



TOYOTA MOTOR THAILAND CO.,LTD





Category: Buildings
 Industries

Title of Activity / Project / Theme:

ENERGY MANAGEMENT SYSTEM

Applicant General Information

Name of Company	: Toyota Motor Thailand Co., LTD.
Business Address	: 82/1 M.1 Old rail way Road T.South Samrong A.Muang Samutprakarn Samutprakarn
Number of Employees	: 3,700
Type of Building/Industry	: Product from Metal
Age of Building/Industry	: 33 Years
Nature of Business	: Automobile Assembly
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Project Abstract:

Toyota Motor Thailand Co., LTD. (Samrong plant) has concerned in global warming and energy shortage problems, so we set the policy according Toyota Motor Corporation (mother company) assignment set the plan for sustain and continuous energy conservation improvement.

We focus on HRD and support in many kind of knowledge and we apply to participate energy conservation in our factory, some activities use budget for investestment and some activities not use budget.

From seriously and continuously energy conservation activities implement along 2 years (2006-2007) All activities that we do 37 activities, so our company able to save total cost is 63.23 Million Baht (13,0456 GJ) and, reduce pollution for global warming as same as CO₂ reduction 13,550 tons- CO₂.



CERTIFICATION AND ENDORSEMENT

Toyota Motor Thailand CO., LTD. (Samrong Plant) hereby agreed to allow the ASEAN Board of Judges and other experts that may be designated by ACE to visit the factory and verify the authenticity of the data. However, two weeks advance notice is required to allow for necessary arrangements.

We also hereby agreed that ACE can publish the whole submission in ACE publications and website, without any prior consent of the owner of the buildings and industries (factories). If the submission will be published in other publications, the consent of the concerned building and industry (factory) would be required.

We, the undersigned certified that the information given is true and accurate and prepared with the consent of the party/ies involved.

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1. Project/Activity Overview

Toyota Motor Thailand, Samrong plant is the one high tech was established in 1975, located in Samutprakarn province.

Samrong plant has assigned by TMC to produce 1 tons pick up car (HILUX VIGO) for domestic sales and export throughout the world, under brand of TOYOTA 's capacity of 240,000 units/year.



Fig 1.1 Samrong product – “HILUX VIGO”

Toyota company not only intent working and product development, quality and service for standardize and customer satisfaction but also intent in energy and environment. Samrong plant has ISO9000, 14000, 18,000 system for manage and control production process, which ensure to customer's confident

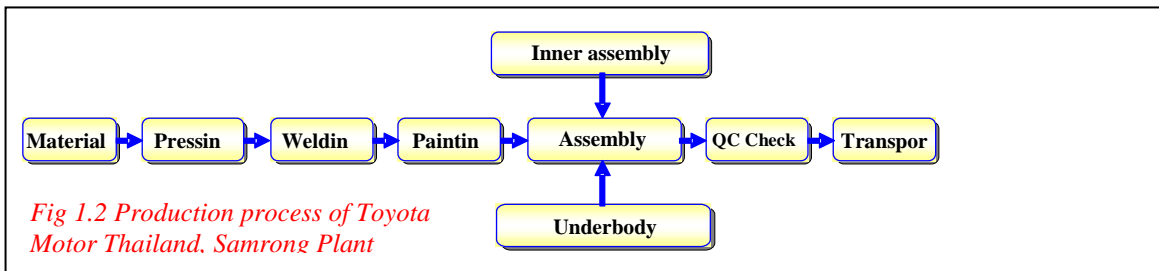


Fig 1.2 Production process of Toyota Motor Thailand, Samrong Plant

“Promote efficient use of resources for the utmost benefit of business and environment. We emphasize on energy conservation with total participation and awareness of energy’s importance among our employees in a sustainable way”

This is the energy concept remark of Mr. Ryoichi Sasaki, Former President of Toyota Motor Thailand Co., Ltd. (2001 – 2006)



Fig 1.3 Mr. Ryoichi Sasaki

Toyota Motor Thailand (TMT) recognizes the importance of energy and environment conservation. This is aligned with the direction of Toyota Motor Corporation, Japan (TMC), which announced the ‘**Global Vision 2010**’ concerning environmental management. Accordingly, TMT has set the policy as well as short-term and long-term plans to reduce CO₂ emission by 20% within 10 years, starting from 2001-2010 .

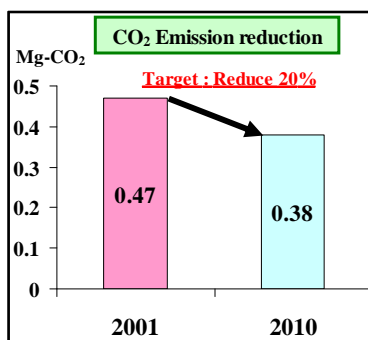


Fig 1.4 Samrong plant's CO2 emission reduction target

Samrong Plant continuously conducted activities on energy conservation so that CO₂ emission was reduced to 0.32 TonCO₂/Unit in 2005, which is actually the target of 2010. Therefore, a new target was set to further reduce CO₂ emission by 10%, or down to 0.29 TonCO₂/Unit in 2010. However, with deep concern over the environment, we set our challenging target at 0.24 TonCO₂/Unit, or 25% reduction (compare with 2005).

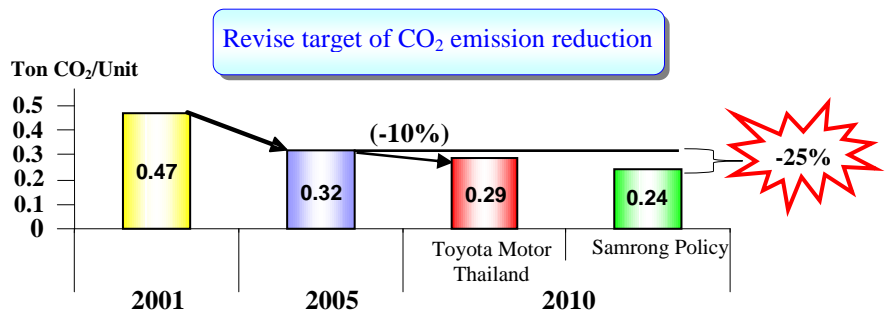


Fig 1.5 Revise target for Samrong plant in 2005

2. Policy on Energy Management

TMT adheres to the 'Toyota Way' as our work concept for all job operating, such as product design process, produce process or quality inspection process. Toyota Way consist of

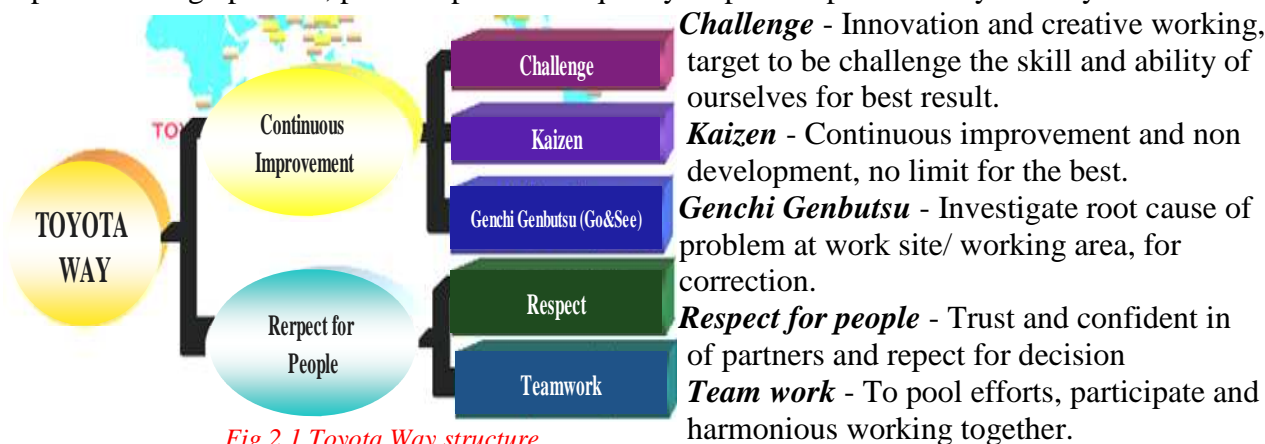


Fig 2.1 Toyota Way structure

Toyota way is the main conceptual for Toyota's staff mind, so we set policy for energy conservation activity consist of

- **Zero loss** → Reduce energy loss such as air leak, oil leak, core loss etc.
- **Efficiency supply** → Maintain best condition for equipment for efficiency supply.
- **Utilization using** → Use limited resource for the most beneficial and valuable ways.
- **Good awareness and skill up** → Promote energy conservation awareness, Continuous develop knowledge and technical skill.
- **Environment friendly** → Aware in environment effect.

By the way all of items are base on safety and quality standard of Toyota, and no effect to the product.

Samrong plant set strategy to drive the energy conservation activities to achieve our target by employee participation and interesting. Human resources of all levels are essential in driving the company towards the goal. Energy conservation activities also work by this way.

We receive the collaboration of all employees from top management to operators. The reduction of energy consumption was set as the KPI for all functions to plan their activities to achieve the target. Follow-ups and reviews are conducted on a monthly basis by top management.

SHOP / LOCATION	Electrical Energy (kWH/unit)											
	2550						2551					
	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
(P)	0.77	0.77	0.77	0.76	0.76	0.76	0.76	0.76	0.76	0.75	0.75	0.75
(W)	47.85	47.85	47.85	47.61	47.61	47.61	47.37	47.37	47.37	47.13	47.13	47.13
FACTORY 4	1.33	1.33	1.33	1.32	1.32	1.32	1.32	1.32	1.32	1.31	1.31	1.31
(T)	196.64	196.64	196.64	195.66	195.66	195.66	194.67	194.67	194.67	193.68	193.68	193.68
(A)	20.57	20.57	20.57	20.46	20.46	20.46	20.36	20.36	20.36	20.25	20.25	20.25
(R)	6.63	6.63	6.63	6.59	6.59	6.59	6.56	6.56	6.56	6.52	6.52	6.52
WASTE PLANT	3.72	3.72	3.72	3.70	3.70	3.70	3.68	3.68	3.68	3.66	3.66	3.66
ALS	15.63	15.63	15.63	15.55	15.55	15.55	15.47	15.47	15.47	15.39	15.39	15.39
QIS	2.91	2.91	2.91	2.89	2.89	2.89	2.88	2.88	2.88	2.86	2.86	2.86
Packing	12.93	12.93	12.93	12.86	12.86	12.86	12.80	12.80	12.80	12.73	12.73	12.73

Fig2.2 Monthly electrical energy consumption target for each Production shop in 2007

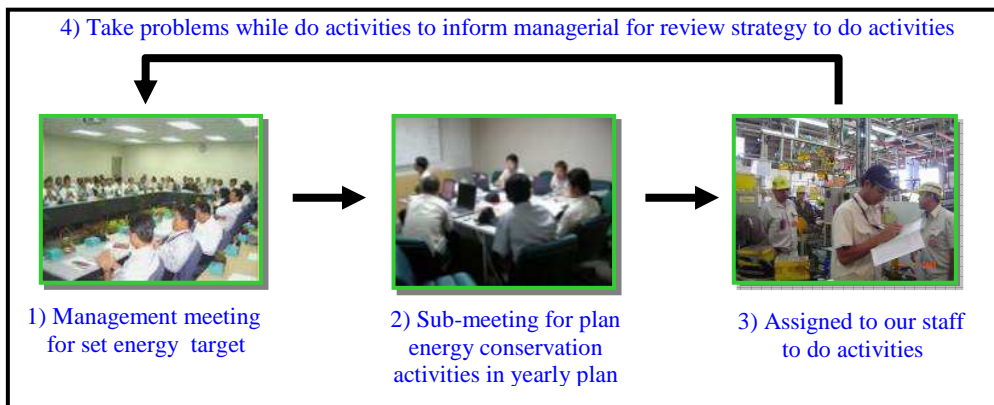


Fig 2.3 Policy implementation process

Employee participation in energy conservation activities can be categorized into 2 as follow:

1. Activities to control and monitor energy consumption

1.1) Energy Conservation Committee

Please see detail in issue#3.4 Energy Management Structure

1.2) Energy Information Center in Samrong Plant

The information center shows the summary of monthly energy consumption in each function. It also presents useful information to implement in other functions.



Fig 2.4 Energy information

1.3) Increase equipment and measuring system installation

This allows employees to record energy consumption of each machine in production process, and create energy consumption standard to benefit the ability to identify abnormality.

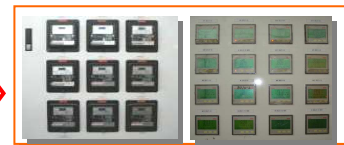


Fig 2.5 Increase to install electrical meter for keep consumption data

Compressed Air Operation for Utility Machine				
Shop	#	Air Compressor Model	Working Day	Holiday
Press	1	VS1310A	6 (6.5-6.9 kg /cm2)	3 (6.0-6.5 kg /cm2)
	2	SG1230A		
	3	SG1230A		
	4	SG1230A		
	5	SG1230A		
	6	SG1230A		
	7	SG1230A		
	8	SG1230A		
Welding	1	AL-90A	3 (6.0-6.4 kg /cm2)	1 (5.0-6.0 kg /cm2)
	2	AL-90A		
	3	AL-90A		
	4	AL-90A		
Util L	1	ALE-100A	3 (6.0-6.4 kg /cm2)	3 (Link line A) (5.0-6.0 kg /cm2)
	2	ALE-100A		
	3	ALE-100A		
	4	ALE-100A		
	5	ALE-100A		
	6	ALE-100A		
Paint	1	VS1310A	5 (6.0-6.4 kg /cm2)	-
	2	VS1310A		
	3	HMT5A		
	4	HMT5A		
	5	HMT5A		

1.4) Create standard of operating and shutting down machines or equipment

The standard of operating and shutting down machines is created by responsible functions, which handle each type of machines, for employees to follow. Also, an automatic system is implemented to enable consumption control and reduce wasted use.

Fig 2.6 Example: Table of air compressors ON-OFF

1.5) Cooperation with the Energy Service Company (ESCO)

Energy expense saved by the project is to be shared with the consulting company. New technologies are utilized to save energy and help increase conservation skills for employees, for example, VSD system installation to control motor loading such as Exhaust Fan, Circulation pump at Paint Shop.

1.6) Monitor and maintain machines in good condition

We emphasize on preventive maintenance and predictive maintenance, resulting in high efficient machine and reduction of machine problems that might cause energy lost or overuse.



Fig 2.7 Cleaning chiller machine on scheduling

2. Activities to promote creativity, awareness, and knowledge among employees

2.1) Energy conservation contest in Samrong Plant
 To promote creativity for improving machine and production process to reach efficient use of energy.



Fig 2.8 Top management listen to staff present energy conservation activity and give rewards to winner

2.2) Sending representatives competition of Toyota affiliates on Energy Conservation

For instance, QCC (Quality Control Circle) activity, CO₂ emission reduction in order to benchmark our ability among domestic and affiliates.



Fig 2.9 Take a photo for QCC competitor group

2.3) Observation and Information sharing among Toyota affiliates

The objective is to increase knowledge and skill in controlling process, Problem – solving and improving the current situation by observing Gate way Plant, Ban Pho Plant, TAW Plant, and the Mother plant in Japan



Fig 2.10 Energy conservation Presentation to Top management of Toyota's affiliate and Hino company



Fig 2.11 Japanese specialist and Thai staff discuss for energy conservation technology

2.4) Training energy conservation to Operational- Level employees

In order to raise awareness of energy conservation to employees, especially on energy saving and improving their way of work

Awareness Training			
COURSE	Training by	Date	Number of trainees
1. Energy conservative awareness for Group Leader	Energy support team	Jun,06	31
2. Energy conservative awareness for Operator	Energy support team	Nov,06	50
3. Energy conservative awareness for Group Leader	Energy support team	May,07	68
4. Energy conservative awareness for Operator	Energy support team	Aug,07	145
Technical Training			
COURSE	Training by	Date	Number of trainees
1. Practical energy conservation training	DEDE*	Jul,05	5
2. Energy conservation technical	TMC *	Mar,06	30
3. Energy conservation for air condition system	Premium Equipment company	Jun,06	2
4. Personel Responsible for Energy (PRE) (Thermal)	DEDE*	Jul,06	1
5. Plant observation at energy management winner factory	Numchau company	Feb,07	2
6. Direction of Hydrogen energy and fuel cell	DEDE*	Oct,07	2
7. New technology for energy conservtion	TMC *	Oct,07	2

DEDE* - Department of Alternative Energy Development and Efficiency, Minister of Energy
 TMC* - Toyota Motor Corporation (Japan)

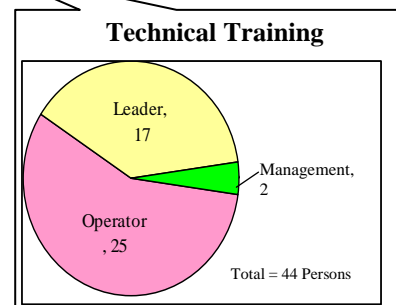
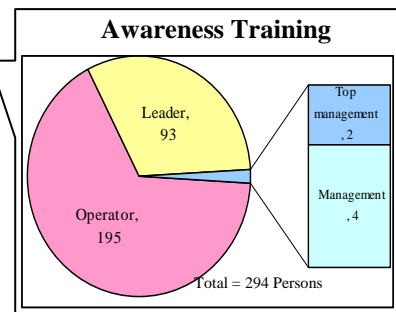


Fig 2.12 Training table for energy conservation and Number of participates

2.5) Setting Energy Saving day in every month

At least once a month (Saturday/Sunday), there is no consumption of energy allowed. This is reduce non- Productive energy, and encourages employees to spend time with their family.

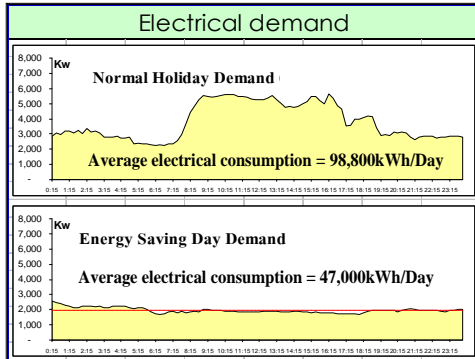


Fig 2.13 Comparison Graph of Electrical consumption between working day and holiday

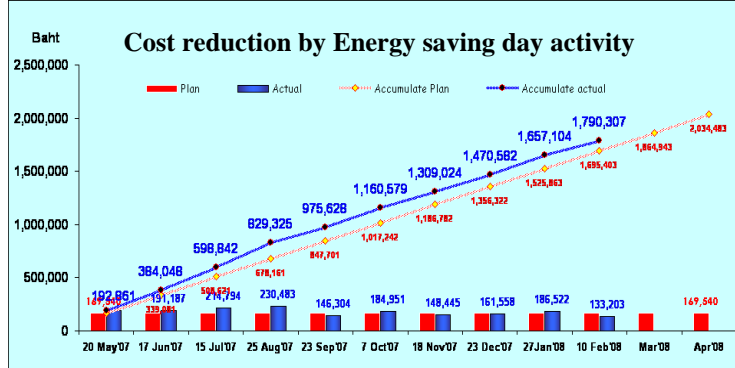


Fig 2.14 Graph of Cost reduction by Energy saving day activity

3. Detail of Energy Conservation Activities

3.1 Specific measures and activities implemented

Sample Measure: Reduce electrical consumption of air compressor by Automatic Load Management

Control System

The main concept of these measure is “Reduce” of exceed necessity of air supply volume and machine’s running hour.

Previous Condition

Press shop need to use more loads (air pressure) in Automatic Die Change (ADC) process, average 1 time/Hr and the process use 7 min/time, so Press shop necessary to operated air compressor to stand by total base load 6 units at 6.2 kgf/cm² for protect the system fault from air pressure low, that’s cause to loss the electrical energy consumption for exceed supply volume.

Countermeasures

First step

We trial to “On” and “Off” air compressor follow actual load consumption so we found:

- In normal operation, air supplies are required to “On” air compressor only 4 units
- In ADC process, air supplies are required to “On” air compressor 6 units

So we set staff to “On-Off” air compressor by these method, but we didn’t think these method is the optimize way to reduce loss from supply side.

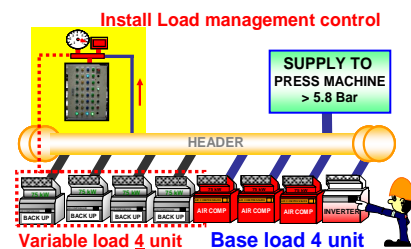


Fig 3.2 Normally air compressor operating at Press shop (After improvement)

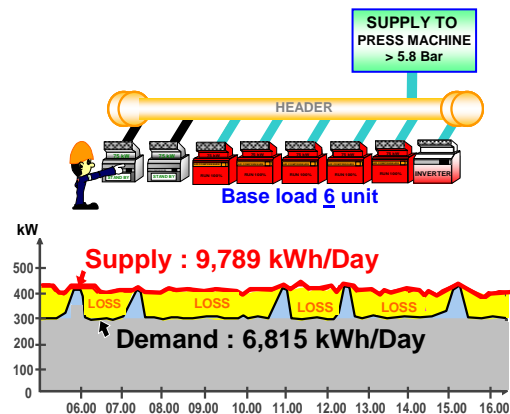
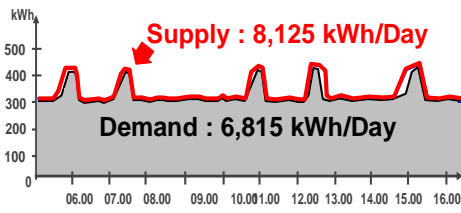


Fig 3.1 Normally air compressor operating and Electrical consumption at Press shop (Before improvement)

Second step

We install Automatic Load Management Control (ALMC) for control air compressor operating follow the actual load requirement. ALMC has controlled air compressor to keep air pressure at 6.2kgf/cm², if pressure drop to 5.8 kgf/cm² because machines are in ADC process, ALMC will command air compressor to start “On” operation in step by step until air pressure in system is keep at 6.2kgf/m² then PLC command to “Off” operation when air pressure is higher than standard pressure.



Current Condition

We can run air compressor in base load for supply to production process is 4 units at 6.2 kgf/cm² and when load required are vary load, the Automatic Load Management Control can automatic adjust air pressure until it's keep in standard pressure

Conclusion

We can reduce electric consumption 17% or 659,328kWh/Year and reduce CO₂ emission 407.46MgCO₂/Year

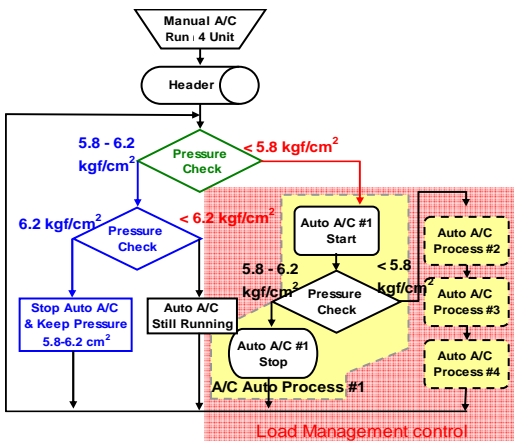


Fig 3.3 Normally electrical consumption (After improvement) And Flow chart of ALMC operating process

3.2 Yearly energy consumption / unit energy consumption (Electricity – kWh; Fuel – Liters; etc.)

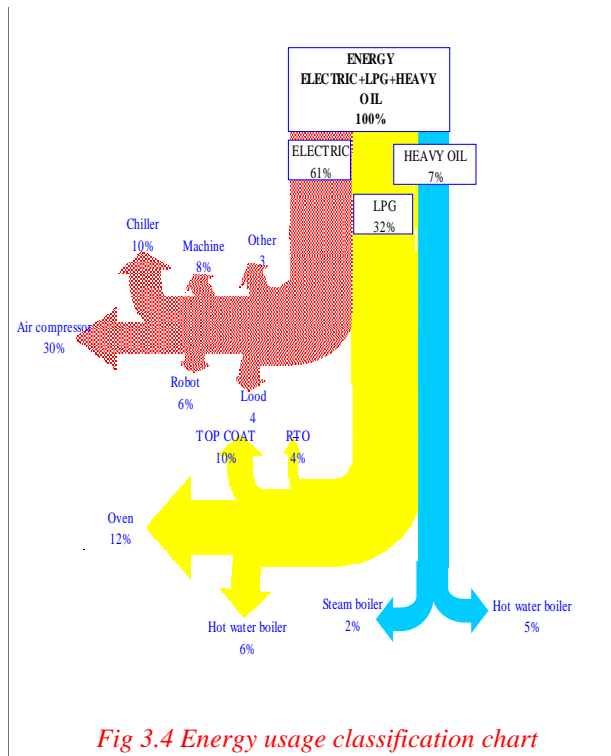


Fig 3.4 Energy usage classification chart

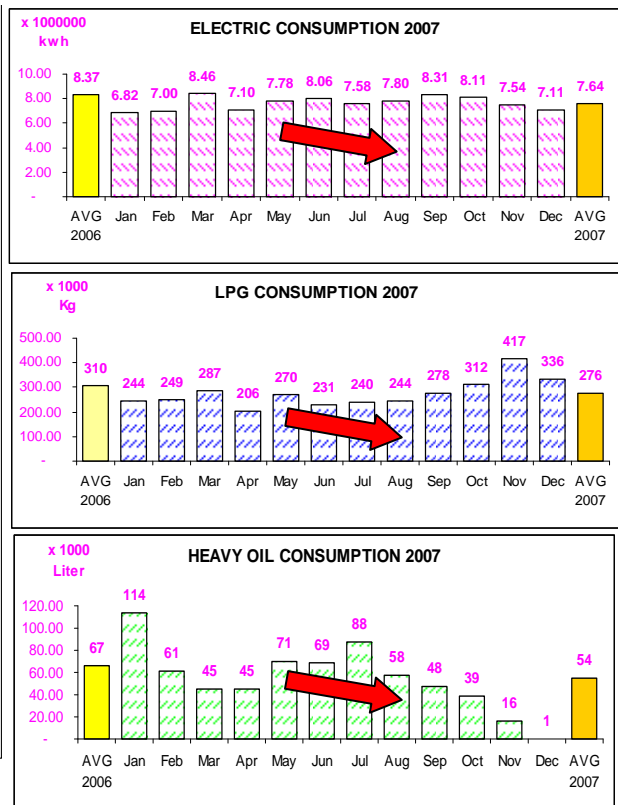


Fig 3.5 Yearly energy consumption of each type

From Fig 3.5, the energy consumption of each energy have trend to going down because of we continuous do energy conservation activities.

3.3 Plans and Targets

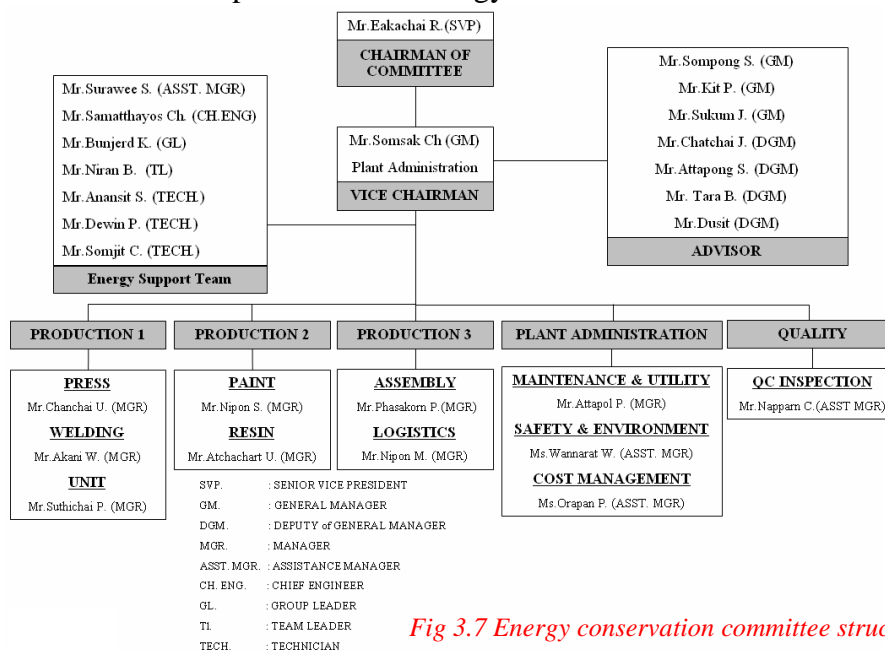
We set plan for energy conservation activity and need to do best for achieve target following plan. In the table is show the main success energy conservation activities

No.	Activity/Measure	Energy efficiency index			Energy Saving/Year						Investment	Payback Period	Return on Investment	Plan				
		Before	After	% Reduction	Electrical			LPG + Heavy Oil						(Thai Baht)	(Y.M)	(%)	Start	Finish
		MJ/One unit of output			(MJ)	(Mbaht)	CO ₂ emission reduction (Mg)	(MJ)	(Mbaht)	CO ₂ emission reduction (Mg)								
Non investment measure																		
1	Reduce steam supply to Booth 1,3,4	219.25	156.26	29%	-	-	-	15,238,287	5.55	1,091.67	-	-	-	Sep-05	Sep-05			
2	Energy saving day	1.64	1.06	35%	2,782,750	2.16	561.59	-	-	-	-	-	-	May-07	May-07			
3	Adjusting temperature after cooling coil	92.99	64.59	31%	5,625,806	4.38	1,135.34	-	-	-	-	-	-	Jul-07	Jul-07			
4	Closed manual silencer valve at ASU	220.97	129.65	41%	-	-	-	15,073,701	6.08	1,079.88	-	-	-	Aug-07	Aug-07			
5	Heat exchanger at boiler Paint shop	129.65	95.56	26%	-	-	-	3,583,473	1.45	256.72	-	-	-	Sep-07	Sep-07			
6	Combine air compressor load Paint shop	79.91	72.18	10%	1,676,592	1.30	338.35	-	-	-	-	-	-	Oct-07	Oct-07			
Investment measure																		
7	Install Electronic ballast	-	-	-	62,208	0.05	10.68	-	-	-	425,000	9.0	11%	Feb-06	Mar-06			
8	Change insulator of steam boiler	19.24	18.96	1%	-	-	-	74,859	0.03	5.36	186,224	6.8	15%	Apr-06	May-06			
9	Change Aircompressor hight efficiency	-	-	-	1,800,000	1.32	363.26	-	-	-	20,000,000	15.1	7%	Apr-06	Apr-06			
10	Sealer oven cancellation	19.03	0.00	100%	414,720	0.33	83.69	25,625,688	7.21	1,616.21	25,000,000	3.3	30%	May-06	Jun-06			
11	Install variable speed drive at condensing water pump	1.23	0.79	36%	1,417,352	1.08	286.04	-	-	-	Investment by ESCO			Nov-06	Nov-06			
12	Change chiller 4 unit	73.49	63.93	13%	5,232,856	4.07	1,056.04	-	-	-	20,000,000	5.0	20%	Apr-07	Apr-07			
13	Install variable speed drive control 23 unit	46.36	31.69	32%	2,728,285	2.12	550.60	-	-	-	Investment by ESCO			Apr-07	Jun-07			
14	RTO Heat recovery (Paint shop)	116.59	81.80	30%	-	-	-	2,808,709	0.81	177.15	1,800,000	2.2	45%	Apr-07	Jun-07			
15	LPG compact boiler at Caustic soda	118.12	109.19	8%	-	-	-	2,739,215	1.11	196.24	2,330,000	2.1	47%	Jun-07	Jun-07			
17	Change Heavy oil boiler to LPG boiler	314.17	190.29	39%	-	-	-	16,826,689	7.78	1,205.46	20,000,000	2.6	39%	Oct-07	Nov-07			
18	Air compressor load management control system	66.20	58.16	12%	2,373,581	1.85	479.01	-	-	-	20,000	0.1	9231%	Nov-07	Nov-07			
TOTAL		1,518.84	1,074.11		24,114,150.00	18.66	4,864.60	81,970,621.00	30.02	5,628.69	89,761,224.00							

Fig 3.6 Energy conservation activities along 2005-2007

3.4 Energy Management structure (team, group, etc)

Samrong plant has established “Energy Conservation Committee”. Top management of Samrong plant (Senior Vice President) is the chairman, General Managers of all departments are advisors, employee representatives are internal coordinators, and Energy support team consisted of energy management specialist, provides support and suggestions of new technologies or methods to be implemented for energy conservation activities.



The committee’s responsibilities are

1. Collect all energy consumption data from each production process and control usage.
2. Set up energy committee monthly meeting.
3. Monthly report energy consumption and activities each shop to Top management
4. Training energy conservation technical and energy awareness.
5. Follow up schedule, result and solve the problem for get achieve target.

Fig 3.7 Energy conservation committee structure

4. Description of Activity/Project results

4.1 Effect of Reduction in energy consumption

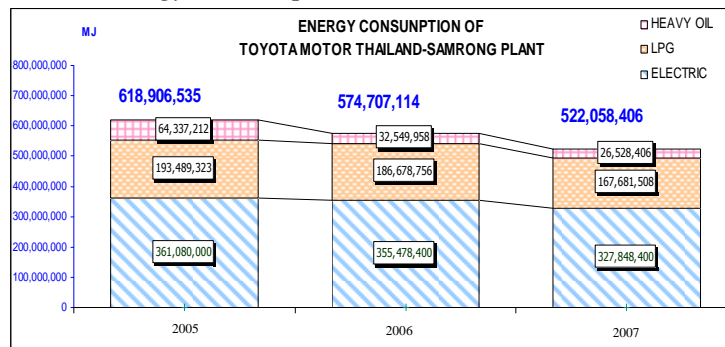


Fig 4.1 Energy consumption in 3 year by separate type of energy

From these graph, the trend of all energy consumption is going down so comparison of energy consumption between 2006 and 2007 is going down 15.64%

4.2 Environment Impact

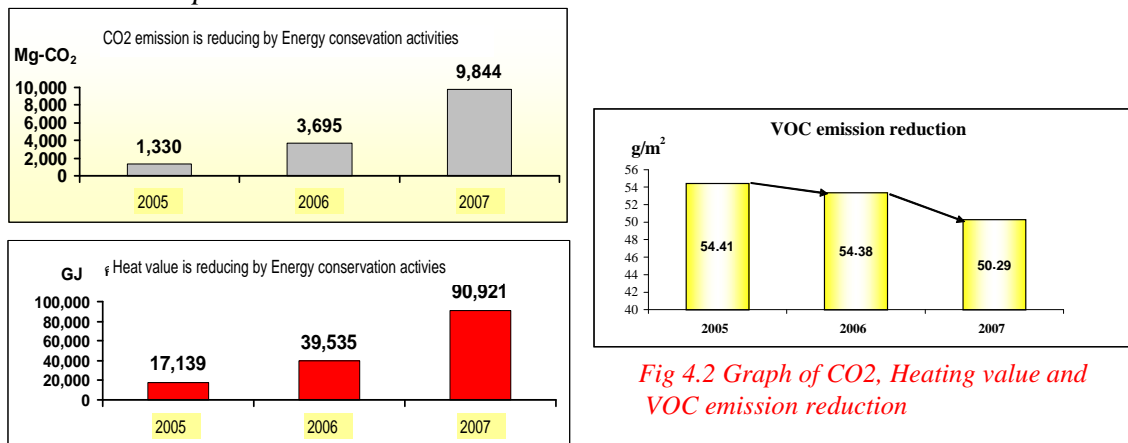


Fig 4.2 Graph of CO₂, Heating value and VOC emission reduction

Expect of continuously energy conservation, our company has environment management for reduce pollution from produce process such as CO₂, So_x, VOC and heat emission.

We can reduce CO₂, heating and VOC emission in highly level and continuous except we concern in environment management as

Waste and Pollution Management

Waste and pollution have effects on the environment. Thus, we set the policy to reduce pollution which effects the environment on the minimum level. Our activities are as follow:

➤ Reduce waste sludge

Reduce waste sludge by using filler press which eliminates the water content volume form sludge by 75 – 85 %. The discharge waste elimination cost, and transportation time can be reduced consequently



Fig4.3 Filter Press machine

➤ Reduce Paint Sludge

by drying paint sludge before disposing to Siam Cement Co., Ltd. For incineration



Fig 4.4 Drying paint sludge

➤ Reduce Volatile Organic Compound (VOC) in the air

1. Arrange car painting sequence by colors to reduce the use of thinner for cleaning the paint injector
2. Set program for partly-paint on cars that needs a repaint, not on the entire body. It helps reduce the amount of color spray and clear coat

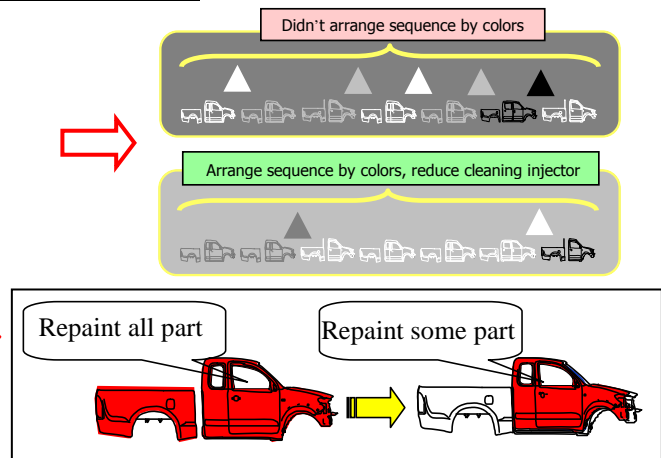


Fig 4.5 VOC emission reduction activity

Recycling

The company is aware of the limited natural resources , so we try to use the resources we have for the most beneficial and valuable ways

- Utilize reuse treated water
For watering the garden, cooling the heat on the roof, flushing , and extinguishing the fire.

Fig 4.6 Utilize reuse treated water



- Bring the not-in-use heat exchanger to utilize with boiler)
The heat exchanger helps warming up temperature of water that will be sent into boiler.

- The copper tip from welding process is lathed for reuse
To lathe the used tip to be shorter makes it possible for reuse. These saves the cost of purchasing new tip, and make the most benefit out of the resource.

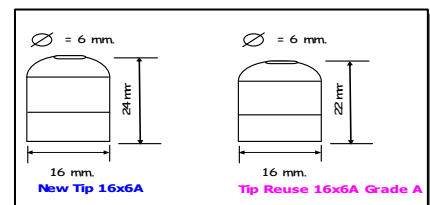


Fig 4.7 Comparison between Copper tip

- Reuse scrap from press shop by sending it to supplier for recycling scrap from pressing process is sold to suppliers for casting anew steal sheet out of the melted scrap.

4.3 Economical effect

In overview of economical effect, include all activities and measures, pay back period of energy conservation activity is 0.1-15.1 years. Some activities had long pay back period because of the activities had not consider on pay back period only but also focus on benefit of environment effect reduction. Totally we can save cost from energy conservation activity = 63.23 Million Baht. (As shown in subject 3.3)

4.4 Energy Efficiency Index

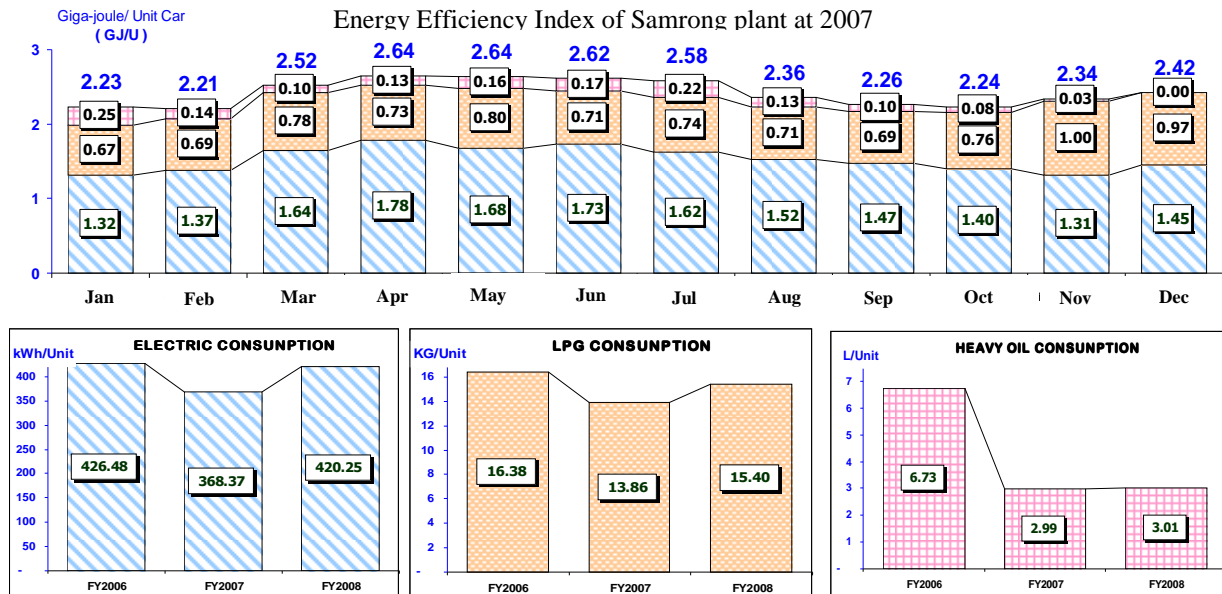


Fig 4.8 Energy Efficiency Index of each energy

Samrong plant do energy conservation continuous so that's make EEI 2007 have trend going down, which comparison with EEI 2006 we can reduce consumption 12%.

Consider the Energy Efficiency Index comparison of each energy consumption in 3 year, we found trend of all energy consumption in 2005-2006 is going down.

But if we consider Energy Efficiency Index in 2006-2007 we can found electrical and LPG consumption are going to high. The electrical and LPG consumption effect from cycle time changing of production process by 1.0 min to 1.2 min and product volumes in 2007 are less than 2006. So effect to vary load consumption is reduce but fix load consumption is constant, that effect to EEI reduce, which look like consumption/unit is higher than 2005-2007.

5. Additional Benefits

5.1 Sustainable activities and implementing organization (improved organization chart, new standardization, new operation mode etc.)

Projects/Activities implemented internally and externally for sustainable

Energy consumption activities are conducted, both inside and outside the organization

❖ **Inside activities are**

1) Idea Contest, QCC and Kaizen activity

These are conducted for employee to present their ideas, analyze problems, improve current conditions, or suggest new ways of energy conservation.



Fig 5.1 Top management reward to employees, who join in Kaizen activity contest Award

2) Public address is to motivate employees to turn off lights, air condition and other appliances before leaving for lunch or during breaks.

3) Good awareness promote

Raise awareness of energy conservation through campaigns promoting switching off the electric bulbs, fans, computer and air conditioners when not in use. Also the campaign includes setting equipment/appliances at a proper degree. Energy conservation tags are displayed on the switching spots as reminder.



Fig 5.2 Example of tag for promote energy conservation awareness

4) Cost reduction and energy conservation exhibition week

Last year, exhibitions, booths were competed to be the most educational and entertaining one. Talk show, dances, music gigs related to the subject of energy conservation were performed on stage by employees of all departments to find the winner.



Fig 5.3 Energy support team was presenting the new technology to interesting staff

5) Finding at abnormal energy consumption

To take countermeasure such as zero air leak and zero oil leak activities

After correct finished, staff will finding next leakage point



Staff finding leakage point

Take tags to attach at leakage point

Repair at leakage point

Fig 5.4 Process of abnormal energy consumption finding activity

6) Energy Data Sharing

Computer Network System is an effective network to distribute knowledge and information promptly and fast. All locations are covered by the network. Information is stored in Lotus Notes System which is accessible at all time.



Fig 5.5 Homepage of Energy Data Sharing.

7) Submission of energy consumption data by function and by process to Manager.

In this way, actual consumption of each function can be detected, leading to finding proper countermeasure when abnormality occurs.



Fig 5.6 Top management comment and suggest to participant.

❖ **Social activity** As our motto, “Toyota Thailand for Thai socially”, we have conducted

“Stop Global Warming” project

To raise awareness and environmental concern over the increase of CO₂ exhaust that cause Green house effect. We are trying to promote environment resources conservation. From the company’s concern over energy conservation or how to consume energy in the most valuable way, activities to promote and lead us to the goal are conducted. Most of the activities are participated voluntarily by employees due to their awareness of energy conservation.

5.2 Replicability of technology used and practices and measures implemented

Measure and Monitoring

The condition before and improvement needs a precise evaluation thus meters was installed to machine and in production process as follow

1. Inspect processes which need meter installation so that energy consumption can be detected
2. Reduce energy consumption data of each area with meter in order to set standard energy consumption of each process
3. Control and monitor abnormal consumption in each process by reporting the overuse of energy to concerned functions for immediate countermeasure
4. Summarize energy consumption of each dept. on a monthly basis. The summary will be utilized as database for conducting activities and activities’ evaluation

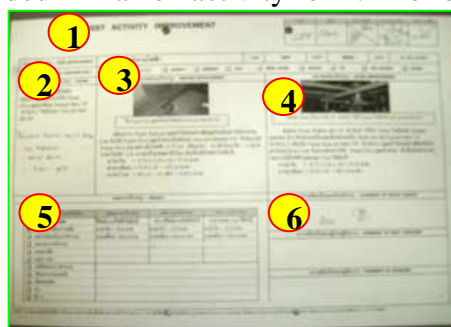
Fig 5.7 Measurement and Monitoring process

Replicability of technology

To share information concerning energy with all depts. Helps expand the knowledge and broaden impacts of energy conservation activities. As a result, every activity is recorded in Kaizen activity form so that it can be shared or distributed to all Toyota group. Our knowledge and technology are managed as the following methods

1. Internal management of knowledge and technology in Samrong plant

When a function conducted energy conservation activity, information and details must be recorded in Kaizen activity form. The form is consisted of the following details:



Topic

1. Subject
2. Root cause
3. Before Improvement
4. After Improvement
5. Result and benefit
6. Comment by manager

Fig 5.8 Kaizen activity form

Window person of each dept. sends the form to energy conservation function, who will observe the actual site. Then, each activity will be evaluated before Sharing.

2. Publication knowledge and technology management in Toyota group, (Gate way Plant, Banpho Plant and TAW Plant)

Energy team sends information to Safety & Environment Office (SEO). SEO is responsible for checking the accuracy of document. After that, Yokoten Plan (implementation plan) is created and shared to all Toyota group on SE data sharing. Users from all worksites can access the data and use it to improve their departments

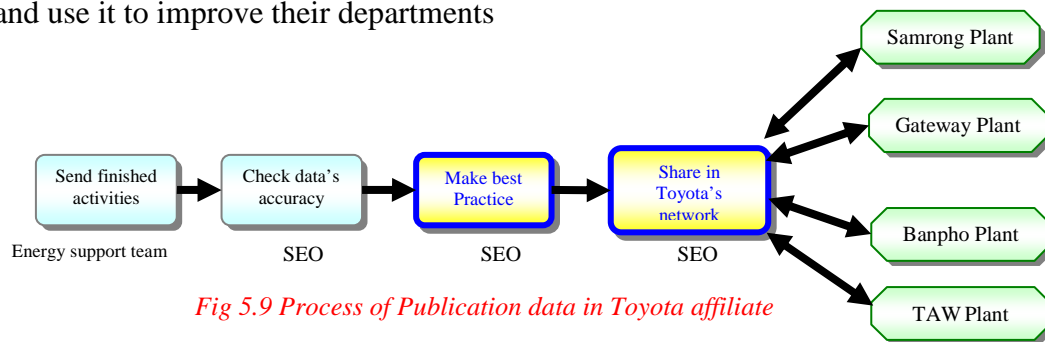


Fig 5.9 Process of Publication data in Toyota affiliate



Fig 5.10 Homepage of SE data sharing

Yokoten Plan		Full: 30 September 2008	
(Non-Compliance & Compliance Case)			
[Detailed description of the Yokoten Plan form, including sections for Yokoten Name, Yokoten Title, and a table for Activity Item, Progress, and Implementation Schedule.]			

Fig 5.11: Yokoten form issued by SEO

5.3 Other tangible and intangible effects (increasing business efficiency, quality productivity, safety, morale, better communication, and pleasant workplace)

Staff proud with in themselves for do good activity for reduce global warming problem and some activities are good for health and safety to working.



Fig 5.13 Take a Photo with Top management

5.4 Creativity / innovation or new ideas

LPG → Use to boiler water before sending the water into boiler.

As we have studied the oven system gives high temperature of 203 Calices Theresa it is possible to install heat exchanger to bring the heat to warming up water.

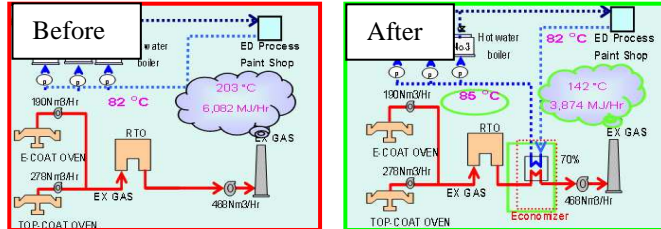


Fig 5.13 LPG improvement activity

Water → Increase efficiency of Reverse Osmosis produce process from 85% to 91%

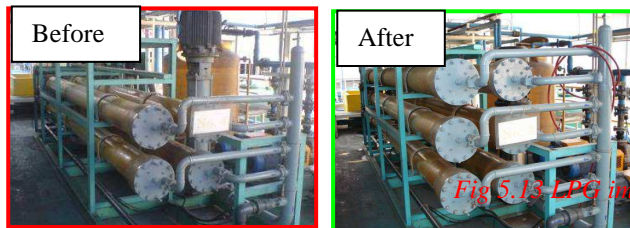


Fig 5.14 Efficiency up for RO producer activity

Realizing with realization of water supply shortages we enhance the Reverse Osmosis process to be more efficient in order to reuse the water and minimize water discharge .

6. Future Energy Conservation/ Improvement Activities

No.	Activity/Measure	Energy Saving/Year						Investment (Thai Baht)	Payback Period (Y:M)	Plan	
		Electrical			LPG + Heavy Oil					Start	Finish
		(MJ)	(Mbaht)	CO2 emission reduction (Mg)	(MJ)	(Mbaht)	CO2 emission reduction (Mg)				
1	Recycle waste water to be clean water	-	-	-	-	-	-	20,000,000	-	Apr-51	Dec-51
2	Air compressoe inverter type installation	75	0.43	1,188,000	-	-	-	10,000,000	8.4	Feb-51	Jun-51
3	Replace Hi-bay light by fluorescent	176	0.75	2,081,916	-	-	-	3,358,000	1.6	Apr-51	Dec-51
4	ON-OFF automatic controller for Chiller machine	100	576,000	1,584,000	-	-	-	500,000	0.3	Apr-51	Sep-51
5	ON-OFF automatic controller for Air compressor	50	288,000	792,000	-	-	-	500,000	0.6	Jan-51	Jun-51
6	Air tank installation for keep air pressure	20	115,200	316,800	-	-	-	500,000	1.6	Apr-51	Dec-51
7	Cooling tower treatment	13	75,927	208,800	-	-	-	250,000	1.2	Apr-51	Apr-52
8	Fluorescent and bullard electronic installation	6.4	36,864	101,376	-	-	-	200,000	2.6	Apr-51	Dec-51
9	Automatic lighting operation system	6	17,280	47,520	-	-	-	100,000	2.1	Apr-51	Dec-51
TOTAL		446	1,109,272	6,320,412	0	0	0	35,408,000			

Fig 6.1 Energy conservation activity plan for future

7. Supporting Document /attachments

- 1 Working day = 2 Shift, 1 Shift = 8 Hours
- 1 Year = 250 Working days = 4,000 Hours
- Production volume = 240,000 units/year
- LPG 1 litter = 0.56 kg = 26.62 MJ
- LPG 1 litter = 8.09 Baht
- Heavy oil 1 litter = 40.64 MJ
- Heavy oil 1 litter = 14.45 Baht
- Electrical 1 kWh = 3.6 MJ
- Electrical 1 kWh = 2.71 Baht