CWV optimisation---new weight for temperature and windspeed

Aim

Optimise weights for temperature and windspeed based on current cwv calculation definition, and to robust gas demand forecasting models.

Data source

LDZ allocation, temperature and windspeed information from 01/10/2007 to 09/03/2019. Smart meter data from 2014. All non-holiday date data are used for analysis.

Methodology

Extract data containing temperature and wind speed weather information also LDZ allocations on daily basis from SQL database. Import to SAS, create non- linear model to mimic cwv calculation definition by using the following calculations. Non- holiday dates are used for analysis.

$$\mathrm{At} = \sum_{i1}^{i12} tw(i) * t\,(i)\ where\ i1..12(5,7,9,11,13,15,17,19,21,23,01,03)$$

$$\mathrm{DWS} = \sum_{j1}^{j6} w(j) * w(j)\ \ where\ j1 \ldots j6(3,7,11,15,19,23)$$

$$\mathrm{WCT} = \mathrm{I}_2 * Max(0, DWS) * Max(0, T_0 - AT)$$

$$CW = WCT + SNET_{term} + ET_{term}$$

Set AT=1 and DWS=1,

$$LDZ_{NDM} \begin{cases} a * \big(CW + I_3 * (CW - V_0)\big) + b & CW < V_0 \\ a * CW + b & CW \geq V_0\ and\ CW \leq V_1 \\ a * \big(V_1 + q * (CW - V_2)\big) + b & CW > V_1\ and\ CW > V_2 \end{cases}$$

AT is actual temperature in degrees Celsius

DWS daily wind speed

WCT

I_2 Wind Chill Weight

T_0 Wind Chill Temperature Cut-Off

I_3 Cold Weather Sensitivity

V_0 Cold Weather Upturn Threshold

V_2 Upper Warm Weather Cut-Off

q Slope Relating to Warm Weather Cut-Off

a slope

b constant

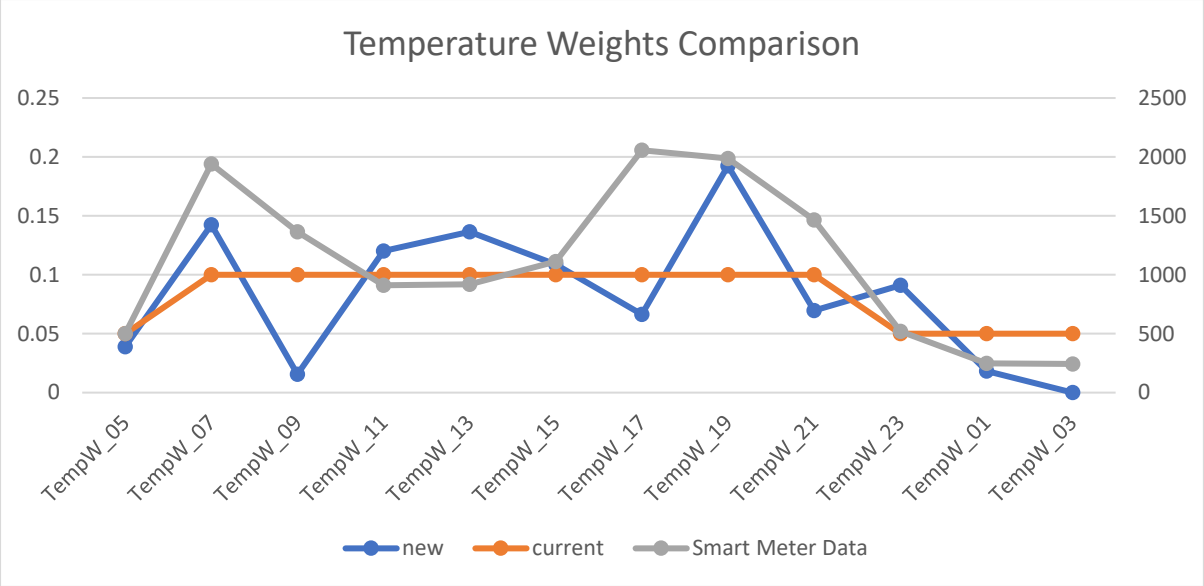
Results

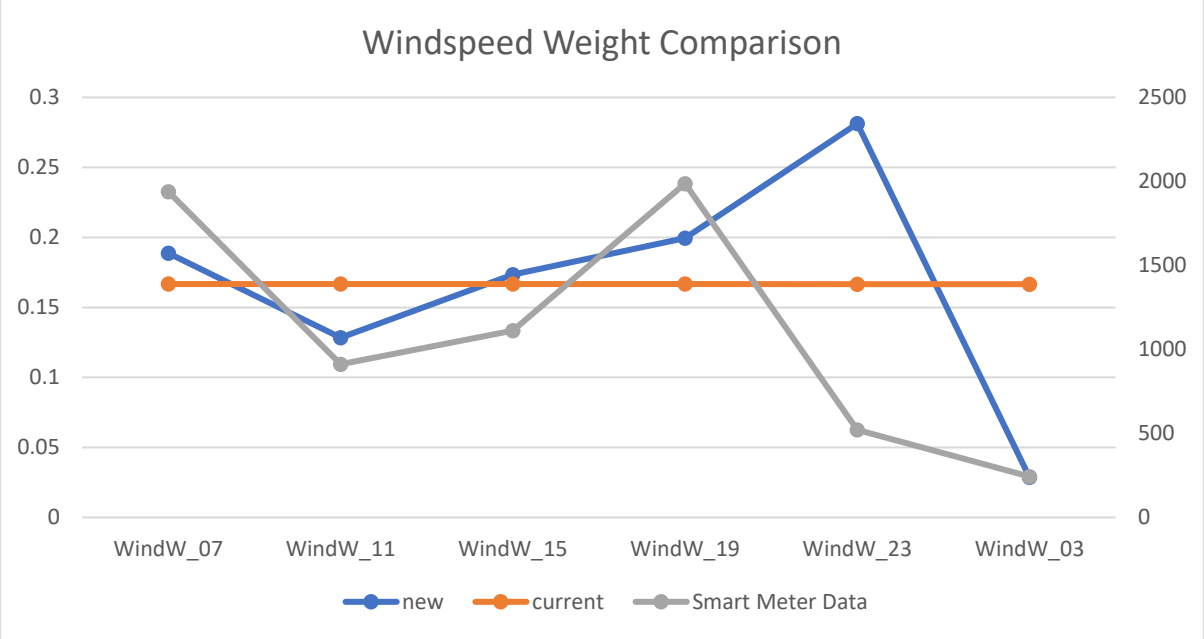
New weights are implemented to the CWV Optimisation template and results are shown in the following. About 80% of the LDZ shows an accuracy improvement by higher R square.

LDZ	Improve	Worse	2015 Weight r2	2020 Weight r2
EA	Y		0.9910	0.9913
EM	Y		0.9916	0.9919
NE	Y		0.9862	0.9867
NO	Y		0.9855	0.9860
NT	Y		0.9928	0.9931
NW		Y	0.9884	0.9883
SC	Y		0.9887	0.9890
SE	Y		0.9914	0.9916
SO		Y	0.9916	0.9909
SW		Y	0.9902	0.9890
WM	Y		0.9918	0.9926
WN	Y		0.9835	0.9846
WS	Y		0.9825	0.9835

When comparing new shape with new weights against smart meter data and original shape with original weights, a better shape is illustrated with new weights.

Overall date





Next step and limitation

As the new weights do not perform well for June, July and August, solar will be implement to the model to robust the results further.

As smart meter data are extracted by national level, while new weight analysis is based on LDZ level, shapes from smart meter date may smooth out and not capture as many details as LDZ level.