User Guide
For Industry Sector

Indonesia 2050 Pathway Calculator

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1. General Description of Industry sector

In Indonesia 2050 Pathway Calculator, industry sector includes non-oil and gas manufacturing industry sector which consist of (i) food, beverages and tobacco industries, (ii) textile, leather, products and footwear industries, (iii) wood and other products industries, (iv) paper and printing products industries, (v) fertilizers, chemical and rubber products industries, (vi) cement and non-metallic quarry products industries, (vii) iron, steel, and basic metal industries, (viii) transport equipment, machinery and apparatus industries, (ix) other manufacturing products. Data from Central Statistics Agency (Badan Pusat Statistik/BPS) shows that the growth of non-oil and gas manufacturing industry sector always increases from year 2004 to2012 (Table 1).

Table 1. Gross domestic product (GDP) based on constant price 2000 by industrial origin

Year	Industrial GDP (Billion Rupiah)
2004	418368.5
2005	442902.6
2006	466249.1
2007	490261.6
2008	510101.7
2009	523167.6
2010	549935.6
2011	587024.1

Source: Central Statistics Agency[1]

The industry sector of non-oil and gas manufacturing was the sector that has the largest contribution to boost the national economic growth for between 2008 and2013 (Table 2). In addition, the comparison of economic growth and non- oil and gas manufacturing can be seen in Figure 1.

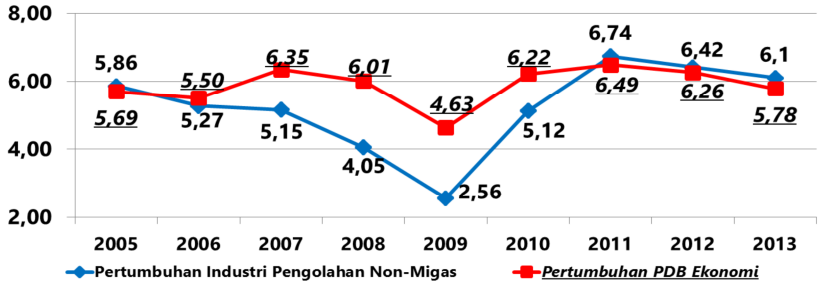


Figure 1. Comparison of economic growth and non- oil and gas manufacturing industry sector
Source: BPS, Processed by Ministry of Industry

[1] http://www.bps.go.id/tab_sub/view.php?kat=2&tabel=1&daftar=1&id_subyek=11&notab=3

Table 2. Sectoral GDP value and Its contribution to national GDP

Industrial Origin	2008		2009		2010		2011		2012		2013	
	V (Rp trillion)	C (%)	V (Rp trillion)	C (%)	V (Rp trillion)	C (%)	V (Rp. trillion)	C (%)	V (Rp trillion)	C (%)	V (Rp trillion)	C (%)
1. AGRICULTURE, LIVESTOCK, FORESTRY AND FISHERY	716,65	14,48	857,19	15,29	985,44	15,31	1.091,45	14,71	1.193,45	14,50	1.311,03	14,43
2. MINING AND QUARRYING	541,33	10,94	592,06	10,56	718,13	11,16	876,98	11,82	970,82	11,80	1.020,77	11,24
3. MANUFACTURING INDUSTRY	1.376,44	27,81	1.477,54	26,36	1.595,78	24,79	1.806,14	24,34	1.972,52	23,97	2.152,59	23,70
a. Oil and Gas Manufacturing Industry	237,77	4,80	209,84	3,74	211,14	3,28	253,08	3,41	254,55	3,09	266,79	2,94
b. Non-Oil and Gas Manufacturing Industry	**1.138,67**	**23,01**	**1.267,70**	**22,61**	**1.384,64**	**21,51**	**1.553,06**	**20,93**	**1.717,96**	**20,88**	**1.885,80**	**20,76**
4. ELECTRICITY, GAS, AND WATER SUPPLY	40,88	0,83	46,68	0,83	49,12	0,76	55,88	0,75	62,23	0,76	70,07	0,77
5. CONSTRUCTION	419,71	8,48	555,19	9,90	660,89	10,27	753,55	10,16	844,09	10,26	907,26	9,99
6. TRADE, HOTEL AND RESTAURANTS	691,48	13,97	744,51	13,28	882,48	13,71	1.023,72	13,80	1.148,69	13,96	1.301,50	14,33
7. TRANSPORT AND COMMUNICATION	312,19	6,31	353,74	6,31	423,16	6,57	491,28	6,62	549,10	6,67	636,88	7,01
8. FINANCE, REAL ESTATE AND BUSINESS SERVICE	368,13	7,44	405,16	7,23	466,56	7,25	535.15	7,21	598,52	7,27	683,01	7,52
9. SERVICES	481,84	9,74	574,11	10,24	654,68	10,17	785.01	10,58	888,99	10,81	1.000,82	11,02
GROSS DOMESTIC PRODUCT	**4.948,68**	**100,00**	**5.606,20**	**100,00**	**6.436,27**	**100,00**	**7.419,18**	**100,00**	**8.229,44**	**100,00**	**9.083,97**	**100,00**

V = Value; C = Contribution

Source: BPS, Processed by Ministry of Industry

National Industrial Policy

National industrial policy has been regulated under Presidential Regulation No. 28/2008. The regulation mention that national industrial policy includes the architecture of national industry, the national industrial development strategy and government facilities. Under the attachment of the regulation, in 2025, the national industry is expected to have the following characteristics:

- Indonesia's Manufacturing industry has been considered as the world-class industry
- The potential of growth and strong structure as well as economic prime mover
- Balance and equitable ability of enterprise in each scale
- High role and contribution to national economic
- Industrial structure of the various aspects to support sustainable development

The architecture of national industry in 2025 is composed of manufacturing industry and future leading industry (Figure 2). In order to achieve the architecture of national industry, the vision of national industry development in the long term is to lead Indonesia towards" a strong industrial country in the world".

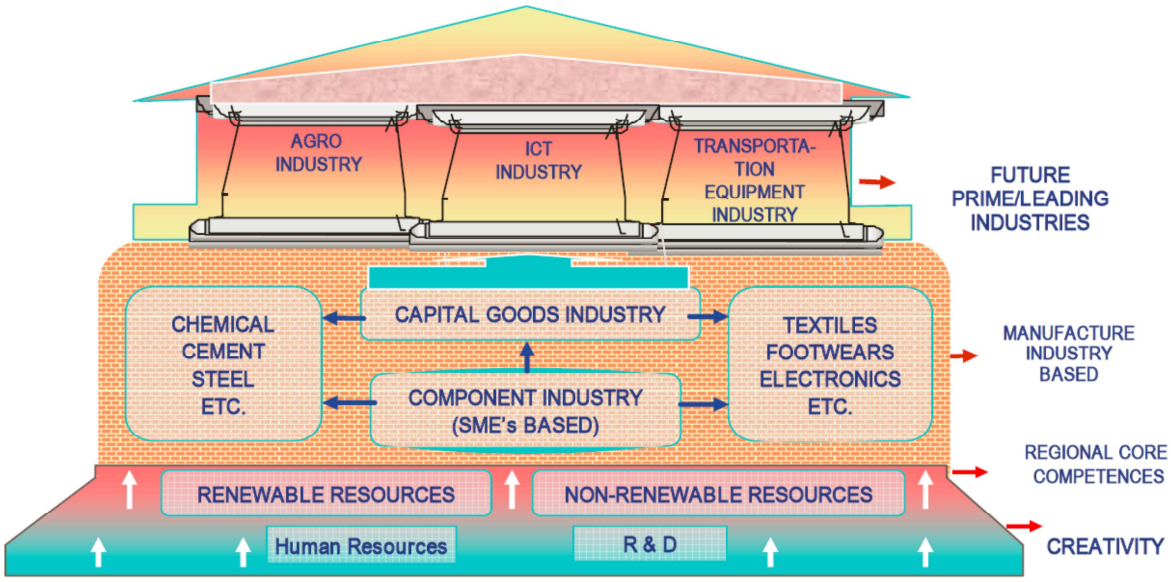


Figure 2. Architecture of national industry

Source: Presidential Regulation No. 28/2008 on National Industrial Policy

Further, in the long term, industry development is aimed at strengthening, deepening and growing the priority industry cluster group as follows:

- Manufacturing industrial base:
    1. Basic material industry consists of (a) iron and steel industry, (b) cement industry, (c) petrochemical industry, (d) ceramic industry.
    2. Machinery industry includes (a) electrical equipment and electrical machinery industry, (b) machinery and general equipment industry.
    3. The labor-intensive manufacturing industry, which produces clothing, food, building material, health, medicine and so forth which include (a) textile industry and textile product, (b) footwear industry, (c) pharmaceutical industry that utilizes domestic raw materials. .
- Agro industry group : (a) palm oil industry, (b) rubber and rubber goods industry, (c) cocoa and chocolate industry, (d) coconut industry, (e) coffee industry, (f) sugar industry, (g) tobacco industry, (h) fruit industry, (i) timber and timber goods industry, (j) fishery and marine industry, (k) pulp and paper industry, (l) milk processing industry.
- Transportation equipment industry: (a) motor vehicle industry, (b) shipping industry, (c) aviation industry, (d) railway industry.
- Electronic and telematics industry include electronic industry, telecommunication hardware industry and its supporters, broadcasting industry and its supporters, computer industry and

its equipment, software industry and content multimedia, creative information technology and communication industry.

- Industry group supporting creative industries and special creative industry including software industry and content multimedia, fashion and craft art.
- Particular small and medium industry which includes processing industry: precious and jewelry industry, folk salt industry, pottery and decorative ceramics industry, essential oil industry and snack food industry.

Industrial development in the long term has a goal to build industry sector that applies the sustainable development concept, which is based on three aspects: economic development, social development and environment. Meanwhile, the objectives of national industrial policy are:

1. Revitalize the industry sector and increase its role in national economy
2. Build the structure of domestic industry in accordance with national priorities and local competence
3. Improve the ability of small and medium industry to be more balance with large-scale industry
4. Encourage the growth of industry outside Java island
5. Create the policy synergy of other development sectors in supporting the development of national industry

Industry sector that continues to evolve needs energy to support its growth. In Handbook of Energy and Economics Statistics of Indonesia, 2012 the industry sector is the largest final energy user (Table 3). Based on Table 3, the energy use in industry sector in 2012 reached 347,137,979 BOE (barrels of oil equivalents), slightly lower than the previous year which reached 359,681,662 BOE.

Table 3. ***Final energy consumption by sector -including biomass (BOE)***

Year	Industry	Household	Commercial	Transport	Others	*Non Energy Utilization*	*Final Energy Consumption*
2000	251,895,942	296,573,110	20,670,389	139,178,658	29,213,878	40,393,109	777,925,086
2001	252,158,714	301,347,223	21,449,843	148,259,584	30,585,607	48,524,092	802,325,064
2002	245,108,900	303,032,794	21,752,300	151,498,823	29,998,546	48,534,290	799,925,653
2003	275,308,517	309,046,165	22,397,122	156,232,909	28,445,436	48,317,775	839,747,924
2004	263,294,377	314,114,684	25,412,327	178,374,391	31,689,809	62,375,806	875,261,394
2005	262,686,505	313,772,025	26,234,764	178,452,407	29,102,166	54,352,999	864,600,867
2006	280,187,757	312,715,871	26,194,683	170,127,492	25,936,873	64,990,106	880,152,782
2007	300,675,120	319,333,000	27,896,499	179,144,177	24,912,051	64,759,190	916,720,038

2008	309,872,959	316,802,419	29,273,897	196,941,689	25,855,949	73,847,398	952,594,312
2009	297,271,113	317,055,653	30,848,294	224,883,086	27,186,782	84,096,759	981,341,686
2010	355,412,885	310,548,074	33,122,376	255,568,629	28,743,347	84,146,777	1,067,542,087
2011	359,681,662	323,355,711	34,077,153	277,404,656	24,816,386	98,412,712	1,117,748,281
2012	347,137,979	331,064,124	35,387,749	310,619,967	26,073,231	110,315,674	1,160,598,724

Source: Handbook of Energy & Economic Statistics of Indonesia, 2012

Energy consumption in the industry sector in 2011 was dominated by the use of coal. Based on Handbook of Energy and Economic Statistics of Indonesia 2012, to the amount of energy used in industry sector was 144,567,000 BOE. The use of various type of energy in the industry sector can be seen in Table 4.

Table 4. ***Energy consumption in Industry sector (thousand boe)***

Tahun	Biomass	Coal	Briquette	Gas	LPG	Kerosene	ADO	IDO	FO	Other petroleum product	Electricity	Total
2000	58,981	36,060	85	86,826	1,073	4,219	37,171	8,008	25,581	13,435	20,850	292,289
2001	55,186	37,021	78	81,861	972	4,160	39,458	7,735	26,680	25,712	21,819	300,683
2002	52,305	38,698	83	80,508	1,093	3,955	38,828	7,311	25,596	22,688	22,578	293,643
2003	50,167	68,264	77	89,912	808	3,980	37,398	6,358	20,756	23,533	22,373	323,626
2004	46,917	55,344	80	85,076	1,101	4,012	42,986	5,862	21,859	37,716	24,719	325,670
2005	43,920	65,744	94	86,277	1,131	3,851	39,929	4,843	15,617	29,614	26,021	317,040
2006	46,676	89,043	94	82,845	1,453	3,394	35,027	2,627	16,154	41,126	26,736	345,178
2007	42,108	121,904	89	79,723	1,242	3,352	33,787	1,422	13,856	39,873	28,077	365,434
2008	44,235	94,035	155	101,668	1,124	2,676	37,206	849	9,961	16,658	29,405	337,972
2009	44,521	82,587	220	117,535	588	1,619	41,193	735	8,384	55,663	28,323	381,368
2010	43,318	136,820	49	114,111	655	964	43,228	889	12,521	55,765	31,254	439,573
2011	43,733	144,567	66	119,649	608	672	36,509	655	8,115	69,978	33,547	458,100

Sumber: Handbook of Energy & Economic Statistics of Indonesia, 2012

Energy Efficiency Activities in Industry Sector

Based on study from De Keulenaer, et al (2004) and Xenergy (1998) within Worrel, et al report (2008), approximately 65% of electricity consumed by industry sector is used for motor system. The efficiency of motor-driven systems can be increased by reducing losses in the motor windings, using better magnetic steel, improving the aerodynamics of the motor and improving manufacturing tolerances. However, maximizing efficiency requires precise component size, improving the efficiency of end-use equipment (pumps, fans, etc.), reducing electrical and mechanical transmission losses and the use of proper operation and maintenance procedures. The implementation of high-efficiency motor-driven systems of the improvement of existing ones in the EU-25 could save about 30% of the energy consumption of up to 202 TWh/year (De Keulenaer, et al, 2004) and over 100 TWh/year by 2010 in the USA (Xenergy 1998). Further, IEA (2006) within Worrel et al report (2008) estimates that steam generation consumes about 15% of global final industrial energy. Steam boiler efficiency can reach 85% through general maintenance, improved insulation, combustion controls and leak repair improved steam traps and condensate recovery. In addition, studies in USA show

that the opportunities of energy efficiency with economically attractive potentials of up to 18-20% (Einstein, et al, 2001; US DOE 2002). According to Ponudura, et al within United Nations report (2005), energy efficiency measures could be in the form of “efficiency retrofits”, where an existing installation are improved by replacing inefficient components with energy-efficient components. Investments in energy efficiency activities can be done at the design and planning stages of new plants. Furthermore, to promote energy conservation or efficient energy use, there are a number of level activities that can be made:

a. In-house management of energy efficiency through maintenance and housekeeping measures with minimal investments or without investment, namely:
    - Establishment of in-house energy management committees
    - Designation of energy managers
    - Data collection
    - Improved maintenance
    - Safety issues
    - Review of operational efficiency
b. Replacement of selected equipment requiring medium-sized investments:
    - Improved waste heat recovery
    - Combustion control of furnaces
    - Co-generation of electricity and process heat
    - Improvement of heat exchangers
c. Modification of entire manufacturing processes, which may requires large-scale investments:
    - Installation or improvements in advanced process controls
    - Installation of gas pressure recovery generators (in the iron and steel industry)
    - Installation of waste heat recovery generators (in the cement industry)
    - Change from “wet” to “dry” process (in the cement industry)

The Indonesian government has already issued a regulation on energy conservation under government regulation No. 70/2009. The regulation stipulates that energy utilization by energy sources user and energy must be performed sparingly and efficiently. Meanwhile, the energy users who consume more than or equal to 6,000 ton oil equivalent (TOE) per year are required to perform energy conservation through energy management. Energy management could be performed by:

- Appointing the energy manager
- Developing the energy conservation program

- Conducting energy audit periodically
- Implementing the recommendation provided in the energy audit result
- Reporting energy conservation implementation every year to the minister, governor or regent in accordance with their authorities respectively.

In the case of energy efficient technology application, as such will be performed through standardization and labeling on energy utilizing equipment. Energy efficiency labeling is done by the manufacturer and importer of energy utilizing equipment. In addition, the government regulation No. 70/2009 also states that the government provides incentives (tax facilities, reduction, relief and exemptions for local tax, low interest rate for investment) to energy users and energy efficient producers. In addition, the government also provides incentives for the energy users through energy audit under partnership program.

2. Methodology

Energy consumption in industry sector is calculated based on the following equation:

Energy Consumption = Activities x Energy Intensity

Activities in industry sector are represented by the GDP growth of the sector which is expressed in GDP rupiah, meanwhile, energy intensity is stated in BOE/ GDP Rupiah per year. The determination of assumptions in one pagers and the parameter that influence the energy consumption projection until 2050 is developed based on expert judgment.

3. Assumptions in Industry sector

In I2050PC, the model structure of industry sector consists of industrial growth, energy intensity (Table 5) and fuel mix (Figure 4). These figures below were obtained based on expert judgment and the result of the discussion with I2050PC team.

Table 5. Scenario in each level

Structure	***Trajectory/Leveling***	***Average of Industrial Growth 2011-2050***
Industrial Growth	Level 1	5.63 %
	Level 2	6.28 %
	Level 3	7.28%
	Level 4	8.12%
Structure	***Trajectory/Leveling***	***Energy Intensity Reduction in 2050***
Energy Intensity	Level 1	5%

	Level 2	10%
	Level 3	25%
	Level 4	30%

Source: Result of Indonesia 2050 Calculator team's internal discussion and stakeholder consultation

The average value at each level of industrial growth is obtained by dividing the trend of industrial growth into several periods. Initially, theI2050PC team has tried to create the industrial growth trend as a linear growth function, yet the team later perceived that the industrial growth trend from the base year to 2050 will not always form a linear pattern for the scenarios of Level 1-4. This is caused by the industrial growth that will eventually reach its saturation point and then slow down. According to the team, the growth of industry sector for each period in each scenario level is presented as follow:

Table 6. Assumptions to obtain the industrial growth average in each Level

	Year 2011	**Year 2012-2035**	**Year 2026-2035**	**Year 2036-2050**	**Growth Average**
Level 1	6.74%	5.25%	5.5%	6%	5.63%
Level 2	6.74%	5.5%	6.25%	7%	6.28%
Level 3	6.74%	6.75%	7%	8%	7.28%
Level 4	6.74%	7%	10%	8%	8.12%

Source: I2050PC Team's Internal Discussion

Industrial growth within level will be affected by a number of things, among others a better Indonesian economic, the availability of infrastructure, raw materials supply, industrial value added, market share increases in domestic and abroad. In addition, the concentration of industrial growth not only based in Java islands but also outside Java islands as well as strengthening, deepening, and growing of six priorities industrial clusters. Based on information in the ministry of industry's strategic plan 2010-2014, 75% of GDP will be contributed from industries in Java and the remaining from outside Java and Bali (Figure 3). This happens due to the spread of industry that is still concentrated in Java. In the future, the distribution of industry is expected not only to concentrate in Java but also outside Java, at provincial and also district level.

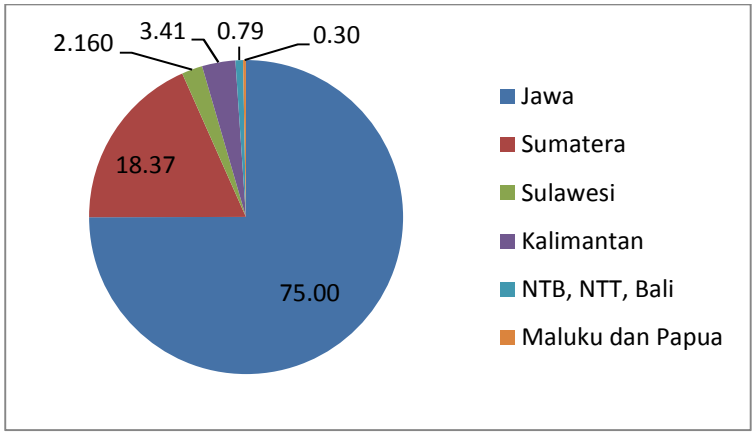
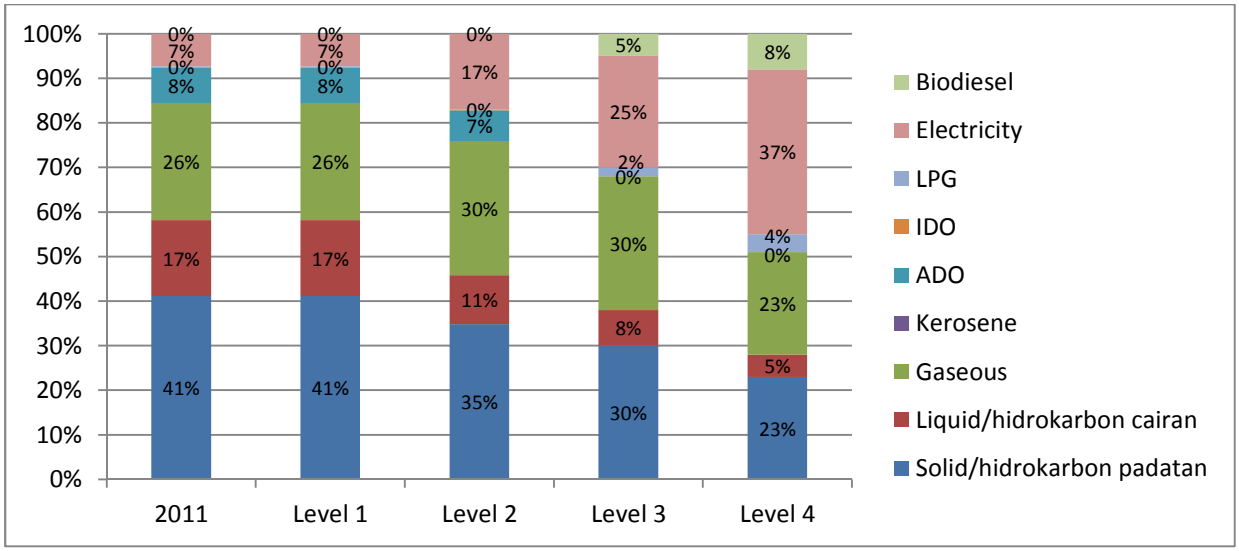


Figure 3. Area share on industry sector's GDP in Indonesia
Source: Ministry of Industry, 2011

Meanwhile, based on Table 5, the highest energy intensity reduction that can be achieved is 30%, the figures is based on the inputs from stakeholders and presentation materials from MEMR (2014) which stated that the energy conservation potential of industry sector is 30%, while the energy conservation target in 2025 is 17%. If the saving target is set to 30% or higher, it will be hard for the industry sector to comply since it will require a big investment cost to replace industrial machines. Further, Rajaminkam et al in their report, states that several recent studies estimates a potential energy saving as much as 30, 40, or even 50 per cent in industry sector.. However, not all energy savings measures which are technically visible are economically viable.[2] In terms of energy mix, the trend of fuel mix in 2050 by the largest share is electricity, hydrocarbon gas, solid hydrocarbon (biomass and coal), respectively. Energy use in the future will be dominated by electricity which will in turn reduce the coal consumption. Figure 5 shows the 2025 energy mix projection in industry issued by Ministry of Industry. In the projection, electricity is the type of energy with the highest share.

[2] Ponudurai Rajamanikam and his associates Mr. Thiyagarajan Velumail (UNDP), Ms. Kamala Ernest and Ms. Gayathry Venkiteswaran.



Note: Data in 2011 is sourced from: Handbook of Energy & Economic Statistics of Indonesia, 2012

Figure 4. Assumptions of energy mix projections in 2050

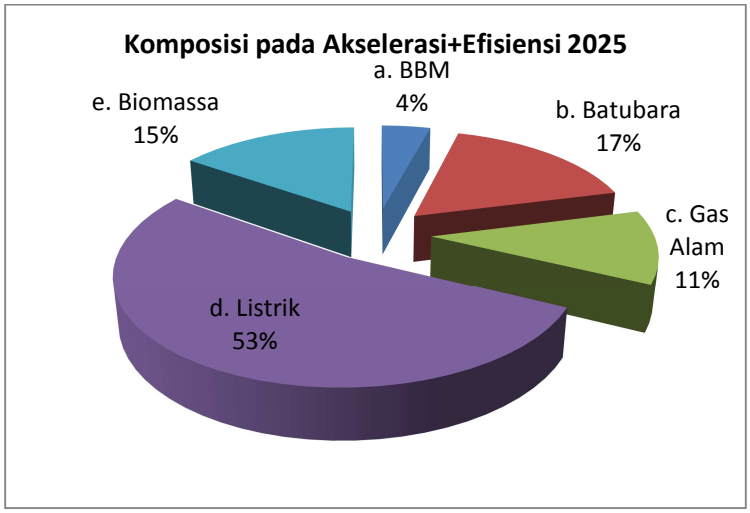


Figure 5. Energy mix projections in industry sector in 2025
Source: Ministry of Industry

Trajectories/One Pagers

A brief description of each level are used in Level 1-4 scenarios for the growth of the industry sector, energy intensity and energy mix is as follows:

I. Industrial Growth

The industry sector is composed of nine sub-sectors, namely (i) food, beverages and tobacco industries, (ii) textile, leather products and footwear industries (iii) wood and other products industries, (iv) paper and printing products industries, (v) fertilizers, chemical and rubber products industries, (vi) cement and non-metallic quarry products industries, (vii) iron and steel basic metal industries, (viii) transport equipment, machinery and apparatus industries, (ix) other manufacturing

products. The growth of the industry sector is divided into 3 periods: 2011-2025, 2026-2035, 2036-2050 period and then the average values for each level of industrial growth are obtained.

Level 1

Level 1 assumes the industry sector in Indonesia will grow at the average of 5.63% during the 2011-2050 periods. This value is slightly higher than the historical growth rate data of the industry sector for 10 years prior to the base year which is 5.25%. Distribution of industrial development is still centered in Java. Infrastructure such as physical facilities and infrastructure (transport, communications, energy) is not sufficiently available. Strengthening, deepening and priority industry cluster growth is not maximized.

Level 2

Level 2 assumes that the industry sector will grow by an average of 6.28% during the 2011-2050 periods. Industrial growth was driven by the manufacturing industry. Infrastructure such as physical facilities and infrastructure (transport, communications, and energy) starting to be available adequately. Distribution of industrial development outside Java begins to take place. The government began to implement policies on promoting added value of domestic commodities. Strengthening, deepening and priority industry cluster growth is manifested and occurred on the basis of industrial manufacturing, including basic materials (iron and steel industry, cement industry, petrochemical industry, ceramic industry).

Level 3

Level 3 assumes the industry sector in Indonesia will grow by an average of 7.28% during the 2011-2050 periods. Indonesia has become the 10th largest economy in the world. Infrastructure such as transportation, communication, energy has been well-developed. The government provides a number of attractive incentives for investors and a conducive environment for industrial investment. Distribution of industrial development has shifted to outside Java and distribution of industrial development began to occur at the provincial level outside Java. Strengthening, deepening and priority industry cluster growth has taken place not only in the basic materials industry but also in labor-intensive manufacturing industry as the producers of clothing, food, building materials, health, medicine and etc.

Level 4

Level 4 assumes an average growth of 8.12% during the period of 2011-2050 in the industry sector. The government has a strong interest to make Indonesia become a strong industrial country. The industry sector is a key driver of the country's economy. Indonesia has become the Strong Industrial Country and a very conducive country to invest in. Infrastructures such as physical facilities (transport, communications, and energy) are available adequately. Program on development of provincial's industrial priority, the development of industry's core competence have been implemented well. At this level, the increase in industrial added value and increase in market share take place in domestic and overseas. In addition, the development of 6 industrial priority clusters (manufacturing industry, agro-industry group, transportation industry group, electronics and telematics industry group, industry groups for supporting the creative industries and particular creative industries, particular small and medium industry) have taken place and the spread of industrial development is not only centralized in Java islands, but also outside of Java, at the provincial level as well as at the district / city level .

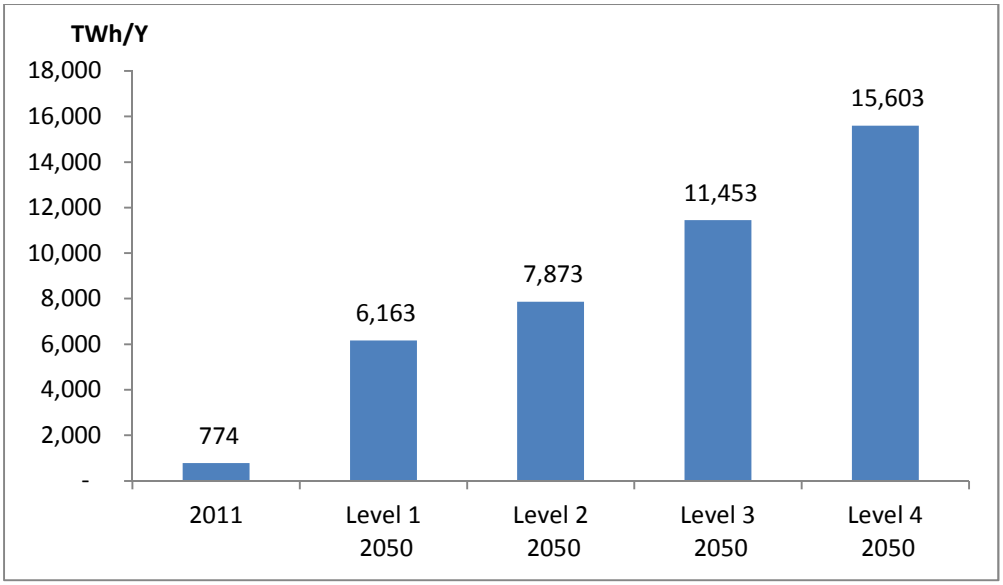


Figure 6. Illustration of energy consumption projection at every level of the industry growth with the assumption of Level 1's energy intensity reduction.

II. Energy Intensity in Industry sector

The industry sector is the largest energy consuming sector in Indonesia in 2011. Energy intensity in the industry sector is defined as the total consumption of energy in an industry divided by the gross domestic product (GDP) of the sector. An increasing use of efficient technology and fuel substitution will result in a decrease in energy intensity in industry sector.

Level 1

Level 1 assumes that energy intensity will decrease by 5% in 2050 in the industry sector compare to the base year. The energy intensity decreases slightly due to the low penetration of efficient technology. This is triggered by the lack of information about energy efficiency to the industry and the unavailability of incentive packages that can attract industry.

Level 2

Level 2 assumes that energy intensity will decrease by 10% in 2050 compare to the base year. Limited energy sources cause industries to think about energy efficiency. The industry sector begins to utilize energy-efficient technology and machine restructuring. Industry sector begins to carry out energy efficiency activities but still limited to low cost energy efficiency activities. Energy management program in industry sector has been started but it is not conducted optimally due to lack of incentives for industry.

Level 3

Level 3 assumes that energy intensity will decrease by 25% in 2050 compare to the base year. Limited energy sources cause the industries to think about energy efficiency. The industry sector utilizes energy-efficient technologies on a greater scale. Energy-efficient equipment investment activities undertaken by the industry, among others improved waste heat recovery, combustion control of furnaces, co-generation of electricity and process heat, and improvement of heat exchangers. Implementation of energy management activities go well along with the incentives in the form of provision of a free energy audit and tax relief for energy utilizing equipment. In addition, ESCO penetration in the industry sector is quite successful.

Level 4

Level 4 assumes that energy intensity will decrease by 30% in 2050 compare to the base year. Limited energy sources cause industries to think about energy efficiency. The industry sector focuses on energy management and utilizes energy efficient technologies. In addition, the industry sector restructures its machinery and substitute fuels to the alternative one for sustainable reason. Such activities are triggered by the obligation for industrial sector to implement energy management, the obligation to use minimum energy performance standards (MEPS) for energy utilizing equipment, the implementation of energy efficient equipment, energy saving labeling and the rise of energy services company (ESCO) for industry sector. Energy efficient equipment investment is undertaken by the industry among others installation or improvements such as motor system efficiency,

advanced process controls, installation of gas pressure recovery generators (in the iron and steel industry), installation of waste heat recovery generators (in the cement industry). Government also actively provides education and consulting services on energy efficiency to industry sector. Incentive schemes in the form of tax breaks, low interest rate for energy efficiency activities receive good responses from industry sector. Disincentives mechanisms in the form of penalty to industry sector which do not conduct the energy management measures have proven to give deterrent effect and encourage the industry to perform energy efficiency.

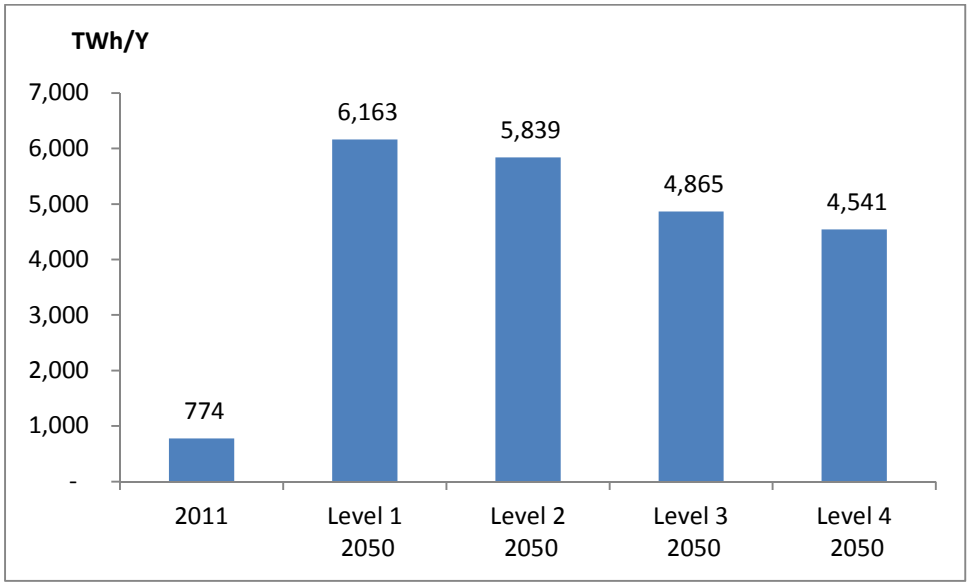


Figure 7. Illustration of energy consumption projection at every level of the energy intensity, with the assumption of Level 1's industrial growth.

III. Energy Mix in Industry sector

In terms of fuel mix in the industry sector, it assumed that there will be a decline in the percentage of solid fuels in 2050. In return, the percentage of electricity, gas will increase and there will be the use of biodiesel. Detail on percentage of fuel for each level is described as follows.

Level 1

Level 1 assumes the energy mix in 2050. Detail on the percentage of fuel for each level is described as follows:

Solid fuels (biomass, coal, and briquette) 41.12%, liquid fuels (FO ,other petroleum) 17.05%, gas 26.12%, kerosene 0.15%, ADO 7.97%, IDO 0.14%, LPG 0.13%, and electricity 7.32%.

Level 2

Level 2 assumes the energy mix in 2050. Detail on the percentage of fuel for each level is described as follows:

Solid fuels (biomass, coal, and briquette) 35%, liquid fuels (FO ,other petroleum) 11%, gas 30%, kerosene 0.15%, ADO 7%, IDO 0.14%, LPG 0.13%, and electricity 17%.

Level 3

Level 3 assumes the energy mix in 2050. Detail on the percentage of fuel for each level is described as follows:

Solid fuels (biomass, coal, and briquette) 30%, liquid fuels (FO ,other petroleum) 8%, gas 30%, kerosene 0.%, ADO 0%, IDO 0%, LPG 2%, electricity 25%,and biodiesel 5%.

Level 4

Level 4 assumes the energy mix in 2050. Detail on the percentage of fuel for each level is described as follows:

Solid fuels (biomass, coal, and briquette) 23%, liquid fuels (FO ,other petroleum) 5%, gas 23%, kerosene 0%, ADO 0%, IDO 0%, LPG 6%, electricity 37% and biodiesel 8%.

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