# PEF in two pages

**What is PEF?**

PEF is an abbreviation for Primary Energy Factor. The factor is used in European legislation to compare mainly electricity to other energy carriers like gas, oil, biomass and coal.

**What is primary energy?**

If you make a cup of coffee, you would use maybe 0.04 kWh of electricity. But that does not account for the total amount of energy gone into producing your coffee.

Let's assume that your electricity was produced at a coal power plant.

- When the coal is burned in the power plant, it lets out heat, which cannot all be converted to electricity, which thus represents an energy loss (unless of course it is a combined heat and power plant, in which case the loss will be smaller).
- When the generator in the power plant starts spinning and creates electricity, this is sent to the transmission grid. It is then converted to lower voltages before it enters your house. These conversions result in further energy losses.
- Other parts of the process will result in minor energy losses as well.

The initial energy that was put at the start of this chain is what we refer to as primary energy. A PEF takes into account these losses, to create a picture of the total energy gone into making your cup of coffee.

**How does the PEF work?**

In the Energy efficiency directive's annex IV a number of conversion factors are listed. For electricity the factor is set at 2.5, meaning that for electricity (regardless of its source), *final* energy (electricity in this case) consumption is multiplied by 2.5 to determine the *primary* energy input.

In other words, as we decided above that boiling your cup of coffee would require 0.04 kWh, it is assumed that the actual amount of energy gone into that cup is 0.04 * 2.5 = 0.1 kWh. If you were to make the same cup of coffee on a gas stove the primary energy consumption would be 0.04 * 1.1 = 0.044 kWh – i.e. half the consumption of primary energy compared to electricity (given the above assumptions).

**Why is PEF necessary?**

The reason for establishing a PEF in the first place was to establish a method of comparing primary energy use across different technologies. Efficient primary energy use was one of the main policy goals in previous decades, as it electricity was mainly produced on fossil fuels.

For instance, if you burn coal in a power plant to produce electricity to make a cup of coffee, how much energy does that actually require compared to making the coffee directly on your stove? Or more relevant – how does heating your house with a local gas boiler compare to heating it with a local oil boiler or with an electric heat pump?

**Where is PEF used?**

Currently the PEF can be found in four legislative acts in the EU.

1. Energy Efficiency Directive
2. Energy Performance of Buildings Directive
3. Eco-design Directive
4. Energy labelling directive

**What about renewables?**

As mentioned above, energy loss occurs e.g. when burning coal to make electricity, but is there an energy loss, when electricity is generated from wind, rain or the sun? The short answer is yes, since the wind turbine for instance, does not capture all the energy in the wind that passes the turbine. The more relevant question is, whether it makes sense to talk about an energy loss of wind, water or sun?

Currently, when determining the common primary energy factor for electricity, renewable energy is included by using a factor of 1.0. This implies that the energy required to make your cup of coffee is equivalent to the energy produced by the wind turbine, solar panel or hydro plant – i.e. without any energy loss.

However, it has been questioned whether this factor should not be set at 0 instead. Using a factor 1 implies that electricity from a wind turbine has the same efficiency as a gas boiler installed in your building. However, whereas the gas boiler actually consumes the energy content of the gas, the wind turbine (or solar panel or hydro plant) does not really use any energy. It rather collects energy which is already there, without depriving others the opportunity to use the same energy. To put it simply, installing solar panels does not deprive you of sunbathing, and installing wind turbines does not take the wind out of the wind surfer's sail. Burning gas or coal, does, however, deprive others of burning that same coal or gas in the future, so here accounting for the energy loss does make sense.

**Why is PEF in need of revision?**

The issue with the PEF is that by multiplying electricity use by 2.5, a disincentive to use electricity is created. The higher the PEF, the great the disincentive. Since broad consensus exists on the need to increased use of electricity to meet EUs climate targets, the higher PEF actually runs counter to EU objectives of creating a secure, competitive and sustainable energy sector. The on-going revision is an ideal moment to align the PEF with the objectives of the Energy Union.

**What is the solution?**

First, the good news. The European Commission commissioned a study on the PEF which was presented on the 13th of May 2016. The experts conducting the study (Fraunhofer, Tecnalia, E7 Energie Markt Analyse and Trinomics) recommend a new method for calculating the PEF, taking better into account the increasing shares of renewables in the electricity mix, and how this decreases the energy loss in the energy system. With this approach, the PEF would in 2015 be 1.90 instead of 2.5 and further decreasing to 1.35 in 2030.

But, there is also bad news. Although the recommendation in the Commission's own study is clear, DG Energy has chosen to ignore this approach, instead opting for status quo – i.e. continuing to apply an "imaginary" energy use from renewable energy sources. This puts not only renewables at a disadvantage but is a barrier to electrification and hence cost-efficient decarbonisation.

Adopting the approach recommended by the expert study, would not only produce a more correct picture of primary energy consumption in the electricity mix in the future. It would also reduce the disincentive to electrification, thereby putting the EU on the path for further decarbonisation.