



## European Commission DG TREN

### Preparatory Studies for Eco-design Requirements of EuPs (II)

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#### **Lot 15** **Solid fuel small combustion** **installations**

#### **Base case explanation document** **for task 5**

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 **AEA Energy & Environment**  
From the AEA group



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# 1. Definition of Base Cases

## 1.1. CRITERIA FOR DEFINING BASE CASES (BCS):

The aim of the Ecodesign Directive is to remove the least efficient appliances from the market. According to the MEEUP methodology<sup>1</sup>, the BC should meet three criteria:

- Significant market share (typically >200 000 appliances sold)
- Significant environmental impact
- Improvement potential

The reason for these criteria is that implementing measures should target appliances which are widespread in the EU market, and causing some damage to the environment, and that can be improved. An appliance that does not meet any one of these three criteria provides little opportunity for policy action, and therefore is not considered as a BC.

The market criterion is not limited to sales, but also concerns stock. The least cost analysis in Task 7 is weighed by the stock of appliances (rather than the sales). Stocks are particularly relevant in the case of Lot 15 appliances, which are long-lived, and which people may keep for up to 50 years. Therefore, a lot of the inefficient appliances on the EU market are simply old appliances, which are not currently sold anymore.

Based on these considerations, eight base cases have been defined for the Lot 15 study. These eight appliances do not cover all possible types of appliances, but represent a large portion of the existing stock and current sales market in solid fuel SCIs. The BC are representative of the appliances relevant ones to this study based on the criteria set forth in the MEEuP methodology for EuP studies.

### → BC1 – Open fireplaces

BC1 is defined as a traditional open fireplace with a nominal heat output capacity equal to 15 kW and an efficiency of 15%. These appliances use natural draft and have no primary or secondary air control mechanisms in this appliance. The appliance is integrated into the structure of the household and is composed of mostly masonry and ceramic materials. One side of the fuel bed and combustion zone is open to the living environment of the household and has no means to be closed. Heat transfer is through direct means, mostly through direct radiant energy from the flames. In the EU, the main fuel used in this appliance is wood logs. Fuel feeding into the combustion zone is manual. Newer appliances may include means for secondary air control. However, such appliances represent a small portion of the overall stock of solid fuel SCIs in the EU and are not represented as a BC in this study.

### → BC2 – Closed fireplaces

BC2 is defined as a closed fireplace with a nominal heat output capacity equal to 10 kW and an efficiency of 55%. These appliances use natural draft, and have no primary or

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<sup>1</sup> [http://ec.europa.eu/energy/demand/legislation/doc/2005\\_11\\_28\\_finalreport1\\_en.pdf](http://ec.europa.eu/energy/demand/legislation/doc/2005_11_28_finalreport1_en.pdf)

secondary air control mechanisms in this appliance. Heat transfer is through direct means, mostly through direct radiant energy from the flames and natural convection of household air from the surfaces of the appliance. The appliance is integrated into the structure of the household and is composed of mostly masonry and ceramic materials (not an insert appliance). The combustion zone and fuel bed are fully enclosed by the walls of the appliance, however the front face of the appliance is glass and can be opened. Heat transfer is through direct means, mostly through direct radiant energy from the flames. In the EU, the main fuels used in this appliance are wood logs and lignite briquettes. Fuel feeding into the combustion zone is manual.

Newer appliances may include means for primary or secondary air control. However, due to the long life of these appliances; products with air control represent a small portion of the overall stock of the appliances in the EU and are therefore not considered as a BC in this study.

Fireplace inserts, despite representing an equally large portion of the stock and sales market as closed fireplaces, tend to represent an improvement option for open fireplaces, since they are designed to fit into existing fireplaces and offer improved environmental performance and limited scope for improvement. **Therefore, fireplace inserts do not constitute a BC but will be considered in Task 6 as a best available technology and will be used as an improvement option.**

### → BC3 – Traditional cookers

BC3 is defined as a traditional cooker appliance with a nominal heat output capacity equal to 10 kW and an efficiency of 55%. Cookers use natural draft, and have no primary or secondary air control. Heat transfer is through direct means to cooking surfaces through conduction and to the household space through convection off the hot surfaces of the appliances. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and not visible from the exterior of the appliance. In the EU, the main fuels used in this appliance are wood logs and lignite briquettes. Fuel feeding into the combustion zone is manual.

Newer appliances may include means for primary air control, secondary air control or forced draught; however, due to the long life of these appliances, products with air control represent a small portion of the overall stock of the appliances in the EU. Newer cookers therefore do not represent a BC for this study, but may be considered as best available technologies in Task 6.

#### 1.1.1. STOVES

The overall stock and yearly sales of stoves in the EU is 25 901 000 and 1 037 200 respectively. Approximately 23% of these stoves are slow heat release stoves, which already have good environmental performance (with efficiencies above 80%) and present little improvement potential. Therefore slow heat release stoves do not meet all criteria for BC definition. Pellet stoves represent less than 2.5% of the stoves; have good environmental performance, and little improvement potential. **Therefore pellet stoves do not meet any of the criteria for BC definition, but may be considered as alternative products in Task 6.** Among the rest of the stoves, four different types of appliances may be distinguished: the traditional stoves, modern stove and advanced stoves (intermittent burning) and the continuous burning stoves. Since continuous

burning stoves and advanced stoves represent a small share of the stove market (<15%), the BC are defined for traditional and modern stoves, described below. **Advanced stoves may constitute example of best available products in Task 6.**

#### → BC4 — Traditional stoves

BC4 is defined as a traditional stove appliance with a nominal heat output capacity equal to 8 kW and an efficiency of 45%. Traditional stoves use natural draft and have no primary or secondary air control mechanism. Heat transfer is through direct means through natural draught convection from the hot surfaces of the appliances. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and visible from the exterior of the appliance through windows on the door. In the EU, the main fuels used in this appliance are wood logs and lignite briquettes. Fuel feeding into the combustion zone is manual.

#### → BC5 – Modern stoves

BC5 is defined as a modern stove appliance with a nominal heat output capacity equal to 8 kW and an efficiency of 60%. Traditional stoves use natural draft and have secondary air control mechanisms. Heat transfer is through direct means through natural draught convection from the hot surfaces of the appliances. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and not visible from the exterior of the appliance. In the EU, the main fuels used in this appliance are wood logs and lignite briquettes. Fuel feeding into the combustion zone is manual.

### 1.1.2. BOILERS

Most of the EU sales are for automatically-fuelled boilers, hence the choice of BC7 (boilers <50kW) and BC8 (boilers 50-500kW). The stock of solid fuel boilers in the EU on the other hand is dominated by boilers <50kW, hence the addition of BC6, to represent manually-fuelled boilers <50kW. Then the specific characteristics of the boilers chosen for BC6, 7, 8 have been decided accordingly:

#### → BC6 – Small domestic boiler: conventional manually fuelled boiler < 50 kW

Small manual boilers can be either typical conventional over-fire boiler or an advanced, gravity-feed boiler. Since gravity-feed boilers represent a smaller share of the market than conventional boilers, as well as smaller improvement potential, the conventional boiler was chosen as the BC6.

BC6 is defined as a small domestic boiler with a nominal heat output capacity equal to 25 kW and an efficiency of 70%. The BC is a boiler using over-fire combustion technology, which is a hypothetical mix of an appliance with natural draught, primary air supply but no secondary air supply, and of an appliance with forced air supply primary and secondary air control. Heat transfer is indirect through a heat exchanger which transfers the combustion heat to water. The accessory heat transfer system (water piping) is not included within the scope of this study and hence does not form part of this base case despite being a necessary component for delivering heat. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and not visible from the exterior of the

appliance. In the EU, the main fuels used in this appliance are wood logs and lignite briquettes. Fuel feeding into the combustion zone is manual.

→ **BC7 – Small automatic boiler: upper-fire automatically fuelled boiler < 50 kW**

Small automatic boilers can be either pellet boilers or mineral fuel (stoker or push-down) boilers. As mentioned above, pellet boilers have little environmental impact and little improvement potential, therefore they do not meet 2 of the MEEUP criteria, and will instead be considered in improvement options in Task 6. Accordingly, the BC chosen is for an upper-fire stoker boiler/push-down boiler.

BC7 is defined as a small domestic boiler with a nominal heat output capacity equal to 25 kW and an efficiency of 80%. The appliance uses upper fire combustion and forced primary air and forced secondary air supplies. This base case is a hypothetical mix of an appliance with an automatic stoker fuel feeding system and push-down fuel feeding system. Heat transfer is indirect through a heat exchanger which transfers the combustion heat to water. The accessory heat transfer system (water piping) is not included within the scope of this study and hence does not form part of this base case despite being a necessary component for delivering heat. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and not visible from the exterior of the appliance. In the EU, the main fuel used in this appliance is other mineral fuels.

→ **BC8 – Medium automatic boiler: stoker/moving grate automatically fuelled boiler (> 50 kW)**

Automatic boilers between 50-500kW can be either pellet boilers, underfeed rotating grate boilers, underfeed stoker boilers or moving grate overfeed boilers. Pellet boilers again have little environmental impact and improvement potential and will therefore be considered in Task 6. Underfeed rotating grate boilers represent a negligible share of the market and therefore do not meet the first of the 3 MEEUP methodology criteria. Therefore, BC8 is considered to be a mix of the stoker and moving grate boiler.

BC8 is defined as a medium domestic boiler with a nominal heat output capacity equal to 100 kW and an efficiency of 85%. The appliance uses upper fire combustion and forced primary air and secondary air supplies. This base case is a hypothetical mix of appliances with automatic under-feed stoker fuel feeding system and moving grate fuel feeding system. Heat transfer is indirect through a heat exchanger which transfers the combustion heat to water. The accessory heat transfer system (water piping) is not included within the scope of this study and hence does not form part of this base case despite being a necessary component for delivering heat. The appliance is freestanding and is composed of mostly iron and steel. The fuel bed and combustion zone are completely enclosed and not visible from the exterior of the appliance. In the EU, the main fuels used in this appliance are wood chips, lignite briquettes.

## 1.2. EMISSIONS FROM BASE CASE APPLIANCES

The emissions from the appliances representing the base cases are presented in Table 1 where available. The appliances are separated by fuel type where available.

**Table 1 : Emissions of base cases with applicable fuel types where available**

	Emission Unit	Efficiency Base case (%)	Particulate min	Particulate max	CO min	CO max	OGC min	OGC max	NOx min	NOx max
Open fireplace – wood log <sup>2</sup>	mg/m <sup>3</sup>	15	150	1000	6000	37500	300	1500		<200
Closed fireplace – wood log <sup>2</sup>	mg/m <sup>3</sup>	55	90	120	6000	17500	200	500		<200
Traditional cooker – wood log <sup>2</sup>	mg/m <sup>3</sup>	55	100	200	8000	20000	300	900		<200
Traditional stove – wood log <sup>2</sup>	mg/m <sup>3</sup>	45	90	120	4000	15000	200	500		<200
Modern stove – wood log <sup>2</sup>	mg/m <sup>3</sup>	60	55	75	1250	1500	100	120		<200
Small manual boiler – wood log <sup>3</sup>	mg/MJ	70	18	18	5043	5043	36	36	89	89
Small manual boiler - mineral <sup>4</sup>	mg/m <sup>3</sup>	70	55	145	1640	4070	55	130	210	345
Small automatic boiler – wood log <sup>3</sup>	mg/MJ	80	18	18	5043	5043	36	36	89	89
Small automatic boiler - mineral <sup>4</sup>	mg/m <sup>3</sup>	80	55	140	115	1005	16	70	270	520
Medium automatic boiler – wood log <sup>3</sup>	mg/MJ	85	18	18	5043	5043	36	36	89	89
Medium automatic boiler - mineral <sup>4</sup>	mg/m <sup>3</sup>	85	32	105	83	420	78,4	86,1	270	400

<sup>2</sup> Estimation of emissions and efficiency 20-30 years old firing for Europe - Comité Européen des fabricants d'appareils de chauffage et de cuisine domestiques, based on DIN+ standard measurements

<sup>3</sup> Estimation of emissions for wood log boilers with similar efficiency from historical emissions data from ABC-energy, based on EN 303-5 standards.

<sup>4</sup> Mineral boiler data is currently based on new appliances, from data collected in Task 4 based on EN 303-5 standards. Updated data on historical emissions is expected and will be incorporated as soon as possible.