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ANALYSIS OF IRON ORE SMELTER INDUSTRY PLANNING FOR THE NATIONAL MINE INDUSTRY DEVELOPMENT (CASE STUDY OF IRON ORE MINING INDUSTRY IN WEST SUMATRA)

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ABSTRACT

The purpose of this study was to determine the content and reserves of primary iron ore resources and the impact of smelter production on the consumption needs and imports of domestic iron and the support of electricity, road and port infrastructure for smelters. The research method of direct sampling survey with observation and guided interview (interview guide) and non-survey reference to related institutions. Analysis of statistical trends in estimating future consumption, production and iron demand. The results of the primary iron ore (iron stone) metal content averaged 62.69%, and the measured reserves were 966,483,571 MT, reserves estimated at 1,002,331,817. and proven reserves of 933,196,138 MT. The estimated production of smelters can reduce imports by 34.5% in 2026 and by 2030 by 27.8%. And contributes 24.7% of the national iron production, and can contribute to the domestic iron demand 12.6% of the total national iron demand in 2026. Support for electricity sub-power infrastructure available As of December 2018 total electricity supply is 703 MW, roads and the port supports smelter investment in West Sumatra.

Keywords: Smelter, Iron Ore, Mining, Primary Iron, Reserves

1. Introduction

An important issue in the mining world today is that raw mineral raw materials from mining products are not allowed to be exported directly before being processed or refined. The regulation is contained in Government Regulation (PP) No. 1 of 2014 and ESDM Ministerial Regulation (Permen) No. 1 of 2014 which is a derivative of the Mineral and Coal Law (Minerba) No. 4 of 2009 which officially came into force on 12 January -Hun 2014. Mineral and Coal Mining Products (Minerba) must be first processed or refined domestically through the construction of smelters. Minister of Energy and Minister of Power (2014).

In connection with the above government regulation primary iron mine (ironstone) is one of the strategic mineral products that must follow these regulations. As is known, iron is the backbone of the national steel industry as the main building material for construction, infrastructure and manufacturing industries. National steel consumption continues to increase every year. As an illustration, in 2014 the national steel demand reached 14.7 million tons, and only 65% of this requirement could be met by domestic production. With the rate of increase in iron demand of 8% per year, our iron needs are predicted to increase to 20 million tons per year in 2020. Compared to developed countries, our steel needs are still very far behind, which is only 40 kg per capita per year, whereas developed countries have reached 600 kg per capita per year. DG Minerba, (2014).

The Mining Sector is one of Indonesia's foreign exchange earners, especially iron ore mining. With abundant yields and reserves being a source of state economic strength, so far mining materials, especially iron ore, are only sold in the form of logs (raw material), so they are of low selling value. The application of Law No. 4 of 2009, besides aiming to protect mining natural resources through the construction of raw material processing smelters (raw materials) into semi-finished goods and increasing the added value of mining goods and can create new work fields. Darmin Nasution (2014). Minerals that are mined from nature are usually still mixed with dirt, which is

an unwanted congenital material that must be cleaned. Mining products must also be refined. Smelter is a place for cleaning and / or purifying minerals directly from a mine.

Regional planning and development in improving the community's economy and in line with the development of the national mineral mining industry development, the concept of regional development and development with an export base model that emphasizes the strategic economic base sector, where the mineral mining commodity industry sector is a strategic economic sector, the region will be able to developing rapidly encourages regional growth rates and can increase the income per capita of the community and can reduce unemployment. Adisasmita Raharjo (2006).

The development of the crude / semi-finished steel industry relies on imported sponge iron raw materials. If these challenges can be overcome as mandated by the Mineral and Coal Law (Minerba) No. 4 of 2009 which is officially in force since January 12, 2014 and investments can be realized, then in 2020, it is estimated that a total economic value of around USD 15,632 will be created. billion, added value of USD 1,707 billion, and employment of around 90,898 people. Contributions to the national economy can boost Gross Domestic Product around 0.203%. ESDM, Jero Wacik (2015).

Iron Demand and Supply in an economic perspective, steel is the most important base metal, with a global sales value of USD 225 billion per year. The main producer of steel is China which contributes 50% of world production, which is then followed by Japan, the USA and India. 1. In 2015, KS Posco began production with a capacity of 3 million tons of crude steel and an increase in KS production capacity of 1 million tons of crude steel, thereby increasing the domestic production capacity to 10.84 Million Tons. 2. In 2020 it is targeted to increase capacity by 4 million tons from the expansion of PT. Krakatau Posco phase II (3 Million Tons) and product processing produced by PT. Jogja Magasa Iron (1 million tons), thereby increasing domestic production capacity to 3. In 2025, an additional production of 6 million tons is targeted to meet the needs of crude steel in 2025 which is estimated to reach 20 million tons. 4. The total investment needed by 2025 to build a smelter facility for the steel industry with a total capacity of 14 million tons is USD ± 14 billion or equivalent to Rp 140 trillion. 5. Total Energy Demand until 2025 in order to build smelter

facilities in the steel industry with a total capacity of 14 Million Tons is 1,174 MW.

6. To meet the demand for iron / steel products from 2013 to 2025 by optimizing raw materials from within the country, it is estimated that at least it must require 250 million tons of iron ore and 110 million tons of iron sand.

The potential of iron ore in Indonesia is widely spread in various regions, such as: Aceh, West Sumatra, Lampung, Bangka-Belitung, Java, West Kalimantan, South Kalimantan, Southeast Sulawesi, East Nusa Tenggara, North Maluku, West Papua, and Papua. The potential of the iron ore has diverse characteristics, both in terms of quality and type of iron minerals contained in it. The quality of Indonesia's iron ore raw materials is still an obstacle in the national steel industry development program based on local raw materials. The quality of Indonesian iron ore is still unable to meet the quality criteria required by the steel industry using this raw material. The quality of iron ore in Indonesia has a relatively high Fe content, although in some places there is a content above 70% Fe, but the distribution is in the form of spots with small quantities. The average Fe content for Primary Iron is 47.144%, iron sand has an average Fe content of 47.08% and laterite iron has an average Fe content of 30.26%. The criteria for the average metal content of iron content from iron stone raw materials (Primary Iron) for smelters ranges from 30% to 70% of the Fe content. The growth of the national steel industry has not been able to meet domestic needs, as a result the import of steel products has continued to increase. This makes the fundamental strength of the national steel industry less robust (Pardiono, 2009). But on the other hand, this condition is an advantage for the development of an iron making plant (Pardiono, 2011). From the de-mand side, the national steel demand until 2014 reached around 17,967 million tons, with an increase of about 5.09% per year, while the existing national steel industry was only able to produce around 11,264 million tons per year. The national steel industry also still uses imported raw materials in the form of pellets and scrap. Spirit, the soul of Law No. 4 of 2009 is that Indonesia may not or is prohibited from exporting raw minerals. In other words, raw minerals must be processed before being exported with minimum restrictions as regulated by Minister of Energy and Mineral Resources Regulation No. 8 of 2015, with a view to generating added value, strengthening industrial structure, providing employment and increasing state revenue. The added value of iron ore into pig iron reaches 5.2 times.

Pig iron products and the like produced from local iron ore can be used as raw materials for the national steel industry so that it will provide a very large multiplier effect. Therefore, the government, mining companies and the steel industry, research and development bodies and other stakeholders should work together to accelerate the implementation of increasing the added value of iron to strengthen the domestic steel industry. Ijang Suherman (2016).

The description above that the iron ore mining company stopped operating due to difficulties in refining mining goods (smelters) due to the demands of law and Government Regulation (PP) No. 1 of 2014, but on the contrary Indonesia has a lot of lack of steel for the needs of domestic steel consumption. Mineral Resources West Sumatra Province has many primary iron ore mining materials (iron stone) where there are 32 primary iron ore mining companies (iron stone) with a total mining area of 5,714.93 Ha, which is spread out in almost all districts in West Sumatra ESDM West Sumatra (2017), but now these companies have stopped operating because of the laws and Government Regulations mentioned above, this requires the construction of iron ore tang smelters in West Sumatra. For the construction of smelters, it is necessary to know through the objectives of this research: To know the metal content of primary iron mining (Fe), know the reserve resources of primary iron mining goods, know the support of electricity resources, road infrastructure, seaports and know the role of smelter production seeds to the needs of consumption, production and import of national iron.

2. LITERATURE REVIEW

The need for input of laterite iron ore smelter in Kalimantan and the type of primary iron (iron stone) in West Sumatra by a focus group discussion (FGD) conducted by BPPT in March 2014, revealed from the results of research that the type of iron ore deposit the abundant laterite in South Kalimantan requires higher processing costs than the type of primary iron (iron stone). BPPT (2014). BPPT itself has tested primary iron ore processing from West Sumatra and the results are satisfactory. Therefore, to meet the needs of existing smelters in South Kalimantan, it is recommended that raw materials be supplied from primary iron ore types from West Sumatra because the quality of iron ore resources / reserves affects smelter processing

technology, in this regard. The supply of primary iron (iron stone) raw materials for the construction of the iron ore smelter industry in South Kalimantan, which originates from West Sumatra, requires high transportation costs, so to further consider the need for institutional policies related to making smelter technology road maps which corresponds to the general types of laterite iron ore and primary iron (iron stone) available in Indonesia.

Iron Ore for Smelter Coordinator of the Metal Minerals Investigation Group Geological Resource-Geological Agency. Armin Tampubolon (2015). The metal content of primary iron stones in the iron ore content testing laboratory of each existing mining company. Referring to the theory of total iron (Fe) content, the quality of existing iron ore is quite varied. This can be seen from the range of different total Fe content for each type of deposit. For primary iron reserves (iron stones), the total Fe content varies from 30.63% to 68.7%. As for the type of laterite iron ore deposits, the Fe content ranges from 9.9% to 60%; and for the type of iron sand the content ranges from 37.8% to 61.5% Fe. Thus the direction of investigation can be focused on the types of iron deposits available in the short, medium and long term. The role of researchers and regional governments in the delivery of information on resources / reserves in the existing Iron Ore IUP through SIGNAS and research bodies is very helpful in gathering national balance sheet data to be more complete and up to date for the construction of the National Mining Industry Smelter.

Geophysical Exploration Gocht, WR., Zantop, H., Eggert, RG (1988), is an initial investigation in the mining field that aims to determine the potential of minerals or minerals in a research area. The results of an exploration are usually in the form of characteristics of minerals, distribution of minerals, or the amount of mineral reserves. In geophysical exploration usually uses several methods such as geoelectric methods, magnetic methods, gravity and seismic methods. Each method is applied in accordance with the object of the excavation material to be investigated. The geoelectric method is perfect for knowing magnetic, gravity and seismic methods. This method can also be applied for mineral exploration such as iron stone and manganese. However, its accuracy is low because the laboratory scale resistivity values for several types of minerals differ from the scale of the field which is influenced by rock structure.

Mining is an activity to extract valuable and economically valuable minerals from the earth's crust, both mechanically and manually, on the surface of the earth, below the surface of the earth and below the surface of the water. The results of this activity include oil and gas, coal, iron stone, iron sand, tin ore, nickel ore, bauxite ore, copper ore, gold ore, silver and manganese ore. Central Statistics Agency (2019). Stages of mining activities include: prospecting and general research, exploration, mining preparation and development, exploitation and processing / refining / refining. Prospecting is an investigation and searching activity to find deposits of valuable minerals or minerals. Exploration is a follow-up activity of prospecting which includes work to determine the size, shape, position, average level and size of reserves and "feasibility study" of deposits of minerals or valuable minerals that have been discovered.

Exploitation is a mining activity which includes the work of extracting and transporting valuable mineral or mineral deposits to the landfill and processing / washing, sometimes to the marketing place. Victor Imanuel Williamson Nalle (2012). Processing / Refining is a job of purifying / raising the level of minerals by separating valuable and valuable minerals, then disposing of these valuable minerals (can be done chemically). Adequate or not exploration activities and results. 2. The truth of the spread and quality of reserves based on the correlation of all exploration data. 3. The feasibility of determining reserve limits, such as Cut of Grade, Stripping Ratio, maximum mining depth, minimum thickness and so on, aims to determine the geological conditions and distribution of primary iron ore [iron rock] below the surface. The whole is analyzed and a total reserve will be obtained. row matrial iron ore primary iron ore mine. 4. Exploration results will be able to know the resources inferred, designated, measured, and measured and proven reserves.

Large analysis of the percentage of metal content contained in the primary iron mining resource (iron stone), carried out several steps. Istiyanti (2015) 1. Take sufficient rock samples in the area of the mine site, provided that the sampling is evenly distributed, which means that the samples taken can represent the existing population. 2. Testing of iron stone mineral samples (primary iron) in menaral laboratories. 3. Laboratory results of testing for iron stone (primary iron) are obtained in percentage Fe2O3, Fe, A12O3, SiO2, TiO2, Na2O, K2O, CaO, P, MgO, S and

Moisture.Consumption Theory (need) for Production and Import. Sadono Sukirno (2008) Keynesian consumption theory. Indonesia's iron consumption needs are influenced by domestic iron production and iron imports from abroad. Furthermore, the concept of consumption, production and import in an international economy is a form of identity equality where:

$Ct = Yt + Mt$ atau $Yt = Ct - Mt$
Where:
Ct = Iron consumption at t-years
Yt = Iron Production at t-years
Mt = Iron Import at t-years

To determine the prediction of future iron consumption using multiple linier regressions. Ainur Komariah (2014) multiple linier analysis. Multiple linier regression General analysis equation:

$Y = \beta 0 + \beta 1\ x1 + \beta 2\ x2 + \ldots\ldots\ldots + \beta r\ xr$
Y = Consumption/needed
X_1 = Production X_2
= Import
$\beta 0$, $\beta 1$, $\beta 2$, ……, βr is parameter of X_1 dan X_2

Road availability infrastructure according to class and weight of the road, availability of shipping and loading ports and installed capacity of electric power supply are the main supports for the smelter industry. Electricity Availability, in the electricity industry, is the main staple for the factory to keep producing. Mining areas are not urban areas. "This is automatic, smelters are made so that PLN makes power plants or there are already enough PLTU or PLTU plants available in the relevant regions. Jero wacik (2014).

3. METHODOLOGY

The method used in this study is the method of survey research sampling directly to existing iron mining companies. In addition, non-survey research methods are used, which are carried out studies of reference tracing, processing and analysis as well as coordinating and collecting data on related institutions. Data collection using observation and guided interview techniques (interview guide). I. Suherman and R. Saleh (2018). Descriptive explorative method that is knowing the situation and understanding the phenomena that occur in the acquisition of a better understanding

with the intention of describing (describing) empirical phenomena accompanied by interpretations with the aim of obtaining a profound picture of the variable of research. Now (2003).

Analysis of reserve resources and the percentage of primary iron metal content (ironstone) from 32 primary iron ore (ironstone) sample companies in West Sumatera by conducting exploration prospecting studies and exploitation of field surveys and research library studies in all iron ore mining companies that there is. From the research study, we obtained reserve resources and percentage of primary iron metal content (ironstone), both in quality and quantity. Quantitatively it can find out the sum of measurable resources, measurable reserve resources and proven reserve resources from exiting.Qualitatively, the percentage of metal content of mining materials will be obtained, such as: Fe2O3, Fe, Al2O3, SiO2, TiO2, Na2O, K2O, CaO, P, MgO, S and Moisture.

Research to determine the impact of West Sumatra iron ore smelter production on the needs and imports of iron in the country was conducted using quantitative methods and descriptive analysis methods, namely research that focuses on observing the problems that exist in the present and the actual using programs regression analysis. The type of data used in this study is time series data, that is data from year to year in accordance with the availability of data for each year under study. The data was obtained from various sources, namely the Central Statistics Agency (BPS), the Directorate General of Energy and Mineral Resources (ESDM), the ESDM Office of West Sumatra and other relevant agencies. To find out the trends in the demand and production of Indonesian iron in the Least Square method with the following equation: Andi Alatas (2015).

Y = a + bx Where:
Y = Volume of Indonesia iron consumption
a = intercept b
= Koefisien
x = Trend

To find out the factors that influence the needs of Indonesian iron ore used a linier regression model with the following equation:

$Y = \alpha + \beta_1 X_1 + \beta_2 X_2 + \varepsilon$

Keterangan:
Y = Kebutuhan/Konsumsi besi)
X_1 = produksi besi
X_2 = Impor besi
α = Constanta,
β_1, β_2 = Koefisien regresi dari masing-masing X_1 dan X_2

ε = Random Error

To facilitated data processing and analysis d, determine α, β1, β2 by using statistical software such as excel and SPSS. Analysis of infrastructure support, especially electricity resources, roads, and main ports are the main components in a smelter automatically must be available. The installed capacity of electric power generator, which is installed capacity and the need for electricity resources. PLN West Sumatera (2017)

4. RESULTS AND DISCUSSION

From the results of research and literature 32 samples of primary iron ore mining companies (ironstone) obtained the number of resources and metal reserves from some of the companies in West Sumatera, namely inferred primary metal (ironstone) Metal resources (MT) in the amount of 320,751,033 MT, indicated by 391,153,150 MT and measured by 134,235,568 MT. Whereas primary iron metal reserves (ironstone) are estimated at 202,,331,817 and proven at 153,871,076 MT. Seen in Table 4.1.

Table 4.1 Total resources and reserves of primary iron metal (iron stone) from 32 companies in West Sumatra

Resources (MT)			Reserves (MT)	
inferred	pointed	Measurable	Estimate	Proven
320.751.033	391.153.150	134.235.568	202,331,817	153,871,076

Kandungan kadar logam dari besi primer (batu besi) dari 32 sampel perusahaan tambang bii besi primer di Sumatera, rata-ratanya kadar kandungan kadar logam besinya (Fe) sebesar 62,69 %, seperti tabel 4.2 dibawah ini.

Table 4.2 Quality of primary iron metal (ironstone) of 32 Mining Companies in West Sumatera

Quality											
Fe2O3	**Fe**	**Al2O3**	**SiO2**	**TiO2**	**Na2O**	**K2O**	**CaO**	**P**	**MgO**	**S**	**Moisture**
%	%	%	%	%	%	%	%	%	%	%	%

83,34	**62.83**	1.27	2.41	0.81	0.28	0.31	1.24	0.03	0.2	0.15	7.66

Analysis of the role of smelter production on needs from the research data also has been obtained from the number and prediction of the needs, production and import of national iron ore from 2002 to 2030. Taufan Adharsyah SEAISI and ITC (2017). The role of primary iron ore smelter production (ironstone). The Assumption of iron ore smelter production in West Sumatera is 2.000.000 ton per year, there will be a reduction in national iron imports next year, the the prediction of the needs, production and import of national iron, it show that every year Indonesia is short of iron ore for the national iron consumption needs to still need to import to meet domestic consumption needs of iron.

Equation trend of iron consumption by linier interpolation:

$Y = 554{,}61x + 3025{,}1$ ……. (1)

Equation trend of iron production by linier interpolation:

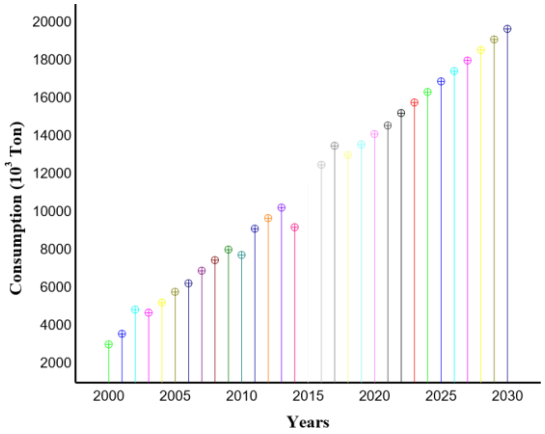
$Y = 161{,}61x + 2399{,}7$ ……..(2)

From equation (1) and (2) above, we get an estimated of the role of primary iron ore smelter production for iron ore needs in 20022 – 2030, which in 2022 contributed to 21,6% reduction in imports, and 18,5% in 2026 and 16,1% in 2030. Furthermore, the estimated production of West Sumatera smelter to the National iron production in 2022, 2026 and 2030 respectivelly about 33,6%, 30,5% and 27,6%. And the estimates production of West Sumatera Smelter can contributed for 2022, 2026 and 2030 respectively 13,1%, 11,5% and 10,2%, shown in table 4.3.

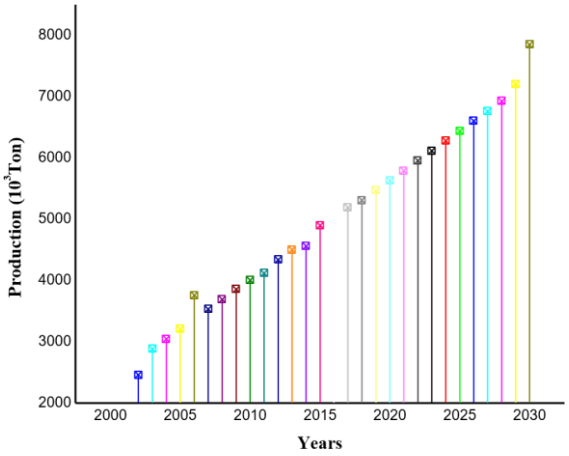
Table 4.3 Consumption, Production and import iron ore Indonesian in 2002 up to 2030 period

Consumption x 1000 T								**Production and Import x 1000 T**							
2002	**2006**	**2010**	**2014**	**2018**	**2022**	**2026**	**2030**	**2002**	**2006**	**2010**	**2014**	**2018**	**2022**	**2026**	**2030**
4.859	**6.245**	**8.017**	**9.203**	**13.500**	**15.227**	**17.444**	**19.663**	**2.462**	**3.759**	**4.003**	**4.501**	**5.309**	**5.955**	**6.602**	**7.248**
Import								**724**	**2.462**	**3.055**	**4.639**	**7.669**	**9.272**	**10.842**	**12.415**
								Iron ore Smelter production of West Sumatera					**2.000**	**2.000**	**2.000**
								Contribute to National iron ore production					**33,6%**	**30,3%**	**27,6%**
								Contribute to National iron ore import					**21,6%**	**18,5%**	**16,1%**
								Contribute to National iron ore consumption					**13,1%**	**11,5%**	**10,2%**

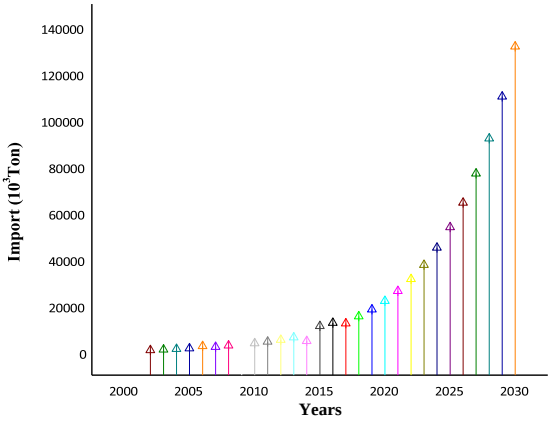
In detail the data on the needs, production and import of Indonesian iron ore in the 2000 up to 2030 period, are presented in the following graphical form:



Graph 4.1. Consumption of iron ore in 2000 up to 2030 period



Graph 4.2. Production of iron ore in 2000 up to 2030 period



Graph 4.3 Import of iron ore in 2000 up to 2030 period

Factors affecting the iron consumption and import National are shown table 4.4.

Table 4.4 Regression results of Indonesian iron ore consumption

Variable	Standardized Coefficients Beta	Std. Error	t	Sig
Constanta	12.579	635.47	0.020	.0.984
National iron Production	1.321	0.254	5.211	0.000
National iron Import	0.791	0.099	7.974	0.000

Dependent Variable: National iron consumption

Based on the linear regression output above, that the National Iron Production and Import variable has a significant effect on the National iron demand.

The multiple regression model used in this study can be formulated as follows

Requirements = 12,579 + 1,321 Production + 0.791 Imports

From Table 4.4 it can be seen that the National Iron Production regression coefficient of 1,321 means that each increase in production is 1 unit, it will increase Indonesia's iron demand by 1,321 units and the National Iron Import regression coefficient of 0.791 means that each increase in production is 1 units, then it will increase Indonesia's iron demand by 0.791 units. Production t-test value of 5,211 is greater than t-table with a significant 0,000 less than 0.05. Import t-count value of 7.974 is greater than t-table with a significant 0.000 less than 0.05. From the results of this t test it was concluded that there was a significant influence on Indonesian iron production and import variables on the volume of iron demand in Indonesia.

The condition of electricity supply is sufficient and reliable to support energy needs for investment and industrial development needs in West Sumatra with the installed capacity of existing electrical energy resources. As of December 2018, the total electricity supply reached 703 MW, with a peak load of only 593 MW.

Road infrastructure support to the needs of primary iron ore smelter in West Sumatra, the condition of the road supports and supports especially the highway to the bay bay seaport. Teluk Bayur Harbor as a supporter of sea transportation is already good. Entering 2018, the revitalization of Teluk Bayur will continue to build warehouse A, as well as the construction of Reception Racility, structuring the electricity network in the port area. The application of the ITOS-NBS (New Billing System) system for

container loading and unloading activities is port digitalization; loading and unloading activities at the gold terminal are more real time and connected to the central office.

5. CONCLUSION

The primary iron ore metal content (ironstone) is around 62,69%, and the measured iron ore reserves (MT) of primary iron metal is 966,483,571 MT, primary iron metal reserves is approximately 1,002,331,817 MT. and primary iron metal reserves proven to be 9331,196,138 MT.

Estimation of iron ore smelter industry builder in West Sumatera for 2022, production can contribute to the reduction in imports by 43.5% and 34.5% in 2026 and in 2030 by 27.8%. The production of West Sumatra smelter in 2026 can contribute 24.7% to the national iron production, and can contribute to the domestic iron demand of 12.6% of the total national iron demand in 2026.

Electricity infrastructure support is available As of December 2018 the total electricity supply reaches 703 MW, roads and ports are very supportive as supporting smelter construction in West Sumatra. This research recommends that it is possible to build an iron ore smelter industry in West Sumatra Province.

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