MULTICRITERION APPROACH TO OBTAIN THE WEIGHTING FACTOR OF POWER CABLE HEALTH INDEX BASED ON CONDITION AND PROFILE FACTORS

Andika Syalom Alfonsus Manik
Dept. of Electrical Engineering
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
6022241055@student.its.ac.id

I Gusti Ngurah Satriyadi Hernanda
Dept. of Electrical Engineering
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
satriyadi@its.ac.id

Suwito
Dept. of Electrical Engineering
Institut Teknologi Sepuluh Nopember
Surabaya, Indonesia
suwito@its.ac.id

***Abstract*—Currently, the replacement of substation power cables is often based solely on age or permanent failure, in the absence of a standardized weighting factor for health index assessment. This paper proposes a weighting factor model for the 20 kV XLPE power cable health index using the Analytic Hierarchy Process (AHP). Data was collected from four experts with operational and maintenance experience. The results show that the Condition Assessment Factor (CAF) is more dominant than the Profile Assessment Factor (PAF) with weights of 0.690 and 0.310, respectively. Among all parameters, Tan Delta has the highest weight (0.233), followed by Partial Discharge (0.164), Insulation Resistance (0.130), Cable Age (0.118), Load Level (0.074), Leakage Current (0.073), Infrared Thermography (0.063), Failure Frequency (0.061), Overvoltage Occurrence (0.055), and Visual Check (0.028). The consistency ratios for all matrices are below 0.1, indicating acceptable consistency. This AHP developed model can serve as a foundation for developing a comprehensive health index model for substation power cables.**

Keywords— AHP, Health Index, Power Cable, Substation, Weighting Factor

I. INTRODUCTION

The reliability of a power system depends on the performance of key components such as transformers and medium voltage power cables in substations. Power cables are vital elements that transfer energy from the transformer to the medium-voltage circuit breaker. To maintain system reliability, periodic assessment of cable "health" through the Asset Health Index (AHI) approach is required. Health Index integrates technical parameters to capture equipment health quantitatively, then represents it informatively and instructively.

However, to date, the weighting factor for the substation power cable Health Index has not been clearly established. Power cables, which serve as conductors connecting power transformers to incoming circuit breakers, are currently replaced based only on age and/or operational failure, without careful consideration of actual equipment health conditions.

The Analytic Hierarchy Process (AHP) is one of the multi-criteria decision-making method which integrates both qualitative analysis and quantitative analysis [1]. AHP contains a hierarchy to determine the significance of a set of alternatives to obtain a certain goal. Reference [2] demonstrated AHP's capability to capture both subjective and objective evaluation measures for circuit breaker health index weighting factors.

Inspired by the correspondence research and looking into the niche where proportional weighting factor has not been conceptually developed yet, therefore, this paper adopts AHP to determine the weighting factor for the substation power cable Health Index.

II. POWER CABLE HEALTH INDEX

Power cables of transformers are frequently observed and thoroughly tested using various measurements. These are the tools used by engineers to evaluate the actual conditions of an asset.

A. The Fundamentals of Cable Health Index Assessment

Health Index Assessment plays a key role as a fundamental concept throughout this particular research. The projection of asset management is to maintain the reliability of the substation; thus, the periodic assessment of cable "health" through structured methodologies is essential. The Health Index (HI) concept has emerged as a fundamental asset management tool, combining multiple technical parameters to quantitatively capture the actual condition and represent it in an actionable context [3].

Mathematically, the Health Index is the aggregate of the product of apparatus condition scores (S_i) and weighting factors (W_i). The score is an empirical assessment in numerical form, while the weighting factor represents the criticality level of one physical parameter compared to others. This is expressed as:

$$\boldsymbol{HI} = \sum_{i=1}^{n} \boldsymbol{W_i} \times \boldsymbol{S_i} \qquad (1)$$

$S_i = condition\ score\ of\ parameter\ i$
$HI = total\ health\ index$
$W_i = weighting\ factor\ of\ parameter\ i\ criticality$
$n = total\ number\ of\ parameters$

B. Scoring The Parameters

For each condition being assessed, there is an indicator to be obtained. For example, a measurement such as a leakage current or other could be a partial discharge severity.

As the requirements of calculation, these condition parameters need to be translated into something we can count as condition scale codes. There are several options of scale codes we use in Asset Health Index, that is Alphanumeric, Linear, logarithmic base 3, and logarithmic base 10 [3]. These are described in the following table (Table 1).

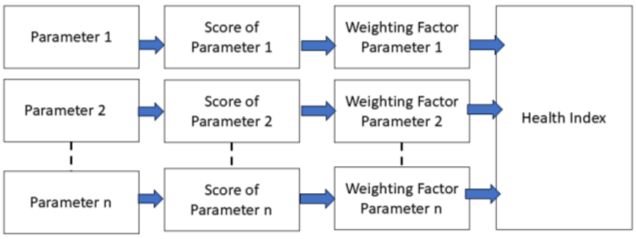

Fig 1 HI Concept

TABLE 1 VARIOUS CONDITION SCALE CODES [3]

Alphanumeric	Linear	Log base 3	Log base 10	Description
A	1	1	1	Very good condition
B	2	3	10	Good condition
C	3	10	100	Fair condition
D	4	30	1000	Poor Condition
E	5	100	10000	Critical Condition

The condition scale codes are involved in Figure 1 as a main component of calculation alongside the Weighting Factor that is discussed in the following paragraph.

C. *Weighting Factor Determination and Function*

The other most significant part of the health index calculation is the Weighting Factor. It represents the significance of each parameter in order to establish an aggregation number of the health index based on various parameters that we consider [4].

D. *Construction of Medium Voltage Power Cable*

Standing as the main object in this whole research, here we have to establish a comprehensive understanding of the asset. Understanding cable construction is essential for meaningful parameter selection. XLPE cables, specifically the NA2XSY [5] [6].

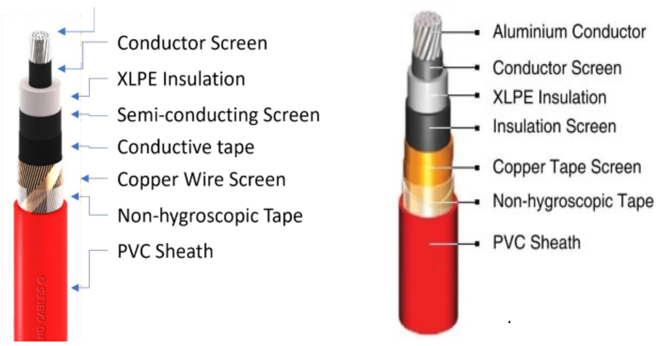

Fig 2 Cross Section of Power Cable

TABLE 2. CONSTRUCTION OF POWER CABLE

Layer	Material	Function
Conductor	Class 2 Stranded Aluminium	Current-carrying component
Inner Semi-conductive	Semi-conductive material	Field stress distribution
Insulation	Cross-linked polyethylene (XLPE)	Primary dielectric barrier
Outer semi-conductive layer	Semi-conductive material	Electric field control
Metallic Screen	Copper Tape or Wire	Fault current path, shielding
Outer sheath	PVC	Mechanical and environmental protection

The diagram below shows the model of a single-line diagram of power cable placement on a substation.

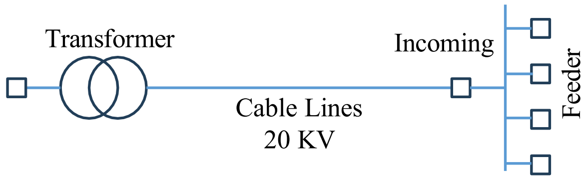

Fig 3 Single Line Diagram of the system

E. *Criteria and Parameters*

Grounded in the recent surveys that had been performed by CIGRE Working Group considering CB failure that uses kinds of factors to recognize the condition of the asset, there are CAF (Condition Assessment Factor) and PAF (Profile Assessment Factor) [7] [8]which are also used in this research. CAF and PAF stand as Layer 3, where the importance of measurement and the profile of the operational environment was considered. Criticality is set to be the main top layer (Layer 1), where Measurement Reliability (MR) and Critical Reliability (CR) are plotted as Layer 2.

- CAF: Condition Assessment Factor

In terms of asset management, we primarily rely on testing parameters as the main tools. Based on IEEE Std 400-2012 [9] The following diagnostic parameters are essential for cable condition assessment. These are also emphasized in [10]. The list is: Insulation Resistance Measurement, Leakage Current, Partial Discharge, Visual Inspection, Tan δ and Thermograph Inspection. They are routine jobs and can be done regularly in the field.

a. Insulation Resistance Measurement [11]

When a DC voltage is applied to insulation, the electric field increases current conduction and electron polarization. For various types of cable, the minimum value given by ICEA are various depend on the kind of cable. On a regular basis, we usually test the cable with 5000 VDC. Insulation Resistance Test relatively simple and light test; however, it is blind to certain types of defects like clean voids and cuts. This LVDC test applied voltage also can not replicate the stress distribution which power frequency AC voltage can provide.

b. Leakage Current Monitoring

During normal operation, leakage current flows through the insulation to ground via the metallic screen. Elevated leakage currents indicate insulation degradation, particularly when correlated with load current trends. Acceptable leakage current thresholds are typically below 1 ampere for normally conditioned cables.

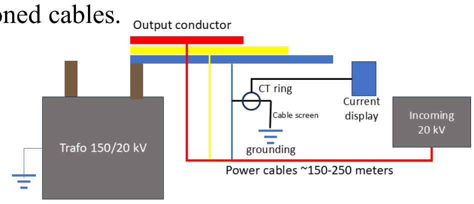

Fig 4 Leakage Current Measurement Setup

c. Tan δ (Dissipation Measurement)

Tan δ represents the ratio of resistive to capacitive current in the insulation. Tan δ measurements provide a global assessment of the dielectric loss. Thus, a single region of high loss, such as a region of severe water treeing, a degraded accessory, an area of high moisture or different cable insulation, can cause the measured value to rise even though the bulk loss of the majority of the system will be lower

$$\tan\delta = \frac{I_R}{I_C} = \frac{V/R}{V\omega C} = \frac{1}{\omega RC} \qquad (2)$$

Where DF is the dissipation factor, I_R as the resistive current, I_c is the capacitive current, V stands for applied voltage, where R is the value of insulation resistance. C is the capacitance of insulation, and ω is the frequency of the applied voltage. Tan δ can be done on various modes of source, e.g., Sinusoidal Continuous, Very Low Frequency, and Damped AC. The routine test at the author's workplace uses the sinusoidal continuous signal with a power frequency at 50 Hz.

For healthy XLPE insulation, tan δ values below 0.005(0.5%) are typical and highly expected. Values above 0.01 (1%) indicate significant degradation, while values exceeding 0.02 (2%) suggest imminent failure risk. The tip-up test z(Δtan δ) between 0.5U and 1.5Un provides additional diagnostic value[3].

d. Partial Discharge Detection

Partial Discharge (PD) occurs when localized electrical stress exceeds the dielectric strength of any presence of insulation voids or interfaces with other substances. PD activity produces measurable phenomena such as electrical pulses in the pC range that are detectable by HFCT sensors, Transient Earth Voltages, Acoustic Emissions, and Electromagnetic radiation in the UHF range. The patterns of typical defects under different types of voltages are obtained as PRPD. [12]

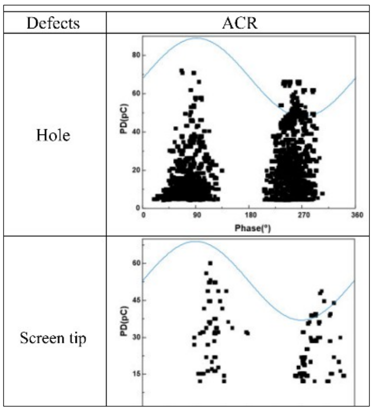

Fig 5 PRPD Wave Pattern

HFCT measurement mode provides various modes, which are No Filter, 500 kHz, and 1.8 MHz filter. For assessment purposes, 500 KHz and 1.8 MHz are preferred. In terms of results identification, PD levels below 250 pC are generally considered good; levels between 250 and 500 pC are fair; and levels beyond 500 pC are defined as critical by the standard.

e. Infrared Thermography

Thermal imaging detects abnormal temperature patterns indicative of poor connections, dielectric losses, and overload conditions.

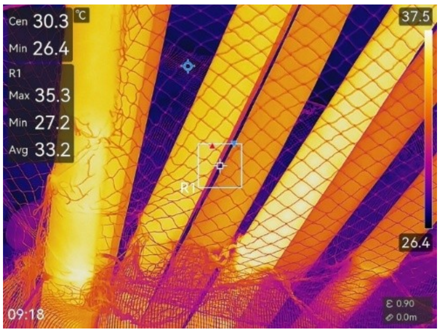

Fig 6 Infrared Thermal Capture

This can detect unusual thermal behaviour, such as high-resistance connectors or high dielectric losses, and can be conducted while the circuit is energized. In spite of the advantages, the disadvantages are that some cables cannot be observed since they are close to a wall, and some defects do not have a temperature gradient as well.

f. Visual Check

PLN uses visual check as one of the assessment tools. Visual checking remains fundamental for detecting the presence of mechanical damage, environmental degradation, and termination conditions [9] [10].


Fig 7 Visual Check Of Cable

As per standard, PLN uses the parameters: normal, electrical treeing, and discoloration.

- PAF: Profile Assessment Factor

Insulation degradation accelerates non-linearly with age, while chronological age alone is insufficient for condition assessment, it serves as a useful risk indicator. Cables exceeding 20 years of service warrant enhanced monitoring.

Operational loading affects thermal aging through the Arrhenius relationship. Overvoltage Occurence somehow acts as a catalyst for insulation degradation. The phenomena of switching surge, lightning strikes, and accelerate the historical event, providing additional impact on cumulative electrical stress. Failure Frequency (failures per year) serves as a leading indicator of impending degradation, particularly when failure rates show increasing trends.

- Critical Reliability (CR) and Measurement Reliability (MR)

MR is designed to calculate the reliability of the results on each parameter, and CR is intended to measure the parameter criticality compared to the others. These criteria are aimed at creating parameter validity from measurement data. MR is talking about the robustness of measurement, while the other parameter is about how its value affects the failure probability of the asset.

III. Comprehensive Understanding And Methodology of AHP in This Research

A. *Analytic Hierarchy Design*

The weighting factor determination approach is based on the implementation of a method called the Analytic Hierarchy Process method, which is capable of accommodating the years of expertise from utility asset engineers [4].

AHP was created by Thomas L. Saaty, combining the formula of Pairwise Matrix, Normalization Matrix, Hierarchy Multi – Criteria Multiplication, and Consistency Validation. This concept works with The Scale of Saaty as the fundamental component [1].

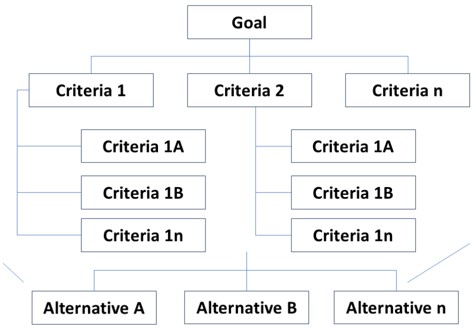

Fig 8 AHP Hierarchy Structure

B. *AHP Calculation Process*

The AHP hierarchy consists of three layers: Layer 1, considering the comparison between CAF and PAF based on Criticality criteria, Layer 2 is the Comparison between Measurement Reliability (MR) and Critical Reliability (CR) for both CAF and PAF, and Layer 3 comparisons among parameters within each factor and reliability aspect.

(1) Determine the objective goal (Determine the weighting factors for power transformer Health Index)

(2) Build the hierarchy (The comprehensive hierarchy of AHP shown with Fig. 9)

   a. Identify the parameters (The parameters are as many as 6 CAF Factors: Insulation Resistance Measurement; Leakage Current Monitoring; Tan δ; Partial Discharge, Visual Check; Infrared Thermograph and PAF Factors: Age of cable, Load Level, Overvoltage Occurrence and Frequency Failure.

   b. The criteria used for comparing parameters are Measurement Reliability and Criticality Reliability (CR). MR measures how reliable the results of each parameter are, while CR measures the criticality of each parameter for the others.

   c. After getting the MR and CR, the next criterion is comparison towards Criticality among CAF and PAF. This step is looking forward to the most representative factor of the Health Index.

(3) Obtain the expert judgments, statistics, and other considerations to fill in the pairwise matrix.

(4) Make a pairwise comparison matrix regarding the contribution or impact of each element to the criterion in the higher level.

(5) Run the test of the consistency of the results.

(6) Perform steps 3,4, and 5 for all levels and criteria inside the hierarchy.

(7) Determine the WF using AHP by summing each weighted priority corresponding to the entry from the lower level.

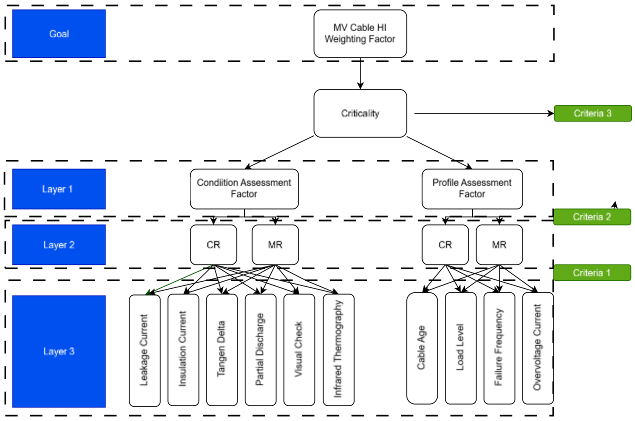

Fig 9 Methodology

The comparison in the pairwise matrix involves each pair of elements at each level to the level directly above. Based on the Saaty scale, this study also attaches the guide of scaling code shown in the following table. The AHP matrix process and eigenvalue was computed with Microsoft Excel.

Table 3 Saaty Scale [1]

Scale	Option A	Option B
9	A is extremely stronger than B	
7	A is far stronger than B	
5	A is stronger than B	
3	A is moderately stronger than B	
1	Equally Strong	
1/3		B is moderately stronger than A
1/5		B is stronger than A
1/7		B is far stronger than A
1/9		B is extremely stronger than A

Data was collected from 4 experts with at least 10 years of experience in electrical theory and practices. The expert Profiles are:

Table 4 Expert Participants

Expert	Affiliation	Experience
E1	PT PLN (Persero)	11 years
E2	PT PLN (Persero)	17 years
E3	Institut Teknologi Sepuluh Nopember	24 years
E4	PT PLN (Persero)	15 years

C. *Data Processing Steps*

- Geometric Mean Aggregation: For more than one input, the formula needs to combine the expert judgments using geometric mean.

$$\boldsymbol{GM} = \left(\prod_{i=1}^{n} x_i\right)^{1/n} \quad \textbf{(3)}$$

- Pairwise Comparison Matrix: Constructing matrices for each level with the reciprocal property using

$$\boldsymbol{C = [a_{ij}] where [a_{ij}] = \frac{1}{[a_{ji}]} and\ [a_{ii}] = 1} \quad (4)$$

- Normalization and Priority Weights: Calculating weights by normalizing each column and averaging relevant rows

$$\boldsymbol{w_i = \frac{1}{n}\sum_{j=1}^{n}\left(\frac{a_{ij}}{\sum_{k=1}^{n} a_{kj}}\right)} \quad (5)$$

- Consistency Test: Ensuring the consistency using

$$\boldsymbol{CI = \frac{\lambda_{MAX} - n}{n-1}, CR = \frac{CI}{RI}} \quad (6)$$

(A CR value less than 0.1 indicates acceptable consistency)

- Global Weight Calculation: Aggregating weights from all levels

For CAF

$$\boldsymbol{W_{global} = W_{PARTIAL\ MR} + W_{PARTIAL\ CR}} \quad (7)$$

$$W_{PARTIAL\ MR} = W_{CAF} \times W_{MR\ CAF} \times W_{PARAMETER\ MR}$$

$$W_{PARTIAL\ CR} = W_{CAF} \times W_{CR\ CAF} \times W_{PARAMETER\ CR}$$

For PAF

$$\boldsymbol{W_{global} = W_{PARTIAL\ MR} + W_{PARTIAL\ CR}} \quad (8)$$

$$W_{PARTIAL\ MR} = W_{PAF} \times W_{MR\ PAF} \times W_{PARAMETER\ MR}$$

$$W_{PARTIAL\ CR} = W_{PAF} \times W_{CR\ PAF} \times W_{PARAMETER\ CR}$$

IV. Results And Discussion

A. Layer 3: CAF & PAF Component Weights

- Condition Assessment Factor – Measurement Reliability

TABLE 5 MR CAF

Parameter	Weight
Insulation Resistance	0.300
Tan δ	0.289
Partial Discharge	0.168
Leakage Current	0.152
Infrared Thermography	0.053
Visual Check	0.038

- Condition Assessment Factor – Critical Reliability

TABLE 6 CR CAF

Parameter	Weight
Insulation Resistance	0.158
Tan δ	0.350
Partial Discharge	0.257
Leakage Current	0.092
Infrared Thermography	0.102
Visual Check	0.041

- Profile Assessment Factor – Measurement Reliability

TABLE 7 MR PAF

Parameter	Weights
Overvoltage	0.461
Failure Frequency	0.264
Load Level	0.157
Cable Age	0.118

- Profile Assessment Factor – Critical Reliability

TABLE 8 CR PAF

Parameter	Weights
Overvoltage	0.414
Failure Frequency	0.359
Load Level	0.149
Cable Age	0.078

B. Layer 2: MR vs CR Comparison

- For Condition Assessment Factor

TABLE 9 WEIGHT OF CAF

Criteria	MR	CR	Weight
MR	1.000	0.275	0.216
CR	3.637	1.000	0.784

- For Profile Assessment Factor

TABLE 10 WEIGHT OF PAF

Criteria	MR	CR	Weight
MR	1.000	3.846	0.794
CR	0.260	1.000	0.206

These results indicate that for CAF, Critical Reliability (78.4%) is more important than Measurement Reliability (21.6%), indicating that parameter criticality outweighs measurement accuracy for condition assessment. Conversely, for PAF, Measurement Reliability (79.4%) dominates, suggesting data accuracy is paramount for Profile [12]factors.

C. Layer 1: CAF vs PAF Comparison

Based on expert judgments aggregated using geometric mean, the comparison between the Condition Assessment Factor and Profile Assessment Factor yielded:

TABLE 11 CAF & PAF COMPARISON

Criteria	CAF	PAF	Weight
CAF	1.000	2.24	0.690
PAF	0.446	1.000	0.310
Consistency Test : $\lambda_{MAX} = 2.00$ CI = 0 and CR = 0 (Consistent)			

D. Global Weighting Factors

Global weights were calculated by aggregating all levels using Equation (7) or (8).

$$W_{global} = W_{PARTIAL\ MR} + W_{PARTIAL\ CR}$$

TABLE 12 GLOBAL WEIGHTING FACTOR

Factor	Parameter	Global Weight	Rank
CAF	Tan δ	0.233	1
	Partial Discharge	0.164	2
	Insulation Resistance	0.130	3
	Leakage Current	0.073	6
	Infrared Thermography	0.063	7
	Visual Check	0.028	10
PAF	Cable Age	0.118	4
	Load Level	0.074	5
	Failure Frequency	0.061	8
	Overvoltage	0.055	9

In Consistency calculations, we must use the *RI* (Random Index) that corresponds to the number n.

TABLE 13 RANDOM INDEX

N	1	2	3	4	5	6	7	8	9	10
RI	0	0	0.58	0.90	1.12	1.24	1.32	1.41	1.45	1.49

a. Consistency Test Summary

All matrices passed the consistency test with CR < 0.1

TABLE 14 CONSISTENCY CHECK

Matrix	n	λmax	CI	RI	CR
CAF Parameters (CR)	6	6.14	0.028	1.24	0.023
CAF Parameters (MR)	6	6.58	0.116	1.24	0.094
PAF Parameters (CR)	4	4.23	0.076	0.90	0.085
PAF Parameters (MR)	4	4.22	0.072	0.90	0.080
MR vs CR (CAF)	2	2.00	0	0	-
MR vs CR (PAF)	2	2.00	0	0	-
CAF vs PAF	2	2.00	0	0	-

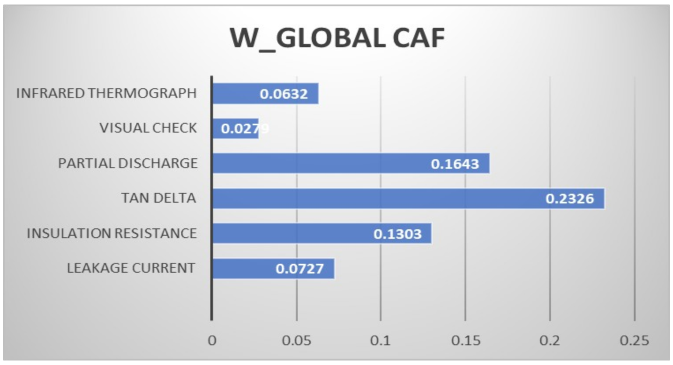

Fig 10 Weighting Factor Condition Assessment Factor Diagram

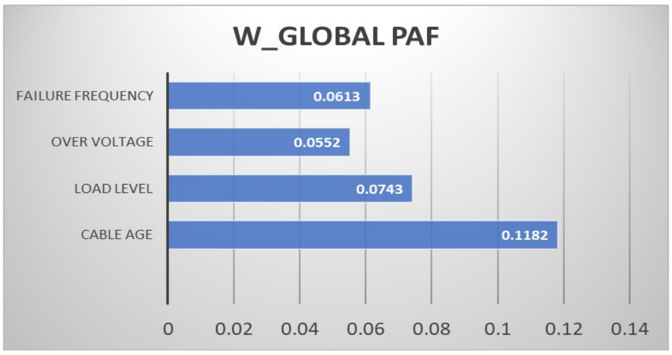

Fig 11 Weighting Factor Profile Assessment Factor Diagram

V. Discussion

A. Dominant Factors and Parameters

The results demonstrate that Tan δ (23.3%) is the most significant parameter affecting the substation power cable health index, followed by Partial Discharge (16.4%) and Insulation Resistance (13%). This aligns with the technical understanding that insulation quality degradation is the primary failure mechanism in XLPE cables [5].

B. Comparison with Previous Research

Comparing with circuit breaker research [2], both studies confirm that CAF dominates PAF. However, the most critical parameters that are :

- Power Cable: Tan δ (0.2333) is most critical
- Circuit Breaker: Contact Resistance (0.231) was most critical

This difference reflects the distinct failure mechanism of each apparatus, validating the specificity of the developed weighting factor.

C. Practical Implications

The weighting factors developed can guide asset management strategies: Prioritize Tan δ and PD measurements for condition monitoring, focus on insulation health as the primary indicator of cable condition, use cable age as a secondary indicator (11.8% weight global), and minimize emphasis on visual check for resource allocation.

VI. Conclusion

Using AHP considering surveys from 4 experts with operational and maintenance experience. The main findings are: Condition Assessment Factor (0.690) is more important than Profile Assessment Factor (0.310) for determining the power cable health index. Tan δ (0.233) is the most significant parameter among all parameters, followed by Partial Discharge (0.164) and Insulation Resistance (0.130), confirming insulation quality as the primary health indicator. All matrices passed the consistency test with CR values below 0.1, validating the reliability of expert judgments. In the future, the AHP model can also be implemented as a similar approach to enhance the health index assessment for other substation apparatus.

VII. Acknowledgment

Special thanks to the Department of Electrical Engineering, Institut Teknologi Sepuluh Nopember (ITS) Surabaya, and all experts who participated in the survey for providing the data and valuable insights.

The author(s) confirm that all participating experts provided formal informed consent before the evaluation process. Participants were briefed on the research objectives and voluntarily agreed to the use of their expert judgments within this research.

VIII. References

[1] T. L. Saaty, "A scaling method for priorities in hierarchical structures," *J. Math. Psychol,* vol. 15, no. 3, pp. 234-281, 1977.

[2] A. Setiawan, W. Adiati, and R. A. Prasojo, "An Approach of The Analytic Hierarchy Process to Acquire The Weighting Factor of High Voltage Circuit Breaker Health Index," in *Int. Conf. on Technology and Policy in Energy and Electric Power (IC-TPEP)*, Bandung, 2020.

[3] CIGRE Working Group, Asset Health Indices for Equipment in Existing Substations, Paris: CIGRE, 2021.

[4] R. A. Prasojo, A. Setiawan, Suwarno, N. U. Maulidevi and B. Anggoro Soedjarno, "Development of Analytic Hierarchy Process Technique in Determining Weighting Factor for Power Transformer Health Index," in *2nd International Conference on High Voltage Engineering and Power Systems (ICHVEPS)*, Denpasar, Indonesia, 2019.

[5] LAPP Kabel, "NA2XSY, VDE, PVC medium voltage cable acc. VDE 0276-620, with aluminium conductor, for fixed installation," 02 March 2016.

[6] I. A. Metwally, "THE EVOLUTION OF MEDIUM VOLTAGE POWER CABLES," *IEEE Potentials,* vol. 31, no. 3, pp. 20-25, 2012.

[7] W. G. A3.12, "Failure survey on circuit breaker control systems summary report for Electra," *Electra,* vol. 216, 2004.

[8] A. Janssen, D. Makareinis and C. E. Solver, "International surveys on circuit breaker reliability data for substation and system studies," *IEEE Trans. Power Del,* vol. 29, no. 2, 2014.

[9] IEEE, "IEEE Guide for Field Testing and Evaluation of the Insulation of Shielded Power Cable Systems Rated 5 kV and Above," IEEE Power & Energy Society, New York, USA, 2012.

[10] CIGRE, International Council on Large Electric Systems (CIGRE) Study Committee B3 : Substations, Paris: SPRINGER REFERENCE, 2019.

[11] IEEE Std 400 ™-2001, IEEE Guide for Field Testing and Evaluation of The Insulation of Shielded Power Cable Systems, 2001.

[12] Y. Chen, et al, "Comparative Study on Partial Discharge Characteristics of Seven Accessory Defects Under Four On-Site Testing Voltages of a 10-kV Cable Line," *IEEE Transactions on Dielectrics and Electrical Insulation,* vol. 30, no. 4, pp. 1834-1843, 2023.

To Author:

Artikel ini membahas tentang pendekatan multikriteria dalam menentukan faktor bobot dari indek kesehatan kabel dengan menerapkan AHP dan telah disajikan dengan baik. Namun demikian masih diperlukan peningkatan penyajian artikel dengan menanggapi komentar-komentar berikut ini. 1. Pada bagian introduction belum mencermikan literatur review terhadap publikasi terkini sehingga kebaruan dari penelitian ini belum tersaji dengan jelas. Seharusnya bisa diperkaya dengan referensi publikasi terkait dan terkini. 2. Semua simbol parameter yang digunakan dalam tiap persamaan seharusnya diberikan penjelasan dan satuan yang digunakan. 3. Pada bagian hasil, masih sangat minim penjelasannya dan lebih didominasi oleh tabel data. Seharusnya diberikan penjelasan sehingga mempermudah pembaca dalam memahami hasil tersebut. 4. Pada bagian kesimpulan disebutkan bahwa ANN mampu memperbaiki kinerja sistem VSI bidirectional untuk kedua kondisi V2G dan G2V. Namun demikian, pada hasil dan pembahasan belum ada analisa yang mendukung hal tersebut. Disarankan untuk disajikan data dan pembahasan dengan menggunakan data pembanding lainnya sehingga perbaikan kinerja jelas terlihat. 5. Bagaimana dengan akurasi dari faktor bobot yang didapatkan dalam menentukan indek kesehatan kabel? Apakah ada data pembanding yang bisa disajikan pada bagian hasil dan diskusi?	This article discusses a multi-criteria approach to determining the weighting factors of a cable health index using AHP and is well-presented. However, the article could be improved by addressing the following comments. 1. The introduction section does not include a literature review of recent publications, so the novelty of this research is not clearly presented. It should be enriched with references to relevant and recent publications. 2. All parameter symbols used in each equation should be explained, along with the units used. 3. In the results section, the explanations are still very minimal, and the section is dominated by data tables. Explanations should be provided to help readers understand the results. 4. The conclusion states that ANN can improve the performance of the bidirectional VSI system for both V2G and G2V conditions. However, the results and discussion sections lack analysis to support this claim. It is recommended to present data and discussion using other comparative data so that the performance improvement is clearly visible. 5. What about the accuracy of the weight factors obtained in determining the cable health index? Is there any comparative data that can be presented in the results and discussion sections?

To General Chair:

Artikel ini membahas tentang pendekatan multikriteria dalam menentukan faktor bobot dari indek kesehatan kabel dengan menerapkan AHP dan telah disajikan dengan baik. Paper ini sebaiknya dimasukkan ke dalam kelompok AI for Power and Energy System.	This article discusses a multi-criteria approach to determining the weighting factors of a cable health index using AHP and is well-presented. This paper should be included in the AI for Power and Energy Systems category.