

COMPLIATION OF THE ENERGY BALANCE

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Introduction

The modern World is moving towards increased consumption of energy resources. New equipments and new technologies are based on the consumption energy resources, new engineering structures are becoming more complex and require more energy. The use of a large number of household appliances which consume energy is becoming the norm. Construction of modern residential buildings is not limited to the general lighting and general elevator. Modern resident want to have in his house parking, a gym and a swimming pool at a minimum.

Therefore the energy branch is one from most important branches of economy of each country. Each country is committed to energy independent, and all the countries are trying to improve the climate and preserve natural resources for future generations.

Compliance of the balance between the growing consumption of energy resources and sources of its coverage is an important part of domestic and foreign policy of each country.

Every year a simple balance between energy consumption and sources of coverage is increasingly becoming as the subject of options for the future development of the country as well as the base for constructing of financial relations within the country and abroad. Economical financial and political relations of country are often almost directly dependent on the version of the energy balance of the country.

1. Classification of energy resources and consumption

At first glance, the energy balance is very simple. The energy balance is defined as complete a quantitative relationship between the consumption and production of all kinds of fuel and energy.

Preparation of the energy balance is a difficult process of harmonization of its components. Main principles of the energy balance are:

- choice of unit;
- choice of conversion factors;
- choice of primary energy form energy that is not combusted;
- physical energy content vs. substitution method;
- temperature adjustment;
- fiscal year, calendar year. [2]

In order to compare and make the right decisions, energy balances of all countries should be drawn up in the same conditions. Principles and conditions of preparing of energy balances can know on the site of the International Energy Agency [2].

All energy balances have incoming and outgoing parts. Incoming part of the energy balance is a system of indicators characterizing the structure and volume of production of energy resources as well as external flows. Outgoing part of the energy balance is a system of indicators characterizing the structure of the use of energy. However a simple compilation of the energy balance does not allow influencing on its components in order to obtain positive changes that are necessary for society. Therefore the total energy balance is considered for individual components.

Receipt of the energy balance is regarding by types of energy resources (coal, oil, gas etc), by the type of energy sources (power plants, etc), by directions flows (exports and imports) as well as by energy storage resources. The expenditure part of the energy balance can be considered by:

- processes (power, lighting, thermal (low, medium and high potential), electromechanical etc);
- energy resources (fuel, electricity, heat, hot air etc);
- economic sectors (industries, transport etc);

Energy balances are: reporting, estimates and forecast. The reporting balance reflects the state of the energy sector of the economy during the reporting

period. Estimate energy balances are different versions of the energy balance in the future date periods under different conditions of development of this industry.

The forecast energy balance is the balance for future period accepted officially and designed for the build of official forecasts, calculations, prices and tariffs on fuels and energy resources. It must be unified.

Classification of energy allows determining more precisely the components that are in one or another may be able to affect the economy and politics of the country and may also affect the country's development in the future.

There are different types of energy classification. So, for example, in order to understand the nature of the impact on economy of each energy source, you can see the incoming part of the energy balance in such classifications of its components proposed by Codomi and Siddayao [1].

A) Primary and secondary form of energy

The primary energy is used to designate an energy source that extracted from a stock of natural resources or captured from a flow of resources and that has not undergone any transformation or conversion other than separation and cleaning (examples : coal, crude oil, natural gas, solar power, nuclear powered).

Secondary energy refers to any energy that is obtained from a [primary energy resources employing a transformation or conversation process. The examples of the secondary energies can be the oil product or electricity and heat.

B) Renewable and non-renewable sources of energy

A non- renewable source of energy is one where the primary energy comes from a finite stock of resources. It can be fossil fuel. If any primary energy is obtained from a constantly available flow of energy, the energy is known as a renewable energy. There can be solar, wind energy etc.

C) Commercial and non- commercial energies

Commercial energies are those that are traded wholly or almost entirely in the market place and therefore would command a market price. Non commercial energies

are those which do not pass through the market place and accordingly. Do not have a market price.

D)Conventional and non conventional energies

This classification is based in the technologies used to capture or harness energy sources. Non Conventional energies are those obtained using new technologies or sources. However it is very conditional distribution. Over time or at a different point in time, non conventional types of energies can be to become quite conventional energies.

Table 1.

Classifications of primary energy resources

Conventionality	Renewability	
	Renewable	Non-renewable
Commercial	Large scale hydro Geothermal Gydrogenic nuclear	Fossil fuels Other nuclear
Traditional/non-commercial	Animal residues Crop residues Windmills Watermills Fuel wood(sustainable) Solar	Unsustainable fuel wood
New and novel	Solar Mini and micro hydro Tidal and Wave Ocean thermal	Oil from sands Oil from coal or gas

Source: Codoni et all. And Siddayao [2].

Different classifications of the energy resources are interesting for consideration with a view to make the best decision for the future of the optimum development of this industry. Each country has its own specific energy sector activities and in connection with this, the detailed classification of energy resources may reflect the features that are unique to this country.

However, you should use the classification of energy resources and their consumption, adopted by International Energy Agency for the preparation of official reports and forecasting documents. This will allow to harmonize all the data by international organizations, to get the right advice from foreign colleagues, and to compare result of the energy sector activities of the own country with the results of the energy sector activities in other countries

Classification in the energy balances adopted by International Energy Agency involves the distribution of all energy consumption for that type of the energy sources like:

- coal and peat;
- crude oil;
- oil products;
- natural gas;
- hydro;
- geothermal, solar etc;
- biofuel and waste;
- electricity;
- heat;
- other.

The total energy consumption distributed by types of energy resources and shared by such groups:

A) Supply (TPES):

- production;
- imports;
- exports;
- Intl, marine bunkers;
- Intl, aviation bunkers;
- Stock changes.

B) Transportations and energy industries own use:

- transfers;

- statistical differences;
- electricity plants;
- heat plants;
- blast furnaces;
- gas works;
- coke /pat. fuel/BKB plants;
- oil refineries;
- petrochemical plants;
- liquefaction plants;
- energy industries own use;
- losses.

C) Final consumption:

a) Industries:

- iron and steel;
- chemical and petrochemical;
- non-ferrous metals;
- non-metallic minerals;
- machinery;
- mining and quarrying;
- food and tobacco;
- paper, pulp and publishing;
- wood and wood products;
- construction;
- textile and leather;
- non- specific.

b) Transport:

- domestic aviation;
- road;
- rail;
- pipeline transport;

-domestic navigation;

-non -specified.

c) Other final consumption:

-residents;

-commercial and public service;

-agriculture/forestry;

-fishing;

-non-specified.

d) Non energy use:

-in industry;

-in transport;

-in other sectors.[1].

2. Energy units

Energy balances use a simple aggregation method where each energy source is converted to a common energy unit and aggregated by simple addition. Two types of units are commonly used;

a) Scientific units. They include calories, joule, Btu and kWth. These indicate are heat or worked measures of energy.

b) Imprecise units (commercial), these units provide a sense of physical quantities of energy.

Conversion to scientific units is easy. They require information on heat content of the energy. Commercial units require establishing equivalence between the chosen fuel and the rest. There are many factors for the transfer of energy commercial units in scientific units of the energy resources.

3.Development of the energy balance

Optimal energy balance is one of important conditions for effective functioning and developing of any country. Economic efficiency, live hoods and energy industries competitiveness direct depends on objectively consumers properties and

quality of energy and their and products, existing scientific and technical potential of the country.

Developing of the energy balance and creating different forecast scenarios of energy balance could be of economic and political decision-making, identification of strategic and sectoral orientation of the energy policy of the country.

Most reliable version of the energy balance is an instrument of the state regulation. It allows avoiding structural and prices imbalances on the internal energy market and creates an effective mechanism of formation and using of energy resources of the national economy.

Analysis of different options for the energy balance is carried out to determine:

- 1) opportunity and feasibility of replacing the various types of the energy to the consumers;
- 2) opportunity and feasibility of the use of different types of energy generating equipments;
- 3) opportunity and feasibility of replacing of the various types of energy transportation;
- 4) opportunity and feasibility of using of different types of energy resources by one energy generating equipment;
- 5) opportunity and feasibility of using of different types of energy sources by one consumers and their operational changes if it is necessary;
- 6) opportunity of reducing loss of energy and other technical and economical parameters of different options for obtaining and using of energy resources.

The purpose of the development of different options of the energy balance- there is also finding of ways of most appropriate and coordinated development of the energy complex of the country and its impact on the development of other sectors of the economy.

Development of energy balance begins with the formation of the energy sources. This stage identifies opportunities of own generation capacities, proportions of

different types of primary energy resources and power plants to satisfy specific processes of the energy consumption.

Energy consumption is determined at the same time. It is determined by the level of development of the national economy.

The next stage of the energy balance is formation of rational limits of the use of different types of energy (various fuels, electricity, hot steam, hot water, hot air, etc.) for the energy consumption.

At this stage, they make comparison of opportunity and feasibility of using of different types of energy for energy consumers in different climatic conditions. Also at this stage, they make decisions to change power schemes on the more energy efficient and on the more energy saving. Then they make pessimistic and optimistic scenarios for prospective balance of own energy consumption that determine the total need for energy to meet the needs of consumers in different types of energy resources.

Following stage is the stage of harmonization between revenue and expenditure sides of the energy balance for different scenarios of the energy consumption in different climate conditions.

Different several of the energy consumption and different options of the generating energy capacities have different options of the transportation energy losses and different options of energy losses during processing it into other form of energy.

Determining the magnitude of the full scope of needs of different types of energy resources allows evaluating existing energy resources and generating capacities to meet the full needs of the energy.

So, we already have many options of generating capacities, many variants of the power supply to consumers and many options for transmission losses of energy and many options for energy losses during transformation of the one type of energy into other forms of energy.

All these options are generated in coordinated technically identical versions under the same climatic conditions. But now there is a discrepancy of opportunities of generating capacity to needs of their customers in each of the options.

Next stage of drawing up the energy balance is stage of determining the need for import of certain types of energy resources for specific needs of the own economy and the opportunities of excess exports of certain types of energy resources to other countries. It will also be many various, even for the same technically and climate balanced versions. You must decide on the most appropriate and effective variations of exports and imports of energy resources.

Each of the many variants of the future forecast balance must meet to simple at first glance formula.

$$E_p + E_i - E_x = E_{ec} + L_{tc}, \quad \text{where} \quad (1)$$

E_p - primary energy production;

E_i -import of energy;

E_x -export of energy;

E_{ec} - own energy consumption by end users;

L_{tc} - losses of energy during transportation to the end users and losses of energy during converting one type of energy to another.

This simple formula in energy balance has a system matrix data under different conditions.

Because just a computer program can identify several technical and climate agreed variations of pessimistic and optimistic forecast energy balances and can find the optimal point of the forecast energy balance which can be taken for official database for pricing of all energy resources. Building of the official forecast energy balance, you should also consider certain conditions to achieve energy efficiency to fulfill the Commitments State to improve the climate in the World and preserving of fossil energy resources for future generations.

Conclusions

Building of the forecast energy balance is a complex process. True forecast energy balance must meet the following conditions:

- only best specialists in energy engineering and economics of this industry should be engaged in process of building of energy balance of the country;
- energy balance must contain true data;
- energy balance need to contain technical approvals data;
- each calculations of the one version of energy balance must be made in the same climatic conditions;
- In the preparation of the energy balance need using only modern software for finding of optimal points.

Reference:

1. **Energy Balance Overview. www.iea.org**
2. **www.springer.com**

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