



# European EnergyManager

## Economic calculation

### Preparation material



## 1. Basic Principles

### 1.1 General

For the assessment of measures with regard to their technical efficiency, ecologically moderating effects and, at the same time, economical use of energy, an economic analysis needs to be carried out in order to determine the commercial economic advantages. However, this does not allow for the inclusion of all the advantages of economical energy use in quantitative or monetary terms

- Economic analyses cannot provide exact values for future costs and benefits. All assumptions, in particular those regarding the future developments in prices and interest rates, are characterised by uncertainties that, as a consequence, produce a corresponding range for the calculated results derived from them.
- Even with methodologically perfect procedures, a comparative economic analysis often cannot provide the basis for a decision between investment alternatives. The results of the commercial economic analyses often lie so close to each other that the deviations lie within the uncertain data related range, which means that economic criteria alone do not enable sensible decision making. Within such alternatives, a decision is thus made using considerations other than economic criteria.
- Many outcomes are not of a type that allow themselves to be valued in full or in part in monetary terms, e.g. improved comfort, simplification of servicing
- Through lowered energy consumption, the environment becomes correspondingly less polluted. At best, financial valuations are only to some extent possible when society is directly affected
- National economic criteria are not compelled to be in harmony with business management standards. Consequential social and ecological costs are not taken into account by commercial management analyses. By means of taxes and duties these external costs can be internalized to a degree. However, in principle, it is not possible to undertake a financial assessment of all the future damage.

Commercial economic advantageousness is only one criterion that lies alongside other important standards such as environmental compatibility, national economic valuations or security of supply. Therefore, the latter criteria must have an influence on the decision in the case where various investment alternatives result in commercially economic measures of equal rating.

### 1.2 Methods of Economic Analysis

In the first instance, investments in energy saving measures must basically be assessed in comparison to the alternative energy costs incurred. As a result these are handled in a different way to investments in production plant where the alternative is for investment in another plant item that has a possibly higher return on capital. In the case of energy saving measures, the comparative costs are fixed: the otherwise unavoidable costs for drawing energy. **Every measure that can provide the desired energy service at a lesser cost than the drawing of energy is economic.**



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In the case of economic analyses over a longer time frame, the interest rate must be taken into account as a fundamental consideration. Dynamic (multi period) methods include these within the analysis in contrast to static (single period) methods. The common methods for economic analyses are:

Static Procedures	Dynamic Procedures
Comparative cost analysis	<b>Capital value method</b>
Cost effectiveness analysis	Internal rate of return
<b>Amortisation analysis</b>	<b>Annuity method</b>

**The static methods of economic analysis** are uncomplicated and can be carried out at little expense. However, they permit only limited meaningfulness. The main distinguishing feature and the simplified assumptions associated with this procedure mean that it does not recognize time-based differences for the entering of payments. In the energy area, amortisation analysis is widespread as a static method for making a quick assessment:

### Amortisation time (Pay-back-period)

Sought: Pay back period

The number of years within which investments are able to be repaid from profits (energy savings). A measure of the degree of the investment related risks. The shorter the pay back period, the more economic the measure becomes. For the assessment of energy technology optimization, it is of only limited suitability because profits accrued after the amortisation period remain unaccounted for.

The amortisation time analysis does not allow for any final conclusions regarding the cost effectiveness of the investment. That is why they are used for the assessment of the investment risk, not an assessment of the economics of the investment. The method leads to the preferential rating of solutions that save little energy with minimal investment.

**The Dynamic Procedures for Economic Analysis** use financial-mathematical methods in order to portray the simplified assumptions used in the static methods in a more realistic way. The main difference is the examination of all the periods that are within the utilisation life of an investment. Payments due at differing points of time are made comparable by means of the addition or subtraction of interest. Example:

A payment of the amount X at a time point of today, and the same payment in five years time, cannot be the same value as that set today because, for the amount X in five years time only the amount Y ( $Y < X$ ) needs to be invested today which, inclusive of interest profits, will have grown to the amount X in five years time.

### Capital Value Method:

Sought: The total costs over the utilisation life

All costs that are incurred during the utilisation life are totaled. At the same time, the costs incurred at a later point in time are not taken into account on their nominal value but on the basis of the amount that one would have had to have invested at the time of starting in order to pay for the later costs. As a result, the capital value is the total amount that needs to be invested which, including interest, covers all the investment and ongoing costs. The goal is to keep the capital value, i.e. the total costs, to the minimum. If not only costs are incurred but revenue is also obtained, then it is the difference between the outgoings and revenue that should be used instead.



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#### Annuity method

Sought: average annual costs

By taking into account interest, the investment is divided into nominally equal payments over the utilisation life. By this means, the costs of the present situation (without investment) and the costs of the optimisation variant (with investment) can be directly compared with each other. The most economic solution is the variant with the lowest total costs per year. The annuity method is the clearest and that is why it is most often used. For training, we will carry out economic analysis on the basis of the annuity method.

## 2. Cost factors

For an economic analysis, three types of costs decide energy technology investments:

Capital costs	Costs for the refinancing of the investment
Consumption costs	Costs for fuel sources (gas, fuel oil, electricity, wood)
Operating costs	Costs for maintenance, staff, upkeep, administration, insurance

### 2.1 Capital costs

The capital costs are the net result of the investment costs, less possible subsidies, multiplied by the corresponding interest factors. The investments required for the components and technical plant are determined from the corresponding cost estimates. Tax rebates, subsidies, interest holidays, etc. are taken into account as reductions in the capital costs.

In the case of a conversion project, the effective cost components connected with the energy consumption are taken into account. One should take particular note that costs that are incurred due to non-energy related redevelopment measures should not be included in the analysis for the energy savings measures. Hence, for the economic analysis, it is only the additional costs, compared to normal redevelopment requirements without energy saving, that are taken into account.

### 2.2 Consumption Costs

For each energy source, the energy costs are derived from the annual energy consumption multiplied by the energy cost.



### 2.3 Operating Costs

The costs for maintenance, staff, upkeep and administration are determined on the basis of their maintenance contracts or from experience values.



## 3. Equivalent Energy Price

Should measures relative to one base variant be compared, e.g. for redevelopment, then the equivalent energy price method is especially advantageous. As above, the total annual costs are derived from the capital costs, the average yearly consumption costs as well as the operating costs. This value is divided by the consumption of utilizable energy. The result in costs per kWh of energy provides a clear comparative value.