



# **PRIMARY ENERGY FACTOR, ECODESIGN DIRECTIVE AND ENERGY LABELLING REGULATION**

**TECHNICAL NOTE**

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## ABOUT MARCOGAZ

Founded in 1968, MARCOGAZ represents 30 member organisations from 20 countries. Its mission encompasses monitoring and policy advisory activities related to the European technical regulation, standardisation and certification with respect to safety and integrity of gas systems and equipment, rational use of energy as well as environment, health and safety issues. It is registered in Brussels under number BE0877 785 464.

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## 1. Introduction

The direct use of the revised Primary Energy Factor (PEF) according to the Energy Efficiency Directive (EED) poses problems for the Ecodesign implementation measures and energy labelling.

This fact was already recognized in Regulation (EU) 2017/1369<sup>1</sup> of July 4, 2017 on energy labelling: in its article 11 on the procedure for the introduction and change of scale of labels, it provides for a period of time (2026 - 2030) that allows the revision of the current frame of reference. This was stipulated to ensure that time is available to carry out the necessary impact assessment.

In the current revision of the PEF and its application, this period of time and the necessary evaluation have to be taken into account.

The present document aims to clarify the position note<sup>2</sup> with technical issues.

## 2. Background and Consequences

In the currently applicable Ecodesign Directive and in the Energy Label Regulation, a PEF of 2,5 is used. Energy efficiency limit values are based on primary energy consumption and all electricity consumption is converted to primary energy using PEF 2,5 value.

The European Commission Consultation updating the PEF value for the Ecodesign Directive and the Energy Labelling Regulation has consequences whenever it plays a role in legislation, for example in determining the (seasonal) efficiency [ $\eta_s$ ] of boilers / Joule effect electric water heaters, electric heat pumps, use of auxiliary electricity (fan, valves, controls).

If the value of the PEF is now evaluated to be 2,1, the energy efficiency limit values of all forms of electricity consumption in the scope must be converted – all things being equal - by a factor (2,5 / 2,1).

The Figure 1 below shows the current and PEF-corrected Ecodesign minimum energy efficiency limits and energy label classes according to the seasonal efficiency for heating [ $\eta_s$ ] for appliances in the scope of lot 1<sup>3</sup>.

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<sup>1</sup> REGULATION (EU) 2017/1369 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU

<sup>2</sup> "Impact Assessment SWD(2016)405 final & the PEF value proposed for the EED - 02 August 2017"

<sup>3</sup> Lot 1: Space/combination heaters under Commission Regulation (EU) No 813/2013 and Commission Delegated Regulation (EU) No 811/2013. Other lots are impacted by this change of PEF, for example lot 2 (Water heaters).

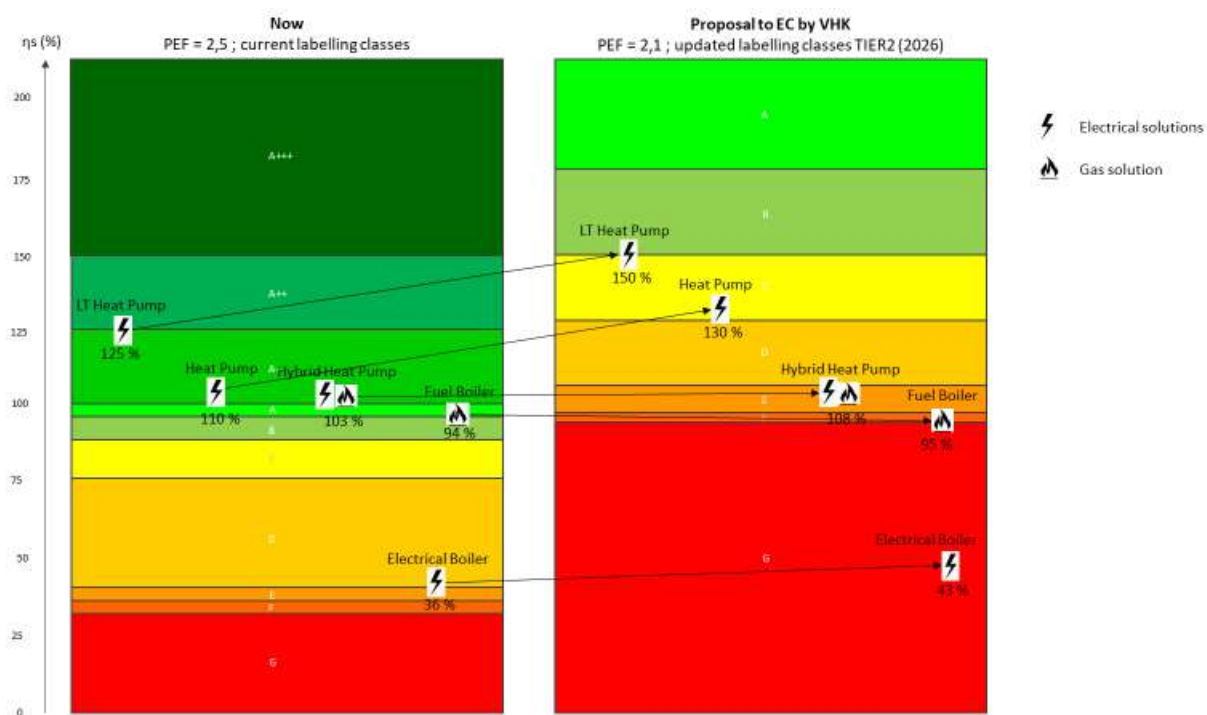


Figure 1. Ecodesign minimum energy efficiency limits and energy label classes, **now** and **proposed**.

Solutions	Now PEF = 2,5		Proposal to EC by VHK PEF = 2,1 (update)				
	$\eta_s$	Energy label classes	$\eta_s$	Energy label classes			
				TIER1	=	(update) NEW TIER2 from 2026	
Low Temperature (LT) Heat Pump	125 %	A++	150 %	A++	=	B	↓↓↓
Heat Pump	110 %	A+	130 %	A+	=	C	↓↓↓
Hybrid Heat Pump	103 %	A+	108 %	A+	=	E	↓↓↓
Fuel Boiler	94 %	A	95 %	A	=	F	↓↓↓
Electrical Boiler	36 %	D	43 %	D	=	G	↓↓↓

Table 1 - Impacts of PEF and energy label classes updates per type of heating solution.

VHK, the EC-appointed consultant, acknowledging the impact of the change of PEF given in the EED on electrical products, and the related favourable change in their energy class, proposes to change the labels so as to offset this specious change.

Based on this new PEF (2,1), new minimum energy efficiency limits are proposed by VHK which in principle means that existing values are merely corrected for the increased PEF (limits are not increased).

However, the minimum space heating energy efficiency ( $\eta_s$ ) for a non-electricity driven appliance (gas or fuel boiler) does not evolve much since the PEF only accounts in a small part of the total of energy consumed (by auxiliaries).

The decrease of the PEF of electricity artificially increases the energy efficiency of electrical applications, and might even allow again non-efficient electrical heating, therefore having a counterproductive effect. It also impacts the labelling of non-electrical products, thus modifying their relative positioning irrespective of their actual efficiency.

Thermally driven heat pumps (e.g. Gas Heat Pumps) could be downgraded/banned if new limits ( $\geq 130\%$ ) are to be applied to all heat pumps irrespective of their type. These products however are a relevant solution for customers who want to replace their gas boiler for a more efficient gas based appliance. Adapting the Ecodesign minimum energy efficiency limits of the space heaters to the new PEF could be logic, but is not fair to the thermally driven (gas/oil) heat pumps to be submitted to one limit for all heat pumps. For electric heat pumps the PEF-correction should apply (130% HT and 150% LT) but for thermally driven heat pumps, i.e. heat pumps that did not profit from the PEF-corrected factor, the current limits should be maintained.

### 3. Conclusions

- As a result of that change of PEF (2,5  $\rightarrow$  2,1) and of minimum space heating efficiency value ( $\eta_s$ ), Ecodesign lot1 revision<sup>4</sup>, **the energy labelling classes also need adjustment**, to take into account the increase for electric appliances.
- Any change in the PEF shall not result in downgrading or upgrading gas appliances on the label's scale. Only the thresholds and energy labelling classes relating to electric space heaters will have to be adjusted in the current scheme of 10 labelling classes, from A+++ to G. This at least until 2025 as mentioned in the 2017 Energy Label Regulation.
- For products providing the same function while using different energy carriers (electrical and gas heat pump, boilers, hybrid boilers), a change of PEF value shall not lead to a change of their relative position on the energy label scale.

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<sup>4</sup> The project is carried out by VHK, for the European Commission, DG Energy.

## Annex I: Primary energy, secondary energy and PEF definitions

- **Primary energy** is energy that has not been subjected to any conversion or transformation process. (e.g.: coal, oil, gas, uranium)
- **Secondary energy** is generated by transforming primary energy sources.

*For example, electricity is generated by the transformation of primary energy at power stations. The primary energy content of electricity therefore depends on the generation equipment used and its efficiency. Thus, electricity is not a naturally available resource, but a secondary energy which enables a variety of primary energy sources to be used.*

- **Final energy** consumption covers all energy supplied to the final consumer for all energy uses.

*Heating, domestic hot water production and cooking use various forms of energy such as natural gas, electricity, LPG and so forth. To ensure that informed choices can be made between various energy solutions, comparisons need to be made using relevant indicators. What may appear easiest, final energy – the one invoiced to the customer – does not reflect all primary energies consumed upstream (uranium, gas, etc.) for its generation, transmission and transformation. Only primary energy can account for a system's overall energy performance.*

- **Primary Energy Factor (PEF)**: to enable such a comparison, the global energy performance of the energy system being considered has to be assessed. The Primary Energy Factor (PEF) is used; defined as the ratio expressing for one unit of a given energy how many units of primary energy are needed for its production/generation/conversion →  $PEF = \text{Final energy} / \text{Primary energy}$ .

As electricity is a secondary energy, the PEF depends on the energy mix, conversion efficiencies and losses in transport and distribution. Thus, the PEF concept is most important for electricity.

## Annex II: Primary Energy Factor (PEF) and Directives

A very schematic summary of the impact of PEF values in the implementation of European Directives is as follows:

Energy Performance of Building Directive (EPBD)	Energy Efficiency Directive (EED)	Ecodesign Directive (ED)
For the Energy Performance of Buildings Directive (EPBD), it is used for the calculation of the energy performance of buildings so as to take into account the various energy carriers <sup>6</sup> .	Under this Directive, all EU countries are required to use energy more efficiently at all stages of energy chain, from production to final consumption <sup>7</sup> .	For the Ecodesign Directive (ED), energy-related products, which are sold throughout Europe (within the internal market), only a single common European value for PEF may be acceptable for a given product <sup>5</sup> .
		<b>Labelling Regulation</b> <p data-bbox="951 792 1394 1137">The purpose of such labelling is to enable consumers to compare products classified in various classes. Since 2010, the European Union's joint energy label has been given a new format: three new energy classes (A+++, A++ and A+) reflect the considerable technical progress made in the area of energy efficiency in the case of some products.</p> <p data-bbox="951 1182 1394 1370">These energy classes for heating, for example (Determined from Annex II of the Regulation on Labelling) are calculated based on <b>the primary energy performance of energy systems in place</b></p>

<sup>5</sup> Else it would distort the putting on the market towards the country(ies) with the most favorable value, which is illegal: else it would favor the placing on the market in one country rather than in another one, which cannot be allowed.

<sup>6</sup> Comparisons or benchmarking between countries can be misleading since many countries use a real global performance, whereas some use only the non-renewable part of energy (assuming that renewables are freely and unlimitedly available). In those countries, a badly designed and/or insulated building can be considered as having an excellent energy performance if supplied by renewables. A change of heating system or of energy supply will then not be taken into consideration.

<sup>7</sup> This Directive has relevance for Ecodesign and/or energy labelling of space/combination heaters (and water heaters) since the EC considers that the PEF it defines should to be used for them.

## Annex III: Reasons for different PEF calculation methods for different uses and aims

The PEF is a concept which is used for various objectives and with various methods depending on assumptions. For buildings on one hand and for energy-related products on the other hand, the outlook has to be quite different, as it is shown in the following:



### Buildings

For this purpose, different climate conditions, buildings, energy mix, policies can be addressed on a national basis, leading to different values in different countries.



### Energy-related products

Energy-related products must be labelled with their environmental impact, in particular their energy consumption. This regulation is independent from national situations.

In this context the user must have the ability to choose one appliance for its intrinsic efficiency according with the primary energy that it needs for operation, regardless of the country of residence.