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 Zakharenkovov
Agenda

• Introduction

• Links: THERMOFLEX & Application-Specific programs

• Importing files into THERMOFLEX

• Merging THERMOFLEX files
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

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Automation / Flexibility

Plant Design Expert
Approximately 45 Inputs

GT PRO
Approximately 3400 Inputs

THERMOFLEX
“ Infinite” Inputs
Automation / Flexibility

Plant Design Expert
Approximately 45 Inputs

GT PRO
Approximately 3400 Inputs

GT PRO + THERMOFLEX

THERMOFLEX
“Infinite” Inputs
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

File: GT-Recip absorption.GTM
Plant Model 1. GT – Recip. Engines with Abs. chiller
Hybrid Model

Gross power
Absorption Chiller (PCE) \([1]\) - Total current load
Gross electric efficiency (LHV)

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File: GT-Recip absorption.TFX
Plant Model 2. 660 MW Coal Plant - Repowering

- This sample demonstrates Feedwater Heater Repowering of 660 MW 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 kW/HR
Plant net HR (LHV): 8644 kW/HR
Plant net eff (HHV): 41.65 %
Plant net eff (LHV): 42.07 %
Aux. & losses: 30967 kW
Fuel heat input (HHV): 5824 GJ/h
Fuel heat input (LHV): 5439 GJ/h
Fuel flow: 4056 t/day

ESD dust collection eff = 99.5 %
ID Fan: 145T
WFGD SO2: 53.3 ppmv
SO2 remov eff = 95 %

SO2 removal eff = 95 %
Dual collection eff = 98.5 %

File: 660 MW ConvCoal.GTM

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Plant Model 2. 660 MW Coal Plant - Repowering

Steam cycle in STEAM MASTER
Feed Water Heater Bypass

Gross power: 795009 kW
GT gross power: 110009 kW
Gross electric efficiency (LHV): 45 %
Net electric efficiency (LHV): 43.17 %
Plant Model 2. 660 MW Coal Plant - Repowering

Plant model results

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

Net Power 424556 kW
LHV Net Heat Rate 6296 kJ/kWh
LHV Net Efficiency 57.18 %

Net Power 424556 kW
LHV Net Heat Rate 6296 kJ/kWh
LHV Net Efficiency 57.18 %

GT MASTER 25.0 Office

1X ALSTOM/GT26 (2011)
(Curve Fit OEM Data Model #503)

File: ISCC model.GTM
Plant Model 3. Integrated Solar Combined Cycle

Hybrid Model: Daytime operation

Site Menu: Ambient temperature 35 C
Site Menu: Ambient relative humidity 60%
Gross power 452725 kW
Gross electric efficiency (LHV) 58.48 %
Plant Model 3. Integrated Solar Combined Cycle
Hybrid Model: Nighttime operation

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 nighttime.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

These files must be computed!

Siemens SGT-750 + HRB
Merging THERMOFLEX files

Cogen Plant

1. Siemens SGT-700 + HRB
2. Gas-fired boiler
3. Siemens SGT-750 + HRB
Q & A session

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

For further questions:

zakharenkov@thermoflow.com
Thank you!