Welcome!

Webinar #4: RECIPROCATING ENGINES & HEAT RECOVERY in TFX
05 JULY 2017

Agenda:

* Introduction
* Reciprocating Engine component in TFX: Database or User Defined
* Available Heat fom Exhaust Gas and Engine Cooling
* Heat Recovery for Hot Water, Steam and Chilled Water
* Multiple Engines
* Off Design Simulation
* Q & A Session

Presenter: IGNACIO MARTIN (SPAIN)
Support: Meritt Elmasri (U.S. HQ)

Thermoflow Training and Support

- Standard Training
- On-site Training course
- Advanced Workshop
- Webinars when new version is released
- Help, Tutorials, PPT, Videos
- Technical Support

→ **Feature Awareness Webinars**

Feature Awareness Webinars

1- Assemblies in THERMOFLEX

2- SCRIPTS in Thermoflow Programs

3- Multi Point Design

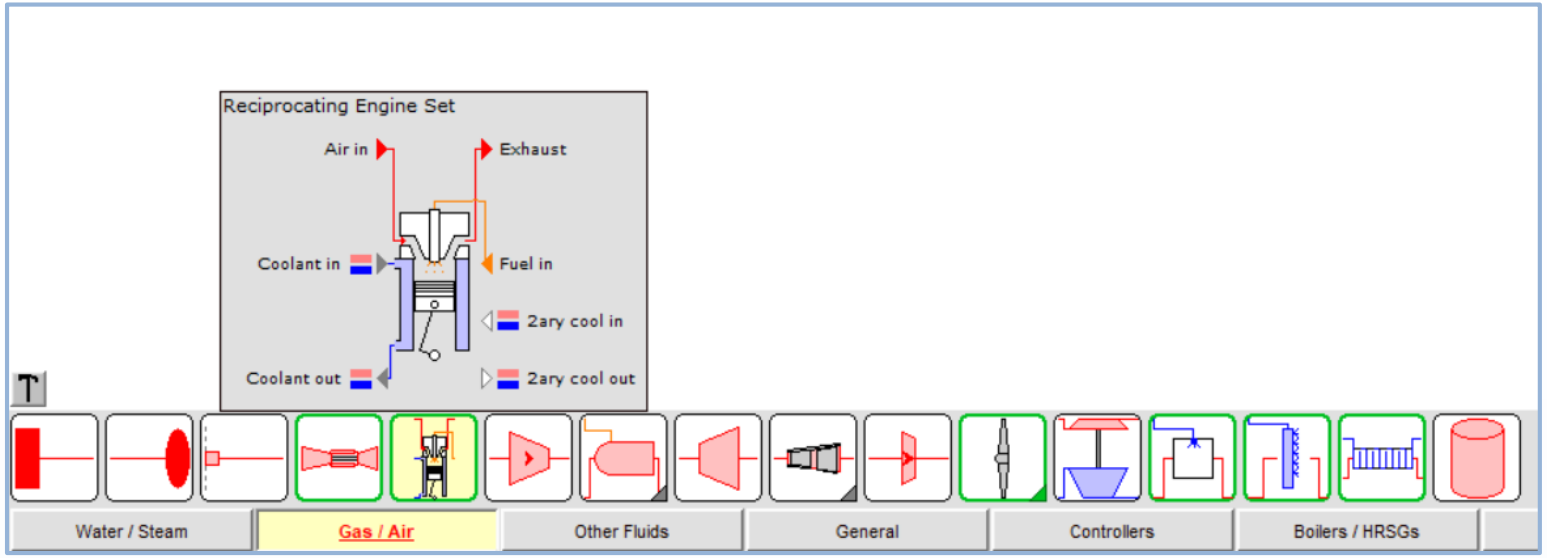
4- Reciprocating Engines

3

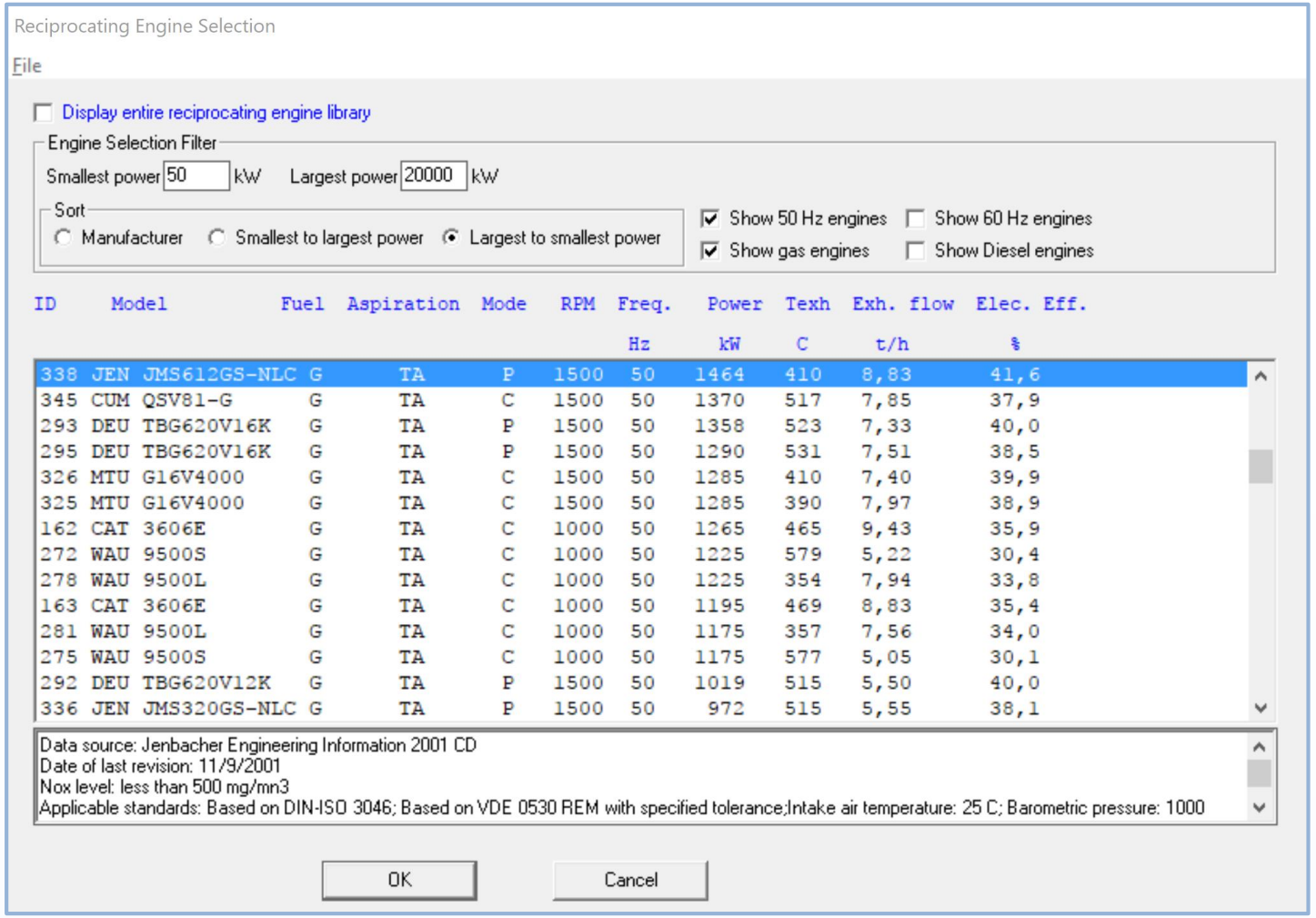
Reciprocating Engine Component in TFX

- Database

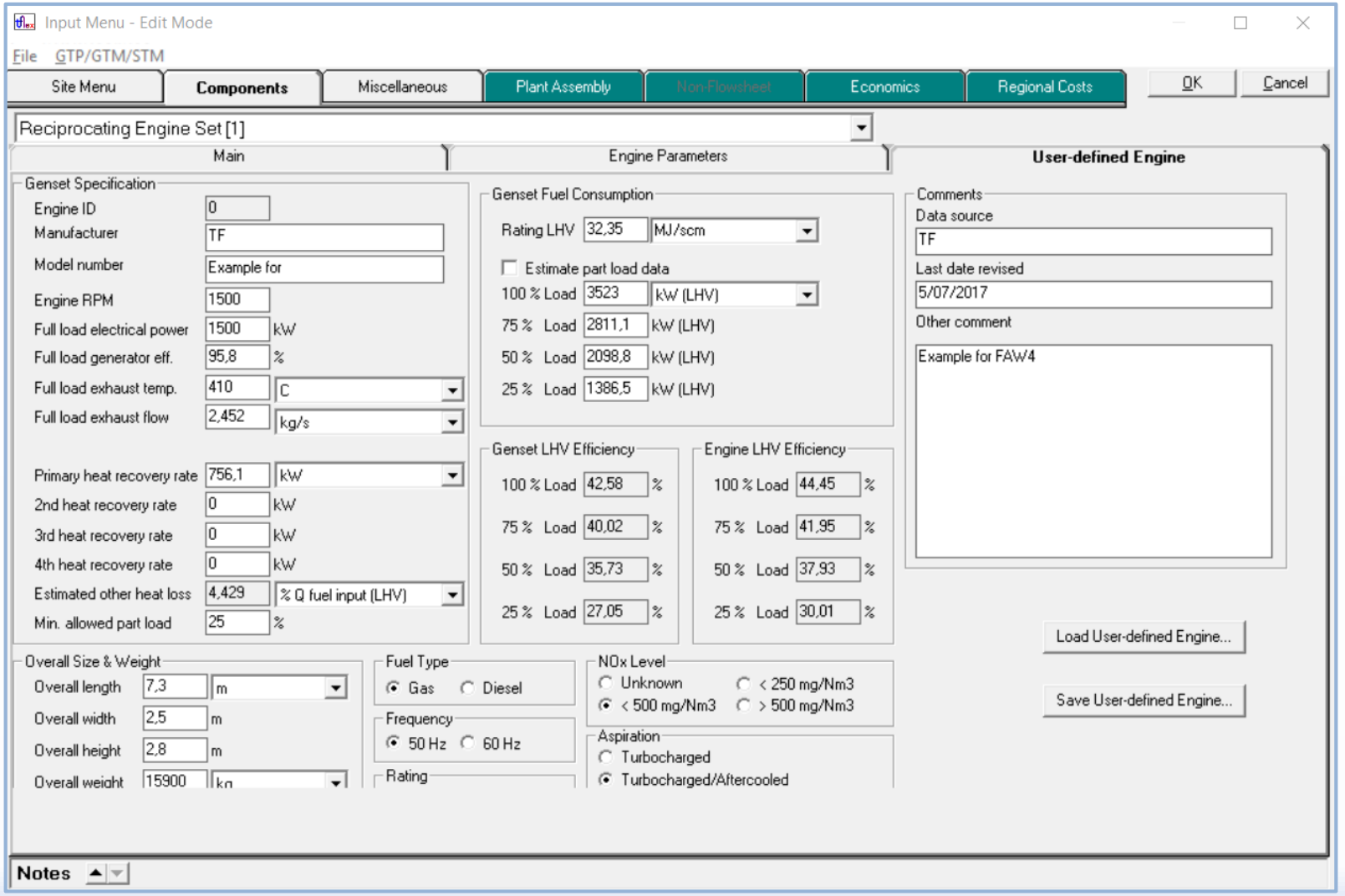
- User Defined



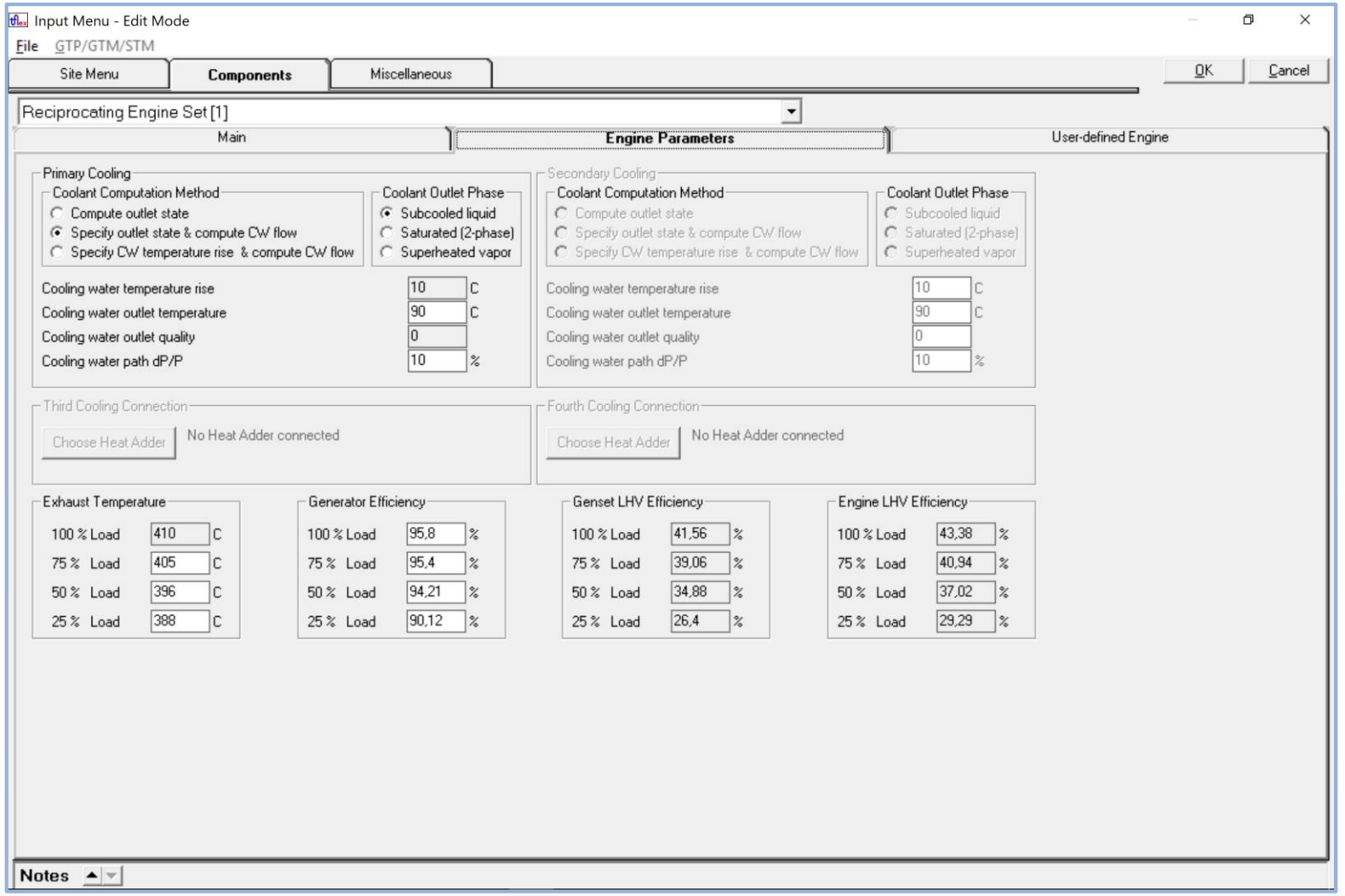
Reciprocating Engine Database



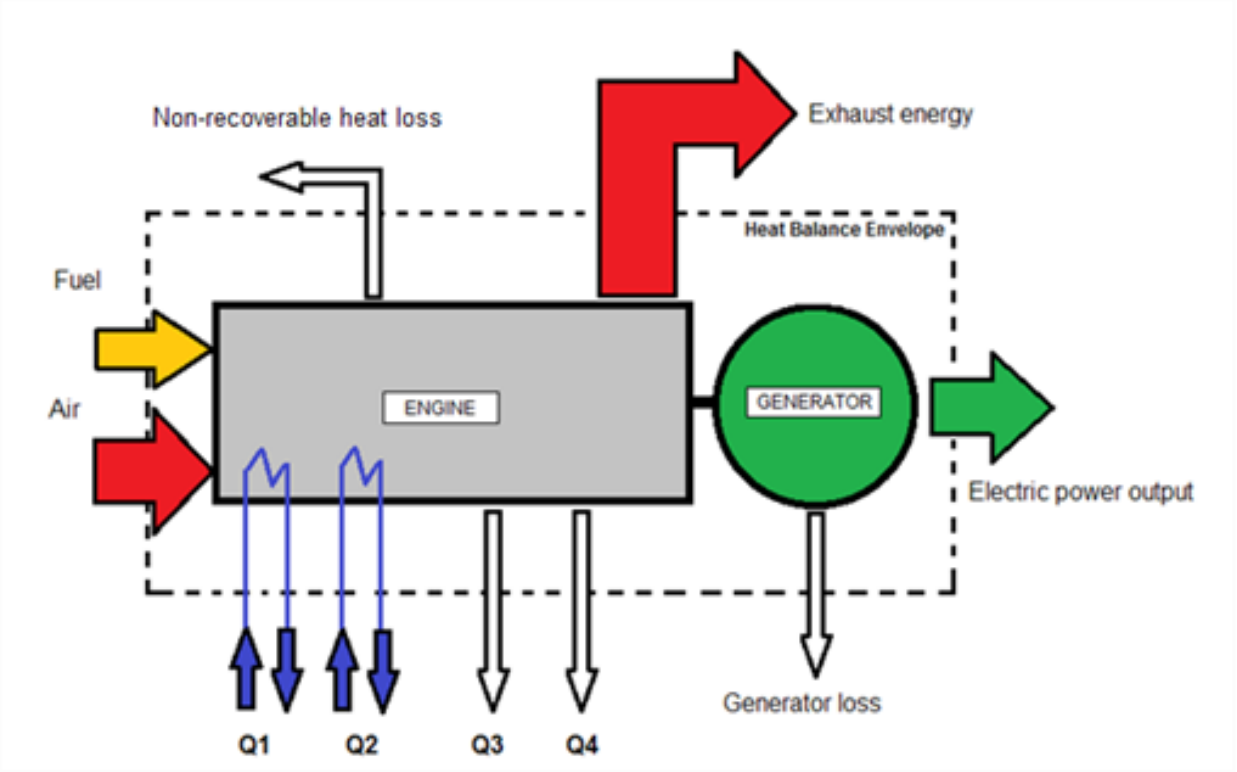
Reciprocating Engine User Defined



Reciprocating Engine User Defined - 2



Reciprocating Engine Heat Balance Envelope



Q1: Heat transfer from the cooling water jackets (primary cooling)
Q2: Heat transfer from a high temperature charge air cooler (secondary cooling)
Q3: Heat transfer from a low temperature charge air cooler
Q4: Heat transfer from the lube oil cooler

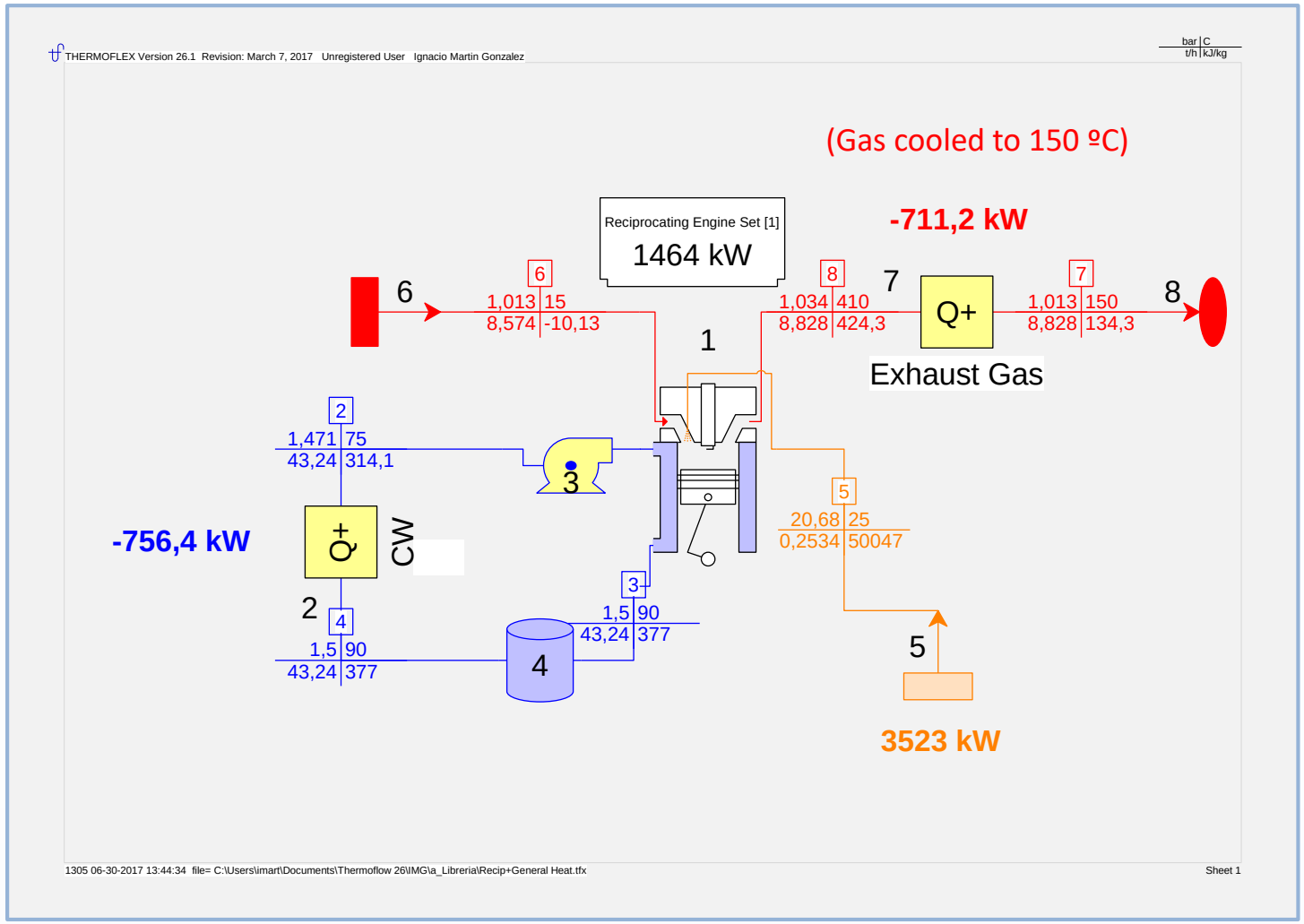
Reciprocating Engine Inputs

	NOMINAL		OFF DESIGN	
	Data Base	*User Def.*	*Data Base*	*User Def.*
Power				
Efficiency				Table
Exhaust mf				
Exhaust T			Table	Table
Generator Eff			Table	Table
Heat Recovery-4				
CW T, DT				
Fuel Consumption				
Air mf				

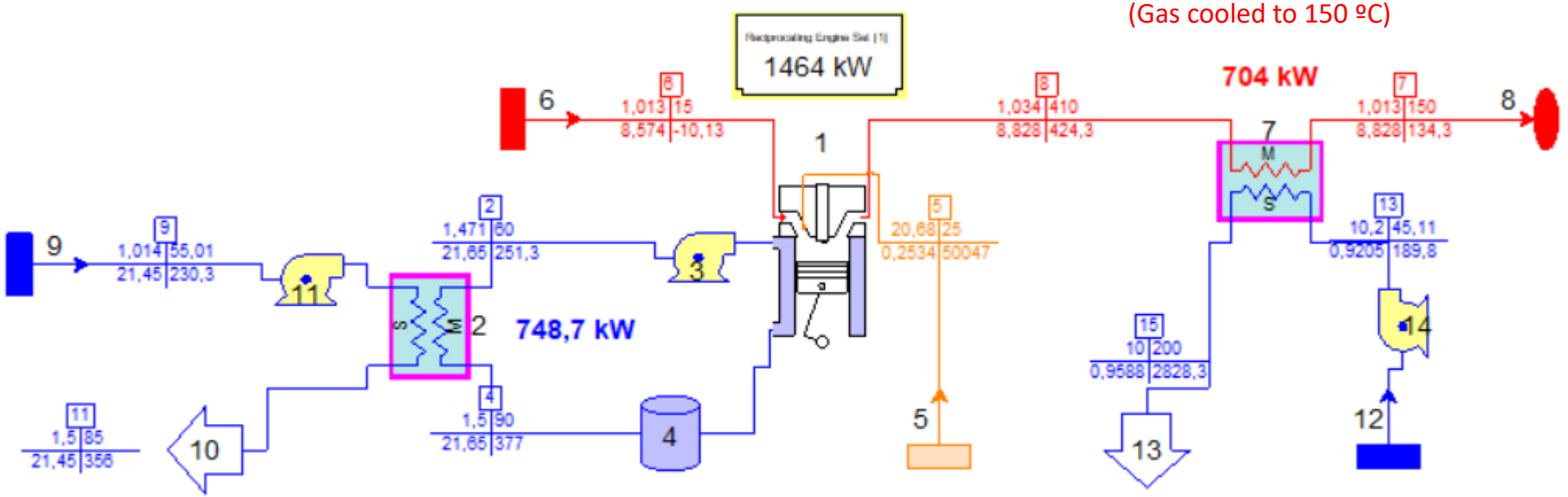
Inputs

Defined / Computed

Heat Balance: Available Heat Recovery

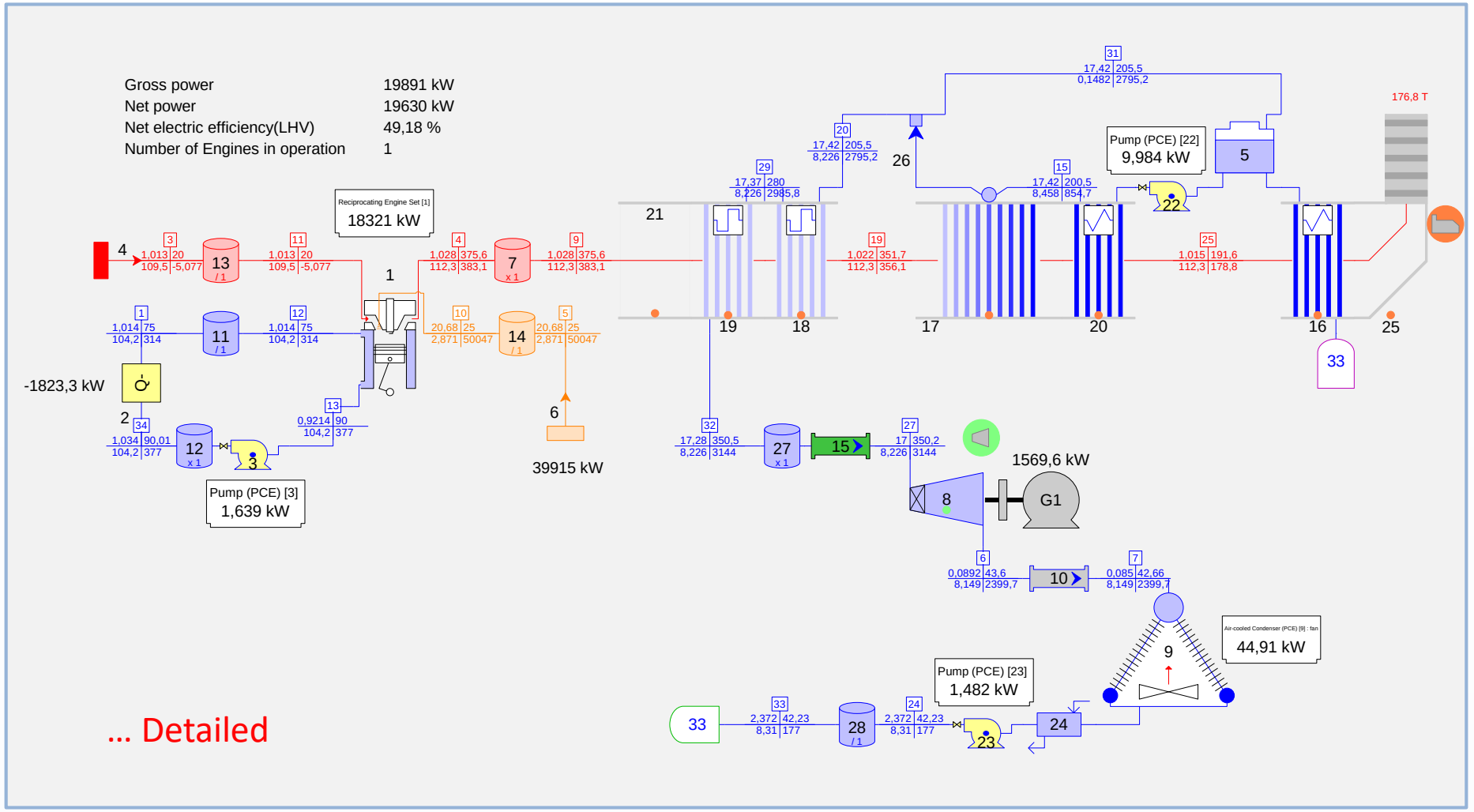


Available Heat Recovery, Hot Water & Steam

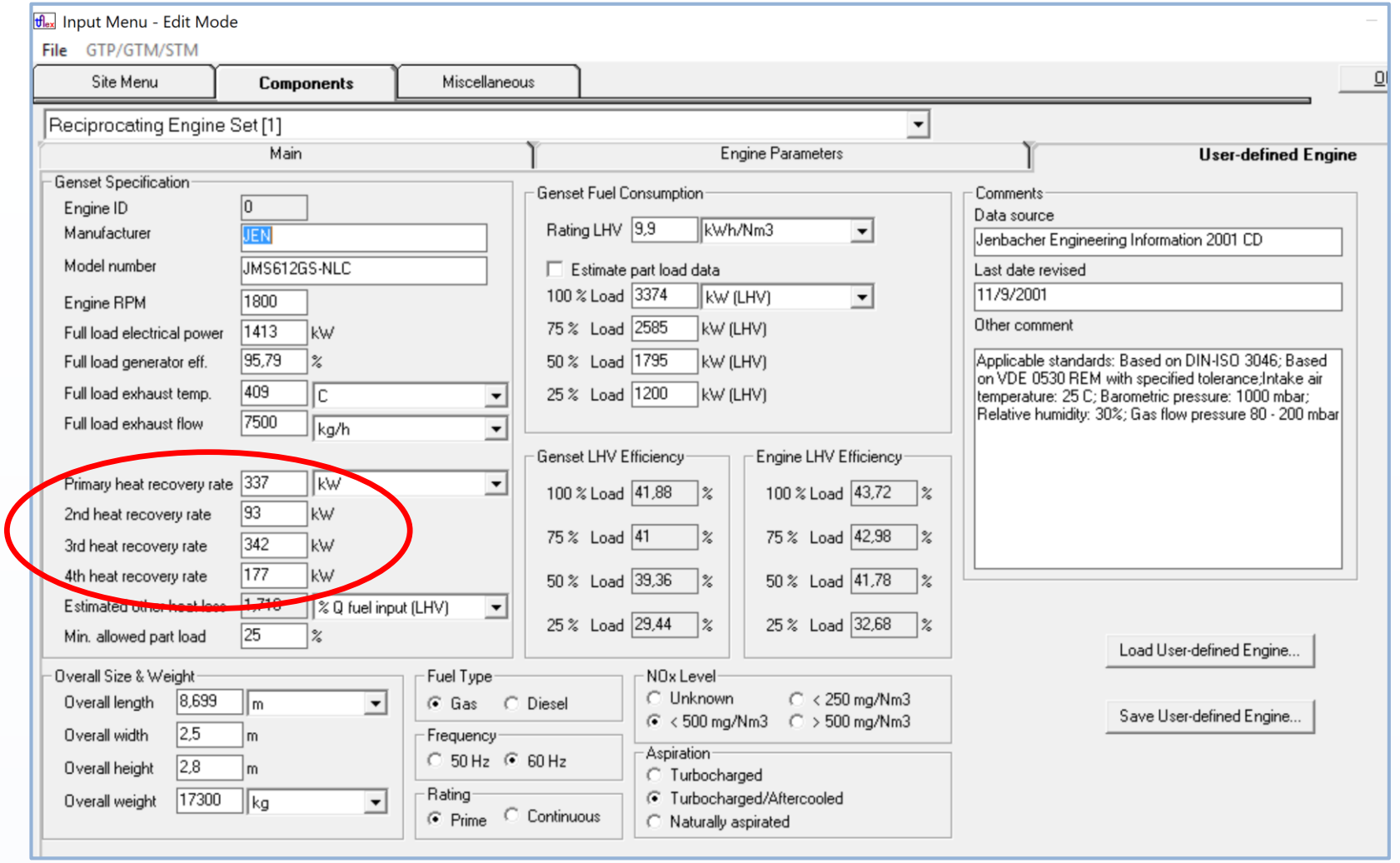


... Simple

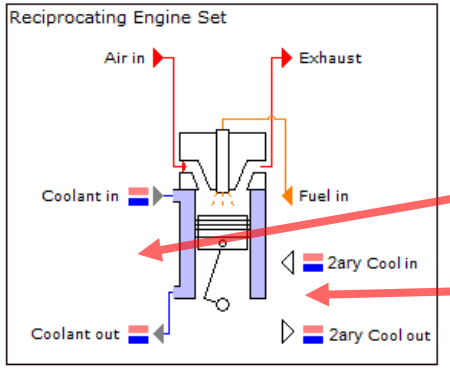
Exhaust Heat Recovery - Combined Cycle

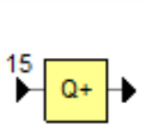


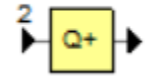
Cooling Water Circuit: 4 Heating Sources



Cooling Water Circuit: 4 Heating Sources







Input Menu - Edit Mode

File GTP/GTM/STM

Site Menu | Components | Miscellaneous

Reciprocating Engine Set [1]

Main | Engine Parameters | User-defi

Primary Cooling

Coolant Computation Method
- ○ Compute outlet state
- ◉ Specify outlet state & compute CW flow
- ○ Specify CW temperature rise & compute CW flow

Coolant Outlet Phase
- ◉ Subcooled liquid
- ○ Saturated (2-phase)
- ○ Superheated vapor

Cooling water temperature rise	10	C
Cooling water outlet temperature	90	C
Cooling water outlet quality	0	
Cooling water path dP/P	10	%

Secondary Cooling

Coolant Computation Method
- ○ Compute outlet state
- ◉ Specify outlet state & compute CW flow
- ○ Specify CW temperature rise & compute CW flow

Coolant Outlet Phase
- ◉ Subcooled liquid
- ○ Saturated (2-phase)
- ○ Superheated vapor

Cooling water temperature rise	10	C
Cooling water outlet temperature	44,5	C
Cooling water outlet quality	0	
Cooling water path dP/P	10	%

Third Cooling Connection

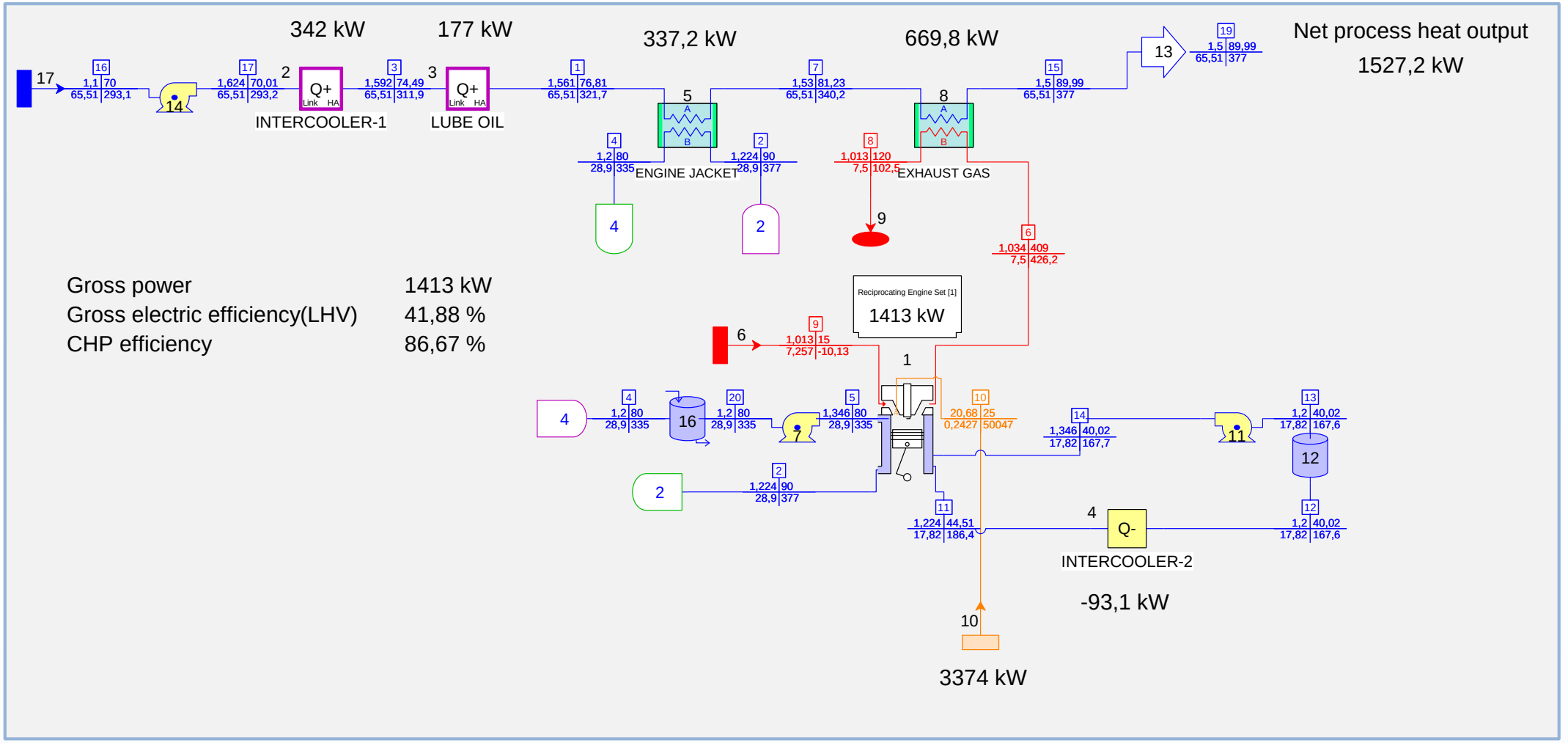
Choose Heat Adder | Heat Adder [2]

Fourth Cooling Connection

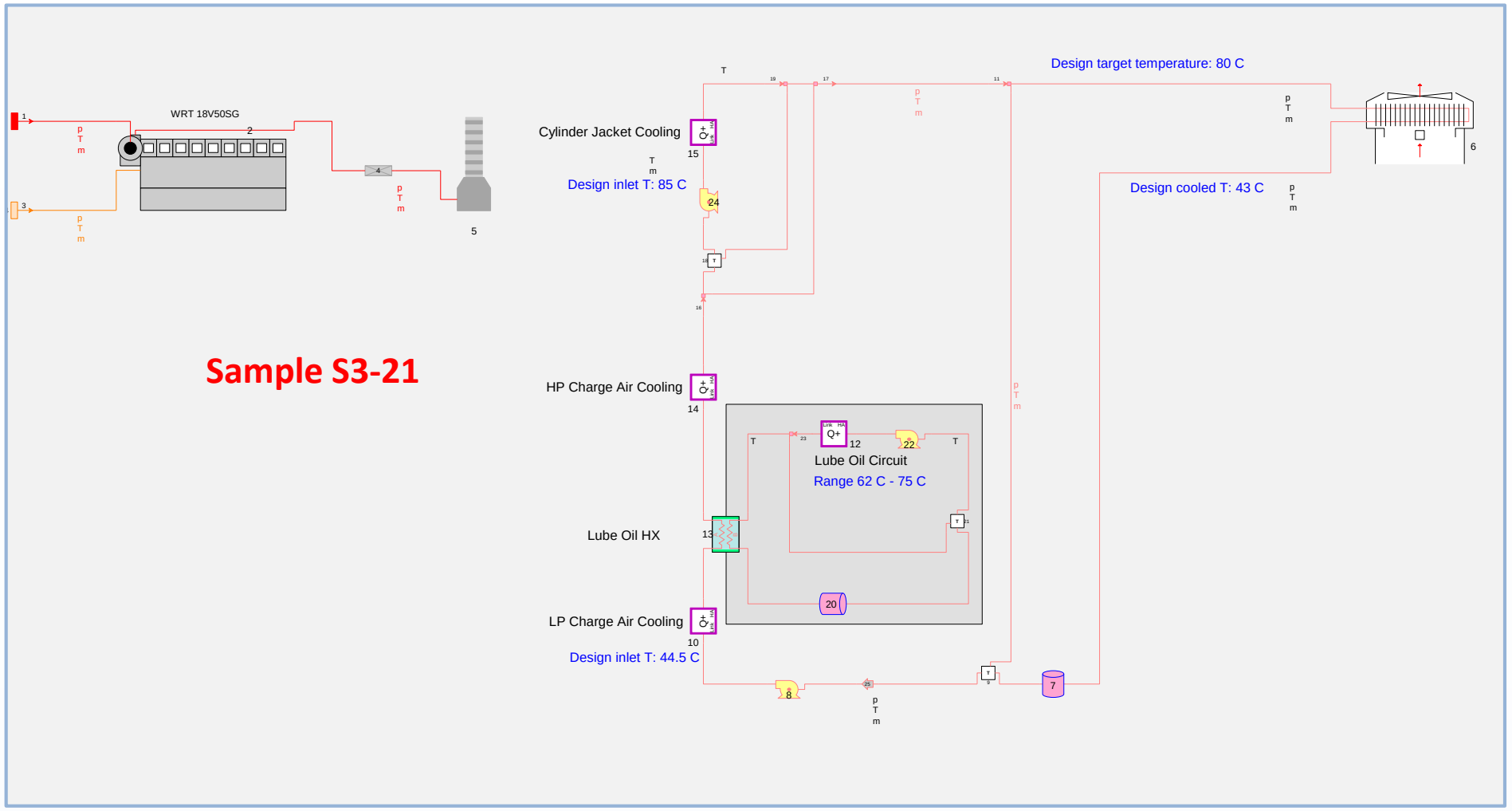
Choose Heat Adder | Heat Adder [3]

Exhaust Temperature			Generator Efficiency			Genset LHV Efficiency			Engine LHV Efficiency		
100 % Load	409	C	100 % Load	95,79	%	100 % Load	41,88	%	100 % Load	43,72	%
75 % Load	410	C	75 % Load	95,38	%	75 % Load	41	%	75 % Load	42,98	%
50 % Load	410	C	50 % Load	94,2	%	50 % Load	39,36	%	50 % Load	41,78	%
25 % Load	410	C	25 % Load	90,09	%	25 % Load	29,44	%	25 % Load	32,68	%

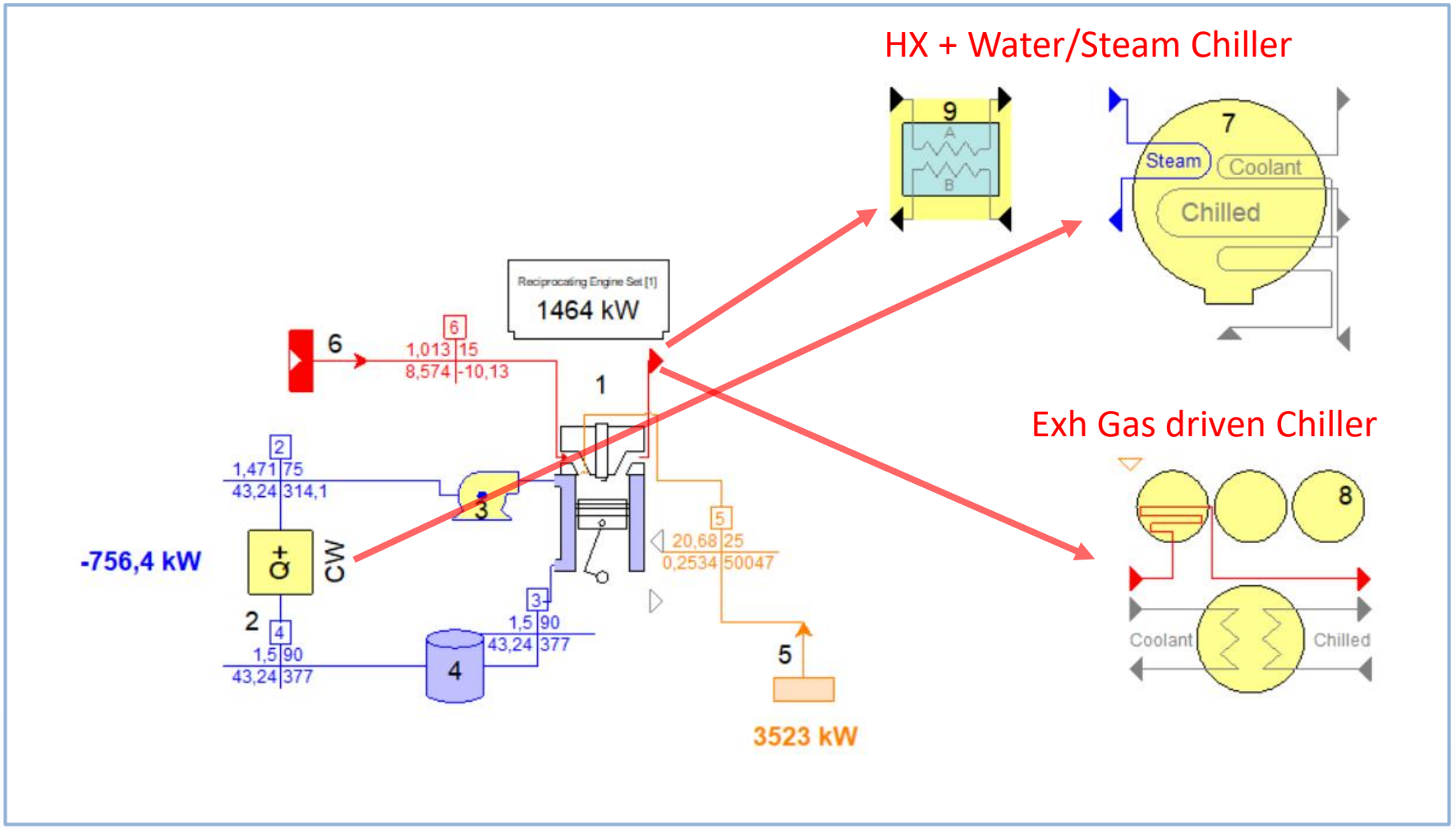
Cooling Water Circuit



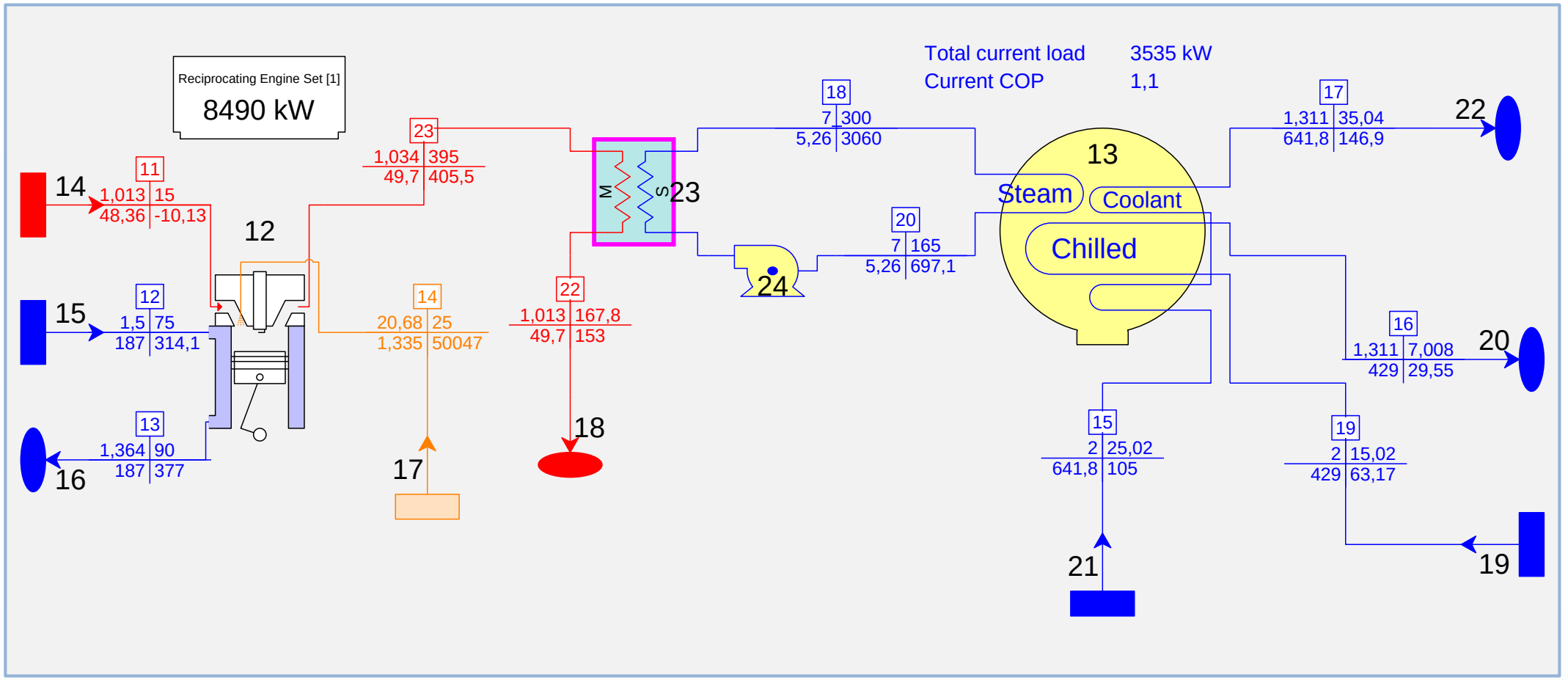
Cooling Water Circuit (detailed)



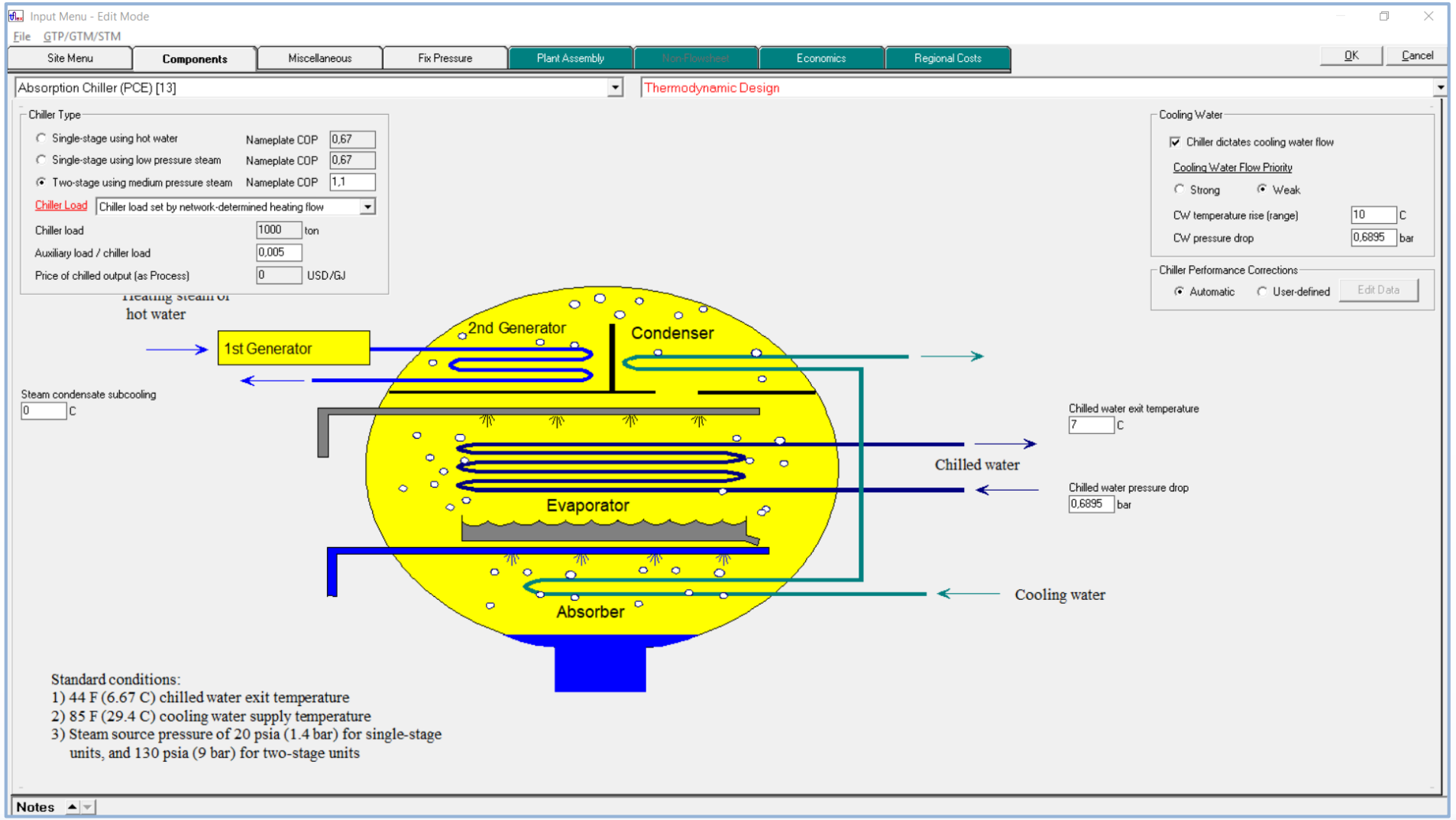
Heat Recovery, Chillers



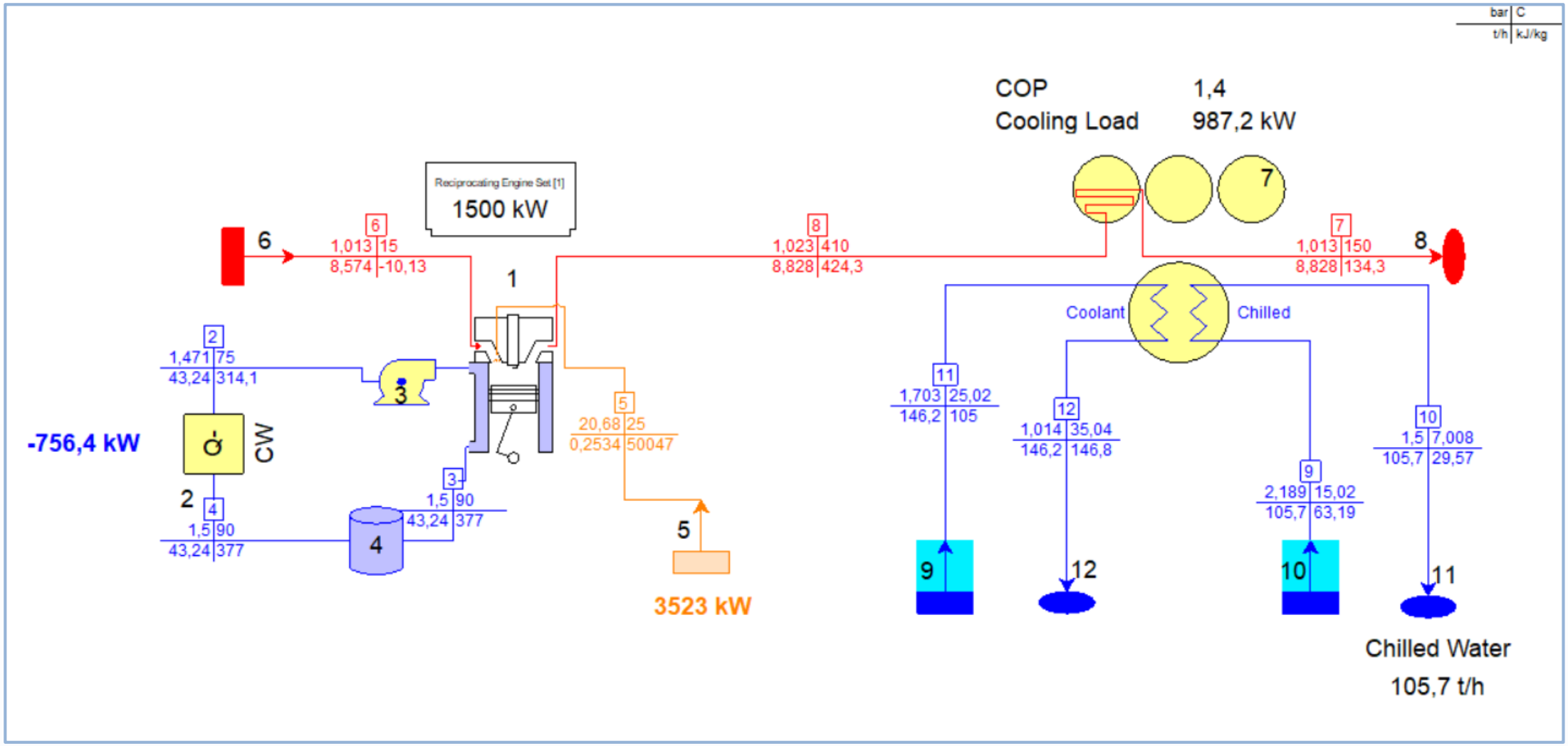
Heat Recovery with Water / Steam Absorption Chillers



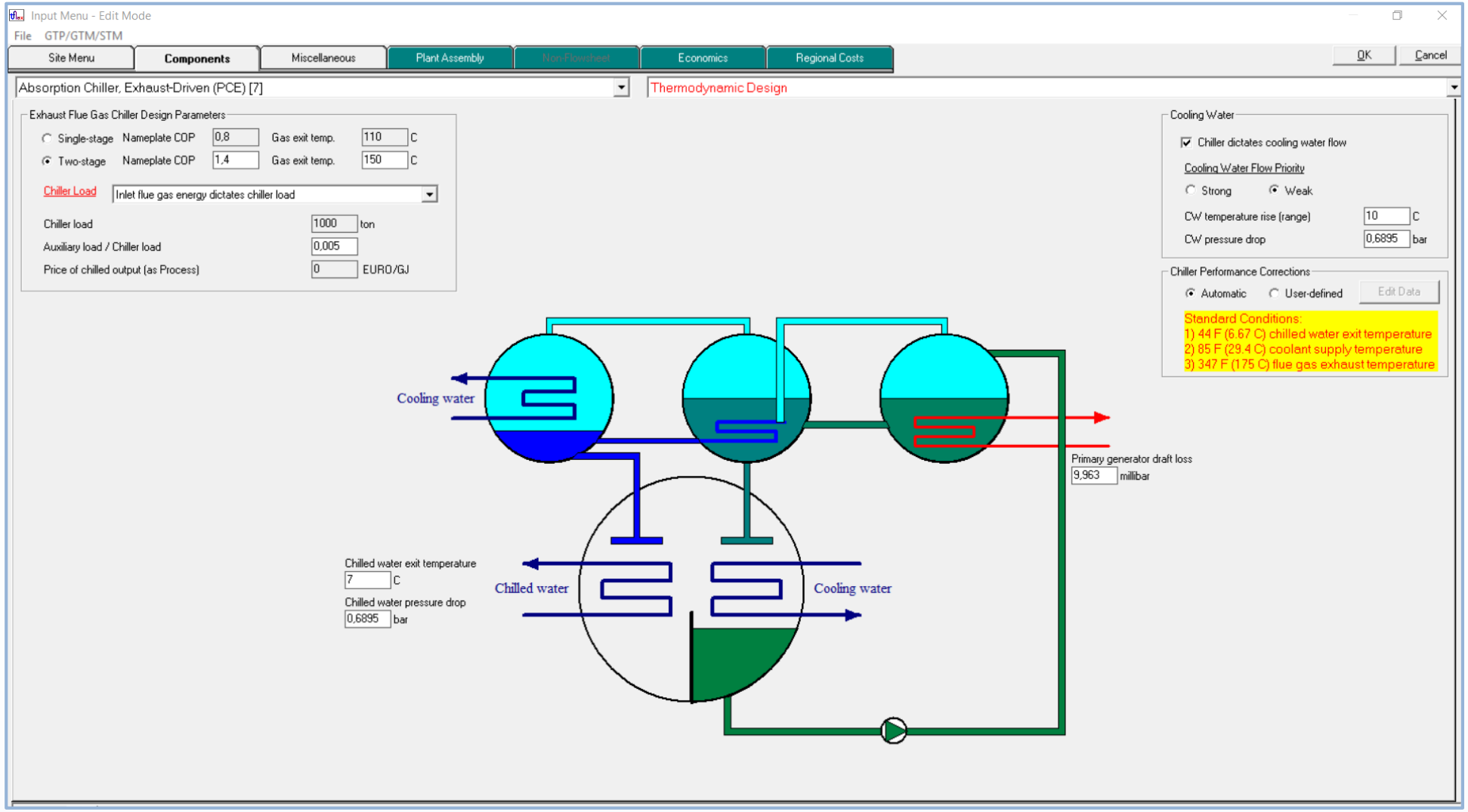
Water / Steam Absorption Chillers



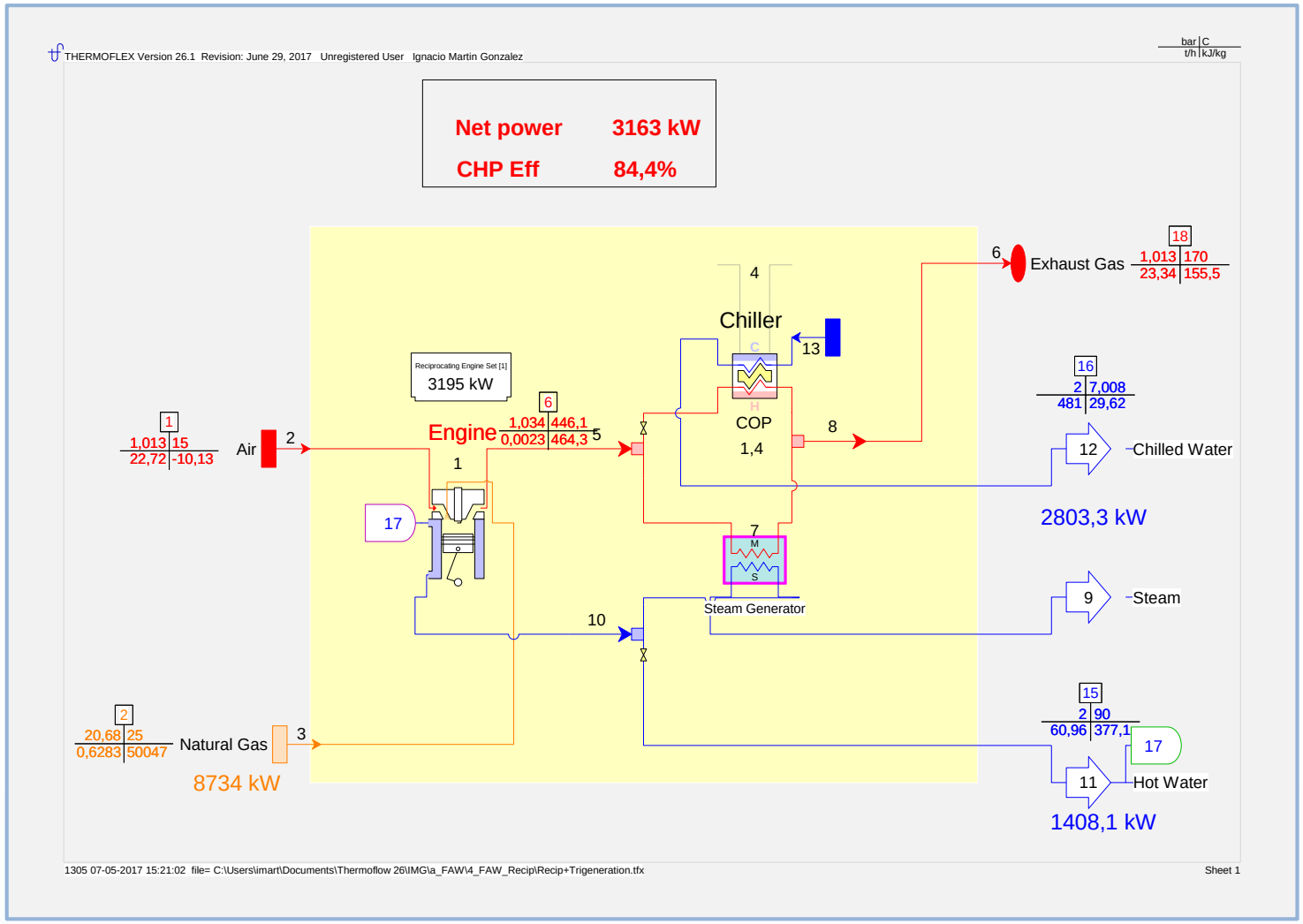
Heat Recovery, Exhaust Gas driven Absorption Chillers



Exhaust Gas-driven Absorption Chillers

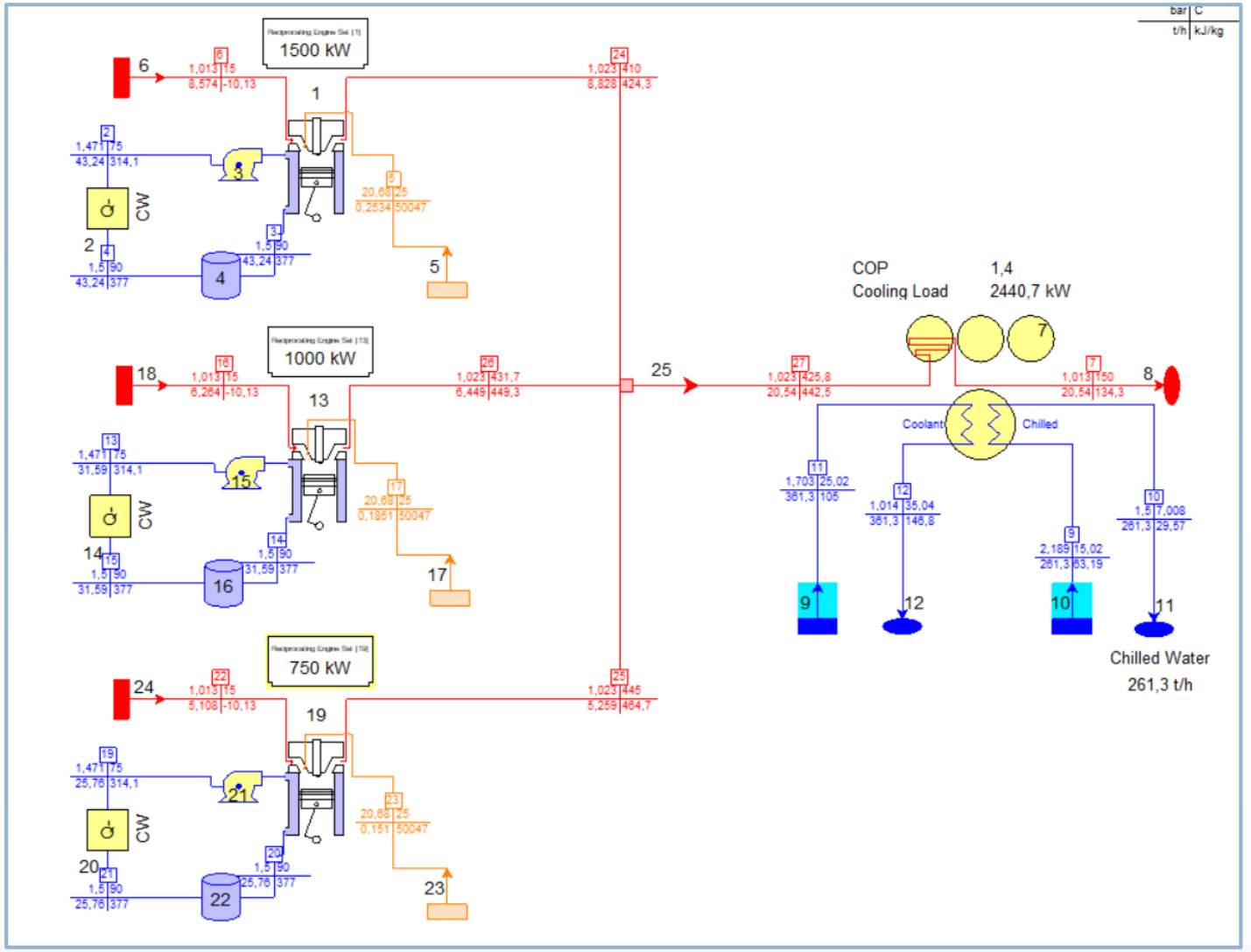


Recip Engine Trigeneration



Multiple Engines

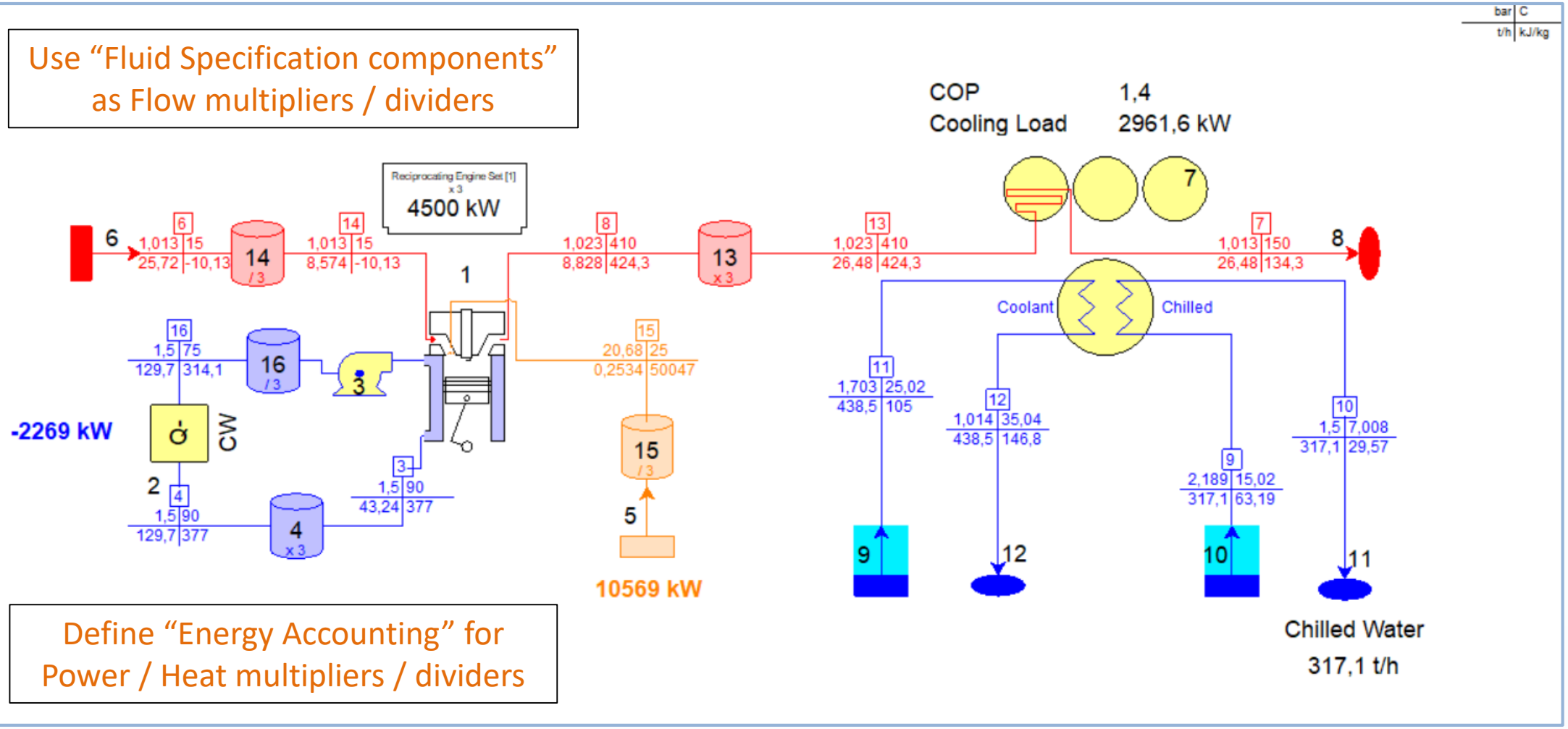
… if different Engine models
or running at different loads



Multiple Engines

… or

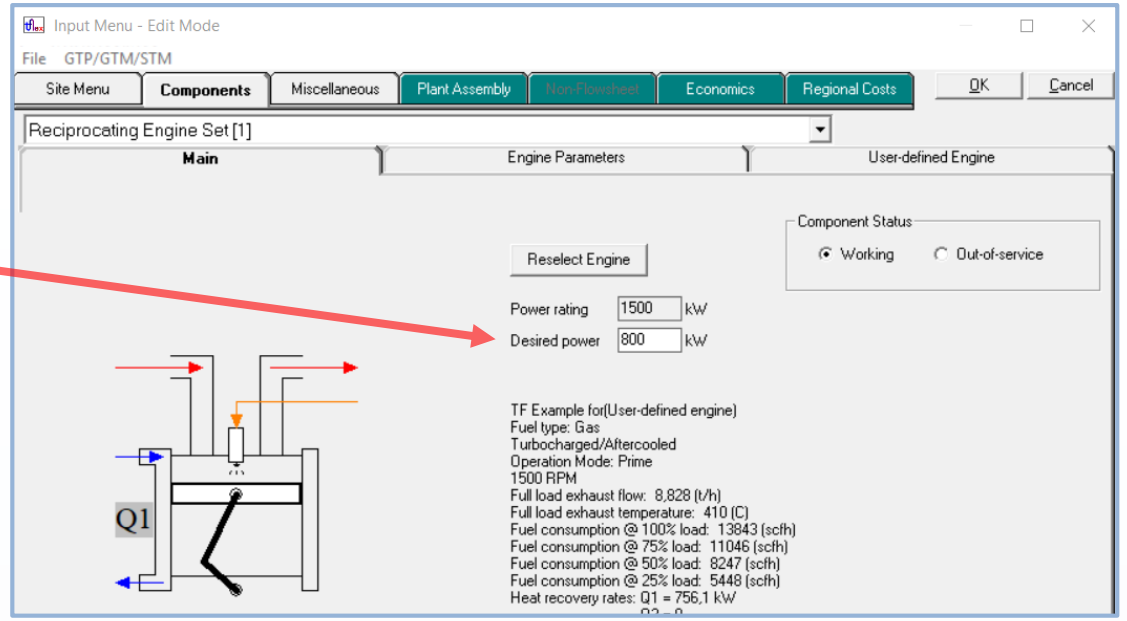
Use “Fluid Specification components” as Flow multipliers / dividers



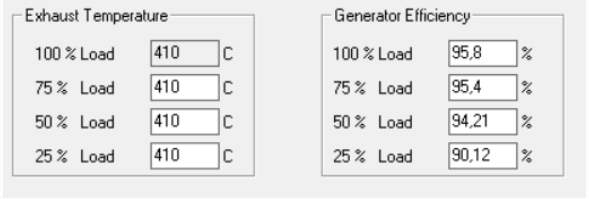
Define “Energy Accounting” for Power / Heat multipliers / dividers

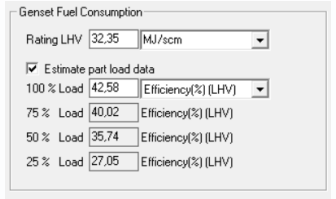
Recip Engines Off-Design Simulation

Recip Engines “modeless”
Just enter the “desired power”
to simulate part load



OD calculations from the Tables





Rest of the parameters computed
“User define” your part load case to match the Engine specs