How does solar impact gas demands? Observations from hourly gas demand data

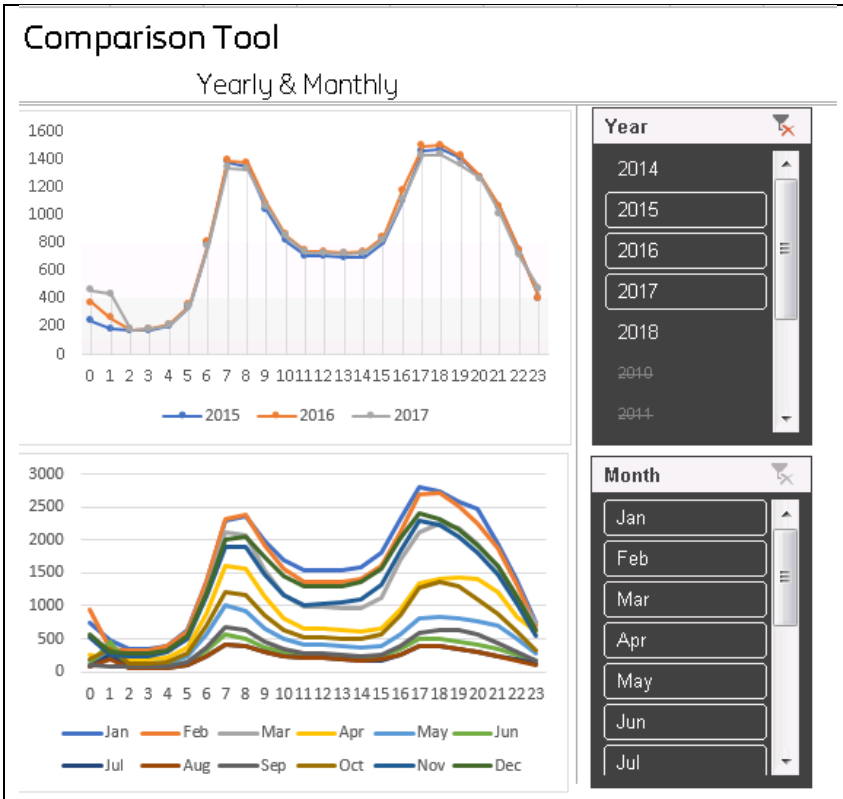
Daily gas demand can be considered as a function of weather and the amount of hours buildings are occupied in a day. The demand requirements of a home will be greater (given the same CWV) if occupiers are indoors for most of the day. Some of this effect is due to calendar effects (higher residential demand on weekend's vs. weekdays) while weather can also influence customer behaviour – remaining indoors on rainfall days.

One direct impact is from the additional warming provided by solar radiance. For example given the lower position of the sun in the winter and South facing rooms. Therefore given the same temperature, gas demands would be lower on a bright day compared to a dull day.

One indirect impact is from the behavioural effect of customers spending time outdoors on bright days, compared to a dull or rainy day when they remain indoors, with heating usage remaining for longer.

Solar is a measurement of direct impacts from lower gas demand requirements on bright days, and is by proxy a measure for rainfall effects and customers remaining indoors.

The following includes example of several days. Firstly here are typical profiles for a year and monthly.



Observations

Gas profile is similar to the electricity shape.

Across years 2015,16,17 the gas profile is similar.

Across Jan to Dec, April demands for the evening peak are more broad than other months

27/09/2017 -solar effect?

Figure 1:27/09/2017 – Wednesday. Levels of solar across the day were low, with CWV at 14.50 and 14.52 for the comparison day. Daily demand differed greatly as a result of higher evening peak demands. An explanation could be due to more heating demand needed following the low levels of solar radiance during the day. However wind speed was also higher, perhaps this could be the reason for higher peak demand. Given CWV is in the transition range it would have no effect on the CWV calculation, if it had CWV would had been lower.

02/08/2017 – solar effect?

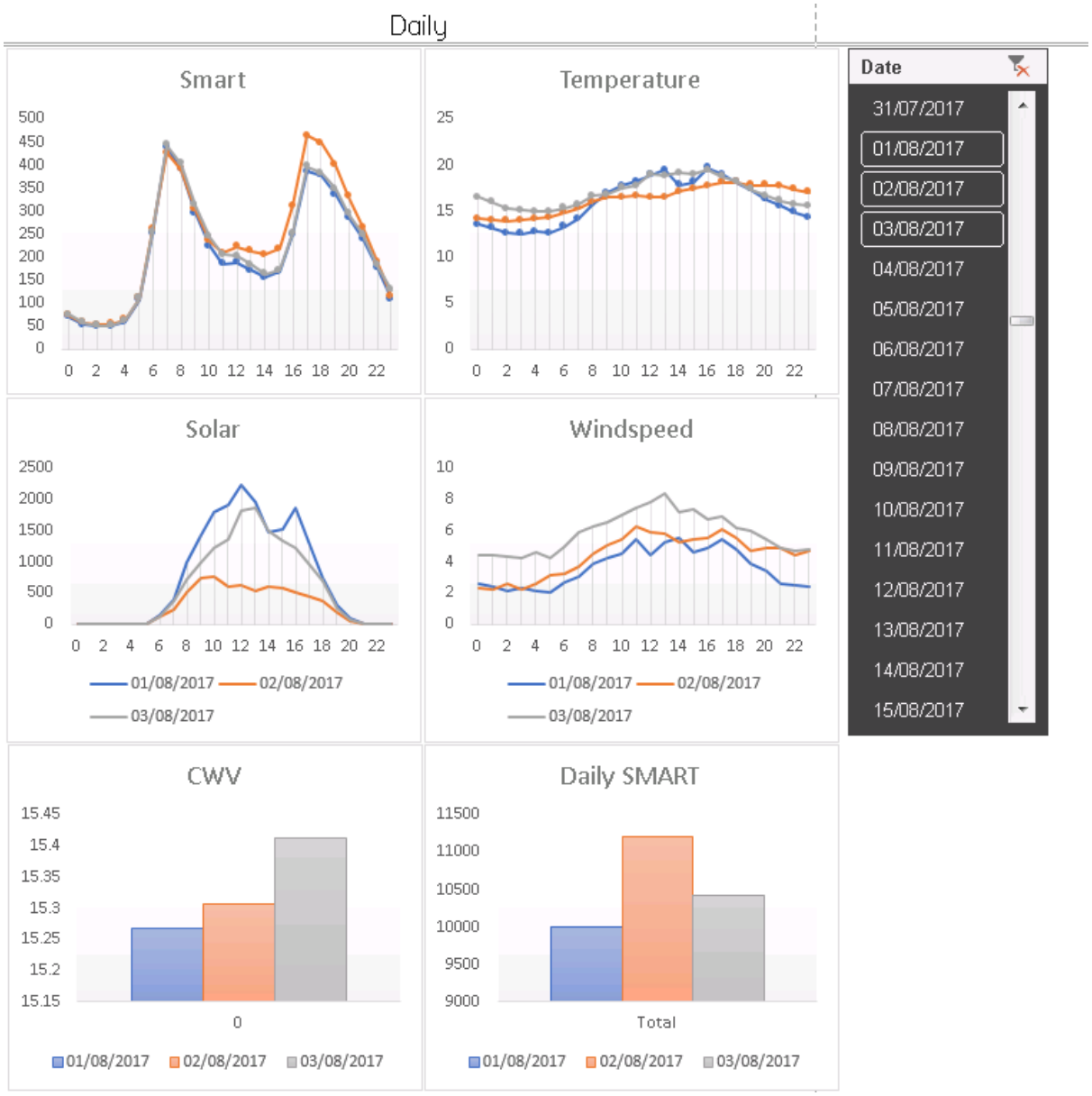


Figure 2 02/08/2017 – Wednesday. Levels of solar across the day were low, with CWV at 15.30 and 15.41 (Thursday) for the comparison day. Daily demand differed greatly as a result of higher evening peak demands. An explanation could be due to more heating demand needed following the low levels of solar radiance during the day. Wind speed was similar to, or high on comparison days, so the effect is more likely to be due to the lower level of solar radiance across the day.

06/01/2018 - solar effect?

Figure 3 06/01/2018 – Saturday - compared to comparison day 20/01/2018 - also a Saturday. Daytime demand from the morning peak is lower, while spot temperatures are lower. Levels of solar are higher.

21/01/2018 - temperature weights for some hours in the CWV calculation too high?

Figure 4 14/01/2018 – Sunday compared with 21/01/2018 - also a Sunday. A day with high model error – under forecasting, possibly due to the temperature profile for the day. CWV is warmer than it should be due to the end of day warming which perhaps does not influence demand as much as suggested by the temperature weights for these hours in the CWV calculation.