INDONESIA'S MINERALS, COAL, AND GEOTHERMAL RESOURCES AND RESERVES 2021

MINISTRY OF ENERGY AND MINERAL RESOURCES REPUBLIC OF INDONESIA
GEOLOGICAL AGENCY
CENTER FOR MINERAL COAL AND GEOTHERMAL RESOURCES

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FOREWORD

By praising our God Almighty, I welcome the publication of the "Indonesia's Minerals, Coal and Geothermal Resources and Reserves 2021". This book is the third publication carried out by the Center for Mineral, Coal and Geothermal Resources, Geological Agency.

The presence of this book is very beneficial especially for the stakeholders and society in general, since this book encloses data and information on minerals, coal and geothermal resources and reserves throughout Indonesia. This book is expected to be a media of promotion in the development of the minerals, coal and geothermal sub-sectors in Indonesia as well as a basis to regulate the direction of national and regional policies.

Distinct form the publication of the previous book, this year there are several reviews on certain minerals that are included in critical minerals. In addition, the classification of coal is adjusted to the Indonesian National Standard 5051: 2019 and a review of geothermal potential as a resource that supports the energy transition.

In this occasion, I would like to express my gratitude and highest appreciation to the Geological Agency and the Center for Mineral, Coal and Geothermal Resources who have worked very hard in compiling this book. I believe that this book can provide more value to the society and it is a valuable contribution to the advancement of the energy and mineral resources sector in Indonesia.

May God Almighty always guide us in carrying out our following tasks in order to accomplish a better future for our nation.

Jakarta, January 2022
Minister of Energy and Mineral Resources

Arifin Tasrif

Indonesia's Minerals, Coal, and Geothermal Resources and Reserves
2021

PREFACE

Praise to the Almighty God, we are finally able to publish for the third time the book of the balance of resources and reserves of mineral, coal, and geothermal. Compilation and updating data for resources and reserves balance of mineral, coal and geothermal reserves are one of the functions of the Center for Mineral, Coal and Geothermal Resources (CMCGR) of the Geological Agency. We thank all parties who have assisted in the compilation and updating process so that the balance sheet can be completed and published smoothly.

In general, the amount of data recorded in 2021 for the balance of resources and reserves of minerals, coal and geothermal consist of; 2,611 metallic mineral data, 4,270 non - metallic mineral and rock data, 1,567 coal data, 70 coal bed methane data, 69 peat data, and 356 geothermal data. In terms of quantity, the main obstacle in preparing and updating this balance is that not all data from the Business Entity, especially the mineral and coal sector are available and can be inventoried, while in terms of quality not all data on resources and reserves on mineral and coal are verified by competent person.

Concerning this issue, every year we strive to improve the quality and quantity of data for minerals, coal and geothermal of national resources balance through coordination with other relevant agencies within the Ministry of Energy and Mineral Resources (MEMR) namely the Directorate General of Minerals and Coal (DGMC), Directorate General of Oil and Natural Gas (DGONG), Special Working Unit for Implementing

Upstream Oil and Gas Business Activities (SKK Migas) and Directorate General of New, Renewable Energy and Energy Conservation (Directorate General of EBTKE) including local governments. These efforts are made mainly to improve the data management on national resources and reserves of mineral, coal (including peat and coal bed methane) and geothermal, so that each year there is an increase in the amount of data successfully inventoried including data successfully verified.

Finally, it is our commitment to continually improve the quality and quantity of national data for mineral, coal and geothermal resources balance sheet. We hope that Indonesia's balance of resources and reserves for minerals, coal and geothermal still continue to present actual and quality data that can be used by various circles for the benefit of optimizing the utilization of resources and reserves of minerals, coal, and geothermal in Indonesia.

Bandung, January 2022
Head of Geological Agency
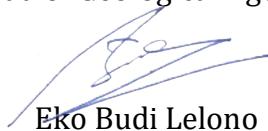
Eko Budi Lelono

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GLOSSARY OF TERMS

MINERALS AND COAL

Hypothetical resources are resources which quantity and quality are obtained based on the results of investigations at the review survey stage with low level of confidence and are needed for the purposes of the national inventory of natural resources by the Government.

Inferred resources are resources which quantity and quality can only be estimated with low level of confidence. Observation points with supporting data are not sufficient to prove continuity, density, shape, dimension, grade, mineral/coal content. Estimates of this confidence category may change significantly with further exploration.

Indicated resources are resources which quantity and quality are obtained based on continuous observation points, their density, shape, dimension, grade, mineral/coal content can be estimated with moderate confidence. Estimates of this confidence category can change significantly with detailed exploration.

Measured resources are resources which quantity and quality are obtained based on continuous observation points, their density, shape, dimension, grade, mineral/coal content can be estimated with high level of confidence.

Probable reserves are part of economically mineable indicated resources after the relevant adjustment factors are applied. It can also be a part of economically mineable measured resources yet containing uncertainty about any or all of the relevant modifiers being applied. .

Proven reserves are measured resources that economically mineable based on the mining feasibility study involving all adjustment factors.

General Investigation is the stage of mining activities to determine regional/general geological conditions and indications of mineralization, as well as to determine exploration target, potential areas or resources of minerals and/or coal.

Prospecting is the part of exploration activity to narrow areas containing potential mineral deposits using geological mapping methods to identify observation points through geochemical methods, geophysical investigations, trenching, well-test, drilling, and sampling, to obtain the shape and general dimension of minerals and to estimate inferred resources.

General exploration is the exploration stage to perform the initial delineation of an identified deposit. Methodology includes geological mapping, wide-range sampling, trenching and drilling for preliminary evaluation of the quantity and quality of a deposit. Interpolation can be carried out on a limited basis, based on the indirect method of investigation. The aim is to determine the geological description of a mineral

deposit, based on indications of distribution and initial estimates of; size, shape, distribution, quantity and quality as well as estimates of indicated resources from mineral deposits, along with information on the social condition and environment.

Detailed exploration is the exploratory stage to detailed 3-dimensional delineation of known mineral deposits from sampling outcrops, trenches, boreholes, shafts and tunnels. Sampling distances are such that the size, shape, distribution, quantity and quality and other characteristics of these mineral deposits can be determined with a high degree of accuracy, for the estimation of the measured resources of the mineral deposits as well as information on the social and environmental environment.

Total coal resources are the sum of inferred resources, indicated resources and measured resources to facilitate the delivery of resource data to the public.

Total mineral resources is the sum of inferred resources, indicated resources and measured resources to facilitate the delivery of resource data to the public.

Total reserves are the sum of probable reserves and proven reserves to facilitate the delivery of reserves data to the public.

An inclusive resource is a resource statement that includes reserve value in the resource.

An exclusive resource is a resource statement that separates the reserve value from the resource.

New data is information on the location and value of resources or reserves that have not been recorded in the previous year's database and are included in the current year.

Updated data is information on the location and value of resources or reserves that have been recorded in the previous year's database and underwent changes based on the latest reports for the current year.

Minerals are inorganic compounds formed in nature, having certain chemical and physical properties as well as regular crystal arrangements or their combinations that form rocks, either in loose or solid form.

Ore is a single mineral or a combination of several minerals contained in a mass or deposit that has economic value and is expressed in tonnage (wmt).

Wet weight (wet metric ton/wmt) is the ore tonnage which indicates the wet condition.

Dry weight (dry metric ton/dmt) is the tonnage of the ore which indicates the dry condition.

Tonnage is an expression of the amount of material expressed in units of measurement expressed in wmt/dmt weight or volume (m³).

Concentrate is a sand deposit containing economically valuable minerals (has been benefited through a separation process for iron sand) and is expressed in volume units.

Grade is the result of physical or chemical measurement of the characteristics of the desired material in the sample and is expressed in units of weight/weight (gr/ton, %) for primary deposits and weight/volume (kg/m³) for secondary deposits.

Metal is the result of multiplying dry ore (dmt)/concentrate by grade.

Main metallic minerals are metallic mineral commodities in ores that can be extracted for use.

Associated metallic minerals are other metallic mineral commodities which are associated with the main metallic minerals in the ore and can be extracted for use.

Crude/Unwashed Bauxite is the state of bauxite ore in nature before undergoing leaching.

Washed Bauxite is the condition of bauxite ore after undergoing washing.

Concretion Factor (CF) is the percentage ratio between the weight of Washed Bauxite to the initial weight of Crude Bauxite.

Coal is the result of accumulation of organic material originating from former vegetation that has undergone peatification and coalification as well as lithification. These materials have undergone compaction, chemical changes and metamorphosis processes by increasing heat during the geological period.

Coal Inventory is an in situ coal estimate that does not consider or does not pass a reasonable prospect test. This includes coal that currently has low prospects due to natural or cultural conditions that preclude mining.

Metallurgical Coal is coal that matches the characteristics in the market (eg. Platts index) namely Hard Coking Coal, Semi Hard Coking Coal, Semi Soft Coking Coal and Low Volatile PCI.

Coal basins are low areas in the earth's crust that are formed due to tectonic movements and where coal accumulates.

The calorific value is the energy contained in the fuel which is determined by measuring the heat generated by the total combustion of a certain amount. Expressed in units of cal/gr or kcal/kg.

Air Dried Basis (adb) is a data statement in an air dry basis, in this case the coal sample is analyzed after the moisture content is removed.

A competent person (CP) is a person who has the knowledge, ability, and experience to report exploration results, resource estimates, and reserve estimates for minerals and coal as evidenced by certificates of competence from professional organizations in accordance with the provisions of laws and regulations.

Registered IUP is a Mining Business Permit (IUP) which does not overlap in terms of licensing, has fulfilled the obligation to pay non-tax state revenues and has fulfilled technical and environmental obligations in accordance with the provisions of laws and regulations.

Unregistered IUP is an IUP which has overlapping licensing issues, problems with payment of non-tax state revenues and does not fulfill technical and environmental obligations in accordance with the provisions of laws and regulations.

PEAT

Peat is layer of soil, rich in organic matter (C-organic > 18%), with thickness of 50 cm or more. Peat is the forerunner of coal and has calorific value that can be used as an energy source.

Peat resource is the quantity of peat deposits estimated based on the location of occurrence, thickness and specific gravity, expressed in tons.

COALBED METHANE (CBM)

Coalbed Methane is methane gas (hydrocarbon) which is formed naturally in the process of coal formation (coalification). CBM is trapped and absorbed in the surface of the coal pores.

CBM resource is the quantity of CBM estimated based on data on coal thickness, area of potential and gas content resulting from CBM exploration, and has prospects for mining.

CBM reserves are the economically mineable part of CBM resources. The determination of reserves has taken into account technical (methods, technology) and non-technical (economic, infrastructure, social, environmental) factors which are economically ready for the development and production stages.

Gas content is the gas contained in coal sema, consisting of methane (CH_4), carbon dioxide (CO_2), ethane, hydrogen, nitrogen, and other gases. Generally, the gas in coal is dominated by methane.

CBM Concession Area (CBM CA) is a certain area within the Indonesian mining legal area which has government permits to carry out Exploration and Exploitation activities of CBM.

GEOTHERMAL

Geothermal is a source of heat energy contained in hot water, water vapor, and rocks along with associated minerals and other gases that are genetically inseparable in a geothermal system.

Exploration is a series of activity that include geological, geophysical, geochemical investigations, test drilling, and drilling of exploration wells with the aim of obtaining information on subsurface geological conditions in order to find and obtain estimates of geothermal reserves.

Geothermal Resources are geothermal potential consisting of speculative, hypothetical, and reserves whose amount and availability are determined by geoscience parameters that allow it to be extracted as an energy source.

Speculative resources are a class of resources whose energy potential is estimated based on observations of the geological conditions review and the estimated reservoir temperature.

Hypothetical resources are a class of resources whose energy potential is estimated by observing geological conditions, geochemical measurements, and geophysics that can at least

describe the lateral distribution of the reservoir and the estimated reservoir temperature.

Geothermal Reserves are part of resources consisting of possible reserves, probable reserves, and proven reserves, each of which potential and availability are determined by detailed geoscience parameters and proven by drilled well data that allows extraction as an energy source in the present day.

Possible reserve is a class of reserves whose energy potential is calculated based on the results of geological, geochemical, geophysical, and/or temperature slope wells so as to describe the conceptual geothermal model and estimate the dimensions and characteristics of fluids and rocks reservoir.

Probable reserve is a class of reserves whose energy potential is calculated based on the results of geological, geochemical, geophysical and/or temperature slope wells and minimum of 1 (one) exploration well so as to prove the conceptual geothermal model and estimate the dimensions and characteristics of fluids and rocks reservoir.

Proven reserves are a class of reserves whose energy potential is calculated based on the results of geological, geochemical, geophysical, and/or temperature slope wells and a minimum of 3 (three) exploration wells of which at least 1 (one) well has successfully drained fluid so that it can be detailed validate the

geothermal model including the dimensions and characteristics of fluids and rocks reservoir.

Electric megawatt (MWe) is unit of electrical power converted from unit of thermal power.

Preliminary Survey is an activity that includes the collection, analysis, and presentation of data related to information on geological, geophysical and geochemical conditions, as well as a temperature slope survey if necessary, to estimate the location and existence of geothermal resources.

Preliminary Survey Assignment (PSP) is an assignment given by the Ministry to carry out preliminary survey activities.

Preliminary Survey and Exploration Assignment (PSPE) is an assignment given by the Ministry to carry out preliminary survey and exploration activities.

Geothermal Permit (IPB) is a permit to conduct geothermal exploitation for indirect use in certain Working Areas (WK).

1. INTRODUCTION

Geologically, Indonesia has various potential geological resources including minerals, coal and geothermal resources. In Indonesia, various types of minerals can be found, both metallic minerals including gold, silver, copper, nickel, tin, zinc, iron, aluminum and rare earth metals, as well as non-metallic minerals and rocks such as limestone, kaolin, zircon, phosphate, gypsum and potassium bearing rocks. Almost all objects used in modern life have mineral elements as raw materials. Minerals play a major role as raw materials in various types of industries including the environmentally friendly energy industry and electric batteries, manufacturing industry, defense industry, chemical industry, transportation industry, and agricultural industry.

One of the energy sources owned by Indonesia and has long been used as a capita for national development is coal. Coal is easy to mine and produces cheap electrical energy. Until now, most of the power plants in Indonesia still use coal as their energy source. Coal can also contain Coalbed Methane (CBM) gas. If successfully exploited, the gas can be used as an energy source equivalent to conventional natural gas. Compared to coal, CBM produces much less CO_2 emissions, so it is a more environmentally friendly energy source. With the decline in conventional oil and gas reserves and environmental issues related to the use of coal, the use of CBM is expected to reduce dependence on coal and also conventional oil and gas. Apart from coal and CBM, Indonesia is also rich in peat resources. Geologically, peat is the forerunner of coal. Because the age of

formation is still very young, peat has lower calorific value and higher water content than coal. In some countries, peat has long been used as an energy source. Although currently peat in Indonesia has not been utilized as an energy source, it is important for the Government to know the potential of peat in Indonesia, especially so that peat can be used for other strategic purposes other than energy sources.

Geological conditions also allow Indonesia to have a very large amount of geothermal resource potential, so that Indonesia is known as one of the largest geothermal producing countries in the world. Geothermal is a renewable energy that is environmentally friendly. With its great potential, geothermal is expected to play a significant role in the national energy mixed and be able to reduce dependence on fossil energy.

As a country with a population of more than 273 million people (status of December 2021, BPS 2022), Indonesia needs reliable energy security and energy policies that are oriented towards sustainable energy supply and increasing accessibility and diversification of energy. Meanwhile, the sustainability of national development also depends on the supply of various types of minerals both for domestic consumption, increasing added value and for export in order to increase state income. Therefore, accurate data on the number of resources, reserves, and production of minerals, coal, and geothermal will be very helpful in making various national policies related to energy use and mineral utilization.

The legal basis for compiling the balance sheet of mineral, coal and geothermal resources by the government, in

general is the 1945 Constitution Article no 33 which mandates that the natural wealth contained in Indonesia's territory is controlled by the state and used as much as possible for the prosperity of the people. Another legal basis is Law Number 3 of 2020 concerning amendments to Law Number 4 of 2009 concerning Mineral and Coal Mining article 6 paragraph (1) states that the Central Government in mineral and coal management has the authority to prepare the balance of mineral and coal resources in national level. Meanwhile, Law Number 21 of 2014 concerning Geothermal Article 6 paragraph (1) states that the government's authority in implementing geothermal activities includes inventory and preparation of the balance of geothermal resources and reserves. Other laws and regulations that support the activities of preparing the balance sheet for mineral, coal and geothermal resources are Law Number 23 of 2014 concerning Regional Government, and Government Regulation Number 23 of 2010 concerning the Implementation of Mineral and Coal Mining Business Activities, as well as Regulation of the Minister of Energy and Mineral Resources Number 7 of 2020 concerning procedures for granting permit areas and reporting on mineral and coal mining business activities of the Ministry of Energy and Mineral Resources (State Gazette of the Republic of Indonesia of 2020 Number 220).

In realizing the mandate of legislations above, the Geological Agency through the Center for Minerals, Coal and Geothermal Resources (CMCGR) as stated in the Minister of Energy and Mineral Resources Regulation No. 15 of 2021 concerning the Organization and Work Procedures of MEMR

has duties and functions, one of which is in the preparation and updating of the national balance sheet data for minerals, coal, and geothermal resources and reserves. The preparation and updating of the balance sheet data is one of the efforts to make inventory and also to update data on the potential wealth of national energy and mineral resources.

2.   DATA COLLECTION AND UPDATING METHODOLOGY

2.1.   DATA SOURCE

The source of data in the preparation of the National Coal and Geothermal Mineral Resources and Reserve Balance come from the results of investigation activities carried out by the government (in this case CMCGR - Geological Agency, BATAN, and local governments), data originating from the results of exploration and exploitation activities of Business Entities, including minerals and coal Contracts of Work (KK), Coal Mining Concession Work Agreements (PKP2B), mineral and coal Mining Business Permits (IUP), mineral and coal Special Mining Business Permits (IUPK), CBM Working Areas, Geothermal Permits (IPB) , Assignment of Preliminary Survey (PSP) and Assignment of Geothermal Preliminary Survey and Exploration (PSPE) (Figure 1).

Figure 1. Data Source of Balance for Mineral, Coal and Geothermal Resources

2.2.   DATA COLLECTION AND UPDATING FLOW

To compile the balance of mineral, coal, and geothermal resources and reserves, the following steps are carried out (Figure 2, Figure 3 and Figure 4):

1) The Geological Agency through CMCGR conducts an inventory of data and information on mineral, coal and

geothermal resources and reserves both from investigation reports conducted by the government and Business Entities holding such as KK/PKP2B/IUP/ IUPK/WK/IPB/PSP/PSPE. Especially for peat, because peat in Indonesia has not been cultivated, the resource data only comes from the results of the investigation activities carried out by the CMCGR.

2) To improve the quality of data on the balance of mineral, coal and geothermal resources, CMCGR carries out data reconciliation activities for the results of business entities' activities in collaboration with the Directorate General of Mineral and Coal (DG Minerba) for mineral and coal commodities, the Directorate General of Oil and Gas (Directorate General of Oil and Gas) and the Special Task Force for Upstream Oil and Gas Business Activities (SKK Migas) for CBM commodities, and the Directorate General of New Renewable Energy and Energy Conservation (DG EBTKE) for geothermal commodities. The success of capturing more data on resources, reserves and production of minerals, coal, CBM and geothermal owned by Business Entities is expected to provide a more accurate picture of the total wealth of mineral and energy resources (coal, CBM and geothermal) owned by Indonesia and its utilization/reduction.

3) The data that has been successfully inventoried is then processed and inputted into a database of mineral, coal (including CBM and peat) and geothermal resources owned by CMCGR. In addition to input new data,

updates are also carried out, namely updating data on mineral, coal, CBM and geothermal resources with the latest data released by Business Entities holding the permits of KK/PKP2B/ IUP/ IUPK/IPB/PSP/PSPE/WK.

4) The updated mineral, coal and geothermal resources balance data is then tabulated and integrated into a web-based Geographic Information System (webGIS) database and potential maps of mineral, coal and geothermal resources. The data is also integrated into the Geological Resources of Indonesia Mobile Application (GeoRIMA), which is an android-based application owned by CMCGR that presents data on Indonesia's mineral, coal and geothermal potential.
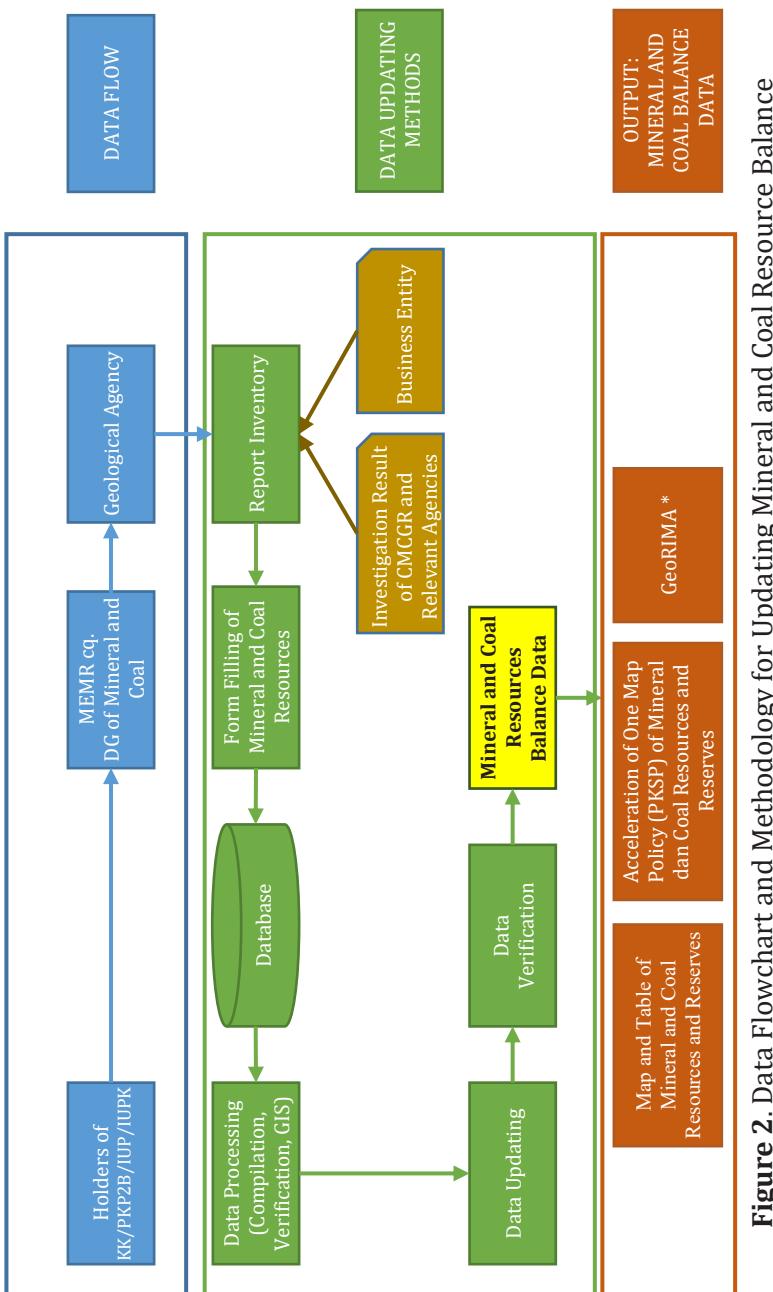
Figure 2. Data Flowchart and Methodology for Updating Mineral and Coal Resource Balance
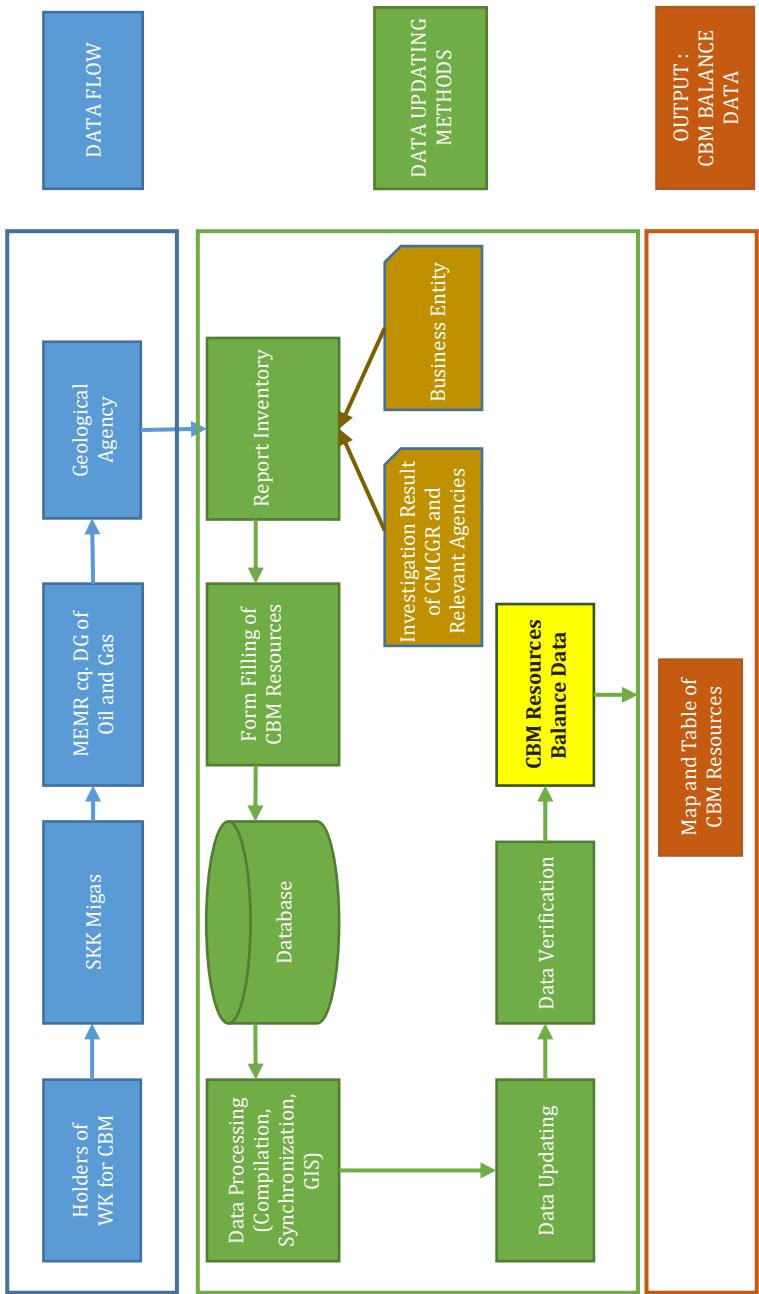
Figure 3. Data Flowchart and Methodology for Updating CBM Resources
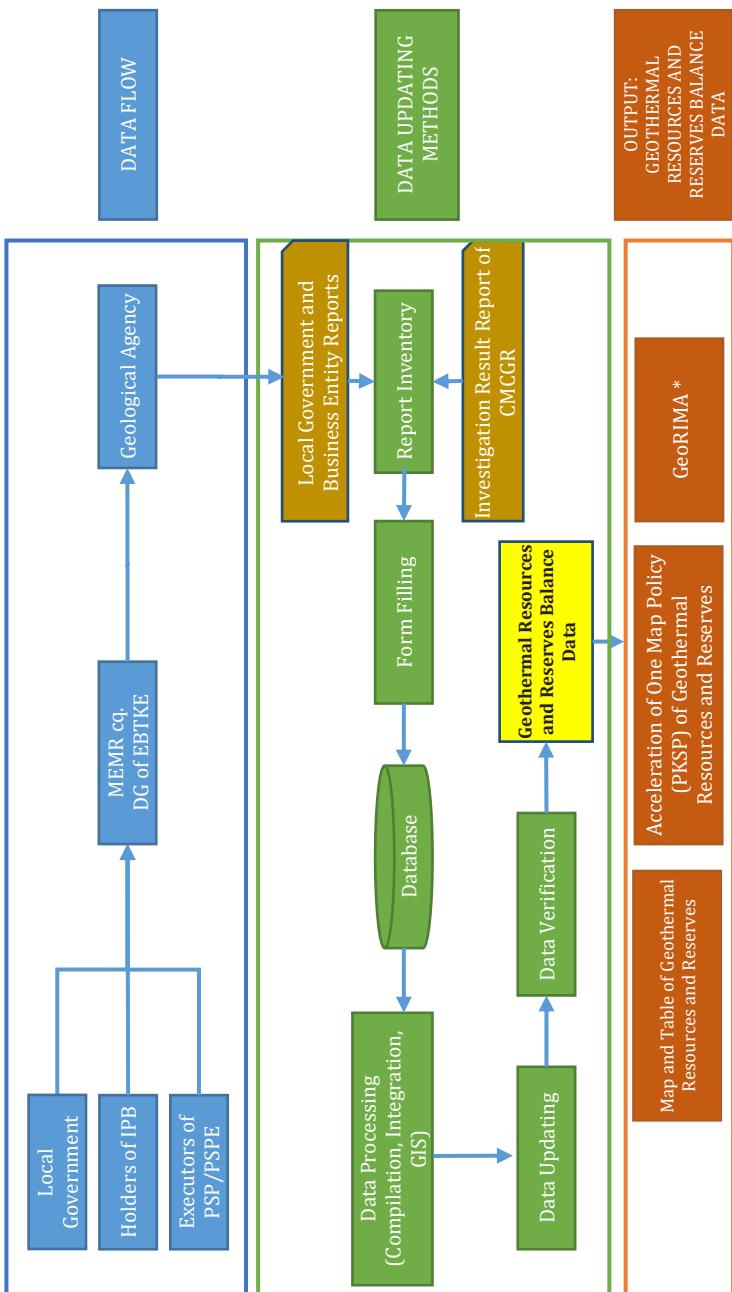
Figure 4. Data Flowchart and Methodology for Updating Geothermal Resources

3. BALANCE OF MINERAL, COAL, AND GEOTHERMAL RESOURCES AND RESERVES

3.1. MINERAL RESOURCES

In the activities of compiling and updating mineral resource and reserve data, CMCGR divides mineral resources into two groups, namely metallic mineral resources and non-metallic mineral resources and rocks. The classification of mineral resources and reserves refers to SNI 6728:4 of 2015 concerning the Preparation of the Spatial Balance of Natural Resources - Part 4: Mineral and Coal Resources and Reserves, and SNI 4726 of 2019 concerning guidelines for reporting the results of exploration of mineral resources and reserves.

Metallic and non-metallic minerals have differences in tabulation appearance. Metallic mineral tonnage tabulation consists of several columns, including ore/concentrate, metal grade and content, even in some commodities the ore tonnage is further divided into wet ore and dry ore. This reflects the condition of the ore in nature in a wet state, then the ore is analyzed in dry conditions to determine the metal grade.

From the results of the data inventory, not all companies report the moisture content or dry ore tonnage, so assumptions are needed to fill in the data. Based on an agreement with several stakeholders in 2020 and the average water content in several prospect locations, data assumptions are made for nickel ore, primary gold ore and bauxite ore, moisture content in nickel ore is 30%, gold ore 15% and bauxite ore 15% respectively .

Starting this year, the inclusion of bauxite ore starts from crude bauxite which is then washed into washed bauxite and the ratio of washed and crude bauxite is called the concretion factor. Some companies include concretion factors in their reports, but many more companies do not, so the data for concretion factors is assumed to be 50%. Washed bauxite that has been dried is analyzed for Al_2O_3 content and other mineral/element content, so that the alumina (Al_2O_3) content in bauxite ore is the product of grade with dry washed bauxite ore.

Notes for improving the preparation of mineral resource and reserve data in 2020 that have not been implemented in 2021 is the uniformity of resource reporting. Currently in Indonesia, most business entities holding KK/IUP/IUPK minerals report their resources inclusively, although it is not stated explicitly but there are still those who report their resources exclusively. This non-uniformity has resulted in the recapitulation of indicated and measured mineral resources being less accurate. It is hoped that in the coming years this will be implemented.

3.1.1. METALLIC MINERAL RESOURCES

In 2021, data updates have been carried out at 403 locations and additional data for 108 new locations (Figure 5). For the 2021 status, the number of metallic mineral locations will be 2,611 points. The main data source for updating activities comes from the report on the activities of the Business Entity. To date, out of 787 from a total of 1425

IUP/IUPK/KK have been inventoried whose resources and/or reserves data are recorded in the metallic mineral resources and reserves database (55.23%), but the data presented have not been separated between verified and unverified data by CP. The number and percentage of IUPs for various commodities that have reported resource and reserve data are presented in Table 1. The data was obtained from the overlapping spatial maps of the location of resources and metallic mineral reserves with valid KK/IUP/IUPK data (status of October 2021) .

Table 1. Percentage of Total IUP/IUPK + KK Accompanied by Resources and Reserves Data

No.	Commodity	Number of IUP/IUPK/KK	Number of IUP/IUPK/KK with resources and reserves	Percentage(%)
1	Antimony	3	3	100.00
2	Bauxite	101	71	70.30
3	Iron	107	78	72.90
4	Gold	152	85	55.92
5	Chromite	9	2	22.22
6	Manganese	88	41	46.59
7	Molybdenum	7	0	0.00
8	Nickel	337	203	60.24
9	Iron Sand	34	18	52.94
10	Copper	25	13	52.00
11	Tin	531	254	47.83
12	Lead/Galena & Zinc	20	13	65.00
13	Tungsten	1	0	0.00
14	Other Metals	10	6	60.00
	Total	**1,425**	**787**	**55.23**

Source : Ditjen Minerba , October 2021

In 2021, several commodities underwent additions and/or data updates, resulting in changes in the number of

resources and the amount of reserves compared to 2020 (Figure 5). Some mineral commodities that have not changed compared to 2020 and the amount of data are; mercury (5), antimony (3), platinum (4), sedimentary iron (6), chromite placer (10), molybdenum (7), titan laterite (19), vanadium (1), monazite (48) and xenotim (5) (Figure 5).
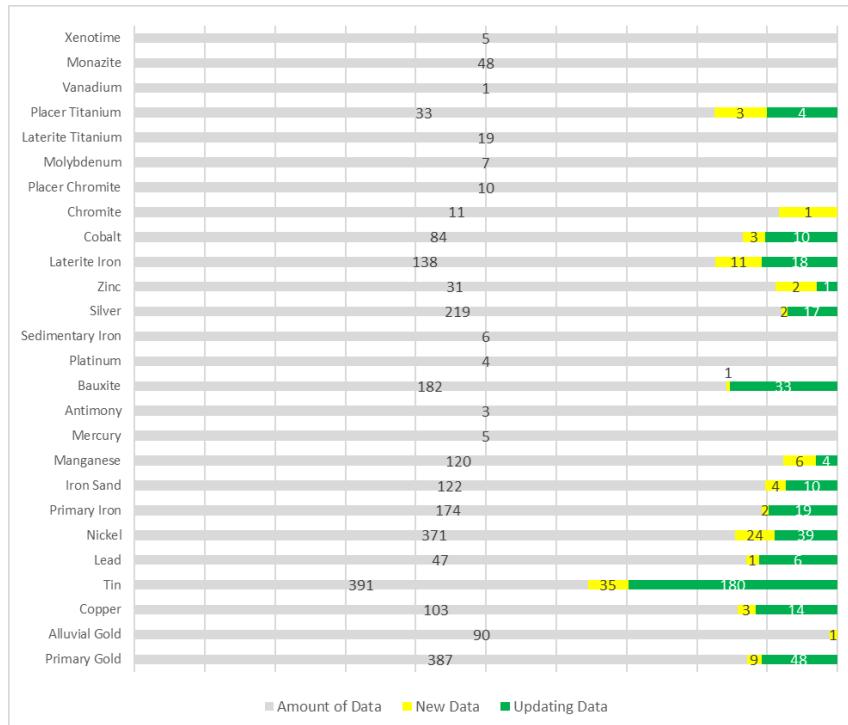
Figure 5. Updating the Number of metallic Mineral Potential Locations for 2020-2021

Updated recapitulation of the national metallic mineral resources and reserves balance sheet and the total resources and total reserves are shown in Table 2 and Table 3.

Table 2. Recapitulation of Metallic Mineral Resources and Reserves in 2021

No.	Commodities	Amount of Locations 2020	Amount of Locations 2021	Data Information 2021 New Data	Data Information 2021 Updates of Data	Resources (metric tons) Hypothetical Ore	Hypothetical Metal	Inferred Ore	Inferred Metal	Indicated Ore	Indicated Metal	Measured Ore	Measured Metal	Reserves (metric tons) Probable Ore	Probable Metal	Proven Ore	Proven Metal
1	Primary Gold *)	378	387	9	48	60,230,728	198	7,182,801,459	3,638	5,923,896,810	2,999	2,922,228,510	2,062	3,067,185,126	1,445	552,286,138	542
2	Alluvial Gold *)	89	90	1	0	410,886,135	74	811,620,666	33	255,582,367	204	565,589,575	118	52,645,632	115	13,080,507	35
3	Copper	100	103	3	14	273,355,127	790,271	8,593,704,727	28,326,841	4,682,297,302	26,034,304	2,675,448,524	11,583,730	2,378,612,663	17,968,844	639,206,927	1,967,173
4	Tin *)	358	391	35	180	100,793,919	6,909	2,329,927,837	666,049	1,655,786,897	617,315	3,173,953,778	1,123,516	5,586,609,343	1,175,383	1,253,734,016	990,522
5	Lead	46	47	1	6	12,629,825	229,844	1,499,525,418	37,115,659	2,364,515,325	53,209,941	145,742,828	3,680,200	38,051,038	1,037,896	38,222,777	1,815,480
6	Nickel	348	371	24	39	219,933,464	2,082,743	8,556,250,566	91,753,245	5,571,608,396	51,103,672	3,557,890,545	34,957,685	3,743,629,534	40,995,747	1,499,908,885	16,116,216
7	Primary Iron	173	174	2	19	314,467,710	175,873,975	1,907,745,296	530,482,780	2,987,293,032	912,328,118	2,454,386,273	228,832,560	1,448,064,767	261,488,082	254,151,392	92,269,404
8	Iron Sand	118	122	4	10	744,791,450	25,491,985	2,264,980,911	344,446,148	797,532,364	256,709,311	877,781,492	289,540,342	859,501,736	339,540,356	357,002,712	136,592,239
9	Manganese	114	120	6	4	2,845,838	1,013,756	96,576,182	45,162,032	45,023,071	20,959,028	49,291,058	21,517,803	108,389,134	50,431,557	21,044,754	6,985,753
10	Mercury	5	5	0	0	-	-	-	-	32,250,169	43	4,713	33	-	-	-	-
11	Antimony	3	3	0	0	-	-	-	-	11,778,633	375,555	111,788	-	3,958,633	15,835	-	-
12	Bauxite	182	182	1	33	-	-	2,307,954,001	319,076,707	2,334,777,970	402,906,786	1,989,406,268	372,202,626	2,293,077,615	359,753,118	927,781,395	160,721,984
13	Platinum	4	4	0	0	250,000	0.01	30,000,000	1,20	32,250,000	6,32	52,500,000	0.35	-	-	-	-
14	Sedimentary Iron	6	6	0	0	743,155	92,956	5,202,186	3,601,615	623,437	78,553	-	-	-	-	-	-
15	Silver	217	219	2	17	502,206	206	3,217,177,183	54,140	4,901,464,273	17,892	2,426,760,813	6,592	2,652,481,278	9,552	463,477,486	1,988
16	Zinc	29	31	2	1	12,818,900	1,695,252	1,394,671,470	18,940,222	2,323,056,513	42,223,470	54,095,853	2,371,361	33,305,962	1,212,421	35,336,220	1,573,390
17	Laterite Iron	128	138	11	18	112,713,437	20,047,966	3,423,231,034	498,180,134	2,122,838,985	275,651,718	2,200,467,204	390,359,548	914,255,883	193,278,588	617,939,371	124,254,292
18	Cobalt	81	84	3	10	970,925	463,476	1,409,758,580	3,198,470	807,036,400	3,176,278	1,066,757,999	1,071,695	442,886,385	227,463	239,526,400	257,017
19	Chromite	10	11	1	0	3,239,850	1,387,522	424,000	177,869	234,000	111,150	17,021,700	6,806,963	12,643,200	5,057,280	10,203,599	4,080,781
20	Placer Chromite *)	10	10	0	0	-	-	265,795	104,711	3,638,236	576,895	891,813	371,716	3,552,165	137,971	-	-
21	Molybdenum	7	7	0	0	-	-	2,744,124,333	270,482	37,000,000	3,955	28,000,000	2,576	-	-	-	-
22	Laterite Titanium	19	19	0	0	9,957,102	70,370	302,945,251	2,598,980	800,079,040	4,040,520	238,661,015	3,333,109	171,180,556	1,048,774	34,680,228	242,927
23	Placer Titanium	30	33	3	4	34,960,593	3,424,595	225,563,703	15,351,992	200,304,431	12,536,663	172,558,958	9,760,630	194,039,743	10,697,528	12,926,309	483,990
24	Vanadium	1	1	0	0	-	-	-	-	183,793,000	1,249,792	47,008,000	324,355	133,447,186	907,441	28,182,330	194,458
25	Monazite *)	48	48	0	0	-	-	6,925,308,651	182,138	203,501	4,493	432,442	32	-	-	-	-
26	Xenotime *)	5	5	0	0	-	-	6,466,257,914	20,734	-	-	-	-	-	-	0.09	0.06
	Total	2,509	2,611	108	403												

*) Ore/concentrate unit in m³
Metal calculated from *dry metric ton* (dmt) ore
There is additional/updates of data

Bold

Table 3. Recapitulation of Total Resources and Total Metallic Mineral Reserves in 2021

No.	Commodities	Total Resources (metric tons)**		Total Reserves(metric tons)	
		Ore	Metal	Ore	Metal
1	**Primary Gold**	**16,028,926,779**	**8,699**	**3,619,471,264**	**1,987**
2	**Alluvial Gold *)**	**1,632,792,609**	**355**	**65,726,139**	**150**
3	Copper	15,951,450,554	65,944,875	3,017,819,590	19,936,017
4	Tin *)	7,159,668,511	2,406,880	6,840,343,359	2,165,905
5	Lead	4,009,783,572	94,005,800	76,273,815	2,853,376
6	**Nickel**	**17,685,749,507**	**177,814,602**	**5,243,538,419**	**57,111,962**
7	**Primary Iron**	**7,349,424,602**	**1,671,643,457**	**1,702,216,159**	**353,757,486**
8	Iron Sand	3,940,294,766	890,695,801	1,216,504,448	476,132,595
9	Manganese	190,890,310	87,638,863	129,433,888	57,417,310
10	Mercury	32,254,882	76	-	-
11	Antimony	11,890,421	375,555	3,958,633	15,835
12	**Bauxite**	**6,632,138,239**	**1,094,186,118**	**3,220,859,010**	**520,475,101**
13	Platinum	114,750,000	8	-	-
14	Sedimentary Iron	5,825,623	3,680,168	-	-
15	**Silver**	**10,545,402,270**	**78,624**	**3,115,958,765**	**11,541**
16	Zinc	3,771,823,836	63,535,053	68,642,182	2,785,811
17	**Laterite Iron**	**7,746,537,224**	**1,164,191,400**	**1,532,195,254**	**317,532,880**
18	**Cobalt**	**3,283,552,980**	**7,446,443**	**682,412,785**	**484,480**
19	Chromite	17,679,700	7,095,982	22,846,799	9,138,061
20	Placer Chromite *)	4,795,844	1,053,322	3,552,165	137,971
21	Molybdenum	2,809,124,333	277,013		
22	Lateritite Titanium	1,341,685,306	9,972,609	205,860,784	1,291,700
23	**Placer Titanium**	**598,457,092**	**37,649,286**	**206,966,052**	**11,181,518**
24	Vanadium	230,801,000	1,574,148	161,629,516	1,101,899
25	Monazite *)	6,925,944,594	186,663	-	-
26	Xenotime *)	6,466,257,914	20,734	0.09	0.06

** without hypothetical
*) Ore/concentrate unit in m^3
Metal calculated from *dry metric ton* (dmt) ore
Bold There is additional/updates of data

Below are some graphs that illustrate the status of resources and reserves in 2021, comparison of resources and reserves in 2017 – 2021 for a period of 5 years and Distribution of Resources and Reserves by Province for the main commodities of metallic minerals in 2021.

To provide clearer information, a graph is also included that illustrates the relationship between changes in the amount of data/data updated and the total amount of resources/reserves. Some graphs are displayed in two abscissa axes due to the large difference in numbers (for example

between ore tonnage and metal tonnage the ratio is 1:100 or even 1: 1,000,000).

In general, the graphic relationship between the amount of resources/reserves and the amount of data illustrates the increase in the number of resources/reserves along with the increase amount of data, while the graph of the updated data reflects the number of companies that actively report the results of their activities every year.

Copper, Gold and Silver

Ores containing copper, gold and silver are found in some locations, but silver is commonly found with gold, but not all gold locations are reported to contain silver.

In some reports, gold ore tonnage is presented in wmt and dmt, even with the metal content in different units (ounces) with the units in the balance table (tonnes). Based on several reports, the water content in wmt ore is around 15%, so this value is used as a reference for converting wmt to dmt if the report only lists ore and grade.

In 2021, most of the copper and gold ore/metal resources are in the category of inferred resources. The resilience of gold and copper reserves can be increased by carrying out further exploration activities so that the inferred resource can be upgraded to a designated and measured resource status (Figure 6 and Figure 11).

During the last 5 years the trend of development of copper ore resources and reserves was relatively gentle, although there was a decline in 2018. As for the total copper

ore resources in 2021, there was an increase of 1.1 billion tons and reserves also increased by 386 million tons compared to data for 2020. Meanwhile, copper metal reserves in 2021 decreased by 3.858 million tons compared to 2020 (Figure 7 and Figure 8). The 2021 update results for total gold ore resources and total reserves are relatively stable, but total gold metal reserves have decreased by 251 tons compared to 2020 (Figure 12 and Figure 13). And for silver metal, the total resources increased significantly and the total reserves decreased by 1000 tons, when compared to 2020 (Figure 17 and Figure 18).

The decline in total copper and gold metal reserves in 2021 is estimated to be due to a decrease in gold reserves in several locations, especially from Papua Province. This is estimated to be due to a decrease in gold reserves at PT Freeport Indonesia (Table 4, Figure 9, and Table 5, Figure 10 and Table 6, Figure 14 and Table 7, Figure 15).
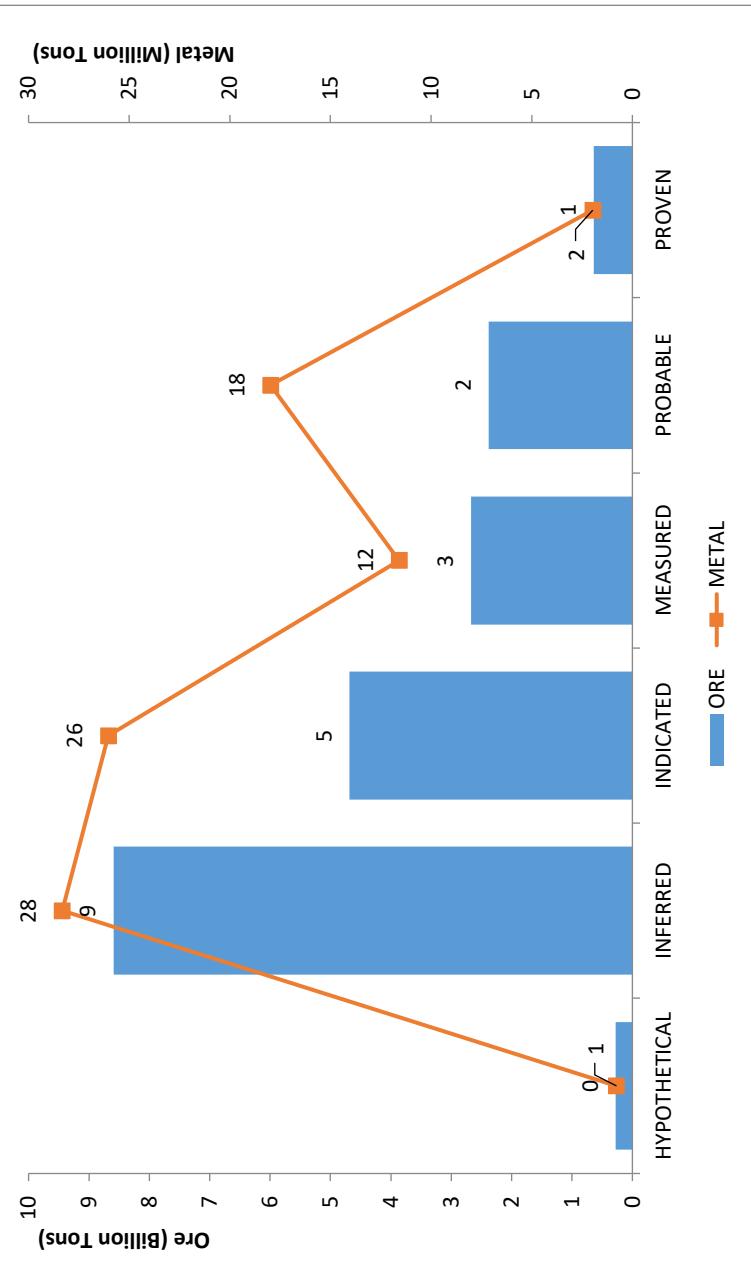
Figure 6. Copper Ore/Metal Resources and Reserves in 2021
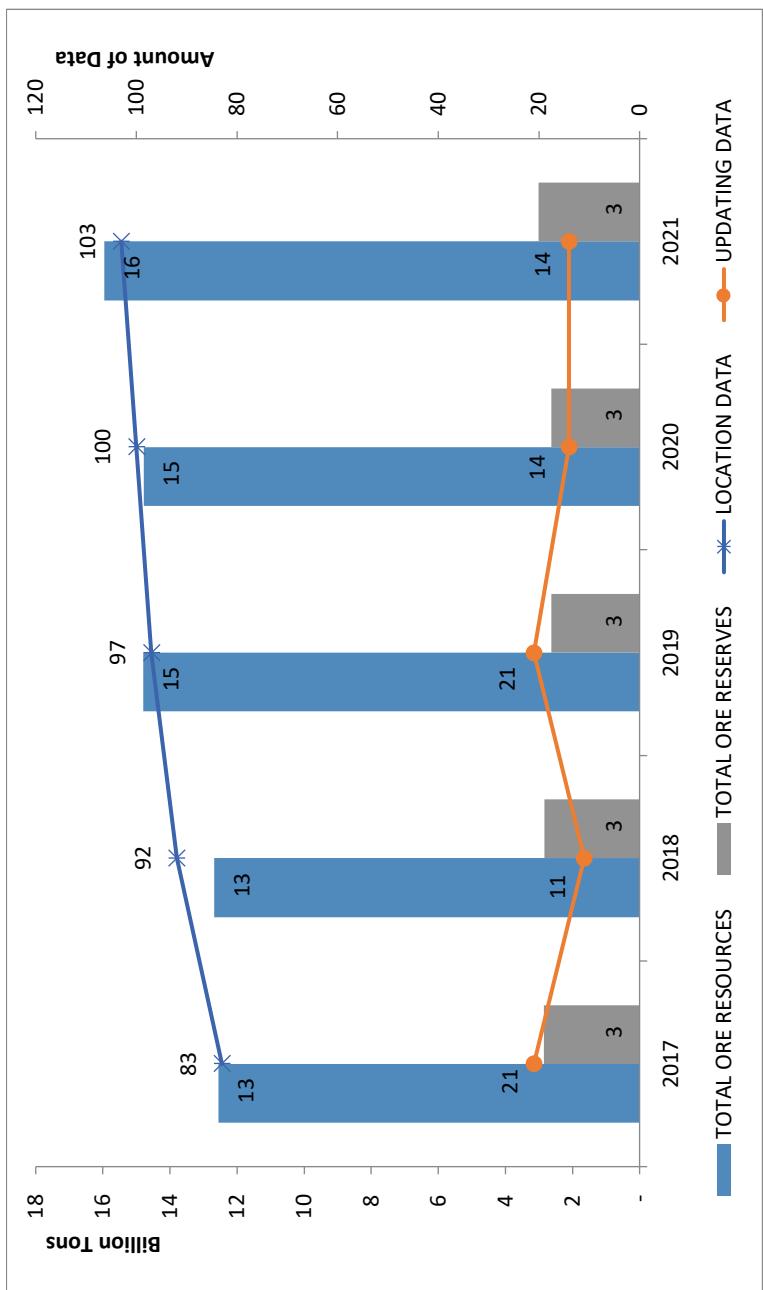
Figure 7. Comparison of Copper Ore Resources and Reserves in 2017 – 2021
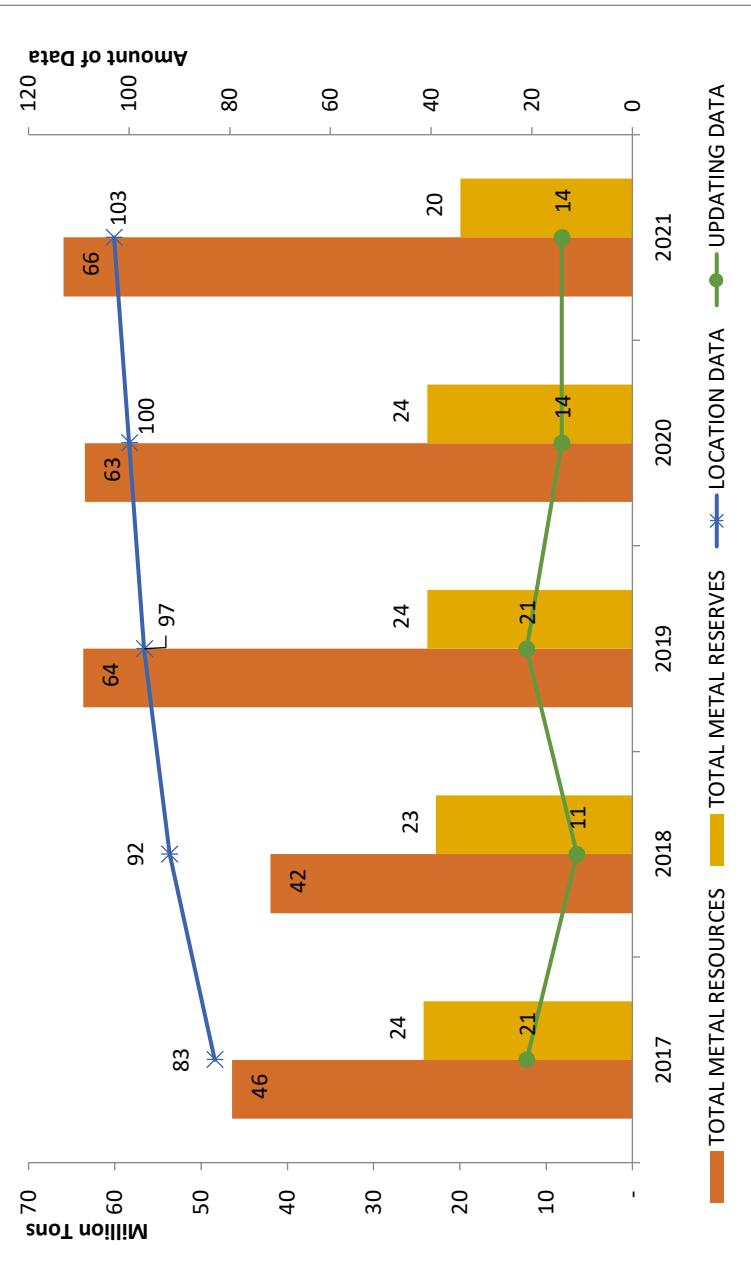
Figure 8. Comparison of Copper Metal Resources and Reserves in 2017 – 2021

Table 4. Total Resources and Total Reserves of Copper Ore/Metal by Province in 2020

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL		INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Aceh	5	-	-	958,400,000	3,016,640	37,000,000	244,800	28,000,000	201,600	-	-	-	-	1,023,400,000	3,463,040	-	-
2	North Sumatra	3	-	-	178,000	551	800,000	3,600	-	-	-	-	-	-	978,000	4,151	-	-
3	West Sumatra	9	16,355,117	199,171	81,647,148	118,968	635,443	4,702	-	-	-	-	-	-	98,637,708	322,841	-	-
4	Bengkulu	3	-	-	100,000	29	-	-	778,000	3,039	-	-	-	-	878,000	3,068	-	-
5	South Sumatra	1	-	-	-	-	-	-	1,760,000	14,080	-	-	-	-	1,760,000	14,080	-	-
6	Banten	1	-	-	-	-	-	-	90,712,000	482	-	-	-	-	90,712,000	482	-	-
7	West Java	7	11	0	8,741,039	29,182	-	-	-	-	11,250,000	41,625	-	-	8,741,050	29,182	11,250,000	41,625
8	Central Java	2	-	-	61,915,000	86,527	3,080,000	2,772	21,590,000	32,385	-	-	-	-	86,585,000	121,684	-	-
9	East Java	3	-	-	1,943,724,327	8,746,759	-	-	10,200	1,510	6,950,000	83,400	1,000,000	22,000	1,943,734,527	8,748,269	8,050,000	105,400
11	West Nusa Tenggara	5	-	-	1,619,750,000	10,032,825	1,991,000,000	10,504,500	1,457,000,000	6,456,500	489,000,000	1,760,400	293,000,000	1,377,100	5,067,750,000	26,993,825	782,000,000	3,137,500
12	East Nusa Tenggara	2	-	-	-	-	1,248,000	28,656	-	-	-	-	-	-	1,248,000	28,656	-	-
10	West Kalimantan	1	-	-	-	-	-	-	-	-	8,731,198	-	-	-	-	-	8,731,198	-
13	Central Tengah	11	-	-	2,841,803,837	3,527,147	37,135,305	173,005	20,971,000	152,165	27,767,000	202,699	671,000	10,065	2,899,910,142	3,852,316	28,438,000	202,764
14	South Sulawesi	5	-	-	6,050,400	192,621	-	-	-	-	-	-	3,750,000	30,000	6,050,400	192,621	3,750,000	30,000
15	Central Sulawesi	1	-	-	47,366,000	-	281,254,000	-	214,714,000	-	-	-	214,714,000	-	543,334,000	-	214,714,000	-
16	West Sulawesi	3	-	-	14,400,250	87,890	8,000,000	40,000	-	-	-	-	-	-	22,400,250	127,890	-	-
17	Gorontalo	13	-	-	191,577,000	374,447	38,110,000	153,338	254,470,000	1,055,146	105,400,000	613,000	108,567,377	247,540	484,157,000	1,602,931	213,967,377	860,540
18	North Maluku	6	-	-	115,656,250	302,272	2,080,444	3,233	71,632,090	117,514	1,456,311	-	-	-	189,368,784	433,019	1,456,311	-
19	Maluku	4	-	-	49,104,076	94,042	41,382,346	76,493	3,402,569	96,264	2,396,154	56,884	9,189,398	239,523	93,888,991	266,798	11,585,552	296,408
20	Papua	15	-	-	653,291,400	1,686,942	2,238,501,980	14,790,999	497,208,294	3,354,982	1,253,000,000	11,897,600	560,000,000	7,618,800	3,389,000,674	19,832,823	1,813,000,000	19,516,400
	Total	100	16,355,127	199,171	8,593,704,727	28,326,841	4,680,227,518	26,026,097	2,662,248,153	11,485,668	1,905,950,663	14,655,609	1,190,991,775	9,545,029	15,952,535,525	66,037,776	3,096,942,438	24,200,637
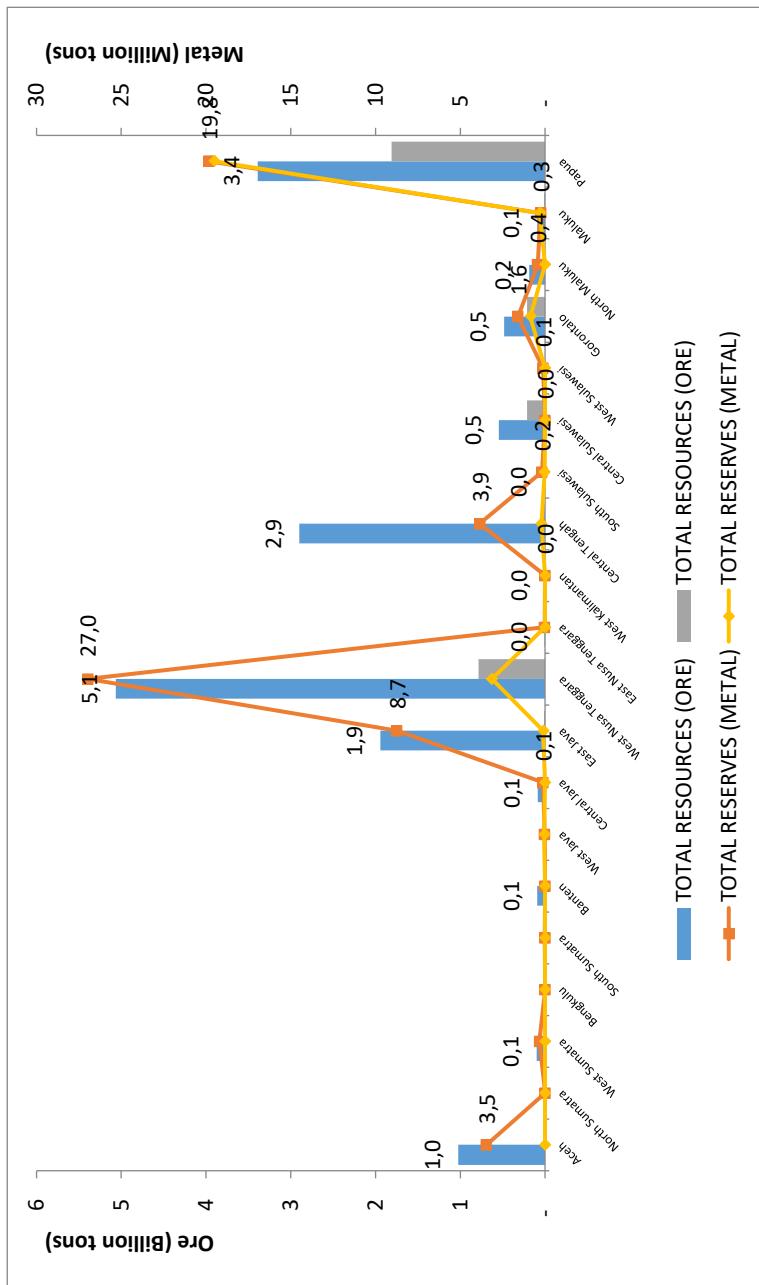
Figure 9. Total Resources and Total Reserves of Copper Ore/Metal by Province in 2020

Table 5. Total Resources and Total Reserves of Copper Ore/Metal by Province in 2021

NO	PROVINSI	JUMLAH LOKASI	SUMBER DAYA (TON) HIPOTETIK BIJIH	HIPOTETIK LOGAM	TEREKA BIJIH	TEREKA LOGAM	TERTUNJUK BIJIH	TERTUNJUK LOGAM	TERUKUR BIJIH	TERUKUR LOGAM	CADANGAN (TON) TERKIRA BIJIH	TERKIRA LOGAM	TERBUKTI BIJIH	TERBUKTI LOGAM	TOTAL SUMBER DAYA BIJIH	TOTAL SUMBER DAYA LOGAM	TOTAL CADANGAN BIJIH	TOTAL CADANGAN LOGAM
1	Aceh	5	0	0	958.400.000	3.016.640	37.000.000	244.800	28.000.000	201.600	0	0	0	0	1.023.400.000	3.463.040	0	0
2	Sumatra Utara	3	0	0	178.000	551	800.000	3.600	0	0	0	0	0	0	978.000	4.151	0	0
3	Sumatra Barat	9	16.355.117	199.171	81.647.148	118.968	635.443	4.702	0	0	0	0	0	0	98.637.708	322.841	0	0
4	Bengkulu	2	0	0	0	0	0	0	778.000	3.039	0	0	0	0	778.000	3.039	0	0
5	Sumatra Selatan	2	0	0	100.000	29	0	0	1.760.000	14.080	0	0	0	0	1.860.000	14.109	0	0
6	Banten	1	0	0	0	0	0	0	90.712.000	482	0	0	0	0	90.712.000	482	0	0
7	Jawa Barat	7	11	0	8.741.039	29.182	0	0	0	0	11.250.000	41.625	0	0	8.741.050	29.182	11.250.000	41.625
8	Jawa Tengah	2	0	0	61.915.000	86.527	3.080.000	2.772	21.590.000	32.385	0	0	0	0	86.585.000	121.684	0	0
9	Jawa Timur	4	0	0	1.943.724.327	8.746.759	0	0	4.931.439	66.744	7.612.000	98.891	1.000.000	22.000	1.948.655.766	8.813.504	8.612.000	120.891
11	Nusa Tenggara Barat	5	257.000.000	591.100	1.619.750.000	10.032.825	1.991.000.000	10.504.500	1.457.000.000	6.456.500	489.000.000	1.760.400	293.000.000	1.377.100	5.324.750.000	27.584.925	782.000.000	3.137.500
12	Nusa Tenggara Timur	2	0	0	0	0	1.248.000	28.656	0	0	0	0	0	0	1.248.000	28.656	0	0
10	Kalimantan Barat	1	0	0	0	0	0	0	0	0	8.731.198	0	0	0	0	0	8.731.198	0
13	Kalimantan Tengah	11	0	0	2.841.863.837	3.527.147	37.135.305	173.005	20.971.000	152.165	27.767.000	202.699	671.000	10.065	2.899.970.142	3.852.316	28.438.000	212.764
14	Sulawesi Selatan	6	0	0	6.050.400	192.621	2.069.784	8.207	8.279.133	32.828	0	0	11.965.152	70.944	16.399.317	233.656	11.965.152	70.944
15	Sulawesi Tengah	3	0	0	14.400.250	87.890	8.000.000	0	0	0	0	0	0	0	22.400.250	87.890	0	0
16	Sulawesi Barat	1	0	0	47.366.000	0	281.254.000	40.000	214.714.000	0	0	0	214.714.000	0	543.334.000	40.000	214.714.000	0
17	Gorontalo	13	0	0	189.877.000	394.447	38.110.000	153.338	256.470.000	1.055.146	105.400.000	613.000	108.567.377	247.540	484.457.000	1.602.931	213.967.377	860.540
18	Maluku Utara	6	0	0	115.656.250	312.272	2.080.644	3.233	71.631.890	117.514	1.456.311	0	0	0	189.368.784	433.019	1.456.311	0
19	Maluku	5	0	0	49.104.076	94.042	41.382.346	76.493	3.402.569	96.264	2.396.154	56.884	9.189.398	239.523	93.888.991	266.798	11.585.552	296.408
20	Papua	15	0	0	653.291.400	1.686.942	2.238.501.980	14.790.999	497.208.294	3.356.982	1.725.000.000	15.195.344	0	0	3.389.001.674	19.832.923	1.725.000.000	15.195.344
	Total	103	273.355.127	790.271	8.593.704.727	28.326.841	4.682.297.302	26.034.304	2.675.448.524	11.583.730	2.378.612.663	17.968.844	639.206.927	1.967.173	16.224.805.681	66.607.256	2.803.105.590	19.936.077

Figure 10. Total Resources and Total Reserves of Copper Ore/Metal by Province in 2021
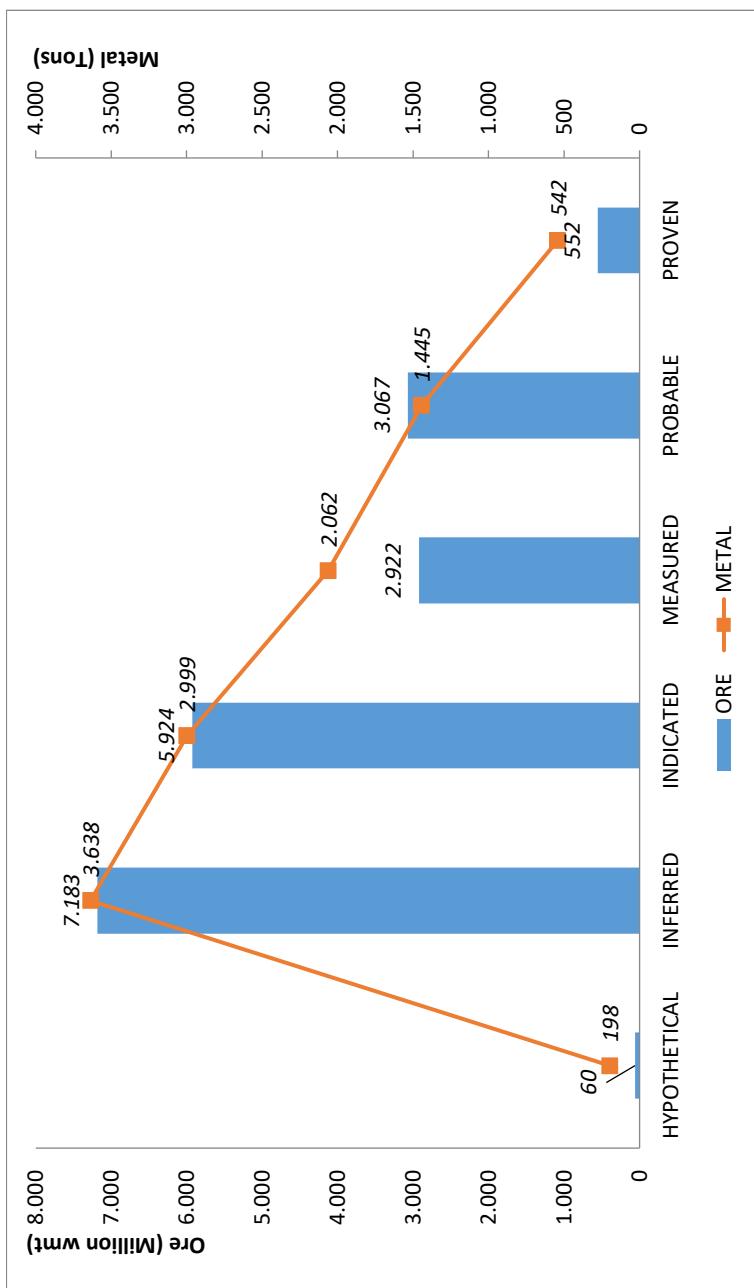
Figure 11. Resources/Reserves of Gold Ore and Metal in 2021
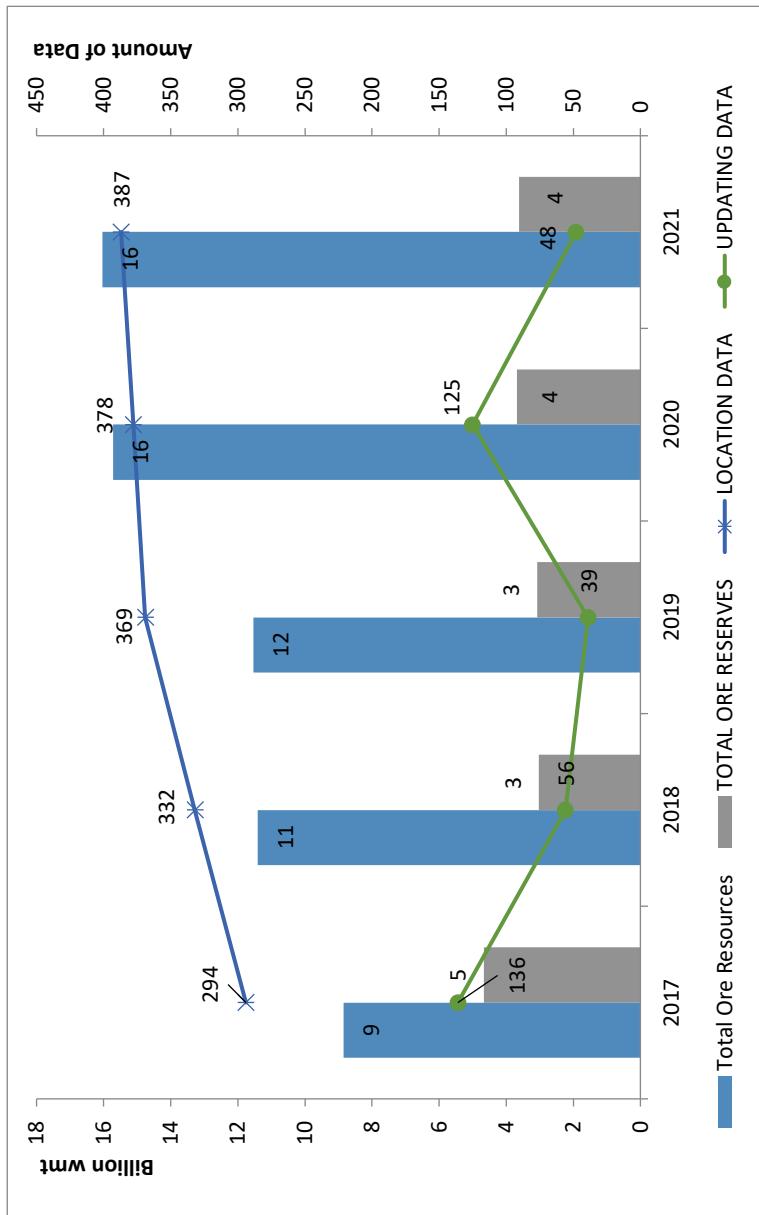
Figure 12. Comparison of Gold Ore Resources and Reserves in 2017 – 2021
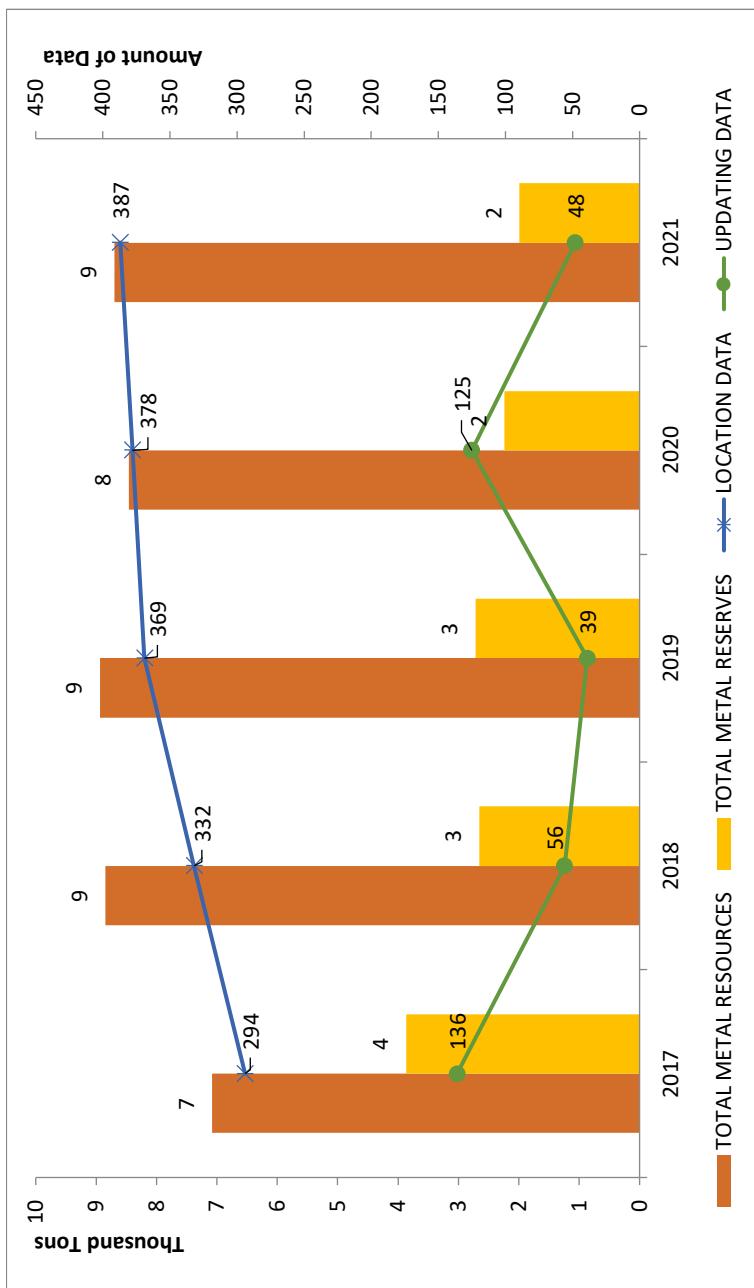
Figure 13. Comparison of Gold Metal Resources and Reserves in 2017 – 2021

Table 6. Gold Ore/Metal Resources and Reserves by Province in 2020

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL ORE	HYPOTHETICAL METAL	INFERRED ORE	INFERRED METAL	INDICATED ORE	INDICATED METAL	MEASURED ORE	MEASURED METAL	PROBABLE ORE	PROBABLE METAL	PROVEN ORE	PROVEN METAL	TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
1	Aceh	10	-	-	810,210,000	321	80,633,408	42	35,241,791	6	70,985,591	35	27,948,308	47	926,085,199	369	98,933,899	82
2	North Sumatra	11	-	-	19,172,690	41	120,943,846	196	105,487,317	107	44,215,200	72	52,345,200	93	245,603,853	344	96,560,400	164
3	West Sumatra	8	-	-	5,429,750	12	196,500	0	860,170	4	6,686,150	15	-	-	6,486,420	17	6,686,150	15
4	Jambi	4	-	-	24,453,643	24	-	-	-	-	-	-	-	-	24,453,643	24	-	-
5	South Sumatra	16	32,448,000	5	4,757,000	7	3,386,000	6	1,817,000	0	9,339,000	10	33,000	0	9,960,000	14	9,372,000	11
6	Bengkulu	11	-	-	17,096,719	10	46,041,716	48	3,813,900	74	2,025,019	5	-	-	66,952,335	132	2,025,019	5
7	Lampung	16	-	-	8,220,309	8	8,909,218	10	1,508,222	8	1,582,034	12	5,922,671	5	18,637,749	27	7,504,705	17
8	West Java	23	241,431	2	9,986,909	42	21,860,610	55	8,496,570	26	7,368,097	26	540,431	2	40,344,089	123	7,908,528	28
9	Banten	13	322,000	3	656,651,628	101	201,354,565	26	4,044,052	8	321,597,865	1	21,506,633	19	862,050,245	135	343,104,498	20
10	Central Java	3	-	-	8,025,000	6	10,600,000	9	13,500,000	10	8,600,000	6	-	-	32,125,000	24	8,600,000	6
11	East Java	11	-	-	2,090,789,330	1,469	22,915,412	12	6,638,971	8	18,795,292	13	2,777,826	2	2,120,343,713	1,490	21,573,118	15
12	West Nusa Tenggara	22	-	-	2,102,054,155	647	2,254,160,044	820	1,478,691,495	477	501,207,728	117	309,780,532	157	5,834,905,693	1,944	810,988,260	274
13	East Nusa Tenggara	5	3,300,000	8	2,659,835	2	2,670,280	4	1,200,000	1	-	-	-	-	6,521,115	7	-	-
14	West Kalimantan	14	-	-	660,107	3	10,604,020	26	5,198,054	5	9,510,878	25	3,407,675	2	16,462,181	34	12,918,552	27
15	Central Kalimantan	58	23,251,372	180	95,125,754	168	243,935,747	178	23,823,037	22	12,076,153	19	9,008,371	8	362,884,538	368	21,084,524	27
16	North Sulawesi	50	666,500	-	101,949,202	124	137,194,236	163	45,245,396	49	76,607,326	90	43,769,121	64	284,388,834	335	120,376,447	155
17	Maluku	5	963,000	0.38	46,761,232	14	44,518,271	20	-	-	-	-	-	-	92,279,503	34	-	-
18	South Kalimantan	7	-	-	13,475,756	27	4,051,129	7	4,985,164	10	1,106,000	2	3,814,000	8	22,512,049	44	4,920,000	10
19	East Kalimantan	2	-	-	-	-	15	0	300,000,000	587	15	0	-	-	300,000,015	587	15	0
20	West Sulawesi	2	1,425	0.01	-	-	-	-	-	-	3,278,429	0	-	-	3,278,429	-	3,278,429	-
21	South Sulawesi	6	-	-	3,041,804	3	41,001,365	51	14,001,741	19	11,600,000	15	8,600,000	12	58,044,910	73	20,200,000	27
22	Central Sulawesi	3	-	-	1,230,000	8	5,310,000	31	5,170,000	35	4,950,000	21	-	-	11,710,000	74	4,950,000	21
23	Gorontalo	28	-	-	439,601,445	223	161,350,687	123	218,580,000	72	156,790,000	54	48,045,969	104	819,532,132	418	204,835,969	158
24	North Maluku	20	-	-	131,772,850	56	36,733,969	123	72,018,090	3	5,578,453	22	273,660	1	240,524,909	182	5,852,113	23
25	Papua	20	-	-	362,211,504	233	2,238,501,980	895	500,677,294	449	1,253,600,000	674	560,000,000	418	3,101,390,777	1,577	1,813,000,000	1,093
26	North Kalimantan	6	-	-	16,058,216	7	18,330,638	8	41,573,686	54	49,444,594	57	1,816,034	1	75,962,540	69	51,260,628	58
27	Southeast Sulawesi	4	-	-	2,103,484	12	491,614	0	491,614	1	491,123	1	491,123	1	3,086,712	14	982,246	2
	Total	378	61,193,728	199	6,973,489,323	3,569	5,716,695,270	2,853	2,893,063,561	2,036	2,576,834,945	1,294	1,100,080,554	944	15,583,248,154	8,458	3,676,915,499	2,238
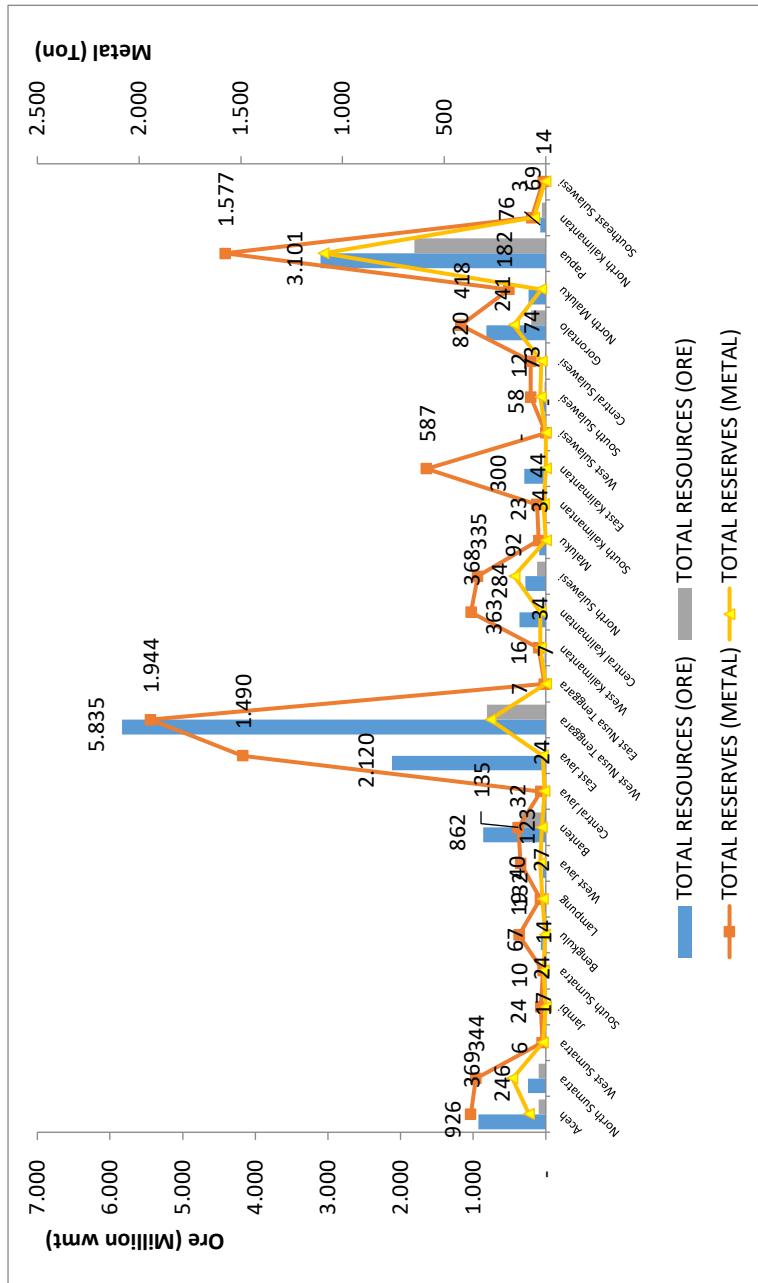
Figure 14. Gold Ore/Metal Resources and Reserves by Province in 2020

Table 7. Gold Ore/Metal Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL		INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Aceh	10	-	-	810,210,000	321	80,633,408	42	35,241,791	6	70,985,591	35	27,948,308	47	926,085,199	369	98,933,899	82
2	North Sumatra	11	-	-	20,474,975	32	232,192,600	199	105,110,000	106	41,199,200	68	53,074,200	94	357,777,575	336	94,273,400	162
3	West Sumatra	8	-	-	5,429,750	12	196,500	1	860,170	4	6,686,150	15	-	-	6,486,420	17	6,686,150	15
4	Jambi	4	-	-	24,453,643	24	-	-	-	-	4,444,594	6	-	-	24,453,643	24	4,444,594	6
5	South Sumatra	17	32,448,000	5	4,857,000	8	3,386,000	6	1,817,000	0	9,339,000	10	33,000	0.2	10,060,000	14	9,372,000	11
6	Bengkulu	10	-	-	18,115,539	12	47,095,925	50	3,813,900	74	3,105,563	6	-	-	69,025,364	136	3,105,563	6
7	Lampung	16	-	-	8,220,309	8	8,909,218	10	1,508,222	8	6,256,589	16	163,571	1	18,637,749	27	6,420,160	16
8	Banten	13	322,000	3	656,711,628	101	201,385,800	26	4,044,052	8	321,500,100	1	21,473,515	19	862,141,480	136	342,973,616	20
9	West Java	24	241,431	2	8,706,390	34	20,501,413	52	12,189,688	33	10,491,747	34	805,882	3	41,397,492	119	11,297,629	37
10	Central Java	6	-	-	8,025,000	6	10,600,000	9	13,500,000	10	8,600,000	6	-	-	32,125,000	24	8,600,000	6
11	East Java	11	-	-	2,729,226,793	1,478	88,826,358	28	27,210,000	17	20,896,540	8	16,556,000	13	2,245,265,151	1,522	37,452,540	21
12	West Nusa Tenggara	23	-	-	2,105,244,155	680	2,258,080,044	823	1,478,691,495	477	501,207,728	117	309,780,532	157	5,642,015,693	1,981	810,988,260	274
13	East Nusa Tenggara	5	3,300,000	8	2,650,835	2	2,670,280	4	1,200,000	1	-	-	-	-	6,521,115	7	-	-
14	West Kalimantan	14	-	-	660,107	3	10,604,020	26	5,198,054	5	9,510,878	25	3,407,675	2	16,462,181	34	12,918,552	27
15	Central Kalimantan	58	23,251,372	180	95,263,254	169	243,761,647	177	23,823,037	22	10,650,153	16	8,698,371	7	362,847,938	368	19,348,524	23
16	South Kalimantan	7	-	-	13,475,756	27	4,051,129	7	4,985,164	10	1,106,000	2	3,814,000	8	22,512,049	44	4,920,000	10
17	East Kalimantan	5	-	-	4,544,308	10	4,760,888	10	304,327,898	596	1,125,972	2	2,732,066	6	313,632,863	616	3,858,037	8
18	North Kalimantan	6	-	-	16,058,216	7	18,330,638	8	41,573,686	54	49,444,594	57	1,816,034	1	75,862,540	69	51,260,628	58
19	West Sulawesi	2	1,425	0	3,278,429	-	-	-	-	-	-	-	-	-	3,278,429	-	-	-
20	South Sulawesi	6	-	-	3,041,804	3	41,001,365	51	14,001,741	19	11,600,000	15	8,600,000	12	58,044,910	73	20,200,000	27
21	Central Sulawesi	3	-	-	1,230,000	8	5,310,000	31	5,170,000	35	4,950,000	21	-	-	11,710,000	74	4,950,000	21
22	Gorontalo	28	-	-	464,391,445	237	161,350,687	123	218,580,000	72	156,790,000	54	48,045,969	104	844,322,132	432	204,835,969	158
23	Southeast Sulawesi	4	-	-	2,103,484	12	491,614	1	491,614	1	491,123	1	491,123	1	3,086,712	14	982,246	2
24	North Sulawesi	50	665,500	-	101,949,200	124	137,194,236	163	45,245,396	49	76,607,326	90	43,769,121	64	284,388,834	335	120,376,447	155
25	North Maluku	23	-	-	239,655,130	67	65,940,989	242	72,968,310	6	11,032,445	33	1,076,771	3	377,964,429	314	12,109,216	35
26	Maluku	8	-	-	38,718,271	21	38,746,271	17	-	-	5,300,000	5	-	-	114,009,593	38	5,300,000	5
27	Papua	20	-	-	362,211,504	233	2,238,501,980	895	500,677,294	449	1,725,000,000	805	-	-	3,101,390,777	1,577	1,725,000,000	805
	Total	387	60,230,728	198	7,182,801,459	3,638	5,923,896,810	2,999	2,922,228,510	2,062	3,067,185,126	1,445	552,286,138	542	16,028,926,779	8,699	3,619,471,264	1,987
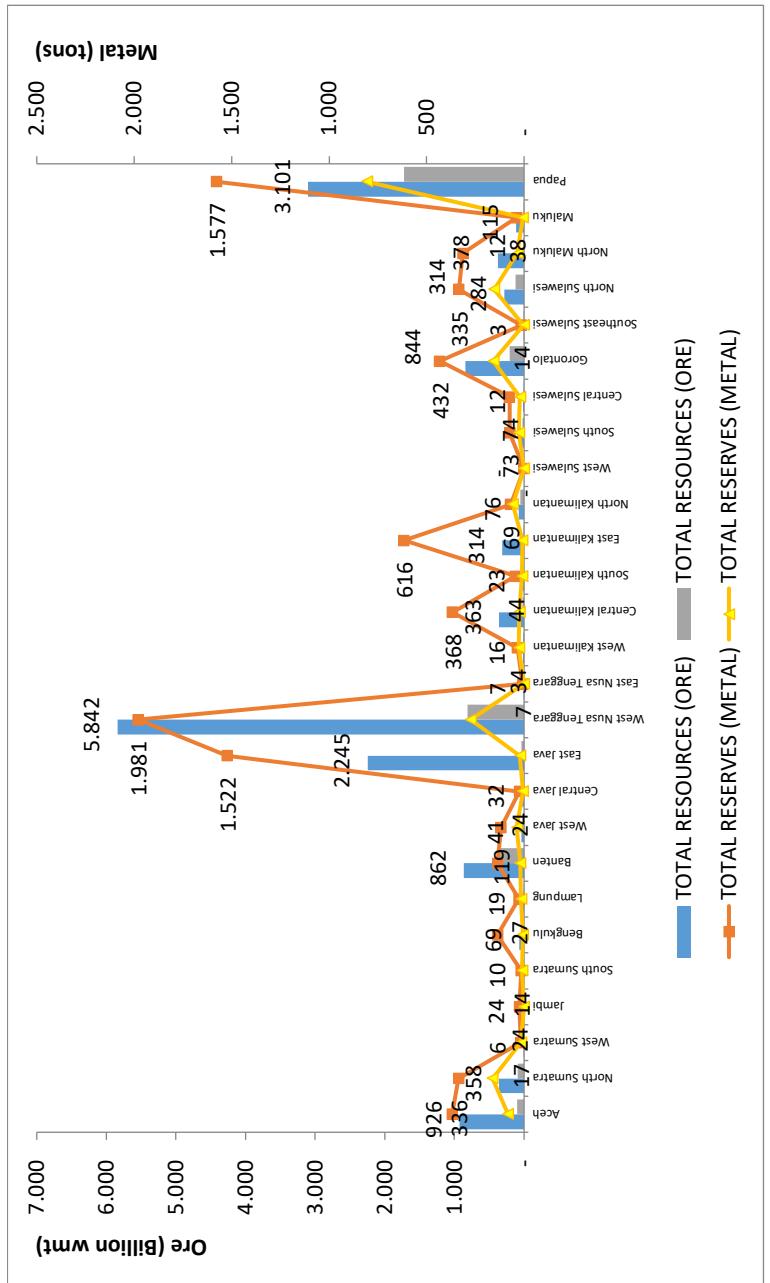
Figure 15. Copper and Gold Metal Ore Resources and Reserves by Province in 2021
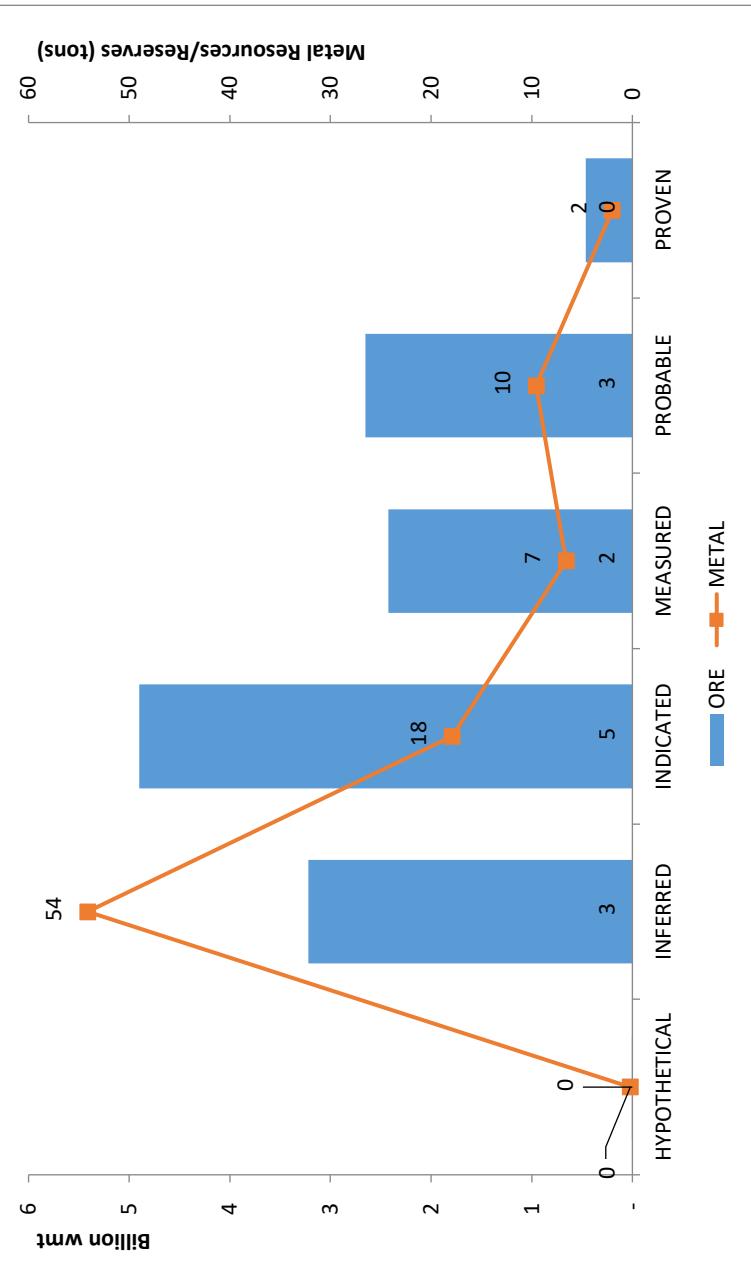
Figure 16. Silver Ore and Metal Resources/Reserves in 2021
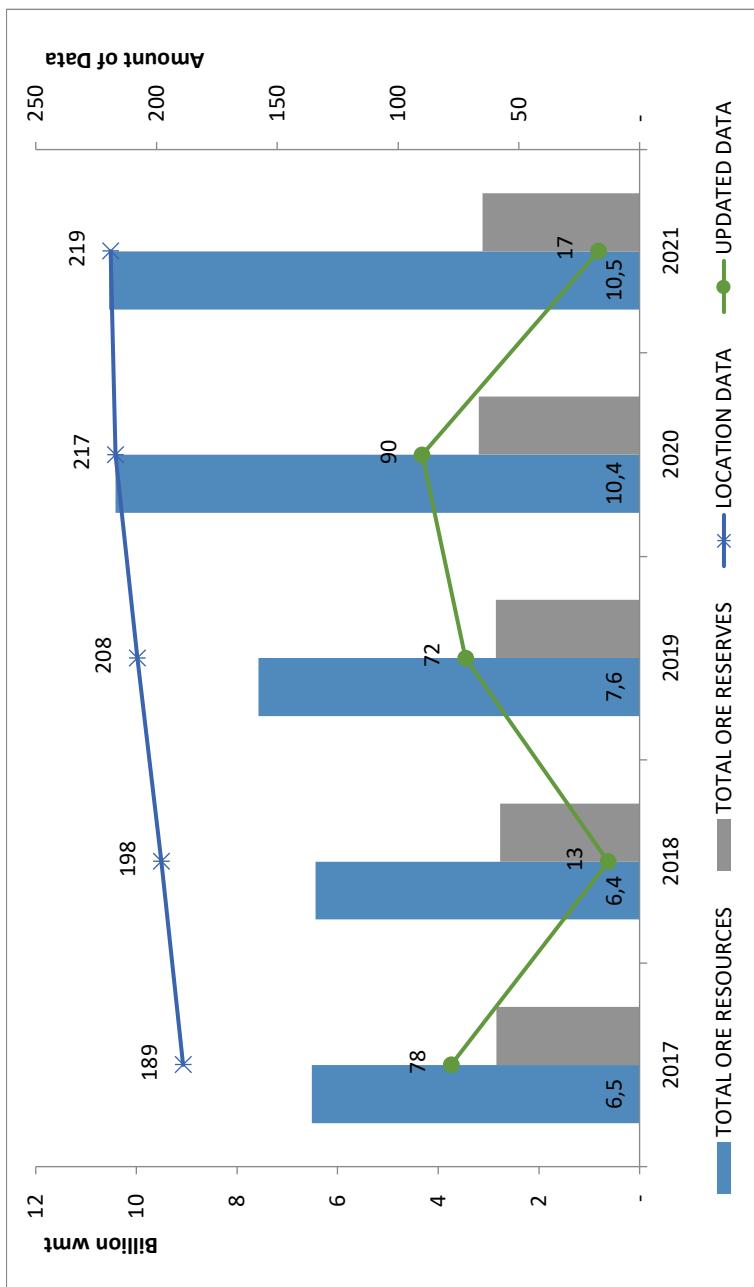
Figure 17. Total Resources and Total Silver Ore Reserves in 2017 - 2021
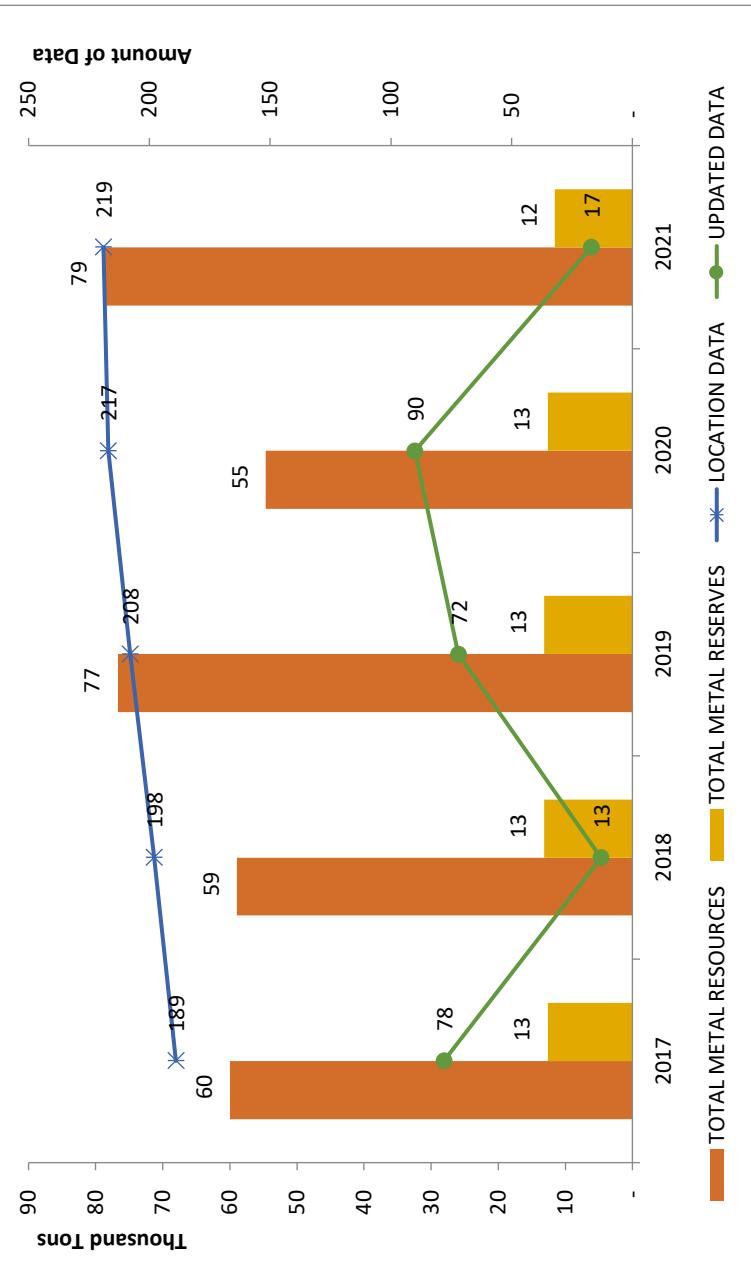
Figure 18. Total Resources and Total Reserves of Silver Metal in 2017 - 2021

Nickel, Laterite Iron and Cobalt

Nickel ores generally contain co-metallic iron and cobalt, but only 25% of reports include co-metal content. In some locations lateritic iron is the main commodity.

Only 3 companies report nickel ore tonnage in wmt and dmt. To convert wmt data into dmt, an agreement was taken with several nickel mining practitioners that the water content of the wmt ore is 30%.

Nickel ore resources and reserves in total are dominated by inferred resources. While the total reserves are mostly in the estimated reserve status. Total nickel ore resources in 2021 experienced a significant increase, while total reserves also increased slightly. Increased resources, especially in inferred, indicated and measurable resources. Meanwhile, the estimated reserves and proven reserves experienced a slight increase. (Figure 19 to Figure 22 and Table 8).

The reported nickel content is quite varied (0.6% to 2.7%), the processing can be grouped into several classes, namely the limits of 1.5% and 1.7%. Data on the type of nickel ore in the form of limonite or saprolite is also very important in nickel ore processing. The results of processing data on nickel resources and reserves based on grades (1.5% and 1.7%) and the type of ore material can be seen in Figures 19 s.d. Figure 22, and Tables 9 to d. Table 11. The results of processing data on laterite iron resources and reserves are presented in Figures 23 to d. Figure 25, while the results of processing data on resources and cobalt reserves can be seen in Figure 26.
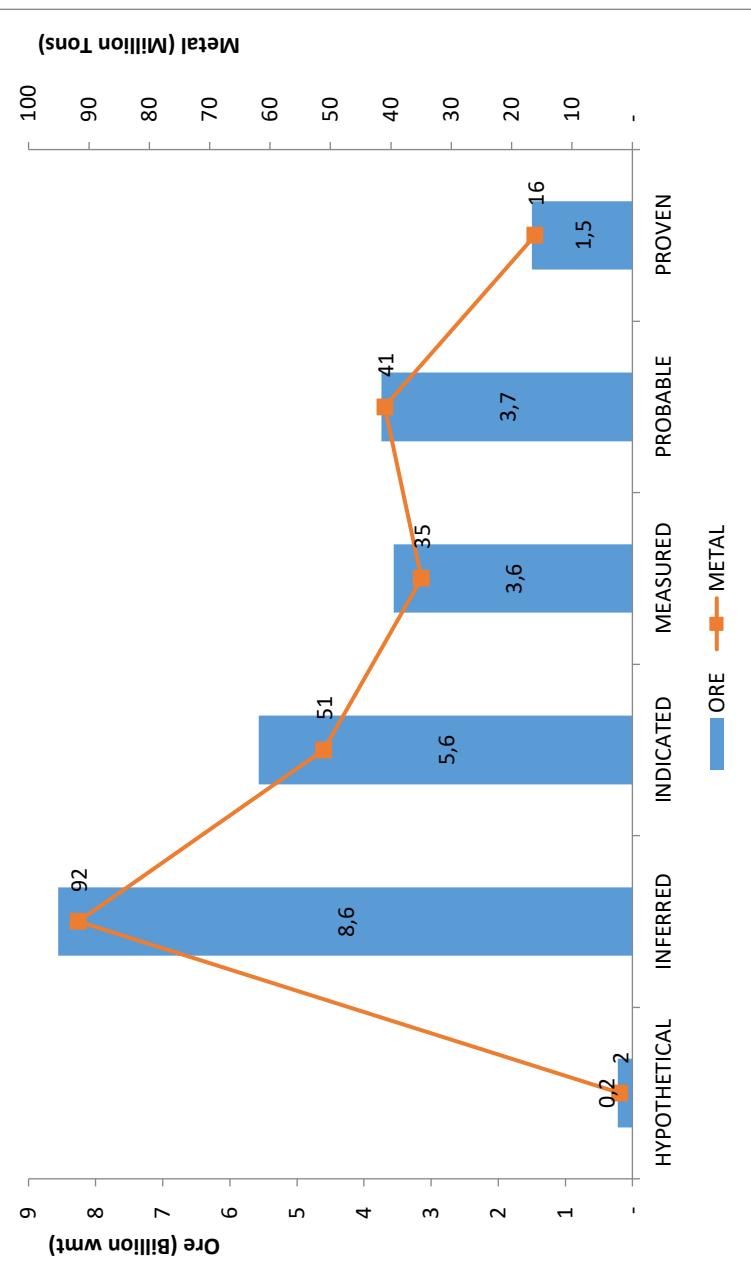
Figure 19. Nickel Ore/Metal Resources and Reserves in 2021
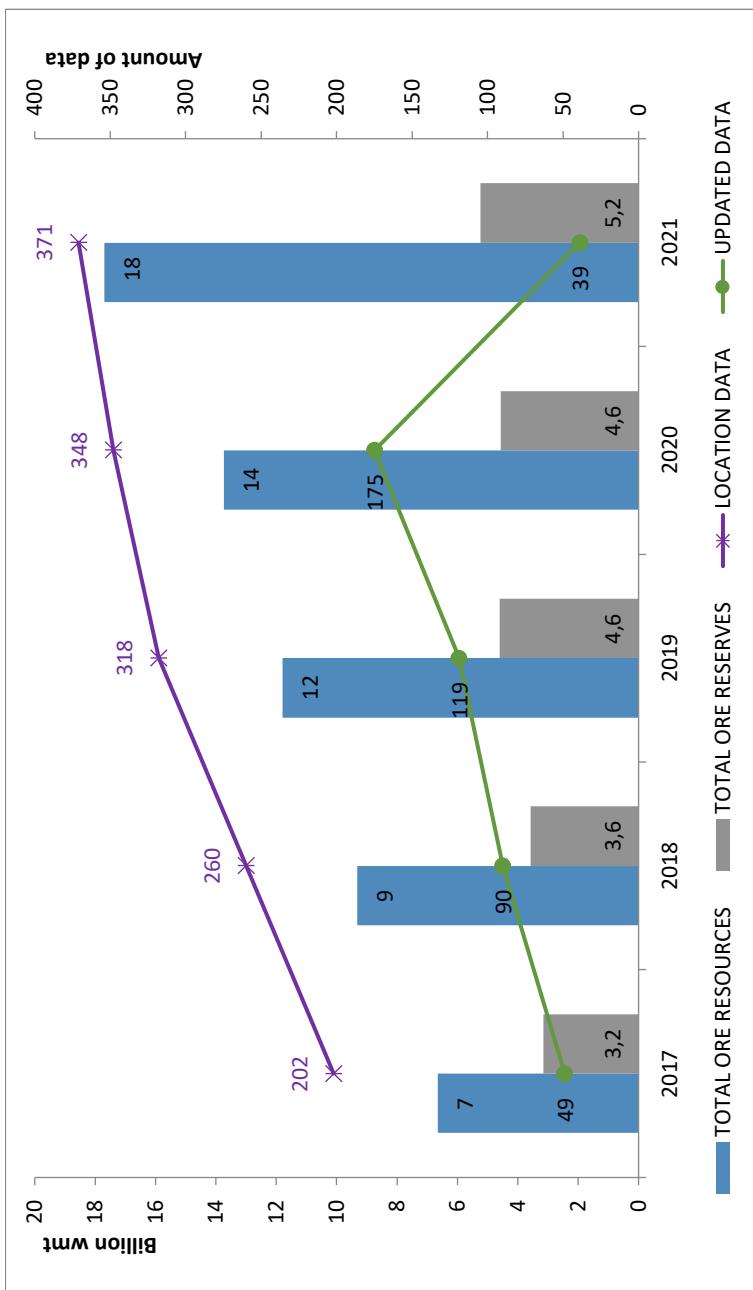
Figure 20. Total Resources and Total Nickel Ore Reserves in 2017 - 2021
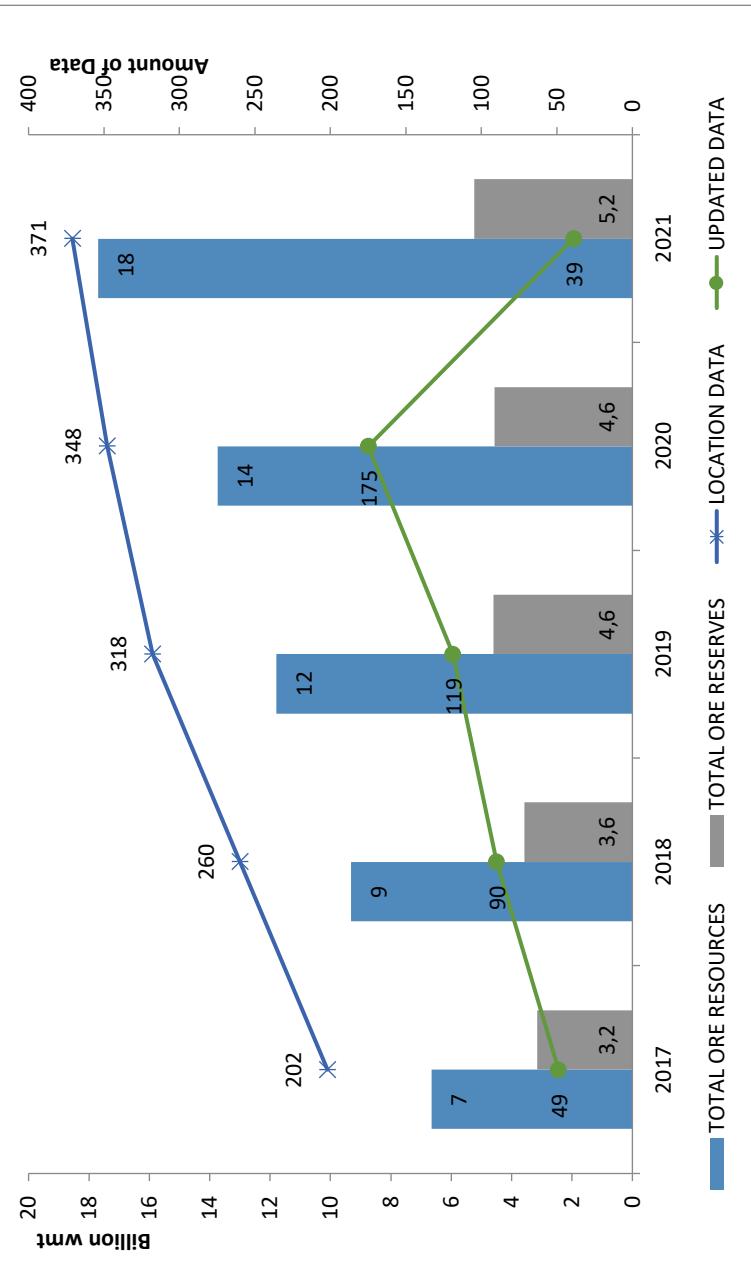
Figure 21. Total Resources and Total Reserves of Nickel Metal in 2017 – 2021

Table 8. Total Nickel Ore/Metal Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL		RESOURCES (METRIC TONS)						RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
					INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Aceh	1	-	-	8,295,040	59,738	-	-	-	-	-	-	-	-	8,295,040	59,738	-	-
2	Central Kalimantan	1	-	-	-	-	21,730,643	275,327	-	-	9,780,719	117,075	-	-	21,730,643	275,327	9,780,719	117,075
3	East Kalimantan	1	-	-	-	-	-	-	-	-	1,202,428	11,784	-	-	-	-	1,202,428	11,784
4	South Sulawesi	12	-	-	238,428,585	1,739,536	174,193,891	987,593	158,557,927	1,373,883	62,115,444	454,210	280,618,308	1,667,379	571,180,403	4,101,011	342,733,752	2,121,589
5	Central Sulawesi	76	20,000,000	196,000	1,439,097,398	14,350,772	1,344,792,960	14,919,510	360,649,205	4,504,476	715,488,392	7,825,942	252,551,521	3,069,327	3,144,539,564	33,774,758	967,969,914	10,895,270
6	Southeast Sulawesi	179	133,053,464	1,390,493	3,636,228,514	35,496,163	1,881,446,816	20,016,652	1,406,366,446	15,334,869	1,665,312,330	17,063,721	439,502,859	5,223,328	6,924,041,775	70,847,684	2,104,815,189	22,287,049
7	North Maluku	79	-	-	1,913,847,526	33,283,899	1,246,305,567	12,802,532	1,121,157,936	12,379,630	1,094,255,581	12,326,298	488,871,067	5,638,508	4,281,311,029	60,466,062	1,583,126,648	17,964,806
8	Maluku	1	-	-	833,703,503	-	694,752,919	-	365,659,431	-	123,694,640	2,300,974	24,125,130	379,348	1,894,115,853	-	147,819,770	2,680,322
9	West Papua	14	-	-	270,650,000	2,882,107	115,385,600	1,151,598	96,259,600	914,314	71,850,000	895,742	14,240,000	138,325	482,295,200	4,948,018	86,090,000	1,034,067
10	Papua	7	64,880,000	476,250	214,000,000	1,941,030	93,000,000	950,460	49,240,000	450,513	-	-	-	-	358,240,000	3,342,003	-	-
	Total	371	219,933,464	2,082,743	8,556,250,566	91,753,245	5,571,608,396	51,103,672	3,557,890,545	34,957,685	3,743,629,534	40,995,747	1,499,908,885	16,116,216	13,957,120,052	145,208,832	4,361,696,675	49,260,841

Figure 22. Total Nickel Ore/Metal Resources and Reserves by Province in 2021

Table 9. Grouping of Nickel Resources and Reserves Based on Ni content < 1.5% and Ni >= 1.5%

Ni Content	RESOURCES								RESERVES			
	Hypothetical		Inferred		Indicated		Measured		Probable		Proven	
	Ore (wmt)	Metal (tons)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)
Ni < 1.5 %	219,933,464	2,082,743	4,719,021,219	32,614,005	3,538,385,978	25,994,338	1,720,427,077	11,982,583	1,397,936,144	12,029,961	156,966,628	1,226,954
Ni > 1.5%			3,837,229,347	59,139,240	2,033,222,418	25,109,333	1,837,463,468	22,975,101	2,345,693,390	28,965,785	1,342,942,258	14,889,262

Table 10. Grouping of Nickel Resources and Reserves Based on Ni content < 1.7% and Ni >= 1.7%

Ni Content	RESOURCES								RESERVES			
	Hypothetical		Inferred		Indicated		Measured		Probable		Proven	
	Ore (wmt)	Metal (tons)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)
Ni < 1.7 %	219,933,464	2,082,743	6,755,933,662	54,462,075	4,374,676,601	35,875,091	2,452,755,078	20,529,458	2,350,292,045	22,449,861	383,426,858	3,764,062
Ni > 1.7%			1,800,316,904	37,291,170	1,196,931,795	15,228,581	1,105,135,467	14,428,226	1,393,337,489	18,545,886	1,116,482,028	12,352,153

Table 11. Grouping of Nickel Resources and Reserves by Type of Ore Material (Limonite/Saprolite)

TYPE OF NICKEL ORE DEPOSIT	RESOURCE							
	Hypothetical		Inferred		Indicated		Measured	
	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)
Limonite	-	-	1,522,797,061	13,143,292	717,765,872	6,692,254	412,998,014	4,138,170
Saprolite	260,000	-	1,685,454,371	19,440,510	722,818,333	9,101,446	714,219,090	8,669,315
Lainnya*	219,673,464	2,082,743	5,347,999,134	59,169,444	4,131,024,190	35,309,972	2,430,673,441	22,150,200

TYPE OF NICKEL ORE DEPOSIT	RESERVE			
	Probable		Proven	
	Ore (wmt)	Metal (tons)	Ore (wmt)	Metal (tons)
Limonite	515,052,457	4,497,360	100,190,020	1,033,081
Saprolite	635,827,492	7,667,582	341,522,226	4,287,730
Lainnya*	2,592,749,585	28,830,804	1,058,196,639	10,795,405

Note: * Others are groups whose data does not include the type of nickel ore material

Laterite iron resources and reserves are mostly dominated by inferred resources, while the total reserves are dominated by estimated reserves (Figure 23). The distribution of laterite iron resources and reserves is mostly in South Kalimantan, Southeast Sulawesi, Central Sulawesi, North Maluku, Maluku and West Papua (Table 12, Figure 25).

Laterite iron resources and reserves 2017-2021 generally increase with the addition of new and updated data. Laterite iron resources and reserves are mostly inferred resource status. To increase the resource, further exploration is needed to increase into designated and measured resource. In general, there is significant increase in the total lateritic iron resources from 2019-2021.

As for the cobalt commodity, the development of resources and reserves in 2017-2021 tends to increase relatively slow (Figure 26).
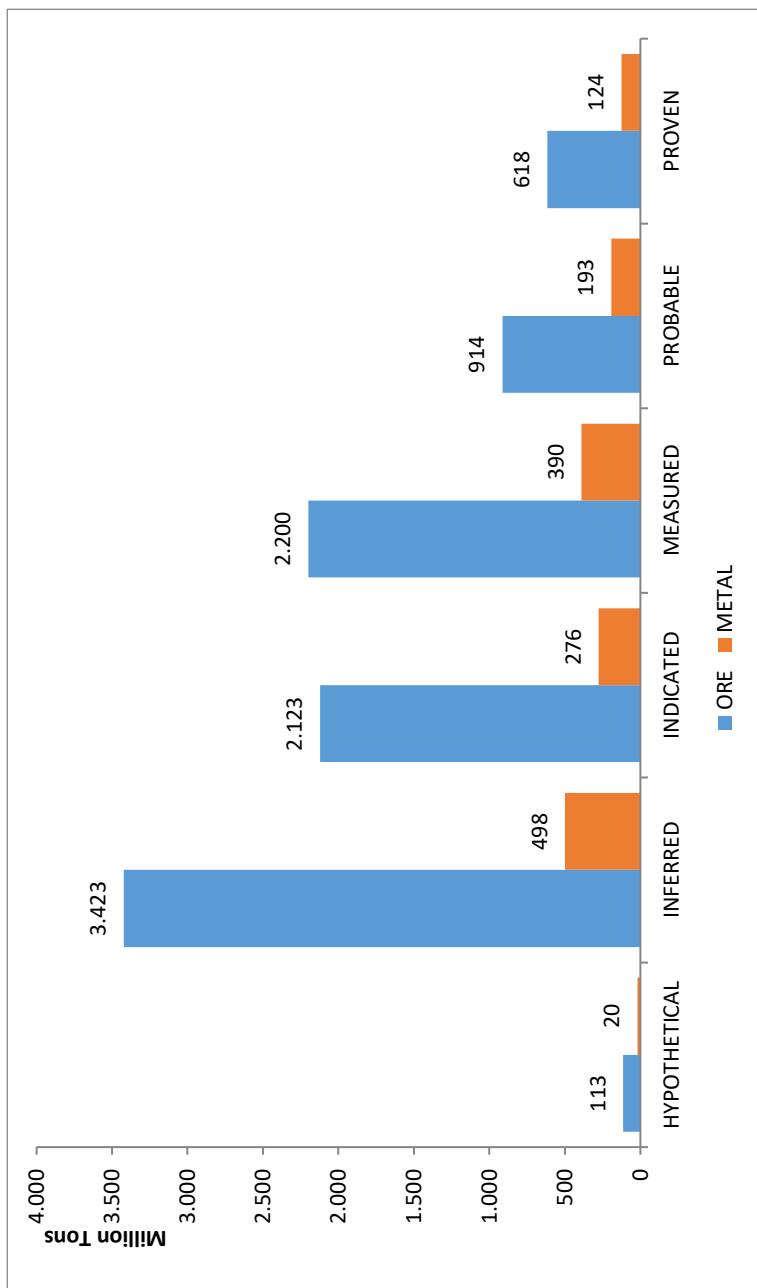
Figure 23. Laterite Iron Resources and reserves in 2021
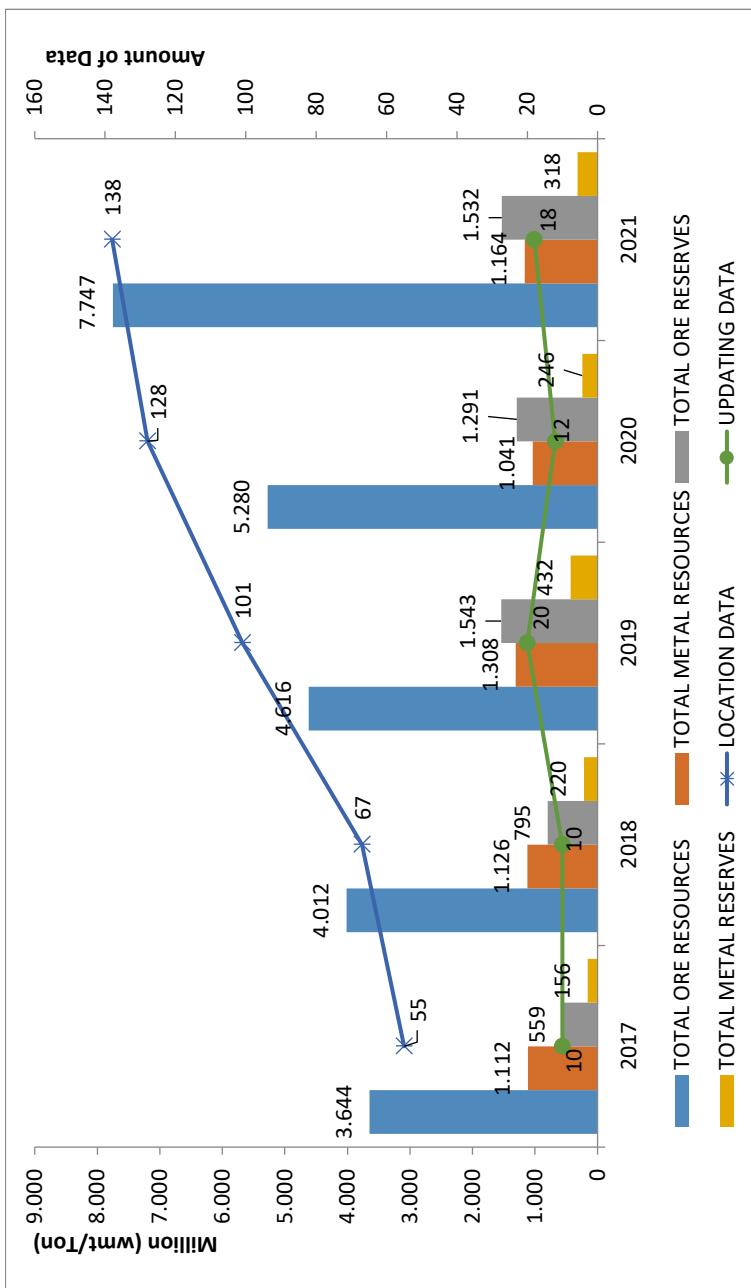
Figure 24. Laterite Iron Resources and Reserves in 2017 – 2021

Table 12. Laterite Iron Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL		INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Aceh	1	-	-	8,295,040	2,058,299	-	-	-	-	-	-	-	-	8,295,040	2,058,299	-	-
2	Lampung	3	2,413,437	295,023	8,000	5,819	-	-	-	-	-	-	-	-	8,000	5,819	-	-
3	West Java	1	-	-	500,000	225,000	-	-	-	-	-	-	-	-	500,000	225,000	-	-
4	South Kalimantan	12	-	-	212,523,157	13,329,043	186,498,137	60,384,781	185,925,533	69,724,502	136,338,391	55,467,929	153,841,144	51,174,724	584,946,827	143,438,326	290,179,535	106,642,652
5	South Sulawesi	6	-	-	390,525,544	187,948,110	17,969,023	4,993,626	4,540,625	685,307	2,565,339	382,586	2,900,156	605,316	413,035,192	193,627,044	5,465,495	1,187,902
6	Southeast Sulawesi	45	110,300,000	19,752,943	546,320,119	80,602,435	437,872,106	82,439,823	707,982,489	152,479,683	150,038,225	25,520,909	68,025,143	12,440,665	1,692,174,714	315,521,941	218,063,368	37,961,574
7	Central Sulawesi	26	-	-	209,205,043	32,793,145	163,601,970	28,522,383	142,010,630	21,160,872	92,240,362	13,952,824	98,131,986	15,504,710	514,817,644	82,476,400	190,372,328	29,457,534
8	North Maluku	25	-	-	870,020,028	147,849,341	530,464,830	97,966,954	682,227,496	122,932,650	350,448,926	44,979,136	260,175,832	36,716,126	2,082,712,954	368,748,945	610,624,758	81,695,262
9	Maluku	1	-	-	833,703,503	-	694,752,919	-	365,659,431	-	123,694,640	51,989,180	24,125,130	7,674,428	1,894,115,853	-	147,819,770	59,663,607
10	West Papua	13	-	-	352,130,000	33,368,941	91,680,000	1,344,151	71,388,000	12,618,763	58,930,000	786,024	10,740,000	138,325	515,198,000	47,331,855	69,670,000	924,349
11	Papua	5	-	-	-	-	-	-	40,733,000	10,757,770	-	-	-	-	40,733,000	10,757,770	-	-
	Total	138	112,713,437	20,047,966	3,423,231,034	498,180,134	2,122,838,985	275,651,718	2,200,467,204	390,339,548	914,255,883	193,278,588	617,939,371	124,254,292	7,746,537,224	1,164,191,400	1,532,195,254	317,532,880
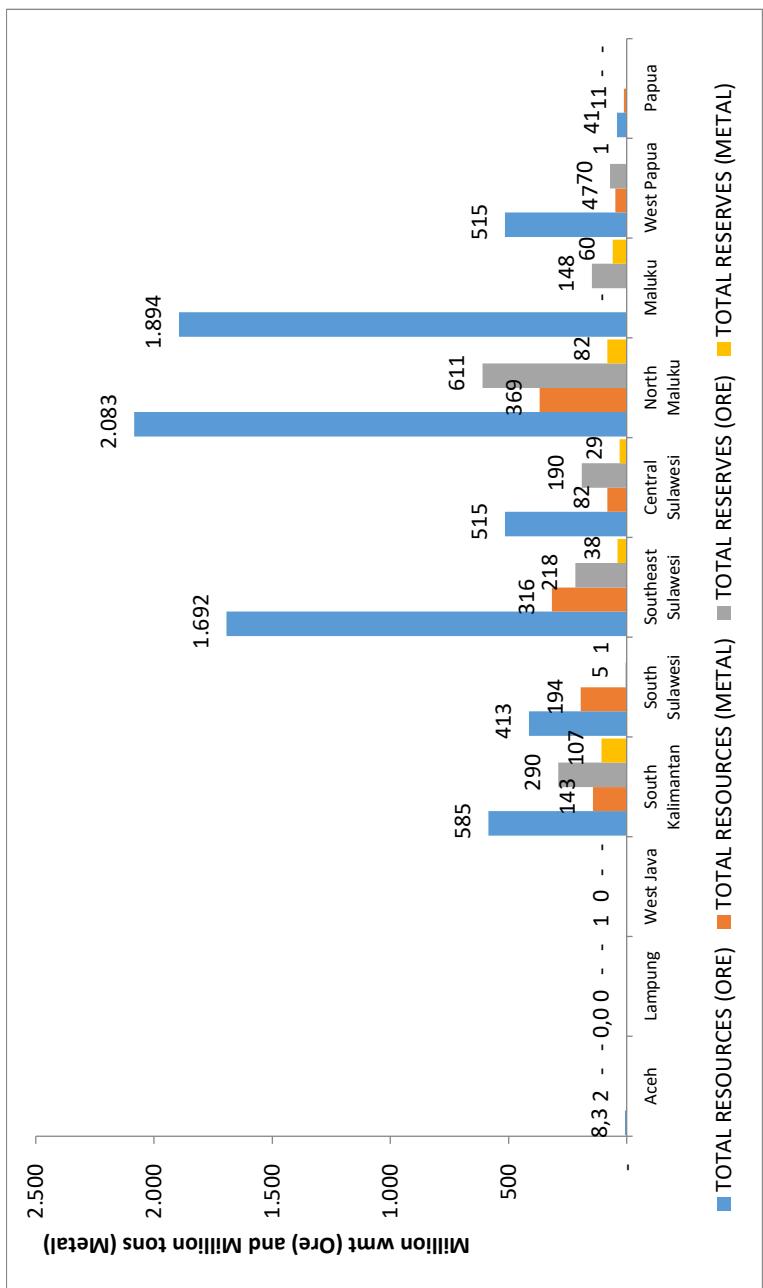
Figure 25. Laterite Iron Resources and Reserves by Province in 2021
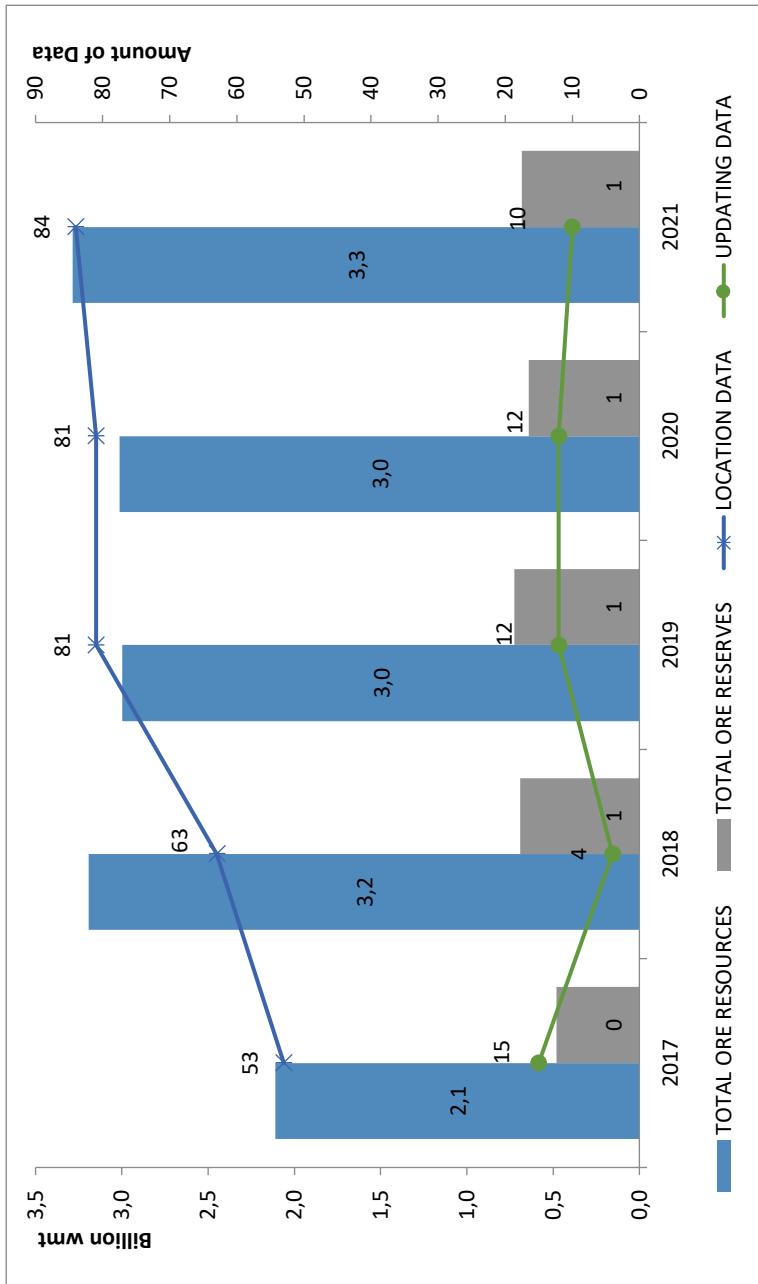
Figure 26. Cobalt Ore Resources and Reserves in 2017 - 2021

Bauxite

Similar to nickel ore and gold ore, bauxite should also be reported tonnage in the form of wmt and dmt. For companies that do not report bauxite resources in the form of dmt, the calculation of the content of metal aluminum (Al_2O_3) is carried out by first converting wmt ore to dmt. Based on the company's report which lists the tonnage of wmt and dmt ore, it is assumed that the moisture content in the wmt bauxite ore is 15%.

In 2021, the composition of bauxite resources and reserves is dominated by indicated resources and probable reserves. To increase the resilience of reserves, it is necessary to explore new areas so that inferred resources will increase and further/detailed exploration is also required so that measured resources will increase (Figure 27).

The development of resources and reserves in the last 5 years tends to increase along with the addition of the amount of data (Figure 28). Bauxite/aluminum resources and reserves by province in 2021 are presented in Table 13 and Figure 29.
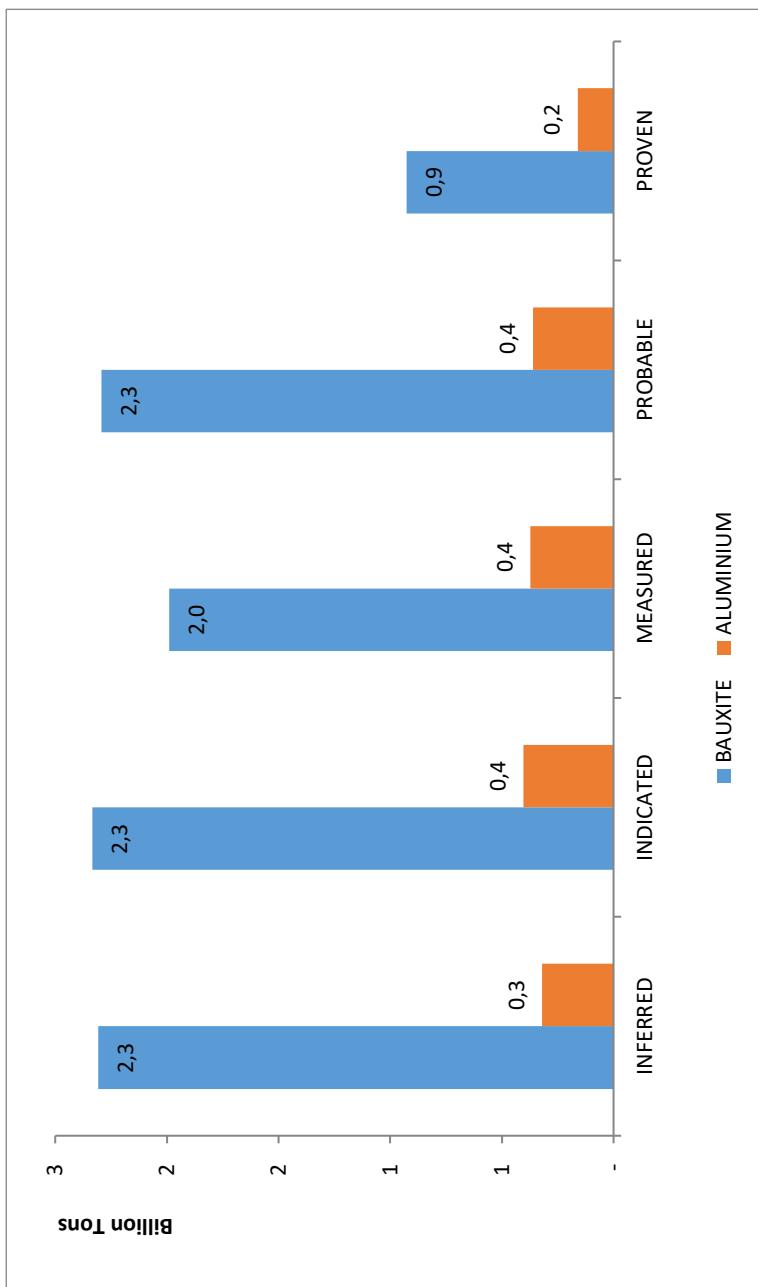
Figure 27. Bauxite and Aluminum Resources and Reserves in 2021
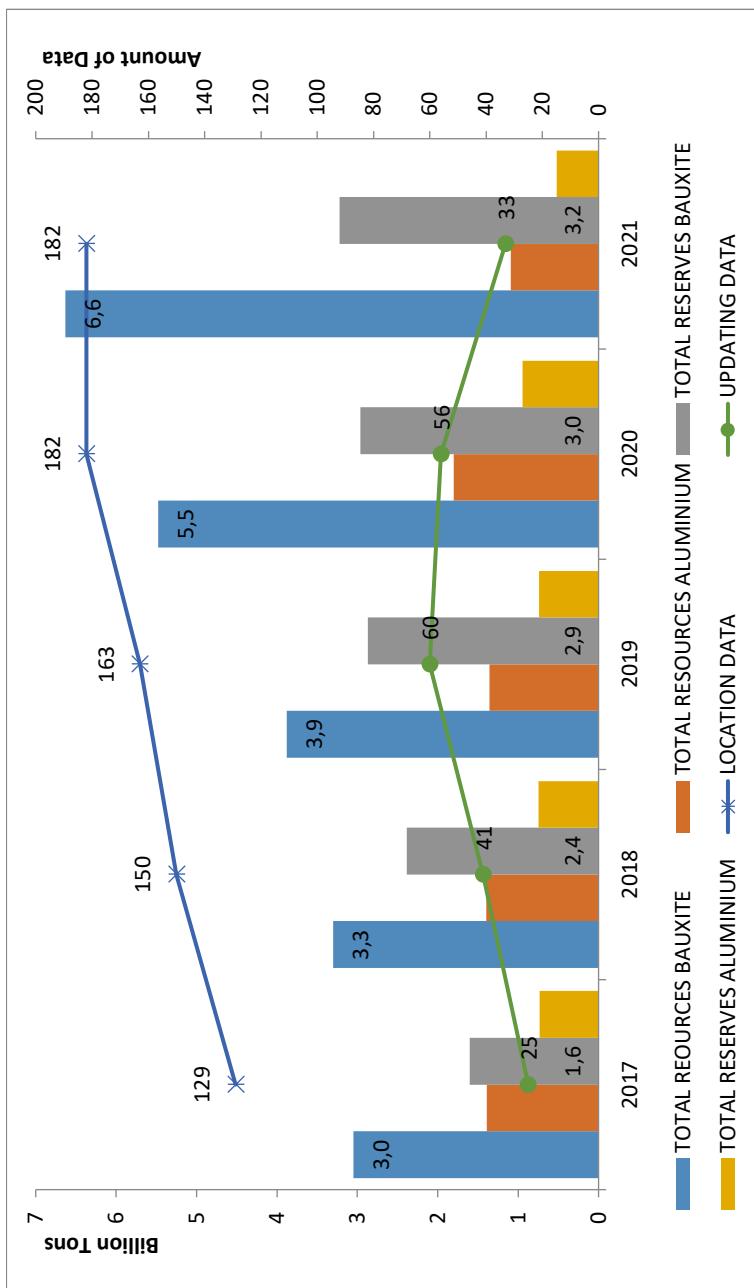
Figure 28. Bauxite/Aluminum Resources and Reserves in 2017 – 2021

Table 13. Bauxite / Aluminum Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL		INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Riau Island	44	-	-	588,603,300	59,900,458	209,295,014	39,755,220	300,304,989	61,381,460	438,111,153	44,040,232	151,015,349	27,711,122	1,098,403,303	161,037,138	589,126,502	71,751,355
2	Bangka Belitung Island	1	-	-	-	-	3,100,000	368,900	-	-	-	-	-	-	3,100,000	368,900	-	-
3	West Kalimantan	126	-	-	1,590,384,668	240,940,894	2,022,038,627	342,869,381	1,583,217,331	291,539,341	1,772,489,692	301,569,838	736,542,056	126,149,110	5,195,640,626	875,349,617	2,509,011,748	427,718,948
4	Central Kalimantan	11	-	-	128,766,033	18,235,355	100,344,329	19,913,284	105,883,948	19,281,824	82,496,770	14,143,047	40,223,990	6,861,751	334,994,310	57,430,464	122,720,760	21,004,798
	Total	182	-	-	2,307,954,001	319,076,707	2,334,777,970	402,906,786	1,989,406,268	372,202,626	2,293,077,615	359,753,118	927,781,395	160,721,984	6,632,138,239	1,094,186,118	6,617,261,883	1,134,862,529
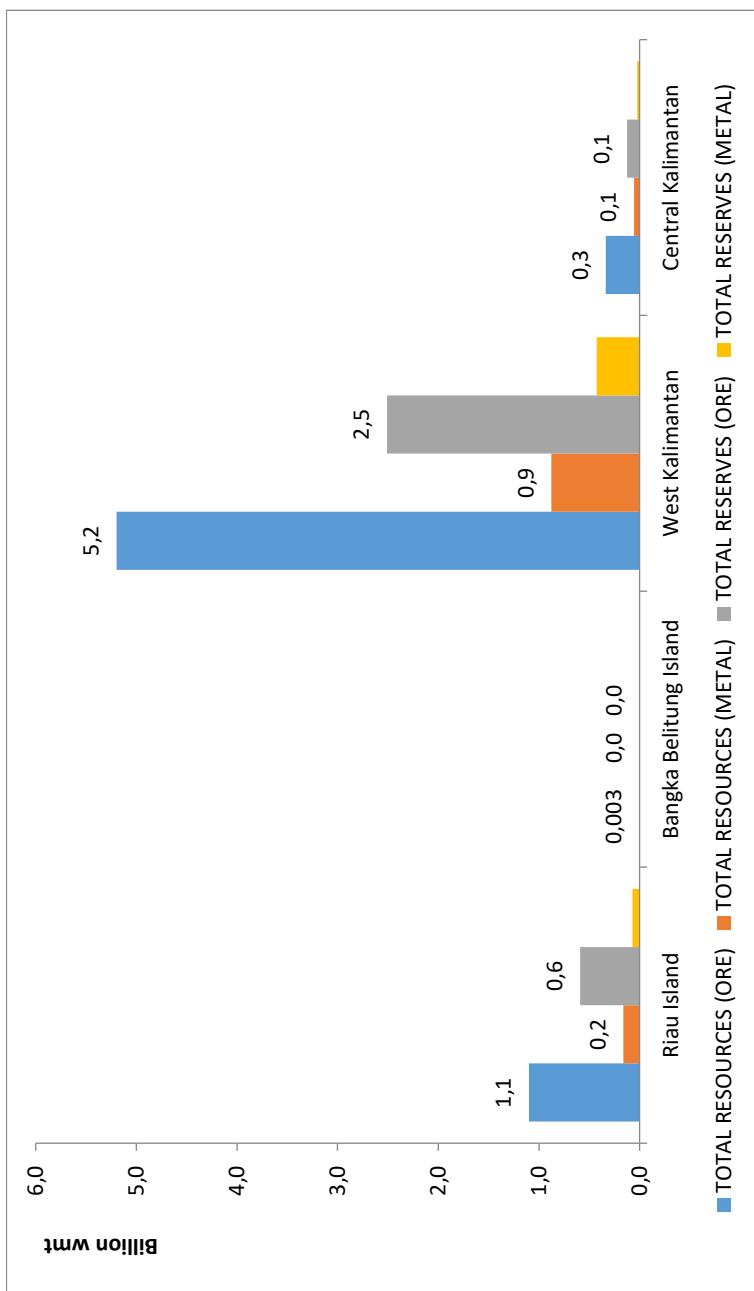
Figure 29. Bauxite/Aluminum Resources and Reserves by Province in 2021

Tin

Based on the development of tin resources and reserves in the last 5 years, in 2021, the update results obtained in 2021 that most of the tin concentrates are estimated reserves status and measured resources. Based on developments over the last 5 years, the value of tin resources and reserves 2017 to d. 2021, in general, experienced a slight decline. (Figure 30 and Figure 31, Table 14).

Based on the development of resources and reserves in the last 5 years, a more detailed feasibility study is needed to upgrade the status of measured resources to estimated reserves. Tin resources and reserves by Province can be seen in Table 15 and Figure 32. In addition, further exploration is needed to improve the status of inferred resources to designated/measured resources, to support the increase in total tin concentrate resources (Figure 33).
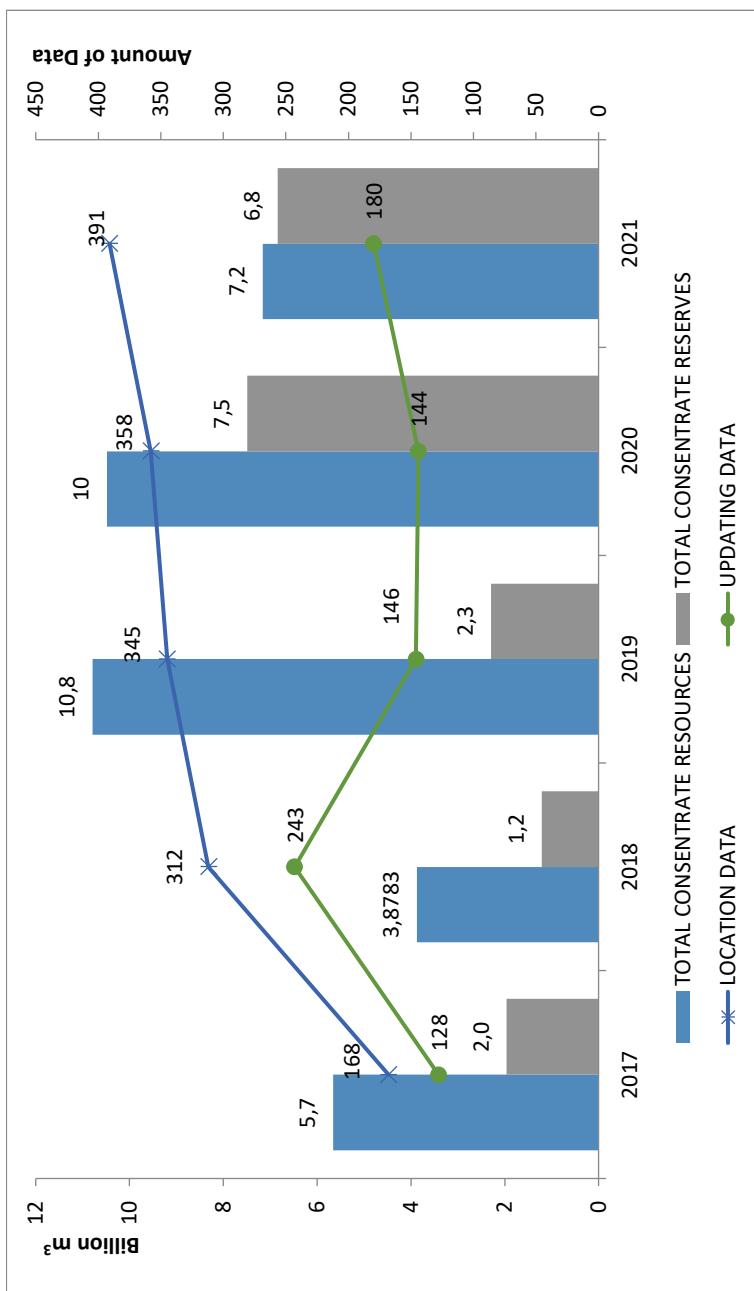
Figure 30. Comparison of Total Tin Concentrate Resources and Reserves in 2017 – 2021
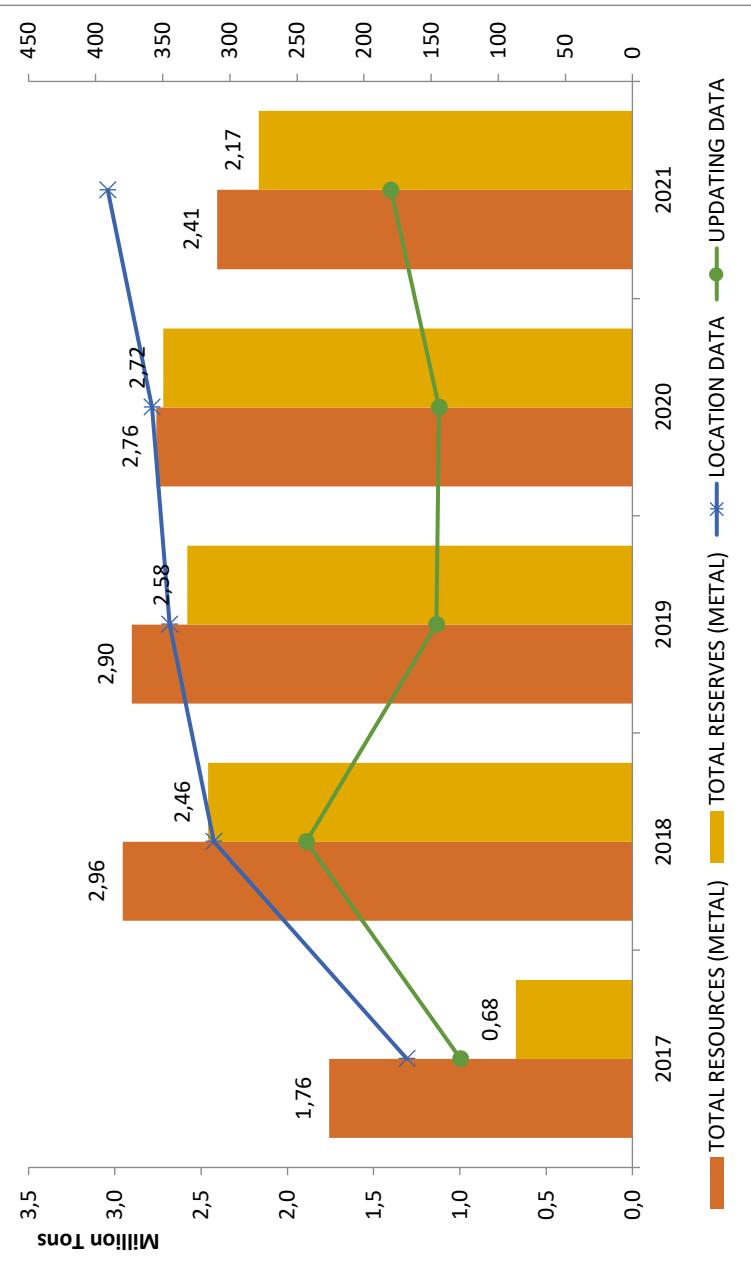
Figure 31. Development of Tin Resources and Reserves in 2017 – 2021

Table 14. Total Resources and Total Tin Sand Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	RESOURCES (METRIC TONS)								RESERVES (METRIC TONS)				TOTAL RESOURCES (METRIC TONS)		TOTAL RESERVES (METRIC TONS)	
			HYPOTHETICAL		INFERRED		INDICATED		MEASURED		PROBABLE		PROVEN		TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL				
1	Riau	5	90,675,000	3,165	4,353,000	169	208,269	5,207	10,000	250	-	-	-	-	4,571,269	5,626	-	-
2	Riau Island	28	-	-	441,397,182	46,027	190,339,541	60,787	501,674,070	110,447	539,675,496	93,329	173,173,585	70,623	1,133,410,793	217,261	712,849,081	163,952
3	Bangka Belitung Island	353	10,118,919	3,744	1,884,177,655	619,853	1,452,199,087	547,410	2,672,269,708	1,012,819	5,045,952,585	1,073,385	1,080,560,430	897,706	6,008,646,449	2,180,081	6,126,513,016	1,971,101
4	West Kalimantan	5	-	-	-	-	13,040,000	3,912	-	-	981,262	8,658	-	22,194	13,040,000	3,912	981,262	30,852
	Total	391	100,793,919	6,909	2,329,927,837	666,049	1,655,786,897	617,315	3,173,953,778	1,123,516	5,586,609,343	1,175,383	1,253,734,016	990,522	7,159,668,511	2,406,880	6,840,343,359	2,165,905
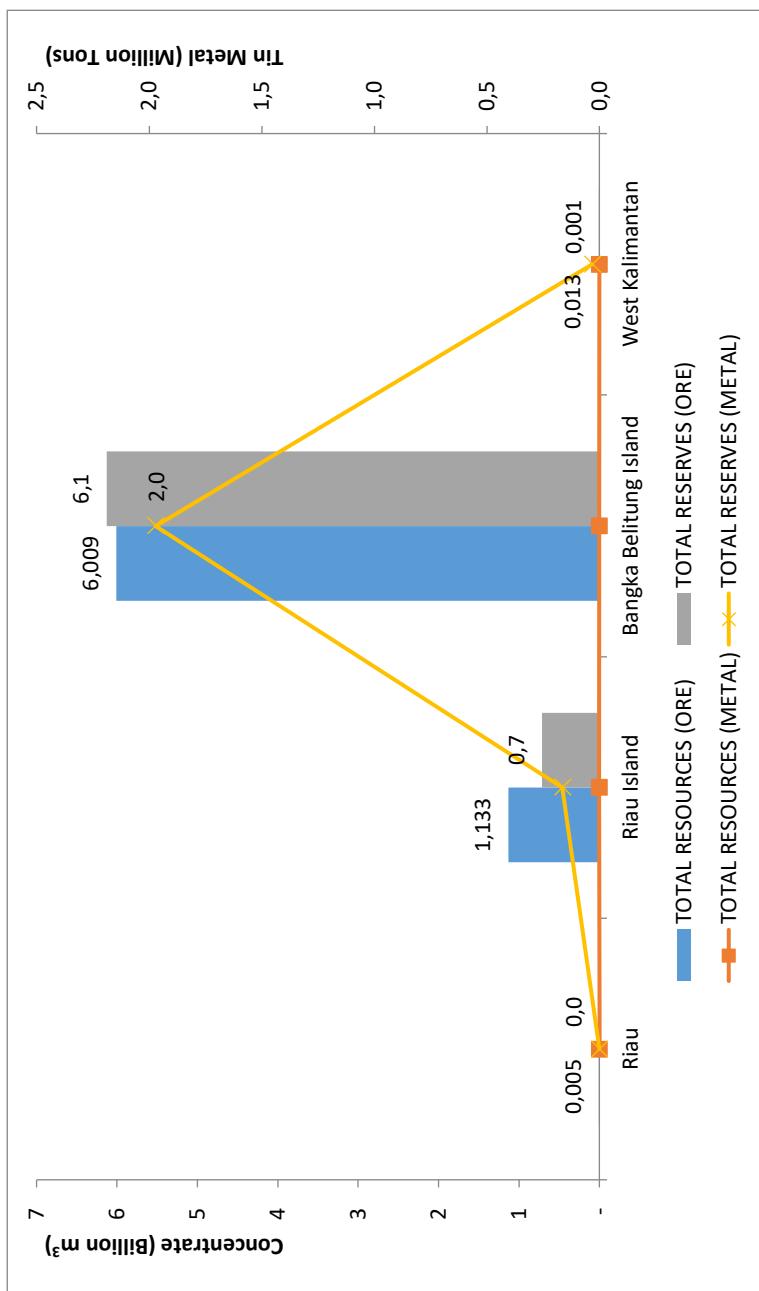
Figure 32. Total Resources and Total Tin Sand Reserves by Province in 2021
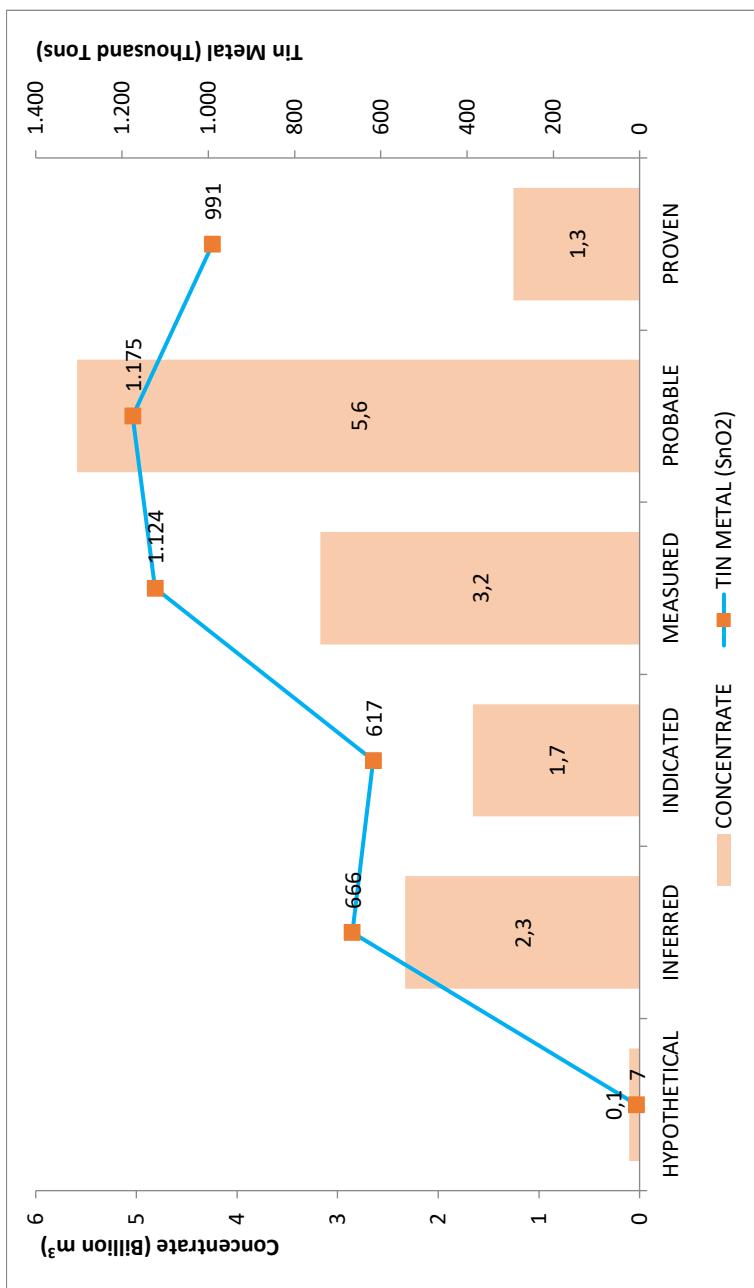
Figure 33. Tin Resources and Reserves in 2021

Iron Ore

Iron ore resources and reserves in 2021 are mostly in the form of indicated and measured resource status, which can be converted into estimated reserves through feasibility studies and including modification factors, so that reserves can be increased (Figure 34).

The development of iron ore resources and reserves in the 5 Years 2017-2021 is relatively fluctuating, although the amount of data tends to continue to increase. In accordance with the data for the last 5 (five) years, generally iron ore resources and reserves in 2021 experienced a relatively small increase from 2020. (Figure 35).

The distribution of iron ore resources and reserves is mostly found in Aceh, South Sulawesi and North Maluku. (Table 15 and Figure 36).
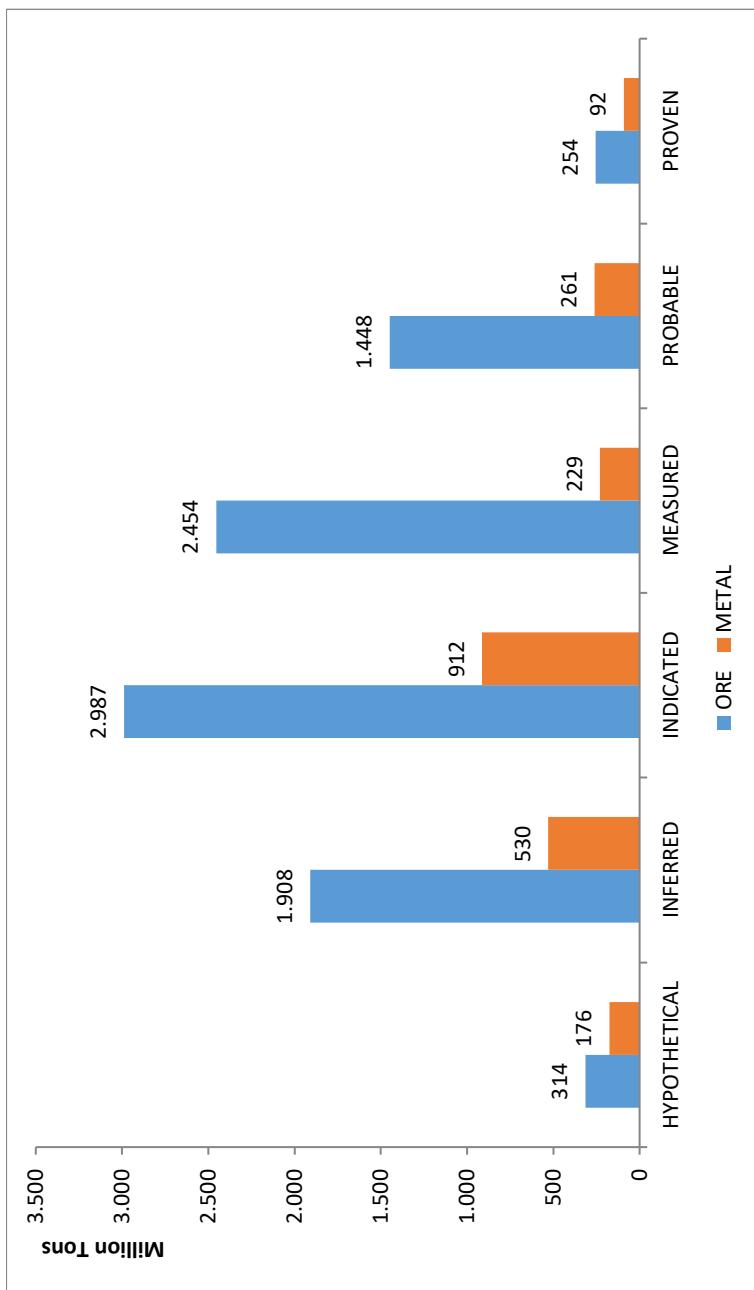
Figure 34. Resources and Reserves of Primary Iron/Metal Ore in 2021
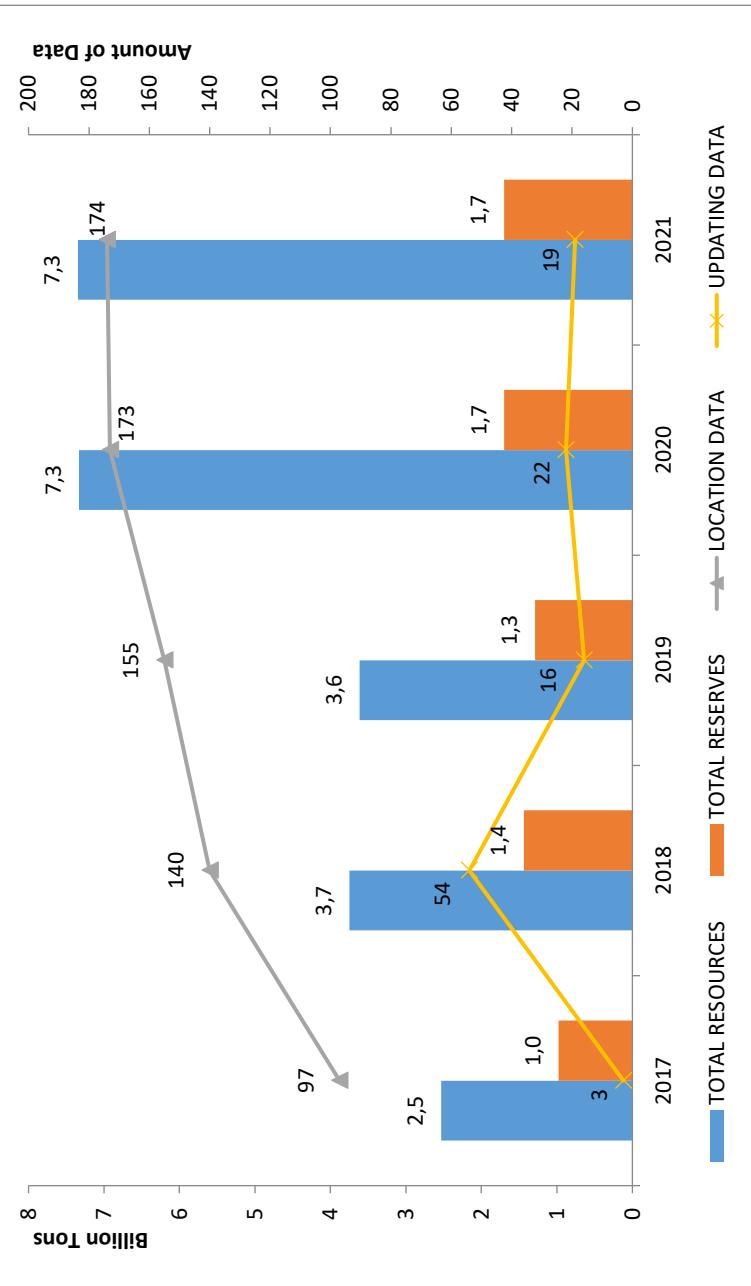
Figure 35. Primary Iron Ore Resources and Reserves 2017 – 2021

Table 15. Resources and Reserves of Primary Iron Ore/Metal by Province in 2021

| NO | PROVINCE | NUMBER OF LOCATION | HYPOTHETICAL | | RESOURCES (METRIC TONS) | | | | | | RESERVES (METRIC TONS) | | | | TOTAL RESOURCES (METRIC TONS) | | TOTAL RESERVES (METRIC TONS) | |
| | | | | | INFERRED | | INDICATED | | MEASURED | | PROBABLE | | PROVEN | | | | | |
			ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	ORE	METAL	TOTAL RESOURCES (ORE)	TOTAL RESOURCES (METAL)	TOTAL RESERVES (ORE)	TOTAL RESERVES (METAL)
1	Aceh	13	350,000	191,100	992,122,678	385,597,653	2,292,485,706	814,351,720	86,184,280	21,300,120	197,734,419	119,962,710	87,188,147	34,424,786	3,370,792,664	1,221,250,493	284,922,566	154,387,496
2	West Sumatra	21	10,708,228	2,150,000	76,390,851	11,206,149	81,299,130	690,497	18,155,854	2,337,491	99,749,977	7,026,783	36,232,168	296,808	175,845,835	14,224,137	135,982,085	7,323,590
3	Riau Island	5	-	-	10,422,920	30,250	-	-	-	-	24,114,934	-	-	-	10,422,920	30,250	24,114,934	-
4	Jambi	8	1,969	767	22,420,820	14,017,334	506,597	314,090	6,626,239	3,997,440	8,104,003	351,267	8,716,687	3,089,361	29,553,656	18,328,834	16,820,690	3,440,627
5	South Sumatra	3	-	-	2,400,000	1,131,840	2,469,440	-	900,000	-	5,086,835	-	739,200	-	5,769,440	1,131,840	5,826,035	-
6	Bangka Belitung Island	4	-	-	-	-	35,916,306	18,524,953	58,377	10	-	-	50,161	10	35,974,623	18,524,963	50,161	10
7	Lampung	7	10,019,250	5,731,706	891,185	448,942	788,612	477,922	1,261,509	638,753	1,142,548	583,956	-	-	2,941,306	1,585,617	1,142,548	583,956
8	West Java	6	-	-	18,000,000	-	-	-	-	-	37,427,111	-	-	-	18,000,000	-	37,427,111	-
9	West Nusa Tenggara	3	-	-	93,506	-	1,081,827	9,554	523,450	-	189,377	-	658,250	-	1,698,783	9,554	847,627	-
10	East Nusa Tenggara	2	-	-	34,965,280	20,979,168	26,223,960	15,734,376	18,208,640	10,947,109	3,496,528	2,097,917	1,748,264	1,048,958	79,397,880	47,660,653	5,244,792	3,146,875
11	West Kalimantan	12	293,000,080	######	288,000	-	-	-	72,908	43,016	49,993,728	13,617,188	45,000,000	25,650,000	360,908	43,016	94,993,728	39,267,188
12	Central Kalimantan	17	-	-	55,491,485	9,145,135	48,840,911	10,441,747	44,789,475	23,281,616	95,728,984	48,609,704	33,520,756	11,099,831	149,079,871	42,868,498	129,249,740	59,709,535
13	South Kalimantan	20	386,960	108,323	20,992,000	11,442,470	3,540,000	1,805,400	20,170,200	10,495,810	18,089,066	10,907,093	11,720,000	5,977,200	44,702,200	23,743,681	29,809,066	16,884,293
14	East Kalimantan	2	-	-	-	-	-	-	18,000,000	9,900,000	409,659	-	-	-	18,000,000	9,900,000	409,659	-
15	South Sulawesi	6	-	-	50,000,000	27,590,000	8,171,060	4,820,925	1,648,578,223	670,559	156,806,912	19,123,568	4,732,000	-	1,706,749,283	33,081,484	161,538,912	19,123,568
16	West Sulawesi	4	1,223	35	6,372	190	-	-	-	-	-	-	-	-	6,372	190	-	-
17	North Sulawesi	1	-	-	-	-	61,936,951	25,394,150	328,092,049	134,517,740	40,245,890	16,500,815	6,594,620	2,703,753	390,029,000	159,911,890	46,840,410	19,204,568
18	Central Sulawesi	2	-	-	3,900,000	2,145,000	368,487,933	-	-	-	368,487,933	-	-	-	372,387,933	2,145,000	368,487,933	-
19	North Maluku	42	-	-	619,402,199	46,728,649	55,544,600	19,762,783	262,746,129	10,700,926	344,256,923	22,707,081	17,235,239	7,978,498	937,711,928	77,193,358	358,508,162	30,685,780
	TOTAL	173	314,467,710	175,873,975	1,895,615,960	532,408,196	2,986,957,610	910,751,173	2,446,579,667	226,456,883	1,436,409,980	261,504,126	268,680,673	94,379,332	7,349,424,602	1,671,643,457	1,704,890,653	355,283,458

Figure 36. Primary Iron Ore Resources and Reserves by Province in 2021

3.1.2. NON-METALLIC MINERALS AND ROCKS RESOURCES

In 2021, the successful inventoried data came from the data on 345 IUPs for non-metallic minerals and rocks from the Directorate General of Minerals and Coal and 32 locations as a result of the CMCGR-Geological Agency investigation.

Table 16 . Data Source of Indonesia's Non-Metallic Mineral and Rock Resources and Reserve Balance in 2021

No	Province	IUPs (Directorate General of Minerals and Coal)	CMCGR Investigation	TOTAL
1	Aceh	1	25	26
2	Sumatra Utara	1	-	1
3	Sumatra Selatan	1	-	1
4	Kepulauan Bangka Belitung	1	-	1
5	Lampung	30	-	30
6	Banten	66	-	66
7	Jawa Barat	95	-	95
8	D.I Yogyakarta	61	-	61
9	Jawa Timur	42	-	42
10	Nusa Tenggara Barat	7	-	7
11	Nusa Tenggara Timur	1	-	1
12	Kalimantan Barat	16	3	19
13	Kalimantan Tengah	12	1	13
14	Kalimantan Timur	8	-	8
15	Sulawesi Tengah	2	-	2
16	Sulawesi Barat	-	3	3
17	Sulawesi Selatan	1	0	1
	TOTAL	345	32	377

Overall, the activity of updating balance data of the resource and reserves of non-metallic minerals and rocks in 2021 has increased compared to the previous year. In 2021, there were 255 new location points (addition of location points) of non-metallic mineral commodities in Indonesia for 17 commodities, and an update of 122 locations for 10 commodities in several provinces. So that the balance of non-metallic minerals in 2021 obtained the number of locations as many as 4,270 commodity points spread throughout Indonesia with a total of 57 types of commodities.
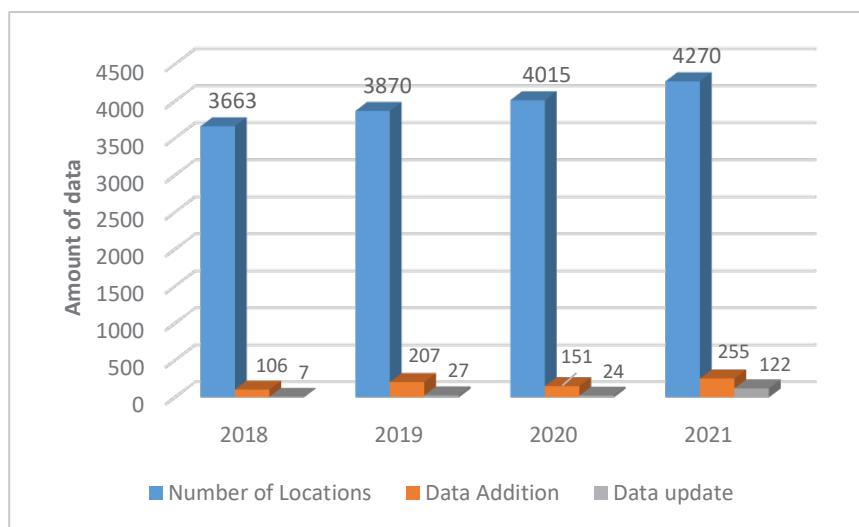
Figure 37. Statistics on the Number of Data Locations, Data Additions and Data Update on Non-Metalic Mineral and Rock Resources and Reserves for 2018-2021

The recapitulation of resources and reserves of all non-metallic mineral and rock commodities is shown in Table 17. In addition to the recapitulation of national resources and

reserves per commodity, the table also displays the amount of data in 2020, 2021, data update and new data. Compared to 2020, non-metallic mineral and rock commodities have also some significant changes in the size of resources and reserves. Some commodities that experience changes in resources include; andesite, limestone, marble, clay, quartz sand, sand and rock, sea sand, zircon, dolomite, bentonite, feldspar, ornamental stone, phosphate, granite, kaolin, tras and zeolite.

Table 17. Recapitulation of Non-Metallic Mineral and Rock Resources and Reserves in 2021

NO	COMMODITY	NUMBER OF LOCATIONS		2021 DATA ADDITION	2021 DATA UPDATE	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
		2020	2021				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	2	3	4	5	6	7	8	9	10	11	12
1	Amethyst	1	1	-	-	-	8.668,00	-	-	-	-
2	Andesite	520	601	81	66	57.689.810.000,00	12.790.494.354,84	4.967.321.254,57	3.299.072.992,75	2.066.679.540,00	1.095.011.889,37
3	Ball Clay	14	14	-	-	99.620.000,00	54.401.000,00	3.400.000,00	457.552,20	51.268,00	925.356,00
4	Barite	5	5	-	-	377.000,00	300.000,00	37.078.000,00	-	-	-
5	Basalt	31	32	1	-	1.282.160.420,00	4.954.151.560,00	89.479.600,00	-	1.675.100.000,00	-
6	Ornamental stone	13	16	3	-	2.940.750.784,04	61.000,00	-	-	-	-
7	Quartz stone	4	4	-	-	390.000,00	3.370.000,00	2.250.000,00	22.715.139,00	4.498.936,00	16.910.000,00
8	Potassium rock	31	31	-	-	-	56.676.412.099,68	13.229.435.792,59	1.439.436.947,98	-	-
9	Pumice	29	29	-	-	601.552.780,00	96.811.000,00	65.283.000,00	-	-	-
10	Limestone	828	865	37	16	607.954.760.100,00	151.730.183.981,21	14.839.694.008,18	10.967.613.152,31	6.854.594.751,95	5.161.447.828,72
11	Slate	6	6	-	-	1.946.958.000,00	-	-	-	-	-
12	Sulfur	17	17	-	-	1.697.000,00	254.400,00	2.610.192,00	357.100,00	2.610.192,00	-
13	Bentonite	105	105	-	2	501.190.800,00	282.096.286,00	62.323.381,00	7.378.039,70	3.472.713,00	5.948.130,08
14	Dasit	22	22	-	-	1.189.258.627,00	2.026.125.000,00	-	-	-	-
15	Diabas	1	1	-	-	625.000.000,00	-	-	-	-	-
16	Diatomacea	12	12	-	-	107.105.800,00	52.000,00	31.004.700,00	-	-	-
17	Diorite	28	28	-	-	8.773.845.000,00	520.000.000,00	780.730,00	-	604.195,00	-
18	Dolomite	52	52	-	1	2.378.907.607,00	849.833.208,90	1.613.457.747,80	8.066.254,45	129.471.072,55	29.077.688,80
19	Feldspar	164	166	2	-	6.435.680.286,00	4.330.206.001,92	456.533.705,44	33.322.114,21	13.429.688,24	21.140.769,79
20	Phosphate	60	62	2	-	19.113.040,00	1.654.913,00	5.477.079,00	1.353.588,00	-	187.561,00
21	Gypsum	13	13	-	-	7.268.422,00	-	9.890,00	161.000,00	-	-
22	Jade	1	1	-	-	-	74.475,00	-	-	-	-
23	Granite	136	142	6	-	60.760.216.683,00	17.575.756.274,00	602.676.825,00	3.213.366.490,00	450.822.652,00	188.051.600,00
24	Graphite	1	1	-	-	-	17.000.000,00	14.300.000,00	-	-	-
25	Granodiorite	8	8	-	-	2.126.000.000,00	-	-	-	-	-
26	Diamond*)	3	3	-	-	100.640,00	33.522.908,00	10.067.293,00	-	10.066.271,00	-
27	Jasper	2	2	-	-	600,00	-	650.000,00	-	-	-
28	Chalsedony	9	9	-	-	109.852,00	1.621.500,00	-	36.000,00	-	-
29	Calcite	7	7	-	-	60.025.000,00	62.092.200,00	-	-	377.632.565,00	-
30	Kaolin	110	113	3	-	1.249.877.424,00	225.335.227,64	97.149.200,00	16.905.292,00	2.302.612,00	5.990.630,00

1	2	3	4	5	6	7	8	9	10	11	12
31	Quartzite	1	1	-	-	-	13,750	-	-	-	-
32	Clay	16	16	-	-	2,975,259,000	80,133,498	217,115,000	-	-	-
33	Magnesite	545	547	2	3	90,949,234,845	8,538,523,811	1,042,960,608	373,818,877	68,677,735	222,341,870
34	Rusted wood	1	1	-	-	780	-	-	-	-	-
35	Marble	110	116	6	2	106,220,384,000	3,751,746,290	577,798,078	487,696,896	9,734,200	9,255,804
36	Obsidian	7	7	-	-	4,150,000	62,720,000	-	-	-	-
37	Ocher	11	11	-	-	123,085,840	-	45,000	-	-	-
38	Onyx	3	3	-	-	527,500	-	-	-	-	-
39	Opal	2	2	-	-	-	-	-	2	-	-
40	Zircon	46	50	4	-	5,026,850	77,393,642	36,919,531	7,638,145	38,291,368	9,924,495
41	Quartz sand	339	340	1	6	23,223,593,600	680,357,291	989,758,916	441,108,884	251,709,829	79,184,656
42	Sea sand**)	19	20	1	8	-	888,822,414	975,149,324	106,481,246	737,461,219	95,196,286
43	Peridotite	19	19	-	-	8,289,422,000	80,555,802	15,443,524	11,790,304	11,813,110	9,890,536
44	Perlite	20	20	-	-	1,287,190,100	193,004,000	938,000	-	-	-
45	Pyrophyllite	8	8	-	-	104,762,000	54,290,171	29,537,736	12,618,802	11,744,638	5,353,063
46	Prehnite	1	1	-	-	-	-	4,200	-	-	-
47	Chert	6	6	-	-	267,663,000	1,089,680	-	-	-	-
48	Serpentinite	12	12	-	-	1,290,635,000	137,500	-	-	-	-
49	Sand and rock	343	444	101	14	5,171,218,700	3,164,111,789	131,583,715	828,961,378	676,815,477	119,300,166
50	Talk	5	5	-	-	185,000	1,945,000	1,200	-	-	-
51	Toseki	36	36	-	-	221,651,000	48,816,000	5,080,000	-	-	-
52	Trakhite	23	23	-	-	4,124,316,000	-	1,286,927,500	-	-	-
53	Trass	106	108	2	4	4,307,815,880	236,989,000	66,718,400	78,187,153	156,304,897	11,874,318
54	Travertine	1	1	-	-	-	7,500	-	-	-	-
55	Ultrabasic	63	63	-	-	42,636,369,900	51,220,479,640	1,516,792,000	-	-	-
56	Iodine	4	4	-	-	-	-	-	138,192	9,020	1,638
57	Zeolite	35	38	3	-	236,081,163	113,100,000	140,993,662	36,770,532	3,029,283	1,105,296

*) unit in carat
**) unit in m^3

Table 18. Recapitulation of Total Resources and Total Reserves of Non-Metalic Minerals and Rocks in 2021

No.	Commodity	Hypothetical (metric tons)	Total Resources (metric tons)*	Total Reserves (metric tons)**
1	2	3	4	5
1	Amethyst	-	8,668	-
2	Andesite	57,689,810,000	21,056,888,602	3,161,691,429
3	Ball Clay	99,620,000	58,258,552	976,624
4	Barite	377,000	37,378,000	-
5	Basalt	1,282,160,420	5,043,631,160	1,675,100
6	Ornamental stone	2,940,750,784	61,000	-
7	Quartz stone	390,000	28,335,139	21,408,936
8	Potassium rock	-	71,345,284,840	-
9	Pumice	601.552.780	162.094.000	-
10	Limestone	607,954,760,100	177,537,491,141	12,016,042,580
11	Slate	1,946,958,000	-	-
12	Sulfur	1,697,000	3,221,692	2,610,192
13	Bentonite	501,190,800	351,797,706	9,420,843
14	Dasit	1,189,258,627	2,026,125,000	-
15	Diabas	625,000,000	-	-
16	Diatomacea	107,105,800	31,056,700	-
17	Diorite	8,773,845,000	520,780,730	604,195
18	Dolomite	2,378,907,607	2,471,357,211	158,548,761
19	Feldspar	6,435,680,286	4,820,061,821	34,570,458
20	Phosphate	19,113,040	8,485,580	187,561
21	Gypsum	7,268,422	170,890	-
22	Jade	-	74,475	-
23	Granite	60,760,216,683	21,391,799,589	638,874,252
24	Graphite	-	31.300.000	-
25	Granodiorite	2,126,000,000	-	-
26	Diamond*)	100,640	43,590,201	10,066,271
27	Jasper	600	650,000	-
28	Chalsedony	109,852	1,657,500	-
29	Calcite	60,025,000	62,092,200	377,632,565
30	Kaolin	1,249,877,424	339,389,719	8,293,242
31	Rusted wood	-	13,750	-
32	Quartzite	2,975,259,000	297,248,498	-
33	Clay	90,949,234,845	9,955,303,296	291,019,605
34	Magnesite	780	-	-

1	2	3	4	5
35	Marble	106,220,384,000	4,817,241,264	18,990,004
36	Obsidian	4,150,000	62,720,000	-
37	Ocher	123,085,840	45,000	-
38	Onyx	527,500	-	-
39	Opal	-	1.67	-
40	Zircon	5,026,850	121,951,318	48,215,864
41	Quartz sand	23,223,593,600	2,111,225,091	330,894,485
42	Sea sand**)	-	1,970,452,984	832,657,505
43	Peridotite	8,289,422,000	107,789,630	21,703,646
44	Perlite	1,287,190,100	193,942,000	-
45	Pyrophyllite	104,762,000	96,446,710	17,097,702
46	Prehnite	-	4,200	-
47	Chert	267,663,000	1,089,680	-
48	Serpentinite	1,290,635,000	137,500	-
49	Sand and rock	5,171,218,700	4,124,656,883	796,115,643
50	Talk	185,000	1,946,200	-
51	Toseki	221,651,000	53,896,000	-
52	Trakhite	4,124,316,000	1,286,927,500	-
53	Trass	4,307,815,880	381,894,553	168,179,215
54	Travertine	-	7,500	-
55	Ultrabasic	42,636,369,900	52,737,271,640	-
56	Iodine	-	138,192	10,658
57	Zeolite	236,081,163	290,864,194	4,134,579

*) unit in carat
**) unit in m³

From the recapitulation data on resources and reserves of non-metallic minerals and rocks (Table 17), it is shown that some commodities have very high hypothetical resources, which are expected to be increased into inferred, indicated and even measured resources, so that efforts to increase exploration activities in the area are needed. Some commodities also show no reserve figures, this proves that there are still few companies that report the amount of reserves and production and/or some commodities have not been extracted and utilized optimally. Therefore, it is necessary

to coordinate with the management of mining business data, both the Central and Regional Government in order to make inventory of the latest developments of non-metallic mineral and rock resources and reserves in each region.

The following describes the condition of resources and reserves of several non-metallic mineral and rock commodities including tables and graphs containing data by Province, the total number of resources, total reserves and the amount of data on several types of non-metallic mineral commodities within period of 5 years (2017-2021).

ANDESITE

Andesite is a non-metallic mineral and rock commodity whose potential is spread out almost all provinces in Indonesia. Andesite is a commodity that plays a very important role in supporting infrastructure development in remote parts of the archipelago. The recapitulation of andesite resources and reserves in each province available in Table 19.

The development of andesite resources and reserves in the last 5 years tends to increase along with addition of the amount of data (Figure 38). However, resources and reserves in 2021 have decreased when compared to 2019 and 2020. It is estimated that in those two years there will be significant additional data from IUP holders, while in 2021 there will be significant updates for this andesite resource and reserve data.

Table 19. Andesite Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Aceh	17	957,700,000	-	-	-	-	-
2	Bali	1	-	403,000	-	-	-	-
3	Banten	47	154,172,000	1,432,148,464	1,342,670,192	510,717,624	705,170,886	303,808,125
4	Bengkulu	1	26,000,000	-	-	-	-	-
5	DI Yogyakarta	11	-	7,646,318	6,599,764	143,949,037	42,592,420	35,949,178
6	Gorontalo	22	-	2,504,000,000	-	-	-	-
7	Jambi	8	494,065,000	2,500,000	-	-	-	-
8	Jawa Barat	147	513,993,500	662,601,347	524,537,931	2,024,112,380	888,204,956	556,359,129
9	Jawa Tengah	19	1,370,740,000	78,000,000	286,094,000	-	-	-
10	Jawa Timur	33	1,377,945,000	31,573,988	19,323,390	45,179,659	20,587,344	22,865,116
11	Kalimantan Barat	46	19,806,125,000	7,137,100,000	126,664,197	-	73,992,254	12,699,463
12	Kalimantan Selatan	21	9,375,560,000	100,000,000	-	-	-	-
13	Kalimantan Tengah	9	156,300,000	71,826,741	3,313,348	2,588,838	3,141,471	2,976,838
14	Kalimantan Timur	6	1,063,255,000	33,649,000	176,921,968	86,002,081	42,708,557	44,278,988
15	Kalimantan Utara	3	1,227,000	-	-	-	-	-
16	Kepulauan Riau	2	134,000,000	-	348,400,000	-	-	-
17	Lampung	39	1,789,532,000	83,589,391	153,529,493	101,768,213	114,282,473	86,104,635
18	Maluku Utara	2	279,170,000	-	-	-	-	-
19	Nusa Tenggara Barat	26	218,142,000	3,490,000	999,309,000	235,050,800	-	-
20	Nusa Tenggara Timur	36	8,934,284,000	92,920,000	68,125,000	-	-	-
21	Papua Barat	1	13,000,000	-	-	-	-	-
22	Riau	2	-	-	714,000,000	-	-	-
23	Sulawesi Barat	8	446,987,500	-	-	-	-	-
24	Sulawesi Selatan	23	1,694,400,000	-	-	-	-	-
25	Sulawesi Tengah	2	1,050,000	-	-	6,160,295	-	5,711,650
26	Sulawesi Tenggara	1	10,000,000	-	-	-	-	-
27	Sulawesi Utara	34	1,957,484,000	48,904,966	21,499,931	3,611,025	36,393,076	554,400
28	Sumatra Barat	10	330,760,000	-	-	-	-	-
29	Sumatra Selatan	16	6,199,668,000	485,141,140	176,333,041	139,933,041	139,906,102	25,447,547
30	Sumatra Utara	8	384,250,000	15,000,000	-	-	-	-
	TOTAL	601	57,689,810.000	12,790,494,355	4,967,321,255	3,299,072,993	2,066,979,539	1,096,755,069
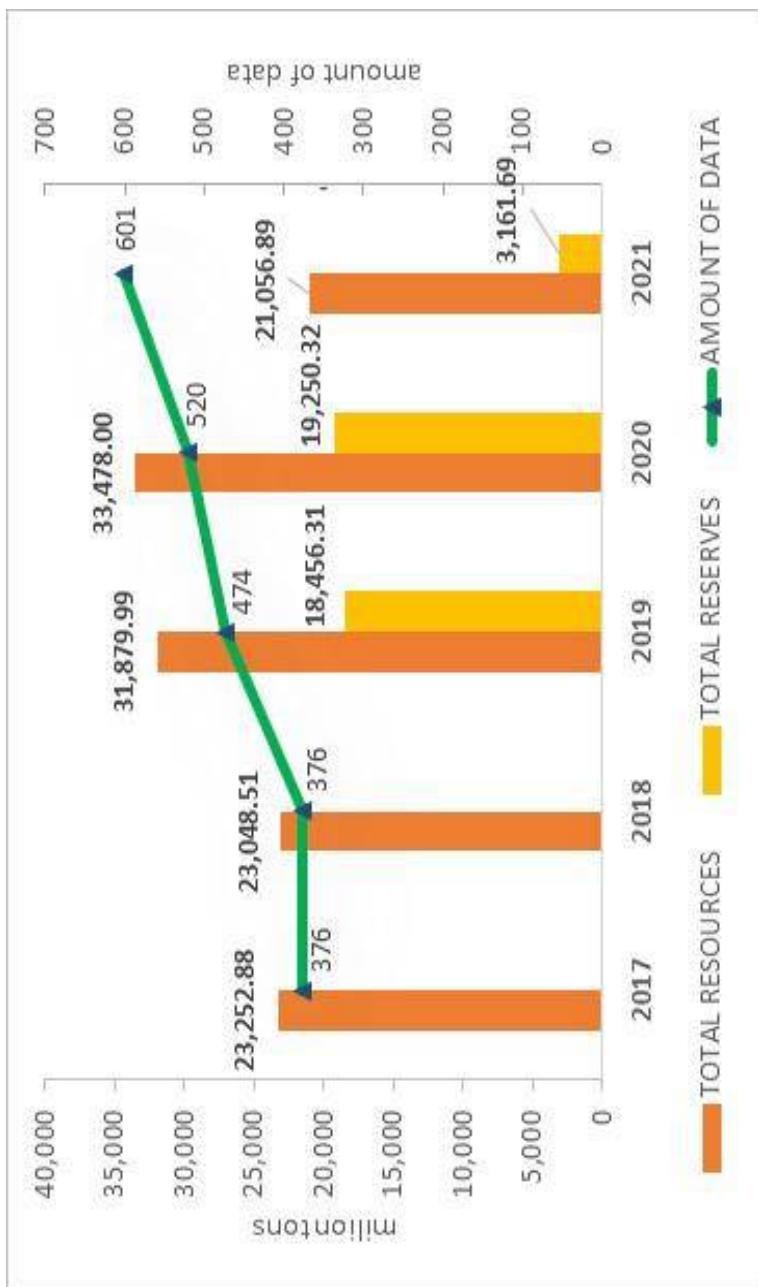
Figure 38. Statistics of Total Andesite Resources and Reserves in 2017 - 2021

LIMESTONE

Limestone is also a non-metallic mineral and rock commodity whose potential is spread out almost all provinces in Indonesia. Currently, limestone is indispensable and has become a very important commodity to support the raw materials for cement and several other industries in Indonesia. Limestone is also used as an alternative building material for certain areas. The recapitulation of limestone resources and reserves in each province available in Table 20.

The development of limestone resources and reserves in the last 5 years tends to increase along with addition of data (Figure 39). This is estimated to be influenced by additional data and significant updates from IUP holder and data from the results of CMCGR investigation activities in 2020, namely limestone investigation activities in Aceh Province.

SEA SAND

Reporting on the amount of resources and reserves of sea sand uses the unit of cubic meters (M^3). The recapitulation of sea sand resources and reserves in each province available in Table 21. The development of sea sand resources and reserves in the last 5 years tends to increase along with additional data (Figure 40). This is estimated to be influenced by additional data and significant data updates of the IUP holders.

Table 20. Limestone Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Aceh	65	10,478,721,000	6,099,010,932	70,000,000	-	916,550,718	1,609,660,500
2	Bali	9	4,982,737,000	-	879,551,000	1,329,500,000	-	-
3	Banten	11	60,000,000	2,544,554,792	463,417,539	625,867,375	2,222,558,558	79,560,000
4	Bengkulu	5	837,088,000	-	-	-	-	-
5	DI Jogjakarta	9	365,602,000	4,532,390	3,612,930	9,626,971	2,649,458	4,616,463
6	Gorontalo	14	-	25,533,350,000	-	-	-	-
7	Jambi	4	8,100,000	1,043,841,600	389,655,360	1,619,684,640	-	-
8	Jawa Barat	35	431,195,000	250,576,485	17,361,158	1,634,823,007	2,044,746,833	1,616,322,270
9	Jawa Tengah	28	625,302,000	4,792,788,568	1,989,386,687	878,383,795	99,247,000	369,833,000
10	Jawa Timur	84	1,191,654,000	597,465,839	1,813,116,469	1,359,253,851	83,014,732	54,595,740
11	Kalimantan Selatan	44	24,815,810,000	1,511,809,630	1,524,050,734	215,810,839	188,413,943	157,580,818
12	Kalimantan Tengah	10	448,775,000	-	-	-	-	-
13	Kalimantan Timur	32	5,494,901,000	12,963,682,642	2,548,038,632	261,951,243	189,737,544	188,893,794
14	Kalimantan Utara	5	1,109,500,000	-	-	-	-	-
15	Lampung	9	15,141,000	231,014,761	8,835,323	6,299,742	5,021,965	2,478,296
16	Maluku	1	65,250,000,000	-	-	-	-	-
17	Maluku Utara	24	11,273,072,800	16,914,250,000	34,290,000	-	-	-
18	Nusa Tenggara Barat	27	1,116,263,000	21,826,000	58,050,000	-	-	-
19	Nusa Tenggara Timur	104	32,504,948,000	30,462,126,000	1,519,388,750	-	-	-
20	Papua	38	19,668,100,000	168,832,034	-	147,142,000	-	-
21	Papua Barat	60	271,599,830,000	5,559,083,000	-	-	-	-
22	Riau	2	42,986,000	-	-	-	-	-
23	Sulawesi Barat	11	616,375,000	-	119,700,000	-	-	-
24	Sulawesi Selatan	44	11,917,414,000	4,275,426,808	515,437,446	359,117,729	9,250,000	349,867,729
25	Sulawesi Tengah	42	20,790,088,300	-	-	-	-	-
26	Sulawesi Tenggara	45	34,275,884,000	36,087,210,782	2,133,535,978	1,689,120,305	773,008,006	492,296,219
27	Sulawesi Utara	14	2,728,715,000	-	-	-	-	-
28	Sumatra Barat	61	83,038,747,000	1,793,028,000	40,845,000	40,845,000	377,632,565	-
29	Sumatra Selatan	16	425,707,000	861,753,289	710,492,003	790,186,655	4,147,000	235,743,000
30	Sumatra Utara	12	1,842,104,000	14,020,430	929,000	-	3,966,430	-
	TOTAL	865	607,954,760,100	151,730,183,981	14,839,694,008	10,967,613,152	6,919,944,752	5,161,447,829
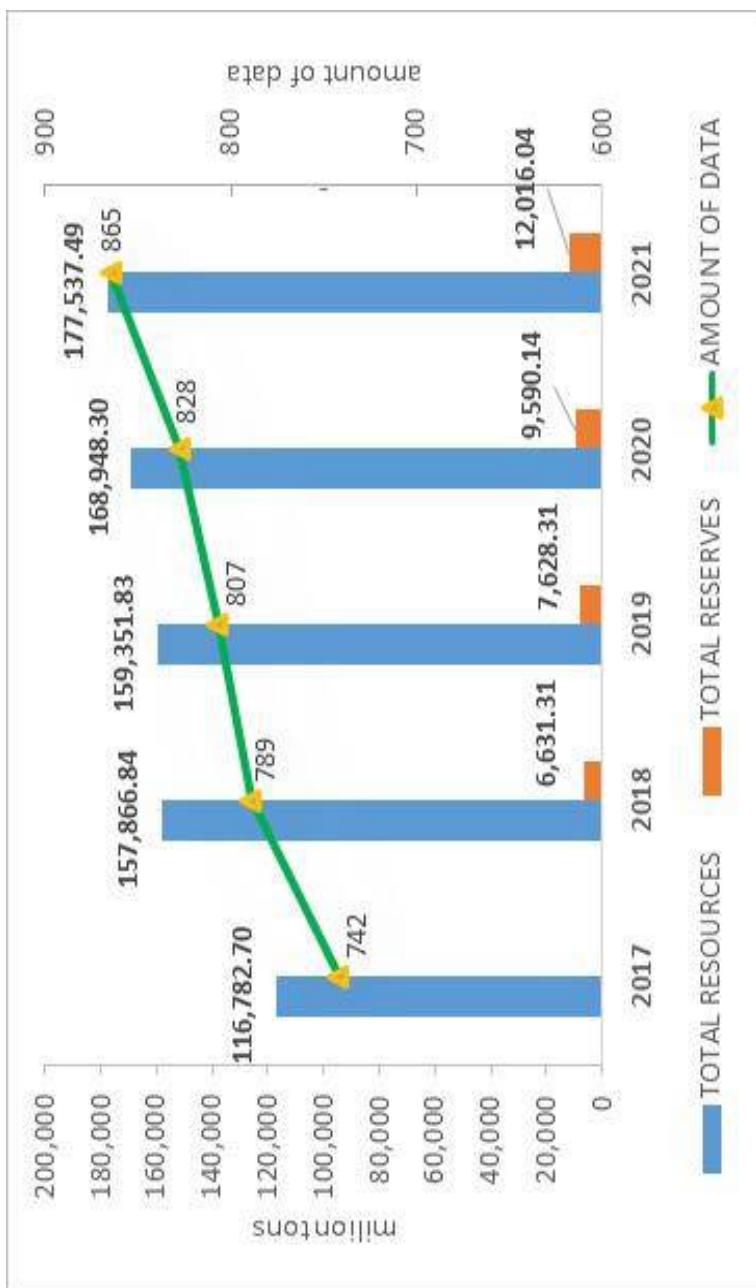
Figure 39. Statistics of Total Limestone Resources and Reserves in 2017 - 2021

Table 21. Sea sand Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (CUBIC METERS)	RESOURCES (CUBIC METERS)			RESERVES (CUBIC METERS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	2	3	4	5	6	7	8	9
1	Banten	10	-	166,208,601	127,489,988	106,481,246	119,394,116	95,196,286
2	DKI Jakarta	9	-	719,776,227	700,825,372	-	471,233,139	-
3	Lampung	1	-	2,837,586	146,833,964	-	146,833,964	-
	TOTAL	20	-	888,822,414	975,149,324	106,481,246	737,461,219	95,196,286

Table 22. Clay Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	2	3	4	5	6	7	8	9
1	Aceh	80	1,047,274,000	1,231,000	30,800,000	-	-	-
2	Bali	1	125,000	-	-	-	-	-
3	Banten	5	420,000,000	213,992,298	151,765,167	118,844,552	31,282,693	-
4	Bengkulu	1	20,000,000	-	-	-	-	-
5	D.I. Yogyakarta	1	18,500,000	-	-	-	-	-
6	Gorontalo	1	-	750,000,000	-	-	-	-
7	Jambi	7	1,646,000,000	70,000,000	-	22,506,000	-	-
8	Jawa Barat	5	44,000,000	35,000,000	-	-	391,516	179,155,659
9	Jawa Tengah	30	137,752,000	152,928,000	175,990,000	-	-	-
10	Jawa Timur	24	3,600,000	12,465,045	119,070,045	172,739,404	3,284,884	15,605,672
11	Kalimantan Barat	32	671,525,000	-	25,000,000	-	-	-
12	Kalimantan Selatan	33	4,167,934,000	237,400,000	490,045,700	19,942,000	-	-
13	Kalimantan Tengah	15	185,933,000	-	-	-	-	-
14	Kalimantan Timur	31	1,065,143,000	52,920,000	-	-	-	-
15	Kalimantan Utara	9	157,325,000	-	-	-	-	-
16	Kepulauan Bangka Belitung	1	19,800,000	-	-	-	-	-
17	Lampung	14	23,350,000	-	-	-	-	-
18	Maluku Utara	4	345,800,000	-	-	-	-	-
19	Nusa Tenggara Barat	10	503,142,000	-	8,361,000	-	-	-
20	Nusa Tenggara Timur	28	2,330,616,895	1,581,827,000	-	-	-	-
21	Papua	13	4,080,150,000	-	-	319,000	-	-

1	2	3	4	5	6	7	8	9
22	Papua Barat	16	5,316,806,000	1,625,000,000	-	-	-	-
23	Riau	26	114,950,000	44,250,000	-	-	-	-
24	Sulawesi Barat	10	414,440,000	-	-	-	-	-
25	Sulawesi Selatan	30	327,458,000	1,160,289,795	38,925,306	14,208,034	15,006,457	11,829,229
26	Sulawesi Tengah	12	1,891,508,600	-	-	-	-	-
27	Sulawesi Tenggara	10	5,810,116,000	-	-	-	-	-
28	Sulawesi Utara	8	980,200,000	6,262,000	-	-	-	-
29	Sumatra Barat	29	10,387,209,000	-	-	262,668	-	-
30	Sumatra Selatan	49	47,670,967,350	2,594,958,673	3,003,390	24,997,219	18,712,185	15,751,311
31	Sumatra Utara	12	1,147,610,000	-	-	-	-	-
	TOTAL	547	90,949,234,845	8,538,523,811	1,042,960,608	373,818,877	68,677,735	222,341,871
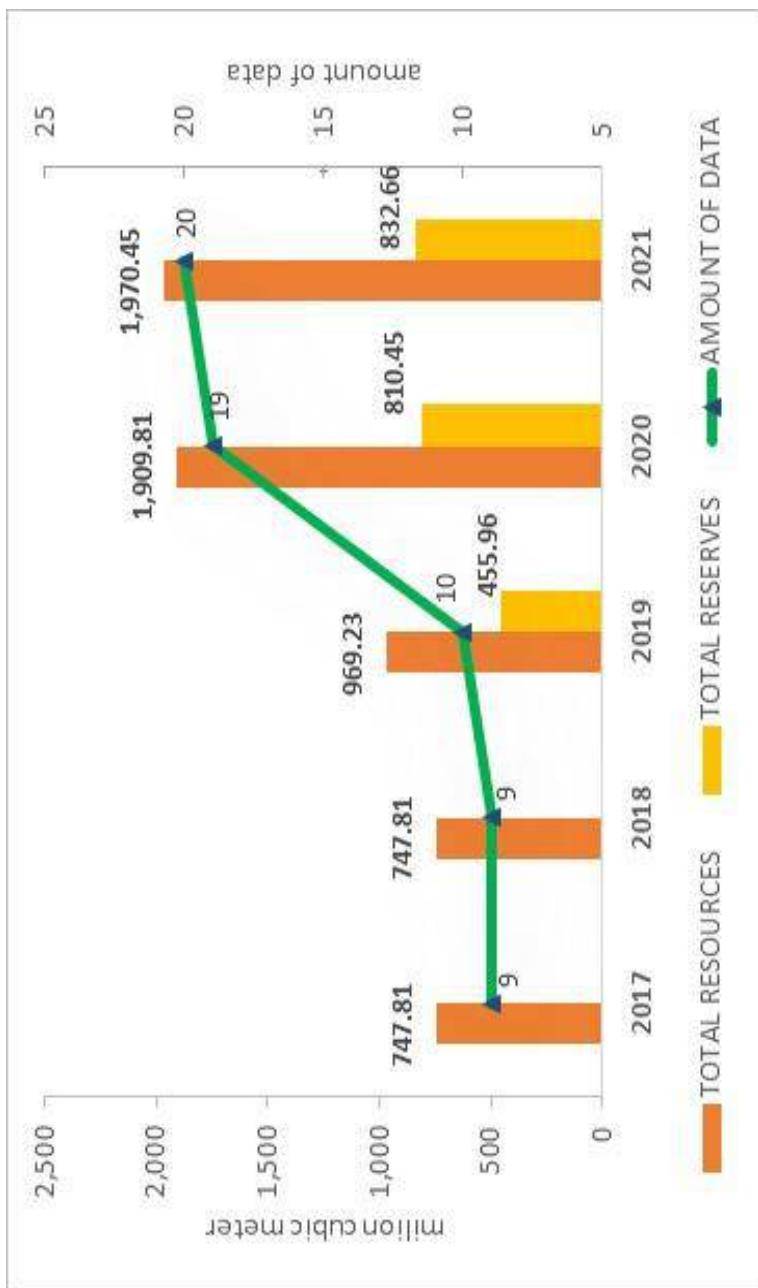
**Figure 40**. Statistics of Total Sea sand Resources and Reserves in 2017 - 2021

CLAY

Clay is also a non-metallic mineral and rock commodity needed to support raw materials for the cement, ceramic and other industries in Indonesia. The recapitulation of clay resources and reserves in each province available in Table 22. The development of clay resources and reserves in the last 5 years tends to increase along with the addition of data (Figure 41). This is estimated to be influenced by additional data and significant data updates from the IUP holders.

QUARTZ SAND

Quartz sand is a non-metallic mineral and rock commodity that is very much needed to support raw materials for the glass, refractory, and several other industries in Indonesia. The recapitulation of quartz sand resources and reserves in each province available in Table 23.

The development of quartz sand resources and reserves in the last 5 years tends to increase along with the addition of data (Figure 42). However, the amount of total reserves in 2021 is relatively lower when compared to 2020, this is estimated to be influenced by updating data of IUP holders.

Figure 41. Statistics of Total Clay Resources and Reserves in 2017 - 2021

Table 23. Quartz Sand Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Aceh	17	58,650,000	1,248,000	-	-	-	-
2	Banten	12	50,000,000	91,037,752	144,157,918	112,533,819	131,546,847	37,523,855
3	Jawa Barat	9	4,184,000	4,184,000	-	33,269,367	2,857,854	-
4	Jawa Tengah	4	20,000,000	1,000,000	26,590,000	-	-	-
5	Jawa Timur	11	3,725,000	-	200,000	4,945,765	-	4,069,312
6	Kalimantan Barat	47	1,722,587,500	-	284,250,000	56,600,000	-	-
7	Kalimantan Selatan	18	133,486,000	30,000,000	248,763,000	29,085,326	11,519,526	-
8	Kalimantan Tengah	14	193,549,000	141,261,400	2,929,000	2,663,000	2,929,000	2,663,000
9	Kalimantan Timur	56	896,857,000	64,050,000	-	-	-	-
10	Kalimantan Utara	14	61,160,000	-	-	-	-	-
11	Kepulauan Bangka Belitung	30	569,310,100	2,124,360	54,823,176	64,167,232	7,354,620	11,035,236
12	Kepulauan Riau	2	190,800,000	-	-	-	-	-
13	Lampung	15	98,950,000	-	-	-	-	-
14	Nusa Tenggara Barat	1	83,000	-	-	-	-	-
15	Nusa Tenggara Timur	3	447,500,000	-	-	-	-	-
16	Papua Barat	2	1,100,000	-	-	-	-	-
17	Riau	22	208,100,000	65,450,000	58,850,000	5,405,000	-	-
18	Sulawesi Selatan	10	101,030,000	10,323,625	-	-	2,511,973	3,139,966
19	Sulawesi Tengah	5	34,370,000	-	-	-	-	-
20	Sulawesi Tenggara	15	4,950,812,000	266,728,154	168,415,822	132,439,376	47,689,072	20,753,288
21	Sumatra Barat	13	11,903,500,000	1,300,000	780,000	-	-	-
22	Sumatra Selatan	10	100,200,000	1,650,000	-	-	45,300,937	-
23	Sumatra Utara	10	1,474,940,000	-	-	-	-	-
	TOTAL	**340**	**23,224,893,600**	**680,357,291**	**989,758,916**	**441,108,885**	**251,709,829**	**79,184,657**
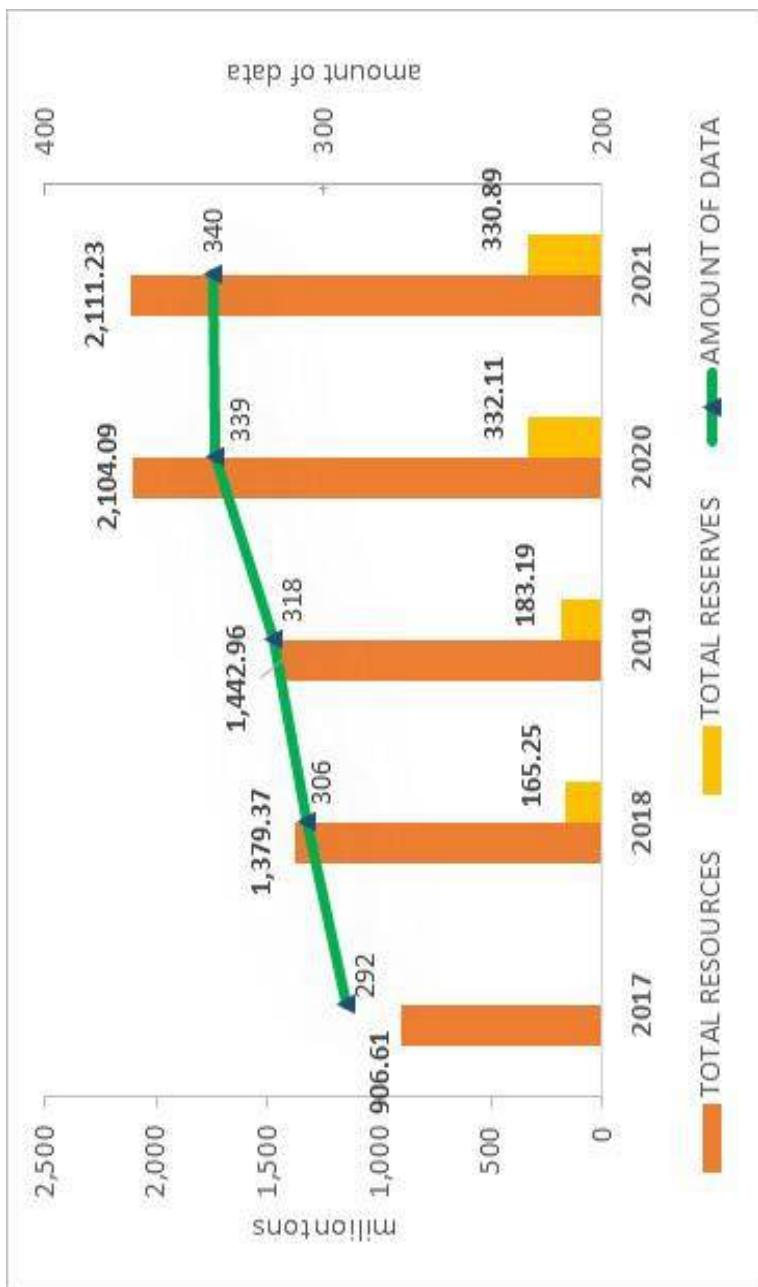
Figure 42. Statistics of Total Quartz Sand Resources and Reserves in 2017 - 2021

SAND AND ROCK

Sand and rock is a commodity of non-metallic minerals and rocks whose potential is spread out almost all provinces in Indonesia. Sand and rock is a commodity needed for building materials of various construction projects and infrastructure including remote parts of the archipelago. The recapitulation of natural resources and reserves in each province available in Table 24.

The development of natural resources and reserves in the last 5 years has tended to increase in line with increasing data (Figure 43).

Table 24. Sand and rock Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Aceh	81	866,515,000	-	-	-	-	-
2	Banten	20	1,285,000	34,396,378	35,744,463	43,727,134	128,611,497	31,715,372
3	Bengkulu	10	263,562,800	-	-	-	-	-
4	D.I. Yogyakarta	46	-	815,500	1,241,635	12,643,181	2,373,428	13,228,952
5	Gorontalo	6	-	282,250,000	-	-	-	-
6	Jawa Barat	75	-	21,047,418	4,683,977	681,523,065	486,504,986	27,229,264
7	Jawa Timur	17	-	62,840,075	21,255,003	20,514,206	35,150,927	16,232,284
8	Kalimantan Barat	17	69,895,000	-	45,477,226	6,740,458	14,634,636	-
9	Kalimantan Selatan	2	135,366,000	-	-	-	-	-
10	Kalimantan Tengah	6	-	7,826,000	6,649,441	6,020,001	6,649,440	6,202,784
11	Kalimantan Timur	10	2,729,000	12,406,460	4,235,008	3,490,906	2,727,843	14,290,612
12	Kalimantan Utara	2	3,825,000	-	-	-	-	-
13	Lampung	3	1,120,000	-	12,134,243	6,067,121	-	-
14	Maluku Utara	10	151,540,000	-	-	-	-	-
15	Nusa Tenggara Barat	7	-	-	-	1,265,307	-	1,984,098
16	Nusa Tenggara Timur	29	70,263,000	2,645,199,469	162,719	32,714,000	162,719	-
17	Papua	15	115,875,000	-	-	-	-	-
18	Papua Barat	11	570,090,000	91,000,000	-	-	-	-
19	Riau	6	39,525,000	5,250,000	-	-	-	-
20	Sulawesi Barat	3	1,282,700,000	-	-	-	-	-
21	Sulawesi Selatan	22	448,093,900	-	-	-	-	-
22	Sulawesi Tengah	13	230,175,000	-	-	14,256,000	-	8,416,800
23	Sulawesi Tenggara	2	84,000,000	-	-	-	-	-
24	Sulawesi Utara	9	30,250,000	870,490	-	-	-	-
25	Sumatra Barat	4	151,450,000	-	-	-	-	-
26	Sumatra Selatan	10	20,774,000	210,000	-	-	-	-
27	Sumatra Utara	7	632,185,000	-	-	-	-	-
28	Aceh	81	866,515,000	-	-	-	-	-
29	Banten	20	1,285,000	34,396,378	35,744,463	43,727,134	128,611,497	31,715,372
	TOTAL	443	5,171,218,700	3,164,111,790	131,583,715	828,961,379	676,815,476	119,300,166

Figure 43. Sand and rock Resources and Reserves by Province in 2021

DOLOMITE

Dolomite is a non-metallic mineral and rock commodity whose distribution is found in Java, Sumatra, Maluku, Nusa Tenggara and Sulawesi Islands. Detail of provinces is as follows: Aceh, North Sumatra, Banten, Central Java, East Java, North Maluku, East Nusa Tenggara, Central Sulawesi, West Sulawesi and Southeast Sulawesi.

At this time dolomite is urgently needed to be used in the agricultural sector as raw material for the fertilizer industry and to support the automotive industry in the future (Source: rri.co.id, May, 2021).

The recapitulation of dolomite resources and reserves in each province availabe in Table 25.

Development of dolomite resources and reserves in the last five years shows that resources began to decline in 2019, however, reserves tended to increase as the status shifted from resources to reserves (Figure 44). Additional and updating data of dolomite reserve is starting in 2019, which is estimated to be influenced by significant data from Dolomite Mining Business Permit (IUP) holders.

ZIRCON

Zircon is a non-metallic mineral and rock commodity whose distribution is only found in three provinces, namely: West Kalimantan, Central Kalimantan and Bangka Belitung Islands. The utilization of zircon can be used for the industries of; ceramic, glass, zircon flour, chemical, zirconium, refractory brick and molding sand (source: Batan, 2016). The

recapitulation of zircon resources and reserves in each province available in Table 26.

The development of zircon resources and reserves in the last five years tends to increase starting in 2018, which in line with the addition and updating of zircon reserve data from companies holding zircon Mining Business Permits (IUP) and yields investigation activities of CMCGR (Figure 45).

Table 25. Dolomite Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Aceh	11	185,500,000	666,960,000	57,327,000	-	-	-
2	Banten	1	-	175,097,913	-	-	-	-
3	Jawa Tengah	2	10,000,000	-	156,000	-	-	-
4	Jawa Timur	13	534,451,000	7,775,295	559,258,747	8,066,254	129,471,072	29,077,688
5	Maluku Utara	3	114,520,000	-	-	-	-	-
6	Nusa Tenggara Timur	8	825,750,000	-	691,258,747	-	-	-
7	Sulawesi Tengah	3	262,818,000	-	-	-	-	-
8	Sulawesi Tenggara	1	324,000,000	-	-	-	-	-
9	Sumatra Barat	4	59,800,000	-	-	-	-	-
10	Sumatra Utara	6	60,068,607	-	305,366,000	-	-	-
	TOTAL	52	2,378,907,607	849,833,208	1,613,457,747	8,066,254	129,471,072	29,077,688

Table 26. Zircon Resources and Reserves by Province in 2021

NO	PROVINCE	NUMBER OF LOCATION	HYPOTHETICAL (METRIC TONS)	RESOURCES (METRIC TONS)			RESERVES (METRIC TONS)	
				INFERRED	INDICATED	MEASURED	PROBABLE	PROVED
1	Kalimantan Barat	32	4,991,623	226,050	7,194,794	-	22,254,529	-
2	Kalimantan Tengah	12	-	77,167,592	29,724,782	7,638,145	16,036,840	9,924,495
3	Kep. Bangka Belitung	6	35,227	-	-	-	-	-
	TOTAL	50	5,026,850	77,393,642	36,919,531	7,638,145	38,291,369	9,924,495
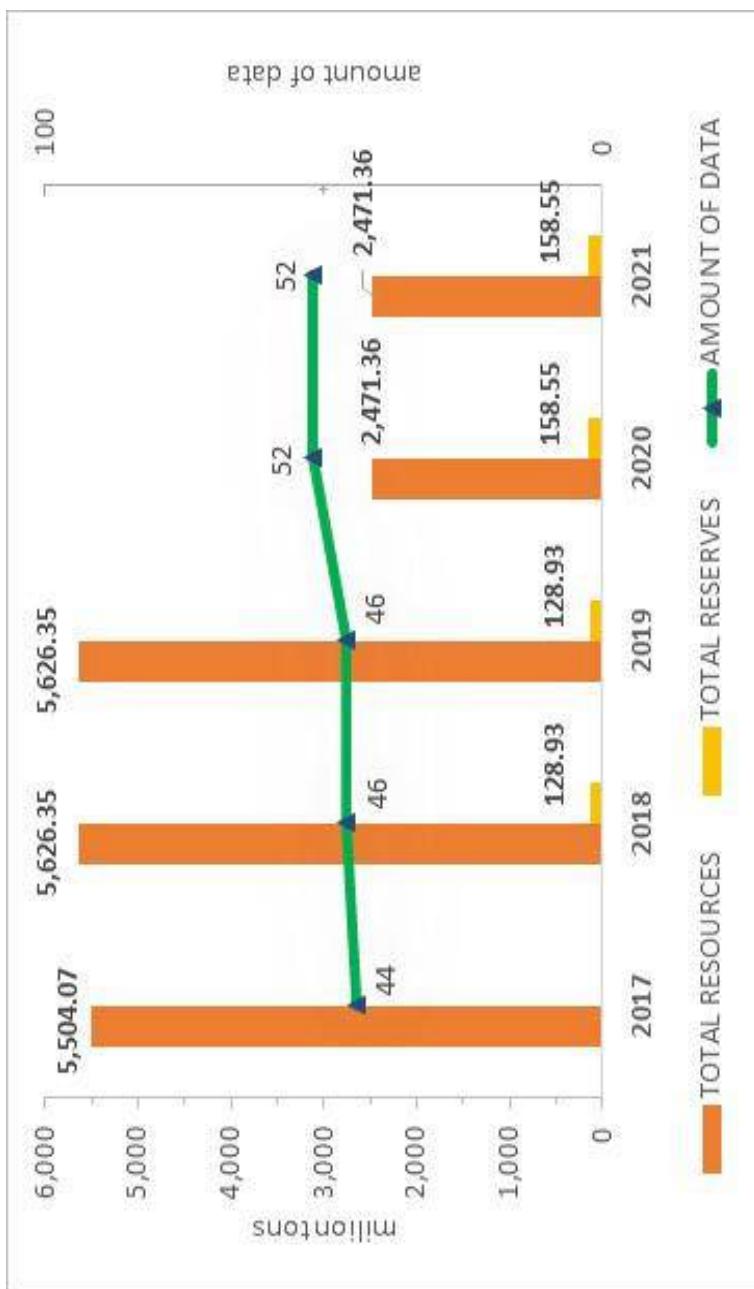
Figure 44. Statistics of Total Dolomite Resources and Reserves in 2017 – 2021

Figure 45. Statistics of Total Zircon Resources and Reserves in 2017 - 2021

3.2.   COAL RESOURCES

According to geological characteristics, CMCGR divides coal resources data into 4 (four) groups, namely surface coal, subsurface coal, Coalbed Methane (CBM) and peat resources. Surface coal is defined as coal seams exposed on the surface to a depth of approximately 100 m below the surface and is suitable for open pit mining method, while subsurface coal is defined as coal seams located at depth of > 100 m or must be extracted with deep mining method. Considering that coal has been explored and exploited for a long time, the data collected includes resources and reserves, while for CBM and peat, because they are still in the early stages of exploration, they only have resource data. In contrast to coal and CBM, peat in Indonesia has not been cultivated as an energy source, but CMCGR of Geological Agency continues to inventory the peat potential of Indonesia even though there is no special regulation regarding peat exploitation.

The grouping of Indonesian coal resources and reserves is guided by the Indonesian National Standard (SNI) issued by the National Standardization Agency. The SNI is entitled Guidelines for Reporting Exploration Results, Coal Resources and Reserves SNI 5015-2019.

Based on SNI 5015 – 2019, the classification of coal resources and reserves is divided into Exploration Targets, Inventory, Inferred Resources, Indicated Resources, Measured Resources, Probable Reserves and Proven Reserves.

The exploration stage reflects the geological confidence level of the technical data used in the coal resource estimation

process (Figure 46). One of the tasks and authorities of the Government in an effort to carry out inventory of the national coal potential is to conduct coal review survey. Inventories published by the government are not only based on assumptions, but are obtained from the results of field observations. This inventory reflects the national coal potential that has not been exploited to date. Its utilization may be constrained by various matters, for example the location of coal in marginal areas or overlap with conservation areas. Coal potential locations that overlap with conservation areas can be designated as National Reserve Areas (WPN) which can later be used for national strategic reserves.
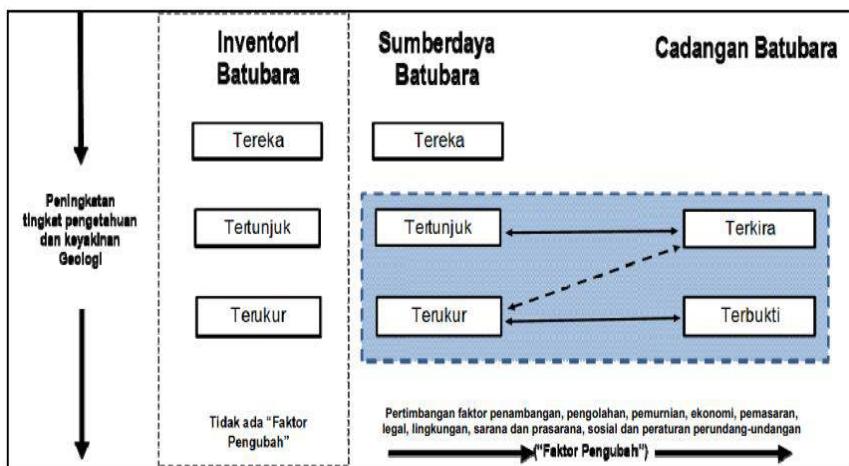
Sumber: Modifikasi Australian Coal Guidelines 2014

Figure 46. The Relationship Between Exploration Results, Resources, and Mineral and Coal Reserves Based on SNI 5015:2019

3.2.1 SURFACE COAL

Data sources for the preparation of the balance of surface coal resources and reserves (hereinafter written as the balance of coal resources and reserves) in 2021 available in Table 27, which comes from 67 PKP2B (100% of the total number of PKP2B); 72 PMA IUPs (100% of the total number of PMA IUPs); 943 IUP PMDN CnC status (90% of the total IUP PMDN CnC); 334 non-CnC IUPs and 151 locations that were investigated by the CMCGR of Geological Agency. Overall, the coal database in 2021 consists of 1,567 locations, an increase of 50 new locations from 2020. The coal locations are spread out across 23 provinces in Indonesia. Until 2021, 10% of PMDN IUPs have not submitted data on resources and reserves, the locations of PMDN IUPs are spread out across eight provinces.

Table 27. Data Source of Indonesia's Coal Resources and Reserves Balance in 2021

No	Province	PKP2B	PMA IUPs	PMDN IUPs	Non Listed IUPs	CMCGR Investigation	TOTAL
1	2	3	4	5	6	7	8
1	East Kalimantan	25	12	299	110	23	469
2	South Kalimantan	17	9	154	65	5	250
3	Central Kalimantan	11	17	176	57	3	264
4	West Kalimantan	0	0	3	0	10	13
5	North Kalimantan	3	1	26	9	9	48
6	Jambi	3	12	91	27	18	151
7	West Sumatera	0	4	31	13	2	50
8	South Sumatera	8	12	118	20	32	190
9	Riau	0	2	15	5	5	27
10	North Sumatera	0	0	1	1	1	3
11	Aceh	0	0	8	2	3	13

1	2	3	4	5	6	7	8
12	Bengkulu	0	3	17	14	2	36
13	Lampung	0	0	1	0	2	3
14	Central Sulawesi	0	0	0	0	2	2
15	South Sulawesi	0	0	1	2	6	9
16	West Sulawesi	0	0	2	1	4	7
17	South East Sulawesi	0	0	0	0	1	1
18	Papua	0	0	0	1	6	7
19	West Papua	0	0	0	3	6	9
20	North Maluku	0	0	0	0	4	4
21	Banten	0	0	0	4	4	8
22	Central Java	0	0	0	0	2	2
23	East Jawa	0	0	0	0	1	1
	TOTAL	67	72	943	334	151	1,567
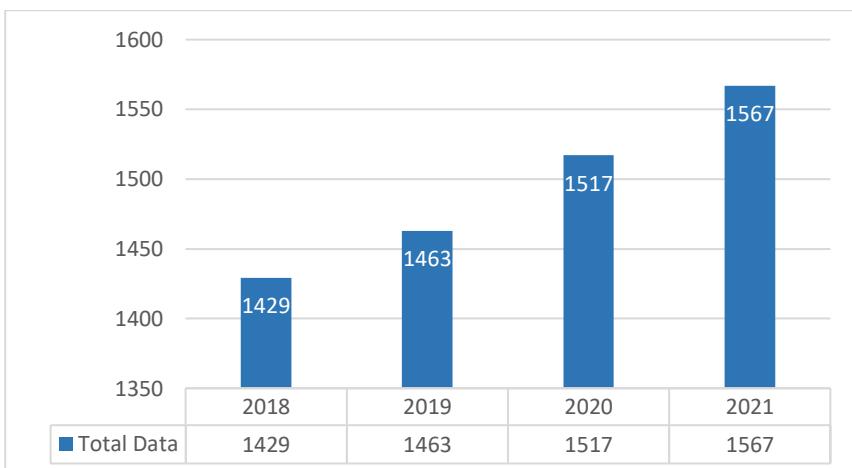
Figure 47. Statistics of Total Data in the Balance of Coal Resources and Reserves for 2018-2021

The results of recapitulation and calculations based on internal and external data show that until December 2021, Indonesia's coal resources amounted to 110,069.91 million tons or 110.069 billion tons; while Indonesia's coal reserves are

36,278.85 million tons or 36.278 billion tons (Table 28 and Table 29). Based on the calorific value of coal on air dried basis, Indonesia's coal resources consist of:

- Low calorie coal (< 5100 cal/g) 37,343.72 million tons
- Medium calorie coal (5100-6100 cal/g) 59,852.38 million tons
- High calorie coal (6100-7100 cal/g) 9,731.85 million tons
- Very high calorie coal (> 7100 cal/g) 3,141.96 million tons

Based on the stages of investigation, Indonesia's coal potential can be divided into five categories, namely Exploration Targets, Total Inventory, Inferred Resources, Indicated Resources and Measured Resources, with the following details:

- Exploration Target   : 6,141.12 million tons
- Total Inventory   : 24,365.84 million tons
- Inferred coal resources   : 34,350.15 million tons
- Indicated Coal resources   : 34,350.38 million tons
- Measured coal resources   : 41,369.38 million tons

As in 2020, data updating activities in 2021 also classify resource and backup data into verified and unverified data. Verified data are resource and reserve data that have been verified by competent persons (CP) or have been verified by the Geological Agency.

The value of Indonesia's coal reserves is obtained from the reports of companies holding PKP2B, PMA IUPs, and PMDN

IUPs business permits. The reserve value status until the end of December 2021 is estimated reserves of 18,374.92 million tons or 18.374 billion tons, while proven reserves are 17,903.92 million tons or 17.903 billion tons.

When compared to the 2020 balance sheet, there was a decrease in the number of coal resources by 33,660.99 million tons, while coal reserves decreased by 2,526.63 million tons. This decrease in resource is due to coal production operations, as well as the increasing use of CP, which increases the level of confidence in resource and reserve data. In addition, it is due to changes in the status of resources into exploration targets and inventories.

The results of the recapitulation and updating show that until December 2021, there are 110.069 billion tons of total coal resources and 36.278 billion tons of total coal reserves. The recapitulation table of resources and reserves is made in two versions, namely the table of resources and reserves based on the calorific value in air dried basis (adb) (Table 28) and the table of resources and reserves by Province (Table 29). Exploration activities carried out by the government (CMCGR-Geological Agency) are included in the exploration and inventory targets. Meanwhile, the value of inferred, indicated and measured resources as well as the value of coal reserves are all obtained from the exploration activities of Business Entity.

The existence of coal production operations, the increasing number of companies that estimate resources and reserves by CP (competent person), and reporting of resource data in 2021 which refers to SNI 5015:2019 will affect the value

composition of coal resources and reserves in 2021. On the balance sheet of coal In 2021, the Geological Agency's investigation activities are included in the Coal Exploration and Inventory Target column because they have not considered technical and economic factors (reasonable prospect test for eventual economic extraction).

Since 2019, there have been additional columns containing information on resource and backup data that have been verified by CP (Tables 28 and 29). The data listed in the "verified" column includes data on the resources of a business entity with registered status that has been verified by CP. For the record, in 2021 the calculation of coal resources and reserves by the business entity has not been entirely carried out by CP. It is expected that in 2022 all business entities in estimating resources and reserves have used CP.

The evaluation results show that of the total number of coal resources and reserves successfully inventoried in 2021, as much as 83.22% (91.606 Mton) of resource data and 87.36% (31.695 Mton) of reserve data have been verified by CP. Details of verified resource and reserve data are available in Table 31. The number of verified data in 2021 also increases compared to the 2020 balance sheet. The verified data is expected to reach 100% in 2022.

Table 28. Quality of Indonesia's Coal Resources and Reserves in 2021

QUALITY	EXPLORATION TARGETS (Million Tonnes)	TOTAL INVENTORY (Million Tonnes)	RESOURCES (Million Tonnes)					RESERVES (Million Tonnes)			
			INFERRED	INDICATED	MEASURED	TOTAL	TOTAL (VERIFIED)	PROBABLE	PROVEN	TOTAL	TOTAL (VERIFIED)
Low calorie	417.17	11,252.41	14,961.91	11,979.49	10,402.32	37,343.72	29,703.20	7,523.85	5,401.22	12,925.07	10,869.81
Medium calorie	2.06	547.38	14,625.47	18,356.99	26,869.92	59,852.38	51,868.94	9,464.74	11,220.50	20,685.24	18,811.62
High calorie	5,040.47	10,717.99	3,368.46	3,135.27	3,228.12	9,731.85	7,246.56	1,139.99	885.96	2,025.95	1,456.17
Very high calorie	681.42	1,848.07	1,394.31	878.63	869.02	3,141.96	2,787.34	246.34	396.25	642.59	558.02
TOTAL	6,141.12	24,365.84	34,350.15	34,350.38	41,369.38	110,069.91	91,606.04	18,374.92	17,903.92	36,278.85	31,695.63

Notes on the 2021 balance sheet

- Data sources represent 1517 locations from 67 PKP2B (100%); 69 PMA IUPs (100%); 858 PMDN IUPs registered status (81%); 333 IUPs were not registered, and 190 locations were investigated by CMCGR of Geological Agency. Only resource data still involves Unregistered IUP data, while all backup data comes from Registered IUP. There is no overlapping area between Registered and Unregistered IUPs
- Verified resources are coal resources resulting from exploration activities of CMCGR and coal resources reported by the Business Entity and estimated by a competent person (CP). Verified reserves are coal reserves reported by the Business Entity and have been estimated by CP.
- Calculation of coal resources and reserves by the Business Entity has not been entirely carried out by CP and has not been entirely referred to SNI 13-5015 2019. Calculation of resources and reserves that have not been verified by CP is in accordance with SNI 13-5015-2015
- Of the total 1,517 points that were successfully input as balance data, 184 points have been verified by CMCGR of Geological Agency, 57 points have been verified by the CP of the PKP2B Companies, 35 points have been verified by the CP of the PMA IUPs Companies and 216 points have been verified by the CP of the PMDN IUPs Companies.
- Coal resources are inclusive (reserves part of the resource)

1. Coal quality is based on the calorific value of coal on an air dried basis (Presidential decree No. 13/2000, updated by PP No. 45/2003)

a. Low calorie   <5100 kal/gr
b. Medium calorie   5100 - 6100 kal/gr
c. High calorie   6100 - 7100 kal/gr
d. Very high calorie   >7100 kal/gr

2. Classification of resources

a. Hypothetic   Result of preliminary survey
b. Inferred   Result of prospecting survey
c. Indicated   Result of preliminary exploration
d. Measured   Result of detail exploration

3. Classification of reserves

a. Probable
b. Proven

Table 29. Quality of Indonesia's Coal Resources and Reserves by Province in 2021

PROVINCE	EXPLORATION TARGETS	TOTAL INVENTORY	RESOURCES (MILLION TONNES)					RESERVES (MILLION TONNES)			
			INFERRED	INDICATED	MEASURED	TOTAL	VERIFIED	PROBABLE	PROVEN	TOTAL	VERIFIED
1	2	3	4	5	6	7	8	9	10	11	12
Banten	**5.47**	**52.18**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Low Calorie	5.47	5.22	-								
High Calorie	-	46.96	-								
Central Java	**-**	**0.82**	**-**	**-**	**.**	**-**	**-**	**-**	**-**	**-**	**-**
Low Calorie	-	0.82	-								
East Java	**-**	**0.08**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
Low Calorie	-	0.08									
Aceh	**1.16**	**87.83**	**275.46**	**421.87**	**325.59**	**1,022.93**	**803.79**	**337.85**	**201.49**	**539.34**	**428.65**
Low Calorie	1.16	20.92	152.81	164.54	117.75	435.11	435.11	94.38	94.56	188.94	188.94
Medium Calorie	-	66.91	122.65	2573.3	207.84	587.82	368.69	243.47	106.93	350.40	239.70
Riau	**3.86**	**322.13**	**142.10**	**527.03**	**301.23**	**970.36**	**856.52**	**202.25**	**193.11**	**395.36**	**359.12**
Low Calorie	-	35.06	95.54	415.07	243.55	789.22	710.76	179.93	174.31	354.24	336.34
Medium Calorie	3.86	286.28	41.59	107.95	54.50	494.17	142.66	21.64	15.94	37.58	21.52
High Calorie	-	0.79	4.97	4.02	3.18	12.96	3.10	0.69	2.86	3.54	1.27
West Sumatra	**1.19**	**156.38**	**79.75**	**72.55**	**105.20**	**257.51**	**39.87**	**35.08**	**28.95**	**64.03**	**23.63**
Medium Calorie	1.19	148.75	64.42	45.02	35.67	145.12	25.44	17.75	2.78	20.53	4.54
High Calorie		6.33	13.09	17.59	59.33	90.00	14.43	13.95	24.75	38.71	19.08
Very High Calorie		1.30	2.24	9.94	10.21			3.37	1.42		
Jambi	**140.31**	**1,517.60**	**1,402.50**	**1,183.88**	**1,987.82**	**4,574.21**	**3,829.45**	**735.28**	**1,096.32**	**1,831.60**	**1,658.59**
Low Calorie	51.81	456.16	494.62	423.51	509.52	1,935.61	1,113.84	304.69	284.26	588.95	474.97
Medium Calorie	88.50	1,051.34	901.41	756.34	1,475.04	4,272.63	2,710.65	426.88	810.88	1,237.76	1,182.54
High Calorie	-	10.10	6.48	4.04	3.26	23.87	4.96	3.71	1.18	4.89	1.08

1	2	3	4	5	6	7	8	9	10	11	12
Bengkulu	**36.86**	**208.61**	**140.27**	**113.69**	**174.61**	**428.56**	**363.58**	**49.69**	**75.01**	**124.69**	**103.30**
Low Calorie	-	51.80	53.08	41.41	66.48	160.96	107.34	18.91	26.23	45.14	35.28
Medium Calorie	-	14.31	82.21	63.30	73.12	218.62	210.62	30.77	42.61	73.38	64.04
High Calorie	36.86	142.51	4.98	8.98	35.02	48.98	45.62	-	6.18	6.18	3.98
South Sumatra	**4,885.39**	**9,262.58**	**11,827.36**	**8,830.51**	**8,079.09**	**28,736.96**	**24,021.01**	**5,200.87**	**4,232.03**	**9,432.90**	**9,291.17**
Low Calorie	334.95	2,513.94	8,260.13	5,348.65	3,576.33	20,034.00	13,773.42	3,817.08	2,063.74	5,880.82	5,803.46
Medium Calorie	4,513.26	6,748.64	3,384.92	3,313.12	4,345.10	22,305.05	9,738.90	1,232.00	2,115.85	3,347.85	3,283.48
High Calorie	37.18	-	181.24	167.12	156.85	542.39	505.21	149.59	52.12	201.70	201.70
Very High Calorie	-	-	1.06	1.62	0.81	3.49	3.488	2.20	0.33	2.53	2.53
North Sumatra	**-**	**14.62**	**10.24**	**8.48**	**7.55**	**26.26**	**-**	**-**	**7.12**	**7.12**	**-**
Low Calorie	-	7.62	-	-	-	-	-	-	-	-	-
Medium Calorie	-	7.00	10.24	8.48	7.55	26.26	-	-	7.12	7.12	-
Lampung	**-**	**106.95**	**149.60**	**134.20**	**29.60**	**313.40**	**-**	**109.80**	**-**	**109.80**	
Low Calorie	-	-	149.60	134.20	29.60	313.40	-	109.80	-	109.80	-
Medium Calorie	-	14.00	-	-	-	-	-	-	-	-	-
High Calorie	-	92.95	-	-	-	-	-	-	-	-	-
West Kalimantan	**2.26**	**386.24**	**11.07**	**53.03**	**14.57**	**78.66**	**1.46**	**0.43**	**-**	**0.43**	**0.43**
Low Calorie	0.08	-	-	-	-	-	-	-	-	-	-
Medium Calorie	2.06	-	-	-	-	-	-	-	-	-	-
High Calorie	0.12	382.44	11.07	53.03	14.57	78.66	1.46	0.43	-	-	0.43
Very High Calorie	-	3.80	-	-	-	-	-	-	-	-	-
Central Kalimantan	**22.54**	**1,445.77**	**4,999.99**	**3,517.60**	**3,474.01**	**11,991.60**	**8,418.80**	**1,639.16**	**1,672.36**	**3,311.52**	**1,995.11**
Low Calorie	-	117.12	581.80	397.19	600.98	1,579.97	734.45	322.64	317.67	640.32	282.32
Medium Calorie	-	441.97	2,299.74	1,623.90	1,597.43	5,521.07	3,761.55	724.25	758.64	1,482.89	901.04
High Calorie	22.54	388.94	918.92	768.47	508.14	2,195.54	1,528.65	374.71	232.66	607.37	307.10

1	2	3	4	5	6	7	8	9	10	11	12
Very High Calorie	-	497.75	1,199.53	728.04	767.46	2,695.02	2,394.15	217.55	363.39	580.95	504.64
South Kalimantan	**7.83**	**643.90**	**3,615.56**	**3,578.78**	**6,310.57**	**13,504.90**	**12,046.99**	**1,650.32**	**2,518.48**	**4,168.80**	**3,679.61**
Low Calorie	-	177.51	798.13	809.67	752.60	2,360.41	2,240.39	265.20	495.57	760.77	699.50
Medium Calorie	-	288.90	1,959.16	2,229.57	4,870.19	9,058.93	8,024.61	1,136.69	1,778.80	2,915.49	2,532.45
High Calorie	7.83	177.49	833.92	524.93	672.41	2,031.26	1,732.74	245.34	238.07	483.41	438.95
Very High Calorie	-	-	24.34	14.60	15.36	54.30	49.25	3.09	6.04	9.13	8.71
East Kalimantan	**872.99**	**9,741.05**	**10,716.07**	**14,907.98**	**19,309.23**	**44,933.27**	**40,024.10**	**7,592.51**	**7,092.48**	**14,684.99**	**13,614.09**
Low Calorie	3.81	7,843.91	3,930.33	3,769.68	3,767.40	11,467.41	10,196.03	1,839.11	1,449.62	3,288.72	2,875.68
Medium Calorie	301.24	1,499.81	5,403.17	9,576.01	13,804.82	28,784.00	26,196.20	5,440.36	5,345.14	10,785.50	10,245.53
High Calorie	567.94	389.73	1,215.42	1,438.73	1,662.64	4,316.79	3,291.43	292.92	272.66	565.58	450.74
Very High Calorie		7.61	167.15	123.55	74.37	365.07	340.45	20.12	25.07	45.19	42.14
North Kalimantan	**25.79**	**302.73**	**971.75**	**996.25**	**1,246.44**	**3,214.44**	**1,183.61**	**818.73**	**779.17**	**1,597.89**	**531.57**
Low Calorie	6.70	25.50	445.86	475.57	738.11	1,659.55	391.87	572.10	495.26	1,067.36	173.32
Medium Calorie	19.09	76.94	347.52	371.43	396.59	1,115.54	674.58	189.77	229.68	419.45	329.48
High Calorie	-	188.90	178.37	148.37	110.92	437.66	117.16	56.86	54.23	111.08	28.78
Very High Calorie	-	11.39		0.87	0.82	1.69	-	-	-	-	
South Sulawesi	**13.79**	**25.74**	**3.02**	**1.84**	**0.72**	**5.57**	**5.57**	**1.16**	**0.61**	**1.77**	**1.77**
Low Calorie	4.16	-	-	-	-	-	-	-	-	-	
Medium Calorie	4.47	11.84	3.02	1.84	0.72	5.57	5.57	1.16	0.61	1.77	1.77
High Calorie	5.16	13.90	-	-	-	-	-	-	-	-	
West Sulawesi	**11.46**	**16.78**	**5.42**	**2.71**	**3.15**	**11.28**	**11.28**	**1.80**	**6.79**	**8.59**	**8.59**
Low Calorie	8.13	-	-	-	-	-	-	-	-	-	
Medium Calorie	-	15.13	5.42	2.71	1.35	9.48	9.48	-	5.53	5.53	5.53
High Calorie	3.34	1.65	-	-	1.80	1.80	1.80	1.80	1.26	3.06	3.06
Central Sulawesi	**0.52**	**1.98**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

1	2	3	4	5	6	7	8	9	10	11	12
Low Calorie	0.52	1.98	-	-	-	-	-	-	-	-	-
Southeast Sulawesi	**0.64**	-	-	-	-	-	-	-	-	-	-
Low Calorie	0.64	-	-	-	-	-	-	-	-	-	-
North Maluku	**8.22**	-	-	-	-	-	-	-	-	-	-
Low Calorie	4.74	-	-	-	-	-	-	-	-	-	-
Medium Calorie	3.48	-	-	-	-	-	-	-	-	-	-
West Papua	**93.66**	**40.51**	-	-	-	-	-	-	-	-	-
Medium Calorie	89.63	9.60	-	-	-	-	-	-	-	-	-
High Calorie	4.03	5.38	-	-	-	-	-	-	-	-	-
Very High Calorie	-	25.53	-	-	-	-	-	-	-	-	-
Papua	**7.20**	**31.36**	-	-	-	-	-	-	-	-	-
Low Calorie	7.20	-	-	-	-	-	-	-	-	-	-
Medium Calorie	-	31.36	-	-	-	-	-	-	-	-	-
TOTAL	**6,141.12**	**24,365.84**	**34,350.15**	**34,350.38**	**41,369.38**	**110,069.91**	**91,606.04**	**18,374.92**	**17,903.93**	**36,278.85**	**31,695.63**

Notes on the 2021 balance sheet

- Data sources represent 1,567 locations from 151 of CMCGR investigation activities, 67 PKP2B (100%); 72 IUP PMA (100%); 943 IUP PMDN registered (90%) and 334 IUP Unregistered. Only resource data still involves Unregistered IUP data, while all backup data comes from Registered IUP. There is no overlapping area between Registered and Unregistered IUPs.
- Verified resources are coal resources resulting from exploration activities of CMCGR and coal resources reported by the Business Entity and estimated by competent person (CP). Verified reserves are coal reserves reported by the Business Entity and have been estimated by CP
- In 2021 the reporting of data on National resources and reserves refers to SNI 5015: 2019, therefore the balance sheet as the result of CMCGR investigations is included in the Coal Exploration and Inventory Target column because it has not considered technical and economic factors (reasonable prospecting test for eventual economic extraction).
- Of the total 1,567 points that have been successfully inputted as balance data, 151 points have been verified by CMCGR, 65 points have been verified by the CP of PKP2B Company, 49 points have been verified by the CP of PMA IUP Company and 598 points have been verified by the CP of PMDN IUP Company.
- Several factors affecting the decline of resources and reserves in 2021:
  1. Increased the use of CP in Business Entities
  2. Changed resource status to Inventory and Exploration

Table 30. Indonesia's Coal Resources and Reserves by Province in 2021

NO	PROVINCE	EXPLORATION TARGETS	TOTAL INVENTORY	RESOURCES (MILLION TONNES)					RESERVES (MILLION TONNES)			
				INFERRED	INDICATED	MEASURED	TOTAL	TOTAL (VERIFIED)	PROBABLE	PROVEN	TOTAL	TOTAL (VERIFIED)
1	Banten	5.47	52.18	-	-	-	-	-	-	-	-	-
2	Central Java		0.82		-	-	-	-	-	-	-	-
3	East Java		0.08		-	-	-	-	-	-	-	-
4	Aceh	1,155	87.83	275.46	421.87	325.59	1,022.925	803.794	337.85	201.49	539.342	428.646
5	North Sumatra		14.62	10.24	8.48	7.55	26.260	-	-	7.12	7.115	-
6	Riau	3.86	322.13	142.10	527.03	301.23	970.360	856.522	202.25	193.11	395.359	359.124
7	West Sumatra	1.19	156.38	79.75	72.55	105.20	257.510	39.867	35.08	28.95	64.031	23.627
8	Jambi	140.31	1,517.60	1,402.50	1,183.88	1,987.82	4,574.209	3,829.45	735.28	1,096.32	1,831.599	1,658.592
9	Bengkulu	36.86	208.61	140.27	113.69	174.61	428.562	363.579	49.686	75.01	124.694	103.300
10	South Sumatra	4,885.39	9,262.58	11,827.36	8,830.51	8,079.09	28,736.962	24,021.015	5,200.87	4,232.03	9,432.902	9,291.166
11	Lampung		106.95	149.60	134.20	29.60	313.400	-	109.800	-	109.800	-
12	West Kalimantan	2.26	386.24	11.07	53.03	14.57	78.662	1.460	0.430	-	0.430	0.430
13	Central Kalimantan	22.54	1,445.77	4,999.99	3,517.60	3,474.01	11,991.600	8,418.798	1,639.16	1,672.36	3,311.524	1,995.107
14	South Kalimantan	7.83	643.90	3,615.56	3,578.78	6,310.57	13,504.899	12,046.986	1,650.32	2,518.48	4,168.802	3,679.610
15	East Kalimantan	872.99	9,741.05	10,716.07	14,907.98	19,309.23	44,933.273	40,024.100	7,592.51	7,092.48	14,684.992	13,614.091
16	North Kalimantan	25.79	302.73	971.75	996.25	1,246.44	3,214.439	1,183.613	818.73	779.17	1,597.895	531.574
17	South Sulawesi	13.79	25.74	3.02	1.84	0.72	5.574	5.574	1.16	0.61	1.769	1.769
18	West Sulawesi	11.46	16.78	5.42	2.71	3.15	11.279	11.279	1.80	6.79	8.591	8.591
19	Central Sulawesi	0.52	1.98		-	-	-	-	-	-	-	-
20	Southeast Sulawesi	0.64		-	-	-	-	-	-	-	-	-
21	North Maluku	8.22			-	-	-	-	-	-	-	-
22	West Papua	93.66	40.51		-	-	-	-	-	-	-	-
23	Papua	7.20	31.36		-	-	-	-	-	-	-	-
	TOTAL INDONESIA	6,141.12	24,365.84	34,350.15	34,350.38	41,369.38	110,069.91	91,606.04	18,374.92	17,903.92	36,278.85	31,695.63

Notes on the 2021 balance sheet

- Data sources represent 1,567 locations from 151 of CMCGR investigation activities, 67 PKP2B (100%); 72 IUP PMA (100%); 943 IUP PMDN registered (90%) and 334 IUP Unregistered. Only resource data still involves Unregistered IUP data, while all backup data comes from Registered IUP. There is no overlapping area between Registered and Unregistered IUPs.

- Verified resources are coal resources resulting from exploration activities of CMCGR and coal resources reported by the Business Entity and estimated by competent person (CP). Verified reserves are coal reserves reported by the Business Entity and have been estimated by CP

- In 2021 the reporting of data on National resources and reserves refers to SNI 5015: 2019, therefore the balance sheet as the result of CMCGR investigations is included in the Coal Exploration and Inventory Target column because it has not considered technical and economic factors (reasonable prospecting test for eventual economic extraction).

- Of the total 1,567 points that have been successfully inputted as balance data, 151 points have been verified by CMCGR, 65 points have been verified by the CP of PKP2B Company, 49 points have been verified by the CP of PMA IUP Company and 598 points have been verified by the CP of PMDN IUP Company.

- Several factors affecting the decline of resources and reserves in 2021:
  1. Increased the use of CP in Business Entities
  2. Changed resource status to Inventory and Exploration

Table 31. Verified Coal Resources and Reserves in 2021

NO	PROVINCE	RESOURCES (MILLION TONNES)				RESERVES (MILLION TONNES)		
		INFERRED	INDICATED	MEASURED	TOTAL	PROBABLE	RPOVEN	TOTAL
1	Aceh	275.42	399.13	129.24	803.79	322.57	106.07	428.65
2	Bengkulu	108.00	94.98	160.60	363.58	45.90	57.40	103.30
3	Jambi	1,057.05	1,018.64	1,753.76	3,829.45	625.47	1,033.12	1,658.59
4	Riau	109.42	481.73	265.38	856.52	184.66	174.47	359.12
5	West Sumatra	14.56	13.21	12.09	39.87	6.20	17.42	23.63
6	South Sumatra	7,890.95	8,299.98	7,830.09	24,021.01	5,090.99	4,200.17	9,291.17
7	West Kalimantan	0.98	0.48	-	1.46	0.43	-	0.43
8	South Kalimantan	3,138.80	3,047.87	5,860.32	12,046.99	1,344.82	2,334.79	3,679.61
9	Central Kalimantan	3,525.03	2,593.39	2,300.38	8,418.80	883.50	1,111.61	1,995.11
10	East Kalimantan	8,763.33	13,395.26	17,865.51	40,024.10	7,184.08	6,430.02	13,614.09
11	North Kalimantan	412.75	420.80	350.06	1,183.61	284.69	246.89	531.57
12	West Sulawesi	5.42	2.71	3.15	11.28	1.80	6.79	8.59
13	South Sulawesi	3.02	1.84	0.72	5.57	1.16	0.61	1.77
	TOTAL INDONESIA	25,304.73	29,770.01	36,531.30	91,606.04	15,976.28	15,719.35	31,695.63

Notes on the 2021 balance sheet

- Data sources represent 1,567 locations from 151 of CMCGR investigation activities, 67 PKP2B (100%); 72 IUP PMA (100%); 943 IUP PMDN registered (90%) and 334 IUP Unregistered. Only resource data still involves Unregistered IUP data, while all backup data comes from Registered IUP. There is no overlapping area between Registered and Unregistered IUPs.
- Verified resources are coal resources resulting from exploration activities of CMCGR and coal resources reported by the Business Entity and estimated by competent person (CP). Verified reserves are coal reserves reported by the Business Entity and have been estimated by CP
- In 2021 the reporting of data on National resources and reserves refers to SNI 5015: 2019, therefore the balance sheet as the result of CMCGR investigations is included in the Coal Exploration and Inventory Target column because it has not considered technical and economic factors (reasonable prospecting test for eventual economic extraction).
- Of the total 1,567 points that have been successfully inputted as balance data, 151 points have been verified by CMCGR, 65 points have been verified by the CP of PKP2B Company, 49 points have been verified by the CP of PMA IUP Company and 598 points have been verified by the CP of PMDN IUP Company.
- Several factors affecting the decline of resources and reserves in 2021:
  1. Increased the use of CP in Business Entities
  2. Changed resource status to Inventory and Exploration

Characterization, evaluation and verification of high-calorie coal (metallurgical coal) has been carried out since 2018. Until 2021, an evaluation has been carried out at 50 business entity locations with 105 samples of coal tested at CMCGR. These locations are spread over several basins and provinces including the Ombilin Basin in West Sumatra Province, Bengkulu Basin in Bengkulu Province, South Sumatra Basin in South Sumatra Province, Tarakan Basin in North Kalimantan Province, Kutai Basin in East Kalimantan Province, Sand Basin in East Kalimantan Province, The Asem-Asem Basin in the Province of South Kalimantan, the Barito Basin in the Provinces of Central and South Kalimantan, and the Upper Kutai Basin in the Province of Central Kalimantan. Laboratory analyzes carried out included total moisture (TM), proximate analysis (in the form of volatile matter (VM), ash content (ash), total sulfur (TS)), ultimate analysis (containing C, H, NO, and S), analysis of the content of major elements in coal ash (coal ash analysis), especially to determine the value of the phosphorus content, and Hardgrove Grindability Index (HGI). Other parameters or analyzes carried out are in the form of organic petrographic analysis, physical and rheological analysis (Rheological Analyses).

Of the 50 indicated locations that were evaluated, 26 locations were confirmed to have metallurgical coal potential. The 26 locations are spread over several basins and provinces including one location in the Ombilin Basin in West Sumatra Province, two locations in the Bengkulu Basin in Bengkulu Province, one location in the Pasir Basin in East Kalimantan, three locations in the Kutai Basin in East Kalimantan, five

locations in the Basin Barito in Central Kalimantan-South Kalimantan and 14 sites in the upper Kutai Basin in Central Kalimantan. Of the total 26 confirmed locations, 24 locations are business entities whose licenses are registered and 2 locations are not registered. The total potential of Indonesia's metallurgical coal resources is 2.74 billion tons and reserves of 0.43 billion tons from registered locations, and a total inventory of 0.48 billion tons from unregistered locations. Details of quantities and records of potential metallurgical coal available in Table 32.

Table 32. Indonesia's Metallurgical Coal Potential in 2021

NO	ISLAND	PROVINCE	TOTAL INVENTORY (Million Tonnes)	RESOURCES (Million Tonnes)				RESERVES (Million Tonnes)		
				INFERRED	INDICATED	MEASURED	TOTAL	PROBABLE	PROVEN	TOTAL
1	Kalimantan	Central Kalimantan	461.20	1,133.90	721.98	584.35	2,440.23	182.18	220.18	402.36
2		East Kalimantan	-	134.71	85.51	28.56	248.78	9.56	4.86	14.43
3	Sumatra	West Sumatra	-	9.40	8.46	3.01	20.87	7.23	6.51	13.74
4		Bengkulu	23.69	1.21	5.44	28.26	34.91	-	3.38	3.38
	Total INDONESIA		484.89	1,279.23	821.39	644.18	2,744.79	198.97	234.93	433.90

Notes:

- Comes from 26 locations that have data on coal characteristics that can be classified as metallurgical coal including TM, ASH, TS, VM, CV, CSN, GKT, Dilatation, Fluidity, Phosphorus, CSR, CRI, etc.
- The 26 locations consist of 24 registered business entities and 2 unregistered business entities.
- Metallurgical coal here is coal that corresponds to the characteristics of the market (for example index platts) that is Hard Coking Coal. Semi Hard Coking Coal. Semi Soft Coking Coal and Low Volatile PCI.
- Some locations still need to be coordinated because in one location there can be metallurgical coal and thermal coal.
- The number can still increase with the increase in confirmed locations.
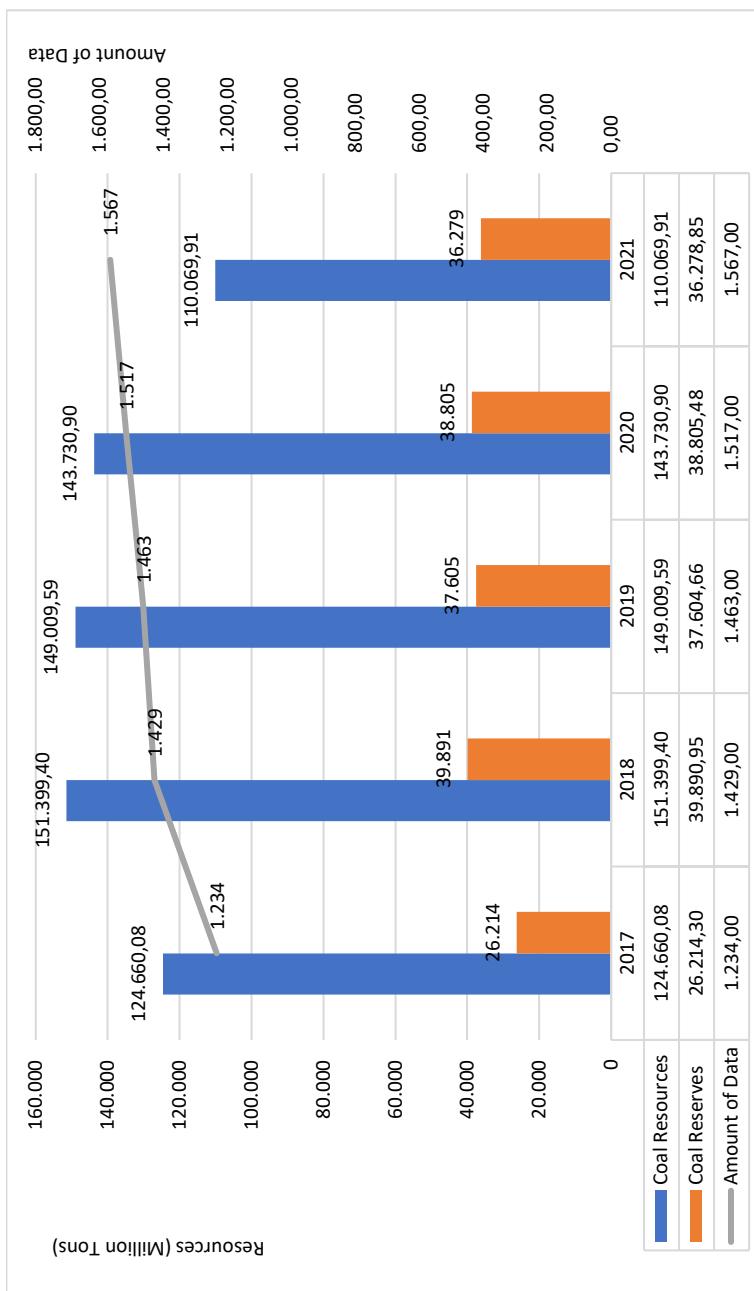
Figure 48. Statistics of Coal Resources and Reserves for 2017-2021

	2017	2018	2019	2020	2021
Coal Resources	124.660,08	151.399,40	149.009,59	143.730,90	110.069,91
Coal Reserves	26.214,30	39.890,95	37.604,66	38.805,48	36.278,85
Amount of Data	1.234,00	1.429,00	1.463,00	1.517,00	1.567,00

3.2.2. SUBSURFACE COAL

Subsurface coal resources are coal resources located at a depth of 100 – 500 meters below the surface. Data on subsurface coal resources comes from internal data, while data on subsurface coal reserves are obtained from IUP PMA and IUP PMDN. Coal resources for subsurface status in December 2021 are 488.94 million tons (Table 33), with total reserves of 173.25 million tons.

Besides being mined using the underground coal mine method, subsurface coal can also be used for the development of Underground Coal Gasification (UCG) as well as for the development of CBM.

Table 33. Mining Coal Resources in Indonesia Status of 2021

NO	ISLAND	PROVINCE	TOTAL INVENTORY	RESOURCES (Million Tonnes)				RESERVES (Million Tonnes)		
				INFERRED	INDICATED	MEASURED	TOTAL	PROBABLE	PROVEN	TOTAL
1	Sumatra	West Sumatra	7.99	120.370	61.406	95.859	277.635	37.970	63.26	101.233
		Jambi	970.60							
		South Sumatra	21.195.92							
2	Kalimantan	South Kalimantan	1.019.16	19.548	33.208	94.149	146.905	12.477	31.29	43.764
		East Kalimantan	17.527.29	0.004	36.117	28.280	64.401	11.387	16.87	28.252
		Central Kalimantan	88.45							
		North Kalimantan	2.210.33							
	TOTAL INDONESIA		43.019.74	139.92	130.73	218.29	488.94	61.83	111.42	173.25

Notes of Subsurface Coal Balance Table for 2021:
* Subsurface resources consist of 16 points. as many as 13 points resulting from exploration activities for IUP PMDN. and 3 Points from IUP PMA.
* In 2021 the reporting of subsurface coal resource data refers to SNI 5015:2019. Therefore, for the balance sheet the results of the Geological Agency investigation activities are included in the Inventory column because they have not considered technical and economic factors (reasonable prospect test for eventual economic extraction).
* Some of the factors influencing the reduction of resources in 2021:
  1. Use of CP in Business Entities
  2. Changed resource status to Inventory

3.2.3. COALBED METHANE (CBM)

The results of data updating activities show that in 2021, Indonesia's total CBM resources will amount to 68.94 Trillion Cubic Feet (Tcf) (Table 34), consisting of 154,668,867,106 Bcf or 0.15 Tcf as a result of CMCGR investigation activities in 16 locations (Table 35) and 68.79 Tcf from exploration activities of 54 WK CBM obtained from the Directorate General of Oil and Gas through SKK Migas (Table 36 and Table 37).

Based on SKK Migas data, the number of CBM Concession Areas (CAs) that are still active until 2021 is only 12 (twelve) areas consisting of 5 (five) CBM CAs in the South Sumatra Basin, 1 (one) CBM CA in the Ombilin Basin, 3 (three) CBM CAs in the Kutai Basin, and 3 (three) CAs in the Barito Basin. Resource data from inactive CBM CAs are still recorded in the CBM database with the consideration that even though the company is no longer actively carrying out activities, the potential for CMB in the CAs still exists. This resource data can later be used as a reference if the area is to be developed.

The amount of CBM resources in 2021 has decreased by 2.4 Tcf when compared to CBM resources in 2020 (Figure 49). The decrease in the number of CBM resources in 2021 comes from Sangata II Region. Based on data from SKK Migas, throughout 2021 there will be no exploration activities from the KKKS WK GMB, so technically there is no data update (process). Several wells, which were originally scheduled to be explored in 2021, have been delayed due to technical and non-technical issues (pandemic).

In general, the amount of CBM resources originating from the Indonesian CBM CA is relatively larger than the amount of resources resulting from the CBM exploration activities that have been carried out by CMCGR. This is because the exploration activities of CBM carried out by CMCGR are still limited (only 1 or 2 wells are drilled in 1 exploration activity), so the area of influence used to calculate CBM resources is also relatively small.

Table 34. Indonesian CBM Resources in 2021

Basin	Coal Rank	Coal Thickness (m)	Coal Depth (m)	Gas Content (scf/tonnes)	Gas Resources (Tcf)
South Sumatera	Lignite - Bituminous	1 - 46	0 - 794	0.69 - 150.53	12.101
Central Sumatera	Lignite	5	160 - 490	18 - 33	7.300
Ombilin	High Volatile Bituminous	0.40 – 13.56	166 - 800	3.15 - 457.25	1.261
Kutai	Sub-Bituminous - High Volatile Bituminous	0.50 - 20	150 - 1500	0.61 - 315.5	29.610
Berau	Sub-Bituminous - High Volatile Bituminous	1 – 9.60	305.60 – 494.35	0.61 - 19.89	0.003
Barito	Lignite - High Volatile Bituminous B	0.30 – 45.39	0 - 1100	0.16 - 231.94	18.522
TOTAL					68.797

Table 35. Resources for CBM Investigations by the Geological Agency

Basin	Location	Area of Potential (km²)	Gas Content (scf/tonnes)			Gas Resources (Scf)		
			Min	Avrg	Max	Min	Avrg	Max
South Sumatra	Tanjung Enim (2009)	20,52	1.71	24.47	47.23	1,485,731,064	2,729,535,501	3,896,109,749
	Nibung (2010)	3	2.26	26.48	50.7	-	-	39,996,473,593
	Muara Lawai (2012)	4	0.69	-	56.25	-	-	1,031,504,260
	Bayung Lencir (2012)	23	6.08	-	12.40	-	-	2,159,152,524
	Muara Kilis (2013)	23.86	6.77	-	13.83	-	-	976,743,936
	Srijaya Makmur (2014)	3	4.74	17.84	30.93	-	-	6,456,017,796
	Mangunjaya (2017)	49	12.99	23.16	33.33	9,497,158,189	13,277,514,948	19,257,182,327
Total South Sumatra								73,773,184,185
Ombilin	Air Dingin (2009)	1	197.03	327.14	457.25	5,023,911,902	7,073,640,271	8,985,723,639
	Bukit Sibantar (2011)	5	3.15	55.33	107.50	314,201,709	1,602,830,632	1,848,090,939
Total Ombilin								10,833,814,578
Berau	Tanjung Redep (2013)	55	0.43	11.27	22.11	1,381,018,377	2,050,348,689	2,957,836,398
Total Kutal								2,957,836,398
Barito	Jangkang (2010)	4	6.80	-	12.80	-	-	207,084,800
	Balangan (2012)	1	13.98	44.04	72.21	436,699,320	1,375,783,342	2,255,655,073
	Paser (2014)	54	2.28	42.60	82.92	-	-	15,007,955,791
	Upau (2015)	4	6.85	29.95	53.04	-	-	47,170,560,996
	Tamiang Layang (2015)	8	24.82	36.56	48.60	742,811,429	1,094,225,281	1,454,497,802
	Ampah (2016)	90	0.34	3.54	6.74	156,612,075	554,113,412	1,008,277,484
Total Barito								67,104,031,946
TOTAL								154,668,867,106

Table 36. CBM Resources Come from Concession Areas of Sumatra

Basin	Location	Institution	Coal Rank	Coal Thickness (m)	Coal Depth (m)	Gas Content (scf/tonnes)	Gas Resources (Tcf)
1	2	3	4	5	6	7	8
South Sumatra	Belida *)	Private	Sub-Bituminus	≥ 23	300 - 450	10 - 60	0.520
	Muara Enim *)	Private	Sub-Bituminus C	44	565 - 724	104 - 141	0.098
	Muara Enim II *)	Private	Sub-Bituminus C	43	400 - 700	27 - 36	1.400
	Tanjung Enim *)	Private	Sub-Bituminus C	46	40 - 528	82 - 115	0.900
	Muralim *)	Private	Lignit - Sub-Bituminus C	30	430 - 630	70 - 185	1.980
	Lematang	Private	Sub-Bituminus	1 - 20	300 - 450	10 - 60	0.210
	Ogan Komering	Private	Sub-Bituminus	≥ 18	420 - 680	40 - 80	1.390
	Ogan Komering II	Private	Sub-Bituminus	≥ 17	210 - 350	0 - 40	0.070
	Air Komering	Private	Sub-Bituminus	5.50 - 6.50	400 - 550	18 - 25	0.191
	Muara Enim I	Private	Suban: Sub-Bituminus C	11.08	794	150.53	0.684
		Private	Mangus: Lignit - Sub-Bituminus C	17.72	741	113.11	
		Private	Babat: Lignit - Gambut	18.97	395.50	37.08	
		Private	Lematang: Gambut	16.24	491	33.18	
	Muara Enim III	Private	Suban: Sub-Bituminus B	4.66	722.50	68.50	0.180
		Private	Mangus: Sub-Bituminus C	1.75	699	80.80	0.270
		Private	Babat: Lignit	26.64	476.50	73.05	0.280
		Private	Lematang: Lignit	15.21	409.50	64.45	0.190
	Air Benakat I	Private	-	-	-	-	0.238
	Air Benakat II	Private	-	-	-	-	0.295
	Air Benakat III	Private	Suban: Lignit	8.73	514.30	50.67	0.130
		Private	Mangus: Lignit	4.46	491.70	95.38	0.170
		Private	Babat: Lignit	13.45	345	48.62	0.120
		Private	Lematang: Lignit	5.65	317	21.36	0.090
	Suban I	Private	-	-	-	-	0.162
	Suban II	Private	Suban: -	-	-	-	-
		Private	Mangus: Lignit - Sub-Bituminus	6	635	80	0.050
		Private	Babat: Gambut	8	339	16.35	0.070
		Private	Lematang: Lignit	8	309	16.60	0.080
	Sekayu	Private	Lignit - Sub-Bituminus	9 - 25	700 - 1000	50 - 200	1.700
	Sekayu II	Private	Lignit - Sub-Bituminus	1 - 30	300 - 850	20 - 130	0.560

1	2	3	4	5	6	7	8
	Batangasin	Private	-	-	-	-	-
	Tanjung Enim (2009)	Government	Sub-Bituminus	1.30 - 5	121 - 700	1.71 - 47.23	0.004
	Nibung (2010)	Government	Lignit - Sub-Bituminus	1 - 13.64	300 - 700	2.26 - 50.7	0.040
	Muara Lawai (2012)	Government	Sub-Bituminus	0.75 - 22	0 - 700	0.69 - 56.25	0.001
	Bayung Lencir (2012)	Government	Lignit	1 - 4.25	335 - 355.35	6.08 - 12.40	0.002
	Muara Kilis (2013)	Government	Lignit	1 - 1.70	300 - 700	6.77 - 13.83	0.001
	Srijaya Makmur (2014)	Government	Sub-Bituminus	1 - 1.90	300 - 700	4.74 - 30.93	0.006
	Mangunjaya (2017)	Government	Lignit - Sub-Bituminus	1.50 - 9.80	271.10 - 700	12.99 - 33.33	0.019
Total South Sumatra							**12.101**
Central Sumatra	Rengat	Private	Lignit	5	160 - 490	18 - 33	1.800
	Indragiri Hulu	Private	-	-	-	-	5.500
Total Central Sumatra							**7.300**
Ombilin	Sijunjung *)	Swasta	*High Volatile* Bituminus A	1 - 20	800	231 - 290	1.250
	Air Dingin (2009)	Government	*High Volatile* Bituminus	1.75 - 13.56	369.75 - 380.24	197.03 - 457.25	0.009
	Bukit Sibantar (2011)	Government	*High Volatile* Bituminus	0.40 - 4.20	166 - 405	3.15 - 107.50	0.002
Total Ombilin							**1.261**

Notes : *)CBM working area active

Table 37. CBM Resources from Concession Areas of Kalimantan

Basin	Location	Institution	Coal Rank	Coal Thickness (m)	Coal Depth (m)	Gas Content (scf/tonnes)	Gas Resources (Tcf)
1	2	3	4	5	6	7	8
Kutai	Sangatta II *)	Private	Sub-Bituminus	0.70 - 6	500 - 900	34 - 205.50	9.500
	Bangkanai III *)	Private	Sub-Bituminus	5.5 - 20	300 - 1000	118.30 - 266.84	0.730
	Bangkanai IV *)	Private	Sub-Bituminus	5.5 - 20	300 - 1000	118.30 - 266.84	1.400
	West Sanga-Sanga I	Private	Sub-Bituminus	9	347 - 700	185.40	0.140
	Sanga-sanga	Private	Sub-Bituminus - Bituminus	1 - 5	750 - 1500	60 - 450	5.700
	Sangatta I	Private	Sub-Bituminus - Bituminus	0.50 - 7	150 - 850	5 - 520	0.500
	Kutai Barat	Private	Sub-Bituminus	9	433.6 - 700	315.50	1.190
	Kutai Timur	Private	Sub-Bituminus - Bituminus	0.50 - 3	150 - 850	50 - 200	0.630
	Kutai	Private	Sub-Bituminus - *High Volatile* Bituminus	1 - 15.40	300 - 1000	100 - 293.59	2.690
	Kutai II	Private	Sub-Bituminus - Bituminus	0.50 - 4	150 - 850	150 - 370	1.440
	Melak Mendung I	Private	Sub-Bituminus - Bituminus	0.50 - 3	150 - 850	50 - 200	0.410
	Melak Mendung III	Private	-	-	-	-	-
	Bangkanai I	Private	Sub-Bituminus	2.75 - 7.50	300 - 1000	110 - 112	0.260
	Bangkanai II	Private	Sub-Bituminus	2.75 - 7.50	300 - 1000	110 - 112	0.830
	Bentian Besar	Private	-	-	-	-	2.290
	Bontang Bengalon	Private	-	-			1.900
Total Kutai							**29.610**
Berau	Tanjung Redep (2013)	Government	Sub-Bituminus - High Volatile Bituminus	1 - 9.60	305.60 - 494.35	0.61 - 19.89	0.003
Total Berau							**0.003**
Basin	*Location*	*Institution*	*Coal Rank*	*Coal Thickness (m)*	*Coal Depth (m)*	*Gas Content (scf/tonnes)*	*Gas Resources (Tcf)*
Barito	Barito *)	Private	Sub-Bituminus	4 - 21	250 - 750	60 - 140	1.100
	Kotabu *)	Private	Sub-Bituminus - *High Volatile* Bituminus B	7.33 - 18.30	440 - 850	181.95 - 231.94	0.628
	Kapuas III *)	Private	Sub-Bituminus	1 - 4.30	200 - 750	23 - 79	0.410
	Tanjung II	Private	C: Lignit	11.33	428.5	49.40	0.210
		Private	B: Lignit	7.03	299.75	60	-
		Private	A: Lignit	11.3	507	55.20	0.180
	Tanjung IV	Private	-	-	-	-	1.880
	Tabulako	Private	-	-	-	-	0.800
	Kuala Kapuas I	Private	-	-	-	-	2.700
	Kuala Kapuas II	Private	Sub-Bituminus	9	200 - 750	25.50	0.138
	Pulang Pisau	Private	Sub-Bituminus A - High Volatile Bituminus B	0.40 - 1.02	235 - 476	17 - 34	0.470
	Barito Tapin	Private	Sub-Bituminus	-	-	-	4.820
	Tanah Laut	Private	Sub-Bituminus	14.25 - 45.39	300 - 800	0.16 - 35	0.430
	Kapuas I	Private	Sub-Bituminus	1 - 4.30	200 - 750	23 - 79	0.440

1	2	3	4	5	6	7	8
	Kapuas II	Private	Sub-Bituminus	1 - 4.30	200 - 750	23 - 79	0.700
	Barito Banjar I	Private	Sub-Bituminus	6 - 28	400 - 1200	100 - 229	1.500
	Barito Banjar II	Private	Sub-Bituminus	4 - 28	400 - 1100	90 - 165	1.300
	Belawa	Private	-	-	-	-	0.749
	Jangkang (2010)	Government	Lignit - Sub-Bituminus	1 - 2.58	192.9 - 700	6.80 - 12.80	0.000
	Balangan (2012)	Government	Sub-Bituminus	16.7	203.30 - 500	13.98 - 72.21	0.002
	Paser (2014)	Government	Sub-Bituminus - *High Volatile* Bituminus	0.30 - 1.28	0 - 700	2.28 - 82.92	0.015
	Upau (2015)	Government	Sub-Bituminus	1.11 - 37.25	12.30 - 470.45	6.85 - 53.04	0.047
	Tamiang Layang (2015)	Government	*High Volatile* Bituminus	2.72	190 - 700	24.82 - 48.60	0.001
	Ampah (2016)	Government	Lignit	1 - 1.50	0 - 700	0.34 - 6.74	0.001
	Total Barito						**18.522**
	TOTAL INDONESIA						**68.797**

**Notes : *)CBM working area active**

Figure 49. Graph of Changes in the Value of CBM Resources in 2017 – 2021

Figure 50. Statistics of Indonesia's CBM Resources per Basin in 2018 - 2021

Table 38. Indonesian CBM Resources per Basin in 2021

Basin	Coal Rank	Coal Thickness (m)	Coal Depth (m)	Gas Content (scf/tonnes)	Gas Resources (Tcf)
South Sumatera	Lignite - Bituminous	1 - 46	0 - 794	0.69 – 150.53	12.10
Central Sumatera	Lignite	5	160 - 490	18 – 33	7.30
Ombilin	High Volatile Bituminous	0.40 - 13.56	166 - 800	3.15 – 457.25	1.26
Kutai	Sub-Bituminous - High Volatile Bituminous	0.50 - 20	150 - 1500	0.61 – 315.5	32.21
Berau	Sub-Bituminous - High Volatile Bituminous	1 - 9.60	305.60 – 494.,35	0.61 – 19.89	0.003
Barito	Lignite - High Volatile Bituminous B	0.30 - 45.39	0 – 1100	0.16 – 231.94	18.52
TOTAL					71.40

A more detailed recapitulation of CBM resource data available in Table 39. In general, Indonesia's CBM resources consist of 0.15 Tcf from CMCGR investigations at 16 locations and 71.25 Tcf from exploration activities by Business Entities in 54 locations. The number of CBM resources in 2020 decreased by 14.90 Tcf when compared to 2019, which came from the results of data reconciliation of 12 (twelve) active and terminated CBM CAs in 2019–2021 conducted by SKK Migas and CMCGR. Based on data from SKK Migas, throughout 2020 there were no exploration activities from the KKKS CBM CAs, so technically there was no data update. In 2021, several areas are planned to be explored, but experiencing delays due to technical and non-technical matters (pandemic).

Table 39. CBM Resources per Exploration Area in 2021

Basin	Location	Institution	Coal Rank	Coal Thickness (m)	Coal Depth (m)	Gas Content (scf/tonnes)	Gas Resources (Tcf)
1	2	3	4	5	6	7	8
South Sumatera	Belida *)	Private	Sub-Bituminous	≥ 23	300 - 450	10 - 60	0.520
	Muara Enim *)	Private	Sub-Bituminous C	44	565 - 724	104 - 141	0.098
	Muara Enim II *)	Private	Sub-Bituminous C	43	400 - 700	27 - 36	1.400
	Tanjung Enim *)	Private	Sub-Bituminous C	46	40 - 528	82 - 115	0.900
	Muralim *)	Private	Lignite - Sub-Bituminous C	30	430 - 630	70 - 185	1.980
	Lematang	Private	Sub-Bituminous	1 - 20	300 - 450	10 - 60	0.210
	Ogan Komering	Private	Sub-Bituminous	≥ 18	420 - 680	40 - 80	1.390
	Ogan Komering II	Private	Sub-Bituminous	≥ 17	210 - 350	0 - 40	0.070
	Air Komering	Private	Sub-Bituminous	5.50 - 6.50	400 - 550	18 - 25	0.191
	Muara Enim I	Private	Suban: Sub-Bituminous C	11.08	794	150.53	0.684
		Private	Mangus: Lignite - Sub-Bituminous C	17.72	741	113.11	
		Private	Babat: Lignite - Gambut	18.97	395.50	37.08	
		Private	Lematang: Gambut	16.24	491	33.18	
	Muara Enim III	Private	Suban: Sub-Bituminous B	4.66	722.50	68.50	0.180
		Private	Mangus: Sub-Bituminous C	1.75	699	80.80	0.270
		Private	Babat: Lignite	26.64	476.50	73.05	0.280
		Private	Lematang: Lignite	15.21	409.50	64.45	0.190
	Air Benakat I	Private	-	-	-	-	0.238
	Air Benakat II	Private	-	-	-	-	0.295

1	2	3	4	5	6	7	8
	Air Benakat III	Private	Suban: Lignite	8.73	514.30	50.67	0.130
		Private	Mangus: Lignite	4.46	491.70	95.38	0.170
		Private	Babat: Lignite	13.45	345	48.62	0.120
		Private	Lematang: Lignite	5.65	317	21.36	0.090
	Suban I	Private	-	-	-	-	0.162
	Suban II	Private	Suban:-	-	-		-
		Private	Mangus: Lignite - Sub-Bituminous	6	635	80	0.050
		Private	Babat: Gambut	8	339	16.35	0.070
		Private	Lematang: Lignite	8	309	16.60	0.080
	Sekayu	Private	Lignite - Sub-Bituminous	9 - 25	700 - 1000	50 - 200	1.700
	Sekayu II	Private	Lignite - Sub-Bituminous	1 - 30	300 - 850	20 - 130	0.560
	Batangasin	Private	-	-	-	-	-
	Tanjung Enim (2009)	Government	Sub-Bituminous	1.30 - 5	121 - 700	1.71 - 47.23	0.004
	Nibung (2010)	Government	Lignite - Sub-Bituminous	1 - 13.64	300 - 700	2.26 - 50.7	0.040
	Muara Lawai (2012)	Government	Sub-Bituminous	0.75 - 22	0 - 700	0.69 - 56.25	0.001
	Bayung Lencir (2012)	Government	Lignite	1 - 4.25	335 - 355.35	6.08 - 12.40	0.002
	Muara Kilis (2013)	Government	Lignite	1 - 1.70	300 - 700	6.77 - 13.83	0.001
	Srijaya Makmur (2014)	Government	Sub-Bituminous	1 - 1.90	300 - 700	4.74 - 30.93	0.006
	Mangunjaya (2017)	Government	Lignite - Sub-Bituminous	1.50 - 9.80	271.10 - 700	12.99 - 33.33	0.019
	Total Sumatera Selatan						**12.101**

1	2	3	4	5	6	7	8
Sumatera Tengah/Central Sumatera	Rengat	Private	Lignite	5	160 - 490	18 - 33	1.800
	Indragiri Hulu	Private	-	-	-	-	5.500
	Total Sumatera Tengah						**7.300**
Ombilin	Sijunjung *)	Swasta	High Volatile Bituminous A	1 - 20	800	231 - 290	1.250
	Air Dingin (2009)	Pemerintah (CMCGR)	High Volatile Bituminous	1.75 - 13.56	369.75 - 380.24	197.03 - 457.25	0.009
	Bukit Sibantar (2011)	Pemerintah (CMCGR)	High Volatile Bituminous	0.40 - 4.20	166 - 405	3.15 - 107.50	0.002
	Total Ombilin						**1.261**
Kutai	Sangatta II *)	Private	Sub-Bituminous	0.70 - 6	500 - 900	34 - 205.50	9.500
	Bangkanai III *)	Private	Sub-Bituminous	5.5 - 20	300 - 1000	118.30 - 266.84	0.730
	Bangkanai IV *)	Private	Sub-Bituminous	5.5 - 20	300 - 1000	118.30 - 266.84	1.400
	West Sanga-Sanga I	Private	Sub-Bituminous	9	347 - 700	185.40	0.140
	Sanga-sanga	Private	Sub-Bituminous - Bituminous	1 - 5	750 - 1500	60 - 450	5.700
	Sangatta I	Private	Sub-Bituminous - Bituminous	0.50 - 7	150 - 850	5 - 520	0.500
	Kutai Barat	Private	Sub-Bituminous	9	433.6 - 700	315.50	1.190
	Kutai Timur	Private	Sub-Bituminous - Bituminous	0.50 - 3	150 - 850	50 - 200	0.630
	Kutai	Private	Sub-Bituminous - High Volatile Bituminous	1 - 15.40	300 - 1000	100 - 293.59	2.690
	Kutai II	Private	Sub-Bituminous - Bituminous	0.50 - 4	150 - 850	150 - 370	1.440
	Melak Mendung I	Private	Sub-Bituminous - Bituminous	0.50 - 3	150 - 850	50 - 200	0.410
	Melak Mendung III	Private	-	-	-	-	-

1	2	3	4	5	6	7	8
	Bangkanai I	Private	Sub-Bituminous	2.75 - 7.50	300 - 1000	110 - 112	0.260
	Bangkanai II	Private	Sub-Bituminous	2.75 - 7.50	300 - 1000	110 - 112	0.830
	Bentian Besar	Private	-	-	-	-	2.290
	Bontang Bengalon	Private	-	-	-	-	1.900
		Total Kutai					29.610
Berau	Tanjung Redep (2013)	Government	Sub-Bituminous - High Volatile Bituminous	1 - 9.60	305.60 - 494.35	0.61 - 19.89	0.003
		Total Berau					0.003
Barito	Barito *)	Private	Sub-Bituminous	4 - 21	250 - 750	60 - 140	1.100
	Kotabu *)	Private	Sub-Bituminous - *High Volatile Bituminous B*	7.33 - 18.30	440 - 850	181.95 - 231.94	0.628
	Kapuas III *)	Private	Sub-Bituminous	1 - 4.30	200 - 750	23 - 79	0.410
	Tanjung II	Private	C: Lignite	11.33	428.5	49.40	0.210
		Private	B: Lignite	7.03	299.75	60	-
		Private	A: Lignite	11.3	507	55.20	0.180
	Tanjung IV	Private	-	-	-	-	1.880
	Tabulako	Private	-	-	-	-	0.800
	Kuala Kapuas I	Private	-	-	-	-	2.700
	Kuala Kapuas II	Private	Sub-Bituminous	9	200 - 750	25.50	0.138
	Pulang Pisau	Private	Sub-Bituminous A - High Volatile Bituminous B	0.40 - 1.02	235 - 476	17 - 34	0.470
	Barito Tapin	Private	Sub-Bituminous	-	-	-	4.820
	Tanah Laut	Private	Sub-Bituminous	14.25 - 45.39	300 - 800	0.16 - 35	0.430
	Kapuas I	Private	Sub-Bituminous	1 - 4.30	200 - 750	23 - 79	0.440
	Kapuas II	Private	Sub-Bituminous	1 - 4.30	200 - 750	23 - 79	0.700

1	2	3	4	5	6	7	8
	Barito Banjar I	Private	Sub-Bituminous	6 - 28	400 - 1200	100 - 229	1.500
	Barito Banjar II	Private	Sub-Bituminous	4 - 28	400 - 1100	90 - 165	1.300
	Belawa	Private	-	-	-	-	0.749
	Jangkang (2010)	Government	Lignite - Sub-Bituminous	1 - 2.58	192.9 - 700	6.80 - 12.80	0.000
	Balangan (2012)	Government	Sub-Bituminous	16.7	203.30 - 500	13.98 - 72.21	0.002
	Paser (2014)	Government	Sub-Bituminous - *High Volatile Bituminous*	0.30 - 1.28	0 - 700	2.28 - 82.92	0.015
	Upau (2015)	Government	Sub-Bituminous	1.11 - 37.25	12.30 - 470.45	6.85 - 53.04	0.047
	Tamiang Layang (2015)	Government	*High Volatile* Bituminous	2.72	190 - 700	24.82 - 48.60	0.001
	Ampah (2016)	Government	Lignite	1 - 1.50	0 - 700	0.34 - 6.74	0.001
	Total Barito						**18.522**
	TOTAL INDONESIA						**68.797**

Notes : *)CBM working area active

3.2.4. PEAT

The investigation of peat as an energy source in Indonesia is currently carried out only by the Geological Agency CMCGR. Therefore, the data entered into the peat resource database only comes from the results of the investigation activities carried out by CMCGR. The tabulation of Indonesia's peat resource data in 2021 includes location of availability (region, regency, province), peat quality (calorific value in adb basis), area (ha), volume of peat (million m³) and peat resources (million tons).

The results of the Geological Agency investigation until 2021 recorded that Indonesia's peat resources were 13.52 billion tons of dry peat (Figure 51, Table 40) with calorific value of 5,950 Cal/gr adb, equivalent to lignite and sub bituminous coal. The distribution of Indonesia's peat resources in 2020 available in Table 40 covering 69 locations, spread across Sumatra (30 locations), Kalimantan (38 locations) and Sulawesi (1 location).

Until now, peat in Indonesia has not been utilized as an energy source, mainly because Indonesia has variety of energy sources that are more economical to develop than peat. However, in terms of potential, Indonesian peat has large enough calorific value, which deserves to be considered as an energy source. However, some of the peatlands in Indonesia are still conservation land, on which there are many conservation forests that support local ecosystems. Peat when burned also produces CO_2 emissions which are considered harmful to the environment. A thorough study of the use of peat needs to be

carried out so that peat in Indonesia can be utilized optimally by considering the positive and negative impacts.
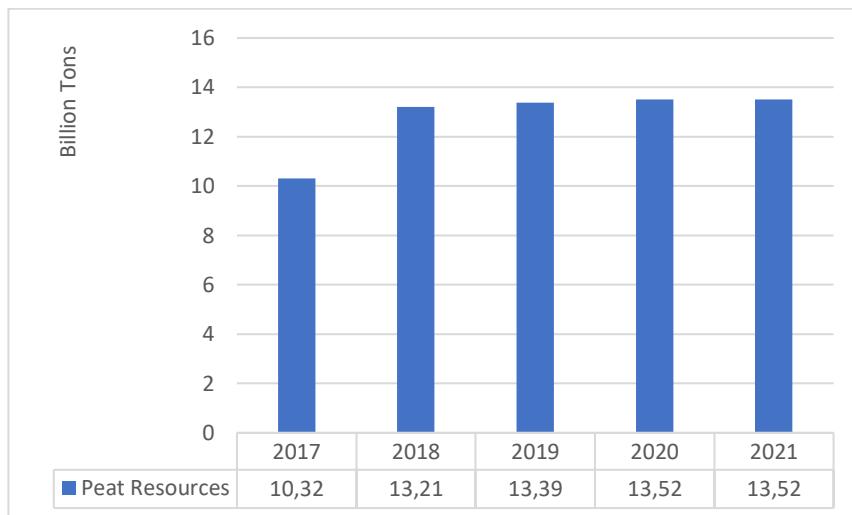

Figure 51. Statistics of Peat Resources for 2017-2021

Table 40. Indonesia's Peat Resources in 2021

No	Province	Location	Location Number	Regency	Calorific Value (cal/g)	Area (ha)	Volume (million m³)	Resources (million tonnes)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**
1	Aceh	Alue Bilie, Darul Makmur	1	Aceh Barat	1545 - 4185	20,000	607.00	91.05
		Trumon, Simpang Kiri	2	Aceh Selatan	3540 - 5035	37,700	1,653.00	148.77
		Total				57,700.00	2,260.00	239.82
2	North Sumatera	Tanjung, Medan, Pantai Tengah,	5	Labuhan Batu	4455 - 5540	26,000	430.00	73.10
		Bilah Hilir, Kp. Rakyat	4					
		Sungai Bilah	3		3958-5143	1,041	30,536.00	93.66
		Total				27,040.63	30,966.00	166.76
3	Riau	Pulau Rupat	6	Bengkalis	4460 - 4925	38,100	1,194.00	143.28
		Pulau Bengkalis	7	Bengkalis	5522 - 5950	66,410	3,000.00	360.00
		Pulau TebingTinggi	9	Bengkalis	4605 - 5085	89,250	4,084.00	367.56
		Pulau Ransang	10	Bengkalis	4395 - 5020	76,000	2,000.00	200.00
		Sungai Siak Kanan	12	Bengkalis	4950 - 5400	110,000	5,290.00	423.20
		Sungai Siak Kiri	11	Bengkalis	4690 - 5115	206,000	3,600.00	396.00
		Bukit Batu	10	Siak	-	0	468,00	42,12
		Tembilahan	14	Siak	4605 - 5085	89,250	4,084.00	367.56
		Sungai Kampar Utara	13	Palalawan	3940	42,050	1,085.00	237.88
		Tembilahan	63	Indragiri Hilir	4547 - 4754	155,069	3,294.52	422.15
		Teluk Meranti dan Segamai	66	Pelalawan	5013-5079	439,027	21,951.32	2,282.94
		Total				1,311,155.50	50,050.84	5,242.69
4	Jambi	Air Hitam	18	Batanghari	3950 - 5115	157,500	10.862,00	977,68
		Sungai Air Hitam/Tanjung	13	Batanghari	3980 - 4680	17,700	531,00	531,00
		Dendang	17	Tanjung Jabung	4680 - 5220	25,000	1.000,00	70,00
		Daerah Muara Sabak	16	Tanjung Jabung Timur	1405 - 3130	60,207	1.000,00	70,00
		Total				260,407	13.393,00	1.648,68

1	2	3	4	5	6	7	8	9
5	South Sumatera	Muara Medak	19	Musi Banyu Asin	4455 - 5540	45,000.00	349.00	59.33
		Nyarang, Tanah Abang	20	Musi Banyu Asin	4280 - 5195	10,475.00	269.40	29.63
		Delta Telang I, Delta Upang	18	Musi Banyu Asin	-	0.00	0.00	0.00
		Panyambungan	24	Ogan Komering Ilir	3920 - 5090	12,000.00	3,660.00	292.80
		Pedamaran, Kota Kayu Agung	25	Ogan Komering Ilir	3815 - 5325	42,325.00	1,703.00	153.27
		Rawang Lebok Hitam	26	Ogan Komering Ilir	4695 - 4980	47,550.00	2,070.00	165.64
		Sungai Riding	22	Ogan Komering Ilir	4615 - 5005	74,000.00	3,191.00	255.28
		Pakbiban - Bekuyu	23	Ogan Komering Ilir	4325 - 5085	43,007.00	1,611.80	128.94
		Air Sugihan	21	Muba, OKI	3018 - 4290	7,200.00	108.00	9.72
		Buring-Merang-Medak-Lalang	21	Musi Banyu Asin	4121-5960	62,080.94	1,388.90	176.92
		Total				343,637.94	14,351.10	1,271.53
		Sumatera Total Peat Resources				1,999,941.07	111,020.94	8,569.47
6	West Kalimantan	Paloh	27	Sambas	3210 - 5485	17,500	769.00	99.97
		Mentibar	28	Sambas	3880 - 5240	11,500	230.00	27.60
		Sekura	29	Sambas	-	-	-	-
		Tembang Kacang, S.Bungur	32	Pontianak	-	-	230.00	27.60
		Sungai Raya	33	Pontianak	4205 - 5155	64,635	281.93	25.37
		Rasau jaya	30	Pontianak	4510 - 5474	44,000	1,500.00	165.00
		Kendawangan	37	Ketapang	3825 - 5670	77,000	89.00	14.24
		Ketapang	36	Ketapang	4510 - 5470	75,000	1,600.00	240.00
		Ketapang	33	Ketapang	-	-	12.97	5.77
		Padang Tikar	34	Pontianak	4883 - 4981	15,700	439.00	43.90
		Padang Tikar	35	Pontianak	-	15,396	552.55	49.73
		Tanjung Satai	58	Ketapang	3360 - 5156	17,654	-	53.68
		Sungai Pawan	8	Ketapang	4253 - 4940	90,778	367.08	0.00
		Kuburaya	65	Kubu Raya	4340 - 5468	119,384	1,830.65	244.00
		Rasau	68	Kubu Raya	2985 - 5431	467,600	1,107.71	132.93
		Total				1,016,147	9,009.89	1,129.79

1	2	3	4	5	6	7	8	9
7	Central Kalimantan	Baung	39	Kota Waringin Timur	4155 - 5010	78,750	3,773.00	377.30
		Sampit	41	Kota Waringin Timur	3395 - 4200	1,071	39.40	3.94
		Daerah Bapinang Pagatan	42	Kota Waringin Timur	3580 - 5210	66,510	2,568.00	256.80
		Katingan	43	Kota Waringin Timur	4335 - 5330	23,753	2,771.00	304.81
		Pandih batu	44	Kapuas	4390 - 5145	13,135	6,469.00	646.90
		Pulau Pisau	47	Kapuas	4390 - 5145	21,750	605.50	54.50
		Sekakajang	48	Kapuas	4020 - 4815	36,895	820.00	139.40
		Sungai Menkatip	50	Barito Selatan	4705 - 5230	77,130	3,531.00	304.81
		Kotabesi	40		-	3,623	67.50	5.40
		Dusun Hilir	50	Barito Selatan		0	0.00	0.00
		Marabahan	51	Barito Kuala	5520 - 5950	12,600	82.00	12.30
		Sukamara	38	Kotawaringin Barat Sukamara	4146-5282	377	254.05	20.32
		Dadahup	62	Kapuas	-	49,695	2,737.54	273.75
		Tumbang Nusa	59	Pulang Pisau	4066 - 5163	30,279	1,220.06	146.40
		Pangkoh	17	Pulang Pisau	4329 - 5296	29,673	908.01	108.961
		Bahaur	33	Pulang Pisau	4452 - 5394	15,911	308.265	33.83
		Mengkatip	48	Barito Selatan	3346 - 5565	46,923	-	286.51
		Jabiren-Maliku dan Kahayan Hilir	64	Pulang Pisau	2216 - 5108	146,445	-	581.65
		Total				654,519.62	26,154.32	3,557.58
8	South Kalimantan	Batumandi	53	Hulu Sungai Utara	2362 - 5320	13,525	483.38	45.81
		Barambai	61	Barito Kuala	4254 -5051	4,010	73.95	9.58
		Daha		Hulu Sungai Selatan	4071 - 4203	233,428	710.50	167.68
		Total				250,963.00	1,267.83	223.07

1	2	3	4	5	6	7	8	9
9	East Kalimantan	Muarakaman 1	55	Kutai Kartanegara	3400 - 3800	5,579	112.37	16.08
		Muarakaman 2	56		4355 - 5480	11,000	330.00	26.40
		Total				**16,579**	**442.37**	**42.48**
Kalimantan Total Peat Resources						**1,938,208.62**	**36,874.42**	**4,952.92**
10	South Sulawesi	Malangke, Luwu	57	Sulawesi Selatan	4680 - 5220	1,250	9.50	1.25
		Total				**1,250**	**9.50**	**1.25**
Sulawesi Total Peat Resources						**1,250.00**	**9.50**	**1.25**

3.3. GEOTHERMAL RESOURCES

The classification of geothermal resources used in the preparation of the Geothermal Resources and Reserve Balance refers to SNI 6009: 2017 concerning the Classification of Indonesia's Geothermal Resources and Reserves. It is based on the results of geoscience studies include; geology, geochemistry, geophysics, drilling, and reservoir engineering. Geological studies are focused on geological structures, rock ages and types, and types of altered rocks in relation to geothermal systems. Geochemical studies include the type and level of water maturation, origin of water, hydrogeological models, temperature and fluid systems. Meanwhile, geophysical studies produce rock physical parameters and subsurface structures of the geothermal system. Drilling is used to determine the actual reservoir depth and temperature. The reservoir engineering studies resulted the reservoir classification, including physical properties of rocks, fluids and fluid displacement from the reservoir. Based on the study of the geosciences above, a model of the geothermal system and energy potential is obtained. The relationship between the results of the study of earth science, resources and reserves of geothermal energy is shown in Figure 52.

Until 2021, 356 geothermal locations have been identified throughout Indonesia, stretching from Weh Island at the west end to Papua Island at the east end. The location is the result of geological, geochemical, geophysical and drilling investigations carried out by the Government and Business Entities.

Resources				
Speculative	Hypotetic	Reserves		
		Possible	Probable	Proven

Earth Science Data is More Details ➤

Figure 52. The Relationship Between the Results of Geothermal Studies, Resources, and Geothermal Energy Reserves (modification of McKelvey, 1972 in SNI 6009:2017)

Geothermal resources can be categorized into volcanic and non-volcanic. Volcanic geothermal resources are found along volcanic pathways that stretch from Sumatra, Java, Bali, Nusa Tenggara, Sulawesi to the Maluku Islands. Meanwhile, non-volcanic geothermal resources are found in Kalimantan, Bangka Belitung Islands, Sulawesi and Papua.

The detail distribution of geothermal areas in Indonesia are as follows: Sumatra (101 locations), Java (75 locations), Bali (6 locations), Nusa Tenggara (34 locations), Kalimantan (14 locations), Sulawesi (90 locations), Maluku (33 locations) and Papua (3 locations). In these locations, about 89% have been surveyed with varying levels ranging from preliminary to detailed surveys. Meanwhile, 4% are in the exploration drilling stage.

The results of recapitulation and updating of the balance of geothermal resources and reserves until December 2021 are obtained total resources of 23,356.9 MWe with reserves of 14,131.9 Mwe. Until 2021, geothermal utilization for Geothermal Power Plants (PLTP) is 10% of the total existing resources. The value of Indonesia's geothermal reserves, especially suspected and proven reserves, is mostly obtained from reports from companies holding Geothermal Permits (IPB).

The total value of geothermal resources recorded in 2021 decreased by 408.6 MWe compared to 2020, with details of 119 MWe in the resource category and 289.6 MWe in the reserve category (Figure 53 and Figure 54). The reason for this change is due to an increase in the status of resources based on data from the results of the 2021 survey activities, re-evaluation of geothermal data, and the latest data from IPB holders. Although the total value of geothermal resources has decreased, the status of geothermal resources data in 2021 has higher level of accuracy and confidence (Table 41 and Table 42).
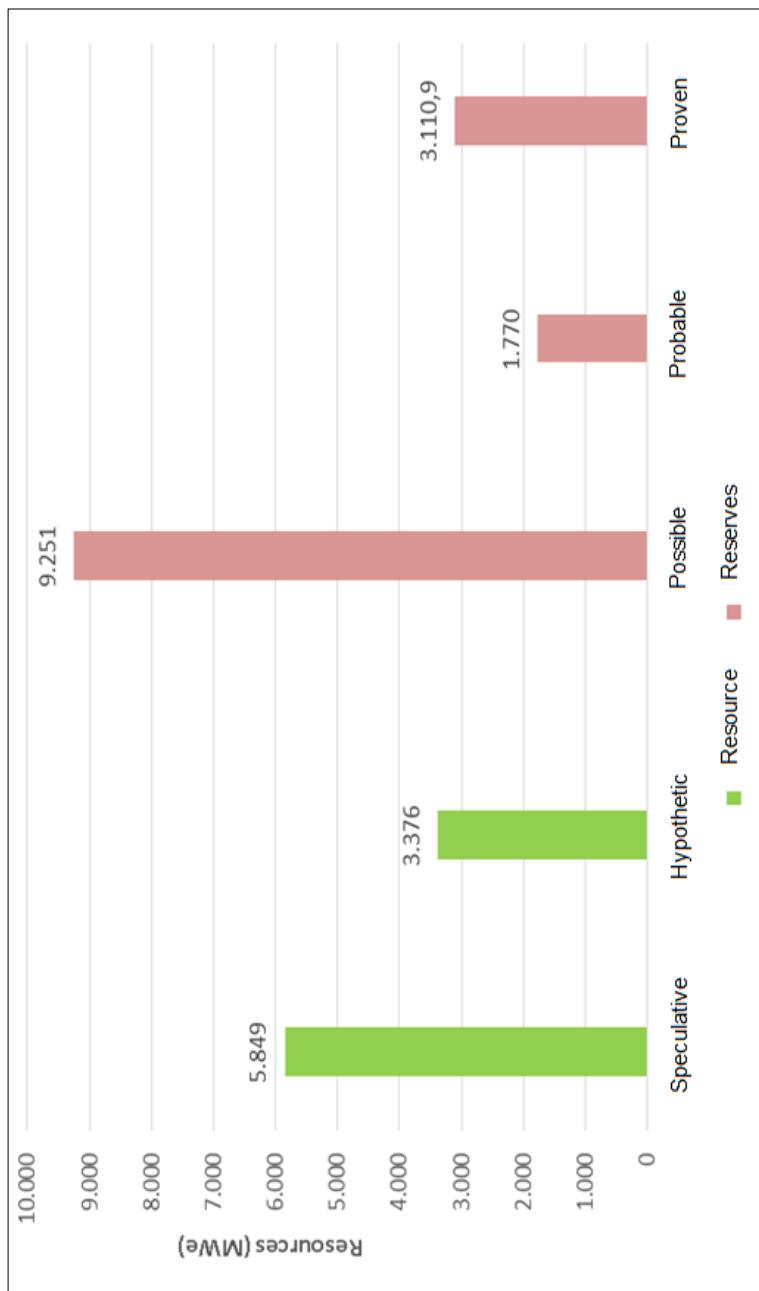
**Figure 53.** Indonesia's Geothermal Resources and Reserves in 2021
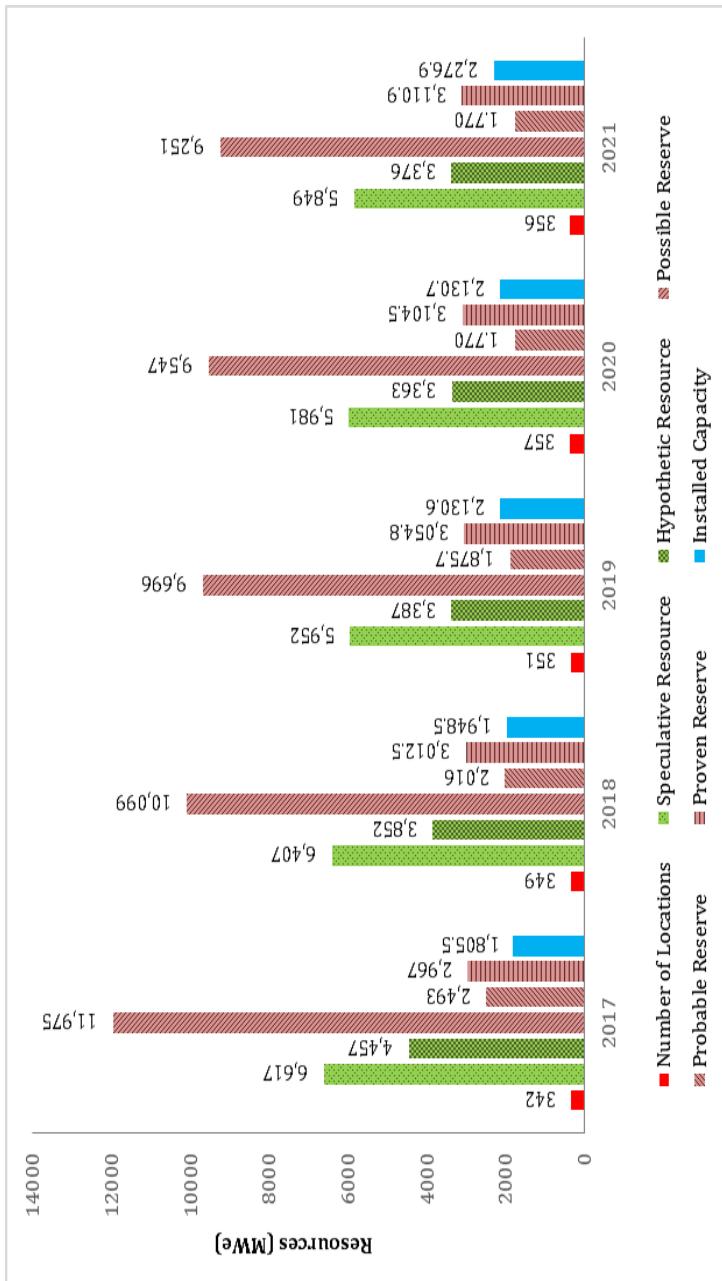
Figure 54. Number of Geothermal Locations, Resources and Reserves, and Installed Capacity of PLTP in Indonesia in 2017-2021

Table 41. Indonesia's Geothermal Resources in 2021

NO.	ISLAND	NUMBER OF TOTAL LOCATIONS	RESOURCES (MWe)				RESERVES			INSTALLED CAPACITY (MW)
			SPECULATIVE	HYPOTHETIC	POSSIBLE	PROBABLE	POSSIBLE	PROBABLE	PROVEN	
1	Sumatra	101	2,167	1,567	3,624		976	1,126.4	880.6
2	Jawa	75	1,259	1,191	3,260		377	1,820	1,263.8
3	Bali	6	70	21	104		110	30	-
4	Nusa Tenggara	34	215	146	783		121	12.5	12.5
5	Kalimantan	14	151	18	6		-	-	-
6	Sulawesi	90	1,352	342	989		180	120	120.0
7	Maluku	33	560	91	485		6	2	-
8	Papua	3	75	-	-		-	-	-
	TOTAL	**356**	**5,849**	**3,376**	**9,251**		**1,770**	**3,110.9**	**2,276.9**
							14,131.9		
					23,356.9				

Table 42. Indonesia's Geothermal Resources by Province in 2021

NO.	ISLAND	NUMBER OF TOTAL LOCATIONS	RESOURCES (MWe)			RESERVES		INSTALLED CAPACITY (MW)
			SPECULATIVE	HYPOTHETIC	POSSIBLE	PROBABLE	PROVEN	
1	2	3	4	5	6	7	8	9
Sumatra								
1	Aceh	19	324	222	515	25	-	-
2	Sumatra Utara	18	250	388	705	180	503	429.4
3	Sumatra Barat	19	427	589	525	50	85	85
4	Riau	4	45	-	-	-	-	-
5	Jambi	9	352	87	319	54	-	-
6	Bengkulu	5	134	-	299	221	110	-
7	Kepulauan Bangka Belitung	7	35	11	-	-	-	-
8	Sumatra Selatan	7	225	230	363	221	208.4	146.2
9	Lampung	13	375	40	898	225	220	220
Jawa								
10	Banten	7	125	161	323	-	-	-
11	Jawa Barat	42	985	469	1,454	174	1,580	1,193.8
12	Jawa Tengah	14	79	271	622	130	240	70
13	Daerah Istimewa Yogyakarta	1	-	-	10	-	-	-
14	Jawa Timur	11	70	290	851	73	-	-
Bali and Nusa Tenggara								
15	Bali	6	70	21	104	110	30	-
16	Nusa Tenggara Barat	3	-	6	80	-	-	-
17	Nusa Tenggara Timur	31	215	140	703	121	12.5	12.5

1	2	3	4	5	6	7	8	9
	Kalimantan							
18	Kalimantan Barat	5	65	-	-	-	-	-
19	Kalimantan Selatan	3	49	1	-	-	-	-
20	Kalimantan Utara	4	20	17	6	-	-	-
21	Kalimantan Timur	2	17	-	-	-	-	-
	Sulawesi							
22	Sulawesi Utara	9	77	51	410	180	120	120
23	Gorontalo	5	129	11	20	-	-	-
24	Sulawesi Tengah	30	391	84	296	-	-	-
25	Sulawesi Barat	12	296	53	32	-	-	-
26	Sulawesi Selatan	21	259	117	139	-	-	-
27	Sulawesi Tenggara	13	200	26	92	-	-	-
	Maluku							
28	Maluku Utara	15	190	7	379	-	-	-
29	Maluku	18	370	84	106	6	2	-
	Papua							
30	Papua Barat	3	75	-	-	-	-	-
	Total	356	5,849	3,376	9,251	1,770	3,110.9	2,276.9
						14,131.9		
					23,356.9			

4. CLOSURE

The government through CMCGR of Geological Agency continues to make various efforts to develop the potential of energy and mineral resources, one of which is through the preparation and updating of Indonesia's mineral, coal and geothermal resource balances. This activity resulted in the current condition of the amount of mineral resources, coal and geothermal which can be used as a reference in making various policies related to energy use and mineral utilization in Indonesia.

To improve the quality of the mineral, coal and geothermal resource balance data, CMCGR continues to collaborate with other stakeholders in conducting evaluation and data reconciliation activities. In the future, the balance of resources and reserves of minerals, coal, and geothermal is expected to continue to increase in quantity (through policies for managing the flow of data on mineral, coal and geothermal resources and reserves) and quality (through standardization of data formats and verification of resource and reserve data by competent person).

The mineral, coal and geothermal resources balance provides information on the potential energy and mineral resources, which can be a reference for the national management and utilization of minerals, coal and geothermal (ESDM sector policies include mineral downstream programs related to reserve resilience and energy transition, the direction of central and regional development, as well as spatial planning). Today, proper management of energy and mineral

resources requires a shift in approach from a single sector priority to an integrated comprehensive planning strategy involving multiple stakeholders. This is carried out with the aim of ensuring that the utilization of energy and mineral resources for various purposes can be maximized while taking into account the overall positive and negative impacts.

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DISTRIBUTION MAP OF INDONESIA'S PRECIOUS METALS MINERAL
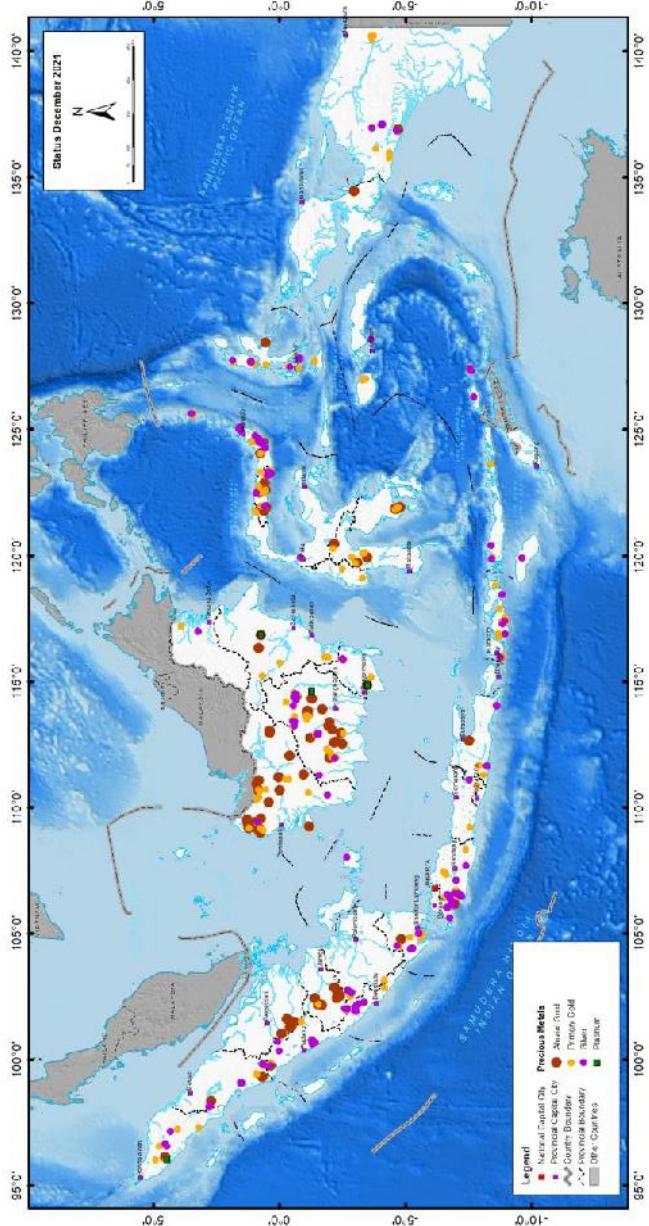
DISTRIBUTION MAP OF INDONESIA'S BASE METALS MINERAL
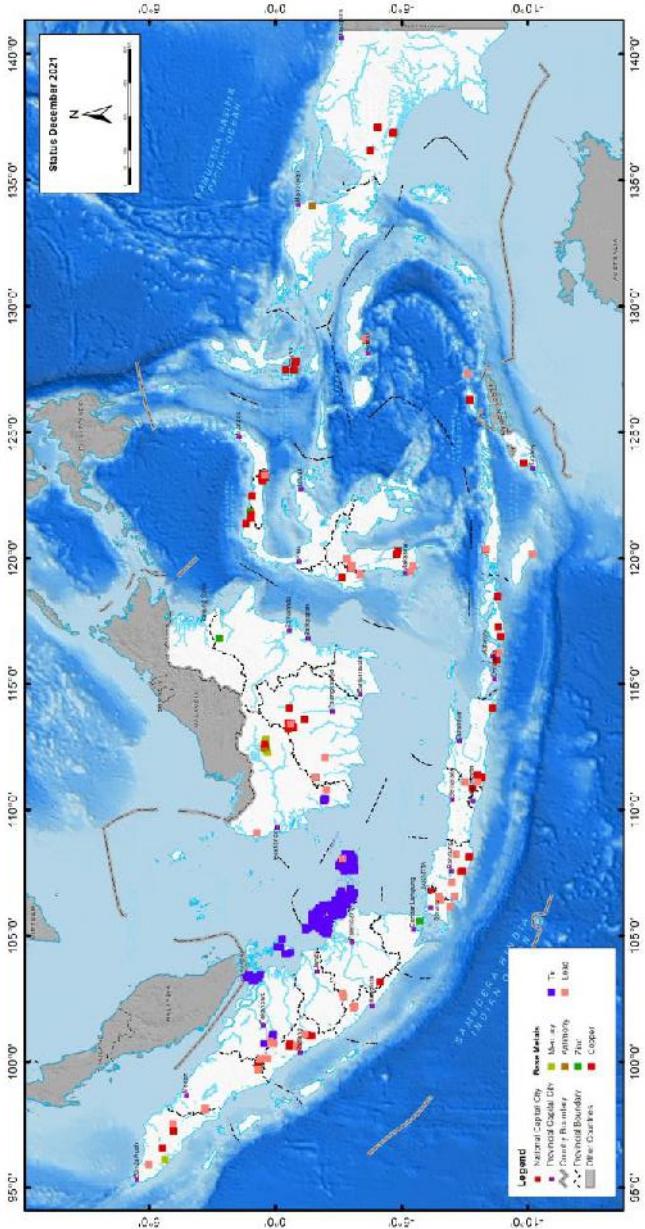
# DISTRIBUTION MAP OF INDONESIA'S IRON AND IRON ALLOYS MINERAL

Status December 2021
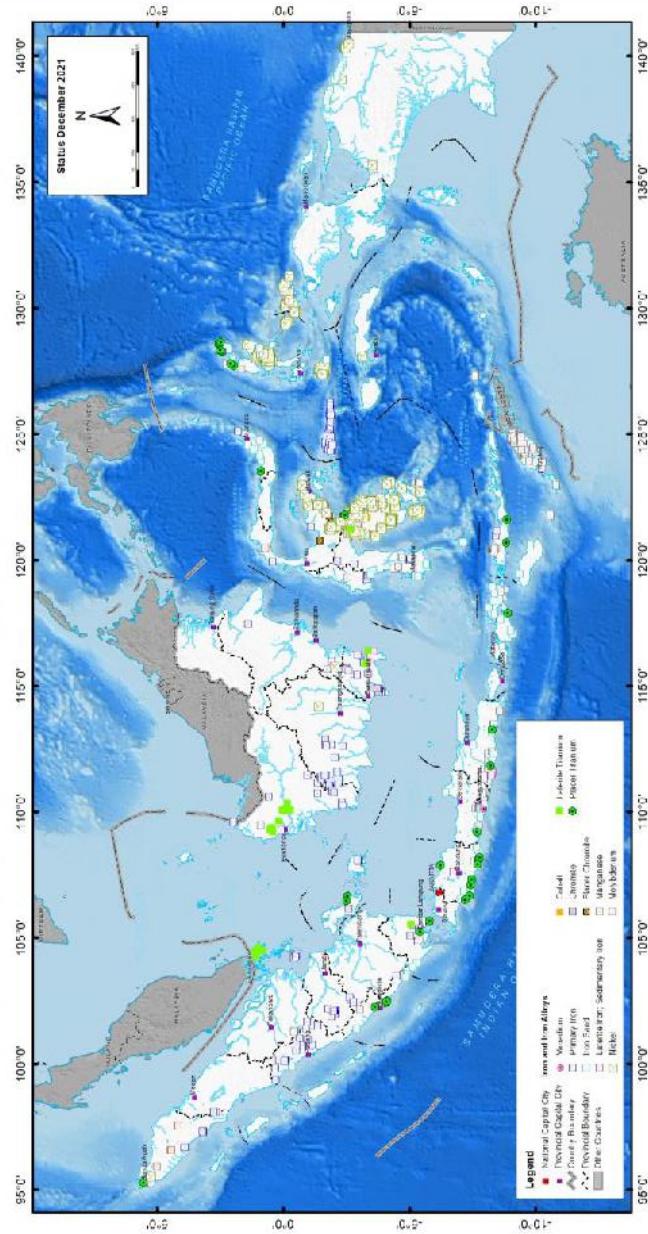
DISTRIBUTION MAP OF INDONESIA'S LIGHT AND RARE METALS MINERAL
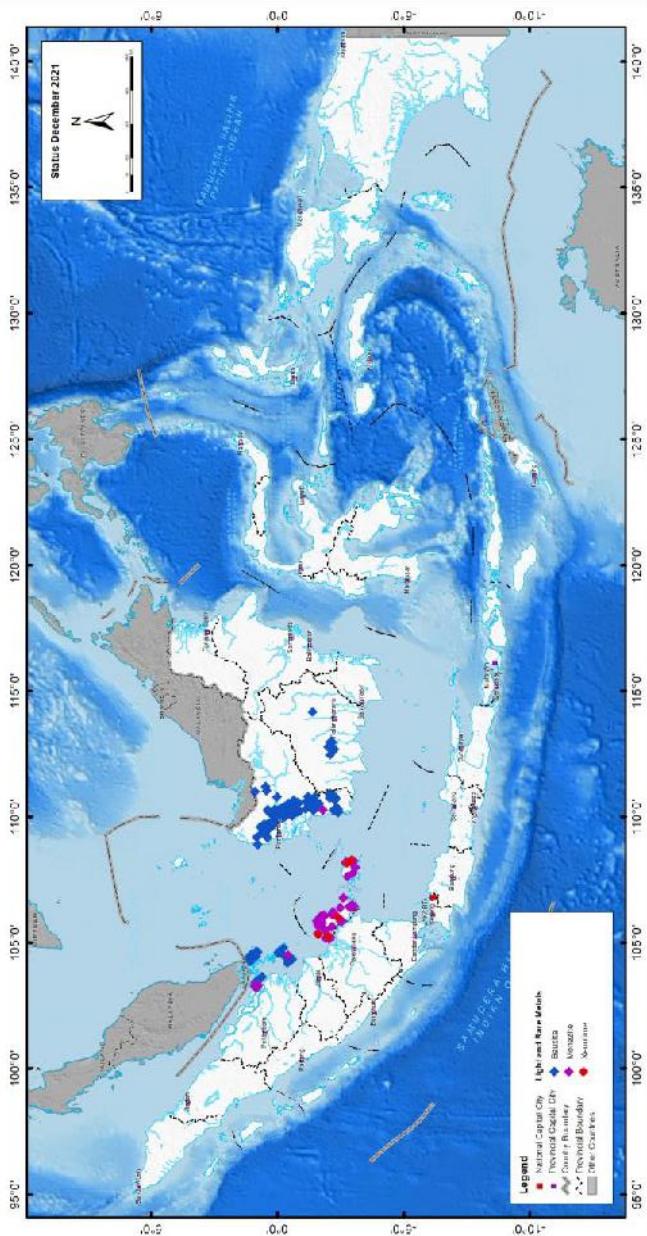
DISTRIBUTION MAP OF INDONESIA'S INDUSTRIALS MINERAL
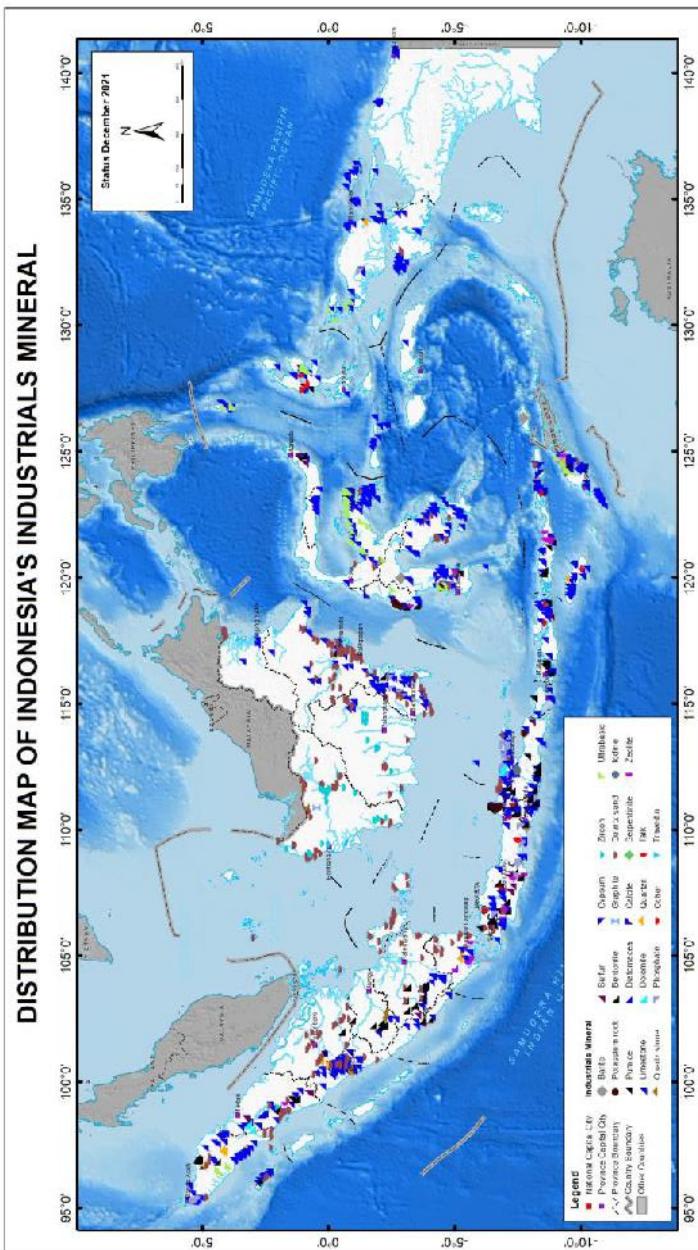
DISTRIBUTION MAP OF INDONESIA'S CERAMIC MATERIALS MINERAL

Status December 2021

N

Legend

National Capital City
Province Capital City
Province Boundary
Country Boundary
Other Countries

Ceramic Materials

Ball Clay
Feldspar
Kaolin
Clay
Magnesite
Obsidian
Perlite
Prophylite
Talde
Trachite
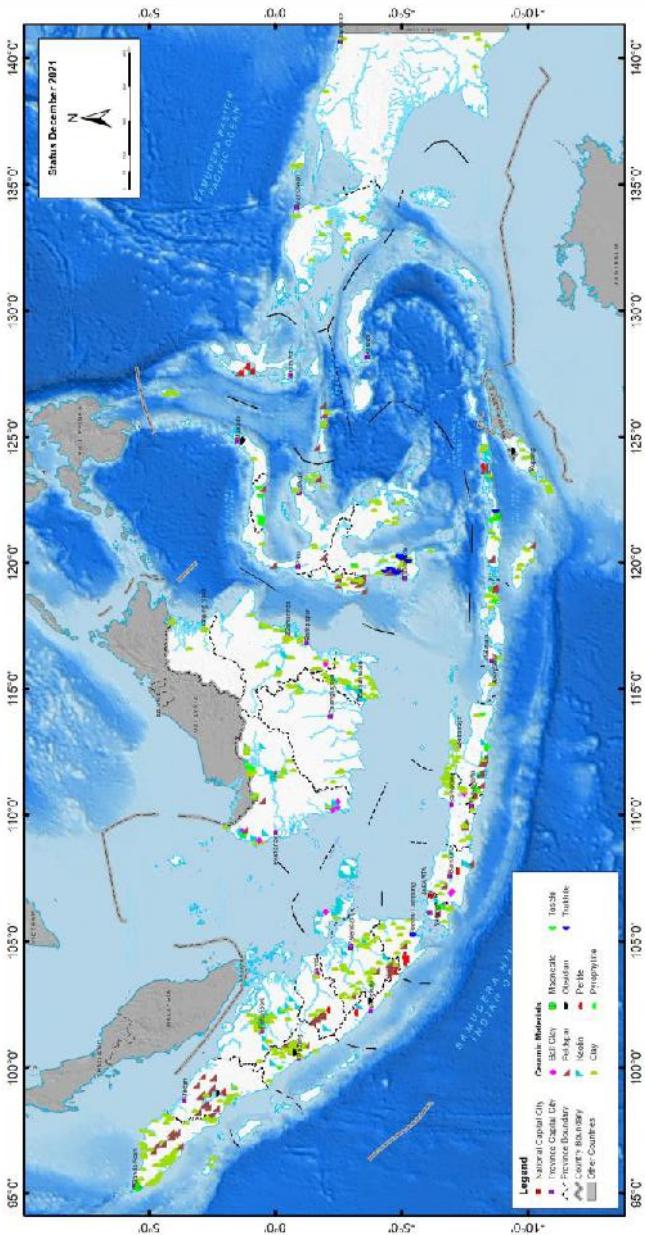
DISTRIBUTION MAP OF INDONESIA'S BUILDING MATERIALS MINERAL
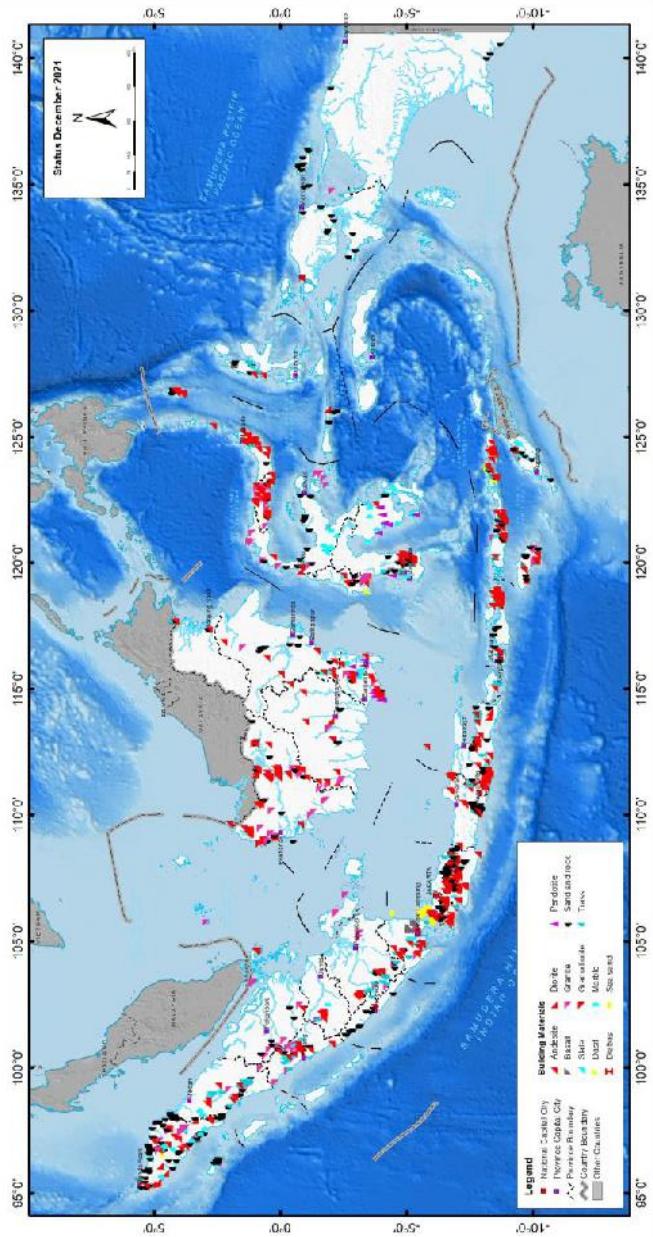
DISTRIBUTION MAP OF INDONESIA'S PRECIOUS STONES

Status December 2021

Legend

Precious Stones

COAL DISTRIBUTION MAP IN INDONESIA

Status December 2021

Legend

- National Capital
- Provincial Capital
- Country Boundary
- Provincial Boundary
- Other Countries

Coal Calorific Value
- Low (<5100 kal/gr)
- Medium (5100 - 6100 kal/gr)
- High (6100 - 7100 kal/gr)
- Very High (>7100 kal/gr)

Coal Bearing Formation Age
- Neogene
- Paleogene
- Pra-Tertiary
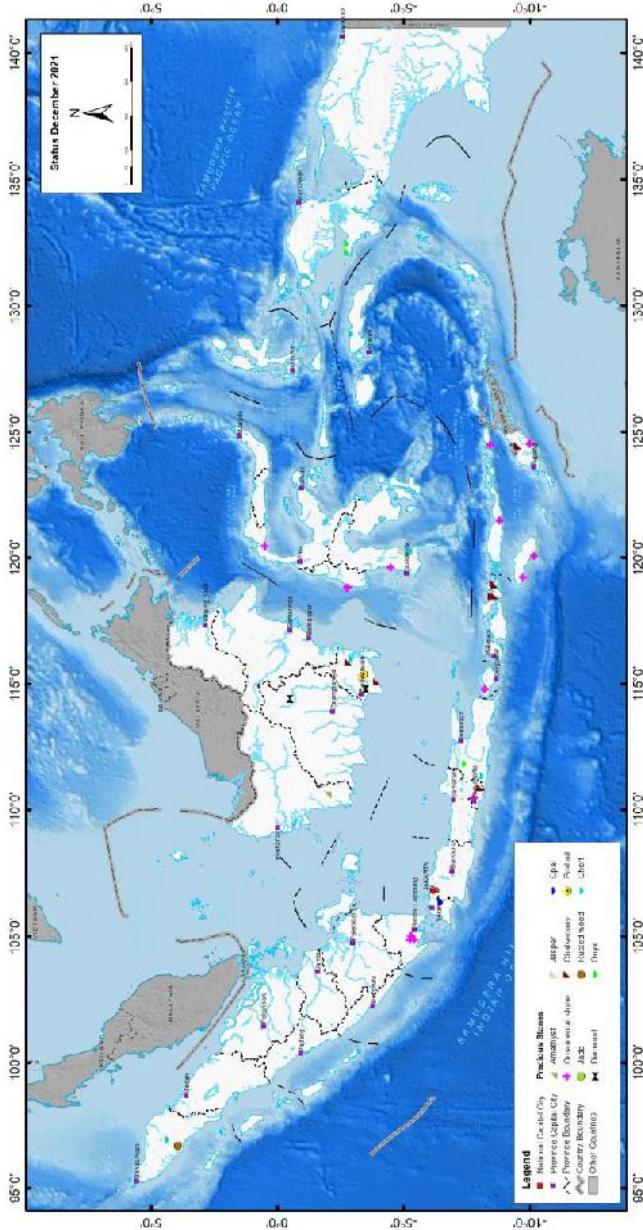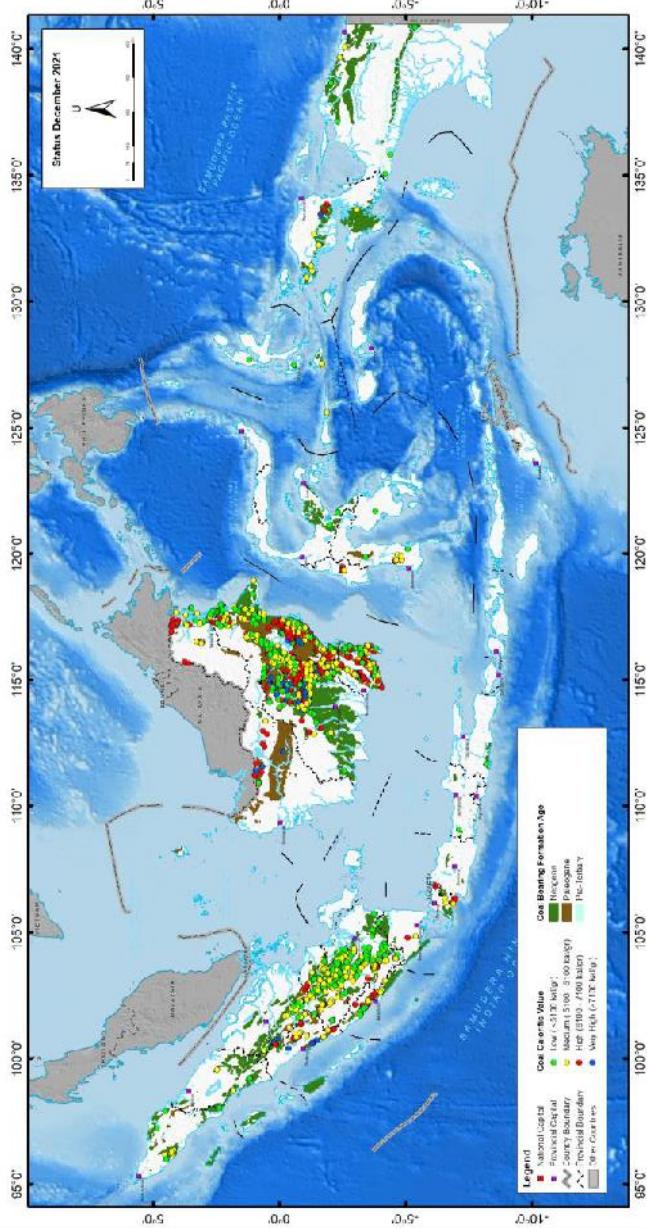
PEAT DISTRIBUTION AND LOCATION MAP IN INDONESIA
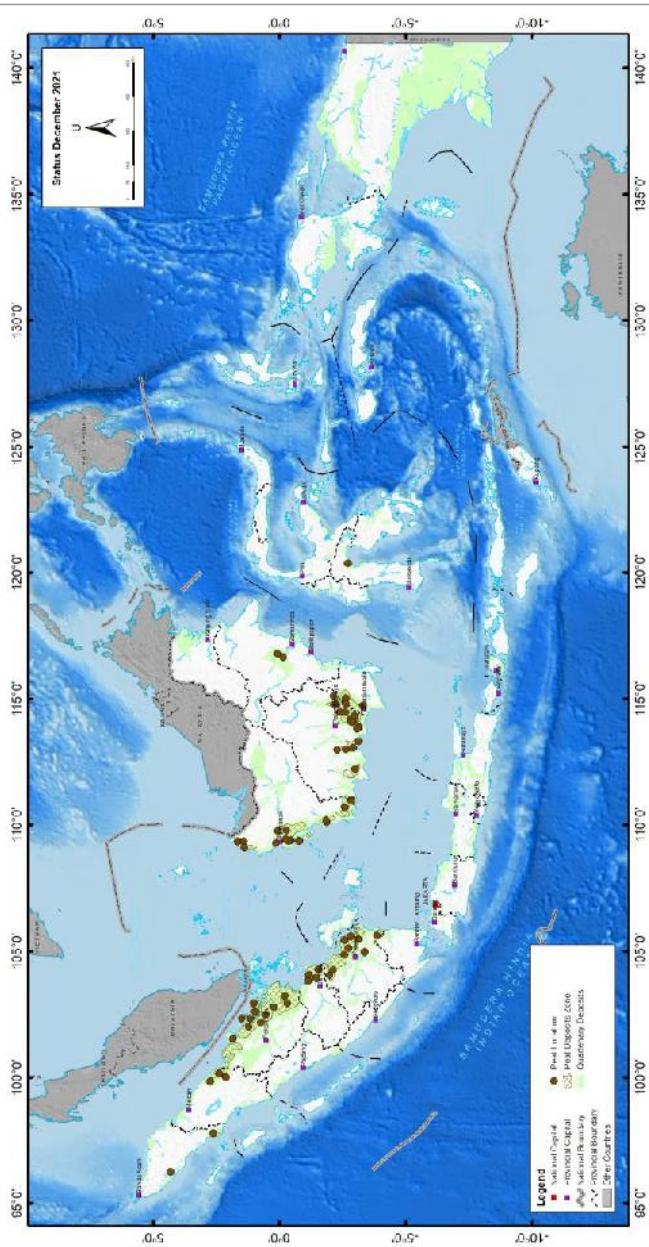
COAL BED METHANE DISTRIBUTION MAP IN INDONESIA

Status December 2021

Legend

- National Capital
- Provincial Capital
- National Boundary
- Provincial Boundary
- Other Countries

CBM Exploration Activities by the Operator/month (CMCGH - Geological Agency)
CBM Exploration Activities by the Company (PSC/Long Area)

Age of Coal Bearing Formation
- Neogene
- Paleogene
- Pre Tertiary
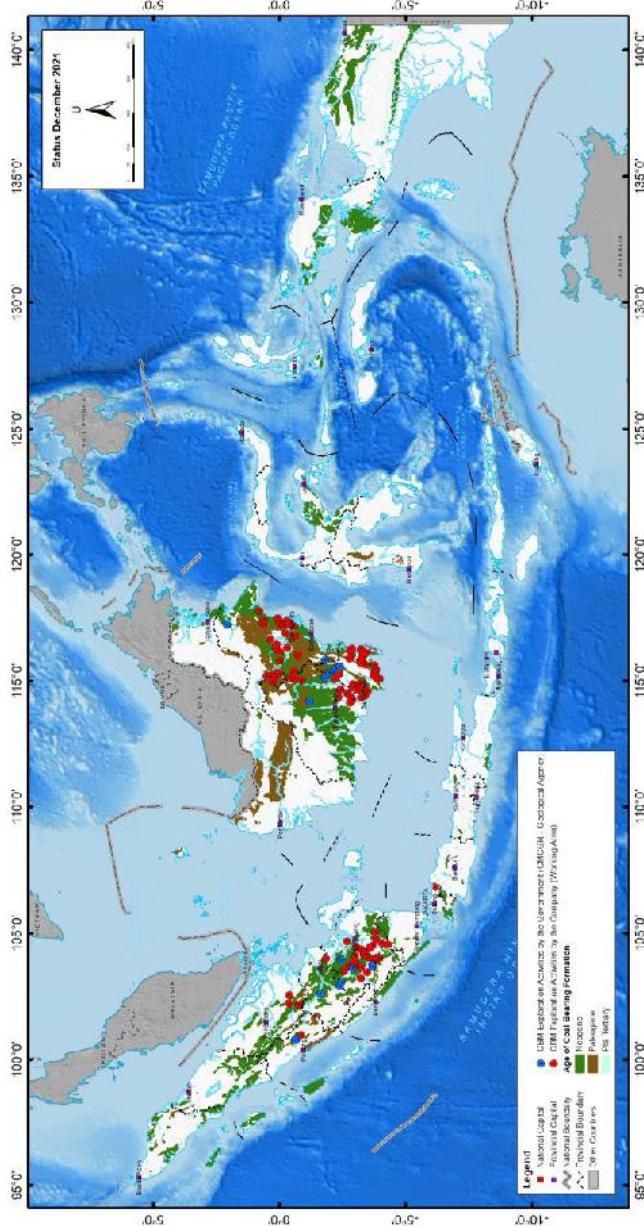
GEOTHERMAL AREA DISTRIBUTION MAP AND ITS POTENTIAL IN INDONESIA