This article provides recent statistics on nuclear energy in the European Union (EU).

Nuclear heat and gross electricity production

The production of nuclear heat is obtained from the fission of nuclear fuels in nuclear reactors. This heat is subsequently used for the production of electricity. The remaining heat (about 2/3 of the total) is mainly lost, except a very small part which is used for agriculture and urban heating. The total production of nuclear heat in the EU-27 in 2018 was 195 738 thousand tonnes of oil equivalent (toe), a decrease of 8.1% compared to
Table 1: Production of nuclear heat, ktoe, 2018Source: Eurostat (nrg_inf_nuc)

The main use of nuclear heat is the production of electricity. The gross electricity generation from nuclear plants within the EU-27 Member States in 2018 was 762 000 GWh, a 16.7 % decrease compared to 2006, or an average decrease of 1.4 % per year. However, two different trends can be distinguished over the period 1990 to 2018. From 1990 to 2004, the total amount of electricity produced in nuclear facilities in the EU-27 rose by 26.9 %, reaching a peak of 928 400 GWh in 2004, due to an increase in the numbers of reactors in operation. Between 2004 and 2006, total production of nuclear power in the EU-27 stabilised, before declining by 16.7 %, between 2006 and 2018, mainly due to the sharp drop by some 54 % of the nuclear production in Germany (see Table 2).

Table 2: Gross electricity generation in nuclear power plants, GWh, 2018Source: Eurostat (nrg_ind_peh)

The by far largest producer of nuclear power within the EU-27 in 2018 was France, with a 54.2 % share of the EU total, followed by Germany (10.0 %), Sweden (9.0 %) and Spain (7.3 %). These four Member States produced 80.5 % of the total amount of electricity generated in nuclear facilities (see Figure 1) in the EU-27.
From 2006 to 2018, some countries increased their production of nuclear electricity: Romania, which started in 1996 (+102.0 %), Hungary (+16.9 %), Czechia (+14.9 %), Slovenia (+4.1 %), Sweden (+2.3 %), Netherlands (+1.3 %). During the same period, the remaining countries (including the main producers) decreased their production of nuclear electricity, with Lithuania recording the most significant decrease as it shut down its nuclear facilities in 2009, followed by Germany (-54.6 %), Belgium (-38.7 %), Slovakia (-17.6 %), Bulgaria (-17.3 %), France (-8.3 %), Spain (-7.3 %) and Finland (-0.5 %).

**Enrichment capacity**

Uranium found in nature consists largely of two isotopes, uranium-235 (U-235, fissile) at 0.7 % and uranium-238 (U-238, non fissile) at 99.3 %. U-238 does not contribute directly to the fission process (though it does so indirectly by the formation of fissile isotopes of plutonium 239). Because of the small percentage of fissile material in the natural uranium and in order to obtain suitable nuclear fuel for the pressurised water reactors (PWR, the majority in Europe), it is necessary to increase the concentration ('enrich') of the U-235 isotope from 0.7 % to 3-5 %. There are two possibilities: the centrifugation or the diffusion of the uranium in gaseous form (hexafluorure UF6). As a result the natural uranium is separated into a small part of enriched uranium and a large part of depleted uranium. An exception is the Canadian "CANDU" reactors in Romania which use natural uranium and this technology does not require enrichment.

The standard measure, the "separative work unit", is the effort required to separate isotopes of uranium (U235 and U238) in the enrichment process: 1 tSWU is equivalent to 1 tonne of separative work unit **tonnes of separative work units (tSWU)**.

Only three of the EU-27 Member States operated enrichment plants in 2018: Germany, the Netherlands and France, bringing the total enrichment capacity of the European Union to 16 700 tSWU (see Table 3).
The fuel assembly constitutes the base element of the nuclear reactor core. The material used is the low enriched uranium (3 % to 4 % U235) produced by the enrichment plants. The standard pressured water reactor core contains about 157 fuel assemblies (depending on the reactor type). The uranium oxide (black powder) is pressed into pellets (small cylinders), then placed inside rods (tubes of about 1 cm diameter, 4 m length) which finally constitute the assemblies. The term "fresh fuel" indicates that it is the first use of uranium extracted from mines contrary to the "MOX fuel" which is mainly made of recycled material. MOX (mixed oxide) assemblies are not included in this section but are covered separately in the section "Production of MOX fuel elements".

Production of fresh fuel elements are measured in **tonnes of heavy metal (tHM)**.

Only five EU-27 Member States produced fresh fuel elements in 2018: Germany, Spain, France, Romania and Sweden (see Table 4 and Figure 2), with an overall decrease from 2009 to 2018 of 16.6 %. Belgium recorded the largest decrease in production of fresh fuel elements as it stopped its production in 2012, followed by Germany (-54.1 %) and Spain (-14.7 %). The remaining countries increased their production, with France recording the largest increase by far (+72.7 %), followed by Romania (+2.3 %) and Sweden (+2.1 %).

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**Table 4: Production of fresh fuel assemblies, tHM, 2018**
Source: Eurostat (nrg_info_nuc), See country codes
Production of MOX fuel assemblies

The production of MOX (Mixed OXide of uranium and plutonium) assemblies is similar to the production of fresh fuel assemblies. The difference is the use of a mix of uranium oxide and plutonium oxide instead of pure uranium oxide.

The aim of the MOX use is the "recycling" of the remaining uranium and the plutonium, both extracted from the spent fuel in the reprocessing plants (97 % of the nuclear material can be reused). The MOX fuel is used mainly in France in a proportion of 1/4 to 1/3 of the total core fuel in some reactors. The production of MOX fuel elements is measured in tHM (tonnes of heavy metal).

As shown in Table 5, only two EU-27 countries produced MOX fuel assemblies in 2009: Belgium and France. However, Belgium stopped its production in 2015. In 2018, France was the only remaining Member State with a MOX production capacity.

Table 5: Production of MOX, tHM, 2018Source: Eurostat (nrg_inf_nuc), See country codes

Production of uranium and plutonium in reprocessing plants

This section refers to the annual production of uranium (U) and plutonium (Pu) in reprocessing plants, measured in tHM. Reprocessing consists of recovering fissile and fertile materials from used nuclear fuel in order to provide MOX fuel for nuclear power plants. The spent fuel, assembled in rods, is first dismantled, then cut in small pieces, before being chemically separated into uranium, plutonium and waste. 97 % of the nuclear material (U and Pu) is recycled and the remaining 3% highly radioactive waste material is vitrified and put into containers for long term storage.

As shown in Table 6, only one of the EU-27 Member States, France, operates a nuclear reprocessing plant.
Table 6: Production of uranium and plutonium in reprocessing plants, tHM, 2018
Source: Eurostat (nrg_inf_nuc), see country codes

France increased its production of U and Pu in reprocessing plant by 8.6 % from 2009 to 2018.

Source data for tables and graphs

- Download Excel file

Data sources

Annual data on nuclear energy production of electricity have been used for all calculations. The most recent data available are for 2018. Data are available for all EU Member States. In general, data are complete, recent and highly comparable across countries.

Context

The basis for nuclear energy in Europe was laid in 1957 by the European Atomic Energy Community (Euratom). The initial goal was to develop the civil use of nuclear material (for medical purposes, electricity production as examples). The sector represents an important source of electrical energy, since nuclear power stations currently produce around a third of the electricity consumed in the European Union.

Energy statistics inform the political decision-making in the European Union and its Member States. Statistics on nuclear energy were incorporated in Regulation (EC) No 1099/2008 on energy statistics. This Regulation states that statistics concerning the civil use of nuclear energy must be transmitted annually by Member States to Eurostat. This regulation was amended several times and the last amendment (Regulation (EU) 2019/2146) entered into force on 5/1/2020. The link to the legislation page on Eurostat’s website is here.

Other articles

- Electricity generation statistics – first results
- Energy statistics - an overview
- Electricity and heat statistics
- Electricity production, consumption and market overview

Main tables

- Energy (t_nrg), see:
  - Primary production of energy by resource (ten00076)
  - Gross inland energy consumption by fuel type (tsdcc320)
Database

- **Energy (nrg)**, see:

  - Energy statistics - quantities (nrg_quant)
    - Energy statistics - quantities, annual data (nrg_quanta)
    - Energy infrastructure and capacities (nrg_inf)
      - Nuclear energy facilities (nrg_inf_nuc)

  - Energy statistics - quantities (nrg_quant)
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    - Energy indicators (nrg_ind)
      - Gross and net production of electricity and derived heat by type of plant and operator (nrg_ind_peh)

Dedicated section

- **Energy**

Publications

- **Energy, transport and environment indicators** - Pocketbook November 2016

Methodology

- **Annual nuclear statistics (nrg_inf_nuc)** (ESMS metadata file — nrg_inf_nuc_esms)

Legislation

- **Legislation for energy statistics**

External links

- **Euratom Supply Agency**
- **European Commission, DG Energy, Nuclear Energy**
- **European Nuclear Society**
- **International Atomic Energy Agency**
- **World Nuclear Association**