Welcome!

Webinar #8. Combining THERMOFLEX & Application-Specific programs

August 3, 2017

The webinar will be starting on time (10:00 EDT)

Host: Meritt Elmasri (US office)
Presenter: Evgeny Zakharenkov

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Agenda

- Introduction
- Links: THERMOFLEX & Application-Specific programs
- Importing files into THERMOFLEX
- Merging THERMOFLEX files

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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**

Thermoflow Product Line

Application Specific

Repowering Steam Cycles

☑ RE-MASTER

Gas Turbine Combined Cycles

☑ PDE, webPDE
☑ GT PRO
☑ GT MASTER

Conventional Steam Cycles

☑ STEAM PRO
☑ STEAM MASTER

Fully Flexible

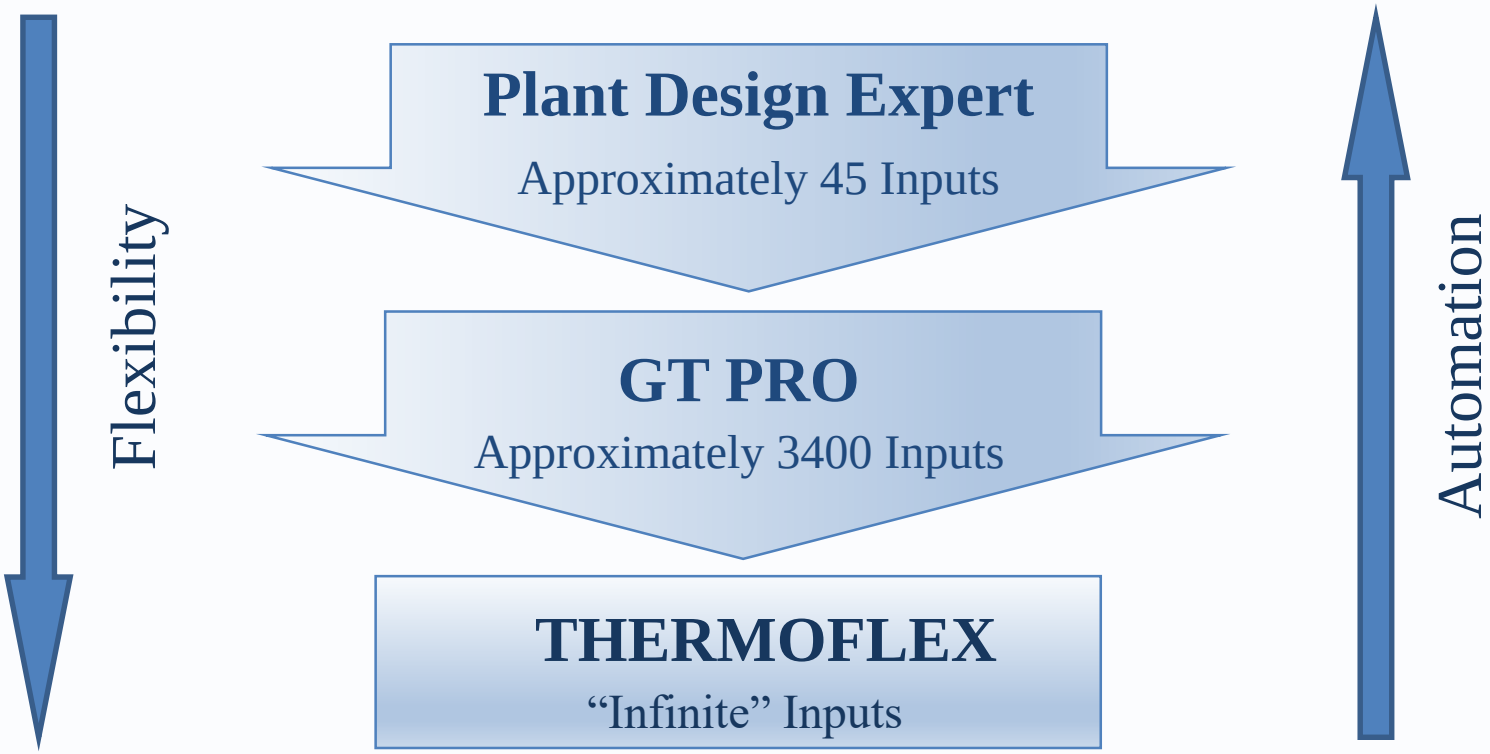
General Thermal Cycles - Emphasis on Power Plants

☑ ThermoFlex

Technical Economic

☑ PEACE

Automation / Flexibility



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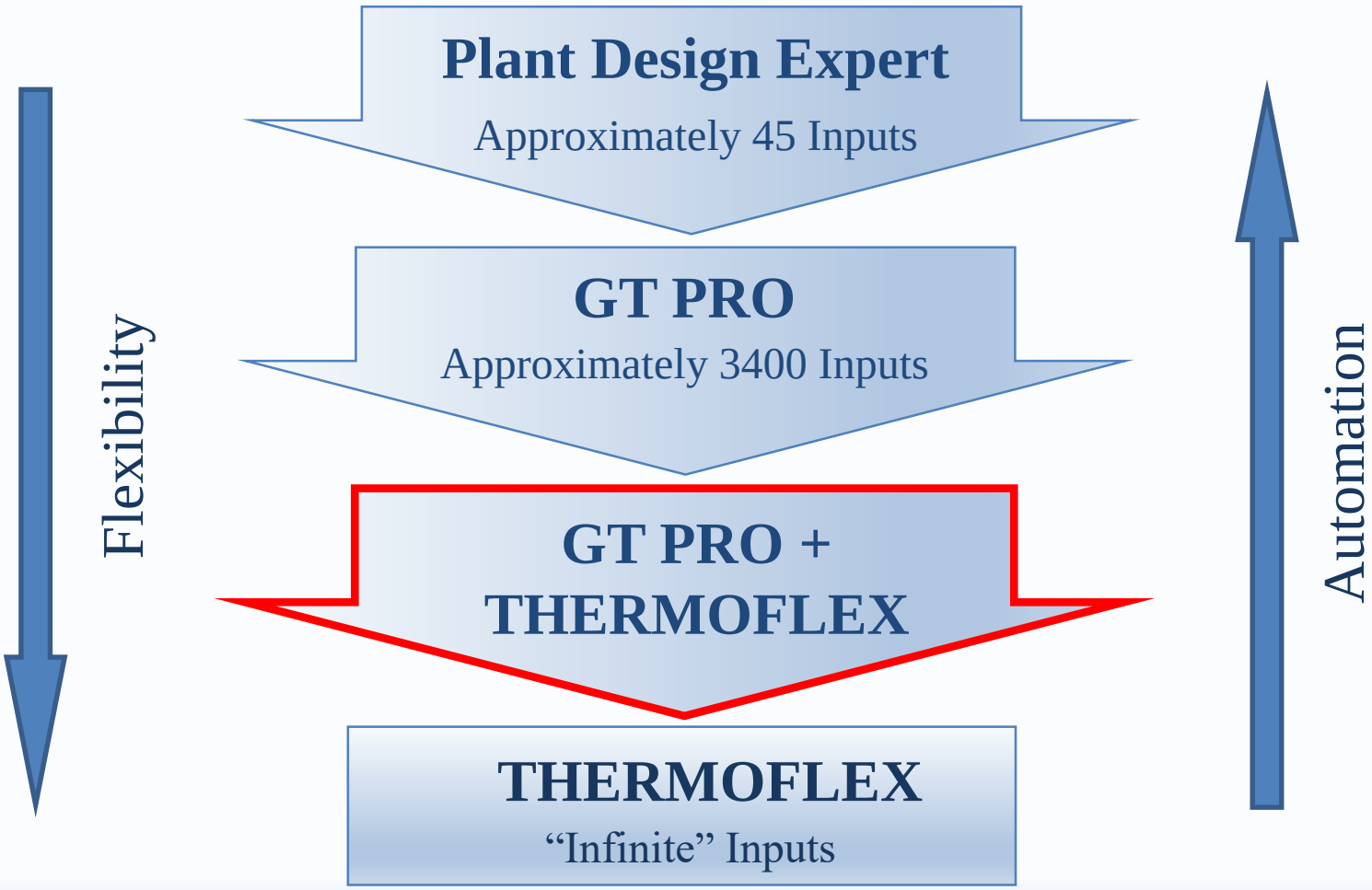
Automation / Flexibility



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Links: THERMOFLEX & Application-Specific programs

- Linking a THERMOFLEX model with one or more of the Application-Specific models (GT PRO, GT MASTER, and STEAM MASTER), creates a hybrid model
- Combining programs allows to model more complex and/or non-standard cycles
- Saving model setup time with fast and automated Application-Specific programs

Hybrid Model Samples

1. GT – Reciprocating Engine plant with Absorption chiller

2. 660 MW Coal Plant – Repowering

3. Integrated Solar Combined Cycle

Plant Model 1. GT – Recip. Engines with Abs. chiller

- This sample demonstrates combined model GT cycle and two reciprocating engines with absorption chiller
- GT PRO/GT MASTER is used to model combined cycle based on Siemens SGT-800 gas turbine and back-pressure steam turbine
- THERMOFLEX – Reciprocating engines with their HRSGs, steam header, absorption chiller, cooling system and linked streams to GT MASTER

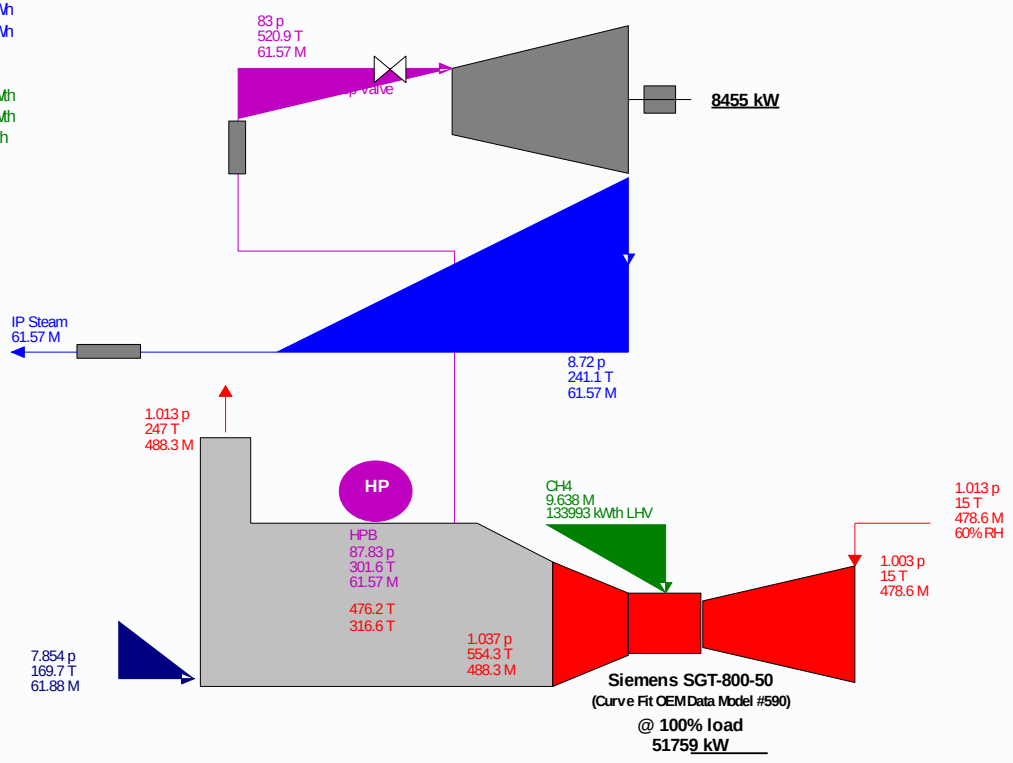
Plant Model 1. GT – Recip. Engines with Abs. chiller

GT MASTER Model results

GT MASTER 25.0 Office

Gross Power	60214 kW
Net Power	58531 kW
Aux & Losses	1683.2 kW
LHV Gross Heat Rate	8011 kJ/kWh
LHV Net Heat Rate	8241 kJ/kWh
LHV Gross Electric Eff.	44.94 %
LHV Net Electric Eff.	43.68 %
Fuel LHV Input	133993 kWth
Fuel HHV Input	148680 kWth
Net Process Heat	37715 kWth

Ambient
1.013 P
15 T
60% RH



p [bar] T [C] M [t/h], Steam Properties: IAPWS-IF97
1987 10-12-2015 16:42:20 file=C:\TFLOW25\MYFILES\GT-Recip absorption chiller.GTM

GT MASTER 25.0 Office

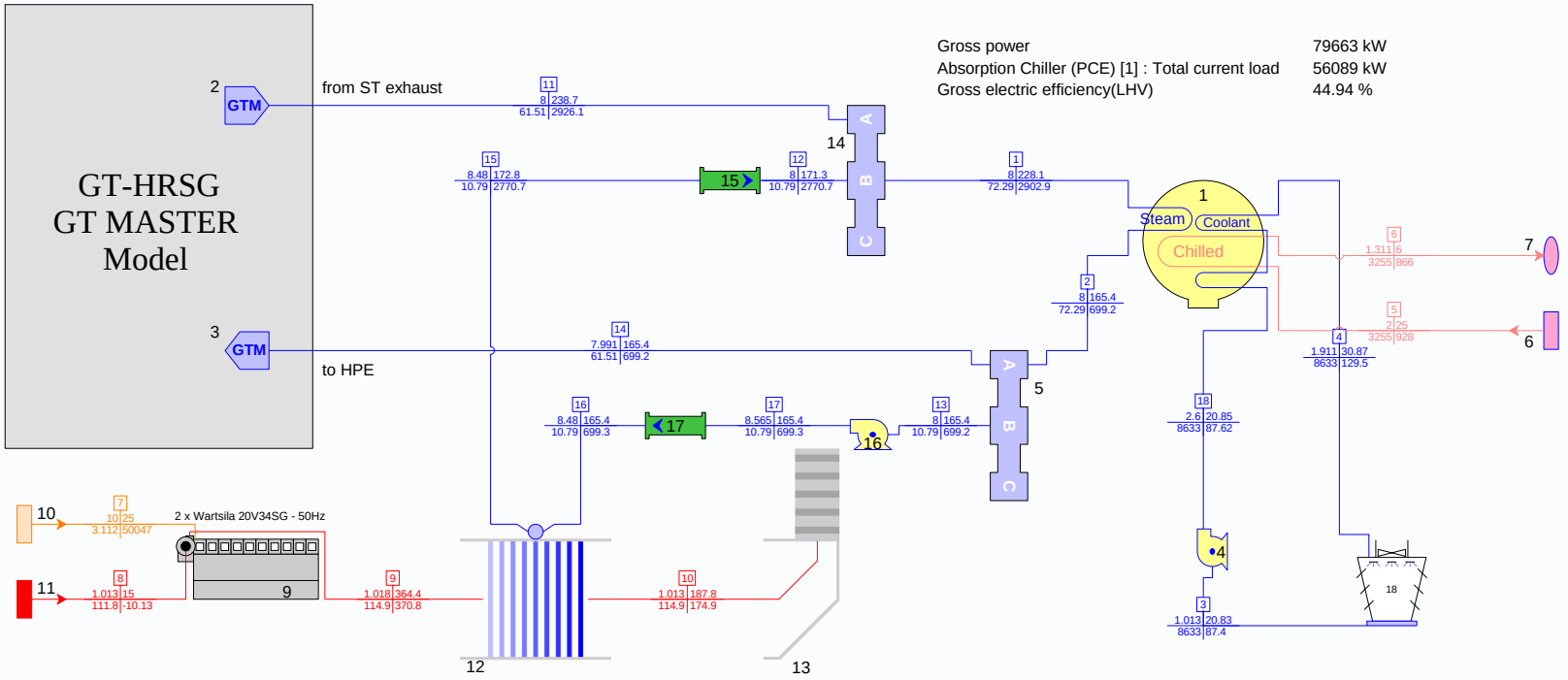
File: GT-Recip absorption.GTM

Plant Model 1. GT – Recip. Engines with Abs. chiller

Hybrid Model

THERMOFLEX Version 25.0 Revision: September 21, 2015 Office Evgeny Zakharenkov

bar | C
t/h | kJ/kg



File: GT-Recip absorption.TFX

Plant Model 2. 660 MW Coal Plant - Repowering

- This sample demonstrates Feedwater Heater Repowering of 660MW conventional steam plant with gas turbine Hitachi H-100
- STEAM PRO/STEAM MASTER is used to model existing steam cycle
- THERMOFLEX is used to model the gas turbine, heat recovery steam generator and links to STEAM MASTER

Plant Model 2. 660 MW Coal Plant - Repowering

STEAM PRO/STEAM MASTER model description

ST Power Output: 660 MW (50 Hz)

Boiler Type: Conventional

Fuel: Coal fired

Steam Turbine Configuration: Single reheat

Steam Turbine Type: Subcritical parameters

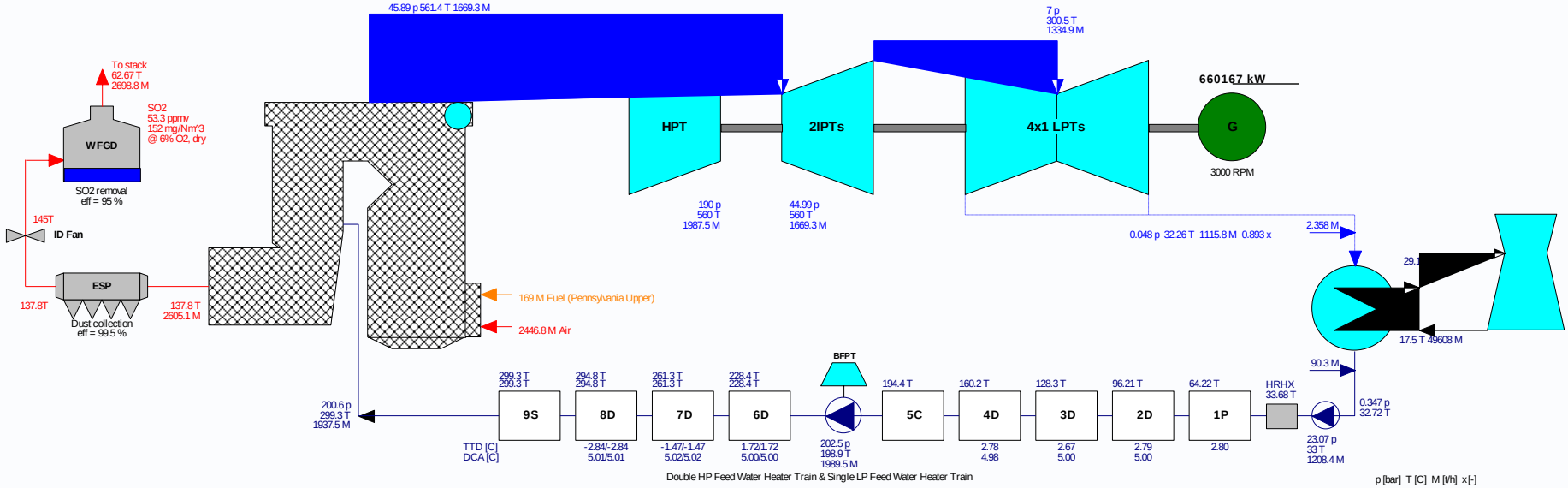
Cooling System Type: Natural draft cooling tower

Plant Model 2. 660 MW Coal Plant - Repowering

STEAM MASTER Model results

Plant gross power	660167	kW
Plant net power	629200	kW
Number of units	1	
Plant net HR (HHV)	8939	kJ/kWh
Plant net HR (LHV)	8644	kJ/kWh
Plant net eff (HHV)	40.27	%
Plant net eff (LHV)	41.65	%
Aux. & losses	30967	kW
Fuel heat input (HHV)	5624	GJ/h
Fuel heat input (LHV)	5439	GJ/h
Fuel flow	4056	t/day

Ambient
1.013 p
15 T
60% RH
10.82 T wet bulb



STEAM MASTER 25.0 Office Evgeny Zakharenkov
1987 10-09-2015 13:45:26 C:\TFLOW25\MYFILES\660 MW CONVCOAL.STM

File: 660 MW ConvCoal.GTM

Plant Model 2. 660 MW Coal Plant - Repowering

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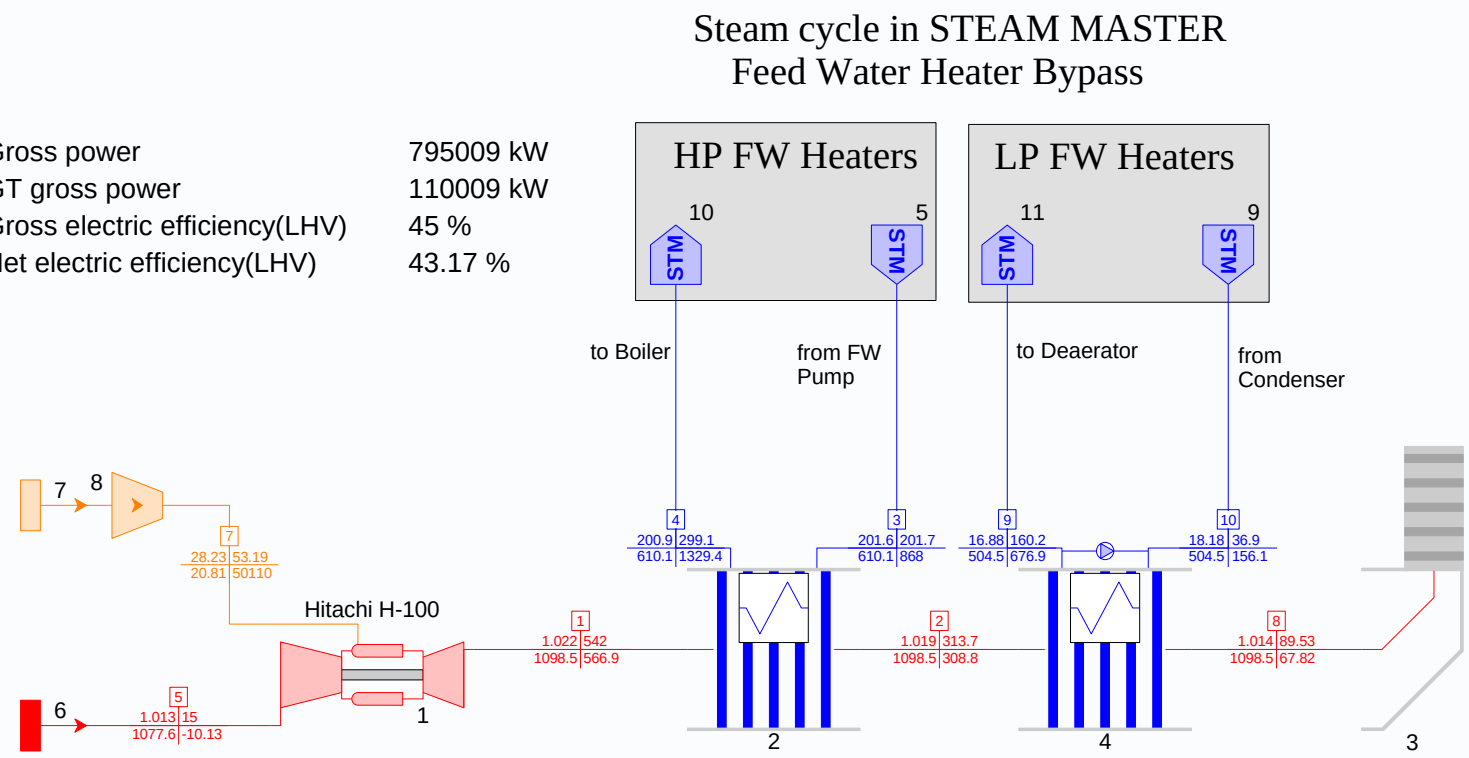
bar | C
t/h | kJ/kg

Gross power	795009 kW
GT gross power	110009 kW
Gross electric efficiency(LHV)	45 %
Net electric efficiency(LHV)	43.17 %



File: 660MW Repowering.TFX

Plant Model 2. 660 MW Coal Plant - Repowering

Plant model results

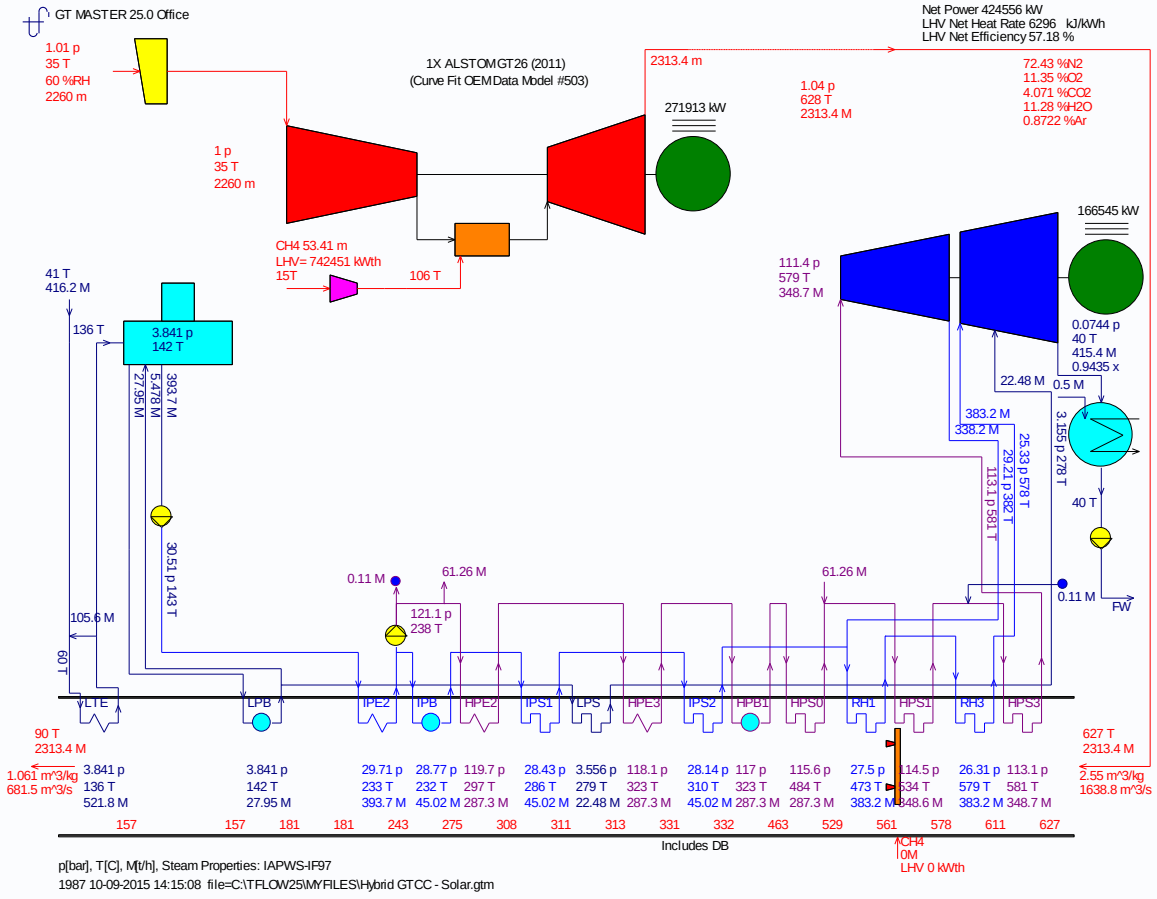
	Existing Plant	Repowering
Gross Power Output, MW:	660	795
- Steam Cycle	660	685
- GT Cycle	-	110
Net el. Efficiency	41.65	43.17
CO2 emission, g/kWh	776.8	694.5
CO2 reduction, g/kWh	-	82.3

Plant Model 3. Integrated Solar Combined Cycle

- This sample demonstrates Integrated Solar System Combined Cycle technology
- GT PRO/GT MASTER is used to model combined cycle based on an Ansaldo GT26 gas turbine
- THERMOFLEX – Solar tower, heat transfer fluid loop with steam generator and linked streams to GT MASTER

Plant Model 3. Integrated Solar Combined Cycle

GT MASTER Model results



File: ISCC model.GTM

Plant Model 3. Integrated Solar Combined Cycle

Hybrid Model: Daytime operation

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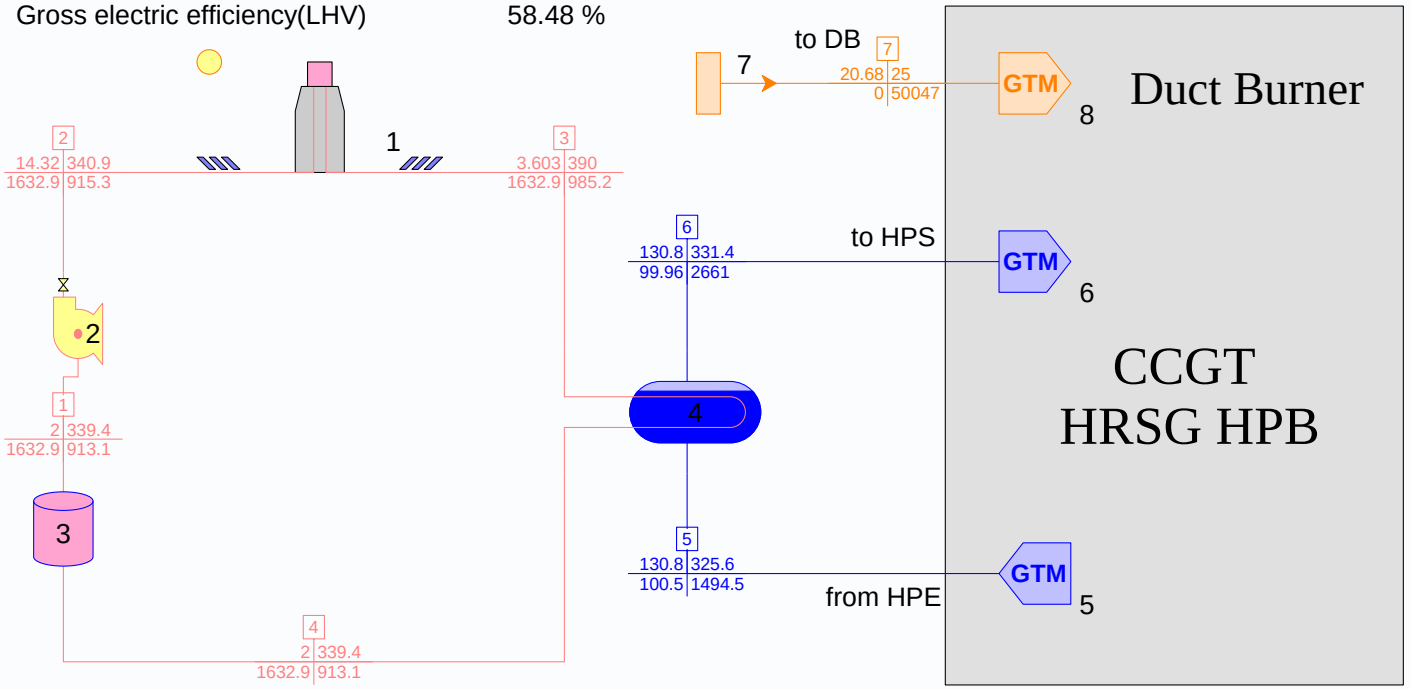
bar | C
t/h | kJ/kg

Site Menu: Ambient temperature	35 C
Site Menu: Ambient relative humidity	60 %
Gross power	452725 kW
Gross electric efficiency(LHV)	58.48 %



File: ISCC plant daytime.TFX

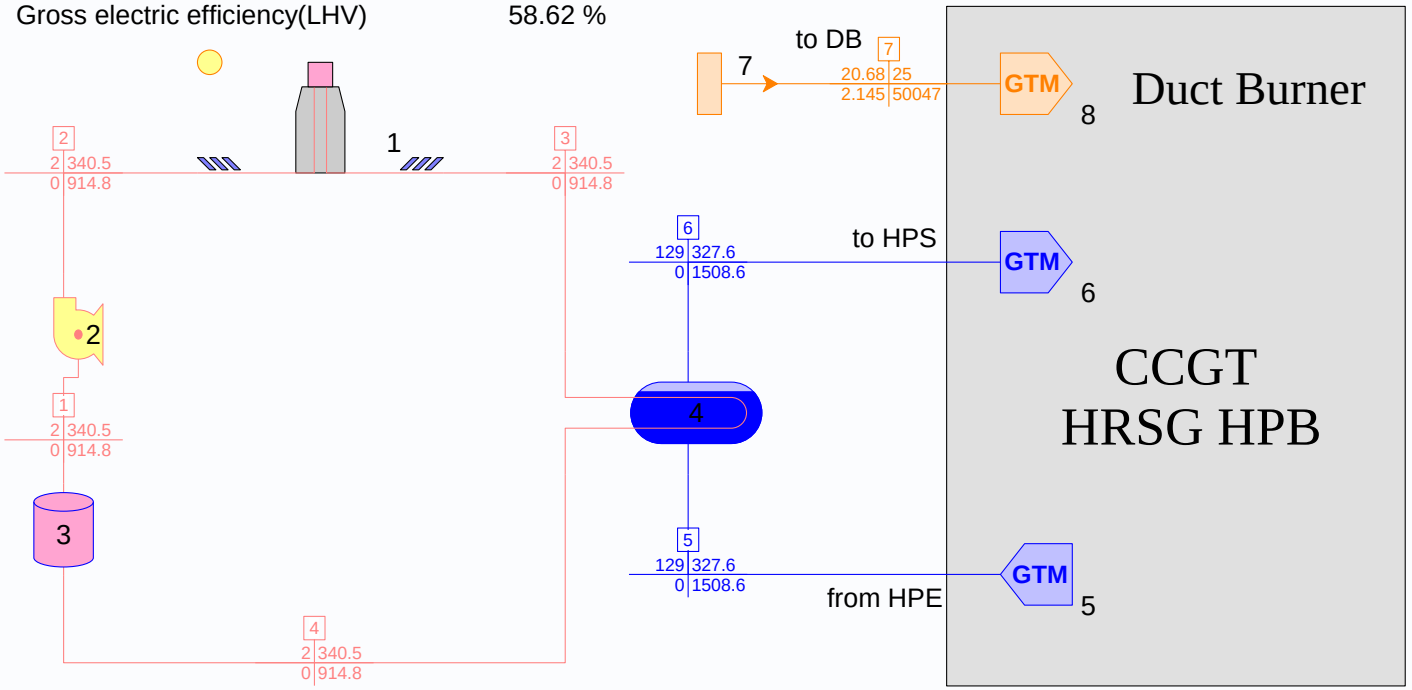
Plant Model 3. Integrated Solar Combined Cycle

Hybrid Model: Nighttime operation

THERMOFLEX Version 25.0 Revision: September 21, 2015 Office Evgeny Zakharenkov

bar | C
t/h | kJ/kg

Site Menu: Ambient temperature	35 C
Site Menu: Ambient relative humidity	60 %
Gross power	452742 kW
Gross electric efficiency(LHV)	58.62 %

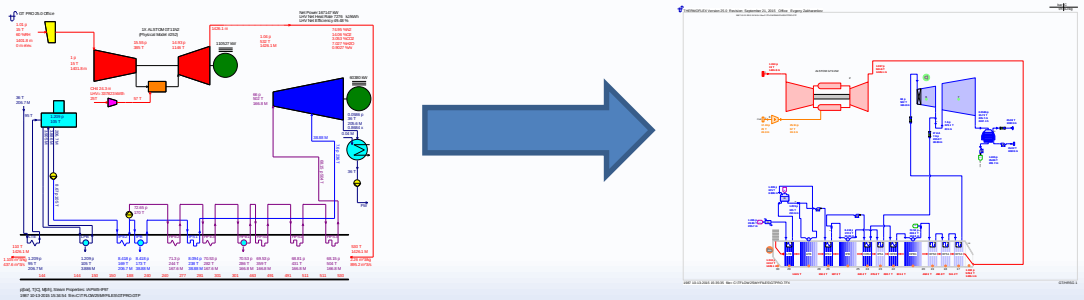


File: ISCC plant nightime.TFX

Importing into THERMOFLEX

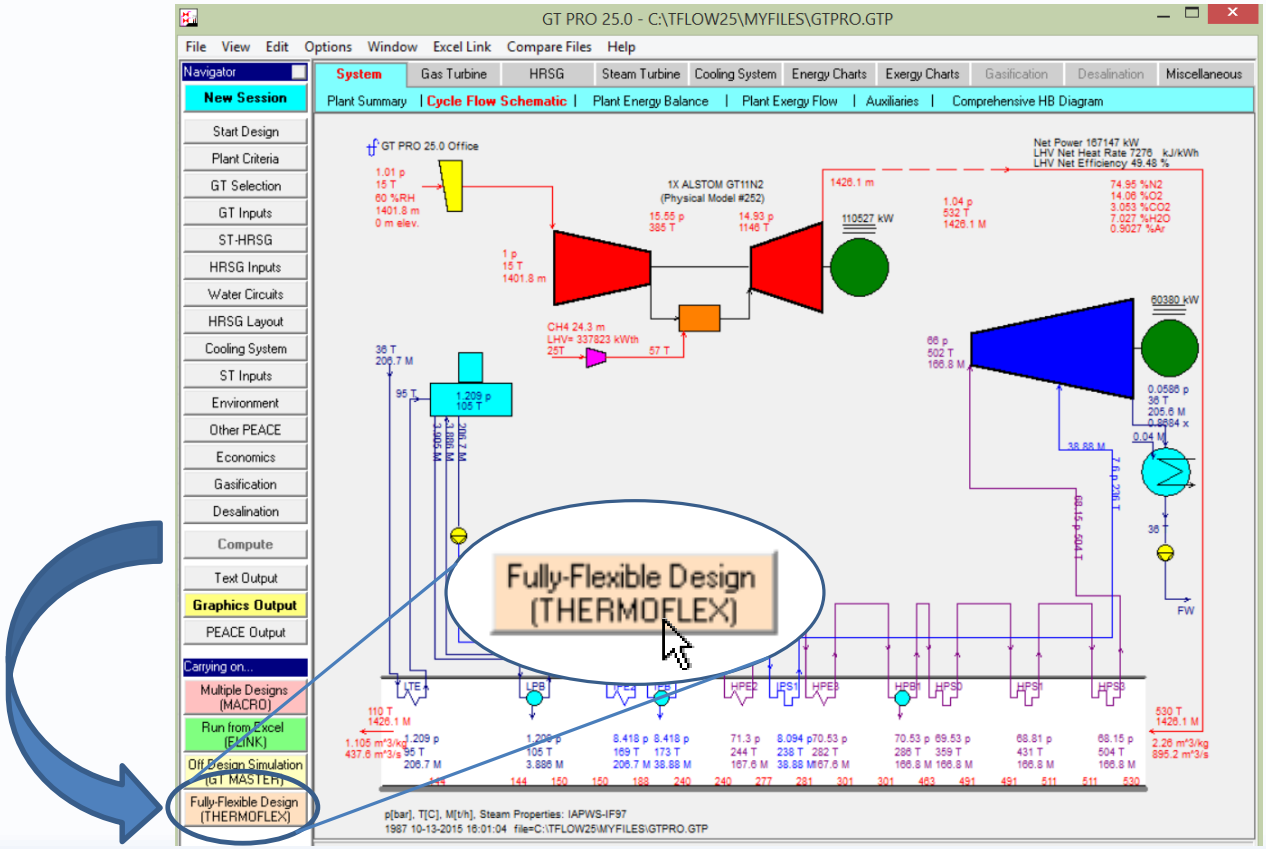
- Importing a GT PRO/MASTER or STEAM PRO design into THERMOFLEX, lets the user build a model of a combined and steam conventional cycles or cogeneration plants quickly and professionally

- The user can import the results of GT PRO PRO/MASTER's or STEAM PRO's design to THERMOFLEX, for the ability to add unique features



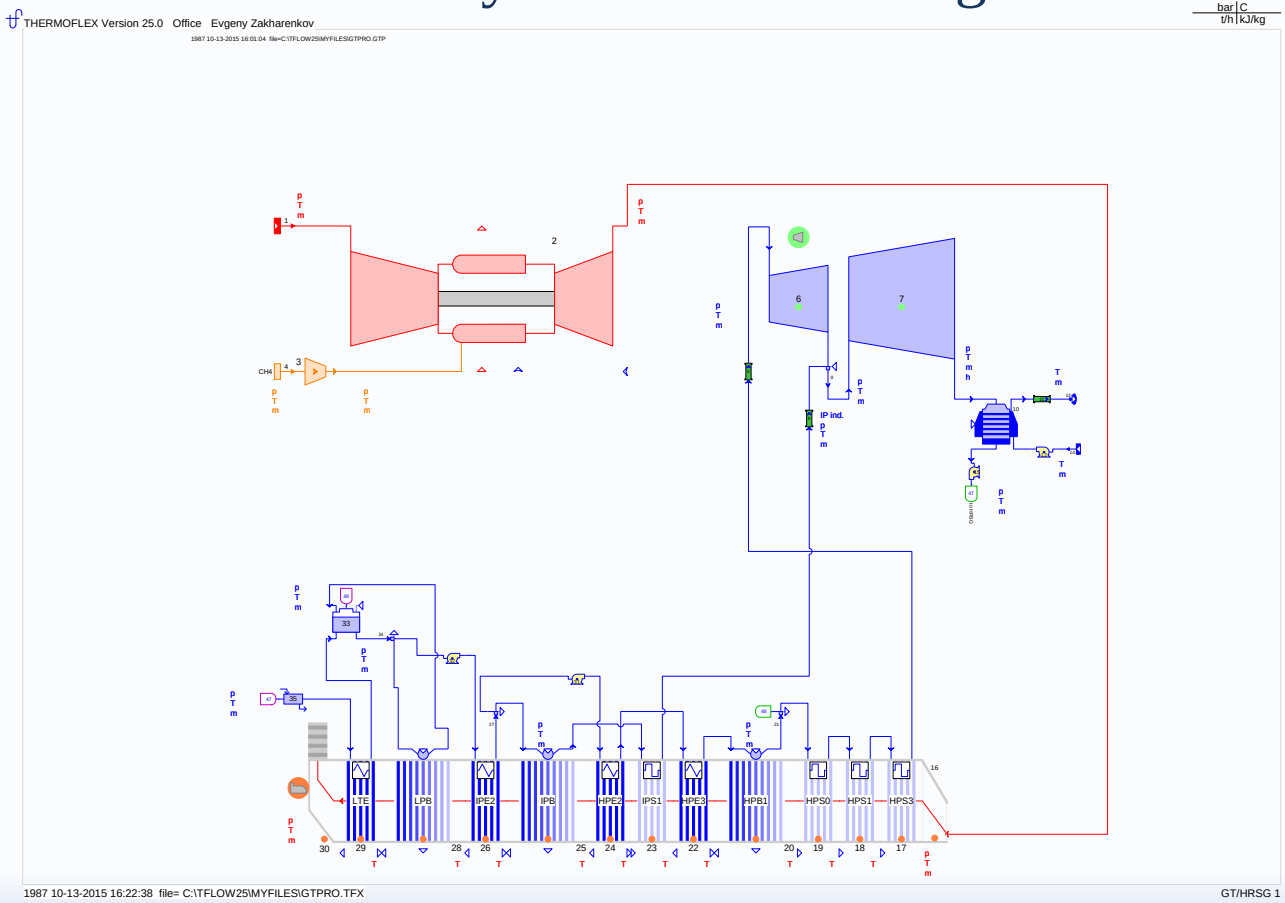
Importing into THERMOFLEX

After computation just click
"Fully-Flexible Design (THERMOFLEX)"



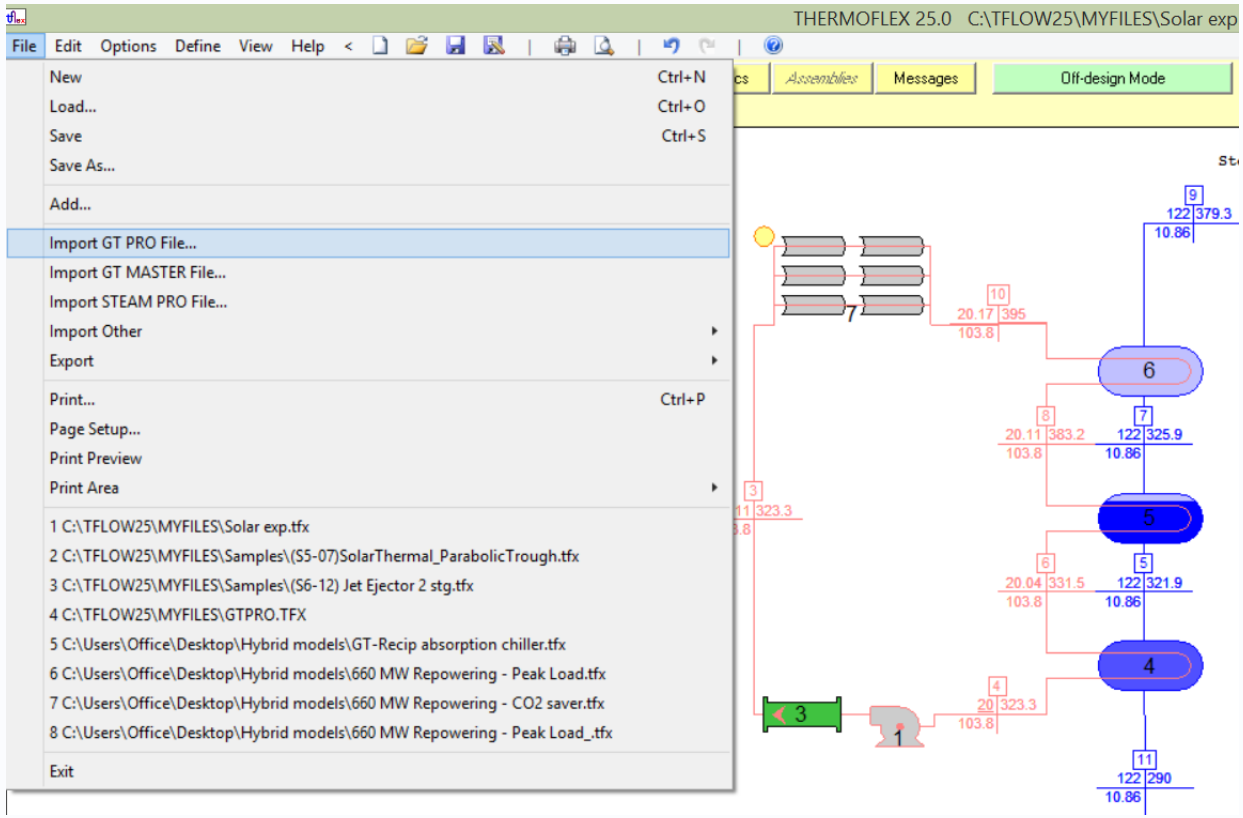
Importing into THERMOFLEX

..and THERMOFLEX will load this exact design for fully-flexible modeling



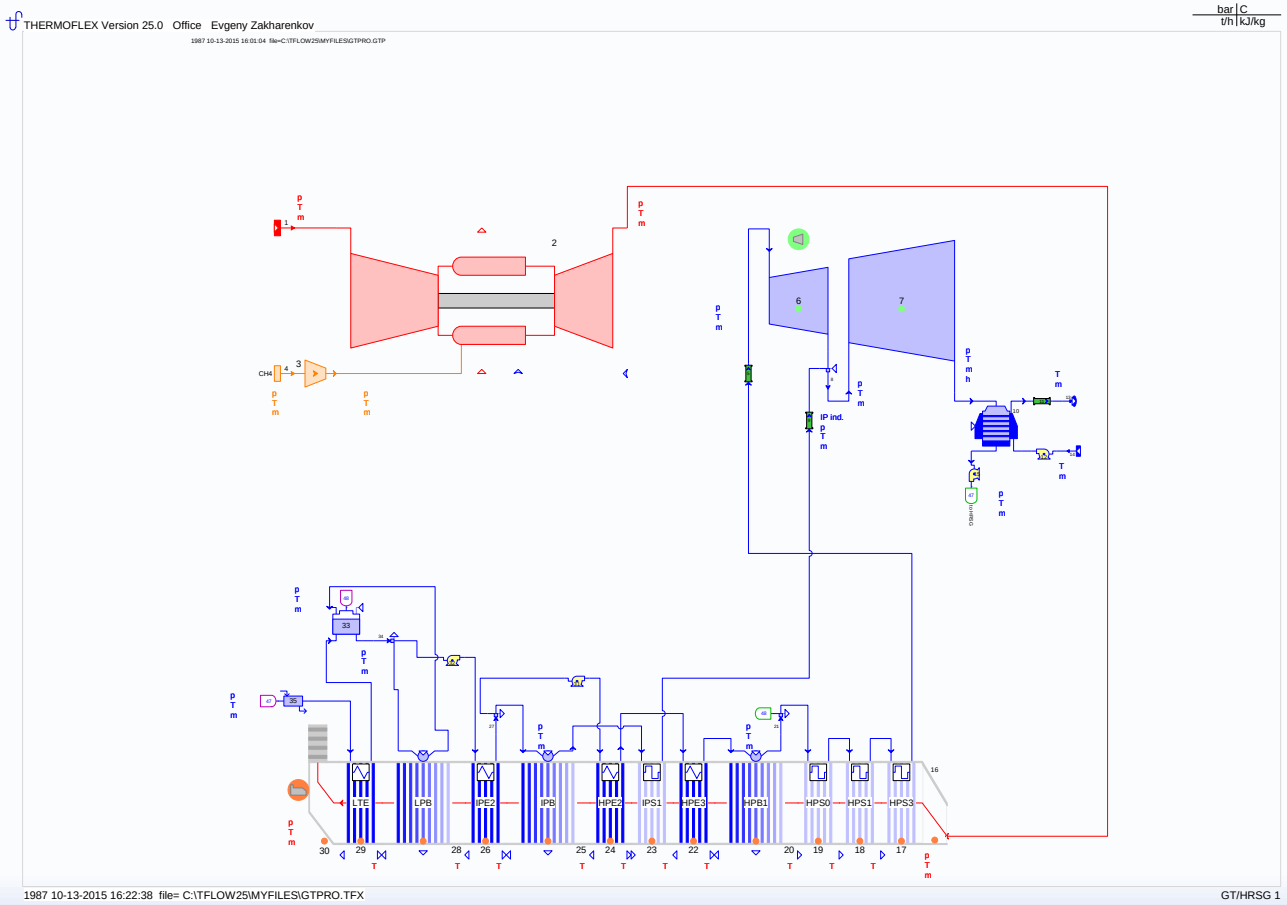
Importing into THERMOFLEX

Also GT PRO/MASTER or STEAM PRO files can be imported from THERMOFLEX menu



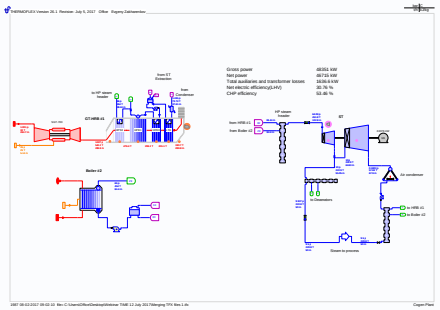
Importing into THERMOFLEX

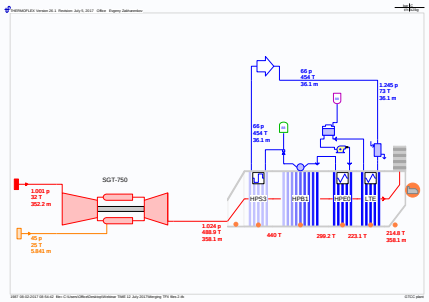
…with the same result



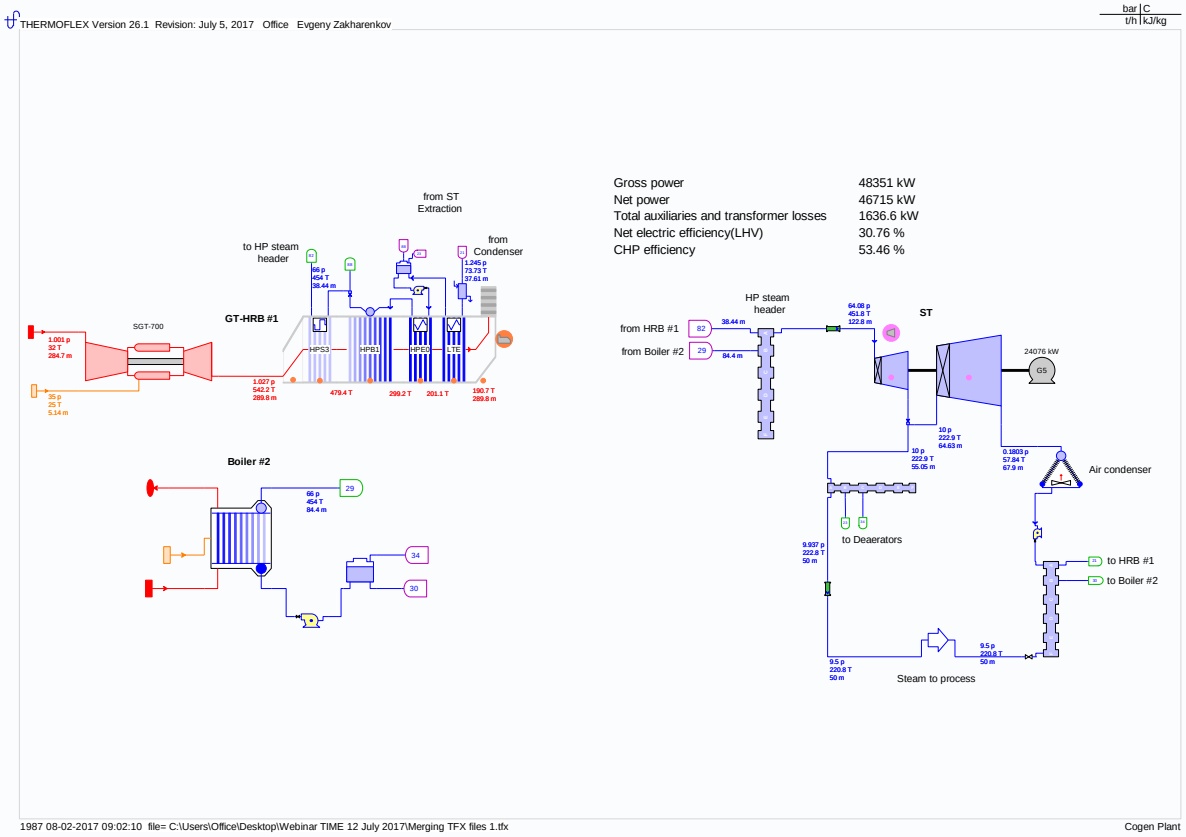
Merging THERMOFLEX files

- THERMOFLEX allows to merge two separate files into one model
- Two engineers can work on different parts of the plant and then assemble it together
- Assembling model from your own database of equipment in THERMOFLEX files





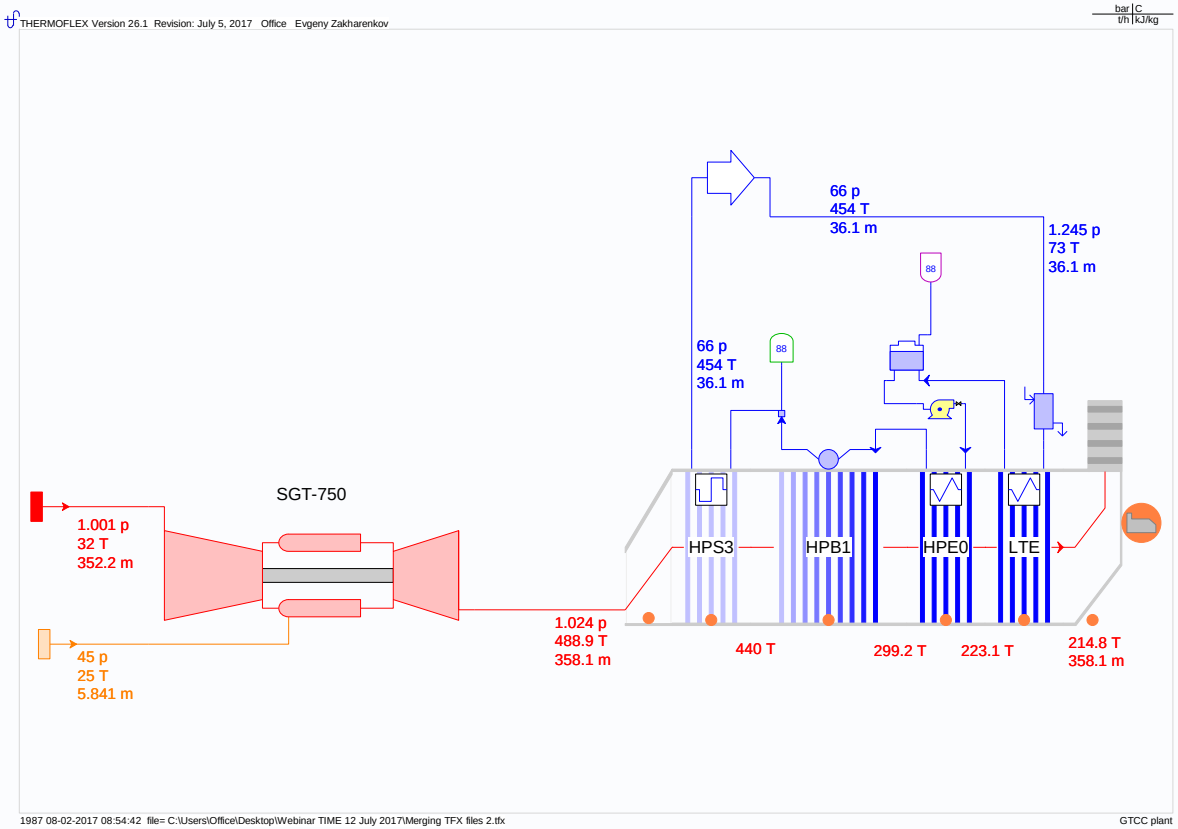
Merging THERMOFLEX files



Cogen Plant

1. Siemens SGT-700 + HRB
2. Gas-fired boiler

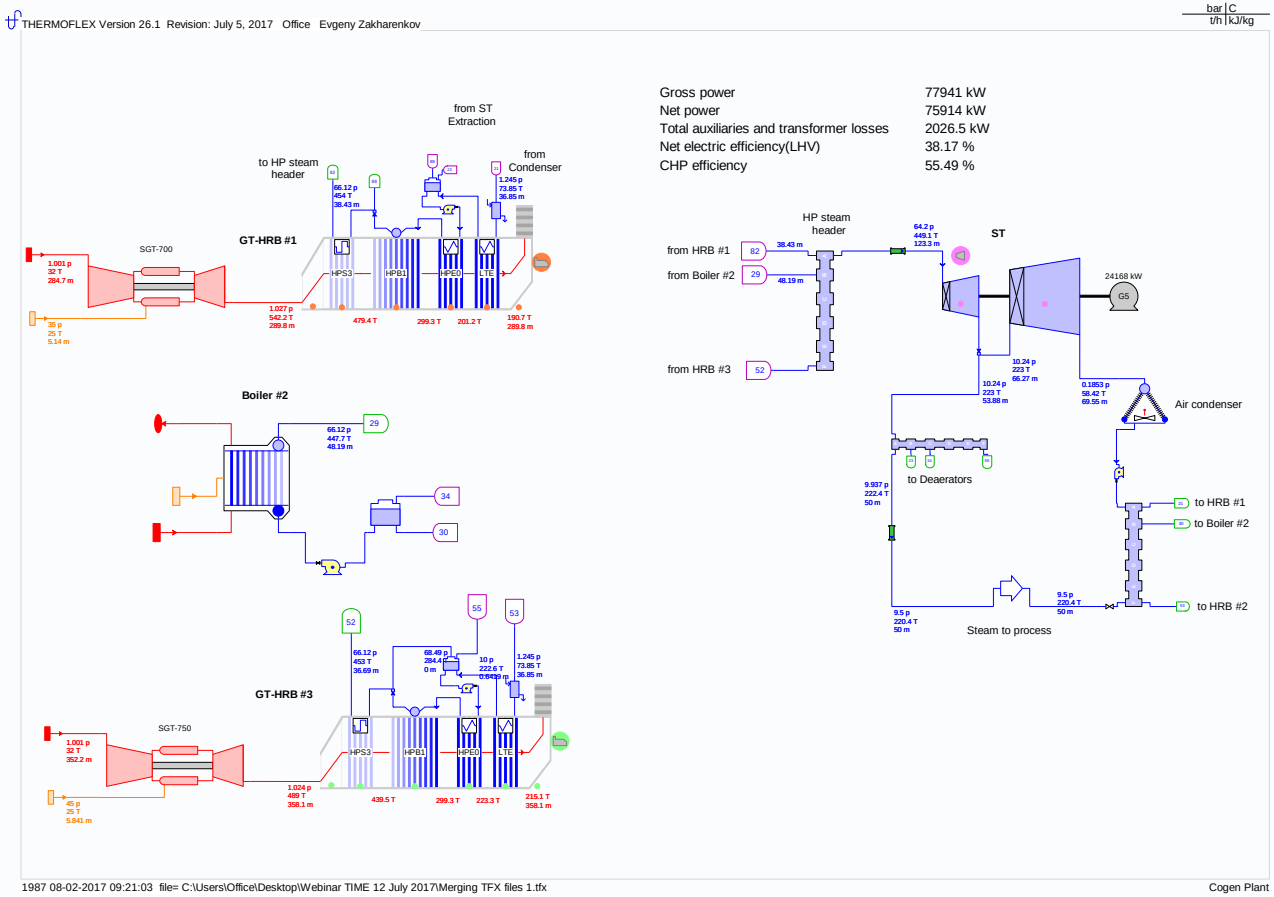
Merging THERMOFLEX files



Siemens SGT-750 + HRB

These files must be computed!

Merging THERMOFLEX files



Cogen Plant

1. Siemens SGT-700 + HRB
2. Gas-fired boiler
3. Siemens SGT-750 + HRB

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Q & A session

Please send your questions to the **presenter** in the webinar chat!

For further questions:
zakharenkov@thermoflow.com

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Thank you!