

Welcome!

Webinar No. 3: MULTI POINT DESIGN– 28th JUNE 2017

Agenda:

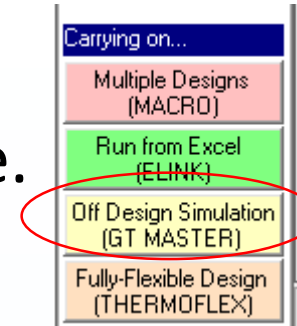
- MPD and the TF Program Suite
- Why Multi Point Design (MPD)
- When to use MPD/Typical Applications
- How to use the MPD feature in GT PRO/GT MASTER
- MPD as applicable to a district heating scheme
- Assumptions & Design Data for CCGT DH system worked example
- Conclusions
- Discussion/Q & A (20 minutes)

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Support: Meritt Elmasri (U.S. HQ)

MPD and the TF Program Suite

- Features in GT PRO only
- Is deployed in the GT PRO -> GTMASTER transition ie.
- Then select the MPD Option ie.



Why Multi Point Design

From TF25 Update
Letter, 9th June 2015

(1) Multi-Point Design:

A plant operating across a range of conditions requires careful compromises in sizing its various components. In the past, we had left it entirely up to users to manage this process, and had discussed in our manuals, training, and customer support the need to make exploratory runs across the operating envelope, then use their results to adjust sizing of various components, either in GTPM (during the transition from GT PRO to GT MASTER), or directly in GT MASTER.

In version 25, we've added a new tool to better manage this process, helping you to synthesize a single GT MASTER model from a family of GT PRO designs which span the range of anticipated plant operating conditions.

We've named this tool MPD (Multi-Point Design). MPD is built into, and invoked from the MACRO. Within the Macro, you define and compute a family of GT PRO cases encompassing your "design domain", then use the MPD tool to interactively synthesize a single GT MASTER model from your family of GT PRO cases. Typically, the design domain will include different ambient conditions, duct firing levels, operation on primary and backup fuels, and, for cogeneration plants, different process steam / water flow rates.

- MPD = A Design Aid Tool Only
- MPD is no substitute for a sound understanding of the design task.

When to Use MPD – Typical Applications

- From the June 2015 Update Letter : *“Typically, the design domain will include different ambient conditions, duct firing levels, operation on primary and backup fuels, and, for cogeneration plants, different process steam / water flow rates”*.
- Whenever there is more than one operating condition of interest - meaning that to correctly design the required cycle, more than one GT PRO design is required ie.
 - District Heating Schemes
 - Industrial process with seasonal variations of process steam etc

How to use the MPD feature in GTPro/M

Step 1 – Ensure a good understanding of the design points which require to be satisfied


Step 2 – Using GT PRO, synthesize the representative case (meaning that all relevant hardware/design parameters subject to further manipulation are represented).



Step 3- Run the model & check for errors, correct any warning and advisory conditions as required.

Step 4 – Select  & then  to initiate the MPD Macro Inputs screen.

Step 5 - Populate the Macro Input screen ie. select the parameters to be manipulated in the subsequent macro runs & set up the runs as required.

Step 6 – Run the MPD Macro. When concluded, check for any warning and advisory messages and correct these as required.

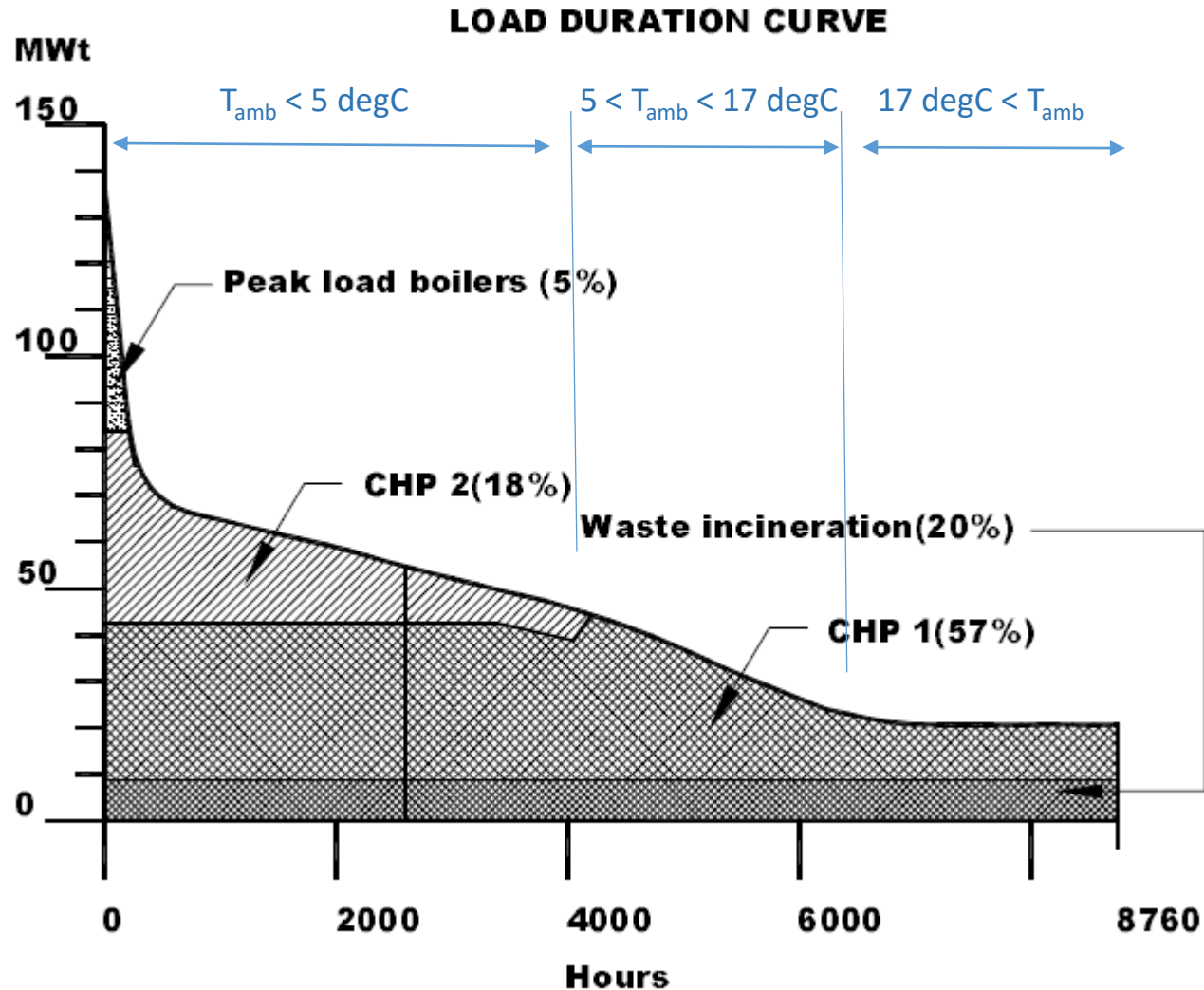
Step 7- Select the  button to Launch the MPD input screen

Step 8 - Build the composite model from the various input tabs, then select either the  or the  option. Note that output is given as a PEACE output screen.

Step 9- Save the resulting composite GTM model- check for any warning and advisory messages and correct these as required.

Step 10 – Simulate the performance of the composite GTM model at each of the significant operating points/extreme conditions and check for any performance issues. Fine tune the model as required.

MPD as Applicable to a District Heating Scheme



- Load Duration Curve = Key Data for CHP Plant Design
- Typically shows that for 1- 2 weeks of the year, all heat sources are required to operate
- The CHP plant can be expected to run in 2 modes but may also operate in a 3rd mode (pure condensing operation if have a combined cycle plant)
- The task to be solved is therefore how to design a single CCGT DH plant that is able to satisfy all three operating points (normal winter, shoulder & pure condensing operation).

Assumptions & Design Data for CCGT DH system worked example

- Site Conditions- winter @ minus 15degC, 10 degC & summer @ 20 degC
- Corresponding DH parameters:
 - Winter operation: $t_{\text{supply}} = 120 \text{ degC}$, $t_{\text{return}} = 60 \text{ degC}$, (84 MWt)
 - Shoulder operation: $t_{\text{supply}} = 90 \text{ degC}$, $t_{\text{return}} = 60 \text{ degC}$ (41 MWt)
 - Summer operation: pure condensing
- DH hardware: 2 DH condensers with WHtr in HRSG (Type 4)
- ST: 2PL, single casing, 2 extractions to DH, 1 controlled extraction (LP) only.
- GT: GT Library ID. No. 589

Key DH Component Sizing Summary

Key Component	Nominal Design	Design @ -15 deg C	Design @ 10 deg C	Design @ 20 deg C
LP DHC1	undersized	✓	✓	undersized
HP DHC2	undersized	✓	undersized	undersized
Condenser	✓	undersized	undersized	✓
FWHtr	undersized	✓	✓ ✓	undersized
Pipe LP Extr. Port	undersized	✓	✓	undersized
Pipe HP Extr. Port	undersized	✓	undersized	undersized
ST LSB	✓	undersized	undersized	✓
DH Circuit Piping	undersized	✓	✓	undersized

Conclusions

- MPD = A useful tool for synthesizing the required GTM model.
- Successful use of the MPD tool requires a sound appreciation of the design problem.
- Best results are achieved with the benefit of foresight ie. Experiment with the GT PRO model before embarking to MPD.