



HOW TO GUIDE

More wholesale markets in energyPRO





Software for techno-economic analyses of energy projects



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 <u>www.emd.dk</u>.

Terms of application

EMD has made every attempt to ensure the accuracy and reliability of the information provided in this Guide. However, the information is provided "as is" without warranty of any kind. EMD does not accept any responsibility or liability for the accuracy, content, completeness, legality, or reliability of the information contained in this Guide.

No warranties, promises and/or representations of any kind, expressed or implied, are given as to the nature, standard, accuracy or otherwise of the information provided in this Guide nor to the suitability or otherwise of the information to your particular circumstances. In no event shall EMD be liable for any loss or damage of whatever nature (direct, indirect, consequential, or other) whether arising in contract, tort or otherwise, which may arise as a result of your use of (or inability to use) this Guide, or from your use of (or failure to use) the information in this Guide.

EMD International A/S, November 2013

Content

1.	Introduction1
2.	License to MARKETS1
3.	Adding a market in energyPRO1
4.	More markets in the Operation strategy2
5.	Time series in the Operation strategy
6.	Prognosis4
7.	Production, graphic5

1. Introduction

With the application of the MARKETS module in energyPRO it is possible to add one or more markets contingent of access to the MARKETS module. This 'How to Guide' details how to get the MARKETS module, examples of how to apply the module including examples of graphical outcome.

2. License to MARKETS

To check if you have a license to MARKETS see "Help" and go to the submenu "About" and a picture similar to that on Figure 1 appears.

onoray					Copyrig	Copyright:	
Encryption of the state of the						EMD International A/S Niels Jernesvej 10 DK-9220 Aalborg O Tef: +45 9635 4444 Fax: +45 9635 4446 E-mail: energypro@emd.dk Info: www.emd.dk Licensed to:	
Internet Conne Email E Activated Lice	ections: <u>MD ene</u> nses:	rgyPRO Upd	ate		1000 Kaspe	r Nagel	
Internet Conne Email E Activated Lice	ections: <u>MD ene</u> nses: English	rgyPRO Upd Danish	ate German	Lithuanian	Polish	r Nagel	
Internet Conne Email E Activated Lice DESIGN	ections: <u>:MD ene</u> nses: English X	Danish	ate German X	Lithuanian X	Polish X	r Nagel	
Internet Conne Email E Activated Lice DESIGN FINANCE	ections: <u>MD</u> ene nses: English X X X	Danish X X	ate German X X	Lithuanian X X	Polish X X	r Nagel	
Internet Conne Email E Activated Lice DESIGN FINANCE ACCOUNTS	ections: <u>MD</u> ene nses: English X X X X X	Danish X X X X	ate German X X X X X	Lithuanian X X X	Polish X X X	r Nagel	
Internet Conne Email E Activated Lice DESIGN FINANCE ACCOUNTS OPERATION	ections: <u>MD</u> ene enses: English X X X X X	Danish X X X X X X	ate German X X X X X X	Lithuanian X X X X X	Polish X X X X X	r Nagel	
Internet Conne Email E Activated Lice DESIGN FINANCE ACCOUNTS OPERATION REGION	ections: <u>MD</u> ene enses: English X X X X X X X	Danish X X X X X X X X	ate German X X X X X X X X X X	Lithuanian X X X X X X X	Polish X X X X X X X	r Nagel	
Internet Conne Email E Activated Lice DESIGN FINANCE ACCOUNTS OPERATION REGION MARKETS	ections: <u>MD</u> ene nses: English X X X X X X X	Danish X X X X X X X X X	ate German X X X X X X X X X	Lithuanian X X X X X X X X X	Polish X X X X X X X X	r Nagel	

Figure 1. "About" showing access to the MARKETS module

If you do not have a license to the MARKETS module, this can be purchased by contacting the sales department at EMD International: sales@emd.dk

3. Adding a market in energyPRO

To add a market you do this by clicking on the blue cross as shown on Figure 2 or by right-clicking on the "Electricity markets"-folder.

<u>A</u> F	Fuel Energy Conversion Unit Store Demand	Operation strategy	
Gas en	Electricity market	Add electricity market Load electricity market	Fixed Tariffs Spot market

Figure 2. Adding an electricity market

4. More markets in the Operation strategy

With the MARKETS module it is possible to e.g. sell electricity production on spot market or through fixed tariffs and purchase of electricity to cover the electricity demand on a flat rate. Figure 3 shows gas engine 1 selling electricity on the Spot market and gas engine 2 selling electricity on fixed tariffs.



Figure 3. Two gas engines selling electricity at different terms

In the operation strategy you select the electricity market you want to show the Net Heat Production Cost for and a graphical illustration as the one on Figure 4 appears.



Figure 4. "Operation Strategy" lets you choose electricity market

In the "Operation Strategy" you can furthermore see the Net Heat Production Cost for each of the individual production units and thus also at what production unit that has the lowest production ost at either Day or Night as shown on Figure 5.

🦲 Operation strategy		
Operation Strategy Minimizing Net Production User Defined Operation S January 2011 (Selection Net Heat Production Cost	n Cost (NPC) trategy t month, to see operation strategy of this month)	Electricity Market: Day & Night
Net Heat Production Cost Energy	gy Unit Setup	
[GBP/MWh-Heat]	Day	Night
Gas engine 2	-2	17
Boilers	14	14

Figure 5. Net Heat Production Cost for gas engine 2 and boilers

5. Time series in the Operation strategy

It is also possible to include time series in the payments which naturally affects the operation strategy as shown on Figure 6.



Figure 6. Including time series as a payment

By using the slider for Gas prices you can see the net heat production cost versus the spot prices at a given natural gas price. The range of the slider represents the range of the time series in the selected month.

6. Prognosis

By double-clicking on market in energyPRO a similar picture as the one on Figure 7 appears and lets the user choose the time series for both the spot market prices and the prognosis.

Each spot market in energyPRO is defined by two time series. The first is the actual spot price. The second one is a spot price prognosis. A special case is if the two time series are identical indicating full knowledge to future spot prices.



Figure 7. Select time series spot market prices and prognosis

When creating prognoses the user has two options. The first one is to create your own prognosis and import them into energyPRO. The second one is to create a new time series function in the time series function folder. Of special interest here is the "Interval"-function, this function creates a prognosis based upon an existing time series and information of how many intervals this times series should be divided into after subtraction of a percentage of extreme values (high prices) as shown below.

度 Prognosis Spo	pt Market	_ 0 🛛
Name: Prognosis	Spot Market	
Development of tir	me series function in Planning period	
Time series fund	ction	
Symbol	TSSpot_Market	
Unit		
Function:	Intervals(Time series name;Number of groups;Extreme hours %])	fx JN
These values	s to be modified in a conversion table As graphics	

Figure 8. Intervals function and change of number of intervals

In Figure 9 is an example, where the original spot price time series (System sell price) has been used for generating a prognosis with 5 intervals and five 5 % extreme prices.



Figure 9. Graph for spot market prices and a spot market price prognosis

7. Production, graphic

To view a visualization of the results, open the "Production, graphic"-report as seen on Figure 10. The second graph from the top shows the priorities of all the production units. Have in mind, that the lower priority number, the better the priority.



Figure 10. "Production, graphic"-report

You can also choose to see any of the time series or time series functions. In the example on Figure 10, the spot price time series is shown. Notice that a high spot price result in a low net production cost for gas engine 1. Gas engine 2 is on a fixed tariff market and therefore unaffected.