New Jersey's Clean Energy PROGRAM
Your Power to Save
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New Jersey Board of Public Utilities
Office of Clean Energy

Pay for Performance - EB Technical Tip

Modeling Combined Heat and Power (CHP)

This technical tip only pertains to existing building facilities with existing on-site CHP. CHP itself is not an eligible measure in the program. Incentives for new CHP projects (including additional capacity) can be applied for through a separate program at www.njcleanenergy.com/CHP

For existing building projects with existing CHP plants, CHP must be explicitly captured in the energy modeling software and calibrated to utility bills. While this technical tip provides an example on how to model CHP using eQuest, the same concepts shall be applied to other approved software packages such as Trane Trace, Carrier HAP, and DOE2.1.

Metering

There are 3 to 5 meters that must be explicitly modeled so that incentives can be calculated and model can be calibrated:

- Grid electric
- Grid gas
- CHP gas
- Renewable electric (e.g. solar PV; if applicable)
- Surplus meter* (if applicable)

*Some software packages have the ability to model a surplus meter. This means that any additional electricity produced beyond the needs of the building will be assigned to this meter as long as the meter is defined as an 'electric sale' meter. If the electricity is not sold, then there is no need for this meter to be defined.

Key Model Inputs

- Capacity of CHP (kW)
- Heat input ratio (ratio of fuel consumption to design electrical output, when both are in the same units, in terms of the higher heating value of the fuel)
- Fraction of input recoverable for exhaust and engine jacket
- Loop assigned (HW, DHW).

Model Calibration

The model must be calibrated for both CHP electricity and grid electricity (i.e. the two electric 'meters' cannot be combined since that can skew recovered heat simulated).

The model will not calibrate if it does not match the utility bills closely. Please make sure to collect 12 months of **all** utility bills, which should encompass all energy usage—electricity, natural gas, CHP gas use, etc. Then, please make sure to develop the model to reflect the actual building.

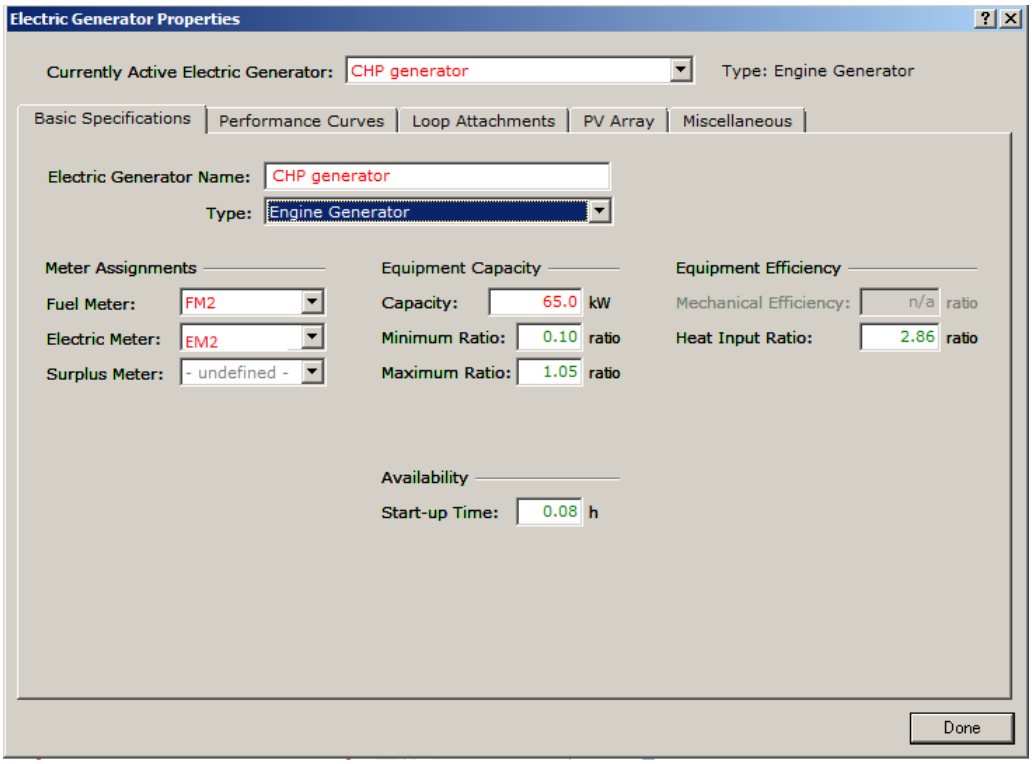
ERP Documentation

- Electricity (kWh) generated by the CHP and consumed on site can be entered in *ERP Tables/Electric Totals tab/Column DC*
- Utilized (not recovered) waste heat from the CHP can be entered into *ERP Tables/Steam tab* or *Hot Water tab*, etc. depending on how the waste heat is being used on site.
- Any assumptions about the system must be detailed in the *ERP Tables/Modeling Approach tab* so they can be applied on the back end for savings verification (this includes calculating how much waste heat is being produced, utilized and dumped).
- Spreadsheet calculations, calculation methodology, and relevant equipment data must be submitted to justify model inputs.

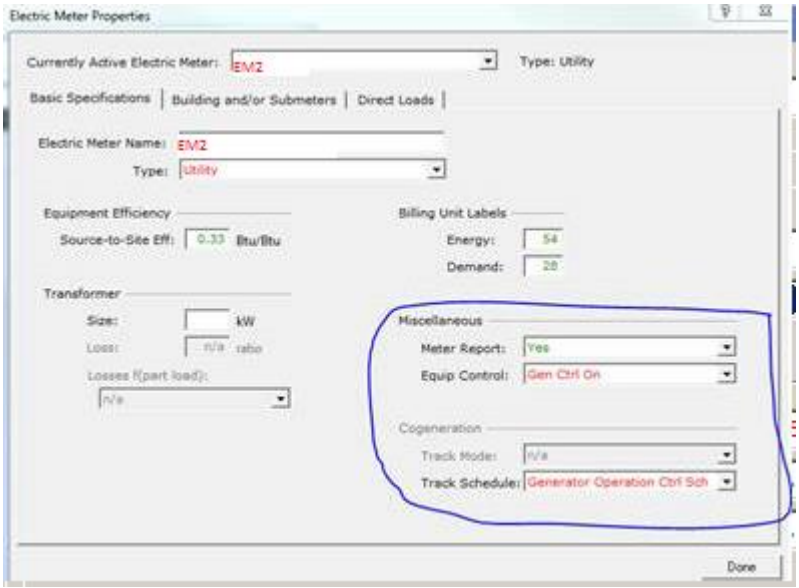
Note: Subject to Market Manager discretion, only savings to grid natural gas consumed by the CHP will qualify for incentives, rather than savings to intermediate electricity and utilized waste heat. For example, energy efficiency measures (e.g. boilers, etc.) that have downstream CHP gas savings may qualify, as well as efficiency improvements to the CHP that will result in gas savings (e.g. more efficient recovery and utilization of waste heat). CHP improvements that only result in additional kWh generation do not qualify.

Example: Modeling CHP in eQuest

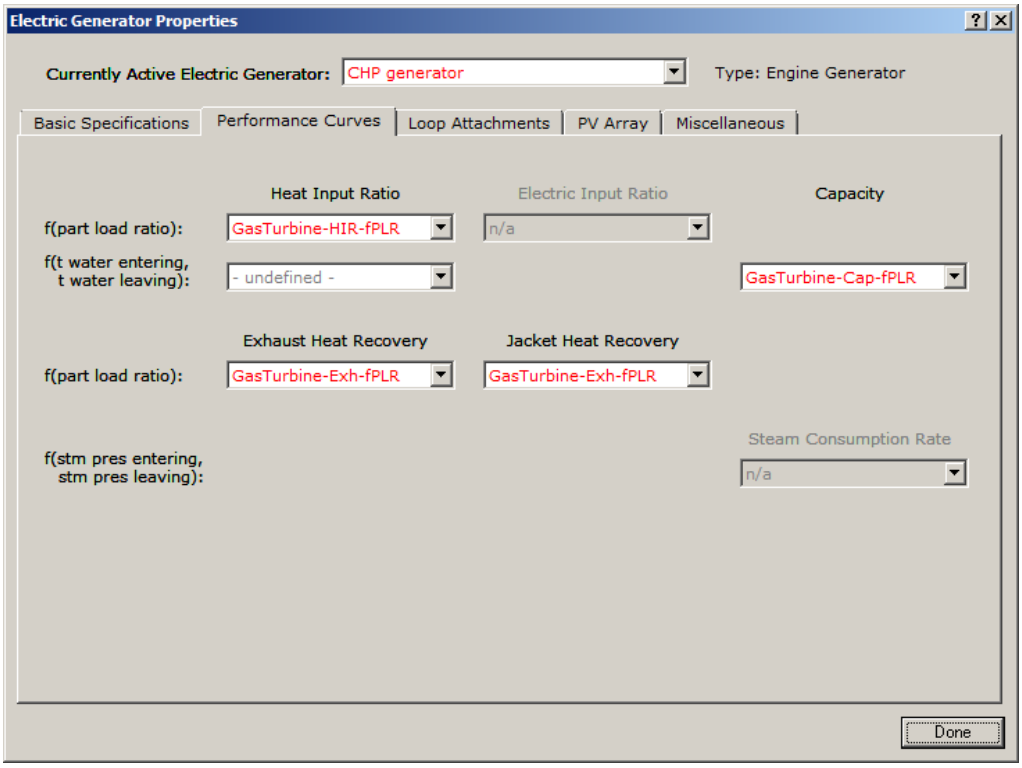
CHP can be modeled in eQuest by creating an electric generator. eQuest will model CHP by assigning gas usage to electric end uses as shown below.



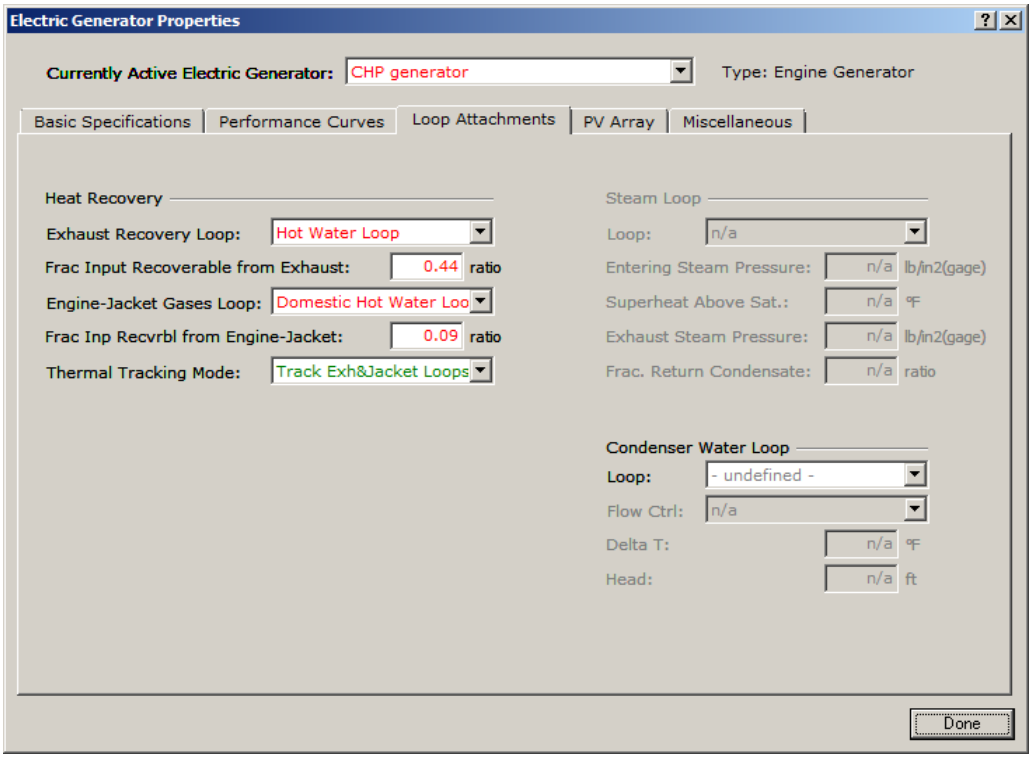
*Note: Separate fuel and electric meters should be created in eQuest as detailed above. Generator can be schedule via inputs on Electric Meter Properties window as shown below.



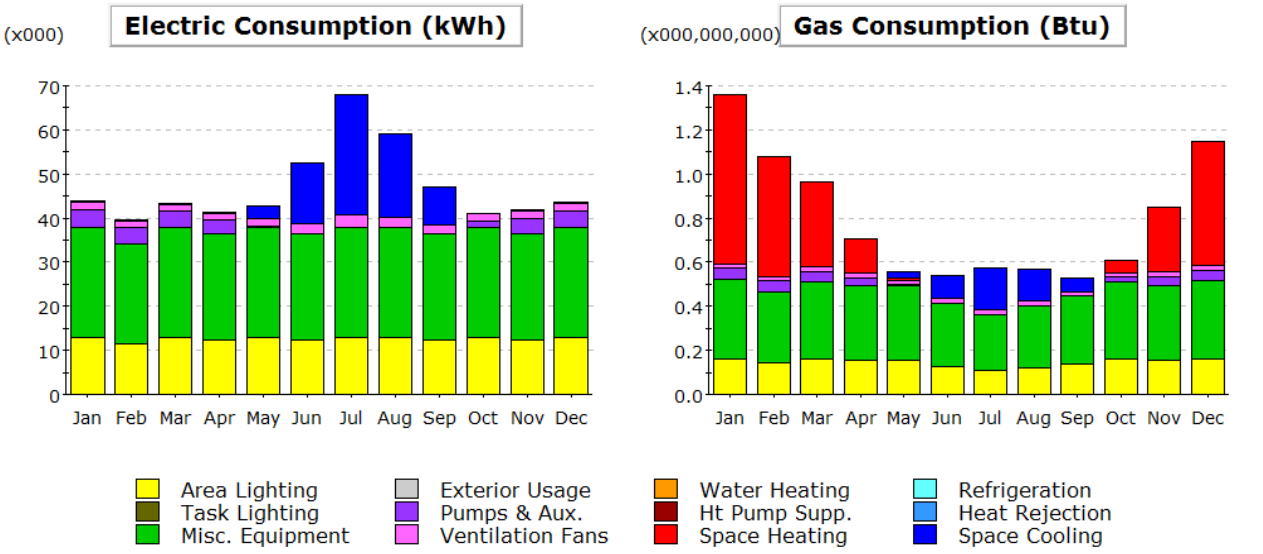
*Note: Default performance curves may be used. However, if manufacturer data is available, custom performance curves can be created and submitted for review.



*Note: Heat recovered to supplement the HW loop and DHW loop should be modeled separately, if applicable.

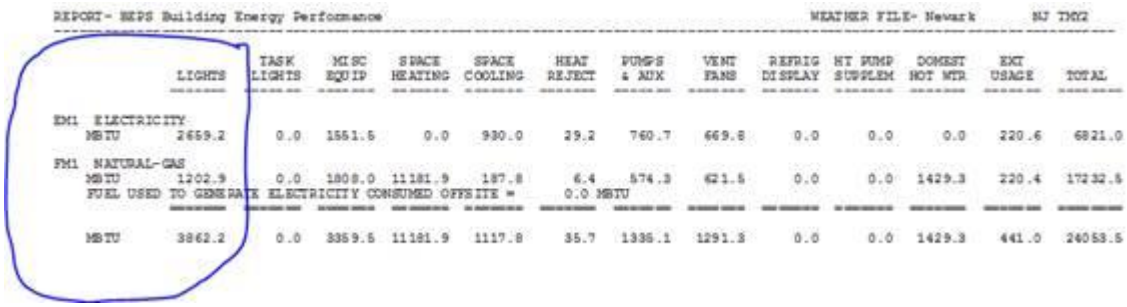


The modeled results will resemble the graphs shown below. Most of the gas usage in the right graph is attributed to lighting (yellow bars), equipment (green bars) and other end uses that do not directly consume gas, but rather consume electricity generated by CHP.



eQUEST will capture contribution of CHP toward electric consumption on economics level reports, including detailed reports with the names starting with letter “E”, such as “ES-A”, “ES-B”, etc., BEPU and BEPS reports, and “* - Parms Mtr.csv” report. Other types of reports, such as for example “*-Parms.csv” focus on demand side and thus will not capture CHP.

Below is BEPS report for a sample project with CHP. Note that lighting end use is split between electricity and gas to account for electricity generated by CHP that goes toward lighting:



REPORT- BEPS Building Energy Performance — WEATHER FILE- Newark NJ TMY2

		LIGHTS	TASK LIGHTS	MISC EQUIP	SPACE HEATING	SPACE COOLING	HEAT REJECT	PUMPS & AUX	VENT FANS	REFRIG DISPLAY	HT PUMP SUPPLEM	DOMEST HOT WTR	EXT USAGE	TOTAL
EM1	ELECTRICITY													
	MBTU	2659.2	0.0	1561.6	0.0	930.0	29.2	760.7	669.8	0.0	0.0	0.0	220.6	6821.0
FM1	NATURAL-GAS													
	MBTU	1202.9	0.0	1808.0	11181.9	187.8	6.4	574.3	621.5	0.0	0.0	1429.3	220.4	17232.5
	FUEL USED TO GENERATE ELECTRICITY CONSUMED OFFSITE =					0.0 MBTU								
	MBTU	3862.2	0.0	3369.5	11181.9	1117.8	35.7	1335.1	1291.3	0.0	0.0	1429.3	441.0	24053.5

eQUEST gas and electricity consumption from economics level reports, such as BEPU/BEPS, should be used to calibrate the model without any external adjustments. The ERP Tables’ built-in functionality to populate with simulation results by copying “-Parm.csv” file on the assigned tab will not function. Instead simulation results must be entered manually for baseline and each measure.