Periodicals of Engineering and Natural Sciences ISSN 2303-4521
Vol.8, No.1, March 2020, pp.516-525

Bordering a set of energy criteria for the contributing in the transition level to sustainable energy in electrical Iraqi Projects

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ABSTRACT

Design Engineering is considered in all their details as an engineering road-map that implementing companies must adhere to. Therefore, designers must consider sustainable standards in engineering designs in general and designs for energy-related parts of buildings. For the purpose of disseminating sustainable energy designs, the analytical require study of performance construction in terms of energy consumption, knowledge of the sources of this energy. The extent to basic electrical and mechanical designs are simulated to the energy performance requirements of a sustainable methodology. For this reason, this research paper sheds light on a survey study of the extent to which projects conform in terms of implementation and design to methodological standards in the performance of sustainable energy by relying on a group of experts and specialists in this field. Therefore, the researcher has adopted a set of standards that simulate the burning environment and in an open questionnaire whose outputs have turned into a closed questionnaire to include a group of specialized experts to reach the importance of organizing these standards to be part of the Iraqi construction electrical projects.

Keywords: Energy, Sustainable, Renewable, PV.

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1. Introduction

The main reason in converting the traditional electrical designs in buildings into sustainable designs is to preserve the energy that meets the requirements of the users and not to cause environmental damage or to be within the acceptable economic range that achieves balance in consumption and supply in the stage of operating buildings. The concept of sustainable energy simulates the general concept of sustainability that it refers to sustainability balancing of environment with essential economic development is vital [1]. The progress to practical and sustainable power source advancements gives a chance to address the ecological issues as well as by and large financial and formative needs to improve the expectations for everyday comforts of individuals with value and monetary supportability. In this way, manageable energy and low-carbon advancements could give approaches to improvement openings that outcome in a world that is sound, feasible and has a protected vitality source [2, 3]. The process of contracting and purchasing of technologies and sustainable materials as part of enhancing the sustainable energy performance that must be found by the owners is considered part of documentation process to ensure the contractors will apply them [4].

1.1. Motivations of study

The traditional standards cannot be relied on in engineering designs, especially with regard to electrical and energy engineering. Therefore, it became necessary to simulate the requirements of sustainability in energy in order to be part of the requirements of work in future projects in developing countries, especially Iraq. The importance of relying on the opinions of experts in this field to set sustainable energy standards as part of the requirements of employers that fit sustainable engineering designs as well as be part of the energy performance assessment.

1.2. Literature review

Energy is fundamental improving expectations for comforts days, improvement and development while the worldwide power request is developing twice as fast as all energy utilization. Access to energy is especially critical for wellbeing offices as power is expected to store antibodies and perform life-sparing activities [5]. Feasible energy structures allude to endeavors to decrease or dispose the needing to consume non-renewable energy sources for space warming and cooling. In existing structures, energy supportability can be practiced by expanding useful energy utilization, related to utilization of diminished sources of energy, and the using of customary sources of energy will be decreased. In these structures, petroleum products are scorched nearby as essential energy and off-site to create power for auxiliary energy [6, 7]. Because of the energy emergency, social issues, ecological, financial, and political and market, analysts are pulled in to create sources of reasonable and sustainable power sources to verify energy utilization, secure the earth, and to advance local improvement [8].In perspective on the constant need of modern social orders for energy, it was important to set up a practical approach in the utilization and improvement of energy generation strategies to be of a feasible measurement and perfect with the components of manageability (natural, monetary and social). So as to accomplish the mix of energy creating frameworks into the engineering building scale, we need to change the customary envelope parts in dynamic components, which can have the option to control the warmth stream between the interior and outer condition in a productively and deftly way. Since long time numerous advances are accessible, for example, protection frameworks and ventilated dividers, manual and programmed concealing gadgets, photovoltaic (PV) boards and sun oriented gatherers [9-12]. Conventional energy assessment methods need to be upgraded to the methods that are appropriate to the sustainability requirements. Sustained energy or its various names are considered clean energy, it must meet the requirements of the current and meet the requirements of upcoming generations and take into consideration without negatively affecting its ability to prejudice what the future requires [13, 14]. When alluding to techniques for creating energy, the expression "manageable energy" is regularly utilized reciprocally with the expression "sustainable power source". Generally, sources of sustainable power, for instance, based on sun, wind, and hydroelectric energy are generally viewed as supportable. In any case, specific sustainable power source ventures, for example, the freeing from woodlands for generation of biofuels, can prompt comparative or much more dreadful ecological harm when contrasted with utilizing petroleum product energy. Giving practical energy is generally seen as perhaps the best test confronting humankind in the 21st century, both as far as addressing the requirements of the present and as far as impacts on people in the future [15].

According to SDG7, in third world nations, more than 2.5 billion individuals depend on customary cooking stoves and open flames to consume coal or biomass for warming and cooking food (2019). Such practices has resulted to unsafe nearby air contamination and expands threat from flames, bringing deaths of about 4.3 million people every year[16]. In addition, genuine neighborhood natural harm, including desertification, can be brought about by over the top reaping of wood and other ignitable material [17]. Advancing utilization of cleaner energizes and increasingly productive innovations for cooking are consequently among the top needs of the Sustainable Energy for UN for All activity. Starting at 2019, endeavors to configuration clean cooking stoves that are economical, controlled by manageable sources of energy, and adequate to clients are in most cases baffling [16].

Sources of Sustainable Energy. When alluding to energy sources, the expressions "economical energy" and "sustainable power source" are regularly utilized reciprocally, anyway specific sustainable power source extends at times raise huge maintainability concerns. Sustainable power source advancements are fundamental supporters of feasible energy as they by and large add to world energy security and lessen reliance on petroleum product assets therefore moderating ozone depleting substance outflows. Solar energy provides around 3% of worldwide power[10, 18]. It is particularly valuable for giving power to remote territories. Albeit for the most part justified for a long time is asserted the a normal solar energy panels can last for almost 40 years .Systems of solar heating can be utilized for modern uses or as an energy contribution for different needs, for example, equipment for cooling. In numerous atmospheres, a sun powered warming framework can give an extremely high rate (of between 20-80%) of local heated energy from water. Warmth can be put away by warm energy stockpiling advances. For example, warmth during summer can be put away for warming during winter. Comparable standards are utilized in storage of winter cold for cooling during summer. Wind power produced around six percent of the worldwide energy in 2018. Among sources of sustainable power, hydroelectric power has the upsides of enduring where a lot of existing power plants have existed for more than hundred years. Additionally, plants for hydroelectric power are ideal and have barely any outflows. Reactions synchronized all over scale plants for hydroelectric power include: separating individuals who lives where the stores are set and influx of ozone harming substances throughout flooding of the reservoir [19].
Biomass power source is very supple, and it is among the most used sources of sustainable power. It is available in many nations, making it appealing for retreating reliance on importing petroleum products. On the off chance that the biomass creation is overseen clearly, carbon outflows can be basically counterbalanced by assimilating carbon dioxide during their life in the plants [20]. Since biomass source is based on horticultural products or city squander, its consumption or changing it into biogas gives rise to an approach to dispose of this waste. Bio-energy generation is combined by carbon and capacity to make a system of carbon free, yet it is farfetched scaled up fast enough [21].

1.3. Sustainable energy attributes

It is considered the most important features and criteria that must be taken into account when preparing the transition from the traditional energy system to a sustainable Energy. This transformation requires any of the small, medium or large projects to take into account the environmental factors and the economic factor that will be decisive in the transformation currency, especially in developing countries. To produce a list of attributes that is broadly established as constructive consequences of Renewable Energy's development. every unconstructive attributes have not been taken into concern as Renewable Energy's negative impact is usually lower than that of conventional power generation technologies, leading to an overall net gain if the generation mix of the country is modified to include a larger share of Renewable Energy's[22]. To overcome difficulties, challenges, and a set of internal factors that may affect the establishment of a sustainable system, great importance must be given by clients. So features such as lower monthly energy costs are important to the local consumer. The environmental pollution factor resulting from the operation of sustainable energy units is also considered a standard. Likewise, the maintenance standards for companies responsible for producing this type of energy and other features of a sustainable dimension will also be considered in the attached questionnaire for the specialists in this field. It is identified that price, equipment efficiency and technology are the critical factors for commercializing renewable energy sources [23, 24]. A feature of adopting sustainable energy in developing countries is defining the goal of assisting poor communities (the social dimension). It has been documented in the industrialized countries that public acceptance of renewable energy technologies is crucial to their successful introduction into society [25, 26]. This is because poor public acceptance of renewable energy technologies could hinder the implementation of sustainable energy technologies which hampers the attainment of important environmental and societal goals [27, 28].

1.4. Research objectives

The research's aim is to be part of the following objectives:

1. Study a set of sustainable energy-related standards;
2. Identify a group of factors that raise the level of energy performance that meets the sustainability methodology by conducting questionnaires in both bases (closed and opening questionnaires);
3. To come up with a summary that explains the most conforming standards to the Iraqi engineering environment.

2. Research methodology

The research methodology is based on the following points and as shown in *Fig (1).*

Firstly, Collection of information relating to the study subject by using open questionnaire.

Secondly, Formulation and designing of closed questionnaire.

In addition, Analyze the questionnaire and produce results of study. Finally, Adoption of the feedback is to clarify the suitability of these standards, selected for the work environment in Iraq, to increase the energy performance requirements in accordance with the sustainability standards.

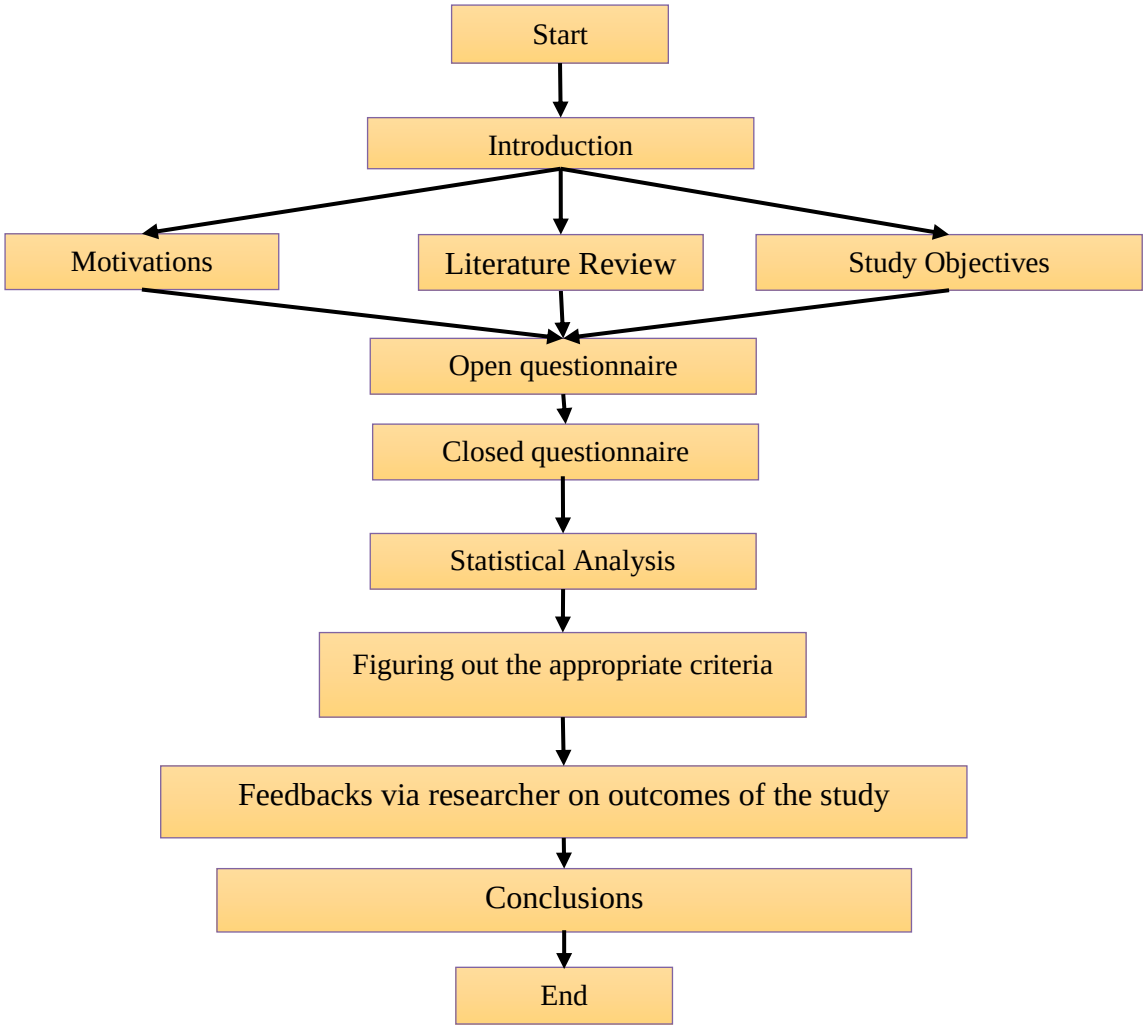

Figure 1. Research methodology

Under implementation or design experts in the sectors of service, industrial, construction and electrical projects, so that their results are part of the open questionnaire. By adopting research samples that are distinguished by being experienced, professional, knowledgeable and Wide-Scientific know in the fields of study and engineering application.

2.1. The research steps

The research sample focused on the following:
1- Site engineers are to cover those section in the sites of projects (construction, electrical and mechanical).
2- Engineers working in the industrial field
3-Academics and consultants with experience
4-Experts in distribution, electrical networks and maintenance sections.

Process of Closed Questionnaire: During the research phase, a number of closed questionnaires were distributed to include a number of governmental and private sector companies as well as self-financing companies and experts working in the fields of investment in the energy field. The total number of closed questionnaires that were distributed (61) was a closed questionnaire form. Table 1 shows the forms collected with the details of the questionnaire received.

Table1. Number and professional level of the respondent.

	Organization	The professional level of the respondent	Number of respondents
1	Private sector companies	Consultants and Technical Engineers	9
2	Government sector	Technical Engineers and Experts	14
3	Self-financing companies	Consultants and Experts	13
5	Academic institutions	Academic Engineers	11
6	Consulting offices	Experts	7
7	Investment companies	Experts, Economists and technical engineers	19
	Total Number		73

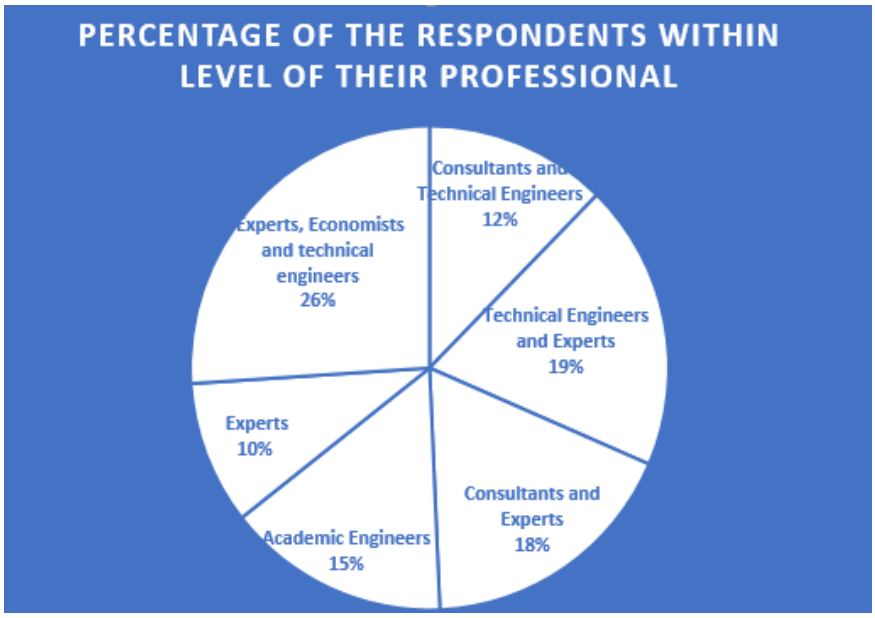

Figure 2. Percentage of the respondents within level of their professional

3. Results and discussion

After completing the process of collecting the required data in the evaluation, the degree (effectiveness) and the extent of the required criteria that will contribute to the process of converting to sustainable energy application according to the experts' point of view. Questionnaire collected forms 71.

3.1. Analysis of questionnaire

The parts of the questionnaire distributed among technical groups and experts were analyzed and the results were as follows:

3.2. Education degree

The tables below associated with this section shows that the number of participants were of higher degrees, especially whose Ph.D. and Master and other experts degrees.

Table 2. showing education levels of participants

*Education Degree:	Numbers	Percentage (%)
Ph.D.	27	36.99%
Master	25	34.25%
Full-technical Diploma	9	12.33%
Bachelor of Engineering	12	16.44%

*Experience (in Years)

The years of experience of the participants are shown in the table below

Table 3. showing the experience of participants in years

No.	Rang	Percentages
1	12- <15 year	16.44%
2	19- <20 year	26.03%
3	16- <25year	21.92%
4	26 More than 30 years	35.62%

The process of analysing the results was the output obtained for the closed questionnaire using the weights method (frequencies) as in the Appendix (A).

The first Step: The questionnaire was based on five options that respondents would answer according to its degree (strength) and how it is being required and the options about the questionnaire whereas in the following table:

Table 4. Questionnaire outlook

Totally ineffective (Not required)	Slightly effective	Effective	Moderately effective	Strongly effective (highly required)

The second step: This step explains the start of the analysis process, which depends on the number of frequencies for each of the options above.
Third step:- Depending on the mean value of the answers. This value is the mean. And to calculate them by adopting the following formula:

$$M=\sum_{i=1}^{i=n} Xi * Fi/N \quad \ldots\ldots\ldots\ldots\ldots\ldots \quad (3\text{-}1)$$

Where: M = Responses weighted mean about requirement.

Xi =Evaluation degree of response class (i) about requirement.
Fi = Response frequency for class (i) about requirement.
N= Sample size in each requirement.

Evaluating the results in the questionnaire by depending on the formula, dividing the average into three sections, which gives the effectiveness of each of the criteria (sets) required for converting to sustainable energy system as in the following:

a- If M< 5 that gives the evaluation of the item is under (poor level) therefore the set is ineffective (not required) based on expert opinions.
b- If $5 \leq M \leq 7$ then the evaluation of the item is (moderate)therefore the set is effective and should be taking into account.
c- If M > 7 then the evaluation of the item is (strong) therefore the factor is strongly effective and should be taking into account.

Table 5. Weight of responses through choices of the questionnaire

Choice for answering	Interval - respondents	Average weight
Totally ineffective	0 – 2	1
Slightly effective	2 – 4	3
Effective	4 – 6	5
Moderately effective	6 – 8	7
Strongly effective (highly required)	8 – 10	9

The following data was analyzed, which represents the strength of the main required criteria (sets) in the table (6). Depending on the (M) for each sets and its evaluation the analyzing process of the questionnaire is to clarify the extent to which any of the elements is required (strong) equivalent level more than seven or not required as in process of converting (neglect) its equivalent the level less than five in the procedures of analysis. The Appendix (A) shows all details Descriptive Statistics.

Table 6. Showing Setting of Required Criteria to transition into Sustainable Energy

Code	**Sets**	**Mean**	**Evaluation**
Set-1	Provides environmental legislation that supports sustainable energy	8.2	Strong (highly required)
Set-2	Development of implementation and design methods in government projects to emulate the principles of sustainability	8.1	Strong (highly required)
Set-3	Demonstrating the sustainability criteria according to the international sustainability codes	7.5	Strong (highly required)
Set-4	The need for methods to monitor and audit energy consumption	6.7	Moderate
Set-5	Promote sustainable energy uses by organization	7.3	Strong (highly required)
Set-6	Establishing investment rules that contribute to increasing investor awareness towards sustainable energy.	5.2	Moderate
Set-7	Encouraging partnership contracts with international companies that possess experience in the field of sustainability and energy.	8.0	Strong (highly required)

Code	Sets	Mean	Evaluation
Set-8	Developing an economically and environmentally renewable energy assessment system	7.8	Strong (highly required)
Set-9	Training and developing the competencies of local companies in the field of sustainable energy use	8.7	Strong (highly required)
Set-10	Adopting sustainable maintenance methods.	4.6	(Poor) Neglected
Set-11	Using of sustainable technology in controlling energy production	5.7	Moderate
Set-12	Develop integrated plan for operating and maintaining the buildings according to the sustainability criteria.	4.7	(Poor) Neglected
Set-13	Making Cost assessment for sustainable energy compared to traditional energy.	7.4	Strong (highly required)
Set-14	Periodic monitoring of equipment and machines in the sustainable generation system.	6.8	Moderate
Set-15	Designs of sustainable energy projects must comply with global codes so that the amount of energy consumption and the associated costs are taken into consideration.	7.3	Strong (highly required)
Set-16	Adoption of legislations to facilitate costs controlling as daily, weekly and evaluating whole those costs (quarterly -semiannual-annual).	8.2	Strong (highly required)
Set-17	Adoption an energy technical reports (semi-annual and annual).	6.8	Moderate
Set-18	Preparing a database by the energy departments that includes classification of buildings according to the nature of their energy consumption.	7.2	Strong (highly required)
Set-19	Approving the energy simulation design for buildings for the purpose of knowing the size of energy savings for the whole building.	7.27	Strong (highly required)
Set-20	Adoption of the national metering system to measure the energy level and activate the methods of managing and rationalizing energy.	7.57	Strong (highly required)
Set-21	Develop an effective action plan for the emergency power supply system as part of a sustainable system.	4.7	(Poor) Neglected
Set-22	Developing an action plan to reduce the environmental and economic impacts on dependence on fossil fuels, and to develop methods for relying on renewable energy.	7.65	Strong (highly required)
Set23	Establishing an internal information network for the purpose of	8.15	Strong (highly required)

Code	Sets	Mean	Evaluation
	developing workers, technicians and companies involved in energy about the mechanisms and applications of sustainable energy and methods of implementation and development.		

3.3. Reliability and validity

By performing the process of repeated questionnaires taking into consideration the time period, we find that the consistency process is at an acceptable level if it was done twice for a different level of samples. This gives a similar degree for the results for the set of criteria required. By adopting of test Cronbach's Alpha for scale of reliability on level of (0.7). The degree of validity where the extent to which the texts and concepts are presented are considered to be valid [16].

Reorder the required Sets of Criteria:

In this part of the research, the required sets have been rearranged according to the degree of their strength, which shows how severe those sets are in the working environment for the purpose of shifting towards sustainable energy measures. And Fig No. (2) Shows the order of standards after analyzing the results in the practical stage.

4. Conclusion

The results obtained through extrapolating the opinions of a number of researchers and experts in the procedures of the open and closed questionnaire to reach a set of required standards as (CIT), which can be considered as the steps that contribute to the transformation process of industrial societies and projects in relying on sustainable energy. In other words, the results of the research paper contribute to setting the main road map in applying sustainability standards in relying on clean energy production methods. Therefore, the conclusions can be summarized as follows:

1- The six set of the criteria whose results reached a threshold level higher than eight (8) by a percentage 26% of whole sets.
2- Where the results of criteria such as (establishing an information network and developing supporting laws) were higher than eight. That contributes to raising the level of technical focus for the partners to implement industrial, investment or construction projects.
3- The emergence of a higher-level training and development as a one of the important sets in the results of the questionnaire. That gives an indication of companies sharpening their focus on research institutions specializing in technical cadres through capacity building processes for contributing to raise the level of focus towards sustainable energy concepts.
4- The experts' opinions were based on the concept of building a set of criteria (with a strong required) that pushed towards sustainable energy, so the results reflected the importance of design criteria and interest in aspects of costs, as well as monitoring and measuring energy through systematic work plans and periodically.

In the end, the transition to sustainable energy cannot be achieved unless companies set the road map contributing to the transition towards building a clean energy system and adopting sustainable standards. Therefore, the research paper (the required sets) reflected this and is necessary for this transformation.

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