Eco-profiles and Environmental Product Declarations of the European Plastics Manufacturers

Bisphenol A (BPA)
PlasticsEurope
January 2019

PlasticsEurope
Association of Plastics Manufacturers

Introduction

This Environmental Product Declaration (EPD) is based upon life cycle inventory (LCI) data from PlasticsEurope's Eco-profile programme. It has been basically prepared by following the PlasticsEurope's Eco-profiles and Environmental Declarations – LCI Methodology and PCR for Uncompounded Polymer Resins and Reactive Polymer Precursors (PCR version 2.0, April 2011) document but includes some evolutions of the next version of the PlasticsEurope methodology, to be issued in 2019. This new version will include for example changes in the eco-profile organisation and management, simplification of the result section of the report, improvement of the water part to better report on its use, consumption and how it has been employed.[PlasticsEurope 2019]

EPDs provide environmental performance data, but no information on the economic and social aspects which would be necessary for a complete sustainability assessment. Further, they do not imply a value judgment between environmental criteria.

This EPD describes the production of the Bisphenol A monomer from cradle to gate (from crude oil extraction to powder or flakes at plant). **Please keep in mind that comparisons cannot be made on the level of the substance alone:** it is necessary to consider the full life cycle of an application in order to compare the performance of different materials and the effects of relevant life cycle parameters. This EPD is intended to be used by member companies, to support product-orientated environmental management; by users of plastics, as a building block of life cycle assessment (LCA) studies of individual products; and by other interested parties, as a source of life cycle information.

Meta Data

Data Owner	PlasticsEurope, Product Group BPA & PC
LCA Practitioner	thinkstep AG
Programme Owner & Manager	PlasticsEurope aisbl
Reviewer	Angela Schindler
Number of plants included in data collection	3
Representativeness	About 70% of EU Production Volume
Reference year	2016
Year of data collection and calculation	2018
Expected temporal validity	2024
Cut-offs	No significant cut-offs
Data Quality	Very good
Allocation method	Varies, see text

Description of the Product and the Production Process

This EPD is for Bisphenol A, also commonly referred to as BPA, an organic chemical with two phenol functional groups. BPA is the essential . basic building block (intermediate) for high-performance polymer plastics and coatings, mainly polycarbonate plastic and epoxy resins. The reference flow, to which all data given in this EPD refer, is 1kg of BPA.

Production Process

Bisphenol A is synthesized by the condensation of acetone (hence the suffix A in the name) with two equivalents of phenol. The reaction is catalyzed by a strong acid, such as hydrogen chloride (HCl) or a sulfonated polystyrene resin. Industrially, a large excess of phenol is used to ensure full condensation.

Data Sources and Allocation

European producers provided the data used in this study through the completion of a direct questionnaire. Primary data on gate-to-gate BPA production is derived from site specific information for processes under operational control supplied by the participating companies of this study. Two different European BPA producers participated in the primary data collection. Data collected from these companies represents the major share of the total European BPA production. As the general PCR for Eco-profiles demands the inclusion of a third company´s dataset – which was not available to be generated from current primary data, the average primary data from the previous BPA Eco-profile was used. That dataset was assumed to represent the missing share of the European BPA market. The data for the upstream supply chain are taken from the database of the software system GaBi ts [GaBi 2018]. All relevant background data such as energy and auxiliary materials are also taken from the GaBi ts database. Most of the background data used is publicly available and public documentation exists [GaBi 2018GABI 2018].

Allocation was applied for the production process of some participants, as minor by-products result from their specific BPA production process. These by-products are Bisphenol A grades with lower economic values than the main BPA product. The BPA product is the desired output of the production process. In this case allocation by mass is equivalent to allocation by energy content. The by-product is mainly burned to generate thermal energy. Due to the incineration of the by-products for energy generation the allocation in this study was done according to energy content.

Use Phase and End-of-Life Management

Bisphenol A, also commonly referred to as BPA, is an organic chemical. It primarily serves as a basic building block for the production of polymer plastics and coatings, mainly polycarbonate and epoxy resins.

Environmental Performance

The tables below show the environmental performance indicators associated with the production of 1 kg of Bisphenol A.

All characterization factors of the environmental impact categories used are developed by CML (2016)

Input Parameters

Indicator	Unit	Value
Non-renewable energy resources1)		
• for energy	MJ	44,13
• for feedstock	MJ	34,20
Renewable energy resources (biomass)1)		
• for energy	MJ	1,51
• for feedstock	MJ	–
Abiotic Depletion Potential		
• Elements	kg Sb eq	5,97E-07
• Fossil fuels	MJ	71,03
Renewable materials (biomass)	kg	0,00E+00
Water consumption		
• Use	kg	683,43
• Consumption	kg	12,43
1) Calculated as upper heating value (UHV)		

Output Parameters

Indicator	Unit	Value
GWP	kg CO2 eq	2,26
ODP	g CFC-11 eq	1,11E-09
AP	g SO2 eq	3,12
POCP	g Ethene eq	0,55
EP	g PO4 eq	0,39
Dust/particulate matter3)	g PM10	0,09
Total particulate matter3)	g	0,15
Waste		
• Non-hazardous	kg	0,013
• Hazardous	kg	1,74E-08
3) Including secondary PM10		

Additional Environmental and Health Information*

The manufacturers of polycarbonate and BPA are working through PlasticsEurope, the American Chemistry Council (ACC) and the Japanese Polycarbonate Manufacturers Group (JPMG) China Petroleum and Chemical Industry Federation (CPCIF) and Korea PC-BPA Council **(KPBC)** to ensure that the safety of their product is supported by sound science, and continue to actively engage with government agencies, the media, and others. Scientific evidence demonstrates that BPA-based polycarbonate is safe when used as intended.

(*) the contents of this section has been elaborated by PlasticsEurope only and are not part of the review.

Information

Data Owner

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Reviewer

This Environmental Product Declaration has been reviewed by Angela Schindler. It was approved according to the Product Category Rules PCR version 2 (2011-04) and ISO 14025:2006. Registration number: PlasticsEurope 2011-0001, validation expires on 31 December 2024 (date of next revalidation review).

Programme Owner & Manager

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For copies of this EPD, for the underlying LCI data (Eco-profile); and for additional information, please refer to http://www.plasticseurope.org/.

References

- Product photographs on cover with kind permission by PlasticsEurope, Product Group BPA & PC.
- PlasticsEurope: Eco-profiles and environmental declarations – LCI methodology and PCR for uncompounded polymer resins and reactive polymer s

Goal & Scope

Intended Use & Target Audience

➢ *Eco-profiles (LCIs) and EPDs from this programme are intended to be used as »cradle-to-gate« building blocks of life cycle assessment (LCA) studies of defined applications or products. LCA studies considering the full life cycle (»cradle-to-grave«) of an application or product allow for comparative assertions to be derived. It is essential to note that comparisons cannot be made at the level of the polymer or its precursors. In order to compare the performance of different materials, the whole life cycle and the effects of relevant life cycle parameters must be considered.*

PlasticsEurope Eco-profiles and EPDs represent polymer production systems with a defined output. They can be used as modular building blocks in LCA studies. However, these integrated industrial systems cannot be disaggregated further into single unit processes, such as polymerisation, because this would neglect the interdependence of the elements, e.g. the internal recycling of feedstocks and precursors between different parts of the integrated production sites.

PlasticsEurope Eco-profiles and EPDs are prepared in accordance with the stringent ISO 14040–44 requirements. Since the system boundary is »cradle-to-gate«, however, their respective reference flows are disparate, namely referring to a broad variety of polymers and precursors. This implies that, in accordance with ISO 14040–44, a direct comparison of Eco-profiles is impossible. While ISO 14025, Clause 5.2.2 does allow EPDs to be used in comparison, PlasticsEurope EPDs are derived from Eco-profiles, i.e. with the same »cradle-to-gate« system boundaries.

As a consequence, a direct comparison of Eco-profiles or EPDs makes no sense because 1 kg of different polymers or polymer precursors are not functionally equivalent.

Once a full life cycle model for a defined polymer or precursor application among several functionally equivalent systems is established, and only then, can comparative assertions be derived. The same goes for EPDs, for instance, of building product where PlasticsEurope EPDs can serve as building blocks.

Eco-profiles and EPDs are intended for use by the following target audiences:

- member companies, to support product-orientated environmental management and continuous improvement of production processes (benchmarking);
- downstream users of plastics, as a building block of life cycle assessment (LCA) studies of plastics applications and products; and
- other interested parties, as a source of life cycle information.

Product Category and Declared Unit

Product Category

The core product category is defined as **uncompounded polymer resins, or reactive polymer precursors**. This product category is defined »at gate« of the polymer or precursor production and is thus fully within the scope of PlasticsEurope as a federation. In some cases, it may be necessary to include one or several additives in the Eco-profile to represent the polymer or precursor »at gate«. For instance, some polymers may require a heat stabiliser, or a reactive precursor may require a flame retardant. This special case is distinguished from a subsequent compounding step conducted by a third-party downstream user (outside PlasticsEurope's core scope).

Functional Unit and Declared Unit

1 kg of Bisphenol A (BPA) »at gate« (production site output) representing a European industry production average.

Product and Producer Description

Product Description

Bisphenol A is produced by condensating of acetone with phenol.

- IUPAC name 4,4'-dihydroxy-2,2-diphenylpropane;
- CAS no. 80-05-7
- chemical formula $C_{15}H_{16}O_2$

Producer Description

PlasticsEurope Eco-profiles and EPDs represent European industry averages within the scope of PlasticsEurope as the issuing trade federation. Hence they are not attributed to any single producer, but rather to the European plastics industry as represented by PlasticsEurope's membership and the production sites participating in the Eco-profile data collection.

The companies contributing data to this Eco-profile and EPD are:

- Covestro AG

  D-51368 Leverkusen

  Germany

  www.covestro.com

- SABIC Innovative Plastics

  PO Box 117 / Plasticslaan 1

  4600 AC Bergen op Zoom, The Netherlands

  www.sabic.com

- Instead of including the production data of an in this case missing third company the weighted average primary data of the BPA Eco-profile project published in 2011 has been used.

Eco-profile – Life Cycle Inventory

System Boundaries

PlasticsEurope Eco-profiles and EPDs refer to the production of BPA monomer as a cradle-to-gate system

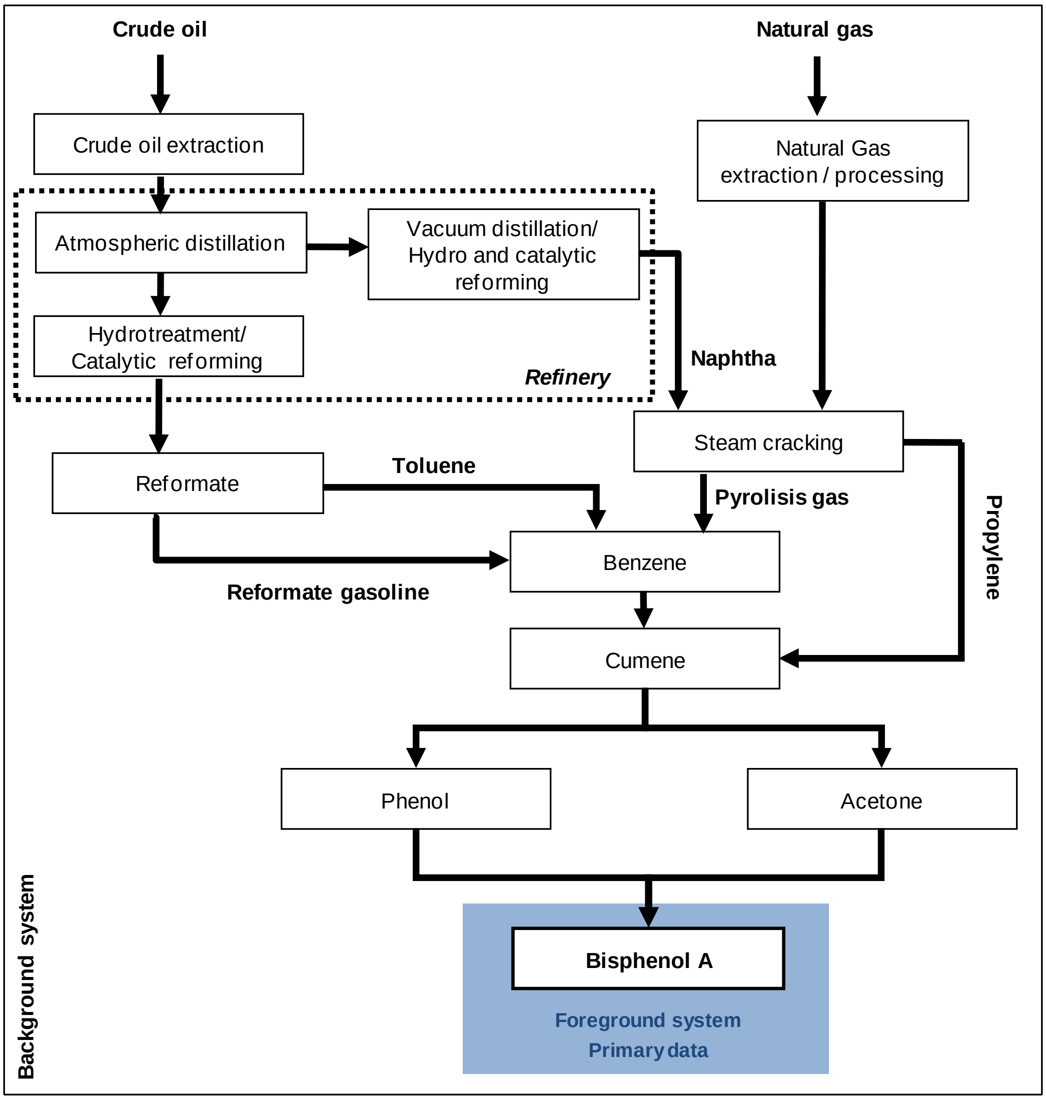

Figure 1: Cradle-to-gate system boundaries

Technological Reference

The BPA production processes are modelled using specific values, representing the specific technology for the participating companies. The LCI data represent technology in use in the defined production region employed by participating producers. The two data delivering participants are estimated to cover the major share in 2016. The technological coverage is representative of the total European BPA production.

The technology used by all companies involves the polymerisation of 2 mol phenol and 1 mol acetone catalyzed by an acid such as hydrochloric acid or by sulfonated polystyrene resins.

Primary data were used for all foreground processes (under operational control), and were complimented with secondary data for background processes (under indirect management control).

Solid and liquid residues from the reaction are burned in incineration plants and have been modeled based on their chemical composition and heat value. For waste water treatment the model used is documented at http://documentation.gabi-software.com.

Temporal Reference

The collected LCI process data represented the yearly average of 2016 for 2 companies. In order to respect the European competition law an average of 2 company data cannot be published. Therefore the weighted average primary data of the previous BPA Eco-profile (collected in 2007, published 2011) have been included to replace the missing third company dataset. Background data have reference years from 2014 to 2017.

The temporal range of the background data is not expected to have a major impact on the results of the study, as no major technological breakthroughs occurred in the last 8 years for refining, re-refining technology or one of the related up-stream technologies. The data is considered to be sufficiently valid, provided no significant change in the production chain occurs The overall reference year for this Eco-profile is 2016 with a temporal validity until 2024.

Geographical Reference

Primary production data for the BPA production comes from two different suppliers in the EU. Fuel and energy inputs in the system reflect the national conditions and whenever applicable site specific conditions were applied. Therefore, the study results are applicable in EU boundaries. Adjustments may be required in order to apply the results to other regions. Bisphenol A imported to Europe was not considered in this Eco-profile.

Cut-off Rules

In the foreground processes all relevant flows were considered, trying to avoid any cut-off of material and energy flows.

According to the GaBi Databases 2018 [GABI 2018], used in the background processes, at least 95 % of mass and energy of the input and output flows were covered and 98 % of their environmental relevance (according to expert judgment) was considered, hence an influence of cut-offs less than 1 % on the total is expected.

Data Quality Requirements

Data Sources

Eco-profile and EPDs developed by PlasticsEurope use average data representative of the respective foreground production process, both in terms of technology and market share. The primary data are derived from site specific information for processes under operational control supplied by the participating member companies of PlasticsEurope (see Producer Description). The data for the upstream supply chain until the precursors are taken from the database of the software system GaBi ts [GABI 2018].]. For Bisphenol A, primary data from the companies participating in this study was collected and reported.

All relevant background data such as energy and auxiliary material were also taken from the GaBi ts database. Most of the background data used is publicly available and public documentation exists.

Relevance

With regard to the goal and scope of this Eco-profile the collected primary data of foreground processes are of high relevance, i.e. data from the most important BPA producers in Europe is required in order to generate a European industry average production. Data for the most environmental relevant intermediates used in the BPA production; acetone and phenol, was taken from the GaBi ts [GaBi 2018]. database. The environmental contributions of each process to the overall LCI results are detailed in the Chapter 'Dominance Analysis'.

Representativeness

The companies participating in the study are estimated to cover about 70% of the total European production of BPA in 2016. Additionally a third dataset was generated to ensure confidentiality and cover 100%. The selected background GaBi ts data can be regarded as representative for the intended purpose, as it is average data and not in the focus of the analysis.

Consistency

To ensure consistency only primary data of the same level of detail and background data only from the GaBi ts databases [GaBi 2018]. were used. The provided primary data was checked by thinkstep to ensure plausibility of mass, energy and water balance. The methodological framework is consistent throughout the whole model as the same methodological principles are used both in foreground and background system.

Reliability

Data sources range from measured to estimated data. Data of foreground processes provided directly by producers were predominantly measured. Data of relevant background processes were measured at several sites or determined by literature data or estimated for some flows, which generally is reviewed and checked for quality.

Completeness

Primary data used for the gate-to-gate production of BPA covers all related flows in accordance with the cut off criteria. Data sourced from the GaBi database [GaBi 2018]. covers all related flows according to the system boundaries and cut off criteria. In this way all relevant flows are quantified and data is considered complete.

Precision and Accuracy

As the relevant foreground data is primary data or modelled based on primary information sourced from the owner of the technology, the data is considered to sufficiently precise and accurate to meet the requirements of the goal and scope of the study. All background data is consistent GaBi professional data with high precision documentation.

Reproducibility

The study has been performed with the LCA software GaBi ts [GaBi 2018]. GaBi software and the associated database integrate ISO 14040/44 requirements. All data and information used are either documented in this report or they are available from the processes and process plans designed within the GaBi ts software. The reproducibility is fully assured for internal use as the owners of the technology provided the data and the models are stored and available in a confidential database. Sub-systems are modelled by ´state of art´ technology using data from a publicly available and internationally used database. For external audiences, full reproducibility to a high degree of detail is not possible for confidentiality reasons.

Data Validation

The data on BPA production collected from the project partners was validated at thinkstep and the data providing companies in an iterative process several times. The collected data was validated using mass-energy balances checks and expert knowledge from thinkstep.
The background information from the GaBi ts database is updated regularly and validated in principle daily by the various users worldwide.

Life Cycle Model

The study has been performed with the LCA software GaBi ts GaBi 2018[]. GaBi software and associated database integrate ISO 14040/44 requirements. Due to confidentiality reasons details on software modelling and methods used cannot be shown here. The calculation follows the vertical calculation methodology, i.e. that the averaging is done after modelling the specific processes.

Calculation Rules

Vertical Averaging

When modelling and calculating average Eco-profiles from the collected individual LCI datasets, vertical averages were calculated (Figure 2).

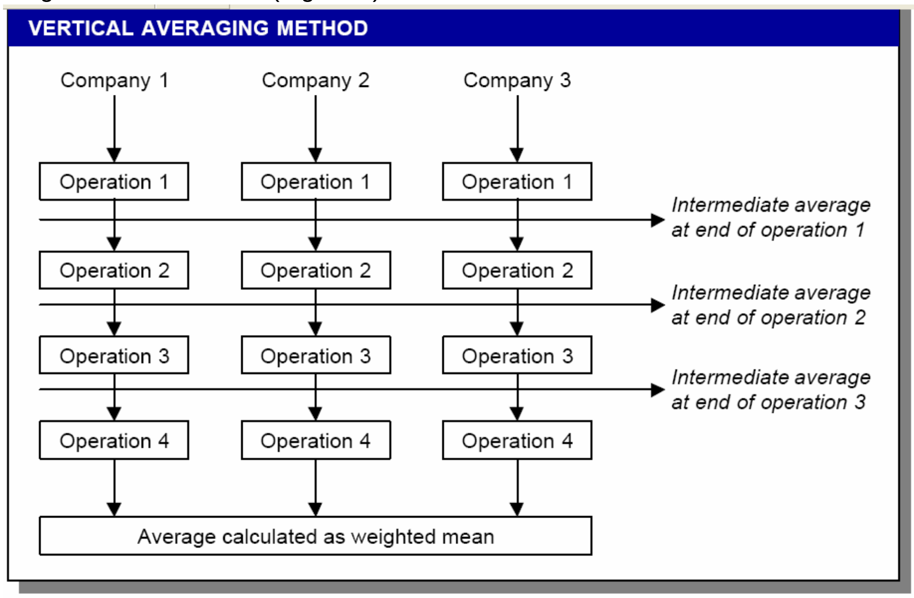

Figure 2: *Vertical Averaging (Source: Eco-profile of high volume commodity phthalate esters, ECPI European Council for Plasticisers and Intermediates, 2001)*

Allocation Rules

Production processes in chemical and plastics industry are usually multi-functional systems, i.e. they have not one, but several valuable product and co-product outputs. Wherever possible, allocation should be avoided by expanding the system to include the additional functions related to the co-products. Often, however, avoiding allocation is not feasible. In such cases, the aim of allocation is to find a suitable partitioning parameter so that the inputs and outputs of the system can be assigned to the specific product sub-system under consideration.

Allocation was applied for the production process of some participants, as minor by-products result from their specific BPA production process. These by-products are Bisphenol A grades with lower economic values than the main BPA product. The BPA product is the desired output of the production process. In this case allocation by mass is equivalent to allocation by energy content. Depending on if the lower grade BPA was used as fuel internally or sold (to be used as fuel) externally a different approach was carried out. Whereas in the first case a cut-off without any burden/credit was applied, in the second case a co-product allocation by energy content was done: The by-product is mainly burned to generate thermal energy. Due to the incineration of the by-products for energy generation the allocation in this study was done according to energy content.

In the refinery operations, co-production was addressed by applying allocation based on mass and net calorific value [GABI 2018GABI 2018]. The choice of allocation method for the refinery is based on several sensitivity analyses, along with expert judgement from petrochemical experts. The data for refinery products is based on a comprehensive refinery model, which can be used to perform sensitivity analyses of possible

alternative allocation keys. The relevance and influence due to other possible allocation methods of refinery products used in this study in this context is small (<1 %).
In the steam cracking process allocation according to net calorific value is applied.

Life Cycle Inventory (LCI) Results

Formats of LCI Dataset

The Eco-profile is provided in four electronic formats:

- As input/output table in Excel®
- As XML document in EcoSpold format (www.ecoinvent.org)
- As XML document in ILCD format (http://lct.jrc.ec.europa.eu)
- As LCI in GaBi format (www.gabi-software.com)

Key results are summarised below.

Energy Demand

As a key indicator on the inventory level, the **primary energy demand** (system input) of 79,84 MJ/kg indicates the cumulative energy requirements at the resource level, accrued along the entire process chain (system boundaries), quantified as gross calorific value (upper heating value, UHV).

As a measure of the share of primary energy incorporated in the product, and hence indicating a recovery potential, the **energy content in the polymer** (system output), quantified as the gross calorific value, is 34,2 MJ/kg

Table 1: Primary energy demand (gross calorific value, system boundary level) of 1 kg BPA

Primary Energy Demand	**Value [MJ]**
Energy content in polymer (energy recovery potential, quantified as gross calorific value of monomer)	34,2
Process energy from non-renewable energy resources	44,13
Process energy from renewable energy resources	1,51
Total primary energy demand	**79,84**

Consequently, the difference (Δ) between primary energy input and energy content in polymer output is a measure of **process energy** which may be either dissipated as waste heat or recovered for use within the system boundaries. Useful energy flows leaving the system boundaries were removed during allocation.

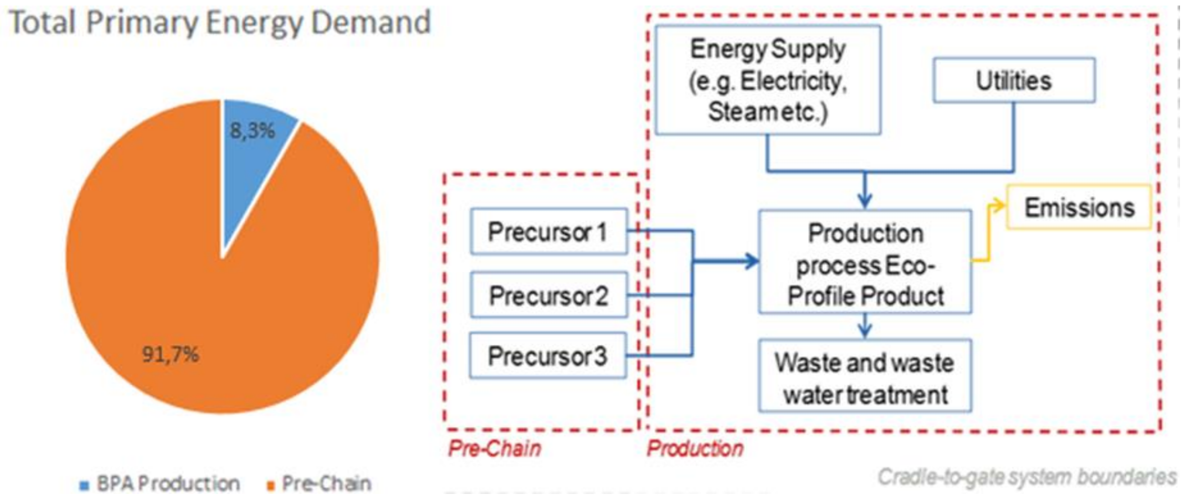

Figure 3: Contribution to primary energy demand per segment

Water Consumption

As the Eco-profile of 2011 did not benefit from a detailed water flow data collection at gate-to-gate level an input/output water balance showing source and application of water in the production system would only be available for two companies. Due to confidentiality reasons it cannot be shown in this report.

Including the water consumption value published in the previous Eco-profile the total weighted average water consumption is calculated as = **6,65 kg**

Dominance Analysis

Table 2 shows the main contributors to the above presented results. An average based on the weighted mean from the different technologies of the participating producers is used.

In all analysed environmental impact categories, the intermediates phenol and acetone contribute from 83 % to 92 % of the total impact, with phenol contributing around 65 % or more across all impact categories. The electricity and thermal energy supply contribute to no more than 12 % of the total impact (depending on the impact category).

Table 2: Dominance analysis of 1 kg BPA

	Primary Energy [MJ]	ADP elements [kg Sb eq.]	ADP fossil [MJ]	GWP [kg CO_2 eq.]	AP [g SO_2 eq.]	EP [g PO_4^{3-} eq]	POCP [g Ethene eq.]
Production Process	0%	0%	0%	0%	0%	0%	1%
Acetone	20%	17%	20%	18%	19%	19%	20%
Phenol	72%	66%	73%	65%	69%	66%	72%
Other Chemicals	0%	2%	0%	0%	0%	0%	0%
Thermal Energy	6%	6%	6%	12%	6%	7%	5%
Electricity	2%	4%	1%	4%	4%	4%	2%
Utilities	0%	5%	0%	0%	1%	1%	0%
Process Waste Treatment	0%	0%	0%	0%	0%	2%	0%
Transports	0%	0%	0%	0%	1%	1%	0%
Total	100%	100%	100%	100%	100%	100%	100%

(BPA) Production Process, Electricity, Process waste treatment, Thermal energy, Utilities are part of the foreground system (compare figure 3 – segment “Production”).

Acetone, Phenol, Other chemicals, Transports are part of the background system (compare figure 3 – segment “Pre-Chain”).

Comparison of the present Eco-profile with its previous version (2011)

Table 3 compares the present results with the previous version of the Eco-profile of BPA.

Table 3: Comparison of the present Eco-profile with its previous version (2011)

Environmental Impact Categories	Eco-profile BPA (2011)	Eco-profile BPA (2019)	Difference
Gross primary energy from resources [MJ]	80,07	79,84	-0,3%
Abiotic Depletion Potential (ADP), elements [kg Sb eq.]	5,33E-07	5,97E-07	12,0%
Abiotic Depletion Potential (ADP), fossil fuels [MJ]	71,6	71,03	-0,8%
Global Warming Potential (GWP) [kg CO_2 eq.]	2,54	2,26	-11,2%
Acidification Potential (AP) [g SO_2 eq.]	4,73	3,12	-34,1%
Eutrophication Potential (EP) [g PO_4^{3-} eq.]	0,5	0,39	-21,7%
Ozone Depletion Potential (ODP) [g CFC-11 eq.]	6,01E-05	1,11E-09	-100,0%
Photochemical Ozone Creation Potential [g Ethene eq.]	0,91	0,55	-39,1%

Table 3 shows a significant improvement of almost all environmental indicators in scope of the BPA Eco-profile compared to the previous study.

As mentioned previously, the dominance analysis shows that the main pre-cursors Phenol and Acetone are decisive for the environmental profile of BPA and therefore an improvement on their production process would definitely cause an improvement of the BPA Eco-profile.

Improvements have already been made in the Bisphenol A polymerisation process in recent years, especially in terms of energy consumption (electricity consumption and thermal energy.

As the total primary energy demand didn´t change / decrease significantly compared to the previous study the main factor causing an improvement of the environmental profile is the “greening” of different energy carrier mixes over time: for example the GWP factor of EU-27 electricity grid mix improved by about 15% in the respective time period.

This leads not only to a better footprint of the direct (in the BPA production process) but also indirect energy consumption (needed in for the production of the consumed raw materials and auxiliaries).

A side-effect/ trade off of this development is shown though by the increase of the indicator ADP elements, which caused due to the higher share of electricity generated by photovoltaics and theír related use of precious metals.

Process residues treatment such as incineration with energy recovery and waste water treatment plant as well as delivery transports of raw materials only showed neglectable contributions

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Review

Review details

The project included meetings with representatives of all participating producers and PlasticsEurope as system operator. In addition, a review meeting between the LCA practitioner and the reviewer was held, including a model and database review, and spot checks of data and calculations.

Review Summary

The present Eco-Profile is an update of an Eco-Profile published in 2011 for the product BPA.
The report was peer reviewed in January 2019, according to the requirements of the Life Cycle Inventory (LCI) Methodology and Product Category Rules (PCR) for Uncompounded Polymer Resins and Reactive Polymer Precursors, version 2.0 (April 2011) accompanied by a draft version with advancement of the PCR to be published in the 1. quarter of 2019.
The review is based on the final Eco-profile document accompanied by a telephone conference for clarifying open questions and comments of the reviewer, including spot checks of the software model applied.
The updated Eco-Profile integrates both new foreground data delivered by the participants of the study and updated life cycle inventories for upstream processes (background data) from the current available GaBi database.
As the data collection covers all main producers in Europe the results for the environmental impacts declared, show a high representativeness of the technology and the currently applied processing for BPA.

The methodological approaches follow the PCR requirements. The recommendations of the reviewer have been followed to clarify certain aspects.
In the review process the applied allocation for by-products has been discussed. So far the PCR does not contain any guidelines for allocations; thus the decision refers to the specific system considered and is argued respectively. This may lead to inconsistencies when having a look at bordering systems of several products/Eco-profiles. Due to sensitivity analysis, the current specific allocation effects are insignificant to the overall results. Associated with further PCR advancements, the development of allocation guidelines may be considered.
The comparative evaluations on the data collection and results of the current study to the previous one shows plausible results and traceable developments. In the review process this section has been revised thus to declare a precise explanation of the changes and improvements of the production processes. The improvements basically refer to developments of the electricity supply. Process specific reduction of energy demand per process step in the overall supply chain is desirable to force the trend of higher efficiency and less environmental impact.
The structure is clear and transparent, thus displaying a reliable source of information.

Salem, January 2019

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