

Chapter 2

Microeconomic and Macroeconomic Issues in the Power Intensive Industry

Abstract Microeconomic and macroeconomic issues are highly important for the power intensive industry. There is a substantial fixed cost associated with starting operating an aluminum smelter, it is referred to as the threshold cost associated with investments in the industry. Investment of this kind is regarded as being a long-term investment, subject to microeconomic input factors involving the availability and cost of energy and labor. Macroeconomic factors include infrastructure, interest rates and inflation, as well as country membership to trade blocs like the EU, EFTA, or NAFTA affecting trading and investment opportunities.

Keywords Controlling stock • Economies of Scale • EEA • EFTA • Endowment • EU

Economic discussion is generally divided into micro economics and macro economics. Companies within the power intensive industry are highly subject to microeconomic and macroeconomic developments. To work on standard economic lines, their operations are dependent on micro-economic conditions, and the overall macro-economic environment is important for business operations in the global economy. Firms are involved in foreign direct investment, when having ownership of controlling stock in operations in a foreign country.

The micro-economic environment is the business operating environment that firms are faced with, when entering into operations. Financial contribution of the power intensive industry is dependent on aluminum prices, with the industry being sensitive to fluctuations in aluminum prices in the world market. Micro-economic factors in the operating environment include availability of electricity and water, as well as skilled labor. Productivity is dependent on the availability of these factors.

Micro-economic foundations of the gravity model were laid out by Bergstrand (1985) to incorporate micro-economic factors like prices into general economic modelling, when explaining the driving forces of exports. Products can vary between firms within industries, or they may vary between countries, referred to as product differentiation. Research by Bergstrand (1990) assumes product differentiation between firms rather than countries.

The nature of investments within the power intensive industry is such that they generally involve huge investments, involving high fixed costs in the beginning of operations. It therefore implies a cost increase in steps as operations expand. Step function application can therefore been suitable for capturing the fixed threshold cost, the Heckman's (1979) two-step procedure has for example proven useful for this type of research (Davies and Kristjánsdóttir 2010; Kristjánsdóttir 2012c).

Macro-economic issues include factors like government stability, and infrastructure. Also country membership to Regional Trade Agreements like the EU or NAFTA is of relevance. Iceland has EFTA membership, and is in the European Economic Area EEA. In a macro-economic perspective it is important to consider the export value for the economy and its contribution to gross domestic product.

Macro economic long-term conditions are important for firms within the power intensive industry, since investment within the industry is generally classified as being a long-term investment. Macro economic factors include electric energy supply, harbor access, and labor availability.

Macro-economic perspective is important when considering the primary production of aluminum in Iceland, with the majority of all aluminum ever made in world still being in use, due to recycling opportunities. Aluminum recycling has proven to be highly beneficial, since the recycling process only requires about 5 % of the energy required for the primary production.

Micro-economic environment accounts for input factors for production, like electric power. The electricity needed to produce 1 kg of aluminum is about 15 kW h. Also, 2 kg of aluminum oxide is required, derived from 4 kg of bauxite, and moreover 0.5 kg of carbon is needed for the production (Icelandic Association of Aluminum Producers 2014).

The main operating firms within the power intensive industry in Iceland include Century Aluminum, Alcoa, Rio Tinto Alcan, Elkem and Becromal.

Power intensive firm operation's have proven to be highly important to promote regional development by providing direct and indirect jobs for the local communities workforce and creating multiplier effects for firms in related industries. The contribution of these firms is substantial for the overall Icelandic economy.

2.1 Norðurál, Century Aluminum

Norðurál has operated an aluminum plant at Grundartangi since 1998. The plant is located in Hvalfjarðarsveit municipality in Vesturland region, Southwest of Iceland. The owner of the plant is Century Aluminum, headquartered in California USA. The operations were previously owned by Columbia Ventures Corporation until 2004. In 2013, the plant produced approximately 290,000 t of aluminum. The energy is obtained from the energy firms of Reykjavík Energy, Landsvirkjun the National Power Company of Iceland as well as HS orka, involving application of



Fig. 2.1 Century Aluminum in the south west of Iceland, at Grundartangi about 40 min drive from the capital city Reykjavík. *Source* Google Earth (2014)

hydroelectric and geothermal resources. The number of employees in 2013 was about 600 people.

In 2008, Norðurál started to construct a new aluminium smelter at Helguvík in the municipality of Reykjanesbær in Suðurnes region, Southwest of Iceland with the aim to produce 250,000 tons aluminium per annum. In 2013, the erection of the aluminium smelter came to a halt due to uncertainties regarding the energy delivery and disputes on the energy prices. That dispute has not been resolved as yet and it is unforeseen when production will start (Figs. 2.1, 2.2, 2.3 and 2.4).

2.2 Rio Tinto Alcan Iceland

The first aluminium smelter in Iceland started in 1969 in Straumsvík, Hafnarfjörður municipality, close to the capital city Reykjavík. It was originally operated under the name Icelandic Aluminum Company (ISAL) and owned by Aluisse in Switzerland. The plant has been enlarged four times. The plant current owner is Rio Tinto, headquartered in London UK, bought the plant. Today it is operated under the name Rio Tinto Alcan. In 2013, about 300 employees worked



Fig. 2.2 Century Aluminum. *Source* Author's photo (2014)



Fig. 2.3 Century Aluminum. *Source* Author's photo (2014)



Fig. 2.4 Rio Tinto Alcan, Straumsvík in the neighbourhood of Reykjavík. *Source* Google Earth (2014)

for the company and the plant produced around 200,000 t of aluminum. The National Power Company of Iceland supplies all electricity to the plant (Figs. 2.5, 2.6, 2.7 and 2.8).

2.3 Alcoa Fjarðaál

ALCOA Fjarðaál started to operate an aluminum plant in 2007 and achieved its full operation in April 2008. The plant is located in Reyðarfjörður, Fjarðarbyggð municipality in the East region of Iceland. The plant has an annual production capacity of up to 350,000 t of primary aluminum. All electricity used by Alcoa is received from Landsvirkjun, the National Power Company of Iceland. There are about 480 employees working in the plant. Alcoa is a multinational firm, headquartered in Pennsylvania in USA (Fig. 2.9 and 2.10).

2.4 Elkem

Elkem Iceland is as Norðurál located at Grundartangi in Hvalfjarðasveit municipality. The plant went into operation in 1979 and currently produces 120,000 tons of ferrosilicon per annum. It also produces refined metal with reduced content



Fig. 2.5 Rio Tinto Alcan in the background of the presidential residence. *Source* Author's photo (2014)



Fig. 2.6 Rio Tinto Alcan. *Source* Author's photo (2014)



Fig. 2.7 Rio Tinto Alcan. *Source* Author's photo (2014)



Fig. 2.8 ALCOA Fjarðaál at Reyðarfjörður in the east part of Iceland. *Source* Google Earth (2014)



Fig. 2.9 Alcoa Fjarðaál. *Source* Author's photo (2013)



Fig. 2.10 Alcoa Fjarðaál at Reyðarfjörður. *Source* Author's photo (2013)

of aluminum, carbon and titanium. Landsvirkjun, the national power company of Iceland, is the sole provider of electricity to Elkem (Figs. 2.11, 2.12, 2.13 and 2.14).

2.5 Becromal

Becromal Iceland started its operation in 2009 in Akureyri municipality, North East of Iceland. The company produces aluminum foil anodizing and receives electricity from Landsvirkjun, the National Power Company of Iceland (Figs. 2.15 and 2.16).

2.6 New Potential Firms

Other foreign companies have shown an interest in examining the potential in the field of investments in power intensive industry in Iceland. As in the projects mentioned above, the government has offered various incentives, including tax deductions by signing investment agreements with the following companies.



Fig. 2.11 Elkem Iceland is located at Grundartangi in Hvalfjordur in the western part of Iceland. *Source* Author's photo (2014)



Fig. 2.12 Elkem at Grundartangi. *Source* Author's photo (2014)



Fig. 2.13 Elkem. *Source* Author's photo (2014)



Fig. 2.14 Becromal is located at Krossanes close to Akureyri in the north. *Source* Google Earth (2014)



Fig. 2.15 Becromal factory in Akureyri, Iceland. *Source* Author's photo (2013)



Fig. 2.16 Becromal factory in Akureyri, Iceland. *Source* Author's photo (2013)

2.7 Silicor Materials

Silicor Materials plans to build and operate a plant in Grundartangi which will be designed for production of 160,000 tons of high-quality solar silicon and 30,000 aluminium by-products (master alloy) per annum. The project estimates to use approximately 90 megawatts (MW) and the power will be provided by Orka Náttúrunnar ohf and Landsvirkjun hf. It is envisaged that the plant will start production before end of 2016 and reach its full capacity in second quarter 2018. In the two year construction time of the plant, Silicor Material estimates that the number of employees will be approximately 400 people. Once the plant is in full operation a special workforce, with a number of highly educated personnel, will be employed. The total number of employees is estimated to 350 people. The current owner of the plant in Iceland is Silicor Materials Inc., headquartered in San Jose, California USA.

According to Terry Jester (2014), CEO of Silicor Materials Inc, the final decision to locate the plant in Iceland is subjected to low energy cost and good knowledge of the metals business in the country. She has also stated that the free trade agreement between China and Iceland signed in 2013, will have positively affect on decision of Silicor Materials.

2.8 PCC Silicon Metal Production Plant

PCC Bakki Silicon hf. plans to build and operate a silicon metal plant at Bakki in Húsavík, Norðurljóna municipality in the north east of Iceland. The owner of the company is the German company PCC SE. The operation of the new plant is estimated to start in 2017 with up to 32,000 tons of production capacity. PCC will need about 58 MW of power for its production and has already signed a power purchase agreement with Landsvirkjun, the National Power Company. It is estimated that approximately 120 people will work at the plant when the operation commences and around 350 people over the construction period.

2.9 United Silicon

United Silicon plans to build and operate a metallurgical grade silicon production plant in Helgufell. The plant is designed for the production of 21,500 tons per annum. United Silicon estimates to use approximately 32 MW of electric energy from Landsvirkjun, the Icelandic National Power Company. It is envisaged that the Plant will start operating in mid-2016 and will reach its full capacity in 2017.

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