POSITION PAPER

COMMENTS ON THE REGULATIONS ABOUT ECODESIGN AND ENERGY LABELLING REQUIREMENTS FOR SOLID FUEL BOILERS AND SOLID FUEL LOCAL SPACE HEATERS

Brussels, November 2023

INTRODUCTION

We welcome the revisions of the Ecodesign regulations for solid fuel boilers (EC 2015/1189), appliances serving central heating needs, and solid fuel local space heaters (EC 2015/1185), products serving local heating needs, as well as the revision for the energy labelling regulations for solid fuel boilers (EC 2015/1187). Biomass-based heating systems, such as pellet, have experienced a surge in sales, particularly due to the energy crisis and, in some countries, such as Germany, they grew by 17% in 2022.

Particularly the usage of 'primary woody biomass' is contributing to deforestation and only 5% of all woody biomass is coming from recovered used, such as furniture or buildings. Considering that 80 to 90 million EU households use solid fuel for heating purposes, it is indeed key to address the threats that solid fuel heating can pose to human health, specifically to indoor and ambient air qualities, its climate impacts as well as biodiversity and forest damages.

An extensive study looking at the impact of using woody biomass for energy production in the EU has been produced by the Joint Research Centre in 2021. Despite the lack of consideration regarding the human health related impacts, when it comes to woody biomass use, the study clearly shows that burning biomass is a lose-lose activity both for climate and biodiversity protection objectives.

ECONOMICS AND HEALTH-RELATED ISSUES

Residential burning with solid fuels is the **predominant source of health and climate damaging pollutants** in the EU: the sector is responsible for 58% of fine particles (PM2.5), 37% of black carbon (BC) and 85% of benzo(a)pyrene (BaP) emitted in the EU. The majority of these emissions come from small appliances burning wood and having a heat output between 4 and 500 kW. This includes solid fuel local space heaters (SFLSH), commonly referred to as stoves or fireplaces as well as solid fuel boilers (SFB, e.g. using firewood, coal or pellets).

Exposure to fine particles above the World Health Organisation (WHO) recommendations for air quality resulted in around 238,000 premature deaths in 2020, as ultrafine particles penetrate deep into the lungs and bloodstream and can thus trigger or aggravate various serious diseases. Nine out of ten urban residents in the EU were exposed to such levels above the WHO recommendations.

Measurements conducted in the course of the LIFE Clean Heat project have shown that particle pollution in residential areas, with predominant wood burning, can substantially exceed pollution levels reached at busy streets during rush hour.

Due to the negative effects on health, domestic wood burning in small stoves also causes substantial strain for the states' health systems. For example, average Danish health costs due to emissions from domestic wood stoves/boilers reach 15.6€/GJ. For comparison purposes, costs caused by district heating powered by coal are 1.3€/GJ, whereas alternatives, such as heat pumps, are zero. Additionally, **firewood is also the heat source releasing the most CO_2 per GJ** and it takes many decades before new trees has taken up the CO_2, causing again significant global warming.

EU CLEAN AIR AND PRODUCT POLICIES INTERACTION

The emission requirements are at the core of the ecodesign regulations. These source-specific emission limit values are complementary to the other two pillars of EU's clean air policy – the standards for **Ambient Air Quality Directive** (AAQD) and the **National Emission Ceiling** (NEC) directive, hence the current ecodesign revisions must cover all relevant pollutants included in both files. A high ambition level regarding the emission requirements is needed for coherence with the Zero pollution target and the revised AAQD, as well as to comply with WHO guidelines as quickly as possible.

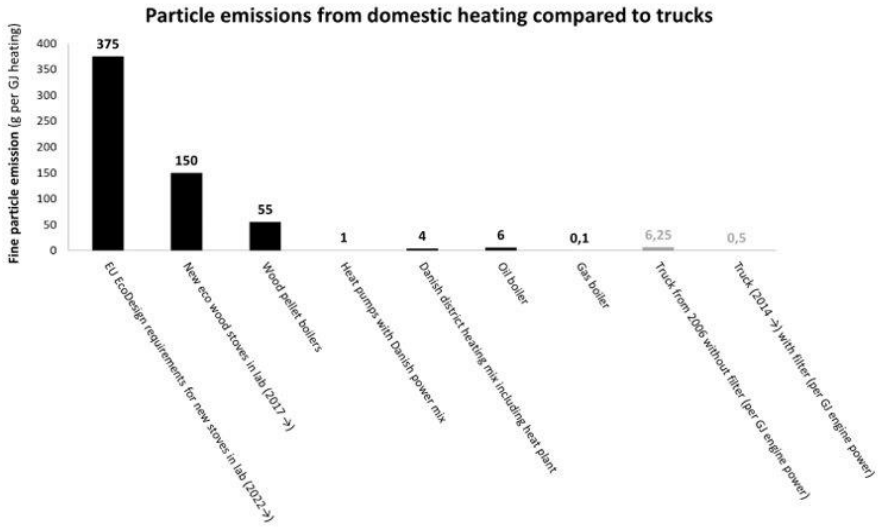

Fig. 1 Particle emissions limits for different heating and transport products

In addition, the ambition in the sector needs to be in line with other source-specific emissions requirements, namely the EURO standards for vehicles. In the medium term, new solid fuel appliances need to fulfil the

same emission limit values (particulate matter/PM, particle number/PN and NO_x) as EURO VI trucks, vehicles sold in the EU after 2014 – as depicted in Fig.1.

The Impact Assessment underpinning the European Commission's proposal for a revised AAQD shows that achieving WHO Air Quality Guidelines in the EU by 2030 will bring net benefits between 38 billion Euro per year, based on VOLY - Value Of a Life Year[1] - to 123 billion per year, based on VSL - value of statistical life[2]. As it continues: '*this analysis assesses technical feasible reductions only and does not include assumptions on fundamental changes in economic activity, dietary patterns, technological breakthroughs or major shifts in our energy systems*'. What civil society expect the Ecodesign standards for stoves and boilers' revision process to do is to promote emissions reductions through ambitious minimum technical while promoting to the buildup of a societal change towards the phase-out of domestic heating appliances based on biomass burning, without leaving anyone behind.

Ecodesign and energy labelling regulations for solid fuel boilers and solid fuel local space heaters can mitigate the impact of the biomass heating by the following elements:

SOLID FUEL BOILERS

SCOPE AND BAT IDENTIFICATION

According to the presentations displayed, coal-powered boilers are not widespread in EU, the stock are mostly in Eastern European countries, where transition is away from coal boilers thanks to financial support schemes (such as in Poland). The overall trend is decreasing, yet these appliances are the most polluting options to warm households; additionally, there is a clear indication from JRC study that coal in boilers, stoves and district heating is almost phased out by 2030, thus we call for a clear **ban on the new installation of coal-fired boilers** in the revision of the Ecodesign requirements (BC 11, 12 and 13).

The scope of the Ecodesign regulations should be extended to boilers **up to 1MW**, this is currently a loophole for those appliances as the Medium Combustion Plant Directive has a scope for units above 1 MW. The preferred option is to close the loopholes by extending the Ecodesign scope, because of the tighter emissions' limits. To provide a clear best practice, the German First Ordinance on the Implementation of the Federal Immission Control Act (1. BImSchV) cover solid fuel appliances of up to 1 MW: reckoning the difficulties to test those appliances in labs, an on-site test could be undertaken after installation, as this is a common practice in Germany, where on-site measurements are mandatory for solid fuel boilers every two years. Furthermore, other central heating products, such as space and waters heaters (lot 1 and 2) have a similar scope to include products up to 1MW, and this would be useful for a future merge of the regulations.

[1] i.e. damage cost calculations based on the potential years of life lost

[2] i.e. damage cost calculations based on how much people are willing to pay for a reduction in their risk of dying from adverse health conditions

In order to define and identify Best Available Technologies (BATs), the impact assessment must necessarily take into account the BAFA list of solid fuel boilers of the German funding scheme (BEG, Bundesförderung für effiziente Gebäude). The BAFA overview lists several hundred boilers that already meet the BEG particle limit value for biomass appliances (2,5 mg/Nm^3 in full load).

EMISSION REQUIREMENTS

Currently, solid fuel boilers are mostly fuelled with wood pellets, but also logwood, wood chips and coal (e.g. in Poland). They usually have fewer emissions than local space heaters but still emit large amounts of **ultrafine particles**. Thus, a substantial reduction of emissions is crucial to protect human health.

Based on the current technically feasible reduction potential, the following requirements are strongly recommended in the revised regulation for solid fuel boilers:

- The present ecodesign emission limits for **particle mass** are 40 mg/Nm^3 (60 mg/Nm^3 for manually stoked boilers). This emission level is way too high to protect human health and does not reflect BATs. The emission requirements for particles in the revised regulations needs to ensure that effective emission reduction technology becomes standards. As shown in presentations for the Consultation Forum and in the BAFA list, the emission limit value should be aligned with the limit value of 2,5 mg/Nm^3 of the German funding scheme (BEG).

- More than 90 % of particles emitted from biomass appliances have a size of less than 1 µm, an additional limit value for **particle number (PN)** needs to be introduced – as it is already the case in the vehicle sector. Further arguments for the introduction of an PN limit value are presented in the section on local space heaters. Based on the emission level reached by appliances with the German Blue Angel eco-label for stoves and electrostatic precipitators (ESP) a PN limit value of 2x10^6/cm^3 (or reduction of more than 90%) is recommended for solid fuel boilers as a first step, with a further reduction in the medium term.

- The current **OGC limit** is 20 mg/Nm^3 (30 mg/Nm^3 for manually stoked boilers), but BAT is 3 mg/Nm^3 or lower for automatically stoked boilers, thus the threshold should be aligned to BAT and explore the possibility to similarly proceed with lower limits for manually stoked boilers.

- In the medium term, new solid fuel appliances need to fulfil the same emission limit values (particulate matter/PM, particle number/PN and NO_x) as EURO VI trucks, vehicles sold in the EU after 2014.

Horizontally, the limit' units need to be changed from mg/Nm^3 to **mg/kWh** of fuel (or to other energy input terms) to harmonise this sector with other energy-consuming sectors with air pollution emissions, allowing comparability and transparency.

Additional technical requirements linked to emission performance that need to be considered in the revision are:

- Low-emission solid fuel boilers are usually equipped with an either internal or external ESP. For the latter, supplementary requirements – like counter of operating hours and automatic cleaning – are recommended to ensure efficiency and continuous operation of emission reduction technology.
- A mandatory buffer tank requirement should be introduced, to reduce operation in partial load conditions, in line with the specifications of the current German funding scheme BEG: buffer tank volume of, at least, 30 litres per kW of nominal heat output.
- Recurring on-site measurements with focus on particle number emissions to ensure that emission reduction technique is working, as it is currently occurring in the vehicle sector.

TESTING PROCEDURE

The present test methods for ecodesign requirements include only particles directly from combustion, not the large volume of condensed particles formed when the flue gas meet the ambient air. We propose to change the test method to a more **realistic test procedure** than the EN-PME, to a method that includes the condensed particles, with the use of a dilution tunnel. We also propose measurement of particle numbers, as it is now the standard for diesel vehicles.

MERGE OF THE ENERGY LABELLING

We **fully support** the European Commission to work on the possibility of merging the energy labelling of solid fuel boilers (lot 15) with space and water heaters (lot 1 and 2). It will unleash the fullest potential of the energy labelling, as consumers can finally compare all the appliances that can serve the same purpose (heating households), as it is currently the case for local heating and cooling applications - under local space heaters (lot 20).

In addition, we propose to add an indication on air pollution on the energy label with a label scale with top classes for the cleanest combustion with least particles, combining total number of condensed particles with particle numbers.

SOLID FUEL LOCAL SPACE HEATERS

These products are fueled with log wood, wood pellets and coal (briquettes), often used as (supplementary) source of heating for single rooms. Emission performance of typical appliances in the market also depends on both fuel used and user behavior. The emissions include large amounts of black carbon and ultrafine particles, and they are responsible for most particle emissions from the residential heating sector in many Member States (e.g. about 80% in Germany, according to DBFZ estimation).

SCOPE AND ADDITIONAL TECHNICAL REQUIREMENTS

Similarly, to the consideration for solid fuel boilers mentioned beforehand, we are calling for a clear **ban on the new installation of coal-fired local space heaters** in the revision of the Ecodesign requirements (BC 4). Out of the countries analyzed, the stocks of this product category are exclusively in Belgium and France and both countries provide incentives to clean heating alternatives.

Wrong setting of combustion air leads to very high emissions in the practical use and this is one reason why real-life emission performance substantially deviates from laboratory testing. With an electronic combustion air control, operating errors will be reduced as well as combustion process will be improved which enables supplementary emission reduction technologies (catalytic converter and ESP) to work more efficiently. Additionally, in the present energy labelling regulations, appliances can increase the efficiency on the label by 4% if they have electronic room thermostat control, which is normally integrated with electronic combustion control. This has been a first useful step to promote electronic combustion air controls. Hence, the revision needs to go beyond and we propose to make **electronic combustion air controls** a mandatory requirement: This is today the case for the German Blue Angel eco-label, stating "*it is not permitted for the air supply to be manually adjustable during intended operation*".

Exhaust cleaning technology must become mandatory for local space heaters – respective emission requirements are needed to ensure this. As a research project from RWTH Aachen concludes: "*With catalytic converters and electrostatic precipitators, effective and, above all, commercially available reduction technologies for wood-burning stoves which, in combination, remove both the acutely toxicologically relevant (VOC) as well as the predominantly chronically harmful solid-particulate pollutants (PM/UFP). and adhering organic substances (including PAHs). Both technologies should be combined, like diesel vehicles having both filters and catalytic converters*". During the PN measurement validation of the Blue Angel eco-label, the electrostatic precipitator reduced particle number by 97% and particle mass by 84%[3], leading to an emission level that is even substantially below the PN limit value included in the Blue Angel eco-label (less than $1x10^6/cm^3$, also reflected in the official test reports of stoves).

We support the important requirement of **third-party verification**, it will avoid unrealistic self-declaration and help market surveillance.

EMISSION REQUIREMENTS

Even new stoves complying with the current Ecodesign standards are allowed to **emit about 40x more PM** per kWh in the type-approval test than a diesel truck (EURO III) that is more than 20 years old and filter-less. The revised regulations need to introduce emission limit values that are based, at least, on today's BATs as a

[3] UBA-Texte xx/2023 (publication pending): Partikelanzahlmessungen im Abgas von Kaminöfen. Validierung des Messverfahrens für das Umweltzeichen Blauer Engel durch Ringversuche.

first step. Here, the provisions of the German eco-label Blue Angel should serve as an example and we advocate for aligned Recommendations (based on stricter testing procedure):

- **Particulate matter (PM):** Total PM is not linked to respective air quality standards in the AAQD (PM10, PM2,5) and not a good indicator of health and climate impacts of stoves. Moreover, the current limit (40 mg/m^3) for logwood appliances is completely outdated, thus, we propose to start with setting the threshold to 15 mg/m^3 for log wood stoves, following today's BAT without condensed particles. For wood pellet appliances, the current limit value (20 mg/m^3) could also be halved.

- **Particle number (PN):** A strict limit value for PN concentration needs to be introduced in order to assess the level of ultrafine particles emitted. In its latest air quality guidelines, WHO underlines that the '*most significant process generating ultrafine particles is combustion…*' and that, in general, there '*is very little or no relationship between PN concentration and mass concentration of larger particles (PM2.5)'*. These are the main reason for having a specific PN limit value, according to the German Environment Agency: **"***A large number of ultrafine particles (smaller than 0.1 µm) are generated when burning wood that are considered to have a particularly negative impact on human health. No special and obligatory emission limits for these ultrafine particles have existed up to now; the ultrafine particles are currently included in the total amount of particulate matter (…) A measurement method has been developed for this purpose that is based on experience gained in combustion motors in the automotive sector and which has been specially adapted for the combustion of wood. A limit for the particle count concentration of 5x10^6/cm^3 has been proposed on this basis (…)*". The PN measurement method of the Blue Angel eco-label has been validated[3] and will presumably be obligatory in the award criteria from 2024. As outlined above, stoves certified with the Blue Angel label reach even lower PN concentrations. Thus, we recommend introducing a PN limit value of at least 2x10^6/cm^3 for local space heaters. This is a quite feasible step as, for comparison purposes, a new truck has a PN emission below 5,000 (and often below 1,000) particles per cm^3.

- **Carbon monoxide (CO) and organic gaseous compounds (OGC):** While strict PM and PN limit values ensure substantial reduction of solid particles and promote the use for electrostatic precipitators, much more ambitious requirements for CO and OGC serve the purpose of minimizing harmful gaseous exhaust components and foster the inclusion of catalytic converters. We call to decrease the current CO ecodesign requirement of 1500 mg/m^3, down to 500mg/m^3 and to decrease the current OGC ecodesign requirement from 120 mgC/m^3 to 40 mgC/m^3 for log wood fired heaters and from 60 mgC/m^3 to 10 mgC/m^3 for wood pellet fired heaters with present measuring methodology, following current BATs.

- **Black Carbon (BC) and Benzo(a)pyren (BaP):** Additional emission limit values for BC and BaP are recommended to consider all relevant pollutants addressed in the AAQD and NEC Directive. BC is the most relevant short-lived climate pollutant for the carbon footprint of wood combustion and is a component of PM. According to the IPCC, BC has an average GWP100 of 900 $CO_{2,eq.}$, however to rapidly reduce climate pollutants, the shorter-term GWP20 is 3,200.
  Based on the emission factors of the European Environment Agency (EEA), new stoves overall emit less PM than old appliances. Nevertheless, the relative amount of BC in particulate matter (PM2.5) is

higher in newer stoves, estimated to be up to 55% in solid particles. Alongside, research carried out by TFZ Straubing has shown that a pellet stove can also emit large quantities of elemental carbon (black carbon).

- In the medium term, new solid fuel appliances need to fulfil the same emission limit values (particulate matter/PM, particle number/PN and NO_x) as EURO VI trucks, vehicles sold in the EU after 2014.

Additional technical requirements linked to emission performance that need to be considered in the revision of the regulation for local space heaters:

- To meet the emission requirements above, stoves need to be equipped with an internal or external ESP. For appliances with an external ESP, a counter of operating hours is strongly recommended to ensure that it is used continuously when burning solid fuels.
- Recurring on-site measurements with focus on particle number emissions to ensure that emission reduction technique is working, as it is currently occurring in the vehicle sector.
- Similarly to solid fuel boilers, we call for emission data should be published per energy input,
- Requirements should be set to limit the increase of indoor air pollution of PM2.5 and PN to stay within WHO health recommendations for indoor air.

TESTING PROCEDURE

The testing procedure needs to be as close as possible to real-usage conditions, this is eventually what consumers will experience, avoiding the development and optimization of lab-only testing conditions by industry manufacturers. The recent development of the vehicle sectors results in the developments of real-driving testing methods, and this is something that solid fuel heating can mirror.

Several completed and ongoing research projects have made recommendations on how to improve testing (i.e. BeReal, elaboration of Blue Angel eco-label for firewood stoves, Real-LIFE emissions) and these findings need to be considered in the revision. Thus, we strongly recommend the following measures:

- **Test cycle (consideration of different phases):** In the ignition phase, substantial amounts of pollutants are emitted, and it needs to be included in the measurement of emissions needs, by starting it with the cold stove. In addition, the current possibility of ignoring specific batches in the emission testing (batch picking) needs to be prohibited at all. Both issues have been solved with the test cycle of the Blue Angel eco-label and the BeReal project.

- **High loading/partial load as typical user errors:** While wrong setting of combustion air is addressed with automated/electronic combustion air controls, the appliances (and exhaust cleaning) need to be able to cope with different amounts of fuels that are commonly used (e.g. ranging 40-150 % of nominal load). This range must be addressed with additional high load and partial-load tests in the

test procedure. Alternatively, we propose to move to the principle of defining full load test according to size of combustion chamber and combine it with a part load test, as in the Norwegian standard NS3058/59

- **Fuel used:** Testing should be accomplished with fuel that is commonly used (e.g., with bark).

- **Indoor pollution/tightness:** We propose an indoor air quality criterion since they are placed indoor in households and are known to be a significant source to indoor particle pollution. These products should not increase indoor air pollution at all – neither with fine particle mass ($PM_{2.5}$) nor with ultrafine particles. This should be ensured by:
    - Additional testing procedure for tightness, based on Blue Angel eco-label: "*Stoves holding the Blue Angel must comply with minimum requirements for their tightness, irrespective of the type of air supply (open flue or balanced flue). The test must be carried out after mechanical stress (opening and closing the doors) has been applied and after cooling of the stove following a thermal overload in accordance with the safety tests pursuant to DIN EN 16510-1:2018-11. The mechanical stress involves opening and closing the firebox door 6000 times; all doors that do not need to be opened daily for the intended use of the stove, such as ash boxes, inspection or fuel storage doors, should be opened and closed 1000 times. The doors should be opened here to the widest possible angle. The tightness should be measured at three different statistical overpressures of between 5 Pa and 15 Pa. For this purpose, the setting controls for the combustion air should remain closed; combustion air openings that cannot be closed should be sealed up.*"
    - Making the producer to be accountable for independent third-party after-sale measurements performed in houses 3, 5 and 10 years after the installation (i.e. measurements to document that local space heaters do not increase indoor air pollution with particles). This could be done by choosing a representative sample to be measured under real conditions in the homes using these products, e.g. a sample consisting of 0.1 % of the total sale of each new model.

- **Condensed particles/dilution:**
  The most popular test method, for ecodesign particle emission limits, is the heated filters test. Currently modified to the EN-PME test method, it has several problems in representing real-life emissions, including:
    - No emissions at start-up.
    - No emission formed when the flue gas meets ambient air.
    - No mandatory part-load testing.
    - No limit to the number of tests that can be performed.
    - No specifications of the filling of the combustion chamber, and it can be unrealistic low compared to the real size of the combustion chamber.
    - No good representation of the ultra-fine particles.

  To solve these problems, we propose to move to **better test methods** for particles, including measurement of particles formed with condensation using the dilution tunnel method that will

include start-up emission, part-load testing filling of the combustion chamber depending on the size of the combustion chamber, requirements of part-load testing, limit to the number of tests that can be performed for type testing, inclusion of test for particle number.

Some of the improvements can easily be introduced with the ecodesign revision, including part-load testing that is already specified as voluntary in the EN-PME method (in the standard EN16510-1), maximum number of tests during a session.
Other improvements are already included in the standard NS3058/59 (measurement of condensed particles, realistic filling of combustions chamber, part-load testing). Thus, it is important to maintain NS3058/59 as a permitted standard for particle emissions limits in ecodesign. Remaining issues can be introduced in a second tier.
Some of the problems with the particle test method is also a problem for testing of CO and OGC emissions, including lack of part-local testing, unrealistic filling of combustion chamber, not measurement of start-up emissions, and no limit to number of trials, thus the abovementioned proposals, also **apply to measurement of CO and OGC**.

Lastly, we firmly believe that **no change to the energy efficiency** methodology and parameters should be made concerning the energy content of woods.

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