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# ENERGY BALANCE OF ELECTRICITY AND HEAT, 2004 YEAR

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# Methodological explanations

## Introductory notes

A need for Energetics to be statistically harmonized with standards of European Union and International Energetics Agency (IEA) is a reason for separation of Energy Statistics as a special statistical branch in the Statistical Office of the Republic of Serbia.

The first task of Energy Statistics is making of annual energy balance sheets.

Methodology for making of energetic balances, defining and grouping of energents and types of energy, as well as statistical terminology, are harmonized with internationally established standards: *Principles and methods of energy balance sheets- Series E: Methods-Catalogue No CA-49-87-785-EN-C.*

Making of energy balance sheets is a comprehensive job that will require a plenty of time. During 2005 energy balance sheets were made for electricity and heat energy for the Republic of Serbia (without Kosovo and Metohia) in 2004. Electricity balance sheet has been made in GWh (gigawatt hours) and TJ, and heat energy balance sheets in TJ .

Because most of the producers of heat energy do not posses devices for metering of generated and delivered heat energy, the heat energy balance sheet is made on the basis of their expert estimates.

Methodological explanations shall be supplemented by new information, according to energy balance sheets for:

-all types of coal and energents generated by coal processing

-crude petroleum and refined petroleum products

-natural gas

-biomass

-municipal and industrial waste

-geothermal energy

-solar energy

-wind energy.

Every well-intentioned suggestion referred from a data user will be accepted with pleasure.

### *Reporting units*

Reporting units for electricity balance sheet are:

- producers of electricity: hydro plants, thermal power plants, autoproducer thermal power plants (plants that generate electricity and/or heat energy, and they are to be found in the scope of industrial enterprises which basic activity is not generation of electricity and/or heat energy),
- enterprises for transmission of electricity
- distributors of electricity
- Direction JP Electric Power Industry of Serbia.

Reporting units for heat energy balance sheet are:

- producers of heat energy: thermal power plants, autoproducer thermal power plants (plants that generate electricity and/or heat energy, and they are to be found in the scope of industrial enterprises which basic activity is not generation of electricity and/or heat energy),
- district heating plants
- enterprises for transmission and distribution of heat energy.

### *Method of data collection*

Data indispensable for making of energy balance sheets are collected in annual periodics.

For electricity energy balance sheets making the following questionnaires are been used:

- Questionnaire for hydro plants, IND-4.1, which collects data on production and own consumption of electricity and on received and delivered electricity.
- Questionnaire for thermal power plants and autoproducer thermal power plants that generate electricity or electricity and heat energy, IND-4.2. It collects data on energents spent for generation of electricity and heat energy and on their caloric value; generation, own consumption, losses and delivery of heat energy generation and own consumption of electricity, received and delivered electricity.

- Questionnaire for transmission of electricity, IND-4.3, which collects data on electricity taken over from producers, losses and transmission of electricity and delivered electricity.
- Questionnaire for distributors of electricity, IND-4.4, that collects data on electricity taken over, losses of distribution and on electricity delivered to end users.
- Questionnaire for Directorate JP Electric Power Industry of Serbia.

For making of heat energy energetic balance sheet the following questionnaires are been used:

- Questionnaire for thermal power plants and autoproducer thermal power plants that generate electricity or electricity and heat energy, IND-4.2.
- Questionnaire for district heating plants and autoproducer thermal power plants that produce only heat energy, IND-4.6. It collects data on energents spent for heat energy generation and on their caloric value; generation, own consumption, losses and delivery of heat energy.
- Questionnaire for enterprises dealing with transmission and distribution of heat energy, IND-4.7, that collects data on heat energy supply, losses in transport and delivered heat energy.

### *Contents of rows in energy balance sheet*

***Domestic supply of primary energy,*** for example: petroleum, coal, natural gas, biomass, etc.

***Gross production of converted energy carriers*** includes generation in hydro plants, thermal power plants, district heating plants, refineries and plants for coal processing.

***Import, export, transit, interconnection with neighboring countries and exchange with the Republic of Montenegro*** include quantities that crossed the national border.

***Stocks changes*** is a difference between stocks in the first day of the year (initial stocks) and stocks in the last day of the year (final stocks).

***Marine bunkers*** include quantities delivered for needs of international ships' traffic and international air transport.

***Statistical difference*** is a category that includes sum of unexplained statistical differences between production and consumption for certain energents.

***Total energy supply*** is been calculated in the following way:

Domestic supply of primary energy + Gross production of converted energy carriers + Import – Export +Transit *entrance* –Transit *exit*+ Interconnection with neighboring EEC (electricity systems) *entrance*- Interconnection with neighboring EEC (electricity systems) *exit*+ Received from the Republic of Montenegro - Delivered to the Republic of Montenegro+- Stocks changes –Marine bunkers - Statistical difference.

***Input for conversion (Transformation)*** is consumption of fuel for generation of energy in thermal power plants, district heating plants, refineries and plants for coal processing.

***Consumption by conversion sector*** includes energy consumption for driving purposes in hydro plants, pumps of reversible thermal power plants, hydro plants, thermal power plants, autoproducer thermal power plants, district heating plants, refineries and plants for coal processing.

***Distribution and transfer losses in*** include losses occurred:

- for electricity: at transfer and distribution;
- for heat energy: at transfer and distribution;

***Net supply for use within the country*** presents energy intended for end users. It is been calculated in the following way: Totally disposable energy- Expenses for generation of energy- Own consumption in energy sector- Losses in transfer and distribution.

***Final consumption*** includes final consumption of disposable energy in industry (fields from 13 to 37, except the field 23 Classification of activities), construction (field 45 Classification of activities), transport (fields from 60 to 64 Classification of activities), households, agriculture and at other users (education, public health, administration, etc.).

## Electricity and heat energy

**Electricity:**

Generated in: hydro electric power stations, thermal power plant and autoproducer thermal power plants.

**Heat energy**

Generated in district heating plants, autoproducer thermal power plants and thermal power plants.

Carriers of heat: hot water[1)] to 110C, boiling water[1)] over 110C and steam.

[1)] Reknagel : Heating and air conditioning : Construction book, Year 1987.

## Special characteristics of certain energy balance sheets

**Electricity balance sheet**

All positions *Final consumption of energy* present estimation of distributive organizations of Electric Power Industry of Serbia.

**Heat energy balance sheet**

Most of the heat energy users, because they don't posses devices for metering of generated and delivered heat energy, put lot of effort and they made an expert estimation of data required in our questionnaires.

**We thank to all that with plenty of good will and enthusiasm have helped in preparation of methodology and making of electricity and heat energy balances.**

| Units of measure | |
|---|---|
| GWh | gigawatt hour |
| t | tonne |
| $Stm^3$ | standard cubic meter |
| TJ | terajoule |

| Signs | |
|---|---|
| - | no occurrence |
| ... | data not disposable |
| 0 | data is lower than 0,5 of given unit of measure |

**Balance of Electricity in the Republic of Serbia (without data for Kosovo and Metohia), 2004 year**

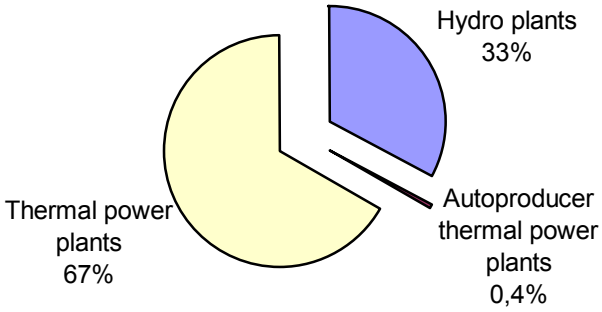
| Supply and consumption | Electricity | |
|---|---|---|
| | GWh | TJ |
| Domestic supply of primary energy | - | - |
| **Gross production of converted energy carriers** | **33874** | **121946** |
| Hydro power plants | 11121 | 40036 |
| Thermal power plants | 22618 | 81424 |
| Autopr.thermal power plants | 135 | 486 |
| District heating plants | - | - |
| Refineries | - | - |
| Coal transformation | - | - |
| Imports[1)] | 11232 | 40436 |
| Exports[2)] | 12045 | 43362 |
| Stock changes | - | - |
| Marine bunkers | - | - |
| Statistical difference | - | - |
| **Total energy supply** | **33061** | **119020** |
| **Input for conversion (Transformation)** | **-** | **-** |
| Thermal power plants | - | - |
| Autoproducer thermal power plants | - | - |
| District heating plants | - | - |
| Refineries | - | - |
| Coal transformation | - | - |
| **Consumption by conversion sector** | **4654** | **16754** |
| Hydro power plants | 57 | 205 |
| Pump storage | 801 | 2884 |
| Thermal power plants | 1955 | 7038 |
| Autoproducer thermal power plants | 6 | 22 |
| District heating plants | 1144 | 4118 |
| Refineries | 143 | 515 |
| Coal transformation | 548 | 1973 |
| **Distribution and transfers losses** | **5633** | **20279** |
| **Net supply for use within the country** | **22774** | **81986** |
| **Final consumption [3)]** | **22774** | **81986** |
| Industry | 4949 | 17816 |
| Construction | 318 | 1145 |
| Transport | 239 | 860 |
| Household | 13832 | 49795 |
| Agriculture | 1068 | 3845 |
| Other | 2368 | 8525 |

[1)] Import+Transfers (entrance)+Interconnection with other Electricity Energy Sistems (entrance)+Received from the Republic of Montenegro.
[2)] Export+Transfers (exit)+Interconnection with other Electricity Energy Sistems (exit)+Given to the Republic of Montenegro.
[3)] Final consumption is estimated by Organization of electricity distribution.

**Generation and final consumption of electricity**

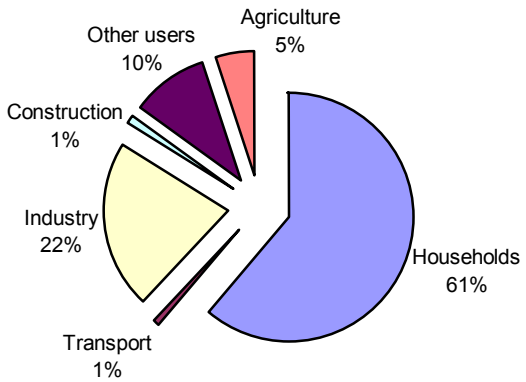
33874 GWh of electricity was generated in the year 2004. The greatest production of electricity was realized in thermal power plants, 67%, than in hydro power plants 33%, while in autoproducer thermal power plants the realized production was 0,4%.

*Generation of electricity*




In final consumption of electricity in 2004 participate mostly households with 61%, than industry with 22%, other users with 10%, agriculture with 5%, while construction and transport participate with 1% each.

*Final consumption of electricity*



**Balance of Heat in the Republic of Serbia (without data for Kosovo and Metohia), 2004 year**

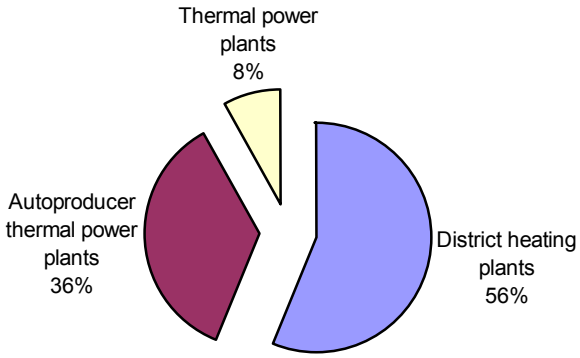
| Supply and consumption [1)] | Heat TJ |
|---|---|
| Domestic supply of primary energy | - |
| **Gross production of converted energy carriers** | **40898** |
| Hydro power plants | - |
| Thermal power plants | 3497 |
| Autoproducer thermal power plants | 14687 |
| District heating plants | 22714 |
| Refineries | - |
| Coal transformation | - |
| Imports | - |
| Exports | - |
| Stock changes | - |
| Marine bunkers | - |
| Statistical difference | - |
| **Total energy supply** | **40898** |
| **Input for conversion (Transformation)** | **-** |
| Thermal power plants | - |
| Autoproducer thermal power plants | - |
| District heating plants | - |
| Refineries | - |
| Coal transformation | - |
| **Consumption by conversion sector** | **6058** |
| Hydro power plants | - |
| Pump storage | - |
| Thermal power plants | 163 |
| Autoproducer thermal power plants | 3766 |
| District heating plants | 2129 |
| Refineries | - |
| Coal transformation | - |
| **Distribution and transfers losses** | **2747** |
| **Net supply for use within the country** | **32093** |
| **Final consumption** | **32093** |
| Industry | 14231 |
| Construction | - |
| Transport | - |
| Household | 15608 |
| Agriculture | - |
| Other | 2254 |

[1)] Supply and consumption are estimated by heat producers, because a lot of them do not have measure equipment

## Generation and final consumption of heat energy

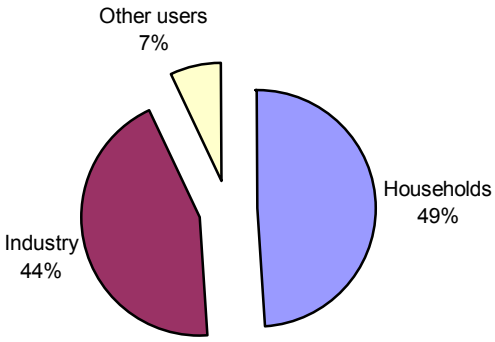
40898TJ of heat energy was generated in the year 2004. The greatest production of heat energy was realized in district heating plants, 56%, than in autoproducer thermal power plants, 36% and in thermal power plants the realized production was 8%.

*Generation of heat energy*




In final consumption of heat energy in 2004 participate mostly households with 49%, than industry with 44%, while participation of other users amounts to 7%.

*Final consumption of heat energy*



**Fuel consumption for production of Electricity and Heat in the Republic of Serbia (without data for Kosovo and Metohia), 2004 year**

| Fuel name | Total | Thermal power plants | Autoproducer thermal power plants | District heating plants |
|---|---|---|---|---|
| **Hard coal, t** | 57813 | 29974 | 13240 | 14599 |
| **Brown coal, t** | 245664 | 81563 | 42513 | 121588 |
| **Lignite, t** | 30829082 | 30762048 | 53646 | 13388 |
| **Dry lignite, t** | 119063 | - | 87599 | 31464 |
| **Gas/diesel oil, t** | 41146 | 5599 | 10011 | 25536 |
| **Residual fuel oil, t** | 7615117 | 154152 | 2264624 | 5196341 |
| **Natural gas, Stm$^3$** | 794283113 | 76005806 | 225645576 | 492631731 |
| **Liquefied Petroleum Gas, t** | 37 | 29 | 4 | 4 |
| **Blast Furnace Gas, Stm$^3$** | 624171 | - | 624171 | - |
| **Wood / Wood wastes, t** | 86733 | - | 85543 | 1190 |
| **Industrial wastes, t** | 20891 | - | 20891 | - |

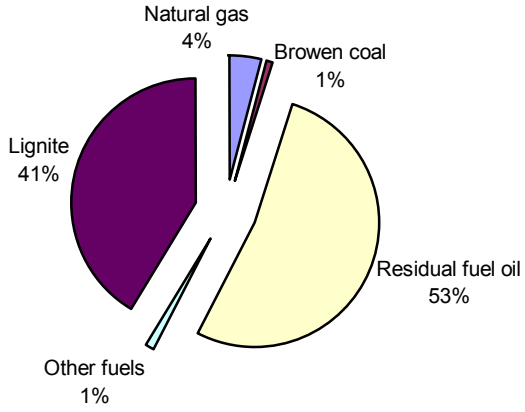
**Calorific value of consumed fuel or production of Electricity and Heat in the Republic of Serbia (without data for Kosovo and Metohia), 2004 year**

| Fuel name | Total | power plants | thermal power plants | plants |
|---|---|---|---|---|
| **Hard coal, TJ** | 1028 | 439 | 252 | 337 |
| **Brown coal, TJ** | 3221 | 779 | 575 | 1867 |
| **Lignite, TJ** | 241001 | 240494 | 305 | 202 |
| **Dry lignite, TJ** | 1520 | - | 1443 | 77 |
| **Gas/diesel oil, TJ** | 1737 | 235 | 413 | 1089 |
| **Residual fuel oil, TJ** | 305741 | 6206 | 89861 | 209674 |
| **Natural gas, Stm$^3$** | 26004 | 2508 | 7446 | 16050 |
| **Liquefied Petroleum Gas, TJ** | 0 | 0 | 0 | 0 |
| **Blast Furnace Gas, Stm$^3$** | 667 | - | 667 | - |
| **Wood / Wood wastes, TJ** | 1471 | - | 1460 | 11 |
| **Industrial wastes, TJ** | ... | - | ... | - |

**Consumption of fuel for production of electricity and heat energy (caloric value)**

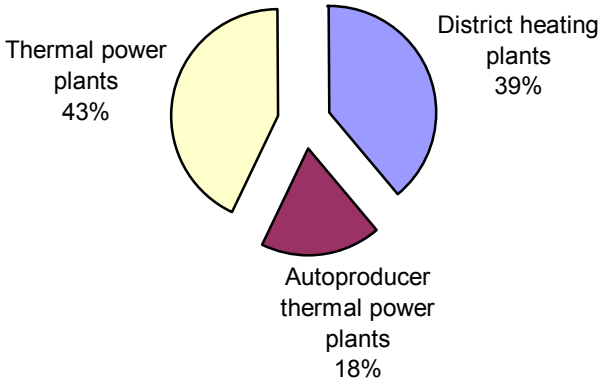
In 2004 for generation of electricity and heat energy residual fuel oil was most consumed, 52%, than lignite, 41%, natural gas, 4%, brown coal, 1%, while consumption of other fuels amounts to 1% (diesel and heating fuel, dried lignite, hard coal, firewood and wooden and plant waste and blast furnace gas)

*Fuel consumption by types*




Of totally consumed fuel for generation of electricity and heat energy the biggest consumption had district heating plants, 39%, than thermal power plants, 43% and autoproducer thermal power plants consumed 18% of fuel.

*Fuel consumption by plants*



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