

ENVIRONMENTAL PRODUCT DECLARATION

In accordance with ISO 14025:2006 for:



Caustic Soda (NaOH – 50%) from Egyptian Petrochemicals Company (EPC)

Programme: The International EPD® System,
www.environdec.com

Programme operator: EPD International AB

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An EPD should provide current information and may be updated if conditions change. The stated validity is therefore subject to the continued registration and publication at www.environdec.com



PROGRAM INFORMATION

PROGRAM OPERATOR



EGYPT
INTERNATIONAL EPD SYSTEM

EPD Programme:

The International EPD® System EPD International AB

Address:

Box 21060
SE-100 31 Stockholm Sweden

Website:

www.environdec.com

E-mail:

info@environdec.com

Product Category Rules (PCR):

PCR: 2021:03 BASIC CHEMICALS version 1.1.5 Product Category Classification: UN CPC 341, 342, 343, 345, PCR moderator: Emre Can Çorumlu (ClimatePrime), ecorumlu@climateprime.com.tr

PCR review was conducted by:

The Technical Committee of the International EPD® System. A full list of members is available at www.environdec.com.
Review chair: Lars-Gunnar Lindfors. The review panel may be contacted via the Secretariat: info@environdec.com

LCA accountability:

The LCA study and the EPD documentation were prepared by **the Extreme Energy Solutions consultancy team**: Ahmed Seyam Basma Hamdy – Mohamed Farrag – Essam Alcebhy – Aly Morsy

Independent third-party verification of the declaration and data, according to ISO 14025:2006, via:

EPD verification by individual verifier

Third-party verification:

Charnett Chau

Approved by:

The International EPD® system

Procedure for follow-up of data during EPD validity involves a third-party verifier:

☐ Yes
☒ No

The EPD owner has the sole ownership, liability, and responsibility for the EPD.

EPDs within the same product category but registered in different EPD programmes, or not compliant with ISO 14025, may not be comparable. For two EPDs to be comparable, they must be based on the same PCR (including the same version number) or be based on fully-aligned PCRs or versions of PCRs; cover products with identical functions, technical performances and use (e.g. identical declared/functional units); have equivalent system boundaries and descriptions of data; apply equivalent data quality requirements, methods of data collection, and allocation methods; apply identical cut-off rules and impact assessment methods (including the same version of characterisation factors); have equivalent content declarations; and be valid at the time of comparison. For further information about comparability, see ISO 14025.

Verifier: Freelance Verifier

Signature: _____

Date: 2026-03-19

MANUFACTURER INFORMATION

EPD OWNER

Contact(s):

Mohamed.Elbhery@egy-petrochem.com
 Contact

Website:

Egyptian Petrochemicals Co.

Owner of the EPD:

Egyptian Petrochemicals Company (EPC)

Name and location of production site(s):

KM 36 Alexandria/Cairo Desert Road El-Amreya –
 El-Nahda Territory – Alexandria, Egypt.



Egyptian Petrochemicals Company (EPC) is a petrochemical company that specializes in the production of chemicals and petroleum derivatives to support various industries locally and globally. The Egyptian Petrochemicals Company is one of the petroleum sector companies that work in everything related to the field of petrochemicals and supporting industries, and produces caustic Soda, PVC, PVC compound, and others. The company is committed to preserving the environment and the safety and health of its workers, as well as the relevant parties, such as contractors and neighboring companies.

EPC produces products of the highest quality, including (Polyvinyl Chloride, Caustic Soda Liquid, Sodium Hypochlorite, and Hydrochloric Acid), focusing on quality, safety, health, and the environment.

MANUFACTURER INFORMATION

EPC Certificates Overview



Certificate	Standard	Issuing Body	Scope	Certificate Number	Issue Date	Expiry Date
Occupational Health & Safety Management System	ISO 45001:2018	Intertek (UKAS Accredited)	Production of PVC Resin, PVC Compound, caustic soda, chlorine, crosslink, polyethylene, hydrochloric acid and supporting services	155346	6 Sep 2020 (initial) 23 Aug 2023 (renewed)	5 Sep 2026
Environmental Management System	ISO 14001:2015	Intertek (UKAS Accredited)	Same scope as above	155344	6 Sep 2020 (initial) 23 Aug 2023 (renewed)	5 Sep 2026
Quality Management System	ISO 9001:2015	Intertek (UKAS Accredited)	Same scope as above	155347	6 Sep 2020 (initial) / 23 Aug 2023 (renewed)	5 Sep 2026
Energy Management System	ISO 50001:2018	OSS Middle East (EGAC Accredited)	Same scope as above	010822E n-1	1 Aug 2025	31 Jul 2028
Guidance on Social Responsibility	ISO 26001:2010	AQAI Accredited	Same scope as above	ARA 2402007 0	26 Nov 2024	25 Nov 2027
Risk Management System	ISO 31000:2018	OSS Middle East (EGAC Accredited)	Same scope as above	RMS-221 1054	26 Nov 2022	25 Nov 2025
General requirements for the competence of testing and calibration laboratories	JSO/IEC 17025:2017	EGAC	In some physical tests of PVC	027015B	17 Jan 2025	16 Dec 2028

MANUFACTURER INFORMATION

EPC Certificates Overview

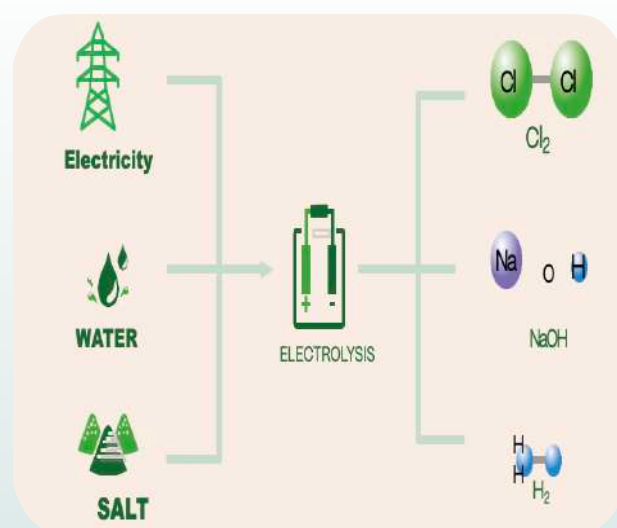
Certificate	Standard	Issuing Body	Scope	Certificate Number	Issue Date	Expiry Date
 Information security management system	ISO /IEC 27001 : 2022	OSS Middle East (EGAC Accredited)	Data center and company security department	420723IS	17 Jul 2023	16 Jul 2026
 GHG Verification Statement	ISO 14064-1:2018 & EU-GHGS guidelines	Energy up VVB (EGAC Accredited)	GHG Emissions for Egyptian Petrochemicals Co.	EU0005/VVB25/ EGY	30 Jan 2025	-
 GHG Sequestration Validation Statement	ISO 14064-2:2019 & EU-GHGS guidelines	Energy up VVB (EGAC Accredited)	Jojoba cultivation project	EU0006/VVB25/ EGY	02 Feb 2025	-
 Product Carbon Footprint Verification statement	ISO 14067:2018	Energy up VVB (EGAC Accredited)	Product Carbon footprint for Caustic Soda (NaOH-50%)	EU0007/VVB25/ EGY	07 JUL 2025	-
 Product Carbon Footprint Verification statement	ISO 14067:2018 & EU- GHGS guidelines	Energy up VVB (EGAC Accredited)	Product Carbon footprint for PVC Resin (K 67)	EU0006/VVB25/ EGY	07 Jul 2025	-
 Product Carbon Footprint Verification statement	ISO 14067:2018& EU- GHGS guidelines	Energy up international VVB (EGAC Accredited)	Product Carbon footprint for PVC Resin (K 70)	EUK 05/VVB25/ EGY/	10 Jan 2026	-

PRODUCT INFORMATION

PRODUCT CHARACTERISTICS

Properties of Caustic Soda 50% Grade

Test Item	Test Method	Specification (% w/w)
Sodium Hydroxide (NaOH)	ASTM E291	48 – 50
Sodium Carbonate (Na ₂ CO ₃)	ASTM E291	0.10 max
Chloride (Cl ⁻)	ASTM D512-C	0.006 max
Sulphate (SO ₄ ²⁻)	ASTM D516	0.0075 max
Silica (SiO ₂)	ASTM D1976	0.006 max
Iron (Fe)	ASTM D1976	0.001 max
Aluminum (Al)	ASTM D1976	0.0025 max



Egyptian Petrochemicals Company (EPC) manufactures Caustic Soda under the trade name Caustic Soda (NaOH – 50%). This product is produced through the electrolysis of the ultra -pure brine in membrane electrolyzers for separation to Caustic Soda, Chlorine and Hydrogen. Caustic soda, also known as sodium hydroxide (NaOH), is a highly versatile chemical with a wide range of applications across various industries.

The present LCA study covers the caustic soda produced at EPC's facility in Alexandria, Egypt which is delivered in liquid form and conforms to international specifications depending on its end-use. The product analyzed in this study and their associated properties are shown in the tables below.

Caustic Soda Applications

- ☐ Caustic soda is essential in the production of chemicals such as alumina, chlorine, and various organic compounds. It serves as a key reactant in many chemical processes.
- ☐ It is used in the pulping process to break down wood fibers, making it vital in producing paper and other cellulose-based products.
- ☐ Caustic soda plays a significant role in water treatment facilities, where it helps adjust the pH of water, neutralizes acidity, and removes heavy metals and impurities.
- ☐ It is an important ingredient in the manufacturing of soaps and detergents. It acts as a saponifying agent, enabling the reaction between fats and oils to produce soap.

LCA INFORMATION

Declared Unit

1 kg caustic soda at 50% concentration, with water, supplied in bulk.

Time Representativeness

January 2024 – December 2024

Reference service life

Not Applicable (N/A)

Geographical Scope Egypt

UN CPC Code: UN CPC 342

The life cycle impact assessment (LCIA) was performed using the Environmental Footprint method (EF) 3.11. Characterization factors and impact assessment methods follow the European Commission Environmental Footprint (EF) methodology as provided in the Ecoinvent EN15804 add-on package.

Target Group

The intended audience of this EPD is business-to-business (B2B) stakeholders only. The EPD is not intended for business-to-consumer (B2C) communication.

SYSTEM BOUNDARIES (Cradle - to- customer Gate);

The study follows the modular life cycle stage structure outlined by Product Category Rules (PCR) for Basic Chemicals, 2021:03, Version 1.1.5. The life cycle is divided into three main stages:

Upstream processes:(cradle-to-gate);

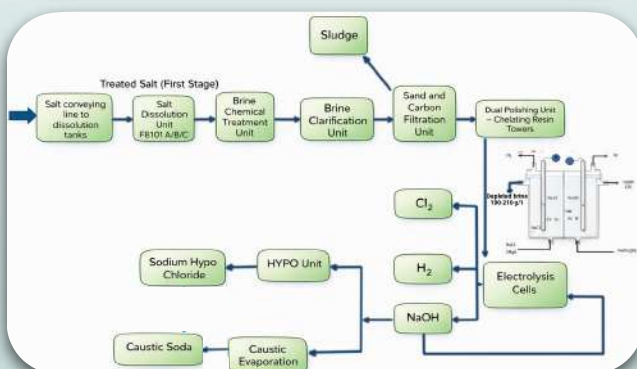
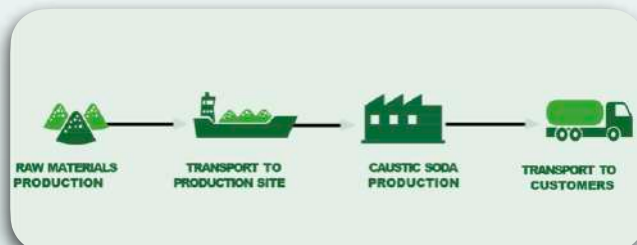
include raw material extraction, preprocessing, and average transportation of inputs to the production facility.

Core processes: (gate-to-gate);

cover all manufacturing activities within the plant, including material conversion, energy use, and internal handling up to the finished product output.

Downstream processes: (gate-to-gate) ;

Accordingly, the upstream transportation modelling follows option (2) of the prioritization hierarchy defined in PCR 2021:03 Section 4.10.3, using calculated as the average distance of a product of that product type transported by different means of transport modes.



Caustic Soda system boundary (core processes)

Upstream: Raw material extraction and processing

Core: caustic soda manufacturing

Downstream: Transport of finished product to customers

EPD TYPE



Single Product EPD

SOFTWARE



openLCA version 2.5

DATABASE



Ecoinvent v3.11

LCA INFORMATION

The modules and unit processes included in the scope for NaOH

Module Life Cycle Stage	Process Description	Declared (X/ND)	Justification (for ND– Not Declared)
Upstream Processes	Extraction of renewable / non-renewable resources (e.g., salt, natural gas)	X	
	Refining and conversion into pure salt	X	
	Production of additives and solvents	X	
	Electricity and fuel production used in upstream stages	X	
	All upstream transportation and waste treatment processes	X	
	Growing and harvesting of renewable resources	ND	NaOH is an inorganic chemical and does not involve renewable biological resources.
	Manufacture of packaging	ND	The product is delivered via bulk loading using reusable customer-owned containers; therefore, no packaging is manufactured within the system boundary.
Core Processes	Transport of main materials to EPC (Egyptian Petrochemicals Company)	X	
	Brine solution preparation	X	
	Brine electrolysis and separation of NaOH, Cl ₂ , and H ₂	X	
	Caustic soda concentration process	X	
	Energy generation for internal use	X	
	End-of-life treatment of manufacturing waste	X	
	Recycling of waste / secondary materials used in production	ND	No recycled or secondary materials are used as inputs in the NaOH production process.
	Storage and maintenance of machines	ND	Storage and maintenance activities are considered negligible as no major maintenance occurred within year 2024 and excluded in line with PCR cut-off rules.
Downstream Processes	Transport of final product to customers	X	
	Use phase	ND	Use scenarios vary significantly depending on industrial application; therefore, the use phase is not modelled in accordance with PCR 2021:03.
	End-of-life (EoL) treatment of product and packaging	ND	Excluded in accordance with PCR 2021:03 Section 4.3, as all criteria for exclusion of EoL treatment are fulfilled.
	Benefits beyond the system boundary	ND	Benefits beyond the system boundary are not considered in this study.

LCA INFORMATION

Allocation

This study follows the allocation guidelines of ISO 14044 and allocation rules specified in the PCR, as well as GPI Version 4.0. It minimizes the use of allocation wherever possible. Allocation procedures were necessary in this LCA study to accurately account for the environmental impacts associated with the production of NaOH specifically as the plant generates further products. Physical/mass allocation was deemed the most accurate and reproducible way of calculating the allocation.

Cut – off Criteria

The PCR for Basic Chemicals recommends a cut-off rule of 1%, meaning that 99% of the results for each environmental impact category, 99% of the product mass, and 99% of the energy use within the product life cycle are accounted for in the inventory. To effectively determine which processes or data points could be excluded based on a 1% cut-off threshold, a comprehensive data collection effort was necessary. Therefore, this study aims for a complete inventory analysis to ensure the most accurate and comprehensive assessment of the environmental impacts associated with the production of NaOH. Then, given the huge amount of chemicals included in the process, the mass flows that are less than 1% were omitted in the impact assessment step.

Excluded life cycle stages

The use stage was excluded due to the wide variety of applications where caustic soda lye is used. The end-of-life stage is excluded as the following criteria are fulfilled:

- The product is physically integrated with other products in subsequent life cycle process so they cannot be physically separated from them at end of life.
- The product or material is no longer identifiable at end-of-life because of a physical or chemical transformation process.
- Sodium hydroxide is an inorganic chemical substance and does not contain any biogenic carbon.
- This EPD is intended exclusively for business-to-business (B2B) communication and shall not be used for business-to-consumer (B2C) communication.

LCA INFORMATION

Assumptions about Electricity Consumption and Other Relevant Background Data

Electricity consumption in the LCA was modelled using the ecoinvent dataset "market for electricity, medium voltage {EG}". This dataset represents the Egyptian national electricity consumption mix and *models the physical electricity available to consumers at the medium -voltage level.*

Assumptions and Excluded Lifecycle Stages

Modeling of Compound Materials:

For compound materials consisting of mixtures of different materials, they were modeled based on the constituent with the highest percentage by mass, if available in the databases. If the primary constituent was not available, the next highest constituent was used, and so on. This approach ensures that the most representative material is used in the life cycle inventory (LCI) while maintaining consistency with available data.

Substitution of Unavailable Pure Components:

In cases where a pure component was not available in the database, a component with similar characteristics (e.g., chemical properties, production process) was chosen as a substitute. This ensures that the environmental impacts of the substituted material closely approximate those of the actual component.

CONTENT DECLARATION

Packaging material:

No packaging material is used and does not contain any recycled materials.

Content Declaration:

The substance covered under REACH registration number 01-2119457892-27-0077 (Sodium Hydroxide) is not listed in the Candidate List of SVHC published by ECHA. Therefore, the product contains no substances of very high concern above 0.1% (w/w).

The table below outlines the representative composition of the NaOH 50% included in this study. All values are expressed per kilogram of product.

Material / Chemical Substance	Mass (kg per DU)	Mass-%	Post-consumer Recycled Material (%)	Biogenic material, mass-% of product	Biogenic material, weight-% and kg C/kg
Sodium Hydroxide (NaOH)	0.50	50	0	0	0
Water (H ₂ O)	0.50	50	0	0	0
TOTAL	1.00	100	—	—	—

Results are per 1 kg caustic soda at 50% concentration, in water, as supplied in bulk

ENVIRONMENTAL PERFORMANCE INDICATORS

IMPACT CATEGORY INDICATORS

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL
Global warming potential (GWP)	Fossil	kg CO ₂ eq.	7.36E-01	2.27E-02	1.09E-05	7.58E-01
	Biogenic	kg CO ₂ eq.	1.70E-04	7.92E-02	4.49E-10	7.94E-02
	Land use and land transformation	kg CO ₂ eq.	1.92E-04	6.47E-06	4.43E-09	1.99E-04
	TOTAL	kg CO ₂ eq.	7.36E-01	1.02E-01	1.09E-05	8.38E-01
Ozone layer depletion (ODP)		kg CFC 11 eq.	1.50E-08	1.48E-09	1.70E-13	1.65E-08
Acidification potential (AP)		mol H ⁺ eq.	1.87E-03	5.10E-05	4.55E-08	1.92E-03
Eutrophication potential (EP)	Aquatic freshwater	kg P eq.	1.64E-05	7.24E-06	1.00E-10	2.36E-05
	Aquatic marine	kg N eq.	3.89E-04	9.33E-05	1.64E-08	4.83E-04
	Aquatic terrestrial	mol N eq.	4.15E-03	1.60E-04	1.81E-07	4.31E-03
Photochemical oxidant creation potential (POCP)		kg NMVOC eq.	2.09E-03	1.60E-04	6.61E-08	2.25E-03
Abiotic depletion potential (ADP)*	Metals and minerals	kg Sb eq.	1.57E-05	7.17E-08	3.07E-11	1.58E-05
	Fossil resources	MJ, net calorific value	1.09E+01	1.67E+00	1.60E-04	1.25E+01
Water deprivation potential (WDP)		m ³ world eq. deprived	1.26E-01	1.91E-03	7.66E-07	1.28E-01

Results are per 1 kg caustic soda at 50% concentration, in water, as supplied in bulk

* Disclaimer: The results of this environmental impact indicator shall be used with care as the uncertainties of these results are high or as there is limited experience with the indicator.

ENVIRONMENTAL PERFORMANCE INDICATORS

Resource use indicators

PARAMETER		UNIT	Upstream	Core	Downstream	TOTAL
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	6.70E-01	6.00E-03	2.10E-06	6.76E-01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	6.70E-01	6.00E-03	2.10E-06	6.76E-01
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.09E+01	1.67E+00	1.60E-04	1.25E+01
	Used as raw materials	MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
	TOTAL	MJ, net calorific value	1.09E+01	1.67E+00	1.60E-04	1.25E+01
Secondary material (optional)		kg	5.92E-03	3.30E-04	1.22E-07	6.25E-03
Renewable secondary fuels (optional)		MJ, net calorific value	1.52E-03	2.23E-05	1.73E-08	1.54E-03
Non-renewable secondary fuels (optional)		MJ, net calorific value	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Net use of fresh water (optional)		m3	3.07E-03	-4.27E-03	2.35E-08	-1.20E-03

Results are per 1 kg caustic soda at 50% concentration, in water, as supplied in bulk

ENVIRONMENTAL PERFORMANCE INDICATORS

Waste Indicators

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Hazardous waste disposed	kg	3.43E-02	9.53E-03	1.87E-07	4.38E-02
Non-hazardous waste disposed	kg	1.05E+00	4.33E+00	1.39E-06	5.37E+00
Radioactive waste disposed	kg	3.30E-06	6.13E-08	3.45E-11	3.36E-06

Output Flow Indicators

PARAMETER	UNIT	Upstream	Core	Downstream	TOTAL
Components for reuse	kg	0.00E+00	0.00E+00	0.00E+00	0.00E+00
Material for recycling	kg	5.24E-03	1.60E-04	1.02E-07	5.40E-03
Materials for energy recovery	kg	6.80E-07	1.00E-08	7.75E-12	6.90E-07
Exported energy, electricity	MJ per energy carrier	1.18E-03	1.97E-05	1.26E-08	1.20E-03
Exported energy, thermal	MJ per energy carrier	2.73E-03	1.60E-05	1.59E-08	2.75E-03

Results are per 1 kg caustic soda at 50% concentration, in water, as supplied in bulk

Impact Contribution

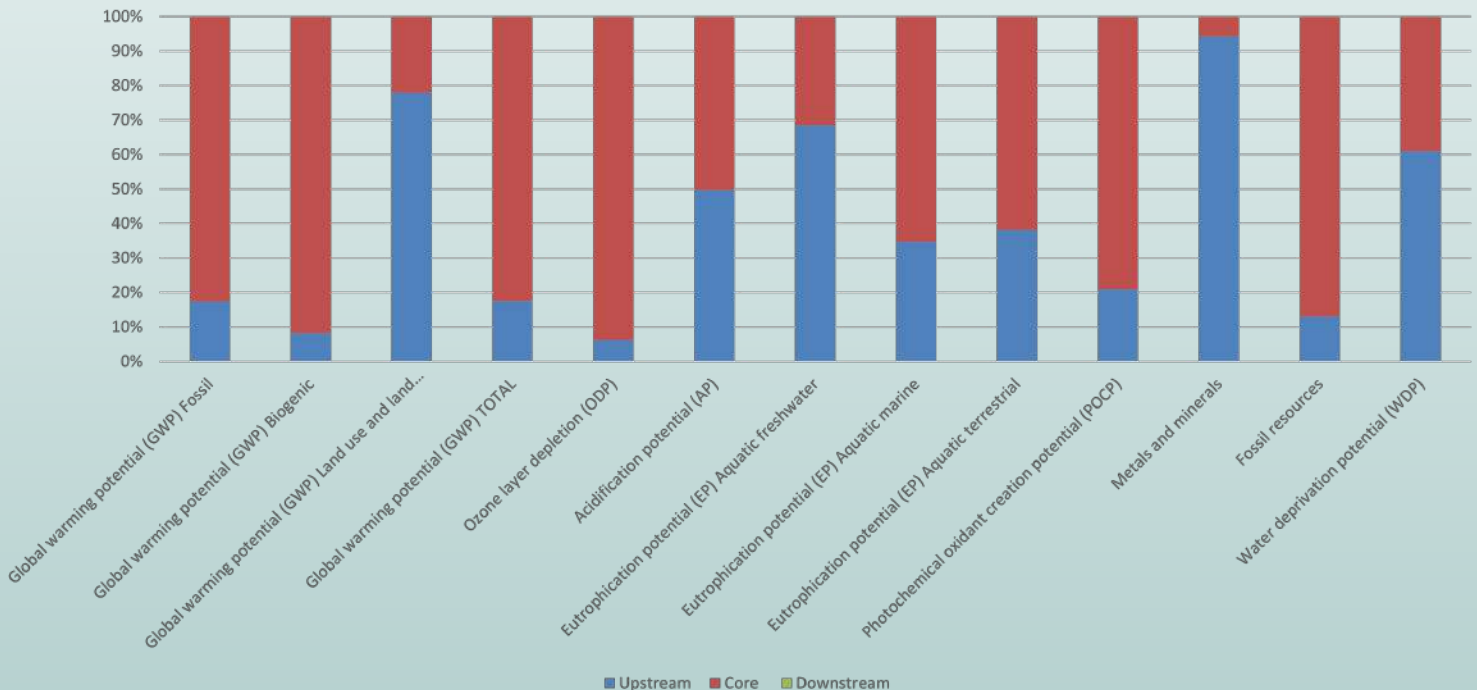
The results show that the upstream stage is the main environmental hotspot, contributing about 80–100% of impacts across most categories, mainly due to raw material extraction, electricity production, and other background supply-chain processes.

The core (gate-to-gate) stage generally contributes 0 –20%, but dominates GWP (biogenic) and freshwater eutrophication, with moderate contributions to marine eutrophication and fossil resource use, reflecting on-site electricity and process energy demand.

The biogenic GWP originates from background wastewater treatment datasets, and its contribution is very small compared to total GWP, making it environmentally negligible.

The downstream stage contributes negligibly, indicating that the system's environmental impacts are primarily driven by upstream supply-chain activities.

The Distribution of the Upstream to Core Impact Contribution



REFERENCES

- 01 General Programme Instructions of the International EPD® System. Version 4.0.
- 02 PCR: 2021:03 BASIC CHEMICALS version 1.1.5 Product Category Classification: UN CPC 341, 342, 343, 345 (EXCEPT SUBCLASS 3451), Published by EPD International AB. Valid until 2026-05-03. Available at: <https://www.environdec.com>.
- 03 EN ISO14025:2006 Environmental labels and declarations – Type III environmental declarations Principles and procedures, and European Committee for Standardization (CEN).
- 04 ISO 14040:2006 Environmental management. Life cycle assessment. Principles and frameworks, European Commission (2021). Product Environmental Footprint Category Rules and Environmental Footprint Method (EF 3.1).
- 05 ISO 14044:2006 Environmental management. Life cycle assessment. Requirements and guidelines.
- 06 Ecoinvent / Ecoinvent Centre, www.Eco-invent.org.
- 07 Egyptian Petrochemicals Company (EPC) - Life Cycle Assessment Background www.egy-petrochem.com.

Contact Information

EPD Owner

Egyptian Petrochemicals Company
Petrochemical manufacturer in Egypt
Alexandria, Egypt

+20 3 477 0012

www.egy-petrochem.com

epc@egy-petrochem.com

LCA Practitioner

Extreme Energy Solutions
Environmental & sustainability consulting
Cairo, Egypt

+20 101 041 8008

www.extremegroup.org

A.seyam@extremegroup.org