



Improved trigeneration energyPRO 4.1

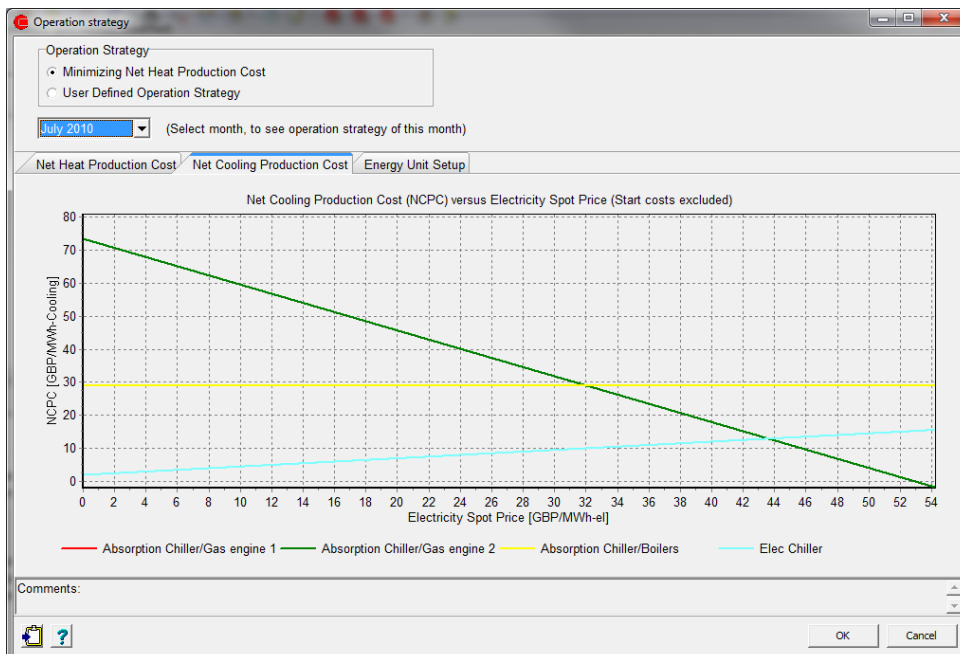
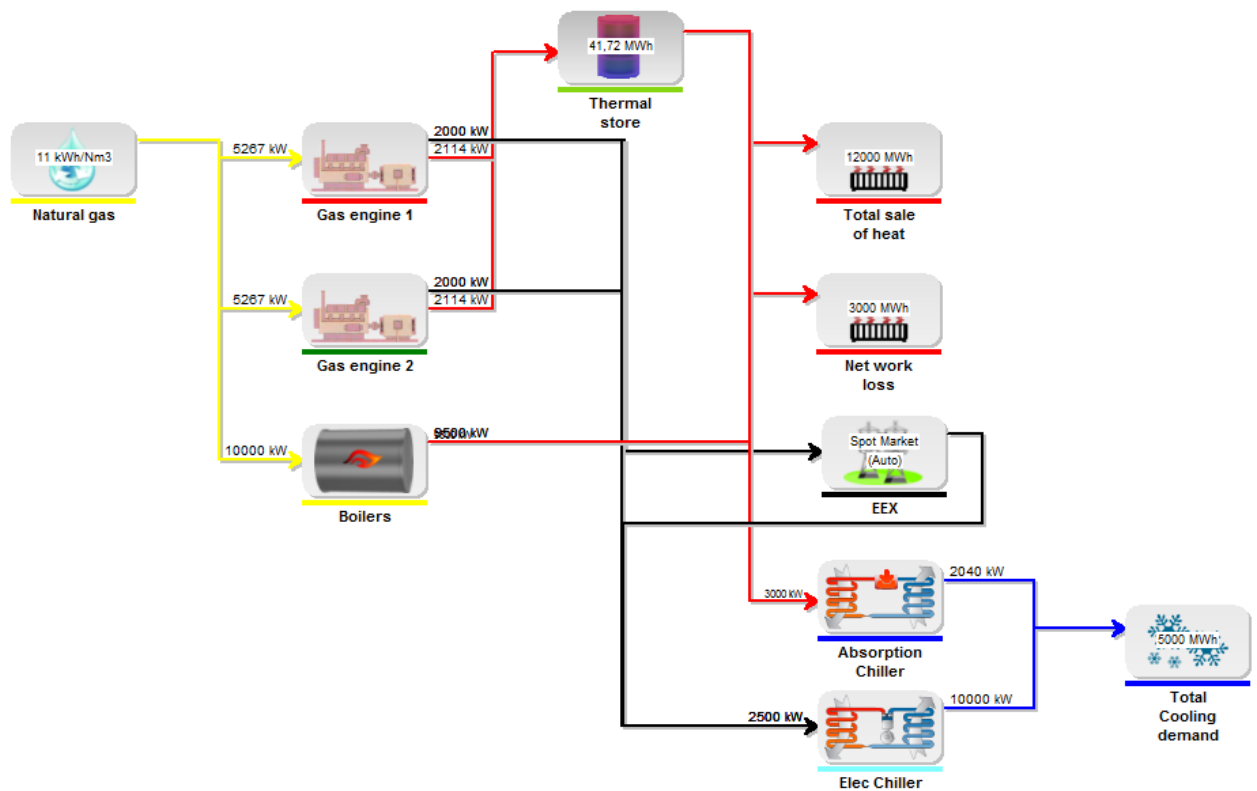


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1. Introduction

With energyPRO 4.1.1 we introduce an improved calculation of trigeneration. The operation of absorption chillers is improved. In the operation strategy you can determine which energy conversion units are allowed to produce heat for the absorption chiller. Whether it is more optimal to produce cooling at the electric chiller or the absorption chiller can now be calculated automatically.

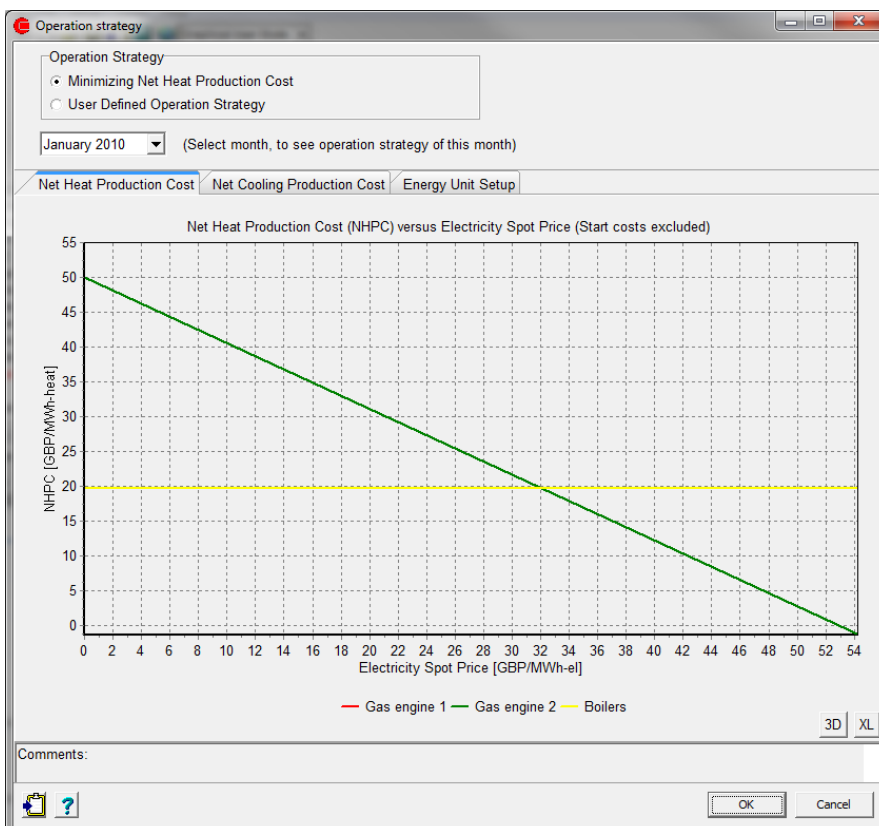
Finally, it is now possible to use cooling store.

Please, take a look at the trigeneration examples included in the English examples in the energyPRO data folder.

2. Improved Operation strategy window

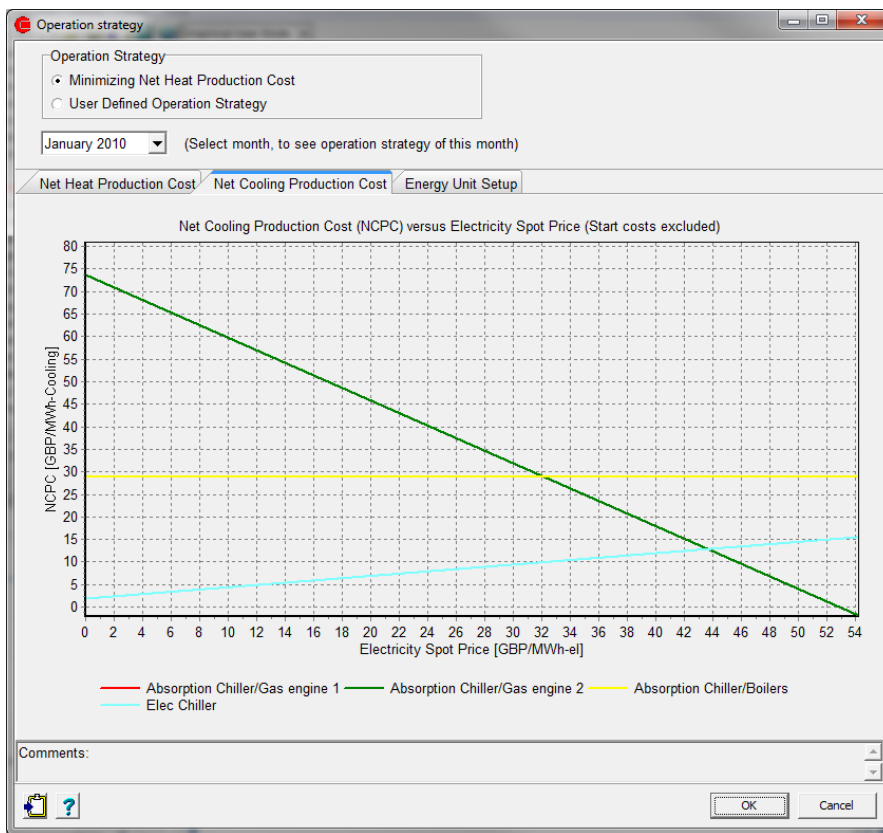
The operation strategy window has changed. We have introduced tab controls.

In the first tab is shown Net Heat Production Cost for the heat producing units. In this example, we have two CHPs and one boiler. The electricity market is a spot market.



Improved Operation strategy window

The second tab will only be present if cooling producing units are present. In this example, we have an absorption chiller and an electric chiller.



The last tab contains the Miscellaneous table.

The screenshot shows the 'Operation strategy' window with the 'Energy Unit Setup' tab selected. The 'Miscellaneous' table is displayed with the following data:

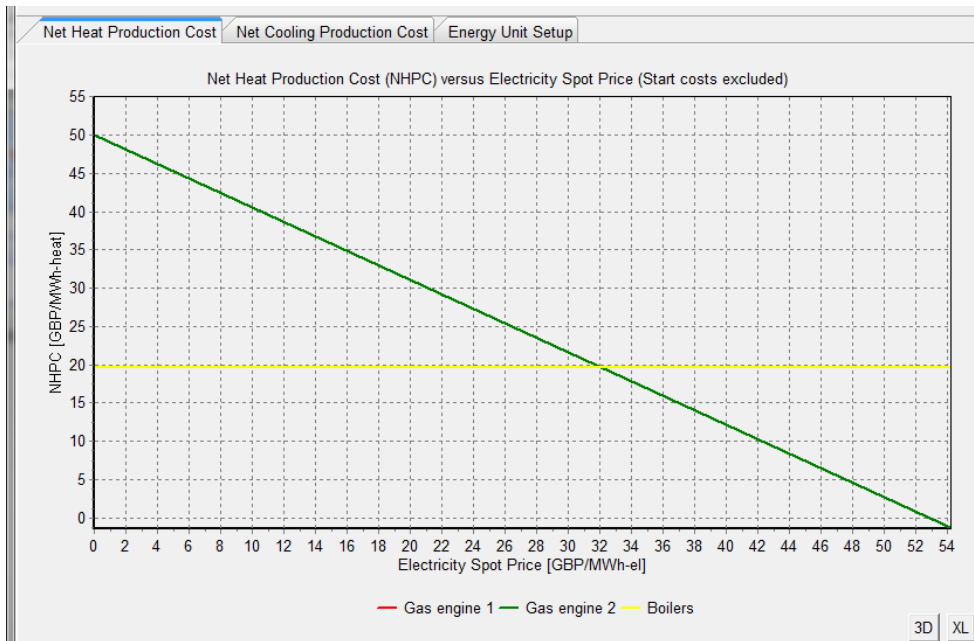
Miscellaneous	Production to store allowed	Partial load allowed	Selected priority in operation strategy
Gas engine 1	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Calculated
Gas engine 2	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Calculated
Boilers	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Calculated
Absorption Chiller	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Calculated
Elec Chiller	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Calculated

2.1 The Net Heat Production Cost tab

The content of this tab depends on the type of electricity market. Compared with the previous version of energyPRO, we now only show the heat producing units.

When having a spot market present the NHPC as function of the spot price is shown as a graph.

Improved Operation strategy window



When having fixed tariffs or a unit tariff, the graph is replaced by a table:

Operation strategy

Operation Strategy

- Minimizing Net Heat Production Cost
- User Defined Operation Strategy

January 2010 (Select month, to see operation strategy of this month)

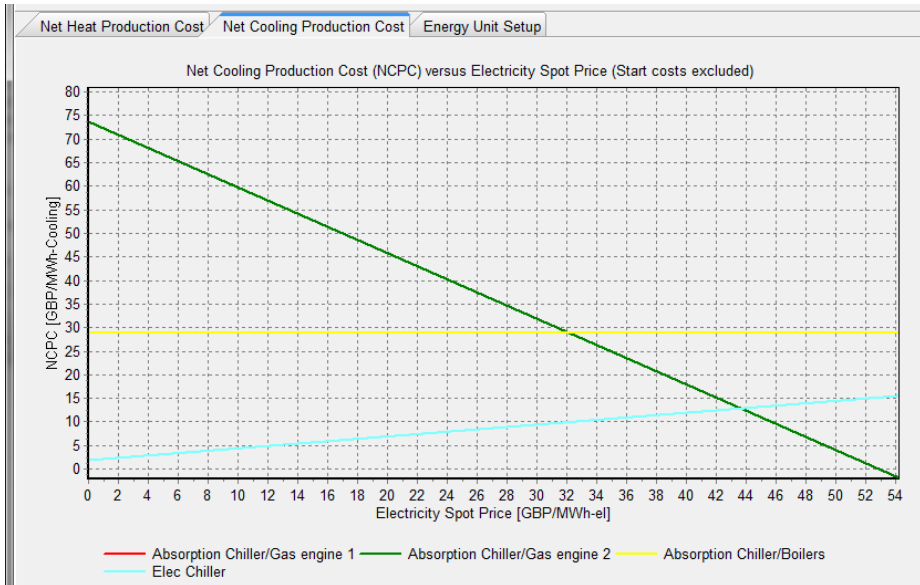
[GBP/MWh-Heat]	Day	Night
Gas engine 1	3	17
Gas engine 2	3	17
Boilers	20	20

2.2 The Net Cooling Production Cost tab

This tab also changes in appearance according to the type of electricity market.

When having a spot market the Net Cooling Production Costs, NCPC, as function of the spot price are shown as a graph.

Improved Operation strategy window



The NCPC of the electric chiller depends on the electricity price, while the NCPC of the absorption chiller depends on which heat producing unit delivers the heat input to the absorption chiller. Since we in this case have three heat producing units we have three curves for the absorption chiller (Gas engine 1 and 2 are identical, hence their curves are placed on top of each other).

The graph tells us that when the electricity price is below 44 GBP the electric chiller produces cooling cheapest and vice versa when the electricity price is above 44 GBP.

When having fixed tariffs the tab looks different.

The 'Operation strategy' dialog box shows the following configuration:

- Operation Strategy:**
 - Minimizing Net Heat Production Cost
 - User Defined Operation Strategy
- Month:** January 2010 (Select month, to see operation strategy of this month)
- Net Cooling Production Cost (GBP/MWh-Cooling):**

	Day	Night
Elec Chiller	14	11
- Max allowed heat production cost:**

	Day	Night
Absorption Chiller	10	7
- Comments:** (Empty text area)
- Buttons:** OK, Cancel

The calculation of the net cooling production cost for the electric chiller is straightforward. The numbers for the absorption chiller are different. They are Max allowed heat production cost. Meaning that if the Absorption chiller is producing cheaper than the electric chiller in the same tariff period, then the heat producing unit has to have a heat production cost lower than Max allowed heat production cost.

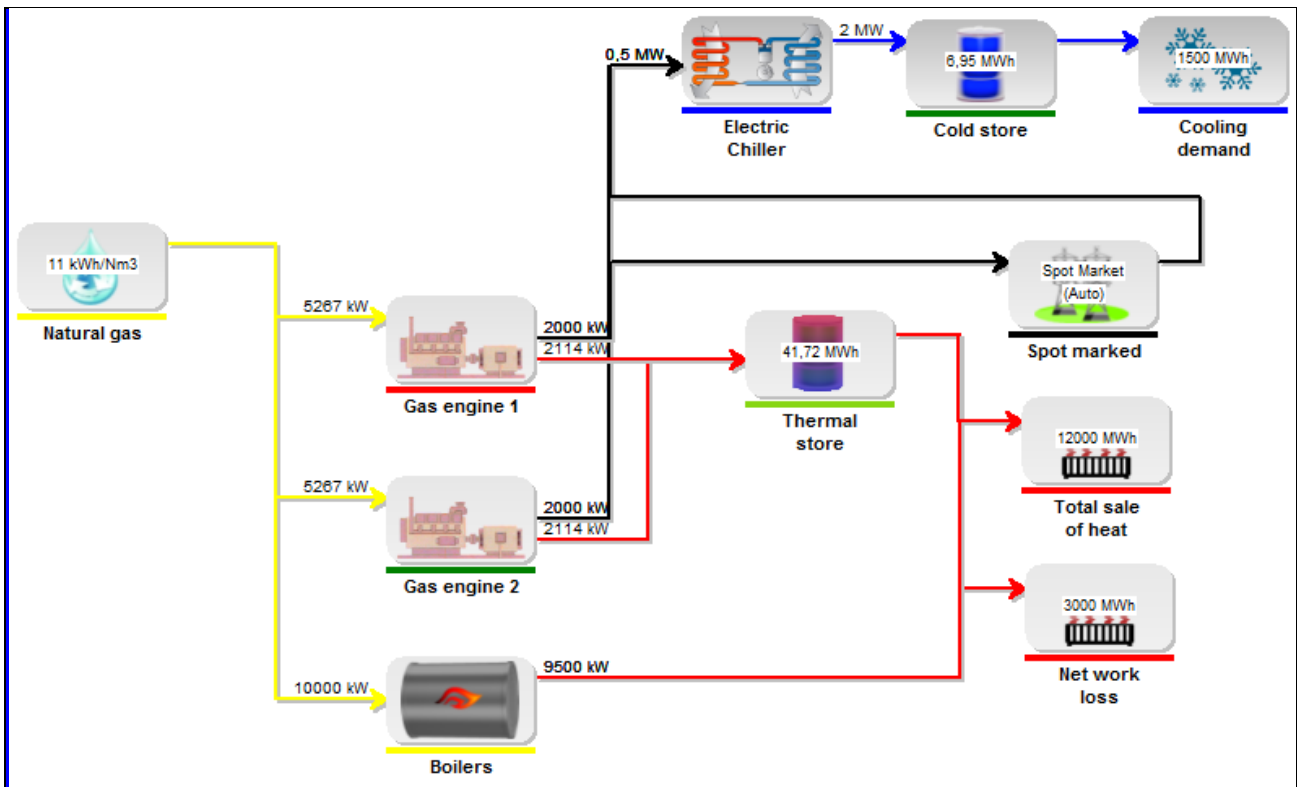
3. Calculation

If you have a project with both heating demand and cooling demand, the heating demand will be covered first.

Thereafter, the cooling demand will be covered. If you have both absorption chiller and electric chiller, the absorption chiller will operate first in the periods where the heat production unit can supply enough cheap heat.

4. Cold store

Together with the improved trigeneration, it is now possible to include a cold store.



The cold store window is very similar to the thermal store window.

Cold store

Cold store

Name: Cold store

Cold store Non availability periods

Volume [V]
1000,0 m³

Temperature in the top [Tt]
12,00 °C

Temperature in the bottom [Tb]
6,00 °C

Utilization
100,0 %

Storage capacity :
7,0 MWh as of Fri 1. January 2010

Storage Loss

Operation restricted to period

You define the volume and the temperatures, and like with the thermal store it is possible to set a storage loss.