**Decision Making Model of Electric Power Fulfillment in Lampung Province Using Soft System Methodology (SSM)**

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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 (AHP), Multi Criteria Decision Making (MCDM), Weighted Sum Method (WSM) and Weighted Product Method (WPM). 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 IPP & 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, Maqian 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, L and Kuetz, M. (2017) discussed production management system of electricity.

1. **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 Soft Systems Methodology has been developed over the past four decades by a team of academics from the University of Lancaster led by Peter Checkland in order to deal with unstructured problems (Checkland, 1981; 2000; and Checkland and Winter, 2006). SSM initially is used to help solving complex problem and involving many stakeholders in management field. Checkland’s Soft Systems Methodology (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 Soft Systems Methodology (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 Soft Systems Methodology (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.

Data Collecting Method

Data Analysis Instrument

Function

 Fig. I. Analysis Instruments

In this study, the first analysis instrument used is AHP (Analytical Hierarchy Process). 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. 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.

**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).

Criteria 1

Criteria 2

Criteria 3

Criteria 5

Criteria 4 4444

Criteria 6

Alternative 1

Alternative 2 2

Alternative 3

Alternative 4

Level 1

Level 2

Level 3

Fig. II. A three Level Hierarchy (Adapted from Saaty and Vargas, 2012 p.3)

* + - * 1. 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.
				2. 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.
				3. 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.

* + - * 1. Calculating Eigen value and testing its consistency. If inconsistent, then, data collecting is repeated.
				2. Repeating the steps for the entire hierarchy levels.
				3. 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.
				4. 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 less than or similar to 10%.

The next SSM analysis instrument is MCDM (Multi Criteria Decision Making). 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 (MODM) 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= (w1,w2,w3,...,wn)

5. Decision matrix, a matrix of decision X that is measured as m x n, contains of elements Xij representing rating from alternative A: i=1,2,3, m toward criteria Cj;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:

  i=1,2,3,4

where i \_ 1, . . . ,m , A\*WSM represents the weighted sum score, aij is the score of the i-th alternative with respect to the j-th criterion and wj is the weight of the j-th criterion(Kolios et al., 2016).

The weighted product model (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:



If the ratio R(Ap/Aq) is greater than or equal to one, then the conclusion is that alternative Apis more desirable than alternative Aq(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 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.

1. **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.

**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:

building additional power plant

cooperating with private electricity agencies (IPP & Excess Power)

building Transmission Line System of Sumatera Interconnection

renting additional power plant

Electricity of Lampung community is fulfilled sustainably

Human resource readiness

Implementation Technique

economic growth

political intervention

population growth

Eksternal

Internal

budget availability

Goal

Criteria

Sub

Criteria

Alternative

Fig.III. 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 & Excess Power), building Transmission Line System of Sumatera Interconnection

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 & Excess Power and building transmission lines of Sumatera interconnection system. The following is description of each existing criterion, sub criterion and alternative:

 Table I. Definition of Criteria

|  |  |  |
| --- | --- | --- |
| NO | Criteria, Sub Criteria, and Alternatives  | Definition |
| 1. | Internal | Criteria that affect the fulfillment of Lampung Electricity in internal of PT PLN (Limited Company)  |
| 2. | External  | Criteria that affect the fulfillment of Lampung Electricity outside PT PLN (Limited Company)  |
| 3. | Budget Availability  | The amount of budget available in PLN to fulfill the needs of Lampung Community electricity  |
| 4. | Human Resource Readiness  | The ability of PLN Human Resource technique in implementing the existing alternative  |
| 5. | Implementation Technique | Easiness of existing alternative implementation completion in fulfilling Lampung electricity needs  |
| 6. | Population Growth  | The number of population growth in Lampung  |
| 7. | 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  |
| 8. | Political Intervention  | How big the political importance affects / involves in electricity fulfillment problem in Lampung.  |
| 9. | 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.  |
| 10. | Renting Additional Power Plant  | The implementation of power plant renting from the third party to add the needs of electricity of Lampung community.  |
| 11. | Cooperation with private electricity (IPP & 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.  |
| 12. | 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.  |

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.

Table II. Result of Expert Choice Calculation



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 & 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 follows:

Table III.Criteria, Evaluation and Definition

|  |  |  |  |
| --- | --- | --- | --- |
| No | Criteria | Evaluation | Definition |
| 1 | Budget Availability | Very adequate | Budget is enough and excessive |
|  |  | Adequate | Budget is enough |
|  |  | Less adequate | Budget is not enough |
| 2 | Human Resource Readiness | Very Ready | Very good technical ability |
|  |  | Ready  | Good technical ability |
|  |  | Less ready  | Poor technical ability |
| 3 | 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.  |
| 4 | Population Growth | Very rapid  | Population growth is very rapid |
|  |  | Rapid | Population growth is rapid |
|  |  | Less rapid | Population growth is less rapid |
| 5 | Economic Growth | Very rapid | Economic growth is very rapid |
|  |  | Rapid | Economic growth is rapid |
|  |  | Less rapid | Economic growth is less rapid |
| 6 | Political Intervention | Very strong | Political intervention affects very strongly |
|  |  | Strong | Political intervention affects strongly |
|  |  | Weak | Political intervention affects weakly |

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 the following:

Table IV. 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 |

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

 Table V. Decision Making Model in the Best Condition

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| No | Criteria | Budget Availability | Human Resource Readiness | Implementation Technique | Population Growth | Economic Growth | Political Intervention |
| Alternative |  |  |  |  |  |  |
| 1 | Building additional Power Plant | Very adequate | Very ready | Very easy | Less rapid | Rapid | Weak |
| 2 | Renting additional Power Plant | Less adequate | Ready | Easy | Less rapid | Less rapid | Weak |
| 3 | IPP & Excess Power | Adequate | Less ready | Very easy | Less rapid | Less rapid | Weak |
| 4 | Building Transmission Lines | Very adequate | Very ready | Very easy | Less rapid | Rapid | Strong |

The table 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 – 10 with the value of very important to very unimportant, as what can be seen from the table below:

 Table VII. 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 |

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

 Table VII. Weighting and its Ordinal Scale

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
| No | Alternative | Weight | Building Aditional Power Plant | Renting Aditional Power Plant | IPP&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 |

 Note: OS means Ordinal Scale

To select the best alternative, the methods Weighted Sum Method (Kolios et al.,2016) and Weighted Product Method (Chen and Hwang, 1992) are used. WSM and WPM method are as follows:

  i=1,2,3,4

and

  i=1,2,3,4

where Ai is the-ith alternative (i=1,2,3,4), aij is the ordinal scale of the-ith alternative and the-jth criteria (j=1,2,3,4,5,6), and wj is the ordinal scale of the weight of the-jth the criteria. The results are presented in Table 8.

 Table VIII. The calculation of WSM and WPM for the four Alternatives

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Methods | Building additional power plant | Renting additional power plant | IPP&ExcessPower | Building transmission line |
| WSM | 141 (P1) | 74 (P3) | 67(P4) | 141(P1) |
| WPM | 1.55 x1017(P2) | 55x109(P3) | 3.3x 109(P4) | 2.97x 1017(P1) |

#  Note: (Pi) means priority i=1,2,3,4

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.

1. **CONCLUSION**

There are four (4) 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 (2) criteria which are internal and external factors, Third: six (6) sub criteria, which are budget availability, human resource readiness, implementation technique, population growth, economic growth, and political intervention, and fouth: four (4) alternatives which are building additional power plant, renting additional power plant, IPP & 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 multi criteria decision making 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 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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