# Environmental Product Declaration

as per ISO 14025 and EN 15804

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| Owner of the declaration: | BauMineral GmbH |
| Publisher: | BCS Öko-Garantie GmbH - Ecobility Experts |
| Programme holder: | BCS Öko-Garantie GmbH - Ecobility Experts |
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| Valid to: | 11.12.2022 |

## EFA-Füller® HP

This Environmental Product Declaration (EPD) refers to 1 t hard coal fly ash from the coal-fired power station Heyden in Petershagen. Hard coal fly ash is a coal combustion product which is used as an additive to concrete in the concrete industry.

BauMineral KraftWerkstoffe

## 1. General information

### BauMineral GmbH

**Programme holder**
BCS Öko-Garantie GmbH - Ecobility Experts
Marientorbogen 3-5
90402 Nürnberg
Deutschland/Germany

### EFA-Füller® HP

**Owner of the Declaration**
BauMineral GmbH
Hiberniasstraße 12
D-45699 Herten

**Declaration number**
EPD-Baumineral-023-DE

**Declared product /declared unit**
1 t hard coal fly ash

**This declaration is based on the Product Category Rules:**
“Produktkategorieregeln für Flugaschen-Anforderungen an Umwelt-Produkt-deklarationen für Flugaschen”
Product category rules for fly ash requirements on Environmental product declaration for fly ash
(issue 2017-06)

**Scope**
EFA-Füller® HP is a hard coal ash from the coal-fired power station Heyden in Peter-shagen. This hard coal ash occurs during power generation in hard coal fired power stations and is captured by electrostatic pre-cipitators before the flue gases reach the chimneys. This EPD refers to the hard coal fly ash EFA-Füller® HP distributed by Baumineral GmbH.
The owner of the declaration shall be liable for the underlying information and evidence. Kiwa BCS Öko-Garantie GmbH – Ecobility Experts shall not be liable with respect to manufacturer information, life cycle assessment data and evidences.

**Issue date**
11.12.2017

**Valid to**
11.12.2022

**Verification**
The CEN Norm EN 15804 serves as the core PCR

Independent verification of the declaration and data according to ISO 14025

✓internally ☐externally

*Signature*
Ppa. Frank Huppertz
(President of Kiwa BCS Öko-Garantie GmbH - Ecobility Experts GmbH)

*Signature*
Prof. Dr. Frank Heimbecher
(Chairman of the independent expert committee BCS Öko-Garantie GmbH – Ecobility Experts GmbH)

*Signature*
Dr. Stephanie Schuler,
(Intern verifier of Kiwa GmbH)

## 2. Product

### 2.1 Product description

The hard coal fly ash, EFA-Füller® is produced in the coal fired power station Heyden in Petershagen. The fly ash is a coal combustion product composed of fine mineral particles. The hard coal fly ash is captured by electrostatic precipitators before the flue gases reach the chimneys. Due to its chemical and physical properties hard fly ash is used in the construction sector in a variety of products.

### 2.2 Application

According to DIN EN 450-1 EFA-Füller® are certified hard coal fly ashes. Due to its chemical and physical properties such as the pozzolanic reactivity, the spherical grain shape and the closeness of grain, fly ash is a valuable recycling product. Hence, hard coal fly ash is used in the building industry as a component of cement or an additive for concrete. These hard coal fly ashes are the ideal building material to optimize the properties of fresh and hardened concrete for different types of application. DIN 1045-2 together with DIN EN 206-1 regulate the application of fly ash.

### 2.3 Technical Data

The technical data for the hard coal fly ash EFA-Füller® HP is shown in the following table. The values refer to the yearly average value of 2015.

| Name | Average value | Unit |
|---|---|---|
| Loss on ignition: Category A /DIN 450-1/ | 3 | M.-% |
| Fineness: grain content > 45 µm /DIN 450-1/ | 20 | M.-% |
| $Na_2O$-equivalent /DIN 450-1/ | 2,13 | M.-% |
| Bulk density /DIN EN 459-2/ | 0,85 | $kg/dm^3$ |
| Particle density /DIN 450-1/ | 2,3 | $kg/dm^3$ |

### 2.4 Placing on the market / Application rules

Quality management of hard coal fly ash conforms to the DIN EN 450-2. The accomplishment of the requirements of the DIN EN 450-1 is marked with a CE-label. To place the product on the market the EU ordinance No. 305/2011 09.03.2011 takes effect. The European regulations are valid for the usage of the products.

### 2.5 Base materials / Ancillary materials

The composition of hard coal fly ash depends on the mineral components of the combustible. Main component of the combustible is hard coal. The following table shows the average values of the main components of EFA Füller® hard coal fly ash.

| Parameter | Value | Unit |
|---|---|---|
| $SiO_2$ | 55 | M.-% |
| $Al_2O_3$ | 23 | M.-% |
| $Fe_2O_3$ | 7 | M.-% |
| CaO | 4 | M.-% |
| MgO | 2 | M.-% |
| $K_2O$ | 2 | M.-% |
| $Na_2O$ | 1 | M.-% |

### 2.6 Manufacture

The hard coal fly ash occurs inevitably as a solid disperse residue during the combustion process in the coal fired power station Heyden in Petershagen. The aim of the power plant is the generation of electricity and heat.

The flue gas purification usually follows three steps. Initially, the reduction of nitrogen oxide compounds is conducted with a denox catalyst. During the second step the hard coal fly ash is captured by electrostatic precipitators. In the last step of the flue gas purification a desulphurisation is conducted in a SO2-washer. During this process step the so-called FGD-gypsum occurs.
while streaming through the electrostatic air filter, hard coal fly ash particles get electrically charged and accumulate on collecting electrode. The resulting “dust layer” is removed at regular intervals by punches of a hammer mill and the fly ash particles are transported through a closed piping system in silos for storage. Inside the silo the conformity with EN 450-1 is controlled. The hard coal fly ash is loaded from the silo to the transport. Generally, silo trucks transport 25 to 27 t of hard coal fly ash to the customer.

### 2.7 Reference service life

The declaration of the reference service life is voluntarily, since the scope of the study is just the production phase of the hard coal fly ash. According to the BBSR-table 2011 / Nr. 363.512 the reference service life of concrete components amounts to ≥ 50 years.

## 3. LCA: Calculation rules

### 3.1 Declared Unit

The declared unit is 1t of hard coal fly ash.

| | Value | Unit |
|---|---|---|
| Declared unit | 1 | t |
| Conversion factor to 1 kg | 1000 | - |

### 3.2 System boundary

This Environmental Product Declaration is a cradle-to-gate EPD, i.e. all potential environmental impacts are considered from cradle to factory gate. During the power production with hard coal the generation of fly ash is ineluctable, and the aim of a hard coal power station is the production of energy, therefore the potential environmental impacts of the energy production are allocated to the power station. For this reason, the system boundary is located after the electrostatic precipitator. All transport and storage processes (until the factory gate) are within the system boundaries. Thus, the system boundary of the manufacturing stage is the finished product at the factory gate. According to DIN EN 15804 this corresponds to the product stage A1-A3.

### 3.3 Estimates and assumptions

The power station Heyden in Petershagen is assumed as the reference power station, because all consumptions due to transports and energy are equal for the different power stations, which are the source for hard coal fly ashes from Baumineral. The data from the EFA-Füller® HP represents the consumption of all fly ashes from Baumineral.

There is no energy needed for the storage in a silo (no heating, no cooling, no aeration). Energy is only needed for the opening and closing of the silo. It is assumed that the energy demand is 0,612 MJ per ton hard coal fly ash (worst-case-assumption).

The estimated distance between silo and factory gate is 500m, which is the worst-case-scenario for all power stations. A truck of 27 t maximum payload and 40 t total weights is presumed (diesel vehicle). The occupancy rate is assumed as 85 percent.

### 3.4 Cut-off criteria

All process specific data is compiled for the production modules A1 to A3. All flows that contribute more than 1 % to the total mass, energy or environmental impact of the system, are considered in the LCA. It can be assumed that the sum of all neglected processes is less than 5 % of all considered impact categories.

### 3.5 Period under review

The data set employed in the EPD is based on 2015 production data.

### 3.6 Comparability

Basically, a comparison or an evaluation of EPD data is only possible if all the data sets were created according to the EN 15804. Product-specific characteristics must be considered. Secondary data to model the environmental impacts of the productionstage is based on the database Gabi 6.

## 4. LCA: Scenarios and additional technical information

No scenarios were analysed in this EPD.

## 5. LCA: Results

The following tables show the results of the indicators of the impact assessment, the resource input as well as the waste materials and other output-flows. The here shown results refer to the declared unit.

| Description of the system boundary (X = Included in LCA; MND = Module not declared) | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Product stage | | | Construction process stage | | Use stage | | | | | | | End of life stage | | | | Benefits and loads beyond the system boundaries |
| Raw material supply | Transport | Manufacturing | Transport from manu-facturer to place of use | Construction-installation process | Use | Maintenance | Repair | Replacement | Refurbishment | Operational energy use | Operational water use | De-construction / demolition | Transport | Waste processing | Disposal | Reuse-Recovery-Recycling-potential |
| **A1** | **A2** | **A3** | **A4** | **A5** | **B1** | **B2** | **B3** | **B4** | **B5** | **B6** | **B7** | **C1** | **C2** | **C3** | **C4** | **D** |
| x | x | x | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND | MND |

| Results of the LCA – Environmental impact: 1 t hard coal fly ash EFA-Füller® HP | | |
|---|---|---|
| **Parameter** | **Unit** | **A1 – A3** |
| Global warming potential | [kg $CO_2$-Eq.] | 1,98E-01 |
| Depletion potential of the stratospheric ozone layer | [kg CFC11-Eq.] | 1,21E-13 |
| Acidification potential of land and water | [kg $SO_2$-Eq.] | 3,84E-04 |
| Eutrophication potential | [kg $(PO_4)^3$-Eq.] | 6,50E-05 |
| Formation potential of tropospheric ozone photchemical oxidants | [kg Ethen-Eq.] | -1,36E-05 |
| Abiotic depletion potential for non fossil resources | [kg Sb-Eq.] | 1,72E-09 |
| Abiotic depletion potential for fossil resources | [MJ] | 2,08E+00 |

| Results of the LCA – Resource use: 1 t hard coal fly ash EFA-Füller® HP | | |
|---|---|---|
| **Parameter** | **Unit** | **A1 – A3** |
| Renewable primary energy as energy carrier | [MJ] | 2,99E-02 |
| Renewable primary energy resources as material utilization | [MJ] | IND |
| Total use of renewable primary energy resources | [MJ] | 2,99E-02 |
| Non renewable primary energy as energy carrier | [MJ] | 2,08E+00 |
| Non renewable primary energy as material utilization | [MJ] | IND |
| Total use of non renewable primary energy resources | [MJ] | 2,08E+00 |
| Use of secondary material | [kg] | IND |
| Use of renewable secondary fuels | [MJ] | IND |
| Use of non renewable secondary fuels | [MJ] | IND |
| Use of net fresh water | [m³] | 3,04E-04 |

| Results of the LCA – Output flows and waste categories: 1 t hard coal fly ash EFA-Füller® HP | | |
|---|---|---|
| **Parameter** | **Unit** | **A1 – A3** |
| Hazardous waste disposed | [kg] | 6,98E-07 |
| Non hazardous waste disposed | [kg] | 3,09E-01 |
| Radioactive waste disposed | [kg] | 2,19E-06 |
| Components for re-use | [kg] | IND |
| Materials for recycling | [kg] | IND |
| Materials for energy recovery | [kg] | IND |
| Exported electrical energy | [MJ] | IND |
| Exported thermal energy | [MJ] | IND |

## 6. LCA: Interpretation

During the production stage 1 % of the total primary energy consumption is covered by primary energy from renewable resources. This small amount is due to the electricity supply of the hard coal power station.
The energy consumption during the storage stage has been identified as a significant parameter. Most of the considered impact categories are influenced by the primary energy consumption.
The global warming potential (GWP) results 88 % from the energy consumption. Likewise, for the depletion potential of the stratospheric ozone layer (ODP) and the acidification potential (AP) the potential environmental impacts are dominated by the energy consumption of the storage by 76 to 73 %. The impact category eutrophication potential (EP) is influenced up to 56 % by energy consumption and 44 % by transport.
The energy consumption dominates with 85 % the abiotic depletion potential for fossil resources (ADPF), whereas the abiotic depletion elements (ADPE) is dominated by the environmental impacts of the transport with 70 %.
The photochemical formation potential of tropospheric ozone (POCP) has a negative value. The positive influence is caused by the direct emission from the transport. The ozone is decomposed by the reaction with the emitted nitrogen monoxide, thus nitrogen dioxide and oxygen are formed. This has a positive effect on the photochemical formation potential of tropospheric ozone (POCP). The energy consumption has negative impacts on the photochemical formation potential of tropospheric ozone (POCP), but the positive effects of the transport outweigh them.

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