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Research Article

An IOT Innovation of Smart Solar Energy Consumption Analysis and Control in Micro Grid

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Solar energy consumption is a systematic study used to review the design of facilities, services, and equipment in an organization against specifications of solar panel. The solar panel energy consumption analysis is a work that should be done at the beginning of a solar energy. This way, potential changes can be highlighted before they affect the solar energy budget and schedule. The proposed model provides the IOT-based smart solar energy consumption analysis and control model by using solar photovoltaic micro grid. The proposed IOT design must meet product and process requirements. The solar panel energy should properly address important aspects of production processes. This should include risks related to product quality and safety. Finally, unacceptable risks must be minimized by design. In the solar energy consumption analysis process, the deliverables should be evaluated; customers should precheck the proposed design and identify problematic areas, if any. Solar energy consumption analysis reveals whether user requirements and features are sufficient to achieve the desired outcome. Likewise, there should be corrective actions for discrepancies found in design reviews.

1. Introduction

The visual inspection of tanks and vessels, which play an important role in oil and gas IOT devicesation, is a cornerstone of integrity assurance and is an important tool in detecting and quantifying defects and corrosion damage in general [1]. However, recent advances in accessibility technologies such as unmanned aerial nodes and remotely controlled nodes combined with imaging technology have begun to replace the human element in visual inspection [2]. Such remote monitoring services have provided significant benefits in preventing high-risk human interventions

in confined spaces and overworked or hazardous environments [3]. Quality assurance and quality control are two different processes that are used in different ways and for different purposes and have advantages in themselves [4]. Quality assurance inspections are process-oriented and focus on error prevention, while quality control inspections are product-oriented and focus on error detection [5]. Quality assurance is a set of activities to ensure quality in the processes by which products are made. Quality control is a series of steps taken to ensure quality in products [6]. Human survival and progress depend on the Earth's natural resources. So it is necessary to use them. Humans are dependent on resources for their survival. Human occupations are determined by the resources available in a place. Human economic activities vary from place to place according to resource availability. Nonrenewable resources should be handled with utmost care. Better research and development is necessary to make full use of renewable resources. These activities mainly focus on detecting defects in products. Quality assurance focuses on the process used to manufacture the product and in this way aims to prevent defects. So it is a proactive quality process [7]. Quality control aims to identify and correct defects in the finished product. So it is a reactive quality process. The purpose of quality assurance is to improve development and testing processes [8]. When this is done, defects do not occur during manufacturing. The purpose of quality control is to detect defects after a product has been developed, but before it is placed on the market [9]. In short, quality assurance is preferred to establish a good quality management system and assess its effectiveness in solar energy consumption analysis, while quality control is used to find and eliminate the sources of quality problems to meet customer requirements [10, 11]. As such, with quality assurance, it is a technique that attempts to prevent quality problems in planned and systematic activities including certification [12]. Quality control is the techniques used to obtain and maintain product quality. Solar energy consumption analysis can succeed in international trade to the extent that they can deliver the right products, at the right time, at the right price [13]. The sun is nature's greatest source of energy. Hundreds of different processes take place within this gaseous sphere every minute. Life on earth would be impossible without the sun, as it is the source of energy for all living things. All natural processes on earth are powered by solar energy. Without the sun, the planet's thermal regulation, photosynthesis, water cycle, and atmospheric circulation would be impossible. The use of solar energy on Earth is as common a phenomenon as inhalation and exhalation by humans. But it can give humanity more. It can be successfully used to obtain industrial energy, heat, or electricity. As global trade increases, the risk of not delivering products on time or not solar energy consumption analysis products of agreed quality is increasing [14]. Customers in different regions of the world need to ensure that the products, materials, and equipment ordered are equivalent to the requested specifications. In this regard, third-party authorized companies that provide independent and impartial service provide preshipment inspection services to ensure that products, materials, and equipment comply with contractual conditions [15, 16]. This way, quality is assured before shipment. Pre-export inspection services generally include the following types of services:

(i) Ensuring that products conform to predetermined specifications

(ii) Packaging control to ensure adequate protection of products during transit

(iii) Checks that loads are properly loaded and secured in the IOT devices nodes (stacking, lashing, and wedging control)

(iv) Verification that documents representing loads are complete

As a result, the report prepared by the authorized energy units as a result of the preshipment monitoring proves that the goods are ready for IOT devices in the ordered quality and quantity and are duly documented [17, 18]. Preshipment tracking services also reduce the risk of damage during transit. These services are offered to all solar energy consumption analysis regardless of the industry they operate in [19]. The development of using solar energy started in the twentieth century. Since then, hundreds of studies have been carried out by scientists from all over the world. They proved that the efficiency of using solar energy can be very, very high. This source can supply the entire planet with more energy than all other resources combined. Also, this type of energy is generally available and free.

With the development of computer and communication technologies, there has been significant growth in many fields throughout the world in recent years [20]. This rapid advancement increases the competition in the market. The quality of manufacturing energy unit's products is the most important factor in the success of the energy units' quality control function. Solar energy consumption analysis needs to evaluate, approve, and inspect materials and products from supplier companies or manufacturing companies to achieve their goals with quality assurance and quality control functions [21, 22]. Audits and evaluations of supplier companies have now become an indispensable process for solar energy consumption analysis in all sectors. Since production activities depend on the type and quality of the product supplied, raw materials are only formed into the actual final product or final product [23]. Therefore, it is important for an industry supplier of raw material to ensure that it is of good quality and standards and that the products it supplies meet all industry standards and policies. The final products must be of quality and reliability and quality that satisfy the customers. Evaluation of the quality program is a joint vendor and supplier activity [24]. The availability of natural resources that can provide energy to the earth is depleting every day. Therefore, active development of various ways of using solar energy is currently underway. This resource is a great alternative to traditional resources. Therefore, research in this area is incredibly important to society. The effectiveness of these energy units provides mutual benefit to all interested parties. With a vendor evaluation program,

the following are mainly evaluated: delivery time, product usage unit, quantity conformance, product delivery time competitiveness, accurate documentation, and response to emergency delivery conditions [25].

2. Literature Review

The most characteristic feature of IOT devices in the field of IOT is the ability to be flexible and responsive to customer needs, depending on the large increase in trade volumes and the need to maintain competitive advantages [1]. This trend is visible not only in local IOT devices chains but also in international IOT devices. This perspective pushes all supply chain organizations, where IOT device station plays a key role, to be more flexible [2]. Therefore, it is important to measure the effectiveness and efficiency of IOT device station activities and find and use suitable nodes. Through detailed analysis of the results obtained through various monitoring activities, solar energy consumption analysis develops appropriate strategies for appropriate infrastructure and technology improvements. IOT device station and IOT systems are strongly interrelated [3]. The performance of processes depends on each other. IOT hubs and container terminals play a very important role in integration. Solar energy consumption analysis operations are analyzed using several new methods for optimization and quality services [4]. There are many types of passive solar energy applications. Most of them are incredibly easy to use, but still very effective. There are also advanced options to help you get more value. For example, the first thing that comes to mind is the water storage container. If you paint it in a dark shade, in such a simple way, solar energy is converted into heat energy, and the water heats up. The next option cannot be done by an ordinary person on his own, as it requires a thorough analysis by an expert. This technology should be taken into account even at the design and construction stage of a house. Based on the climatic conditions, the building is designed to act as a solar collector. After that, materials are selected to maximize energy harvesting from the sun's rays.

The quality and reliability of solar energy consumption analysis operations depend on many factors, for example, distance to IOT devices, localization of distribution points and cargo IOT device station conditions, IOT devices nodes capacity, technical speed of nodes movement, technical deficiencies of cargo IOT devices, and systems and structural features of loading and unloading highways [5]. In addition, solar energy consumption analysis want to ensure that products are properly handled, that safe, IOT devices conditions meet all quality and safety requirements, and that goods are stored and IOT devices in accordance with good solar energy consumption analysis practices, regardless of the means of IOT devices used [6]. As a result, all the problems faced reduce the production efficiency in the energy units, cause waste of valuable materials, and increase operating costs. In some cases, it causes significant damage and threatens the health of employees. For solar energy consumption analysis to be successful, failure analysis must be part of all asset integrity management practices. The success of these studies depends on the use of appropriate analytical techniques [7]. Collectors are fundamental to the power supply principle. Such equipment absorbs energy and converts it into heat, with the help of which you can heat a house or heat water and convert solar energy into electrical energy. Collectors are widely used in industrial scale and private plots and agriculture. In addition to collectors, another equipment of the active system is panels with photocells. This device allows you to use solar energy in everyday life and on an industrial scale. Such panels are very simple, easy to maintain, and durable.

It is a well-known fact that coarse aggregate plays an important role in solar unit's construction. Coarse aggregate usually makes up about one-third of the volume of solar units. According to researches, coarse aggregate changes affect the strength and fracture properties of solar units. To accurately predict the behavior of solar units under loads, it is necessary to know the effects of aggregate type, size, and content [26]. This information can only be obtained through solar units and aggregate tests and observations. There is strong evidence that aggregate type is a serious factor in the strength of solar units. In high-strength solar units, high-strength coarse aggregates generally provide high compressive strength [27]. There are debates regarding the effects of coarse aggregate sizes on solar units, particularly on fracture energy. Understanding the effects of coarse aggregate has gained more importance with the use of high strength solar units [28].

In ordinary strength solar units, failure in compression is only related to cement bonding with aggregate particles. As the strength of the cement that makes up the solar units increases, the hardness and strength compatibility usually occur between the harder and stronger coarse aggregate and the surrounding mortar [29]. Therefore, microcracks in solar units are caused by aggregate particles. In this respect, aggregate strength becomes an important factor in high strength solar units. Therefore, solar units and aggregate tests performed in advanced laboratories are important [30]. Defects and safety incidents in machinery, pressurized equipment, and facilities cause health, safety, environmental, solar energy consumption analysis, and reputational damage in the oil and natural gas industry. Equipment failures occur without realizing how effective a facility's reliability programs are. Although not all failures are catastrophic, many failures are caused by gradual deterioration of features or excessive wear and tear, before the design life has expired and the components are no longer functional [31]. These negatives cost solar energy consumption analysis huge financial losses and downtime every year.

3. Proposed Model

Fault analysis is a study to determine why a broken system or component is not fulfilling its intended function. First, observations are made to identify the mechanical and human causes and hidden causes of the problem, and an engineering solution is implemented. Product specifications and user requirements must be clearly defined before starting a design review. At the end of solar energy consumption

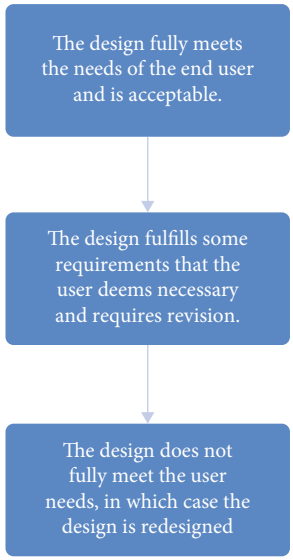

Figure 1: Possible outcomes of proposed model.

analysis studies, three possible outcomes emerge shown in Figure 1.

(i) The design fully meets the needs of the end user and is acceptable

(ii) The design fulfills some requirements that the user deems necessary and requires revision

(iii) The design does not fully meet the user needs, in which case the design is redesigned, another organizational design that meets the user needs, or the user needs are removed

The proposed provides solar energy consumption analysis and inspection services within the scope of services provided during design. Thanks to these services, solar energy consumption analysis can provide highly efficient, high-performance, and quality services that are secure, fast, and seamless. These methods have made it possible to create systems for harnessing solar energy, which are of two types:

(i) Active (photovoltaic systems, solar power plants and collectors)

(ii) Passive (selection of building materials and design of premises to maximize the use of solar energy)

By harnessing solar energy in this way, we have been able to harness an inexhaustible resource with greater productivity and return on investment. An energy unit's manager is a person with various skills such as

(i) Management

(ii) Leadership

(iii) Technical

(iv) Conflict management

(v) Client relations

Let us not forget that the sun already heats everything on Earth and your house is no exception. Therefore, the beneficial effect can be increased by making some corrections at the construction stage and using special techniques. Thus, you will get a house with very comfortable thermal regulation without much investment. In the past, different inspection and inspection strategies, inspection types, and inspection intervals were determined to reduce inspection costs. In these studies, different methods were used according to audit errors, audit amounts, and audit costs. Today, production monitoring and technical monitoring inspections are carried out for two purposes: evaluating compliance with design specifications and increasing product quality and reliability. Using solar energy to heat water is the easiest and cheapest way available to humans. Such equipment can be purchased at a reasonable price. At the same time, they can restore themselves quickly, significantly reducing the cost of centralized energy supply. Inspection controls, product quantity, product cost, and product monitoring study operational performance shown in Figure 2.

(i) Initiating

(ii) Planning

(iii) Executing

(iv) Controlling

(v) Monitoring

(vi) Completion

An energy unit is an activity with a start and end date, a transition, a unique and unknown element, and therefore a degree of risk. Energy units are usually created to solve a problem or take advantage of an opportunity. The day-to-day work normally undertaken by a solar energy consumption analysis is not an energy unit. The factor that determines whether an activity is an energy unit is its uniqueness. A successful energy unit's manager must simultaneously manage these four key elements of energy units shown in Figure 3.

(i) Solar panel energy construction resources

(ii) Optimization duration

(iii) Operational cost

(iv) Scope of the IOT devices

All these elements are interrelated, and each must be managed effectively. The most used resource in all energy units is the employees participating in the energy units. Energy unit's managers must ensure that the energy units works, that potential problems are resolved quickly, that the energy units is completed on time, and that the energy units quality and budget are acceptable. Energy unit managers are responsible for directing all activities necessary and that are shown in the following Figure 4.

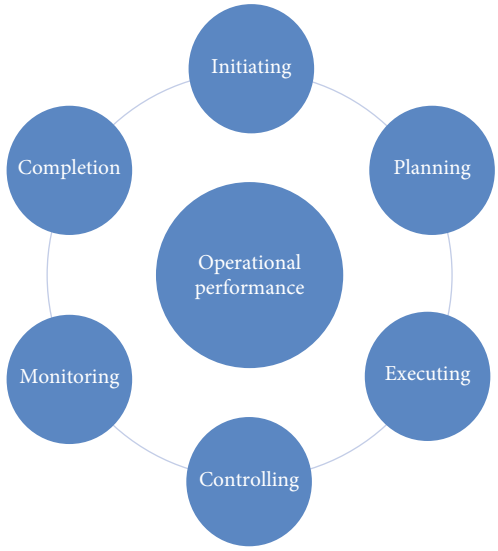

Figure 2: Operational performances.

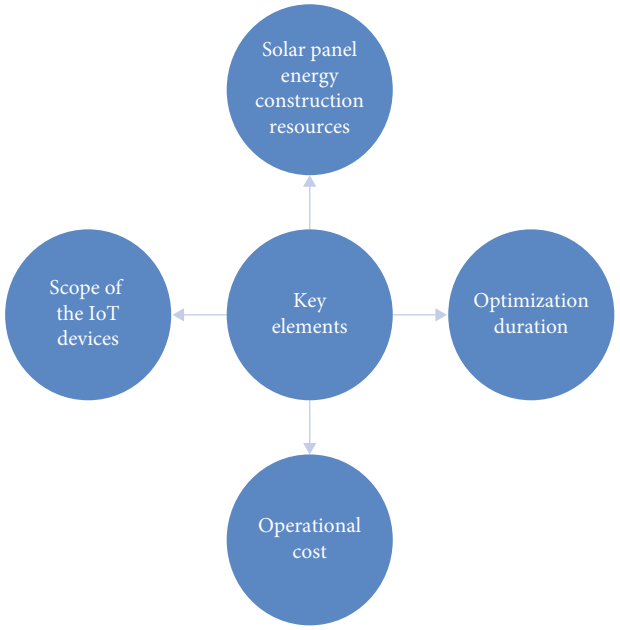

Figure 3: Key elements of energy units.

(i) Successfully achieve energy units goals

(ii) Performing risk management

(iii) Identifying and resolving potential problems before they occur

(iv) Recommending alternative approaches to emerging problems

(v) Reporting energy units progress

(vi) Planning is key to successful implementation

It is the easiest and cheapest way to use solar energy. Special devices that absorb solar radiation during the day and illuminate areas at night are very popular among owners of

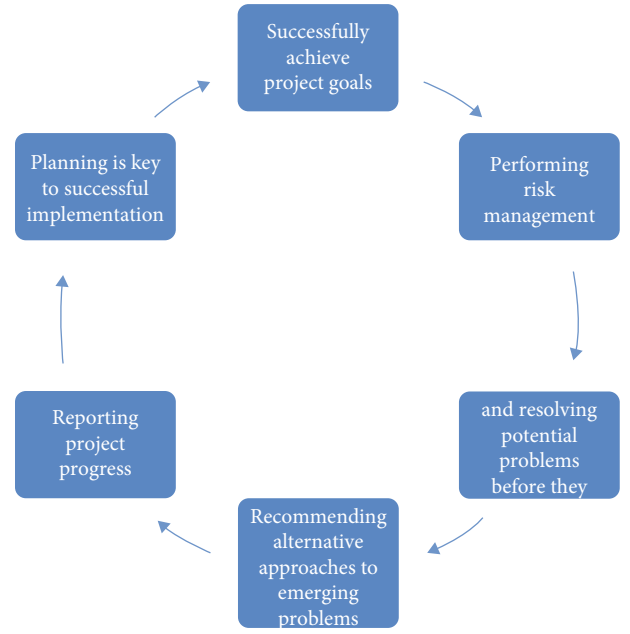

Figure 4: Energy directing activities.

private houses. Generally, production monitoring inspections focus on machine tool accuracy testing, part or product inspections, and process quality control. Additionally, solar energy consumption analysis should always check their product and process quality. These services provided by authorized organizations include monitoring of the manufacturing process, quality monitoring of end products, dimensional monitoring, packaging and loading monitoring, handling and storage monitoring, and source control. Therefore, failure and damage analysis should be performed to understand the root cause of problems, avoid recurrence, and reduce the cost of reliability. Technical solutions to understand malfunctions and their causes are incorporated at various stages, thus avoiding recurrence of malfunctions. This method uses a completely different system. A solar receiver looks like a multilayer structure. Its principle of operation looks like this. When passing through the glass, the rays strike the dark metal, which is known to absorb light well. Solar radiation heats the water under the iron plate. Then, everything happens as in the first method. Hot water can be used to heat space or generate electricity. True, the effectiveness of this method is not enough to be used everywhere.

4. Results and Discussions

The proposed solar energy consumption analysis model (SECAM) was compared with the existing organic photovoltaic energy harvesting system (OPEHS), a hybrid multimodal energy harvester (HMEH), improved metaheuristic-based clustering (IMBC), and Multi-Objective Optimization with Mayfly Algorithm (MOOMA).

4.1. Remote Monitoring. These services reduce solar energy consumption analysis' health and safety risks and increase

Table 1: Comparison of remote monitoring.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	59.23	60.68	59.00	71.48	87.17
500	59.12	60.70	58.83	71.21	86.67
750	59.10	61.58	59.56	71.51	86.79
1000	59.02	61.89	59.69	71.43	86.50
1250	58.96	62.34	59.97	71.45	86.31
1500	58.89	62.79	60.25	71.46	86.12
1750	58.83	63.24	60.53	71.48	85.93

Table 2: Comparison of quantitative analysis.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	59.02	61.89	59.69	71.43	86.50
500	58.95	62.34	59.97	71.44	86.31
750	58.89	62.79	60.25	71.46	86.12
1000	58.82	63.24	60.53	71.47	85.93
1250	58.76	63.69	60.81	71.49	85.74
1500	58.69	64.14	61.09	71.50	85.55
1750	58.62	64.59	61.37	71.51	85.36

resource utilization, thereby increasing efficiency in solar energy consumption analysis integrity. This remote monitoring was compared and demonstrated in the following Table 1.

In addition to quality control of energy units in the construction industry, an inspection of gas cylinders, pipelines, and storage tanks in the chemical industry and management of pipelines, chimneys, phase separators, and boilers in the oil and natural gas industry, nuclear power plants, wind turbines, solar panels, and dams are all included in remote monitoring services. It is preferred in inspecting accessible structures and enclosed areas or in the infrastructure investigation of viaducts, railways, and bridges.

4.2. Quantitative Analysis. Speeding up the process requires a detailed and quantitative analysis of the causes and effects along the critical path of a particular process. Depending on the operations of the solar energy consumption analysis, key processes include order status, inventory of equipment in stock, design verification, manufacturing progress, testing, packaging, solar energy consumption analysis, and distribution. This quantitative analysis was compared and demonstrated in the following Table 2.

Expediting the process ensures the efficiency and successful execution of procurement contracts involving unlimited goods and services, improves communication, helps avoid solar energy consumption analysis spillovers, and controls production delays. Process acceleration is one of the best quality assurance methods for energy units to be carried out within schedule and cost.

4.3. Process Acceleration. In short, process acceleration is an energy unit's management technique used as part of the procurement process based on ensuring the quality and timely delivery of materials and components. Solar energy consumption analysis must monitor and control the supplier's progress at the manufacturing facility to ensure that their products arrive at the agreed destination, at the agreed quality, and on the agreed contract delivery date. The expediting process is usually between the manufacturer and the supplier. This process acceleration was compared and demonstrated in the following Table 3.

Recognized companies provide efficient and cost-effective services in production planning and manufacturing processes for all major industry sectors and equipment. The proposed model provides process acceleration services within the scope of supplier services provided during equipment manufacturing. Thanks to these services, solar energy consumption analysis can provide highly efficient, high-performance, and quality services that are secure, fast, and seamless.

4.4. Acceptance Tests. Factory acceptance tests are an important way to ensure that purchased equipment and systems conform to agreed design specifications. These tests allow any problems to be corrected at the vendor's location or prior to production. Thanks to these tests, which require technical expertise and resources, any undesirable situation in the plant is prevented, and the overall quality of the product supplied is improved. This acceptance tests were compared and demonstrated in the following Table 4.

Although there are some general rules for factory acceptance testing in practice, the process is actually a customized process. Factory acceptance tests are very complex and depend on different factors. To succeed in factory acceptance testing, it is important to clarify expectations early and communicate effectively throughout the process. The processes of factory acceptance tests include planning, performing test operations, collecting test results, determining problems, and resolving problems when necessary.

4.5. Production Monitoring. It is an important method of evaluation that involves inspection, measurement, testing, and comparison of products or materials. An inspection process is to determine whether a material or material used in production is of appropriate size and condition or fits and conforms to specified requirements. Monitoring inspections at each stage of production is one of the main components of the quality management system in any energy units. Different selections are required at different stages of production to achieve the required quality. This production monitoring was compared and demonstrated in the following Table 5.

4.6. Planning Process. In the planning process, the tests to be performed, test criteria, protocols, required equipment, acceptable features, and responsibilities, as well as the personnel to participate in the tests are determined. Factory acceptance tests are coordinated and applied according to planned requirements, specifications, and contracts. This planning process was compared and demonstrated in the following Table 6.

Table 3: Comparison of process acceleration.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	62.20	64.41	62.90	75.02	90.02
500	63.40	65.73	63.63	76.34	90.40
750	64.01	66.56	64.52	76.88	90.97
1000	64.42	66.96	64.60	77.18	90.67
1250	65.32	68.03	65.41	78.11	91.14
1500	66.05	68.88	66.01	78.81	91.39
1750	66.77	69.73	66.61	79.51	91.64

Table 4: Comparison of acceptance tests.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	66.05	68.88	66.01	78.81	91.40
500	66.78	69.73	66.61	79.51	91.65
750	67.51	70.58	67.21	80.21	91.90
1000	68.24	71.43	67.81	80.91	92.15
1250	68.97	72.28	68.41	81.61	92.40
1500	69.70	73.13	69.01	82.31	92.65
1750	70.43	73.98	69.61	83.01	92.90

Table 5: Comparison of production monitoring.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	50.72	64.31	61.51	75.68	87.01
500	52.21	66.28	63.93	77.88	87.00
750	53.01	67.41	64.34	78.68	88.20
1000	54.27	69.10	66.09	80.41	88.59
1250	55.42	70.65	67.51	81.91	89.19
1500	56.56	72.20	68.92	83.41	89.78
1750	57.71	73.75	70.34	84.91	90.38

Table 6: Comparison of planning process.

No of inputs	OPEHS	HMEH	IMBC	MOOMA	SECAM
250	54.27	69.10	66.09	80.41	88.59
500	55.41	70.65	67.50	81.91	89.19
750	56.56	72.20	68.92	83.41	89.78
1000	57.70	73.75	70.33	84.91	90.38
1250	58.85	75.30	71.75	86.41	90.98
1500	59.99	76.85	73.16	87.91	91.57
1750	61.13	78.40	74.57	89.41	92.17

Briefly, factory acceptance testing is the process followed during and after the assembly process to verify that it conforms to design specifications and is functional. Thanks to these inspections, it is ensured that the components work properly according to the equipment's functionality.

5. Conclusion

Most of the companies provide remote visual inspection services to solar energy consumption analysis. Remote visual inspections and nondestructive inspection services are offered to solar energy consumption analysis from all sectors as a safe, flexible, and cost-effective alternative to traditional visual inspection methods. In this way, solar energy consumption analysis makes their operations faster, safer, and more cost-effective. The proposed solar energy consumption analysis model (SECAM) was compared with the existing organic photovoltaic energy harvesting system (OPEHS), a hybrid multimodal energy harvester (HMEH), improved metaheuristics-based clustering (IMBC), and Multi-Objective Optimization with Mayfly Algorithm (MOOMA). Solar energy consumption analysis strives to simplify and accelerate the integration of global operations. Speeding up processes is one of the key factors contributing to the successful implementation of large energy units. In this way, the solar energy consumption analysis ensures that its operations continue as planned and manages to minimize delays and costly product shortage issues.

Data Availability

The data used to support the findings of this study are included within the article. Further data or information is available from the corresponding author upon request.

Conflicts of Interest

The authors declare that there are no conflicts of interest regarding the publication of this paper.

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