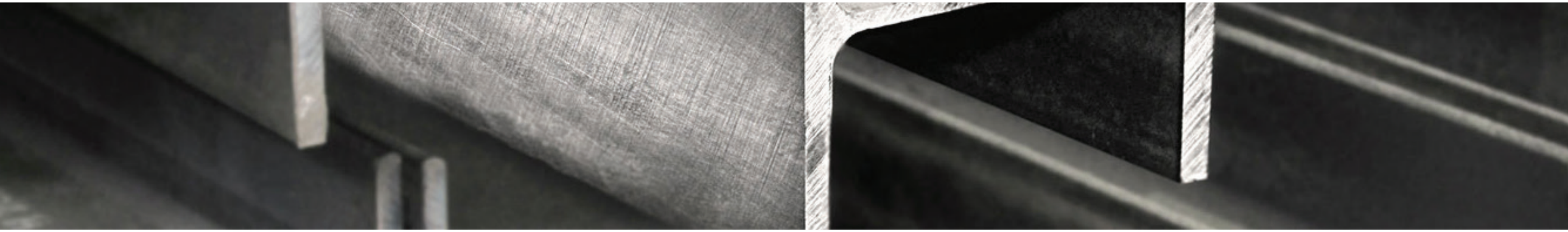
Environmental Product Declaration

In accordance with ISO 14025:2006 and EN 15804:2012+A2:2019/AC:2021 for:

Hot Rolled Structural Steel Shapes

(Meeting ASTM/ASME Standard)



From

PT Gunung Raja Paksi Tbk

Jl. Perjuangan No.8, RT.004/RW.006, Sukadanau,
Kec. Cikarang Barat, Bekasi, West Java 17530, Indonesia

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

EPD registered through the fully aligned regional hub
EPD Southeast Asia,
https://www.epd-southeastasia.com/

Programme operator
EPD International AB

Regional Hub
EPD Southeast Asia

EPD registration number
S-P-06674

Publication date
2023-08-18

Valid until
2028-08-17

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General information

Programme information

Programme	**The International EPD ® System** EPD registered through the fully aligned regional hub: EPD Southeast Asia
Address:	**EPD International AB** Box 210 60, SE-100 31 Stockholm, Sweden **EPD Southeast Asia** Kencana Tower Level M, Business Park Kebon Jeruk Jl. Raya Meruya Ilir No. 89, Jakarta Barat 11620, Indonesia **Website** www.environdec.com www.epd-southeastasia.com **Email** info@environdec.com

Accountabilities for PCR, LCA and independent, third-party verification
Product category rules (PCR): CEN standard EN 15804:2012+A2:2019 serves as the Core Product Category Rules (PCR)
Product Category Rules (PCR): Product Category Rules (PCR) of Construction Products (PCR 2019:14 Version 1.2.5) and UN CPC 41211
PCR review was conducted by: The Technical Committee of the International EPD® System. **Review chair:** Claudia A. Peña, ADDERE Research & Technology The review panel may be contacted via the Secretariat www.environdec.com/contact.
Life Cycle Assessment (LCA) LCA accountability: PT Life Cycle Indonesia
Third-party verification Independent third-party verification of the declaration and data, according to ISO 14025:2006, via: ☑ EPD verification by individual verifier
Third party verifier: Claudia A. Peña, ADDERE Research & Technology **Approved by:** The International EPD® System
Procedure for follow-up of data during EPD validity involves 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 EN 15804, 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 EN 15804:2012+A2:2019 and ISO 14025.

Company information

Description of the organisation

Established in 1970 in Medan, North Sumatra, the company with the name of PT Gunung Naga Mas, started the business by producing hot steel, gradually producing beams and steel sheets. In 1991, PT Gunung Naga Mas transitioned to PT Gunung Raja Paksi (GRP). GRP is located in Cikarang Barat, West Java Province, Indonesia, covering more than 200 hectares. By now, GRP has achieved production capacity of around 2.2 million tonnes per year. In the coming years, GRP will continue to grow and ensure the fulfillment of the need for high quality steel products.

As one of the largest private steel companies in Indonesia, PT Gunung Raja Paksi Tbk (GRP), a member of Gunung Steel Group, has a vision to be the most competitive and valuable benchmark for large private steel companies in Indonesia. To become a world-class integrated steel manufacturer, GRP always nurtures a culture of continuous improvement through achievement and advancement in all fields of development. The mission of the company is to ensure stakeholders' and customers' satisfaction through innovation, efficiency, productivity, quality products and services as well as company social responsibility.

GRP continues to show sustainable growth in all areas. Until now, there are more than 4 500 qualified employees, who have undergone rigorous training, helping Gunung Steel Group (GSG) achieve corporate success in Indonesia. The company is committed to always operating beyond compliance, including on the aspect of the environment. Therefore, GRP is very concerned about the quality of products and its management system. The ability of GRP has been proven by international market customers in Asia, South Asiam Australia, Africa, Europe, Middle East, and America.

Product-related or management system-related certifications

This is evident from the many international certifications obtained such as

- LR QA - 0038/UK/CPR/MUM/2210002/5
- LR QA - 2814/CPR/MUM/2210002/4
- BSI (British Standards Institution) ISO 14001:2015 - EMS 739669
- ISO 17025:2017 - LP-786-IDN
- ISO 45001:2018 - OHS 727495
- LRQA ISO 9001:2015 - 10499914
- Membership of Climate Action CO2 Worldsteel Association
- SNI (Indonesian National Standard) 2610:2011 - 34/W/RE/B/I/2018
- SNI (Indonesian National Standard) 07-2054-2006 - 32/W/RE/B/I/2018
- SNI (Indonesian National Standard) 07-7178-2006 - 33/W/RE/B/I/2018

Details of GRP's commitment to sustainable development can be found in the company's sustainability report.

Name and location of production site(s)

Jl. Perjuangan No.8, RT.004/RW.006, Sukadanau, Kec. Cikarang Barat, Bekasi 17530, West Java, Indonesia

Product information

Product name

Hot Rolled Structural Steel Shapes ASTM/ASME

Product identification

ASTM/ASME

Product description

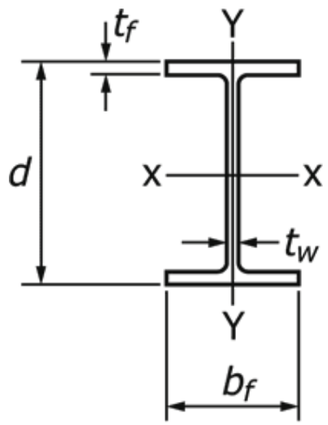
Hot rolled structural steel shapes (H-Beam and I Wide Flange) are made from Beam Blank or Billet which where deformed in the continuous/semi-continuous type hot rolling mill. This EPD is for a specific product, i.e., Hot Rolled Structural Steel Shapes ASTM/ASME. The provided data represents the average environmental performance of various grades/specifications of these structural steel shapes, taking into account the total production of GRP's steel products over a one-year period within the study timeframe. Specification of ASTM/ASME that produced by GRP is covering for structural mild on the table 1 below:

Table 1. Product Standard GRP

Steel Type	General Description	Typical Uses	Specification Standard
Structural Mild Steel	Hot rolled structural steel shapes (H-Beam and I Wide Flange) with nominal 250 – 300 MPa yield strength.	• Structural steel for general construction • Structural Steel Work for fabrication and erection • Bridge design • Buildings	ASTM A36/ASME SA36

Steel Dimension

GRP products refer to the ASTM A6/A6-M standard dimensions as shown below:



d : depth web
tf : thickness flange
tw : thickness web
bf : width flange

Maximum Web Thickness is 30 mm and Standard length is 12 000 mm which GRP capable to supply. However, the standard dimensions refer to the width of the web (100 - 600 mm) that GRP can produce. The following is a standard dimension table in table 2 below:

Table 2.A. Dimension Hot Rolled Structural Steel Shapes “W” Shapes

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	W610 × 113	14 500	608	228	17.3	11.2
	× 101	13 000	603	228	14.9	10.5
	× 92	11 700	603	179	15	10.9
	× 82	10 500	599	178	12.8	10
	W530 × 409	52 200	613	327	55.6	31
	× 369	47 000	603	324	50.5	27.9
	× 332	42 300	593	322	45.5	25.4
	× 300	38 200	585	319	41.4	23.1
	× 272	34 600	577	317	37.6	21.1
	× 248	31 500	571	315	34.5	19
	× 219	27 900	560	318	29.2	18.3
	× 196	25 000	554	316	26.3	16.5
	× 182	23 200	551	315	24.4	15.2
	× 165	21 100	546	313	22.2	14
	× 150	19 200	543	312	20.3	12.7
	× 138	17 600	549	214	23.6	14.7
	× 123	15 700	544	212	21.2	13.1
	× 109	13 900	539	211	18.8	11.6
	× 101	12 900	537	210	17.4	10.9
	× 92	11 800	533	209	15.6	10.2
	× 82	10 500	528	209	13.3	9.5
	× 72	9 180	524	207	10.9	9
	× 85	10 800	535	166	16.5	10.3
	× 74	9 480	529	166	13.6	9.7
	× 66	8 390	525	165	11.4	8.9
	W460 × 349	44 400	535	296	53.6	29.5
	× 315	40 100	525	293	48.5	26.9
	× 286	36 400	517	291	44.4	24.4
	× 260	33 100	509	289	40.4	22.6
	× 235	29 900	501	287	36.6	20.6
	× 213	27 100	495	285	33.5	18.5
	× 193	24 700	489	283	30.5	17
	× 177	22 600	482	286	26.9	16.6
	× 158	20 100	476	284	23.9	15
	× 144	18 400	472	283	22.1	13.6
	× 128	16 300	467	282	19.6	12.2
	× 113	14 400	463	280	17.3	10.8
	× 106	13 400	469	194	20.6	12.6
	× 97	12 300	466	193	19	11.4
	× 89	11 400	463	192	17.7	10.5
	× 82	10 500	460	191	16	9.9
	× 74	9 480	457	190	14.5	9
	W460 × 68	8 710	459	154	15.4	9.1
	× 60	7 610	455	153	13.3	8
	× 52	6 650	450	152	10.8	7.6
	W410 × 149	19 000	431	265	25	14.9
	× 132	16 900	425	263	22.2	13.3
	× 114	14 600	420	261	19.3	11.6
	× 100	12 700	415	260	16.9	10
	× 85	10 800	417	181	18.2	10.9
	× 75	9 480	413	180	16	9.7
	× 67	8 580	410	179	14.4	8.8
	× 60	7 610	407	178	12.8	7.7
	× 53	6 840	403	177	10.9	7.5
	× 46.1	5 880	403	140	11.2	7
	× 38.8	4 950	399	140	8.8	6.4
	W360 × 382	48 800	416	406	48	29.8
	× 347	44 200	407	404	43.7	27.2
	× 314	40 000	399	401	39.6	24.9

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	× 287	36 600	393	399	36.6	22.6
	× 262	33 400	387	398	33.3	21.1
	× 237	30 100	380	395	30.2	18.9
	× 216	27 500	375	394	27.7	17.3
	× 196	25 000	372	374	26.2	16.4
	× 179	22 800	368	373	23.9	15
	× 162	20 600	364	371	21.8	13.3
	× 147	18 800	360	370	19.8	12.3
	× 134	17 100	356	369	18	11.2
	× 122	15 500	363	257	21.7	13
	× 110	14 100	360	256	19.9	11.4
	× 101	12 900	357	255	18.3	10.5
	× 91	11 500	353	254	16.4	9.5
	× 79	10 100	354	205	16.8	9.4
	× 72	9 100	350	204	15.1	8.6
	× 64	8 130	347	203	13.5	7.7
	× 58	7 230	358	172	13.1	7.9
	× 51	6 450	355	171	11.6	7.2
	× 44.6	5 710	352	171	9.8	6.9
	× 39.0	4 960	353	128	10.7	6.5
	× 32.9	4 190	349	127	8.5	5.8
	W310 × 313	39 900	374	325	48.3	30
	× 283	36 000	365	322	44.1	26.9
	× 253	32 300	356	319	39.6	24.4
	× 226	28 800	348	317	35.6	22.1
	× 202	25 700	341	315	31.8	20.1
	× 179	22 800	333	313	28.1	18
	× 158	20 100	327	310	25.1	15.5
	× 143	18 200	323	309	22.9	14
	× 129	16 500	318	308	20.6	13.1
	× 117	15 000	314	307	18.7	11.9

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	× 107	13 600	311	306	17	10.9
	× 97	12 300	308	305	15.4	9.9
	× 86	11 000	310	254	16.3	9.1
	× 79	10 100	306	254	14.6	8.8
	× 74	9 480	310	205	16.3	9.4
	× 67	8 520	306	204	14.6	8.5
	× 60	7 610	303	203	13.1	7.5
	× 52	6 650	317	167	13.2	7.6
	× 44.5	5 670	313	166	11.2	6.6
	× 38.7	4 940	310	165	9.7	5.8
	× 32.7	4 180	313	102	10.8	6.6
	× 28.3	3 590	309	102	8.9	6
	× 23.8	3 040	305	101	6.7	5.6
	× 21.0	2 680	303	101	5.7	5.1
	W250 × 167	21 200	289	265	31.8	19.2
	× 149	19 000	282	263	28.4	17.3
	× 131	16 700	275	261	25.1	15.4
	× 115	14 600	269	259	22.1	13.5
	× 101	12 900	264	257	19.6	11.9
	× 89	11 400	260	256	17.3	10.7
	× 80	10 200	256	255	15.6	9.4
	× 73	9 290	253	254	14.2	8.6
	× 67	8 580	257	204	15.7	8.9
	× 58	7 420	252	203	13.5	8
	× 49.1	6 260	247	202	11	7.4
	× 44.8	5 700	266	148	13	7.6
	× 38.5	4 910	262	147	11.2	6.6
	× 32.7	4 190	258	146	9.1	6.1
	× 28.4	3 630	260	102	10	6.4
	× 25.3	3 220	257	102	8.4	6.1
	× 22.3	2 850	254	102	6.9	5.8

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	× 17.9	2 280	251	101	5.3	4.8
	W200 × 100	12 700	229	210	23.7	14.5
	× 86	11 000	222	209	20.6	13
	× 71	9 100	216	206	17.4	10.2
	× 59	7 550	210	205	14.2	9.1
	× 52	6 650	206	204	12.6	7.9
	× 46.1	5 890	203	203	11	7.2
	× 41.7	5 320	205	166	11.8	7.2
	× 35.9	4 570	201	165	10.2	6.2
	× 31.3	3 970	210	134	10.2	6.4
	× 26.6	3 390	207	133	8.4	5.8
	× 22.5	2 860	206	102	8	6.2
	× 19.3	2 480	203	102	6.5	5.8
	× 15.0	1 910	200	100	5.2	4.3
	W150 × 37.1	4 740	162	154	11.6	8.1
	× 29.8	3 790	157	153	9.3	6.6
	× 22.5	2 860	152	152	6.6	5.8
	W150 × 24.0	3 060	160	102	10.3	6.6
	× 18.0	2 290	153	102	7.1	5.8
	× 13.5	1 730	150	100	5.5	4.3
	× 13.0	1 630	148	100	4.9	4.3
	W130 × 28.1	3 590	131	128	10.9	6.9
	× 23.8	3 040	127	127	9.1	6.1
	W100 × 19.3	2 470	106	103	8.8	7.1

[A] Actual flange and web thicknesses vary due to mill rolling practices; however, permitted variations for such dimensions are not addressed

Table 2.B. Dimension Hot Rolled Structural Steel Shapes “M” Shapes

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	M 318 × 18.5	2 361	318	95	5.8	3.9
	× 17.3	2 213	317	89	5.4	3.9
	M 310 × 17.6	2 240	305	78	5.7	4.5
	× 16.1	2 050	304	78	5.3	4.1
	× 14.9	1 900	304	83	4.6	3.8
	M 250 × 13.4	1 710	254	68	4.6	3.6
	× 11.9	1 520	253	68	5.2	4.0
	× 11.2	1 430	253	68	4.4	3.3
	M 200 × 9.7	1 240	203	57	4.8	3.4
	× 9.2	1 170	203	58	4.5	3.3
	M 150 × 6.6	832	152	47	4.3	2.9
	× 5.5	703	150	51	3.3	2.5
	M 130 × 28.1	3 580	127	127	10.6	8.0
	M 100 × 8.9	1 150	97	97	4.1	3.3
	× 6.1	775	102	57	4.3	2.9
	M 75 × 4.3	550	76	57	3.3	2.3

[A] Actual flange and web thicknesses vary due to mill rolling practices; however, permitted variations for such dimensions are not addressed.

Table 2.C. Dimension Hot Rolled Structural Steel Shapes “HP” Shapes

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	HP460 × 304	38 700	464	460	28.6	28.6
	× 269	34 300	457	457	25.4	25.4
	× 234	29 800	451	454	22.1	22.1
	× 202	25 700	445	451	19.1	19.1
	HP410 × 272	34 700	419	413	28.6	28.6
	× 242	30 800	413	410	25.4	25.4
	× 211	26 900	406	406	22.2	22.2
	× 181	23 000	400	403	19.1	19.1
	× 151	19 200	394	400	15.9	15.9
	× 131	16 700	389	398	13.7	13.7
	HP360 × 174	22 200	361	378	20.4	20.4
	× 152	19 400	356	376	17.9	17.9

Standard Dimension	Designation [Nominal Depth in Milli- metres and Mass in Kilo- grams per Metre]	Area A, mm²	Depth d, mm	Flange		Web Thickness tw, mm[A]
				Width bf, mm	Thickness tf, mm[A]	
ASTM A6/A6-M	× 132	16 800	351	373	15.6	15.6
	× 108	13 800	346	370	12.8	12.8
	HP310 × 132	16 900	314	313	18.3	18.3
	× 125	15 900	312	312	17.4	17.4
	× 110	14 100	308	310	15.5	15.4
	× 93	11 900	303	308	13.1	13.1
	× 79	10 000	299	306	11.0	11.0
	HP250 × 85	10 800	254	260	14.4	14.4
	× 62	8 000	246	256	10.7	10.5
	HP200 × 53	6 840	204	207	11.3	11.3

[A] Actual flange and web thicknesses vary due to mill rolling practices; however, permitted variations for such dimensions are not addressed.

Table 3. Mechanical Properties

Specification & Grades	Type	Applicable Thickness in GRP (mm)	Tensile Test (Transversal)				
			YS (N/mm²)	TS (N/mm²)		EL (%)	
						200	50
			Min	Min	Max	Min	Min
ASTM A36/ASME SA36	Shapes[A]	2 ≤ T ≤ 3	250	400	550	20[B]	21[B]

Remarks:
[A] See the Orientation subsection in the Tension Tests section of Specification A6/A6M.
[B] For wide flange shapes with flange thickness over 3 in. [75 mm, the 80 ki [550 MPa] maximum tensile strength does not apply and a minimum elongation in 2 in.[50 mm] of 19 % applies.

UN CPC code

41251 - Angles, shapes and sections, not further worked than hot-rolled, hot-drawn or extruded, of iron or non-alloy steel

Geographical Scope

Manufactured in Indonesia, supplied to Indonesia

LCA information

Declared unit

1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME

Reference service life

Not applicable

Time representativeness

specific data for the manufacturing collected from 2021-11-01 to 2022-10-31. The 10-year age requirement for generic data has been met.

Database(s) and LCA software used

generic data for upstream and downstream processes use Ecoinvent 3.8 database and modelled by using SimaPro Developer software version 9.4.0.2. No datasets older than 10 years were used.

Description of system boundaries

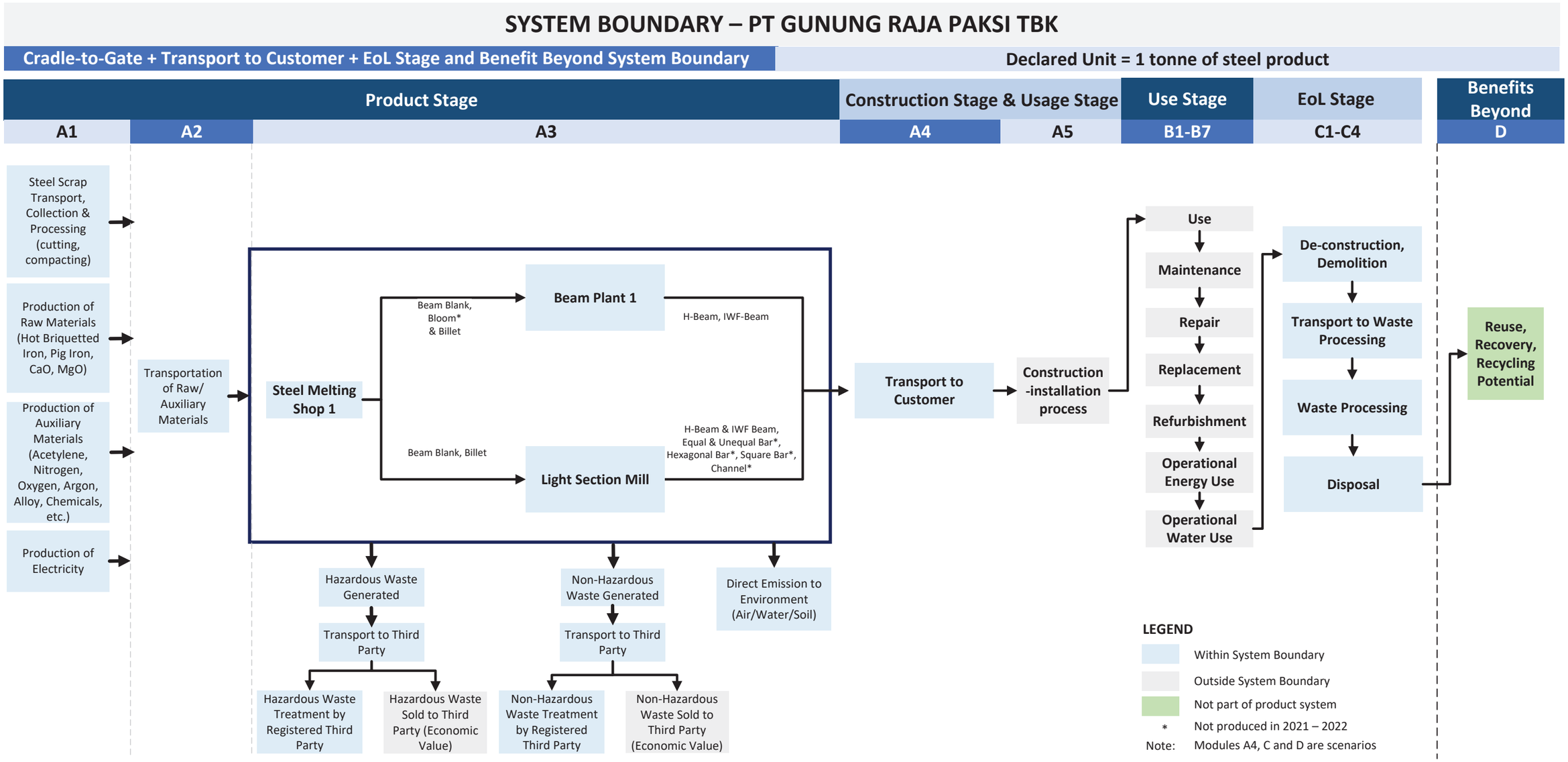
The system boundary was chosen based on the goal and scope of the study and in accordance with EN 15804:2012+A2:2019, i.e. “cradle-to-gate” with the end of life stage as well as benefits and loads beyond the system boundary (module A1-A4, C1-C4, D). Modules A5 and B1-B7 have not been included due to the inability to predict how the material will be used in the construction process and use stage. The processes below are included in the product system to be studied:

1. **Upstream (A1-A2)**
   a. Steel Scrap collection & processing
   b. Production of raw materials (Hot Briquetted Iron, Pig Iron, CaO, MgO)
   c. Production of auxiliary materials in the form of solid, liquid or gas (e.g. Alloy, Chemicals, Electrode, Acetylene, Argon, Nitrogen, Oxygen, LNG, etc.)
   d. Production of electricity from electricity mix in Indonesia from Ecoinvent Database
   e. Transportation of raw/auxiliary materials from the supplier to manufacturing plant

2. **Core (A3)**
   a. Steel Melting Shop 1 (SMS 1): Press Bundle Machine, Shear Cutting Machine, Electric Arc Furnace, Ladle Furnace, Tundish, Continuous Casting Machine, Cutting, Marking, & Scarfing.
   b. Beam Plant 1 (BP 1): Reheating Furnace, Descaler, Breakdown Mill, Hot Saw 1 & 2, Finishing Mill, Cooling Bed & Marking, Straightening Machine, Piling Machine.
   c. Light Section Mill (LSM): Reheating Furnace, Descaling, Roughing Mill, Intermediate Mill, Finishing Mill, Flying Shear, Cooling Bed, Straightening Machine, Bar Transfer Layer, Cold saw 1 & 2, Stacking/Piling Machine, Bundling Machine 1 & 2.
   d. Clarifier (vessel)
   e. Dust collector & blower
   f. Waste treatment (slag, skull, scrap, welding wire, electrode, grinding disc, etc.)
   g. Hazardous waste generated and waste treatment in the registered third party
   h. Non-hazardous waste generated that sold to the third party
   i. Direct emission to the environment

3. **Downstream (A4, C1-C4, D)**
   a. Transport to the building/construction site
   b. Deconstruction & Demolition
   c. Transport to waste processing unit
   d. Waste processing for the scrap steel
   e. Disposal
   f. Reuse/Recovery/Recycling of the end of life of the products

System diagram



More information

Relevant websites for more information regarding the process in manufacturing:
www.gunungrajapaksi.com

Key Assumptions and Limitations

- Production process of materials in upstream process taken from Ecoinvent database reflects average or generic production and therefore does not correspond to actual suppliers.
- The data collected from Light Section Mill (LSM) area is of 1 May – 31 October 2022 as the operation has just commenced in May 2022.
- Land use change emissions in module A3 were considered immaterial. The plant is in an industrial zone which was established in 1990 (more than 30 years ago).
- The water consumption was counted from the amount of makeup water to compensate the losses due to water evaporation.

Cut-off rules

In case of insufficient input data or data gaps for a unit process, the cut-off criteria shall be 1 % of renewable and non-renewable primary energy usage and 1 % of the total mass input of that unit process. The total of neglected input flows per module, e.g. per module A1-A3, C1-C4 and module D shall be a maximum of 5 % of energy usage and mass. In this study, all data in the product system is included. If there is missing specific data, generic data from the database or literature was used.

Data Quality

- Time related coverage: specific data were collected from 2021-11-01 to 2022-10-31, and generic data are representative of the year 2021.
- Geographic coverage: specific data were collected from area under study, i.e., West Java, Indonesia. Generic data were collected from global average data.
- Technological coverage: specific data were collected from current steel making process under study. Generic data from global average with technology aspects were similar with what described in the process under study, but merits improvement as processes were not modelled with specific data.

Data quality for both specific and generic data were sufficient to conduct life cycle assessment in accordance with the defined goal and scope.

Allocation

Economic allocation was applied in accordance with EN 15804:2012+A2:2019. Allocation was applied to allocate the main product and the steel scrap coming out the manufacturing i.e., cutting scale and mill scale. For the end-of-life of waste generated in the manufacturing process (e.g., slag), polluter pays principle are applied for each type of waste. This means that GRP will carry the full environmental impact until the end-of-waste state is reached.

Multi-input allocation is relevant for any material sent to landfill, i.e. steel scrap and also waste generated in the manufacturing. The emissions to air and soil (from leaching) are determined based on the physical/chemical composition of the inputs or physical properties of the material going to landfill. As a result, steel products or other waste generated (paint container, used spray paint containers, penetrant, etc.) that end up in landfill only contribute to those emissions that are likely to occur based on the input material. Overhead processes associated with landfill (e.g. energy used in equipment for managing the landfill site) are attributed to waste flows based on their mass. Mass allocation is considered a reasonable estimation for attributing overhead processes to various waste flows. This allocation is applied as well for any material sent to incineration, i.e. contaminated gloves and rags

In this study, the closed-loop process is applied between modules A-C and module D. When the scrap is used in the manufacture of a new product, there is an allocation (or debit) associated with the scrap input. Meanwhile the recovered steel scrap for recycling is allocated a credit (or benefit) associated with the avoided impacts of the virgin material. If the amount of recovered steel scrap for recycling is less than what the product system requires/steel scrap needed in the manufacture, then the environmental burdens associated with meeting the raw material demand are included in this closed-loop model. If, however, the amount of recovered steel scrap for recycling is larger than what the product system requires/steel scrap needed in the manufacture, then the product system receives a net credit, equivalent to the net amount of virgin material avoided.

The recovered steel scrap that is not looped back to the manufacture (leaving product system that have passed the end-of-waste state), goes to module D, except those which have been allocated as co-product. The end-of-waste state of the steel scrap is reached when the steel scrap is processed in the waste processing (Module C3). The steel scrap is sorted and pressed into blocks and ready to be used for other specific purposes. After the point of end-of-waste, the downstream emissions related to transportation process from recycler to manufacture is attributed to the processing unit that uses the secondary material.

The impacts assigned to the credit or burden that comes from module D are calculated by adding impact connected to secondary steel production from EAF plant (beyond system boundary) and subtracting the impacts resulting from primary steel production at BOS plant. The difference between 100% primary steel production (BOS plant) and 100% secondary steel production (EAF plant) is the result of the module D. The calculation is following worldsteel methodology of steel scrap.

The benefit beyond system boundary (module D) is a credit estimation resulted from the system. The recovery rate for recycling is adjusted to the rate in indonesia, i.e., 15%.The unrecyled steel scrap is considered as material losses that will go to another disposal scenario to landfill.

LCA Scenarios and Additional Technical Information

- Electricity grid in module A3 was based on Ecoinvent database for Indonesia that was modified to represent JAMALI (Java-Madura-Bali) electricity network. The composition of electricity mixed for JAMALI and the amount of electricity losses were adjusted based on Statistic from Directorate General of Electricity (2019) which is highly reliant on coal (66%), gas fired (27.5%), hydropower (4%), geothermal (2%), and diesel (<1%). The climate impact of the electricity is 1.2 kg CO2 eq./kWh.
- The 'Resource depletion – water' (RDW) indicator requires water scarcity data for the production areas, and these were modelled using the specific watershed scarcity data for Bekasi, West Java, i.e., 0.4m3/m3 for the characterisation factor.
- For module beyond A3, the scenarios included are currently in use and are representative for one of the most probable alternatives.
- Pig iron was sent to GRP in solid form from the supplier in London. Therefore, the global Ecoinvent database was modified by using available UK Ecoinvent databases. This modification was applied as well for Hot briquetted iron (HBI) that was imported from supplier in Singapore.
- For ferro manganese and silicon manganese production, the global Ecoinvent database is modified by using available Indonesia Ecoinvent databases for water and wastewater.
- Transportation using truck in Indonesia use EURO3 to represent the current condition.

- Transport distance was estimated by Google Maps from GRP to Indonesia's Port (47 km), GRP to customer's based on customer's provinces and nearest port
- Transportation in Indonesia were estimated based on statistic for average truck travelled 300 kilometres a day (2021).
- Amount of diesel used for demolition process was modelled using Ecoinvent database for global data, i.e., 0.626 MJ diesel/kg steel.
- Amount of diesel and electricity consumption for waste processing was modelled using Ecoinvent database for global data on sorting and pressing iron scrap, i.e., 0.1 MJ diesel/kg steel and 0.01 kWh/kg steel.
- The steel recycling rate in Indonesia is 15% according to the Ministry of National Development Planning of the Republic of Indonesia (2021).
- GRP uses external scrap in its steel production. Net scrap was calculated by excluding the amount of internal scrap (home scrap). The potential environmental benefit calculated for the end-of-life stage (Module D) was based on the net amount of scrap left in the system in accordance with "value of scrap" worldsteel methodology.

Modules declared, geographical scope, share of specific data (in GWP-GHG results) and data variation (in GWP-GHG results):

	Product stage			Construc-tion process stage		Use stage							End of life stage				Resource re-covery stage
	Raw material supply	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling-potential
Module	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Modules declared	X	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	X	X	X	X	X
Geography	ID, UK, SG, GLO	ID	ID	ID	-	-	-	-	-	-	-	-	ID	ID	ID	ID	GLO
Specific data used	>90%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – products	<10%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation – sites	Not Relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

X: Declared

ND : Not declared

Content declaration

Hot Rolled Structural Steel Shapes (H-Beam and I Wide Flange) ASTM/ASME that manufactured by GRP is made of low alloy steels with pig iron & cast-iron 12% and approximately 88% scrap-based material. GRP followed the chemical range of ASTM/ASME as per the specifications that mentioned above, therefore, the average chemical composition can be seen below.

Product content	Weight, %				
Iron (virgin sources)	Approx. 12%				
Recycled material (Post consumer material)	Approx. 88%				
Specification & Grades	**Type**	**Range Thickness (mm)**	**Chemical Composition**	**Standard Specification (wt%)**	**Typical in GRP (wt%)**
ASTM A36/ASME SA 36	Shapes [A]	All	Carbon (C)	≤ 0.26	0.10-0.12
			Manganese (Mn)	-	0.80-0.90
			Phosphorus (P)	≤ 0.040	0.040 max
			Sulphur (S)	≤ 0.050	0.020-0.035
			Silica (Si)	0.40 max	0.20-0.25
			Copper (Cu)	≤ 0.020	-
Remarks: [A] Manganese content of 0.85-1.35 % and silicon content of 0.15-0.40 % is required for shapes with flange thickness over 3 in. [75 mm]					
Packaging materials					
No packaging used for the products					
Dangerous substances from the candidate list of SVHC for Authorisation					
No dangerous substances					

Environmental performance

The estimated impact results provided in this EPD report are solely relative statements and do not serve as indicators of the end points of the impact categories, surpassing threshold values, safety margins, or risks.

Potential environmental impact – mandatory indicators according to EN 15804:2012+A2:2019

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Impact Indicator	Unit	Total A1-A3	A4	C1	C2	C3	C4	D
GWP-fossil	kg CO_2 eq.	1.72E+03	5.89E+01	5.37E+01	4.15E+01	2.04E+01	3.74E+01	8.25E+02
GWP-biogenic	kg CO_2 eq.	1.09E+01	1.59E-02	1.93E-02	1.12E-02	9.49E-02	1.08E-02	-2.38E+00
GWP-luluc	kg CO_2 eq.	2.25E+00	4.44E-04	7.88E-04	3.13E-04	2.11E-02	3.39E-04	1.20E-01
GWP-total	kg CO_2 eq.	1.72E+03	5.89E+01	5.37E+01	4.15E+01	2.04E+01	3.74E+01	8.25E+02
ODP	kg CFC 11 eq.	7.96E-05	1.41E-05	1.21E-05	9.96E-06	2.21E-06	8.91E-06	2.75E-05
AP	mol H^+ eq.	8.53E+00	4.03E-01	5.81E-01	2.83E-01	1.53E-01	2.63E-01	1.98E+00
EP-freshwater	kg P eq.	2.27E-01	2.71E-05	4.21E-05	1.91E-05	2.22E-03	2.39E-05	-1.86E-03
EP-marine	kg N eq.	1.24E+00	1.68E-01	2.60E-01	1.18E-01	5.37E-02	1.10E-01	-2.01E-01
EP-terrestrial	mol N eq.	1.94E+01	1.84E+00	2.86E+00	1.30E+00	5.89E-01	1.21E+00	3.16E+00
POCP	kg NMVOC eq.	5.69E+00	4.75E-01	6.83E-01	3.34E-01	1.44E-01	3.14E-01	4.15E+00
ADP-minerals & metals[2]	kg Sb eq.	2.65E-04	2.71E-06	2.40E-05	1.91E-06	4.11E-06	1.73E-06	1.76E-02
ADP-fossil[2]	MJ	2.21E+04	8.44E+02	7.45E+02	5.95E+02	2.37E+02	5.34E+02	6.91E+03
WDP[2]	m^3	2.93E+00	-4.62E-04	4.63E-03	-3.26E-04	1.79E-02	-4.17E-06	3.50E+02

Acronyms

- **GWP-fossil** : Global Warming Potential fossil fuels
- **GWP-biogenic** : Global Warming Potential biogenic
- **GWP-luluc** : Global Warming Potential land use and land use change
- **ODP** : Depletion potential of the stratospheric ozone layer
- **AP** : Acidification potential, Accumulated Exceedance
- **EP-freshwater**: Eutrophication potential, fraction of nutrients reaching freshwater end compartment
- **EP-marine** : Eutrophication potential, fraction of nutrients reaching marine end compartment
- **EP-terrestrial** : Eutrophication potential, Accumulated Exceedance
- **POCP** : Formation potential of tropospheric ozone
- **ADP-minerals&metals** : Abiotic depletion potential for non-fossil resources
- **ADP-fossil** : Abiotic depletion for fossil resources potential
- **WDP** : Water (user) deprivation potential, deprivation-weighted water consumption

[1]The impact category deals mainly with the eventual impact of low dose ionizing radiation on human health of the nuclear fuel cycle. It does not consider effects due to possible nuclear accidents, occupational exposure nor due to radioactive waste disposal in underground facilities. Potentioal ionizing radiation from the soil, from radon and from some construction materials is also not measured by this indicator

[2]The results of this environmental impact indicator shall be used with care as the uncertainties on these results are high or as there is limited experienced with the indicator.

Potential environmental impact – additional environmental information according to EN 15804:2012+A2:2019

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Impact Indicator	Unit	Total A1-A3	A4	C1	C2	C3	C4	D
PM	Disease incidence	1.21E-04	6.69E-06	1.58E-05	4.72E-06	3.40E-06	4.61E-06	4.05E-05
IRP[1]	kBq U235 eq.	1.18E+01	3.65E+00	3.25E+00	2.57E+00	5.59E-01	2.31E+00	3.28E+00
ETP-fw[2]	CTUe	1.32E+04	3.45E+02	2.51E+02	2.43E+02	6.39E+01	2.21E+02	2.40E+04
HTP-c[2]	CTUh	6.71E-06	2.19E-08	3.24E-09	1.54E-08	2.10E-09	1.33E-08	-8.79E-06
HTP-nc[2]	CTUh	4.70E-05	7.54E-07	2.55E-07	5.32E-07	1.36E-07	4.74E-07	-5.00E-05
SQP[2]	dimensionless	7.34E+02	2.20E+00	2.10E+00	1.55E+00	1.05E+00	3.64E+01	1.87E+03

Acronyms

- **PM**: Particulate Matter emissions
- **IRP**: Ionizing radiation - human health
- **ETP-fw**: Eco-toxicity – freshwater
- **HTP-c**: Human toxicity - cancer effects
- **HTP-nc**: Human toxicity - non-cancer effects
- **SQP**: Land use related impacts / soil quality

Resource use indicators

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Indicator	Unit	Total A1-A3	A4	C1	C2	C3	C4	D
PERE	MJ	6.51E+02	9.84E-01	1.12E+00	6.94E-01	4.90E+00	7.10E-01	8.94E+02
PERM	MJ	0	0	0	0	0	0	0
PERT	MJ	6.51E+02	9.84E-01	1.12E+00	6.94E-01	4.90E+00	7.10E-01	8.94E+02
PENRE	MJ	2.33E+04	8.96E+02	7.91E+02	6.32E+02	2.59E+02	5.67E+02	7.21E+03
PENRM	MJ	0	0	0	0	0	0	0
PENRT	MJ	2.33E+04	8.96E+02	7.91E+02	6.32E+02	2.59E+02	5.67E+02	7.21E+03
SM	kg	7.10E+02	0	0	0	0	0	0
RSF	MJ	0	0	0	0	0	0	0
NRSF	MJ	0	0	0	0	0	0	0
FW	m^3	7.51E+01	2.28E-01	1.97E-01	1.61E-01	7.19E-01	1.45E-01	-5.61E+00

Acronyms

- **PERE** : Use of renewable primary energy excluding renewable primary energy resources used as raw materials
- **PERM** : Use of renewable primary energy resources used as raw materials
- **PERT** : Total use of renewable primary energy resources
- **PENRE** : Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials
- **PENRM** : Use of non-renewable primary energy resources used as raw materials
- **PENRT** : Total use of non-renewable primary energy re-sources
- **SM** : Use of secondary material
- **RSF** : Use of renewable secondary fuels
- **NRSF** : Use of non-renewable secondary fuels
- **FW** : Use of net fresh water

Waste production and output flows

Waste production

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Indicator	**Unit**	**Total A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Hazardous waste disposed	kg	1.29E-02	0	3.22E-01	0	5.14E-02	0	-9.13E+01
Non-hazardous waste disposed	kg	7.30E+01	6.32E-05	0	0	0	8.50E+02	-6.11E+00
Radioactive waste disposed	kg	1.86E-06	0	0	0	0	0	0

Output flow indicators

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Parameter	**Unit**	**Total A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
Components for re-use	kg	0	0	0	0	0	0	0
Material for recycling	kg	0	0	0	0	1.50E+02	0	0
Materials for energy recovery	kg	0	0	0	0	0	0	0
Exported energy, electricity	MJ	0	0	0	0	0	0	0
Exported energy, thermal	MJ	0	0	0	0	0	0	0

Potential environmental impact – environmental information according to EN 15804:2012+A1:2013

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Impact Indicator	**Unit**	**Total A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP	kg CO_2 eq.	1.69E+03	5.84E+01	5.31E+01	4.12E+01	2.03E+01	3.71E+01	7.31E+02
ODP	kg CFC 11 eq.	6.51E-05	1.11E-05	9.57E-06	7.86E-06	1.75E-06	7.03E-06	3.90E-05
AP	kg SO_2 eq.	6.77E+00	2.92E-01	4.13E-01	2.05E-01	1.16E-01	1.90E-01	1.66E+00
EP	kg PO_4^{3-} eq.	1.07E+00	5.65E-02	9.14E-02	3.98E-02	2.54E-02	3.71E-02	-9.50E-02
POCP	kg C_2H_4 eq.	3.43E-01	7.27E-03	4.89E-02	5.11E-03	9.39E-03	4.96E-03	6.62E-01
ADPE	kg Sb eq.	2.66E-04	2.71E-06	2.40E-05	1.91E-06	4.11E-06	1.73E-06	1.76E-02
ADPF	MJ	2.79E+04	8.24E+02	7.28E+02	5.81E+02	2.86E+02	5.22E+02	1.03E+04

No biogenic carbon content in product.

Climate impact (GWP-GHG) – according to PCR

Results per 1 tonne of Hot Rolled Structural Steel Shapes ASTM/ASME								
Indicator	**Unit**	**A1-A3**	**A4**	**C1**	**C2**	**C3**	**C4**	**D**
GWP-GHG[1]	kg CO_2 eq.	1.70E+03	5.86E+01	5.32E+01	4.13E+01	2.04E+01	33.72E+01	7.68E+02

[1] This indicator accounts for all greenhouse gases except biogenic carbon dioxide uptake and emissions and biogenic carbon stored in the product. As such, the indicator is identical to GWP-total except that the CF for biogenic CO2 is set to zero.

Interpretation of results

- Module A1-A3 contributes significantly to the impact generated by the whole life cycle.
- The electricity production process is the largest contributor to majority of the potential impacts followed by casting iron production and transport activities.
- Transport to customer (module A4) makes a relatively small contribution to life cycle emissions for most indicators. However, it is significant for several impact categories, such as, ozone depletion, ionising radiation, acidification potential, eutrophication potential and photochemical ozone formation.
- Activities carried out on the end-of-life of the steel life cycle (module C1-C4) did not have a significant impact on the overall steel life cycle studied.
- Sensitivity Sensitivity analysis was conducted for different electricity consumption in Electric Arc Furnace SMS. The results show insignificant changes with average overall variation is no more than 20%. Therefore, the results are representative.

Environmental Initiatives

PT Gunung Raja Paksi Tbk cooperates with Institut Pertanian Bogor (IPB) or Bogor Agricultural University, are managing 7 green areas at GRP covering the employee mess area and the environment around the production area. This cooperation intends to reduce CO2 and maintain good and healthy air quality in those areas. PT Gunung Raja Paksi Tbk (GRP) officially signed a cooperation agreement with the Sharingyuk Community from Institut Pertanian Bogor (IPB) in September 2021.

The company is committed to support the Government program towards green industry that recognized for ten years in a row by the PROPER certificate awarded by the Republic of Indonesia's Ministry of Environment and Forestry. Aspects of the assessment include environmental permits, water pollution control, air pollution control and management of hazardous and toxic waste.

PT Gunung Raja Paksi Tbk has been obtained ISO 14001:2015 – Environmental Management System certificate. Every 6 months, PT Gunung Raja Paksi Tbk conduct environmental monitoring, such as measuring ground water, air, chimney emission, etc for reporting to UKL-UPL (Upaya Pengelolaan Lingkungan dan Upaya Pemantauan Lingkungan).

PT. Gunung Raja Paksi is increasingly determined and committed to continuous improvement for sustainable living. In terms of the use of renewable resources, PT. Gunung Raja Paksi has collaborated with Total Energies on the installation of the first phase of the 700 Kwp solar power plant (PLTS) in 2022 and further plans to build a Phase 2 Rooftop PLTS of 6,480 Kwp and Phase 3 of 12,800 Kwp. All the power generated is channeled and used for production support activities. The Company continues to strive to control greenhouse gas emissions that cause global climate change, including through implementing solar panels supported by advanced and modern technology. The Company's efforts to reduce energy and emissions are a form of the Company's commitment to preserving the environment.

PT Gunung Raja Paksi Tbk (GRP) became Indonesia's first and one of Asia's first steel mills to purchase carbon credits. The carbon credits were purchased through Gunung Capital from Climate Impact X (CIX) as much as 10 000 tonnes of carbon credits in October 2021. The carbon credits were purchased from eight recognised Natural Climate Solution (NCS) projects at USD 8.00 per tonne. The NCS projects are global selection of quality projects with high environmental and social impact that spanning reforestation and avoided deforestation initiatives – across Africa, Asia and Latin America – demonstrate the high-performance of carbon sequestration and high levels of verified co-benefits, such as supporting biodiversity, along with social and economic development in local communities.

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Southeast Asia EPD

Environmental Product Declaration

SHAPING TOMORROW

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