CHAPTER 4
Result and Analysis

This chapter the result from the previous chapter has test by apply with three important task which relate with regulator decision because those tasks has affect with large amount of industry's stakeholder and resident of country. The task like emergency plan and demand response has relate with operator of industry, while Ft cost has affect with large amount of country resident. Therefore, this chapter will prove that methodology can apply to every type of task in electricity supply industry.

4.1 Emergency plan

Since 1884, when Thailand start to use electricity as a part in many industry layers not only for support the country industry but also used as a part of people lifestyle. In term of country economic especially for industrial sectors, they need to use the electricity to run their production in order to run their 24 hours production line. As similar as people lifestyle, it need to use the electricity in order to support their general life such as use for living overnight or used for charging their gadget. Therefore, the demand for using the electricity has increase everyday which electricity supplier need to take their responsibility for produce the electricity to support that demand. However, produce the energy has no enough to support that demand level because the electricity generator need to schedule time to closing for maintenance, and the resource for electricity producing has limited in term of cost, and quantity. While the information that transfer in electricity sector has indicate as the important part that use for communication in that sector, it has been suggested to support the emergency plan creation which necessary for every parts of electricity sector.

In General, an emergency plan defined as the methodology of strategic organizational to management process which use to protect the organization from the possible hazard risk, and ensure the resiliency of the organization within their planned lifetime () especially for the industry that need to maintain their twenty-four hours

business operation on the maximum service because their business was sensitive with every people or it necessary with the life cycle of people in society.

If looking specific to Electricity Supply Industry (ESI), an Emergency plan seem like the important plan which every partner should to concern because the bad situation on electricity industry may affect with the wide range of people in society, and that industry need fast response time in order to make the action for solve any bad situation which may happen in electricity sector. Moreover, the emergency plans which designs for electricity industry should support business strategies. It means that ESI need to make the clear strategies in order to make its quality of emergency plan for solve their bad situation as-fast-as possible. Based on design the Balance Scorecard (BSC) for manage and identify the information which transfer between business partners, and use the BSC as baseline in order to generate the Common Information Model (CIM) which identify the detail of each information in CM-1 and sub-detail in CM-2 form. The CIM prove that it can help the decision maker know which people take responsible in each selected procedure and the detail of information that sender need to transfer to specific receiver. The objective of this journal is to applied the CIM detail for support the process for Emergency Plan creation which can identify the people that response in each plan procedure and the best information that transfer in the shortest time to support the response team for solve any emergency cases.

4.1.1 Emergency Plan and its difficulties

Aimed at writing the emergency plan for any business, the main point which all writer need to concern is Emergency Management Plan (EMP) consist by three difference sub-plans not only Emergency Response Plan (ERP) but also Business Continuity Plan and Crisis Management Plan. Before describe in the detail of each plan, every emergency plan has the concern point are as follows (Arlington, 2009):

Writer need to concern on the limited human resource which used for each plan

Every plan should have support resource list at least 3 name

Training on emergency plan should practice on schedule at least one time per year

Training course should to simulate in reality event

It should have evaluate result on every training to find the weak of that emergency plan

For Crisis Management Plan is the plan that used for encounter with the organization image and confidence from people in the crisis case like the case of Johnson & Johnson company that have some people put the cyanide in Tylenol Capsule which make many people killed, so Johnson & Johnson decided to call the medicine back from the whole market that cost 11 million dollar lost in their benefit. From this case make customer who use Johnson & Johnson's product has more confidence in order to support their product. Therefore, the Crisis Management Plan (CMP) should to make as early plan which provide the time for solve the problem without the pressure (Gullstrand J., 2009). The good CMP which conform to other plan, Emergency Response Plan-ERP and Business Continuity Plan –BCP, should provide details are as follows (the Joint Commission on Accreditation of Healthcare Organizations., 2005):

- It should have clear Company Policy.
- It should to give the record of plan maintenance.
- It should specific the name of person who response in team organization.
- It should specific the person who receive and take action from notification procedure.
- It should have the roles and responsibilities check list which advice to people for ready to action.
- It should have incident management system, which include the event procedure, responsible of each event and support information.
- it should provide scenarios and response procedure, communication plan, plan of accounting for the workforce and team roster to emergency response resource that help them to estimate the danger level of event

Therefore, the Crisis Management Plan (CMT) should consolidate with emergency response plan (ERP) and business continuity plan (BCP) and the people who have responsible for each action should have full authorization on that plan.

On the other hand, the business continuity plan (BCP) is the plan for maintain the core business, like financial control or supply chain management system, for make organization to continue their business while it have emergency situation (Arlington, 2009). Because of highly investment cost for make one-hundred percent on organization reservation system, so organization need to complete the business impact analysis (BIA) in order to classify the truth core business functions which can help organization to fix the necessary investment cost (Homeland Security, 2008). The example can be shown in the case of company head Quarter has close from any situation, the Information system department should have plan for transfer information to back up site. Moreover information department should have plan for manage their laptop or computer give as the support computer to any staff who work in their core business activity. Consequently, Business Continuity plan (BCP) requires procedures are as follows:

- First, it start from create the risk assessment.
- Create Business have an impact on Analysis (BIA) based on the information of each department which include the strategy and human resource of each department.
- Simulate the possible solution to find the gap between current situation and the plan.
- Create Business Continuity plan (BCP) of each department and start to sign contract with any vendor for reserve the resource which use on the emergency's situation.
- Training the plan for find the weak point.

From the requirement above show that best BCP can show the suitable on the potential of each department and identify any department which support when emergency plan was happened.

The last sub plan is Emergency Response Plan (ERP) is the plan that provides the information plan which department use to corporate with other department. ERP use

to estimate the dangerous level and risk of each level (Valerie Dorge and Sharon L. Jones, 1999). Emergency Response plan (ERP) should include the content are as follows (Energy Emergencies Executive Committee, 2012):

- The name of person who responsible for plan maintenance
- The information of each department provided for generate the notification & communication list
- The procedure for activation & response that includes:
  - Emergency response organization chart
  - Role & responsibilities
  - Requesting assistance
  - Reporting procedure
- The response procedure list
- Command system for manage the command line of each responsible people
- The list of response team member contact
- The list of equipment that necessary for each dangerous level

The procedure for management every plan in order to make the best performance is act like when people manage the ISO plan, so every industry need to concern to train their staff all the time for make the plan up-to-date which reduce the risk level of the whole organization.

Understanding the step of come across the emergency case or disaster

In order to encounter the emergency or disaster case has include four steps not only the prevention & mitigation but also the step of preparedness, response and recovery (District of Columbia, 2010). The framework of emergency meet with case can be show below:

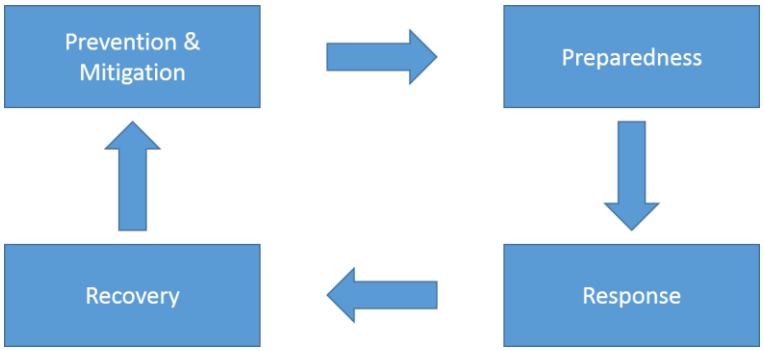

Figure 4.1 Emergency plan procedure

For Prevention & Mitigation use for support or protect business from risk activity which organization respects to occur (Valerie Dorge and Sharon L. Jones, 1999). Most procedure in this phase is installation the safety part in order to meet the minimum standard. The best example can be showed in the case of fire which safety parts such as water pump and fire alarm should to be work automatically.

For Preparedness, this phase has generated the plan for against the dangerous activity by providing the procedure for each action and the information of person who have direct responsibility for that action. The plan which organization need to provide in this step are Emergency Response Plan (ERP), Business Continuity Plan (BCP) and Crisis Management Plan (CMP), and include employee training in order to maintain the response level for each action.

Next phase is Response which is the real action while the business is under the dangerous situation. It measure on the time that people used for response in dangerous situation, and the last phase call "Recovery" which show the time to boot the business from dangerous situation back to normal operation. The objective of this phase is to keep the business to operate continuity in the most normal way or lose information as short as their can. AFter business has come back to normal situation, the emergency plan was circle back to Prevention & Migration phase in order to modify the plan the support current situation. Moreover some business use another stage call "Crisis Management" which used to manage the change of dangerous level while applied the emergency plan for avoid the crisis on image and faith of business in the eye of another

people (Gullstrand, J., 2009). So as to apply the Crisis Management in emergency case, it can be show in the figure below:

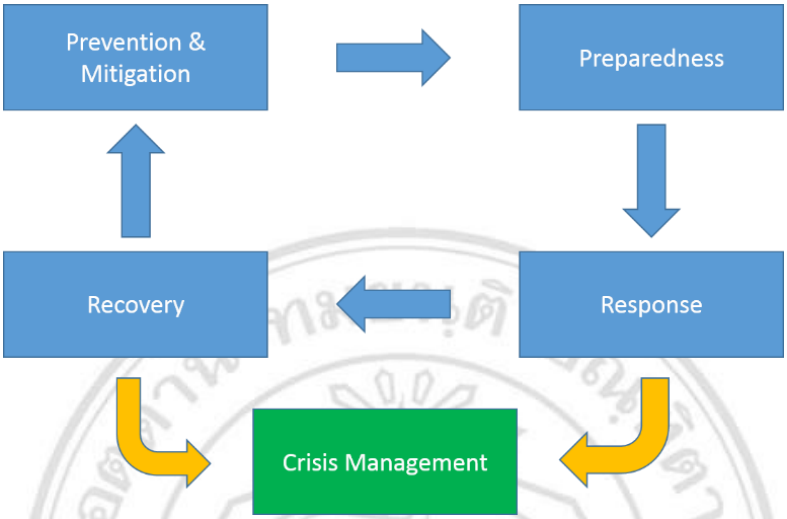

Figure 4.2 Adding crisis management on emergency plan procedure

4.1.2 Propose Idea and Solution

The propose idea of this research for design an emergency plan which have quality to support any bad situation on Electricity Supply Industry present that its emergency plan should design for support the company strategies on ESI for clearly response on procedure and responsible people of each procedure (Energy Emergencies Executive Committee, 2012). Reference to other idea which develops the strategic of ESI by used the Balance Scorecard (BSC) to identify the business need and it key performance indicator for any business partner. Moreover, another continues research use Common Information Model to identify the information and its relationship that transfer between ESI's partners. Therefore, this research present the solution for design an emergency plan based on information from ESI's balance scorecard (BSC) and common information model (CIM). These solution claims that any emergency plan which has designed from BSC and CIM should have more effective than other emergency plan. However, this research focus on design only on Emergency Response Plan (ERP) because it was the first emergency plan which affect with other two

emergency plan, an Business Continuity Plan (BCP) and Crisis Management Plan (CMP) which design after complete of Emergency Response Plan. So, if ERP has quality design with clear procedure and responsible people. It can suggest that another emergency plan also have more effectiveness.

The necessary of Emergency Response Plan (ERP) for Electricity Supply Industry (ESI) can be showed in case of power failed of Jersey Central Power & Light (JCP&L) from Hurricane Sandy that come to United State in October 2012. These disasters cause nearly eight-point-one millions of homes and businesses lost their electricity power, and cost the company impact from customer petition as high as fifty billion dollar. After that bad situation, the top members of JCP&L make the meeting for analyst their emergency plan for avoid their future significant challenges and potential financial losses. They claim that emergency response plan has necessary for company in-order-to support them as an alternative way to remain operational, or support them to recovery their business quickly. As a result, Emergency Response Plan (ERP) has included not only the supply chain for manage the resource for electricity generator, and essential personnel that identify to minimum staff to remain on-side duty during situation but also included the equipment need which identify the necessary equipment for emergency operation. Moreover, company's member emphasize the two important factor which should to include in Emergency Response Plan (ERP) which are data and computer needs for identify the information from company report in the specific of time, which may support the on-time decision of company member and also identify the minimum of software requirement to re-establish technology related critical business processes, and communication needs that identify the clear communication channels between related people for communicate the information although recovery strategy to avoid business procedure mistaken.

In-order-to applied a conceptual balance scorecard (BSC) for Electricity Supply Industry, it show the main object that business partner use as guide line for set their strategic target and key performance indicator (KPI). Therefore, it claims that balance scorecard can support strategy's planner to make the quality plan which clearly on strategic definition, objective and its target. Subsequently, the information which

transfers between each partner has defined in CM-1 and CM-2 form base on CommonKADS methodology which present many details of information include name, responsibility people, important level, report time and the message when information has received and sanded between partners. So the base line of information has presented in diagram form that help end user to understand the information layer and the source of information from each partner. Then, the Common Information Model (CIM) has generate from after that the diagram has used as the standard guideline for develop the emergency plan of Electricity Supply Industry (ESI). The methodology can be showed in the figure below

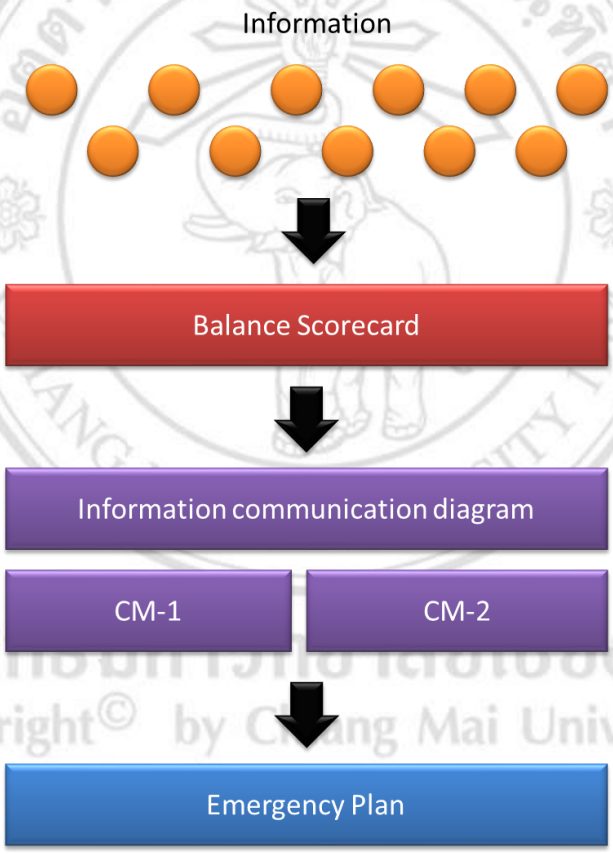

Figure 4.3 Methodology to create Emergency Plan

4.1.3 Emergency's situation on electricity industry, the case of resource crisis

In Thailand, the emergency's situation that affect with the wide range of Thai people can be show in the case of resource crisis of electricity generation because the unexpected shutdown of gas rig at Burma, and the accident at offshore rig name "Bongkot (BKT)". Based on this case, it show that Thailand electricity industry use the resource, include both oil and gas, from two main areas not only from the bay of Thailand but also form the Burma country. The oil and gas which come from the bay of Thailand has send by the pipe line from offshore rig, which generate by PTTEP Co. Ltd. and CHEFRON, to oil refinery. At the oil refinery the crude oil and mix gas has refine to diffidence layer, and distribute to difference industry. For the electricity industry especially from central generator, call Soult Bangkok and Bangprakong, which generate the electricity for serve many province on the central, northeast and southeast area of Thailand. Moreover the other main gas pipe line from Burma has come to serve at Ratchaburi generator to generate the electricity to north and south area of Thailand. The gas and oil pipe line map has showed in the figure below:

Figure 4.4 Gas and crude oil pipe line map of Thailand

On the day 9 August 2010 time 5:00 AM, offshore rig call JDA was under the planed shut down, so the generation level of whole country was reduce from 3519 MW to 3258 MW which present the level of generator down to load curve. Therefore, electricity generator has advice to EGAT to run coal generator, run crude oil generator, open the dam 24 hours for generate electricity and buy the electricity from SPP and Lao republic but it use 3 day to respond this advice. Additionally, open the dam water to generate the electricity was creating the rumor from people who live near the dam about the dam collapse that reduce the image of electricity industry.

On 15 August 2010, the pipe line accident was found at offshore rig in Burma call “Yadana” which force them to stop their production, and force energy regulator to open more spill way at many dam that increase the rumor level of people, and it also reduce the generation level to 3391 MW near load curve. The situation can show in figure below:

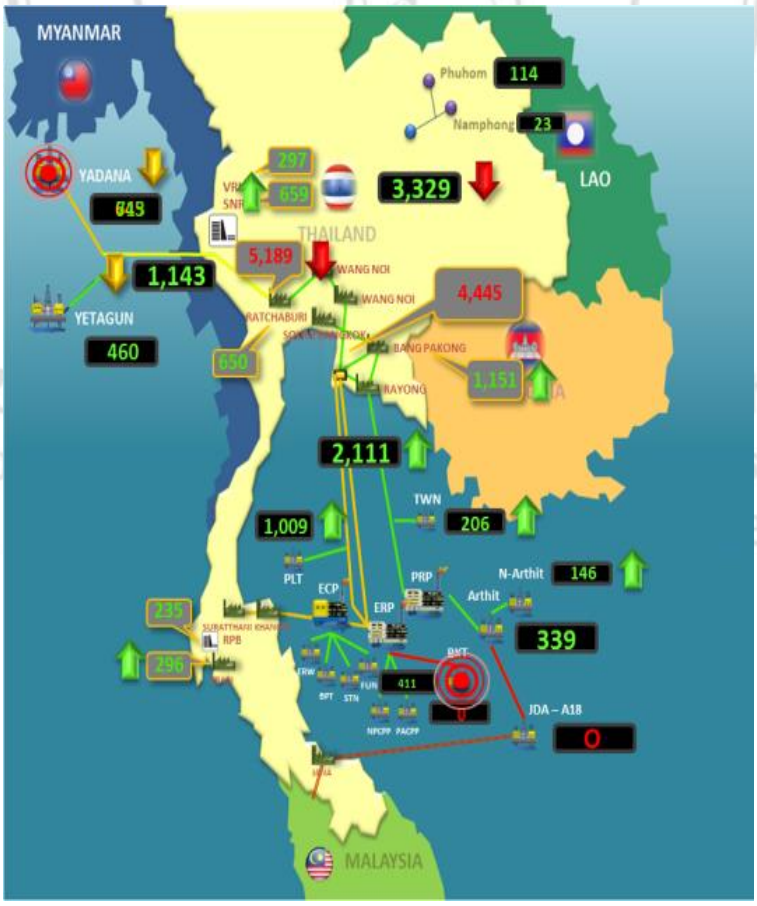

Figure 4.5 Gas pipe line accident at Burma offshore rig

After three days from gas pipe line accident at Burma the other accident was happen at Arthit offshore in the bay of Thailand which has shot time electricity shut down and cause little affect with generation level of the whole country. However, the generation level of Thailand was back to 3700 MW which stays in general generates level. However, the industrial image was reducing rapidly because the wrong rumor of people in the society. Most of them give the opinion that Energy Regulatory Commission (ERC) has slowed advice to EGAT because their waiting for the incoming report from many partner and use eleven days to response this situation that not include the responsibility of PTTEP that sign contract with EGAT in order to grantee the distribution level of gas supply to EGAT. Based on this contract, PTTEP claim that this emergency's situation was not the fault situation of PTTEP because they try to increase the production level of many offshore rig to maintain gas distribution level, but the lose cost come from the wrong advice from ERC which order EGAT to open the spill way at many dam that make people scare and reduce overall industrial image.

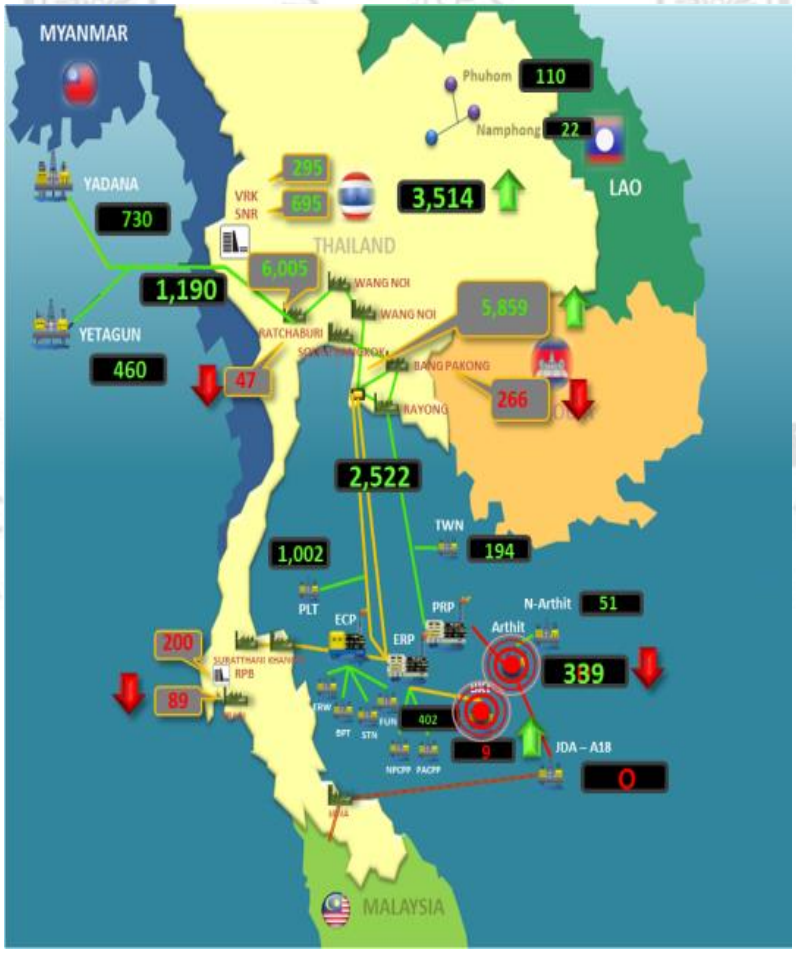

Figure 4.6 Unplanned electricity shut down at Arthit offshore rig

Based on the situation above show disaster process which define the step which Energy Regulation Commission Committee has manage the gas supply crisis solution. Therefore, it can be conclude to the work flow below:

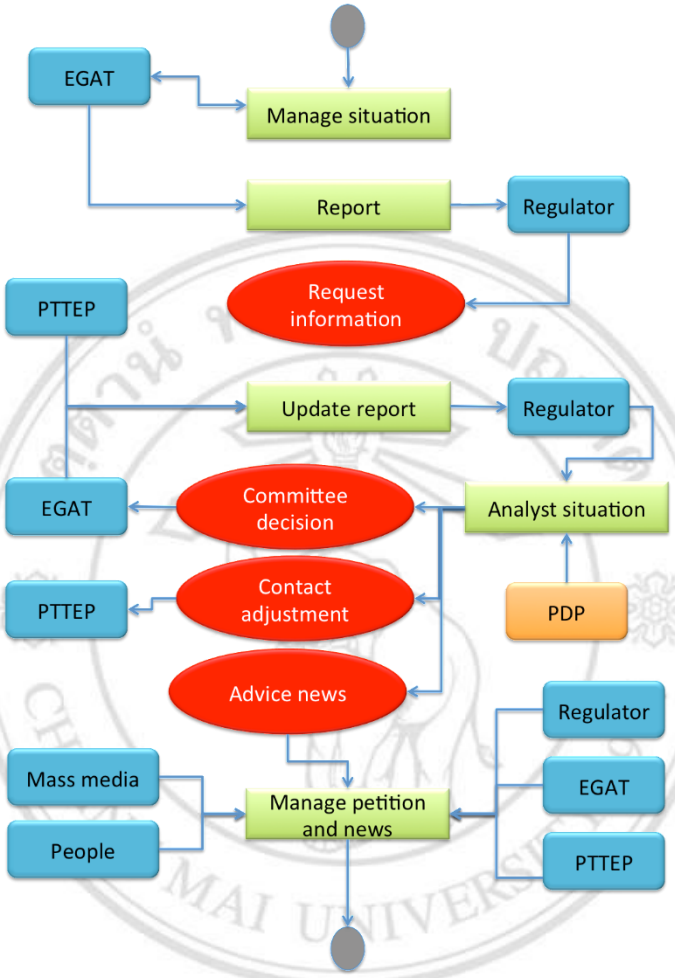

Figure 4.7 Emergency Plan procedure

Based on the work flow above show that the situation start from EGAT manage situation by themselves first before report to energy regulator. If regulator have some question, they will request from EGAT or PTTEP. On this process concern that EGAT or PTTEP may not report to regulator before they can manage any bad situation. After that PTTEP and EGAT update report to regulator which use for analyst the situation together with theirs Power Development Plan, then they use to make committee decision, and also make the contact adjustment or advice the news about situation to any mass media. Then, they make to manage petition and news from their customer. From this workflow show the concerning point that the report from EGAT or PTTEP to

regulator has come in unstructured of time which may interrupt to regulator decision, and the news that regulator give to mass media has not update and may cause to committee give wrong news to any customer and theirs stakeholder.

4.1.4 Emergency response Plan for electricity industry

After applied the Balance Scorecard (BSC) in Electricity Supply Industry (ESI), it use to generate the communication model which include CM-1 and CM-2 from to present the information definition for each partner. Formerly, ERC's staff may use that model as a guide line in order to design the emergency response plan as shown in figure below:

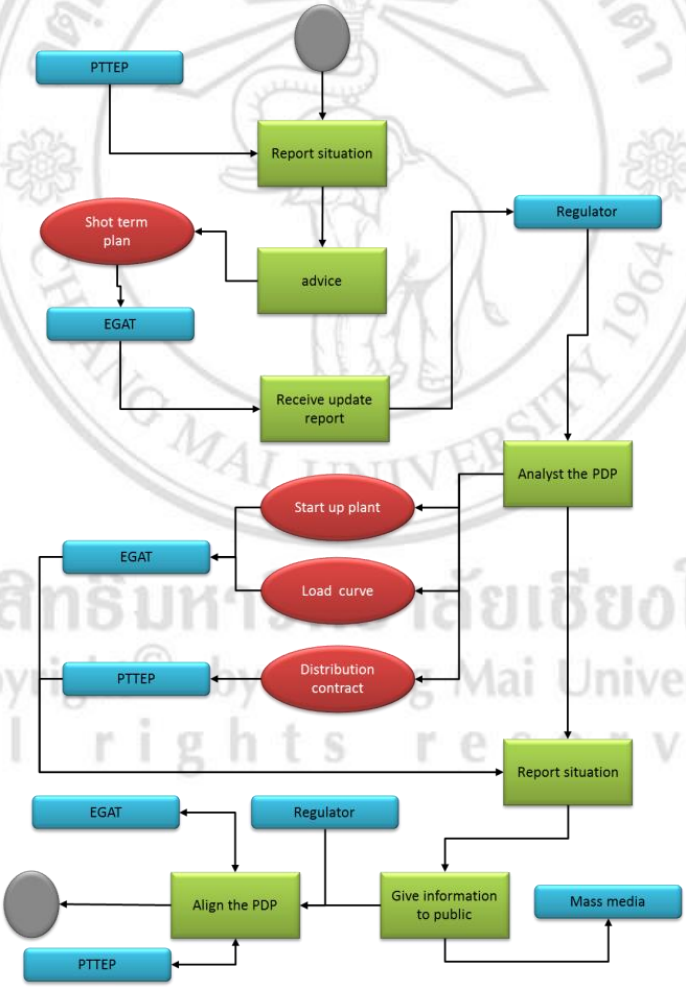

Figure 4.8 Emergency Plan procedure

The diagram above show the case of resource crisis for electricity generation, if the crisis happen, it start by the PTTEP staff at offshore rig to their head quarter then the PTTEP head quarter will sent the urgent report to ERC for request to response. After ERC staff receives the report, they make contact with Electricity Generation Authority of Thailand (EGAT) so as to order the short term response plan while maintain and analyst the power development plan (PDP), reserve ratio and level of generation compare with load curve to find out the order to open reserved generator from cheapest resource like water, solar, wide to expensive resource as oil or coal to avoid the affect with electricity price of the country. The second step show the order from ERC decision which sends to PTTEP and EGAT for advice the best procedure to them, and ERC wait the response the update information from EGAT and PTTEP in order to make the best decision. After that ERC staff will compile the information and decision result and publish as news to mass media for reduce the rumor of people in society. Finally, ERC will work together with EGAT and PTTEP to align the Power Development Plan (PDP) for update the situation which concern to maintain both of reserve ratios and generate level of overall country.

Table 4.1 Compare usage time of new plan and original plan

Procedure	**Partner**	Report	Before	After
Report situation	EGAT	Electricity load curve	1 week	1 week
		Resource usage	1 week	1 week
		Generation capacity	1 week	1 week
	PTTEP	Resource quantity	1 week	3 day
		Total	1 week	1 week

Table 4.1 Compare usage time of new plan and original plan (Continued)

Procedure	**Partner**	Report	Before	After
Analyst situation	EGAT	Power Development Plan (PDP)	6 month	6month
	PTTEP	Distribution contact	1 month	2 week
		Resource quantity	1 week	1week
		Total	1 month	2 week
Manage Petition and news	Regulator	Generator Startup plan	2-3 day	1 day
		Resource usage order	2-3 day	1 day
		Situation news	3 day	1 day
		Total	3 day	1 day

The table above show the interesting point that regulator use shot time to make decision not only on analyst situation step but also on manage customer petition and guide line for public news. For the first procedure which show the time that business partner report the information to regulator. The result show that it use same period of time between original and new procedure because the report in this step was update to regulator in the fix period of time, and regulator may request any necessary information from each partner. However, the time has shown the difference on the second and third step of procedure. the second procedure which show the time that use to analyst the situation which show that regulator can save time from one month to two week by save time from contact directly with oil and gas supplier while the original procedure show that regulator receive that

information form energy regulator. Meanwhile, the time on final step was reduce from three day to one day because it can reduce time in order to give the news to mass media from three day to one day because regulator have support information which support regulator to answer on best decision result. Finally, these three procedure used to generate the emergency plan especially for Emergency Response Plan (ERP) based on common information model (CIM) in order to make that plan more suitable with the gas crisis situation. So, the detail of Emergency Response Plan has present in table below:

Table 4.2 Emergency Response Plan for the case of resource crisis

Procedure No.	procedure	Information request	Responsible person
1	Staff report the emergency case to energy regulatory commission	Crude oil and mix gas quality per min	PTTEP
		Load curve and Peak curve	EGAT
		Reserve ratio	EGAT
2	Energy Regulatory commission request more information	PDP	EGAT (SO)
		Gas distribution contract	PTTEP
3	Staff use shot term response to situation	ERC advice	ERC
		Startup plant order	ERC
4	ERC receive the update information	Startup plant situation	EGAT (SO)
		Crude oil and mix gas quality per min	PTTEP
5	Analyst current Power Development Plan (PDP)	Peak load curve of the year	EGAT
		Generation curve per minute	EGAT
		PDP	EGAT
		Oil and gas price	PTTEP
6	ERC make decision on situation	Committee decision result	ERC
7	ERC receive the update information	Startup plant situation	EGAT (SO)
		Crude oil and mix gas quality per min	PTTEP
8	ERC public update information as news to society	Situation report	ERC
9	ERC align the plan with EGAT and PTTEP	Reserve ratio	EGAT
		PDP	EGAT
		Peak load curve of the year	EGAT
		Gas distribution contract	PTTEP
		Startup plant plan	EGAT

So, it can conclude that emergency plan procedure can improve by identify the attribute of whole industry which expressed the procedure's stakeholder and information, and it can reduce the time to deliver information to decision maker like regulator even though it cannot reduce in all of procedure time but it can help stakeholder to clearly understand their responsible and information that their need to send to decision maker when it needed.

4.1.5 Example of source data which used to validate emergency plan

For raw data which use to create the EMS on emergency plan case can present in a detail below.

4.1.5.1 Electricity generation curve

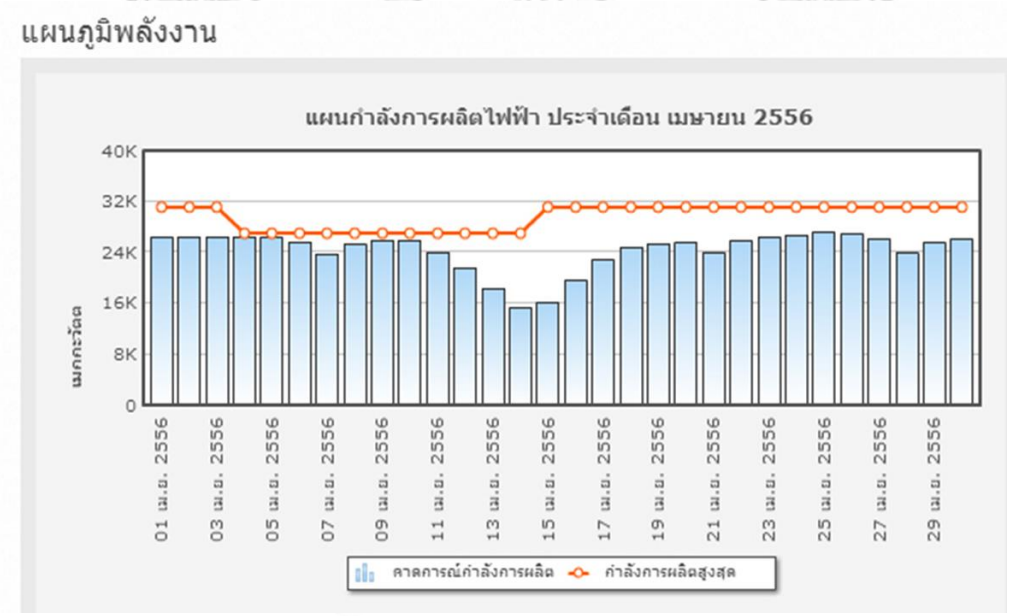

Figure 4.9 Sample of electricity generation curve

This data present the level of generation curve in country for one month, and the detail data of generation curve can present on the table 4.3

Table 4.3 EGAT's Generation forecast

Fiscal Year	Peak Generation			Energy Generation			Load Factor
		Increase			Increase		
	MW	MW	%	GWh	GWh	%	%
Actual							
1987	4 734	553	13.23%	28 194	3 414	13.78%	67.99%
1988	5 444	710	15.00%	31 998	3 804	13.49%	67.10%
1989	6 233	789	14.49%	36 458	4 460	13.94%	66.77%
1990	7 094	861	13.81%	43 190	6 732	18.46%	69.50%
1991	8 045	951	13.41%	49 226	6 036	13.98%	69.85%
1992	8 877	832	10.34%	56 007	6 781	13.78%	72.02%
1993	9 730	853	9.61%	62 181	6 173	11.02%	72.95%
1994	10 709	979	10.06%	69 651	7 470	12.01%	74.25%
1995	12 268	1 559	14.56%	78 880	9 229	13.25%	73.40%
1996	13 311	1 043	8.50%	85 924	7 044	8.93%	73.69%
1997	14 506	1 195	8.98%	92 728	6 804	7.92%	72.97%
1998	14 180	- 326	-2.25%	92 134	- 593	-0.64%	74.17%
Forecast							
1999	14 499	319	2.25%	93 178	1 044	1.13%	73.36%
2000	15 254	755	5.21%	97 858	4 680	5.02%	73.23%
2001	16 214	960	6.29%	103 685	5 827	5.95%	73.00%
2002	17 308	1 094	6.75%	110 436	6 751	6.51%	72.84%
2003	18 399	1 091	6.30%	117 341	6 905	6.25%	72.80%
2004	19 611	1 212	6.59%	124 532	7 191	6.13%	72.49%
2005	20 818	1 207	6.15%	132 228	7 696	6.18%	72.51%
2006	22 168	1 350	6.48%	141 300	9 072	6.86%	72.76%
2007	23 728	1 560	7.04%	151 322	10 022	7.09%	72.80%
2008	25 450	1 722	7.26%	162 438	11 116	7.35%	72.86%
2009	27 232	1 782	7.00%	173 532	11 094	6.83%	72.74%
2010	28 912	1 680	6.17%	184 213	10 681	6.16%	72.73%
2011	30 587	1 675	5.79%	194 930	10 717	5.82%	72.75%

Resources: FRAnnex A

4.1.5.2 Load profile for user

This present the level of electricity usage of resident in country for a mount, and it present in figure below:

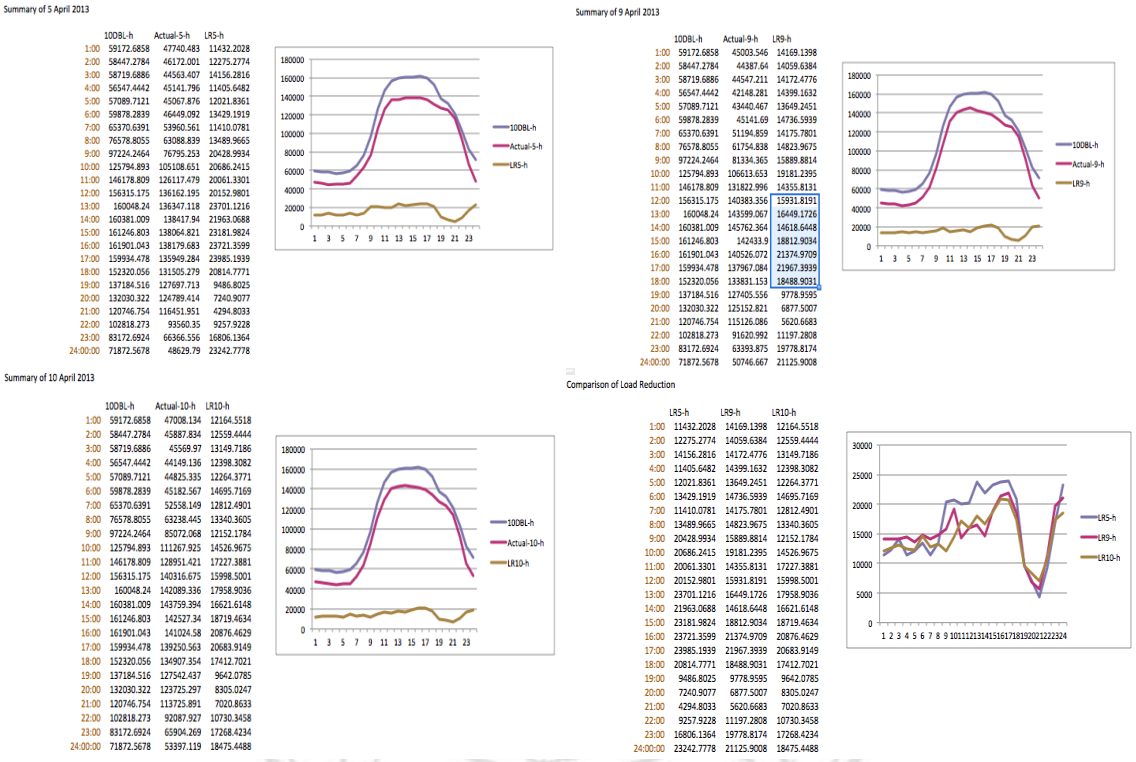

Figure 4.10 Sample data for load profile

A figure above compare load profile for many type of PE and MEA customer which have difference style of electricity usage and use it in difference time. Therefore, generator need to track the load profile every hour in order to avoid electricity shutdown.

4.1.5.3 Resource usage

It present the level of resource which use to generate electricity for one power plant which order and selected by system operator and regulator. Therefore, the graph of resource usage can show in the figure 4.11.

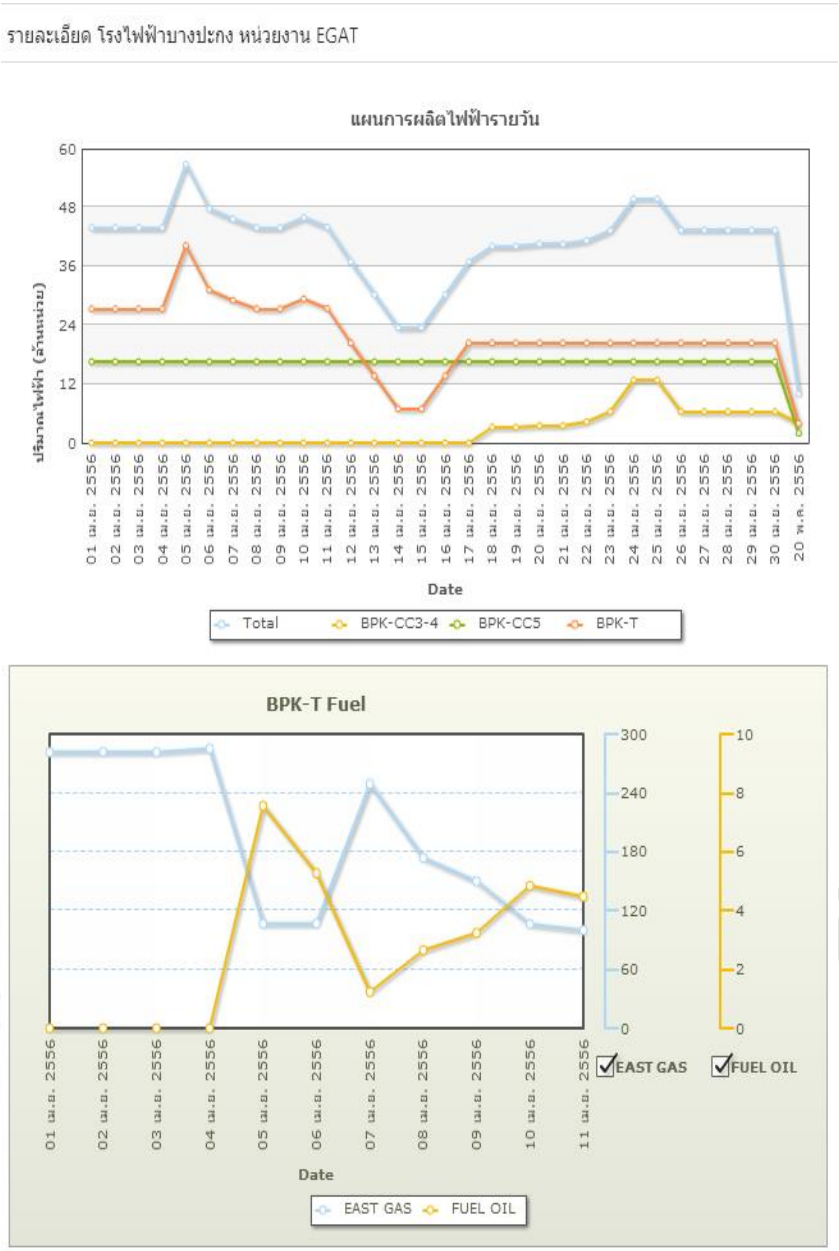

Figure 4.11 Resource Usage

4.1.5.4 History of gas and crude oil price

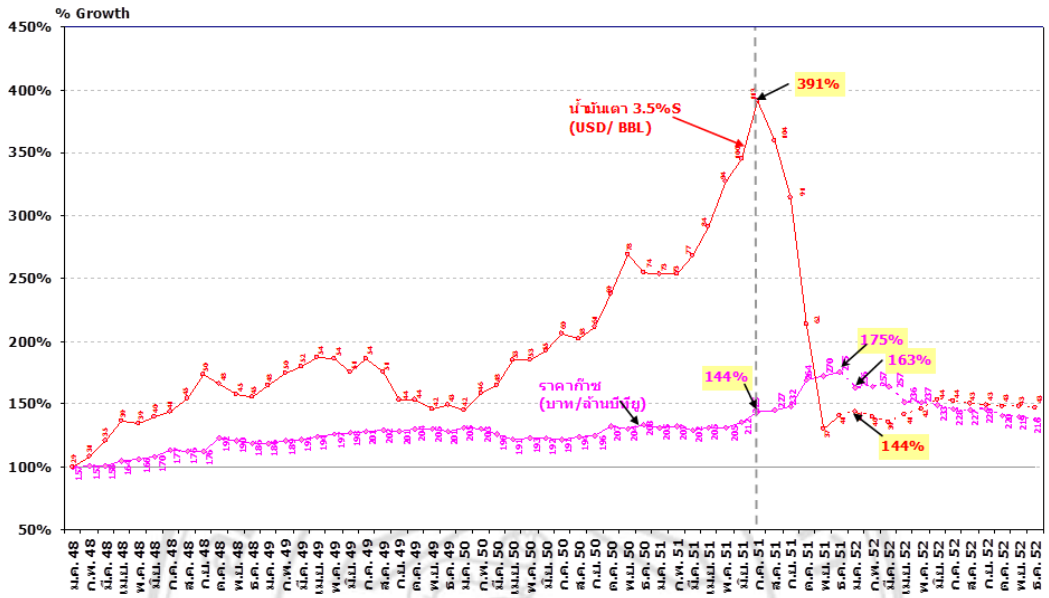

Figure 4.12 Sample data for gas and oil price

The figure above present history of gas and oil price which measure every mount and track it in many year to estimate the price level in the future.

4.2 Demand Response

After research methodology has applied in emergency plan, it seems that BSC can support player for make more accurately and clearly plan. Therefore, research methodology also applied in another case which are demand response because this case never identify the procedure before, so an attribute of demand side management can identify below:

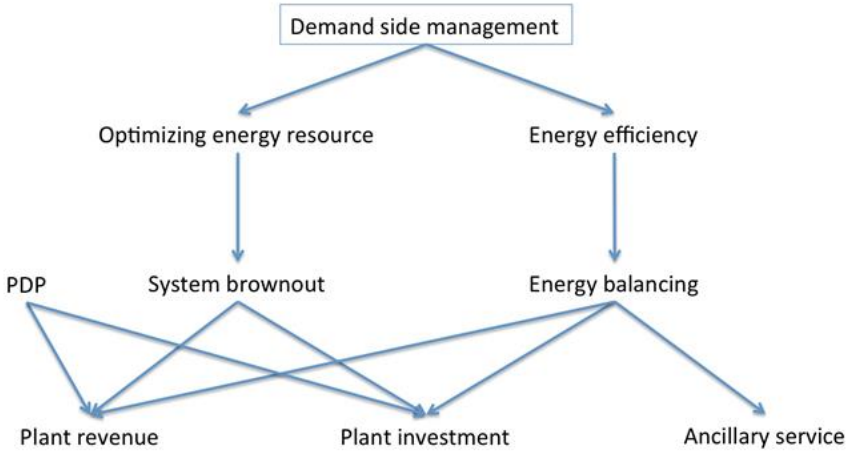

Figure 4.13 Demand side management

4.2.1 Defining demand response

Demand side management can defined as situation which happen on the rapidly increase of load curve in one period of time, and regulator need to make decision to find some power to support the electricity demand for avoid electricity shutdown. So, the attribute of demand response has focus on optimize energy resource usage while maintain the level of energy efficiency. Therefore, it can set a communication plan by separate with stakeholder as EGAT, System Operator, regulator, MEA and PEA, and every player keep information as figure below:

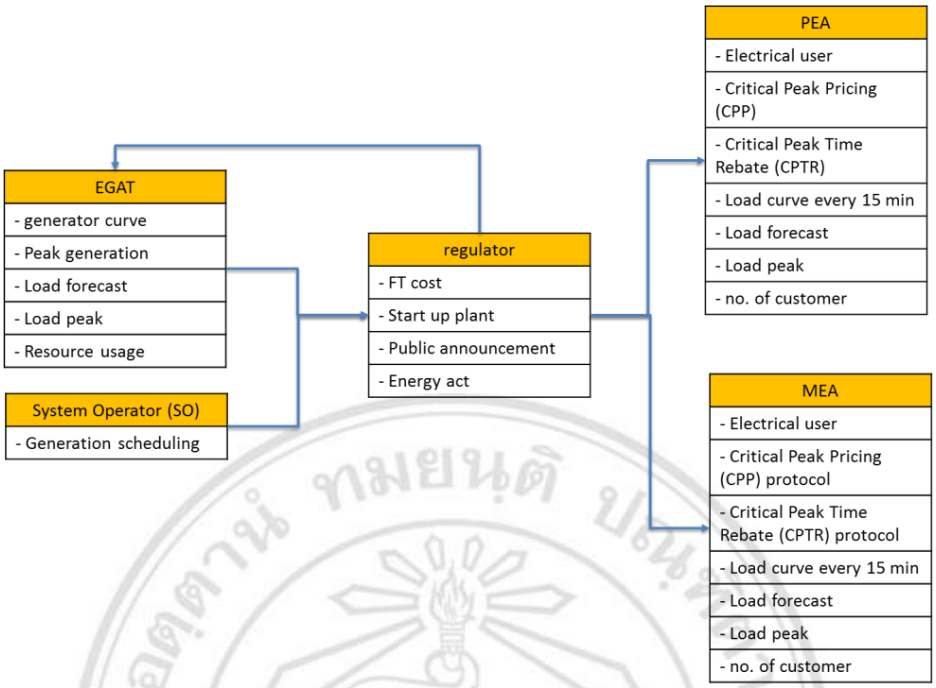

Figure 4.14 CIM for Demand response

After that the task template has identify by start from monitoring generation curve and try to balance with country load profile. If electricity demand has increase rapidly. The regulator need to request information from EGAT, MEA and PEA, then use information to make the decision to start up reserve plant or reduce load demand by ask for corporation form contactor to stop using their electricity. Finally regulator uses their decision to select compensation plan or adjust their Ft cost, and also announce to their mass media.

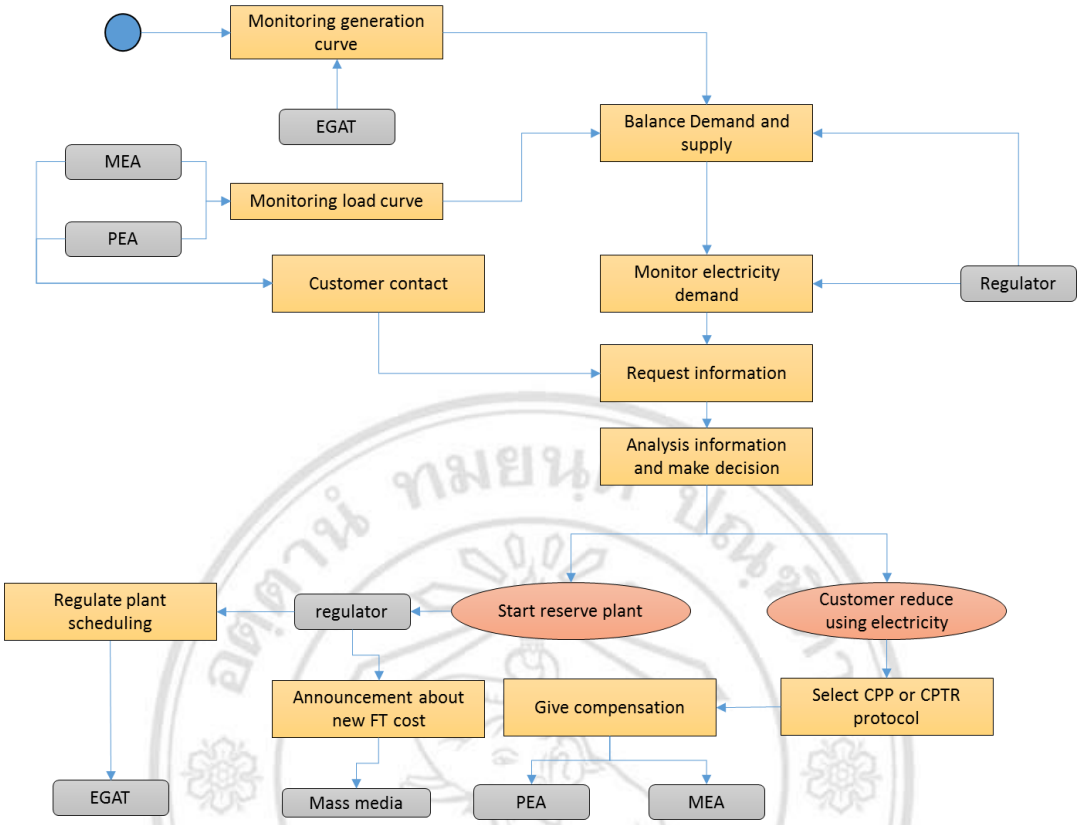

Figure 4.15 Task template for demand response

Then communication plan and task template use to identify the player and information request in each procedure and use to write the procedure plan form beginning of demand response situation until its end. Finally the detail of demand response procedure can present in table below:

Table 4.4 Demand response procedure

Procedure No.	Procedure	Information request	Responsible person
1	Energy regulator have meet with EGAT, MEA,PEA	Energy act for support demand side management	regulator
		No. of customer in each type, Load curve	MEA/PEA
		No. of power plant, Generation curve	EGAT
2	System operator (OS) monitor electricity demand and supply	Load curve, load forecast	MEA/PEA
		Generation curve	EGAT
		Resource usage	EGAT/SO
3	MEA and PEA sign contact with customer who use monitor which can calculate CPP and CTPR	No. of customer in each type	MEA/PEA
		Critical Peak Pricing (CPP)	MEA/PEA
		- Critical Peak Time Rebate (CPTR)	MEA/PEA
		Load forecast	EGAT
4	System operator (OS) report to regulator incase of low demand	Load curve, load forecast	MEA/PEA
		Generation curve and startup plant	SO
		Load peak	EGAT
5	Regulator request information for make decision	Customer contact	MEA/PEA
		PDP	SO
		FT cost	EGAT
6	Incase of start reserve plant: regulator give their decision to SO then order to EGAT to start up reserve plant	Startup plant	SO
		Regulator suggestion	Regulator
		Generation scheduling report	SO
		Generation curve	EGAT
		New FT cost	regulator
		announcement	regulator
7	Incase of reduce electricity usage: regulator give announce to MEA and PEA then customer who sign contact will reduce their electricity usage	Load curve	MEA/PEA
		Customer contact	MEA/PEA
		Compensation cost	regulator

4.2.2 Example of source data which used to validate demand response

For raw data which use to create the EMS on demand response case can use form many source such as EGAT, MEA and PEA, so the sample of information can present below.

4.2.2.1 Electricity generation curve

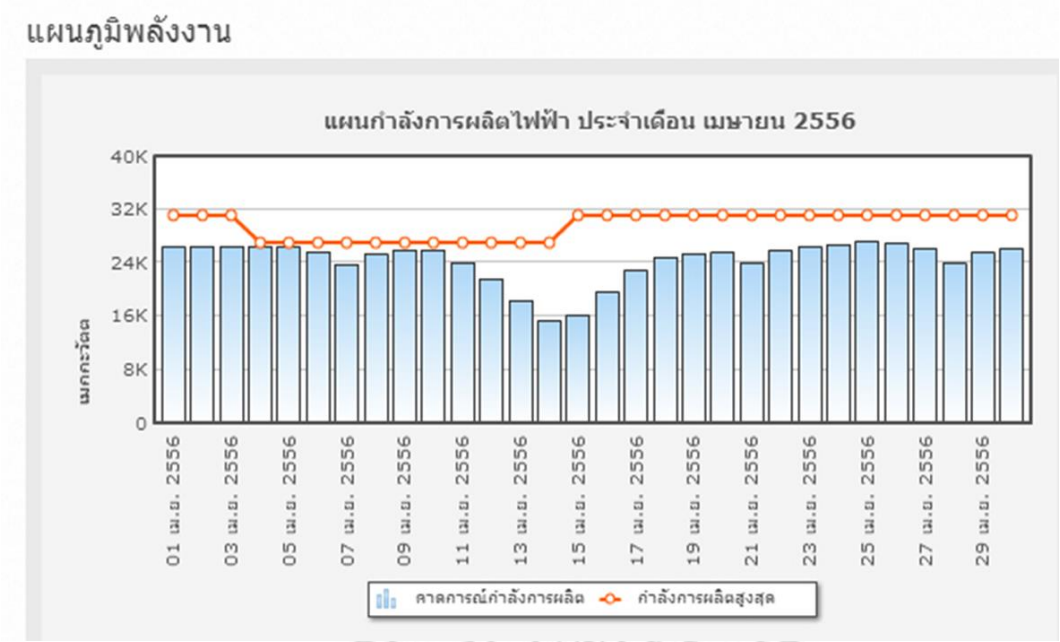

Figure 4.16 Sample of electricity generation curve

This data present the level of generation curve in country for one month, and compare with peak generation of the previous year. Therefore, the detail of generation curve can present on the table 4.5 which showed below:

Table 4.5 EGAT's generation requirements forecast on Sept. 1998

Fiscal Year	Peak Generation			Energy Generation			Load Factor
		Increase			Increase		
	MW	MW	%	GWh	GWh	%	%
Actual							
1987	4 734	553	13.23%	28 194	3 414	13.78%	67.99%
1988	5 444	710	15.00%	31 998	3 804	13.49%	67.10%
1989	6 233	789	14.49%	36 458	4 460	13.94%	66.77%
1990	7 094	861	13.81%	43 190	6 732	18.46%	69.50%
1991	8 045	951	13.41%	49 226	6 036	13.98%	69.85%
1992	8 877	832	10.34%	56 007	6 781	13.78%	72.02%
1993	9 730	853	9.61%	62 181	6 173	11.02%	72.95%
1994	10 709	979	10.06%	69 651	7 470	12.01%	74.25%
1995	12 268	1 559	14.56%	78 880	9 229	13.25%	73.40%
1996	13 311	1 043	8.50%	85 924	7 044	8.93%	73.69%
1997	14 506	1 195	8.98%	92 728	6 804	7.92%	72.97%
1998	14 180	- 326	-2.25%	92 134	- 593	-0.64%	74.17%
Forecast							
1999	14 499	319	2.25%	93 178	1 044	1.13%	73.36%
2000	15 254	755	5.21%	97 858	4 680	5.02%	73.23%
2001	16 214	960	6.29%	103 685	5 827	5.95%	73.00%
2002	17 308	1 094	6.75%	110 436	6 751	6.51%	72.84%
2003	18 399	1 091	6.30%	117 341	6 905	6.25%	72.80%
2004	19 611	1 212	6.59%	124 532	7 191	6.13%	72.49%
2005	20 818	1 207	6.15%	132 228	7 696	6.18%	72.51%
2006	22 168	1 350	6.48%	141 300	9 072	6.86%	72.76%
2007	23 728	1 560	7.04%	151 322	10 022	7.09%	72.80%
2008	25 450	1 722	7.26%	162 438	11 116	7.35%	72.86%
2009	27 232	1 782	7.00%	173 532	11 094	6.83%	72.74%
2010	28 912	1 680	6.17%	184 213	10 681	6.16%	72.73%
2011	30 587	1 675	5.79%	194 930	10 717	5.82%	72.75%

Resources : FRAnnex A

4.2.2.2 Generation curve and demand response

The figure below present the prediction level of generation curve before and after use demand response plan, so it can show the benefit which electricity industry will get from that plan.

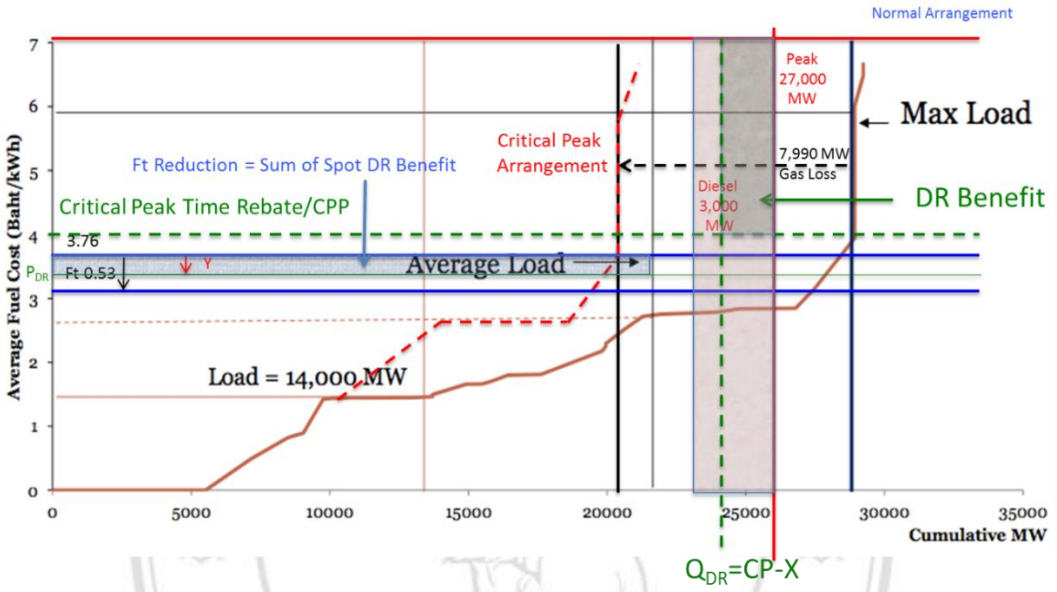

Figure 4.17 Sample of generation curve compare with demand response

Therefore, it present that the demand response benefit can reduce the chance that regulator need to order to start up some expensive resource plant, and avoid effect on increase of Ft cost that direct impact with large amount of country resident.

4.2.2.3 Load profile for user

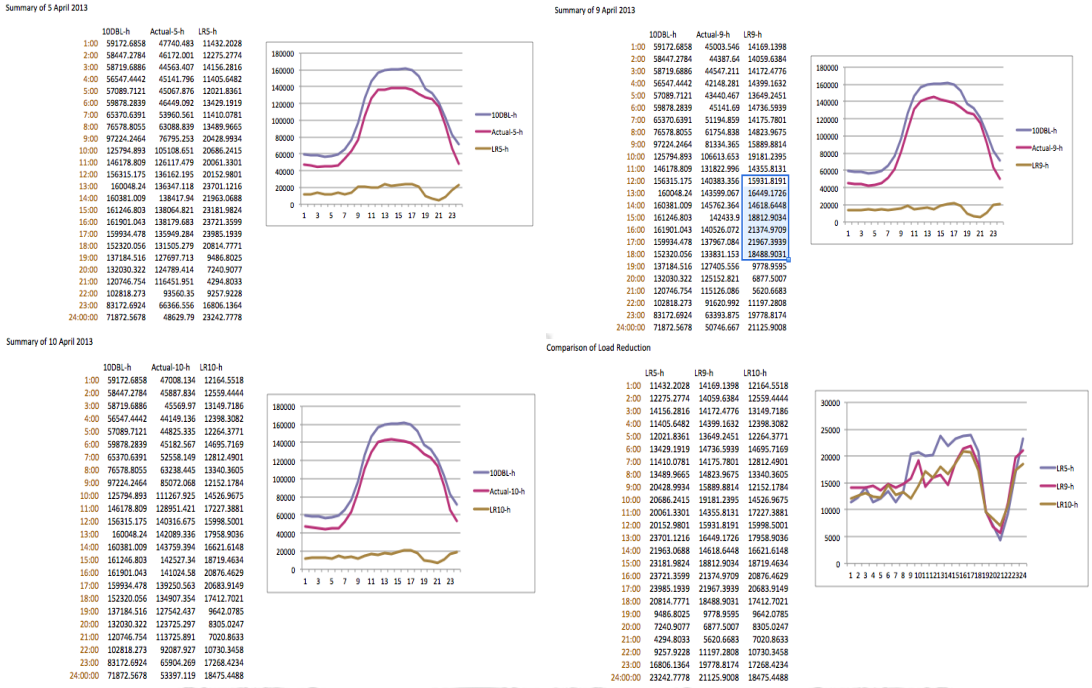

Figure 4.18 Sample data for load profile

It present the electricity usage from difference type of customer in a point of time and present the detail in table below:

Table 4.6 Load profile raw data

	3/22/2013	3/25/2013	3/26/2013	3/27/2013	3/28/2013	3/29/2013	4/1/2013	4/2/2013	4/3/2013	4/4/2013	1DBL	1DBL-h	4/5/2013	Actual-5-h	LR5	LR5-h	4/9/2013	Actual-9-h	LR9	LR9-h	4/10/2013	Actual-10-h	LR10	LR10-h
0:15	72259.728	61164.464	74119.188	74603.64	81576.388	70628.204	49748.784	55457.012	51160.24	44956.324	63567.3972		47188.316		16379.0812		46486.228		17081.1692		48105.34		15462.0572	
0:30	70499.968	52726.812	69737.956	67156.68	74878.264	65607.676	45045.032	53986.188	51445.928	45532.612	59661.7116		47801.828		11859.8836		45945.316		13716.3956		47904.94		11756.7716	
0:45	64645.084	54880.792	67659.004	62080.032	69952.416	71535.62	44252.116	54387.228	50846.28	45479.688	57671.826		48192.816		9479.01		45214.364		12457.462		45301.204		12370.622	
1:00	57618.64	52322.808	69799.516	64604.052	60006.172	64757.504	42762.3	52734.152	50362.224	42930.716	55789.8084	59172.6858	47778.972	47740.483	8010.8364	11432.2028	42368.276	45003.546	13421.5324	14169.1398	46721.052	47008.134	9068.7564	12164.5518
1:15	60506.432	54604.508	65094.404	62444.604	57218.684	65856.3	41437.764	53587.228	49960.88	43125.328	55383.6132		45015.696		10367.9172		42174.136		13209.4772		46456.484		8927.1292	
1:30	62164.948	62461.56	66817.932	65265.592	54639.584	77752.912	40938.488	54840.54	50626.816	43214.548	57872.292		45997.612		11874.68		44860.312		13011.98		45609.78		12262.512	
1:45	59666.24	63496.356	67349.232	69536.684	68743.792	75875.304	40422.12	55067.348	51368.1	43480.008	59500.5184		47173.224		12327.2944		45265.612		14234.9064		45414.14		14086.3784	
2:00	70236.272	55339.944	74121.808	70871.792	74080.292	75395.02	40641.448	54212.188	52303.524	43124.612	61032.69	58447.2784	46501.472	46172.001	14531.218	12275.2774	45250.5	44387.64	15782.19	14059.6384	46070.932	45887.834	14961.758	12559.4444
2:15	68476.12	61186.264	69496.536	66093.296	75615.164	64834.992	40448.384	53450.7	52278.692	43407.076	59528.7224		44939.128		14589.5944		44450.144		15078.5784		45911.64		13617.0824	
2:30	60767.448	58578.424	71037.392	71177.192	74998.296	71130.496	39906.256	53849.496	51534.54	45842.748	59862.2288		44638.044		15224.1848		44506.488		15355.7408		45612.44		14249.7888	
2:45	53385.176	59059.764	65879.932	66300.72	66711.828	74468.112	39764.516	53203.656	51674.408	46828.228	57728.034		44434.88		11293.154		44764.504		12963.53		45723		12005.034	
3:00	57856.948	61427.864	66784.488	68040.552	62934.088	72188.06	39188.772	53106.608	49445.196	46625.116	57759.7692	58719.6886	44241.576	44563.407	13518.1932	14156.2816	44467.708	44547.211	13292.0612	14172.4776	45032.8	45569.97	12726.9692	13149.7186
3:15	57780.588	60203.432	68357.14	72336.668	66129.912	73179.216	38837.472	52027.836	50189.032	45095.568	58413.6864		45267.808		13145.8784		42282.224		15531.4624		44544.312		13869.3744	
3:30	66262.396	52898.752	61077.94	70281.456	70706.8	75309.648	38392.06	52358.068	47253.3	44060.636	57860.1056		45120.368		12739.7376		42581.472		15278.6336		44364.832		13495.2736	
3:45	60795.032	48523.516	66429.476	59988.464	67783.044	67264.28	38501.424	52566.868	46559.424	41216.716	54962.8244		45233.388		9729.4364		41242.72		13720.1044		43631.144		11331.6804	
4:00	64406.108	55368.264	58839.688	53081.268	76214.82	63022.86	38291.808	51969.82	47644.612	40692.356	54953.1604	56547.4442	44945.62	45141.796	10007.5404	11405.6482	41886.708	42148.281	13066.4524	14399.1632	44056.256	44149.136	10896.9044	12398.3082
4:15	63750.892	51362.6	60167.176	65134.896	75886.828	70941.604	38852.188	52951.596	49581.684	40630.532	56925.9996		45317.64		11608.3596		43302.812		13623.1876		45086.308		11839.6916	
4:30	58253.396	58135.364	69460.792	61799.516	71605.592	62784.82	39561.944	52200.744	49523.928	40914.488	56424.0584		44112.5		12311.5584		43303.912		13120.1464		44611.712		11812.3464	
4:45	55620.756	59436.76	67346.164	69543.468	67687.628	68256.168	39612.732	52828.48	49272.508	42157.888	57176.2552		46085.7		11090.5552		43701.264		13474.9912		44871.312		12304.9432	
5:00	57620.788	58019.892	67329.612	73175.872	61210.944	73444.056	40201.424	52881.088	49377.244	45064.432	57832.5352	57089.7121	44755.664	45067.876	13076.8712	12021.8361	43453.88	43440.467	14378.6552	13649.2451	44732.008	44825.335	13100.5272	12264.3771
5:15	56663.576	55750.66	75706.392	70365.8	56110.764	77020.1	40740.744	51854.552	46296.52	48514.308	57902.3416		45157.608		12744.7336		44034.36		13867.9816		45471.9		12430.4416	
5:30	68110.324	64957.572	63689.716	67346.396	65642.024	71958.528	41361.396	50190.4	46405.604	50104.948	58976.6908		44262.56		14714.1308		44837.716		14138.9748		45864.504		13112.1868	
5:45	65832.128	60957.492	70432.992	72302.996	72947.888	79011	42620.384	51244.352	49501.488	49746.096	61459.6816		47999.62		13460.0616		45286.256		16173.4256		44486.804		16972.8776	
6:00	60140.552	64094.576	64764.736	71495.188	72878.388	76792.732	43129.124	54850.04	52095.64	51503.24	61174.4216	59878.2839	48376.58	46449.092	12797.8416	13429.1919	46408.428	45141.69	14765.9936	14736.5939	44907.06	45182.567	16267.3616	14695.7169
6:15	72214.012	67974.788	63418.892	78437.96	71188.016	74621.016	44878.308	56921.7	55761.484	53387.928	63880.4104		50719.672		13160.7384		49094.944		14785.4664		49613.676		14266.7344	
6:30	73855.44	68380.416	57751.664	78142.38	74823.82	85357.06	47045.624	58873.756	57689.924	54917.168	65583.7252		54058.836		11624.8892		51021.812		14661.9132		51048.02		14635.7052	
6:45	72987.716	68038.032	58909.98	76547.252	65014.424	82348.376	48877.948	61095.54	60354.516	56827.36	65100.1144		55204.628		9895.4864		51401.596		13698.5184		53635.396		11464.7184	
7:00	71775.376	71712.496	71400.252	72177.172	70084.712	81763.496	50138.632	60742.172	60047.636	58341.12	66818.3064	65370.6391	55859.108	53960.561	10959.1984	11410.0781	53261.084	51194.859	13557.2224	14175.7801	55935.504	52558.149	10882.8024	12812.4901
7:15	69559.924	71768.076	74579.74	71168.592	82147.728	82767.232	53535.36	60940.952	62451.432	62798.584	69171.762		59651.712		9520.05		55291.292		13880.47		58407.232		10764.53	
7:30	75298.008	69867.16	85636.196	82579.044	87100.208	84627.876	57255.372	65813.06	66909.972	66074.684	74116.158		61116.78		12999.378		59182.924		14933.234		60270.156		13846.002	
7:45	74763.444	84118.46	93302.58	88487.976	94931.184	89398.144	61911.564	69663.356	69074.94	67016.3	79266.7948		64730.656		14536.1388		63897		15369.7948		64511.976		14754.8188	
8:00	86116.22	86633.948	91313.408	92165.848	95590.188	97722.688	67074.256	76302.804	74199.004	70486.708	83760.5072	76578.8055	66856.208	63088.839	16904.2992	13489.9665	68648.136	61754.838	15112.3712	14823.9675	69764.416	63238.445	13996.0912	13340.3605
8:15	92729.356	83807.74	93008.616	92101.78	94421.4	100027.756	74049.476	81314.808	79675.008	77379.92	86851.586		67606.596		19244.99		71319.06		15532.526		74042.02		12809.566	
8:30	103286.108	84791.08	106481.852	107284.48	100183.508	104614.388	79731.304	87775.244	84601.784	83909.896	94265.9644		72617.532		21648.4324		77917.68		16348.2844		81905.78		12360.1844	
8:45	103840.832	100690.044	110587.148	105812.548	100697.92	110610.968	86336.904	90641.492	90520.076	91236.588	99097.452		79101.432		19996.02		85044.54		14052.912		88856.12		10241.332	
9:00	105884.7	116433.464	118768.652	122947.956	115756.896	124432.124	93823.212	96400.088	94639.368	97733.372	108681.983	97224.2464	87655.452	76795.253	20826.5312	20428.9934	91056.18	81334.365	17625.8032	15889.8814	95484.352	85072.068	13197.6312	12152.1784
9:15	122023.18	119359.08	125166.824	120973.116	121244.304	123589.432	103344.664	102126.248	101328.812	104651.768	114380.743		95835.324		18545.4188		95618.776		18761.9668		102419.996		11960.7468	
9:30	125764.4	125917.372	130296.356	136569.256	133192.32	138287.788	111653.52	109326.132	108680.608	112043.356	121373.111		103818.376		19354.7348		103106.06		20067.0508		108355.896		14817.2148	
9:45	136714.876	134089.156	130787.832	140163.532	145700.72	142542.596	118753.224	119648.376	115519.228	115785.04	129970.458		106817.588		23152.87		109339.792		20630.666		114022.284		15948.174	
10:00	140440.892	145177.048	124685.472	139979.608	155625.94	150590.748	123811.668	130210.636	122729.764	123300.828	135655.258	125794.893	113963.316	105108.651	21691.9424	20686.2415	118389.984	106613.653	17265.2744	19181.2395	120273.524	111267.925	15381.7344	14526.9675
10:15	149932.58	149058.42	129761.744	142037.968	149030.148	149337.536	129290.548	136257.3	130614.12	132296.508	139821.687		120532.004		19289.6832		125824.196		13997.4912		123035.444		16786.2432	
10:30	150582.108	160815.996	133429.584	140249.952	158877.524	151192	131654.492	140788.496	132706.336	136739.016	143703.55		125243.344		18460.2064		129921.496		13782.0544		127645.708		16057.8424	
10:45	139845.368	167474.18	145667.628	138563.76	164641.8	163223.624	136309.12	145138.612	137657.228	140697.304	147921.862		128063.04		19858.8224		134641.176		13280.6864		130465.808		17456.0544	
11:00	153410.784	165446.94	159408.36	153336.536	166223.984	162791.584	141165.812	147110.636	138928.488	144858.24	153268.136	146178.809	130631.528	126117.479	22636.6084	20061.3301	136905.116	131822.996	16363.0204	14355.8131	134658.724	128951.421	18609.4124	17227.3881
11:15	153389.54	159269.352	157250.736	150377.492	174424.848	171433.052	144235.168	146562.092	142790.504	146422.808	154615.559		134418.844		20196.7152		139736.888		14878.6712		137954.776		16660.7832	
11:30	158761.576	143762.712	161234.96	162820.152	172193.044	173393.32	145084.288	148808.948	142335.492	146325.076	155471.957		136614.9		18857.0568		140173.148		15298.8088		141299.976		14171.9808	
11:45	162719.428	155534.44	150871.572	160686.364	165662.164	174994.364	149477.376	151871.024	142554.164	147006.416	156567.731		137060.7		19507.0312		140269.952		16297.7792		141783.66		14784.0712	
12:00	167197.164	160961.816	157300.1	169808.676	172977.92	168994.376	150683.036	150053.84	142739.88	145337.724	158605.453	156315.175	136554.336	136162.195	22051.1172	20152.9801	141353.436	140383.356	17252.0172	15931.8191	140228.288	140316.675	18377.1652	15998.5001
12:15	159896.048	164450.52	159534.676	161954.208	171753.884	175814.548	151491.772	150744.9	147042.208	147128.556	158981.132		137015.472		21965.66		142760.052		16221.08		140888.28		18092.852	
12:30	168767.46	161667.476	157208.376	167442.264	165409.532	173337.384	151624.212	152683.196	150148.048	148219.156	159650.71		135323.268		24327.4424		144291.848		15358.8624		141671.4		17979.3104	
12:45	168116.704	166581.316	162576.3	163902.46	156319.18	176855.744	152570.352	153374.572	151534.94	147583.616	159941.518		136448.548		23492.9704		142668.852		17272.6664		142669.596		17271.9224	
13:00	168300.16	168185.968	159836.668	170216.424	167670.208	179166.216	149346.168	152740.356	152641.096	148092.712	161619.598	160048.24	136601.184	136347.118	25018.4136	23701.1216	144675.516	143599.067	16944.0816	16449.1726	143128.068	142089.336	18491.5296	17958.9036
13:15	169190.764	167316	159738.824	168816.104	162411.628	174834.404	151493.012	153006.004	153885.584	148387.624	160907.995		137306.196		23601.7988		145245.408		15662.5868		143636.172		17271.8228	
13:30	172309.624	166840.58	152403.38	173775.036	173098.116	167637.812	150833.308	155421.588	153742.268	146667.656	161272.937		138557.728		22715.2088		145560.396		15712.5408		143733.016		17539.9208	
13:45	165297.88	160274.552	157488.188	171721.536	170341.784	169095.936	150412.36	155660.544	153599.732	148252.9	160214.541		138233.776		21980.7652		146119.44		14095.1012		144361.844		15852.6972	
14:00	162914.824	163331.308	147637.336	164959.78	175786.248	170027.352	151309.092	155572.472	151404.252	148342.96	159128.562	160381.009	139574.06	138417.94	19554.5024	21963.0688	146124.212	145762.364	13004.3504	14618.6448	143306.544	143759.394	15822.0184	16621.6148
14:15	168549.036	157406.444	144927.848	162318.508	177938.92	176572.94	151979.468	154674.796	151713.884	147849.68	159933.152		139160.268		20232.8844		144558.732		14834.4204		143399.968		17993.1844	
14:30	164721.732	146946.324	156341.564	166048.552	176709.928	177874.384	151366.6	153138.42	153749.928	148007.68	159490.511		137770.668		21719.8432		143733.136		15757.3752		143082.336		16408.1752	
14:45	172432.064	160645.36	166152.752	164405.004	176174.072	170572.32	152505.276	153915.096	152598.96	148679.556	161808.046		137228.144		24579.902		141762.476		20045.57		142975.616		18832.43	
15:00	172061.204	162693.976	167837.64	175186.288	181522.592	177049.3	149226.704	154986.452	153567.488	148823.396	164295.504	161246.803	138100.204	138064.821	26195.3	23181.9824	139681.256	142433.9	24614.248	18812.9034	142651.44	142527.34	21644.064	18719.4634
15:15	170358.696	163674.068	167582.14	170334.688	175002.024	169637.436	151824.784	153835.94	153212.016	149426.192	162488.798		138682.504		23806.2944		140264.948		22223.8504		141490.336		20998.4624	
15:30	165821.676	160528.872	154007.08	173223.328	168795.516	176731.092	148263.436	152995.536	153808.444	149345.308	160352.027		138545.42		21806.6068		141209.26		19142.7668		141364.78		18987.2668	
15:45	173898.764	169581.424	163635.148	169934.248	173026.152	172504.716	150694.584	153745.46	151975.72	149196.984	162617.32		138340.02		24277.3		140733.38		21883.94		140832.252		21785.068	
16:00	163670.168	170844.764	163906.736	168919.74	173539.38	179154.052	152048.516	153329.764	148078.64	147968.504	162146.026	161901.043	137150.788	138179.683	24995.2384	23721.3599	139896.7	140526.072	22249.3264	21374.9709	140410.952	141024.58	21735.0744	20876.4629
16:15	163487.748	173686.76	163138.34	171614.144	174589.876	175651.216	149445.2	151951.308	146308.196	146398.7	161627.149		136498.584		25128.5648		138637.188		22989.6608		138832.232		22794.9168	
16:30	163249.864	167826.376	157848.588	169474.472	178370.444	173492.844	151239.604	150882.316	146674.18	145780.26	160483.895		135828.804		24655.0908		137909.756		22574.1388		138521.42		21962.4748	
16:45	160821.924	157314.56	160219.396	170998.212	176882.212	172853.776	150070.66	150392.812	144854.44	145145.564	158865.356		136187.732		22777.6236		137675.544		21289.8116		139912.36		19052.9956	
17:00	165060.376	159344.036	161835.552	173566.34	166415.832	172572.328	148679.016	149086.092	144888.62	145166.932	158661.512	159934.478	135282.016	135949.284	23179.4964	23985.1939	137645.848	137967.084	21015.6644	21967.3939	139736.24	139250.563	18925.2724	20683.9149
17:15	163074	151406.98	157612.24	169179.52	170950.328	173289.632	147682.992	148705.572	144789.828	144867.048	157155.814		133797.304		23358.51		136471.884		20683.93		137987.088		19168.726	
17:30	154357.132	149456.86	155507.58	159545.768	170339.48	161344.62	147400.344	149840.644	143321.532	144485.86	153559.982		132414.136		21145.846		135642.624		17917.358		137497.964		16062.018	
17:45	152137.596	147101.44	157685.46	154086.824	162955	164768.184	147844.632	147121.108	143459.996	144798.976	152195.922		130715.06		21480.8616		134747.584		17448.3376		135071.788		17124.1336	
18:00	145719.588	146209.252	147140.368	142246.22	160259.208	152997.68	144211.768	145780.992	137874.092	141245.9	146368.507	152320.056	129094.616	131505.279	17273.8908	20814.7771	128462.52	133831.153	17905.9868	18488.9031	129072.576	134907.354	17295.9308	17412.7021
18:15	139157.78	142617.64	140494.928	138318.684	145411.996	143977.536	137795.892	139183.86	136288.876	136381.756	140365.865		128205.02		12160.8448		127708.016		12657.8488		128142.892		12222.9728	
18:30	133909.496	140476.048	131699.572	137842.572	141042.052	141412.128	137625.8	139153.396	136428.404	134765.228	137435.47		127522.64		9912.8296		127229.376		10206.0936		128221.96		9213.5096	
18:45	133556.6	136766.112	129619.908	137694.364	139483.976	140085.736	136808.448	139218.872	134914.696	133904.3	136211.301		127663.96		8547.3412		127420.036		8791.2652		127154.576		9056.7252	
19:00	131671.732	135887.324	128576.416	136425.46	136440.444	138407.46	136059.964	136740.344	133609.056	133436.064	134725.426	137184.516	127399.232	127697.713	7326.1944	9486.8025	127264.796	127405.556	7460.6304	9778.9595	126650.32	127542.437	8075.1064	9642.0785
19:15	130903.424	133927.88	128935.624	135447.528	135061.744	138194.816	134888.256	135446.96	132657.972	132912.648	133837.685		126619.524		7218.1612		126795.696		7041.9892		125601.448		8236.2372	
19:30	130157.54	133508.348	129425.864	134407.104	134048.32	137653.788	134308.404	134992.144	131213.516	131044.456	133025.238		125513.524		7561.7144		126175.9		6899.1384		124833.804		8241.4344	
19:45	129284.46	132821.336	128623.836	132941.576	132948.132	136975.12	132818.036	133914.636	129556.464	129236.608	131912.02		124237.28		7674.7404		124845.236		7066.7844		123514.692		8397.3284	
20:00	126336.812	130102.532	126542.7	130381.288	131221.44	133422.332	130317.604	131285.228	127158.672	126194.82	129296.343	132030.322	122787.328	124789.414	6509.0148	7240.9077	122794.452	125152.821	6501.8908	6877.5007	120951.244	123725.297	8345.0988	8305.0247
20:15	124013.404	126853.34	123372.44	127171.116	127865.016	130172.7	128198.732	127607.876	123645.076	123192.268	126209.197		120580.836		5628.3608		120372.668		5836.5288		118429.244		7779.9528	
20:30	120236.86	122974.432	120150.372	123757.484	123536.396	125971.424	124446.84	123675.584	120315.26	120384.16	122544.881		118188.716		4356.1652		118191.728		4353.1532		115969.904		6574.9772	
20:45	117476	119850.72	117048.688	120265.108	120359.916	123019.348	121775.764	119404.86	117490.46	116160.096	119283.95		115580.104		3701.846		115343.472		5738.478		112724.124		7011.826	
21:00	113909.22	114431.704	112936.624	115973.784	116395.336	120184.88	116498.384	115349.752	112648.344	111181.864	114950.989	120746.754	111458.148	116451.951	3492.8412	4294.8033	108396.476	115126.086	6554.5132	5620.6683	108234.292	113725.891	6716.6972	7020.8633
21:15	107189.7	106270.852	106286.096	108044.764	110088.084	115179.948	108100.544	109209.28	105657.84	105452.276	108147.938		105636.68		2511.2584		102697.8		5450.1384		103157.448		4990.4904	
21:30	98757.544	98844.148	97814.168	101157.4	102690.6	109365.324	99352.432	100718.268	98122.256	97951.272	100477.341		96871.34		3606.0012		94865.212		5612.1292		94996.736		5480.6052	
21:45	94196.844	113161.84	106446.176	114137.856	110009.096	125398.36	93618	92964.492	90908.496	90384.46	103122.562		88762.728		14359.834		88442.696		14679.866		88304.728		14817.834	
22:00	94853.532	109587.672	107169.24	109046.792	111537.94	119266.488	87821.616	85175.264	86004.476	84747.276	99525.2496	102818.273	82970.652	93560.35	16554.5976	9257.9228	80478.26	91620.992	19046.9896	11197.2808	81892.796	92087.927	17632.4536	10730.3458
22:15	79118.7	100310.28	98383.38	104789.264	103337.824	114648.836	82013.204	78444.844	77395.16	76675.156	91511.6648		76153.408		15358.2568		72736.7		18774.9648		73264.412		18247.2528	
22:30	84813.344	94274.768	90608.692	99368.116	97624.088	107550.652	78358.568	74346.424	67793.56	70997.48	86573.5692		69160.308		17413.2612		65307.584		21265.9852		65958.648		20614.9212	
22:45	91594.992	84175.736	77751.028	84099.736	88932.06	94984.288	74551.696	70527.392	62189.736	66190.548	79499.7212		62997.308		16502.4132		59541.26		19958.4612		65761.604		13738.1172	
23:00	87954.404	76904.912	75180.396	80678.532	82414.816	94085.62	69241.368	65332.864	57416.552	61848.68	75105.8144	83172.6924	57155.2	66366.556	17950.6144	16806.1364	55989.956	63393.875	19115.8584	19778.8174	58632.412	65904.269	16473.4024	17268.4234
23:15	83320.764	87084.248	75660.988	92488.744	87109.428	100252.136	65641.524	60076.468	54241.112	56811.68	76268.906		53516.624		22752.282		53049.276		22219.63		57648.26		18620.646	
23:30	71059.216	82127.168	77363.064	82164.9	92394.412	94783.808	63481.956	57838.888	50227.48	55948.344	71898.9236		49233.492		22465.4316		50765.672		20933.2516		54183.08		17515.8436	
23:45	78330.152	77009.316	75530.696	81417.28	83931.2	92072.948	60610.192	55730.292	48126.176	53884.104	70664.2356		46851.204		23813.0316		50217.296		20446.9396		52154.548		18509.6876	
24:00:00	78093.944	81325.9	77852.024	75222.78	80928.12	87173.768	55029.112	55188.864	47307.82	50459.728	68858.206	71872.5678	44917.84	48629.79	23940.366	23242.7778	48954.424	50746.667	19903.782	21125.9008	49602.588	53397.119	19255.618	18475.4488

4.2.2.4 Hourly demand of based line day VS actual of event day

The detail of electricity need on one day can be showed below:

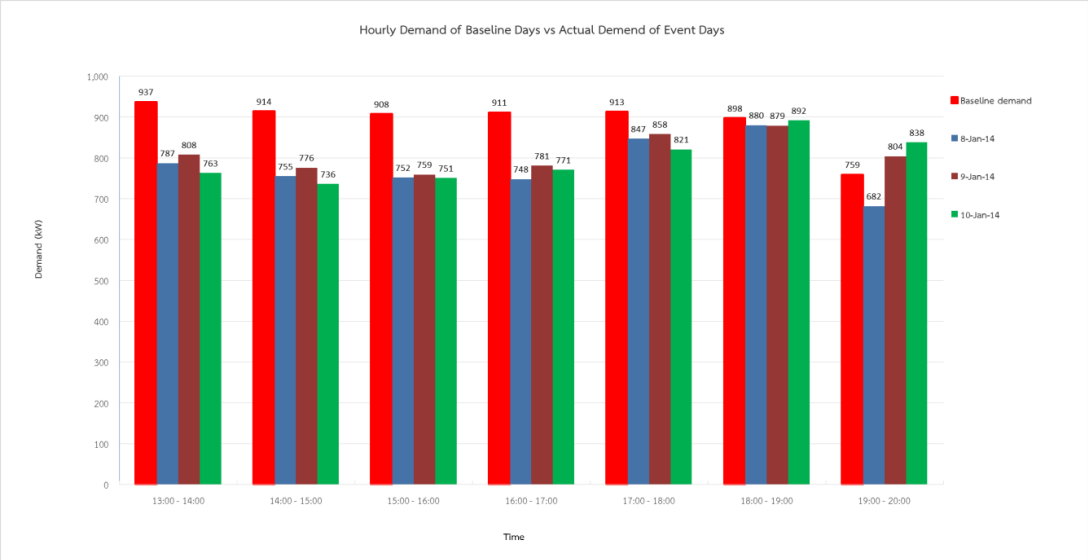

Figure 4.19 Sample data of Hourly demand of based line day VS actual of event day

The figure above show the level of electricity demand in the period of hour for once day which compare between based line and event day. As a result show that electricity demand for based line will reduce in the evening, while the demand will stable all day in event day.

4.2.2.5 Resource usage

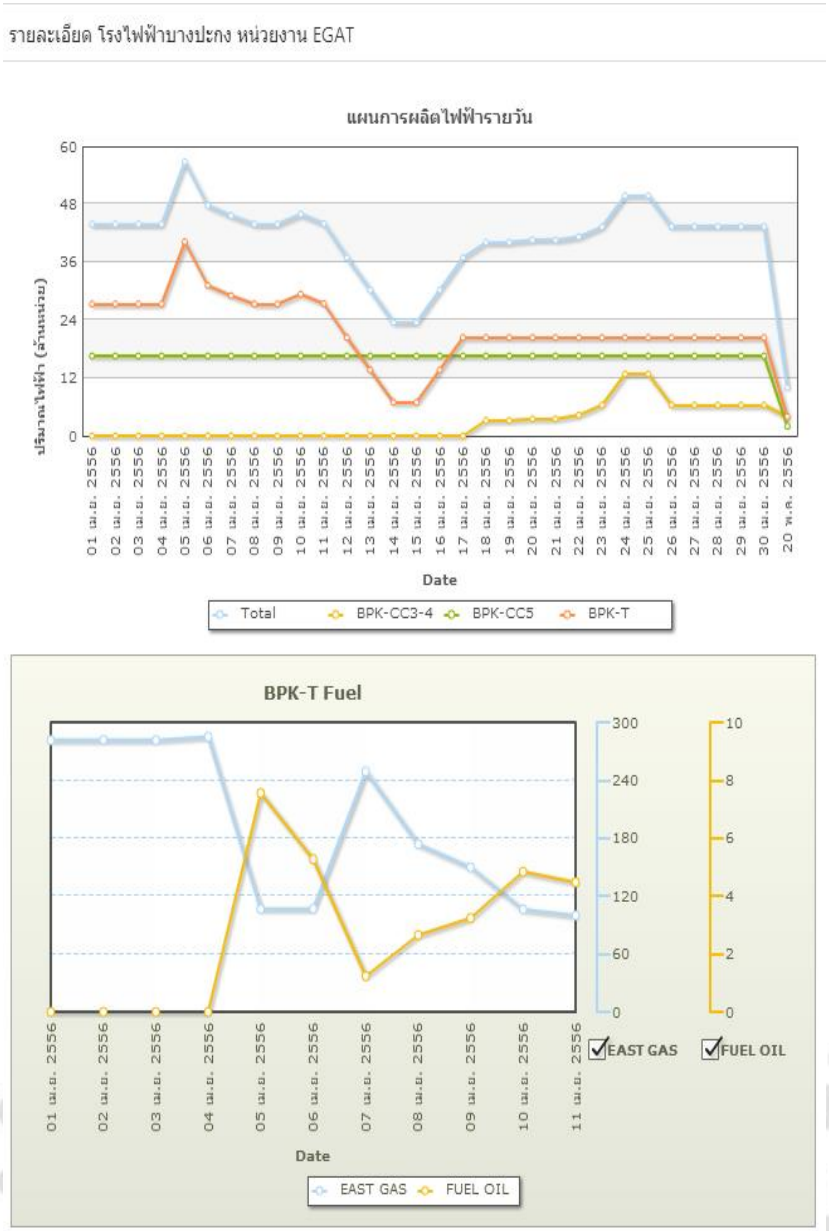

Figure 4.20 Resource usage

It present the amount of resource usage compare with level of electricity production of one plant, and it show that one plant can use many resource to produce their electricity in order to avoid electricity shout down. So, regulator normally will order to run cheaper resource on power plant first because the expensive resource have impact with plant investment cost and finally impact with Ft cost.

4.3 Ft cost

For test on third case, the electricity tariff in the part of FT calculation has selected to run the result because it present as an important part which regulator's decision has relate with many player in industry, and large amount of country resident. Therefore, the information from balance scorecard was focus on Ft option in report which EGAT calculate and present to regulator.

4.3.1 Validate result on Ft cost

Formerly, it shows that EGAT submit Ft report which includes Ft option and current electricity price to regulator. Moreover, they also present generation curve and daily load curve to regulator as their support information, while plant scheduling and power development plan (PDP) has presented to regulator by system operator (SO) for them to make the correct information. In order to make decision on Ft cost, regulator also investigates the information from PEA and MEA which are electricity price of each customer type. Consequently, the information flow can showed on figure below:

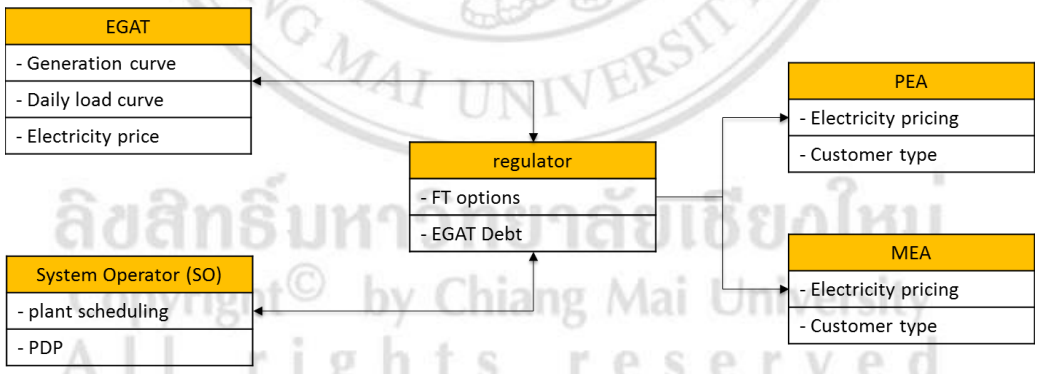

Figure 4.21 CIM for Ft decision

Based on figure above, they can design task template for FT decision flow of regulator are as follow:

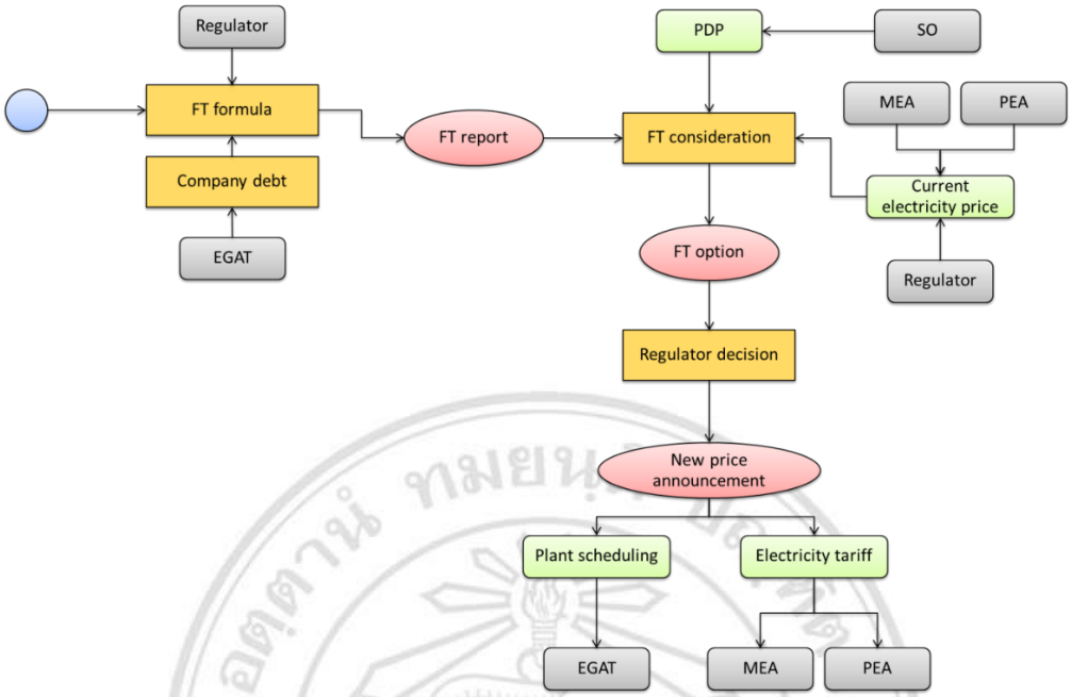

Figure 4.22 Task template for Ft decision

The figure above presents the task for FT decision of regulator. It start by EGAT create Ft report for new period by use support information like company debt and current electricity price, then use that information to create four Ft option and present to regulator. When regulator receive Ft report, they

Table 4.7 Ft cost decision procedure

Procedure No.	procedure	Information request	Responsible person
1.	EGAT design FT report	Electricity price	EGAT
		EGAT Debt	EGAT
		PDP	System Operator (SO)
2.	Submit FT report to regulator for make decision	FT option	EGAT
		Electricity price	MEA/PEA
		PDP	System Operator (SO)
		Plant scheduling	System Operator (SO)
3.	Regulator make final decision	New Electricity price	regulator
		Adjustable PDP	regulator

As the result, it seem that EMS for Ft cost decision can manage from whole industry balance scorecard but most of information come from one source which is EGAT who act as both electricity generator and system operator. Therefore, regulator need to be in force to believe on EGAT FT presentation report, so it can conclude that EMS for Ft cost can design by using ESI's balance scorecard. Though, the final decision has related with current industry politics and policy.

4.3.2 Example of source data which used to validate Ft cost

4.3.2.1 History of Ft pricing

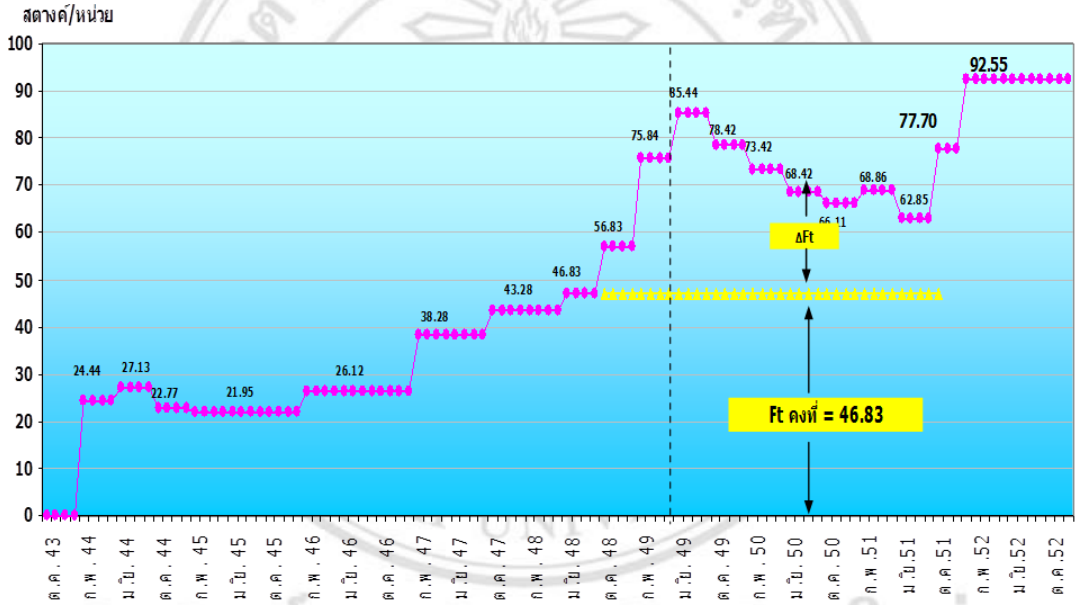

Figure 4.23 History of Ft price

Sources: 2009-09-04_ElectricityPriceStructure

The figure above show history of Ft cost in Thailand which regulator and EGAT track every week, so it present the increase level of Ft cost in a year, which means that electricity industry need to find the cheaper resource in order to run their business and avoid the expensive of electricity price in a future.

4.3.2.2 Ft Option graph

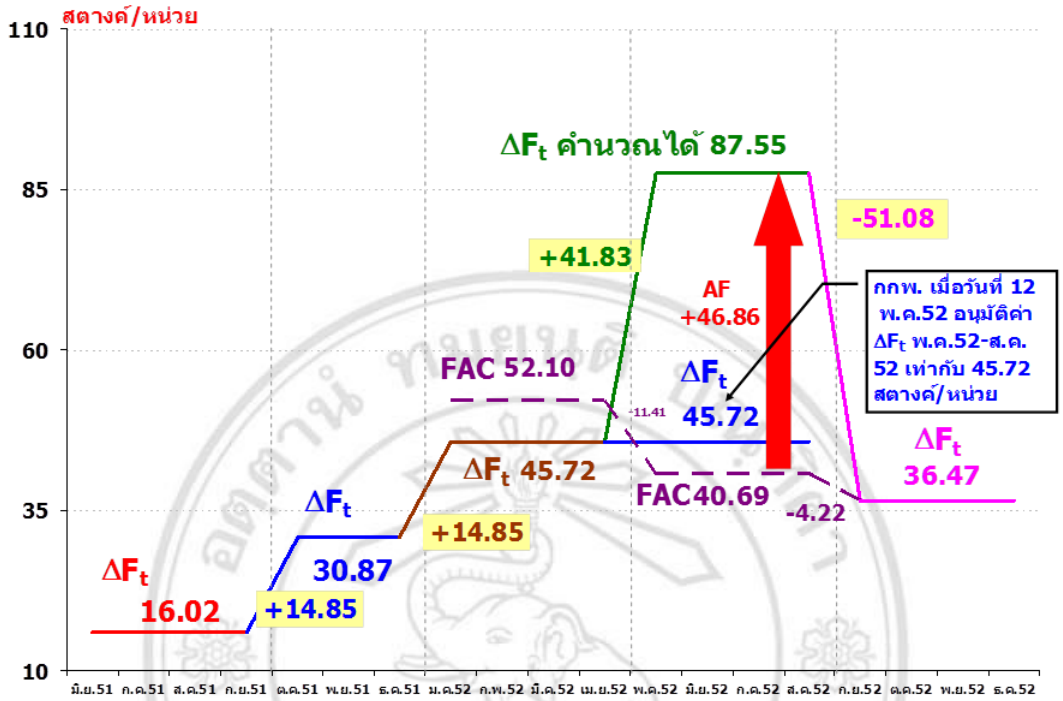

Figure 4.24 Ft Option in Ft report from EGAT

It present the sample of one of Ft option from Ft report which provide to regulator by EGAT which present the level of Ft cost in the part from regulator decision and the option in the present which calculate from EGAT debt and investment in the period of time. Therefore, regulator need to select one choice in order to balance between EGAT debt and electricity price.

4.3.2.3 History of gas and crude oil price

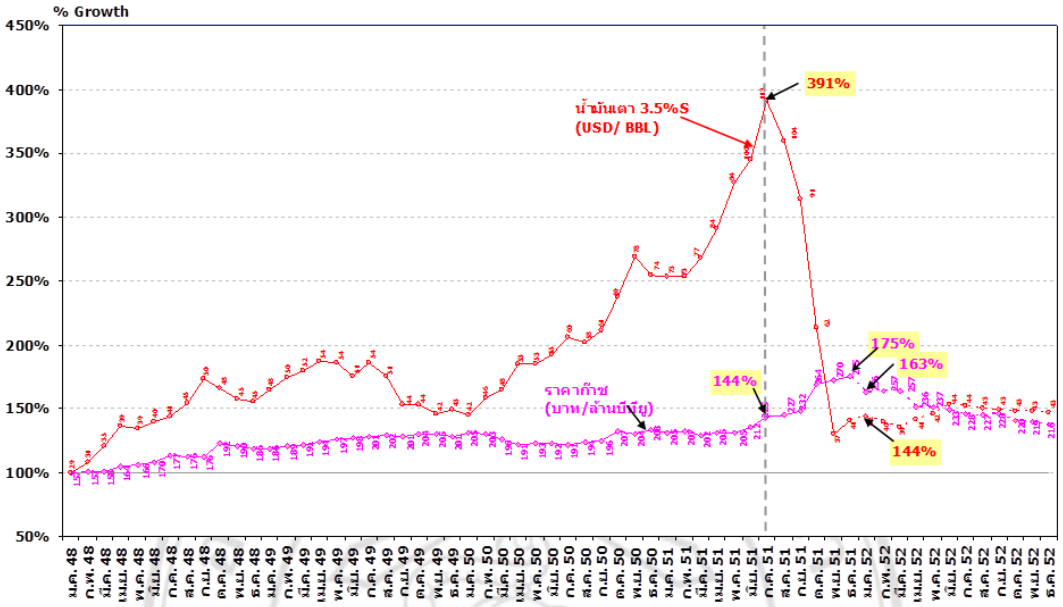

Figure 4.25 Oil and gas price per month in a years

It present the change of oil and gas price which use to support regulator to make the decision on Ft cost. It means that regulator can make the decision to stay the Ft at the same cost in case of low price of oil and gas, on the other hand regulator need to change the Ft cost in case of higher oil and gas price to avoid industry bankrupt.

4.3.3.4 Generation peak per hour

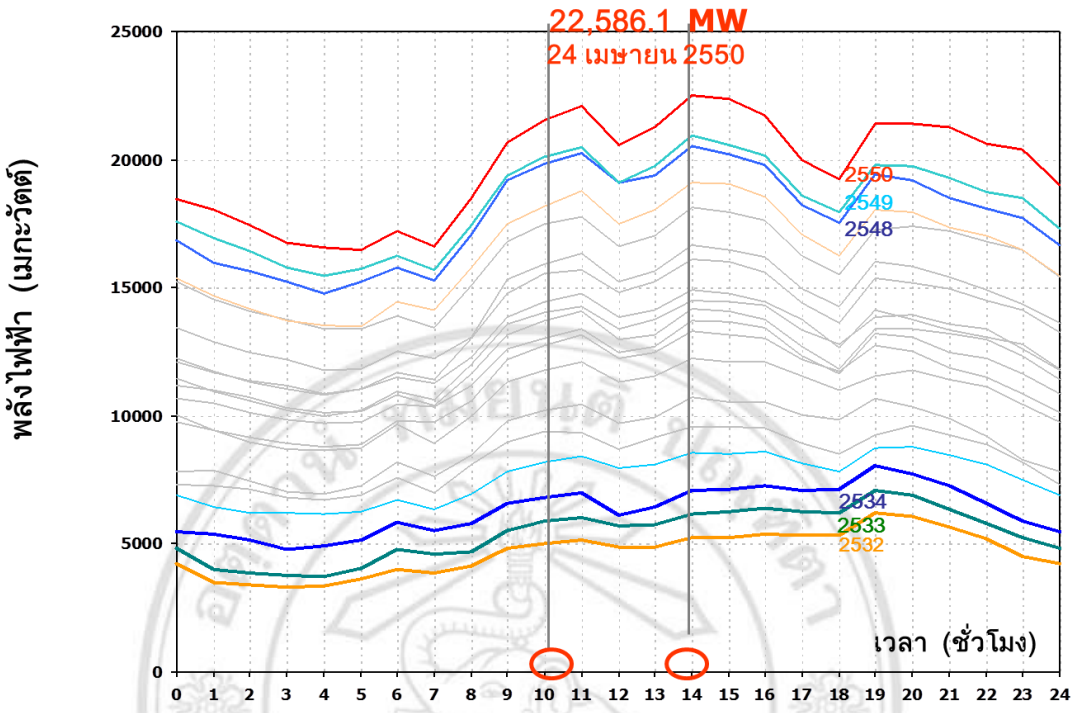

Figure 4.26 Generation peak per hour compare 30 days

The figure above show the measure level of generation curve which chapter only peak point in an hour for 24 hour a day, and compare with peak generation curve of another 30 day. Therefore, regulator can predict the generation level of all country and estimate the electricity cost in case of order to startup expensive power plant.

Chapter review

Finally, it can be conclude that design the Balance Scorecard and create the Common Information Model for identify the communication model of each partner in any business can support the staff for create not only more suitable and accuracy emergency response plan but also for Demand Response and calculate Ft cost. Moreover, Common Information Model also present as a reference guideline to staff to know how the information transfer between business partner and the person who will response with that information in each procedure, which may help the business to have more support detail to adjust the emergency plan for avoid the complicate in real emergency's situation.