|  |  |  |
| --- | --- | --- |
| Model Name: CHP\_Model\_lib/CHP ThermalModel | | |
| Name and affiliation of author or POC:  Ed Corbett, MIT Lincoln Laboratory | Model Symbol: | Accreditation:  Model based on HVAC parameters associated with existing research laboratory facility. Model not validated through  Independent testing. |
| Date of Publication:  8/3/2016 |
| Version Information:  1.0 |
| Model accessibility (open source, license, …):  HIL Members Only |
| Model Description and Theory of Operation:  This model provides a simulated thermal load including heating demand, piping losses and thermal mass for a notional research facility. The model assumes that base load heat is provide by a boiler which is offloaded by heat supplied by a CHP heat recovery steam generator. In addition it includes simple models for directional control valves that direct CHP heat to either the load or to a radiator dump depending on demand. A control interface that includes thermal instrumentation (temperature and steam flow rate) is provided via Modbus TCP to a microgrid controller that enables the microgrid controller to optimize operation of the heating system.  The boiler operates in a minor loop to maintain control of building temperature, but if CHP steam is used for heat and building temperature exceeds the boiler loop setpoint (provided by the microgrid controller), then the microgrid controller is responsible for shifting CHP steam to the dump radiator to reduce temperature. | | |
| Model Specifications:   1. Boiler loop    1. Maximum boiler output: 20 MBtu/hr (17,000 lb/hr)    2. Nominal time constant: 0.72 seconds (made short to accommodate Symposium 2017 simulation timescale)    3. Displacement: 125 liters 2. CHP    1. Maximum output: 20% of input energy (4630 lb/hr)    2. Piping loss: 2%    3. Transport delay: 10 seconds 3. Modes    1. Boiler only    2. Boiler plus CHP    3. Boiler loop reset 4. Thermal mass: 50 deg F/MBtu   Assumptions and Limitations   1. CHP Heat exchanger efficiency is encapsulated in 20% overall efficiency 2. Boiler and CHP capable of operating from 0% output to 100% output | | |
| Interfacing Information (platform, input requirements, possible outputs):  Platform: The model is intended for real-time execution on an OPAL RT target  Inputs and Outputs:  Modbus TCP interface (defined in file “CHP\_lave\_cfg.xls” ):  Temperature setpoint (input)  CHP enable (input)  Actual temp (output)  Boiler heat supplied (output)  CHP heat supplied (output)  Model inputs and outputs:  Heat recovered (from generator model)  Heat load (from file)  Parameters:  Thermal load mass: 50 deg F/MBtu  Initial temperature: Adjustable  Time dilation: 600:1 (300 hours -> 30 minutes) | | |
| Diagrammatic Representation of Model Internals: | | |
| Model Validation (technique used, evidence): N/A | | |
| Simulation Platform, Solvers:  Matlab 2013a with Simscape. A discrete solver with 100 us time step was used. | | |
| Known Issues: | | |
| Models which use this block:  Energy/HIL/Components/CHP and Thermal/CHP\_Test\_Model.slx | | |