Energy balance of industrial enterprise

The **energy balance** is an important characteristic of the energy sector of the enterprise and reflects the full quantitative correspondence between the amount of supplied **energy** (profitable part), on the one hand, and the sum of **useful energy** and **losses** (expenditure part), on the other.

Compilation and analysis of **energy balances** are aimed at solving the following main tasks:

- assessment of the actual condition and **efficiency of energy use** at the enterprise, identification of the causes and determination of **losses of energy resources and energy carriers**;
- identification and assessment of **fuel and energy saving reserves** and development of a **program of measures** aimed at **improving** **energy efficiency**; improvement of operating modes of technological and power equipment;
- determination of rational sizes in production processes and installations; improvement of **methods of rationing** and development of norms of **fuel** **and energy consumption** for production;
- definition of requirements to the organization and improvement of system of the account and control of **expenses of energy resources and energy carriers**;
- obtaining initial information to address issues of creating new equipment and improving technological processes in order to **reduce energy costs**;
- optimization of the structure of the **energy balance** of the enterprise as a result of choosing the optimal directions, methods and sizes of the use of supplied and **secondary energy resources**;
- improvement of the **fuel and** **energy saving** incentive system.

According to the period of time for which they are compiled, **energy balances** can be design, planning and reporting.

Project **energy balances** are compiled during the creation of a project for the construction or reconstruction of industrial enterprises and are the basis for the development of schemes for their energy supply.

Planned **energy balances** are developed on the basis of fuel and energy consumption rates and are divided into current and future.

Reporting **energy balances** are compiled on the basis of equipment testing, measurements and accounting of actual **energy costs and losses** for the relevant past period of time.

Depending on the objects for which the **balance** is drawn up, there are **energy balances** of individual units and installations, consumer groups, individual technological processes, site, shop, enterprise.

Depending on the types of energy resources and energy sources that are taken into account when compiling **balance** sheets, there are partial and consolidated **energy balances**.

Partial **balances** are compiled for certain types of **fuel**, **energy** and **energy carriers**. Each of type of partial **balance** is composed in the appropriate units.

To establish the magnitude and graphs of the **energy load** of the enterprise, power **balances** are compiled. They reflect the modes of operation of individual power plants and their participation in

ensuring the overall energy load.

The consolidated **energy balance** of an enterprise is a set of interconnected partial balances relating to the consumption in the production of certain types of **fuel** and **energy** or the use of appropriate **energy sources**. This **balance** is formed in units of **heat** and reflects the structure of **energy resources** used in the enterprise, or the total need for these resources and sources of its satisfaction. The consolidated **balance** sheet also makes it possible to establish the level of **energy efficiency** at the enterprise.

Energy **balances** of industrial facilities can be obtained by experimental research, combined calculation and research methods.

The most accurate are the **energy balances** compiled experimentally, i.e. on the basis of equipment tests. During these tests, the **power** and **energy supplied** to the unit, as well as the parameters of the main and all branched energy flows are measured with the help of appropriate devices.

Based on the results of the analysis of **energy balances** of industrial facilities, **plans of organizational and technical measures to save energy resources** are drawn up.

When conducting **energy audits** to determine the components of the **balance** a combined method is often used. Usually the company does not have enough information needed to determine all components of the balance sheet. In this case it is necessary to use the reference literature, to make approximate analytical calculations, to involve narrow-profile experts or, most often, to carry out personal measurements of necessary sizes.

If the company has protocols of scheduled audits or information taken from the **automated system for monitoring** the condition of the facility, the analysis of the actual state of **energy use** at the facility and determining the components of its actual balance can be performed on this documentation. In the absence of the necessary information, the **energy auditor** must perform measurements of the values necessary to obtain an actual "photograph" of the distribution of the total **energy flow** within the inspected object.

It is obvious that for most types of **energy balances** their components should be presented in uniform units of measurement (mainly in tons of conventional fuel) for the considered period of time.

(energy consumption) may include: receiving of **fuel**

, **electricity** and **heat** from the outside and energy produced by installations that utilize

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- **fuel** used for technology, and
- **fuel** used for the production of **heat and electricity**.

Then the energy supply of the enterprise will be required

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At all stages of **energy** movement (receiving, production, transformation, distribution) there are **irrational costs (losses**) of **energy** Σ*Q*BT

Taking into account **energy costs** for own needs, source and **losses**, energy consumption will make:

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and - **thermal and electrical energy** produced by own sources; - **energy consumption** for the source's own needs.

The **balance** of **energy** used in the enterprise can be recorded taking into account the directions of its use.

where

, , - total **energy costs** for technology, heating, ventilation, air conditioning, hot water

- release of **energy** to the side; - other **energy costs**.

Obviously, the above components of the energy balance for the company are the sum of **energy consumption** in the shops (production, sites) and take into account both useful (conditionally useful) **energy** and **energy losses** (regulatory and excessive).

Secondary energy resources that can be formed from all components of **energy use** can serve as an additional **source of energy** for the company.

The direction of use of **secondary energy resources** (**SER**) depends on the size, structure and mode of **energy consumption** of the enterprise, as well as on the type, parameters and number of **SER** generated, and in each case should be selected based on the development of optimal fuel and **energy balance**, taking into account the greatest **efficiency**.

Where

Depending on the types and parameters of **SER** used in four main areas:
supply;

- **fuel** - direct use of combustible **SER** as boiler-furnace **fuel** in **power generating installations** or in installations that use **fuel**.
- thermal - the use of **energy** produced by **SER**, in recycling facilities or obtained directly as **SER**, to meet the demand for **heat**. This direction also includes obtaining artificial cold due to **SER** in absorption refrigeration units.
- power - the use of **SER** overpressure with the conversion of **energy** to generate **electricity** in gas or steam turbines or use them to drive individual units and installations.
- combined - transformation of the potential of **SER** for production in utilization installations (utilization of thermal power plants) on a district heating cycle of the **electric power** and **thermal energy.**

Secondary energy resources can be used to meet **energy** needs directly, without changing the type of **energy source** or with changing the **energy source** by generating heat (steam, hot water), artificial cold or electricity in recycling facilities.

The use of **SER** reduces **fuel consumption**. At the current level of energy prices, the costs of construction of plants for the use of **SER** are 2-3 times smaller than the costs of extracting fuel equivalent in terms of **energy potential**. Trends in the development of the **fuel** and **energy** complex provide for an increased importance and economic efficiency of the use of **SER**.

The use of **SER**, as a rule, allows to save other types of resources (raw materials, water, **electricity**, auxiliary materials).

An indispensable condition for the introduction of plants for the utilization of **SER** is the presence of **consumers of low-potential heat** or other types of **energy**.

Low-potential heat generated in recycling plants can be used in water or air heating systems, and

SER can also be used to preheat feed water in boilers. **SER** of high and average potential is expedient to use as the heating **heat carrier** in generators of absorption and refrigerating machines for receiving cold. Perspective planning of the use of **SER** and the introduction of utilization facilities should be conditioned by technical and economic calculations and measures to materially stimulate **energy saving**.

To characterize **secondary energy resources** suitable for direct use without energy conversion, the following indicators are used: **SER** yield, actual **SER** use, utilization reserve, possible and actual fuel savings due to **SER**, **SER** utilization factor.

To characterize the **secondary energy resources** used with the conversion of **energy** in the disposal plant, the following indicators are used: output **SER**; possible **energy** production due to **SER** - actual production and actual use of energy obtained by **SER**; energy utilization factor; disposal reserve; possible and actual fuel savings due to **SER**; **SER** utilization factor. **SER** utilization factor is characterized by the ratio of actual or planned (for the future) fuel savings to possible ones.