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ENERGY BALANCE OF ELECTRICITY AND HEAT, 2004 AND 2005

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Methodological explanations

Introductory notes

A need for Energetic to be statistically harmonized with standards of European Union and International Energetic 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 work that will require a plenty of time. During 2006 energy balance sheets were made for electricity and heat energy for the Republic of Serbia (without Kosovo and Metohia) in 2005, as well as some corrections of data regarding electricity and heat energy balance sheets for 2004, obtained in the scope of a pilot project. Electricity balance sheet has been made in GWh (giga watt hours) and TJ, and heat energy balance sheet 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 a pleasure.

Reporting units

Reporting units for electricity balance sheet are:

- producers of electricity: hydro plants, thermal power plants, auto-producers (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),
- Serbian Transmission System
- Regional distributors of electricity and
- Direction JP Electric Power Industry of Serbia.

Reporting units for heat energy balance sheet are:

- producers of heat energy: thermal power plants, auto-producers (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 periodic.

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 auto-producers 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 distributors of electricity, IND-4.4, that collects data on electricity taken over, losses while distributing electricity and on electricity delivered to end users.
- Questionnaire for Directorate JP Electric Power Industry of Serbia, IND-4.5, that collects summary data on the level of electrical industry of Serbia.

- Data on electricity that crossed the national border are been taken over from Serbian Transmission System.

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

- Questionnaire for thermal power plants and auto-producers that generate electricity or electricity and heat energy, IND-4.2.
- Questionnaire for district heating plants and auto-producers that produce only heat energy, IND-4.6. It collects data on energents spent for heat energy generation and on their calorific 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, CHP, district heating plants, refineries and plants for coal processing.

Import, export 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:

Primary energy generation + Gross production of converted energy carriers + Import –Export +- Stock changes- Marine bunkers- Statistical difference.

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

Distribution and transfer losses 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 auto-producers.

Heat energy

Generated in district heating plants, auto-producers and thermal power plants.

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

Special characteristics of certain energy balance sheets

Electricity balance sheet

Data on electricity that crossed the national border are been taken over from the Serbian Transmission System

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

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

Derived indicators

Electricity generation by inhabitant is calculated in the following way:

(Totally generated electricity+ Imports+ Exports-Losses in transmission and distribution)

Energy efficiency in thermal-electrical and heat energy is calculated in the following way: (Generated thermal-electrical energy in TJ +Generated heat energy in TJ)/ Fuel spent for thermal-electrical and heat energy generation in TJ) *100.

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	gig watt hour
t	ton
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

[2)] Estimation of inhabitants′ number was made in the middle of the year at the Statistical Office of the Republic of Serbia.

Balance of Electricity in the Republic of Serbia

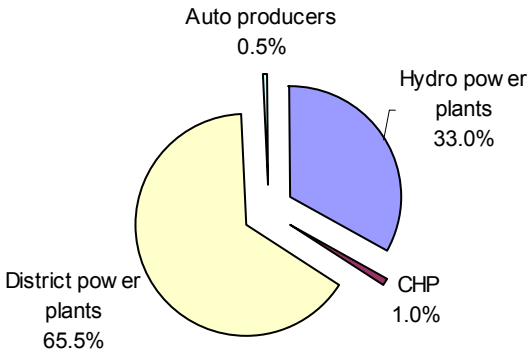
Supply and consumption	Electricity, GWh		Electricity , TJ	
	2004	2005	2004	2005
Domestic supply of primary energy	-	-	-	-
Gross production of converted energy carriers	**33874**	**36474**	**121946**	**131306**
Hydro power plants [1)]	11121	12032	40036	43315
Thermal power plants	22166	23873	79798	85943
CHP	452	381	1627	1372
Auto-producers	135	188	486	677
District heating plants	-	-	-	-
Refineries	-	-	-	-
Coal mines	-	-	-	-
Coal transformation	-	-	-	-
Imports	5975*	6751	21510*	24304
Exports	6248*	8694	22493*	31298
Stock changes	-	-	-	-
Marine bunkers	-	-	-	-
Statistical difference	-	-	-	-
Total energy supply	**33601***	**34531**	**120964***	**124312**
Input for energy generation	**-**	**-**	**-**	**-**
Thermal power plants	-	-	-	-
CHP	-	-	-	-
Auto-producers	-	-	-	-
District heating plants	-	-	-	-
Refineries	-	-	-	-
Coal mines	-	-	-	-
Coal transformation	-	-	-	-
Own consumption in energy sector	**3301***	**3519**	**11884***	**12668**
Hydro power plants	57	51	205	184
Pump storage	801	962	2884	3463
Thermal power plants	1511*	1735	5440*	6246
CHP	55	46	198	166
Auto-producers	6	33	22	119
District heating plants	180*	186	648*	670
Refineries	143	122	515	439
Coal mines	548	384	1973	1382
Coal transformation	-	-	-	-
Distribution and transfers losses	**5633**	**5349**	**20279**	**19256**
Energy disposable for final consumption	**24667***	**25663**	**88801***	**92387**
Final consumption	**24667***	**25663**	**88801***	**92387**
Industry	5687*	5757	20473*	20725
Construction	318	297	1145	1069
Transport	239	246	860	886
Households	13626*	14191	49054*	51088
Agriculture	207*	216	745*	778
Other consumers	4590*	4956	16524*	17842

[1)] Reversible hydro power plants also included, also.

Generation and final consumption of electricity

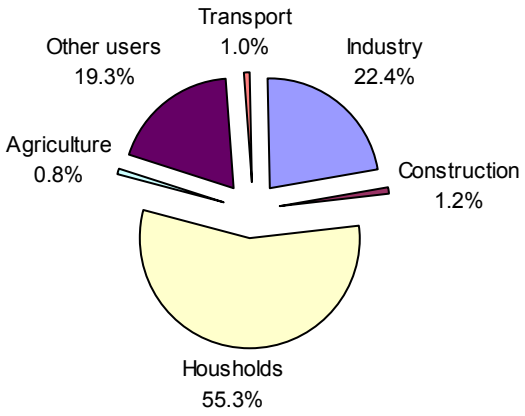
36474 GWh of electricity was generated in the year 2005. The greatest production of electricity was realized in thermal power plants, 65.5%, than in hydro power plants 33%, while in CHP the realized production was 1% and auto-producers realized 0,5%.

Generation of electricity



In final consumption of electricity in 2005 participate mostly Households with 55.3%, than Industry with 22.4% other users with 19.3%, Agriculture with 0.8%, while Construction participate with 1.2% and Transport participate with 1%.

Final consumption of electricity



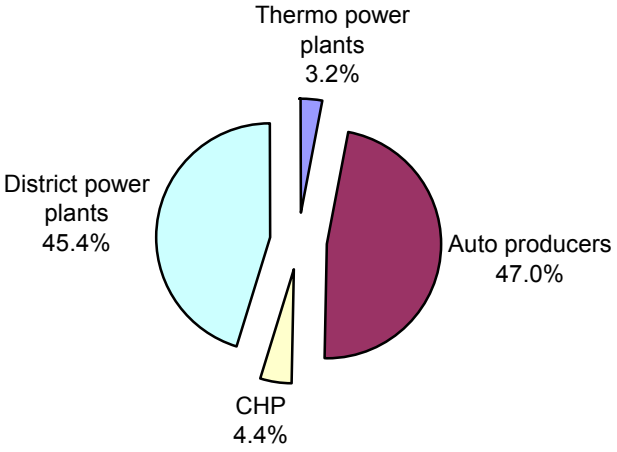
Balance of Heat in the Republic of Serbia

Supply and consumption [1)]	**Heat** , TJ	
	2004	2005
Domestic supply of primary energy	-	-
Gross production of converted energy carriers	**49206***	**48799**
Hydro power plants	-	-
Thermal power plants	1279	1543
CHP	2218	2163
Auto-producers	22900*	22947
District heating plants	22809*	22146
Refineries	-	-
Coal mines	-	-
Coal transformation	-	-
Imports	-	-
Exports	-	-
Stock changes	-	-
Marine bunkers	-	-
Statistical difference	-	-
Total energy supply	**49206***	**48799**
Input for conversion (Transformation)	-	-
Thermal power plants	-	-
CHP	-	-
Auto-producers	-	-
District heating plants	-	-
Refineries	-	-
Coal mines	-	-
Coal transformation	-	-
Own consumption in energy sector	**2292***	**1018**
Hydro power plants	-	-
Pump storage	-	-
Thermal power plants	**...**	17
CHP	163	89
Auto-producer thermal power plants	-*	-
District heating plants	2129	912
Refineries	-	-
Coal mines	-	-
Coal transformation	-	-
Distribution and transfers losses	**2787***	**2927**
Energy disposable for final consumption	**44127***	**44854**
Final consumption	**44127***	**44854**
Industry	25137*	25181
Construction	-	-
Transport	-	-
Households	16247*	16397
Agriculture	195*	219
Other consumers	2548*	3057

Generation and final consumption of heat energy

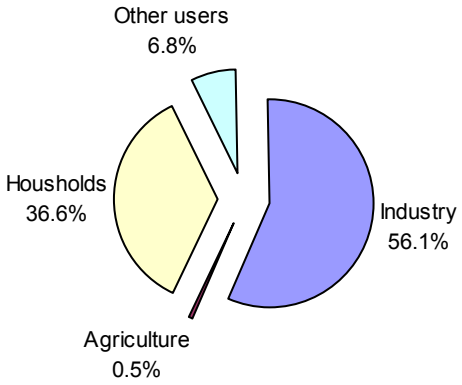
48799 TJ of heat energy was generated in the year 2005. The greatest production of heat energy was realized in auto-producers, 47%, than in district heating plants, 45.4%. In CHP was realized 4.4% and in thermal power plants the realized production was 3.2%.

Generation of heat energy



In final consumption of heat energy in 2005 participate mostly Industry with 56,1%, than households with 36.6%, while participation of other users amounts to 6.8% and Agriculture with 0.5%.

Final consumption of heat energy



Fuel consumption for Electricity and Heat production in the Republic of Serbia, 2004

Fuel name	Total	Thermal power plants	CHP	Auto-producers	District heating plants
Hard coal, t	57813	29974	-	13240	14599
Brown coal, t	247091*	81043	520	44920*	120608*
Lignite, t	31038762*	30762048	-	263646*	13068*
Dry lignite, t	117978*	-	-	87593	30385*
Gas/diesel oil, t	14071*	5599	-	7675*	797*
Residual fuel oil, t	418326*	56234	97909	157334*	106849*
Natural gas, Stm^3	890855682*	-	76005806	302281123*	512568753*
Liquefied Petroleum Gas, t	33*	29	-	4	-*
Blast Furnace Gas, $000Stm^3$	624171	-	-	624171	-
Wood / Wood wastes, t	10861*	-	-	9671*	1190*
Industrial wastes, t	20891*	-	-	20891*	-

Calorific value of consumed fuel (in TJ) for Electricity and Heat production in the Republic of Serbia, 2004

TJ

Fuel name	Total	Thermal power plants	CHP	Auto-producers	District heating plants
Hard coal	1028	439	-	252	337
Brown coal	3237*	772	7	607*	1851*
Lignite	242559*	240251	-	2111*	197*
Dry lignite	1943*	-	-	1443	500*
Gas/diesel oil	590*	235	-	322*	33*
Residual fuel oil	16731*	2249	3916	6293*	4273*
Natural gas	29397*	-	2508	9975*	16914*
Liquefied Petroleum Gas	2*	2*	-	0	-
Blast Furnace Gas	2372*	-	-	2372*	-
Wood / Wood wastes	...	-	-	...	...
Industrial wastes	...	-	-	...	-
Total	297864*	243948*	6432	23376*	24108*

Fuel consumption for Electricity and Heat production in the Republic of Serbia, 2005

Fuel name	Total	Thermal power plants	CHP	Auto-producers	District heating plants
Hard coal, t	80908	61337	-	2965	16606
Brown coal, t	328824	127427	-	56914	144483
Lignite, t	32238225	31933980	-	287941	16304
Dry lignite, t	77518	-	-	40237	37281
Gas/diesel oil, t	13655	6368	-	6443	844
Residual fuel oil, t	499899	60415	107369	208788	123327
Natural gas, Stm^3	907212118	-	78218577	284015806	544977735
Liquefied Petroleum Gas, t	62	31	-	31	-
Blast Furnace Gas, $000Stm^3$	777266	-	-	777266	-
Wood / Wood wastes, t	36374	-	-	34302	2072
Industrial wastes, t	31488	-	-	31488	-

Calorific value of consumed fuel (in TJ) for Electricity and Heat production in the Republic of Serbia, 2005

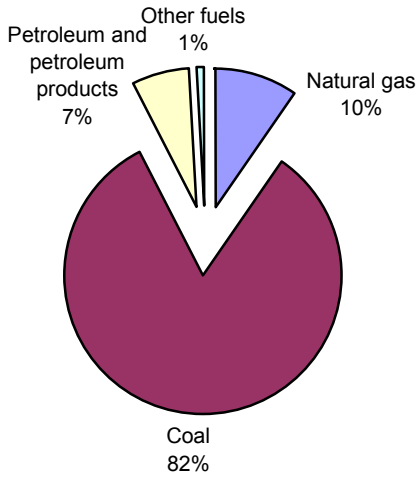
TJ

Fuel name	Total	Thermal power plants	CHP	Auto-producers	District heating plants
Hard coal	1211	779	-	68	364
Brown coal	4290	1352	-	879	2059
Lignite	253230	250144	-	2849	237
Dry lignite	1226	-	-	617	609
Gas/diesel oil	572	268	-	269	35
Residual fuel oil	20050	2365	4390	8385	4910
Natural gas	30444	-	2597	9684	18163
Liquefied Petroleum Gas	3	2	-	1	-
Blast Furnace Gas	2954	-	-	2954	-
Wood / Wood wastes	...	-	-	...	...
Industrial wastes	...	-	-	...	-
Total	313980	254910	6987	25706	26377

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

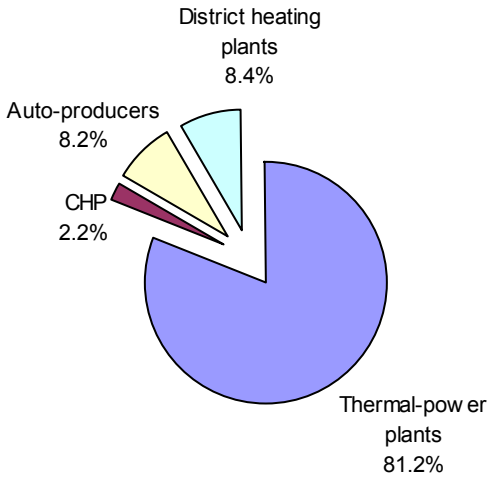
In 2005 for generation of electricity and heat energy coal was most consumed, 82%, than natural gas, 10%, petroleum and petroleum products 7%, while consumption of other fuels amounts to 1%.

Fuel consumption by types



Of totally consumed fuel for generation of electricity and heat energy the biggest consumption had thermal power plants, 81.2%, than district heating plants 8.4% , auto-producers consumed 8,2% and CHP consumed 2.2% of fuel.

Fuel consumption by plants



Derived indicators

Electricity consumption by employee in the Republic of Serbia

	KWh
2004	3747
2005	3922

Energy efficiency in thermal electric energy and thermal energy generation in the Republic of Serbia

	%
2004	44,0
2005	43,6

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