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Narrative for IES VE Title 24 2022.1.0 Sensitivity Tests

General:

This short document is used to provide an explanation of observations made while creating the sensitivity models. They fall into three headings:

- Models not considered
- Models not currently included
- Models that have failed

The following models are not considered in the IES VE Title 24 2022.1.0 sensitivity tests:

- 0418606-OffLrg-TES-StoTnkShp – The VE does not model storage tank shape
- 0418706-OffLrg-TES-StoTnkLoc – The VE does not model storage tank location
- 1014315-RetlStrp-WSHP – The VE does not contain the Title 24 WSHP curves
- 1014506-RetlStrp-WSHP – The VE does not contain the Title 24 WSHP curves
- 0519515-RetlMed-HPWtrHtrSplitTnkCprsrIns – The VE does not designate a compressor zone
- MF models – the VE does not currently cater for residential buildings

Explanation for models that fail:

- 0500115-RetlMed-EnvelopeRoofInsulation
- 0500215-RetlMed-EnvelopeWallInsulation
- 0500315-RetlMed-EnvelopeHeavy

For CBECC 2019 the variation from the baseline for these models showed a fall in TDV, due to the envelope changes. The same was observed for the VE and thus these models passed. For 2022, the VE shows the same trend as 2019 i.e. the TDV for variant models fall. However, for CBECC, in 2022 the TDV is now rising and this is resulting in a fail. As the underlying principle of these tests have not changed we are trying to understand why the CBECC variation is now rising.

- 0307906-OffMed-HVACPVAV EconomizerType (CBECC: -0.77%, VE: 0.24%)
- 0408516-OffLrg-HVACChWdeltaT (CBECC: -1.11%, VE: 0.51%)

The above models are failing due to a less than 1% movement in the opposite direction to CBECC, which is also showing approx. less than 1% movement. Because of the very tight margins we ask that these be considered as a pass. It should be noted that the same was seen in 2019.

- 0418406-OffLrg-TES-ChlrPriority
- 0418506-OffLrg-TES-StoPriority

As was the case in 2019, these models are showing higher TDV Energy in the TES model than the Baserun model. This is for the exact same reason as explained for the 2019 models. See below.

Test Fail: Thermal Energy Storage Loop

- CEC Comment: Higher TDV Energy in the TES model than the Baserun model.

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IES Response:

The TES model in IESVE has a Water-to-water heat exchanger (WWHX) that transfers heat between the TES loop and the ChWL (see Figure 1 below). This heat exchanger is permanently coupled with the TES tank to avoid any potential mixing of water/glycol with water only; thus maintaining the heat transfer properties of water in the Chilled Water Loop. The WWHX has a non-zero approach temperature. i.e., there will always be a temperature drop in the WWHX. To account for this temperature drop, when the chiller is cooling the building, the chiller leaving water temperature needs to be lower than the required ChWL supply temperature (44°F) because it must first overcome the inefficiency of the WWHX.

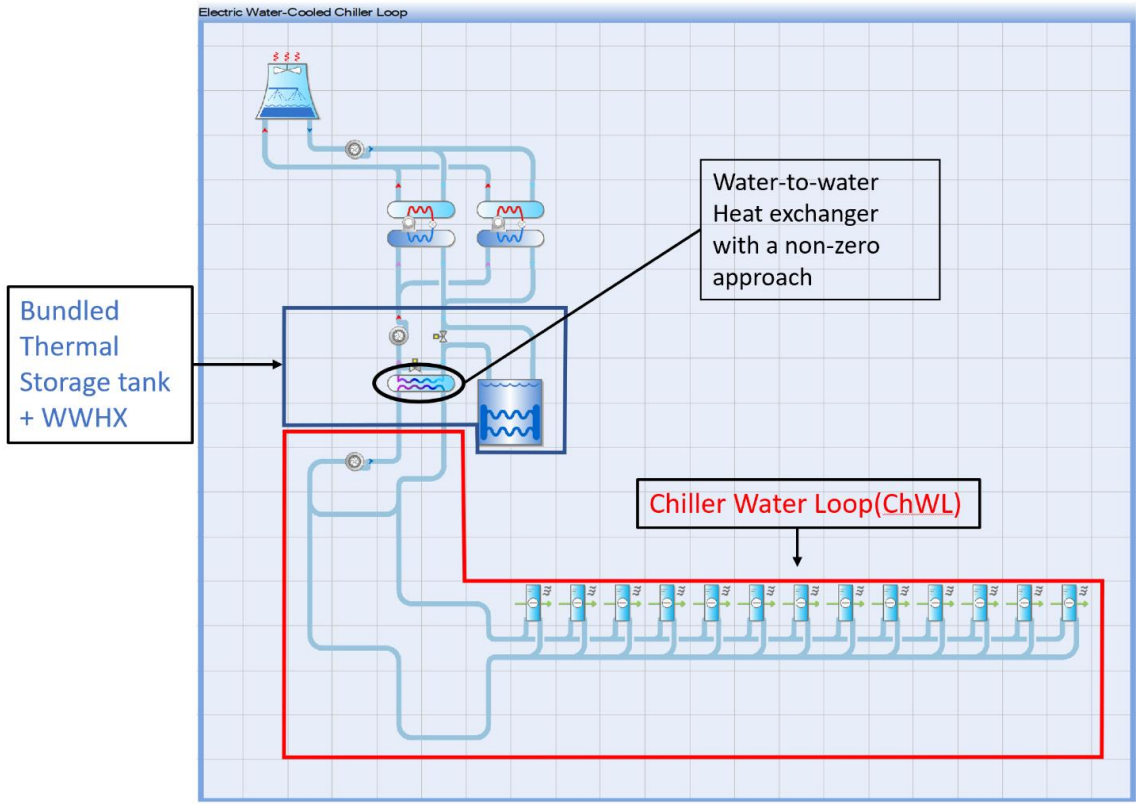

Figure 1: IESVE TES loop and ChWL

However, the baseline model (400006) does not have a WWHX. As a result, the chiller water leaving temperature is 44°F.

Since the chillers in the TES model has to cool the water to a lower temperature (to account for the temperature drop in the WWHX) the chillers consume more energy than the baseline chiller. This has therefore been reflected in the TDV of the model. Figures below show the TDV of the baseline chiller

(400006) and the TDV of the TES chiller (418506) during a week in the non-TES operating month (Figure 2) and a week in TES operating month (Figure 3).

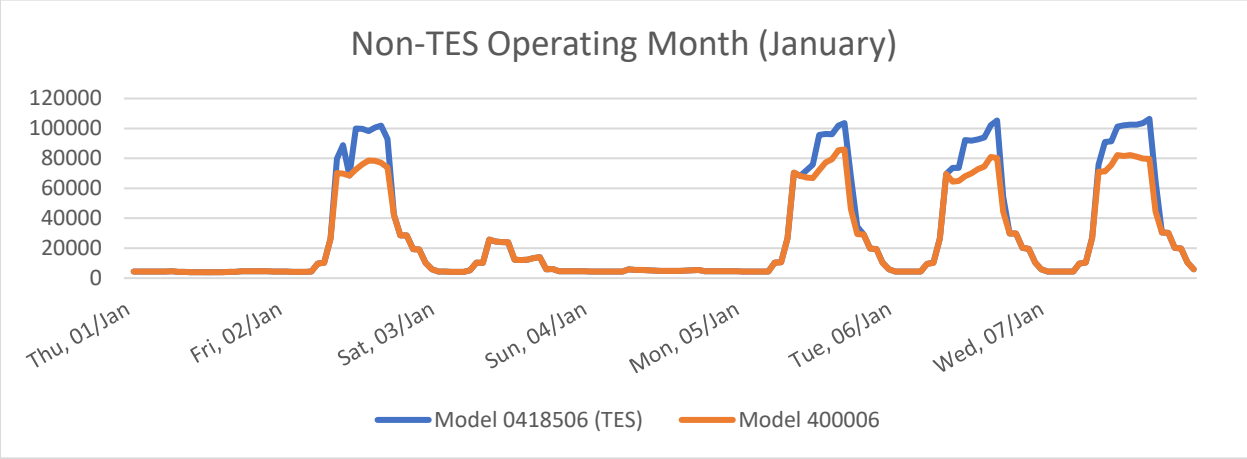

Figure 2: TDV Energy of baseline (0400006) and TES (0418506) model in January (non-TES operating month)

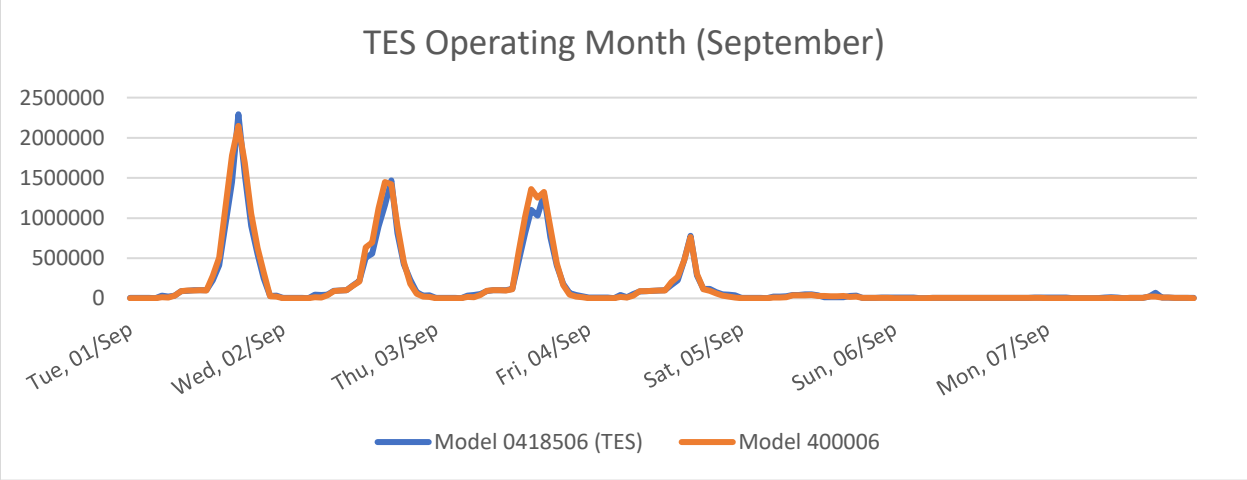

Figure 3: TDV Energy of baseline and proposed model in September (TES operating month)

Observations:

1) During the period when the TES is not operating (Figure 2), the TES TDV Energy (blue line) is higher than the baseline TDV (Orange line). We believe this is because the TES system has to cool the water to a lower temperature to account for the temperature drop in the WWHX.

2) During the TES operation period (Figure 3), we can see that the TDV Energy of the TES model (blue line) is lower than the TDV Energy of the baseline model. i.e. it's operating as expected.

Conclusion:

WWHX (no bypass), in the TES model 0418506, is causing a year-round inefficiency, especially during periods where the TES is not operational, because the WWHX cannot be bypassed. Baseline model 400006 has no WWHX; therefore the baseline is not penalized for the inherently inefficient WWHX.