

RISK MANAGEMENT STRATEGY OF POWER GENERATING OF PT INDONESIA POWER

Sripeni Inten Cahyani

Staff of Inventory Management of PT. Indonesia Power

e-mail address : inten.cahyani@indonesiapower.co.id

Keywords: Selecting Risk Management Strategy by AHP

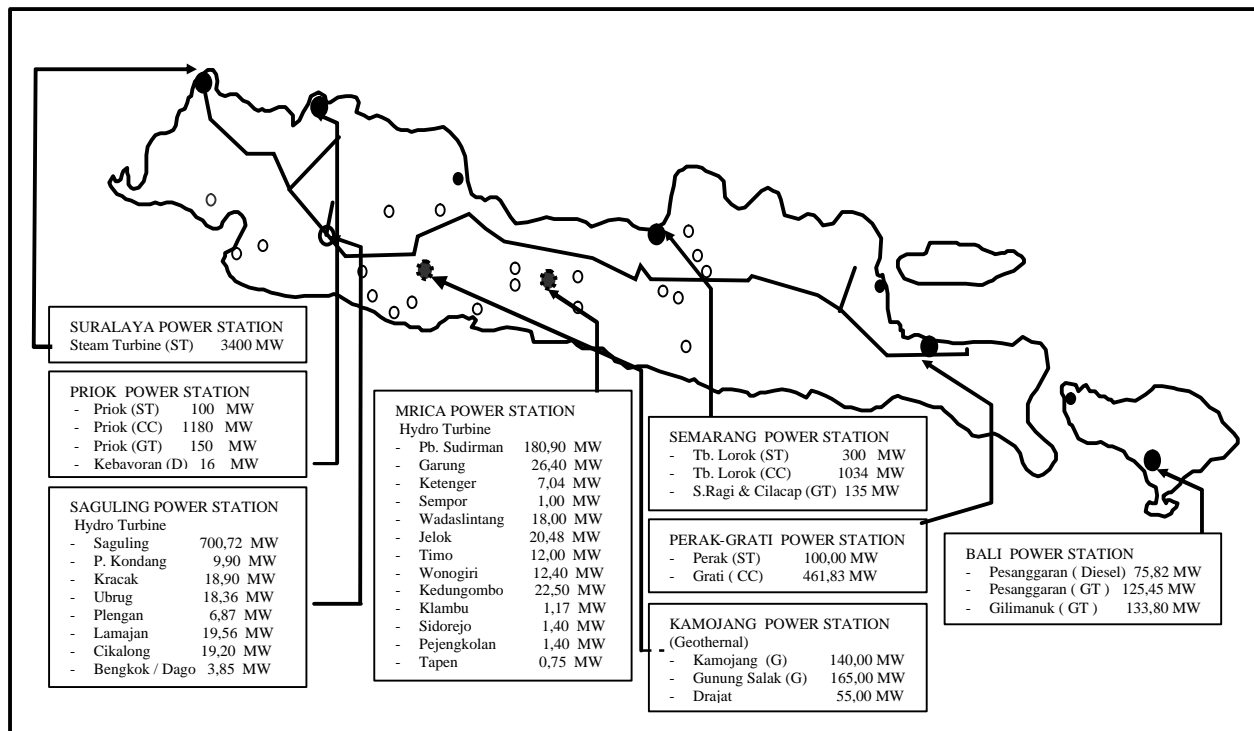
Summary: *PT. Indonesia Power is the largest power generating company in Indonesia, operating eight power generating business units around Java Bali Island with 8,978 MW installed capacity and more than 50 % market share in Java Bali system. The different kind of power generating units are based on the different kind of primary energy which is used to operates turbine to produce electricity. Thermal Power Generating Units risk is higher than the Hydro one, because possibility of loosing which is caused by fire. There are many kind of risk management tools that could be used to manage that risks. Analytical Hierarchy Process is one of the decision-making tools that is used in selecting which strategy that suitable for PT Indonesia Power. There are some variables to be considered: level of risk, cost and effectiveness of risk management strategy, and also policy and resources of the company.*

1. Background

PT. Indonesia Power was founded as subsidiary of the state power company, PT. PLN (Persero), that is business and profit oriented, while not entirely neglecting the social mission of the parent company. Having 130 units Power plants in 8 locations around Java Bali island with total capacity 8,978 MW shows that Indonesia Power having an important role. In the other side, Indonesia Power faces high risk concerning in operation their business. Since using gas, oil and geothermal as fuel in producing electricity in condition with high temperature and pressure, high speed machine and high voltage electricity area. Indonesia Power operates many kind of power generating units, Steam Turbine at Suralaya, Semarang, Priok and Perak , Gas Turbine at Priok, Semarang, Bali and Grati, Combined Cycle at Priok, Semarang and Grati, Diesel at Priok and Bali, Geothermal at Kamojang and Hydro Turbine at Saguling and Mrica Power Stations as shown on Figures 1.

Playing a strategic role and facing high risk in operating its business, Indonesia Power has to manage risk affectively to keep the Power Plant reliable. Beside that Indonesia Power shall to maintain their position as a market leader in Java Bali, in according to achieve its Vision to become a world class public generating company . At the moment, to manage risk, Indonesia Power together with Marsh as the insurance consultant has implement risk transfer to Insurance company. The insurance is only cover for property damage risk for eight location of Power stations. The cost is high by 5% in the total of Operation Cost, but the benefit not optimally enough. This paper, describe and discuss How Risk Management process could be implemented entirely to meet the optimal result in cost and effectiveness. The risk management is particularly for Hydro and Thermal Power Generating Units / power plant of PT. Indonesia Power. Each unit faces pure risk related with installation of Power plant. The risk is categorized into five, these are: Human Error (R1), Machinery Breakdown (R2), Property Damage (R3), catastrophe (R4) and Riot & strike (R5). There are many methods to manage the risk. Generally, the literatures said that the alternatives Risk Management Strategy are Risk Assumption, Loss Prevention, Insurance, Loss Reduction, and Risk Avoidance. The Goal of this paper is to select the proper strategy of risk management for hydro and thermal Power plant including the implementation program, based on the condition level of risk, policy and resources of Indonesia Power

Figures 1. Location of Generation Power Station of PT. Indonesia Power



2. Risk Management

2.1 Definition

There are several definition of risk, mentioned on literatures, i.e. (1) hazard / exposure to adversity, (2) chance of loss (3) uncertainty, (4) deviation of realization and target, (5) possibility of loss, (6) Opportunity arising out a deviation from the target . Definition of Risk Management is a scientific approach to dealing with pure risks by anticipating possible accidental losses and designing and implementing procedures that minimize the occurrence of losses or the financial impact of the losses hat do occur .¹⁾Williams and Heinz define risk management as the minimization of the adverse effects of risk at minimum cost through its identification, measurements and control.²⁾

2.2 Step of Risk Management

There are many opinions of the experts in relation with Risk management step, i.e. Mark S Dorfman (1991: 40), Emmet J Vaughan (1985: 34), William C Arthur, and also that state in Buletin Risk Management January 1988 (I.B.12). All of these opinion principally similar to each other, in some areas: (1) Risk Identification, by check list and questionnaire, interview, flow chart, financial report, data of losses, risk survey report, etc. (2) Evaluation and Assessment of Risk. The assessment by calculate the risk with dimensions “Risk = Probability x Severity “, or with dimension of qualitative equations i.e. almost nil, slight, moderate, etc, or with numerical scale 1-5 as shows on Figures. 2.

¹⁾ Emmet J. Vaughan (1997). *Risk Management* , John Wiley and Sons, page 7 , 30.

²⁾ C.Arthur Williams and Richard M. Heinz (1985), *Risk Management and Insurance*, New York , McGraw-Hill, page 11

Figures 2. Criteria of Risk Assessment.

Frequency	Value	Severity	Impact to The Company
Most Probable	5	Catastrophe	High impact for continuity business
Probable	4	High	Impact to achieving target / goal
Fair	3	Medium	Impact to mid term goal
Slight	2	Low	Arising a disturbance
Improbable	1	Negligible	No impact

(3) Dealing Risk is matching between map of risk into F-S Risk Management Tools matrix as shown on Figures 3³⁾. The risk management strategy particularly to the risk. Selecting an effective strategy need some variables to be considered i.e. cost, effectiveness of risk management strategy and the level of its risk.

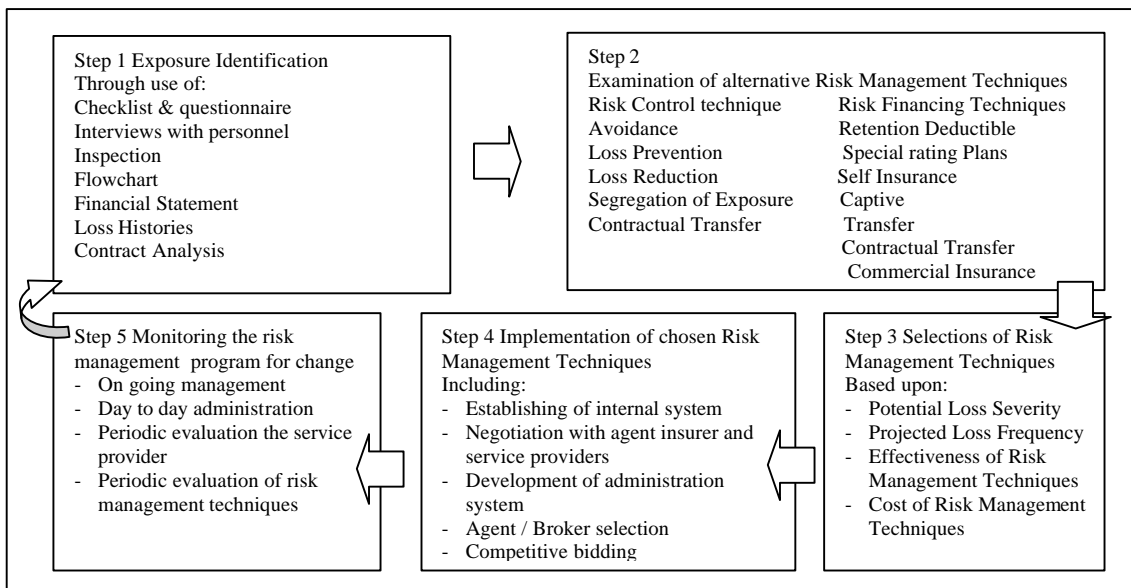
Figures 3. Matrix of Risk Management Tool

		Frequency of Loss	
		Low	High
Severity	Low	Risk Assumption: Also Loss Prevention And Loss Reduction if the cost justified the benefits	Loss Prevention: Also Loss Reduction if the cost justified the benefits Assume risk if cost of prevention or reduction can't be justified
	High	Insurance: Also Risk Transfer Loss Reduction Loss Prevention	Risk Avoidance Also Loss Prevention Loss Reduction if possible

4) Implementation of the strategy must be described into operational strategy to define the goal. The whole Risk Management Process mentioned on Bulletin Risk management describes the process comprehensively as shown on Figures 4.

³⁾ Mark S.Dorfman (1991). *Introduction to Risk Management and Insurance*, 4th Edition, Prentice Hall, page 55

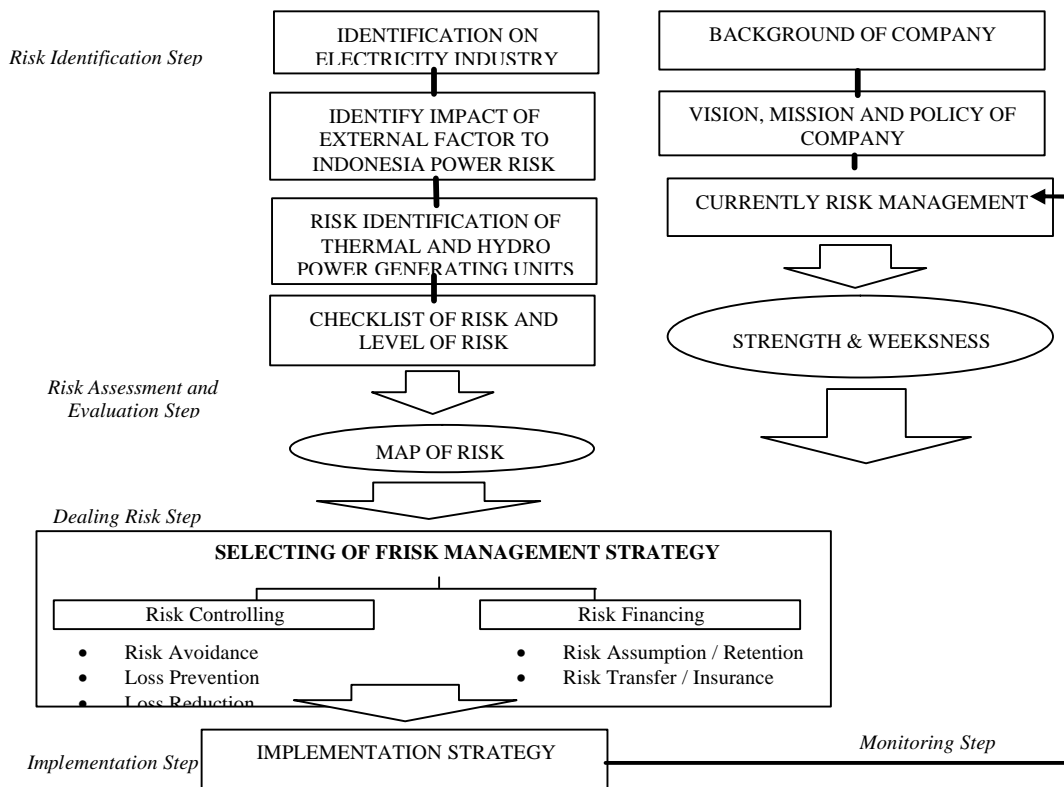
Figures 4. Risk Management Process



3. Research Method

In according to select which strategy will suitable to Indonesia Power for both Thermal and Hydro generating business units, we do Risk Management process with framework analysis shows on Figures 5.

Figures 5. Framework Analysis

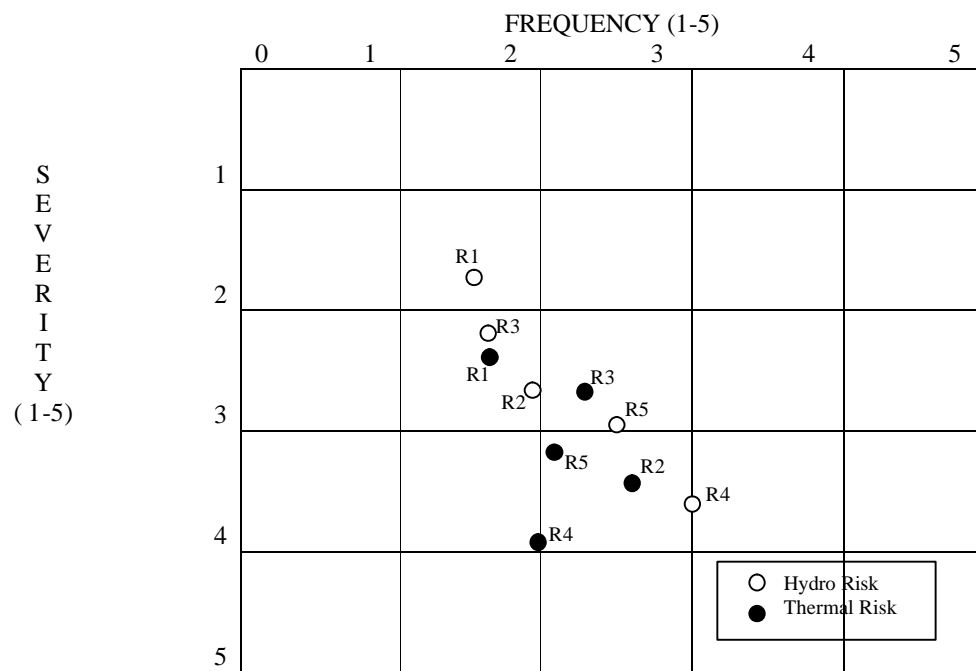


Beginning with Step (1), **Risk Identification**, we collect loss historical data from start from identifying risk of R1, R2, R3, R4 and R5 in each eight location of Power station, historical data of losses / failure, interview with personnel who in charge with each risk for Hydro PP and Thermal PP. The data then be compiled in the checklist.

Step (2), **Each risk then be evaluated and be assessed into frequency and severity dimension**. In this step we used Internal data from failure data, report, discussion with the person who in charge with risk management in PP, and from external data from risk survey by Insurance Broker and report from independent risk surveyor. We use mean value to shows risk of both Hydro and Thermal PP. Value of risk in Frequency – Severity dimension, then be plotted on Matrix F-S, shown on Figures 6.

Step (3) **Dealing risk**, in this step, we matched data map of risk on F-S matrix into four quadrant as shown on Figures 3 Risk Management Tools. One risk could be managed by several strategies of risk management depend on which quadrant that they lie. Selecting the proper strategy to manage risk is considered by cost and effectiveness of risk management strategy as described on Step 3 Figures 4. Beside that , we also consider the strength and weakness of current risk management strategy to be the judgment However, we have limited historical data and only level of risk, but we have experience and ability enough in accordance with policy of company to manage risk, intuition and thought related with managing risk, comprehensively. This condition leads us to use Analytical Hierarchy Process as a decision making tools for selecting the alternative strategy.

Figures 6. Map of Risk of Hydro and Thermal Power Generating Unit of PT. Indonesia Power.



3.1 Selecting Risk Management Strategy by AHP using Expert Choice Program.

Based on the Analytical Hierarchy Process, a hierarchy is used in Expert Choice to organize thought and intuition in logical fashion. This hierarchic approach allows the decision maker to analyze all options for efficient decision maker. Doing sequent begin with step (1) **create the decision models**. First we define the decision problem as the goal, and then structure the problem as levels of criteria (or objectives) within a hierarchic framework. Once these factors have been determined, the alternatives are placed at the bottom level of hierarchy under each criterion. In this paper, our goal is selecting of the risk management of Hydro / Thermal PP. The variables as criteria are level of risk, cost and effectiveness of Risk management Strategy. Sub criteria of level of risk are Frequency and Severity. Each frequency and severity have element variable are kind of risk R1, R2, ...until R5. As describe above matter, there are five alternative

strategy could be used, these are Risk Assumption, Loss Prevention, Loss Reduction, Insurance, Risk Avoidance. Step (2) **Enter Judgments**; expert choice leads the decision maker through a series of judgments between the alternatives under each criterion (or objectives) and then between the criteria. The judgment process can be based on importance, preference or likelihood, with three types of comparison models: verbal, numerical and graphical, or let us enter direct data. In this paper we use judgment based on preference with type is numerical and also enter direct data (especially for the criterion F and S). To do judgment, we have discussion with other personnel who in charge with risk management in Power plant. There are different value of judgment on the result but insignificant. The aggregate approach used for the final result

$$Y_{ab} = \sqrt{(Y_a \times Y_b)} \dots\dots\dots(1)$$

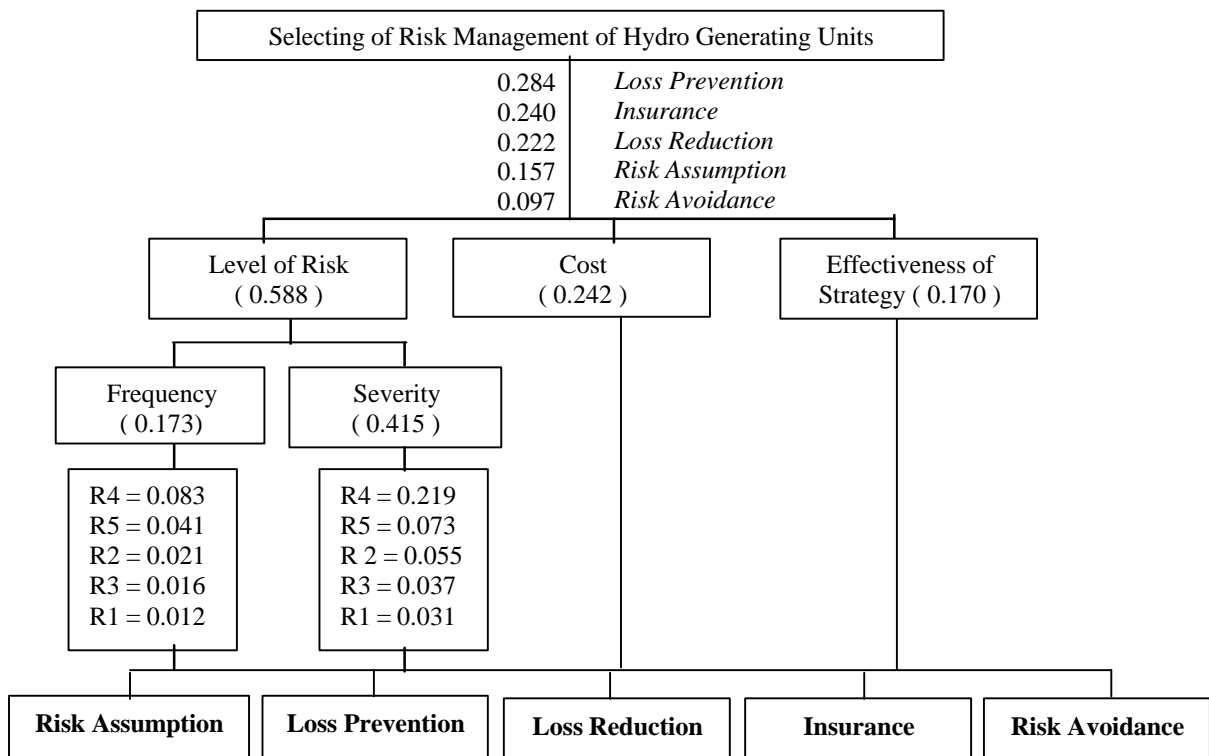
Step (3) **Improve consistency**, is important to do to get a reasonable result. The inconsistency index must below 10%. With Expert Choice, it's become easier. Step (4) Finally, expert choice will **combines all of the priorities** to arrive at an overall ranking of the alternatives, by select synthesis from the main screen.

4. Result

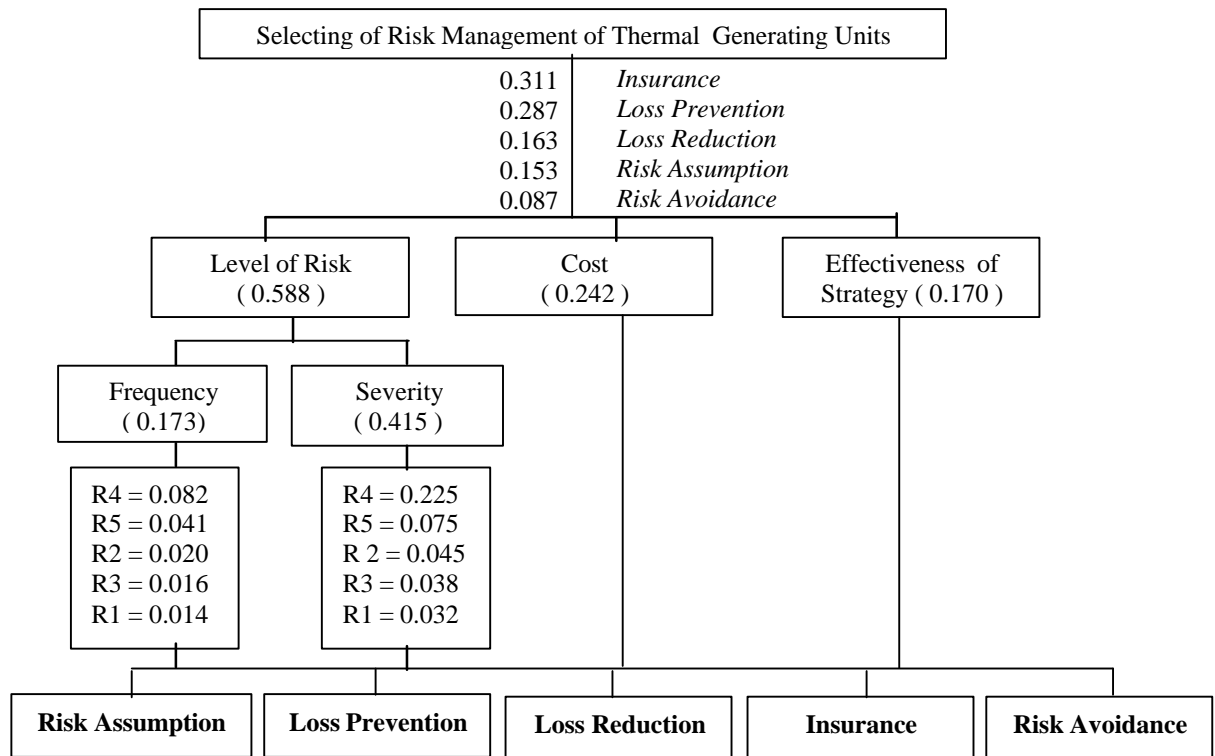
The results of the calculation using Expert Choice Program are shown on Figures 7, 8, describe that :

1. The priority of Risk management Strategy of Hydro PP focused on Loss Prevention, and for Thermal PP focused on Insurance.
2. Level of risk of Hydro PP dominated by Cathastrophe risk, but for Thermal PP dominated by Machinery Breakdown risk and property damage risk.

Figures 7. AHP Diagram Selecting of Risk Management Strategy of Hydro Generating Units



Figures 8. AHP Diagram Selecting of Risk Management Strategy of Thermal Generating Units



Hydro PP generally has low risk level. The turbine operates by potential energy of waterfalls that relatively safe or has less probability arising fire. The major risk probable occurs is catastrophe risk, such as flood, storm, earthquake, landslide, etc. These risks are unpredictable and caused high impact of loss. The priority of proper strategy is to prevent risk occur particularly to R3, R2 and R1. That is become the priority done, although with low cost, since, hydro PP as no complexity as Thermal PP. Catastrophe perils must be covered by Insurance, but must be evaluated in cost –benefit analysis between premium cost and the claim settlement and term and condition of insurance cover.

Thermal PP generally has moderate to high-risk level, caused by potential loss arising out fire from the fuel. Thermal PP has more complexity than Hydro PP. The potential risk of Thermal PP is form R2, R3, indeed must be cover by Insurance not only loss prevention as in Hydro PP.

Step (4) the implementation must be built from the priority strategy for each PP. Table 1 describe the implementation step as generally that each program related with particular risk.

Table 1. Focusing of Implementation Program for Hydro and Thermal PP

Risk Management Strategy	Implementation Program (general)	Related Risk				
		R1	R2	R3	R4	R5
	Hydro generating Units					
<i>Loss Prevention</i>	House keeping, Socialize safety Program, rambu bahaya, Hot Work Permit, Procedure of safety Management Program, tagging system			x		
	Add security persons	x		x		x
	Check list system, report system, routine meeting	x	x	x		
	Thermal generating Units					
	Check list system, report system, routine meeting	x	x	x		
	Law inforcement, reward & punishment system for safety program			x		x
<i>Insurance</i>	Hydro generating Units					
	Priority 1. Catastrophe Insurance Priority 2. Machinery Breakdown Insurance Priority 3. Liability Insurance For Unit with big capacity (Saguling Hydro PP and Pb. Sudirman Hydro PP) Selecting Broker Selecting Insurance company competitively.	x	x		x	x
	Thermal generating Units					
	Priority 1. Machinery Breakdown Insurance Priority 2. All Risk insurance with catastrophe Insurance Priorities 3. Liability Insurance With priority to unit that big capacity and optimize in component of unit	x	x	x	x	x
<i>Loss Reduction</i>	Fire protection system, Quality assurance, Emergency procedure	x	x	x	x	
<i>Risk Assumption</i>	Self insurance policy, by budgeting allocation					
<i>Risk Avoidance</i>	Improving organization structure for enhances responsibility of risk management role, certification of competency for operator units. Community development	x	x	x		x

5. Conclusion and Suggestion

Analytical Hierarchy Process by using Expert choice program help to select a proper strategy from five alternatives strategies to manage five pure risks based on historical data, judgment, intuition, experience and thought of PT. Indonesia Power.

Based on level of risk, Indonesia Power's risk is on a moderate risk category. With Considering cost and effectiveness of Risk management strategy, the proper risk management strategy for Hydro Power Plant is Loss Prevention and Thermal PP is Insurance.

Risk management strategy for Hydro PP is Loss Prevention concerning to R3 (property damage) Implementation could improve safety program, housekeeping and training effectively. Managing R2 (machinery breakdown) done by Predictive Maintenance. Insurance will be priority on catastrophe risk (R4).

Risk management strategy for Thermal PP is insurance concerning to R2 (machinery breakdown) by insurance also to R3 (property damage) including R4 (catastrophe risk). This strategy will be supported by

Loss prevention for availability data and reporting documents, and Loss Reduction for providing and availability protections system apparatuses

Indonesia Power as a market leader power generating company in Java Bali Electricity System, has a strategic role. It needs fully commitment in managing risk by improving structure of organization, focusing in role and responsibility of risk management role, add job & function for controller function, develop a conducive environment to build transparency reporting and by supporting availability historical data completely and accurately.

If This strategy was implemented in 2000 and 2001 year period, the benefit for the company is:

- Hydro PP: as insurance cost has been paid, caused by the hydro Power plant no need to be covered by insurance. This strategy could be implemented in the next 5 years, and evaluated periodically particularly on variable of probability of catastrophe risk which only manage by insurance.
- Thermal PP shall be cover by Insurance, particularly to Machinery Breakdown and property damage risk including catastrophe risk. If only limited budget for insurance, the optimization value of assets and optimization on selecting units are considered by function on merits system.

References

C. Arthur Wiliems, JR. & Richard M. Heins (1985). *Risk Management and Insurance*, Fifth Edition, Mc Graw Hill.

Emmet J. Vaughan (1997). *Risk Management*, John Wiley and Sons.

Mark S. Dorfman (1991). *Introduction to Risk Management and Insurance*, 4 th Edition, Prentice Hall.

Marsh. An MMC Company. *A 30 Year Review of Large Losses in The Power Industry (1969 – 1998)* Seventh Edition.

MFG Risk (1988) Management Introduction. Original Printing January 1988

PT. PLN PJB I. *Rencana Jangka Panjang Perusahaan 1999 – 2003*

PT. PLN PJB I. *Rencana Kerja dan Anggaran Perusahaan , Tahun 1997 – 2000.*

Thomas L. Saaty (1986) . *Expert Choice*, Tutorial, User Manual.

Thomas L. Saaty (1991). *Pengambilan Keputusan*, PT. Pustaka Binaman Pressindo.

