EPD® THE INTERNATIONAL EPD® SYSTEM

EPD SOUTHEAST ASIA THE INTERNATIONAL EPD SYSTEM

Environmental Product Declaration
In accordance with ISO 14025 for:

Electricity

From

PT PLN Indonesia Power PRIOK POMU

PLN Indonesia Power

Programme
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PLN Indonesia Power

Programme Information

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PLN Indonesia Power

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SOUTHEAST ASIA EPD THE INTERNATIONAL EPD SYSTEM

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Company Information

Owner of the EPD: PT PLN Indonesia Power Priok POMU
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Company Description

PT PLN Indonesia Power Priok Power Generation and O&M Services Unit (PROPOMU) is a company that produces electrical energy from steam gas power plant unit (PLTGU) owned by PT PLN Indonesia Power located in Jalan RE Martadinata – Ancol, North Jakarta City. This generating unit has a total capacity of 2,723 MW.

Gas and Steam Power Plant is an installation of equipment that functions to convert thermal energy into useful electrical energy. The PLTGU system is a merger between PLTG and PLTU. PLTU utilizes heat and steam energy from exhaust gases from combustion at PLTG to heat water in HRSG (Heat Recovery Steam Generator), so that it becomes dry saturated steam. It is this dry saturated steam that will be used to rotate the blade, the gas produced in the combustion chamber at the gas power plant (PLTG) will drive the turbine and then the generator, which will convert it into electrical energy. Similar to coal-fired power plants, PLTG fuel can be in the form of liquid (BBM) or gas (natural gas). The use of fuel determines the degree of combustion efficiency and the process.

Certification

- ISO 9001:2015
- ISO 14001:2015
- ISO 45001:2018
- ISO 26001:2010
- ISO 31000:2018
- ISO 50001:2018

Name and Location of Production Site

Jl. RE Martadinata – Ancol, Tanjung Priok, Jakarta Utara, Indonesia

Product Information

Product Name

Electricity.

Product Description

The function of electrical products is used as an energy source to support activities both in the community and industrial activities.

UN CPC Code

UN CPC 171 Electrical Energy.

Geographical Scope

The location of the entire process studied is in Indonesia with the following details:

- The location of the natural gas supplier is in North Kalimantan.
- The location of the plant is in Tanjung Priok Area, North Jakarta.
- The electricity distribution location is in Gandul Cinere, Depok and Cawang, North Jakarta.

LCA Information

Functional Units

1 kWh of net electricity generated by gas and steam power plants (PLTGU).

Database

The databases used in this EPD are Ecoinvent 3.8. are used in calculating the impact of *upstream, core,* and *downstream* processes.

Time Representativeness

The data period of upstream used within 10 year (2015-2020), data core period within 1 year (January 01 – December 31 2020), and data downstream used is 2015 and 2016.

LCA Software

The LCA study was conducted using SimaPro 9.4 and Microsoft Excel software.

Reference Service Life

PT PLN Indonesia Power Priok POMU is assumed to operate for 40 years

Assumptions

There are several assumptions contained in this LCA study:

1. Calculation of electrical consumption based on the design and of the tools used during the production process and measurement of the actual operating hours used during the production process.
2. Infrastructure and decommissioning of power plants (core), transmission and distribution (downstream) will operate for the next 40 years, based on the typical technical service life table in Appendix 3 PCR it is stated that power plants using combustion technology can operate for 40 years.

Cut-off rules

The cut-off rules in this LCA are follow in accordance with the Product Category Rules (PCR) Electricity Generation and Distribution, 2007:08: Version 4.2 and UN CPC 171 where data for the underlying stream and from the product system that contributes a minimum of 99% of the stated environmental impact has been included. system boundaries of the LCA study of PT PLN Indonesia Power Priok POMU in 2021 is Upstream to Downstream.

Data Quality

This LCA has followed the data quality requirements according to the Product Category Rules (PCR) Electricity Generation and Distribution, 2007:08, Version 4.2 and UN CPC 171 where specific data should always be used. All specific data used for core processes is collected from the actual factory (PT PLN Indonesia Power Priok POMU) where product-specific processes are performed, except for core infrastructure data, which is collected from the Ecoinvent 3.8 database due to unavailable data. For upstream, downstream processes and infrastructure, the selected generic data has been used because specific data is not available. Data quality assessments have been conducted in accordance with the Data Quality Assessment Guidelines for Lifecycle Inventory Data.

Allocations

Ths LCA has followed the allocation rules in accordance with *Product Category Rules* (PCR) *Electricity Generation and Distribution*, 2007:08, *Version* 4.2 and UN CPC 171. The principle applied to this LCA is that all allocation cases follow the 100% product rule so that the total impact generated for all product of each process is equal to the output load for each process. PT PLN Indonesia Power Priok POMU only produces electrical product, so there is no allocation of co-product.

System Boundaries

The system boundaries of the LCA study of PT PLN Indonesia Power Priok POMU in 2021 is Upstream to Downstream in accordance with the Agreement of the National Electricity Environmental Association (ALLIN) related to the LCA Implementation Plan for Power Plant Activities in the 2021 PROPER assessment and Product Category Rules (PCR): Electricity Generation And Distribution, 8:2007 Version 4.2 UN CPC 171. The production system starts from the Upstream stage, there is a process of drilling and producing natural gas, natural gas transportation, production and transportation of high speed diesel (HSD), the production and transportation of chemicals, the production and transportation of fuels, as well as the production and transportation of oil lubricants used by PT PLN Indonesia Power Priok POMU. The main processes (Cores) in this system are divided into infrastructure data (construction and decommissioning), the process of burning fuel (natural gas and HSD) with air, the conversion of thermal energy into electrical energy, as well as other auxiliary processes such as the fuel preparation process, maintenance process, use of backup power, on-site transportation, and hazardous waste treatment. Then the Downstream stage consists of infrastructure (construction and decommissioning), the process of transmitting electricity, and the process of distributing electricity to the community.

The reason for choosing system boundaries in accordance with the agreement on the association and Product Category Rules (PCR) Data that can be collected and available at PT PLN Indonesia Power Priok POMU may include the system boundaries of the Upstream to Downstream study system. The flow chart of the company's production process as a whole can be seen in Figure 1.

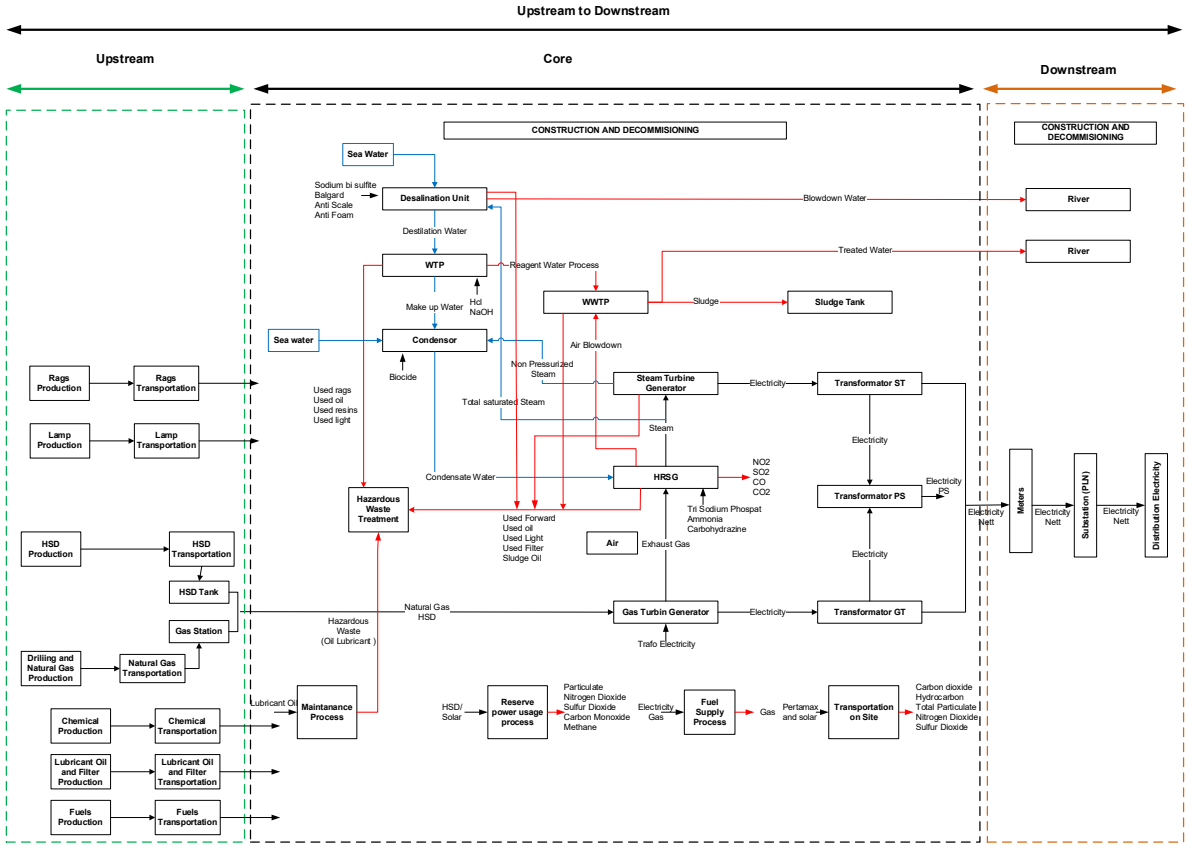

Figure 1 PT PLN Indonesia Power Priok POMU Electricity Production System and System Boundaries

Procedur of Data Collection

PT PLN Indonesia Power Priok POMU collects data on each process unit covered by the system boundary including data on raw materials, fuel, electrical energy use, emissions into the air, emissions to water. Hazardous Waste and land use data in 2020 The data collected is grouped into 2 types of data, namely primary data and secondary data in accordance with what has been determined at the National Electricity Environment Association (ALLIN) related to the LCA Implementation Plan for Power Plant Activities in the 2021 PROPER assessment and Product Category Rules (PCR): Electricity Generation And Distribution, 8:2007 Version 4.2 UN CPC 171. The definitions of primary data and secondary data are:

a. Primary data: the data obtained either by measuring or calculated according to the company's monitoring results.
b. Secondary data: data derived from literature studies or journals relating to the required calculations.

The details of the inventory data used in this LCA study are as follows:

- *Input*
  a. Fuel/energy: *Natural gas,* HSD, pertamax, solar, *Exhaust gas*, *steam*, non pressurized steam, *Saturated steam (*250°C, 7,3 *Bar).*

b. *Chemicals:* Tri Sodium Phosphate, Ammonia, Carbohydrazide, Biocide H-130 M, Biocide C-treat 6, Anti Scale, Anti Foam, HCl, NaOH, Balgard EV, Sodium Bi-Sulfite.
c. Water use: Sea Water, demin water, destilate water, condensate water, and feed water.
d. Other material uses: Oil Lubricant, MBE A, MBE B, lubricating oil, rags, and oil filter.

- *Output* and/or Product
  a. Emissions into the air: Total Particulate, Nitrogen dioxide (NO_2), Sulfur Dioxide (SO_2), Carbon Monoxide (CO), Carbon Dioxide (CO_2), Carbon Monoxide (CO), Dinitrogen Oxide (N_2O), Methane (CH_4), Hydrocarbon (HC), Nitrogen Oxide (NO).
  b. Emissions into water: Cl_2, *Ammonia*, TSS, Fe, PO_4^{3-}, Oil/ Fat, Zn, Cu, Cr, BOD5, COD, *Total Coliform*, Suspended Solid (TSS), Oils and fats, Free Chlorine, Chromium (total), Copper, Iron (total), Seng, Phospate, $KMnO_4$.
  c. *Hazardous waste*: WWTP sludge, used lubricating oil, used rags, resin waste, and oil filter.
  d. Main product: Electrical
  e. Byproduct:-

Environmental Performance

The assessment result are summarized in below and quantities are expressed per declared unit:

1. For upstream, core, core-infrastructure, and total generated, the number are expressed per 1 kWh generated.
2. For downstream, downstream – infrastructure, and total distributed the numbers are expressed per 1 kWh electricity delivered to a customer. Distribution lossess are set to 1% of generated electricity.

Potential Environmental Impact

No	Impact Category		Unit/ kWh	Upstream	Core	Core-Infra	Total Generated	Down-stream	Downstre m-Infra	Total Distributed
1	***Global Waming Potential (GWP)***	***Global Waming Potential – Fossil Fuels***	Kg CO_2 eq/kWh	7.99E-02	2.10E-01	1.29E-03	2.91E-01	2.91E-03	3.06E-06	2.94E-01
		Global Waming Potential – biogenic	Kg CO_2 eq/kWh	1.24E-04	3.77E-12	7.62E-06	1.31E-04	1.31E-06	3.66E-05	1.69E-04
		Global Waming Potential – Land use	Kg CO_2 eq/kWh	3.03E-05	8.70E-13	1.01E-06	3.14E-05	3.14E-07	1.86E-03	1.89E-03

No	Impact Category		Unit/ kWh	Upstream	Core	Core-Infra	Total Generated	Down-stream	Downstrem-Infra	Total Distributed
		and LU change								
		Global Waming Potential – Total	Kg CO_2 eq/kWh	8.01E-02	2.10E-01	1.30E-03	2.91E-01	2.91E-03	1.90E-03	2.96E-01
2	***Acidification Potential* (AP)**		Mol H+ eq/kWh	4.74E-04	2.61E-04	2.61E-04	7.48E-04	7.48E-06	7.82E-05	8.34E-04
3	***Eutrophication Potential* (EP)**	***Eutrophication Potential, Aquatic freshwater***	Kg P eq/kWh	5.24E-06	3.02E-10	6.88E-07	5.93E-06	5.93E-08	6.08E-06	1.21E-05
		Eutrophication Potential, Aquatic marine	Kg N eq/kWh	5.16E-05	1.07E-04	2.30E-06	1.61E-04	1.61E-06	4.52E-06	1.67E-04
		Eutrophication Potential, Terrestrial	Mol N eq/kWh	5.28E-04	1.17E-03	1.17E-03	2.53E-05	1.73E-05	6.00E-05	1.81E-03
4	***Photochemical Ozone Creation Potential* (POCP)**		Kg NMVOC eq/kWh	3.71E-04	2.79E-04	7.86E-06	6.58E-04	6.58E-06	1.74E-05	6.82E-04
5	***Ozone Depletion Potential* (ODP)**		Kg CFC 11 eq/kWh	5.49E-09	1.12E-15	9.05E-11	5.58E-11	5.58E-11	1.63E-10	5.80E-09
6	***Abiotic Deplation Potential***	***For mineral and metal (non-fossil resources)***	Kg Sb eq/kWh	2.63E-07	1.37E-14	1.11E-07	3.73E-07	3.73E-09	1.80E-06	2.18E-06
		For fossil resources	MJ, *net calorific value/kWh*	7.35E+00	1.51E-07	1.48E-02	7.36E+00	7.36E-02	2.18E-02	7.46E+00
7	***Water Deprivation Potential* (WDP)**		M^3 World EQ, Deprived /kWh	2.93E-03	0.00E-00	3.41E-04	3.27E-03	3.27E-05	1.44E-03	4,75E-03

Use of Resources

Parameter		Unit/kWh	Non-Contruction Products:						
			Upstream	*Core*	*Core-Infra*	*Total Generated*	*Down-stream*	*Downstrem-Infra*	*Total Distribusi*
Primary energy resource-Renewable	Use as energy carrier	MJ, net calorific value/kWh	1.25E-01	1.08E-05	4.44E-04	1.25E-01	1.25E-04	1.14E-03	1.27E-01
	Use as energy materials	MJ, net calorific value/kWh	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value/kWh	1.25E-01	1.08E-05	4.44E-04	1.25E-01	1.25E-04	1.14E-03	1.27E-01
Primary energy resource Non-Renewable	Use as energy carrier	MJ, net calorific value/kWh	7,30E+00	1,48E-07	1,42E-02	7,31E+00	7,31E-02	2,18E-02	7,41E+00
	Use as energy materials	MJ, net calorific value/kWh	0	0	0	0	0	0	0
	TOTAL	MJ, net calorific value/kWh	7,30E+00	1,48E-07	1,42E-02	7,31E+00	7,31E-02	2,18E-02	7,41E+00
Secondary material		Kg/kWh	3,53E-03	2,69E-04	1,36E-05	3,81E-03	3,81E-05	2,42E-06	3,85E-03
Renewable secondary fuels		MJ, net calorific value/kWh	0	0	0	0	0	0	0
Non-renewable secondary fuels		MJ, net calorific value/kWh	0	0	0	0	0	0	0
Net use of fresh water		m^3 /kWh	1,22E-04	0	8,12E-06	1,32E-04	1,32E-06	3,34E-05	1,67E-04

Waste Production

Parameters	Unit/kWh	*Upstream*	*Core*	*Core-Infra*	*Total Generated*	*Down-stream*	*Downstrem-Infra*	*Total Distribusi*
Hazardous waste disposed	Kg/kWh	1,18E-04	1,66E+01	2,14E-06	1,66E+01	1,66E-01	3,89E-05	1,66E+01
Non-hazardous waste disposed	Kg/kWh	2,08E-04	0	0	2,08E-04	2,08E-06	5,18E-03	5,39E-03
Radioactive waste disposed	Kg/kWh	0	0	0	0	0	0	0

Output Flows

Parameters	Unit/kWh	*Upstream*	*Core*	*Core-Infra*	*Total Generated*	*Down-stream*	*Downstrem-Infra*	*Total Distribusi*
Component for reuse	Kg/kWh	0	0	0	0	0	0	0
Material for recycling	Kg/kWh	0	0	0	0	0	0	0
Material for energy recovery	Kg/kWh	0	0	0	0	0	0	0
Exported energy, electricity	MJ/kWh	0	0	0	0	0	0	0
Exported energy, thermal	MJ/kWh	0	0	0	0	0	0	0

Impact Contribution

The contribution of the impact resulting from the upstream - downstream process of PT PLN Indonesia Power Priok POMU can be seen in the chart below. Most of the contributor comes from the upstream, core, and core-infrastructure. Impact in the upstream mostly contributed by the natural

gas and chemical production and transportation. On the other hand, impact in the core contributed by the infrastructure (construction and decommissioning) process and emission from the HSRG emits through the chimney, While in the downstream process, the impact of resource use mostly caused by the transmission and distribution networks infrastructure.

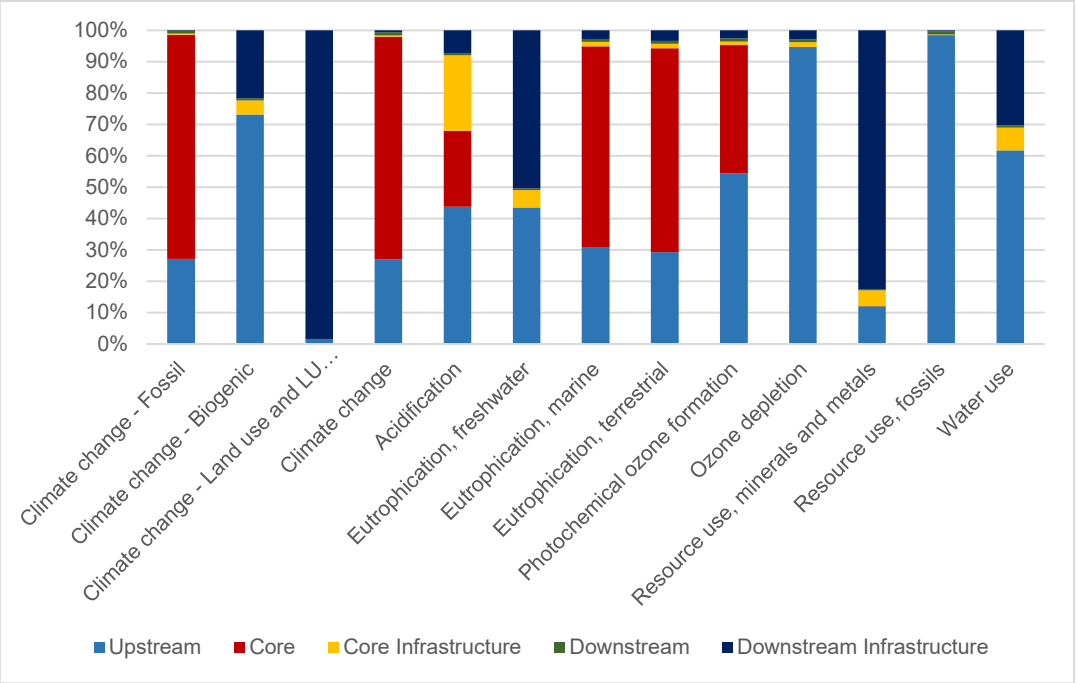

Figure 2 The Distribution of The Upstream To Downstream Impact Contribution

Additional Information

Biodiversity Conservation Development

1. The Taman Hati PKK RW 05 Sunter Agung program is a series of company efforts to assess the potential and plan it with the community in a participatory manner that has been running since 2017. The results of the analysis carried out by the company are then realized in the program planning in a gradual and sustainable manner. Carbon absorption at the Taman Hati and RPTRA Sunter Agung locations In 2020 amounted to 80,687.2 kg of CO_2 Eq. This amount is high for an area of 2,915 m^3. The biodiversity index in the Taman Hati program is 2.75 which is relatively low
2. The UPJP Priok Area Program is an effort to maintain biodiversity with an in situ conservation program since 2017 which includes the maintenance of plant species that are native to Java Island in the North Jakarta Area, while the ex situ conservation program includes the maintenance of landfill species outside the plant's natural habitat. Carbon absorption at the UPJP Priok site in 2020 is 226,843.92 kg CO_2 eq, this amount is relatively high for an area of

2,586 m^3. In general, the UPJP Priok area is able to absorb and store carbon, most of which are mangrove plants that can store carbon in the form of biomass. Biodiversity awareness in the UPJP Priok area in 2020 is 3.5 or relatively low.

3. The Kampung Sehat Hijaunesia Power Warakas program is a program of UPJP Priok assisted villages since 2017. The program is carried out by procuring ornamental plants and TOGA plants in the vertical garden system. Based on the results of observations and inventory of plants in the Warakas area, 115 types of carbon absorption plants were obtained for the Warakas location in the form of medicinal plants and ornamental plants amounting in 2020 is 3,620,350.5 CO_2 Eq. This number is quite high for an area of 77,857 m^3. The biodiversity index in The Kampung Sheat Hijaunesia Power Warakas program is 1.89 which is relatively low

Noise

The noise produced by a power plant comes from the running machines such as turbines, pump, fans, etc. This can easily be reduced by conventional techniques such as installing the “silencer” at the power plant building.

Electromagnetic Field

According to Indonesia Law, there is no restriction on electromagnetic fields (EMF) and no data available from the power plant.

Land Use

PT PLN Indonesia Power Priok POMU power plant, has an area 23.8 Hectare.

Contact Information

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