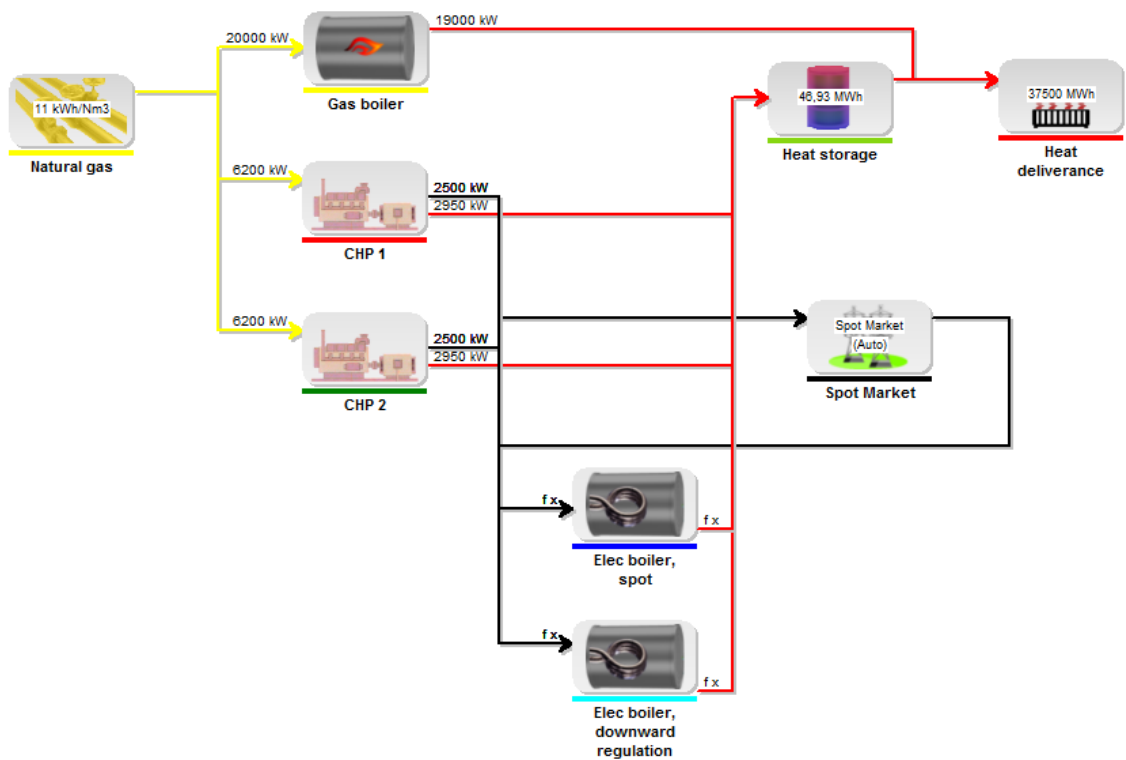




Time series in economy

energyPRO 4.1



Elec. purchase, downward regulating

Unit Selection

Payment concerns: Production unit

Production Unit: Elec boiler, downward regulation

Type: Electricity consumption

Formula selecting monthly amounts: EC(Elec boiler, downward regulation;All Periods)

Price per Unit: N2010() kr/MWh (in januar 2010) Variable monthly price

Include in operation strategy: Payment included in operation strategy calculation

OK Cancel

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1. Introduction

With energyPRO 4.1 we introduce time series in the economy section of energyPRO.

With time series in economy you are no longer constrained to have a fixed monthly price in your payments.

At the end of the paper other changes in the input data structure are presented.

2. Price per unit as time series

Today it is possible to trade electricity on several different markets. It is not only spot markets, but also regulating power markets that might be relevant to model. The example below illustrates an electric boiler, which is buying electricity in both a spot market and a downward regulation market.

Two instances of the electric boiler are made. One, where the boiler purchases electricity on the spot market, when that is feasible, and another where the boiler purchases electricity on the downward regulation market, when that is feasible and the boiler is not trading on spot.

A time series with the actual downward regulation prices is included in the external conditions.

The payment regarding purchase of downward regulation is modeled as seen below. As you can see in the Price per Unit box you can choose between Fixed monthly price and Variable monthly price.

When choosing Variable monthly price the Price per Unit input changes to a dropdown, where it is possible select a time series from external conditions.

Price per unit as time series

The screenshot shows a dialog box titled "Elec. purchase, downward regulating". It contains the following fields and options:

- Unit Selection:**
 - Payment concerns: Production unit
 - Production Unit: Elec boiler, downward regulation
 - Type: Electricity consumption
 - Formula selecting monthly amounts: EC(Elec boiler, downward regulation;All Periods)
- Price per Unit:**
 - Unit: kr/MWh (in januar 2010)
 - Price type: Variable monthly price (selected from a dropdown menu that also shows Fixed monthly price)
- Include in operation strategy:**
 - Payment included in operation strategy calculation:

At the bottom, there are icons for help and a question mark, and buttons for "OK" and "Cancel".

Another example is varying fuel prices. In the example below the natural gas consumption is subject to a varying fuel price.

The screenshot shows a dialog box titled "Gas purchase". It contains the following fields and options:

- Unit Selection:**
 - Payment concerns: Received fuel
 - Fuel: Natural gas
 - Formula selecting monthly amounts: ReceivedFuel(Natural gas)/HeatValue(Natural gas)
- Price per Unit:**
 - Unit: kr/Nm3 (in januar 2010)
 - Price type: Variable monthly price (selected from a dropdown menu)
- Include in operation strategy:**
 - Payment included in operation strategy calculation:

At the bottom, there are icons for help and a question mark, and buttons for "OK" and "Cancel".

Another new feature is the possibility to state whether a payment is to be included in the operation strategy calculation.

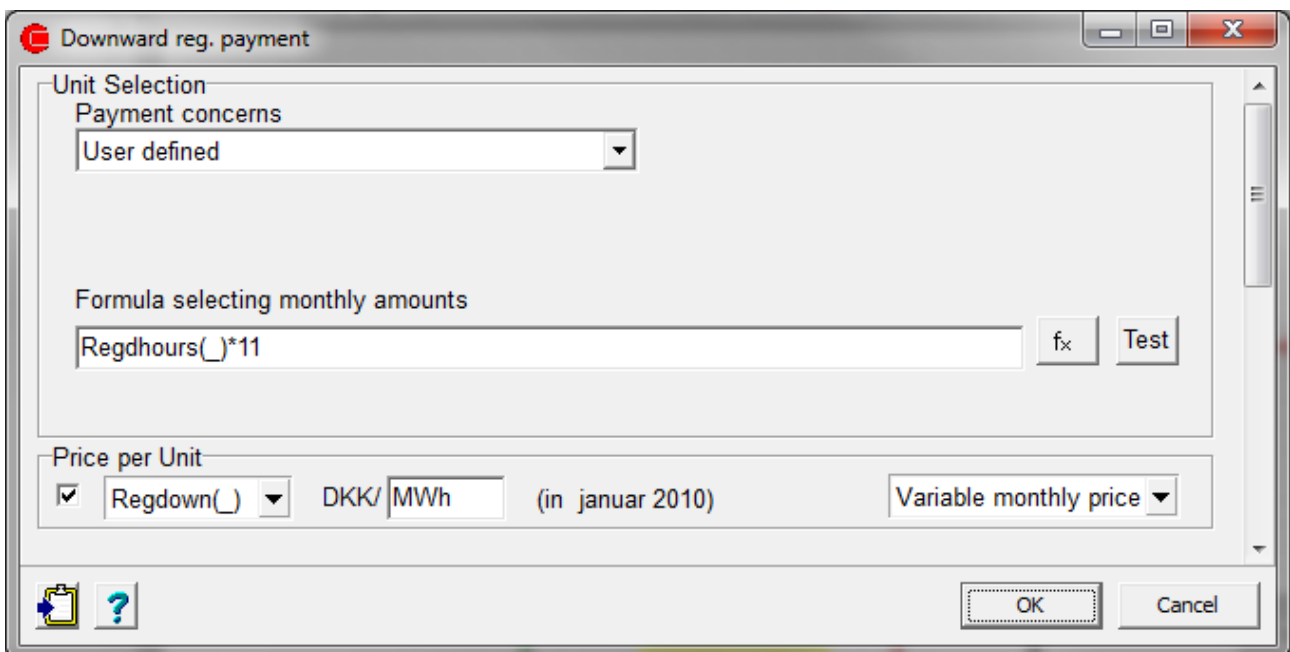
Up to now, payments have automatically been included in the automatic operation strategy calculation, with the exception of payments, which always have the same value regardless of the production on the energy conversion units, as these were ignored.

By default, payments are included in the operation strategy. You have to uncheck this option if you don't want to include a payment in the operation strategy.

If a payment is included in the operation strategy calculation and time series is part of the formula for selecting monthly amounts or price per unit, the monthly average of the time series is used when calculating the operation strategy.

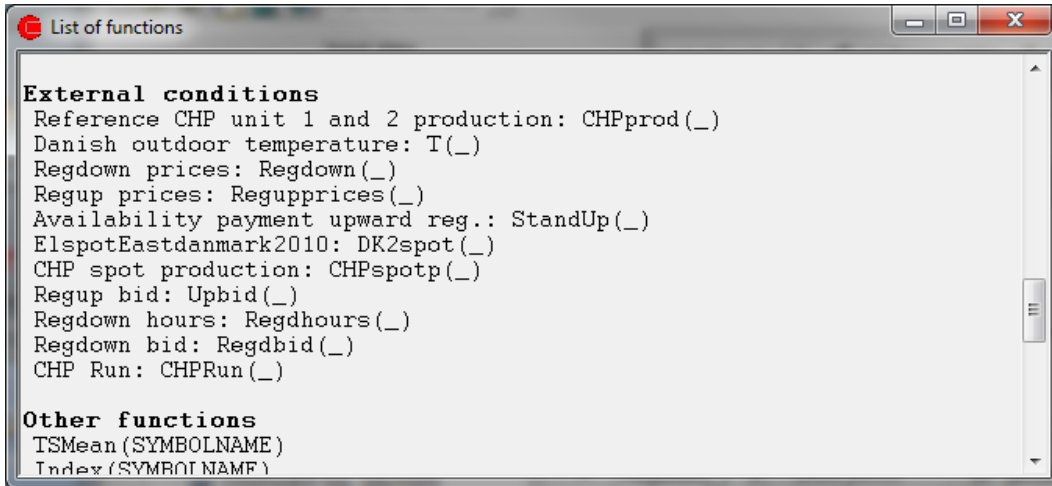
3. Time series in formula selecting monthly amounts

It is also possible to include time series in the formula selecting monthly amounts, see example below:



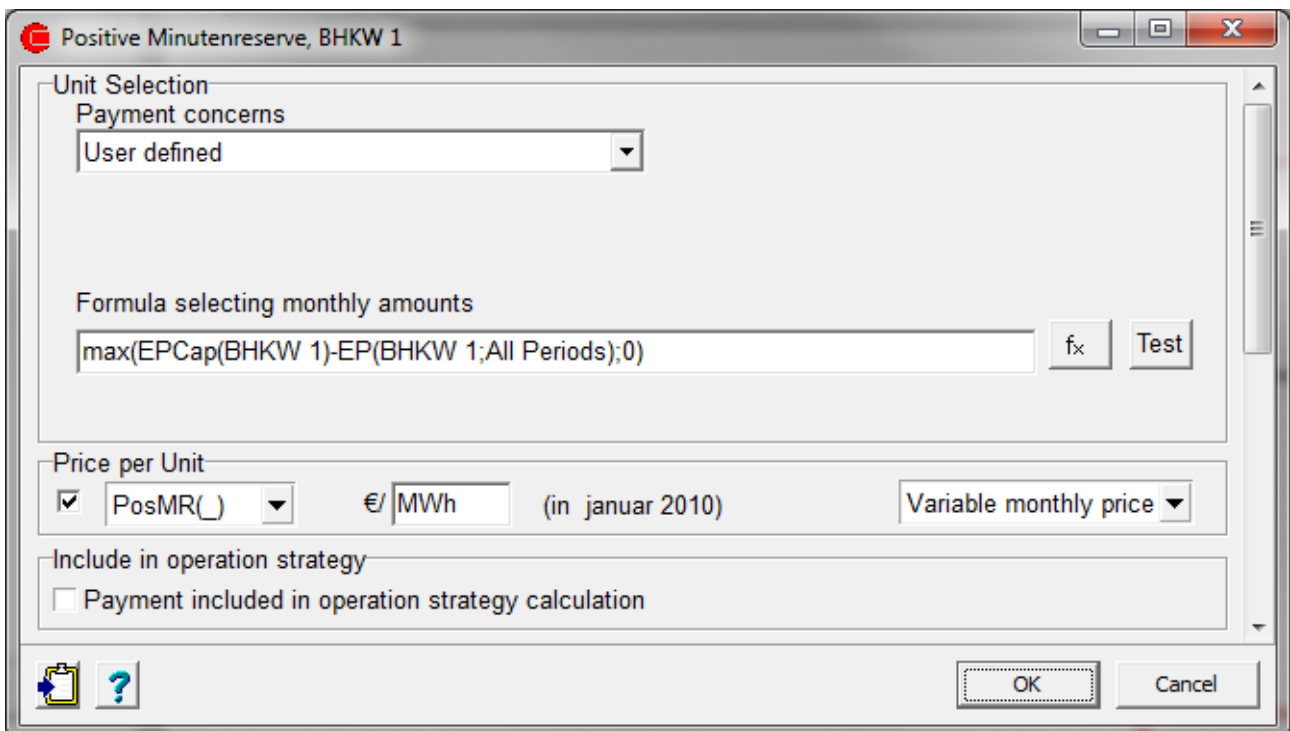
In order to get access to time series in the formula field, you set the Payment concerns to User defined.

Pressing fx provides you with a list of time series available.



4. Capacity as part of formula selecting monthly amounts

If a CHP or an electric boiler is traded on an availability electricity market, like the German Minutenreserve you need to include the electric capacity of the unit in the formula selecting monthly amounts. Below is an example:



The payment calculates the Positive Minutenreserve on the CHP BHKW 1. EPCap returns the electricity production capacity and EP is the electricity production. In a given hour, if the CHP unit is not operating the formula returns the capacity, which is available for the Positive Minutenreserve. This is multiplied with the price in the Minutenreserve market at the given hour, represented by the time series PosMR(_). If the CHP is operating at full load the formula returns zero.

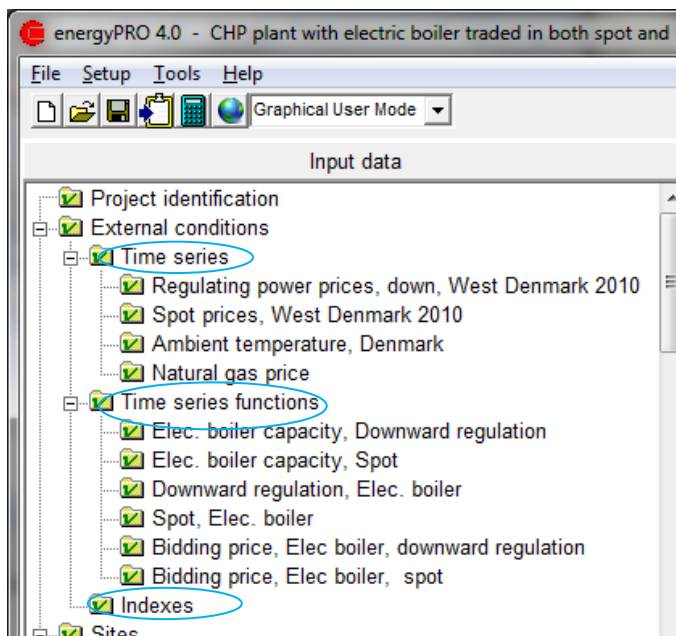
The complete list of capacity functions is listed here (ECU = energy conversion unit):

- EPCap(ECU): Electricity Production Capacity
- ECCap(ECU): Electricity Consumption Capacity
- FPCap(ECU): Fuel Production Capacity
- FCCap(ECU): Fuel Consumption Capacity
- HPCap(ECU): Heat Production Capacity
- HCCap(ECU): Heat Consumption Capacity
- CPCap(ECU): Cooling Production Capacity
- PHPCap(ECU): Process Heat Production Capacity
- PHCCap(ECU): Process Heat Consumption Capacity

5. External conditions

Up to now, energyPRO has had an External conditions subfolder in the economy folder. In energyPRO 4.1 this folder has been removed. Now financial indexes are available from the main External conditions folder.

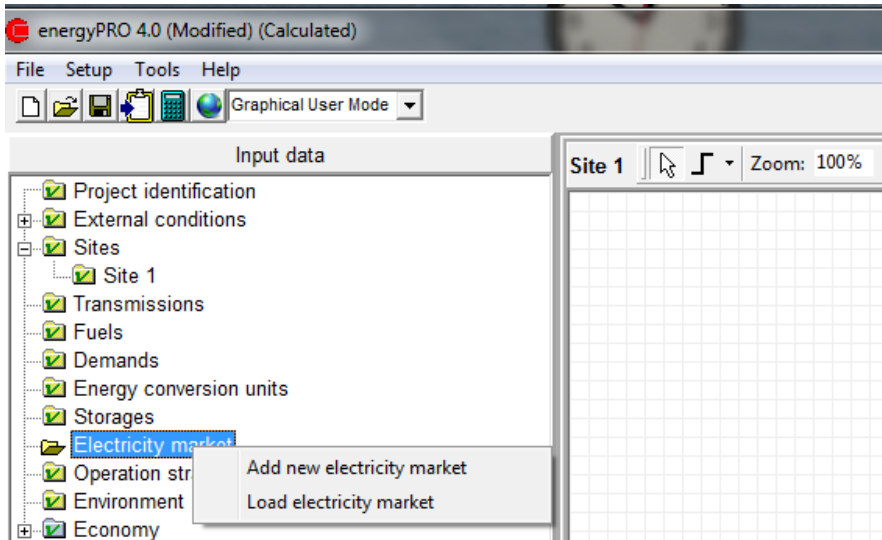
At the External conditions folder three subfolders are included:



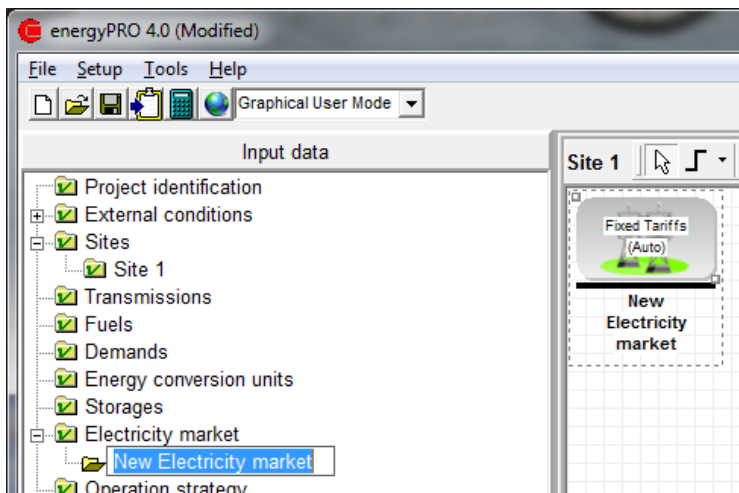
The time series, time series functions and indexes are automatically located at the right subfolder.

6. Electricity market as subfolder

In order to obtain a more stringent setup of the input data the folder Electricity Market has been redefined. The folder is empty when starting a new project. Right click on the folder to add or load an electricity market:



When adding a new electricity market, it is possible to name it:



In the form it is possible to choose between flat rate, fixed tariffs or spot market.

It is possible to add one additional electricity market. However, this market is limited to flat rate, and it is only possible to add an extra market when the first market is fixed tariffs or spot market.

In other words, the functionality with adding electricity markets replaces the functionality “Access to flat rate, when having spot market or fixed tariffs”, which in previous version was accessible from the Project identification.

7. New Storage folder

In order to obtain a more stringent setup of the input data a new folder is made, Storages.

In this folder all the storages are placed.

