



Study On Post Production Arun LNG Refinery Utilization as LNG Receiving Terminal And Regasification Upon Local Economy

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ABSTRACT

The aim of the study is the development analysis of post production Arun LNG refinery whose period of operation within 1978-2014, then modified and utilized as LNG receiving terminal and regasification is useful to satisfy gas requirement in Aceh and North Sumatera provinces. To realize the feasibility of a project, a study of economy was conducted in 2 years period of improvement, 20 years operation, and supply of LNG some 150 MMSCFD for first year, and stage by stage up to 350 MMSCFD fifth year to twentieth year for maximum capacity of production. The study of the project feasibility is carried out by way of 4 parameters: NPV, IRR, BCR, and PBP analyses in 3 scenarios. As for the best result of the economic analysis feasible in first scenario which the NPV is US\$ 831.564 million, IRR 19%, B/C Ratio 4 and PP on 5th year to 6 months of operation. PT. Arun was delivering significant contributions of 52.88% North Aceh economic composing sectors; it is visible while in reduction of 2006-2012 North Aceh Gross Regional Domestic Product (GRDP), a reduction of IDR 7.68 trillion in 2006 to IDR 4.32 trillion in 2012. with the average rate of growth minus nine percent (-9%) per year. Based on the mean rate of growth (3%) per year, the condition reflects potential decline of local output and their considerable relevance to decrease in production of PT. Arun. Based on the study, the Arun post production LNG Refinery Re-utilization will be delivering contribution of GRDP some IDR 1.081 trillion in 2015, rise to IDR 2.651 trillion in 2034 and the rate of growth at 16% per year. When the degree of change in GRDP (ΔY) is related to Arun LNG Refinery Re-utilization, the projection of investment and job opportunity for formation of GRDP per year will be discovered. Growth rate of labor productivity declines due to the growth of labor is higher than the growth of capital and capital productivity would other wise rise. Labor productivity level in capital-labor ratio in Y/L and Y/K with LNG Refinery Re-utilization larger than Y/L and Y/K without Arun LNG Refinery Re-utilization. This project have net social gain (NSG) in 2015 IDR 72.12 billion with net gain coefficient (NGC) some 6.70% had increase in 2034 some IDR 91.44 billion or NGC some 3.64% with average NGC some 3.77% per annum.

Keywords: Arun LNG Refinery, Receiving Terminal, Regasification, Economic Analysis, Local Economy

INTRODUCTION

Arun LNG plant in Blang Lancang North Aceh district (Figure 1) covers an area of 271 ha with a length of 1.7 km and a width of 1.5 km has six train unit in an LNG plant with the capacity of each train 300 million SCFD (Standard Cubic Feet per Day), 5 five units of capacity of 127,200 m³ LNG tanks, four condensate tanks four units of capacity 530,000 barrels, two propane tanks capacity of 83,500 m³, butane tank capacity of 67,500 m³ 2 units, gas turbine power generator unit capacity of 20 MW eleven, eight steam generator units with a pressure of 10 kg/cm², sweaters pump eight units of 10,000 m³/h and equipped with two ports for shipping LNG production to the buyer's country. For delivery condensate is equipped with two means of loaders, ie Single Point Mooring (SPM) and Multi Buoy Mooring (MBM).

Companies formed and started production in 1978 was established as a joint venture with the composition of the shares owned by PT Pertamina (55 percent), Mobil Oil Inc. as the company merged Exxon Mobil (30 percent), and the association of gas buyers in Japan (JILCO) has a stake of 15 percent. Until the end of 2012 PT. Arun producing and has 20 ship to shipping LNG it is equivalent to 1,956,014 m³, this figure is much smaller than at the peak of production in 1994 reached 224 vessels per year with volume 27,656,488 m³ of LNG. (PT. Arun, 2011). Along with the depletion of reserves of natural gas production volumes resulted Arun Arun LNG plant will continue to decline and ceased production in 2014. As a result, some industrial gas users in the area were forced to reduce production capacity. In fact, there are companies which stopped production so that thousands of employees lost their jobs and existing plant facilities abandoned.

While on the one hand the economic growth of North Aceh district is still heavily influenced by the mining and quarrying sector, especially oil and gas mining. During the period of 2006 through 2012, economic growth in North Aceh showed declining trend, which is characterized by negative growth in line with the decline in the growth of oil and gas mining subsector. (BPS North Aceh in Figures Year 2006-2013).

As a result of a decrease in the contribution of the sector to be no response/solution so that the utilization of the Arun LNG plant-oil sector GRDP not be negative therefore necessary to study the post-production investments refinery utilization as the Arun LNG receiving terminal and regasification of LNG so that economic growth can be grown in North Aceh future (Figure 2).

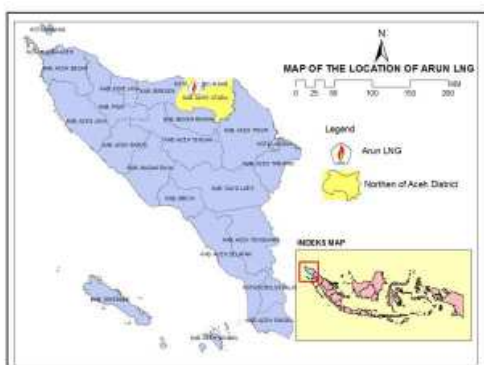
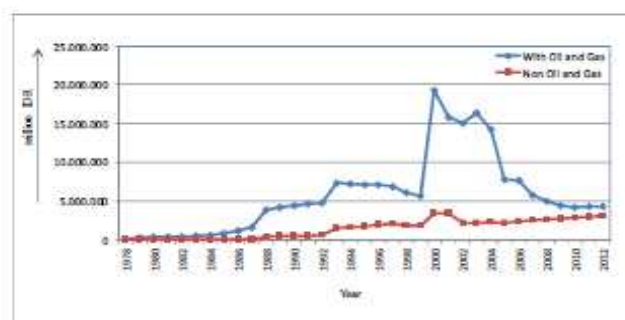


Figure 1. Map of the location of Arun LNG



Sources: Central bureau of statistics, North Aceh, regional gross domestic product by the year 1978-2013 the business field

Figure 2. Gross regional domestic product with and whitout oil and gas in 1978-2012

MATERIAL AND METHOD

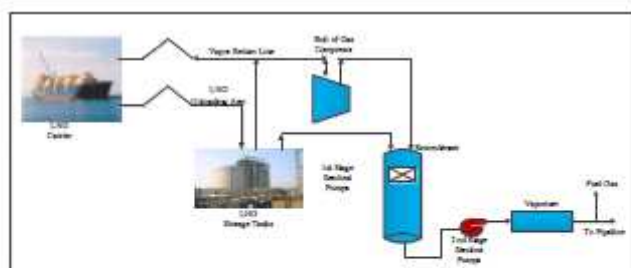
Theory

Receiving Terminal and LNG Regasification

Receiving terminal receives liquefied natural gas (LNG) from a special vessel LNG carrier, then store them in special storage tanks for LNG (Figure 3).

After that, LNG will be evaporated or regasification of natural gas that will be re-distributed through a piping system to the end user who need this. Therefore, the terminal that receives the supply of LNG from the LNG tankers, it is usually LNG terminal founded by the sea or can also waters near the mainland (floating receiving terminal). LNG receiving terminal in addition to supplying gas directly to end users such as fertilizer industry, power plants, it is can also supply gas for peak shaving the special use for heating in the winter. For a market that cannot be reached with the gas piping system of LNG receiving terminals, gas is usually supplied in the form of LNG is transported by truck to the tank for the cryogenic technology.

Furthermore trucked LNG will be received at the satellite station is equipped with regasification system. Addition of LNG truck can also be used to supply LNG fueling stations for vehicles such as buses and others. (PT. Arun, 2011; T.R. Harsya, 2013).



Source : PT. Arun, 2011; T.R. Harsya, 2013.

Figure 3. Flowchart regasification LNG receiving terminal at the facility

The study was conducted with the following steps:

Methodology The study was conducted with the following steps:

1. Project appraisal techniques using four parameters :

- Net Present Value

$$NPV = - I_0 + \sum_{t=1}^n \frac{C_t}{(1+i)^t}$$

- Internal Rate of Return

$$IRR = \sum_{t=0}^n \frac{C_t}{(1+i)^t} = \sum_{t=0}^n \frac{C_t}{(1+i)^t}$$

- Benefit Cost Ratio

$$B/C \text{ Ratio} = \frac{\sum \text{Benefit}}{\sum \text{Cost}}$$

- Payback Period

$$PP = \frac{\text{nilai invest}}{\text{arus kas tak}} \times 1 \text{ year.}$$

2. Input-Output Model (Miernyk, 1965) :

$$\text{Income multiplier (IM)} = \sum_{j=1}^n \frac{I_j b_{ij}}{I_j}$$

$$\text{Investment multiplier (I)} = \sum_{j=1}^n \frac{K_j b_{ij}}{K_j}$$

$$\text{Employment multiplier (LM)} = \sum_{j=1}^n \frac{W_j b_{ij}}{W_j}$$

3. Net Social Gain

Revenue – Cost ± Net External Effect.

RESULT AND DISCUSSION

Capital Expenditure

The costs incurred for the construction of an LNG receiving terminal post production Arun consists of several components as shown in Table III.1. These costs are incurred in the first year since the project started which is the process of development and utilization adjustment Arun LNG plant into a receiving terminal which covers LNG regasification process. The total investment cost incurred for this project is US\$ 471 million for the first scenario, US\$ 543 million for the second scenario, and US\$ 616 million for the third scenario. With the biggest cost is the cost of building the pipeline distribution of US\$ 400 – US\$ 500 million and the cost of additional equipment for the gasification of US\$ 22-35 million. (PT. Pertamina, 2011; T.R. Harsya, 2013).

Operational Expenditure

The cost of operation of the receiving terminal and regasification of LNG Arun covers the cost of production (regasification), maintenance, employee payments, utilities, fuel, contractors, spares, and other costs to support the passage of the process of distribution and in the Arun LNG regasification. In addition to operating costs, there is the cost of leasing existing equipment such as LNG storage tanks that paid to the Government. Total operating costs for 20 years of operation is known of US\$ 847.278 million as shown in Table III.2. (PT. Pertamina, 2011; T.R. Harsya, 2013).

Revenue

Income derived from LNG regasification costs before distributed to PLN industries and areas of Aceh and North Sumatra. Determination of the gas price to the industry and the PLN did not become a revenue structure of this project because it is an agreement between a supplier of LNG (LNG Tangguh and other suppliers) to the purchaser (buyer). Based on the data obtained, known revenue from LNG regasification process in year 1 of US\$ 90.408 million, year-to-2 to US\$ 120,544 million, and 3 increased to US\$ 150.544 then the 4th year of US\$ 180.816 million and constant from year 5 to 20 per year is US\$ 210.952 million as shown in Table III.3. (PT. Pertamina, 2011; T.R. Harsya, 2013).

Table III.1 Capital Expenditure of Arun LNG Terminal

Item Cost	Cost (million US\$)		
	Scenario		
	1	2	3
Direct Cost			
Regasification Equipment	22.000	28.817	35.943

Instrument & control system	6.000	7.859	9.803
Piping	11.500	15.063	18.788
Electrical	3.500	4.584	5.718
Construction & Installation	7.000	9.169	11.436
Civil works	500	655	817
Process and safety	200	262	327
Spare Parts	300	393	490
Pipes Distribution	400.000	450.000	500.000
Indirect Cost			
Project management	2.500	3.275	4.085
Engineering	2.000	2.620	3.268
Facility Improvement	11.000	14.409	17.972
Insurance	500	655	817
Contingency	4.000	5.240	6.535
Total Capital Expenditure	471.000	543.000	616.000

Source : PT. Pertamina, 2011.

Table III.2 Operational Expenditure of Arun LNG Receiving Terminal and Regasification

Component	Cost (million US\$)			
	2015	...	2016	Total
Rental Existing Facilities	5.000	...	5.000	5.000
Operation & Maintenance				
Board of Directors and Management	2.229	...	2.693	49.089
Employee and Contractor	1.620	...	1.957	35.671
Maintenance	1.058	...	1.058	21.150
Spare part	1.763	...	1.763	32.250
Utilities, Power, Fuel and Nitrogen	13.872	...	35.053	459.648
Miscellaneous	4.459	...	11.267	147.434
Total Operational Expenditure	30.000	...	58.791	847.278

Source: PT. Pertamina, 2011.

Feasibility Analysis

Net Present Value

NPV calculations performed using microsoft excel with cash flow as Figure 4. Obtained from the sum of cash flows in (revenue) with cash flow out that came out negative. To calculate NPV, assuming the terminal is expected during the operating life of 20 years with a value of *i* by 7% (maximum limit) taken by the current BI rate. The calculation of NPV values obtained in scenario 1 for US\$ 831.564, scenario 2 was US\$ 799.922 and scenario 3 is US\$ 767.832. From the above calculation shows that the NPV of this project may provide benefits to employers or in other words the project is feasible.

Component	Year of					Unit
	1	2	3	4	5-20	
LNG feed	150	200	250	300	350	MMSCFD
Regas and distribution fee	1,74	1,74	1,74	1,74	1,74	US\$/MMBTU
Operation day	335	335	335	335	335	day/year
HHV	1.034	1.034	1.034	1.034	1.034	BTU/SCF
Gas	155.100	206.800	258.500	310.200	361.900	MMBTU/day
Revenue/year	90.408	120.544	150.680	180.816	210.952	million US\$/year

Table III.3 Revenue of Arun LNG Terminal per year

Source : PT. Pertamina, 2011.

Year of	Cash Flow		
	Scenario 1	Scenario 2	Scenario 3
0	-723,000	-794,996	-868,000
1	79,547	83,147	86,797
2	102,450	106,05	109,700
3	125,354	128,954	132,604
4	148,257	151,857	155,507
5	171,160	174,76	178,410
6	171,160	174,76	178,410
7	171,160	174,76	178,410
8	171,160	174,76	178,410
9	171,160	174,76	178,410
10	171,160	174,76	178,410
11	171,160	174,76	178,410
12	171,160	174,76	178,410
13	171,160	174,76	178,410
14	171,160	174,76	178,410
15	171,160	174,76	178,410
16	171,160	174,76	178,410
17	171,160	174,76	178,410
18	171,160	174,76	178,410
19	171,160	174,76	178,410
20	171,160	174,76	178,410
NPV	USD 831,564	USD 799,922	USD 767,832
	=NPV(7%;B5;B6:B25)	=NPV(7%;C5;C6:C25)	=NPV(7%;D5;D6:% 25)

Figure 4. NPV Calculations Using Microsoft Excel

Internal Rate of Return

IRR is the discount rate used in calculating the economic cost that will make the NPV of all the cash flows involved in the project is equal to 0 (zero). IRR is an indicator of efficiency, quality or yield of an investment. The greater the value of the IRR of a project, the more profitable the project indicates to run.

Based on the data obtained and using microsoft excel. Value used is the total cash flow from year 0 (development) project lasted until last year (year-to-20 operational). From the calculation (see Figure 5), obtained IRR for scenarios 1, 2 and 3 respectively 19%, 17% and 16% greater than the MARR (minimum attractive rate of return) of 15% project (PT. Pertamina, 2011, T.R. Harsya, 2013). This indicates that the project is feasible and profitable to run.

B/C Ratio

BCR is the ratio between the net profit earned in a project with the costs to be incurred. Used a net profit gains net of taxes and operating and maintenance costs per year. While the costs are used as the divisor represents costs incurred in the initial investment includes the cost of new equipment, installation of equipment, piping, and other items.

BCR values obtained in this project amounted to 4, both scenarios 1,2 and 3 which indicates that the gains obtained during the operation outweigh the costs. In other words, the BCR values obtained indicate that the project would be profitable if executed.

Benefit Cost Ratio Calculation:

$$B/C \text{ Ratio} = \frac{3.917.680}{\frac{723.000}{20 \text{ year}} + 247.270} = 4$$

Year of	Cash Flow		
	Scenario 1	Scenario 2	Scenario 3
0	-723,000	-794,996	-868,000
1	79,547	83,147	86,797
2	102,450	106,050	109,700
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11	171,160	174,760	178,410
12	171,160	174,760	178,410
13	171,160	174,760	178,410
14	171,160	174,760	178,410
15	171,160	174,760	178,410
16	171,160	174,760	178,410
17	171,160	174,760	178,410
18	171,160	174,760	178,410
19	171,160	174,760	178,410
20	171,160	174,760	178,410
IRR	19%	17%	16%
	= IRR (B5:B25)	= IRR (C5:C25)	= IRR (D5:D25)

Figure 5. IRR Calculations Using Microsoft Excel

Payback Period

Payback Period represents the time required to restore the cash flow that comes out when the investment. At this point shows the issued capital has been returned as a result of cash inflows after some time the project progresses.

It is expected that this project payback period is 7 years after the operation. Based on calculations, scenario 1 is known that the time-value of cumulative cash flow positive in 6th years of the project. In the 5th year of the project, the cumulative cash flow was negative and amounted to US\$ -96,233 and in 6th years had positive value of US\$ 74,928.

From these data we will know when the payback period for scenario 1 to fall on a year to 5 to 6 months. As for scenario 2, the payback period falls in the year to 5 months to 10, and scenario 3 year payback period falls to 6 months to 1. (for details see Table III.4).

Table III.4 Payback Period Calculation

Scenario 1

	Annual Cash Flow	Cummulative Cash Flow	Time
Initial Investment		-723000	
1st year cash flow	79.547	-643453	1 year
2nd year cash flow	102.450	-541003	1 year
3rd year cash flow	125.354	-415649	1 year
4th year cash flow	148.257	-267392	1 year
5th year cash flow	171.160	-96232	1 year
6th year cash flow	171.160	74.928	0,56 year

Payback period = 5th year + (0,56 x 12) month = 5th year 6 month

Scenario 2

	Annual Cash Flow	Cummulative Cash Flow	Time
Initial Investment		-795000	
1st year cash flow	83.147	-711853	1 year
2nd year cash flow	106.050	-605803	1 year
3rd year cash flow	128.954	-476849	1 year
4th year cash	151.857	-324992	1 year

flow			
5th year cash flow	174.760	-150232	1 year
6th year cash flow	174.760	24.528	0,86 year

Payback period = 5th year + (0,86 x 12) month = 5th year 10 month

Scenario 3

	Annual Cash Flow	Cummulative Cash Flow	Time
Initial Investment		-868000	
1st year cash flow	86.797	-781203	1 year
2nd year cash flow	109.700	-671503	1 year
3rd year cash flow	132.604	-538899	1 year
4th year cash flow	155.507	-383392	1 year
5th year cash flow	178.410	-204982	1 year
6th year cash flow	178.410	-26572	1 year
7th year cash flow	178.410	151.838	0,15 year

Payback period = 6th year + (0,15 x 12) month = 6th year 1 month

The Benefits from PT. Arun to District North Aceh on The Economic

Linkages to The Backward and Forward

Size to look backward and forward linkages of a sector with other sectors of the economy sector in wilyah (Bulmer - Thomas, 1982; U.W. Soelistijo, 2012).

In Table III.5. indicated that investment in the manufacturing sector of α_j ($\alpha_j = 4.0925$) give (yield) the highest, followed by sector Bank and Other Financial Institutions ($\alpha_j = 1.3163$) and services sector ($\alpha_j = 1.1567$) . Where these three sectors above criteria value ($\alpha_j > 1$), But there are still six sectors under the criterion value ($\alpha_j < 1$), the Agriculture sector ($\alpha_j = 0.1810$), Electricity and Water Supply sector ($\alpha_j = 0.1610$), transport and communications sector ($\alpha_j = 0.0910$), trade sector, hotels and restaurants ($\alpha_j = 0.0508$), Mining and Quarrying sector ($\alpha_j = 0.0426$) and the Building and Construction sector ($\alpha_j = 0.0337$), it is means all investments in these sectors provide results (yield) is lower than the average of the backward sector linkages.

Therefore the terms of the forward linkages, there are four economic sectors that are above criteria ($\beta_j > 1$), the Drinking Water and electricity sectors ($\beta_j = 2.2627$) followed Building and Construction sector ($\beta_j = 2.2225$), Manufacturing sector ($\beta_j = 1.4599$) and the sector of

Transportation and Communications ($\beta_j = 1.4312$). This implies that the sector has a high forward linkages with other sectors.

Multipier Analysis Investment, Income and Employment

In the economic sphere of Aceh Utara that is known the highest multiplier investment are Building and Construction sector ($IM = 3.3446$), Trade sector, Hotels and Restaurants sector ($IM = 2.2842$) then followed by processing industry sector ($IM = 1.7278$). The Lowest investment multiplier are Mining and Quarrying sector ($IM = 1.3203$), and services sector ($IM = 1.2647$). (see Table III.6).

In terms of the income multiplier, which the highest is Electricity and Water Supply sector ($PM = 8.1399$), Manufacturing ($AM = 3.0756$), and then Banks and Other Financial Institutions sector ($PM = 1.7661$). for details see Table III.7.

Income multiplier implies that the IDR 1 of increament in income would produce IDR times income multiplier of output (Y), for example: with IDR 1 million of increament in electricity and Water Supply sector ($PM = 8.1399$) will result IDR 8.13 million of output.

Then with approach of sectoral employment multipliers. Electricity and Water Supply as first rank, with employment multiplier ($NM = 2.6657$), hen manufacturing sector ($NM = 2.3910$), and Building and Construction sector ($NM = 1.7207$). The employment multiplier value is defined that any increase in rupiah in GRDP can create job opportunities which result is timed employment multiplier on GRDP rise in certain sectors.

Suppose the Electricity and Water sector ($NM = 2.6657$) with the increase in sectoral output of one million dollars means to create employment opportunities IDR 2.67 million. For detail see Table III.8 Based upon the results of the analysis can be understood that the sector has a small multiplier if have characteristics:

- 1) have less dependence on other sectors in meeting the needs of production inputs,
- 2) quite dependent on other sectors, but not in the economic sector in the region's economy,
- 3) production run labor-intensive (labor intensive). To see the pattern of the relationship between the three multiplier value above (see Figure 6).

Table III.5 Linkages Forwad and Backward of Economic Sector

No	Industrial Origin	$\sum_i b_{ij}$	$\sum_j b_{ij}$	$\frac{1/n \sum_i}{\sum_j b_{ij}}$	Linkages			
					Backward (α_j)	Ranking	Forward (β_i)	Ranking
1	Agriculture	0,1075	0,2687	0,5937	0,1810	4	0,4525	7
2	Mining and Quarrying	0,0253	0,1670		0,0426	8	0,2813	9
3	Manufacturing Industries	9,7189	0,8667		4,0925	1	1,4599	3
4	Electricity and Water Supply	0,0956	1,3434		0,1610	5	2,2627	1
5	Building and Construction	0,0200	1,3195		0,0337	9	2,2225	2
6	Trade, Hotel and Restaurants	0,0302	0,4978		0,0508	7	0,8384	5
7	Transportation and Communication	0,0540	0,8497		0,0910	6	1,4312	4
8	Financial Intermediaries	0,7815	0,3550		1,3163	2	0,5980	6
9	Services	0,6867	0,1909		1,1567	3	0,3215	8

Table III.6 Income multiplier, employment multiplier and investment multiplier

Income Multiplier

Code	Industrial Origin	1	2	3	4	5	6	7	8	9
201	Wages	586.801	918.877	51.049	4.483	215.877	239.418	231.652	79.430	585.535
180	Intermediate input	2.913.122								
	Income Coefficient	0,20143	0,31543	0,01752	0,00154	0,07411	0,08219	0,07952	0,02727	0,20100
	$\sum l_j \times b_{ij}$	0,21917	0,33071	0,05390	0,05011	0,12341	0,11920	0,12055	0,04815	0,21456
Type I	$\sum l_j \times b_{ij} / l_j$ (Income Multiplier)=	1,08807	1,04845	3,07557	8,13991	1,66530	1,45032	1,51593	1,76609	1,06745

Advanced Table III.6 Employment multiplier

Code	Industrial Origin	1	2	3	4	5	6	7	8	9
201	Input Coefficients of Wages (w _j)	0,17231	0,14897	0,06476	0,08083	0,17057	0,16434	0,16324	0,20706	0,55366
	$\sum w_j \times b_{ij}$	0,20266	0,18990	0,15485	0,21548	0,29351	0,26886	0,27736	0,29708	0,60004
N _j	$\sum w_j \times b_{ij} / w_j$	1,17611	1,27475	2,39101	2,66574	1,72072	1,63599	1,69912	1,43473	1,08376

Advanced Table III.6 Investment multiplier

Code	Industrial Originil	1	2	3	4	5	6	7	8	9
203	Depreciation Coefficient (k _j)	0,03474	0,04285	0,07122	0,12694	0,03048	0,02490	0,12965	0,03544	0,04934
	$\sum k_j \times b_{ij}$	0,05496	0,05657	0,12305	0,20405	0,10195	0,05688	0,18185	0,05102	0,06239
	$\sum k_j \times b_{ij} / k_j$ (Investment Multiplier)	1,58203	1,32028	1,72782	1,60742	3,34456	2,28422	1,40261	1,43977	1,26470

Source : Derived from input-output table of North Aceh District.

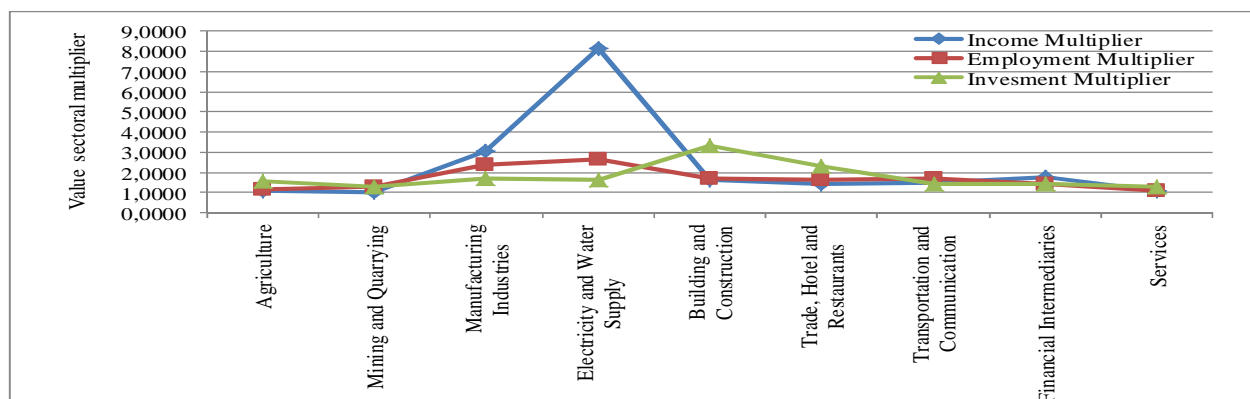


Figure 6 Investment multiplier relationship patterns, income and employment between sectors of the economic in Northern Aceh

Analysis of Labor Productivity and Capital Productivity

Based on the calculations of Table III.7 economic output, capital stock and labor district of North Aceh were reviewed on the basis of constant 2000 prices (with oil and gas). Labor productivity has grown relative decline, it is because of the growth of labor is higher than the growth of capital and capital productivity rose reverse capital productivity will go up.

The level of labor productivity in the comparative capital-labor showed decreased movement (see Figure 7), from $Y/L = 118.12$ in 2000 to $Y/L = 12.38$ in 2012. In the graph of capital productivity in labor-capital appeal number (with oil and gas) showed fluctuating movement; however, it's showed a significant lowering trend (see Figure 8). while without oil shows that the productivity of capital and labor-capital appeals numbers are moving constantly.

From the results of the above studies decreased the contribution of the oil and gas sector both on the regional GRDP, labor productivity and capital productivity so that the required response/ solution, namely the use of post-production of the LNG plant as LNG receiving and regasification terminal.

Table III.7 Rank productivity of labor and capital North Aceh District year of 2000-2012 (oil and gas)

Year	Y 2000 IDR (Million) ¹	Investment (K) IDR (Million) ²	Labor (L) IDR (Million) ³	Y/L	K/L	Y/K	L/K
2000	19.235.946	133.635	162.845	118,12	0,82	143,94	1,22
2001	15.773.487	123.031	196.640	80,22	0,63	128,21	1,60
2002	15.039.304	170.541	261.767	57,45	0,65	88,19	1,53
2003	16.381.430	185.497	197.148	83,09	0,94	88,31	1,06
2004	14.295.310	134.087	143.944	99,31	0,93	106,61	1,07
2005	7.788.450	257.333	172.087	45,26	1,50	30,27	0,67
2006	7.678.480	259.545	182.262	42,13	1,42	29,58	0,70
2007	5.762.960	259.806	203.326	28,34	1,28	22,18	0,78
2008	5.010.810	255.704	173.513	28,88	1,47	19,60	0,68
2009	4.475.630	215.784	224.540	19,93	0,96	20,74	1,04
2010	4.233.850	232.109	226.382	18,70	1,03	18,24	0,98
2011	4.295.450	274.675	236.272	18,18	1,16	15,64	0,86
2012	4.323.630	334.309	349.206	12,38	0,96	12,93	1,04

Table III.8 Rank productivity of labor and capital North Aceh District year of 2000-2012 (non oil and gas)

Year	Y 2000	Investment (K)	Labor (L)	Y/L	K/L	Y/K	L/K
	IDR (million) ¹	IDR (million) ²	IDR (million) ³				
2000	3.382.516	114.290	162.195	20,85	0,70	29,60	1,42
2001	3.396.444	109.341	195.978	17,33	0,56	31,06	1,79
2002	2.207.057	155.273	261.101	8,45	0,59	14,21	1,68
2003	2.200.460	168.885	196.334	11,21	0,86	13,03	1,16
2004	2.275.390	117.043	143.160	15,89	0,82	19,44	1,22
2005	2.151.870	230.300	171.539	12,54	1,34	9,34	0,74

2006	2.453.140	257.806	181.698	13,50	1,42	9,52	0,70
2007	2.544.060	194.869	202.742	12,55	0,96	13,06	1,04
2008	2.637.420	224.483	172.828	15,26	1,30	11,75	0,77
2009	2.726.210	174.749	223.834	12,18	0,78	15,60	1,28
2010	2.827.060	201.797	225.779	12,52	0,89	14,01	1,12
2011	2.939.130	218.007	235.733	12,47	0,92	13,48	1,08
2012	3.063.650	303.874	348.626	8,79	0,87	10,08	1,15

Source : BPS North Aceh District, 2013, processed.

Information :

- 1) Calculation results GRDP (Y) at constant price in 2000.
- 2) Investment calculation results on the basis of constant prices in 2000.
- 3) Labor calculation result on the basis of constant prices in 2000.

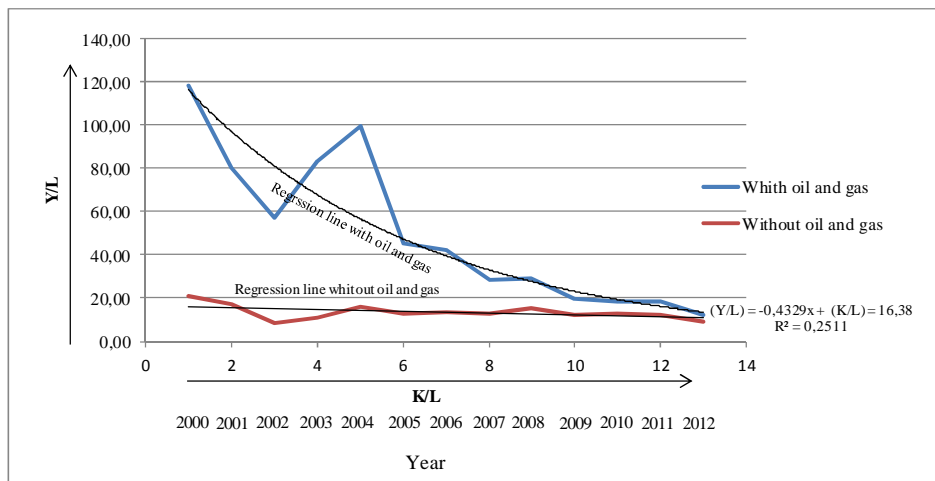


Figure 7 Comparison of labor productivity Northern Aceh District with oil and gas without oil and gas at constant prices of 2000, where (Y/L) whith oil and gas > (Y/L) without oil and gas

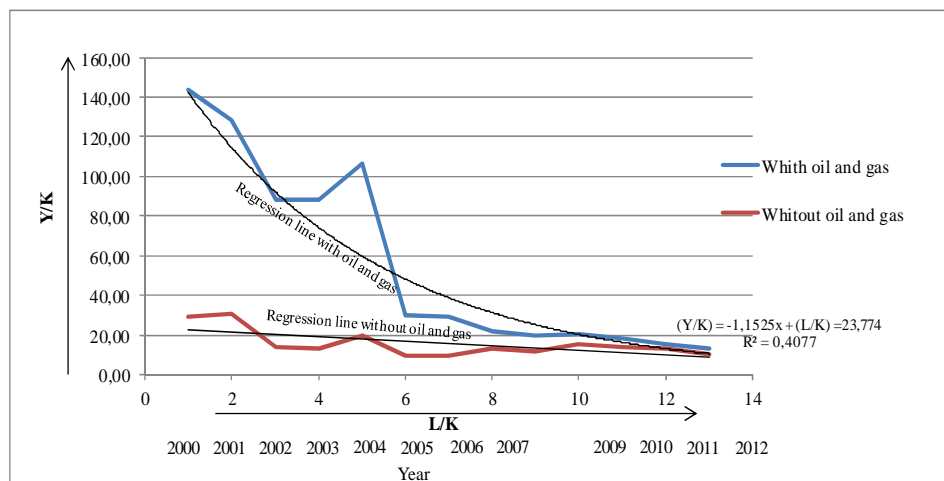


Figure 8 Comparison of labor productivity Northern Aceh District with oil and gas without oil and gas at constant prices of 2000, where (Y/K) with oil and gas $>$ (Y/K) without oil and gas

Refinery Post Production Benefits As Arun LNG and Regasification LNG Receiving Terminal on the Economy of North Aceh District

Sector Investment and Employment Opportunities

In an effort to increase local revenues should increase in the direction towards the creation of sectoral production. In this sense every sector can contribute to the formation of GRDP (Y) districts.

Based on the average growth rate (16%) per annum (the Arun LNG plant utilization as a receiving terminal and regasification), then in the projection period 2015-2034 the contribution to GRDP of North Aceh Regency (based on 2000 constant price) in 2015 amounted to IDR 1,081,017,957 million increased by IDR 2,651,021,738 million in 2034. Based on the value of investment multiplier and employment multiplier then unknown amount of investment and employment opportunities per year. When linked with the rate of change in GRDP (ΔY) with utilization of Arun LNG plant, then known projected investment and employment opportunities to the formation of GRDP per year.

In 2016 the employment generation (ΔN) of 84 477 people or 5,280 people a 1.0% increase in GRDP. Moreover, in 2034 decreased by 5,277 people or 330 people per 1.0% increase in GRDP.

In the projection of the value of labor (ΔL) average of IDR 138,490,861 million with employment opportunities (ΔN) by an average of 18 411 people or 1,153 people a 1.0% increase in GRDP.

Investment levels also decreased in 2016 of IDR 202 591 166 million decreased to IDR 1,108,212 million in 2020, then from 2021 in 2034 has increased to as much as IDR 1,318,733 Increased to IDR 12,655,537. Changes in investments during the years 2015-2034 an average of IDR 46,533,114 million per year. Without the use of the Arun LNG plant with an average growth rate (16%), so the North Aceh Regency of reach IDR 5,162,737 million in 2015 and increased to IDR 140,692,938 million in 2034.

This creates employment by an average of (ΔN) 230 people in 2016, or approximately 14.40 people per 1.0% increase in GRDP. So that in 2034 employment be approximately 5,277 people or 330 people.

Total employment mean (average $\Delta N = 1,592$ people), or approximately 99 people per 1.0% increase in GRDP.

Changes in investment (ΔI) reached an average of IDR 4,018,686 million and the value of labor (ΔL) an average of IDR 227,148,616 million. Learn more about the projected value of investments and the value of labor can be seen in Table IV.9 and Table III.10.

Table III.9 Projection of the regional gross domestic product North Aceh District (the utilization of the Arun LNG plant)

Year	Y ¹⁾	ΔY	Investment Projections ²⁾		Employment Projections ³⁾			
	IDR (million)	IDR (million)	IM	ΔI (IDR. million)	NM	ΔL (IDR. million)	UG (IDR)	ΔN (people)
2015	1.081.017.937		1,775		1,676		7.134.337	

2016	1.440.617.257	359.599.320		202.591.166		602.688.460		84.477
2017	1.800.402.952	359.785.695		202.696.166		603.000.825		84.521
2018	2.160.410.433	360.007.481		202.821.116		603.372.538		84.573
2019	2.520.681.840	360.271.406		202.969.806		603.814.877		84.635
2020	2.522.648.917	1.967.078		1.108.213		3.296.822		462
2021	2.524.989.739	2.340.822		1.318.773		3.923.218		550
2022	2.527.775.318	2.785.579		1.569.340		4.668.630		654
2023	2.531.090.156	3.314.838		1.867.515		5.555.669		779
2024	2.535.034.814	3.944.658		2.222.342		6.611.246		927
2025	2.539.728.957	4.694.143		2.644.587		7.867.383		1.103
2026	2.545.314.987	5.586.030		3.147.059		9.362.186		1.312
2027	2.551.962.362	6.647.375		3.745.000		11.141.001		1.562
2028	2.559.872.739	7.910.377		4.456.550		13.257.792		1.858
2029	2.569.286.087	9.413.348		5.303.295		15.776.772		2.211
2030	2.580.487.972	11.201.885		6.310.921		18.774.359		2.632
2031	2.593.818.214	13.330.243		7.509.996		22.341.487		3.132
2032	2.609.681.203	15.862.989		8.936.895		26.586.369		3.727
2033	2.628.558.160	18.876.957		10.634.905		31.637.779		4.435
2034	2.651.021.738	22.463.578		12.655.537		37.648.957		5.277
Average per year				46.553.115		138.490.862		18.441

Source : Statistic of North Aceh Regency, 2013, processed.

PT. Pertamina and PT. Arun, 2011.

Information :

1) GRDP (Y) projection is calculated based on the average growth rate of 16% per year projected.

2) Investment (ΔI) projections calculated by fomula: $\Delta I = \Delta Y / IM$

Where; ΔY is the Y value changes per year;

IM is the investment multiplier Northern Aceh District.

3) Employment projections(ΔN) calculated by the formula : $\Delta N = \Delta L / UG '2012 \rightarrow \Delta L = NM \times$

Where; ΔL is the value of labor (IDR);

UG 2012 is the average salary wage base year 2012;

NM is the employment multiplier Northern Aceh District.

Table III.10 Projection of the regional gross domestic product North Aceh District (whitout utilization of the Arun LNG plant)

Year	Y ¹⁾	ΔY	Investment Projectipn ²⁾		Employment Projection ³⁾			
	IDR (million)	IDR (million)	IM	ΔI (IDR. million)	NM	ΔL (IDR. million)	UG (IDR)	ΔN (people)
2015	5.162.737		1,775		1,676		7.134.337	
2016	6.143.657	980.920		552.631		1.644.022		230
2017	7.310.952	1.167.295		657.631		1.956.386		274
2018	8.700.033	1.389.081		782.581		2.328.100		326
2019	10.353.040	1.653.006		931.271		2.770.439		388

2020	12.320.117	1.967.078		1.108.213		3.296.822		462
2021	14.660.939	2.340.822		1.318.773		3.923.218		550
2022	17.446.518	2.785.579		1.569.340		4.668.630		654
2023	20.761.356	3.314.838		1.867.515		5.555.669		779
2024	24.706.014	3.944.658		2.222.342		6.611.246		927
2025	29.400.157	4.694.143		2.644.587		7.867.383		1.103
2026	34.986.187	5.586.030		3.147.059		9.362.186		1.312
2027	41.633.562	6.647.375		3.745.000		11.141.001		1.562
2028	49.543.939	7.910.377		4.456.550		13.257.792		1.858
2029	58.957.287	9.413.348		5.303.295		15.776.772		2.211
2030	70.159.172	11.201.885		6.310.921		18.774.359		2.632
2031	83.489.414	13.330.243		7.509.996		22.341.487		3.132
2032	99.352.403	15.862.989		8.936.895		26.586.369		3.727
2033	118.229.360	18.876.957		10.634.905		31.637.779		4.435
2034	140.692.938	22.463.578		12.655.537		37.648.957		5.277
Average per year				4.018.686		227.148.617		1.592

Source : Statistic of North Aceh regency, 2013, processed.

PT. Pertamina and PT. Arun, 2011.

Information :

1) GRDP (Y) projection is calculated based on the average growth rate of 16% per year projected.

2) Investment (ΔI) projections calculated by fomula: $\Delta I = \Delta Y / IM$

Where; ΔY is the Y value changes per year;

IM is the investment multiplier Northern Aceh District.

3) Employment projections(ΔN) calculated by the formula : $\Delta N = \Delta L /UG '2012 \rightarrow \Delta L = NM x$

Where; ΔL is the value of labor (IDR);

UG 2012 is the average salary wage base year 2012;

NM is the employment multiplier Northern Aceh District.

Analysis of Labor and Capital Productivity

If investment growth is lower than the population growth because exports are declining, the cost of labor-capital appeals (L/K) would increase or a decrease in the rate of capital-labor appeal (K/L). Figures appeals (K/L) fall due to declining investment amount (lower exports) while the population continues to grow, the decline in labor productivity will cause a decline in income (Y/L) at the beginning of the period. Only by changes in technology can overcome the decline (Y/L). (A. Amrullah, 2007).

Table III.11 calculations based on economic output, capital stock and labor district of North Aceh were reviewed on the basis of constant 2000 prices (with the use of the Arun LNG plant).

Labor productivity has grown relative decline, it is because the growth of workers is higher than the growth of capital and capital productivity would otherwise rise. The level of labor productivity in the comparative capital - labor showed decreased movement (see Figure 9), ie from Y/L = 2,318 in 2015 to Y/L = 969 in 2034 and Y/K = 2.348 in 2015 rose to Y/K = 759 in 2034 . at chart productivity in a number of capital-labor versus capital (with the use of the Arun LNG plant) shows

the movement fluctuated , but showed a downward trend of relatively constant (see Figure 10). whereas without the use of Arun LNG plant shows that the productivity of capital and labor - capital appeals numbers are moving constantly.

Table III.11 Rank productivity of labor and capital North Aceh District year of 2000-2012 (the utilization of the Arun LNG plant)

Year	Y 2000 IDR (million) ¹⁾	Investment (K) IDR (million) ²⁾	Employment (L) IDR (million) ³⁾	Y/L	K/L	Y/K	L/K
2015	1.081.017.937	460.345	466.410	2.318	0,99	2.348	1,01
2016	1.440.617.257	512.147	511.912	2.814	1,00	2.813	1,00
2017	1.800.402.952	569.779	561.852	3.204	1,01	3.160	0,99
2018	2.160.410.433	633.895	616.664	3.503	1,03	3.408	0,97
2019	2.520.681.840	705.227	676.824	3.724	1,04	3.574	0,96
2020	2.522.648.917	784.586	742.852	3.396	1,06	3.215	0,95
2021	2.524.989.739	872.875	815.322	3.097	1,07	2.893	0,93
2022	2.527.775.318	971.099	894.862	2.825	1,09	2.603	0,92
2023	2.531.090.156	1.080.376	982.162	2.577	1,10	2.343	0,91
2024	2.535.034.814	1.201.950	1.077.978	2.352	1,12	2.109	0,90
2025	2.539.728.957	1.337.205	1.183.142	2.147	1,13	1.899	0,88
2026	2.545.314.987	1.487.680	1.298.565	1.960	1,15	1.711	0,87
2027	2.551.962.362	1.655.088	1.425.248	1.791	1,16	1.542	0,86
2028	2.559.872.739	1.841.334	1.564.290	1.636	1,18	1.390	0,85
2029	2.569.286.087	2.048.538	1.716.897	1.496	1,19	1.254	0,84
2030	2.580.487.972	2.279.059	1.884.391	1.369	1,21	1.132	0,83
2031	2.593.818.214	2.535.520	2.068.226	1.254	1,23	1.023	0,82
2032	2.609.681.203	2.820.840	2.269.995	1.150	1,24	925	0,80
2033	2.628.558.160	3.138.268	2.491.447	1.055	1,26	838	0,79
2034	2.651.021.738	3.491.415	2.734.504	969	1,28	759	0,78

Source : BPS North Aceh District, 2013,
processed.

Information :

1) Calculation results GRDP (Y) at constant
price in 2000.

2) Investment calculation results on the basis of constant prices
in 2000.

3) Labor calculation result on the basis of constant
prices in 2000.

Table III.12 Rank of labor and capital productivity of North Aceh District year of 2000-2012 (whitout utilization of the Arun LNG plant)

Year	Y 2000 IDR (million) ¹⁾	Investment (K) IDR (million) ²⁾	Employment (L) IDR (million) ³⁾	Y/L	K/L	Y/K	L/K
2015	5.162.737	418.436	466.166	11,07	0,90	12,34	1,11
2016	6.143.657	465.522	511.838	12,00	0,91	13,20	1,10
2017	7.310.952	517.907	561.985	13,01	0,92	14,12	1,09
2018	8.700.033	576.187	617.044	14,10	0,93	15,10	1,07
2019	10.353.040	641.025	677.498	15,28	0,95	16,15	1,06
2020	12.320.117	713.159	743.874	16,56	0,96	17,28	1,04
2021	14.660.939	793.410	816.754	17,95	0,97	18,48	1,03
2022	17.446.518	882.692	896.774	19,45	0,98	19,77	1,02
2023	20.761.356	982.021	984.633	21,09	1,00	21,14	1,00
2024	24.706.014	1.092.527	1.081.101	22,85	1,01	22,61	0,99
2025	29.400.157	1.215.469	1.187.020	24,77	1,02	24,19	0,98
2026	34.986.187	1.352.245	1.303.316	26,84	1,04	25,87	0,96
2027	41.633.562	1.504.412	1.431.006	29,09	1,05	27,67	0,95
2028	49.543.939	1.673.703	1.571.206	31,53	1,07	29,60	0,94
2029	58.957.287	1.862.043	1.725.142	34,18	1,08	31,66	0,93
2030	70.159.172	2.071.578	1.894.159	37,04	1,09	33,87	0,91
2031	83.489.414	2.304.691	2.079.736	40,14	1,11	36,23	0,90
2032	99.352.403	2.564.037	2.283.494	43,51	1,12	38,75	0,89
2033	118.229.360	2.852.566	2.507.215	47,16	1,14	41,45	0,88
2034	140.692.938	3.173.564	2.752.854	51,11	1,15	44,33	0,87

Source : BPS North Aceh District, 2013, processed.

Information :

- 1) Calculation results GRDP (Y) at constant price in 2000.
- 2) Investment calculation results on the basis of constant prices in 2000.
- 3) Labor calculation result on the basis of constant prices in 2000.

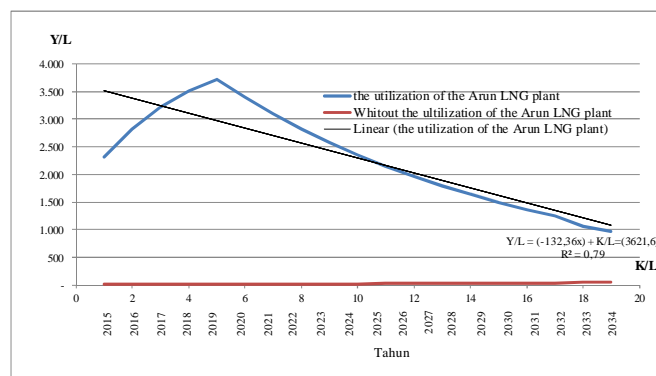


Figure 9. Comparison of labor productivity Northern Aceh District with the utilization of the Arun LNG plant and without utilization of the Arun LNG plant at constant prices of 2000, where (Y/L) with > (Y/L) without oil and gas

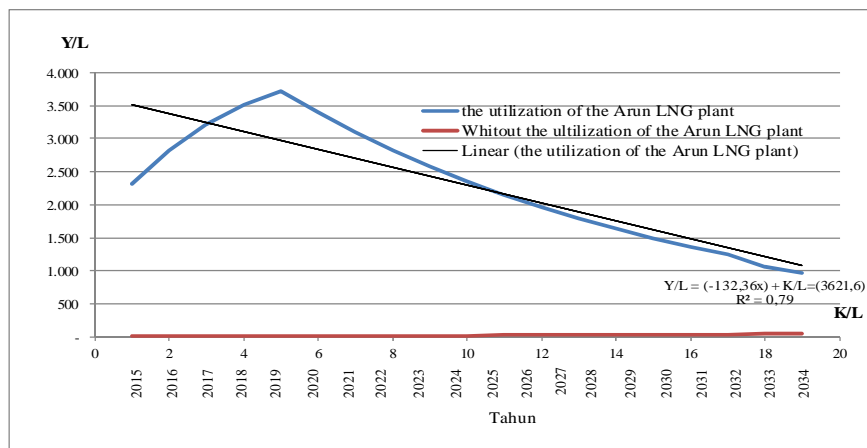


Figure 10. Comparison of labor productivity Northern Aceh District with the utilization of the Arun LNG plant and without utilization of the Arun LNG plant at constant prices of 2000, where (Y/L) with > (Y/L) without oil and gas

Economic Linkages and Net Social Gain

Linkage of Economic Rent (Rj)

In the calculation and analysis of the net social benefits of economic rent (Rj), wages and salaries adjusted to the price used market prices to reflect the true economic value. Therefore, there are three adjustments in the analysis, namely, the value of the input and output, wages, and the value of foreign exchange (subsequently transferred to the corresponding value of the rupiah exchange rate). But the economic rent for the North Aceh Regency is zero, because it does not have ownership of company stock. For example, the calculation of the economic linkages rent is as follows:

- The total value of the input 2015
= IDR 375,011,900,000
- The value of output in 2015
= IDR 1,075,852,701,000
- $R_j = (IDR 1,075,852,701,000 - IDR 375,011,900,000) = IDR 718,840,801,000$ (repatriated ≈ 0) to PT. Pertamina 55%, ExxonMobil 30%, 15% JILCO.
- so, North Aceh district has $R_j = zero$.

Linkage of Excess Payment (Pj)

Linkage of Exces payment (Pj) is the contribution due to the price adjustment between the market price and the price of local labor economics (North Aceh). Number of employees taken projection data are respectively from the year 2015-2034 was 352 people in 2015 and in 2034 amounted to 396 people.

Wage considered as economic costs in creating additional employment, measured by forgone benefit the other sectors left for workers who do not or semi-skilled. Wages if the worker is assessed for work on public sector as the livelihood of local origin (agriculture). To see the

benefits of the level of development in this dimension, the calculation of the projection period 2015-2034 with the value of benefits per year.

as an example of the calculation of excess payment (Pj) in 2015 as follows:

-PT local workforce. Arun = 352.

- The shadow price of labor = IDR 2,185,941 (value of outside labor wages if PT. Arun, namely in the agricultural sector).

- Pj = IDR 2,185,941 x 352 = IDR 769,451,223.

Linkage of Externalities (Ej)

A variety of indirect benefits (externalities) that arise with the presence of the Arun LNG plant in North Aceh district includes linkages backward, forward, technology, payments to local governments (taxes) and the needs of the end with the details below:

a. Backward Linkages

Backward linkages associated with regional benefits that act as suppliers of inputs, production processes include, among others, labor, raw materials and auxiliary materials and services. On the other hand the backward linkages benefits obtained due to the creation of employment opportunities for local contractors who access the potential of local personnels.

b. Forward Linkages

Because the output of the Arun LNG plant in the form of gas, all distributed through the pipe and directly to consumers, small and linkages with other sectors in the economy of North Aceh. Effects forward linkages to low and not counted.

c. Technological Linkages

Utilization of the Arun LNG plant in operation and processing has the characteristics of modern technology, making it less influence on technology and technical skills possessed economic sectors in the region are still largely traditional. However, in this connection a few things that need to be calculated is the availability of neighbor infrastructure companies, as well as the allocation of funds relating to the infrastructure used by the local community.

This has an influence on the progress of the region, such as: roads, health, education, housing, airports, sea ports and oil terminals, as well as electricity and water supply facilities. Projected amount of assistance to community development (community development) calculated as 1% of total revenues net of tax (Act No.40 of 2007), in 2015 IDR 8,163,043,000 and in 2034 was IDR 19,064,990,000.

d. Fiscal Linkages

Linkages tax policy relating to public sector in spending income taxes on other economic sectors. Double benefit of tax linkage is yet to be identified. But local revenue sourced from the company can be known through the Law No. 18 Year 2011 special autonomy NAD neighbor.

Payments to the Government of the North Aceh district, which in 2015 amounted to IDR 57,405,600,000 up to IDR 58,207,660,000 in 2034.

e. Final Demand Linkages

Spending patterns 'reception' good income, (employees, companies, communities, and other sectors) associated with the use of post-production Arun LNG plant as LNG receiving and regasification terminal gives an indication of the expansion of the demand for services and goods locally, because that is the purchasing power of income (purchasing power) and is a potential demand for sectors of the economy in the area.

So as to encourage increased productivity in other sectors due to the double effect of regional. 2015-2024 Projected year end number needs PT. Arun and his family reached IDR 60,511,500,000 the number of employees increased to 3,621 people. IDR 66,841,110,000 and employs 3,851 people in the year 2025 to 2034.

Net Social Benefit Utilization of Post Production Arun LNG Refinery

Based on the model used in this study, that the NSG consists of economic rent (R_j), the excess payment (P_j) and externality (E_j). (Bulmer – Thomas, 1982; Pearson and Cownie, 1974; U.W. Soelistijo, 2009, 2012, 2013). So it is known, that the existence of an LNG refinery utilization Arun Post Production in North Aceh Regency net social benefits over the current price. In 2015 of IDR 72,123,680,173 the coefficient of net benefits (NGC) has increased by 6.70% in 2034 of IDR 91,439,272,075 or $NGC = 3.64\%$, which decreased NGC caused by the output value is greater than the value of the NSG and the year to 5-20 has a constant output value, while the value of the NSG have continued to rise up to 20 years (see Table III.13).

Changes in Net Social Benefit (NSG) Changes in the utilization of net social benefits Post Production Arun LNG plant based on present value (PVF with the 2014 Bank Indonesia interest ($i = 12\%$) note that in 2015 US\$ 80,778,521,794 the coefficient of net benefits ($NGC = 0.06704$ or $\approx 6.70\%$). In 2034 increased by IDR 882,050,018,671 with a net gain coefficient (3.64%). More results on equalization NSG can be seen in Table III.14.

The NSG coefficient means that if the firm's output increases, for example IDR 1.000.000,- the impact on the increase in value of the NSG in a given year is equivalent to the result of multiplying the number of coefficients, for example, in 2015 amounted to 6.70% means that the impact on the increase in value of NSG of IDR 67.000.

Table III.13 Net Social Gain of the use of post production Arun LNG plant on the North Aceh District 2015-2034

Variable	Year									
	2015	2016	2017	2018	2019	2020	2021	2022	2023	2024
Revenue	1.075.855.200.000	1.434.473.600.000	1.793.092.000.000	2.151.710.400.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000
Cost	357.000.000.000	368.364.500.000	380.276.400.000	392.771.400.000	405.873.300.000	419.605.900.000	434.004.900.000	449.106.000.000	464.944.900.000	481.557.300.000
I. Economic Rent	718.855.200.000	1.066.109.100.000	1.412.815.600.000	1.758.939.000.000	2.104.455.500.000	2.090.722.900.000	2.076.323.900.000	2.061.222.800.000	2.045.383.900.000	2.028.771.500.000
II. Net External Effect										
Consists of:										
Backward-Forward Linkages	2.185.941	2.443.085	2.730.479	3.051.680	3.410.666	3.811.881	4.260.294	4.761.455	5.321.571	5.947.577
- Fiscal Linkages	58.175.051.232	58.308.532.090	58.458.921.003	58.617.773.120	58.793.930.426	58.986.852.803	59.198.607.310	59.436.275.440	59.693.501.270	59.979.858.644
- Final Demand Linkages	5.783.400.000	5.840.520.000	5.901.210.000	5.958.330.000	6.019.020.000	6.079.710.000	6.140.400.000	6.201.090.000	6.261.780.000	6.326.040.000
- Technological Linkages	8.163.043.000	10.888.500.000	13.614.076.000	16.339.533.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000
III. Net Social Gain (NSG)	72.123.680.173	75.039.995.175	77.976.937.482	80.918.687.800	83.881.351.092	84.135.364.684	84.408.257.604	84.707.116.895	85.025.592.841	85.376.836.221
IV. Output Value (uj.v1)	1.075.855.200.000	1.434.473.600.000	1.793.092.000.000	2.151.710.400.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000
V. Net Gain Coefficient (NGC)	0,06704	0,05231	0,04349	0,03761	0,03341	0,03352	0,03362	0,03374	0,03387	0,03401
(NSG/uj.v1) in %	6,70%	5,23%	4,35%	3,76%	3,34%	3,35%	3,36%	3,37%	3,39%	3,40%
[PVF : I = 12%] *	1.1200	1.2544	1.4049	1.5735	1.7623	1.9738	2.2107	2.2107	2.7731	3.1058
PV NSG **)	80.778.521.794	94.130.169.948	109.551.982.823	127.327.121.839	147.827.601.473	166.068.291.440	186.599.765.717	209.731.702.202	235.782.665.347	265.167.493.811
PV Output Value (PVuj.v1)	1.204.957.824.000	1.799.403.683.840	2.519.165.157.376	3.385.757.971.513	4.424.057.082.777	4.954.943.932.711	5.549.537.204.636	6.215.481.669.192	6.961.339.469.495	7.796.700.205.835
PV NGC	0,06704	0,05231	0,04349	0,03761	0,03341	0,03352	0,03362	0,03374	0,03387	0,03401
(PVNSG/PVuj.v1) in %	6,70%	5,23%	4,35%	3,76%	3,34%	3,35%	3,36%	3,37%	3,39%	3,40%

Advanced Table III.13

Variable	Tahun									
	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034
Revenue	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000
Cost	498.978.900.000	517.245.400.000	536.416.300.000	556.515.400.000	577.602.200.000	599.724.300.000	622.929.300.000	647.276.700.000	672.814.100.000	699.612.900.000
I. Economic Rent	2.011.349.900.000	1.993.083.400.000	1.973.912.500.000	1.953.813.400.000	1.932.726.600.000	1.910.604.500.000	1.887.399.500.000	1.863.052.100.000	1.837.514.700.000	1.810.715.900.000
II. Net External Effect										
Consists of:										
Backward-Forward Linkages	6.647.223	7.429.173	8.303.107	9.279.847	10.371.486	11.591.541	12.955.118	14.479.100	16.182.356	18.085.975
- Fiscal Linkages	60.302.908.625	60.651.458.221	61.040.377.553	61.474.341.707	61.964.210.624	62.501.114.826	63.111.540.902	63.778.548.100	64.522.105.908	65.369.706.100
- Final Demand Linkages	6.390.300.000	6.450.990.000	6.515.250.000	6.583.080.000	6.647.340.000	6.715.170.000	6.783.000.000	6.850.830.000	6.918.660.000	6.986.490.000
- Technological Linkages	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000	19.064.990.000
III. Net Social Gain (NSG)	85.764.845.848	86.174.867.394	86.628.920.660	87.131.691.554	87.686.912.110	88.292.866.367	88.972.486.020	89.708.847.200	90.521.938.264	91.439.272.075
IV. Output Value (uj.v1)	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000	2.510.328.800.000
V. Net Gain Coefficient (NGC)	0,03416	0,03433	0,03451	0,03471	0,03493	0,03517	0,03544	0,03574	0,03606	0,03643
(NSG/uj.v1) in %	3,42%	3,43%	3,45%	3,47%	3,49%	3,52%	3,54%	3,57%	3,61%	3,64%
[PVF : I = 12%] *	3.4785	3.4785	4.3635	4.8871	5.4736	6.1304	6.8660	7.6900	8.6128	9.6463
PV NSG **)	298.337.303.954	335.735.214.528	378.004.698.570	425.822.360.211	479.960.079.660	541.270.027.349	610.888.726.957	689.857.966.479	779.643.882.023	882.050.018.671
PV Output Value (PVuj.v1)	8.732.304.230.535	9.780.180.738.199	10.953.802.426.783	12.268.258.717.997	13.740.449.764.157	15.389.303.735.856	17.236.020.184.158	19.304.342.606.257	21.620.863.719.008	24.215.367.365.289
PV NGC	0,03416	0,03433	0,03451	0,03471	0,03493	0,03517	0,03544	0,03574	0,03606	0,03643
(PVNSG/PVuj.v1) in %	3,42%	3,43%	3,45%	3,47%	3,49%	3,52%	3,54%	3,57%	3,61%	3,64%

Sources : PT. Pertamina, Arun LNG receiving terminal project, 2011, processed.

Information :

*) Present Value Factor = $(1+i)^{-n}$, where i (ROR)=12% ; i is the interest Indonesian central of Bank, n = year.

**) Net Social Gain (NSG) product with Present Value Factor.

Table III.14 Net social gain (NSG) projections to Northern District of Aceh

Year	NSG At Current Prices	Output Value (IDR)	n *)	i *) (%)	PVF *)	PV-NSG **) (IDR)	PV-Output **) (IDR)	NGC-PV ***)	
2015	72.123.680.173	1.075.855.200.000	1	12	1,1200	80.778.521.794	1.204.957.824.000	0,06704	(6,70%)
2016	75.039.995.175	1.434.473.600.000	2	12	1,2544	94.130.169.948	1.799.403.683.840	0,05231	(5,23%)
2017	77.976.937.482	1.793.092.000.000	3	12	1,4049	109.551.982.823	2.519.165.157.376	0,04349	(4,35%)
2018	80.918.687.800	2.151.710.400.000	4	12	1,5735	127.327.121.839	3.385.757.971.513	0,03761	(3,76%)
2019	83.881.351.092	2.510.328.800.000	5	12	1,7623	147.827.601.473	4.424.057.082.777	0,03341	(3,34%)
2020	84.135.364.684	2.510.328.800.000	6	12	1,9738	166.068.291.440	4.954.943.932.711	0,03352	(3,35%)
2021	84.408.257.604	2.510.328.800.000	7	12	2,2107	186.599.765.717	5.549.537.204.636	0,03362	(3,36%)
2022	84.707.116.895	2.510.328.800.000	8	12	2,4760	209.731.702.202	6.215.481.669.192	0,03374	(3,37%)
2023	85.025.592.841	2.510.328.800.000	9	12	2,7731	235.782.665.347	6.961.339.469.495	0,03387	(3,39%)
2024	85.376.836.221	2.510.328.800.000	10	12	3,1058	265.167.493.811	7.796.700.205.835	0,03401	(3,40%)
2025	85.764.845.848	2.510.328.800.000	11	12	3,4785	298.337.303.954	8.732.304.230.535	0,03416	(3,42%)
2026	86.174.867.394	2.510.328.800.000	12	12	3,8960	335.735.214.528	9.780.180.738.199	0,03433	(3,43%)
2027	86.628.920.660	2.510.328.800.000	13	12	4,3635	378.004.698.570	10.953.802.426.783	0,03451	(3,45%)
2028	87.131.691.554	2.510.328.800.000	14	12	4,8871	425.822.360.211	12.268.258.717.997	0,03471	(3,47%)
2029	87.686.912.110	2.510.328.800.000	15	12	5,4736	479.960.079.660	13.740.449.764.157	0,03493	(3,49%)
2030	88.292.866.367	2.510.328.800.000	16	12	6,1304	541.270.027.349	15.389.303.735.856	0,03517	(3,52%)
2031	88.972.486.020	2.510.328.800.000	17	12	6,8660	610.888.726.957	17.236.020.184.158	0,03544	(3,54%)
2032	89.708.847.200	2.510.328.800.000	18	12	7,6900	689.857.966.479	19.304.342.606.257	0,03574	(3,57%)
2033	90.521.938.264	2.510.328.800.000	19	12	8,6128	779.643.882.023	21.620.863.719.008	0,03606	(3,61%)
2034	91.439.272.075	2.510.328.800.000	20	12	9,6463	882.050.018.671	24.215.367.365.289	0,03643	(3,64%)
								0,03770	(3,77%)

Source : Derived from the calculation of the Net Social Gain (NSG) in 2015-2034.

Information :

*) $PVF = (1+i)^n$; i is interest Indonesian central of Bank and n = year.

**) PV NSG and PV Output is the product of PVF with the NSG and the current price or value of the output.

***) PVF NGC is the quotient between the PV-NSG with PV-output value.

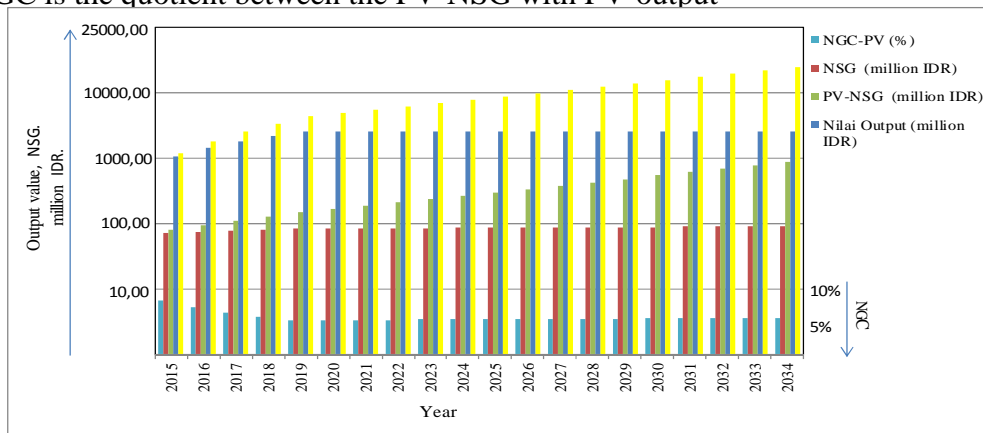


Figure 11. Graph of the Net Social Gain (NSG) regional Northern District of Aceh

CONCLUSION

Economic analysis of post production plant utilizing the Arun LNG receiving terminal and regasification as demonstrate that the project is economically feasible and may provide benefit based on eligibility parameters that have been calculated as follows :

scenario 1

Net present Value of US\$ 831.564 million, Internal Rate Of Return 19 %, B/C ratio of 4 and Payback Period falling in Year 5 Months to 6

scenario 2

Net present Value of US\$ 799.922 million, Internal Rate Of Return 17 %, B/C ratio of 4 and Payback Period falling in Year 5 Months to 10.

scenario 3

Net present Value of US\$ 767.832 million, Internal Rate Of Return 16 %, B/C ratio of 4 and Payback Period falling in Year 6 Months to 1. With the cost of regasification and used the toll fee of US\$ 1.74 and the uncertainty of 5% as well as LNG supply coming in the first year amounted to 150 MMSCFD, in the second year increased by 200 MMSCFD, the third year of 250 MMSCFD and in the fourth year of 300 MMSCFD to 350 MMSCFD constant when it reaches the fifth year until the end of the operation .

Judging from the economic aspect, the presence of PT. Arun as a multinational company that produces oil and gas is processed into LNG in North Aceh district can provide benefits for regional development, the presence of PT. Arun has significant impact on the economy of the North Aceh district, reflected in the number of regional gross domestic product (GRDP) North Aceh at constant prices of 1975, 1983, 1993, and 2000 in the span of years from 1978 to 2005 with the mining of oil and gas has increased from IDR 120 billion in 1978 to IDR 7.79 billion in 2005 with an average growth rate of 26%. Per year, whereas the period of 2006-2012 in base year of 2000 constant price decreased from IDR 7.68 trillion in 2006 to IDR 4.32 billion in the year 2012 with an average growth rate of negative (-9%). This is due to the depletion of oil and gas reserves Arun, and therefore contributes to the amount of production.

In the period 2015-2034 with projections Arun LNG refinery utilization contributed to the GRDP of North Aceh Regency (base on 2000 constant price) in 2015 amounted to IDR 1,081 trillion increase to IDR 2.651 billion in 2034 with growth rate of 16% per year.

When linked with the rate of change in GRDP (ΔY) with utilization of Arun LNG plant, then known projected investment and employment opportunities to the formation of GRDP per year. In 2016 the employment generation (ΔN) of 84477 people or 5,280 people a 1.0% increase in GRDP. Subsequently in 2034 decreased by 5,277 people or 330 people per 1.0% increase in GRDP.

In the projection of the value of labor (ΔL) average of IDR 138.49 billion with employment opportunities (ΔN) by an average of 18 411 people or 1,153 people a 1.0% increase in GRDP. The level of investment in 2016 amounted to IDR 202.60 billion decreased to IDR 1.10 trillion in 2020, later than in 2021 increased by IDR 1.32 trillion to IDR 12.66 trillion in 2034. With the change in investment during the years 2015-2034 an average of IDR 46.54 trillion per year.

Based on the study, the relative decline in labor productivity growth, this is due to the growth of labor is higher than the growth of capital and capital productivity would otherwise rise. The level of labor productivity in the comparative capital-labor $Y/L = 2,318$ in 2015 to $Y/L = 969$ in 2034 and $Y/K = 2348$ decreased to $Y/K = 759$ in 2034.

NSG approach at current prices, demonstrate the benefits of North Aceh district during the period 2015-2034 reached IDR 72.12 billion with a net gain coefficient (NGC) of 6.70% in 2015 to increase the nominal value in 2034 of IDR NGC = 91.44 billion, or 3.64%, NGC caused by declining output value is greater than the value of the NSG and the year to 5 s/d 20 has a constant output value, while the value of the NSG have continued to rise up to 20 years. The average value of the net gain coefficient (NGC) the period of 3.77% per year.

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