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press release

INSTITUTO NACIONAL DE ESTATÍSTICA
STATISTICS PORTUGAL

15 November 2017

Physical Flow Energy Account
2000-2015

Between 2000 and 2015, the energy intensity of the Portuguese economy decreased by 13.7% and households reduced their energy use *per capita* by 15.4%

Between 2000 and 2015, domestic energy use decreased by 11.1%, contrasting with an increase in the Gross Domestic Product (GDP) of 3.0% in volume. This evolution resulted in a 13.7% reduction in energy intensity. The households reduced their energy use *per capita* by 15.4%.

In the energy sector, the share of renewable energy inputs in the electricity generation increased from an average of 17.8% in the five-year period 2000-2004, to 34.6% in the five-year period 2011-2015. There was also a significant increase of 254.0% in energy exports in the same period, mainly as a result of investments in the refining system, as well as a reduction in energy dependence (on average from 84.7% in the five-year period 2000-2004 to 73.9% in the five-year period 2011-2015).

Statistics Portugal releases, for the first time, the Physical Energy Flows Account (PEFA), for the period from 2000 to 2015. Detailed tables are available in Statistics Portugal website, in the area of dissemination of the National Accounts (section of the Satellite Accounts).

PEFA establishes an accounting system that allows the complete and consistent recording of supply and use of physical energy flows, measured in Joules (J)[1], between the environment and the economy (industries, households and the rest of the world). This project's reference is the System of European Environmental Economic Accounts (SEEA).

PEFA presents results for energy supply and use by branch of activity, compatible with national accounting criteria, allowing the economic and environmental analysis and guaranteeing the fundamental principle of mass and energy conservation, ensuring equality of supply and use for all physical flows within the system.

This press release is organized in four parts: 1. Analysis of supply and use of energy in the national economy; 2. Emission-relevant use of energy; 3. Economic-environmental indicators (direct comparison of physical and economic data, with the objective of measuring the energy and environmental efficiency of the economy); 4. Comparisons within the European Union (EU).

[1] Note: Joule is the energy unit from the International System of Units; in this press release the units are presented in multiples (MJ – Megajoule, GJ – Gigajoules, TJ – Terajoules).

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1. Energy supply (origin) and use (destination)

PEFA comprises three generic types of physical energy flows, having as reference:

- **Natural energy inputs -** energy flows from the environment into the economy. They include all physical energy inputs originating in the environment (such as energy mineral resources) or directly incorporated into production processes (such as the sun or wind);
- **Energy products -** goods and services that result from economic activity (produced domestically or imported). The scope of products included in physical flows accounts is normally limited to **products with monetary value**. They are **subdivided into primary energy products** (those produced directly from the extraction or capture of energy resources from the environment) and **secondary energy products** (resulting from the transformation of energy products, primary or secondary into new energy products). Energy products may be used for non-energy purposes (eg. petroleum products used in the production of bitumen, lubricants or plastics);
- **Energy residuals –** flows of solid, liquid and gaseous materials, and energy, which return to the environment or are recovered from the environment (produced by the industries and households through production, consumption or resulting from accumulation processes). They include renewable and non-renewable waste, the release of energy (energy losses) of all types (during extraction, distribution, storage and processing, as well as heat dissipated in the final uses) and the energy incorporated in products of non-energy use (eg plastics).

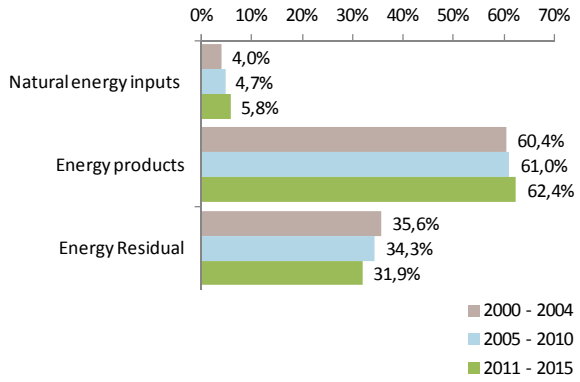
PEFA is compiled in an accounting system called the Physical Supply and Use Tables (PSUT), consisting of two tables:

- The **physical supply table** records the energy flows by origin: 1) supply of energy products by the producing industries and residuals generated by industries; 2) residuals generated by private households; 3) accumulation (residuals from scrapping and demolition of produced assets and emissions from controlled landfill sites); 4) rest of the world (imports of products and residuals received); and 5) environment;
- The **physical use table** records the energy flows by its destination: 1) intermediate use of energy products, natural energy inputs received, i.e. extracted, by the industries, and collection and treatment of residuals; 2) household final consumption (which is subdivided into the subclasses transport, air conditioning and other); 3) accumulation (change of physical stocks of energy products that constitute fixed assets and changes in inventories - gross capital formation - and accumulation of waste); 4) rest of the world (exports of products and residuals sent); and 5) environment.

1.1. Energy supply (origin) in Portugal

The analysis of national energy supply, by flow type, reflects a structure composed mainly of energy products (60.4% on average in the five-year period 2000-2004 and 62.4% in the five-year period 2011-2015), followed by energy residuals (35.6% in the five-year period 2000-2004 to 31.9% in the five-year period 2011-2015), and only a small share of natural energy inputs (4.0% in the five-year period 2000-2004 and 5.8% in the five-year period 2011-2015).

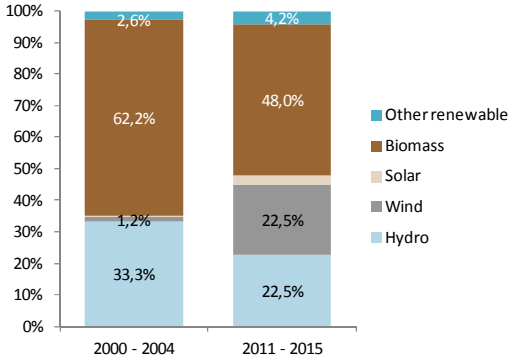
Chart 1 **Energy supply by flow type**



1.1.1. Natural energy inputs

Natural energy inputs averaged in the 2000-2004 and 2011-2015 five-year periods, respectively, 126,952.8 TJ and 176,250.8 TJ. There was a significant increase in the relative importance of wind energy that went from 1.2% to 22.5% of natural energy inputs, between 2000-2004 and 2011-2015 five-year periods. Solar energy also showed an increase, less expressive (from 0.7% to 2.7%). On the contrary, there was a reduction in the relative importance of biomass (from 62.2% to 48.0%) and from hydropower (from 33.3% to 22.5%). It should be noted that the relevance of hydro energy is naturally dependent on rainfall in each period.

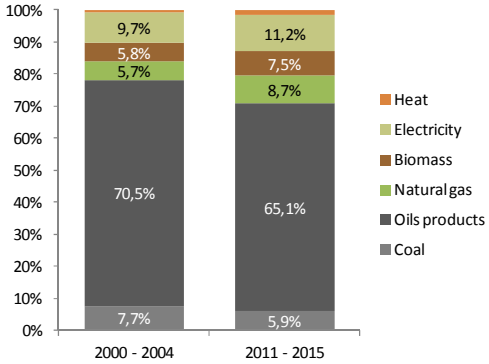
Chart 2 **Evolution of the natural energy inputs structure**



1.1.2. Energy products

Energy products accounted for an average of 1,902,525.4 TJ and 1,911,476.7 TJ in the quinquennials 2000-2004 and 2011-2015, respectively. Although petroleum products continue to prevail in the energy product structure (70.5% in the period 2000-2004 and 65.1% in the period 2011-2015), there has been a structural change, with an increase in the relative importance of electricity, natural gas and biomass (biomass products such as briquettes).

Chart 3 **Evolution of the energy products structure**



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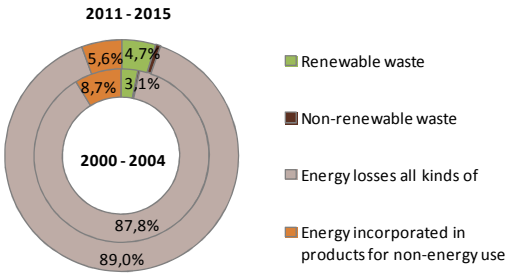
1.1.3. Energy residuals

In the five-year periods 2000-2004 and 2011-2015, energy residuals were, on average, 1,121,136.8 TJ and 976,503.6 TJ, respectively. Energy losses for the environment were the most important component (87.8% in the five-year period 2000-2004 and 89.0% in the five-year period 2011-2015). In the same periods, the relative importance of renewable waste[2] increased (from 3.1% to 4.7%) and there was a reduction of energy incorporated in products for non-energy use (from 8.7% to 5.6%).

Chart 4 **Evolution of the energy residuals structure**



1.2. Energy use (destination) in Portugal

Circumscribing the analysis of the energy use (destination) by the main economic activities and by the households (Chart 5), it is possible to observe that:

1) energy transformation activities, namely the manufacture of coke and refined petroleum products (NACE C19) and the electricity, gas, steam and air conditioning supply (NACE D) were the main users of energy. There was an increase in relative importance, from the first to the last five-year periods under review, from 31.2% to 33.9% of NACE C19 and from 18.4% to 20.5% of NACE D;

2) other industries with relevant energy use showed different behaviors: for example, the relative importance increased (from 4.2% to 5.3%) in the manufacture of paper and paper products and printing (NACE C17-C18); decreased (from 4.7% to 2.8%) in the manufacture of other non-metallic mineral products (NACE C23); and maintained its relative weight (4.7%) in the manufacture of chemicals and chemical products, of basic pharmaceutical products and pharmaceutical preparations and of rubber and plastic products (NACE C20-C22);

3) agriculture, forestry and fisheries (NACE A) reduced their relative importance from 5.5% to 5.2%;

4) transportation and storage (NACE H) reduced their relative weight from 5.3% to 5.2%;

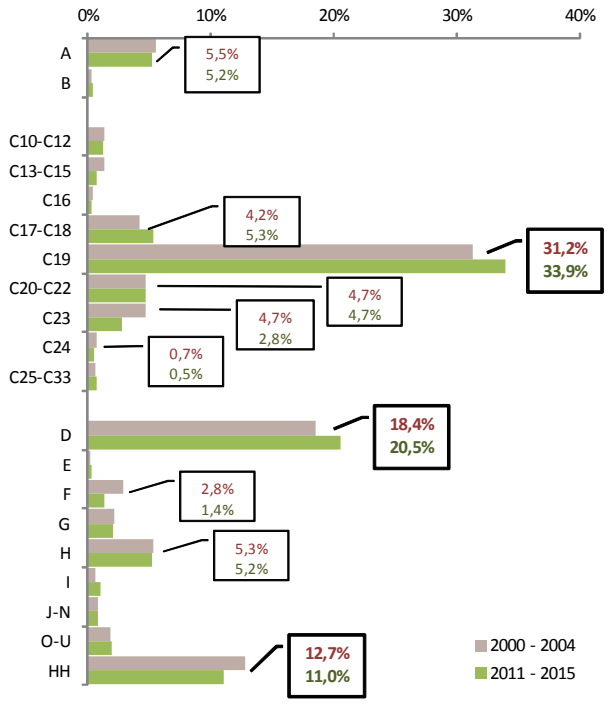
5) construction (NACE F) reduced its weight from 2.8% to 1.4%;

6) the relative importance of household energy use decreased from 12.7% to 11.0%.

The comparison between the Gross Value Added (GVA) and the energy use structures (Chart 6) shows that service activities, less energy consuming, have gained relative importance in the national economy, to the detriment of the energy consuming activities, such as industrial activities and electricity generation. This change in the production structure conditioned the profile and evolution of the national energy consumption.

[2] Renewable waste includes: biologic material produced by households and industries and byproducts of pulp production (black liquor).

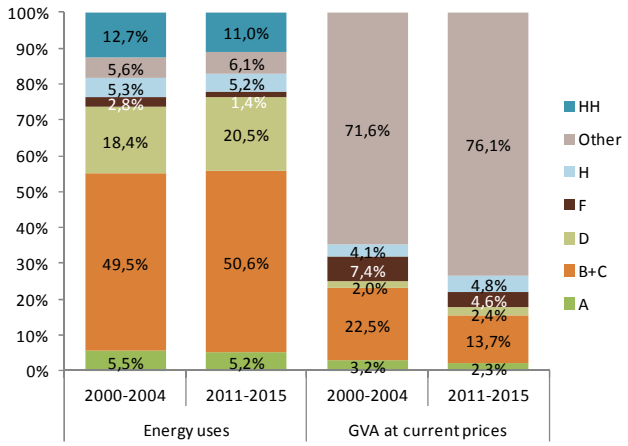
Chart 5 **Energy uses by NACE activities and households (HH)**



Legend:

A Agriculture, forestry and fishing
B Mining and quarrying
C Manufacturing
C10-C12 Manufacture of food products, beverages and tobacco
C13-C15 Manufacture of textiles, wearing apparel and leather products
C16 Manufacture of wood and of products of wood and cork, except furniture
C17-C18 Manufacture of paper and paper products and printing
C19 Manufacture of coke and refined petroleum products
C20-C22 Manufacture of chemicals and chemical products, of basic pharmaceutical products and pharmaceutical preparations and of rubber and plastic products
C23 Manufacture of other non-metallic mineral products
C24 Manufacture of basic metals
C25-C33 Others
D Electricity, gas, steam and air conditioning supply
E Water supply; sewerage, waste management and remediation activities
F Construction
G Wholesale and retail trade; repair of motor vehicles and motorcycles
H Transportation and storage
I Accommodation and food service activities
J-N Information and communication, financial and insurance activities, real estate activities, professional, scientific and technical activities and administrative and support service activities
O-U Public administration and defence; compulsory social security, education, human health and social work activities, arts, entertainment and recreation, other service activities, activities of households as employers and Activities of extraterritorial organisations and bodies
HH Households

Chart 6 **Energy uses and GVA structure**



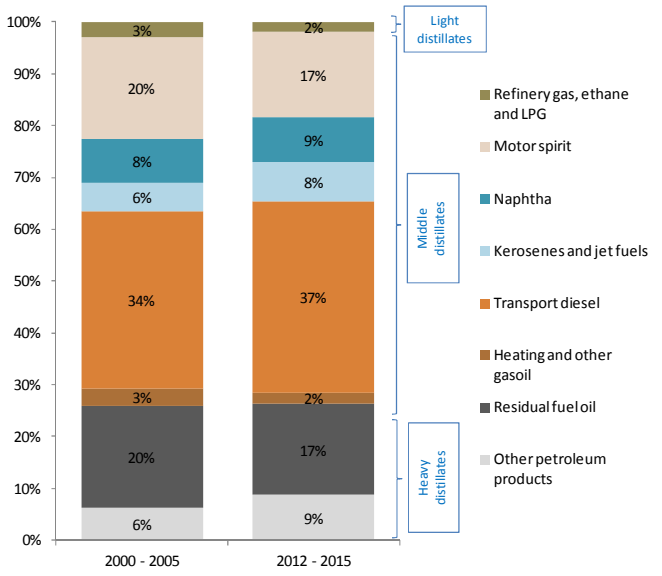
1.2.1. Energy flows for transformation use

Energy flows for transformation use to generate new energy flows are fundamentally for the manufacture of coke and refined petroleum products and for the Electricity, gas, steam and air conditioning supply.

1.2.1.1. Manufacture of coke and refined petroleum products (C19)

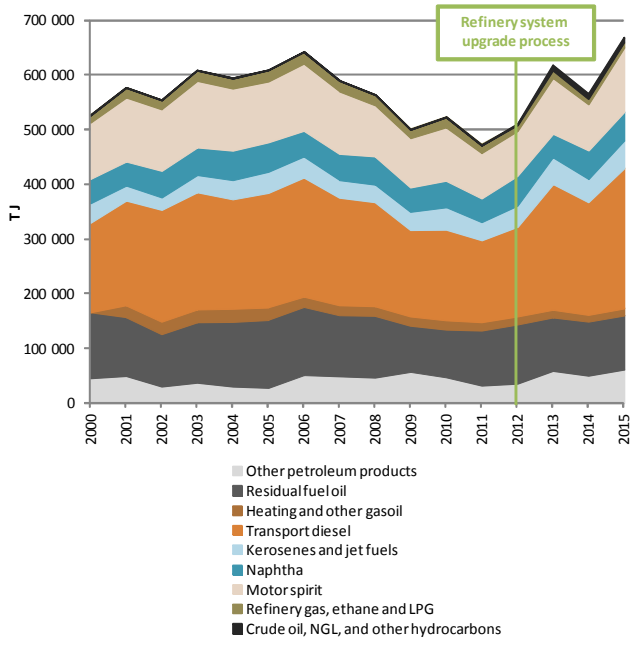
The national refining sector, made up of two refineries in Sines and Matosinhos, has made significant investments in the last decade, aiming at greater adaptation to markets and greater articulation with the petrochemical industry. The refinery mix changed over the period under review, with an increase in the production of middle distillates, namely gas oils, aviation fuels (kerosene and jet fuels) and naphtha.

Chart 7 **Oil products mix for Manufacture of coke, and refined petroleum products (C19)**



In particular, the national refining apparatus was the subject of an upgrade process in 2012, with effects starting in 2013. The reduction in supply observed in 2014 was due to a scheduled stoppage at the Sines refinery, re-establishing normal operation in 2015.

Chart 8 **Evolution of the supply of the Manufacture of coke and refined petroleum products (C19)**[3]



[3] Note: LPG - Liquefied Petroleum Gas (butane and propane); NGL – Natural Gas Liquefied

1.2.1.2. Electricity, gas, steam and air conditioning supply (D)

The composition of the physical energy flows to supply the electricity generation sector has traditionally been affected by rainfall, as measured by the annual hydro capability factors and, more recently, by the wind regime as measured by the annual wind capability factors. In the driest years, with hydro capability factors below the unit (2005, 2008, 2012 and 2015 - see following charts), there is an increase in the electricity generation through thermal, with the corresponding increase in the use of fossil fuels.

Table 1 - **Evolution of the energy flows for transformation use in the electricity sector**

Unit: TJ	2000-2004	2005-2010	2011-2015	rate of change 2015/2000	rate of change 2015/2000
NATURAL ENERGY INPUTS					
Hydro based renewable	42,299	34,234	39,687	-23.5%	83.0%
Wind based renewable	1,511	6,383	41,789	6809.5%	**554.7%**
Solar based renewable	830	950	6,226	704.8%	**555.5%**
Biomass based renewable	19	44	370	2542.9%	740.9%
Other renewable	3,353	2,749	7,829	168.0%	184.8%
ENERGY PRODUCTS					
Hard coal	133,882	138,955	136,059	1.6%	-2.1%
Natural gas (without bio)	51,453	96,663	90,119	75.1%	-6.8%
Transport diesel (without bio)	1,083	1,083	906	-16.4%	-16.4%
Residual fuel oil	72,320	78,210	9,560	**-86.8%**	-87.8%
Refinery gas, ethane and LPG	693	1,188	670	-3.3%	-43.6%
Wood, wood waste and other solid biomass, charcoal	7,551	8,713	25,376	**236.1%**	190.1%
ENERGY RESIDUALS					
Renewable waste	3,682	4,713	7,165	**94.6%**	52.0%
Non-renewable waste	3,647	4,444	4,156	14.0%	-6.5%

Between 2000 and 2015 stands out:

- A sharp reduction in the use of fuel oil (86.8%), replaced by the use of other fossil fuels such as coal and natural gas;

- Greater share of renewable resources, such as wind and solar photovoltaic, in electricity generation, especially from 2005;
- An increase in the use of wood, wood waste and other solid biomass exceeding 230%;
- An increase in the use of renewable waste, mainly black liquor (pulp and paper residuals) by about 95%, especially for use in electricity cogeneration.

Chart 9 **Use of energy flows for transformation use in Electricity, gas, steam and air-conditioning supply (D)**

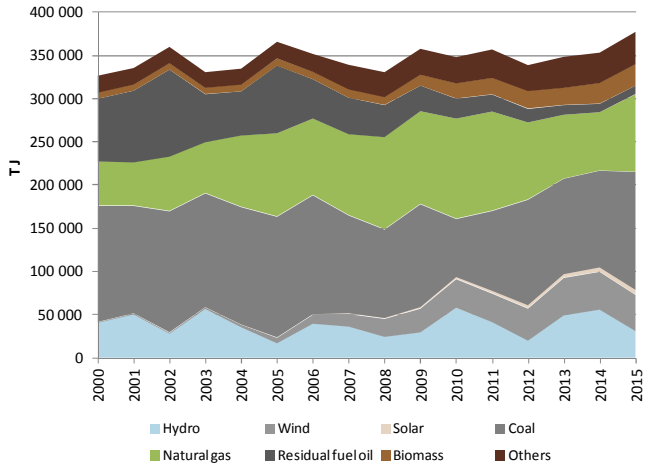
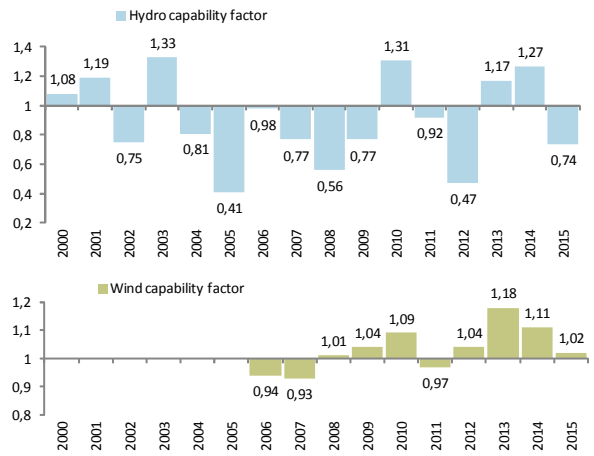


Chart 10 **Hydro and wind capability factors**



Source: Rede Elétrica Nacional, Annual Reports

1.2.2. Energy flows for end use

End uses of energy flows are made by households, in final consumption, and by branches of economic activity, in their own activity and in the production of non-energy goods and services.

With regard to families it is possible to observe that between 2000 and 2015:

- Energy use decreased by 14.9% and was accompanied by a diversification of energy supply sources;

Table 2 **Energy use by households**

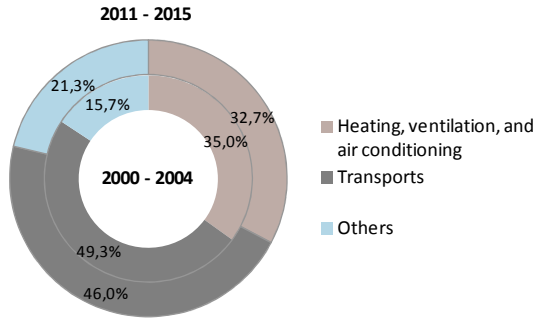
Unit: TJ	2000-2004	2005-2010	2011-2015	rate of change 2015/2000
ENERGY PRODUCTS				
Natural gas (without bio)	5,661	9,880	10,731	259.3%
Motor spirit (without bio)	75,365	57,301	41,361	-50.9%
Transport diesel (without bio)	44,981	53,319	46,960	33.9%
Refinery gas, ethane and LPG	30,419	25,910	19,490	-42.0%
Wood, wood waste and other solid biomass, charcoal	48,219	45,493	31,553	-33.6%
Liquid biofuels*	0	1,759	3,602	412.6%
Electrical energy	40,558	49,600	45,255	19.1%
Heat	544	816	1,832	302.4%
TOTAL	247,369	246,380	204,099	**-14.9%**

Note*: liquid biofuels were introduced in Portugal from 2006; the rate of change of liquid biofuels corresponds to the period 2006 to 2015.

- In the 2000-2004 consumption structure, transport accounted for almost half (49.3%) of energy use, followed by heating, ventilation and air conditioning (35.0%) and other uses (cooking, lighting, appliances and other uses) that contributed only 15.7%. In the five-year period 2011-2015, energy use in transport continued to prevail, but it had a lower relative importance (46.0%) and heating,

ventilation and air conditioning (32.7%), while other uses increased their relative weight (from 15.7% to 21.3%).

Chart 11 **Energy use structure by households' use**



From the analysis of the end uses by the different economic activities it is possible to conclude that, in the period of 2000 to 2015:

- **Energy intensity** (ratio of energy use to industry GVA at constant prices) decreased in agriculture, forestry and fisheries (A), and manufacturing (C) activities;
- In energy-intensive industrial activities, energy use has declined over the period and gains in energy efficiency have been achieved in virtually all industries: in the manufacture of food, beverage and tabacco (C10-12), in the manufacture of textiles, wearing apparel and leather products (C13-15), in the manufacture of chemicals and chemical products (C20), in the manufacture of rubber and plastic and other non-metallic mineral products (C22-23) and in the manufacture of basic metals and fabricated metal products, except machinery and equipment (C24-25);
- The manufacture of paper and paper products (C17) registered a substantial increase in production as of 2010, as a result of the investments made in the near doubling of national production capacity. The increase in energy uses has accompanied this trend, ascertaining an increase in energy intensity;
- **In general, there has been a diversification of energy sources**, with increased use of biomass and other renewable energies, as well as an increase in the share of electricity in end use of energy.

Table 3 **Energy end use and energy intensity in the main economic activities**

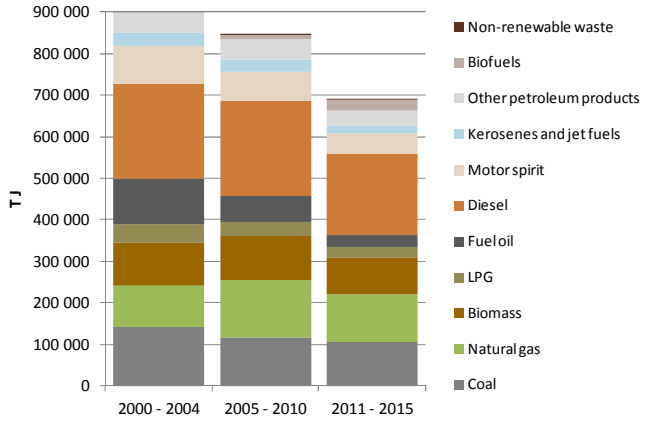
	Indicator	2000-2004	2005-2010	2011-2015	annual average rate of change	rate of change 2015/2000
NACE A - Agriculture, forestry and fishing	Energy end use (TJ)	28,382	26,370	24,737	-2.4%	-32.2%
	GVA at constant 2011 prices (M€)	3,257	3,216	3,260	0.3%	4.7%
	Sectorial energy intensity (MJ/€)	8.7	8.2	7.6	-2.7%	**-35.3%**
	Share of renewable energies in energy end use (%)	0.0	1.1	2.7	-	-
	Share of electricity in energy end use (%)	11	14	13	3.6%	76.6%
NACE C - Manufacturing	Energy end use (TJ)	284,963	258,445	241,620	-1.1%	-15.8%
	GVA at constant 2011 prices (M€)	21,596	21,022	20,425	-0.1%	-1.7%
	Sectorial energy intensity (MJ/€)	13.2	12.3	11.8	-1.0%	**-14.4%**
	Share of renewable energies in energy end use (%)	19.0	22.7	19.1	-0.5%	-7.6%
	Share of electricity in energy end use (%)	19	21	22	1.3%	23.3%
NACE C10-12 - Manufacture of food products, beverages and tobacco	Energy end use (TJ)	25,112	26,217	22,841	-0.7%	-10.1%
	GVA at constant 2011 prices (M€)	3,010	3,224	3,459	1.0%	18.0%
	Sectorial energy intensity (MJ/€)	8.3	8.1	6.6	-1.7%	**-23.7%**
	Share of renewable energies in energy end use (%)	14.3	15.7	7.8	-5.1%	-56.4%
	Share of electricity in energy end use (%)	23	25	29	1.7%	31.8%
NACE C13-15 - Manufacture of textiles, wearing apparel and leather products	Energy end use (TJ)	25,435	18,587	14,076	-4.2%	-50.1%
	GVA at constant 2011 prices (M€)	4,685	3,611	3,485	-1.6%	-23.2%
	Sectorial energy intensity (MJ/€)	5.4	5.2	4.0	-2.7%	**-35.0%**
	Share of renewable energies in energy end use (%)	8.4	13.1	4.5	-9.2%	-78.7%
	Share of electricity in energy end use (%)	31	31	33	0.8%	14.4%
NACE C17 - Manufacture of paper and paper products	Energy end use (TJ)	48,426	50,324	56,671	0.7%	11.1%
	GVA at constant 2011 prices (M€)	1,025	985	864	-0.9%	-13.0%
	Sectorial energy intensity (MJ/€)	47.2	51.6	65.7	1.5%	27.7%
	Share of renewable energies in energy end use (%)	65.1	66.7	63.0	0.1%	1.2%
	Share of electricity in energy end use (%)	12.8	16.8	17.2	2.4%	46.1%
NACE C20 - Manufacture of chemicals and chemical products	Energy end use (TJ)	33,738	27,458	20,375	-3.1%	-39.7%
	GVA at constant 2011 prices (M€)	1,024	898	806	-1.6%	-22.2%
	Sectorial energy intensity (MJ/€)	33.0	30.5	25.3	-1.6%	**-22.5%**
	Share of renewable energies in energy end use (%)	4.2	5.9	1.7	-14.2%	-91.4%
	Share of electricity in energy end use (%)	22.3	28.0	35.6	2.8%	56.3%
NACE C22-23 - Manufacture of rubber and plastic products and other non-metallic mineral products	Energy end use (TJ)	91,016	76,894	51,620	-4.0%	-48.2%
	GVA at constant 2011 prices (M€)	2,509	2,466	2,295	-0.5%	-8.2%
	Sectorial energy intensity (MJ/€)	36.3	31.1	22.4	-3.5%	**-43.5%**
	Share of renewable energies in energy end use (%)	15.3	19.6	9.9	-5.5%	-59.3%
	Share of electricity in energy end use (%)	9.1	11.0	13.4	3.3%	67.7%
NACE C24-25 - Manufacture of basic metals and of fabricated metal products, except machinery and equipment	Energy end use (TJ)	12,261	13,998	13,483	-0.7%	-10.1%
	GVA at constant 2011 prices (M€)	2,192	2,329	2,261	0.4%	6.2%
	Sectorial energy intensity (MJ/€)	5.6	6.0	6.0	-1.0%	**-15.4%**
	Share of renewable energies in energy end use (%)	2.0	2.3	1.3	-2.3%	-31.1%
	Share of electricity in energy end use (%)	48.1	55.9	59.9	3.6%	76.9%

2. Emission-relevant energy uses for polluting gases and particulates into the atmosphere

The emission-relevant energy uses are defined as the uses of energy flows during the economic activities of production and consumption (mainly in combustion processes), which give rise to emissions of polluting gases and particles into the atmosphere.

Emission-relevant energy uses decreased by 19.5% between 2000 and 2015 (22.9% between 2000-2004 and 2011-2015), due to a reduction in the energy uses of more polluting flows (such as coal and petroleum derivatives) which have been replaced by natural gas and non-emissions-related renewable energy sources.

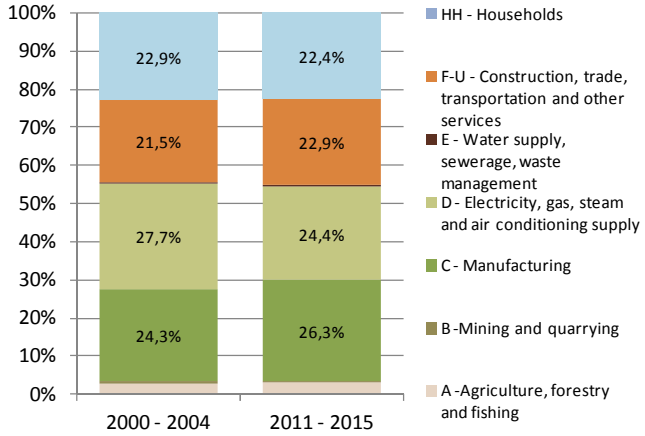
Chart 12 **Total emission-relevant energy uses**



In the first five years of the series under analysis, the production and distribution of electricity, gas, steam, hot and cold water and cold air was the most important activity in the structure of energy uses relevant to emissions (27.7%), followed by manufacturing industries (24.3%) and households (22.9%).

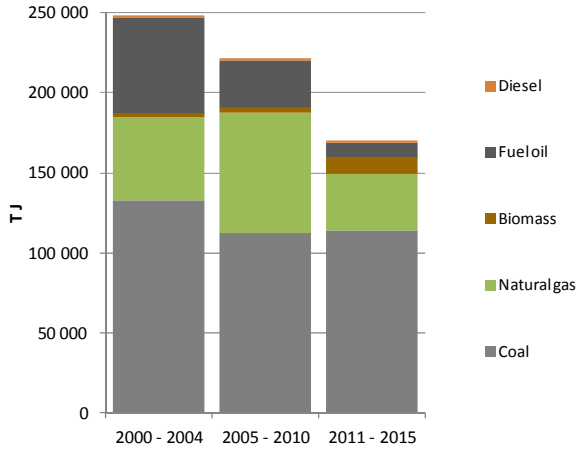
This hierarchy has changed in the last five years, with the loss of relative importance of the energy sector (24.4%). The manufacturing industry moved to first place (26.3%). The households moved to fourth place (22.4%), due to an increase in the relative weight of construction and services (from 21.5% to 22.9%).

Chart 13 **Evolution of the structure of emission-relevant energy uses, by economic activities and by households**



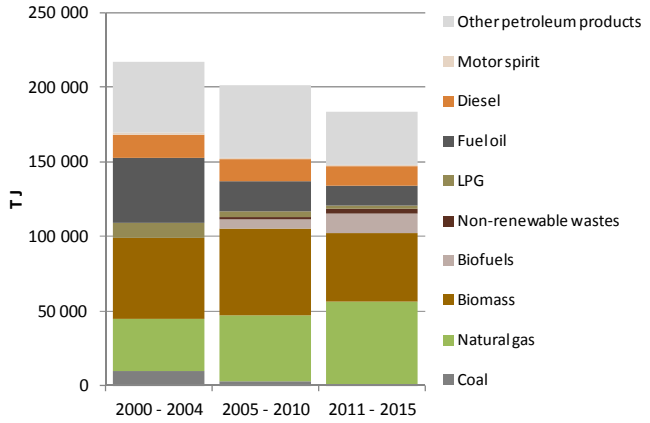
Emission-relevant energy uses for electricity production and distribution fell by 27.3% between 2000 and 2015 (31.3% between 2000-2004 and 2011-2015). Coal (hard coal, derived gases and secondary coal products) has been the fossil fuel most commonly used in electricity production. With the introduction of natural gas in the country, in 1997, there was a gradual increase in the weight of this fuel until 2010. From 2011 onwards, natural gas has been losing importance, due essentially to two reasons: 1) strong increase of electricity production through renewable energies, coupled with years in which water and wind capability factors were favorable, particularly in 2013 and 2014; 2) reduction of the relative price of coal against natural gas.

Chart 14 **Emission-relevant energy uses by the production and distribution of electricity, gas, steam, hot and cold water and cold air (D)**



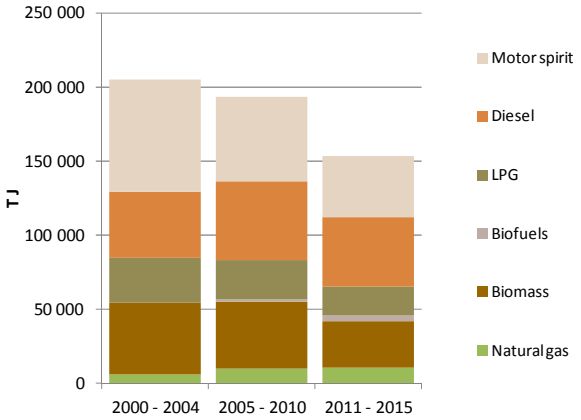
Manufacturing saw a decrease of 18.0% in emissions-relevant energy uses between 2000 and 2015 (15.4% between the two quinquennials 2000-2004 and 2011-2015). Of particular note is the increase in the use of natural gas, particularly in cogeneration units, to the detriment of fuel oil.

Chart 15 **Emission-relevant energy uses by manufacturing industries (C)**



There was a 23% decrease in energy consumption relevant to household emissions between 2000 and 2015 (25% between 2000-2004 and 2011-2015). The substantial weight of gas oil and gasoline in the structure of consumption is highlighted for use in transports. The consumption of natural gas has been gaining relative weight, partly due to the replacement of LPG, which has lost importance.

Chart 16 **Emissions-relevant energy uses by households**



3. Economic and environmental indicators

PEFA allows the calculation of a set of key, physical, monitoring indicators, represented in Table 4. The combination of physical energy variables with socioeconomic variables also yields indicators on the relationship between energy, economy and environment, presented in table 5.

Table 4 **Evolution of the key indicators of the physical energy flow account**

Unit: TJ	2000-2004	2005-2010	2011-2015	rate of change 2015/2000
Extraction of natural energy inputs by economic activities	126,953	151,097	176,251	37.6%
Domestic production of energy products	863,150	899,725	925,841	26.3%
Intermediate consumption of energy products	1,531,726	1,534,224	1,409,995	4.5%
Household consumption of energy products	247,369	246,380	204,099	-14.9%
Use of waste for energetic purposes	39,000	43,035	53,131	42.5%
Net domestic energy use	1,089,794	1,071,126	929,910	**-11.1%**
Total energy input / output	1,984,287	2,005,009	1,901,319	6.1%

Table 5 **Evolution of indicators on the relationship between energy, economy and environment**

Theme	Sub-theme	Indicator	Ratio or value	Unit	2000-2004	2005-2010	2011-2015	rate of change 2015/2000
Use and production patterns	Energy supply efficiency	Efficiency of energy conversion and distribution	Energy losses in transformation systems (including losses in electricity generation, transmission and distribution)	TJ	984,556	976,920	863.192	-12.3%
	Energy end use	Energy intensity	Domestic energy use / GDP at constant 2011 prices	MJ/€	**6.4**	6.0	**5.5**	**-13.7%**
		Energy intensity of the households	Households energy use / Private consumption at constant 2011 prices	MJ/€	2.3	2.2	1.9	-18.6%
		Households energy use *per capita*	Households energy use / Population	GJ / inhabitant	**23.8**	23.4	**19.5**	**-15.4%**
	Diversification (Fuel mix)	Renewable energy share in electricity	Sum of renewable energy supply (hydro, wind, solar, biomass and others) / Total supply of energy flows for electricity generation	%	**17.8**	22.3	**34.6**	**15.3 p.p.**
Security of supply	Imports	Energy dependency	Net energy imports / Net domestic energy use	%	**84.7**	83.3	**73.9**	-8.4 p.p.
Exports	Exports	Energy exports	Energy use from the rest of the world (energy exports and residues send)	TJ	116,343	169,735	295.459	**236.4%**

In the analysis of the behavior of **key indicators** between 2000 and 2015, the following stands out:

- significant growth in the extraction of natural energy inputs (37.6%), domestic production of energy products (26.3%) and use of waste for energetic purposes (42.5%);
- the increase in intermediate consumption of energy products by economic activities (4.5%) and the reduction of final consumption of energy products by households (14.9%);
- the decrease in net domestic energy use, ie the net amount of energy used in the economy (11.1%). Thus, there is a downward trend in energy consumption by resident units;
- an increase of 6.1% in total energy inputs and outputs (supply and use).

The analysis of the evolution of **energy, economy and environment indicators** for the same period shows an improvement in the energy use and production patterns, security of supply and exports:

- reduction of losses in energy transformation systems by 12.3%, which means an improvement in energy supply efficiency;
- decrease in the energy intensity of the economy (ratio between the domestic energy use and GDP at constant prices), which fell by 13.7%;
- a reduction in the *per capita* energy use of households of 15.4%;
- a 15.3 p.p. increase in the share of renewable energy inputs in the production of electricity, which represented 17.8% in the first five years of the

period under analysis and increased to 34.6% in the last five years.

- a reduction in energy dependency (ratio between net energy imports and net domestic energy use) from 84.7% to 73.9% in the first and last five years;
- a substantial increase (236.4%) in energy exports, mainly as a result of investments in the refining apparatus.

Comparison between PEFA's domestic energy use and gross domestic consumption of energy balance

The results obtained in PEFA differ from the National Energy Balances and Energy Questionnaires of the International Energy Agency (IEA) / Eurostat, due to methodological and conceptual differences, particularly the adoption in PEFA of the principle of residence of the economic agent instead of principle of economic territory. This difference is particularly important in the economic activity of air and sea transport.

The principle of residence adopted by PEFA (like the National Accounts) considers all institutional units living[4] in the economy, regardless of where they are physically located. According to the territory principle, statistics are compiled for all units physically located in the territory, and units located physically outside the territory are considered part of the rest of the world. This dichotomy is reflected in slight differences in some indicators, such as the energy intensity of the economy.

Chart 17 **Evolution of domestic energy use and gross domestic energy consumption**

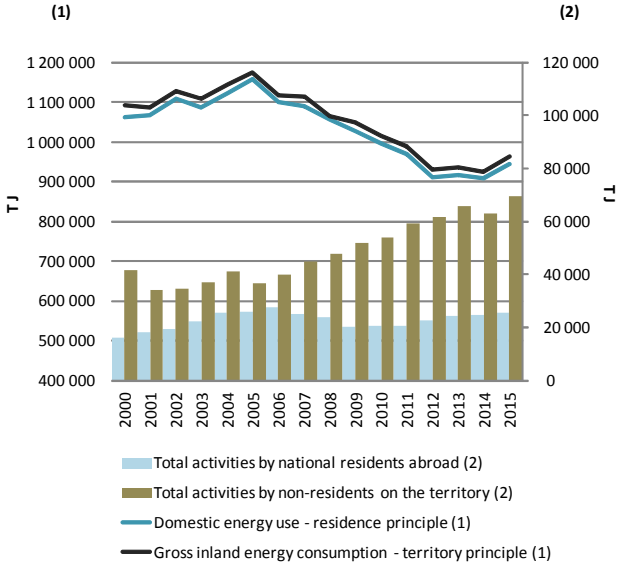
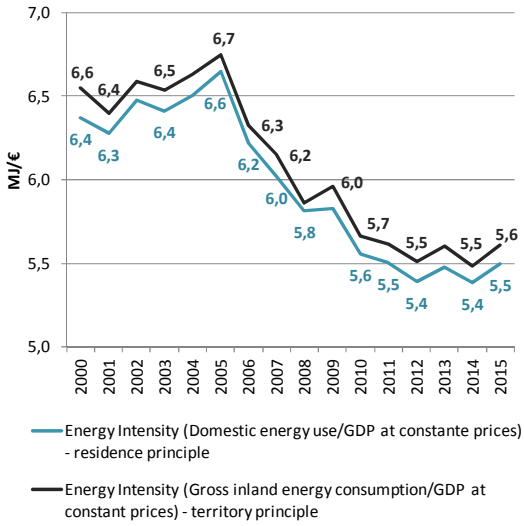


Chart 18 **Evolution of energy intensity**



The breakdown by domestic activity is also different in the two projects, namely the calculation of energy use in transports, which is individualized in the Energy balance, and distributed by industries and by households in PEFA.

[4] According to the European System of Accounts, ESA 2010, it is considered to be a resident unit of a country when it has a predominant economic center of interest in the economic territory of that country, that is to say, when it carries out economic activities in that territory for an extended period (one year or more).

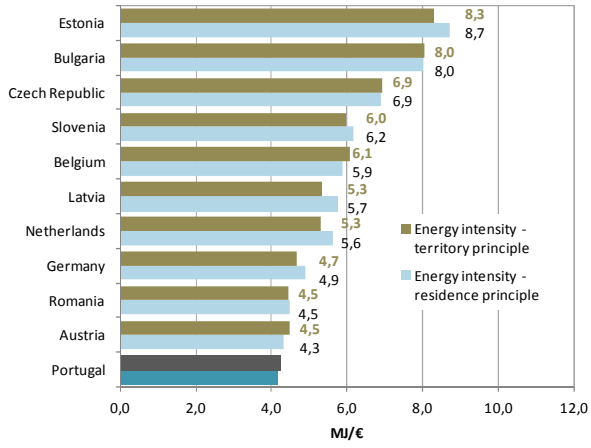
4. Comparisons with the European Union (EU)

The submission of results from PEFA to Eurostat by the EU countries became compulsory only from 2017 onwards. For this reason, existing EU information results from experimental accounts for a limited number of countries and for few years, with 2014 being the common year.

Eurostat reports results of domestic energy use (residence principle) and gross domestic energy consumption (territory principle), as well as domestic household energy use (residence principle). For the purpose of international comparisons, the option was to relativize the first two by GDP in purchasing power parities (ppp), and the latter by the population.

The energy intensity is very different, since it is quite dependent on the productive structure of each country, in particular the relative importance of the energy-intensive activities, as well as the climatic aspects.

Chart 19 **International comparisons of households energy intensity in ppp in 2014**

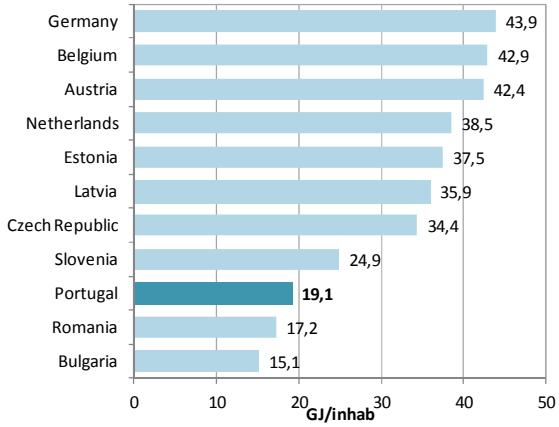


Source: *Physical energy flow accounts totals bridging to energy balances totals - pilot project data* [env_ac_pefa05], Eurostat (última atualização 06.04.2017); PEFA data for Portugal in 2014; Eurostat for GDP in purchasing power parities (ppp) [*Purchasing power parities (PPPs), price level indices and real expenditures for ESA 2010 aggregates* (prc_ppp_ind)]

The energy intensity of the Portuguese economy is the lowest in the group of countries analyzed, being close to the Austrian and Romanian economies.

Per capita energy use by Portuguese households is the third lowest, with less than half of the figures presented by Germany, Belgium and Austria.

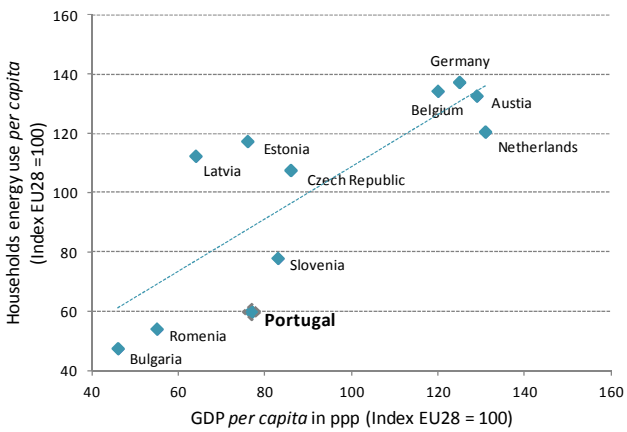
Chart 20 **International comparisons of households energy use *per capita* in 2014**



Source: *Physical energy flow accounts totals bridging to energy balances totals - pilot project data* [env_ac_pefa04], Eurostat (last update 06.04.2017); PEFA data for Portugal in 2014; Eurostat *database* for population.

Comparing the household energy use *per capita* with GDP *per capita* in ppp, it is possible to observe that, with the exception of Nordic states such as Latvia and Estonia, the countries with the lowest levels of income are those with the lowest domestic energy use. It is important to note that households' energy use is also influenced by climatic factors, which are not reflected in the comparison with GDP *per capita* in ppp.

Chart 21 **Ratio of *per capita* GDP to *per capita* household energy use by households in EU countries in 2014**



Source: *Physical energy flow accounts totals bridging to energy balances totals - pilot project data* [env_ac_pefa04], Eurostat (last update 06.04.2017); PEFA data for Portugal in 2014; Eurostat *database* for GDP in purchasing power parities (PPP).

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