

The energy balance

The national energy balance

The importance of energy in modern society led man not only to create complex “energy systems”, but also to try and measure how much energy he uses each year and understand which source he gets it from and from which Country he imports it from.

These problems have been solved by using adequate energy measurement units and a scheme representing the energy flows that enter a country and how energy is used in the different sectors along the year: the National Energy Balance. Like any other balance, the energy balance collects information on energy input and output. The national energy balance is the most famous one and is a collection of information on how energy is produced and used within a Country during the year.

How can the National Energy Balance (NEB) be read? To begin with, the energy available from the various sources is reported with a common unit of measurement mentioned before: the Tonne of oil equivalent. This allows the sum and the comparison of data relating to different sources.

The first piece of information contained in the NEB is the total available energy, subdivided according to the sources (also known as energy primary consumption and primary sources). Such data show how much energy is made available in a country to be consumed directly (for example, the electric energy imported or produced in hydroelectric power plants) or to be transformed into by-products to be launched on the final-user market afterwards (for example oil is refined into petrol and gas oil) or, finally, to be transformed into electric energy (coal, gas and oil used in thermoelectric power plants to produce electricity).

The energy supplied by primary sources can belong to the country concerned (national production: for example the natural gas extracted by Italy from the field of the Po valley or the Adriatic sea) or be imported (for example the oil Italy imports from the Middle East or the natural gas imported from Libya and Russia).

Mention should be made that during this definition stage of primary energy consumption the national production of electric energy only includes the production of hydroelectric, geothermal, solar and wind power plants or any renewable resources but, as was stated before, does not include the energy obtained by burning fossil fuels. This distinction was introduced to avoid that part of the energy available is counted twice, first as oil and then as electric energy produced by burning the oil. The exported energy and the variation of stocks are to be subtracted from the sum of the national production and imports of different sources. Thus the primary energy available is achieved (also said primary energy consumption or gross domestic consumption).

Information obtained from the NEB

The National Energy Balance is drafted every year. Thus comparing and contrasting the energy consumption is possible over the years by analyzing the different origin (whether imported or home produced), the different composition (which energy sources were exploited) and the development of national consumption (whether increasing or decreasing) of energy.

The information that can be obtained from the comparison of the energy consumption over the years is very important. For example, by comparing the primary energy consumption with the production data of a country one can see whether, over the years, the country succeeded in achieving a better management of the energy available, by using less energy to produce more. Else, one can check whether the renewable energy sources or those causing less polluting emissions in the air have progressively replaced the most polluting energy sources. A further useful piece of information is whether the country depends upon of energy imports. In countries like Italy, for example, energy resources under the surface are limited and there is a need to import over 80% of the primary energy from abroad. Since great part of our development and daily prosperity depends upon the energy available, countries like Italy, which are markedly dependent upon foreign energy supplies, need to maintain good and stable relations with the energy exporting countries.

Final use of energy

How does a country use the annual primary energy sources available? The answer is provided in the second part of the NEB containing data on the finale use of energy.

Energy uses include the energy consumption of households and enterprises (of course enterprises producing electric energy to be destined to final uses are excluded).

Therefore part of the energy available as a primary source needs to be transformed to be used. As seen before, the most important transformation is the thermoelectric transformation, i.e. fossil fuels becoming electric energy.

By moving from primary consumption to the final consumption we see that the composition of energy sources varies because the quantity of fossil fuels decreases and that of electric energy increases.

Besides in the composition of energy sources, there is a variation also in the quantity of available energy for final uses. The quantity which can be actually destined to final uses is smaller than the primary energy available because the transformation processes involve consumption and losses. For example, the use of fossil fuels (coal, oil, natural gas) to produce electric energy approximately involves a 60% average loss of the energy originally contained in the fuel. It means that if among the primary sources 100 Tonne of oil equivalent of coal are available to produce electricity, at the final use stage only 40 Tonne of oil equivalent of electric energy will be available. The remaining 60 Tonne of oil equivalent were lost during the electric transformation process and cannot be used by households or industrial plants (final uses).

At this stage of the National Energy Balance we have the available energy quantity for the final uses, i.e. the quantity of energy consumed by industries (plants), transports (cars, lorries, trains, buses), citizens (households), agriculture and finally bunkering (the fuel consumption of ships).