

Indicators of financial efficiency of energy saving measures

To analyze the effectiveness of investments in [energy saving measures \(ESM\)](#), it is necessary to calculate the **indicators of financial efficiency**, which include: the expected annual savings of energy resources in kind; initial cost indicators; criteria of economic efficiency of technical decisions.

Initial cost indicators are the basis for further calculation of **efficiency criteria for investment** in the **ESM**. These include **investment costs**, annual **energy saving** potential during project implementation, current cost savings (profit growth) and investment income.

In general case, the **total investment costs** include capital investment and the need for working capital:

$$K_{\text{ПОВН}} = K + K_{\text{ОБ}},$$

where K - **investment in fixed capital** (capital investment); $K_{\text{ОБ}}$ - the need for production that is created in **working capital** or its change in accordance with changes in the scale of production or other factors.

The need for **working capital** must be taken into account for projects related to the manufacture of products; for **energy-saving projects**, investments in the acquisition, modernization and reconstruction of fixed assets are used as investments.

In general, the composition of **investments** may include the following types of costs:

$$K = K_{\text{БУД}} + K_{\text{ОБ}} + K_{\text{СУП}},$$

where $K_{\text{БУД}}$ investment in building structures; $K_{\text{ОБ}}$ investment in working machines and equipment, including the cost of their acquisition, delivery and installation; $K_{\text{СУП}}$ accompanying investments, which include pre-production costs for pre-investment research, design and development of feasibility studies; intangible assets (acquisition of licenses, know-how, patents, etc.); other.

For the developed (created) fixed assets the cost is established according to calculation of cost of works, for the purchased - at the purchase price. To calculate the investment, if necessary, estimates are made for the purchase and installation of fixed **assets**, which includes the cost of equipment with transport costs and the cost of construction and installation work (CIW). The estimated cost of CIW includes the following cost elements:

$$C_{\text{БМР}} = \Pi_3 + H_{\text{В}} + \Pi_{\text{Н}},$$

where Π_3 - direct costs, which includes the basic wages of workers, material costs and operating costs of machinery and equipment ($\Pi_3 = 30 + M + E$); $H_{\text{В}}$ - overhead costs of construction and installation organization; $\Pi_{\text{Н}}$ - planned savings, or the normative estimated profit of the construction and installation organization.

Overhead costs and planned savings are determined by the approved standards for different types of EU by the formulas: - direct costs, which includes the basic wages of workers, material costs and operating costs of machinery and equipment (software = $30 + M + E$); $N_{\text{В}}$ - overhead costs of construction and installation organization; $P_{\text{Н}}$ - planned savings, or the normative estimated profit of the construction and installation enterprises.

Overhead costs and planned savings are determined by the approved standards for different types of ESM by the formulas:

$$HP = 0,01 \alpha_1 (30 + \Theta),$$

$$\Pi H = 0,01 \alpha_2 (30 + \Theta),$$

де α_1, α_2 — respectively, the standard of overhead costs and planned savings,%.

In the absence of design and estimate documentation, investment in equipment can be calculated in an enlarged form by the formula:

where k_{TR} - coefficient that takes into account the cost of packaging and transportation, it is taken approximately 10 ÷ 13% of the selling price (contract value); k_M - coefficient that takes into account the cost of installation of equipment and commissioning, depending on the type of technical means (it is usually 10 ÷ 20% of the selling price of equipment in need of installation, but in some cases, for example, for powerful [heat sources](#), this figure may be 50%).

The amount of **related investments** (КСУП) is determined on a contractual basis between the customer (investor) and the executors of relevant works (design and survey, research, legal, etc.).

The annual **energy saving potential** in general is determined by the total **savings of all types of energy resources** in the implementation of the **ESM**:

$$\Delta \Theta = \Delta ET + \Delta EQ + \Delta EW + \Delta EB = \zeta_T DBH + \zeta_Q DQ + \zeta_W DW + \zeta_B DVB,$$

де $\Delta ET, \Delta EQ, \Delta EW, \Delta EB$ - respectively the cost of **saved fuel, heat, electricity** and water; DVN, DQ, DW, DVB - respectively annual **savings of fuel, heat and electricity** in kind; ζ_T - price per unit of natural **fuel**; ζ_Q - price per unit of heat; ζ_W - tariff for **electricity**, ζ_B - cost of 1 cubic meter of water.

When assessing a specific **ESM** in the calculations we need to take into account only those types of **energy consumption** that change during the implementation of this project. Thus, in the reconstruction of boilers it may be the **cost of fuel, electricity** and water. For projects related to the modernization of heating and ventilation of facilities that use the purchased thermal electricity, the **savings in total energy consumption** can be expressed by changing the **consumption of thermal and electrical energy**. It is worth noting that in some projects, along with **saving heat and fuel**, there may be an increase in **electricity consumption**. In this case, the component $\Delta \Theta$ acquires a corresponding negative value.

The calculation of the **profit** received by the enterprise as a result of project implementation depends on the specifics of the project. Thus, if the project involves the purchase of new energy-saving technical means (TM), which were not previously used at the facility, the **profit** is determined from the expression:

$$\Pi = \Delta E - CE,$$

where ΔE - is the cost of saved **energy resources**; CE - current costs associated with the operation of new TM (excluding **energy consumption**).

As a rule, the increase in current costs is associated with additional costs for depreciation (D), as well as maintenance and repair (R) is determined by the formula:

$$CE = D + R.$$

Current cost savings in the case of replacement of existing equipment with more efficient is determined by the formula:

$$\Pi = \Delta E - \Delta CE = \Delta E - [(DH + RH) - (DC + RC)],$$

where ΔCE - change in current costs associated with the operation of the TM, when replacing them;
DN, DS - respectively depreciation of new and replaced equipment; RN, RS - respectively, the cost of maintenance and repair of new and replacement equipment.

In some cases, the introduction of the ESM may be accompanied by changes in labor costs of key workers (for example, when replacing boilers running on solid fuel, gas-fired boilers, reducing labor costs of workers - boilers). In this case, the indicator ΔCE is determined by the formula:

$$\Delta CE = [(AH + PH + 3PH + OCH) - (DC + RC + 3PC + OCC)],$$

де $3PH$, $3PC$ - accordingly, the wages of key workers after and before the introduction of the **ESM**;
 OCH , OCC - deductions for social needs from the salary fund after the introduction of the **ESM**.

In some cases, **current costs** should also take into account other costs related to the specifics of the project. For example, for **energy saving measures** related to the reconstruction of the heating system, the **losses** caused by emissions from boilers must be included in the **losses**. It is determined based on differentiated rates of pollution charges, as well as additional health care costs.

Calculation of depreciation costs performed on the basis of data on the book value of fixed assets introduced (used) for each variant of **energy-saving technology**, and uniform rates of depreciation.

$$A = 0,01 (HR K),$$

where HR - the rate of annual costs for repair and maintenance of this type of vehicle,%.

The cost of repair and maintenance of power equipment, depending on its type can also be determined by the formulas:

$$R = CR NR k,$$

$$R = CYE NYE ,$$

де CR — average annual costs for repairs and maintenance of fixed assets per unit of repair complexity .; CYE - the average annual cost of repair and maintenance of conventional units of electrical equipment in power grids; NR - the number of units of repair complexity for this type of fixed assets; NYE - the number of conventional units of electrical equipment in the grid section; k - coefficient that takes into account the cost of repairing the energy part of this type of fixed assets.

The salary fund of employees is determined based on hourly rates of members of the workforce and labor costs:

$$3\Pi = S \text{ сті} \cdot T_i \cdot \text{кд} ,$$

where сті - hourly wage rate of workers of the i-th category, T_i - labor costs of workers of the i-th category; кд - coefficient that takes into account additional wages.

Deductions for social needs from the salary fund are determined by the formula:

$$BC = kC * 3\Pi,$$

where kC - coefficient that takes into account the deductions for social needs, relative units.

The increase in net profit (NP) of the enterprise is determined by taking into account income tax and property:

$$\text{ЧП} = (\Pi - \Pi M) \times (1 - \text{СПП} / 100) ,$$

de CPP - payroll deduction rate per income,%; PM - a deposit on the lane.

It should be noted that in most cases, property tax can be ignored in the evaluation of projects, as its value is insignificant and is within the allowable error of calculation.

Income investment (primary investment income Д) at the time of the return of the supplementary energy investment is determined by the formula:

$$Д = ЧП + АН.$$

The case of replacing existing equipment with a more efficient income is determined by the formula:

$$Д = ЧП + (АН - АС).$$

Where AH and AC - respectively, depreciation of new and old (replaceable) TM.

According to PMKEU "PATRIOT"

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