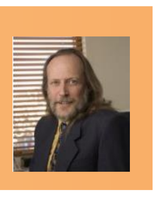

2015 ASIA-PACIFIC SOLAR RESEARCH CONFERENCE

Weather Affects Building and PV Performance Simulation v Monitoring

Trevor Lee[1], Grant Edwards[2]

[1]*Exemplary Energy Partners, TT Architecture Centre, 35 Kennedy Street, Kingston, Canberra, Australia*

[2]*Macquarie University, Balaclava Road, North Ryde, Sydney, Australia*

E-mail: trevor.lee@exemplary.com.au

Abstract

Apart from occupant and management behaviours, weather variability is the biggest confounding factor in comparing simulation results with metered energy performance (e.g. NABERS commitment agreements vis a vis initial NABERS rating). The variability and comparison of simulation performance with recent actual weather and the climatically typical weather used in most simulations were discussed, as well as the data normalisation process and its PV performance. The use of actual weather data allows more reliable monitoring of energy efficiency to prompt timely response to system malfunction. This is illustrated by comparison of simulation results for three archetypical commercial buildings using Reference Meteorological Year data and the immediate past 12 months of recorded weather. The simulations are used to generate a set of Exemplary Weather and Energy Indices that are published monthly for Facilities Management (FM) application without charge.

Real-Time Year (RTY) Weather Data

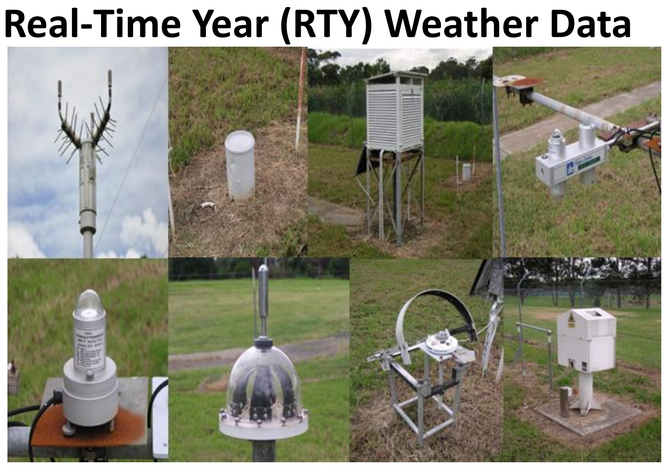

Figure 1. Instruments for acquiring Real-Time data

Other Weather Data Services

- Extreme Meteorological Year (XMY)
- P90 data (90th %ile low solar)
- Ersatz Future Meteorological Year (EFMY)

More info at:

www.exemplary.com.au/solar-climate-data.php

Applications of RTYs and EWE Indexes

- Simulation Model Calibration
- Building or energy system monitoring
- Renewable energy generator monitoring
- Measuring actual output or consumption in previous 12 months or month relative to Reference (i.e. typical) Meteorological Years (RMYs)

Normalisation for nearby sites

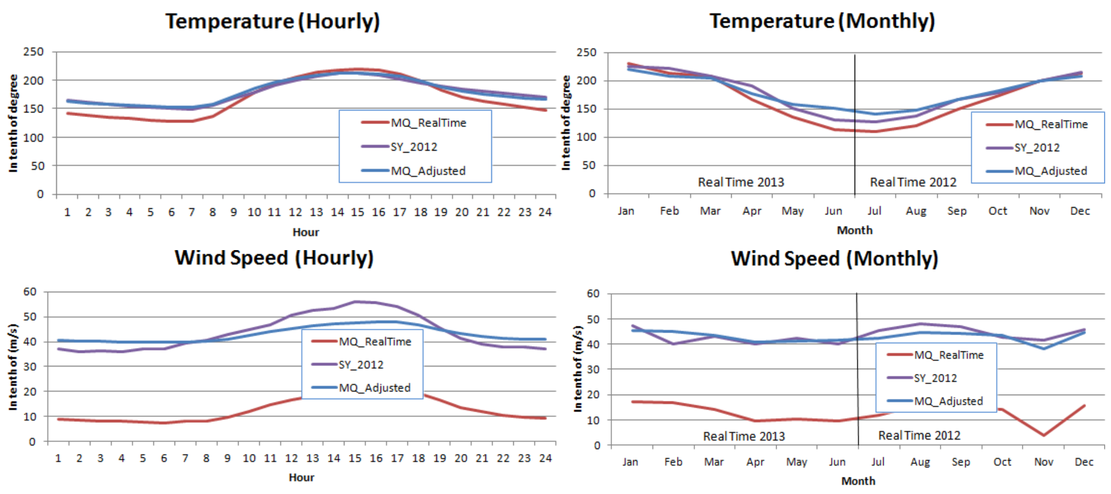

Figure 2. Macquarie University AWS– Normalisation to Sydney CBD

Comparison of Sources of Sydney Solar and Weather Data

Quality Assurance of the source data from Sydney is currently being carried out. This involves the comparison between University of Technology Sydney (UTS). University of NSW (UNSW) and Macquarie University (MQ) sources with Bureau of Meteorology (BOM) coincident measurements. The gist of the results of that comparison may be made public through the free monthly e-newsletter *"Exemplary Advances"*.

New subscribers welcome: exemplary.energy@exemplary.com.au

Real-time Data – Weather vs Climate

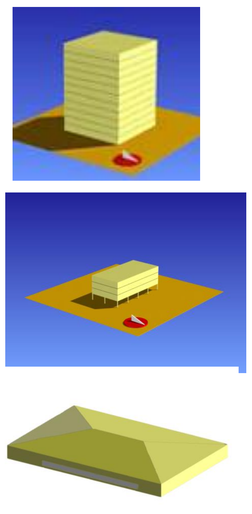

Table 2 . Exemplary Weather and Energy Index Sydney – 12 months actual v RMY

Weather Energy Index	10-storey Office		3-storey Office		Supermarket	
	Cooling	Heating	Cooling	Heating	Cooling	Heating
Nov-14	7%	N.A.	9%	N.A.	26%	-100%
Dec-14	-5%	N.A.	-5%	N.A.	13%	N.A.
Jan-15	-2%	N.A.	-3%	N.A.	4%	N.A.
Feb-15	-21%	N.A.	-23%	N.A.	-4%	N.A.
Mar-15	-20%	N.A.	-24%	N.A.	-15%	N.A.
Apr-15	-10%	N.A.	-12%	N.A.	-20%	N.A.
May-15	3%	-89%	4%	-90%	133%	-100%
Jun-15	22%	-82%	28%	-82%	1011%	-100%
Jul-15	21%	-68%	28%	-65%	317%	-98%
Aug-15	22%	-93%	33%	-93%	406%	-100%
Sep-15	8%	-99%	15%	-100%	219%	-100%
Oct-15	12%	N.A.	20%	N.A.	146%	N.A.

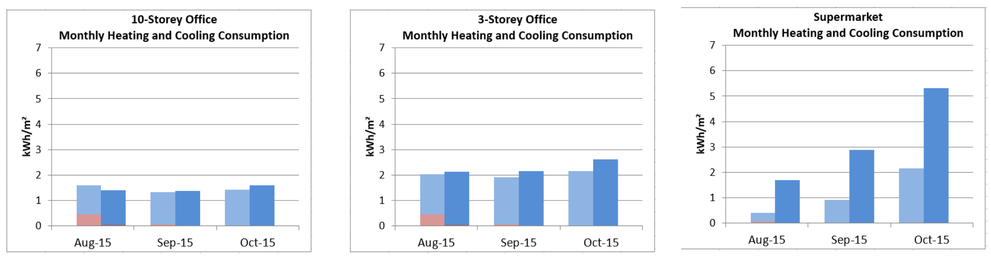

Figure 3. Exemplary Weather and Energy Index – Sydney Building Simulation

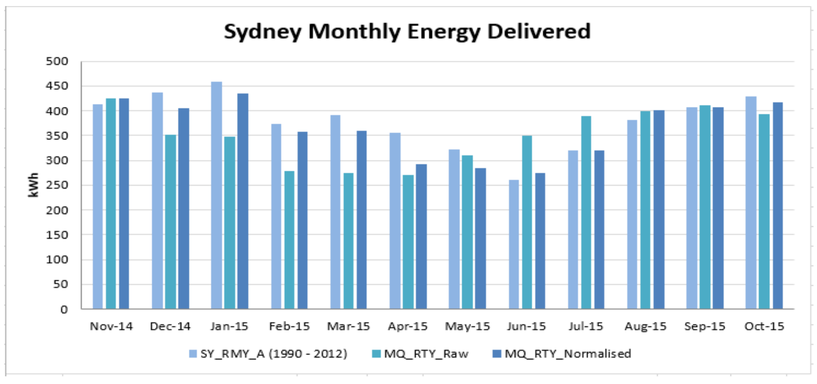

Figure 4. Exemplary Weather and Energy Index – Sydney PV

RTY data services have been updated every month for Canberra (with CSIRO), Perth (with Murdoch University) and Sydney (with Macquarie University) since July 2013. More info at

www.exemplary.com.au/solar_climate_data/real-time-year.php#RTY_Simulation

Conclusions

- RTY Data can be applied with building and renewable energy system simulation techniques to monitor and maintain actual operating systems in optimal working order commensurate with designs.
- That same data can be applied to publish a Weather and Energy Index based on archetypical systems as an indicator of variation in weather (compared with long term indicative weather - i.e. with climate).
- The RTY data normalisation process was successful to match data with nearby but different key locations – e.g. Macquarie University with the Sydney CBD

References

Exemplary Energy Partners, 2015, "*Energy Weather Indices, Monthly Graphs*", Exemplary Energy Partners, Canberra, available at http://www.exemplary.com.au/solar_products/EWE%20indices.php

Acknowledgements

The authors thank Alberto Troccoli and Chris Price from CSIRO for assistance . The Exemplary team, especially Talent Deng, Fangwei Ding, Chris Wang and Maria Salazar for technical assistance with the data and report analysis.