HOW TO GUIDE

Fuel producing units in energyPRO

Software for techno-economic analyses of energy projects

EMD
www.emd.dk

Preface

energyPRO is a Windows-based modeling software package for combined techno-economic analysis and optimisation of complex energy projects with a combined supply of electricity and thermal energy from multiple different energy producing units.

The unique programming in energyPRO optimises the operations of the plant including energy storage (heat, fuel, cold and electrical storages) against technical and financial parameters to provide a detailed specification for the provision of the defined energy demands, including heating, cooling and electricity use.
energyPRO also provides the user with a detailed financial plan in a standard format accepted by international banks and funding institutions. The software enables the user to calculate and produce a report for the emissions by the proposed project.
energyPRO is very user-friendly and is the most advanced and flexible software package for making a combined technical and economic analysis of multi-dimensional energy projects.
For further information concerning the applications of energyPRO please visit www.emd.dk.

Terms of application

EMD International A/S, November 2013

Content

1. Introduction

In energyPRO it is also possible to integrate fuel producing units. Fuel producing units are able to produce output fuel other units need as input fuel and this 'How to Guide' therefore shows you how to incorporate these with point of departure in an example of an electrolysis unit producing hydrogen from electricity.

2. Project example

To begin with open the file "Fuel producing unit" found on C:\energyPRO Data\English\Project examples
Press open and a similar set up as the one on Figure 1 should appear.

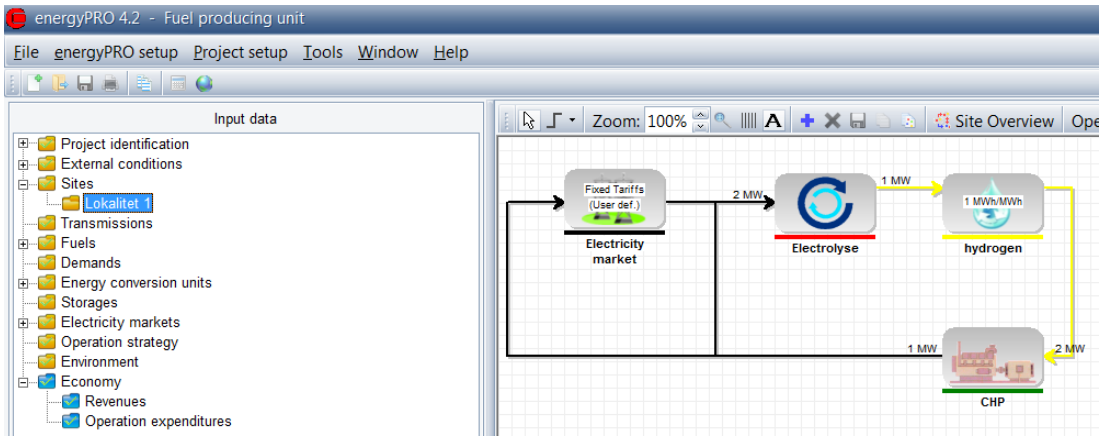

Figure 1. Open the file "Fuel producing unit"

It is a simple example with an electrolysis unit using electricity to produce hydrogen. The fuel hydrogen is saved in a fuel storage and consumed by an engine, which produces electricity. The electrolysis unit is operating in the night tariff, while the engine is operating in the day tariff.

3. Enabling fuel producing units

To enable fuel producing units in the project you need to set a checkmark in the "Project identification"-folder as shown on Figure 2.

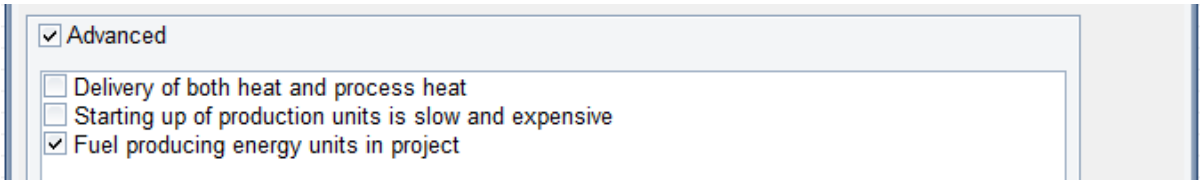

Figure 2. Mark "Fuel producing energy units in project"

4. Energy conversion unit

Upon check marking the box in "Project identification" you should open the "Electrolyse"-folder in the "Energy conversion unit"-folder and a similar window as the one on Figure 3 should appear.

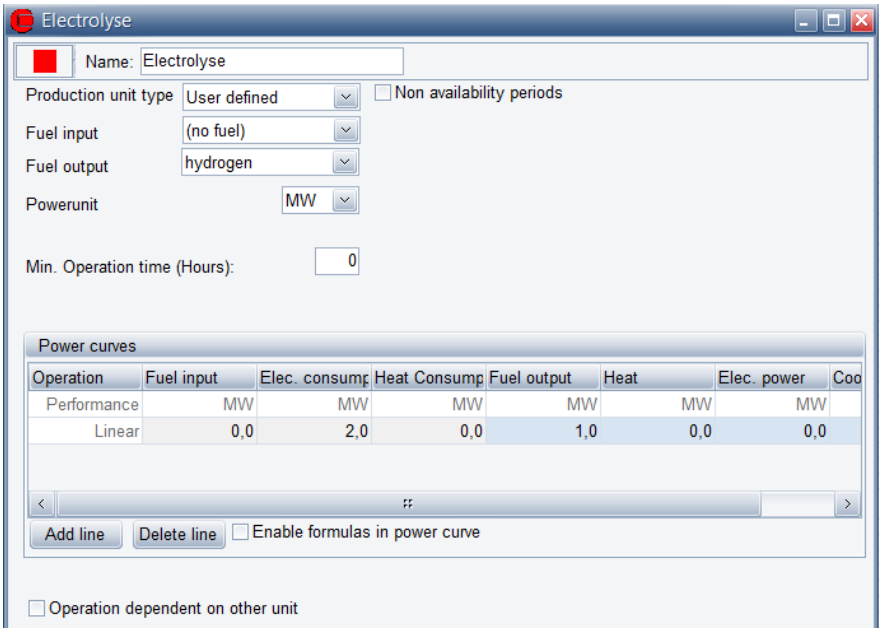

Figure 3. Open the "Electrolyse"-folder

You have to change the "Production unit type" to User defined and add the Fuel output in the "Power curves".

5. Fuel

Typically, the produced fuel has restrictions in the amount of offered fuel and a fuel storage. Therefore, open the Hydrogen-folder under "Fuels" in order to mark the restrictions and the size of these in the window as shown on Figure 4.

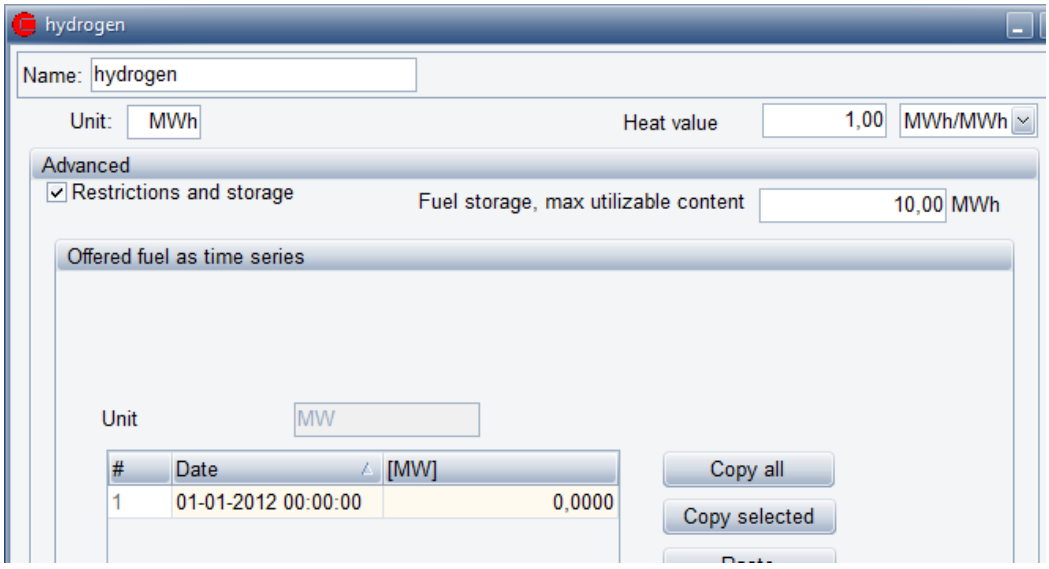

Figure 4. Add restrictions and fuel storage to the fuel

6. User defined operation strategy - only

When working with fuel producing units the "Operation strategy" has to be user defined. It is important to notice that working with fuel producing units also allows for change in the "Fuel Production Strategy" as shown on Figure 5.

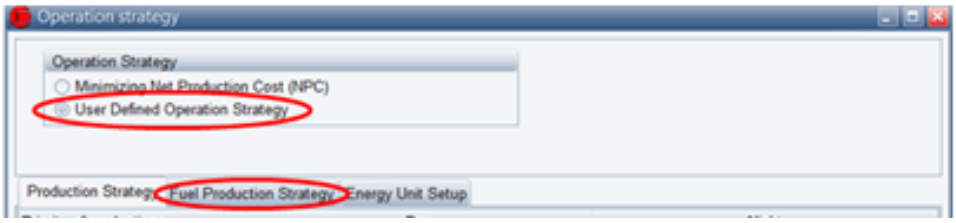

Figure 5. A new tab emerges when working with fuel producing units

The operation strategy in a fuel producing case is specified by both the settings in the "Production strategy" tab and the "Fuel production strategy" tab.

6.1 Production strategy

The production strategy is specified as in other projects. In the figure below this means that the highest priority is "Electrolyse" in Night tariff, followed by "CHP" in Day tariff, CHP" in Night tariff and finally "Electrolyse" in Day tariff.

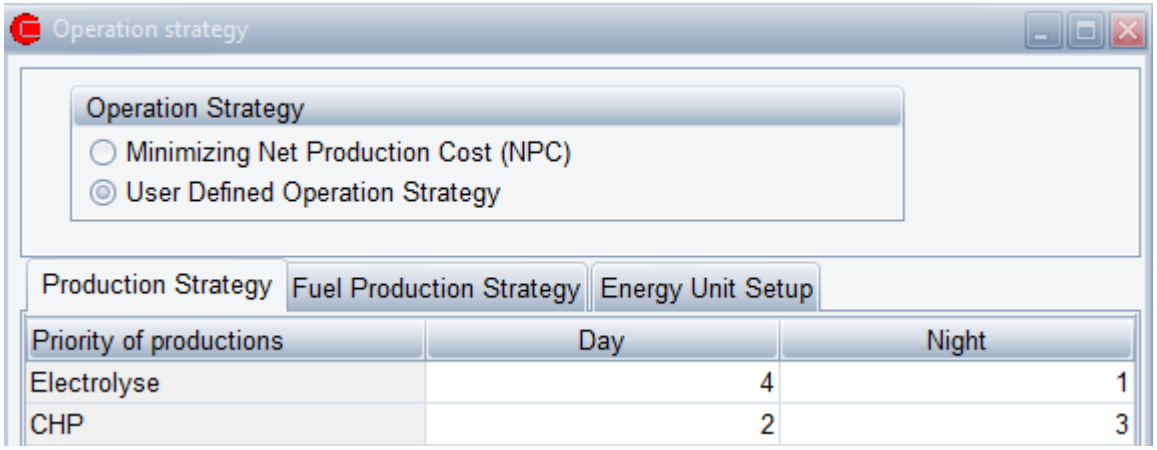

Figure 6. Production strategy

6.2 Fuel production strategy - Max allowed priority number

When selecting "Fuel Production Strategy" you have the option of setting the max allowed priority number of fuel producing units as shown below.

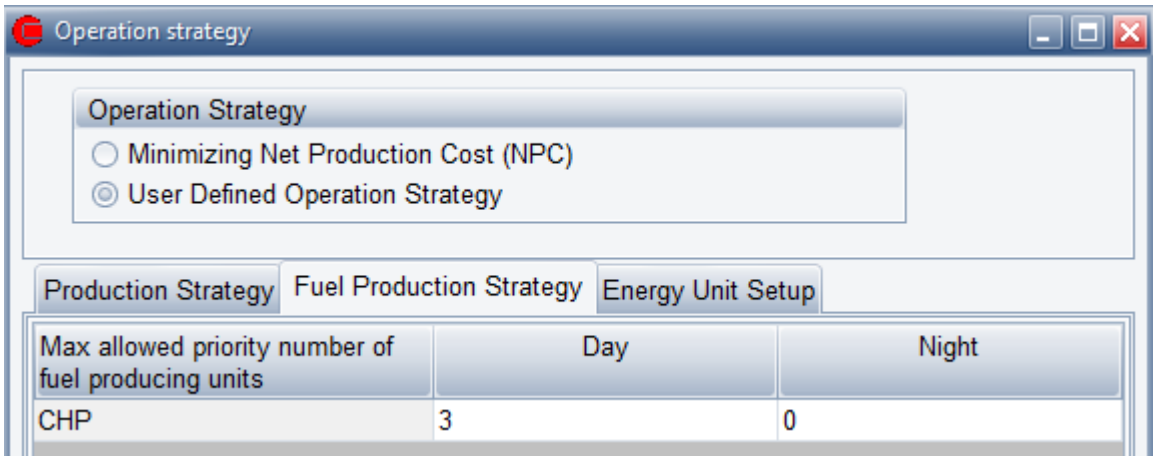

Figure 7. Selecting the "Fuel Production Strategy"

You have to define the max allowed priority number of fuel producing unit, which is the highest priority number in the “Fuel Production Strategy” the CHP will allow the fuel producing unit to run at.

In this case the CHP needs fuel produced from the fuel producing unit (here electrolysis).

If the CHP is to produce in the day tariff, it will try to start the electrolysis if the priority number of the electrolysis is equal to or below 3 and in night tariff equal to or lower than 0.

Comparing Figure 6 and Figure 7 shows that the electrolysis can only operate in Night tariff. The CHP request a fuel producing unit “electrolyse”, with a priority equal to or below 3 , this is only possible for “Electrolyse” in Night tariff. In the night tariff the CHP request a fuel producing unit “electrolyse”, with a priority equal to or below 0. This is never the case. Hence, the “electrolyse” can only operate in Night tariff and the CHP in Day tariff.

If no fuel storage was present in the model, there would be no production at all.

7. Production, graphic

Under “Reports” it is possible to collect reports of the project. In the “Production, graphic” similar figures as the one on Figure 8 can be seen.

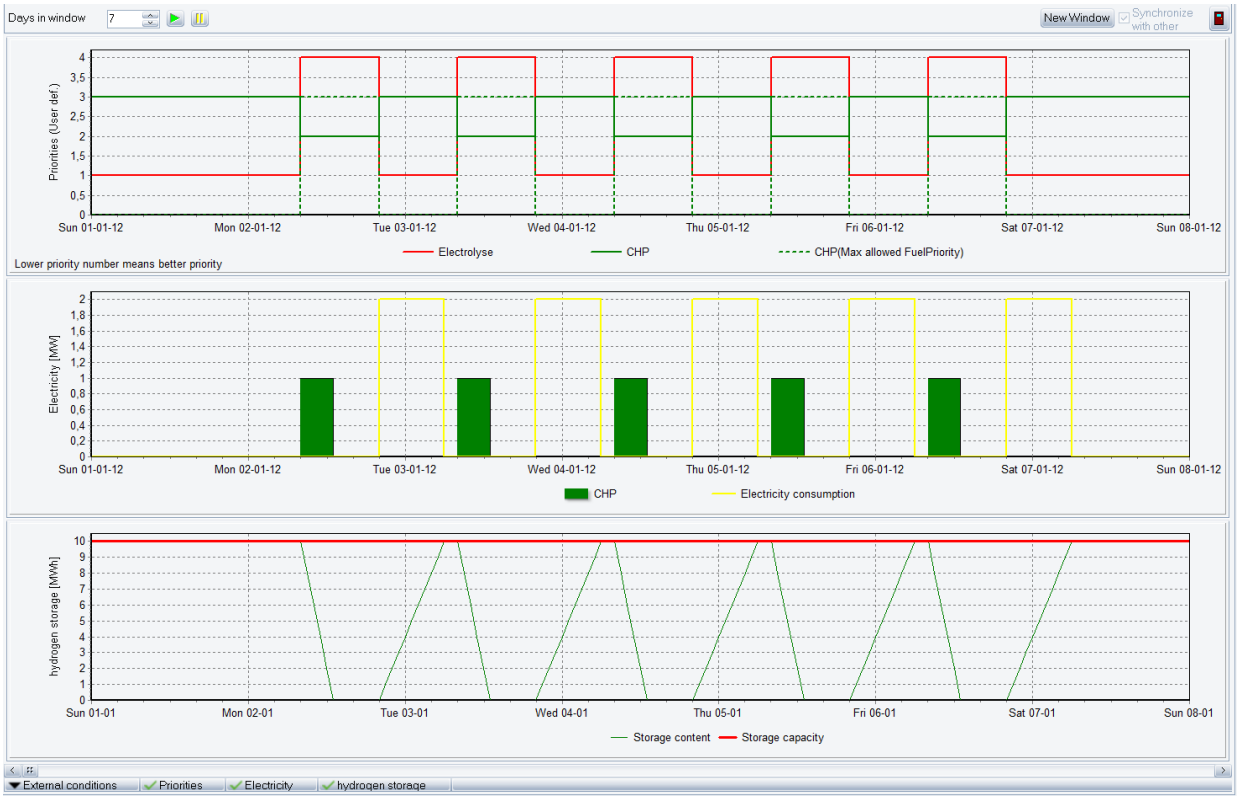

Figure 8. "Production, graphic"-report of the project

The CHP operates in Day time emptying the hydrogen store. In the Night time the electrolysis operates and charge the store.

8. Energy conversion, annual

It is also possible to collect other reports such as the "Energy conversion, annual"-report which indicates that the fuel section has changed as seen on Figure 9.

Fuels:

Byfuel

	Fuelconsumption	Fuelproduction	Offeredfuel	Fuelnotused
hydrogen	2.604,0 MWh	2.604,00 MWh	0,00 MWh	0,00 MWh

Byenergyunit

Electrolyse	0,0 MWh	2.604,0 MWh
CHP	2.604,0 MWh	0,0 MWh
Total	2.604,0 MWh	2.604,0 MWh

Byenergyunit(inoriginalfuelunits)

Electrolyse	0,0 ---	2.604,0 MWh
CHP	2.604,0 MWh	0,0 ---

Figure 9. "Energy conversion, annual"-report of the project

EMD International A/S
Niels Jernes Vej 10 • DK-9220 Aalborg Ø • Denmark
Tel.: +45 9635 4444 • Fax: +45 9635 4446 • E-mail: emdmd.dk • www.emd.dk