

ISO 50001 Energy Management System Case Study

2020

Indonesia

PT Petrokimia Gresik

is a fertilizer plant located in Gresik, East Java, Indonesia, which already ISO 50001 certified, the most complete fertilizer company in Indonesia, achieved cost saving USD 3,261,914 through EnMS.



Figure 1. Ammonia Plant 1A of PT Petrokimia Gresik

Organization Profile & Business Case

Company Profile : PT Petrokimia Gresik (PG) as state-owned company under Pupuk Indonesia group was established on July 7, 1972, located in Gresik, East Java, Indonesia. PG has 2 (two) ammonia-urea plants i.e. 1A/1B, 8 (eight) NPK plants, 3 (three) ZA plants, 1 (one) super phosphate plants, 2 (two) ZK plants, 2 (two) sulphuric acid plants, 2 (two) phosphoric acid plants, 2 (two) purified gypsum plants, 1 (one) aluminium fluoride plant, 2 (two) CO₂ liquid plants, 2 (two) HCl plants, and 150 petroganik plants. Since 2015 PG has become the most complete fertilizer company in Indonesia, producing 6.50 million tons of fertilizer and 3.96 million tons of non fertilizer product per year.

EnMS Drivers and Goals :

Core Business Driver

Natural gas price in Indonesia is remarkably higher than

Case Study Snapshot	
Industry	Fertilizer
Product/Service	Ammonia
Location	Plant 1A
Energy management system	ISO 50001
Energy performance improvement period, in years	1 year
Energy Performance Improvement (%) over improvement period	3.16 %
Total energy cost savings over improvement period	USD 3,261,914
Cost to implement EnMS	USD 53,021
Total Energy Savings over improvement period	512,880 GJ
Total CO ₂ -e emission reduction over improvement period	46,583 metric tons

the middle east country, while the current natural gas price at PG is 7.4 USD/mmbtu. In fertilizer industry, energy cost from natural gas is the biggest (up to 60%) production cost factor. Beside that, global ammonia and urea prices are decline through 2016 - 2019 and are



Figure 2. EnMS Implementation Road Map of PG

predicted to continue its trend. This condition is aggravated with the weakening of rupiah – dollar

exchange rate which cause severe loss in company, particularly because PG buys natural gas in dollar and sells some of the products domestically in rupiah in order to meet the requirement of Government’s Public Service Obligation (PSO). In order to survive, production cost reduction is mandatory to be done by all of employee, and focused on natural gas efficiency as the most significant object.

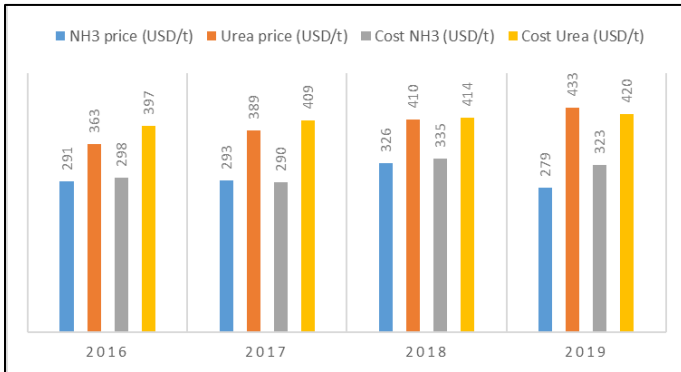


Figure 3. Cost of Good Sold vs Price of Ammonia & Urea

Survival Driver

- Government regulation (PP no. 70/2009) about energy conservation.
- President instruction no. 13/2011 about water and energy conservation.
- Energy & mineral resources regulation no. 14/2012 about energy management.
- Establishing energy efficiency programs.
- Top management’s instruction called “Business Transformation (Shifting Paradigm)” to alter company’s culture about energy, cost, and utilities efficiency.
- To achieve gold-PROPER (National Program for Assessment of Company’s Performance Rating in Environmental Management).
- Integrated system management signed by President Director.

“Energy efficiency should be on the top priority list for our company, it is the fastest, easiest, and cheapest way to save money.”

-Rahmad Pribadi, President Director

Business Benefits

PG initially implemented ISO 50001 at Ammonia 1A plant since December 2018 with total implementation cost USD 53,021 resulting :

Tangible Benefits:

Financial Benefit : Cost saving USD 240,504 calculated based on energy performance gap between actual energy consumption compared to baseline, then can be described in terms of cumulative sum (cusum) shown in Figure 4. Baseline is set using regression method, actual energy consumption (GJ) in 2019 generate linear formula $y=39.31x + 9215$.

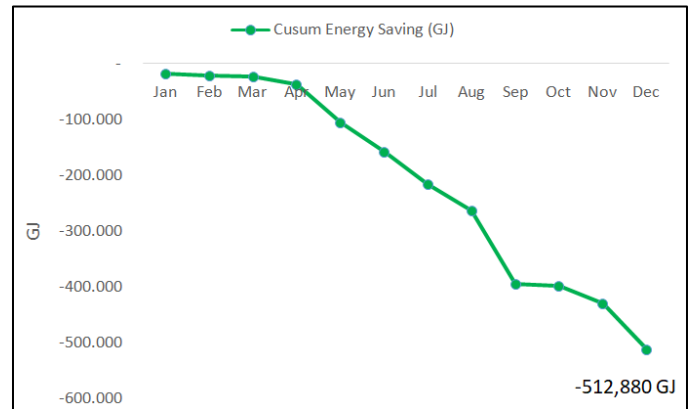


Figure 4. Cusum of Energy Saving Ammonia 1A Plant

Environmental Benefit: CO2 reduction of 46,583 ton, since the main energy source was natural gas, then CO2 reduction calculated based on energy saving (in mmBtu) multiplied by CO2 emission factor 53 kg CO2/mmBtu.

Productivity Benefit: Increasing back end rate 0.2% in ammonia converter lead to product increase 2.7 ton/day resulted from changing rotor air compressor turbine.

Intangible Benefits:

- Improving energy-saving culture showed by company innovation regarding energy efficiency has increased from 117 innovation group in 2018 to 130 innovation group in 2019.

- In 2019, PG has received Green-the 2nd highest award in PROPER assessment out of more than 1000 industry participate in national level.
- Gold – Asia Pasific Stevie Award for innovation and industrial design in 2019.
- Gold winner in International Business reward for large chemical plants in 2019.
- Platinum-the highest category in SNI award 2019.
- In 2019, PG has received 3 diamond, 13 platinum, and 3 gold category in national convention and quality control held in Batam, Indonesia.
- In 2019, PG has received 3 stars (the highest award) in international convention on quality control circle, and also got best impact on transformation category.

Plan

Top Management Commitment: At first Petrokimia Gresik’s top management have already issued energy policy stated in Integrated Management System (IMS) point no. 8 “doing sustainable energy conservation particularly on energy efficiency”, and board of director thought that this IMS would be more comprehensive by implementing EnMS ISO 50001.

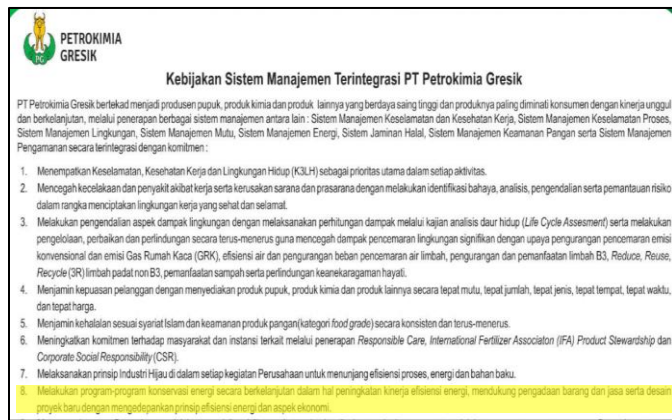


Figure 5. Integrated Management System

Certifying to ISO 50001 may require significant time and resources. The largest investment is in staff time and expertise, which is required to implement all the provisions of the standard. This includes establishing policies regarding energy management. A strong and obvious commitment from top management will be

required to provide the guidance needed in order for the staff to understand the importance of the standard to the organization.

During the implementation of ISO 50001 in 2018, top management has committed to provide necessary resources in term of budget totaling of USD 500,000. Top management appoints dedicated implementation team and facilitates them with sufficient training programs to ensure good competency.

Energy Review, Baseline, and EnPI : PG has real-time online monitoring data in Ammonia 1A Plant for a basis to analyze and identify SEU (Significant Energy User) such as energy of process, energy of primary reformer, energy of steam, and energy of electricity. Baseline period was set for 1 year operation after annual maintenance, considered as the best plant performance.

Plant	SEU	Driver	Baseline	R2	EnPI
Ammonia 1A	Primary Reformer	Ammonia Product	y = 39.31x + 9215	0.995	GJ
	Package Boiler				
	Cooling Tower Fan				

Figure 6. Baseline and EnPI

Objective & target : 3% energy saving target equivalent to USD 3,096,869 by 2019 was the priority according to long term corporate plan that stated in “Long Term Corporate Energy Planning Document” with target in 2020 Urea 1A Plant are implemented EnMS based on ISO 50001.

Eco List and Action Plan: The Energy Conservation Opportunity (ECO) list was identified from internal energy audit and Focus Group Discussion (FGD). ECO list will be classified into operational (no cost), investment, and turn around. Operational ECO list directly turned into action plan program. Investment and turn around ECO list will be an action plan programs through risk management scoring.

ECO NAME	DESCRIPTION
Ernine Varipulse	Breaker and motor circuit modification to save energy on demin pump P-20218
Mekamon	Sealing system modification to increase boiler feed water pump efficiency P-2203
Libero Pantem	Modification of pressure transmitter at ammonia exchanger EA-203 to decrease electricity consumption
Zasui	Modification of line spool for cleaning oil cooler gas turbine generator to decrease downtime from 2 days into 2 hours

Figure 7. Example of ECO List Data

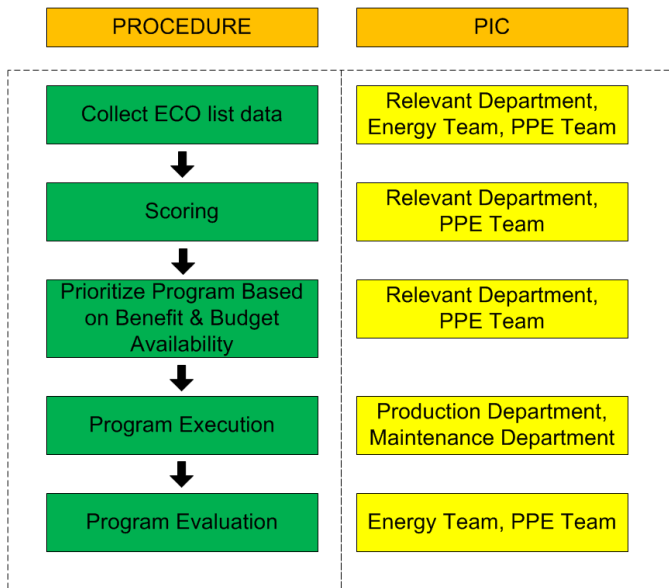


Figure 8. Risk Management Scoring Procedure

“ISO 50001 implementation will be a great chance for our company to save money by saving energy consumption.”

—I Ketut Rusnaya, Production Director

Do, Check, Act

Implementation Action Plan: The following are the top programs that have been implemented:

No	Energy Performance Improvement Program at Ammonia 1A Plant	2018		2019	
		Cost (USD)	Saving (USD)	Cost (USD)	Saving (USD)
<i>Operasional Program (no cost)</i>					
1	Reduce oxygen excess in Reformer flue gas from 2% to 1,5%	-	15.643	-	19.282
2	Reduce temperature outlet Primary Reformer from 810 degC to 790degC	-	-	-	377.143
<i>Investment Program</i>					
1	Modification of purge gas line to boiler	-	-	7.143	1.428.993
2	Catalyst replacement at HTS, LTS, and Primary Reformer using high efficiency catalyst	433.620	130.086	1.099.828	659.897
3	Enlarge ammonia pipeline from 3" to 4"	-	-	285.714	392.857
<i>Turn Around Program</i>					
1	Rotor Air Compressor turbin replacement	-	-	257.143	822.857
2	Mol Sieve 4A replacement	18.788	7.515	-	9.770
Total		452.408	153.244	1.649.828	3.710.799

Figure 9. Energy Improvement Program 2018-2019 at Ammonia 1A Plant

PG has an annual event on Q1 current year named “PG Innovation Convention” which is held to appreciate and

give reward to employee particularly in energy improvement innovation. Several selected innovations were given opportunity to be published. During 2018-2019, 19 innovation group awarded nationally (3 diamond, 13 platinum and 3 gold) and 4 innovation group were appreciated 3 stars (the highest award in global level) and also best impact on transformation.

Design and Procurement: One of the best investment (in terms of saving and cost) to improve energy performance was the modification of purge gas line to boiler which costs pretty low, only 1% of total improvement cost in 2018-2019 resulted greatest impact on energy saving of 0.9 GJ/ton product.

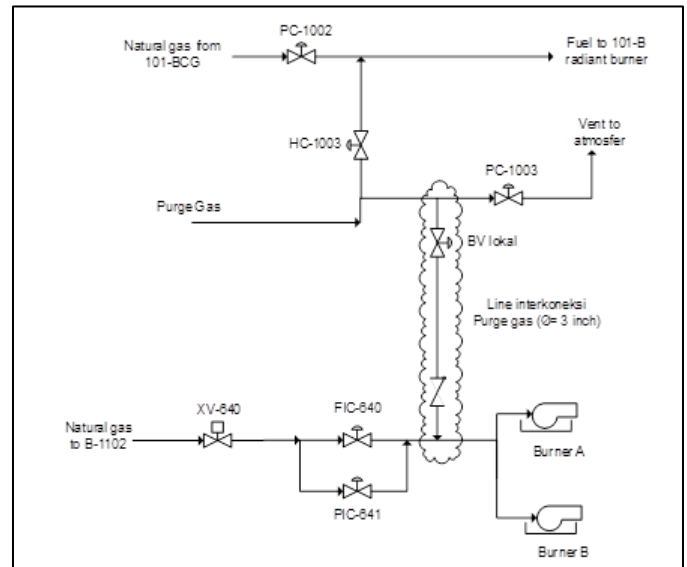


Figure 10. Modification of Purge Gas Line to Boiler

Beside that, PG has replaced its catalyst in Primary Reformer, High Temperature Shift Converter, and Low Temperature Shift Converter using high efficiency catalyst to achieve energy reduction up to 0,4 GJ/ton product.

Furthermore, PG has also 2 main programs during turn around period in 2018-2019, replacing rotor of air compressor turbine which yield energy reduction up to 0,6 GJ/ton product and molecular sieve type 4A replacement which grant energy reduction up to 0,13 GJ/ton product.

Capacity Building: To fulfill the competency requirement of the team, 22 personnel were trained well. Petrokimia

Gresik has 4 (four) nationally certified energy manager and 4 (four) energy auditor respectively.

Monitoring Measurement Plan: Energy team has prepared monitoring measurement plan to ensure energy performance improvement.

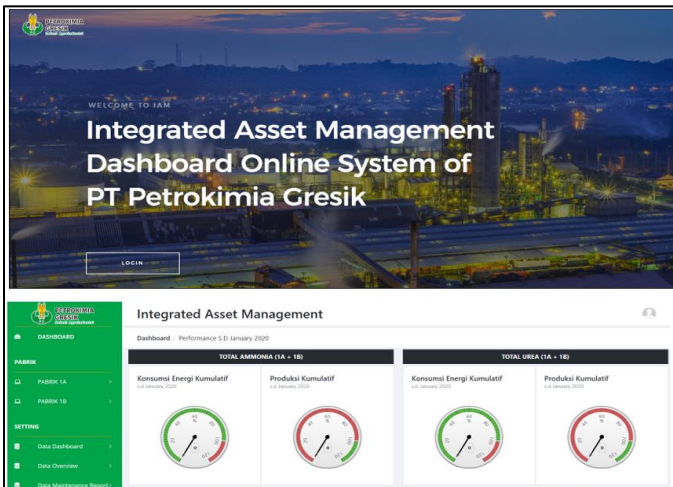


Figure 11. SEU Online Monitoring

For operational control, PG has been implementing industry 4.0 concept where the critical parameter were integrated to DCS (Distributed Control System) and internal website www.digifert.petrokimia-gresik.com. Critical parameter also known as Key Operating Parameter (KOP) was set in threshold limit and connected to alarm to warn SEU operator to response based on operating procedure.

For objective target accomplishment, operational data from DCS is compared to daily baseline equations to get energy efficiency improvement as shown in Figure 12. In 2019 PG has reached 3.16% on energy efficiency and satisfy the top management.

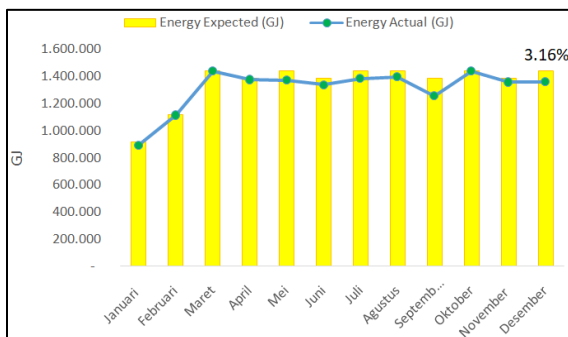


Figure 12. Energy Efficiency Improvement 2019

Verification and Validation: Petrokimia Gresik has no issue related to equipment calibration since PG was certified ISO 17025. The monitoring measurement plan is verified by internal nationally certified energy manager and energy auditor and to be validated by top management. Energy performance is daily reported to Pupuk Indonesia group and yearly reported to government via POME (Online Energy Management Reporting System).

Internal Audit and Management Review: Internal audit was performed annually by internal certified auditor while annually Management Review is lead by Board of Director.

Transparency

Petrokimia Gresik publishes achievements related to energy efficiency and the success story of ISO 50001 implementation through following media :

Internal Organization:

- Internal web portal (km.petrointernal.net)
- Internal magazine “GEMA”

External Organization:

- Videotrons located at PG neighborhood
- Banner located at PG neighborhood
- Official instagram PG

Regarding energy efficiency performance verification, Petrokimia Gresik as state-owned company reported the confidential data to :

1. Pupuk Indonesia group as daily report of energy performance.
2. Indonesian Ministry of Energy and Mineral Resources via Online Energy Management Reporting System (POME).
3. Indonesian Ministry of Environment and Forestry via PROPER.
4. Announce nationally via innovation competition at Subroto award

Lessons Learned

- After successfully doing ISO 50001 implementation at Ammonia 1A plant, Petrokimia Gresik are going to replicate EnMS at Urea 1A plant with the aid of PG's four certified energy manager and four energy auditor.
- PT Petrokimia Gresik are able to adapt into the latest ISO 50001:2018 (the current certification is ISO 50001:2011).
- For the next certification, PT Petrokimia Gresik are willing to improve energy performance even further exceeding 3.16% of existing target.
- Energy is extra credit point in innovation scoring. Petrokimia Gresik should alter the awarding system, i.e. double reward for employee whose innovation contain energy conservation which has a lot of benefit to company.



Figure 13. Energy Team PT Petrokimia Gresik

Through the Energy Management Working Group (EMWG), government officials worldwide share best practices and leverage their collective knowledge and experience to create high-impact national programs that accelerate the use of energy management systems in industry and commercial buildings. The EMWG was launched in 2010 by the Clean Energy Ministerial (CEM) and International Partnership for Energy Efficiency Cooperation (IPEEC).

For more information, please visit www.cleanenergyministerial.org/energymanagement.