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INDUSTRY AND MARKET PROSPECT OF
NICKEL PROCESSING
IN INDONESIA

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Chemical Industries



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Fisheries

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LIST OF CONTENT
BIZTEKA
INDUSTRY & COMMODITY
092/June/2023

BIZTEKA OPINION

**THE HILIRIZATION OF NATURAL RESOURCES MUST BE FOLLOWED.
THIS IS A FOLLOW-UP TO THE EXPORT BAN OF MINERALS, RESOURCES, AND OTHER
LOCAL RAW MATERIALS** _____ **1**

PROFILE VARIOUS INDUSTRY

INDUSTRY AND MARKET PROSPECT OF NICKEL PROCESSING IN INDONESIA	3
INTRODUCTION	3
NICKEL DESCRIPTION	4
INDONESIA NICKEL RESERVES	4
EXPORT OF NICKEL ORE IS PROHIBITED BY POLICY	7
NICKEL ORE MINING COMPANIES	7
NICKEL ORE EXPORTS	11
NICKEL ORE IMPORTS	12
DOMESTIC SUPPLY OF NICKEL ORE	13
SMELTER INDUSTRY IN INDONESIA	14
ELECTRIC CAR BATTERY MANUFACTURERS ...	23
STARTING TO INVADE INDONESIA	23
COMPANIES PRODUCTION OF ELECTRIC CARS INCREASES, IN INDONESIA	25
NON-TAX REVENUE ROYALTY RATE	29
NICKEL PRICES	30
NICKEL ORE PRODUCTION PROJECTION	30
SMELTER BUSINESS HAS BRIGHT PROSPECTS IN THE FUTURE	31
CONCLUSION	34

COMPANY PROFILE

PT. VALE INDONESIA TBK	36
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BUSINESS & ANALISYS

SECTOR OF VARIOUS INDUSTRY

-DOMESTIC MOTORCYCLE SALES REACH 5.2 UNITS BY 2022	40
-OJK WILL REVOCATE MORATORIUM ISSUING NEW PERMITS FOR FINTECH (P2P) LENDING COMPANIES	43
-THE POLICY OF LIMITATIONS ON THE IMPORT OF STEEL HAS PROS AND CONS	48
-DESPITE THE COVID-19 OUTBREAK, INDONESIA BIKE EXPORTS HAVE INCREASED	52
-PT. GTS INDONESIA, Tbk A TARGETS NET PROFIT OF US\$ 4 MILLION IN 2023	56
-INDONESIA EXTENDS IMPORT DUTY FOR CHINESE ANTIDUMPING STEEL	61
-IN THE LAST FIVE YEARS, INDONESIA'S AKI EXPORTS HAVE TENDED TO DECLINE	66

ADDITIONAL INFO

-INDONESIAN IMPORTS OF POLYMETHYL METHACRYLATE RESIN (PMMA) BY PORT OF LOADING OR ORIGIN DURING SEPTEMBER 2021	71
-WORLD IMPORT - HS CODE 2604 : NICKEL ORES AND CONCENTRATES	73

INFO BIZTEKA

5-HYDROXYMETHYL FURFURAL FACTORY DESIGN FROM HYACINTH,

WITH CAPACITIES 10.000 TON/YEAR	75
INTRODUCTION	76
PROCESS DESCRIPTION AND	
RAW MATERIAL	77
UTILITIES	90
CONSIDERATION OF SAFETY, OCCUPATIONAL HEALTH, AND ENVIRONMENTAL ASPECTS	103
COMPANY ORGANIZATION	104
ECONOMIC EVALUATION	109
CONCLUSION	123

LIST OF PROFILE INDUSTRY

INDUSTRY PROFILES HAVE BEEN PUBLISHED

❖ PROFILE OF CHEMICAL INDUSTRY

2023

EDITION 091-May-2023
EDITION 089-March-2023
EDITION 087-January-2023

“Prospect Industry and Marketing **TOLUENE DIISOCYANATE** in Indonesia”
“Prospect Industry and Market **HYDROGEN PEROXIDE** in Indonesia”
“Prospect Industry and Marketing **ZINC OXIDE** in Indonesia”

2022

EDITION 085-November-2022
EDITION 083-September-2022
EDITION 081-July-2022
EDITION 079- May -2022
EDITION 077-March-2022
EDITION 075-January-2022

“Prospect Industry and Market **AMMONIA** in Indonesia”
“Prospect Industry and Market **MODIFIED STRARCH** in Indonesia”
“Prospect Industry and Marketing **UNSATURATED POLYESTER RESIN** in Indonesia”
“Prospect Industry and Marketing **ACTIVE CARBON** in Indonesia”
“Prospect Industry and Marketing **SODIUM HYDROXIDE** in Indonesia”
“Prospect Industry and Marketing **CAPROLACTAM** in Indonesia”

2021

EDITION 073-November-2021
EDITION 071-September-2021
EDITION 069-July-2021
EDITION 067- May -2021
EDITION 065-March-2021
EDITION 063-January-2021

“Prospect Industry and Marketing **SORBITOL** in Indonesia”
“Prospect Industry and Marketing **PURIFIED TEREPHTHALIC ACID** in Indonesia”
“Prospect Industry and Marketing **POLYSTYRENE** in Indonesia”
“Prospect Industry and Marketing **ETHANOL** in Indonesia”
“Prospect Industry and Marketing **WHITECARBON** in Indonesia”
“Prospect Industry and Marketing **WATERGLASS** in Indonesia”

2020

EDITION 061-November-2020
EDITION 059-September-2020
EDITION 057-July-2020
EDITION 055- May -2020
EDITION 053-March-2020
EDITION 051-January-2020

“Prospect Industry and Marketing **METHYL ETHYL KETONE** in Indonesia”
“Prospect Industry and Marketing **MSG** in Indonesia”
“Prospect Industry and Marketing **BUTADIENE** in Indonesia”
“Prospect Industry and Marketing **TOLUENE** in Indonesia”
“Prospect Industry and Marketing **XYLENE** in Indonesia”
“Prospect Industry and Marketing **BENZENE** in Indonesia”

2019

EDITION 049-November 2019
EDITION 047-September 2019
EDITION 045-July 2019
EDITION 043- May 2019
EDITION 041-March 2019
EDITION 039-January 2019

“Prospect Industry and Marketing **ETHYLENE** in Indonesia”
“Prospect Industry and Marketing **PROPYLENE** in Indonesia”
“Prospect Industry and Marketing **ANIMAL FEED CHEMICALS** in Indonesia”
“Prospect Industry and Marketing **OLEOCHEMICAL** in Indonesia”
“Prospect Industry and Marketing **PAINT CHEMICALS** in Indonesia”
“Prospect Industry and Marketing **CALCIUM CARBONATE** in Indonesia”

2018

EDITION 037-November 2018
EDITION 035-September 2018
EDITION 033-July 2018
EDITION 031- May 2018
EDITION 029-March 2018
EDITION 027-January 2018

“Prospect Industry and Marketing **METHANOL** in Indonesia”
“Prospect Industry and Marketing **UPSTREAM AROMATICS** in Indonesia”
“Prospect Industry and Marketing **SODA ASH** in Indonesia”
“Prospect Industry and Marketing **GLYCERINE** in Indonesia”
“Prospect Industry and Marketing **FOOD CHEMICALS** in Indonesia”
“Prospect Industry and Marketing **PROPYLENE GLYCOL** in Indonesia”

2017

EDITION 025-November 2017
EDITION 023-September 2017
EDITION 021-July 2017

“Prospect Industry and Marketing **ALUMINIUM HYDROXIDE** in Indonesia”
“Prospect Industry and Marketing **CHEMICALS FOR PULP & PAPER** in Indonesia”
“Prospect Industry and Marketing **PESTICIDE** in Indonesia”

❖ **PROFILE OF VARIOUS INDUSTRY****2023**

EDITION 090-April-2023

“Development And Investment Prospects **TOLL ROAD** in Indonesia”

EDITION 088-February-2023

“Industry Prospect of **SEA CARGO TRANSPORTATION** in Indonesia”**2022**

EDITION 086-December-2022

“Plantation and Market Prospects **COFFEE** in Indonesia”

EDITION 084-October-2022

“Prospect Industry and Market **TUNA FISH** in Indonesia”

EDITION 082-August-2022

“Prospect Industry and Marketing **PULP** in Indonesia”

EDITION 080-June-2022

“Prospect Industry and Marketing **GAS EARTH** in Indonesia”

EDITION 078-April-2022

“Development and Prospects **HOSPITAL** in Indonesia”

EDITION 076-February-2022

“Development and Prospects **ELECTRICITY** in Indonesia”**2021**

EDITION 074-December-2021

“Prospect Industry and Marketing **CAR** in Indonesia”

EDITION 072-October-2021

“Prospect Industry and Marketing **TOOTHPASTE** in Indonesia”

EDITION 070-August-2021

“Prospect Industry and Marketing **PRINTING INK** in Indonesia”

EDITION 068-June-2021

“Prospect Industry and Marketing **WHEEL RIM** in Indonesia”

EDITION 066-April-2021

“Prospect Industry and Marketing **RUBBER GLOVE** in Indonesia”

EDITION 064-February-2021

“Prospect Industry and Marketing **INDUSTRIAL ESTATE (Tentatif)** in Indonesia”**2020**

EDITION 062-December-2020

“Prospect Industry and Marketing **BICYCLE** in Indonesia”

EDITION 060-October-2020

“Prospect Industry and Marketing **SHEET GLASS** in Indonesia”

EDITION 058-August-2020

“Prospect Industry and Marketing **MASK** in Indonesia”

EDITION 056-June-2020

“Prospect Industry and Marketing **PALM COOKING OIL** in Indonesia”

EDITION 054-April-2020

“Prospect Industry and Marketing **GYP SUM** in Indonesia”

EDITION 052-February-2020

“Prospect Industry and Marketing **BEEN** in Indonesia”**2019**

EDITION 050-December 2019

“Prospect Industry and Marketing **SEAWEED** in Indonesia”

EDITION 048-October 2019

“Prospect Industry and Marketing **TINPLATE** in Indonesia”

EDITION 046-August 2019

“Prospect Industry and Marketing **COAL** in Indonesia”

EDITION 044-June 2019

“Prospect Industry and Marketing **COLD STORAGE** in Indonesia”

EDITION 042-April 2019

“Prospect Industry and Marketing **PAPER-BASED PACKAGING** in Indonesia”

EDITION 040-February 2019

“Prospect Industry and Marketing **HOT ROLL COIL** in Indonesia”**2018**

EDITION 038-December 2018

“Prospect Industry and Marketing **SUGAR** in Indonesia”

EDITION 036-October 2018

“Prospect Industry and Marketing **PALM OIL** in Indonesia”

EDITION 034-August 2018

“Prospect Industry and Marketing **NATURE RUBBER** in Indonesia”

EDITION 032-June 2018

“Prospect Industry and Marketing **CREATIVE INDUSTRY** in Indonesia”

EDITION 030-April 2018

“Prospect Industry and Marketing **HEAVY TOOLS** in Indonesia”

EDITION 028-February 2018

“Prospect Industry and Marketing **HEALTH TOOLS** in Indonesia”**2017**

EDITION 026-December 2017

“Prospect Industry and Marketing **LUBRICATING OIL** in Indonesia”

EDITION 024-October 2017

“Prospect Industry and Marketing **AMDK** in Indonesia”

EDITION 022- August 2017

“Prospect Industry and Marketing **SPORT SHOES** in Indonesia”

EDITION 020 - June 2017

“Prospect Industry and Marketing **SEAPORT** in Indonesia”

EDITION 018 - April 2017

“Prospect Industry and Marketing **ANIMAL FEED** in Indonesia”**INDUSTRY PROFILE TO BE PUBLISHED**

EDITION 093 JULY 2023

“Prospect Industry and Marketing **PHTHALIC ANHYDRIDE** in Indonesia”

EDITION 094 AUGUST 2023

“Prospect Industry **TOURISM** in Indonesia”

OPINI BIZTEKA

THE HILITARIZATION OF NATURAL RESOURCES MUST BE FOLLOWED THIS IS A FOLLOW-UP TO THE EXPORT BAN OF MINERALS RESOURCES, AND OTHER LOCAL RAW MATERIALS

W | Editors



Since January 1, 2020, the government of Indonesia has officially implemented a policy to ban the export of nickel ore. With policies that are continued with consistent supervision, it is evident that in 2020, Indonesia's nickel exports will have fallen drastically. Even though in the previous year, namely 2019, nickel exports by Indonesia were still 32.4 million tonnes, in 2020 they were only 1,405 tons.

With the cessation of Indonesian nickel exports, the domestic smelter industry has begun to move. Based on Bizteka's research, until 2022 in Indonesia, there will be 12 nickel ore processing and refining factories (smelters) that produce nickel ferronickel, then 18 smelter factories that produce nickel pig iron (PIN), 2 smelter factories that produce matte nickel, and 3 hydrometallurgy factories that produce MHP (Mixed Hydroxide Precipitate) products, namely nickel sulphate, cobalt sulphate, nickel hydroxide, and nickel hydroxide. This data is one of the impacts of the ban on the export of mineral materials, especially nickel, implemented by the government of Indonesia.

The Downstream Programme being promoted by the government is a bit ambitious because several parties have been enjoying the export rents from local products so far. However, this must be accelerated in a more rigid manner, one of which is by limiting or banning the export of various Indonesian natural resource products. Various local products that also need to be downstream include those for the agro-industry, which is focused on palm oil, seaweed, and cocoa to be processed into food or pharmaceutical products. The metal mineral industry focuses on steel, aluminium, nickel, and copper, which are further processed into automotive products, machinery, and other equipment. Meanwhile, for the oil and gas and coal industries, downstream is directed at the petrochemical or fertiliser industries.

The ban on the export of Indonesia's natural resources will certainly face many challenges from within and outside the country. From within the country are those who are connoisseurs of export rents, as well as from other countries that have been enjoying raw material products from Indonesia. One of them, the European Union, has sued the World Trade Organisation (WTO) over the nickel export ban. In the lawsuit, the WTO rejected Indonesia's defence because its policies were considered to violate several articles in the 1994 General Agreement on Trade and Tariff (GATT). The WTO panel recommended that Indonesia be asked to cancel the nickel ore export ban policy.

After the trial, in October 2022, a decision was issued by the WTO that Indonesia was considered to have violated Article XI.1 of the GATT of 1994. Regarding the WTO decision, according to the Indonesian government, there is still an opportunity to appeal. The Indonesian government also believes that there is no need to change regulations or even revoke policies that are considered inappropriate before a dispute decision is adopted by the Dispute Settlement Body (DSB). In fact, Indonesia will still be conducting further appeals, and a decision on the appeal is expected to come out in 2028.

Even though there are various challenges both within and outside the country, the government's policy to prohibit the export of raw materials and to continue the downstream programme in the country must be encouraged in the future.

With the conditions of downstream development starting to materialise as described above, BIZTEKA is interested in discussing more about nickel raw materials. In this June 2023 issue, the Bizteka Business Journal presents an industry profile entitled "Prospects of the Nickel Processing Industry and Market in Indonesia.". With this informative presentation, hopefully it will be more interesting for business people in Indonesia.

In the future, Bizteka only hopes that by starting to move downstream of local raw material products, starting from mineral mining products, it will soon be followed by moving downstream of other local products. Hopefully...!!!

Bravo BIZTEKA

PROFILE VARIOUS INDUSTRY

PROSPECT INDUSTRY AND MARKET NICKEL PROCESSING IN INDONESIA

FI Editors

INTRODUCTION



The government makes policies, and mining and coal management must provide significant added value to state revenues to be further used for the welfare of the community. Law No. 4 of 2009, as a legal umbrella in the management of minerals and coal, requires that mineral and coal management not be carried out only by exporting raw materials but processed domestically.

The government then officially implemented a policy banning the export of nickel ore (HS 2604.00.00) starting January 1, 2020. This finally became a new chapter for the nickel ore mining industry and the smelter industry in Indonesia. This is evidenced by the presence of several new players in the nickel ore mining industry in Indonesia as well as the increased production capacity of nickel ore.

On the other hand, Indonesia has quite a number of processing and refining factories (smelters) that are spread across several countries. These smelter factories include ferronickel, pig iron, nickel-nickel, and matte nickel factories, and no less importantly, Indonesia has a hydrometallurgical smelter that produces MHP (mixed hydrogen precipitate) products, namely nickel sulphate, cobalt sulphate, and nickel hydroxide, two cathode components for electric vehicle batteries.

Most encouragingly, this policy has had a positive impact on the downstream industry, as several countries have begun to invest in the electric battery, electric vehicle, and electric bicycle industries. Seeing this phenomenon prompted CCI-Bizteka to be interested in

exploring further the prospects for the industry and market for nickel processing in Indonesia. In preparing this report, it covers the development of nickel reserves, mining companies, and the nickel smelter industry. This report was compiled based on data from related sources such as the Ministry of Energy and Mineral Resources (ESDM), the Central Bureau of Statistics (BPS), the Indonesian Nickel Mining Association (APNI), the CCI-BIZTEKA Data Bank, and other sources.

NICKEL DESCRIPTION

Nickel is one of the most abundant metal minerals in the earth's crust, with a silvery white base colour, being shiny, slightly golden, and quite hard. Nickel can be found in nature in two types, namely sulfide or laterite nickel ore. Sulfide ores are usually obtained from volcanic and hydrothermal processes in the presence of copper (Cu), cobalt (Co), and usually several other valuable metals such as gold, platinum, and palladium. Laterite ores are usually formed in tropical areas around the equator, such as areas in Western Australia or South Africa.

Chemically

For chemical characteristics, nickel has the chemical name Ni. Nickel has an electronegativity value of 1.9, so its conductivity to meet ions is very high. This makes the atoms easily attached to nickel or other minerals such as steel, iron, copper, and similar metals.

INDONESIA NICKEL RESERVES

Indonesia is known as the world's largest nickel producer. Based on the records of the Ministry of Energy and Mineral Resources (ESDM), the area of nickel mines in Indonesia reaches 520,877.07 hectares, which are spread across seven provinces in Indonesia, namely Southeast Sulawesi (198,624.66 ha), North Maluku (156,197.04 ha), Central Sulawesi (115,397.37 ha), Papua (16,470 ha), West Papua (22,636 ha), Maluku (4,389 ha), and South Sulawesi (198,624.66 ha). The seven areas are considered to have nickel content of up to 11.7 billion tonnes and reserves of 4.5 billion tonnes, including low grey-grade (limonite nickel) and high grey-grade (saprolite nickel).

1. SouthEast Sulawesi

Southeast Sulawesi is one of the largest nickel-producing areas in Indonesia. It was recorded that the total area of nickel-producing areas in Southeast Sulawesi (Southeast Sulawesi) reached 198,624.66 ha. The areas that produce nickel in Southeast Sulawesi are Kolaka, Wundukalo, Wolo, Baula, Tanggertada, Pomalaa, Watubangga, and Latambaga.

2. South Sulawesi

South Sulawesi Province is also said to have abundant natural resources; one of their main mining products is nickel. The largest nickel-producing area in South Sulawesi is Magani Village, which is located in Nuha District, East Luwu. The mining company that controls this area is PT. Vale Indonesia.

3. Central Sulawesi

Central Sulawesi is known as the largest nickel-producing area. One of the areas that holds the largest natural resources in Central Sulawesi is Morowali Regency, and several areas are scattered in Bench Pesisir, Bahodopi, and Petasia Timur. One of the largest nickel mining companies in Central Sulawesi is PT IMIP (Indonesia Morowali Industrial Park), which has a mining area of 115,397.37 ha.

4. North Maluku

North Maluku Province is also known as the largest nickel-producing area in Indonesia. Nickel-producing areas are in Maba, Wasile, and East Halmahera districts. In fact, this area is also known as a mining area with very complete natural resource processing facilities. As many as 12 mining companies have been established and are operating in North Maluku. The area of nickel mining in North Maluku is 156,197.04 ha.

5. Maluku

Maluku Province has a mining area of 4,389 ha, which functions as a centre for mineral mining. The area surrounded by volcanic mountains makes Maluku Province store millions of mineral mining products such as base metals, copper, gold, mica, quartz sand, nickel, coal, and limestone.

6. Papua

Papua has a nickel mine of 16,470 ha. Not only nickel, but Papua is also known as an area with a wealth of natural resources. Mining materials such as gold, copper, iron, petroleum, and natural gas can be found in this area.

7. West Papua

The last largest nickel-producing area in Indonesia is West Papua, precisely located on Gag Island, which is known for having abundant natural resources. One of them is plantations, mining, forest products, and eco-tourism. However, mining activities carried out on Gag Island were limited to the exploration and observation of nickel mining products. It is recorded that the area of nickel-producing areas in West Papua is 22,636 ha.

Table – Indonesia's Total Nickel Reserves, 2022

Commodity	Total Power Source (Million Ton)		Total Reserves (Million Ton)	
	Ore	Metal	Ore	Metal
NICKEL	11,784.28	170.02	4,594.59	71.99

Source : Ministry of Energy and Mineral Resources (ESDM), processed by Bizteka.

Indonesian lateritic nickel ore consists of low-grade limonite and high-grade saprolite, which are scattered in several areas such as Central Sulawesi, Southeast Sulawesi, Halmahera, and Papua.

Table - Indonesia's Nickel Resources and Reserves by Laterite Type

Laterite Type	Ore Power Source (million wmt)	Ore Reserve (million wmt)	Metal Power Source (Mt)	Metal Reserve (Mt)
Limonite	1,446.2	383.2	14.0	3.8
Saprolite	2,660.5	755.6	32.2	9.7
Unspecified	9,850.1	3,422.9	98.9	35.8

Source : Geological Agency of Indonesia, 2021, processed by Bizteka.

Table - Indonesia's Nickel Resources and Reserves by Nickel Content

Content of Ni	Ore Power Source (million wmt)	Ore Reserve (million wmt)	Metal Power Source (Mt)	Metal Reserve (Mt)
Ni < 1.5%	7,573.5	1,805.8	73.0	17.3
Ni > 1.5%	6,383.3	2,755.9	72.2	32.0

Source : Geological Agency of Indonesia, 2021, processed by Bizteka.

EXPORT OF NICKEL ORE IS PROHIBITED BY POLICY

The Indonesian Government's commitment to encouraging downstream mining is confirmed in Law No. 4 of 2009 concerning Mineral and Coal Mining (Minerba Law). Article 102 of the Minerba Law stipulates that mining business actors (holders of Mining Business Permits and Additional Special Business Permits) are required to increase the added value of mineral and/or coal resources by carrying out mining, processing, and refining (smelters) within the country.

The government then issued a derivative regulation in the form of Regulation of the Minister of Energy and Mineral Resources (Permen ESDM) Number 34 of 2009 concerning Prioritising the Supply of Mineral and Coal Needs for Domestic Interests, including Nickel. However, the provisions regarding prioritising supply for the domestic nickel processing industry are considered not to have run optimally.

In 2018, the government again issued a new regulation through Permen ESDM No. 25 of 2018 to revoke the previous regulation and accelerate the downstream processing industry in the country. The regulation stipulates that sales of nickel with a grade of less than 1.7% (nickel ore) abroad can only be carried out in a certain amount no later than January 11, 2020, provided that mining business actors have produced processed products or are currently building refining facilities and have paid export duty (BK) in accordance with statutory regulations. Sales abroad can only be made until January 11, 2020, at the latest.

However, the deadline for selling nickel ore abroad was then accelerated to January 1, 2020, through the Minister of Energy and Mineral Resources No. 11 of 2019 concerning the Second Amendment to the Minister of Energy and Mineral Resources No. 25 of 2018. Based on the Regulation of the Minister of Trade (Permendag) No. 96 of 2019 concerning Provisions for the Export of Processed and Refined Mining Products, the Government officially implements a policy banning the export of nickel ore (HS 2604.00.00) starting January 1, 2020.

NICKEL ORE MINING COMPANIES

Government policies encourage the domestic mining sector, making nickel mining businesses more enthusiastic. The Indonesian Nickel Business Association said that there are quite a number of nickel ore mining companies in Indonesia. Several large companies,

namely PT Aneka Tambang Tbk (ANTAM), have nickel mining areas in Indonesia. Among them are North Konawe and Southeast Sulawesi, which are operated by the North Konawe Nickel Mining Business Unit.

The nickel mine in East Halmahera, North Maluku, which is managed by the North Maluku Nickel Mining Business Unit, and the nickel mine on Gag Island, West Papua, which is operated by PT Gag Nikel, Nickel ore commodity ferronickel comes from a nickel mine in Kolaka, Southeast Sulawesi, which is operated by the Kolaka Nickel Mining Business Unit. As what is known as an integrated nickel mining company, ANTAM has a nickel processing company (smelter), namely PT FENI Haltim, Haltim Ferronickel Factory (P3FH) for ferronickel products, PT Nusa Karya Arindo, and PT Sumber Daya Arindo for nickel ore products.

Then PT Vale Indonesia Tbk (INCO) This company also owns a number of nickel mining areas in Indonesia, including: Soroako Block: East Luwu Regency (South Sulawesi) and Morowali Regency (Central Sulawesi); Suasua Block: North Kolaka Regency, Southeast Sulawesi; Pomalaa Block: Regency Kolaka and East Kolaka, Southeast Sulawesi; Bahodopi Block: Morowali Regency (Central Sulawesi) and East Luwu Regency (South Sulawesi); Similar to ANTAM, the company also has processing and nickel refining (smelters) in the form of matte nickel products.

Then there is PT Indonesia Morowali Industrial Park (IMIP), which is a joint venture between Tsangshan Steel Holding from China and local company PT Bintang 8 Mineral. The company owns a nickel mine in Central Sulawesi, which is located in Bahomoahi, Bahomotefe, Bahodopi, and Morowali Regency. IMIP is an integrated nickel mining company that has nickel processing companies (smelters), namely PT Sulawesi Mining Investment and PT Indonesia Guan Ching Nickel and Stainless Steel.

PT Ifishdeco Tbk is an integrated nickel mining company. The company has a nickel mining area in South Konawe Regency, Southeast Sulawesi. The total land area owned by IFISH is 2,580 hectares, and the IUP operation and production area is 800 hectares. According to the information obtained, this company has a nickel processing (smelter) subsidiary named PT Bintang Smelter Indonesia (BSI), which produces Nickel Pig Iron (NPI) and Ferronickel Alloy (FeNi).

PT Central Omega Resources Tbk. (DKFT), which is engaged in mining, mineral processing (nickel ore), and trading of mining products through its subsidiaries, Information that BIZTEKA obtained about the company's nickel mine was carried out by PT Mulia Pacific Resources, whose mining area is located in Petasia District, North Morowali Regency, Central Sulawesi Province (producing nickel ore), PT Itamatra Nusantara (Sawa District, North Konawe Regency, Southeast Sulawesi Province), and PT Bumi Konawe (Petasia District, North Morowali Regency, Central Sulawesi Province). Currently, as one of the largest nickel mining companies, it also carries out nickel refining (smelting), namely ferronickel and nickel pig iron (NPI), through its subsidiary, PT COR Industri Indonesia.

PT PAM Mineral Tbk. (NICKL), a company that was founded on January 15, 2008, has a business engaged in mining and quarrying, especially nickel ore mining. Based on the information obtained, it currently has two operational areas: Laroenai Village, Bungku Pesisir District, Central Sulawesi, and Lameruru Village, Langgikima District, North Konawe Regency, Southeast Sulawesi (conducted by a subsidiary of PT Indrabakti Mustika). Meanwhile, the company's nickel ore has a Ni content of between 1.4% and 1.8%.

Another nickel mining company, namely PT Bintang Delapan Mineral, has a Mining Business Licence (IUP) for nickel mining and nickel ore in Bahomoahi, Bahomoteffe, Bahodopi, Keurea, and Fatufia, Bungku Tengah and Bahodopi Districts, Morowali Regency, Bahomoahi Village, Bahomoteffe, Lalampu, Lele, Dampala, Siumbatu, Bahodopi, Keurea, and Fatufia, Morowali Regency, Central Sulawesi, PT Makmur Lestari Primatama has a mining area in Langgikima District, North Konawe Regency, Southeast Sulawesi. PT Citra Silika Mallawa has a mining area in Lasusua District, North Kolaka Regency, Southeast Sulawesi.

Table - Nickel and Nickel Ore Mining Companies in Indonesia, 2023

COMPANIES OF NICKEL AND NICKEL ORE	
Antam Tbk., PT	Adhi Kartiko Pratama, PT
Vale Indonesia Tbk., PT	Bosowa Mining, PT
PAM Mineral Tbk. (NICKL).PT	Elit Kharisma Utama, PT
Ifishdeco Tbk .PT	Gema Kreasi Perdana, PT
Central Omega Resources Tbk.PT	Konutara Sejati, PT
Harita Nikel.PT	Makmur Lestari Primata, PT
Weda Bay Nikel.PT	Pertambangan Bumi Indonesia, PT

COMPANIES OF NICKEL AND NICKEL ORE	
Citra Silika Mallawa.PT	Dharma Bumi Kendari, PT
Bumi Buton Delta Megah, PT	Rohul Energi Indonesia, PT
Alvindo Mining Resources, PT	Sultra Sarana Bumi, PT
Andalan Energi Nusantara, PT	Pulaursa Tamita, PT
Citra Arya Sentosa Utama, PT	Bososi Pratama, PT
Modern Sinar Energi, PT	Paramitha Persada Tama, PT
Nikelindo Suryakencana Agung, PT	Bhumi Karya Utama, PT
Akar Mas Internasional, PT	Indrabakti Mustika, PT
Dharma Bumi Kendari, PT	Adhikara Cipta Mulia, PT
Wijaya Nikel Nusantara, PT	Tiran Indonesia, PT
Apollo Nickel Indonesia, PT	Pernick Sultra, PT
Kolaka Mineral Resources, PT	Etc

Obtained by BIZTEKA from various sources

Meanwhile, the expansion of nickel ore mining in the country has triggered an increase in nickel ore production. Based on data from the Ministry of Energy and Mineral Resources (ESDM), Indonesia's nickel ore production during the 2018–2022 period increased by an average of 20.21% per year. In 2018, nickel ore production was recorded at 38,329,146 tonnes, and then in 2019, it rose quite high to 60,948,143 tonnes, or an increase of around 59.01%.

In 2020, Indonesia's nickel ore production decreased to 48,040,003 tons. This condition is due to the COVID-19 outbreak hitting the country. Then, in 2021, production activities will start to run normally again, and nickel ore production will again increase to 65,509,854 tons. Meanwhile, in 2022, nickel ore production is estimated to reach 69,866,259 tons.

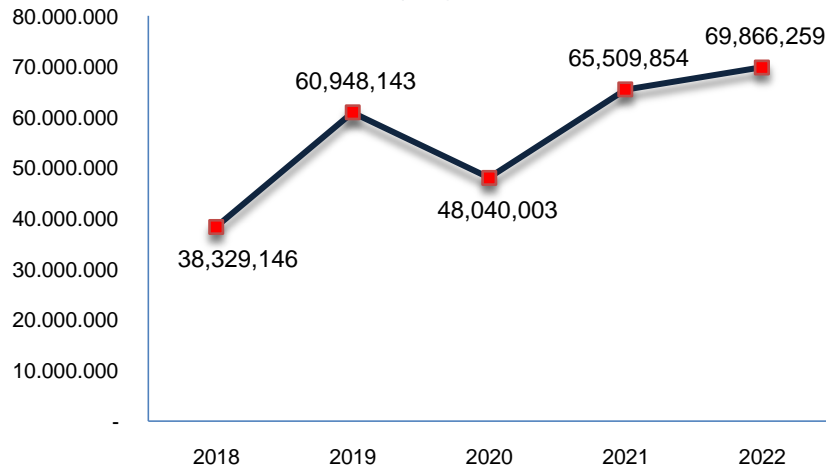
Table - Nickel Ore Production, Indonesia, 2018-2022

Year	Nickel Ore Production (Ton)	Growth (%)
2018	38,329,146	--
2019	60,948,143	59.01
2020	48,040,003	-21.18
2021	65,509,854	36.37
2022*)	69,866,259	6.65
Average Growth (%/Yr)		20.21

**) Estimate*

Source : Ministry of Energy and Mineral Resources, processed by Bizteka

Graph - Nickel Ore Production, Indonesia, 2018-2022
(ton)



Source : Ministry of Energy and Mineral Resources, processed by Bizteka

NICKEL ORE EXPORTS

The government's policy of banning the export of nickel ore, as of January 1, 2020, has been proven to be real. Based on data from the Central Statistics Agency (BPS), nickel ore exports fell sharply to only 1,405 tons. In fact, in 2021–2022, nickel ore exports will start to disappear significantly, from 65 kg to 492 kg. Even though in 2018–2019 nickel ore export activities were quite large with quite high values, In 2018, for example, where export faucet activities were still carried out, Indonesia exported 19,764,459 tonnes of Indonesian nickel ore with a value of US\$ 628,027 thousand. In the following year (2019), exports of nickel ore jumped sharply to 32,380,135 tonnes worth US\$ 1,097,013 thousand.

Based on the information BIZTEKA obtained, the nickel ore exports were carried out by PT Macika Mada Madana, PT Aneka Tambang (ANTAM) Tbk, PT Rohol Energi Indonesia, PT Sinar Jaya Ultra Utama, PT Wana Tiara Persada, PT Trimegah Bangun Persada, PT Gane Permai Sentosa, PT Tekindo Energi, and PT Gebe Sentra Nickel.

However, the export ban turned out to be a polemic because this policy was later sued by the European Union at the World Trade Organisation (WTO). In the lawsuit, the WTO rejected Indonesia's defence because the policy violated a number of articles in the 1994 General Agreement on Trade and Tariff (GATT). The WTO panel recommended that Indonesia immediately take steps in accordance with its obligations under the 1994 GATT. the nickel ore.

Table – Indonesia Nickel Ore Export, 2018-2022

Year	Volume (Ton)	Value (US\$'000)
2018	19,764,459	628,027
2019	32,380,135	1,097,013
2020	1,405	117
2021	--	--
2022	--	--

Source :Central Bureau of Statistics, processed by Bizteka

As stated above, Indonesia exported nickel ore in quite large quantities in 2019. These exports were aimed at a number of countries, and the largest destination, namely China, amounted to 31,153,857 tonnes worth US\$ 1,051,604 thousand, followed by Ukraine with 1,175,478 tonnes worth US\$ 43,687 thousand, and Japan with 50,800 tonnes worth US\$ 1,721 thousand.

Table – Indonesia's Nickel Ore Export Development, 2019

Destination Countries	Volume (Kg)	Share (%)	Value (US\$)
China	31,153,856,812	96.21	1,051,604,330
Ukraine	1,175,478,000	3.63	43,687,090
Japan	50,800,000	0.16	1,721,104
TOTAL	32,380,134,812	100.00	1,097,012,524

Source : Central Bureau Of Statistics, processed by Bizteka

NICKEL ORE IMPORTS

Similar to exports, during this period Indonesia also imported nickel ore. However, in line with the policies issued by the government, imports of nickel ore were finally stopped. Based on data from the Central Statistics Agency (BPS), in 2018 Indonesia did not import nickel ore, and in 2019 Indonesia again imported 169,193 tonnes of nickel ore. In 2020, Indonesia will again not import nickel ore, and in 2021, imports will be carried out again, but the volume is very small. Meanwhile, in 2022, imports of nickel ore will increase to 22,503 tons. Based on the information obtained by Bizteka, the imported nickel ore is of low quality.

Table – Indonesia's Nickel Ore Import, 2018 - 2022

Year	Volume (Ton)	Value (US\$'000)
2018	--	--
2019	169,193	4,356
2020	--	--
2021	1	10
2022	22,503	2,318

Source : Central Bureau Of Statistics, processed by Bizteka

Similar to export activities, in 2019, Indonesia also imported nickel ore from a number of countries. The largest imports came from the Philippines, reaching 169,193 tonnes worth US\$4,353 thousand. Furthermore, from Australia and China, the volume and value of imports are listed in the following table.

Table – Development of Nickel Ore Imports, by Country of Origin, 2019

Country of Origin	Volume (Kg)	Share (%)	Value (US\$)
Philippines	169,193,000	100.00	4,353,065
Australia	52	0.00	2,718
China	2	0.00	35
TOTAL	169,193,054	100.00	4,355,818

Source : Central Bureau Of Statistics, processed by Bizteka

DOMESTIC SUPPLY OF NICKEL ORE

As mentioned above, the marketing of nickel ore is intended for domestic industries. Through this policy, it can be seen that the supply of nickel ore during the 2018–2022 period experienced a fairly high growth rate of an average of 41.25% per year. In 2018, Indonesia's supply of nickel ore was still recorded at 18,564,687 tonnes, but in 2019, the supply experienced a sharp spike to 28,737,201 tons. In 2020, it rose again to 48,040,002 tons. The increase in supply will continue in 2021 and 2022. Even in 2022, the supply of nickel ore will reach 69,888,763 tons. The large supply of nickel ore eventually prompted the presence of a number of processing and refining factories (smelters), such as ferronickel, nickel pig iron, nickel matte, and other industries in Indonesia.

Table - Nickel Ore Supply Development in Indonesia,2018-2022

Year	Volume (Ton)				Growth (%)
	Production	Import	Export	Supply	
2018	38,329,146	-	19.764.459	18.564.687	--
2019	60,948,143	169.193	32.380.135	28.737.201	54.79
2020	48,040,003	-	1,405	48.040.002	67.17
2021	65,509,854	1	-	65.509.855	36.37
2022	69,866,259	22.503	-	69.888.763	6.68
Average Growth (%/Year)					41.25
<i>Processed by Bizteka -CCI</i>					

SMELTER INDUSTRY IN INDONESIA

According to Law Number 3 of 2020, IUP and IUPK holders are required to increase the added value of their domestic mining products through mineral processing and refining (smelters). It is through this decree that business actors are competing to build nickel smelters.

The Indonesian Nickel Mining Association (APNI) said that currently in Indonesia there are 12 nickel ore processing and refining factories (smelters) that produce nickel ferronickel, then 18 smelter factories that produce nickel pig iron (PIN), 2 smelter factories that produce nickel matte, and 3 hydrometallurgy factories that produce MHP (mixed hydrogen precipitate) products, namely nickel sulphate, cobalt sulphate, and nickel hydroxide.

According to APNI, processing and refining factories (smelters) will continue to increase because there are a number of new smelter companies currently carrying out construction or in the construction stage. Even in 2023, it is confirmed that a number of smelters will have been completed and operational.

It should be noted that the nickel processing process is divided into two kinds of extraction technologies, namely pyrometallurgy and hydrometallurgy. Both are different methods. The pyrometallurgical process is a method of extracting metals from the oldest ores. Because, when using high temperatures, melting will occur, and the nature of this method itself is fast, meaning that it only takes a matter of hours. Meanwhile, hydrometallurgy is a metal extraction process in which the ore is first treated using a water reaction or low-grade dissolution at a relatively low temperature.

Ferronickel Company

Based on the data obtained by BIZTEKA, there are 12 processing and refining factories for nickel ore that produce ferronickel products in Indonesia. The companies are PT Virtue Dragon Nickel Industri, PT Obsidian Stainless Steel, PT Century Metalindo, PT Cahaya Modern Metal Industri, PT Megah Surya Pertiwi, PT Cor Industri Indonesia, PT Wanatiara Persada, PT Huadi Alloy Nickel Indonesia, PT Bintang Smelter Indonesia, PT Yashi Indonesia Investment, PT Antam Pomalaa, and others.

Of the twelve companies that have a large capacity, PT Virtue Dragon Nickel Industri (VDNI) The company with foreign investment (PMA) status, located in Konawe, Southeast Sulawesi, has a ferronickel production capacity of 1,000,000 tonnes per year. According to information BIZTEKA obtained during the nickel smelting process, the company PT Virtue Dragon Nickel Industri uses reduction kiln electric furnace (RKEF) technology.

Then PT. Obsidian Stainless Steel, a subsidiary of Xiangyu Group and Delong Group, Currently, the company's smelter production line is in Pohar Village, Morosi District, Konawe Regency, Southeast Sulawesi Province (Southeast Sulawesi), or not far from PT Virtue Dragon Nickel (VDNI). The information that BIZTEKA obtained in the process of smelting and refining nickel uses the same technology used by VDNI, namely reduction kiln electric furnace (RKEF).

Megah Surya Pertiwi (Harita Group): this company is controlled by several shareholders, namely Xinxing Ductile Iron Pipes Co., Ltd. (China), Harita Group (Indonesia), and Corsa Investments Pte. Ltd. (Singapore), with a total investment of USD 350 million. According to information obtained by Bizteka, the company has a ferronickel production capacity of 198,158 tons. Currently, the technology for smelting and refining nickel uses a blast furnace (BF).

PT Aneka Tambang (P3FH) is currently completing the construction of a ferronickel factory in East Halmahera, North Maluku (13,500 tonnes/year). According to the information obtained by Bizteka, if the ferronickel plant in East Halmahera operates, it will increase the installed production capacity of ANTAM's ferronickel plant from 27,000 TNi per year to 40,500 TNi per year.

Table - Nickel Ferronickel Companies in Indonesia, 2023

Companies	Location	Process	Product Capacities (Ton/Year)
Cahaya Modern Metal Industri.PT	Banten	BF	98,000
Century Metalindo.PT	Banten	SAF	50,000
Megah Surya Pertiwi.PT	North Maluku	RKEF	200,000
Wanatiara Persada.PT	North Maluku	BF	161,740
Yashi Indonesia Investment.PT	North Maluku	RKEF	300,000
Antam Pomalaa.PT	South East Sulawesi	RKEF	27,000
Aneka Tambang (P3FH).PT	North Maluku	RKEF	13,500
Virtue Dragon Nickel Industry.PT	South East Sulawesi	RKEF	1,000,000
Huadi Alloy Nickel Indonesia.PT	South Sulawesi	RKEF	60,000
Obsidian Stainless Steel.PT	South East Sulawesi	RKEF	1,200,000
Bintang Timur Steel.PT	Banten	BF	292,000
Indonesia Guang Ching Nickel and SSI.PT	Central Sulawesi	RKEF	100,000
TOTAL			3,502,240

Information : SAF (Submerge Arc Furnace), BF Blast Furnace), RKEF (Reduksi Kiln Electric Furnace)

Source : ESDM, processed by Bizteka

Nickel Ferronickel Production

The development of nickel-ferronickel production in Indonesia in the last five years has grown quite rapidly. This condition is inseparable from the availability of abundant nickel ore raw materials. In 2018, Indonesia's nickel ferronickel production was recorded at 572,158 tonnes; in 2019, it jumped sharply to 1,151,740 tonnes, or an increase of 100%.

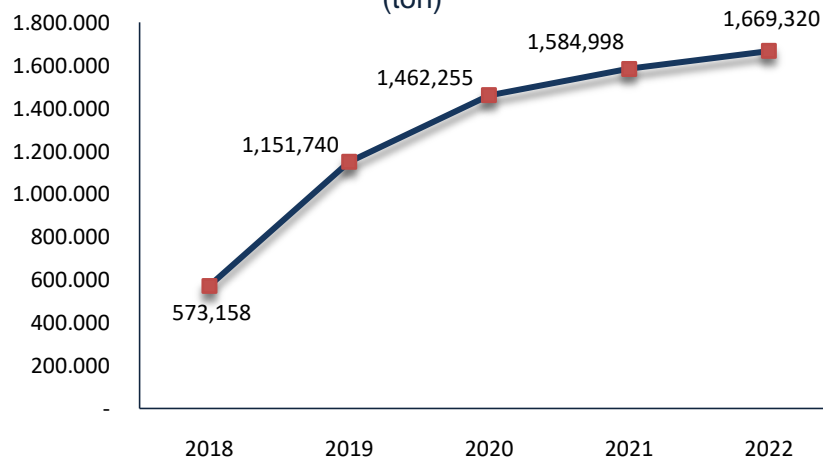
The increase in nickel ferronickel production will continue in 2020, reaching 1,462,255 metric tons. In 2021, production will again increase to 1,584,998 tons. Even in 2022, nickel-ferronickel production exceeded 1,669,320 tons. It can be said that during this period, it experienced an average growth rate of 35.41% per year.

Table - Development of Indonesia's Nickel Ferronickel Production, 2018-2022

Year	Nickel Ferronickel Production, (Ton)	Growth (%)
2018	573,158	--
2019	1,151,740	100.95
2020	1,462,255	26.96
2021	1,584,998	8.39
2022	1,669,320	5.32
Average Growth (%/Yr)		35.41

Source: ESDM, reprocessed by BIZTEKA

Graph - Development of Indonesia's Nickel Ferronickel Production, 2018-2022
(ton)



Source: ESDM, reprocessed by BIZTEKA

Nickel Pig Iron Company

The processing and refining industry (smelter) has become a magnet for companies both domestically and abroad. Based on the information BIZTEKA obtained, there are 18 companies involved in the nickel-pig iron (NPI) industry. Both old and new companies. Currently, they are scattered in Southeast Sulawesi, Central Sulawesi, North Maluku, and Banten.

These companies are namely PT Bintang Smelter Indonesia, PT. Weda Bay Nickel, PT. Tsingshan Steel Indonesia, PT. Sulawesi Mining Investment, PT. Indonesia Guang Ching Nickel and SSI, PT. Huadi Nickel-Alloy Indonesia, PT. Gunbuster Nickel Industry, PT. Fajar Bhakti Lintas Nusantara, PT. Lestari Smelter Indonesia, PT. Cahaya Smelter Indonesia, PT. Bukit Smelter Indonesia, and others.

PT Gunbuster Nickel Industry (GNI) is owned by a Chinese steel company, namely Jiangsu Delong Nickel Industry Co. Ltd. Currently, the nickel ore processing and refining (smelter) facility to convert nickel pig iron (NPI) is located in North Morowali, Central Sulawesi. According to information obtained by Bizteka, the nickel smelter being built uses Rotary Klin Electric Furnace (RKEF) technology by developing 25 production lines.

PT COR Industri Indonesia is owned by PT Centra Omega Resources Tbk and PT Metrolink Nickel Development. According to the information BIZTEKA obtained, the PT CORII smelter uses blast furnace technology. The need for the main raw material in the

form of nickel ore is met by a mining company located next to the smelting location. Located in North Morowali Regency, Central Sulawesi Province. PT CORII employs approximately 700 employees, consisting of domestic and foreign workers.

Bintang Smelter Indonesia (BSI) is a subsidiary of PT Ifishdeco Tbk. According to information obtained by Bizteka, the company has a nickel ore refining product in the form of nickel pig iron (NPI). Currently, the technology is in the process of smelting and refining nickel using the blast furnace (BF) process.

Table – Nickel Pig Iron Company in Indonesia, 2023

Companies	Location	Process	Product Capacities (Ton/Year)
Bintang Smelter Indonesia.PT	SouthEast Sulawesi	BF	80,000
Weda Bay Nickel.PT	North Maluku	RKEF	180,000
Walsin Nickel Industrial Indonesia.PT	Central Sulawesi	RKEF	380,000
Virtue Dragon Nickel Industry.PT	SouthEast Sulawesi	RKEF	600,000
Sulawesi Mining Investment.PT	Central Sulawesi	RKEF	300,000
Ranger Nickel Industry.PT	Central Sulawesi	RKEF	15,000
Lestari Smelter Indonesia.PT	Central Sulawesi	RKEF	300,000
Indonesia Tsingshan Stainless Steel.PT	Central Sulawesi	RKEF	600,000
Indonesia Rupu Nickel and CA.PT	Central Sulawesi	RKEF	300,000
Indonesia Guang Ching Nickel and SSI.PT	Central Sulawesi	RKEF	600,000
Huadi Nickel-Alloy Indonesia.PT	South Sulawesi	RKEF	50,000
Hengjaya Nickel Industry.PT	Central Sulawesi	RKEF	15,000
Gunbuster Nickel Industry.PT	Central Sulawesi	RKEF	430,000
Fajar Bhakti Lintas Nusantara.PT	North Maluku	BF	120,000
Growth Jawa Industri (Indofero).PT	Banten	BF	25,000
COR Industri Indonesia.PT	Central Sulawesi	BF	100,000
Cahaya Smelter Indonesia.PT	Central Sulawesi	RKEF	150,000
Bukit Smelter Indonesia.PT	Central Sulawesi	RKEF	150,000
TOTAL CAPACITIES			4,395,000

Source : ESDM, processed by Bizteka

Nickel Pig Iron Production

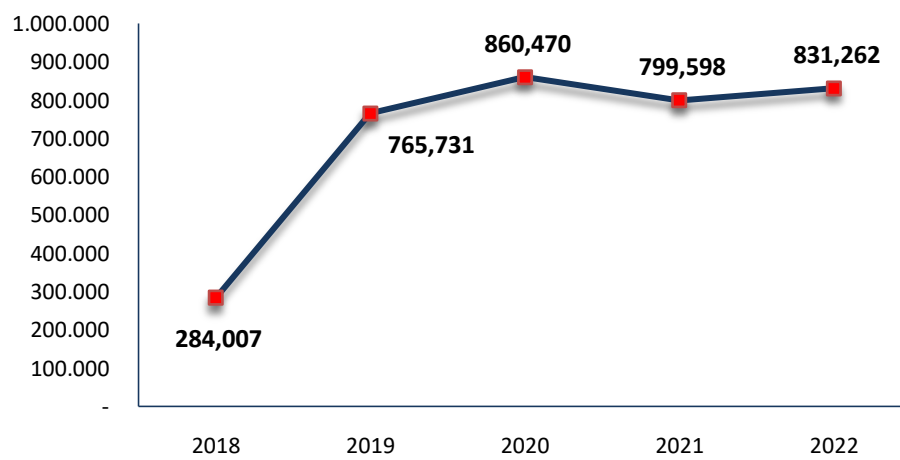
As the number of nickel pig iron (NPI) companies increased, it also boosted NPI production capacity. Based on data from the Ministry of Energy and Mineral Resources (ESDM), in the last five years, NPI production has increased quite rapidly or experienced an average growth rate of 44.72% per year.

In 2018, Indonesia's nickel pig iron (NPI) production was 284,007 tonnes, and in 2019, there was a sharp increase to 765,731 tonnes, or an increase of 169.62%. The increase in nickel pig iron production will continue in 2020, reaching 860,470 tons. In 2021, production decreased to 799,598 metric tons. But in 2022, nickel pig iron production will again increase to 831,262 tons. According to information obtained by BIZTEKA, the decline in nickel pig iron production is due to repairs to the smelter furnace starting in May–November 2021.

Table – Development of Indonesia's Nickel Pig Iron (NPI) Production, 2018-2022

Year	Nickel Pig Iron (NPI), Ton	Growth (%)
2018	284.007	--
2019	765.731	169,62
2020	860.470	12,37
2021	799.598	-7,07
2022	831.262	3,96
Average Growth (%/Yr)		44,72
<i>Source : ESDM, processed by Bizteka</i>		

Graph - Development of Indonesia's Nickel Pig Iron (NPI) Production, 2018-2022 (Ton)



Source: BIZTEKA

Nickel Matte Company

Based on the information BIZTEKA has obtained, there are currently two companies involved in the nickel matte industry in Indonesia. One company is an old player, namely PT Vale Indonesia Tbk, and the other is a new player, PT Youshan Nickel Industry.

PT Vale Indonesia Tbk (INCO) is a subsidiary of Vale, a global mining company headquartered in Brasilia. PT Vale Indonesia has operated an open-pit nickel mine and nickel smelter in Sorowako, Sulawesi, since 1978. Currently, PT Vale Indonesia is the largest nickel producer in Indonesia and contributes around 5% of the world's nickel supply. The ore mined at PT Vale Indonesia is laterite nickel ore, which is then processed into matte nickel.

In general, the processing of laterite nickel ore at PT Vale Indonesia includes drying, calcination, smelting, and converting processes. The drying process is carried out in a rotary dryer to reduce the surface water content (moisture) from 40% to 20%. Then the calcination process is carried out in a rotary kiln for moisture removal to 0%, crystal water removal, metal oxide reduction, and sulfidization.

Furthermore, the smelting process in an electric furnace (electric furnace or SAF) is the smelting of calcine from a rotary kiln at an operating temperature of 1500 °C to produce matte and slag. Matte produced from an electric furnace contains about 50% iron, so matte needs to be purified by an oxidation process with air to reduce the iron content to 0.3%. This process is carried out in the converter primarily to increase the nickel content from about 25% to 76–80% in matte. So that its value is higher than ferronickel, which only has 25%–45% nickel content.

Another company, namely PT Youshan Nickel Indonesia, is a joint venture founded by the Huayou group and Tsingshan group, which are also shareholders in the smelters in Morowali and Youshan in Weda, and is so far known as the largest producer of cobalt products in China. Currently, the company has a nickel matte production capacity of 43,600 metric tonnes per year.

Table - Nickel Matte Company, 2023

Companies	Location	Process	Product Capacities (Ton/Year)
Vale Indonesia.PT	South Sulawesi	RKEF	80,000
Youshan Nickel Indonesia .PT	North Maluku	RKEF	43,600
TOTAL			123,600

Source: ESDM, processed by Bizteka

Nickel Matte Production

Similar to ferronickel and nickel pig iron (NPI) products, Indonesia's nickel matte production during the 2018–2022 period also experienced positive growth, although it fluctuated. In 2018, Indonesia's matte nickel production was recorded at 75,708 tonnes; in 2019, it decreased to 72,015 tons.

In 2020, nickel matte production again rose to 91,692 tons. But in 2021, production will again decline to 82,345 tons. Meanwhile, in 2022, nickel matte production will again increase to 83,926 tons. It can be said that during this period, it experienced an average growth rate of 3.54% per year.

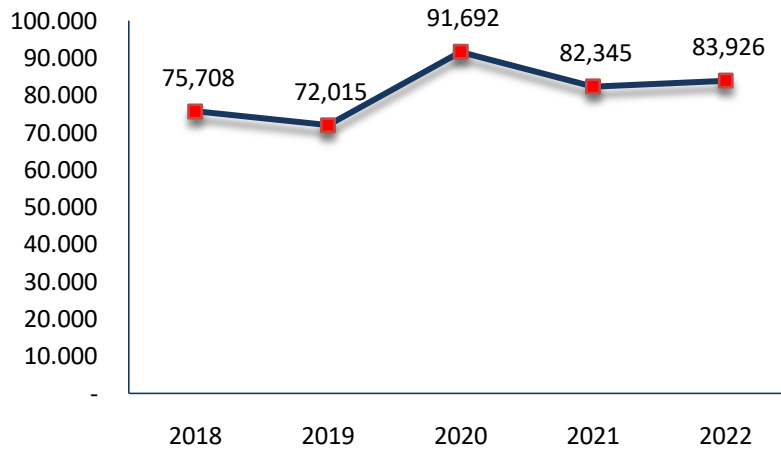
Nickel matte is an intermediate product obtained from nickel ore processing. This type of product has a nickel content of 78%, so the value is higher than ferronickel, which only has a nickel content of 25%–45%.

Table - Development of Indonesia's Matte Nickel Production, 2018-2022

Year	Nickel Matte Production, Ton	Growth (%)
2018	75,708	--
2019	72,015	-4.88
2020	91,692	27.32
2021	82,345	-10.19
2022	83,926	1.92
Average Growth (%/Yr)		3.54

Source: ESDM, processed by Bizteka

Graph – Development of Indonesia's Matte Nickel Production, 2018-2022
(Ton)



Source : ESDM, processed by Bizteka

Mixed Hydroxide Precipitate (MHP) Companies

Indonesia has also entered a new era in processing nickel ore with the presence of a hydrometallurgy plant that produces a product called Mixed Hydroxide Precipitate (MHP). This MHP is used to produce nickel sulphate and cobalt sulphate, the two cathode components of electric vehicle batteries.

The company that is involved in this business is PT Halmahera Persada Lygend (HPL), which is a subsidiary of the Harita Nickel Group and a partner with Zhejiang Lygend Investment Co., Ltd. of Chinese origin. The company, located on Obi Island, South Halmahera, and North Maluku, has built a nickel refinery facility using High Pressure Acid Leaching (HPAL) technology using nickel limonite to produce nickel sulphate and cobalt sulphate.

According to the information obtained, PT Halmahera Persada Lygend's factory has a production capacity of 365,000 tonnes of MHP per year, 246,750 tonnes of nickel sulphate per year, and 31,800 tonnes of cobalt sulphate per year. The company is currently carrying out the final trial phase, namely entering the upgrade/lean-up stage to reach full production capacity. When this is completed, the company PT Halmahera Persada Lygend will be ready to produce nickel sulphate as the core material for making the largest electric vehicle (EV) battery in Indonesia.

PT Smelter Nickel Indonesia, located in Banten, has been 100% built and has successfully conducted a production trial in 2021. However, currently, the company's activities are not optimal because it is waiting for additional funds for operating activities. According to information, the company's nickel refining process uses High Pressure Acid Leaching (HPAL) technology to produce nickel sulphate and cobalt sulphate products.

Table - Mixed Hydroxide Precipitate (MHP) Smelter Companies, 2023

Companies	Location	Process	Product Capacities (Ton/Year)
Halmahera Persada Lygend.PT	North Maluku	HPAL	246,750
Smelter Nikel Indonesia.PT	Banten	HPAL	76,500
Gebe Industry Nickel	North Maluku	BF	24,000
TOTAL			323,250
<i>Information : HPAL (High Pressure Acid Leaching),</i>			
<i>Source: ESDM, processed by Bizteka</i>			

ELECTRIC CAR BATTERY MANUFACTURERS STARTING TO INVADE INDONESIA

Indonesia's success in downstreaming nickel has encouraged world electric vehicle (EV) battery manufacturers to start investing in Indonesia.

PT LG Chemical Ltd. has invested in Indonesia by building an integrated battery factory with an investment of US\$9.8 billion, or IDR 142 trillion. Companies from South Korea, namely PT LG Energy Solution and Hyundai Motor Group, with PT Indonesia Battery Industry, or Indonesia Battery Corporation (IBC), are building an electric car battery factory, PT HKML Battery Indonesia, in Karawang, West Java.

The project has an investment value of US\$1.1 billion, or the equivalent of Rp. 15.6 trillion. Currently, the factory is in the completion stage; if there are no obstacles in 2023, it will be operational. In the first phase, production capacity will reach 10 gigawatts per hour.

In addition, the South Korean company, through PT LG Energy Solution, has started the stage of developing an integrated electric battery industry in the Batang Integrated Industrial Area (KITB), Batang Regency, Central Java Province, in 2022. If there are no obstacles, production will start in the first half of 2024. The company is capable of producing 3.5 million units and 200 gigawatts of electric vehicle batteries per year.

Other companies Contemporary Amperex Technology Co. Ltd. (CATL) from China will invest US\$ 5.1 billion in Indonesia. This figure is equivalent to Rp. 71.9 trillion, referring to today's exchange rate of Rp. 14,116/US\$.

According to his information, in building a battery factory, Contemporary Amperex Technology Co. Ltd. (CATL) partners with Huayue, PT Indonesia Battery Corporation (IBC), and PT Aneka Tambang Tbk (ANTM). In this project, CATL will become the majority shareholder, with Antam and IBC planned to only be minority shareholders or hold around 30%–40% shares for projects on the downstream side or the battery factory until the electric vehicle battery recycling. Meanwhile, the location for the factory itself has not yet been determined between Batang and North Kalimantan.

Apart from these two companies, there is another company that is interested in investing in the battery industry, namely Britishvolt (a British manufacturer of lithium-ion batteries for the automotive industry). Britishvolt is collaborating with a subsidiary of the Bakrie Group, PT VKTR Technology Mobilitas, with an investment of around USD 2 billion in 2027. Currently, the investment licencing process for the construction of Britishvolt and the Bakrie Group's electric vehicle battery factory has entered the final stage.

Apart from that, he continued, there were also BASF and Volkswagen from Germany. The two giant German companies will spend US\$ 4.6 billion, or the equivalent of Rp. 68.08 trillion, to invest in electric car battery factories in Indonesia. Volkswagen and BASF will each invest US\$ 2.6 billion, or the equivalent of Rp 38.48 trillion (at an exchange rate of Rp 14,800). Information Volkswagen obtained through its stun battery manufacturer, PowerCo The plan is to invest in cooperation with PT Vale Indonesia (INCO), US car manufacturer Ford Motor Co., and China's Zhejiang Huayou Cobalt to build a stun battery ecosystem in South Sulawesi.

Then there is the name Foxconn, which comes from Taiwan. All of these names have committed to investing in the country. Not only the multinational companies mentioned above, Indonesia also has PT Industri Baterai Indonesia, a company that is the result of a joint venture between State-Owned Enterprises (BUMN), MIND ID through PT Aneka Tambang Tbk, Pertamina, and the State Electricity Company (PLN).

Table - Electric Car Battery Companies in Indonesia, 2023

Companies	Countries
LG CHEMICAL LTD	South Korea
CONTEMPORARY AMPEREX TECHNOLOGY CO. LTD (CATL)	China
PT INDUSTRI BATERAI INDONESIA	Indonesia
BRITISHVOLT	United Kingdom
BASF	Germany
VOLKSWAGEN	Germany
FOXCONN	Taiwan
TESLA	United States
<i>Obtained by BIZTEKA from various sources</i>	

Based on the information BIZTEKA obtained, there are quite a number of electric vehicle battery companies in the world. However, one that has a large enough production, namely Contemporary Amperex Technology Co. Ltd. (CATL), LG Energi Solution, Panasonic, Samsung SDI, BYD Co., Sk Innovation, CALB, Gotion High-Tech, AESC, and Ruipu Energi Co.

COMPANIES PRODUCTION OF ELECTRIC CARS INCREASES, IN INDONESIA

The Association of Car and Motorcycle Equipment Industries (GIAMM) stated the government's commitment to electrification (electric car vehicles). Finally making history in the automotive industry in Indonesia, where a number of Japanese, Chinese, and Korean automotive companies are committed not only to assemble but also to produce electric cars in Indonesia.

The company PT Astra Internasional Tbk (ASII) has invested up to US\$2 billion, or the equivalent of Rp. 28.29 trillion, to build an electric car factory in 2024. There are 10 electric car hybrid models to be made, five of which are plug-in types. Hybrid Electric Vehicles (PHEV) One of these hybrid models is the Kijang Innova.

Then PT. Mitsubishi Motors Krama Yudha Indonesia is known to be producing the Xpander Hybrid in Indonesia in 2023. The company has made a new investment of IDR 11.2 trillion to produce two other new models at their factory in Bekasi. Another company, PT. Hyundai Indonesia Mtr., is committed to starting electric car production next year at its new factory in Bekasi, West Java.

Apart from Hyundai, there is PT. Honda Prospect Motor, which has used a new investment of IDR 5.2 trillion to produce the Honda Hybrid. Another Japanese company, PT Indomobil Sukses Internasional Tbk (IMAS), has made a new investment of IDR 1.2 trillion to produce electric cars. Barring any hurdles, the company will produce the light electrified model XL7 Mild Hybrid in 2023.

PT SGMW Motor Indonesia (Wuling) has also stated that it is preparing to produce electric cars in Indonesia. Models that have the potential are electric cars that have been marketed in China, such as the E100, E200, and E300, and the Mini EV. Finally, PT Sokonindo Automobile (DFSK Indonesia) is following Wuling's footsteps in producing electric cars domestically. The resulting product is said to be sold at affordable prices. DFSK Indonesia said that their factory in Cikande, Serang, and Banten, which had been established in 2017, was capable of producing electric vehicles.

It should be noted that the Ministry of Energy and Mineral Resources (ESDM) has disclosed Indonesia's roadmap towards a net zero emission (NZE) target in 2060. In this roadmap, it is stated that sales of conventional motorcycles will stop in 2040 and conventional cars in 2050.

Table - Companies Committed to Producing Battery Electric Vehicles (BEV) in Indonesia, 2023

Companies	Line of Business
PT. Astra Internasional Tbk (ASII)	Electric Battery Vehicles / (BEV)
PT. Hyundai Indonesia Mtr	Electric Battery Vehicles / (BEV)
PT. Mitsubishi Motors Krama Yudha Indonesia	Electric Battery Vehicles / (BEV)
PT. Honda Prospect Motor	Electric Battery Vehicles / (BEV)
PT. Indomobil Sukses Internasional Tbk (IMAS)	Electric Battery Vehicles / (BEV)
PT. Sokonindo Automobile	Electric Battery Vehicles / (BEV)
PT. Vale Indonesia Tbk	Plans to develop electric vehicles

Obtained by BIZTEKA from various sources

Electric Car Sales Trend Continues to Growth

The government, in this case the President, is very serious about developing battery-based electric vehicles (KLBB). This seriousness began with the issuance of Presidential Regulation Number 55 of 2019 concerning the acceleration of the battery electric vehicle programme for road transportation. Followed by the issuance of various derivative regulations to facilitate the programme.

Presidential Decree No. 55 of 2019 aims to increase efficiency, resilience, and energy conservation in the transportation sector. This regulation also has a target to reduce vehicle exhaust emissions, including aiming to achieve a net zero emission target by 2060.

The President also provided facilities for the development of the electric vehicle ecosystem to be boosted. Some forms of relief and convenience provided include tax policy, electricity price policy, growth in the number of charging stations, and ease of establishing new factories related to electric vehicles.

As a result, the sales trend of battery-based electric cars, or battery electric vehicles (BEV), is increasing. According to data from the Association of Indonesian Automotive Industries (Gaikindo), during January–March 2023, sales volume reached 1,801 units, an increase of around 2,700% compared to the first quarter of last year.

The only electric car in Indonesia throughout the first quarter of 2023 is the Hyundai Ioniq 5 Signature Extended, with a wholesale number of 886 units. This figure overtook the achievement of the wholesale Wuling Air EV Long Range, which once dominated the market, in 2022.

The number of electric car sales in Indonesia has the potential to continue to increase in the future. The reason is that, starting this year, the government is providing incentives in the form of government-borne value added tax (PPN DTP) for the purchase of four-wheeled electric vehicles and buses. This has been stipulated through Minister of Finance Regulation Number 38 of 2023.

Starting April 1, 2023, the government will impose a 10% VAT discount on electric car purchases. That is, the buyer is only subject to the remaining 1% VAT. However, incentives are only given for purchasing battery-based electric cars, or BEVs, with a domestic component level (TKDN) above 40%. Currently, electric cars that meet these criteria are the Wuling Air EV and the Hyundai Ioniq 5. On the other hand, electric buses can still get incentives even though their TKDN is lower. Electric buses with TKDN in the range of 20%–40% can get a 5% VAT discount. This means that the remaining tax to be paid by the buyer is only 6%.

Table - Sales of Battery Electric Vehicles (BEV), 2022 - Kuartal I 2023

Year 2022	Sales (Unit)
January	36
February	9
March	19
April	99
May	200
June	132
July	131
August	1,021
September	2,154
October	2,157
November	1,965
December	2,404
TOTAL	10,327
Tri Wulan I 2022	
January	36
February	9
March	19
TOTAL	64
Triwulan I 2023	
January	298
February	390
March	1,113
TOTAL	1,801

Source : Gaikindo, processed by Bizteka

Electric Motorcycle Sales Still Not Exciting

The Indonesian Electric Motorcycle Industry Association (Aismoli) said that the growth of battery-powered motorbikes in the country is still low. From 2019 to October 2022, only around 31,827 electric motorbikes have been recorded on Indonesian roads. When compared to gasoline-powered motorbikes, the population of electric motorbikes is still small. In the same period, 2019–2022, alone, sales of conventional motorcycles sold 29 million units.

Even though sales of electric motorbikes have remained low in the last three years, the Indonesian Electric Motorcycle Industry Association (Aismoli) hopes that there will be significant changes starting this year. For example, recently, the government announced the provision of subsidies for the purchase of electric motorbikes starting March 20, 2023. The value of this subsidy is Rp. 7 million per unit for 200,000 electric motorbikes.

The subsidy is given to electric motorbikes that are produced in Indonesia and have a domestic component level (TKDN) of more than 40%. In addition, the company must be committed to not increasing the selling price and be willing to produce a certain amount while the subsidy lasts.

Currently, the Indonesian Electric Motorcycle Industry Association (Aismoli) records that there are seventeen brands of electric motorcycles in Indonesia, namely Segway (eScooter and motorcycle), Gesits G1, Selis E-Max, Volta 401, Polytron Fox-R, NIU Gova 3, Davigo Dragon Lithium, Yadea G6, Rakata S9, Viar Q1, U-Winfly X7, Alfa One, Smooth Combat, Charged Maleo, United MX-1200, ION M1-S, and Honda U-GO GT.

NON-TAX REVENUE ROYALTY RATE

The government has issued PP Regulation Number 26 of 2022 concerning Types and Tariffs for Types of Non-Tax State Revenue. Based on the PP, nickel commodities (nickel ore) are subject to 10.0% of the price, and nickel ore of Ni content 1.570 as a raw material for the battery-based electric motor vehicle industry is subject to 2.0% of the price. More details can be seen in the table.

Table - Tarif Main Mineral Royalty Rates Based on Government Regulation Number 26 of 2022

TYPE OF NON-TAX STATE REVENUE		
Nickel	Unit	Tariff
a) Nickel Ore		
i. Nickel Ore	Per Ton	10,00 % from Price
ii. Nickel Ore Ni < 1.570 as raw material for battery-based electric motor vehicle industry	Per Ton	2,00 % from Price
b) Purification Products		
i. Nickel Pig Iron (NPI)	Per Ton	5,00 % from Price
ii. Nickel Matte/Ferro Nickel (FeNi)/ Nickel Oxide/Nickel Hydroxide/Nickel MHP/Nickel HNC/Nickel Sulfide/Cobalt Oxide/Cobalt Hydroxide/Cobalt Sulfide/Chrome Oxide/Chrome Metal/Manganese Oxide/Magnesium Oxide/Magnesium Sulfate	Per Ton	2,00 % from Price
iii. Nickel Metals	Per Ton	1,500 % from Price
c) Wind, fall Profit for price Nickel Matte > USD21,000/ton	Per Ton	1,00 % from Price

Source : Ministry of Finance, processed by Bizteka

NICKEL PRICES

Quoting LME (London Metal Exchange) data, the price of nickel for a 3-month contract recorded a decrease of US\$ 20,346 per tonne as of Thursday (4/5/2023). Throughout 2023, the LME nickel price was at US\$ 31,846 at the beginning of the year.

According to business actors, the current decline in nickel prices is still within reasonable limits, and in general, the decline in commodity prices will affect their share prices. We still hope that the nickel price level is above US\$20,000, which is still reasonable considering the current market conditions. So maybe if it goes down, it only goes down for a moment; it doesn't trend down continuously for a long time.

Table – Price of Nickel LME, January - May 2023

Month	Prices (US\$ / ton)
January	31,846
February	21,153
March	20,867
April	19,692
May	20,346

Source : LME, processed by Bizteka

NICKEL ORE PRODUCTION PROJECTION

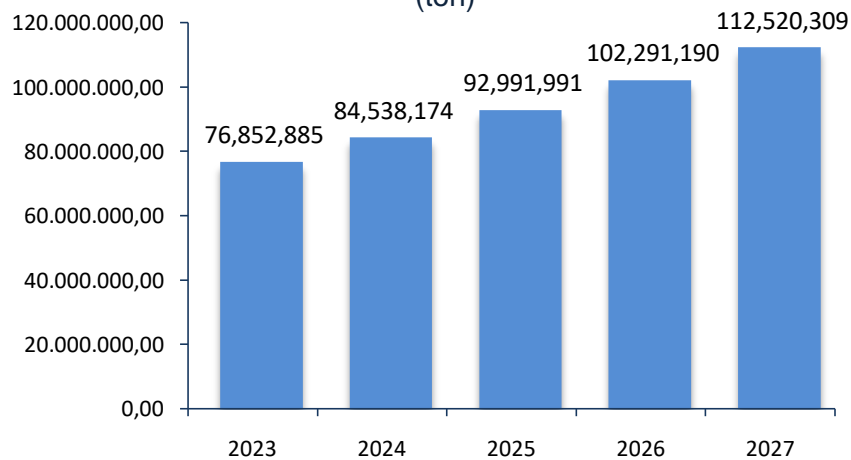
National nickel ore production is expected to continue to increase in line with the rapid growth of the domestic smelter industry. Moreover, nickel ore is needed in nickel ferronickel, nickel pig iron (PIN), matte nickel, mixed hydroxide precipitate (MHP), and others.

Seeing this fact, BIZTEKA projects that in the next five years, domestic production of nickel ore will increase by an average of 10% per year. In 2023, nickel ore production is predicted to be 76,852,885 tonnes, and in 2024, it will increase to 84,538,174 tons. The increase is projected to continue until 2027, when it will reach 112,520,309 metric tons.

Table - Indonesia's Projected Nickel Ore Production, 2023-2027

Year	Nickel Ore Production (Ton)	Growth (%)
2023	76.852.885	--
2024	84.538.174	10,0
2025	92.991.991	10,0
2026	102.291.190	10,0
2027	112.520.309	10,0
Average Growth (%/Yr)		10,0

Source : BIZTEKA – CCI

Chart – Indonesia's Projected Nickel Ore Production a, 2023-2027 (ton)

Source : BIZTEKA – CCI

SMELTER BUSINESS HAS BRIGHT PROSPECTS IN THE FUTURE

The smelter business has bright prospects for the future. This is evidenced by a number of smelter companies that used to be in the construction stage and are now starting to operate in 2023–2024. In addition, there are a number of companies, both local and foreign, planning to build factories.

A number of these smelters, namely PT Bumi Mineral Sulawesi (BMS), are currently completing the construction of a nickel smelter located in Karang-Karangan Village, Bua District, Luwu Regency, South Sulawesi. The smelter is targeted to be operational in 2023.

Furthermore, there is PT Huayue Nickel Cobalt, located in the Indonesian Region of Morowali Industrial Park (IMIP) in Kab. Morowali Prov., Central Sulawesi. With a total investment of USD 1.28 billion, this hydrometallurgical project was built in two phases: first, it was carried out with a production capacity of 30,000 tonnes of nickel and cobalt hydroxide per year, and then during the second phase, it increased to 60,000 tonnes per year. Huayue started construction in 2019. This project adopts the world's most advanced 3rd generation HPAL process, which can utilise all precious metal compositions of lateritic nickel ore to extract nickel, cobalt, and manganese simultaneously and integrate them into a new energy ternary battery material. The largest shareholder in this company is Huayue, Huaqing Nickel & Cobalt Co., Ltd.

PT Teluk Metal Industry (TMI) The company is building a nickel sulphate crystal factory with a capacity of 60,000 tonnes per year and an investment of USD 1.26 billion. The company predicts that smelter operations can start in 2023. TMI's shares are controlled by two Hong Kong-based companies, namely Perlux International Co., Ltd., and Green Source International Industrial Ltd. Perlux International controls 99.9% of the shares, while the remaining 0.1% is held by Green Source. Judging from the composition of the board of directors, TMI is almost completely controlled by the Tsingshan Group.

PT Vale Indonesia Tbk (INCO) cooperates with Zhejiang Huayou Cobalt Company (Huayou) to develop a smelter with High Pressure Acid Leaching (HPAL) technology in Sorowako. The new HPAL factory will process limonite nickel ore into Mixed Hydroxide Precipitate (MHP) products with an annual production capacity of up to 60,000 tonnes of nickel and nickel cobalt products. According to the information obtained, this joint development project is a form of realisation of Vale's commitment to sustainable mining and strategy in supporting the government's programme to create an electric car ecosystem in Indonesia.

PT QMB New Energy Materials (QMB) was founded with an authorised capital of USD 998.57 million. Products to be produced are nickel sulphate, cobalt sulphate, and manganese sulphate. There are five companies that directly hold QMB shares. First, GEM (Jingmen) New Material Co., Ltd., which is a subsidiary of GEM Co., Ltd., has the largest shareholding of 36%.

Second, Brunp Recycling Technology Co., Ltd., a subsidiary of Contemporary Amperex Technology Co., Ltd. (CATL), controls a 25% stake. Third, New Horizon International Holding Ltd., which controls 21% of the shares, New Horizon is wholly owned by Tsingshan Holding Group Co., Ltd., the main investor in the IMIP area through its subsidiary Shanghai Decent. Meanwhile, PT IMIP itself controls 10% of QMB shares. Finally, a trading company from Japan, Hanwa Co., Ltd., holds an 8% stake.

BASF, together with a French multinational mining and metallurgical company, Eramet, will build a factory for raw materials for electric batteries up to the precursor stage in the early second half of 2023. The location of the battery raw material factory will be in Weda Bay, Central Halmahera, and North Maluku. According to the information, the builders of the new factory will be based on renewable energy sources and a green industry. This commitment is expected to maintain the sustainability of the electric battery ecosystem supply chain in Indonesia going forward.

Table – Smelter Company Plans to Operate in Indonesia, 2023-2024

Companies	Location	Process
Ferronickel		
Ceria Nugraha Indotama.PT	SouthEast Sulawesi	RKEF
Heng Tai Yuan Indonesia.PT	Banten	BF
SBC Prime Metal.PT	SouthEast Sulawesi	RKEF
Sulawesi Resources.PT	Central Sulawesi	
Wanxiang Nickel Indonesia.PT	Central Sulawesi	BF
Ang And Fang Brother.PT	Central Sulawesi	RKEF
Bahodopi Nickel Smelting Indonesia.PT	Central Sulawesi	RKEF
Bumi Mineral Sulawesi.PT	South Sulawesi	RKEF
Nickel Pig Iron (NPI)		
Mapan Asri Sejahtera.PT	SouthEast Sulawesi	BF
Macika Mineral Industri.PT	SouthEast Sulawesi	RKEF
Huake Nickel Indonesia.PT	North Maluku	SAF
Sinar Deli Bantaeng.PT	South Sulawesi	
Titan Mineral Utama.PT	South Sulawesi	BF
Angel Nickel Industry.PT	North Maluku	RKEF

Companies	Location	Process
Anugrah Tambang Sejahtera.PT	Central Sulawesi	BF
Artha Mining Industry.PT	Central Sulawesi	
Artabumi Sentra Industri.PT	Central Sulawesi	BF
Huadi Wuzhou Nickel Industri.PT	South Sulawesi	RKEF
Huadi Yatai Nickel Industry.PT	South Sulawesi	RKEF
Mixed Hydroxide Precipitate (MHP) and Nickel Hydroxide (NiOh)		
Huayue Nickel Cobalt.PT	Central Sulawesi	HPAL
QMB New Energy Materials Indonesia.PT	Central Sulawesi	HPAL
Adhikara Cipta Mulia.PT	SouthEast Sulawesi	HPAL
Teluk Metal Industry.PT	Central Sulawesi	HPAL
Vale Indonesia Tbk (INCO).PT	Central Sulawesi	HPAL
Fajar Metal Industry.PT	Central Sulawesi	HPAL
<i>Source : ESDM, processed by Bizteka</i>		

CONCLUSION

The domestic nickel processing industry has developed quite rapidly in the last five years. This is evidenced, firstly, by the many new players in nickel mining and nickel ore, such as PT Weda Bay Nickel, PT Citra Silika Mallawa, PT Bumi Buton Delta Megah, Alvindo Mining Resources, PT Pertambangan Bumi Indonesia, PT Dharma Kendari, PT Rohul Energi Indonesia, PT Sultra Sarana Bumi, PT Pulaurusa Tamita, and others.

Second, Indonesia's nickel ore production has increased quite significantly, namely by an average of 20.21% per year. If in 2018 nickel ore production was recorded at 38,329,146 tonnes, then in the last two years (2020–2022) it has jumped quite sharply to 65,509,854 tonnes and 69,866,259 tonnes, respectively.

Third, the rapid development of processing and refining (smelters) in Indonesia, which produces ferronickel, nickel pig iron, and nickel matte, has also boosted their production capabilities and the raw material products for electric vehicles, nickel sulphate and cobalt sulphate. Based on data from the Ministry of Energy and Mineral Resources, ferronickel

products during the 2018–2022 period increased by an average of 35.41% per year. In 2018, Indonesia's nickel ferronickel production was recorded at 573,158 tonnes; in 2019, it rose to 1,151,740 tonnes; and in 2022, production exceeded 1,669,320 tons.

Nickel pig iron (NPI) products for the last five years have experienced an average growth rate of 44.72% per year. In 2018, Indonesia's nickel pig iron (NPI) production was 284,007 tonnes, and in 2019, it jumped to 765,731 tons. Furthermore, in 2022, nickel pig iron production will increase again to 831,262 tons.

Likewise, nickel matte production during the 2018–2022 period also experienced positive growth. In 2018, Indonesia's nickel matte production was recorded at 75,708 tonnes, and in 2022, nickel matte production reached 83,926 tons. It can be said that during this period, production experienced an average growth rate of 3.54% per year.

With the recent growth in nickel ore production, Indonesia already has a hydrometallurgical plant that produces nickel sulphate and cobalt sulphate products, two cathode components for electric vehicle batteries. The factories are PT Halmahera Persada Lygend (HPL), PT Smelter Nickel Indonesia, and Gebe Nickel Industry.

The successful development of the nickel industry and its derivative products means that Indonesia currently has an electric vehicle battery factory, or battery electric vehicle (BEV), as owned by other developed countries. In the end, Indonesia is also increasingly attractive to a number of investors in the world's battery industry, such as LG Chemical Ltd., Contemporary Amperex Technology Co. Ltd. (CATL), British Volkswagen, BASF, Volkswagen, Foxcon, and Tesla.

For the next five years, Bizteka projects nickel ore production will increase by an average of 10% per year, so that by 2027, domestic nickel ore production will reach 112.5 million tons.

COMPANY PROFILE

F | Editors



PT. VALE INDONESIA Tbk

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Fax. : +62 21 524 9020
E-mail : ptvi-corpsec@vale.com;
ptvi.investorrelation@Vale.com

Representative Office

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Makassar 90113 - South Sulawesi, Indonesia
Phone : +62 411 366 9000
Fax. : +62 411 366 9020

Processing Factory

Sorowako Luwu Timur 92984
South Sulawesi, Indonesia
Tel. : +62 475 332 9100
Fax. : +62 475 332 9575

DATE OF ESTABLISHMENT

25 July 1968

STOCK CODE

INCO

LISTING DATE ON THE EXCHANGE

16 May 1990

LEGAL STATUS

PT (Limited Liability Company)

Capitalization

Authorized capital : 39,745,354,880 share,
Value : IDR 25 per share.

Issued capital
and Fully Paid : 9,936,338,720 share,
Value : IDR 25 per share

SUPERVISORY BOARD

President Commissioner : Desnee Naidoo
Vice : Muhammad Rahmat Kaimuddin

Commissioners :

: Gustav Garavaglia
: Fabio Ferraz
: Yusuke Niwa
: M.Jasman Panjaitan
: Farrah Karrim

Independent Commissioner

: Raden Sukhyar
: Rudiantara
: Dwia Aries Tina Pulubuhu

BOARD OF MANAGEMENT

President Director : Febriani Eddy
Vice : Adriansyah Chaniago

Directors : Bernardus Irmanto
: Vinicius Mendes Ferreira
: Abu Ashar
: Matt Cherevaty

ASSOCIATED

-Vale Canada Limited	43,79%
-Publik	20,64%
-PT Indonesia Asahan Aluminium (Persero)	20,00%
-Sumotomo Metal Mining Co., Ltd	15,03%
-Vale Japan Limited	0,54%

Information :

PT Vale Indonesia Tbk (INCO) is a subsidiary of Vale Canada Limited, a global mining company headquartered in Brasilia. PT Vale Indonesia has operated an open-pit nickel mine and nickel smelter in Sorowako, Sulawesi, since 1978. Currently, PT Vale Indonesia is the largest nickel producer in Indonesia and contributes around 5% of the world's nickel supply. The ore mined at PT Vale Indonesia is laterite nickel ore, which is then processed into matte nickel.

In general, the processing of laterite nickel ore at PT Vale Indonesia includes drying, calcination, smelting, and converting processes. The drying process is carried out in a rotary dryer to reduce the surface water content (moisture) from 40% to 20%. Then the calcination process is carried out in a rotary kiln for moisture removal to 0%, crystal water removal, metal oxide reduction, and sulfidization.

Furthermore, the smelting process in an electric furnace (electric furnace or SAF) is the smelting of calcine from a rotary kiln at an operating temperature of 1500 °C to produce matte and slag. Matte produced from an electric furnace contains about 50% iron, so matte needs to be purified by an oxidation process with air to reduce the iron content to 0.3%. This process is carried out in the converter primarily to increase the nickel content from about 25% to 76–80% in matte. So that its value is higher than ferronickel, which only has 25%–45% nickel content.

According to information obtained by BIZTEKA, PT Vale Indonesia's nickel matte production in the last five years has decreased by 5.23% per year. In 2018, PT Vale Indonesia produced 74,806 tonnes of matte nickel, and in 2019, production decreased to 71,025 tons.

In 2020, PT Vale's nickel matte production rose again to 72,237 metric tons. But the following two years (2021–2022) have seen a decrease to 65,388 tonnes and 60,090 tonnes, respectively. The decline in production, he said, was due to the fourth furnace rebuilding project in the first half of 2022.

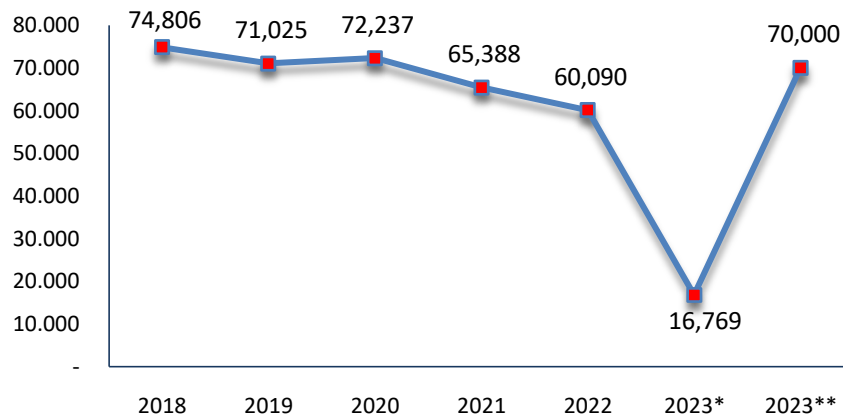
Meanwhile, in 2023, management said the company would again increase its nickel matte production capacity to 70,000 metric tons. This is considering that Furnace 4 is back in operation. For now, in the first quarter of 2023, the company is capable of producing 16,769 tonnes of matte nickel.

On the same occasion, his party also explained that PT Vale Indonesia, together with Zhejiang Huayou Cobalt Co., Ltd. (Huayou), are carrying out a groundbreaking for the development of the Pomalaa Block project in Kolaka Regency, Southeast Sulawesi. This project is being worked on by PT Kolaka Nickel Indonesia (KNI) with a total investment of IDR 67.5 trillion for the construction of a nickel smelter with high pressure acid leaching (HPAL) technology.

The Pomalaa Block Project has even been designated a national strategic project using HPAL Huayou technology to produce mixed hydroxide precipitate (MHP). MHP is semi-finished nickel, which needs to be processed again into nickel and cobalt sulphate, the cathode precursors of electric vehicle (EV) batteries. In addition to these two minerals, the EV battery cathode precursor consists of lithium, manganese, or aluminium. The battery type is lithium-ion NCM or NCA. This development project is one form of realisation of Vale's commitment to sustainable mining and strategy in supporting the government's programme to create an electric car ecosystem in Indonesia.

Table – Nickel Matte Production Development, PT Vale Indonesia Tbk, 2018-2023

Year	Production (Ton)	Growth (%)
2018	74.806	--
2019	71.025	-5.05
2020	72.237	1.71
2021	65.388	-9.48
2022	60.090	-8.10
2023*)	16.769	--
2023**)	70.000	--
Average Growth (%/Yr)		-5.23
*) Triwulan I		
**) Planning		
Source : PT Vale Indonesia Tbk., processed by Bizteka		

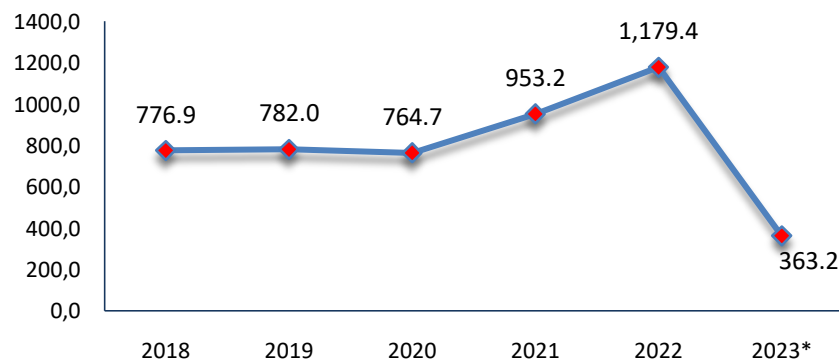
Graph – Nickel Matte Production Development, PT Vale Indonesia Tbk

Source : PT Vale Indonesia, Processed by Bizteka-CCI

Vale Earns Rp 5.3 Trillion from Nickel Matte Sales in the First Quarter

Based on information obtained from all of the company's nickel matte products, 80% of them were sold to Vale Canada Limited (VCL) and the other 20% to Sumitomo Metal Mining Co. Ltd. (SMM) through long-term contracts denominated in US dollars. Nickel matte that is sold is shipped monthly to Japan using ships owned by Vale Canada Limited (VCL) or chartered vessels. The total sales value of matte nickel in 2022 reached US\$ 1,179.4 million, up 24% from US\$ 953.2 million in 2021.

Meanwhile, in 2023, to be precise, in the first quarter of January to March 2023, PT Vale Indonesia sold 16,758 tonnes of matte nickel. From the sale, Vale earned revenue of US\$363.2 million, or around Rp5.3 trillion.

Graph – Revenue of PT Vale Indonesia Tbk, 2018-2023

Source: PT Vale Indonesia Tbk

BUSINESS & ANALISYS

SECTOR VARIOUS INDUSTRY

1. DOMESTIC MOTORCYCLE SALES REACH 5.2 UNITS BY 2022

AI Editors



The Indonesian Motorcycle Industry Association (AISI) recorded sales of motorcycles for the domestic market throughout 2022, reaching 5.22 million units. This number has exceeded the minimum target set by AISI, amounting to 5.1 million units.

Based on data released by AISI, motorcycle sales for the domestic market throughout 2022 increased 3.2 percent compared to the previous year, which reached 5.06 million units.

The Head of AISI's Commercial Division said that the biggest contribution to achieving the target of motorcycle sales in Indonesia in 2022 was the national economic condition, which was starting to recover. As for domestic sales throughout 2023, they are expected to increase again because, until April, sales had reached 2,178,396 units.

Economic conditions, which have started to revive since the easing of the Restrictions on Community Activities (PPKM), and the still high prices of export commodities have contributed to the improvement in motorcycle sales in the domestic (local) market.

Meanwhile, for sales in the export market, throughout 2022 there was a decrease of 7.5 percent year-on-year (yoy), or down from 803,931 units in 2021, declining to 743,551 units in 2022. Meanwhile, sales in the export market in 2023 are expected to decline due to the fact that in April there were only 163,059 units recorded, as listed in the following table.

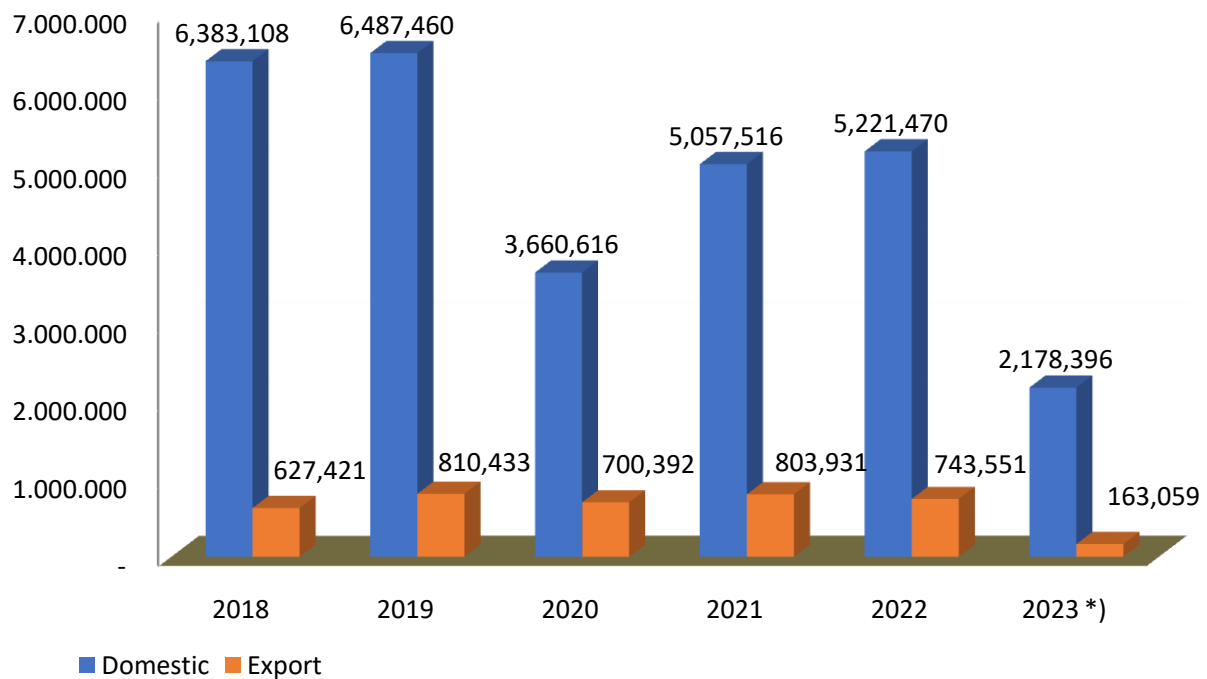
Table – Indonesia's Motorcycle Sales by Market, 2018 2023 (unit)

Year	Domestic	Growth (%)	Export	Growth (%)	TOTAL	Share (%)	
						Domestic	Export
2018	6,383,108	-	627,421	-	7,010,529	91.05	8.95
2019	6,487,460	1.63	810,433	29.17	7,297,893	88.89	11.11
2020	3,660,616	- 43.57	700,392	- 13.58	4,361,008	83.94	16.06
2021	5,057,516	38.16	803,931	14.78	5,861,447	86.28	13.72
2022	5,221,470	3.24	743,551	- 7.51	5,965,021	87.53	12.47
2023 *)	2,178,396		163,059		2,341,455	93.04	6.96
Average Growth (%/Yr)		- 0.13		5.72			

*) January - April
Source : AISI, processed by Bizteka

Chart - Indonesia's Motorcycle Sales by Market, 2018 2023

(unit)

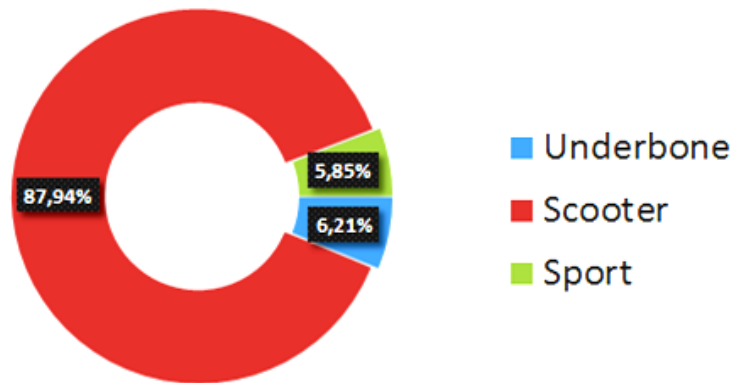


*) January - April

Source : AISI, processed by Bizteka

Meanwhile, motorcycle sales in 2022 for the domestic market will be dominated by scooter types, with a percentage of 87.94 percent. In second place was the underbone type with 6.21 percent, followed by the motor sport type with a percentage of 5.85 percent, as shown in the following diagram.

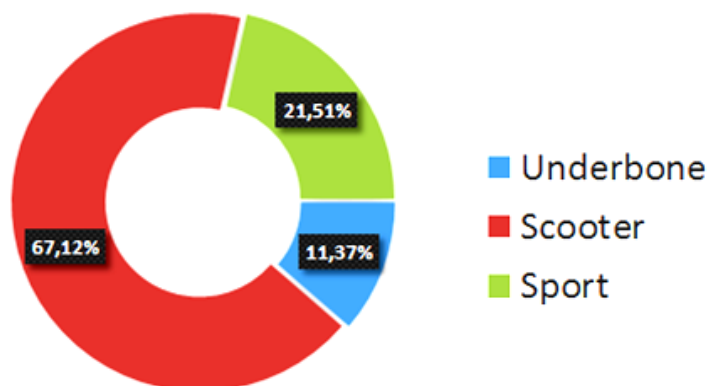
Pict – Distribution Domestic by Category, 2022



Source : AISI, processed by Bizteka

Meanwhile, motorcycle sales for the export market in 2022 will be dominated by scooter types, with a percentage of 67.12 percent. In the second position, the sport type is 21.51 percent, followed by the underbone motorbike type with a percentage of 11.37 percent, as shown in the following diagram.

Pict – Distribution Export by Category, 2022



Source : AISI, processed by Bizteka

2. OJK WILL REVOCATE MORATORIUM ISSUING NEW PERMITS FOR FINTECH (P2P) LENDING COMPANIES

D | Editors



The Financial Services Authority (OJK) will revoke the temporary suspension or moratorium on peer-to-peer lending or online loan (pinjol) financial technology service permits in 2023. OJK Deputy Commissioner Bambang Budiawan said the moratorium would likely be lifted in the third quarter of this year at the earliest. "At the latest in the fourth quarter of 2023. From the regulations, we have no problems with supervision getting to the final," said Bambang while attending the CSIS event on Tuesday, May 16, 2023.

Bambang explained that later, the new players would be allowed to submit themselves. Therefore, he appealed to interested parties in P2P lending to prepare themselves so that the process could be fast. "In the past, there had to be two stages, namely principle permits and operational permits. Now, directly, they can be optional. "Consequently, they must have documents, IT, capital, and other requirements ready," he said.

The Indonesian Joint Funding Fintech Association (AFPI) considers that the plan to lift the moratorium is good for the P2P lending fintech industry.

Akseleran CEO and Head of Law, Ethics, and AFPI Protection Ivan Nikolas Tambunan said lifting the moratorium could reduce the impact of illegal fintech. "Because there are many new players who want to enter, but in the end they can't, of course there will be a tendency to even become illegal," said Ivan. Therefore, Ivan said that players who have just entered the fintech business must also be well selected to implement the new POJK standards, especially from a capital perspective that must be strong so that the business system is ready.

He also explained that lifting the moratorium has the potential to bring new players and innovation to the industry. Thus, it can help develop the fintech industry. "Now, for example, if there is a moratorium, even though there are new players who are competitive, they won't

be able to implement their innovation," he said. Ivan said he didn't mind the large number of new players wanting to enter the fintech industry. According to him, the most important thing is to compete healthily. "In fact, if it is closed with a moratorium, the competition will not be healthy. "Consequently, each player must have their own advantages," he said.

Previously, Director of Financial Technology Supervision of the Financial Services Authority (OJK), Tris Yulianta, said the move to lift the moratorium would be carried out in line with the launch of new technology for loan licencing.

Tris hopes that the new technology can be completed in the near future so that the existing moratorium can be lifted soon. "We are working on this in 2023—maybe not even until the end of this year, but in the near future," he said Friday (5/5).

Meanwhile, the Head of the Department of Supervision of Other Financial Services Institutions of the OJK, Triyono Gani, said that the OJK said that the delay in granting this licence had been carried out since 2020. The OJK was also ready to revoke this policy in line with improved governance implemented in the past few years.

If you look in the mirror in 2020, the situation in the P2P lending industry is quite apprehensive. Regulations that were still loose were taken advantage of by unscrupulous perpetrators of illegal loans in the early days of the proliferation of loans, resulting in many victims.

"Now that we have made improvements and so on, we feel that the arrangements made have had a positive impact. And of course, because this is innovative, we cannot continue to close," said Triyono.

In addition, the number of public complaints about illegal loans has decreased considerably. Plus, people are starting to feel the benefits of borrowing as a means of inclusive funding for MSMEs and other small entrepreneurs.

Then, Triyono said, the loan licensing moratorium would soon be opened if the parameters previously set by OJK were reached. There are at least five parameters for the success of this moratorium.

First, the control of illegal loans, which are currently said to have decreased in number, although they cannot be eradicated 100 percent, Second, the launch of regulations, where OJK issued a revision of POJK No. 77/2016 into POJK No. 10/2022,

Third, OJK has improved the governance of P2P companies by intensifying inspections of 102 loan companies registered with OJK. Fourth, the preparation of the OJK system, where his party is preparing an integrated licencing system There is one of the modules that we have prepared, namely the P2P lending licencing module.

"The final status is that of the 5 parameters that I conveyed, 4 have been completed, and the other one may still be in process; that's why you said earlier that if the process is complete, then it can be done," he stated.

Fintech lending, peer-to-peer lending, or online lending is the provision of financial services to bring together lenders and loan recipients in order to enter into loan agreements in rupiah directly through an electronic system. Fintech lending is also referred to as "information technology-based joint funding services" (LPBBTI).

Meanwhile, information from the OJK revealed that as of March 9, 2023, the total number of fintech peer-to-peer lending or fintech lending providers licenced at the OJK was 102, consisting of 95 conventional providers and 7 sharia providers.

The total assets of companies organising fintech lending until March 2023 were recorded at Rp. 6388.45 billion, with total liabilities of Rp. 3,497.08 billion and total equity of Rp. 2,891.38 billion.

A complete overview of the organisers of fintech lending until March 2023 can be seen in the table below:

Table - Overview of Fintech Lending Operators, March 2023

Description	Total Organizer (Unit)	Total Asset (billion Rp)	Total Liabilities (billion Rp)	Total Equity (billion Rp)
Conventional Organizer	95	6,259.59	3,386.00	2,873.59
Syariah Organizer	7	128.87	111.08	17.79
TOTAL	102	6,388.45	3,497.08	2,891.38

Source : OJK, Ministry of Finance of the Republic of Indonesia

Based on data from the Financial Services Authority (OJK) of the Ministry of Finance, it is stated that the total operating and non-operating income of fintech lending providers in Indonesia for the period of March 2023 was recorded at Rp. 3,007.08 billion, consisting of operating income of Rp. 2,916.75 billion and non-operational income of Rp. 90.33 billion. This total income increased by 68.1% when compared to income in March 2022, which reached Rp. 1,831.66 billion, including operating income of Rp. 1,735.66 billion and non-operational Rp. 96 billion.

The total income for March 2023 also increased quite significantly compared to the income for February 2023, which reached Rp. 1,940.21 billion, consisting of operating income of Rp. 1,880.62 billion and non-operational income of Rp. 59.59 billion.

On the other hand, the total expenses (expenses) of fintech lending organisers in March 2023 were recorded at Rp. 2,727.79 billion, consisting of operating expenses of Rp. 2,547.97 billion and non-operating expenses of Rp. 179.82 billion. The total expenses for the fintech lending organisers have increased when compared to the total expenses for the same period in 2022, reaching Rp. 1,853.33 billion, consisting of operating expenses of Rp. 1,789.80 billion and non-operating expenses of Rp. 63.53 billion.

Based on this report, from January to March 2023, companies implementing fintech lending in Indonesia earned a profit after tax of Rp. 50.48 billion in January, Rp. 98.25 billion in February, and in March 2023, they achieved a profit of Rp. 206.48 billion, which means it has jumped quite high when compared to the profits of the previous 2 months. In fact, in the period from January to March 2022, companies organising fintech lending suffered after-tax losses of Rp. 16.14 billion each in January, Rp. 23.32 billion in February, and in March 2022, a loss of Rp. 44.09 billion.

In detail regarding the profit and loss reports of fintech lending organisers in Indonesia for the periods January–March 2022 and January–March 2023, see the table below:

Table - Profit and Loss Statement of Fintech Lending Operator
(Billion Rp)

Account	Jan-22	Feb-22	Mar-22	Dec-22	Jan-23	Feb-23	Mar-23
Operating Income							
Income on Loan Repayment	437.62	878.28	1.376.61	8081.99	820.50	1549.30	2.409.31
Income from Lending	102.27	208.03	329.91	1599.34	155.46	293.23	444.39
Income on Fines	9.52	18.70	29.14	144.01	22.82	38.09	63.04
Total Operating Income	549.41	1105.00	1.735.66	9.825.34	998.79	1880.62	2916.75
Operating Expenses							
Labor Expenses	154.47	309.59	478.34	2101.81	212.94	383.45	590.56
Marketing and Advertising Expenses	145.16	301.86	488.50	3210.58	299.20	594.56	894.79
General and Administrative Expenses	137.41	278.84	449.17	2040.74	167.55	339.10	530.50
IT Development and Maintenance Expenses	72.11	128.79	197.73	1201.35	94.09	176.04	262.20
Depreciation expense	7.71	15.46	22.54	107.45	11.87	22.99	29.43
Amortization Expense	7.00	14.50	22.59	93.35	9.33	18.13	26.42
Financial Burden	28.18	55.01	85.48	442.89	29.84	53.05	75.85
Cooperation Expenses	15.90	30.87	45.45	409.08	65.67	89.54	138.21
Total Operating Expenses	567.94	1134.91	1.789.81	9607.26	890.49	1676.85	2.547.97
Operating Profit (Loss)	(18.53)	(29.91)	(54.15)	218.07	108.30	203.77	368.78
Non-Operating Income							
Interest Income / Profit Sharing Income	1.78	3.45	5.31	27.31	3.42	6.14	9.32
Other Income	29.09	60.54	90.69	274.70	27.12	53.45	81.01
Total Non-Operating Income	30.87	63.99	96.00	302.00	30.54	59.59	90.33
Non-Operating Expenses							
Interest Expense / Profit Sharing Distribution	1.74	5.10	10.16	28.62	0.29	0.64	0.95
Bank administrative burden	4.21	8.81	14.73	60.82	12.46	12.25	14.29
Gain (Loss) on Exchange Difference	0.80	1.83	1.94	26.53	0.31	11.62	6.70
Other Expenses	13.01	23.63	36.71	344.19	50.60	100.06	157.89
Total Non-Operating Expenses	19.76	39.37	63.53	460.17	63.65	124.58	179.82
Profit (Loss) Before Tax	(7.42)	(5.29)	(21.68)	59.91	75.19	138.77	279.29
Tax expense	8.72	18.03	22.41	100.96	24.71	40.52	72.81
Profit (Loss) After Tax	(16.14)	(23.32)	(44.09)	(41.05)	50.48	98.25	206.48
Other Comprehensive Income (Expenses).	0.31	0.29	0.27	1.24	(0.00)	0.21	0.23
Comprehensive Profit (Loss)	(15.83)	(23.03)	(43.82)	(39.82)	50.47	98.46	206.71

Source : Financial Services Authority (OJK) - Indonesian Ministry of Finance, processed by Bizteka

3. THE POLICY OF LIMITATIONS ON THE IMPORT OF STEEL HAS PROS AND CONS

F | Editors



The government, in this case the Ministry of Finance, recently issued Decree of the Minister of Finance (KMK) Number 23 of 2022. One of these regulations regulates restrictions on imports of iron or alloy steel products and their derivatives.

This policy eventually raised pros and cons from several observers and business actors, who considered that the issuance of this decision could raise new problems. The head of the Centre of Industry, Trade, and Investment at the Institute of Development of Economics and Finance (Indef) considers that restrictions on iron and steel raw materials can actually be implemented.

Nevertheless, the government needs to be careful in evaluating the implementation of this decision. This is because the behaviour of the industry currently still relies on imports of raw materials, especially iron and steel. So it is necessary to look again at what is prohibited in the country. What needs to be limited, in my opinion, for iron and steel is the final product.

On the other hand, the Chairman of Gaikindo explained that his party supports the government's efforts to limit imports of this commodity on the condition that the domestic supply of iron and steel can meet the current needs of the industry. This is because, until now, the commodity balance for automotive materials such as iron and steel has not materialised.

On the other hand, this restriction could affect players in the automotive industry who still need imported steel raw materials. Here, what is meant by import is not to import goods that are already available domestically. If the goods are not yet available in the country, we have to import them, like it or not.

Meanwhile, the management of PT FSCM Manufacturing Indonesia, a manufacturer of automotive components in the form of wheel chains (accessories and spare parts), welcomed the decision taken by the government, especially as an effort to support the iron and steel industry in the country. Even if necessary, no longer import it.

The same thing was stated by PT Daido Indonesia Manufacturing, a motorcycle chain company; so far, it has been using domestically made iron-steel products. Therefore, the policies issued by the government did not have a major effect on the company.

Please note that based on the attachment to KMK 23/2022, there are 1,519 lists of goods that are restricted for import. Of these types, chains for two-wheeled bicycles or motorcycles are goods that are restricted by several HS codes. Then there are doormats, rugs, and tyres for motorised vehicles. Finally, the fuel for diesel-engined vehicles

The Indonesian Motor Industry Association (AISI) explained that this regulation is expected to reduce dependence on imported product components, especially now that there are already many domestic automotive companies that produce various automotive components ranging from electrical products to engine components, chassis, brake linings, radiators, and others.

Table - KMK No. 23 Year 2022 Import Restrictions on Iron or Alloy Steel Products and Derivatives

HS Code	Information
73151110	Roller chain for bicycles or motorcycle chain
73151191	Other roller chain,transmission type of a pitch length $\geq 6\text{mm}$ & $< 32\text{mm}$
73151199	Other roller chain, transmission type of a pitch length $> 32\text{ mm}$
73151210	Other chain, bicycle or motorcycle chain
73151290	Other chain, not bicycle or motorcycle chain

Source :Ministry of Finance, processed by Bizteka

Import of Motorcycle Chain and Sparpate Expected to be Suppressed

Meanwhile, with the issuance of this new regulation, it is expected that imports of motorcycle chains and spare parts can be significantly reduced. In 2018, imports of motorcycle chains and spare parts were recorded at 39,104 tonnes; in 2019, they rose to 42,520 tons.

In the following year, 2020, imports dropped sharply to 21,318 tons. But in 2021, imports will again increase to 26,483 tons. In fact, this increase continued in 2022 and reached 38,144 tons. As shown in the following table.

Table – Import Motorcycle Chain and Sparts Indonesia, 2018-2022

Year	Volume (Ton)	Growth (%)	Value (US\$'000)	Growth (%)
2018	39,104	--	121,541	--
2019	42,520	8.74	89,274	-26.55
2020	21,318	-49.87	74,666	-16.36
2021	26,483	24.23	89,245	19.52
2022	38,144	44.03	102,707	15.08
Average Growth (%/Yr)		6.78		-2.08

Source: Central Bureau Of Statistics, reproccesd by BIZTEKA

The Association of Automobile and Motorcycle Equipment Industries (GIAMM) said that the strength of the component industry in Indonesia is currently supported by 1,000 companies divided into Tier 1, Tier 2, and Tier 3 spread throughout Indonesia, including DKI Jakarta, Banten, West Java, Java Central, and East Java.

Of these, 240 companies are members of the Association of Automobile and Motorcycle Equipment Industries (GIAMM), and around 122 companies are members of the Automotive Components Small and Medium Industries Association (PIKKO).

These automotive component companies include PT Denso Indonesia, PT Aisin Indonesia, PT Bridgestone Astra Indonesia, PT Baterai Century Indonesia, PT Astra Visteon Indonesia, PT Manufaktur Federal Izumi, PT APM Armada Autoparts, PT IRC Inoac Indonesia, PT Bakrie Autoparts, PT EDS Manufacturing Indonesia, PT Fuji Seimitsu Indonesia, PT Akashi Wahana Indonesia, PT Kawasaki Motor Indonesia, and others.

Table - Automotive Component Companies in Indonesia, 2023

AUTOMOTIVE COMPONENT COMPANIES	
Aisin Indonesia. PT	PT Adient Automotive Indonesia
Rem Akebono Astra Indonesia. PT	PT Advics Manufacturing Indonesia
Asmo Indonesia	PT Adyawinsa Plastics Industries
Astra Visteon Indonesia. PT	PT Adyawinsa Stamping Industries
DI Indonesia. PT	PT Aisin Automotive Indonesia
Autoplastik Indonesia. PT	PT Aisin Indonesia

AUTOMOTIVE COMPONENT COMPANIES	
Bridgestone Astra Indonesia. PT	PT Akashi Wahana Indonesia
Baterai Century Indonesia. PT	PT Aneka Banusakti
CV Sinar Baja Electric	PT APM Armada Autoparts
CV. MURAL TIMBER WORLD	PT APM Armada
Denso Indonesia. PT	PT Ardendi Jaya Sentosa
Manufaktur Dharma Electrindo. PT	PT Armada Indah Agung Glass
Polimetal Dharma. PT	PT Asahimas Flat Glass Tbk
Poliplast Dharma. PT	PT Asano Gear Indonesia
DIC Astra Kimia. PT	PT Asno Horie Indonesia
Ban Evoluzione. PT	PT Astra Otoparts Div. Adiwira Plastik
Ewindo. PT	PT Astra Otoparts Tbk Divisi Nusametal
Manufaktur Federal Izumi. PT	PT Autocomp Systems Indonesia
Industri Federal Nittan. PT	PT Autokorindo Pratama
Fuji Seimitsu Indonesia. PT	PT Autoliv Indonesia
Gemala Kempa Daya. PT	PT Automotive Fasteners Aoyama Indonesia
Baterai GS. PT	PT Bakrie Autoparts
Hi-Lex Indonesia. PT	PT Bando Indonesia
INDOKARLO PERKASA. PT	PT Braja Mukti Cakra
Inti Ganda Perdana. PT	PT BS Indonesia
IRC INOAC INDONESIA. PT	PT Buanatama Metalindo
Kasai Teck Lihat Indonesia. PT	PT Chuhatsu Indonesia
Kayaba Indonesia. PT	PT Citra Nugerah Karya
Meiwa Mould Indonesia. PT	PT Dasa Windu Agung
Mikuni Indonesia. PT	PT Dharma Electrindo Mfg
Nusa Keihin Indonesia. PT	PT Dragon Pack
Oerlikon Balzers Artoda. PT	PT Dwiutama Intiterang
Shimano Batam. PT	PT Edico Utama
Adhi Wijayacitra. PT	PT EDS Manufacturing Indonesia
Ekamitra Jayatama. PT	PT Gajah Tunggal Tbk (GJTL)
PT Multistrada Arah Sarana Tbk (MASA)	PT Goodyear Indonesia Tbk (GDYR)
PT Indospring Tbk (INDS)	PT Multi Prima Sejahtera Tbk (LPIN)
PT Indo Kordsa Tbk (BRAM)	PT Garuda Metalindo Tbk (BOLT)
PT Bintraco Dharma tbk (CARS)	PT Nipress Tbk (NIPS)
PT Prima Alloy Steel Universal Tbk (PRAS)	PT Kawasaki Motor Indonesia
PT Selamat Sempurna Tbk (SMSM)	Etc
Obtained by BIZTEKA from various sources	

4. DESPITE THE COVID-19 OUTBREAK, INDONESIAN BIKE EXPORTS HAVE INCREASED

AI Editors



Despite being constrained by the COVID-19 outbreak, Indonesia's bicycle exports tended to increase. Throughout 2018 to 2022, exports will decline in 2022 due to the threat that the global economy is predicted to be hit by a recession in 2023.

This increase in Indonesian bicycle exports shows that the quality of Indonesian bicycle products is very good and meets international standards. Besides, the price also competes with producers from other countries.

Based on export records from the Central Bureau of Statistics, Indonesia's bicycle exports from 2018 to 2022 tend to increase at a rate of 4.11% per year for volume, while the export value increases even more, namely 7.65% per year. During this period, exports decreased only in 2022.

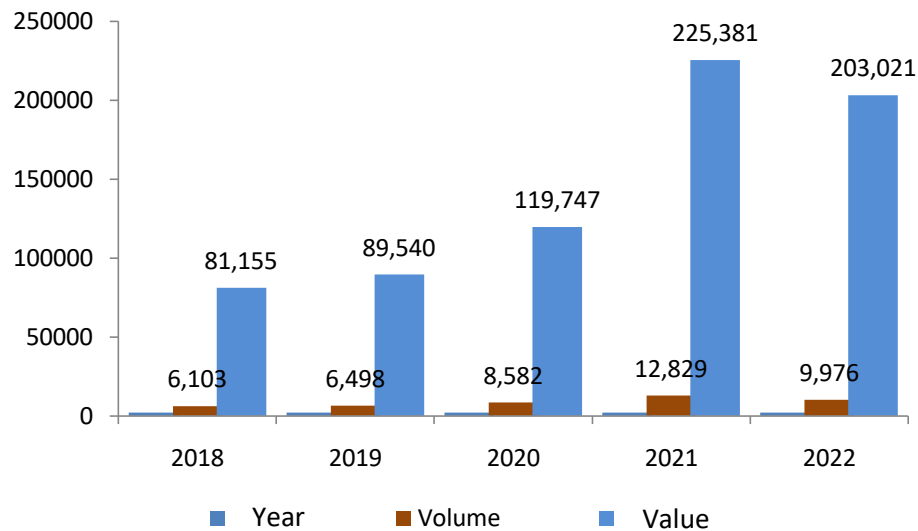
According to sources from the Central Statistics Agency, in 2018, Indonesia's bicycle exports were recorded at 6,103 tonnes, or the equivalent of 452,065 units (assuming that each bicycle weighs between 10 kg and 17 kg), with a value of US\$ 81,155 thousand. In the following three years, exports continued to increase and reached 12,829 tonnes, or the equivalent of 950,394 units in 2021, valued at US\$ 225,381 thousand. However, with the prediction of a global economic recession in 2023, exports in 2022 decreased by 22.24% to 9,976 tonnes, or the equivalent of 738,996 units worth US\$203,021 thousand, as listed in the following table.

Table - Indonesia's Bicycle Export Development, 2018 - 2022

Year	Volume (Ton)	Equi (Unit)	Growth (%)	Value (US\$,000)	Growth (%)
2018	6,103	452,065	-	81.155	-
2019	6,498	481,356	6.47	89.540	10.33
2020	8,582	635,741	32.07	119.747	33.74
2021	12,829	950,394	49.49	225.381	88.21
2022	9,976	738,996	-22.24	203.021	-9.92
Average Growth (%/Year)			4.11		7.65

Source : Central Bureau of Statistics, processed by Bizteka

Chart - Indonesia's Bicycle Export Development, 2018 – 2022
(Ton)



Source : Central Bureau of Statistics, processed by Bizteka

So far, Indonesia's bicycle exports have succeeded in penetrating export markets in various countries. In 2020, for example, the largest exports were directed to England with a volume of 3,487 tonnes, or around 40.63% of total exports, with a value of US\$ 41,963 thousand (35.04%). Then it was sent to the United States in 1,114 tonnes (12.98%) worth US\$ 22,823 thousand (19.06%), Denmark in 814 tonnes (9.49%) worth US\$ 8,543 thousand (7.13%), Sweden in 493 tonnes (5.75%) worth US\$ 5,259 thousand (4.39%), and 398 tonnes (4.64%) were destined for Australia with a value of US\$ 9,167 thousand (7.65%).

Other countries that are the main destinations for bicycle exports in 2020 are India, Canada, the Netherlands, Singapore, Japan, Malaysia, Norway, Spain, and others with export volumes and values listed in the following table.

Table - Bicycle Exports by Destination Country, 2020

Countries	Volume (Kg)	Share (%)	Value (US\$)	Share (%)
United Kingdom	3,486,833	40.63	41,962,559	35.04
United States	1,114,215	12.98	22,822,752	19.06
Denmark	814,024	9.49	8,542,671	7.13

Countries	Volume (Kg)	Share (%)	Value (US\$)	Share (%)
Sweden	493,317	5.75	5,259,318	4.39
Australia	398,347	4.64	9,166,628	7.65
India	249,235	2.90	1,747,766	1.46
Canada	226,989	2.64	4,681,897	3.91
Netherlands	196,329	2.29	3,126,942	2.61
Singapore	165,699	1.93	3,082,259	2.57
Japan	149,578	1.74	2,108,542	1.76
Malaysia	143,301	1.67	2,965,121	2.48
Norway	139,277	1.62	1,548,817	1.29
Spain	138,207	1.61	1,321,632	1.10
Germany, Fed. Rep. Of	130,431	1.52	1,278,946	1.07
New Zealand	108,859	1.27	1,864,190	1.56
Israel	85,079	0.99	1,389,869	1.16
Estonia	76,602	0.89	653,262	0.55
Finland	75,238	0.88	778,657	0.65
Saudi Arabia	58,122	0.68	204,487	0.17
Slovenia	51,906	0.60	480,529	0.40
East Timor	32,659	0.38	87,323	0.07
Ecuador	32,265	0.38	704,298	0.59
Poland	27,662	0.32	457,391	0.38
Austria	22,224	0.26	311,009	0.26
Chile	20,795	0.24	738,910	0.62
China	19,751	0.23	253,692	0.21
Russia Federation	19,158	0.22	310,040	0.26
Ukraine	18,953	0.22	438,434	0.37
Czech Republic	14,025	0.16	219,064	0.18
Mexico	9,876	0.12	228,781	0.19
Greece	8,268	0.10	74,313	0.06
Belarus	6,375	0.07	108,201	0.09
Korea, Republic Of	6,163	0.07	54,079	0.05
Philippines	5,193	0.06	118,373	0.10
Argentina	4,974	0.06	170,480	0.14
Bolivia	4,527	0.05	55,453	0.05
Croatia	3,521	0.04	46,510	0.04
Monaco	3,363	0.04	61,701	0.05

Countries	Volume (Kg)	Share (%)	Value (US\$)	Share (%)
Bosnia And Herzegovina	3,306	0.04	39,799	0.03
Cyprus	2,740	0.03	22,910	0.02
Others	14,714	0.17	259,890	0.22
TOTAL	8,582,103	100	119,747,494	100

Source : Central Bureau of Statistics, processed by Bizteka

Producer's and Their Capacities

According to sources from the Indonesian Bicycle Industry Association (AIPI), there are currently around 13 bicycle industry companies in Indonesia with a total capacity of around 6.14 million units per year. The company with the largest capacity is PT. Terang Dunia Internusa with a capacity of 1 million units per year, followed by PT. Wijaya Indonesia Makmur with 800,000 units per year, and PT. Insera Sena with 750,000 units per year, as can be seen in the table below.

Table - Bicycle Manufacturers and Their Capacity in Indonesia, 2020

COMPANIES	LOCATION	PRODUCT CAPACITIES (Unit/ Year)	BRANDS
PT. Insera Sena	Sidoarjo - East Java	750,000	Polygon, Tern, Marin
PT. Terang Dunia Internusa	Bogor - West Java	1,000,000	United, Genio, Patrol, Rubic
PT. Wijaya Indonesia Makmur	Tangerang - Banten	800,000	WIM
PT. Indonesia Bike Works	Gresik - East Java	300,000	Thrill, Tabibito
PT. Roda Pasifik Mandiri	Semarang - Central Java	700,000	Pacific, Exotic, Turanza, Aviator, Dahon
PT. Roda Maju Bahagia	Kendal - Central Java	300,000	Element, Police, Alton, Camp, PMB, Dahon
PT. Roda Makmur Sentosa	Demak - Central Java	500,000	Phoenix, Trax
PT. Juara Bike	Tangerang - Banten	240,000	Selis
PT. Harapan Source Cahaya	Semarang - Central Java	300,000	Phoenix, Trax
PT. Jakarta Tunggal Citra	Tangerang - Banten	400,000	Famili, Inferno, Totem
PT. Viva Mas Adi Pratama	Tangerang - Banten	400,000	Viva Cycle
UD SAE	Ponorogo - East Java	200,000	Commando
PT. Jaya L Angka H Global	Semarang - Central Java	250,000	Atlantis, Odessy
TOTAL CAPACITIES		6,140,000	

Source : Association of Indonesian Cycling Industry

5. PT. GTS INDONESIA, Tbk A TARGETS NET PROFIT OF US\$ 4 MILLION IN 2023

DI Editors



Entity Tommy Soeharto (GTSI) is aiming for a profit of IDR 59.25 billion in 2023. This is supported by the performance in the first quarter of 2023, which was quite brilliant, namely posting a net profit of US \$ 2.15 million or around IDR 31.74 billion (assuming an exchange rate of Rp. 14,750 per US dollar).

For information, Tommy Soeharto owns GTSI through PT. Humpuss Maritime International. Based on the financial report, GTSI's net profit jumped 69.88 percent year-on-year (yoy) to US\$ 2.15 million compared to the same period in 2022 of US\$ 1.26 million. Despite the increase in profit, the company's revenue edged down 0.79 percent yoy to US\$10.36 million in the first quarter of 2023 compared to the previous year's US\$10.44 million.

In detail by segment, the company's revenue was supported by boat charter services of US\$10.25 million and crew and ship management services of US\$162,928. That income minus a \$50,000 elimination fee The company's cost of revenue increased 3.34 percent yoy to US\$ 6.45 million, compared to the previous year's US\$ 6.24 million, so that the company's gross profit fell 6.95 percent to US\$ 3.9 million. Nevertheless, the Director of PT. GTSI Dandun Widodo, said that the company's profitability in 2023 will decrease compared to last year.

"This year's performance will decrease slightly compared to last year because for two months our vessels will be unemployed or lose around US\$ 3 million. So in terms of revenue and profit, we will slightly decrease compared to last year," Dandun told reporters at the GTSI Analyst Meeting on Friday (12/5/2023).

Even so, the company is trying to ensure that revenue and profits in 2023 do not drop too significantly because there will be the docking of two ships, namely the Eka Putra and Tri Putra ships. Dandun said that his party is aiming for a profit target for the current year of US\$ 4 million, while profit for the current year in 2022 is US\$ 5.12 million. "Our maximum

target this year is to record a bottom line or net profit of around US\$4 million," he said. If it is assumed that today's exchange rate is at the level of IDR 14,814, it is possible that the profit will touch IDR 59.25 billion.

Meanwhile, since 2021, the global liquefied natural gas market has tightened, and global gas consumption is expected to decline by 0.8 percent in 2022 as a result of a 10 percent contraction in Europe and no change in demand in the Asia-Pacific region. The company predicts global gas consumption will only grow by 0.4 percent in 2023, but this prospect will also be affected by various global uncertainties, such as the wars between Russia and Ukraine, which are still raging. " However, the liquefied natural gas industry in Indonesia in 2023 is expected to be more stable and less affected by supplies from Russia.

Natural gas is currently also a mainstay of the transition process from dirty energy to clean energy, so the product of liquefied natural gas, or LNG, in Indonesia is also expected to continue to increase," he said. Based on the balance sheet, the company's total assets decreased in the first quarter of 2023 to US\$ 118.9 million compared to the position at the end of December 2022 of US\$ 123.8 million. The company's liabilities fell to US\$ 59.12 million in December 2022, down from US\$ 66.83 million in December 2022. Equity has also decreased to US\$ 59.78 million from US\$ 59.96 million at the end of 2022.

Furthermore, PT. GTS Indonesia Tbk (GTSI) targets an investment of US\$ 508 million, or Rp. 7.5 trillion, by 2026, in line with government initiatives that encourage renewable energy.

According to SKK Migas data, the government is targeting LNG production in 2023 of 204 cargoes, which is higher than actual LNG production in 2022, which reached 196 cargoes. This is in line with the green fuel transformation programme, from oil fuel to gas fuel.

PT. GTSI welcomes this opportunity. GTS International Finance Director Dandun Widodo said the company is aiming for an investment of US\$ 19.75 million, or Rp. 291.2 billion, in 2023.

Dandun detailed that this year (2023), GTSI will buy a small carrier Liquefied Natural Gas (LNG) ship for US\$ 12.5 million, mobilise it for US\$ 550 thousand, and then complement the expansion with PPH22, import duties, and US import VAT of \$2.7 million.

GTSI Main Director Tammy Meidharma said his party will build an LNG storage and shuttle, which requires US\$ 50 million in 2024, and a floating storage and regasification unit (FSRU) or floating storage and regasification unit ship worth US\$ 265 million.

GTSI will also carry out a regasification project worth US\$175 million, which is projected to operate in June 2026. Then, the construction of a US\$18 million retail and booking LNG facility will be completed in the second quarter of 2024.

The funding from some of these investments will be funded through capital expenditures. However, Tommy did not rule out the possibility that in the future, his company will take corporate actions, such as a rights issue, to realise the investment.

"One of them is a rights issue (source of funds), but we are also partners; that's what we have been doing so far, partners, just like with Japan," he said. On the same occasion, Dandun said, GTSI International allocated capital expenditure (Capex) of US\$ 19–20 million in 2023.

Director of GTSI, Dandun Widodo, said the liquefied natural gas industry in Indonesia in 2023 is expected to be more stable and less affected by supplies from Russia. Natural gas has now become a mainstay of the process of transitioning from dirty energy to clean energy, so the production of liquefied natural gas (LNG) in Indonesia is also expected to continue to increase.

The Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas) targets LNG production in 2023 of 204 cargoes, higher than actual LNG production in 2022, which reached 196 cargoes.

Meanwhile, based on data from the Central Statistics Agency, Indonesia's LNG exports during 2018–2022 tended to decline at a rate of 8.3% per year. However, in terms of value, it has increased by 4.1% per year.

If in 2018, Indonesia's LNG export volume was recorded at 16.61 million metric tonnes valued at US\$ 6.95 billion, in 2019, it decreased by 21.1%, or 12.32 million metric tonnes, and its value decreased by 25.1%, or US\$ 5.21 billion.

Then in 2020, Indonesia's LNG exports fell again, although only by 0.7%, namely to 12.23 billion, and the value fell even further, namely by 30.7%, or to US\$ 3.60 billion. Meanwhile, LNG exports in 2021 decreased in volume again, but the value increased by 27.7%, or to US\$ 4.60 billion, while the volume decreased by 8.9%, or to 11.14 million metric tons.

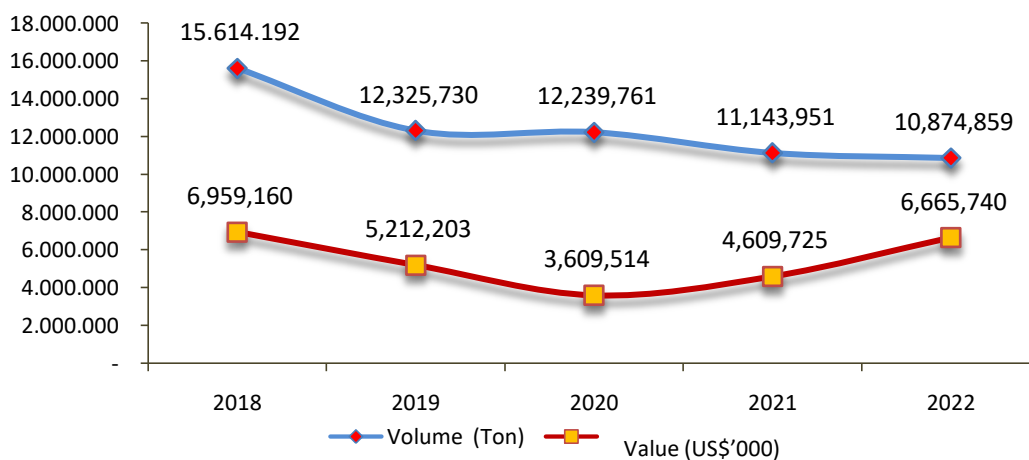
The same condition also occurred in 2022, where the volume of exports decreased by 2.4% while the value increased by 44.6%. Details regarding the development of Indonesia's LNG exports throughout 2018–2022 can be seen in the table below :

Table – Development of Indonesia's LNG Exports, 2018-2022

Year	Volume (Ton)	Growth (%)	Value (US\$'000)	Growth (%)
2018	15,614,192	---	6,959,160	---
2019	12,325,730	(21.06)	5,212,203	(25.10)
2020	12,239,761	(0.70)	3,609,514	(30.75)
2021	11,143,951	(8.95)	4,609,725	27.71
2022	10,874,859	(2.41)	6,665,740	44.60
Average Growth		(8.28)		4.12

Source : Central Bureau Of Statistics, processed by Bizteka

Graph - Development of Indonesia's LNG Exports, 2018-2022



Source : Central Bureau Of Statistics, processed by Bizteka

Throughout 2020, Indonesia's largest LNG exports were destined for China, Japan, and the Republic of Korea. The total volume of Indonesian LNG exports from the three countries reached 10.38 million tonnes, or around 84.8%, and the value reached US\$ 3.07 billion, or

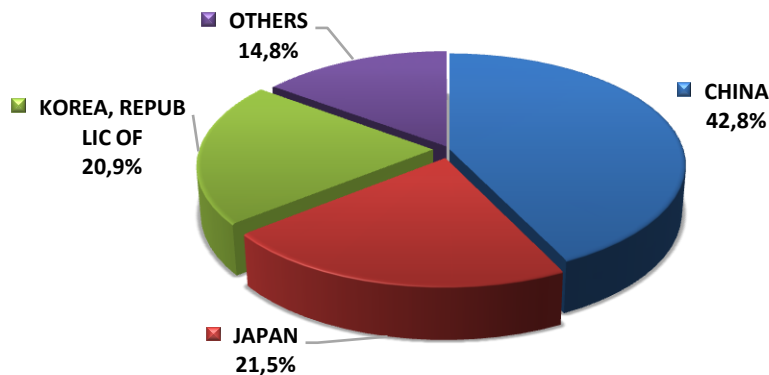
a market share of around 85.2%. While the rest is intended for the other seven countries. Details regarding Indonesia's LNG exports by destination country throughout 2020 can be seen in the table below:

Table - Indonesia's LNG Exports by Destination Country, 2020

Destination Countries	Volume (Kg)	Share (%)	Value (US\$)	Share (%)
China	5,345,737,868	43.68	1,542,988,849	42.75
Japan	2,112,314,855	17.26	775,353,550	21.48
Korea, Republic Of	2,927,065,382	23.91	756,337,345	20.95
Taiwan	1,098,882,259	8.98	356,770,289	9.88
Mexico	262,724,656	2.15	74,839,692	2.07
Thailand	217,346,799	1.78	43,892,808	1.22
Singapore	151,218,577	1.24	33,072,911	0.92
Australia	61,370,833	0.50	14,751,050	0.41
Pakistan	63,099,843	0.52	11,507,119	0.32
TOTAL	12,239,761,072	100.00	3,609,513,613	100.00

Source : Central Bureau Of Statistics, processed by Bizteka

Graph- Main Destination Countries of Indonesia's LNG Exports, 2020



Source : Central Bureau Of Statistics, processed by Bizteka

6. INDONESIA EXTENDS IMPORT DUTY FOR CHINESE ANTIDUMPING STEEL

FI Editors



A sunset review investigation into the imposition of Anti-Dumping Import Duty (BMAD) on imported products H and Section I originating from China. Previously, the imposition of BMAD was in effect based on Minister of Finance Regulation (PMK) Number 24/PMK.010/2019, which took effect on April 2, 2019 and ended on April 2, 2024.

In this regulation, H-section products are non-alloy iron or steel products, not further processed other than hot rolled, hot drawn, or extruded, with a height of 80 mm or more, which are included in tariff headings 7216.33.11 and 7216.33.19.

Whereas Section I products are non-alloy iron or steel products, not further worked on other than hot-rolled, hot-drawn, or extruded, with a height of 80 mm or more, which are included in tariff headings 7216.32.10 and 7216.32.90.

The Chairman of the Indonesian Anti-Dumping Committee (KADI) said that this investigation was a follow-up to a request from PT Gunung Raja Paksi Tbk., one of the local steel producers. The company is pushing for a review of the imposition of BMAD on imports of Section H and I products.

After researching and analysing the application, KADI found that there was a practise of dumping H- and I-section products from China. So that if the imposition of anti-dumping duties (BMAD) is stopped or not extended, the applicant's losses will recur.

Meanwhile, the legal basis for the investigation to review the imposition of BMAD is Government Regulation Number 34 of 2011 concerning antidumping measures, compensation measures, and trade security measures. In addition, it also refers to the

Regulation of the Minister of Trade of the Republic of Indonesia Number 76 of 2012 concerning Procedures for Investigations in the Context of Imposing Antidumping Actions and Countermeasures.

KADI has conveyed information regarding the commencement of the investigation to interested parties, particularly the domestic industry, importers, associations, exporters, and producers from China that are known, the Embassy of the Republic of Indonesia in China, and representatives of the Chinese government in Indonesia.

KADI provides an opportunity for other interested parties who are not yet known to submit notifications to participate in the investigation no later than 14 days from the date of the announcement.

Imports Jumped Sharply

Meanwhile, based on data from the Central Statistics Agency (BPS), it is clear that during the 2018–2022 period, Section I products (non-alloy iron or steel products) that were not further processed other than hot-rolled, hot-drawn, or extruded, with a height of 80 mm or more (which are included in the tariff headings 7216.32.10 and 7216.32.90) experienced a sharp spike, especially in the last three years, namely 2020 to 2022.

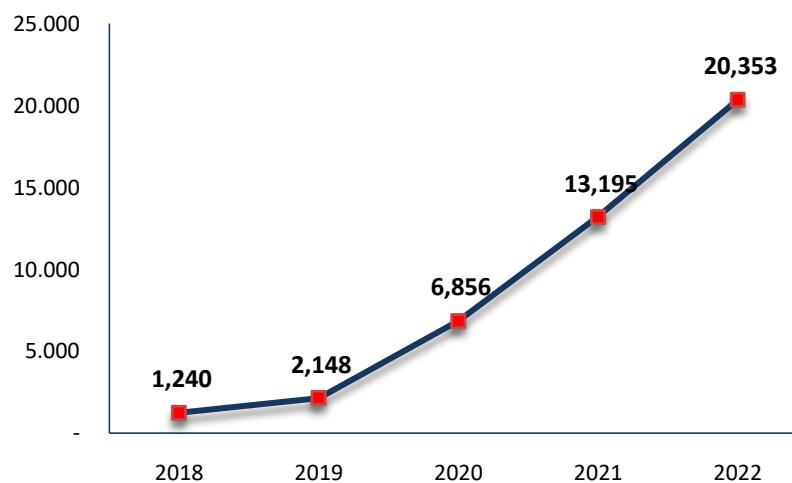
In 2018, steel imports were recorded at 1,240 tonnes, and in 2019, they increased to 2,148 tonnes, or US\$1,662 thousand. Furthermore, in 2020, steel imports jumped sharply to 6,865 metric tonnes with a value of \$4,816 thousand. This condition will continue in 2021 to reach 13,195 metric tonnes worth US\$ 12,463 thousand. Even in 2022, the surge in imports reached 20,353 tonnes valued at US\$ 17,428 thousand. This indicates that imported steel products are still being dumped.

Table – Development of Indonesia's Section I Steel Imports, 2018-2022

Year	Volume (Ton)	Growth (%)	Value (US\$'000)	Growth (%)
2018	1,240	--	954	--
2019	2,148	73.29	1,662	74.21
2020	6,856	219.17	4,816	189.83

Year	Volume (Ton)	Growth (%)	Value (US\$'000)	Growth (%)
2021	13,195	92.45	12,463	158.78
2022	20,353	54.24	17,428	39.83
Average Growth (%/Yr)		109.79		115.66
<i>Source : Central Bureau Of Statistics, processed by Bizteka</i>				

Graph – Development of Indonesia's Section I Steel Imports, 2018-2022
(Ton)



Source : Central Bureau Of Statistics, processed by Bizteka

Even though the BMAD has been imposed, it turns out that China is still the largest steel exporter (Section I) in Indonesia. In 2020, the supply reached 4,363 tonnes, or 63.64% of total imports, followed by Singapore with 1,201 tonnes, then Japan with 308 tonnes, Australia with 246 tonnes, and the Republic of Korea with 239 tons. For other countries, see the following table.

Table - Imports of Section I Steel by Country of Origin, 2020

Countries of Origin	Volume (Kg)	Share (%)	Value (US\$)
China	4,363,263	63.64	2,753,406
Singapore	1,200,676	17.51	885,419
Japan	308,262	4.50	256,397
Australia	246,063	3.59	311,583

Countries of Origin	Volume (Kg)	Share (%)	Value (US\$)
Korea, Republic Of	238,937	3.48	161,223
Luxembourg	133,384	1.95	154,060
Malaysia	129,730	1.89	85,203
United Kingdom	100,415	1.46	59,786
Thailand	81,914	1.19	56,767
Germany, Fed. Rep. Of	27,507	0.40	67,022
United Arab Emirates	13,047	0.19	10,445
Turkey	8,432	0.12	9,997
Spain	4,136	0.06	4,411
Taiwan	329	0.00	290
Poland	159	0.00	195
TOTAL	6,856,254	100.00	4,816,204

Source: Central Bureau Of Statistics, processed by Bizteka

Imports of steel and H-section products (tariff headings 7216.33.11 and 7216.33.19) also experienced a surge in imports, although in the last three years there has been a decline. However, in the last five years, it has continued to grow by an average of 33.24% per year.

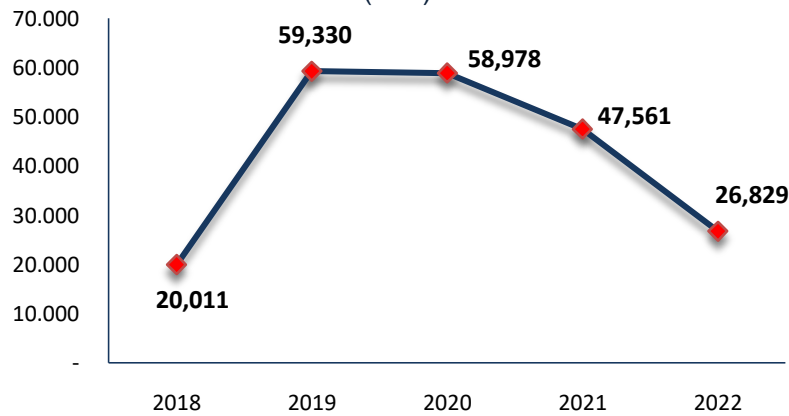
In 2018, steel imports were recorded at 20,011 tonnes; in 2019, they jumped to 59,330 tons. Furthermore, in 2020, steel imports decreased slightly to 58,978 metric tonnes with a value of US\$ 33,496 thousand. This condition will continue in 2021, with 47,561 metric tonnes worth US\$ 36,296 thousand. In fact, in 2022, imports dropped dramatically to 26,829 metric tonnes worth US\$ 24,828 thousand.

Table – Development of Indonesia's H Section Steel Imports, 2018-2022

Year	Volume (Ton)	Growth (%)	Value (US\$'000)	Growth (%)
2018	20,011	--	13,992	--
2019	59,330	196.49	35,367	152.76
2020	58,978	-0.59	33,496	-5.29
2021	47,561	-19.36	36,296	8.36
2022	26,829	-43.59	24,828	-31.59
Average Growth (%/Yr)		33.24		31.06

Source: Central Bureau Of Statistics, processed by BIZTEKA

Graph – Development of Indonesia's H Section Steel Imports, 2018-2022 (Ton)



Source: Central Bureau Of Statistics, processed by BIZTEKA

Meanwhile, steel imports for H-section products will be imported in 2020 from Thailand, followed by China and Malaysia. Each of 30,070 tonnes, 20,591 tonnes, and 6,684 tons. Meanwhile, other countries come from Singapore, Australia, the Republic of Korea, and the United Arab Emirates; more details can be seen in the table.

Table- Imports of H Section Steel by Country of Origin, 2020

Countries of Origin	Volume (Kg)	Share (%)	Value (US\$)
Thailand	30.069.947	50,98	16.663.948
China	20.590.552	34,91	11.825.251
Malaysia	6.683.568	11,33	3.601.388
Singapore	990.466	1,68	735.198
Australia	519.743	0,88	553.446
Korea, Republic Of	78.590	0,13	74.065
United Arab Emirates	28.200	0,05	22.284
Luxembourg	13.688	0,02	16.775
Taiwan	3.662	0,01	3.928
TOTAL	58.978.416	100,00	33.496.283

Source: Central Bureau Of Statistics, processed by Bizteka

7. IN THE LAST FIVE YEARS, INDONESIA'S AKI EXPORTS HAVE TENDED TO DECLINE

AI Editors



The rampant COVID-19 outbreak in 2019–2020 caused Indonesia's battery exports during this period to continue to decline. As a result of the COVID-19 outbreak, the government implemented a policy of imposing restrictions on community activities (PPKM). As a result, the performance of the battery industry in Indonesia tends to decline, which results in exports also continuing to decline.

Based on export records from the Central Bureau of Statistics, from 2018 to 2022, Indonesia's battery exports as a whole tended to decline at a rate of minus 11.36% per year in terms of volume, while the export value tended to decrease to minus 8.14% per year.

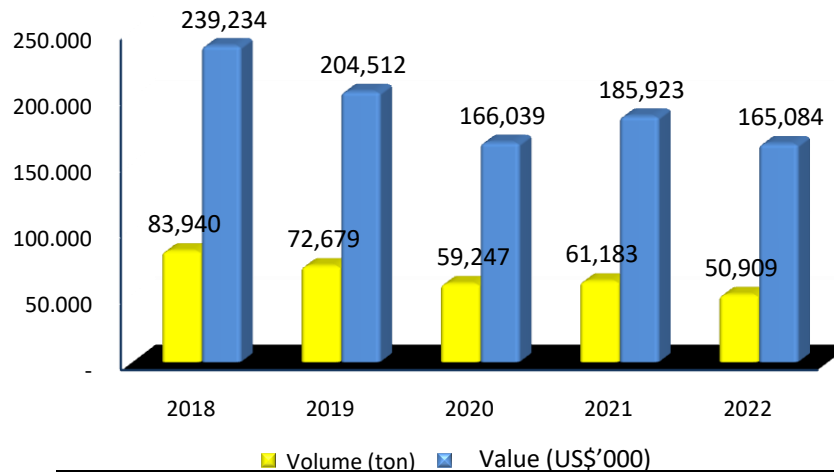
According to a source from the Central Statistics Agency, Indonesia's exports of batteries for vehicles (automotive and others) in 2018 reached 83,940 tonnes with a value of US\$ 239,234 thousand. However, with the outbreak of COVID-19, in the following two years exports continued to decline and reached only 59,247 tonnes worth US\$ 166,039 thousand in 2020.

Starting from the slowing down of the COVID-19 case and the improvement in the world economy in 2021, Indonesia's battery exports have again increased by 3.27% to 61,183 tonnes worth US\$ 185,923 thousand. However, due to the threat that the global economy is predicted to be hit by a recession in 2023, Indonesia's battery exports in 2022 will again decrease by 16.79% to 50,909 metric tonnes with a value of US\$ 165,084 thousand, as listed in the following table.

Table – Development of Indonesia's Battery Exports, 2018 – 2022

Year	Volume (ton)	Growth (%)	Value (US\$'000)	Growth (%)
2018	83,940	-	239,234	-
2019	72,679	- 13.42	204,512	- 14.51
2020	59,247	- 18.48	166,039	- 18.81
2021	61,183	3.27	185,923	11.98
2022	50,909	- 16.79	165,084	- 11.21
Average Growth (%/Yr)		- 11.36		- 8.14

Source : Central Bureau of Statistics, processed by Bizteka

Chart – Development of Indonesia's Battery Exports, 2018 – 2022

Source : Central Bureau of Statistics, processed by Bizteka

So far, exports of Indonesian vehicle batteries have succeeded in penetrating export markets in various countries. In 2020, the largest export was aimed at England, reaching 17.26% of total battery exports with a volume of 10,227 metric tonnes and a value of US\$ 20,026 thousand (12.06%). The second largest was destined for Malaysia with 7,139 tonnes (12.05%) worth US\$ 19,345 thousand (11.65%), followed by the Philippines with 4,484 tonnes (7.57%) worth US\$ 13,774 thousand (8.30%).

Other countries that are the main destinations for Indonesian battery exports are the United Arab Emirates, Japan, Italy, Thailand, Saudi Arabia, Singapore, Spain, Sudan, France, Grace, Yemen, Ethiopia, Chile, Kenya, and so on, with export volume and value listed in the following table.

Table – Indonesian Battery Exports by Destination Country, 2020

Destination Countries	Volume (Kg)	Share (%)	Value (US\$)	Share (%)
United Kingdom	10,227,490	17.26	20,025,996	12.06
Malaysia	7,138,601	12.05	19,344,768	11.65
Philippines	4,483,914	7.57	13,774,045	8.30
United Arab Emirates	3,378,943	5.70	8,201,708	4.94
Japan	2,716,445	4.58	10,729,526	6.46
Italy	2,703,987	4.56	5,807,175	3.50
Thailand	2,575,441	4.35	6,923,503	4.17
Saudi Arabia	2,495,818	4.21	8,487,167	5.11
Singapore	2,038,881	3.44	6,401,336	3.86
Spain	1,778,788	3.00	3,918,791	2.36
Sudan	1,734,458	2.93	5,230,038	3.15
France	1,538,158	2.60	4,067,071	2.45
Greece	1,328,969	2.24	2,602,278	1.57
Yemen	1,229,407	2.08	3,593,184	2.16
Ethiopia	1,036,505	1.75	3,256,793	1.96
Chile	878,179	1.48	2,469,937	1.49
Kenya	794,633	1.34	2,240,210	1.35
United States	780,79	1.32	2,953,145	1.78
Taiwan	688,917	1.16	2,023,155	1.22
Netherlands	642,967	1.09	6,160,058	3.71
Australia	569,806	0.96	1,442,074	0.87
South Africa	564,934	0.95	1,225,216	0.74
Kuwait	541,543	0.91	1,111,609	0.67
Oman	508,383	0.86	1,322,719	0.80
Afghanistan	468,244	0.79	1,423,427	0.86
Myanmar	428,237	0.72	1,217,568	0.73
Viet Nam	392,363	0.66	1,007,378	0.61
Papua New Guinea	390,483	0.66	1,130,717	0.68
New Zealand	341,391	0.58	671,591	0.40
Nigeria	311,278	0.53	774,905	0.47
Tanzania, United Rep. Of	306,678	0.52	654,703	0.39
East Timor	243,018	0.41	622,429	0.37
Colombia	231,417	0.39	802,586	0.48
Suriname	227,83	0.38	520,43	0.31
Djibouti	221,556	0.37	542,633	0.33
Paraguay	221,323	0.37	492,941	0.30
Germany, Fed. Rep. Of	197,519	0.33	481,468	0.29
Venezuela	182,33	0.31	342,004	0.21

Destination Countries	Volume	Share	Value	Share
	(Kg)	(%)	(US\$)	(%)
Peru	178,341	0.30	550,796	0.33
Iran (Islamic Republic Of)	165,903	0.28	478,433	0.29
Hong Kong	159,426	0.27	3,755,128	2.26
Mexico	137,268	0.23	518,7	0.31
Brunei Darussalam	134,843	0.23	415,293	0.25
Egypt	124,02	0.21	371,291	0.22
Mozambique	120,927	0.20	279,2	0.17
India	120,014	0.20	483,132	0.29
Argentina	115,489	0.19	313,239	0.19
Canada	89,825	0.15	166,689	0.10
Sweden	89,717	0.15	176,153	0.11
Qatar	86,625	0.15	212,266	0.13
Pakistan	86,25	0.15	291,075	0.18
Trinidad And Tobago	85,779	0.14	181,273	0.11
Costa Rica	72,051	0.12	166,934	0.10
Burundi	71,562	0.12	205,336	0.12
Brazil	63,563	0.11	321,184	0.19
China	63,253	0.11	741,603	0.45
Maldives	50,304	0.08	146,129	0.09
Saint Lucia	49,336	0.08	87,338	0.05
Guatemala	47,816	0.08	154,185	0.09
Syria Arab Republic	46,922	0.08	135,309	0.08
Somalia	42,774	0.07	105,843	0.06
Bahrain	42,217	0.07	97,22	0.06
Cambodia	38,96	0.07	199,99	0.12
Zambia	37,317	0.06	82,993	0.05
Bangladesh	33,013	0.06	126,668	0.08
Guinea	32,866	0.06	64,872	0.04
Nicaragua	28,161	0.05	90,697	0.05
Guyana	25,668	0.04	61,077	0.04
Turkey	23,578	0.04	89,67	0.05
Barbados	22,768	0.04	48,275	0.03
Russia Federation	21,371	0.04	48,479	0.03
Lebanon	19,416	0.03	57,96	0.03
Seychelles	18,893	0.03	33,653	0.02
Congo	18,803	0.03	43,606	0.03
New Caledonia	17,612	0.03	32,166	0.02
Cyprus	17,521	0.03	35,587	0.02
Ghana	17,405	0.03	55,184	0.03
Madagascar	15,505	0.03	30,725	0.02

Destination Countries	Volume	Share	Value	Share
	(Kg)	(%)	(US\$)	(%)
Hungary	14,833	0.03	56,474	0.03
Korea, Republic Of	12,984	0.02	350,536	0.21
Israel	12,234	0.02	43,978	0.03
Tunisia	11,334	0.02	32,58	0.02
Honduras	11,069	0.02	41,48	0.02
Others Countries	11,942	0.02	62,128	0.04
TOTAL	59,247,103.23	100.00	166,038,815	100.00

Source : Central Bureau of Statistics, processed by Bizteka

Five Companies

Information obtained by Bizteka from the Association of Automobile and Motorcycle Equipment Industries (GIAMM) indicates that in Indonesia, there are at least six companies in the battery industry that are members of GIAMM with a total production capacity of 35,180,000 pcs per year.

In terms of production capacity, the GIAMM member with the largest capacity is PT Yuasa Battery, with a battery production capacity of 13,200,000 pcs per year under the Yuasa brand. The second-largest position is occupied by PT GS Battery, which produces batteries under the GS brand with a production capacity of 10,200,000 pcs per year. And the third place is occupied by PT Trimitra Baterai Prakasa with the G-Force brand, with a capacity of 5,200,000 pcs per year. The other two companies are PT Nipress Energi Otomotif and PT Tri Mega Baterindo, with capacities and brands as listed in the following table.

Table – Battery Manufacturers and Their Capacity in Indonesia, 2023

Companies	Product Capacities (Pcs/Year)	Brands
PT Yuasa Battery	13,200,000	Yuasa
PT GS Battery	10,200,000	GS
PT Trimitra Baterai Prakasa	5,200,000	G-Force
PT Nipress Energi Otomotif	4,000,000	NS
PT Century Batteries Indonesia	2,400,000	Incoe
PT Tri Mega Baterindo	180,000	Nagoya
TOTAL CAPACITIES	35,180,000	

Source : GIAMM, processed by Bizteka

ADDITIONAL INFO

1. **INDONESIAN IMPORTS OF POLYMETHYL METHACRYLATE RESIN (PMMA) BY PORT OF LOADING OR ORIGIN DURING SEPTEMBER 2021**

D | Editors

Based on BIZTEKA's research, it is known that the number of loading ports or ports of origin for imports of polymethyl methacrylate resin (PMMA) by Indonesia throughout September 2021 is quite large. However, there are only 4 ports that are classified as large, namely: the Port of Singapore, Laem Chabang, Yokohama, and the Port of Shanghai.

The Port of Singapore is the largest and most congested seaport in Southeast Asia. In the world ranking, the port of Singapore always ranks second or third. Indonesia's total imports of polymethyl methacrylate resin (PMMA) were loaded from the port of Singapore throughout September 2021, totaling 736 tonnes (67.3%) worth US\$ 1.71 million, or a market share of around 54.4% of the total import value throughout September 2021. At the same time, it was the biggest compared to other ports.

Followed by Laem Chabang port, this port is located in Chonburi province, Thailand, about 100 kilometres southeast of Bangkok, the capital city of Thailand, and is the main centre of shipping and logistics in the region. The port, which has a capacity of 8.10 million TEU during September 2021, loaded 155 tonnes (14.1%) of the chemical polymethyl methacrylate resin to Indonesia worth US\$ 460.69 thousand, or with a market share of 14.7% of the total import value throughout September 2021.

Yokohama Port is located in Tokyo Bay and has ten main piers. Throughout September 2021, this port sent 93 tonnes (8.5%) of polymethyl methacrylate resin to Indonesia worth US\$ 305.86 thousand, or a market share of around 9.7%, and ranks third after the ports of Singapore and Laem Chabang.

Meanwhile, the Shanghai port, which is located at the mouth of the Yangtze River, shipped 22.9 tonnes (2.1%) of polymethyl methacrylate resin to Indonesia, worth US\$ 171.41 thousand, or a market share of 5.5% of the total imported material value. this chemistry throughout the period.

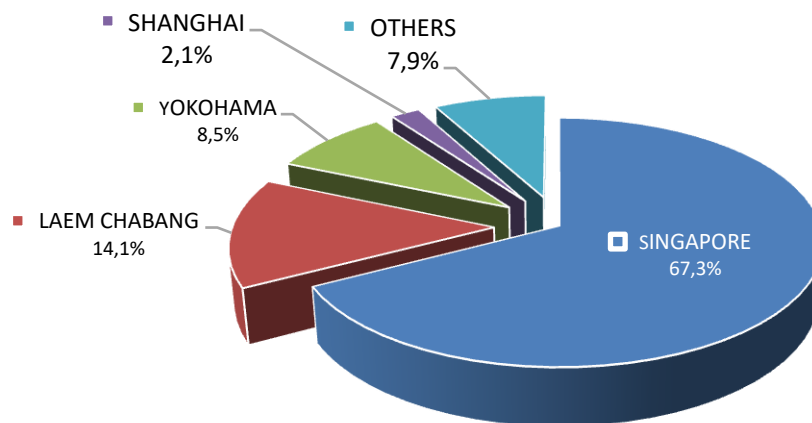
Details regarding Indonesia's imports of polymethyl methacrylate resin by port of loading or origin throughout September 2021, along with their volume and value, can be seen in the table below :

Table - Indonesia's Imports of Polymethyl Methacrylate Resin (PMMA) by Port of Loading/Origin, September 2021

No.	Port Of Loading/Origin	Volume (KGS)	Share (%)	Value (US\$)	Share (%)
1	Singapore	736.100	67,29	1.707.175	54,39
2	Laem Chabang	154.500	14,12	460.699	14,68
3	Yokohama	93.009	8,50	305.861	9,75
4	Shanghai	22.990	2,10	171.414	5,46
5	Kaohsiung	21.954	2,01	54.954	1,75
6	Mumbai (Ex Bombay)	19.200	1,76	46.464	1,48
7	Pasir Gudang, Johor	16.000	1,46	29.600	0,94
8	Busan	11.784	1,08	99.859	3,18
9	Kobe	10.043	0,92	213.578	6,81
10	Others	8.327	0,76	48.878	1,56
TOTAL		1.093.907	100,00	3.138.482	100,00

Source : Research BIZTEKA-PT. CCI, from various source

Chart - Imports of Polymethyl Methacrylate Resin into Indonesia by Major Ports, September 2021



Source : Research BIZTEKA-PT. CCI, from various source

2. WORLD IMPORT - HS CODE 2604 : NICKEL ORES AND CONCENTRATES

D | Editor

From the results of BIZTEKA's monitoring, so far (2018–2022), the demand for products that enter the world's HS code 2604 (nickel ores and concentrates) has been carried out by many countries, namely: China, Canada, the Republic of Korea, Finland, Japan, and others with relatively small imports.

Overall, the rate of growth in the world import value of HS Code 2604 products during 2018–2022 has increased quite significantly, with an increase rate of around 13.8% per year. If in 2018 the total import value of HS Code 2604 products was recorded at US\$ 4.07 billion, a year later it jumped to US\$ 4.96 billion, up 21.9%. However, with the COVID-19 outbreak that hit the world, the world's import value of HS code 2604 products also decreased, falling by 20.5% or to US\$ 3.95 billion. However, with the easing of COVID-19, the total world import value of HS code 2604 products continues to increase; even in 2021, the value rose 48.9%, or to US\$ 5.88 billion, and in 2022, it will still show an increase, even though the percentage is only 4.9%, or US\$ 6.17 billion.

Meanwhile, although imports of HS Code 2604 (nickel ores and concentrates) are carried out by many countries, China is the largest importer. In fact, the percentage of import value during 2018–2022 averaged 75% more than the total import value during 2018–2022.

In 2018, for example, the total import value of HS code 2604 products by China was recorded at US\$ 2.97 billion, or a market share of 73.1% of the total world import value. Then in 2019, it rose quite high, namely 35.4%, or US\$ 4.03 billion. However, the import value in 2020 fell by 27.3%, or to US\$ 2.93 billion, and in the following two years, the import value increased to US\$ 4.42 billion in 2021 and US\$ 4.54 billion in 2022, respectively; during this period, the growth rate of the import value averaged 15.4% per year.

Followed by imports from Canada, with a growth rate that also increased throughout 2018–2022. In 2018, the value of imports by Canada was recorded at US\$ 190.25 million; in 2019, it dropped quite sharply, namely by 70.9%, or to US\$ 55.20 million. However, in subsequent years, it continued to increase, reaching US\$ 503.77 million in 2022, or a market share of around 8.2%.

Then followed imports by the Republic of Korea, with an import value in 2022 of US\$ 382.43 million or a market share of around 6.2%, and imports by Finland, with an import value in 2022 of US\$ 346.26 million or a market share of around 5.6%, and Japan, with an import value of US\$ 285.73 million or a market share of around 4.6%.

Details regarding world importers of HS Code 2604 products from 2018 to 2022 are as follows:

Table - World Import - HS Code 2604 – Nickel Ores and Concentrates
(US Dollar thousand)

IMPORTERS	2018	2019	2020	2021	2022
China	2,974,961	4,029,682	2,928,071	4,420,154	4,536,097
Canada	190,251	55,203	242,747	369,960	503,779
Korea, Republic of	236,024	233,130	203,595	340,685	382,427
Finland	184,744	230,118	209,957	236,132	346,261
Japan	215,710	217,622	171,052	287,583	285,727
Macedonia, North	72,223	110,225	103,554	107,528	58,408
Ukraine	69,326	68,227	75,791	58,929	15,428
Cyprus	4	1,151	-	23,659	11,045
Australia	-	121	615	1,836	6,508
Belgium	81,512	2,284	679	2,888	4,492
Germany	5,270	6,008	7,762	4,395	3,942
Dominican Republic	-	-	-	5,641	3,876
Brazil	383	518	38	720	3,794
Indonesia	1	4,356	23	10	2,318
South Africa	12	73	408	1,827	2,000
Czech Republic	-	1	52	164	802
Viet Nam	755	35	31	60	552
Greece	389	4,153	446	278	452
Portugal	87	144	462	191	323
Singapore	80	259	264	297	320
Thailand	36	93	63	115	178
United States of America	123	84	668	189	159
Romania	518	5	108	260	157
United Arab Emirates	22	-	3	42	143
Sweden	-	-	-	-	121
Italy	1,665	724	66	81	53
Curaçao	-	-	5	10	53
Honduras	-	-	-	-	50
Netherlands	8	2	-	5	45
Switzerland	16	1	-	49	30
Malaysia	93	334	287	33	16
France	85	50	8	4	12
Spain	14	3	16	-	8
Argentina	-	8	8	-	7

IMPORTERS	2018	2019	2020	2021	2022
Serbia	1	1	2	11	6
Zambia	8	-	4	6	6
India	2	3	87	219	5
Denmark	-	1	15	2	4
Ireland	-	3	30	13	3
United Kingdom	3	12	7	14,525	3
Chile	-	3	-	2	2
Botswana	-	-	-	-	1
Lithuania	-	-	-	-	1
Luxembourg	1	-	-	9	-
Madagascar	1	3	-	-	-
Mexico	7	-	-	-	-
Taipei, Chinese	-	-	206	2	-
Latvia	26	48	-	27	-
Liberia	-	-	-	4	-
New Zealand	-	-	-	8	-
Philippines	571	145	-	-	-
Slovakia	-	-	11	-	-
Türkiye	-	2	-	5	-
Egypt	-	-	24	-	-
Bulgaria	8	-	1	-	-
Colombia	-	2	1	-	-
Costa Rica	-	1	-	-	-
Croatia	-	1	-	-	-
Austria	31	68	92	43	-
Bolivia, Plurinational State of	-	8	9	23	-
Israel	-	16	-	-	-
Jordan	-	-	-	2	-
Hungary	-	-	1,891	1,334	-
Ecuador	1	13	-	-	-
Palestine, State of	2	-	-	-	-
Ghana	-	1	-	-	-
Iran, Islamic Republic of	-	-	-	764	-
British Virgin Islands	-	1	-	-	-
Cuba	-	15	-	46	-
Tunisia	-	-	1	-	-
Zimbabwe	36,855	-	-	-	-
Russian Federation	-	1	1	-	-
Saudi Arabia	-	-	10	28	-
Kuwait	1	-	-	-	-
Lao People's Democratic Republic	-	31	-	-	-
Tanzania, United Republic of	-	-	6	-	-
TOTAL	4,071,830	4,964,993	3,949,177	5,880,798	6,169,614

Sources: ITC calculations based on UN COMTRADE statistics, processed by BIZTEKA – CCI

BIZTEKA INFO

FACTORY DESIGN OF 5-HYDROXYMETHYL FURFURAL FROM HYACINTH, WITH CAPACITIES 10.000 TON/YEAR

by : Febi Pramesti Dewi

INTRODUCTION

Indonesia is a tropical country that is rich in natural resources, especially vegetables. In life, vegetables or plants are widely used as food, clothing, or medicinal ingredients. Even so, several plants are included in the weed category, one of which is water hyacinth. Water hyacinth is an aquatic plant that floats with a high growth rate, so it is considered to be detrimental to the aquatic environment. Plants themselves contain lignocellulosic material, which is an important raw material for the production of various valuable products. Seeing this, even though a plant is considered a weed, its lignocellulose can still be used to produce valuable products. Lignocellulose itself is dominated by cellulose, hemicellulose, and lignin. Several valuable products that can be obtained from the utilisation of lignocellulosic materials include levulinic acid, furfural, and hydroxymethyl furfural (HMF).

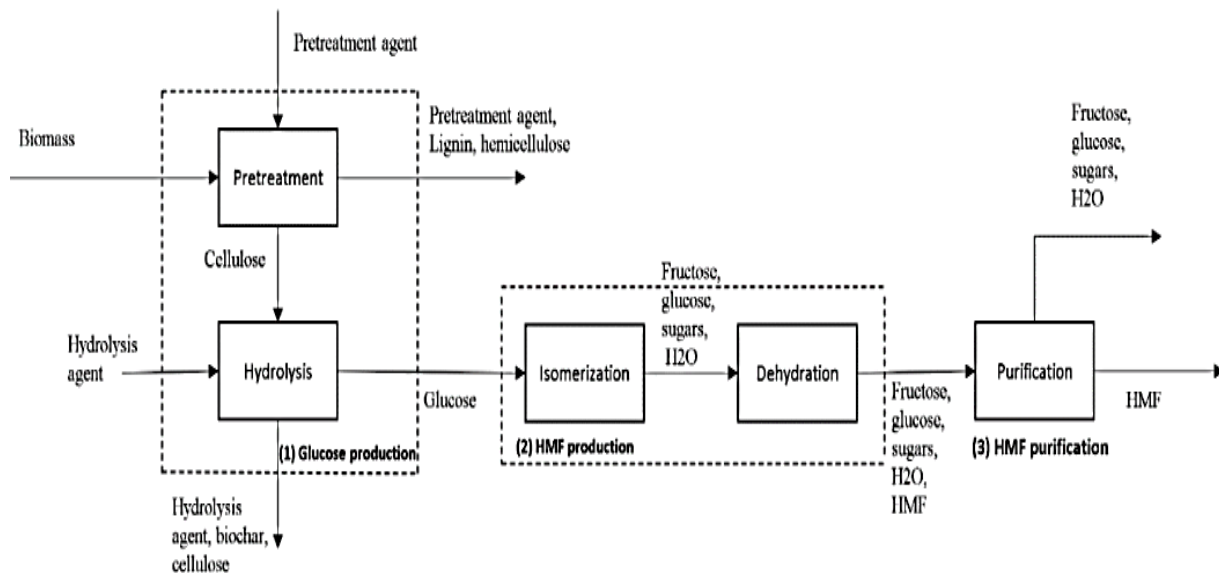
HMF is a very valuable product derived from biomass, and this compound is widely used in the synthesis of fine chemicals, pharmaceutical intermediates, solvents, and liquid fuels (Zhou et al., 2020). Nonetheless, HMF tends to be unstable. A high level of sensitivity to heat or acids causes degradation and unwanted reactions such as dimerization or oligomerization (Fan et al., 2019). HMF itself is obtained through the dehydration process of glucose or fructose, where fructose itself is obtained from glucose hydrolysis. Therefore, lignocellulosic fermentation needs to be carried out in the pretreatment and hydrolysis stages so that glucose is obtained (Zhou et al., 2020).

Making HMF by utilising biomass is a form of concrete action that implements Sustainable Development Goals (SDG) numbers 8 and 12. SDG number 12 has a mission to ensure sustainable patterns of consumption and production. By using biomass as a raw material, the production of this HMF is a form of concrete action to achieve this goal. Meanwhile, one of the goals of SDG number 8 is to reduce poverty, so if this factory is built, it will indirectly be able to create jobs, which are expected to reduce the poverty rate.

PROCESS DESCRIPTION AND RAW MATERIAL

1. Process Production of HMF

Pict - HMF Production Process Flow (Burnard, 2019) and (Motogamwala et al ., 2019)



The picture above is a simple process flow chart of HMF production. The HMF production process from biomass consists of three stages: (1) glucose production, (2) HMF production, and (3) HMF purification. In the first stage, the biomass, which is the raw material before being hydrolyzed into glucose, needs to be pretreated to separate the cellulose components from lignin and hemicellulose. After that, the process of hydrolysis of cellulose is carried out to obtain glucose, which will be used as a raw material for making HMF. In the second step, glucose is isomerized to form fructose, which is then dehydrated to form HMF. In the third stage, to get HMF with higher purity, it needs to be purified.

2. Process Selection

The HMF production process from lignocellulosic biomass from water hyacinth is expected to have a process that is environmentally friendly, fast, and not too expensive, especially in terms of capital costs.

In the pre-treatment process, the processes used were milling for physical pre-treatment, steam explosion for physical chemical pre-treatment, and NaClO_2 and peracetic acid for chemical pre-treatment.

The physical pretreatment process uses the milling process. This is due to the use of ball mills, which are very common, so the procurement of these tools will not be a problem. In addition, the use of milling can also increase the saccharification process by up to 60%, which is far higher than the extrusion method, which only increases saccharification by 25%, and the ultrasonic method, which only increases it by 21.3%.

Table - Comparison of Milling and Extrusion Processes

Process	Plus	Minus	References
Ball Milling	1. Reduces cellulose crystallinity. 2. Reduces the degree of polymerization. 3. Forms a homogeneous particle size 4. Increases the effectiveness of saccharification up to 62%	Requires high power and energy	(Singla and Negi, 2015; Harun et al., 2011; Jedrzejczyk et al., 2019; Maurya et al., 2015)
Extrusion	1. Short residence time. 2. Can be used at moderate temperatures. 3. Can be used on a large scale. 4. Forms heterogeneous particle sizes 5. Increase the effectiveness of saccharification up to 25%	Abrasion issues may increase capital investment	(Kuster Moro et al., 2017) (Zhang, Hou and Bao, 2016)
Microwave	1. Increase lignin solubility 2. Requires less energy. 3. Very short residence time. 4. Generally used for methane production.	Significant damage to polysaccharides. High pressure. Technologically unready	(Bhutto et al., 2017; Jedrzejczyk et al., 2019; Kostas et al., 2017)
Ultrasonic	1. Increase sugar yield 2. Short residence time 3. Lower operating conditions 4. Increase the effectiveness of saccharification up to 21.3%	Not ready for large scale	(Bhutto et al., 2017; Bussemaker & Zhang, 2013; Jedrzejczyk et al., 2019; Sarker et al., 2021)

Furthermore, for physical chemical pretreatment, the steam explosion (SE) process was chosen because this process requires lower pressure and temperature, lower residence time, can completely remove hemicellulose, forms environmentally friendly waste, and has the potential for increased methane production up to 3.2 times, which can be used for biogas factory production later.

Table - Comparison of Physich -Chemistry Pretreatment Processes

Process	Condition of Operation	Plus	Minus	References
Steam explosion (SE)	P = 0,7 - 4,8 MPa; T = 160 - 260 °C; t = 2-10 minute	1. Energy demand feasibility on a moderate industrial scale. High energy efficiency. 2. Non-corrosive 3. Does not use chemicals. 4. Reduces cellulose crystallinity. 5. Removes hemicellulose 6. No recycling cost required 7. Low environmental hazard. 8. low capital investment. 9. Increased methane production 3.2 times	1. Utilizes high thermal energy 2. Formation of weak acids in by-products. 3. Formed inhibitors.	(Scapini et al., 2021; Baruah et al., 2018; Sarker et al., 2021)
Liquid hot water (LHW)	P>5 MPa; T - 160 - 230 °C; t = 15-30 minute	1. Non-corrosive. 2. Does not use chemicals. 3. Little inhibitor formed 4. easy pH control. 5. Economically feasible in large-scale operations	1. Requires higher pressure than SE 2. High water requirement 3. Low lignin removal capability.	(Scapini et al., 2021; Poonia and Chaudhari 2021; Singla and Negi, 2015)
Subcritical Water (SCW)	P = 1-20 MPa; T = 100- 374 °C; t = 10-50 minute)	1. Not corrosive 2. Does not use chemicals 3. Selectivity to polysaccharides is higher than supercritical water 4	1. Requires higher pressure than SE and LHW. 2. Requires higher operating temperature 3. Requires high operating costs 4. Degradation of substantia 1 of cellulose.	(Sarker et al., 2021)

Then, the selection of NaClO_2 and peracetic acid for chemical pretreatment is due to their economic and environmental feasibility, which is very promising. Peracetic acid is known to be an environmentally friendly compound because its degradation products are harmless and dissolve easily in water. In addition, the selection of NaClO_2 and peracetic acid is also based on a process that can remove lignin with the least negative impact on cellulose.

Table - Comparison Compounds used in chemical Pre-Treatment Alkali
(Abdel-Fattah & Abdel-Naby, 2012)

Pre-Treating Agent	component recovered (%)			References
	Lignin	Cellulose	Hemicellulose	
NaOH	14.03	86.1	12.5	(Abdel-Fattah & Abdel-Naby, 2012)
Peracetic Acid	5.86	80.85	20.54	
H_2O_2	12.3	90.5	50	
NaClO_2	16.3	100	100	
$\text{NaClO}_2 + \text{NaOH}$	3.96	89.55	60.44	
$\text{NaClO}_2 + \text{H}_2\text{O}_2$	1.98	92.24	46.82	
$\text{NaClO}_2 + \text{Peracetic Acid}$	2.56	96.69	81.38	

In the hydrolysis process, the hydrolysis process using enzymes is selected. This is because the hydrolysis process using enzymes has excellent performance, produces a low environmental impact, and requires low energy consumption. Enzymatic hydrolysis is known as one of the most environmentally friendly routes for converting polysaccharides into their monomers. Meanwhile, the use of strong acids in the hydrolysis process requires additional processes such as neutralisation, recycling, and acid waste treatment, which will have an impact on increasing equipment and capital costs. Enzymatic hydrolysis of cellulose to glucose is also known to give yields of up to 80% in 2 hours and up to 98% in 24 hours (Zhang et al., 2020). which will have an impact on increasing tool costs and capital costs.

Table - Summary Condition Operations, Plus, and Minus from each Hydrolysis Process

Process	Condition of Operation	Plus	Minus	References
Dilute acid hydrolysis	Atmosferik; T = 100-250 °C; konsentrasi asam 0,1-9 wt%	1. Short reaction time 2. Cheap 3. Hemicellulose yields up to 90%	1. Corrosive 2. Consumes more energy 3. Formation of inhibitors	(Baruah et al., 2018; Zheng et al, 2021)
Concentrated Acid hydrolysis	Atmosferik; T = < 100 °C konsentrasi asam 30-70 wt%	1. Fast reaction. 2. Lower operating temperature than dilute acid hydrolysis.	1. Corrosive 2. Toxic to the environment 3. Low recycle	(Baruah et al., 2018) (Zheng et al, 2021)

Process	Condition of Operation	Plus	Minus	References
		3. Compound is relatively cheaper than enzyme.	capability 4. Additional waste treatment required 5. Pilot plant unavailable	
Enzymhydrolysis	Atmosferik; T = 40 - 50 °C; pH 4-5.	1. low energy consumption. 2. Not harmful to the environment. 3. Effective hydrolysis.	4. High cost 5. Easily inhibited in the presence of inhibitors	(Tao Wang et al 2021) (Zheng et al, 2021)

H₂O/Methyl isobutyl ketone (MIBK) solvent system using a turbular reactor This is due to the activity of the process, as seen from the large yield of HMF formed, the low operating conditions of temperature and pressure, and the recyclability of the catalyst. The NbP catalyst is a solid and thus does not require the separation that would be required if a homogeneous catalyst were used. Then, the H₂O/Methyl isobutyl ketone (MIBK) solvent system was chosen because of its easy separation and recovery system, simply by ordinary evaporation, with a percentage of solvent recovered of more than 99%. The use of a turbular reactor is due to the fact that the turbular system shows the most feasible results and is ready to be scaled up.

Table - Continuous Process Comparison Synthesis of 5-HMF from Glucose

Type of Reactor	Katalis	Sistem Pelarut	Rasio Org:Aq	Suhu Operasi	Tekanan Operasi	Waktu Tinggal	5-HMF Yield	Referensi
Fixed-bed Mikroreaktor	TiO ₂	H ₂ O/MIBK	1:1	200 °c	2000 Psi	3 menit	13%	(McNeff et al 2010)
Fixed-bed Mikroreaktor	TiO ₂	H ₂ O/MIBK	10:1	180 °C	500 Psi	2 menit	29%	(McNeff et al 2010)
Mikroreaktor kapiler slug flow	AlCl ₃ + HCl	H ₂ O/MIBK	4:1	160 °c	10 bar	16 menit	53%	(Guo et al 2020)
Reaktor turbular	NbP	H ₂ O/MIBK	10:1	150 °C	10 bar	7,67 menit	45%	(Souzanchi, Nazari, Venkateswara Rao et al 2021)

The proposed purification process is a single-stage evaporation and further condensation process for the solvent. This is because the conditions are in accordance with the conditions of the studies that have been carried out, namely the H₂O/MIBK solvent system and the ratio of organic to aqueous solution of 10:1.

3. Process Description

3.1. Pre-treatment Process Stage

In the first stage, before being stored in storage warehouse G-01, the harvested water hyacinth is cut at the roots and dried first. Cutting at the root was carried out to remove ash, metal, and some lignin parts that were distributed a lot in the root (Cheng et al., 2010). Water hyacinth from the storage warehouse G-01 is transported by belt conveyor E-01 to the chipper machine B-01, where there is a reduction in the size of the harvested water hyacinth to 10 mm. After that, further reduction was performed using hammer mills B-02 to obtain an average size of 2 mm. The purpose of size reduction is to reduce the degree of crystallisation of cellulose and increase the surface area and porosity of the biomass.

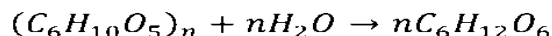
After downsizing, the biomass is then mixed with a 0.5% concentration of potassium hydroxide (KOH) solution in the M-02 mixer with a ratio of solid mass to 0.5% KOH solution of 1. Mixing the biomass with a 0.5% KOH solution is carried out in order to minimise the amount of cellulose mass that is lost due to dissolving or reacting with glucose in the steam explosion pretreatment process in reactor R-01. After being mixed, the mixture is flowed to the R-01 reactor to remove the hemicellulose content using the SC-01 screw conveyor. On the SC-01 screw conveyor, heating occurs using saturated steam with a pressure of 1 atm until a slurry discharge temperature of 80°C is obtained. The slurry feed into the steam explosion reactor R-01 is at operating conditions of 80°C and 1 atm. In the R-01 reactor, the slurry will be heated to a temperature of 230°C and then detonated using saturated steam at a pressure of 28 atm for 4 minutes. After that, the product mixture was separated using a CY-01 cyclone. The top product from the cyclone is steam, which is flowed to the steam generating unit to turn the turbine, while the bottom product is slurry, which will then be washed with an F-01 filter to dissolve the hemicellulose component as a whole.

After steam explosion pretreatment, the biomass in slurry form will be delignified in two stages, where the first stage uses peracetic acid (H_2O_2) and the second stage uses sodium chlorite (NaClO_2). The reason for doing it in two stages is because, based on Abdel-Fattah and Abdel-Naby (2012), it can remove more than 90% of lignin. The first stage of delignification with H_2O_2 was carried out in the R-02 reactor at an operating condition of 1 atm pressure and a temperature of 100°C with a residence time of 30 minutes, followed by washing in the F-02 filter and cooling in

the SC-02 screw conveyor using air to obtain a slurry temperature of 75°C. The second stage was delignification with NaClO_2 in the R-03 reactor at an operating pressure of 1 atm and a temperature of 75°C with a residence time of 1 hour, then washing the slurry in filter F-03 and cooling it in the SC-03 screw conveyor using air until the slurry temperature reached 300°C and was simultaneously sent to the glucose hydrolysis unit. The purity of the cellulose obtained was 99% on a dry basis.

3.2. Hydrolysis Process Stages

The second stage of the 5-HMF production process from water hyacinth is the enzymatic hydrolysis of cellulose in the hydrolysis unit. Cellulose in slurry form will be transported and heated using a screw conveyor SC-04 to an output temperature of 500°C with saturated steam at 1 atm pressure in reactor R-04. Inside the reactor, the slurry is mixed with a sodium acetate buffer solution (CH_3COONa) containing sodium azide (NaN_3) and cellulase enzymes. The sodium acetate buffer solution serves to maintain the pH of the solution at 4.8. The dose of cellulase enzyme used was 30 FPU g⁻¹. In addition, NaN_3 serves to remove contaminants that can damage enzymes. The equation for the hydrolysis reaction of cellulose can be seen in the equation below.



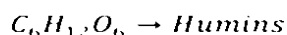
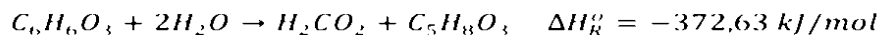
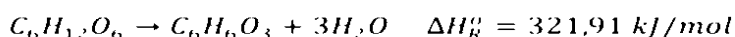
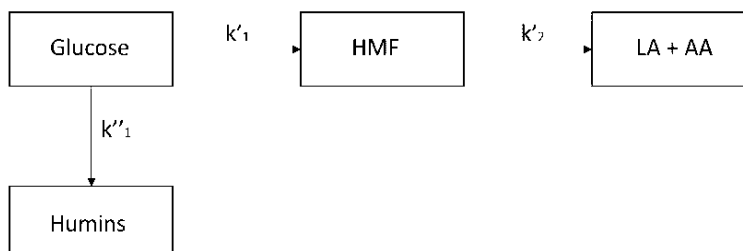
The reaction process runs in batches with a reaction time of 2 hours. When finished, the solution is then filtered using a filter F-04 to remove insoluble solids. After that, the solution will be cooled by the heat exchanger HE-04 using a propane cooler, and the pressure will be increased by the pump HP-01 until the pressure and temperature reach 3 atm and 30°C. Then, proceed to separate the glucose in the solution using a membrane filter MF-01. After that, the glucose solution flowed into the 5-HMF synthesis unit.

3.3. HMF Synthesis and Purification Process Stages

The third stage occurs in the 5-HMF synthesis unit. This process includes the formation of 5-HMF from glucose and product purification. The glucose solution from the hydrolysis unit is mixed with the salt solution in the mixer M-09 and then heated using a steam injector SI-01 until the temperature is 150°C and the pressure is increased to 10 atm. Before entering the R-05 reactor, the solution is mixed with an organic solution in the form of MIBK under the same operating conditions at a

pressure of 10 atm and a temperature of 150°C in mixer M-10. The schematic equation for the reaction can be seen below.

Table - Routes Reasi Glucose become HMF



The reaction was carried out using a biphasic NaCl/H₂O-MIBK system in a plug flow reactor R-05 at a temperature of 150°C and a pressure of 10 atm. The reaction is carried out in a biphasic manner to reduce the formation of side products in the form of levulinic acid and acetic acid, which react in the aqueous phase. Therefore, an organic phase solvent is needed to extract 5-HMF from the aqueous phase to the organic phase. Methyl Isobutyl Ketone (MIBK) was chosen because it has a partition coefficient value of the concentration of 5-HMF in the organic phase to the aqueous phase in a good equilibrium state. In addition, MIBK is an organic compound that is environmentally friendly. The addition of salt itself increases the value of the partition coefficient so that it can cause higher concentrations of 5-HMF, which can be in the organic phase (Mohammad et al., 2016).

After exiting the R-05 reactor, the water and organic phases were separated by the D-01 decanter. The top product from the D-01 decanter is an organic MIBK solution, then the temperature is lowered first to 40°C with a HE-06 heat exchanger, followed by a pressure drop of up to 1 atm with a DP-02 pump. The reason for lowering the temperature first is that at a temperature of 150°C and a pressure of 1 atm, the MIBK phase is vapour, which if that happens, will damage the pump. The bottom result is an aqueous phase solution; the pressure is reduced with the DP-01 pump to 1 atm, and the temperature with the HE-07 heat exchanger is up to 60°C,

followed by the HE-08 heat exchanger at 40°C. The cooling process with the HE-07 heat exchanger uses water cooling, while the HE-08 heat exchanger uses propane. After that, it was sent to the extractor EX-01 for extraction with MIBK organic solvent to extract the 5-HMF, which was still left in the liquid phase at a pressure of 1 atm and a temperature of 40°C. After extraction, the aqueous phase solution will flow to the utility, while the MIBK solution will be mixed with the results of the D-01 decanter in mixer M-11 and then flowed to the EV-01 evaporator.

The EV-01 evaporator functions to evaporate MIBK, and a high-purity liquid phase of 5-HMF will be obtained. The evaporation process was carried out at vacuum pressure and a temperature of 40°C. Vacuum pressure is created because 5-HMF is sensitive to heat. The top product from the EV-01 evaporator in the form of MIBK will be condensed in HE-09 using propane refrigerant and recycled for reuse in the feed reactor R-05 and extractor EX-01. The bottom product, in the form of 5-HMF, is flowed to the T-08 storage tank.

4. Material Specification

4.1. Raw Material

4.1.1. Water Hyacinth

4.1.2. Potassium Hydroxide (KOH)

Component	Percentage (%)
Cellulose	60,00
Hemicellulose	8,00
Lignin	17,00
Others	15,00

4.1.3. Sodium Azide (NaN_3)

Molecular Formula	NaN_3
Phase	Solid, Powder
Color	White
Molecular Weight	65,01 g/mol
Density	1,846 g/cm ³ (20°C)
Solubility	40,16 g/100 mL water (10°C, 1 atm) 41 g/100 mL water (17°C, 1 atm)
Flash Points	Non flammable
Melting Point	275°C
Boiling Point	N/A
Price (2022)	\$ 260,00/kg

4.1.4. Enzyme Cellulase

Cellulase enzymes are enzymes produced by fungi, bacteria, and protozoa which function to degrade cellulose into its monomers.

Molecular Formula	KOH
Phase	Solid, Crystal
Color	White
Molecular Weight	56,10 g/mol
Density	2,044 g/cm ³ (20°C)
Solubility	97 g/100 mL water (0°C, 1 atm) 178 g/100 mL water (100°C, 1 atm)
Flash Points	Non flammable
Melting Point	380°C
Boiling Point	1320°C
Price (2022)	\$ 0,60/kg

4.1.5. Niobium Phosphide Catalyst (NbP)

Molecular Formula	NbP
Phase	Solid, TetragonalCrystal
Color	Strong Grey
Molecular Weight	123,88 g/mol
Density	6,48 g/cm ³
Solubility	Insoluble in Water
Flash Points	N/A
Melting Point	N/A
Boiling Point	N/A
Price (2022)	\$ 2,00/kg

4.1.6. Water (H₂O)

Molecular Formula	H ₂ O
Phase	Liquid
Color	No Color
Molecular Weight	18,02 g/mol
Density	0,995 g/cm ³ (20°C)
Solubility	Completely Miscible
Melting Point	0°C
Boiling Point	100°C

4.1.7. Methyl Isobutyl Ketone (MIBK)

Molecular Formula	CH ₃ COCH ₂ CH(CH ₃) ₂
Phase	Liquid
Color	No Color
Molecular Weight	100,16 g/mol
Density	0,995 g/cm ³ (20°C)
Solubility	100 to 500 mg/100 mL water (70°F)

	Miscible with ethanol, ether, acetone, benzene. Miscible with most organic solvent
Flash Points	18°C (Closed Cup)
Melting Point	-84,7°C
Boiling Point	116,5°C
Price (2022)	\$ 320,00/kg

4.1.8. Sodium Chlorite

Molecular Formula	NaClO_2
Phase	Solid (crystal form)
Color	White
Molecular Weight	90,04 g/mol
Density	2,468 g/cm ³ (20°C)
Solubility	64 g/100 g water (17°C)
Flash Point	Non flammable
Boiling Point	180°C-200°C

4.1.9. Acetic Anhydride

Molecular Formula	$\text{C}_4\text{H}_6\text{O}_3$
Phase	Liquid
Color	No color
Molecular Weight	102,09 g/mol
Density	1,082 g/cm ³ (20°C)
Solubility	120 g/l (20°C)
Flash Points	53,89°C
Melting Point	-73°C
Boiling Point	139°C
Price (2022)	\$ 0,70/kg

4.1.10. Hydrogen Peroxide

Molecular Formula	H_2O_2
Phase	Liquid
Color	No color
Molecular Weight	34,015 g/mol
Density	1,71 g/cm ³ (20°C)
Solubility	1000 g/l (20°C)
Flash Points	Non flammable
Melting Point	-43°C
Boiling Point	1150,2°C
Price (2022)	\$ 0,50/kg

4.1.11. Sodium Acetate

Molecular Formula	$\text{C}_2\text{H}_3\text{NaO}_2$
Phase	Solid
Color	No color/white
Molecular Weight	82,03 g/mol

Density	2,17 g/cm ³ (25°C)
Solubility	119 g/100 ml water (0°C)
Flash Points	Non flammable
Melting Point	324°C
Boiling Point	-
Price (2022)	\$ 0,15/kg

4.1.12. Acetic acid

Molecular Formula	CH ₃ COOH
Phase	Liquid
Color	No color
Molecular Weight	60,05 g/mol
Density	1,0446 g/cm ³ (25°C)
Solubility	1000 mg/ml
Flash Points	44,4°C (open cup); 39°C (closed cup)
Melting Point	16°C
Boiling Point	118°C
Price (2022)	\$ 0,80/kg

4.1.13. Natrium Chloride (NaCl)

Molecular Formula	NaCl
Phase	Solid, Powder crystal
Color	No color/white
Molecular Weight	58,44 g/mol
Density	2,17 g/cm ³ (25°C)
Solubility	36 g/100 ml water (25°C)
Flash Points	Non flammable
Melting Point	800,7°C
Boiling Point	1465°C
Price (2022)	\$ 0,30/kg

4.2. Product

4.2.1. 5-HMF

Molecular Formula	C ₆ H ₆ O ₃
Molecular Weight	126,11 g/mol
Boiling Point	110°C 2,67 Pa), 114-116°C (133,32 Pa)
Melting Point	31,5°C
Density	1,2062 g/cc
Refractive Index	1,5627 (18°C)
Flash Points	79°C
CAS registry number	67-47-0
LogP (o/w)	-0,09
Price (2022)	\$ 200,00/kg

4.2.2. D-Glucose

Molecular Formula	C ₆ H ₁₂ O ₆
Molecular Weight	181,15 g/mol
Boiling Point	150°C
Density	1,5620 (18°C) g/cc
CAS registry number	105931-74-6
LogP (o/w)	-2,6
Price (2022)	\$ 5,00/kg

4.2.3. Xylose

Molecular Formula	C ₅ H ₁₀ O ₅
Molecular Weight	150,130 g/mol
Phase	Crystal Solid
Color	white
Boiling Point	153°C
Density	1,525 g/cc
Refractive Index	1,517
Solubility	1,17 g/ml H ₂ O
Price (2022)	\$ 5,00/kg

4.2.4. Furfural

Molecular Formula	C ₆ H ₄ OCHO
Phase	Liquid
Color	No color
Molecular Weight	96,08 g/mol
Boiling Point	161,7°C
Melting Point	-36,5°C
Flash Points	60°C (closed cup)
Density	1,1594 g/cc (20°C)
Solubility	Soluble in alcohol, ether; 8,3% soluble in water at 20°C
CAS registry number	67-18-6
Price (2022)	\$ 10,00/kg

4.2.5. Formic Acid

Molecular Formula	HCOOH
Phase	Liquid
Color	No color
Molecular Weight	46,025 g/mol
Boiling Point	101°C
Melting Point	8,3°C
Flash Points	69°C (closed cup) 58,89°C (open cup)
Density	1,2223 g/cc
Solubility	Miscible with water, ether, acetone, ethyl acetate, methanol, ethanol; partially soluble in benzene, toluene, xylene

CAS registry number	64-18-6
Price (2022)	\$ 0,46/kg

4.2.6. Levulinic acid

Molecular Formula	C ₆ H ₈ O ₃
Phase	Crystal Solid
Color	White
Molecular Weight	116,11 g/mol
Boiling Point	245,5°C
Melting Point	33°C
Density	1,136 – 1,147 g/cc
Refractive Index	1,439 – 1,445
Solubility	Soluble in water, alcohol, and oil
CAS registry number	123-76-2
Price (2022)	\$ 125/kg

UTILITIES

A. Water Supply and Treatment Unit

1. Water Requirement

1.1. Water For Public Use

Water for public purposes includes water needed to meet the needs of offices, laboratories, housing, and landscaping, with the following details (Ministry of Public Works and Public Housing, 2018).

Table - Details of Water Needs General

Water Needs	ToTAL KG/hour
Office With 500 Employees (100 L/Person/Day)	2083,33
Housing With 250 Family Head (1500 L/Family Head/Day)	15625,00
Garden (20% From Housing)	3125,00
Laboratory (80% From Office)	1666,67
TOTAL	22500,00
Overdesign 20%	27000,00

1.2. Hydrant Water

Water for hydrant needs is reserve water provided for firefighting needs. The water needed for this hydrant is situational and not continuous. It is estimated that the need for hydrant water is 20% of the general requirement, which is 5400 kg/hour. With an overdesign of 20%, the required water for the hydrant is 6480 kg/hour.

1.3. Cooling Water

Several process reactions at this HMF plant are exothermic, which will generate heat for the environment and potentially cause an increase in system temperature. Meanwhile, the operating conditions need to be kept stable so that the reaction can take place optimally. Therefore, it is necessary to have a coolant to prevent changes in operating conditions that affect it. In addition, cooling water will also act as a consideration for safety and control solutions if the operating temperature is too high or too low.

Table - Cooling Water Needs

Tools	cooling water needs kg/hour
r-02	13,8977
he-04	5.729,7676
he-07a	919.065
total	924808,6653

1.4. Water Process

The need for process water at this plant is to dissolve and dilute raw materials and wash, at RDVF.

Table - Process Water Requirements

Tools	Water Process Needs Kg/Hour
M-01	7,006,458
M-04	114,361,7
F-01	64,816,85
F-02	9,062,625
F-03	7,073,918
M-05	3,134,806
F-04	189,862,1
M-08	20,168,47
Total	415,486,9
Overdesign 20%	498,584,3

The need for process water is very crucial in the production process, so to overcome the shortage, process water is provided with an additional overdesign of 20% of the total calculated requirement. Therefore, the amount of process water that needs to be provided is 498,584.3 kg/hour.

1.5. Boiler Feed Water

This plant requires steam both as process steam and as a heater. To meet the steam requirement, demineralized water is needed, which will be used as boiler feed water.

Steam that has been used will not be completely recycled again, where only about 90% of the condensate will be recovered. Make up is needed to fulfil the missing needs.

Table - Summary Water Needs

Tools	Boiler Feed Water Needs Kg/Hour
HE-01	32,048,100
HE-02	249,336
SC-01	225,667
R-01	1,430,325
R-03	541,092
SC-04	48,55059
HE-03	167,6214
R-04	350,3048
SI-01	966,6199
HE-05	1,638,030
R-05	825,855
EV-01	32,064,13
Total	70,555,83
Overdesign 20%	84,666,990
Make up	8,466,699

2. Water Source

The factory is located in the Guntung industrial area, Bontang, East Kalimantan Province. The source of water for utility purposes in the form of water is obtained from sea water. The selection of this type of industrial water is based on the factory location, environmental conditions, and season. The selected water source is the Makassar Strait, considering the location of the factory, which is located in the Guntung Industrial Area, Bontang.

3. Water Processing

Seawater from the Makassar Strait is taken directly (direct intake) using a pipe. The seawater intake pipe is equipped with a strainer (screener) to prevent objects such as garbage, sewage, and fish from getting inside. The next stage is chlorination, which is carried out in the equalisation pond using sodium hypochlorite (NaClO). Chlorination is

carried out to kill bacteria and microorganisms so that biological fouling does not occur on the osmosis membrane. The water that enters the equalisation pond is also intended to maintain the stability of the river discharge, which will be further processed.

Furthermore, seawater is channelled into the sedimentation pond. In this sedimentation pond, silt and sand contained in seawater will be deposited by gravity. Water from the sedimentation pond is pumped into the clarifier for the process of settling colloidal particles using chemicals such as aluminium sulphate (alum) and soda ash. Solid or colloidal particles need to be removed because they can also cause fouling, so the clarifier uses coagulation and flocculation processes using a coagulant. The best and most frequently used coagulant is alum (Edzwald JK and Haarhoff J., 2011). Furthermore, the water coming out of the clarifier is pumped into the sand filter for the filtering process, using sand as the filter medium. After that, the water output from the sand filter is flowed into the carbon filter to purify the water and remove volatile organic compounds (VOCs) and odours from seawater. The carbon filter also functions to remove chlorine injected into the chlorination unit, so it is hoped that the water flowing towards the membrane will not experience oxidation because if the water still contains chlorine, the membrane material will oxidise. Then the water is pumped to reverse osmosis (RO) as the main tool in the Makassar Strait seawater desalination process. Seawater will be pumped at a pressure of 55 to 85 bar through the RO membrane. After passing through the membrane, the salt content in the water will be reduced by up to 99.7%, with RO recovery reaching 45% (Lenntech, 2016).

After passing through the RO, the permeate is stored in Storage Tank I, while the remaining brine is flowed back to the sea. From the storage tanks, some of the water is supplied to meet general needs and the needs of fire extinguishers (hydrants), and most of it is for cooling water, process water, and boiler-generated steam needs.

RO output water that will be distributed for general purposes is pumped and stored in the sanitation tank and for hydrant needs in the hydrant tank.

Water from Storage Tank I is pumped into the cold basin and used as cooling water. After being used for the cooling process, the water is collected in the hot basin before the cooling process is carried out in the cooling tower. The cooling tower's output water will flow back to the cold basin to be reused as cooling water. However, because during the cooling process in the cooling tower, evaporation occurs, the cooling tower output water is mixed with make-up water first.

In addition to cooling water, water from the water tank filter is also used as water for steam generators and is treated first before being processed into steam. The output water from the water tank filter, or Storage Tank I, is pumped to the cation exchanger and anion exchanger for the demineralization process. The output water of the anion exchanger is collected in the Demin Water Tank before being processed into steam in the steam generator unit. Water from the demining tank is pumped into the deaerator to remove its oxygen content. After that, water is converted into steam, and this process occurs in the boiler. Water from the demin tank is also channelled into the process water storage tank to meet process water needs.

The calculation is divided into the initial clarification section (including filtration and desalination), the process water section and boiler requirements, and the cooling water recovery section (cooling tower).

B. Generating Unit Steam

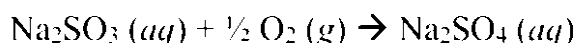
At this HMF plant, steam will be used as feed for the steam explosion and steam injector, as well as heat exchanger heaters and reactor jackets. There are 3 types of steam used: superheated steam with a temperature of 180°C (10 atm), 25 atm (337°C), and saturated steam at 100°C (1 atm). The main boiler produces 10 atm of saturated steam. Steam with a pressure of 1 psi will be obtained through expansion. The following are the stages of steam generation.

i. BFW Preparation Process

The water used as BFW is steam condensate and make-up water taken from demin water. The main process for BFW preparation is the deaeration process, which functions to remove O₂ and CO₂ content that causes boiler corrosion. In the deaerator, water undergoes a process of physically and chemically removing O₂. Physical deaeration occurs at the top of the water through forced O₂ stripping by steam. Chemical deaeration occurs underwater through the removal of O₂ by oxygen scavengers. The following chemicals are added in the preparation of BFW.

- **Oxygen Scavenger**

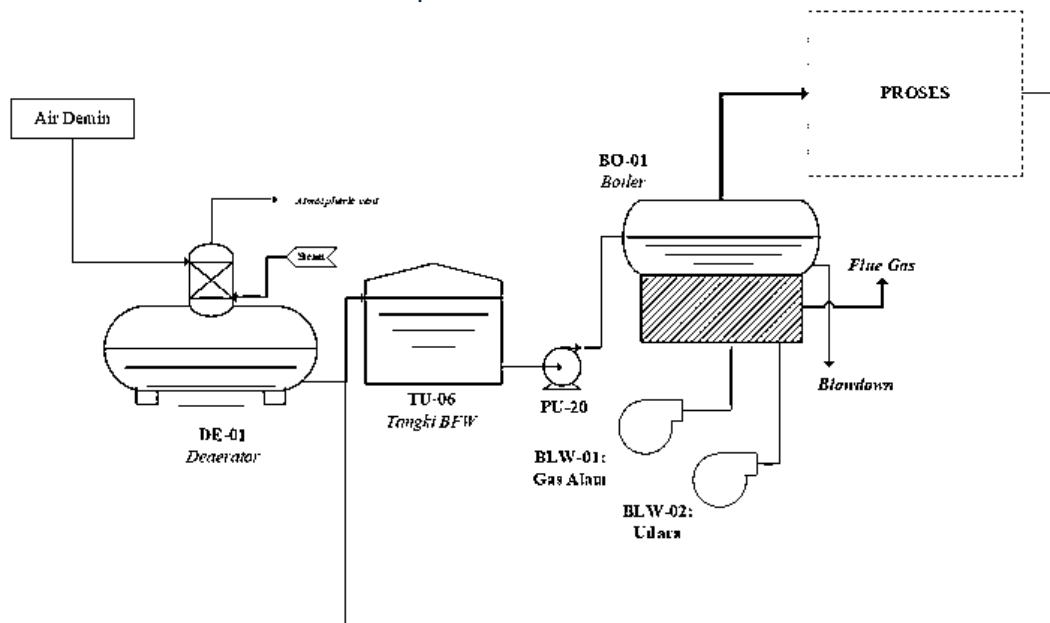
An oxygen scavenger is a reducing agent that can be oxidised by O₂. This material is injected into the economizer inlet to remove the remaining O₂ after the deaeration process. The material used is sodium sulfite (Na₂SO₃). Sodium sulfite reacts with O₂ to form sodium sulphate, which is non-corrosive.



- **Diethylaminoethanol**

Diethylaminoethanol is used to adjust the pH of BFW so that the pH is within the range of 9.5–11.5. Diethylaminoethanol is injected into the deaerator exit pipe.

Table - Preparation of Boiler Feed Water



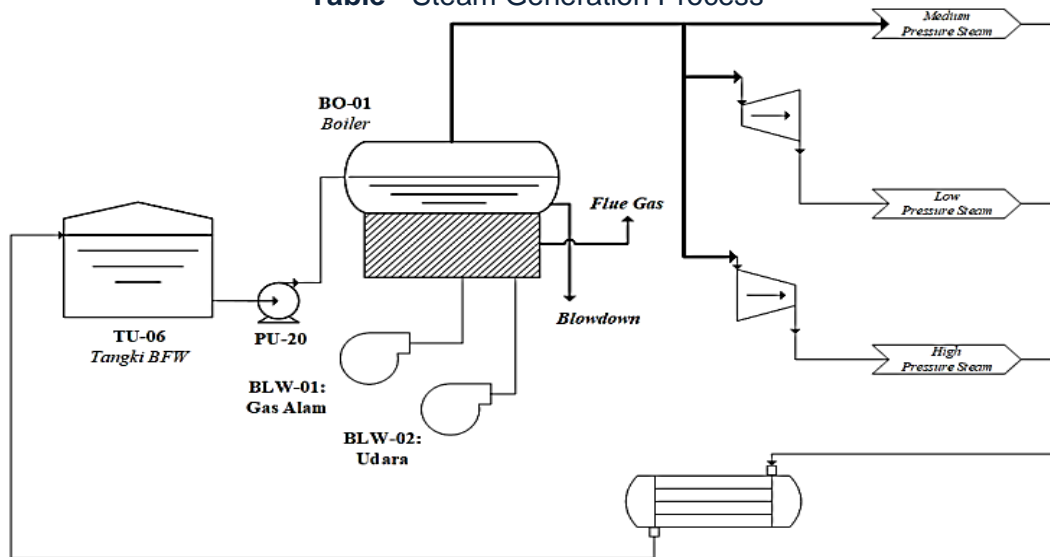
ii. Steam Generation Process

Water from the deaerator (boiler feed water) is put into the boiler. The heat from burning coal is used to convert water into steam. A burner is a tool used to inject fuel into the combustion chamber. The type of boiler used is a fire-tube boiler. Blowdown in the boiler is carried out to prevent the accumulation of total dissolved solids and total suspended solids, which are still contained in the water. If the amount of water blowdown current is very large, it will release a lot of energy from the system. Then the optimum blowdown rate is 5–10% boiler feed water.

The main boiler will produce 190°C (10 atm) of superheated steam. The steam requirement in the HMF factory process unit is divided into three based on the required steam specifications. Lower-pressure saturated steam with a pressure of 1 atm is required for process equipment HE-02, SC-01, R-03, SC-04, HE-03, R-04, R-05, and EV-01. Lower-pressure saturated steam will be obtained through expansion using a turbine. Medium-pressure steam with a pressure of 10 atm (180°C) is required for process equipment HE-01, SI01, and HE-05. This steam is flowed directly from the boiler, with the temperature

difference assumed to come from heat loss due to contact with air. Higher-pressure saturated steam of 25 atm (337°C) is required for the R-01 feed. Higher-pressure saturated steam will be obtained by isentropic compression using a compressor. The following are the stages of generation and steam.

Table - Steam Generation Process



iii. Fuel Needs

The type of boiler used is a Fire-Tube Boiler with gas fuel. The reason for this choice is because the product of the steam explosion is in the form of gas which has the potential to become gaseous fuel. The shortage and at the beginning of the establishment of the factory will be met by natural gas.

The heat requirement for saturated steam used in the production process is taken from the heat balance calculation in the previous report.

Total Steam Needs	84667 kg/hour 23,5186 kg/s
Energy Needs	$1,06 \times 10^0$ J/s
Q Boiler (efficiency 80%)	$(1,06 \times 10^0)/0,8 = 1,32 \times 10^0$ J/s
LHV	28 MJ/m ³
Biogas Needs	47,2 m ³ /s $1,63 \times 10^5$ kg/hour

C. Waste Management Unit

i. Waste Gas Management

The gas produced from this industrial process will be adjusted to the ambient air quality standard set by the government. The waste gas from this factory consists of CO_2 , CO , O_2 , N_2 which come from the combustion reaction of natural gas used in steam generator boilers. However, N_2 is assumed to be inert, which means it does not react with oxygen. Therefore, there is no further processing of the exhaust gas from this factory.

ii. Solid Waste Management

The solid waste from this factory comes from the septic tank. This waste is mixed with other sanitary wastes, which contain water, oil, detergent, soap residue, and others. This sanitation and office waste has separate channels from process waste. The waste from the septic tank will not be processed independently but will be drained periodically by outsiders from the factory.

iii. Liquid Waste Management

The plant's liquid waste comes from the production process and utility units. The list of factory effluents can be seen in the Table below.

Table - Waste List Factory

No	Process Waste
1	Cellulose
2	Hemicellulose`
3	Lignin
4	Glucose
5	Cellulase
6	KOH
7	Acetic Acid
8	Furfural
9	Peracetic Acid
10	NaCl
11	Levulinic Acid
12	Formic Acid
13	MIBK
14	IIMF

No	Process Waste
15	NaClO ₂
16	NaN ₃
17	Sodium Acetate
18	H ₂ O
Utility Waste	
19	Expired chemicals
20	LAB waste
21	Adsorbent waste
22	WWTP sludge
23	Waste lubricating oil
24	Waste resin
25	Dust

Before the waste is mixed in the equilizer column, waste that is categorised as toxic needs to be separated first. The following is a list of toxic waste produced by this factory and how to handle it.

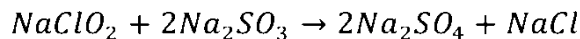
a. Furfural

At this factory, the furfural concentration that comes out of the F-01 filter is 3.16 grammes per litre. Based on the Safety Data Sheets (SDS) of furfural, the minimum concentration allowed so as not to poison marine life is 10 mg/l. Therefore, before mixing furfural in the equaliser column, it needs to be treated first. The furfural removal process from this current can be carried out by an adsorption process using activated carbon. After being adsorbed, the minimum concentration of furfural in the F-01 stream was 0.98 mg/litre.

b. Sodium Chlorite (NaClO₂)

The concentration of sodium chlorite that comes out of the F-03 filter is 28.196 grammes per litre. This figure exceeds the minimum concentration specified in SDS, which is 1 mg/L. Therefore, sodium chlorite needs to be removed first before being mixed in the equilibration pond. In addition, the presence of sodium chlorite can also kill bacteria in the anaerobic waste treatment process.

The process of removing sodium chlorite from this stream is carried out by reacting sodium chlorite with sodium sulfite in the following reaction.



Based on the above reaction, 78.57 kg of sodium sulfite is needed per day.

c. Sodium Azide (NaN_3)

The concentration of sodium azide leaving the membrane filter (MF-01) was 1.637 grammes per litre. Sodium azide (NaN_3) in water will form an azide ion, which is a compound with a high hazard to the environment and is very toxic to aquatic life in the long term. Therefore, the azide ion needs to be treated first before flowing into the equalisation column by reacting it with nitric acid.

After the toxic and biodegradable compounds have been removed, the streams are mixed in the equalisation pond. The steps for the waste water treatment process are as follows:

1. Bak Equalisation

Waste originating from the process unit and utility unit is mixed in the equalisation pond. In the equalisation pool there is a mixture of water and oil. The mixture leaving the equalisation pool is sent to the oil separator.

2. Oil separator

An oil separator functions to separate water and oil based on differences in density. Oil at the top flowed into the oil tank. When the oil tank is full, the oil is removed and then burned. The water at the bottom flows into the sedimentation pond.

3. Tank Flocculation

Before entering the flocculation tank, the pH level is calculated using a pH metre. If the pH of the waste is above 7.5, then hydrochloric acid will be added. If the pH of the waste is below 6.8, then sodium hydroxide will be added. This process aims to maintain the pH of a neutral solution.

The liquid waste is then added to alum as a flocculant. Stirring is also carried out in the tank to increase the efficiency of the flocculant particles in binding solids to the water.

4. Sedimentation Stage 1

Stage 1 of the sedimentation process aims to remove the formed floC. The remaining sediment will be removed by means of a pump from the belt press filter. This process will reduce the levels of total suspended solids (TSS).

5. Biological Treatment

The bacteria used in this waste treatment are *Bacillus subtilis*. This bacterium is of the anaerobic and suspended growth type, so a biodegester is used. Bacteria need nutrition in the form of TSP or ammonia.

6. Sedimentation Stage 2

Sedimentation stage 2 aims to separate the precipitate from the results of bacterial decomposition. The resulting precipitate will be flowed by pump to the Belt Press Filter. The resulting water separation can be used as treated water.

7. Belt Press Filter

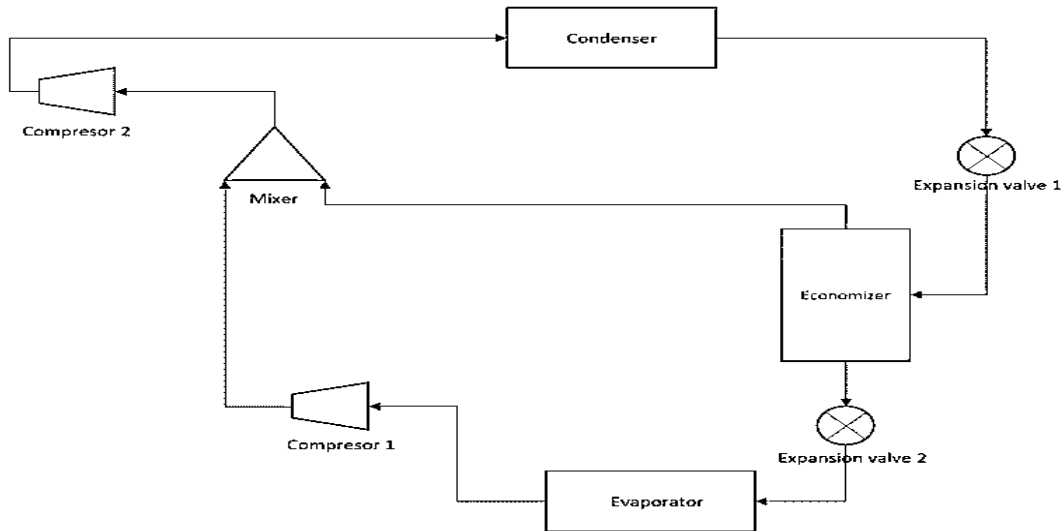
The Belt Press Filter is used to separate water and sludge produced by sedimentation stages 1 and 2. The solids resulting from the separation will be made into fertiliser while the separated water is returned to the equilisation pond.

D. Refrigerator Unit

The refrigerant used in the main process is liquid-phase saturated propane. Propane refrigeration systems are like most closed-cycle refrigeration systems. The liquid propane is condensed and then distributed to the heat exchanger so that it undergoes evaporation, and then the propane is compressed, cooled, and condensed using a seawater cooler once through. Before being returned to the sea, seawater is channelled through a pipe so that it has long enough contact with the air so that the water temperature becomes 40 °C (PermenLH No. 8/2009).

Process flow diagrams of simple forms and PH diagrams are shown in the following figure.

Table - Flow Diagram Of The Shape Process Simple Refrigeration Unit.

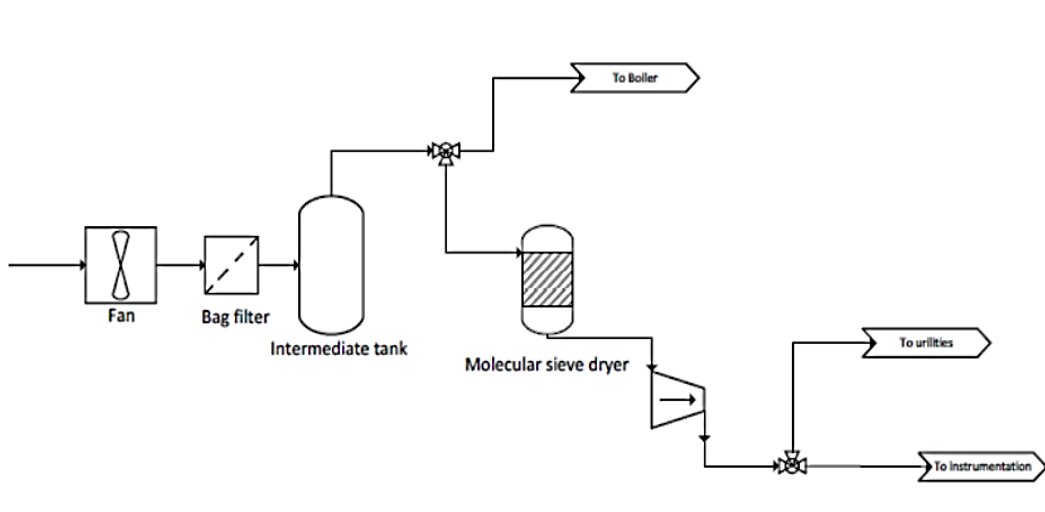


The mass of cooling water needed by this factory is 1214552.968 kg/hour.

E. Instrument Air Supply Unit

In general, compressed air is used as instrument air for various purposes in factories. Instrument air is used to move instrument tools that use a pneumatic system. The air used comes from environmental air that has been filtered with an air filter and then fed to the vessel. The total instrument air requirement is 500 m³/hour (STP condition).

Table - Flow Diagram of Air Supply Unit Process



1. Calculation of the drying vessel

Mass of instrument air requirement = 659.3406 kg/hour

Total air requirement = 2,534,376.3015 kg/hour

Vessel capacity = 6.4487 m³

With

Diameter = 1.6015 m

Height = 3.2030 m

2. Calculation of ideal compression power

Ideal W = 31.663 kW

Assuming 85% efficiency,

W real = 49.9523 hp

So for the NEMA standard, a compressor power of 50 hp was chosen.

F. Electrical Distribution Unit

Main process equipment electricity requirement : 350.5 hp

Utility equipment electricity requirement : 51333.5 hp

Total appliance electrical requirement = 51684 hp

Instrumentation electrical needs = 10%; total tool electrical needs = 5168.4 hp.

Supporting electricity needs = 25% total tool electricity needs = 12921 hp

The theoretical total electricity requirement is = 69773.4 hp.

Total actual electricity demand = 208,827,682 btu/hour

If there are obstacles from PLN in meeting total actual electricity needs, EDG made from fuel oil will be used. The calculation of fuel using EDG is as follows.

EDG = 208.827.682 btu/day

NHV = 136.887,2811 btu/gal US

Fuel Volume = 1525,545 gal US/hour

If it is assumed that the EDG efficiency is 85%, then the actual fuel requirement is 1,794.759 US gal /hour. To meet electricity needs for one month, 1,292,226.48 US gal of fuel is needed.

CONSIDERATION OF SAFETY, OCCUPATIONAL HEALTH, AND ENVIRONMENTAL ASPECTS

A. System Management Safety

The methodology for studying and implementing aspects of protecting the environment and maintaining health and safety in the workplace is called Safety, Health, and Environment (SHE). In short, this methodology takes into account the following 3 things:

1. Safety

Safety aspects in chemical processes include the identification and management of hazards originating from raw materials, supporting materials, equipment, waste, and products in the main process or utilities, process conditions, location, and factory layout.

2. Health

Aspects of occupational health and safety in the chemical industry can be seen based on the potential exposure to chemicals that can threaten workers in the factory environment or the community around the factory.

3. Environment

Environmental aspects when designing chemical plants need to be considered because of the potential hazards from factory waste that is discharged into the environment either directly or indirectly. The resulting impact can be in the form of natural sustainability to social impacts.

B. SHE Management Structure

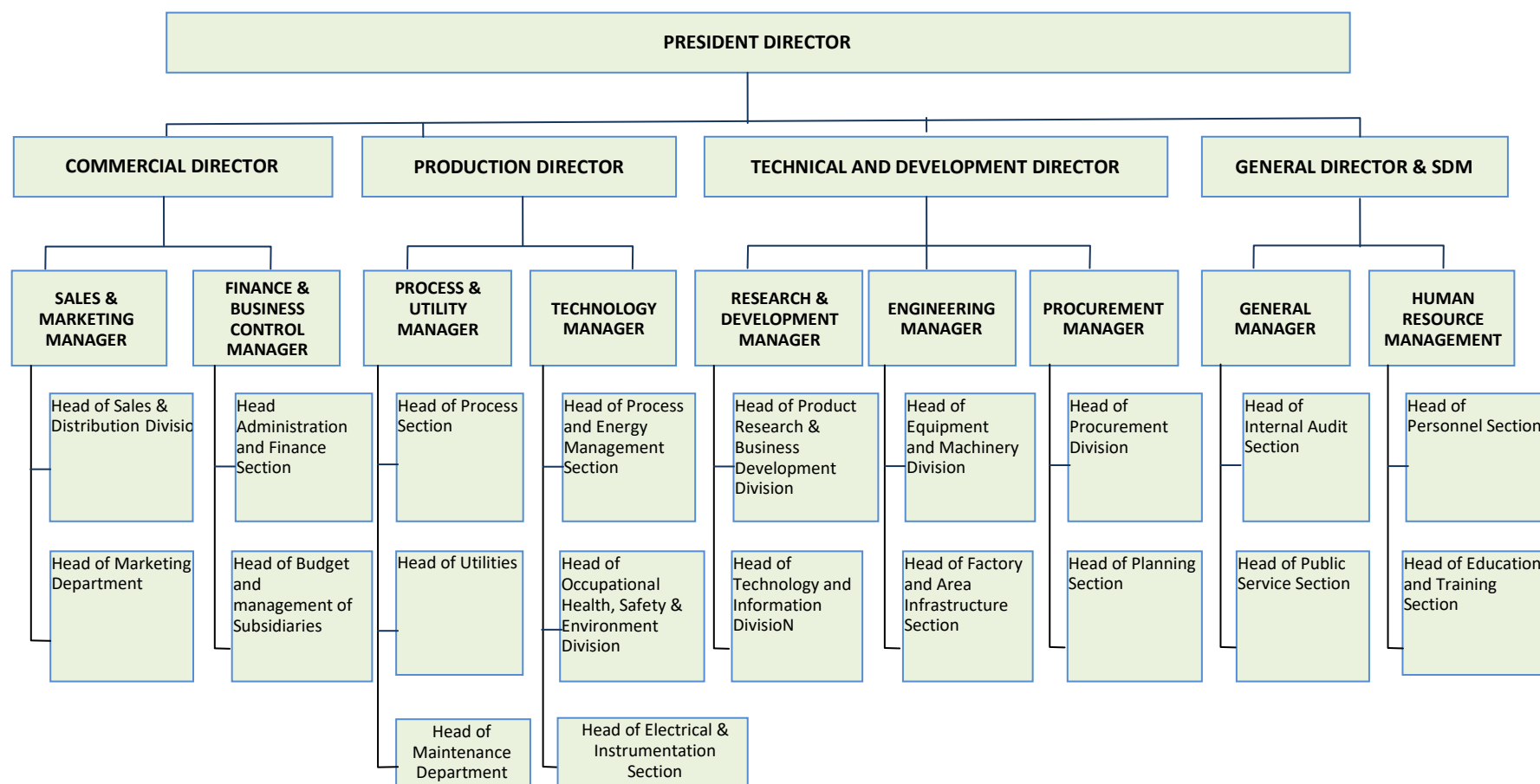
HMF Factory's organisational structure can be headed by a general manager. The general manager himself acts as the person in charge of the operation of the entire factory and supervises all managers in various fields. The general manager also reports directly to the senior vice president of operations. The HSE Manager oversees four section heads, whose job it is to coordinate each member based on their job description. The Environmental Section is in charge of managing matters related to the environment, starting from prevention, pollution, and pollution control. The Fire and Insurance Section is in charge of ensuring that there are no fire triggers that could cause a fire and handling them in the event of a fire. The Safety Section is tasked with ensuring that the work area at the factory is safe, creating, coordinating, and implementing programmes aimed at improving safety, running the on-site clinic, and preparing everything related to Accident First Response (P3K).

COMPANY ORGANIZATION

A. Chart Organization

In order to manage a company that is good and free from KKN, a clear and transparent organisational structure is needed. The organisational chart for this company can be described as follows:

Diagram - Organization HMF Factory



B. Details Task Each Part of the Structure Company Organisation

The HMF factory is a limited liability company (PT) that will be built in Bontang, Kalimantan. With this form of business entity, the amount of the company's capital will be listed in the articles of association. The capital is obtained from the sale of shares, for which the shareholder is responsible for fully depositing the amount stated in each share.

This factory chose the line and staff organisation type of organisation because the lines of authority are specific, simple, and practical. With this type of organisation, it is necessary to have expert staff from their fields who will provide ideas and advice to achieve company goals.

In its implementation, shareholders as owners of the company will be assisted by the Board of Commissioners. Meanwhile, the executive duties of running the company will be borne by the main director, who is assisted by the commercial director, production director, engineering and development director, and general director and HR director. The following details the duties and authorities of each part of the company's organisational structure:

1. Shareholders

Shareholders are company owners who are authorised to increase capital to establish and run the company. For companies in the form of limited liability companies, the highest authority is held by the General Meeting of Shareholders (GMS), which is a forum that provides 4,444 shareholders with the opportunity to receive information or reports about the company from both the Commissioners and Directors. Without the GMS, shareholders will not have power as owners of power.

2. Board of Commisioners

As the supervisory body for all company activities, the committee also has the authority to provide advice to the directors regarding the development of the company in accordance with company goals. The obligations and responsibilities of the Board of Commissioners are written in Article 114 (3) of the Companies Act as follows:

- a. Do supervision and provide advice to the Board of Directors so that all activity is in accordance with decisions that have been set in the Meeting of General Shareholders.
- b. There are no personal conflicts of interest on the Board of Directors. Good in a manner direct nor in a manner that directly can result in loss.

3. President Director

The President Director has the authority granted by the Board of Commissioners to formulate and determine the general policies and programmes of a company or organisation in accordance with the authority. In addition, the president director also oversees and supervises the director of production processes, the director of finance and marketing, and the general director.

The President Director has the responsibility to maintain corporate governance and organisational stability and to maintain good relations between shareholders, management, employees, and consumers. In addition, the President-Director also has the authority to appoint and dismiss section heads with the approval of the General Meeting of Shareholders.

4. Production Director

The Director of Production is the director who is responsible for all activities in the fields of process, production, maintenance, process, and management of energy, safety, occupational health, and the environment, as well as electricity and instrumentation. In addition, the production director is also responsible directly to the president director. His job is to lead the implementation of factory activities in the fields of process, production, operations on tools and materials, and employees who work during production.

5. Commercial Director

The commercial director is the director who is responsible for all activities in the fields of marketing, sales, and product distribution. Apart from being the commercial director, he is also responsible for financial planning. The Commercial Director is directly responsible to the President Director. His job is to lead the implementation of factory activities in the areas of marketing, sales, and product distribution.

6. Technical and Development Director

The Director of Engineering and Development is the director who is responsible for all activities in the fields of quality control and factory development. The Technical and Development Director reports directly to the Main Director. His job is to lead the implementation of factory activities in the field of quality control and factory development.

7. General Director and Human Resources

The Director of General Affairs and Human Resources is the director who is responsible for all activities in the audit process and the management of human resources. The Director of General Affairs and HR is directly responsible to the President Director. His job is to lead the implementation of factory activities in the fields of auditing and human resource management.

8. Operator

Operators are needed to make sure the tools work during production. According to Ulrich (1984), the calculation of the number of operators is based on the estimated operator needs for each tool, as follows:

Table – Operator Needs

No	Tools	Total (UnitS)	Operator (Unit/shift)	Operator/shift
1	Reaktor	5	0.5	2.5
2	Evaporator	1	0.3	0.3
3	Extraction Column	1	0.3	0.3
4	Dekanter	1	0.2	0.2
5	Heat Exchanger	9	0.1	0.9
6	Screw Conveyor	4	0.1	0.4
Utility				
1	Screener	2	0.05	0.1
2	Cation Exchanger	2	0.5	1
3	Anion Exchanger	2	0.5	1
4	Dearator	1	2	2
5	Boiler	1	1	1
6	Cooling Tower	1	1	1

No	Tools	Total (Units)	Operator (Unit/shift)	Operator/shift
7	Clarifier	1	0.2	0.2
8	Sand Filter	1	0.2	0.2
9	Carbon Filter	1	0.2	0.2
10	Reverse Osmosis	1	0.2	0.2
Total				11.5

From the calculation above, it is concluded that the need for operators is 12 people per shift. If there are four shifts in one day, then the number of operators needed is 48.

C. Classification Wages

Salary payments are paid on the 25th of each month. The payment system and employee salary classification can be seen in the table below:

Table - Employee Salary Classification

No.	Position	Total	Salary/person month	Total Salary month
1	President Director	1	70,000,000	70,000,000
2	Director	4	50,000,000	200,000,000
3	Manager	9	30,000,000	270,000,000
4	Head of Section	21	20,000,000	420,000,000
5	Head of Subdivision	3	15,000,000	45,000,000
6	Expert Staff	23	12,000,000	276,000,000
7	Staff	180	10,000,000	1,800,000,000
8	Technician	16	8,000,000	128,000,000
9	Shift Head	4	7,500,000	30,000,000
10	Operator	12	6,000,000	72,000,000
11	Analyst	4	5,000,000	20,000,000
12	Security	5	2,500,000	12,500,000
13	Cleaning Officer	30	2,500,000	75,000,000
TOTAL		312	238,500,000	3,418,500,000

D. Shifting Hours of Work

In order to support the division of labour, the company issues company regulations covering working hours, occupational health and safety, welfare, and social security. This rule is in accordance with the rules of the Ministry of Manpower of the Republic of Indonesia.

Based on working hours, employees can be divided into permanent employees and shift employees. The division of shift work aims to ensure the smooth operation of the factory and allows it to operate 24 hours a day. The factory operates 24 hours a day, 330 days a year.

a. Working Hours Employee Regular or Non-Shift

Regular employees are employees who work five days a week. Regular employees are not directly involved with production activities and/or factory supervision and security. Regular employees work from Monday to Friday and have holidays on Saturday, Sunday, and national holidays. The regular employee work schedule is as follows:

- a. Monday– Thursday : 09.00 – 16.00
Break : 11.30 – 12.30
- b. Friday : 09.00 – 16.00
Break : 11.30 – 13.00

b. Working Hours of Shifts employees

Shift employees are employees who work in a shift system in order to support factory production 24 hours a day. Shift employee working hours are set as follows:

- a. Shift 1 : 08.00 – 16.00
- b. Shift 2 : 16.00 – 00.00
- c. Shift 3 : 00.00 – 08.00

ECONOMIC EVALUATION

A. Calculation of Price Index

The index ratio calculation is performed to predict the price of equipment in the future. The HMF factory will begin construction in 2024, so it is necessary to estimate the price of equipment in 2024 using the Chemical Engineering Plant Cost Index (CEPCI). The following is a table containing CEPCI data for various years and a graph containing a linear equation for the year's relationship to the CEPCI value.

Table - CEPCI Values at Various Year

Year	CEPI	Year	CEPI	Year	CEPI	year	CEPI
1963	102.4	1978	218.8	1993	359.2	2007	525.4
1964	103.3	1979	238.7	1994	368.1	2008	575.4
1965	104.2	1980	261.2	1995	381.1	2009	521.9
1966	107.2	1981	297.0	1996	381.7	2010	550.8
1967	109.7	1982	314.0	1997	386.5	2011	585.7
1968	113.7	1983	317.0	1998	359.5	2012	584.6
1969	119.0	1984	322.7	1999	390.6	2013	576.3
1970	125.7	1985	325.3	2000	394.1	2014	576.1
1971	132.3	1986	318.4	2001	394.3	2015	556.8
1972	137.2	1987	323.8	2002	395.6	2016	541.7
1973	144.1	1988	342.5	2003	402.0	2017	567.5
1974	165.4	1989	355.4	2004	444.2	2018	603.1
1975	182.4	1990	357.6	2005	468.2	2019	607.5
1976	192.1	1991	361.3	2006	499.6	2020	596.2
1977	204.1	1992	358.2			2021	636.7

Obtained equality mathematics as following:

$$y = 9,4329x - 18434$$

Where,

x = year

y = *CEPCI*

Then with these equations, CEPCI calculations are performed as shown in the following table:

Table – CEPCI Calculation Result

Year	CEPCI
2021	628,522
2022	642,404
2023	656,286
2024	670,168

B. Fixed Capital Calculation

1. Calculation of Process Equipment and Utilities Prices

The prices for process equipment and utilities for the HMF Factory that have been calculated in reports T4a, T4b, and T5 are the prices for equipment in 2022, so it is necessary to calculate equipment prices for 2024. Based on the calculations made, the total price for the process equipment needed is \$43,285,629.99 and the total cost of the utility is \$10,802,768.70.

2. Calculation Of Land And Building Prices

The HMF factory was established in Guntung, Bontang, South Kalimantan so land and building price calculations need not be calculated based on existing data in Indonesia. The required land area is 30802 m² and the required building area is 18034.4 m². The total price of land and buildings is IDR 101,059,560,000.00.

3. Calculation of Labour in the Installation Factory

This HMF factory uses local workers; there are no foreign workers. The working time for one day is 8 hours. Local labour wages are calculated according to the City Minimum Wage (UMK) in Bontang City, which is Rp. 3,300,000.00 per person. For calculations, data on the wages of foreign workers is needed to convert the calculation of labour costs for foreign workers to local workers. The wage for foreign workers used is \$17.00 per man hour. Meanwhile, the ratio of the effectiveness of foreign workers to local workers is 1/3 (1 foreign worker equals 3 local workers). The calculations can be seen in the following table: Based on the calculations, the installation labour costs were Rp. 33,610,018,583.00; piping labour costs of IDR 38,861,583,986.60; instrument labour costs of IDR 6,301,878,484.31; and isolation labour costs of IDR 5,251,565,403.59.

4. Calculation of Fixed Capital

Calculation of Fixed Capital from the HMF Factory is carried out by estimating the value of each component other than the price of land and buildings against the results of calculating the price of the equipment. The calculation of Fixed Capital can be seen in the following table.

Table - Calculation of Fixed Capital

FIXED CAPITAL					
Item		Persentase		Value	
				\$	Rp
Delivered Equipment Cost	Purchased Equipment Cost Proses			43,554,374.92	
	Import Cost	15%	PEC	6,492,844.50	
	Entry Tax	5%	PEC	2,164,281.50	
	Transportation to location	5%	PEC	2,164,281.50	
Delivered Equipment Cost				54,107,037.49	
Installation	Material	11%	PEC	4,761,419.30	
	Labor	32%	PEC		33,610,018,583.00
Pemipaan / Piping	Material	21%	PEC	9,089,982.30	
	Labor	15%	PEC		38,861,583,986.60
Instrumentation	Material	24%	PEC	10,388,551.20	
	Labor	6%	PEC		6,301,878,484.31
Isolation	Material	3%	PEC	1,298,568.90	
	Labor	5%	PEC		5,251,565,403.59
Electrical installation		10%	PEC	4,328,563.00	
Land Purchase and Improvement	The land price				36,984,000,000.00
	Improvement	10%		The land price	3,698,400,000.00
Building and Equipment Costs price	Building				64,075,560,000.00
Utility	Tool Price			10,802,768.70	
	Import Cost	15%	PECU Dolar	1,620,415.31	
	Entry Tax	5%	PECU Dolar	540,138.44	
	Local Transportation	5%	PECU Dolar	540,138.44	
	Installation	40%	PECU Total	4,321,107.44	
Physical Plant Cost				112,620,098.04	188,783,006,547.51
Engineering Construction, and Supervision		20%	PPC	22,524,019.61	37,756,601,291.50
Direct Plant Cost				135,144,117.65	226,539,607,749.01
Contractor's Fee		5%	DPC	6,757,205.88	11,326,980,387.45
Contingency		10%	DPC	13,514,411.77	22,653,960,774.90
Fixed Capital				155,415,735.30	260,520,458,911.36

C. Calculation of Manufacturing Cost and Working Capital

Manufacturing cost calculations require data from the results of calculations for raw materials, products, and operator expenses. Based on these results, it can be used to estimate the values of other components needed. The calculation of working capital uses price data for raw materials and manufacturing costs with a vulnerable time per month. The calculation of manufacturing costs and working capital is shown in the following table.

Table – Calculation of Manufacturing Cost

Manufacturing Cost	Item	Persentase		Value	
				\$	Rp
Raw Material				587,963,736.66	
Labor					3,369,600,000.00
Supervision	10-25%	25%	Labor		842,400,000.00
Maintenance Cost	8-10%	10%	FC	15,541,573.53	26,052,054,891.14
Plant Supplies		15%	Maintenance		3,907,808,233.67
Royalties and Patents		3%	Sales	34,500,000.00	
Utilitas	Material prices per year			202,032,994.61	
Direct Manufacturing Cost				840,038,304.80	34,171,863,124.81
Payroll Overhead	15-20%	15%	Labor		505,440,000.00
Labor	10-20%	15%	Labor		505,440,000.00
Plant Overhead	50-100%	75%	Labor		2,527,200,000.00
Packaging and Shipping		3%	Sales	58,750,000.00	
Indirect Manufacturing Cost				58,750,000.00	3,538,080,000.00
Depreciation	8-10%	10%	FC	15,541,573.53	26,052,054,891.14
Property tax	1-2%	2%	FC	3,108,314.71	5,210,410,978.23
Insurance	1%	1%	FC	1,554,157.35	2,605,205,489.11
Fixed Manufacturing Cost				20,204,045.59	33,867,671,358.48
Total Manufacturing Cost				918,992,350.39	71,577,614,483.29

Table - Calculation of Working Capital

Working Capital				
Item	Persentase		Value	
			\$	Rp
Raw material Inventory	1 month	Raw Material	48,996,878.05	
In Process Inventory	1/4 day	Manufacturing Cost	673,478.05	54,225,465.52
Product Inventory	1 month	Manufacturing Cost	74,082,695.87	5,964,801,206.94
Extended Credit	1 month	Sales	95,833,333.33	
Available Cash	1 day	Manufacturing Cost	2,693,916.21	216,901,862.07
Working Capital			222,280,301.51	6,235,928,534.53

D. Calculation of General Expenses

General expenses are costs that need to be incurred for administrative matters and other costs outside the production process. This calculation is estimated using the value of sales. The sales value is the total sales of factory products. Since the product of this factory is only 5-HMF, the sales value equals the total sales of 5-HMF at \$1,150,000,000.00. The calculation of general expenses can be seen in the following table.

Table - Calculation of General Expenses

General Expenses					
Item		Presetase		Value	
				\$	Rp
Administration	2-3 %	3%	Sales	34,500,000	
Sales Expense	2-30%	5%	Sales	57,500,000	
Research	2-4%	3%	Sales	34,500,000	
Finance	0-10%	8%	FC + WC	30,215,691,03	21.340.518.195.67
General Expenses				156.715.691,03	21,340,518,195.67

E. Calculation of Sales and Profit

The total product sales from this factory are 5-HMF, with total sales of \$1,150,000,000.00. Meanwhile, the values for manufacturing costs and general expenses are \$954,287,950.94 and \$152,199,345.34 respectively, at an exchange rate of 1 dollar worth Rp. 36 of 2008. Concerning income tax, the corporate tax rate is set at 25%. Based on these data, the calculation of profit is as follows :

$$\text{profit before tax} = \text{sales} - \text{manufacturing cost} - \text{general expenses}$$

$$\begin{aligned} \text{profit before tax} &= \$ 1.150.000.000,00 - \$ 893.849.696,84 - \$ 158.163.885,28 \\ &= \$ 97.986.417,88 \end{aligned}$$

$$\begin{aligned} \text{profit after tax} &= \$ 97.986.417,88 - 0,25(\$ 97.986.417,88) \\ &= \$ 73.489.813,41 \end{aligned}$$

From these calculations, the profit after tax value is \$ 73,489,813.41 and the profit before tax is \$. 97,986,417.88.

F. Feasibility Analysis

The HMF plant from water hyacinth is classified as a high-risk factory. This is because of the following considerations:

- i. Factory This Has Not Yet Been in Indonesia
- ii. Proposed process use condition operation highest of 25 atm and a temperature of 233⁰c.

1. Return of Investment (ROI)

Return of Investment or ROI is the rate of return on capital per year. The equation for calculating ROI is as follows:

$$ROI_b = \frac{P_b}{FC} \times 100\%$$

$$ROI_a = \frac{P_a}{FC} \times 100\%$$

Where,

ROI_b = return of investment before tax

ROI_a = return of investment after tax

P_b = profit before tax

P_a = profit after tax

FC = fixed capital investment

So with this equation, the HMF factory ROI is as follows:

$$ROI_b = \frac{\$97.986.417,88}{\$173.094.985,63} \times 100\% = 56,61\%$$

$$ROI_a = \frac{\$73.489.813,41}{\$173.094.985,63} \times 100\% = 42,46\%$$

For the category of high risk pharmaceuticals, the minimum acceptable ROI before tax is 56% (Aries & Newton, 1955). The ROI before tax value is 56.61% so that the value is above the minimum limit.

2. Pay out time (POT)

Pay out time (POT) is defined as the minimum period of time (in years) theoretically required to return the initial investment capital. The equation for calculating POT is as follows:

$$POT_b = \frac{FC}{P_b + 0,1FC}$$

$$POT_a = \frac{FC}{P_a + 0,1FC}$$

Where,

POT_b = POT before tax

POT_a = POT after tax

So with the above equation, the POT of this factory is as follows:

$$POT_b = \frac{\$173.094.985,63}{\$97.986.417,88 + 0,1(\$173.094.985,63)} = 1,50$$

$$POT_a = \frac{\$173.094.985,63}{\$97.986.417,88 + 0,1(\$173.094.985,63)} = 1,91$$

In the category of high-risk pharmaceuticals, the maximum acceptable POT before tax is 2 years (Aries & Newton, 1955). This HMF factory still meets the maximum permitted requirements.

3. Lang Factor

The Lang factor is a constant obtained from calculating the ratio of fixed capital to the cost of purchased equipment. Mathematically, it is as follows:

$$L = \frac{FC}{PEC}$$

Where,

L = Lang Factor

PEC = Purchased equipment cost

FC = Fixed capital

So for this factory, the calculation of the Lang Factor value is as follows:

$$L = \frac{\$173.094.985,63}{\$43.285.629,99} = 3,999$$

From the calculation results, a Lang Factor value of 3.99 is obtained, which, according to Aries and Newton (1955), is the Lang Factor value for a solid-fluid plant of 3.63, so that the factory meets the conditions permitted to operate.

4. Break Even Point (BEP) and Shut Down Point (SDP)

The breakeven point (BEP) is the level of production capacity that provides a breakeven point between sales results and total production costs. If the capacity is below the BEP value, the factory will suffer losses, while if the capacity is above the BEP, the factory will make a profit. In addition, BEP can also be used as a parameter to determine whether or not a factory is attractive. In Indonesia, the attractive value is 40% BEP 60%. The lower the BEP value, the more attractive the factory is to build.

Shutdown Point (SDP) is a parameter that shows the production level of the factory. If a factory has a production level below the SDP value, then the factory should be closed.

To determine these values, the values of manufacturing costs and general expenses are combined, then categorised into 3 categories as follows:

- a. *Fixed Cost* (F_a)
Cost no annual affected level production.
- b. *Variable Cost* (V_a)
Cost comparable year straight with level production.
- c. *Regulated Cost* (R_a)
cost-dependent year with level production, however, no too sharp.

Due to the lack of data, the following assumptions are made:

- i. Value of total cost on capacity factory 0%, same with value 0.3 R_a .
- ii. Value of total cost on capacity factory is 100% the same as R_a value.

So that the BEP and SDP values are approximated by the following equation :

$$BEP = \frac{F_a + 0,3R_a}{S_a - V_a - 0,7R_a}$$

$$SDP = \frac{0,3R_a}{S_a - V_a - 0,7R_a}$$

Where,

BEP = break even point

SDP = shut down point

F_a = fixed cost

V_a = variable cost

S_a = sales 100% capacity

Calculation of the value of fixed costs, variable costs, and regulated costs can be seen in the following table:

Table – Calculation of Fixed Cost, Variable Cost, and Regulated Cost

Fixed Cost (Fa)	
Depreciation	\$ 17,309,498.56
Property Tax	\$ 3,461,899.71
Insurance	\$ 1,730,949.86
TOTAL	\$ 20,771,398.28
Variable Cost (Va)	
Raw Material	\$ 587,963,736.66
Packaging and Shipping	\$ 28,750,000.00
Utilities	\$ 202,032,994.61
Royalties and Patents	\$ 34,500,000.00
TOTAL	\$ 853,246,731.27
Regulated Cost (Ra)	
Labor	\$ 228,665.27
Supervision	\$ 57,166.32
Plant Overhead Cost	\$ 171,498.95
Operating Supplies	\$ 265,188.75
Maintenance	\$ 17,309,498.56
Laboratory	\$ 34,299.79
General Expenses	\$ 158,163,885.28
Payroll Overhead	\$ 34,299.79
TOTAL	\$ 176,264,502.73

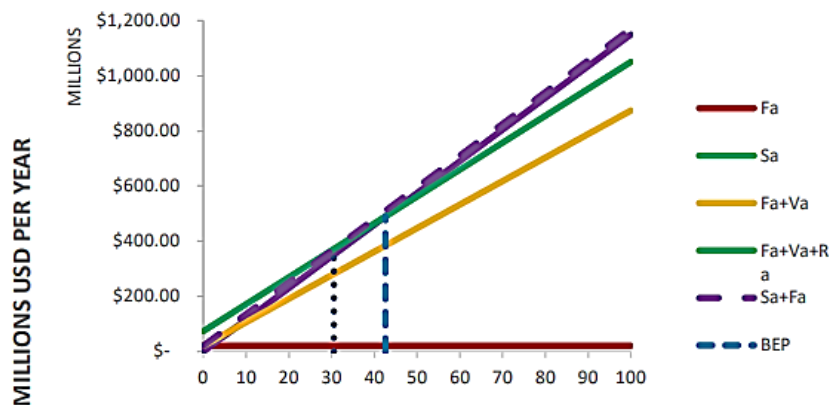
Then with these values the BEP and SDP calculations are obtained as follows:

$$BEP = \frac{\$20.771.398,28 + 0,3(\$176.264.502,73)}{\$1.150.000.000,00 - \$853.246.731,27 - 0,7(\$176.264.502,73)} \times 100\% = 42,48\%$$

$$SDP = \frac{0,3(\$176.264.502,73)}{\$1.150.000.000,00 - \$853.246.731,27 - 0,7(\$176.264.502,73)} \times 100\% = 30,50\%$$

Where visually it can be seen in the picture following:

Graph - BEP and SDP



Based on the picture above, a BEP value of around 43% is obtained, which, when compared with the results of calculating the BEP value, gives a value of 42.48%. Both of these results show that the BEP value is below the maximum value for a plant that is said to be attractive, namely 60%. In addition to the BEP value, the figure also shows that the SDP value is obtained at around 30%, which, when compared with the results of calculating the SDP value, gives a value of 30.50%. Based on these descriptions, this plant can be said to be interesting to study further.

5. Discounted Cash Flow Rate of Return (DCFRR)

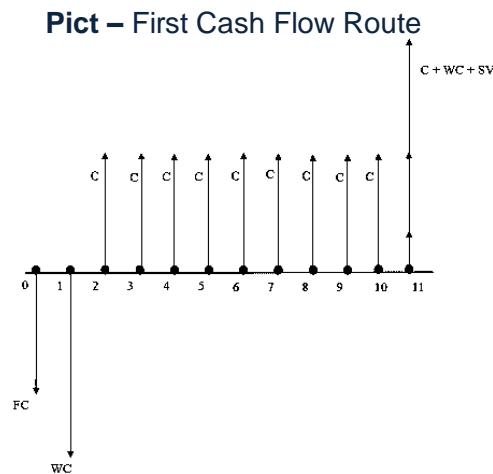
The discounted cash flow rate of return is a method that analyses the interest rate generated when the net present value is zero. The assumptions used in the DCFRR calculation are:

- Age economical factory = 10 years
- Annual profit and constant taxes every year.
- depreciation The same every year.
- The salvage value is taken at 0.1 FC.

The HMF factory will be established in 2024 for 2 years, so working capital does not need to be spent in the first year. Based on Towler & Sinott (2013) in general, in the first year, spending accounts for as much as 30% of fixed capital. Therefore, to be sure, a DCFRR analysis was carried out on two routes. The first route is the first year of spending fixed capital, and the second year is working capital. During the second route, namely the first year, 30% of fixed capital is spent, and then 70% of fixed capital and working capital in the second year. The DCFRR calculations for both are as follows:

i. First Route

The first route proposes that fixed capital is issued in its entirety at the beginning, then in the following year working capital is issued. The cash flow that describes this route is as follows:



Based on the picture above, the equation for calculating the DCFRR for this route is as follows:

$$FC + \frac{WC}{(1+i)^1} = C \left[\sum_{n=2}^{11} \frac{1}{(1+i)^n} \right] + \frac{WC + SV + C}{(1+i)^{11}}$$

Where,

FC = fixed capital

WC = working capital

C = annual cash flow

= profit after tax + finance + depreciation

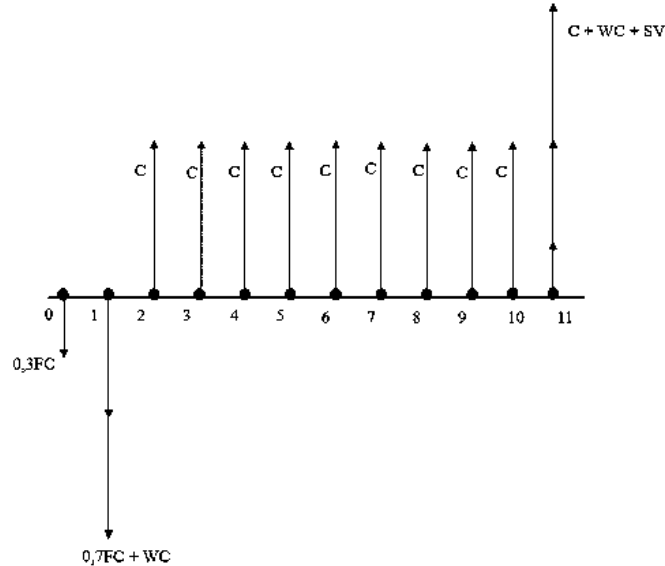
SV = salvage value = 0,1FC

i = DCFRR

So with trial and error , a DCFRR value of 26.46% is obtained.

ii. Second Route

The second route proposes that 30% of fixed capital is issued at the beginning, then in the following year working capital and 70% of fixed capital are issued. The cash flow that describes this route is as follows:

Gambar – Second Cash Flow Route

Based on the picture above, the equation for calculating the DCFRR for this route is as follows:

$$0,3FC + \frac{0,7FC + WC}{(1+i)^1} = C \left[\sum_{n=2}^{11} \frac{1}{(1+i)^n} \right] + \frac{WC + SV + C}{(1+i)^{11}}$$

Where,

FC = fixed capital

WC = working capital

C = annual cash flow

= profit after tax + finance + depreciation

SV = salvage value = 0,1FC

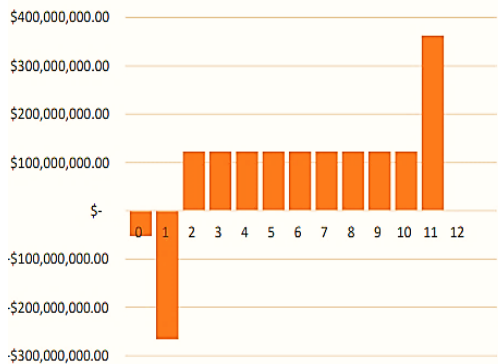
i = DCFRR

So, with trial and error, a DCFRR value of 28.78% was obtained.

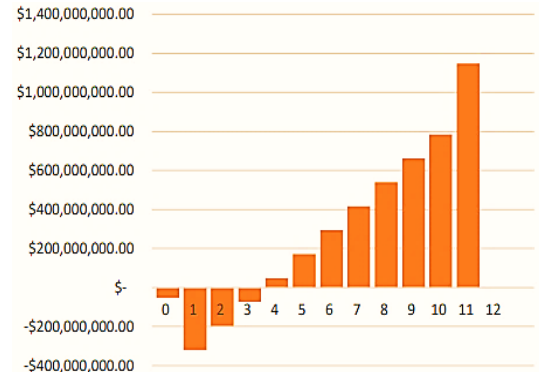
Based on the calculation of the DCFRR of the two routes, the second route was chosen because it has a greater DCFRR value than the first route. In addition, it can be seen that the DCFRR obtained was 28.78%, which is higher than Bank Indonesia's latest data rate, on May 24, 2022, of 3.5%, so that this factory can be considered economically profitable.

The cash flow if the selected rate is the same as the 2nd route DCFRR is shown in the figure below.

Graph - Factory Cash Flow HMF



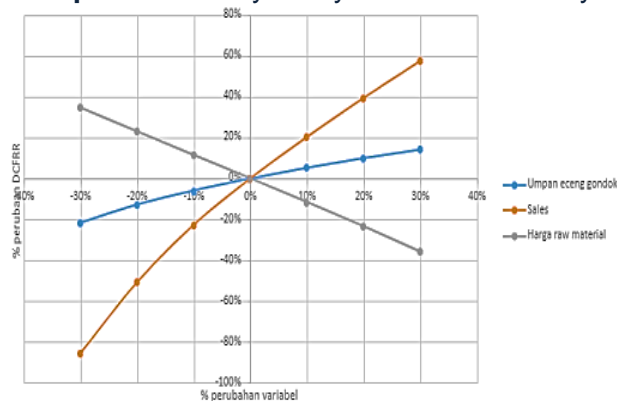
Graph - Factory Cash Flow Cumulative HMF



A. Sensitivity Analysis

Sensitivity Analysis is a method that can predict changes in DCFRR values as a result of changes in production parameters that affect system performance in generating profits. In this analysis, production parameters were selected in the form of water hyacinth feed capacity, sales, and raw material prices.

Graph - Sensitivity Analysis of HMF Factory



Based on the results above, it can be seen that the price of raw materials and sales are the factors that most influence the economic balance of this factory. The water hyacinth feed capacity is relatively stable. So from these results, the variables that need to be considered carefully are the price of raw materials and sales so that the factory does not go out of business.

CONCLUSION

Based on the feasibility analysis, the 5-Hydroxymethylfurfural plant from water hyacinth is included in the high-risk category with the results of the feasibility analysis calculation as follows:

Table - Summary Calculation of Feasibility Parameters Economy

No	Parameter	Value	Standar	Source
1.	<i>Return of Investment (ROI) before tax</i>	56,61%	Min 56%	Aries & Newton, 1955
2.	<i>Return of Investment (ROI) after tax</i>	42,46%	-	-
3.	<i>Pay Out Time (POT) before tax</i>	1,50 Year	Max 2 Year	Aries & Newton, 1955
4.	<i>Pay Out Time (POT) after tax</i>	1,91 Year	-	-
5.	<i>Break Even Point (BEP)</i>	42,48%	40% - 60%	Aries & Newton, 1955
6.	<i>Shut Down Point (SDP)</i>	30,50%	-	-
7.	<i>Discounted Cash Flow Rate of Return (DCFRR)</i>	28,78%	3,50%	Bank Indonesia (access 15 June 2022)

Considering the above values, this factory is economically feasible because it starts with the ROI before tax value, which meets the minimum value of 56%; the POT before tax value, which is not greater than the permissible value of 2 years; the BEP value, which has a vulnerability of 40%–60%; and a DCFRR value no greater than 1.5 Bank Indonesia interest.

Besides that, based on sensitivity analysis, to maintain the economic stability of the factory, it is necessary to pay close attention to the price of raw materials and sales from this factory. Therefore, based on the economic feasibility analysis, this factory deserves to be studied more deeply.

Source : Baha Tegar Ramadhan
Anyar Arqia Anugrah