OPEN

software

OPEN (OPtimum ENergy) is a new software that optimizes the energy systems.

The OPEN function is the determination, for any energy use type, of the energy system that minimizes the energy use costs.

Specific applications are also useful within the field of the distributed power generation.

The above costs are the sum of the energy primary source ones plus the capital costs of the new equipment to be installed plus the relevant installation and operation & maintenance costs minus the energy efficiency incentives minus the revenues realized by possible various energy types sales. Hence, in the particular case of existing energy consumption centres restructure, the energy system deltacost found by OPEN is the global net money saving in comparison with the current energy supply cost.

As OPEN minimizes in particular the primary energy source consumption, it maximizes the pollution reduction and the energy saving.

The considered energy user can be any centre of any size, either industrial or residential or commercial, having a given energy demand, anyhow distributed among power, heat and cold and anyhow variable throughout the 24 hours and throughout the year 365 days.

The result, that includes the operation vs. time configuration, is exact and verifiable in a simple way.

We report as an example the result of an OPEN optimization, concerning a corporate user.

We premise that the OPEN options were the purchase of any units number, anyhow sorted out, to be chosen within a few natural gas alternative engines and the purchase of a chilling heat absorption system.

The chosen (optimum) solution can be summarized in the following figures:

- net improvement of the plant energy bill extended to the whole life of the investment, that is difference between
  1. the global energy bill (gas + power) before the investment and
  2. the (gas + integrative power from the grid) cost after the investment plus the investment cost, thereincluding the installation, plus all the engine operation & maintenance costs: 4,329,444 €
- investment inflation-net Pay-Out Time: 1.26 years
- chosen investment inflation-net Internal Rate of Return: 78.98 %
- investment life: 9.05 years
- energy system energy saving index: 40.60 % (this percentage is also approximately correspondent to the pollution reduction)
- chosen engine electrical power: 1.169 MW

Before the OPEN features illustration we make the following premise.

Cogeneration presents a joint costs problem. The economic theory states that any common costs allocation criterion among single joint products is arbitrary.

But not only cogeneration presents a joint costs problem. Energy systems always envisage joint products offer situations because the value of a certain energy vector in different periods *is* different according to the different demand level, purchase price, sale price, sometimes also according to different offer level (as for instance in the hydroelectric energy case). When joint products are present within any single period (that is in the cogeneration case) the joint products problem becomes compound.

It's necessary continuously compare single energy vectors marginal costs particularly in order to continuously state the possible purchase / sale convenience.

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We can now examine the OPEN features:

-    modelization of the energy consuming centre
-    utilization of an adequate algorithm for the optimum energy system determination, inclusive of both continuous and discrete (integer numbers) variables and of both linear and non linear constraints, in such a way as to be warranted that better energy systems, within the available primary source / energy transformation machine types, do not exist
-    formulation and solution of the thermodynamic-economic problem about the power / heat cogeneration joint costs apportionment among the different energy vectors: the so determined actual marginal cost (continuously variable vs. the production amount) in any different period, for instance of the produced power, can thus be matched against the price of an external grid, in such a way as to enable the algorithm to each time establish the possible convenience of either purchasing or selling power from / to the external grid
-    formulation, within the optimizing algorithm, of government incentives and relevant conditions to be necessarily complied with in order to profit by them

Supplementary features, such as for instance storage of power, heat, cold, can be included.