SNET and SNES calculation

This document details the calculation of the Seasonal Normal Effective Temperature (SNET) data series used in the CWV calculation. A new data item Seasonal Normal Effective Solar (SNES) is calculated for the CWV+ definition and is created in a similar method, and will also be explained.

SNET

To recap, the SNET, is used to calculate CW & CWV:

$$CW = I_1 ET_D + (1 - I_1) SNET_D - I_2 \max(0, WS_D - W_0) \max(0, T_0 - AT)$$

- Seasonal Normal Effective Temperature $SNET_D$ & I_1 - Effective Temperature Weight.

The SNET is the first step in the calculation of new CWV parameters, the Effective Temperature Weight I_1 , which is used to calculate the SNET Term $(1 - I_1) SNET_D$.

The aim of the SNET Term is to give a seasonal normal basis to the CWV calculation, effectively bringing CWV towards a seasonal normal level (30%) while 70% of the CWV calculation is related to temperature observations from the Actual Temperature and Effective Temperature terms.

SNET Calculation

For the 2020 parameters, the SNET is calculated using 8 years of data from 2010/11 to 2017/18.

The calculation is set out in the CWV+ Optimisation tool (now "SCWV Optimisation Template Total SSE V1.0") as replicated from the approach detailed in the document Pseudo_SNET_HighLevelPrinciples_V1.pdf- Document prepared: 24th January 2019 by Xoserve.

From history of temperatures, a seasonal normal is created by the use of Fourier analysis to create a data series called Pseudo SNET. Pseudo is referring to the demand correction used in the seasonal normal series to bring its effective temperature series closer to a level of a seasonal normal demand scaled to represent the effective temperature series.

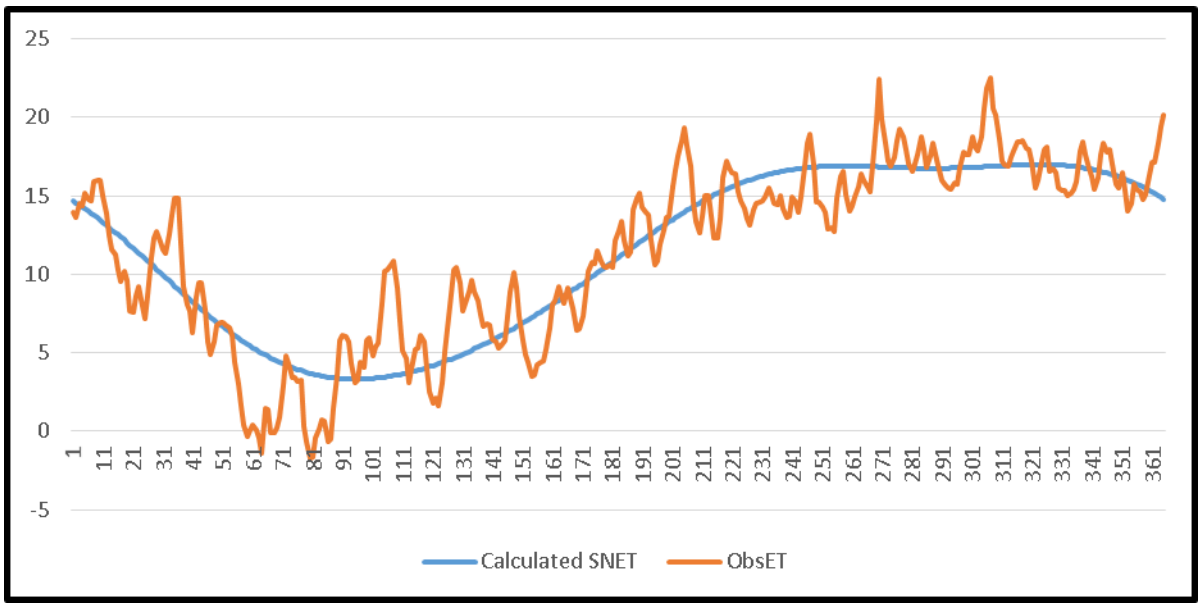
For each of the years, an autoregressive demand model of the following form was derived using non-holiday days (excluding 29th February) with ETmin<ET<ETmax:

$$D = \alpha - \sum_{1=1}^{3} \beta i \sin\left(\frac{2id\pi}{365}\right) - ci \cos\left(\frac{2id\pi}{365}\right) + dET + eWC + fFRI + gSAT + hSUN + \mu$$

The SNET term is one of the important parts of the CWV as it improves the accuracy of the demand model during the shoulder months in March, April, May, Sept and October where given the same Effective Temperature demands can differ due to differing seasonality.

Figure 1, below, illustrates the SNET calculated from its effective temperature series. The SNET aims to be a centre of the ET observations, with the Pseudo demand correction giving values closer to a level of seasonal demand.

Figure 1: Observed Effective Temperature and its calculated SNET



For each of the X years, the SNET is calculated and the average from the X years forms the SNET used in the SNET Term.

SNES

To recap, the proposed CWV+ definition includes solar as a new term, the Solar Term:

$$Solar\ Term = S_0 SR_D$$

Where SR_D is measured as the log difference between actual solar observations and a seasonal normal & S_0 - is a new parameter Solar Radiance Effect.

$$SR_D = \log AS_D - \log SNES_D$$

For the CWV+ definition, the SNES will be a first step in the calculation of new CWV parameters, produced at the same time as the SNET calculation. A SNES tool is being created for this purpose, likely to be included in the CWV+ optimisation tool.

The aim of SNES is to provide a seasonal normal level of solar for use in the Solar Term, to identify days that are brighter or duller than a seasonal normal. This determines if the CWV+ is warmer or colder than CWV and thus allowing the modelling of lower or higher levels of demand.

SNES Calculation

For the 2020 parameters, the SNES is calculated using 8 years of data from 2010/11 to 2017/18.

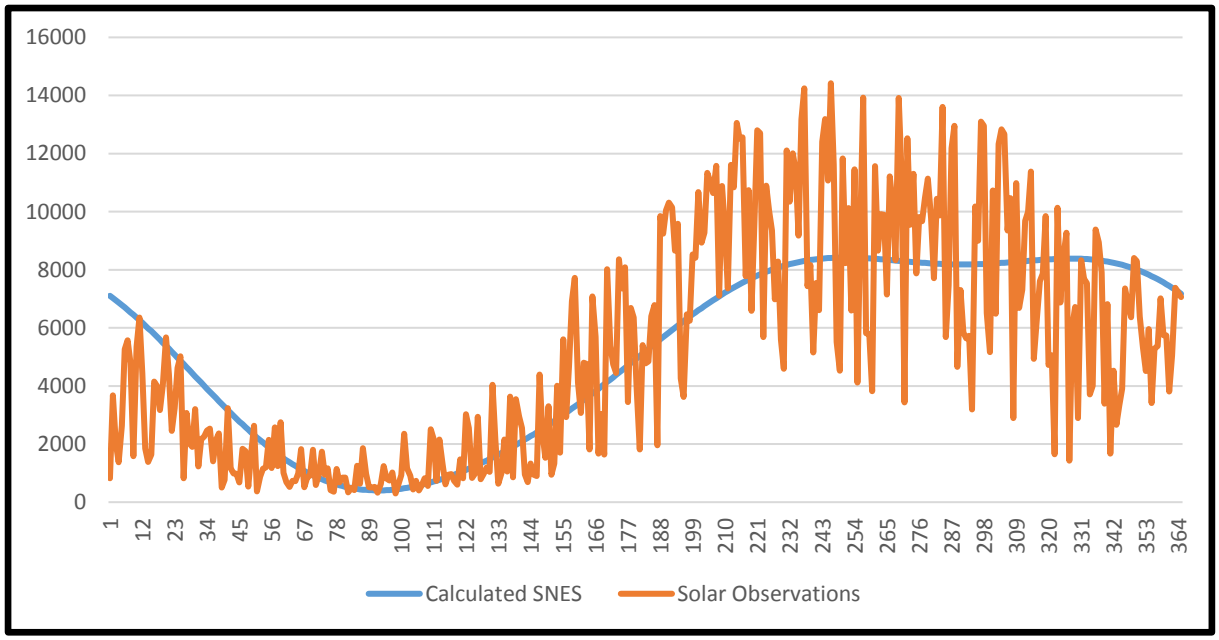
The calculation is similar to SNET with an additional solar variable, fSolar.

For each of the years, an autoregressive demand model of the following form was derived using non-holiday days (excluding 29th February) with ETmin<ET<ETmax:

$$D = \alpha - \sum_{1=1}^{3} \beta i \sin\left(\frac{2id\pi}{365}\right) - ci\cos\left(\frac{2id\pi}{365}\right) + dET + eWC + \text{fSolar} + gFRI + hSAT + iSUN + \mu$$

Figure 2, below, illustrates the SNES calculated from its solar observation series. The SNES aims to be centre of the solar observations. The effect of the demand correction can be seen from observations 60 to 120 (winter) as solar normal values are lower than a centred averaged, for September and October solar normal values are higher than a centred average.

Figure 2: Observed Solar and its calculated SNES



For each of the X years, the SNES is calculated and the average from the X years forms the SNES used in the Solar Term.