

STATISTICS ON ENERGY CONSUMPTION

Energy statistics are a key source of information to deal with energy transition, to understand the energy system (e.g. who consumes what, what are the losses), particularly focused on the national scale. Therefore, the students get to know:

1. Where energy statistics can be accessed;
2. How to make energy conversions;
2. Understand what an energy balance is (e.g. Portugal)
3. Find and explore energy statistics;
 - i) Build indicators and charts with added value;
 - ii) Analyze economic sectors and interpret their performance in terms of energy consumption and greenhouse gas emissions (as presented in a previous class)

1. Energy Unit Conversion

A first reading can be accessed herein: <http://www.aps.org/policy/reports/popa-reports/energy/units.cfm>

Joule (J) is the basic energy unit of the International System of Units (SI). It is desirable that all energy units should be presented in J. [James Prescott Joule](#) was a self-educated British physicist and brewer whose work in the middle of the 19th century contributed to the establishment of the energy concept. The international unit of energy bears his name. "1 Joule [J] refers to the energy needed to raise a 102-g-apple 1 m."

Watt (W) is a unit of power (energy per unit time). Power units can be converted to energy units through multiplication with seconds [s], hours, [h], or years [yr]. For example, 1 kWh [kilowatt hour] = 3.6 MJ [MegaJoule]. Calories and/or kilocalories [cal and/or kcal] were commonly used to measure heat (energy) in the past and are still used sometimes today. Heating a gram of water 1 °C requires 1 cal. Normally, in scientific and technical works we should use The International System of Units. However, there are many other energy units. A still very frequent unit used in the energy business is "ton of oil equivalent" (toe). 1 toe equals 11630 kWh. It means that the energy content in one tonne of oil is the same as in 11 630 kWh.

The best option to manage energy units is through the use of converters. There are several online energy unit converters you may use. Here is one with many options:

<https://www.unitjuggler.com/energy-conversion.html>

Also, you need to be familiar with the prefix used to manage energy numbers, as presented in the next table.

Table 2.2 Prefixes commonly used

Factor	Prefix name	Symbol
<i>Multiple</i>		
10 ¹⁸	Exa	E
10 ¹⁵	Peta	P
10 ¹²	Tera	T
10 ⁹	Giga	G
10 ⁶	Mega	M
10 ³	kilo	k
10 ²	hecto	h
10 ¹	deka	da
<i>Submultiple</i>		
10 ⁻¹	deci	d
10 ⁻²	cents	c
10 ⁻³	milli	m
10 ⁻⁶	micro	μ
10 ⁻⁹	nano	n
10 ⁻¹²	pico	p
10 ⁻¹⁵	femto	f
10 ⁻¹⁸	atto	a

2. ENERGY STATISTICS:

SELECT JUST ONE CASE TO WORK: 2.2 (EUROPE) OR 2.1. (PORTUGAL)

2.1. Portuguese Energy statistics

<https://www.dgeg.gov.pt/pt/>

ESTATÍSTICA / Energia

BALANÇOS ENERGÉTICOS / Balanços Energéticos Nacionais

You may download the last version available ([2019 \(Provisório\)](#) xls) in excel format.

You may also access different energy statistics files:

- *Balanços Energéticos* (excel files in portuguese)
- *Indicadores Energéticos* (Energy Indicators: table (xls) with indicators in Portuguese)
- and other statistics regarding '*Renováveis*', '*Gás Natural*', '*Petróleo*', '*Carvão*'

The Energy Balance is a spreadsheet organized in terms of energy producers and energy consumers (in rows) of different energy forms (in columns). In Europe, all the national authorities send their energy national balances to EUROSTATS, which consolidate them to the EU level.

Direção-Geral de Energia e Geologia Direção de Serviços de Planeamento Energético e Estatística									
BALANÇO ENERGÉTICO tep	Húlia e Antracite	Coque de Carvão	Total de Carvão	Petróleo Bruto	Refugos e Produtos Intermédios	GPL	Gasolinas	Petróleos	Jets
2019 provisório	1	2	3 = 1+2	4	5	6	7	8	9
PRODUÇÃO DOMÉSTICA	02								
VARIAÇÃO DE "STOCKS"	03	276 461	- 238	276 223	48 878	-76 234	-29 395	11 369	- 37 661
SAÍDAS	04	99 544	79	99 623	147 226	90 470	1 666 052		1 474 527
Exportações	04.01	99 544	79	99 623	147 226	90 470	1 666 052		16 424
Transportes Marítimos Internacionais	04.02								
Aviação Internacional	04.03								1 458 103
CONSUMO DE ENERGIA PRIMÁRIA	05	1 241 333	6 998	1 248 331	11 429 232	1 481 535	764 971	-1 401 588	322
PARA NOVAS FORMAS DE ENERGIA	06	1 237 895		1 237 895	11 423 655	917 663	-111 408	-2 530 212	- 197
Briquetes	06.01								
Coque	06.02								
Produtos de Petróleo	06.03				11 423 655	1 002 277	-181 717	-2 530 212	- 197
Hidrogénio	06.04								
Petroquímica	06.05					-113 219	70 309		
Electricidade	06.06	1 237 895		1 237 895					
Cogeração	06.07					28 625			
Produção de Electricidade	06.07.01					28 625			
Refinação de Petróleo	06.07.02					28 625			

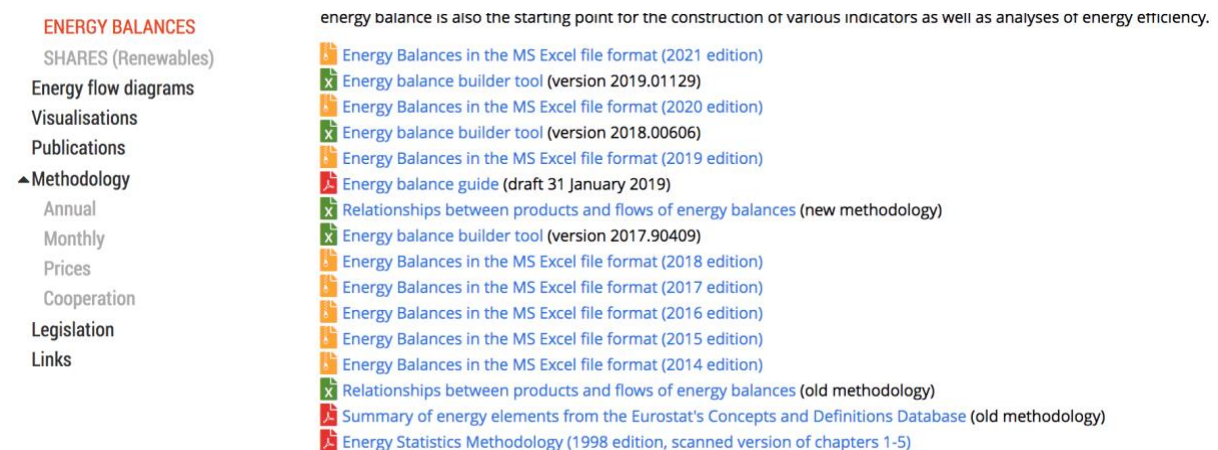
After understanding the energy balance, you are able to answer the following questions, and build graphics:

- What is the mix of final energy forms in Portugal during 2019?
- Select a specific sector of activity - Agriculture and Fisheries, Industry, Transport, domestic, or Services-, and assess:
 - i. How the mix of the final energy consumption in that sector (consider the main forms of final energy such as petroleum products, natural gas, electricity) has changed in the last 10 years? To answer this question, you have to download the Energy Balance of 2009.
 - ii. How much the total final energy consumption has increased or decreased in this period in that sector?
 - iii. Since the use of electricity and of renewables are key options to decarbonize the economic sectors, what is the share (%) of electricity consumption in relation to the total final energy consumption in the sector you've selected? And the share of renewables? How the participation of electricity and renewables has changed in the last 10 years?

2.2. European Energy Statistics: EUROSTATS

<http://ec.europa.eu/eurostat/web/energy/data/main-tables>

You may select ENERGY BALANCES (in the left) and then Energy Balances in the MS Excel file format (2021 edition) (in the right) where you can find the Energy Balances for all the member States and for the EU28 and EU27.



You may download the file (country or EU) of your interest, and may want to analyse:

- the Primary Production of energy by resource: take a look at the consumption of natural gas and oil.
- the Electricity consumption by industry, transport activities or households/services: take a look at a specific sector of consumption (e.g. the same as you picked previously).
- Decide upon a couple of indicators you find useful to explore (e.g. how has been evolved the energy consumption in industry in Portugal in the last decade, in comparison with Spain and the European Union?).