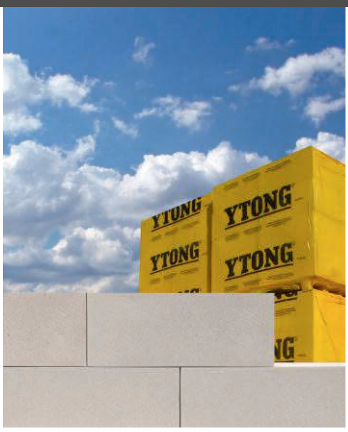
Environmental Product Declaration

According to ISO 14025



Ytong® Autoclaved Aerated Concrete

Turk Ytong A.S.

Declaration number
EPD-TUY-2011111-E

Institute Construction and Environment
www.bau-umwelt.com

Institut Bauen und Umwelt e.V.

Summary

Environmental Product Declaration

Institute Construction and Environment **Institut Bauen und Umwelt e.V.** **www.bau-umwelt.com**	**Program holder**
Turk Ytong A.S. Central Production Site – Pendik Factory Pendik, 34899, Istanbul / TURKEY	**Declaration holder**
EPD-TUY-2011111-E	**Declaration number**
Declared building product This declaration is an environmental product declaration according to ISO 14025 and describes the specific environmental impacts of the mentioned Ytong Autoclaved Aerated Concrete. It is supposed to foster the sustainable development of environmentally and health friendly construction. All relevant environmental data is contained in this validated declaration. The declaration is based on the PCR document „PCR Autoclaved Aerated Concrete“, 09-2009.	**Declared Building Products**
This validated declaration entitles the usage of the label of the Institute Construction and Environment. This exclusively applies to the mentioned products, one year from the date of issue. The declaration holder is liable for the basic information and verifications.	**Validity**
The **declaration** is complete and contains in detailed form: – Product definition and physical data – Information about raw materials and origin – Specifications on manufacturing the product – References for product processing – Information on product in use, singular effects and end of life – LCA results – Evidence and verifications	**Content of the declaration**

March 24th, 2014	**Date of Issue**
Prof. Dr.-Ing. Horst J. Bossenmayer (President of the Institut Bauen und Umwelt e.V.)	**Signatures**

This declaration, and the rules on which it is based, have been verified by the independent Advisory Board (SVA) according to ISO 14025.		**Verification of the Declaration**
Prof. Dr.-Ing. Hans-Wolf Reinhardt (Chairman of the SVA)	Dr. Frank Werner (Verifier appointed by the SVA)	**Signatures**

Summary

Environmental Product Declaration

Product description

The products mentioned are non-reinforced building blocks in various formats made of autoclaved aerated concrete. AAC belongs to the porous steam-cured light-weight concrete group.

Applications

Non-reinforced building blocks for brick-laid, monolithic, load-bearing and non-load-bearing walls. As intended, no direct contact with groundwater is possible, because aerated concrete is always coated and there is no direct contact with soil.

Scope of the LCA

The LCA is performed according to ISO 14040 ff. corresponding to the requirements of the guide lines concerning Type III declarations of the Institute for Construction and Environment and Product Categorization Rules „PCR Autoclaved Aerated Concrete“,09-2009. Specific industrial data from Turk Ytong A.S. as well as data from the data base „GaBi 4“ are used as data basis. The LCA comprises raw material and energy consumption, raw material transports ,the actual production phase of AAC and the packaging of products, as well („cradle to gate“).

Results of the LCA

Ytong AAC

Parameter	**Unit per kg/m^3 product**	**Product**
Primary energy, non-renewable	[MJ]	1579
Primary energy, renewable	[MJ]	140.3
Global Warming Potential (GWP 100a)	[kg CO_2-eqv.]	191.6
Ozone Depletion Potential (ODP)	[kg R11-eqv.]	1.23E-06
Acidification Potential (AP)	[kg SO_2-eqv.]	8.30E-01
Eutrophication Potential (EP)	[kg PO_4^{3-}-eqv.]	6.32E-02
Photochemical Ozone Creation Potential (POCP)	[kg C_2H_4-eqv.]	6.01E-02

Elaborated by: PE INTERNATIONAL, Office Turkey, Kabatas, Istanbul
In cooperation with Turk Ytong A.S.

PE INTERNATIONAL
EXPERTS IN SUSTAINABILITY

Evidence and verifications

The following evidence and verifications are also described in the Environmental Product Declaration.

• Radioactivity	Measurement of radionuclides
• Leaching out properties	According to Council Directive on the Landfill of Waste (1999/31/EC) and the related Council Decision (2003/33/EC)

Scope of validity

This declaration is prepared for the AAC product of Turk Ytong A.S., which has four production sites located in different regions of Turkey. These four production plants are located in Pendik, Antalya, Bilecik and Trakya.

1 Product definition

Product definition

The products mentioned are non-reinforced building blocks in various formats made of autoclaved aerated concrete. AAC belongs to the porous steam-cured light-weight concrete group.

Application

Non-reinforced building blocks for brick-laid, monolithic, load bearing and non-load-bearing walls. As intended, direct contact with ground water is avoided thanks to the constructional features.

Placing on the market/ Codes of practice

TS EN 771 part 4; general approval by the certification authorities.

Quality control

Supervision by the manufacturer and externally according to the above mentioned standards/general approval by certification authorities.

Delivery status, properties

- Thickness: from 50 to 400 mm
- Density: from 300 to 600 kg/m^3
- Colour: White

Constructional data

- Coefficient of linear expansion: 0,008 mm/m ° C
- Strength: from 1,5 to 6,0 N/mm^2 differentiated according to the kind of stressing, if necessary
- Melting point: ≈ 1100° C
- Heat conductivity at 20 ºC: 0,085 – 0,16 W/(m K)
- Electric conductivity at 20 ºC: -
- Fire protection: Depending on the formation of the wall, fire resistance categories up to F 180 according to DIN 4102 are attainable.

2 Basic materials

Base materials primary products

Sand	55-70 M-%
Cement	15-30 M-%
Quick lime	10-20 M-%
Gypsum	2-5 M-%
Aluminium	0.05-0.15 M-%

In addition, 50-75 M-% water is used (in relation to the solid substances)

Auxiliary sub-stances / additives

Mould oil

Material explana-tion

Quartzite/Sand: The used quartzite/sand is a natural raw material that contains natural minor components and traces of minerals, along with the main mineral quartz (SiO_2). It is a significant raw material for the hydrothermal reaction during steam-curing.

Cement: According to TS EN 197-1; cement is used as a bonding agent and is mainly produced using limestone marl or a mixture of limestone and clay. The natural raw materials are burnt and subsequently ground.

Quicklime: According to TS EN 459; quicklime is used as a bonding agent and is produced by burning natural limestone.

Gypsum: Gypsum ($CaSO_4.2H_2O$) is used as a sulphate carrier to influence the solidification period of the AAC and comes from natural deposits.

Aluminium: Aluminium powder or paste is used as a pore-forming agent. It reacts to the release of hydrogen gas in the alkaline milieu, which forms pores and escapes once the expanding (rising) process is concluded.

Water: The presence of water is the basis for the hydraulic reaction of the bonding agent. Moreover, water is necessary to produce a homogeneous suspension.

Mould oil: Mould oil is the release agent to separate the aerated autoclaved concrete mass from the mould.

Raw material extraction and origin

The sand/quartzite is from sand pits or quartzite quarries within immediate proximity to the AAC plant. Any other raw materials (apart from the slight amounts of aluminium powder or paste and gypsum) come from a surrounding area of at most 150 kilometres from the plant.

Availability of raw materials

Mineral building products such as aerated autoclaved concrete mainly consist of mineral raw materials. There is no shortage of resources.

3 Product manufacturing

Manufacturing the building product

The quartz rich sand/quartzite is grounded and mixed with the lime, cement, gypsum ad AAC recycling material that has been reduced into small pieces, water and aluminium powder or paste (pre-mixed with water) in a mixer. Then it is poured into the steel casting moulds.

In moulds, the mixture is aerated due to the aluminium reactions in an alkaline milieu caused by lime and cement. Thus, gaseous hydrogen is formed which creates porous structure in the mass and escapes without leaving any residue. The pores usually have a diameter of 0,049-0,147 cm and are filled exclusively with air. After setting once, semisolid raw AAC blocks are created through a series of cutting arrangements with high dimensional accuracy.

The formation of the final qualities of the AAC building components is performed by steam-curing over 8-12 hours at approximately 190°C temperature and 12 bar pressure in big pressurized containers called autoclaves. During steam-curing process, the chemical reactions in the autoclave continue until the formation of calcium silicate hydrate which corresponds to the naturally occurring mineral tobermorite. The reaction of material is completed when removed from autoclave. After completion of the steam curing process, the waste steam is used for other autoclave cycles or for heating of water and slurry by the use of the energy recovery systems. The accumulated condensate is used as process water. Thereby, energy is saved and harm to the environment due to hot exhaust steam and wastewater is avoided. AAC building blocks are then separated, put onto wooden pallets and shrink – wrapped in polyethylene wrap respectively.

The process steps taken into consideration in the life cycle inventory analysis are shown in Figure 1:

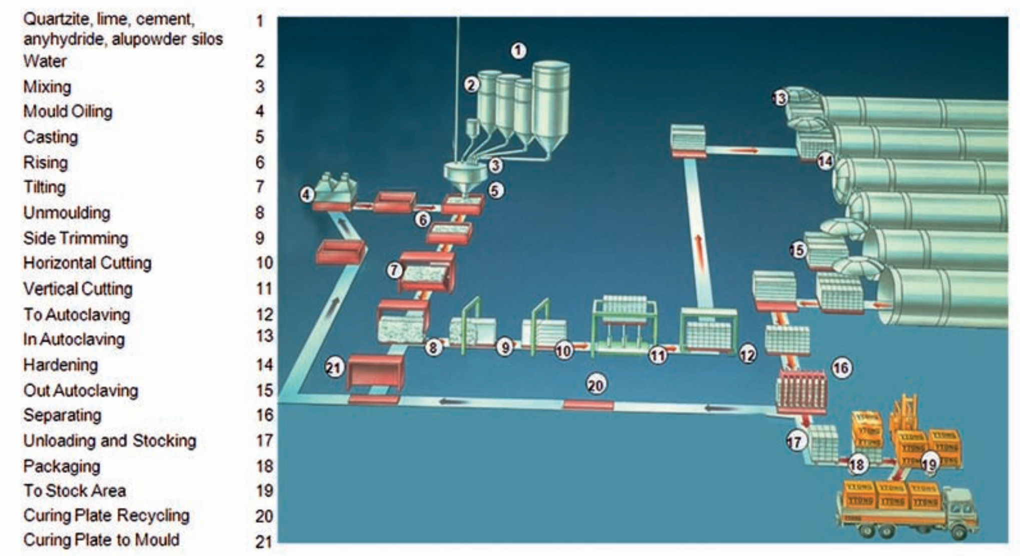


Figure 1 Flow diagram of the production process of Ytong®-AAC (Source: Ytong®-Xella)

Health protection Production

The body of rules and regulations of the employers' mutual insurance association applies. No special measures need to be taken for the protection of employees' health.

Environmental protection

Production

The national regulations apply. No special measures need to be taken for the protection of the environment.

4 Product processing

Processing recommendations

AAC building blocks are AAC building blocks are worked with manually. Lifting gear is necessary with building components with a mass over 25 kg. Building blocks are cut by using band saws or by hand with carbide metal saws, as this only generates coarse dust particles rather than fine dust. High-speed tools, such as abrasive cutting-off machines are inapplicable for working with AAC, as they release fine dust articles.

The AAC building blocks are cemented to each other or to other standardized building materials using thin-bed mortar according to DIN 1053, part 1; in special cases, normal or light mortar (15 kg mortar/m³) can also be used. The AAC building blocks can be plastered, coated or painted. Alternatively, it is possible to line with small-sized parts or to affix facing shell according to DIN 1053, part 1.

To assess mortars and coatings, the corresponding IBU-declarations must be taken into account.

Occupational safety The body of rules and regulations of the employers' mutual insurance association applies. The thin–bed mortars used when working with autoclaved aerated concrete are mineral mortars and hardly contain any organic substances, apart from methylcellulose. No special measures need to be taken for the protection of the environment when working with the building material.

Environmental protection The body of rules and regulations of the employers' mutual insurance association applies. The thin-bed mortars used when working with autoclaved aerated concrete are mineral mortars and hardly contain any organic substances, apart from methylcellulose.

No special measures need to be taken for the protection of the environment when working with the building material.

When selecting any additional auxiliary materials necessary, make sure that the quality does not negatively influence the environmental sustainability of the building products described.

Residual material The recycling and disposal activities of AAC are realized according to the 27th Clause of the Regulation on Control of Excavation Soil and Construction Waste (date of issue: 18.03.2004, Turkish Official Journal Number: 25406 (Reg. 25406)). According to the Regulation on Control of Excavation Soil and Construction Waste recycling of construction waste is the general principle to be applied for the protection of natural resources, minimization of waste to be landfilled, generation of economical value. Unrecyclable waste can be utilized in landfills as daily covering material after it undergoes appropriate sorting and dimensional diminution.

Packaging Any packaging, palettes or remaining AAC accumulated on the building site must be collected. The polyethylene shrink-wrap is recyclable. Any PE sheets that have not been soiled (care must be taken that the collected material is not mixed). According to the waste categories given in Annex 4 of the Turkish „Regulation on General Principles of Waste Management – Annex 4 shrink wrap belongs to the plastics category (15 01 02) and palettes belong to the wood category (15 01 03). These codes are as same as in the European Waste Catalogue and European Waste List (2002).

5 Condition when in use

Constituent parts As explained in item 2 "Manufacturing the building product", autoclaved aerated concrete mainly consists of tobermorite, a natural mineral. It also contains not reacted raw components, predominantly coarse quartz, if applicable carbonates. The pores are completely filled with air.

Effects on environment and health AAC does not emit relevant levels of any contaminants, e.g. VOCs. The emission of natural ionizing radiation of AAC products is extremely low and harmless in terms of health [reference to testing results to be included].

Useful life AAC does not change once it leaves the autoclaves. When used as intended, it is boundlessly stable. According to the Sustainable Building Guideline of IBU the average life expectancy of AAC is 100 years.

6 Singular effects

Fire

No toxic gases or vapours are released in case of a fire. The products referred to fulfil the requirements of building product category A1, “non-flammable” according to DIN 4102.

Water

When exposed to water (e.g. floods), AAC has a slight alkaline reaction. However, no substances are washed out which could be harmful to water. [reference to testing results to be included].

7 End of life phase

Reuse

The reuse of assembly components made from AAC has been and is still being put into practice. Up till now, walled AAC building blocks have hardly ever been reused

Subsequent use

AAC outlasts the service life of the buildings it is used for. This means that, when this type of building is dismantled, the materials can be used again with no concerns regarding their durability.

Closed-loop recycling

Unmixed AAC surpluses can be returned to the AAC manufacturers and recycled. This has been done for decades for production residues. This material is either processed to granules or is added to AAC mixture as a substitute for sand.

Open-loop recycling

Open loop recycling is not given within this study.

Disposal

The recycling and disposal activities of AAC are realized according to the 27th Clause of the Regulation on Control of Excavation Soil and Construction Waste (date of issue: 18.03.2004, Turkish Official Journal Number: 25406 (Reg. 25406)).

8 Life cycle assessment

8.1 Information on system definition and modelling of the life cycle

Declared Unit

The declared unit used for this study is the production of 1 cubic meter (m^3) of Ytong Block. All types of Ytong Block products show similar recipes but their densities differ. The different densities of Ytong Blocks are averaged to 0.4 t/m^3. Except the density differences, all Ytong Blocks go through the same production procedure.

System boundaries

The system boundary covers the production of Ytong Block products from extraction of raw material to the production of finished packaged product at the factory gate (cradle to gate).

The system boundary specifically includes:

- Manufacture of all materials employed (incl. pre-products e.g. cement)
- Transport of raw materials and pre-products
- Product manufacturing cost (auxiliaries, energy supply, waste management, emissions), including pre- products and energy generation from resources.

Production of packaging materials (wooden pallet, plastics) and end-of-life of the packaging materials for final products

Assumptions and estimations

Since Ytong Blocks are produced in 4 different plants, there is a need for an overall representative value for 1 m^3 Ytong Block produced.

In order to calculate such an averaged value, the amount of Ytong Block production at each plant has been proportioned to the overall sum of Ytong Blocks' production. This weighting has been considered by the calculation of each data contributing to the overall value/sum.

Cut-off criteria

In the assessment, all data from the production data acquisition have been considered, i.e. all raw material used as per formulation, utilised thermal energy, internal fuel consumption and electric power consumption, direct production waste, and all emission measurements available. For all considered inputs and outputs assumptions have been made on the expenditures for transports. Thus also material and energy flows with a proportion of less than 1% have been considered.

It can be assumed that the total sum of neglected processes does not exceed 5% of the impact categories.

Machines and facilities required during production will be neglected.

Transports

All transportation of raw and auxiliary materials used was considered in the assessment. All shipments of the raw and auxiliary materials to the manufacturing plant were taken into account in the material balances. The transport distances are derived prior to the information provided by Turk Ytong A.S.

Period under consideration

The data for the production of the building materials which analyzed (Ytong®-AAC) are based on the year 2009.

Background data

The data base GaBi 4.4 / GaBi 2011/ was used to calculate the energy generated and the transport. In detail, this covers:

- The compositions of all used substances (preliminary products)
- Expenditure for production (energy, waste, emissions)
- Preliminary products and energy supply

Transport and packaging of raw materials and preliminary products

Data quality

All relevant flows are calculated in this study. As a measure of data quality, it is reported whether the data were measured, calculated, or estimated. The age of the data employed in this study is due to 2009. Wherever possible, primary data directly measured from Turk Ytong A.S. plants are utilized after weighting according to the amounts of Ytong Blocks produced at each location.

Most of the data for the precursor chain is derived from industrial sources that were collected under consistent chronological and methodological framework conditions (primary data as well as background data). The process data and the used background data are consistent. In addition, the origin of the data is documented. Additional information is gathered regarding the age of the data and geographical and technology coverage. The supplied data (processes) were provided by Türk Ytong A.S. and checked for plausibility. Therefore, the data quality can be described as good.

Allocation

There are no co-products in the manufacturing of Ytong Blocks in all locations except Pendik-Istanbul where 13.3 % of the production constitutes Ytong reinforced products. In this case an allocation per mass is applied, since the production of the reinforced products shows the same manufacturing procedure and thus needs the same expenditures in terms of energy, raw materials and auxiliaries. Only steel is needed in addition.

Beyond that, there is no need for allocation of multi-input processes, since there are no multi-input processes in the manufacturing of Ytong Blocks. The allocation of open and closed loop recycling on the input side was made, in which the internal reuse of aerated autoclaved concrete flour and broken fractions (so called, production waste) in manufacturing of Ytong Blocks is defined as closed-loop recycling, which is integrated into the model.

Thermal recycling of wastes and packaging
The recycling of all packaging materials has conservatively been neglected due to the lack of representative process data for substitution.

Information on use stage
The lifetime of building products depends on the respective construction, use, service and maintenance. Within the study, the use phase is not considered.

Information on disposal stage (
The recycling and disposal activities of AAC are realized according to the 27th Clause of the Regulation on Control of Excavation Soil and Construction Waste (date of issue: 18.03.2004, Turkish Official Journal Number: 25406 (Reg. 25406)) as mentioned in Chapter 7 (End of Life Phase).

Choice of the end-of-life scenario
The end of life phase is not considered within this study.

Credits
Not applicable as the end of life phase is not considered.

8.2 Description of the assessment results and analysis

Primary energy
Table 1 and Figure 2 show the input of primary energy (renewable and non-renewable) for the production of 1 m³ Ytong®-AAC.

Table 1 Primary Energy input for the Production of 1 m³ Ytong®-AAC

Ytong AAC		
Indicator	Unit per m^3	Ytong AAC
Primary Energy, non-renew.	[MJ]	1578
Primary Energy, renew.	[MJ]	140.3

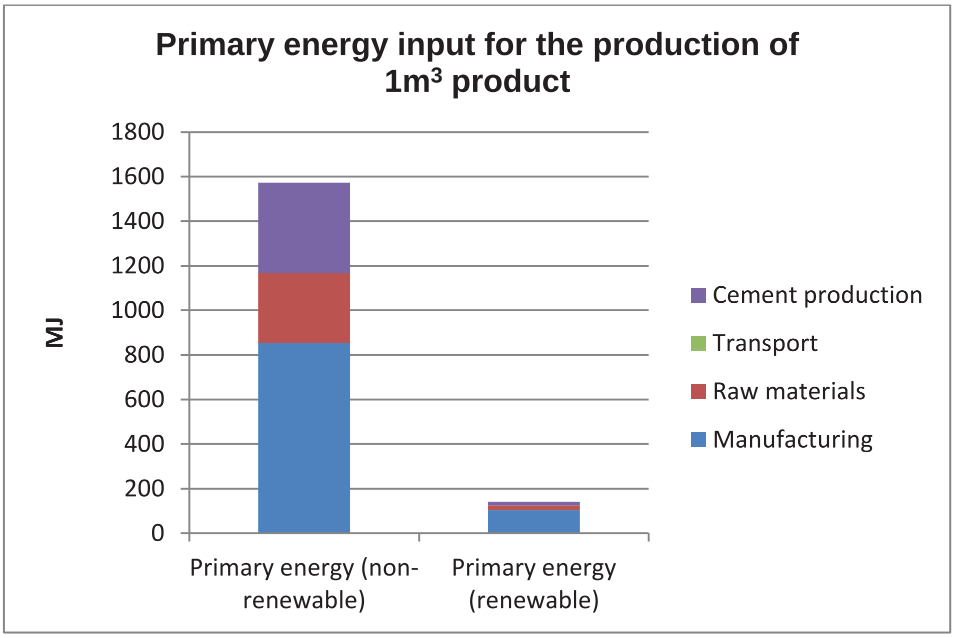


Figure 2 Primary energy input

Closer examination of the input of primary energy (Figure 3) for the production of Ytong®-AAC reveals that natural gas is used as the major primary energy source, followed by crude oil, lignite, black coal and uranium. The high proportion of natural gas in the primary energy input is due to the use of steam for steamcuring.

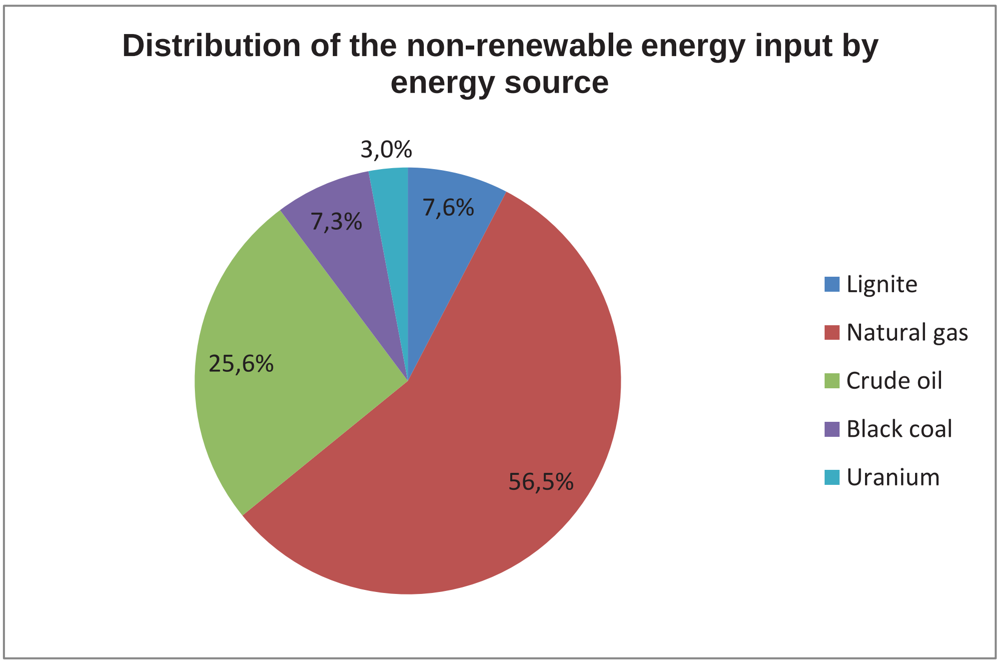


Figure 3 Distribution of the non – renewable energy input by energy source

The sources of renewable primary energy are dominated by two main energy sources, solar energy and hydropower. The high contribution of solar energy to the renewable energy input is due to the use of wooden pallets at the production plant, since solar energy is essential for the growing process of trees which requires this type of energy input. The second important contributor to the renewable energy input is the hydropower. The electricity grid mix stands as the main reason for this contribution. Wind power, geothermal energy, wood and biomass have only very small shares in the generation of renewable primary energy and their proportion corresponds to 1.17%, 1.14%, 0.88% and 0.11% respectively. On the other hand, the consumption of renewable combustibles and tidal range is nearly zero, so that the use of these sorts of energy sources can be ignored. The obtained results are visualized in Figure 4.

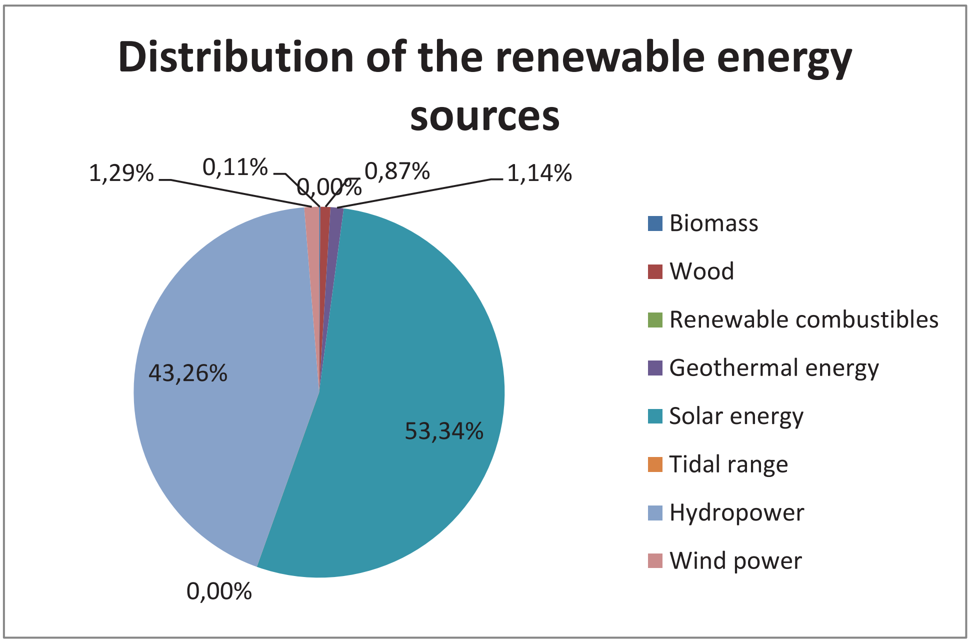


Figure 4 Distribution of the renewable energy input by energy source

Water utilisation

During the production of 1 m^3 AAC 1.183 m^3 of water is consumed. Depending on the location (different production plants), the source of water utilized in the production process was either ground water, surface water or potable/ drinking water. The proportion representing the utilization of ground water, surface water and drinking water are 44.5%, 55.3% and 0.2% respectively.

The dominating fractions of water utilization are groundwater, surface water and drinking water, whereas the other fractions are very small in quantity. The contribution of these major fractions to water consumption values in terms of manufacturing, raw materials, transport and cement production are summarized in Table 2 as weighted volume for all production plants.

Table 2 Water utilisation

Water [m3]	Total	Manufacturing	Raw Materials	Transport	Cement
Groundwater	0.530	0.490	0.021	3.89E-06	0.019
Surface water	0.651	0.414	0.056	1.04E-04	0.181
Drinking water	2.37E-03	1.79E-04	1.16E-03	8.93E-04	1.38E-04
Total	1.183	0.904	0.079	0.001	0.200

Wastes

The analysis of the waste accumulated for the production of 1 m³ Ytong® is presented separately for the 4 fractions stockpile goods, radioactive waste, consumer waste and hazardous waste (Table 3).

Table 3 Waste accumulated during the production of 1 m^3 Ytong – AAC

Ytong AAC	
Indicator	Ytong AAC
Stockpile goods	217,88
Consumer waste	0,06
Radioactive waste	0,02
Hazardous waste (incl. radioactive waste)	0,12

Impact assessment

The following figure (Figure 5) shows the comparative contributions of raw materials, manufacturing, transport and cement production for 1 m³ Ytong®- for the impact categories Global Warming Potential (GWP), Ozone Depletion Potential (ODP), Acidification Potential (AP), Eutrophication Potential (EP), Photochemical Ozone Creation Potential (POCP).

The most important contribution to the impact categories is generated by cement production. According to this assessment, manufacturing constitutes the second important category and it is followed by raw materials. The transportation step has almost no contribution to the impact categories.

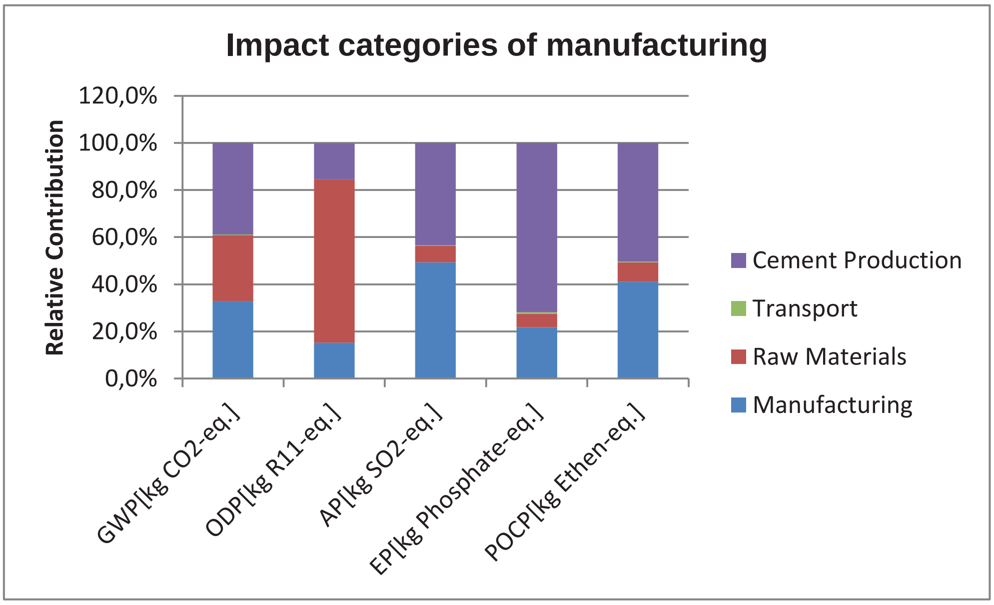


Figure 5: Impact categories of manufacturing

The absolute contributions of the production of 1 m³ Ytong® to the individual environmental impacts are shown in Table 4.

Table 4 Absolute contributions of the production of Ytong AAC to the individual environmental impacts per cubic meter

Ytong AAC		
Impact Category	**Unit**	**Total**
GWP	[kg CO_2-eqv./ m^3 product]	191.6
ODP	[kg R11-eqv. / m^3 product]	1.23E-06
AP	[kg SO_2-eqv/ m^3 product.]	8.30E-01
EP	[kg PO_4^{3-}-eqv./ m^3 product]	6.32E-02
POCP	[kg C_2H_4-eqv./ m^3 product]	6.01E-02

The contributions of all production stages to the Global Warming Potential (GWP) excluding transport are in the same range and they correspond to 33%, 28% and 39% for manufacturing, raw materials and cement production, respectively. In this case, the cement production and manufacturing stages of the production are again the dominating sub modules, since they are energy intensive processes and cause high amounts of carbon dioxide and methane emissions as a result of their relevant burning processes.

The distribution of the portions of production stages (raw materials, cement production, manufacturing, and transport) shows differences in the ODP and the AP. The highest impact to ODP is induced by the raw materials stage, which has a share of 69% and arises from the pre-processes of aluminum powder and lime. The Eutrophication Potential (EP) mainly caused by cement production and its associated nitrogen oxides emitted. For the Acidification Potential (AP) the situation is similar, however the manufacturing stage of the production is a second major contributor besides cement production. This is induced by sulphur dioxide and nitrogen oxides. In this case the manufacturing stage compromises the highest portion with 49%.

Cement production’s and manufacturing stage’s dominance is the same for the Photochemical Ozone Creation Potential (POCP) due to the emission of carbon monoxide, sulphur dioxide, nitrogen oxides and non-methane volatile organic compounds (NMVOC).

9 Evidence

Radioactivity

Measurement of nuclide concentration in Bq/kg for Ra-226, Th-232, K-40. All mineral raw materials contain minor amounts of naturally radioactive substances. According to the measurements, the natural radioactivity enables an unrestricted use of this building material from the radiological point of view. (The tests results are provided by the Council of Turkish Atomic Energy. Performed analyses are acredited by TURKAK (Turkish Accreditation Body)).

Leaching

The leaching out of autoclaved aerated concrete is significant for the assessment of its post-use environmental impact once landfilled.

Test point: LGA Institut für Umweltgeologie und Altlasten GmbH, Nürnberg, 18.05.2011, IUA2011170.

Result: All criteria for landfilling according to non hazardous waste class of the Council Directive on the Lanfill of Waste (1999/31/EC) and the related Council Decision (2003/33/EC) are fulfilled.

10 PCR-document and verification

This declaration is based on the Product Category Rules – PCR Autoclaved Aerated Concrete,09-2009

Review of the PCR-Documents by the Committee of Experts. Chairman of the Committee of Experts: Prof. Dr.-Ing. Hans-Wolf Reinhardt (University of Stuttgart, IWB)
Independent verification of the declaration according to ISO 14025: ☐ internal ☒ external
Validation of the declaration: *Dr. Frank Werner*

11 References

/Institut Bauen und Umwelt/ Leitfaden für die Formulierung der produktgruppen-spezifischen Anforderungen der Umwelt-Produktdeklarationen (Typ III) für Bauprodukte, www.bau-umwelt.com

/GaBi 4 2009/ GaBi 4: Software und Datenbank zur Ganzheitlichen Bilanzierung. LBP, Universität Stuttgart und PE International, 2001-2009.

Standards and laws

/ISO 14025/ ISO 14025: 2007-10, Umweltkennzeichnungen und -deklarationen - Typ III Umweltdeklarationen - Grundsätze und Verfahren (ISO 14025:2006); Text Deutsch und Englisch

/ISO 14040/ ISO 14040:2006-10, Umweltmanagement - Ökobilanz - Grundsätze und Rahmenbedingungen (ISO 14040:2006); Deutsche und Englische Fassung EN ISO 14040:2006

/ISO 14044/ ISO 14044:2006-10, Umweltmanagement - Ökobilanz - Anforderungen und Anleitungen (ISO 14044:2006); Deutsche und Englische Fassung EN ISO 14044:2006

DIN 4102 DIN 4102:1994-03, Brandverhalten von Baustoffen und Bauteilen; Zusammenstellung und Anwendung klassifizierter Baustoffe, Bauteile und Sonderbauteile

TS EN 771-4 DIN EN 771-4:2005-05, Festlegungen für Mauersteine - Teil 4: Porenbetonsteine; Deutsche Fassung EN 771-4:2003 + A1:2005

TS EN 197-1 DIN EN 197-1:2009-09, Zement - Teil 1: Zusammensetzung, Anforderungen und Konformitätskriterien von Normalzement; Deutsche Fassung prEN 197-1:2009

TS EN 459-1 DIN EN 459-1:2008-08, Baukalk - Teil 1: Begriffe, Anforderungen und Konformitätskriterien; Deutsche Fassung prEN 459-1:2008

DIN 1053-1 DIN 1053-1:1996-11, Mauerwerk - Teil 1: Berechnung und Ausführung

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