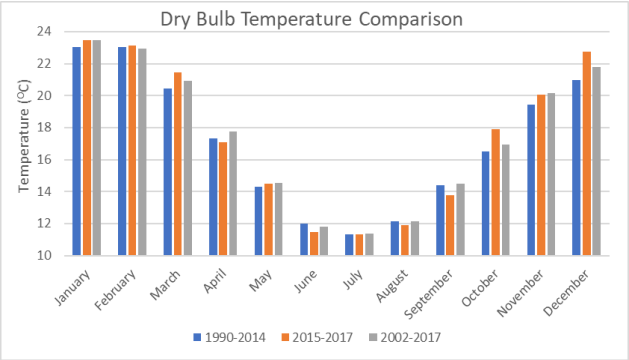
Perth had cooler than average weather in April. The mean average, maximum and minimum temperatures were lower by 0.3°C, 1.0°C and 4.0°C respectively. The two office building models had cooling consumptions lower than the norm due to the cooler air temperatures during the day. Only the supermarket model had a higher cooling consumption due to the warmer than the average air temperature during midnight. The cooling consumption of the 10-Storey office South facing zone was over 18% lower than the norm. The North and West facing zones also had cooling consumption 11.5 and 40.4% lower due to the cooler weather during the day. It was cloudier than the average, therefore, the solar PV array had an energy yield of 26% lower.

Sydney had warmer than average weather in April in terms of air temperature. The mean average and minimum temperatures were higher than the averages by 0.5°C and 2.2°C respectively. However, during the day the temperatures were slightly lower than the averages. It was cloudier as well. The cooling consumption of all the three commercial building models were lower than the norm by 3% - 4%. The cooling consumption of the 10-storey office East and West facing zone were around 8 – 9% less than the norm. South facing zone was also around 8% less due primarily to the slightly cooler air temperatures. The solar PV array had an energy yield same as the average under this weather.



Temporal Analysis of Weather Data – Adelaide

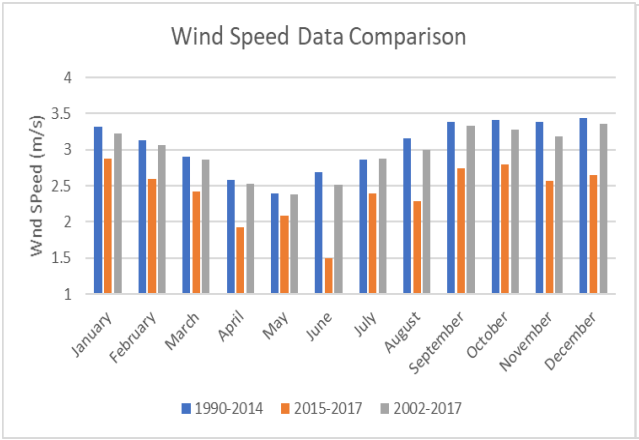
Exemplary has prepared updates to its set of 201 Australian sites most recently published for the quarter century of 1990-2014. Especially in the context of a changing climate, we are routinely processing data from subsequent years and comparing this with the prior decades. Most recently, this has been 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).

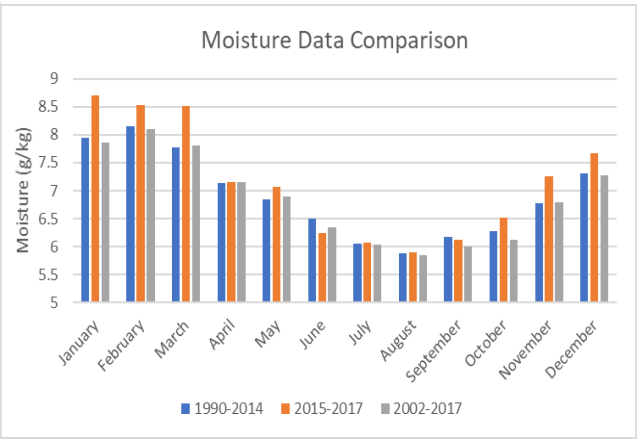


The Temporal Analysis has been carried out for the eight capital cities plus Alice Springs (Arid) and Cabramurra NSW (Alpine) so as to cover the gamut of the Climate Zones in the Building Code of Australia (BCA) - now part of the National Construction Code (NCC). This issue of Exemplary Advances brings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

The new batch of processed data resulted in many changes to the RMY months data. P10 and P90 data have changes to 9 and 10 months respectively. P10 data saw only September change to a year from the 2015-2017 period (it was changed from 2005 to 2015), while P90 data had January and November change to 2015 (from 1990) and 2016 (from 2008) respectively.

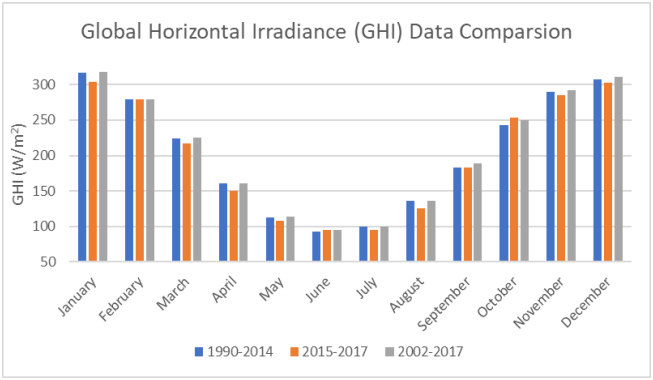
RMY-A had changes only in two of its months, while RMY-B and RMY-C months each had changes in 3 of its months. RMY-A's changes were June changing from 2002 to 2013 and October changing from 1997 to

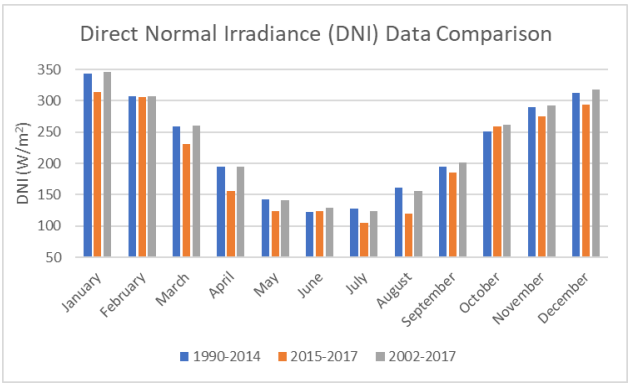




2010. RMY-C was the only RMY to have a recent year in the changes, which was September changing from 2009 to 2017.

The two new months for RMY-A showed an increase in mean temperature by 0.068 degrees, a decrease to moisture of 0.18%, a decrease to wind speed of 11.36% and GHI and DNI both increasing by 1.52% and 2.29% respectively.





Comparing the 1990-2014 data with the 2015-2017 data, an increase in mean temperature by 0.32 degrees was noticed, further, an increase in moisture of 3.55%, a decrease in wind speed of 21.32%, and a decrease to GHI and DNI of 1.87% and 7.91% respectively was also seen.

The 2002-2017 data with respect to the 1990-2014 data showed an increase of mean temperature by 0.13 degrees while the increase to wind speeds remained at 8.01%. Moisture decreased by 0.25%, while GHI increased by 0.12% and DNI decreased by 1.29%.

Further to this temporal analysis of weather data for **Adelaide** 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"***.

Rainfall Data to be Added to Climate Files

Technically speaking, we will be adding Precipitation data to our files as the measure for "rainfall" includes snow, hail, sleet, dew and mist where they are sufficient to meet the 0.2 mm minimum measurement trigger of current instruments. Aligning with the format conventions for ACDB solar data and TMY2 solar data, we are using half hourly data to generate hourly data to the ACDB convention of the hour centred on the time stamp (i.e. half hour before and half hour after) and the TMY2 convention of the hour leading up to the time stamp (i.e. the two preceding half hours). This subtle difference in solar data is currently ignored in the officially available climate data for commercial building simulation in Australia to the discredit of those who generate it.

The ACDB data format has sufficient unused cells to allow the precipitation data to be added to the end of each hourly line in a form agreed with the CSIRO's Dr **Dong Chen**. However, the TMY2 format has no space for precipitation and so we must graduate now to the TMY3 format to achieve this weather and climate richness of reporting and simulation.

There are other complications to be dealt with too. Accordingly, we are embarking on a statistical analysis of half-hourly precipitation data to allow the best possible alignment of that data for the full period 1990 to 2019 even in the earlier years when only daily rainfall data was being manually collected on a 24 hours to 9:00 AM basis in many of our over 200 sites of interest.

[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.