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Distributed Generation (DG) system using COPRAS method

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Abstract: *Distributed Generation (DG) system. Distributed Generation (DG) power systems, Expansion of power systems in remote areas, and Very recently as a sustainable way of electrification popular. Depletion of conventional fossil fuels, Fuel price volatility, and emissions Awareness environment about reduction, Due to this its demand is increasing. DG systems have additional power quality challenges. There are many types of DG power sources that produce electrical power with different voltages at various frequencies. RES-Based Distributed Generation (DG) Systems are conventional energy systems In finding new modern solutions for planning have contributed Widespread use of DG is old and Defines new views, Current delivery system The only way to deal with the project Calling for more complex defenses. COPRAS (Complex Proportionality Assessment) is very Multiple criteria used in decision-making methods is one. This technique is different Decision making by researchers Used to solve problems. Investment cost, operating cost, Primary energy consumption, CO2 emissions. Energy storage system, fuel system, Wind Solar Hybrid System, Conventional System, PV energy storage system. Involvement of Distributed Generation (DG) system PV energy storage system ranked 1st, and the Conventional system also got 5th position.*

Keywords: *Energy storage system, fuel system, winds solar Hybrid System, Conventional System, PV Energy Storage System, COPRAS.*

1. INTRODUCTION

Numerical and Mathematical Modeling Generation (TG) System Based on optimization techniques Distributed this review An overview is provided in the paper. These two broad types of DG The optimization techniques are different compared to the features from the studies examined Explore applications and capabilities Identifying research directions. Distributed Generation (DG) power system, Expansion of power system of remote areas and Recently became very popular as a sustainable way of electrification. Depletion of conventional fossil fuels, fuel Fluctuation in price, and Environmental pollution Awareness of reduction Due to the increasing demand. Hybrid distributed without load shedding generation (TG) system design and The impact of seasonal load variation are studied. Associated with integrated power quality system conditioners Several DGs have been proposed in the literature. Today, many renewable energy Distributed Generation (DG) units are based, on interface converters with the grid-connected, so the converters are flexible This harmonic can be compensated by the control Able to perceive activities. In this article, DG units are local controllers' Harmonic distribution systems Compensation review procedures Using focuses. A conventional current-regulated and voltage-regulated DG Harmonics compensation functions in systems How to feel is given. This article is DG- Distribution system harmonics through grid interface converters Focuses on control. Two alternate DG systems, ie current-controlled DG and voltage-controlled DG are considered. The previous one related to harmonic compensation Most of the work is current-controlled Although based on the method, voltage- A new using a controlled method Harmonic control scheme In this paper has been created. Voltage-controlled mode Highly flexible and conventional current- Similar compared to the controlled method Has compensatory performance. DC voltage For generating DG systems, DG system with grid An inverter is used to connect the inverter A switch is a specific implemented control Determined based on strategy. TG Generators of systems occur during disturbances The ability to resolve errors can significantly affect results. Distributed generation (DG) is the latest Widely used to provide energy over the years. of the total energy required in power systems Electricity generation gradually from DG, for the most part, is taking Interconnection of DG, Apply A major change in the structure of the distribution network brings Distributed in a distribution system Impact of Load Models on Generation (DG) Scheduling Explored at work. Load Models DG Scheduling significantly affected. Usually a static force Most of the load model (real and reactive). Considered in studies. Currently distributed Manufacturing (DG) is getting more and more valuable attention received, especially the stability of the power system and Especially the reliability of the distribution system. The optimum of DG Planning is not about the size of the DG, but the Overloading of generators. In DG system System to install DG at an optimum location with optimum size Performance optimization and distribution system A cost-effective solution for arrangements. Delivery Optimum DG displacement system voltage in the system Holding constant, more tax losses Reduced power distribution system reliability and Improves stability. This research work on the optimal location and Scale of Distributed Generation (DG) and Maximum benefits derived from the distribution system Based on various optimization techniques provides On the quality and availability of electricity Growing concerns are more and more distributed leading to the establishment of production. parallel, and electric of the rapid trend towards deregulation of the sector Background, grouped under various sub-services Segment services and market for some of these services There is a need to create. These services of distributed generation provide some This article discusses the possibilities. Most common of distributed generation categories and to use them as ancillary service providers This also includes the relevant electronic interfaces that allow The paper present Capabilities of power electronic interfaces are provided, and of these interfaces Implications for design are described. Distributed generation is positive in power quality and can have negative effects. It is distributed depending on the type and size of the generation, as well Electricity used to connect these units to the grid Interfaces and control schemes It depends. The issues covered in this article are discussed. This paper Power System Islanding and Islanding Presents an overview of detection techniques. Distribution with Distributed Generation (DG). Island detection techniques for system remotes are broadly divided into local techniques. Distant The island detection technique is the island on the application side relates to detection, whereas the local technique DG Relates to island detection on the side. Power system Planners and Operators, Energy Policy Classifiers and Controllers, and Developers of Disseminated manufacturing (DG) have sparked great interest It has been more than a decade since its inception. In distributed generation electric power systems of major issues related to integration, This article presents the overview, which they are today are very interested. In many countries around the world DG integration, especially of the renewable type Key drivers behind the focus are discussed. The key to overcome in the process A summary of the challenges is presented. DG with electrical systems Dispensing away from the linking approach Active management of networks and others Power system planning and operation using DG Forget the unifying principle Special emphasis is given to necessity.A large variety of power transmission systems transmission system as a result of scaled DG coupling Also examine the effects of operation and expansion Performs, constant function, contingency analysis, Safety integration, and dynamic behavior analysis Focus on issues related to impacts on pays. For the provision of ancillary services by DG A discussion of feasibility is also included. Cobras The system is based on the appropriate code Used to prioritize items. For Energy Storage systems, fuel systems, air solar hybrid systems, conventional systems, and PV energy storage systems, DG uses the COPRAS method in systems. First, by Zavatskas and Kaklauskas A process developed, multi-criteria problems COPRAS analogy for handling, correct Choosing air conditioners is right in the banking industry Choosing websites and suppliers and Various including selecting vendors It has led to many applications from fields. Cargo Adjustment of policies and evaluation of market segments, A few may be mentioned.

2. MATERIALS AND METHODS

Energy storage systems, fuel systems, wind solar Hybrid systems, conventional systems, PV energy storage Systems; DG Systems COPRAS Systems are using the COBRAS method. COBRA's method with better resolution rate determines a solution. Alternative methods and values of criteria and adequate measurement of weights are an illustration of the versions examined in the scale system Importance and straightforwardness of application and this method assumes proportional bias. In typical cobras, Weighting and substitution criteria are soft numerical data Ratings are calculated as they are taken. However, many conditions underlie real-world decision-making Flexible enough to handle problems, data Insufficient, on the other hand, is accurate knowledge not easy to get. These results are accurate making it accurate. Consequently, COPRASF is proposed where the criteria are the weights and Alternative estimates are given by linguistic terms are addressed using fuzzy numbers. To assess maintenance strategies COPRAS technique was used. Finally, the alternatives are ranked and the best one is selected. Create a hierarchical structure of criteria after calculating the weight, the significance of alternatives is assessed by the COPRAS technique. Finally, according to the results of the COPRAS method, ranked alternatives sort, the best alternative is selected. To evaluate research alternatives COPRAS method is considered. An alternative test for evaluating performance Criteria is related to these criteria, To evaluate information and meet the needs Evaluation of participation criteria It is necessary to develop methods. The decision maker (DM) considers a particular set of alternatives Consider; generally, conflicting criteria Thus, there are many alternatives to choose from Decision analysis include the situation. For this reason, Zavadskas and Kaklauskas (1996) developed A complex proportionality assessment (COPRAS) method that can be used. Alternatives to general practice Better multi-criteria decision-making for ranking (MCTM) techniques and COPRAS are selected. Between the COPRAS method in this field, A good agreement is observed. COPRAS can be done effortlessly The options and features are huge. of DG system Substitute for material selection problems based on A comprehensive MCDM using COPRAS as a tool-based approach. Before the COPRAS model Different from extensions, the proposed DG The system-based COPRAS model is real-world Subjectivity and ambiguity in decision-making problems can be handled very intelligently and flexibly. ALTERNATIVES IN COPRAS METHOD DG of unique codes used in systems are described by values. Cobras to reach the goal method are proposed. used in this study The framework of the proposed model is given. In this work, based on the COBRAS method A decision model is proposed. COBRA's method ranking results without finalizing the best solutions Provides utility and cost criteria Uses a separate integration process. We use the COPRAS system as a ranking system, It provides information in a sensible and useful way A suitable strategy for preparing A strategy used by cobras, among other strategies containing more accurate information compared to the Complexity of information from discrete points Standardization can be done based on proportionality calculation. This study was contributed by COBRAS and DG Analytical Hierarchy Process for Systems in the integration of techniques. The COPRAS method is a simple composite weighting method As, however, compares these two methods Based on research results, the COPRAS method is Very accurate in calculation There are alternate rankings that Because maximum and minimum There was an evaluation of the displayed criteria. The COPRAS method is used because the positive best solution calculates the negative ideal, the solution considering the final value, the selected alternative is the most positive best solution value, and the least negative is the best solution value. Additionally, in the process of computing the COBRAS method, Data Replacement Data Discrepancies Normalized to avoid.

2.1. Energy storage system: Under COPRAS systems, the traditional system of High priority had value and higher investment cost it became an optimal system only if attention was paid. The priority values of energy saving systems are very there were few, so these are the least preferred options. However, with a large number Of investors, the cost of investment in decision-making Considering economic development needs and Policy restrictions cannot be met. Therefore, more decision-making factors should be considered. In this paper, the sensitivity of the optimal system To analyze and make different decisions Minimum optimal setup under criteria There are also six different result scenarios set up for detection. Multi-criteria decision of DG system this ensures that the problem can be studied in more detail.

2.2. *Fuel system:* In COPRAS methods, the highest priority value and only when the investment cost is more focused the traditional system became the optimal system. Fuel cell Priority values for the system was very low, So these are the best options. However, considering investment cost in decision-making, Economic development by increasing investors to meet requirements and policy constraints could not hence, more decision-making factors should be considered. In this thesis, the optimal to analyze the sensitivity of the system, different Minimum optimums under decision criteria six different result views for system detection are set up. Several criteria of DG systems A more detailed study of the decision problem this is to ensure that it is done.

2.3. Wind solar hybrid system: For this thesis, a small business in Central Province Building, abundant solar energy resources, and relatively Area with limited wind energy resources, DG COBRAS system in systems was studied using.

2.4. Conventional system: A distributed energy system is energy to use layer Based on the concept, It's about resources and renewable energy To achieve comprehensive application Distributed on the demand side. More attention Preference for regular setting values was very low, so these are some of the best options, It is DG systems A multi-criteria decision-making problem Confirmed to investigate in more detail.

2.5. PV Energy storage system: In COPRAS methods, the highest priority value and only when the investment cost is more focused The traditional system became the optimal system. PV energy storage Settings priority values are too low there were, so these are the best options. However, considering the cost of investment in decision-making, Economic growth by increasing investor's Requirements and policy Restrictions could not be met. Hence, more decision-making factors should be considered. In this thesis, the optimal To analyze the sensitivity of the system, different Minimum optimum under decision criteria and to detect the system Six different ending scenarios are set. Multi-criteria decision of DG system this confirms that it can be done.

3. RESULT AND DISCUSSION

Energy storage systems, fuel systems, wind solar hybrid systems, conventional systems, PV energy storage systems, and DG systems use COPRAS systems. The scope of this research is on DG systems used by COPRAS. When planning integration, the uncertainty associated with the generation of DG sources should also be considered. This paper presents the optimal sizing of energy storage systems, fuel systems, wind solar hybrid systems, conventional systems, and PV energy storage systems in an unbalanced distribution network by investment cost, operation cost, primary energy consumption, and CO2 emissions. Reinforcement learning is practical Random data in situations It is an effective coping strategy.

TABLE 1.COPRAS of Distributed Generation (DG) system

	Investment cost	**Operation Cost**	**Primary Energy Consumption**	**CO2 Emissions**
Energy storage system	801.00	177.00	4712.00	88.40
Fuel system	829.00	139.00	3024.00	81.30
Wind solar hybrid system	767.00	160.00	2970.00	51.10
Conventional system	277.00	189.00	5283.00	153.84
PV Energy storage system	875.00	147.00	2106.00	45.06

Table 1 shows the information collection in COPRAS of distributed generation (DG) systems on the energy storage system, fuel system, wind solar hybrid system, conventional system, PV energy storage system, Investment cost, operational cost, primary energy consumption, and CO2.

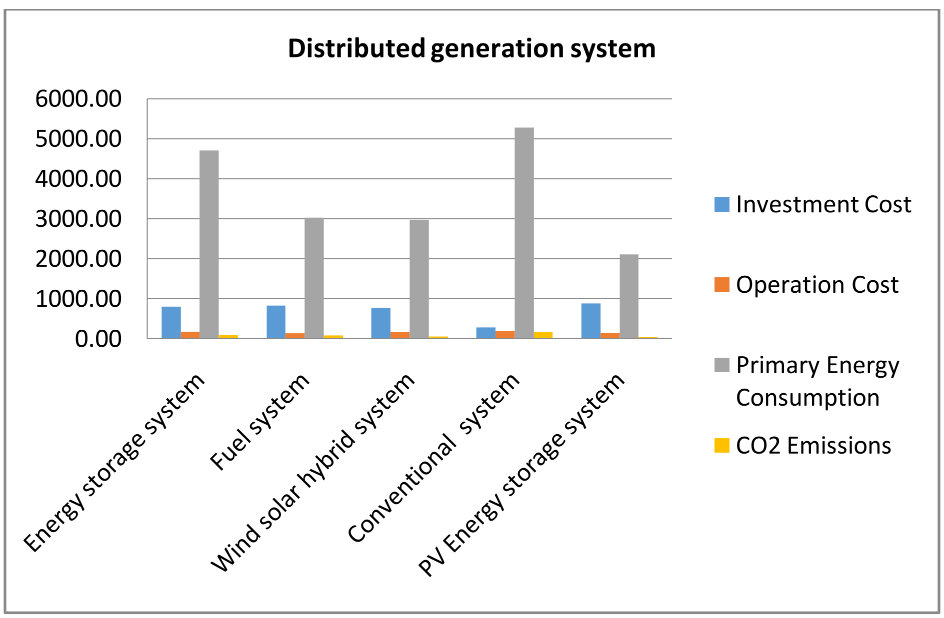

FIGURE 1. COPRAS in Distributed generation system

Figure.1 shows the graphical information collection in the COPRAS Distributed generation system on the energy storage system, fuel system, wind solar hybrid system, conventional system, PV energy storage system, Investment cost, operational cost, primary energy consumption, and CO2.

TABLE 2. Normalized Data on Distributed Generation (DG) system

Normalized Data			
Investment cost	**Operating cost**	**Primary energy consumption**	**CO2 Emissions**
0.2257	0.2180	0.2604	0.2106
0.2336	0.1712	0.1671	0.1937
0.2161	0.1970	0.1641	0.1218
0.0781	0.2328	0.2920	0.3665
0.2465	0.1810	0.1164	0.1074

Table 2 shows the normalized data which is calculated from the data set each value is calculated by the same value in table 1.

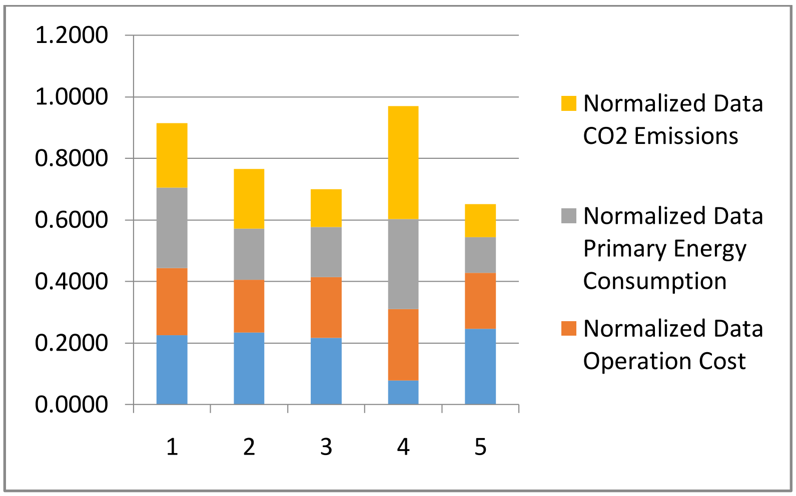

FIGURE 2. Normalized Data

Figure.2 shows the graphical information collection in COPRAS of distributed generation (DG) system on normalized data, investment cost, operational cost, primary energy consumption, and CO2 emissions.

TABLE 3. Weight

Weight			
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25
0.25	0.25	0.25	0.25

Table 3 shows the weight of the weight is equal for all the values in the set of data in table 1. The weight is multiplied by the previous table to get the next value.

TABLE 4. Weighted normalized decision matrix

Weighted normalized decision matrix			
0.06	0.05	0.07	0.05
0.06	0.04	0.04	0.05
0.05	0.05	0.04	0.03
0.02	0.06	0.07	0.09
0.06	0.05	0.03	0.03

In Table 2 and Table 3, the weight and Calculated by multiplying the efficiency value Result of weighted normalization Table 4 shows the matrix.

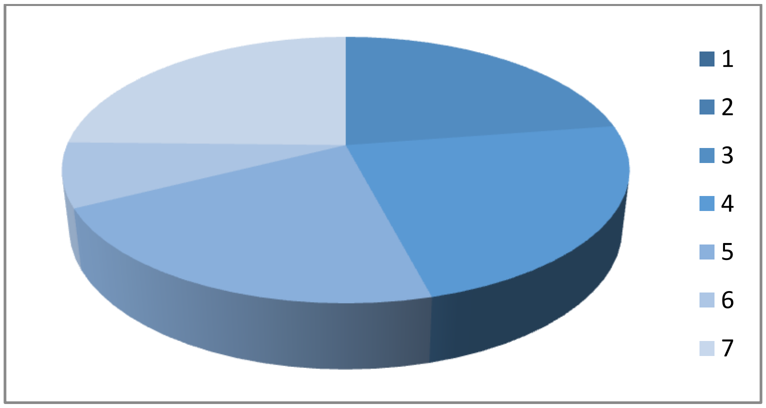

FIGURE 3. Weighted normalized result matrix

Figure 3.Weighted normalized result Displays the matrix.

TABLE 5. Bi & Ci & Min(Ci)/Ci

Bi	**Ci**	**Min(Ci)/Ci**
0.110919	0.117758	0.475019
0.101192	0.090207	0.620097
0.10329	0.071472	0.782644
0.077702	0.164627	0.339781
0.106896	0.055937	1
min(Ci)*sum(Ci)	0.0280	3.217541

Table 5 shows the value of Bi, Ci, Min(Ci)/Ci: Calculated from the sum of energy storage system, fuel system, wind solar hybrid system, conventional system, PV energy storage system. is calculated from the sum formula used.

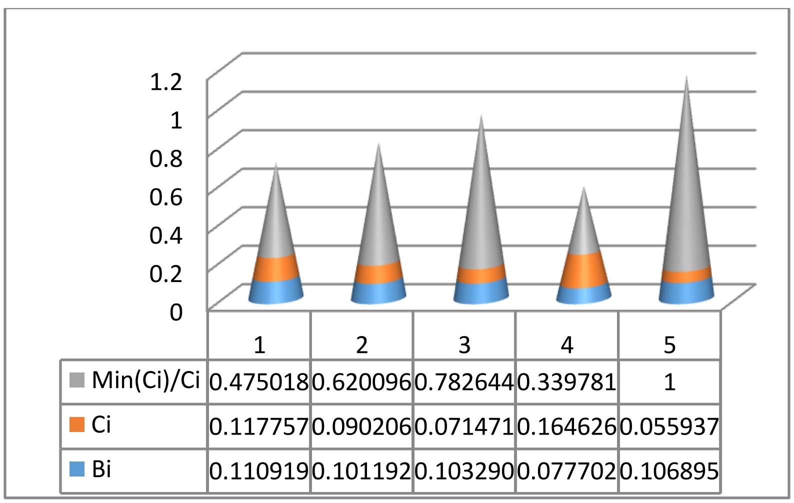

FIGURE 4. Bi & Ci & Min(Ci)/Ci

Figure 4 shows the value of Bi, Ci, Min(Ci)/Ci, Bi is calculated from the sum of the energy storage system, fuel system, wind solar hybrid system, conventional system, and PV energy storage system.

TABLE 6. Qi & Ui & Ui %

Qi	Ui	Ui %
0.184736	70.43111	70%
0.197554	75.31789	75%
0.224912	85.74805	86%
0.130504	49.75471	50%
0.262294	100	100%

Table 6 shows the Qi & Ui & Ui % value Qi sum, minimum formulas using this table.

TABLE 7. Rank

	Rank
Energy storage system	4
Fuel system	3
Wind solar hybrid system	2
Conventional system	5
PV Energy storage system	1

Table 7 shows the final result of this paper, the energy storage system ranks 4th, the fuel system ranks 3rd, the wind-solar hybrid system ranks 2nd, the conventional system ranks 5th, and finally, the PV energy storage system ranks 1st. Ranking shows.

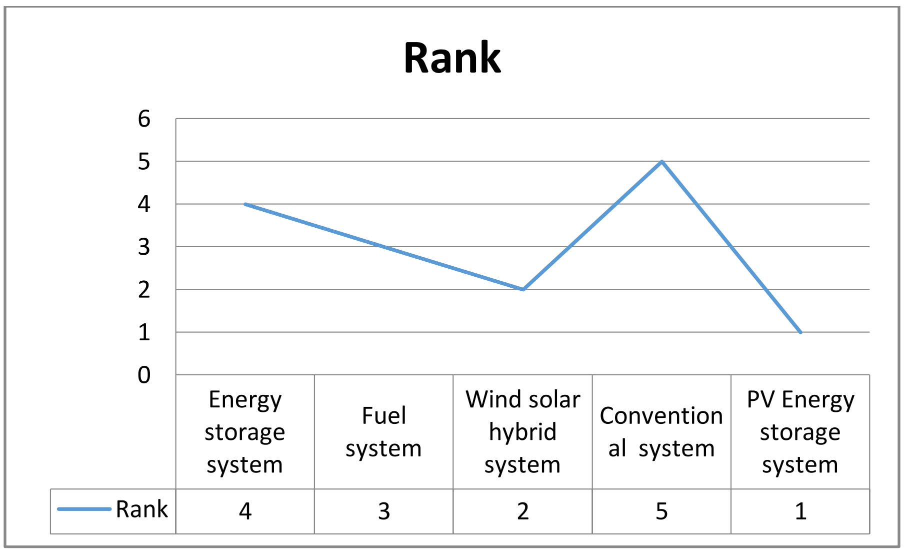

FIGURE 5. Rank

Figure 5 shows the final result of this paper, the energy storage system ranked 4th, the fuel system ranked 3rd, the wind-solar hybrid system ranked 2nd, and conventional system ranked 5th, and finally, the PV energy storage system ranked 1st.

4. CONCLUSION

This article is distributed DG on the performance of networks, Relevant aspects related to DG Include more potential Reviews of the objectives of the impact. Electricity network losses and Acceptable reliability level and guaranteed voltage profile. The optimization process is solved. Distributed Generation (DG) is for load centers A nearby power system, which produces a Strategy regarding the use of units Small ones are installed on the points. Small gas turbines, micro-turbines, Fuel cells, and wind and solar energy are adopted in DG technologies. DG can be used in isolated mode, by consumers Can meet local demand, or integrated The system can supply electricity to others. that electricity flows from the electrical system to the load Based on the assumption Distribution systems are designed. So, grid, power quality, or Mount the release of safety and security from DG or generators due to discharges Cumulative based on a reverse flow It can also have some impact on the system. Distributed nearby Large share of generation (DG) power system is predicted to play With distributed generation The voltage at the feeder is low Remember that In this example the voltage is reduced Because line drop compensator control of dg Reduces observed load. The distribution system has great potential for efficiency improvement of DGcontained and should be encouraged. However, the distribution system design and operating procedures are Generally based on radial currents production that has and is successfully distributed This creates a special challenge to introduce. Energy storage systems, fuel systems, wind solar Hybrid systems, conventional systems, PV energy storage Systems, DG Systems COPRAS Systems are using this distributed generation For efficient integration Network innovations are required. Active distribution network management Since development is centralized Highly distributed Required for computer management. of computer administration Information, communication and with complexity Control infrastructures are required. The COPRAS method at its simplest was chosen because of the computational process. The COPRAS method is simple additive weighting (SAW). Similar to the method, however, Both of these methods are Based on the results of comparative research, the max Since the assessment, and minimum criteria, The COPRAS method is very useful in calculating alternative rankings and is accurate. COPRAS method is used, Because computation is a positive ideal solution and Final based on negative best solution Assumes value, so the selected alternative is a higher positive ideal solution value, and The less negative the better the solution value. COPRAS methods, traditional methods, more Priority value, and investment cost are more focused Only when paying became the optimal setting. Additionally, in the process of computing the COBRAS method, the data Alternative data are normalized to avoid discrepancies. Distributed Generation (DG) PV energy storage system on system involvement ranking 1st place and regular setting It also got 5th place. COPRAS method, the value of criteria Many by increasing and decreasing Criteria can be used for decision making. of criteria for benefits or costs Method types are considered separately. Therefore, the COPRAS method Alternative ranking results using Compared to other methods allow for differences and also in evaluating the results of calculation Also very accurate in checking.

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