Welcome!

Webinar #5. TIME and Annual model
July 12, 2017

Host: Meritt Elmasri (US office)
Presenter: Evgeny Zakharenkovov
Agenda

• Introduction
• Snapshot
• Annual model
• What is TIME, when to use TIME
• TIME, power plant sample
• Q & A session
Introduction

Heat balance & equipment design

Cost & labour estimation

Cashflow & investment analysis

Thermoflow software
Introduction

Thermoflow Features for Cashflow & Investment Analysis

• Snapshot (GT PRO/MASTER, STEAM PRO/MASTER, THERMOFLEX)
• Annual model (GT PRO/MASTER, STEAM PRO/MASTER)
• TIME - Time Integrated Modeling Economics (GT MASTER)
Snapshot

Snapshot - multiplying plant performance at the average ambient conditions by the number of operating hours per year

Plant performance at average conditions \( \times \) Operating hours per year (full load equivalent) \( \rightarrow \) NPV, ROI...
Snapshot

- quick analysis
- plant operated mainly at base load
- low range of ambient conditions
Snapshot

But, it does not work when:

• The plant is started and stopped every day or several times per week

• Duct firing is used to generate more power when the power price is high

• The plant supplies steam to variable demand customer

• ...

Annual model or TIME
Annual model

Annual model is simple, quick and easy method for users who have no time to perform an exhaustive analysis, but who still wish to have a more accurate model, than may be possible with a single point average input (snapshot)
Annual model
TIME

• Tool for GT MASTER (added in version TF24), Time Integrated Modeling Economics (TIME)

• It is used when you want to compute plant economics and performance by combining results from a single model at different operating conditions, each applied for a specified period of time.

• TIME helps to compute project’s NPV when running with ambient conditions and loads that vary naturally throughout the year.
How does it work?

TIME

Year

1 X Plant performance #1
2 X Plant performance #2
3 X Plant performance #3
... X Plant performance #N

Project’s NPV

Time bins, representing some number of hours, certain operating and financial conditions
How to launch
This plant is located in Montana, Miles City, TMY (Typical Meteorological Year) ID 742300. It is CCGT based on gas turbine GE GT-7F.04. The power station is operated on the following scenario:

**Daily load curve**

- **Summer**
- **Winter**
This plant is located in Montana, Miles City, TMY (Typical Meteorological Year) ID 742300. It is CCGT based on gas turbine GE GT-7F.04. The power station is operated on the following scenario:

<table>
<thead>
<tr>
<th></th>
<th>Electricity price, USD/kWh</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Summer</strong></td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>0.927</td>
</tr>
<tr>
<td>Off Peak</td>
<td>0.043</td>
</tr>
<tr>
<td><strong>Winter</strong></td>
<td></td>
</tr>
<tr>
<td>Peak</td>
<td>0.061</td>
</tr>
<tr>
<td>Off Peak</td>
<td>0.039</td>
</tr>
</tbody>
</table>

**Summer (May-Oct)**

- 8am: Off peak
- 10pm: Off peak
- 12am: Peak

**Winter (Nov-Apr)**

- 8am: Off peak
- 12am: Peak
- 9pm: Off peak
TIME sample (GT PRO design)

Make the following Inputs:

**New Session**: Above 200 MW, GT, HRSG and condensing reheat ST

**Plant Criteria**: 0.921, 8.88 °C (year average TMY), RH 56.3 % (year average TMY), 60 Hz, Water cooling with mechanical cooling tower

**Plant Criteria-Regional costs**: Montana

**GT Selection**: GE GT-7F.04 (ID 612)

**ST-HRSG**: Steam superheat/reheat – 579/579 °C

**Environment**: NOx produced 9 ppm, include SCR – 80% effectiveness

**Economics**: Fuel price - 4.15 USD/GJ, Overall tax rate – 39.39% (Federal – 35%, 6.75% - Montana), Variable O&M costs - 0.0032 USD/kWh.
Q & A session

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