

Inalum as Locomotive in Enhancement of Added Value for Aluminum Industry in Supporting Program of Mp3ei (Master Plan Acceleration and Expansion of Indonesia Economic Development)

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ABSTRACT

Aluminum is an environmentally friendly and basic metal future commodity needed by the human being because it is strong, durable, flexible, impermeable, lightweight, corrosion-resistant, 100 percent recyclable, good electrical conductor, and sterile as well as wood alternative material relevant to the issue of global warming. The goods containing Aluminum can be found in many applications used in our daily life. Aluminum smelting industry is a capital intensive industry and a very strategic technology that can be a major driver of the nation's economy and supports the development of national strategic industries such as defense, transportation, and information technology because the Primary Aluminum as basic metal of a semi-finished material will spur on the development of upstream and downstream industries. Until now, basic Industrial Added Value based Aluminum Indonesia has been enjoyed by other countries, whereas Indonesia has abundant natural resources such as low-cost Bauxite, Green Coke, Coal, Potential Hydro Power and low cost Aluminum Smelter. Creation of synergies by integrating all the potential "Aluminum-Based Supply Chain Industry" by Indonesia will generate tremendous value added and foreign exchange savings of the State including the expansion of employment opportunities and strengthening national economic connectivity locally.

Keywords: Aluminum, locomotive, INALUM, bauxite.

INTRODUCTION

Industrial Cluster Development of Leading Aluminum resource base is one of 22 main economic activities set out in MP3EI to achieve the Vision of Indonesia 2025 namely Indonesia's Independent, well Developed, Equitable and Prosperous Society. PT Inalum, the only Aluminum Smelter Plant in Southeast Asia and has a production capacity of 250,000 tons per year, requiring approximately 500,000 tonnes of alumina per year is a very promising company in the business and strategically to support the national industry and can still be optimized and further developed. Although Inalum is the only aluminum smelter in Southeast Asia, Indonesia Aluminum demand is still mostly imported. Inalum Aluminum Ingots can only supply the domestic market demand of about 30% because large portion of production should be exported to Japan in accordance with the share ratio.

Indonesia has spent a lot of foreign exchange and lost opportunity to gain added value due to import Aluminum and Alumina and export Bauxite as a raw materials and Green Coke for more than 42TRp.per year.

Alumina is obtained through Bayer process by dissolving bauxite into caustic soda solution (NaOH) followed with separation process of insoluble material and forming of Alumina crystal as well as calcined process in the temperature over 1000°C. Approximately 91% of the mined bauxite all over the world is used to produce Alumina as raw material of Aluminum. As main raw materials including coke and coal tar pitch, Alumina demand increases with the increasing needs of Aluminum. In theory, it takes 1.89 tons of alumina and 0.3 tons of carbon (a mixture of coke and coal tar pitch) to get a ton of Aluminum.

Since C.M. Hall (AS) and P.L.T. Heroult (France) separately discovered the method of Aluminum production process in 1886, the Aluminum smelting process was started in many industries. In this process, Alumina (Aluminum oxide) is dissolved into a solution of cryolite (as fluoride Aluminum mineral, Na₃AlF₆). Alumina is then separated into forming elements through electrolysis process. In spite of many efforts to replace this process, until now this Hall-Heroult method is the only one used to produce commercial Aluminum. The basic similarity of Hall-Heroult method is:



Profile of PT Indonesia Asahan Aluminum (INALUM)

PT Indonesia Asahan Aluminum is a joint-venture between the Government of Republic of Indonesia with 12 companies from Japanese investors who are members of Nippon Asahan Aluminum Co., Ltd. PT INALUM was incorporated on January 6, 1976. PT INALUM has constructed and operated aluminum smelting plant to produce Aluminum ingots in Kuala Tanjung, District Coal and Hydroelectric Power (hydropower) in Paritohan, Toba Samosir with a total capacity of 603 MW. Asahan River water source is Lake Toba which has an area of 1,100 km² of water catchment and rainfall of 2000 mm/year.

One of Inalum missions is to achieve sustainable and profitable smelting plant by operating the hydroelectric power effectively and efficiently. In line with that issue, a strategy was developed based on an integrated concept between theoretical knowledge and operational experience, as well as internal development with minimum investment and optimization of all resources. PT INALUM already obtained ISO 9001, ISO 14001 and golden flag and Proper Blue SMK3 KLH level. Production of Inalum Aluminum Ingot (Primary Aluminum Ingot) with better quality than the international standard has been listed on the London Metal Exchange (LME) since September 23, 1987.

Smelting Plant INALUM

Aluminum Smelting Plant in PT INALUM was designed by Sumitomo Chemical, Japan. The design capacity is 225,000 tons/year of aluminum ingot with electric current 175 kA, the current efficiency of 87.6% and electrical energy consumption in the direction of 14 500 kWh/ton-Al. Aluminum smelting plant consists of three lines of reduction furnace (potline), each potline has 170 anode baking furnace-type reduction outside (prebaked cell) and the anode busbar on the outside (end riser) arranged side by side. By conducting independent technology development, PT INALUM has reached a production capacity of 250,000 tons/year of aluminum ingot with electric current 200 kA, the current efficiency of 92.7% and electrical energy consumption in the direction of 14,000 kWh/ton-Al.

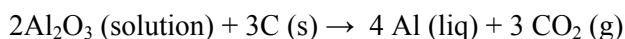
PRODUCTION AND PROSPECT OF ALUMINUM

Aluminum is the most abundant metal in the earth's crust, and becomes the third largest element after oxygen and silicon (about 8% of the solid surface of the earth). Due to its very reactive nature, aluminum is found as free metal, but binds to more than 270 different minerals (Bassam Z. Shakhashiri, 2007). Aluminum is the main source of Bauxite ore which are found in tropical and sub-tropical areas.

Aluminum Production Process

In general, to produce Aluminum, Bauxite ore are refined into alumina and electrolyzed into aluminum metal. Aluminum electrolysis process on all modern aluminum smelter currently uses the method of Hall-Heroult independently discovered by Charles Martin Hall in the United States and Paul LT Heroult in France in 1886. The basic aluminum production is shown in Fig. 1. The plant to produce primary aluminum is mostly built in places that have abundant energy availability such as hydroelectric power. Two to three tonnes of bauxite are needed to produce one ton of alumina, and two tonnes of alumina are needed to produce one ton of aluminum metal.

In aluminum production process, alumina is dissolved in the electrolyte solution called cryolite (sodium aluminum fluoride, Na_3AlF_6) at a temperature of 960°C . Then, very high direct electric current flows through the electrolyte solution at low voltages and then flows from the carbon anode to the cathode carbon. Aluminum reduction furnace is a steel box which consists of rock and insulation as the building blocks of carbon on the side and base walls. Above the base wall, the carbon cathode is laid out together with collector rod made of mild steel that serves as a conductor of electricity. In simple way, the reaction is as follows:



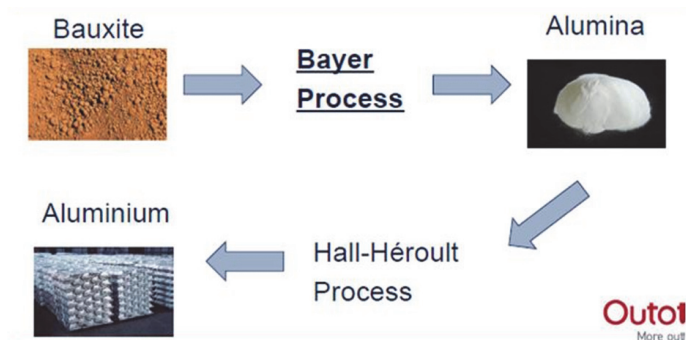


Figure 1: Basic aluminum production

Aluminum Processing

Primary aluminum can be mixed with other materials to produce a metal alloy with different types and properties. The main composition of the aluminum alloy is iron, silicon, copper and magnesium. Several ways can be used to process the primary aluminum into products in which some of the methods are:

1. Casting to be various forms to infinity.
2. Rolling, a form of disc (plate), sheets or a very thin layer of wafer. The metal rolling process has changed the characteristics to be more pliant.
3. Extrusion to be a convoluted and slit shape.

Products made of aluminum can be recycled many times. The energy required to recycle aluminum and greenhouse gas emissions arising is only 5% of primary aluminum production.



Figure 2: Aluminum processing

Benefits and Application of Aluminum

Aluminum has been widely used in various applications which cover the area of construction, transportation, electrical equipment and materials for packaging due to the nature and characteristics of aluminum that is light, strong, malleable, resistant to corrosion, high electrical conductivity, and retaining heat and cold. The properties of aluminum are highly advantageous for applications especially in construction of buildings instead of wood, automotive and electrical transmission. All types of aluminum products can be used in the construction and renovation of buildings, such as order, elbow, windows, glass, roof, doors, screens, rain fences, canopies, and others. Light automotive engine provides benefit in an effort to save fuel and also environmentally friendly during the lifetime of the vehicle. Lighter cable transmission requires less and lighter support structure. In addition, aluminum products are also widely used for protection, packaging and serving of food and beverages.

Pure aluminum is quite soft but by mixing it with small amounts of other metals, the resulting alloy can have the strength of steel with only half mass. Aluminum corrosion rate of 1/25 times of high resistant steel. Aluminum mass equivalent to 1/3 of copper mass while the electrical conductivity of aluminum is two times higher than copper.

Aluminum can be diluted (rolling) into a very thin layer with properties that are lighter and stronger thus able to maintain the quality of insulation in food, cosmetics, and pharmaceutical products besides act as protective cover to the products from ultra violet light, odors and bacteria. Aluminum packaging is safe, damage-resistant, hygienic, easy to open and can be recycled. Aluminum continues heat conduction and reflects heat radiation. Approximately half of cookware in the market is made of Aluminum. The cookware from aluminum requires only a quarter of the energy to heat the steel or cast iron. Aluminum only loses about 7% of the received heat and uses the rest 93% for cooking.

Aluminum Potential Market

It is estimated that Supply & Demand in the long term are still very tight (refer Figure 3). In 2035 Supply & Demand remain balanced in the amount of 105 million and 104.6 million tons/year. Domestic Market also increases (CRU International Limited, 2011).

Year	Unit	2001~2011	2012~2013	2014~2035
Production Rate	%/year	5,5	5,5	3,75
Consumption Rate	%/year	5,8	5,5	3,90
Price LME 3M	US\$/T	1365*~2600	2210 ~ 2430	3071 Nominal 2116 RealTerm
<p>Currently Price LME3M, Ave Jan~May, 2012 : 2,155 US\$/Ton June 1~11, 2012 : 1,981 US\$/Ton</p> <p>Reference: 1. MBR Mar, Oct 2011 & June.6, 2012. *Dampak Tragedi WTC 2001 & Global Financial Crisis 2008 2. The Long Term Outlook for Aluminium 2010, Issued Updated Mar.2011 by CRU International Limited.</p>				

Figure 3: Estimated supply and demand 2001-2035

One of the indicators for a level of welfare of Nation is also determined on how much the consumption of aluminum in per capita (refer Figure 4). Developed countries such as Germany, Canada, America, Japan, Korea, Australia, Italy, China: 17.6kg/kap. Indonesia: 1.4 and the world average: 6.7. Indonesia market is still widely open because of the potential need for an increase of 1.4 to 6.7 kg/cap (The Long Term Outlook for Aluminum 2010 by CRU updated Mar.2011).

Item / Calender Year	Unit	2001 ~ 2011 (10Years)	2012	2013
World Production	M.Ton	33,746	47,278	59,406
World Consumption	M.Ton	33,535	46,664	48,777
<p>Remarks; Aluminium Consumption/Capita 2012;</p> <p>1. World : 6,7 Kg/Capita 2. Developed Country* : 17,6 Kg/Capita 3. Asean Country : 2,7 Kg/Capita 4. Indonesia ; 1,4 Kg/Capita</p> <p>* Such as, Canada, Germany, USA, Japan, Italy, Australia, China (The Long Term Outlook for Aluminium 2010 , issued updated Mar. 2011 by CRU, MBR, June.6. 2012, Issued 286).</p>				

Figure 4: Aluminum production and consumption

From figure 5, the Aluminum Consumption Index is very high compared to the other metals such as copper, lead, nickel, tin and zinc.

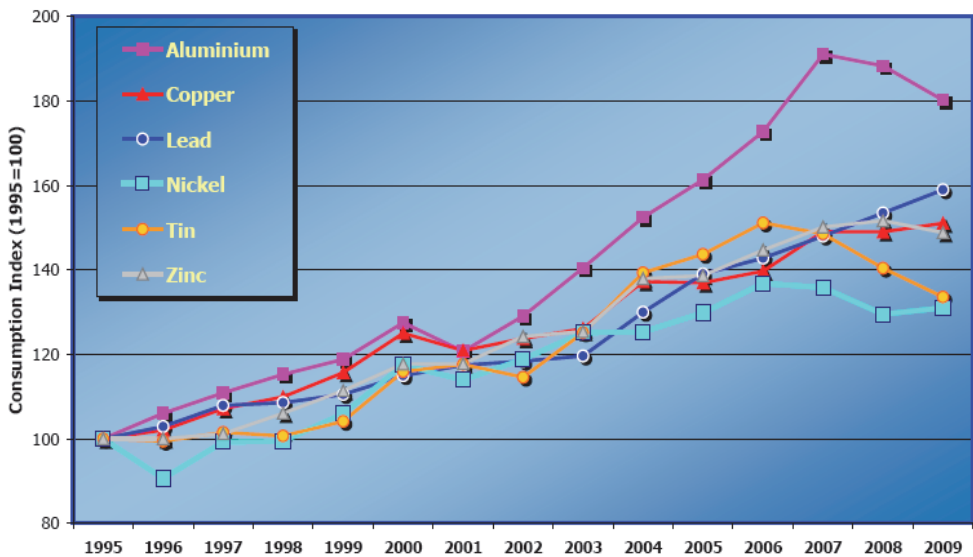


Figure 5: World growth in non-ferrous metal consumption

REASON OF INDONESIA TO NECESSITY OF ALUMINUM INDUSTRIES

Aluminum is an environmentally friendly future commodity and much needed by human being (Aachen Univ.-Prof. Dr. Werner Gocht, Aluminum for future generation, 40 474 Essen, 2001). Today, most of the deficiency for Aluminum Industry in Indonesia is imported. Inalum only can supply Aluminum Ingots in the domestic market of about 30%. Indonesia has spent a lot of foreign exchange and lost opportunity to gain added value due to import of Aluminum and Alumina and export of Bauxite and Green Coke for more than Rp. 42 trillion/year. So far the Value Added of Industry-based foundation Aluminum Indonesia is enjoyed by other Countries. Industrial Cluster Development of Leading Aluminum Resource Base as one of 22 major economic activities set out in MP3EI to achieve the Vision of Indonesia 2025 namely Indonesia's Independent, Developed, Prosperous and Just Indonesian Society.

ISTRENGTH AND OPPORTUNITIES OF INDONESIA ALUMINUM INDUSTRY SUPPLY CHAIN

Indonesia has the Comparative and Competitive Advantages in the Aluminum Industry such as abundant bauxite reserves, hydropower potential, coal and low cost aluminum smelting. Bauxite potential reserves in Indonesia are approximately 400 million ton aluminum which is able to meet the needs of Asean more than 50

years. The current Asean consumption is 2.7 kg/person (The Long Term Outlook for Aluminum 2010 Updated issued in March 2011 by CRU International Limited). Besides that, Potential reserves of Green Coke by-product of oil refinery Dumai. Green Coke is a raw material for Calcined Petroleum Coke which is also a major raw material in the Aluminum Industry Supply Chain. Aluminum Industry is an Intensive Energy, Indonesia has a substantial source of energy, hydro (Lake Toba, Memberamo River), stone-coal (Kalimantan, South Sumatra, Aceh), gas (Natuna, Papua, Kalimantan). Indonesia has PT Inalum, Aluminum Smelting Plant, the only one in Southeast Asia with the low cost and excellent operating capability. Creation of synergies by integrating all the potential "Aluminum-Based Supply Chain Industry" by Indonesia will generate tremendous value added and foreign exchange savings including the expansion of employment opportunities and strengthening national economic connectivity locally.

CONCLUSION & SUGGESTIONS

Inalum which until now is the only Aluminum Smelter in Southeast Asia has to be entirely taken over by Indonesia to support the program of MP3EI for national interests and development of Indonesia. Integrity among commodities of Bauxite-Alumina-Aluminum including Calcined Petroleum Coke Green Coke is really required in order to create tremendous added value in the National Aluminum Industrial Cluster and foreign exchange savings, including the expansion of employment opportunities as well as get for more than 42TRp/Year. To welcome the transfer of Inalum in October 2013, the government of Indonesia should be more intensive in order to oversee and control the plant Inalum in prime operating condition and not to be a junkyard, having competent human resources, competitive technologies as well as an extensive and strong network. Inalum after October 2013, production optimization should be done at the first stage, and the next stage is production expansion using more efficient and latest technology to meet the needs of Indonesian market.

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