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ISSUES OF FUEL – ENERGY BALANCE AND STRUCTURAL BLUE FORMATION

I.U.Rakhmonov, N.N.Kurbanov
Tashkent State Technical University

The fuel-energy balance is an economic-statistical calculation of the flow of fuel-energy resources from mining to their consumption. The fuel-energy balance, it reflects information on the amount of each produced, transmitted or distributed, stored, and consumed fuel-energy resource formed on the basis of values in general, current or relative units. An energy balance helps us understand how energy is converted from one form to another [1].

Energy balance has several goals [2]:

a) improve the relevance of energy statistics by providing comprehensive and coordinated information on the energy situation of the national territory;

b) to understand the state of energy security, efficient operation of energy markets and other relevant policy objectives, as well as to provide comprehensive information on energy supply and supply in the national territory for energy formation;

c) serve as a quality tool to ensure the completeness, consistency and comparability of basic statistical data;

d) provide comparability between different data periods and between different countries;

e) provide data for estimating CO2 emissions relative to national territory;

f) create a basis for indicators of the role of each energy product in the country's economy;

g) calculating the efficiency of the transformation processes taking place in the country (for example, processing, electricity generation by burning fuel, etc.);

h) calculate the relative share of supply/consumption of various products (including renewable and non-renewable) in the country's total supply/consumption;

i) provide data for modelling and forecasting.

The scale of the energy balance is determined by, inter alia, area, product and flow boundaries [2]:

(i) territory border - defined by the border of the national territory of the constituent country;

(ii) product limit - determined by the scale of all energy products indicated in the balance columns;

(iii) Flow limit - determined by the range of energy flows (usage) shown in the balance lines.

Product and flow limits are set in the short term. If new sources of energy are found and used, they should be reflected in the balance sheet.

Energy balance does not include:

• Passive energy, for example, solar energy falling on the ground for heating the building and growing crops, etc.;

• Energy resources and reserves;

• Mining of any materials not included in primary energy production;

• Non-energy products that are not used for energy purposes (for example, waste and wood are covered only to that extent in the energy balance)

An energy balance takes the form of a matrix, where the columns represent all the different energy sources or "products" and the rows represent all the "flows." They are combined into three main blocks: energy supply; transformation and use of energy; and final consumption.

The first law of thermodynamics should be kept in mind when drawing up energy balances. The law of conservation of energy states that the total energy of an isolated system is constant; energy can be transferred from one form to another, but it cannot be created or destroyed. The first law is often formulated by showing that the change in internal energy of a closed system is equal to the amount of heat supplied to the system, equal to the amount of work done by the surrounding system. Consequently, energy cannot be increased and, if present, they are the result of statistical inconsistency (low precision data) or failure to fully account for all input products within the energy statistics.

Building energy balances in 3 steps [3]:

The first step is to compile commodity balances for each energy carrier in natural measurement units of the energy carrier - physical units (tons and cubic meters) or energy units (GWh for electricity and TJ for heat).

The second step is to convert the commodity balance in different units into a total energy unit by multiplying all the data by the appropriate conversion factor (caloric values for energy carriers in physical units and unit conversion factor for energy carriers measured in energy units).

The third step involves arranging the columns and rows of the energy balance to avoid double counting energy. For example, the production of secondary products is shown in the production line in commodity balances and is presented as a transformation product in the energy balance.

It is known that organizing in real-time is a very complicated process. At the same time, the law of movement of a certain energy resource is a confusing process. There is a high probability that one value is calculated twice or three times during the preparation of the fuel energy balance. During our research, the movement cycle of energy resources was observed, and common aspects of all resources were studied. As a result, a method of fuel energy organization was developed at the republic level, and a single web system was created based on this method. In it, the formation of the energy balance is carried out as follows:

1. Initially, three types of functions were developed for enterprises participating in the process of energy resource extraction and consumption[4]:

a) Input function - in which the enterprise can extract or produce a fuel energy resource. If both are present, that is, if the enterprise simultaneously processes its mined product and produces another resource, it is enough to connect this function once.

b) Consumption function - this function exists in all enterprises, and each enterprise has consumption functions.

c) Output function - determines whether there is a state of transfer or sale of the energy resource.

All enterprises attached to the web system attach which of the listed functions are available to them.

2. Taking into account the general state of resources, fuel and energy resources can be exported or imported, can be kept in reserve, can be sent to another enterprise for recycling, can be transferred to another enterprise, can be produced from one resource to another resource. Based on this, in the second stage, any available cases for functions "a" and "c" in the first stage will be attached and they will have to fill in the places "to" or "from".

3. The above two steps are performed only once after registration from the web system. If any function is to be added, it can be added freely, if any function is to be removed, it can be done on request. Of course, in the process of connecting to the system, each enterprise will have to attach the codes of the national classifier of its types of economic activity.

4. If a certain system has been established in the enterprises and there is an opportunity to implement the integration, it will be integrated into the web system, if it is not available, the personnel will fill in the information in the sections assigned to the functions.

5. Based on the entered data, a Sankey diagram is created, and it will be possible to analyze them not only in their own unit but also in such units as toe, GJ, Kcal.

There is another problematic situation when the energy resource changes from one type to another, it is difficult to put them on one chart. In this case, it is possible to use different scales for each resource or transfer them to units such as tbf, toe, GJ, and Kcal using the coefficient of conversion to one unit.

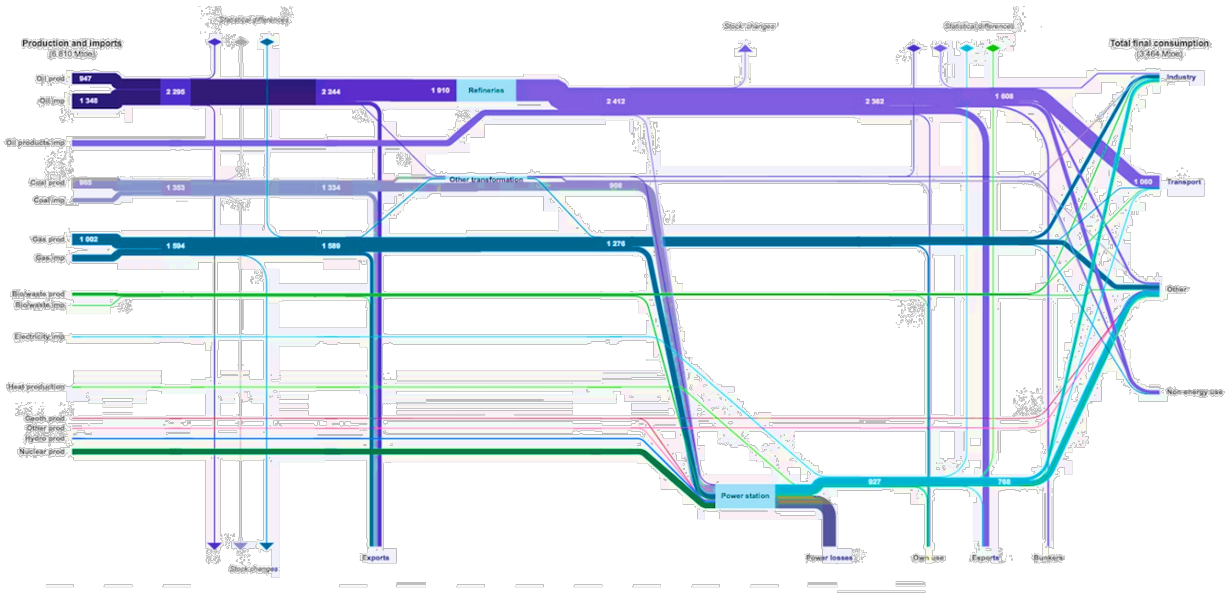

Figure 1. Sankey diagram of fuel energy balance

In addition, it is possible to get the result in the form of a table:

	Ko`mir/ Уголь/Coal	Tabiiy gaz/ Г`аз природный/Natural gas	Neft, gaz kondensatini qo`shgan holda/Нефть, включая газовый конденсат/Oil, including gas condensate	Benzin/ Бензин моторный/Motor gasoline	Dizel yoqilg`isi/ Топливо дизельное/Diesel fuel	Mazut/ Мазут/Fuel oil	Gazlar suyultirilgan uglevodorod /Г`азы углеводородные сжиженные/Liquefied petroleum gases	Kerosin / Керосин/Kerosene	Koks/Кокс/Coke	Boshqa turdagi yonilg`ilar/ Прочие виды нефтепродуктов/Other types of petroleum products	Atoma energiyasi/ Атомная энергия/Nuclear energy	Elektr energiyasi/Электро энергия /Electric power	Issiqlik energiyasi/ Теплоэнергия/Heat energy
Birlamchi energiya ishlab chiqarish	1183.2	40418.7	2781.5	-	-	-	-	-	-	-	-	429.9	-
Import (+)	1041.8	-	724.8	261.3	421.9	93.3	-	-	0.04	227.9	-	447.7	-
Eksport (-)	-	-2478.4	-	-	-	-	-	-	-	-	-	-231.0	-
Aksiya o'zgarishi (+,-)	239.2	-535.2	4.8	55.0	3.3	3.4	1.5	4.8	-	-	-	-	-
Umumiy energiya sarfi (=)	**2464.2**	**37405.2**	**3511.1**	**316.3**	**425.2**	**96.6**	**1.5**	**4.8**	**0.0**	**227.9**	-	**646.6**	-
Kengaytma	-	-	-	-	-	-	-	-	-	-	-	-	-
Statistik farqlar	-0.5	-0.4	0.0	0.0	-0.1	-	0.4	39.8	-	29.2	-	2.0	-0.06
Elektr stansiyalari	-	-	-	-	-	-	-	-	-	-	-	-	-
Issiqlik elektr stansiyalari	-1321.9	-12130.2	-	-	-1.5	-140.2	-	-	-	-	-	4676.0	1414.9
Issiqlik ta'minoti	-0.5	-567.8	-	-	-0.9	-23.4	-	-	-	-	-	-50.6	1779.0
Gaz qurilmalari	-	-	-	-	-	-	-	-	-	-	-	-	-
Neftni qayta ishlash zavodlari	-	-	-3489.9	1095.7	968.6	168.3	816.4	131.3	35.8	172.4	-	-	-
Ko'mirni qayta ishlash	-23.2	-	-	-	-	-	-	-	-	-	-	-	-
Gazni suyuqlikka va gazni suyultirish	-	-	-	-	-	-	-	-	-	-	-	-	-
Boshqa turdagi yoqilg'ilarni qayta ishlash	-	-384.3	-	-	-	-	-	-	-	-	-	-	-
Energetika sektorining o'z ehtiyojlari	-0.7	-2370.5	-4.5	-	-6.4	-17.0	-16.4	-	-	-2.1	-	-266.2	-
Yo'qotishlar	-0.8	-905.2	-16.7	-4.7	-0.6	-	-0.5	-	-	-	-	-32.1	-179.3
Umumiy iste'mol	**1116.6**	**21408.9**	-	**1407.3**	**1384.3**	**84.3**	**801.4**	**175.9**	**35.8**	**427.4**	-	**4467.0**	**3014.5**
Sanoatga	**186.3**	**4322.3**	-	**1.8**	**55.4**	**15.1**	**2.8**	**3.1**	**35.8**	**14.0**	-	**1572.2**	**429.2**
Tog'-kon sanoatiga	0.1	106.9	-	0.03	5.6	0.00	-	-	-	-	-	42.7	24.2
Kimyo sanoati (neft sanoatidan tashqari)	0.1	1204.2	-	0.87	8.3	0.0	1.1	0.50	-	14.0	-	323.3	44.2
Metallurgiya sanoati	6.9	553.5	-	0.3	27.6	4.8	-	0.1	35.8	-	-	702.9	208.1
Metall bo'lmagan mineral mahsulotlar ishlab chiqarish	175.8	985.2	-	0.03	7.6	9.4	-	0.4	-	-	-	141.9	9.8
Mashinasozlik sanoati	0.0	75.0	-	0.06	0.8	0.8	0.1	0.1	-	-	-	44.5	8.5
Oziq-ovqat, ichimliklar va tamaki mahsulotlari ishlab chiqarish	0.4	311.4	-	0.011	1.0	0.1	0.6	0.46	-	-	-	43.9	67.4
Qog'oz va nashriyot sanoati	0.0	54.0	-	-	0.0	-	-	0.422	-	-	-	3.1	4.6
To'qimachilik, kiyim-kechak, cham va tegishli mahsulotlar sanoati	0.0	252.4	-	-	3.47	0.05	-	-	-	-	-	188.7	21.2
Boshqa sohalar	2.9	779.7	-	0.5	1.1	-	1.0	1.0	-	-	-	81.1	41.2
Transport sohasiga	**3.3**	**2987.6**	-	**1247.1**	**1327.3**	**0.1**	**382.2**	**147.8**	-	-	-	**91.0**	-
temir yo'l transporti	3.3	-	-	2.0	82.5	0.1	-	1.5	-	-	-	32.0	-
avtomobil transporti	-	2541.1	-	1244.0	1244.7	-	382.2	-	-	-	-	-	-
Boshqa transport turlari (suv, havo)	-	-	-	1.1	-	-	-	146.3	-	-	-	5.7	-
Maxsus transport	-	446.5	-	-	-	-	-	-	-	-	-	53.3	-
Avtomobil transporti	-	-	-	-	-	-	-	-	-	-	-	-	-
Boshqa sohalarga	**927.1**	**13374.6**	-	**158.33**	**1.6**	**69.1**	**415.0**	**25.0**	-	**60.2**	-	**2803.9**	**2585.4**
Uy-joy sektoriga	282.4	9675.4	-	-	-	0.5	412.6	0.5	-	-	-	1337.0	1178.8
Qurilish	1.8	-	-	-	-	-	-	-	-	60.2	-	124.5	-
Savdo va davlat tashkilotlari	107.5	2395.0	-	158.23	-	0.1	-	24.5	-	-	-	450.5	1197.1

Figure 2. The interface of the fuel energy balance table.

On this basis, while allowing for the full implementation of the objectives in clauses (a), (b), (c), (f), and (g), each time the energy for the fuel energy resource has been produced over the years or provides an opportunity to learn about the distribution of extracted, consumed, transferred fuel energy resources and (i) use them for the purpose in punk.(a)

(b)

Conclusion

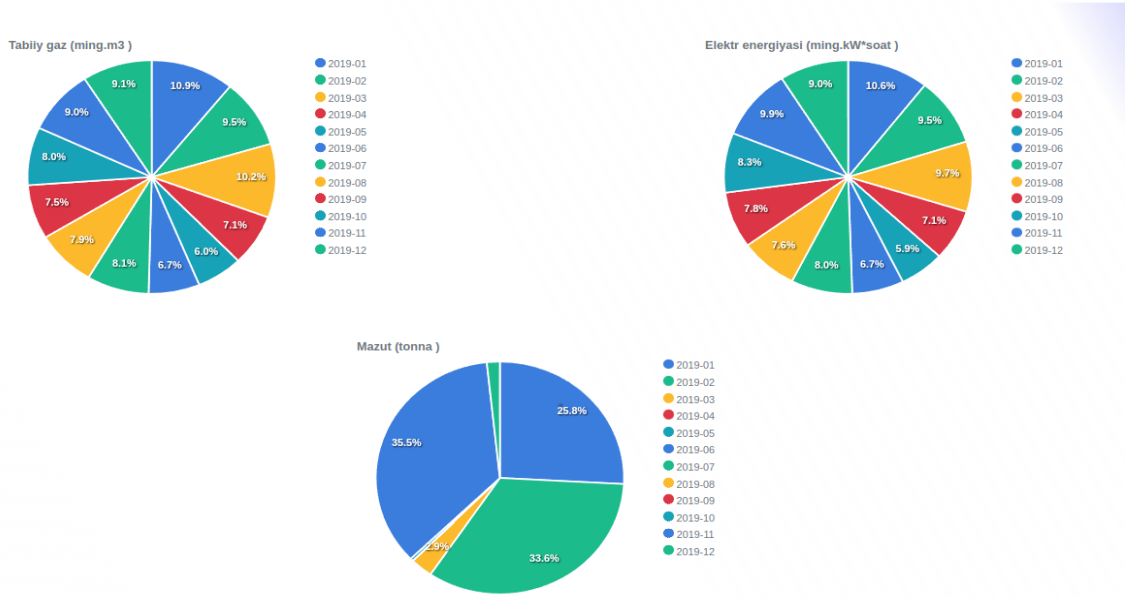

Figure 3. Distribution of fuel energy resources in a) consumption, b)

production by years.

Energy data are generally collected independently across different commodities, such as oil, natural gas or coal. As such, commodity balances provide the simplest way to present the data for one fuel together, expressed in physical units.[5]

Compilation of the fuel and energy balance on the republic scale is considered a very complicated process, and reflecting the process of transition of one resource to another resource in the balance sheet is considered a complex issue. On top of that, the formation of double values in the process of drawing up the fuel energy balance brings uncertainty. For this purpose, as a result of studying the movement cycle of several energy resources during research, a methodology for creating a fuel energy balance and a web system was developed based on this methodology.

As you know, the balance sheet is created based on several goals. The balance sheet built on the basis of this structured methodology can meet the 6 listed points.

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