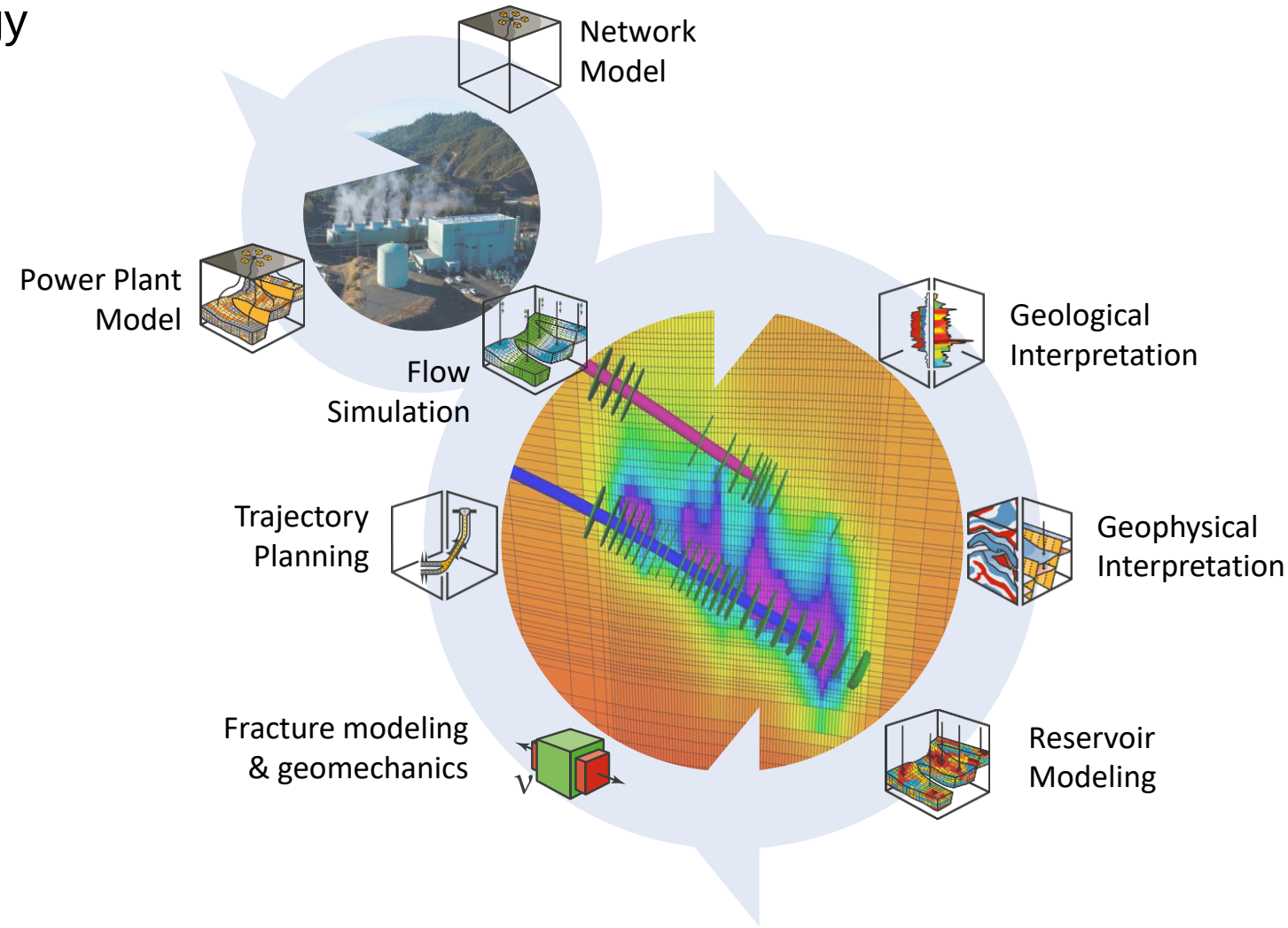
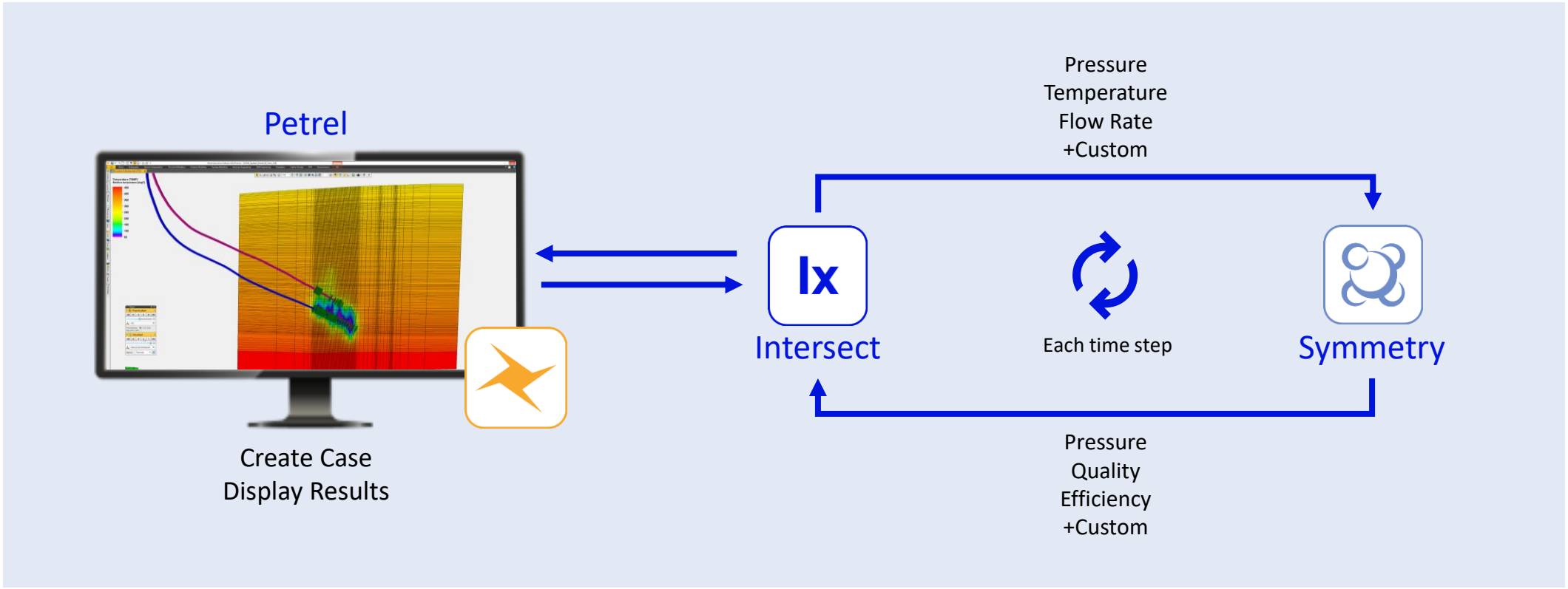
From Reservoir to Power Plant.
A unified Digital Twin for Development and Operation

Holistic approach to modeling

- Optimize asset design during development
- Assure long-term, sustainable energy production



Surface- subsurface integration



Maximise power output

Optimize operations

Data quality & data management

Symmetry | SS-Symmetry Intersect Coupled Geothermal Power Plant.vsym

File Home Pipe View Tools Reporting

Auto-hide Help

New Open Thermo Case

Solver Active Stop Re-solve Steady State

Simulation Engine Selection Unit Set Field Main Settings

Ready

Simulation Tree

- Main Flowsheet
  - Gathering_System
  - Injection_Wells
  - ORC_Power_Plant
  - Production_Wells

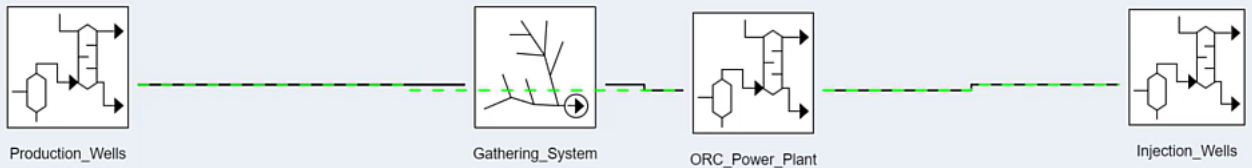
Unit Op Type All In Case View

Search for Streams and Unit Operations (Ctrl+F)

- Main Flowsheet
  - Flowsheet
    - Flowsheets
- Property Packages
  - SS-Geothermal_Power_Plant_VMGThermo
- Productivity Tools
  - Case Studies
    - InletSep_P
    - ORCPump_P_Ratio
    - PreHeater_Out_T
    - Turbine_Inlet_P
  - Optimizer Cases
    - Optimizer2
- Reporting
  - Summary Sets
    - SummarySet_1
      - Source

Shapes Simulation Tree Errors

Steady State-VMGSim (Process) PFD



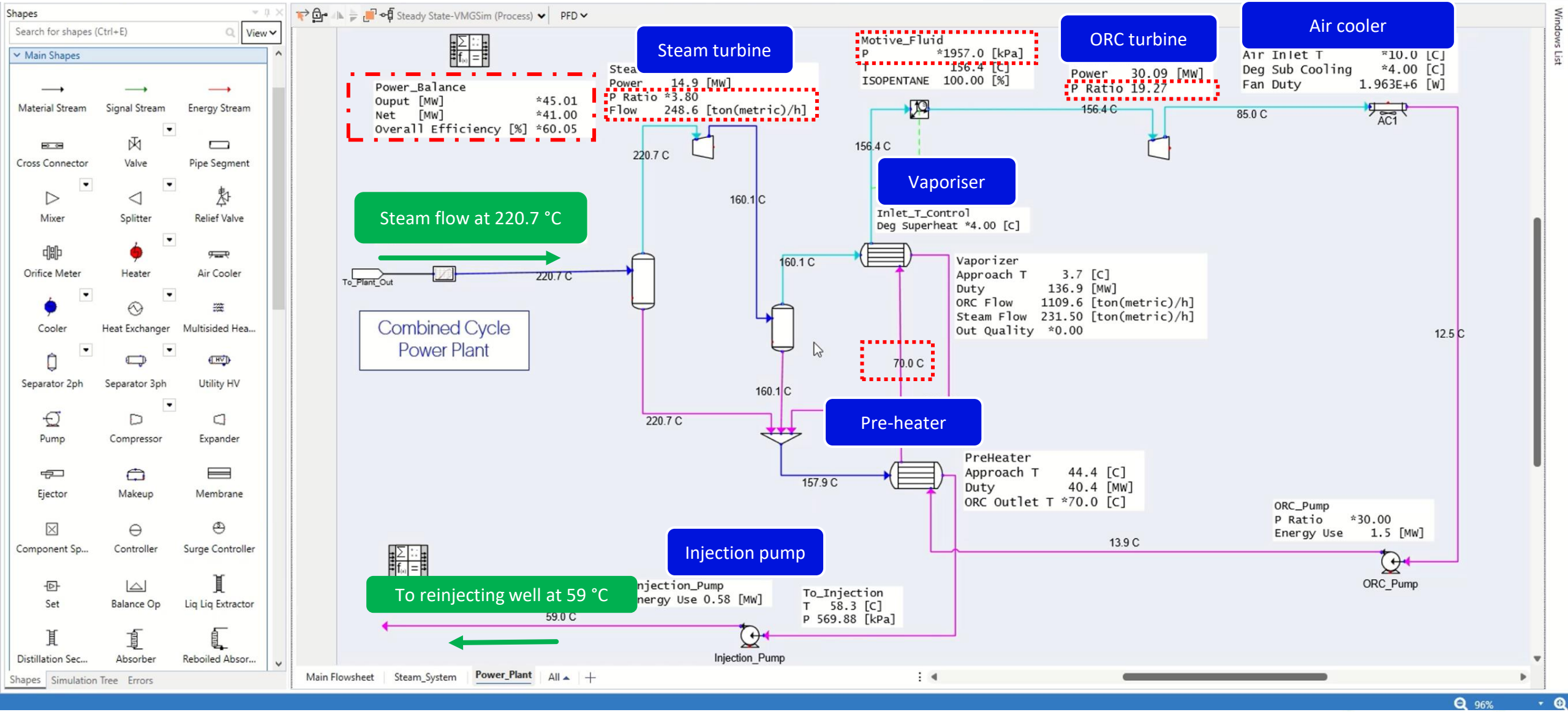
Geothermal System

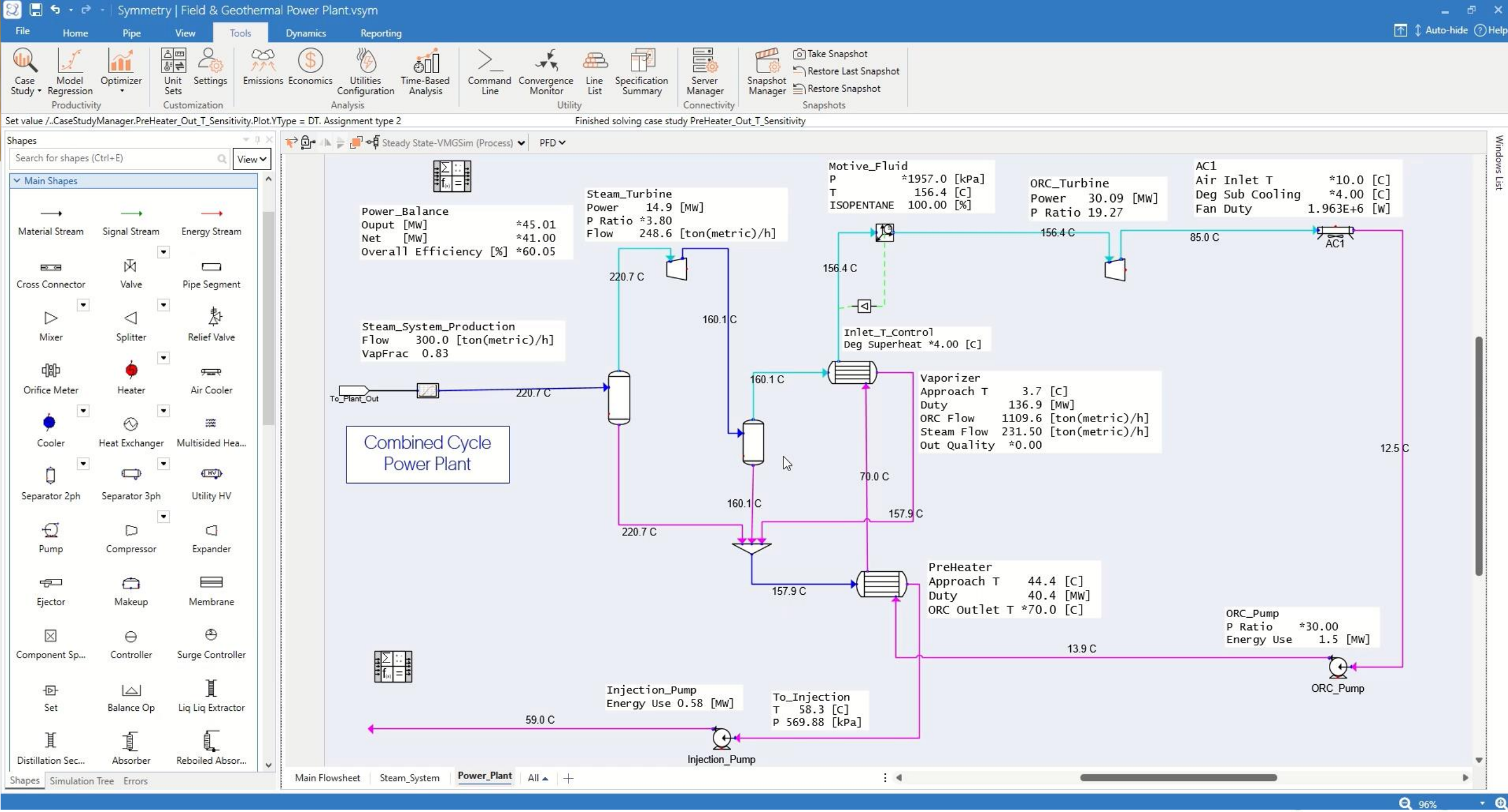
Main Flowsheet Production_Wells Gathering_System ORC_Power_Plant Injection_Wells All

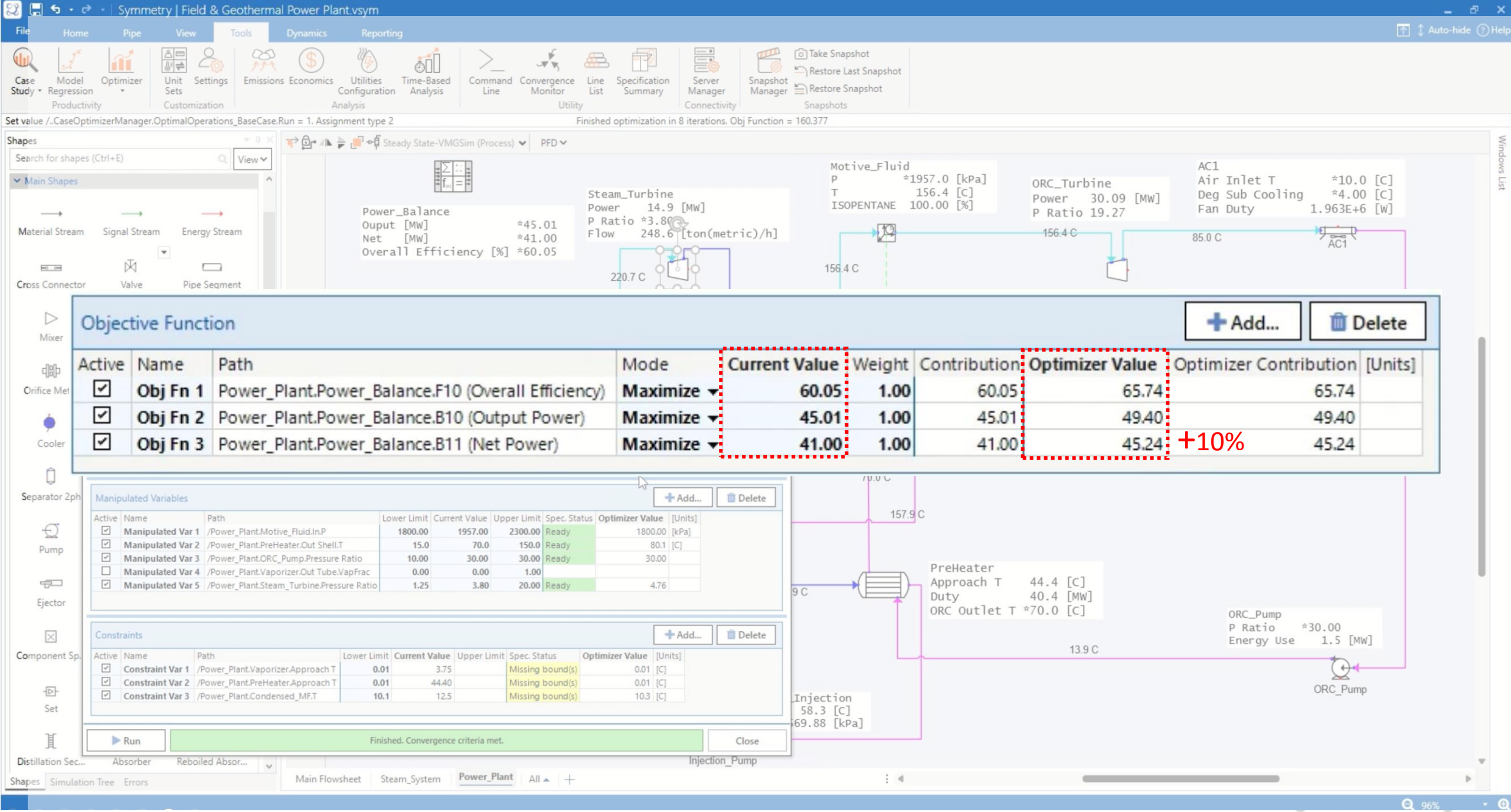
Windows List

Search Windows by Name or Type

Surface- subsurface integration




Symmetry | Field & Geothermal Power Plant.vsym
File
Home
Pipe
View
Tools
Dynamics
Reporting
Case Study
Model Regression
Optimizer
Unit Sets
Settings
Emissions
Economics
Utilities Configuration
Time-Based Analysis
Command Line
Convergence Monitor
Line List
Specification Summary
Server Manager
Snapshot Manager
Take Snapshot
Restore Last Snapshot
Restore Snapshot
Productivity
Customization
Analysis
Utility
Connectivity
Snapshots
Set value /..CaseStudyManager.PreHeater_Out_T_Sensitivity.Plot.YType = DT. Assignment type 2
Finished solving case study PreHeater_Out_T_Sensitivity
Shapes
Search for shapes (Ctrl+E)
Main Shapes
Material Stream
Signal Stream
Energy Stream
Cross Connector
Valve
Pipe Segment
Mixer
Splitter
Relief Valve
Orifice Meter
Heater
Air Cooler
Cooler
Heat Exchanger
Separator 2ph
Separator 3ph
Utility HV
Pump
Compressor
Expander
Ejector
Makeup
Membrane
Component Sp...
Controller
Surge Controller
Set
Balance Op
Liq Liq Extractor
Distillation Sec...
Absorber
Reboiled Absor...
Steady State-VMGSim (Process)
PFD
Power_Balance
Ouput [MW] *45.01
Net [MW] *41.00
Overall Efficiency [%] *60.05
Steam_Turbine
Power 14.9 [MW]
P Ratio *3.80
Flow 248.6 [ton(metric)/h]
Motive_Fluid
P *1957.0 [kPa]
T 156.4 [C]
ISOPENTANE 100.00 [%]
ORC_Turbine
Power 30.09 [MW]
P Ratio 19.27
AC1
Air Inlet T *10.0 [C]
Deg Sub Cooling *4.00 [C]
Fan Duty 1.963E+6 [W]
Steam_System_Production
Flow 300.0 [ton(metric)/h]
VapFrac 0.83
Inlet_T_Control
Deg Superheat *4.00 [C]
Vaporizer
Approach T 3.7 [C]
Duty 136.9 [MW]
ORC Flow 1109.6 [ton(metric)/h]
Steam Flow 231.50 [ton(metric)/h]
Out Quality *0.00
PreHeater
Approach T 44.4 [C]
Duty 40.4 [MW]
ORC Outlet T *70.0 [C]
ORC_Pump
P Ratio *30.00
Energy Use 1.5 [MW]
Injection_Pump
Energy Use 0.58 [MW]
To_Injection
T 58.3 [C]
P 569.88 [kPa]
To_Plant_Out
Combined Cycle Power Plant
220.7 C
160.1 C
156.4 C
85.0 C
70.0 C
157.9 C
12.5 C
13.9 C
59.0 C
Main Flowsheet
Steam_System
Power_Plant
All
Windows List
96%


Symmetry | Field & Geothermal Power Plant.vsym
Set value /..CaseOptimizerManager.OptimalOperations_BaseCase.Run = 1. Assignment type 2
Finished optimization in 8 iterations. Obj Function = 160.377
Power_Balance
Ouput [MW] *45.01
Net [MW] *41.00
Overall Efficiency [%] *60.05
Steam_Turbine
Power 14.9 [MW]
P Ratio *3.80
Flow 248.6 [ton(metric)/h]
Motive_Fluid
P *1957.0 [kPa]
T 156.4 [C]
ISOPENTANE 100.00 [%]
ORC_Turbine
Power 30.09 [MW]
P Ratio 19.27
AC1
Air Inlet T *10.0 [C]
Deg Sub Cooling *4.00 [C]
Fan Duty 1.963E+6 [W]
Objective Function
Add...
Delete
Active | Name | Path | Mode | Current Value | Weight | Contribution | Optimizer Value | Optimizer Contribution | [Units]
Obj Fn 1 | Power_Plant.Power_Balance.F10 (Overall Efficiency) | Maximize | 60.05 | 1.00 | 60.05 | 65.74 | 65.74
Obj Fn 2 | Power_Plant.Power_Balance.B10 (Output Power) | Maximize | 45.01 | 1.00 | 45.01 | 49.40 | 49.40
Obj Fn 3 | Power_Plant.Power_Balance.B11 (Net Power) | Maximize | 41.00 | 1.00 | 41.00 | 45.24 | 45.24
+10%
Manipulated Variables
Active | Name | Path | Lower Limit | Current Value | Upper Limit | Spec. Status | Optimizer Value | [Units]
Manipulated Var 1 | /Power_Plant.Motive_Fluid.In.P | 1800.00 | 1957.00 | 2300.00 | Ready | 1800.00 | [kPa]
Manipulated Var 2 | /Power_Plant.PreHeater.Out Shell.T | 15.0 | 70.0 | 150.0 | Ready | 80.1 | [C]
Manipulated Var 3 | /Power_Plant.ORC_Pump.Pressure Ratio | 10.00 | 30.00 | 30.00 | Ready | 30.00
Manipulated Var 4 | /Power_Plant.Vaporizer.Out Tube.VapFrac | 0.00 | 0.00 | 1.00
Manipulated Var 5 | /Power_Plant.Steam_Turbine.Pressure Ratio | 1.25 | 3.80 | 20.00 | Ready | 4.76
Constraints
Active | Name | Path | Lower Limit | Current Value | Upper Limit | Spec. Status | Optimizer Value | [Units]
Constraint Var 1 | /Power_Plant.Vaporizer.Approach T | 0.01 | 3.75 | Missing bound(s) | 0.01 | [C]
Constraint Var 2 | /Power_Plant.PreHeater.Approach T | 0.01 | 44.40 | Missing bound(s) | 0.01 | [C]
Constraint Var 3 | /Power_Plant.Condensed_MF.T | 10.1 | 12.5 | Missing bound(s) | 10.3 | [C]
Run
Finished. Convergence criteria met.
Close
PreHeater
Approach T 44.4 [C]
Duty 40.4 [MW]
ORC Outlet T *70.0 [C]
ORC_Pump
P Ratio *30.00
Energy Use 1.5 [MW]
Injection
58.3 [C]
69.88 [kPa]
Main Flowsheet
Steam_System
Power_Plant

Unified Environment for Operations for Maintenance