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Article

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Decision Making Model of Electric Power Fulfillment in Lampung Province Using Soft System Methodology

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ABSTRACT

At present, Lampung Province is experiencing electric power deficit. This study aims to investigate the criteria and decision making alternative solution of electricity distribution management, to determine alternative possibilities of decision-making, and decision alternative priority. Method used in this study is soft system methodology by using analytical hierarchy process, multi criteria decision making, weighted sum method and weighted product method. The result has two criteria, which are internal and external, with three sub-criteria in each existing criteria. Among others are budget availability, human resources readiness, and implementation technique for internal criteria, population growth, economic growth and political intervention for external criteria. Moreover, some decision making alternatives are building additional power plants, transmission lines, renting additional power plant and independent power producer (IPP) and excess power. There are 30 possibilities decision making model. And alternatives that become priority which are building transmission line and building additional power plant constructions.

Keywords: Decision Making, Alternative Priority, Soft System Methodology

JEL Classifications: D7, Q41, Q42

1. INTRODUCTION

Imbalance of electric power supplies and public needs cause the presence of electric power deficit. One of electric power deficit is occurring in Sumatra Island is in Lampung Province. Based on National Electric Company (NEC) data in 2014 (PLN, 2014), it is known that the growth of electricity demand in Lampung Province is adequately high, around 15% each year. Electricity ratio in Lampung reaches only around 76% so that it electricity development is still needed to increase electric power supplies, power quality as well as its reliability. At the end of 2015, Lampung is having the worst deficit of electric power condition, which reached 79,4-189,3 MW in November.

Therefore, a study needs to be conducted to investigate criteria and decision making solution alternative of electricity distribution management, to determine decision making alternative possibilities of electricity needs fulfillment based on existing criteria and to determine priority of decision alternative on what must be done to conduct electric power fulfillment in Lampung Province. There are many studies discussed about the electricity, Maqin and Sidharta (2017) discussed about the relationship of economic growth with human development and electricty consumption; Rodrigues et al. (2017) discussed about the efficiency of power transmissiona and distribution of electricity; Mylnikov and Kuetz (2017) discussed production management system of electricity.

2. METHODOLOGY

This study uses soft system methodology (SSM) approach because it needs complex approach system with unstructured problem and it keeps developing that has certain purpose. The SSM has been developed over the past four decades by a team of academics from the University of Lancaster led by Checkland in order to deal with unstructured problems (Checkland, 1981; 2000; Checkland and Winter, 2006). SSM initially is used to help solving complex problem and involving many stakeholders in management field. Checkland's SSM (Checkland, 2000) presents as being a powerful holistic approach that is highly developed. It delivers effective levers of organizational change as it enables participants to engage in a continuous learning process that enhances the willingness to collaborate in achieving the desired outcome and is inclusive of the cultures of both the participants and the end users. SSM is developed by management technicians in Lancaster University to help solving problems related to efficiency and effectiveness involving modern technology with high complexity in human organization. Checkland (2000), and Checkland and Scholes (1999) have attempted to transform these ideas from systems theory into a practical methodology that is called SSM. Checkland's premise is that systems analysts need to apply their craft to problems of complexity that are not well defined, and that SSM attempts to understand the wicked and fuzzy world of complex organizations. This is achieved with the core paradigm of learning (Checkland, 2000).

The 7-stage SSM implementation of Checkland thought really dominated this soft method, even when it is used, Checkland's idea cannot be left. The Checkland's seven stages are entering the problem situation, expressing the problem situation, formulating root definitions of relevant systems, building conceptual models of human activity systems, comparing the models with the real world, defining changes that are desirable and feasible, taking action to improve the real world situation (Checkland, 2000). This approach is used when technical approach is not able to explain varied phenomena faced entirely and accurately. Therefore, it can be concluded that SSM is a holistic approach in viewing real and conceptual aspects in society. SSM sees each matter occurring as human activity system because the series of human activities can be named as a system, which is each activity relates to each other and forms a bond. Soft systems approach is considered as a very productive methodology to learn each human activity that is organized in achieving certain goals.

In this study, the first analysis instrument used is analytical hierarchy process (AHP). It aims to investigate criteria and decision-making solution alternative of electricity distribution. It is also appropriate due to complex and unstructured problem faced by NEC. AHP is a supporting model of decision that is developed by Saaty (1980; 1992). This decision-supporting model will parse multi factor problems or multi criteria problems that are complex into a hierarchy. According to Saaty and Vargas (2012), a hierarchy is defined as a representative of a complex problem in a multi-level structure where the first level is a goal, followed by level of factor, criteria, sub criteria, and continuously to the bottom until the last level of alternative as shown in Figure 1. With hierarchy, a complex problem can be parsed into groups that then are arranged into a form of hierarchy, so the problem will be seen more structured and systematic. AHP is often used as a problem solving method compared to other methods because of some reasons as the following: Structure that has a hierarchy, as a consequence of the chosen criteria, to the deepest sub criteria; considering validity to the limit of inconsistent tolerance from varied criteria and alternatives selected by decision maker; and Considering durability of decision-making sensitivity analysis output.

2.1. AHP Stages

In AHP method, steps done are as the following:

1. Defining problems and determining desirable solutions.
2. Making a hierarchy structure that is started by main goal. After setting the main goal as the top level, then, hierarchy level that is in the lower level, which is suitable criteria, is arranged to consider or to evaluate alternatives that we give and to determine the alternatives. Each criterion has different intensity. The hierarchy is then followed by sub criteria (if it is needed).
3. Creating a paired comparison matrix that illustrates relative contribution or the effect of each element on the goal or upper criteria. To start the paired comparison process, a criterion from the top level is selected, for example, K and then from the lower level, the element that will be compared, for example, E1, E2, E3, E4, E5.
4. Defining paired comparison so that it can be obtained the number of all evaluations as many as n [(n−1)/2] item, with n is the number of elements that are compared.
5. Importance intensity

   1 = Both elements are equally important, both elements have great effect.

   3 = One element is slightly more important than the other element, experience and evaluation slightly support one element compared to the other element.

   5 = One element is more important than the other element, experience and evaluation strongly support one element compared to the other element.

   7 = One element is absolutely more important than the other element; one element is strongly supported and is dominantly seen in practice.

   9 = One element is absolutely more important than the other element, evidence that supports one element toward the other element has the highest confirmation level that might strengthen it.

   2, 4, 6, 8 = Values between two values of considerations that are adjacent, this value is given if there are two compromises in between two opposite selections = if for activity i, it gets one number compared to activity j, then j has the opposite value compared to i.
6. Calculating Eigen value and testing its consistency. If inconsistent, then, data collecting is repeated.
7. Repeating the steps for the entire hierarchy levels.
8. Calculating Eigen vector from each paired comparison matrix that is a weight for each element to determine priority of elements in the lowest hierarchy level to goal achievement.
9. Checking the consistency of hierarchy. What is measured in AHP is the consistency ratio by looking at the consistency ratio. Expected consistency is the one nearly perfect in order to produce decision that is nearly valid. Even though it is difficult to achieve, consistency ratio is expected to be ≤10%.

The next SSM analysis instrument is multi criteria decision making (MCDM). It is a method that helps in conducting decision making on some alternatives of decision taken with some criteria consideration (Zimmermann, 1987; Jones, et al., 1986). According to many authors (Zimmermann, 1987; Pohekar and Ramachandran, 2004) MCDM is divided into multi-objective decision making and multi-attribute decision making (MADM). Although MADM methods may be widely diverse, many of them have certain aspects in common (Chen and Hwang, 1992; Tzeng and Huang, 2011) which are:

1. Alternative; alternative is objects that are different and have opportunity to be chosen by decision maker.

2. Attribute; attribute is often named as decision criteria.
3. Conflict between criteria; some criteria generally have conflict between one to another, for example profit criteria will have conflict with cost criteria.
4. Decision weight, decision weight shows relative importance from each criterion, $W = (w_1, w_2, w_3,\ldots, w_n)$
5. Decision matrix, a matrix of decision X that is measured as m x n, contains of elements X_{ij} representing rating from alternative A: i = 1, 2, 3, m toward criteria C_j;j = 1, 2, 3,…, n

The last tool used is weighted sum method (WSM) and weighted product method (WPM).

The WSM is the simplest available method, applicable to single-dimensional problems, due to the fact that it follows an intuitive process. In the background of this method, the additive utility hypothesis is applied, which implies that the overall value of every alternative is equivalent to the products' total sum. In problems with the same units' ranges across criteria, WSM is easily applicable; however, when the units' ranges vary, for example when qualitative and quantitative attributes are employed, the problem becomes difficult to handle, as the aforementioned hypothesis is violated, and hence, normalisation schemes should be employed. It is common practice to use WSM along with other methods, for instance AHP, because of the method's plain nature. For the case of n criteria and m alternatives, the optimum solution to the problem is obtained by the following equation:

$$A^*_{WSM} = \left\{ A_i \mid \max_i \sum_{j=1}^{6} a_{ij} w_j \right\} \quad i = 1, 2, 3, 4$$

Where i_1,…, m, A*WSM represents the weighted sum score, a_{ij} is the score of the i^{th} alternative with respect to the j^{th} criterion and w_j is the weight of the j^{th} criterion (Kolios et al., 2016).

The WPM is very similar to the WSM. The main difference is that instead of addition in the model there is multiplication. Each alternative is compared with the others by multiplying a number of ratios, one for each criterion. Each ratio is raised to the power equivalent to the relative weight of the corresponding criterion. In general, in order to compare alternatives Ap and Aq (where M ≥ p, q ≥ 1) the following product (Triantaphyllou and Sanchez, 1997) has to be calculated:

$$R\left(\frac{A_p}{A_q}\right) = \prod_{j=1}^{N} \left(\frac{a_{pj}}{a_{qj}}\right)^{w_j}$$

If the ratio $R(A_p/A_q)$ is greater than or equal to one, then the conclusion is that alternative A_p is more desirable than alternative A_q (for the maximization case). The best alternative is the one which is better than or at least equal to all other alternatives. The WPM is sometimes called dimensionless analysis because its structure eliminates any units of measure. Thus, the WPM can be used in single and multi-dimensional decision making problems.

All analysis instruments, their function and data collecting method can be seen in Figure 2. All analysis instruments above are used for the final goal which is decision making. Robbins et al., (2014) stated that decision is a choice made from alternative. Decision making process is series of stages consisting of a number of steps including identifying problem, selecting an alternative, and evaluating decision. The process that found this decision making model is a management technology. Management technology basically gives contribution in solving learning problems so that learning process can achieve learning goal effectively and efficiently. The result from the study of decision-making model then can be applied in management information system. Management information system is a system that is integrated between human and machine that is able to give such information to support the running of the operation, the running of management, and the function of decision making in an organization (Davis, 2005).

To conduct data analysis, data collecting is initially needed. In this study, in order to get deeper data, questionnaire distribution, focus group discussion, and in depth structured Interview are done with practitioners of electricity distribution in NEC of Lampung and related external parties. There are five main interviewees who are representatives from NEC, government, electricity association, and consumer protection agencies.

3. RESULTS AND DISCUSSION

Presently, electricity condition in Lampung depends on several factors: The ability of electrical power (reliability of power source supply, power transfer from Palembang (South Sumatra) both from the number of transferred power and the reliability of its transmission), good voltage condition that is affected by isolator, material type of conductor, diameter of conductor, length of conductor, usage load capacity or power used by community that is affected by culture and economic growth. At this moment, the peak load of Lampung reaches ±850 MW with the last peak load in April 2016 as much as 847.5 MW and maximum of 861 MW, capacity of electric power plant in Lampung as much as ±500 MW and Sumatera Interconnection power transfer as much as ±350 MW with transfer minimum of 270 MW and maximum of 360 MW. Therefore, Lampung electricity condition now can be said mediocre. In this condition, when the main plant unit is having disturbance or maintenance, Lampung electricity then becomes deficit.

Considering the deficit electricity condition, Lampung distribution NEC conducts varied means for improvement such as electricity distribution management in Lampung that is known as Lampung sub system, setting rolling blackouts pattern with schedule based on several things which are separation between priority customers and other customers, the number of power produced by power plant and the one that can be distributed, the number of electricity load that must be reduced, electricity distribution based on feeders order in an area and blackout frequency. Besides setting blackouts pattern, Lampung NEC will add power supply, rent a 160 MW power plant, and build transmission in eastern route. Voltage improvement is then done, it relates to power transfer through transmission lines from Sumatera interconnection, some have been installed with capacitor used to improve voltage in transmission line, because the longer the distance the smaller the voltage will be. However, it is only small part of it due to limited budget. All means of capacity addition, in its implementation, constrained few things, so that it has not been able to handle electric power deficit effectively. Therefore, it is necessary to make a decision-making model of electrical power fulfillment in Lampung Province.

3.1. Decision Making Model of Electric Power Fulfillment in Lampung Province using AHP

Based on the result of interview and focus group discussion with the previous interviewees, it can be arranged AHP hierarchy as the following:

From the hierarchy above, there are three (3) hierarchy levels, one (1) goal, which is the electricity fulfillment of Lampung community sustainably, two (2) criteria, which are internal and external factors, six (6) sub criteria which are budget availability, HR readiness, implementation technical, population growth, economic growth, and political intervention, and four (4) alternatives which are building additional power plant, renting additional power plant, IPP and excess power and building transmission lines of Sumatera interconnection system as shown in Figure 3. The Table 1 is the definition of each existing criterion, sub criterion and alternative:

Based on the AHP hierarchy above, questionnaire filled by 5 interviewees from varied fields both from internal and external of PLN is made. Moreover, the result of the questionnaire is processed by using application of expert choice, so it produces calculation as the following for each criterion, sub criterion, and alternative, as shown in Table 2.

The study found that in order to achieve the sustainable electricity fulfillment, the decision alternative with the biggest priority is based on internal factors with weight of 0.676, compared with PLN external factors (0.324), budget availability is a sub criterion with the biggest weight which is 0.362 compared with sub criterion of human resource readiness with the weight 0.323 and sub criterion of implementation technique with the weight 0.313. Moreover, alternative with the biggest weight is building additional power plant (0.090) compared with renting additional power plant (0.029), IPP and excess power (0.039) and building transmission lines (0.078). From the existing weight data, evaluation and evaluation definition are made for each criterion as shown in Table 3:

To get possibilities of decision making, the weighting result of expert choice above, range is made in accordance with evaluation and definition from each measurement criteria as shown in Table 4:

Therefore, qualitatively, it can be interpreted as the following as in Table 5.

Table 1: Definition of criteria

Criteria, sub criteria, and alternatives	Definition
Internal	Criteria that affect the fulfillment of Lampung electricity in internal of PT PLN (limited company)
External	Criteria that affect the fulfillment of Lampung electricity outside PT PLN (limited company)
Budget availability	The amount of budget available in PLN to fulfill the needs of Lampung community electricity
Human resource readiness	The ability of PLN human resource technique in implementing the existing alternative
Implementation technique	Easiness of existing alternative implementation completion in fulfilling Lampung electricity needs
Population growth	The number of population growth in Lampung
Economic growth	The capacity increasing process of Lampung economic production that is realized in the form of regional income increase where the existence of economic growth is an indicator the success of economic development
Political intervention	How big the political importance affects/involves in electricity fulfillment problem in Lampung
Building addition power plant	The building of new power plant coming from new energy and is renewed by using existing potential in Lampung in order to add electricity needs of Lampung community
Renting additional power plant	The implementation of power plant renting from the third party to add the needs of electricity of Lampung community
Cooperation with private electricity (IPP and excess power)	The implementation of electrical power produced by private party, with difference which IPP is independent power producer, a private party that intentionally builds power plant and produces electrical power and it is sold entirely to PLN, while excess power is where there is a private party that has its own power plant and has excessive power so the electrical power is sold to PLN
Building transmission lines of sumatera interconnection system	Adding transmission eastern lines that connect Menggala – Seputih Banyak, so it adds the reliability of Sumatera electricity system interconnection

Table 2: Result of expert choice calculation

Goal	Level 1 (Criterion)	Level 2 (Sub Criterion)	Alternatives	Priority
To fulfill electricity of lampung sustainably (L:.1000)	Percent internal (L: .676)			70.7
	Internal (L: .676)	Percent budget availability(L: .362)		23.6
		Budget availability(L: .362)	Building additional power plant	0.09
			Renting additional power plant	0.029
			IPP & excess Power	0.039
			Building transmission line	0.078
		Percent human resource readiness (L: .323)		21.8
		Human resource readiness (L: .323)	Building additional power plant	0.08
			Renting additional power plant	0.037
			IPP & excess power	0.03
			Building transmission line	0.071
		Percent implementation technic (L: .315)		25.3
		Implementation technic (L: .315)	Building additional power plant	0.078
			Renting additional power plant	0.051
			IPP & excess Power	0.046
			Building transmission Line	0.078
	Percent external (L: .324)			29.3
	External (L: .324)	Percent population growth (L: .253)		8
		Population growth (L: .253)	Building additional power plant	0.026
			Renting additional Power plant	0.014
			IPP & excess power	0.01
			Building transmission line	0.03
		Percent economic growth (L: .363)		11.2
		Economic growth (L: .363)	Building additional power plant	0.043
			Renting additional power plant	0.017
			IPP & excess power	0.017
			Building transmission line	0.035
		Percent political intervention (L: .384)		10.1
		Political intervention (L: .384)	Building additional power plant	0.025
			Renting additional power plant	0.015
			IPP & excess power	0.015
			Building transmission line	0.046

Table 3: Criteria, evaluation and definition

Criteria	Evaluation	Definition
Budget availability	Very adequate	Budget is enough and excessive
	Adequate	Budget is enough
	Less adequate	Budget is not enough
Human resource readiness	Very ready	Very good technical ability
	Ready	Good technical ability
	Less ready	Poor technical ability
Implementation technique	Very easy	Implementation of electricity power fulfillment is very easy
	Easy	Implementation of electricity power fulfillment is easy
	Difficult	Implementation of electricity power fulfillment is not easy
Population growth	Very rapid	Population growth is very rapid
	Rapid	Population growth is rapid
	Less rapid	Population growth is less rapid
Economic growth	Very rapid	Economic growth is very rapid
	Rapid	Economic growth is rapid
	Less rapid	Economic growth is less rapid
Political intervention	Very strong	Political intervention affects very strongly
	Strong	Political intervention affects strongly
	Weak	Political intervention affects weakly

Table 4: Evaluation range

Description	Very adequate/Ready/Easy/Rapid/Strong	Adequate/Ready/Easy/Rapid/Strong	Less adequate/Ready/Easy/Rapid/Strong
Range	0.0667–0.1	0.0334–0.0667	0–0.0333

Table 5: Decision making model in the best condition

Criteria	Budget availability	Human resource readiness	Implementation technique	Population growth	economic growth	Political intervention
Alternative						
Building additional power plant	Very adequate	Very ready	Very easy	Less rapid	Rapid	Weak
Renting additional power plant	Less adequate	Ready	Easy	Less rapid	Less rapid	Weak
IPP and excess power	Adequate	Less ready	Very easy	Less rapid	Less rapid	Weak
Building transmission lines	Very adequate	Very ready	Very easy	Less rapid	Rapid	Strong

IPP: Independent power producer

Table 6: Evaluation range

Description	Highly very important	Very important	Important	Adequately important	Little important	Little unimportant	Adequately unimportant	Unimportant	Very unimportant	Highly very unimportant
Alternative range	0.091–0.1	0.081–0.09	0.071–0.08	0.061–0.07	0.051–0.05	0.041–0.05	0.031–0.04	0.021–0.03	0.011–0.02	0.001–0.01
Weight range	0.91–1	0.81–0.9	0.71–0.8	0.61–0.7	0.51–0.6	0.41–0.5	0.31–0.4	0.21–0.3	0.11–0.2	0.01–0.1
Ordinal value	10	9	8	7	6	5	4	3	2	1

Table 7: Weighting and its ordinal scale

Alternative	Weight		Building aditional power plant		Renting aditional power plant		IPP and excess power		Building transmission line	
Criteria										
Internal	Weight	OS (wj)	Weight	OS (a1j)	Weight	OS (a2j)	Weight	OS (a3j)	Weight	OS (a4j)
Budget availability	0.362	4	0.090	9	0.029	3	0.039	4	0.078	8
Human resource readiness	0.323	4	0.080	8	0.037	4	0.030	3	0.071	8
Implementation technique	0.315	4	0.780	8	0.051	6	0.046	5	0.078	8
External										
Population growth	0.253	3	0.026	3	0.014	2	0.010	1	0.030	3
Economic growth	0.363	4	0.043	5	0.017	2	0.017	2	0.035	4
Political intervention	0.384	4	0.025	3	0.015	2	0.015	2	0.046	5

OS: Ordinal scale

The Table 5 is some decision making models that can be taken in the best condition, what alternative that can be taken in condition of each existing criterion. However, if we analyzed the possibility there will be many chances of decision-makings.

Besides there are many possibilities for decision-making model, to determine the priority of alternative decision-making model in the fulfillment of electrical power in Lampung province, to determine alternative priority of decision making of electricity power fulfillment in Lampung Province, expert choice calculation has weight value that is then conversed into ordinal scale from 1 to 10 with the value of very important to very unimportant, as what can be seen from the Table 6:

Therefore, value change is obtained from the weight of expert choice calculation result along with its ordinal scale are as shown in Table 7:

To select the best alternative, the methods WSM (Kolios et al., 2016) and WPM (Chen and Hwang, 1992) are used. WSM and WPM method are as shown Table 8:

$$A^*_{WSM} = \left\{ A_i \mid \max_i \sum_{j=1}^{6} a_{ij} w_j \right\} \quad i = 1, 2, 3, 4$$

and

$$A^*_{WPM} = \left\{ A_i \mid \max_i \prod_{j=1}^{6} (a_{ij})^{w_j} \right\} \quad i = 1, 2, 3, 4$$

Table 8: The calculation of WSM and WPM for the four alternatives

Methods	Building additional power plant	Renting additional power plant	IPP and excess power	Building transmission line
WSM	141 (P1)	74 (P3)	67 (P4)	141 (P1)
WPM	1.55×10^{17} (P2)	55×10^{9} (P3)	3.3×10^{9} (P4)	2.97×10^{17} (P1)

(Pi) means priority i=1, 2, 3, 4. WSM: Weighted sum method, WPM: Weighted product method, IPP: Independent power producer

Figure 1: A three level hierarchy (adapted from Saaty and Vargas, 2012. p. 3)

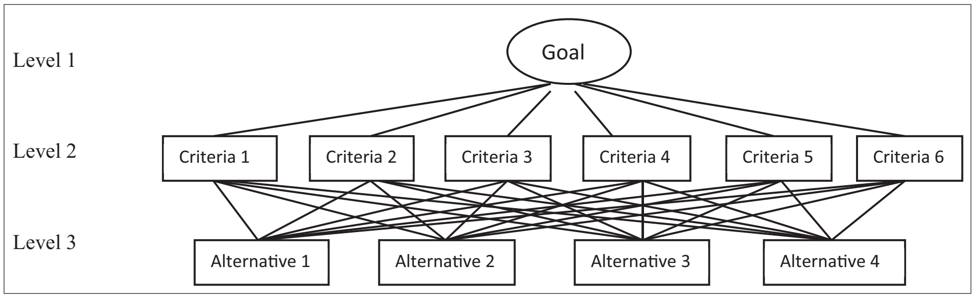
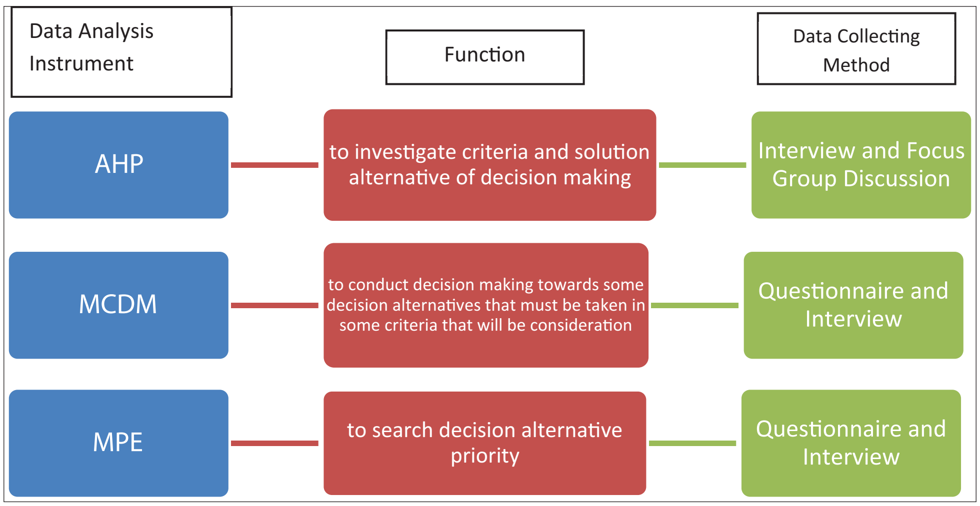


Figure 2: Analysis instruments



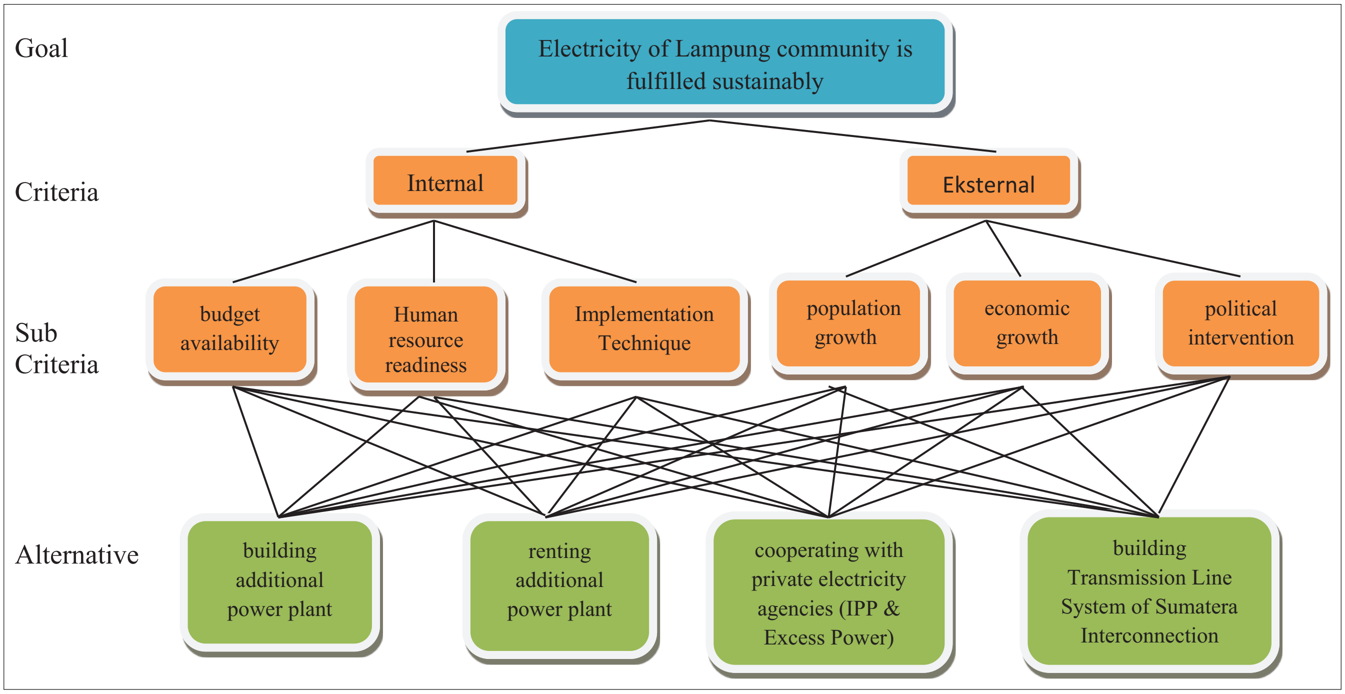
Where A_i is the-i^{th} alternative (i = 1, 2, 3, 4), a_{ij} is the ordinal scale of the-i^{th} alternative and the-j^{th} criteria (j = 1, 2, 3, 4, 5, 6), and w_j is the ordinal scale of the weight of the-j^{th} the criteria. The results are presented in Table 8.

From the calculation result of exponential comparison above, it can be known that in fulfilling NEC electricity in Lampung sustainably, there are some alternatives of decision making according to WSM and WPM calculation. WSM raises two alternative decision-making with the same priority which are building a transmission line and building an additional power plant. For that we need other analysis tools that can show us the main priority in fulfilling the electricity needs in Lampung, by using WPM. The results with WPM are that with the existence of the peak load growth projection as much as 9.2% in 2022, building transmission line especially from areas with a surplus supply of electricity such as southern Sumatra is an alternative solution for the short term. The transmission line will be connected from Aceh to Lampung. And then for the medium and long term, building an additional power plant becomes an alternative solution that must be done. PLN Lampung should use energy source potential in Lampung, both water energy, geothermal energy.

4. CONCLUSION

There are four hierarchy levels of structured problem that can be found with AHP, first is goal which is the fulfillment of electricity in Lampung community sustainably, second: Two criteria which are internal and external factors, Third: Six sub criteria, which are budget availability, human resource readiness, implementation technique, population growth, economic growth, and political intervention, and fouth: Four alternatives which are building additional power plant, renting additional power plant, IPP and excess power, and building transmission lines of Sumatera interconnection system. Afterwards, analysis of decision making model possibilities is done, and it is obtained that there are 30 possibilities of decision making model in fulfilling electricity needs in Lampung based on the calculation of MCDM that can be chosen in varied dynamic conditions. Moreover, according to WSM calculation, there are two alternative decision-making with the same priority which are building a transmission line and building an additional power plant. For that we need other analysis tools that can show us the main priority in fulfilling the electricity needs in Lampung, by using WPM. According to WPM calculation, building transmission line especially from areas with

Figure 3: AHP Model of Electric Power Fulfillment in Lampung Province



Alternative

Explanation:

Goal → Electricity of Lampung community is fulfilled sustainably

Criteria → Internal and External

Sub criteria → Budget availability, human resource readiness, implementation technique, population growth, economic growth, political intervention

Alternative → Building additional power plant, renting additional power plant, cooperating with private electricity agencies (IPP and Excess Power), building Transmission Line System of Sumatera Interconnection

a surplus supply of electricity such as southern Sumatra is an alternative solution for the short term. And then for the medium and long term, building an additional power plant becomes an alternative solution that must be done. Based on the entire study results above, PLN is able to conduct improvement in Lampung electricity condition with several existing alternatives especially building transmission line. In addition to continuing the existing transmission, later if Sumatera has been connected as a whole and has a reliable transmission, electricity can be distributed from anywhere on the Sumatera Island. Besides building a transmission line, PLN also needs to build an additional power plant for the electricity reliability of the local area.

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