Generate Clean Energy in The Holy Shrines in Karbala (Energy Generated by Human Steps)

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الخلاصة

ان عملية توليد طاقة كهربائية نظيفة تحتاج الى عدة عوامل منها المواد التي تنتج الطاقة والتقنية المستخدمة في انتاج الطاقة وكذلك البيئة التي ممكن انتاج الطاقة النظيفة فيها. وهذا ما تم ايجاده في حركة الزوار للعتبات المقدسة في كربلاء حيث وجد البحث امكانية توليد طاقة كهربائية كافية لتغذية الانارة الخارجية بواقع (38) عمود انارة خارجية فقط من حركة الزوار ولمدة (10) ساعات باليوم وهذا مما يساعد شبكة الكهرباء الوطنية.

الكلمات المفتاحية

جول، خطوات، الكهرباء، المراقد المقدسة، الزوار.

Abstract

The process of generating clean electricity requires several factors, including materials that produce energy and technology used in the production of energy as well as the environment in which it is possible to produce clean energy. This is what was found in the movement of visitors to the holy shrines in Karbala, where the research found the possibility of generating sufficient electrical energy to feed the external lights by (38) external lighting column only from the traffic of visitors and for a period of (10) hours of the day, which helps the national electricity network.

Keywords

Joules, footsteps, electricity, holy shrines, visitors.

1. Introduction

Clean energy has become one of the most important issues in the life of societies. There are many ways of generating clean energy depending on the Environment and spatial conditions, some of which may be through the movement of air or the sun or the movement of people and others.

The holy shrines in Iraq have a large number of visitors and employees, and therefore the movement generated from them can be exploited to generate clean electrical energy that contributes to the preservation of the environment.

2. Objective of the research

The research aims is obtaining general indicators of the amount of clean electrical energy that can be generated from visitor steps to the two holy shrines in Karbala.

3. Renewable energy

Renewable energy can be defined as energy generated from relatively unlimited sources of vanishing, such as wind, water, sun and others, also does not depend on the combustion of conventional fuel [1] and add to it the electrical energy generated by human movement, a relatively modern energy which is transformed movement of human foot cover on the ground to generate a clean electrical energy that can be used in street lighting or advertising signs or other applications.

4. Generation of electricity from human movement

As a result of the ongoing search for new sources of clean energy, science has reached the possibility of generating electricity from human movement on special tiles of floor. "The steps of man are not just a movement from one point to another, but these steps can generate electricity." [2] "The world is wasting energy every day that can be exploited in a good way." [3] A number of companies have produced special tiles of floor - which varies their shape and specifications according to the manufacturer - generate electricity by storing energy from human traffic within batteries and then reproducing them to generate continuous electricity depending on the number of steps that generate this energy. Fig (1(.

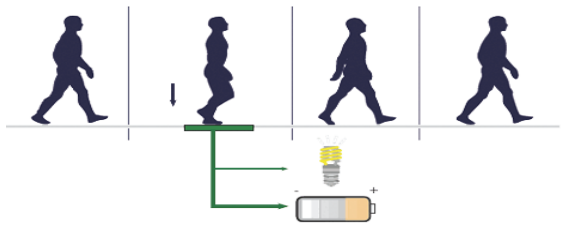

Fig (1): generate electricity by human steps [4]

A (Piezoelectric) is a technique that can generate electricity by pressure, such as the pressure exerted on the feet during walking, and generates an electric current that can be used to charge batteries, and this is an old technique that has long been used in lighters. Electricity can be generated by the pressure of certain materials such as quartz Generates voltage difference resulting in a simple

electric current and the result of changing the size, when pressed on the material converge some of the electrical charges, generating on both ends of an electric effort [5].

For the purposes of research, we will study the product of a company to determine the amount of electrical energy that can be produced as a result of visitors' traffic in Karbala. And this product will be with piezoelectric technique (Pavegen, UK) – (V3) technology. These tiles are resistants to water, dust and chemicals. They also carry a weight of up to (700) kg per piece for (0.1) square meters and a (25) year warranty. For heat, special specifications can be requested by country of manufacture [6]. Where each footstep generates approximately (3-5) joules of energy [7] therefore we can have considered that the average is (4) joules per step, Fig (2).

As for cost of tiles there is a large different between companies depending on the cost of employs, material, taxes, place of project and so many other elements that effect of the final cost of the project, because of that this research will be limited on the object of power (amount of clean electrical energy generated) only without considering the cost issue.

Fig (2): The shape of (V3) technology piece which have three generators and the manner of its arrangement [8]

5. Space of human movement

The principle of the work of the tile is the pressure caused by foot step, and we will assume -for research purposes- that the path moves by one person and regularly in case of more than one person or a smaller step, this means increasing the number of steps and thus increasing the energy generated by these steps. Therefore, our calculations will be based on the minimum expected steps, not the maximum.

Fig. (3) shows the difference between the distance between the footsteps of the adult man according to the nature of movement, where we note that the distance between the feet during the walk varies from (625 - 875) mm. and therefore can be considered that the average of distance between the footsteps is ((625 + 875) / 2 = 750 mm.). This figure also shows the width of the human body, which is (625) mm. Since there is no detailed statistics of the number of visitors showing whether the visitor is a man, woman or a child and so on, therefore adult measurements will be adopted for purposes of calculations within the search.

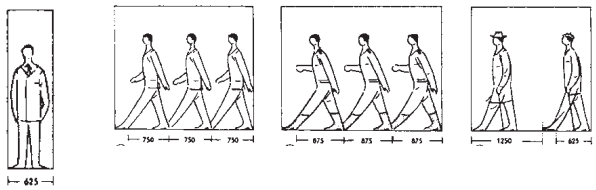

Fig (3): Measuring the distances of the traffic patterns and the standard of the human body [8]

Based on the measurements above we can draw up a diagram that shows the following:

A- Floor with dimensions (7250 x 650) mm. which is (7.25 0.65) m. and the approximate area (4.7) m^2 can provide ten footsteps for an adult and as in Fig (4).

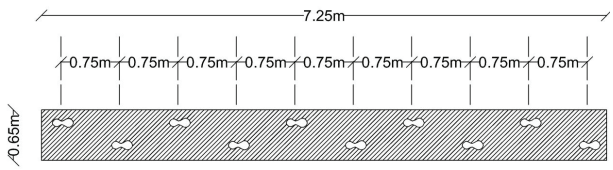

Fig (4): Plan showing the dimensions of the floor needed for ten steps
Source: Researcher

B- Floor with dimensions (3.63 × 0.65) m. and the approximate area (2.3) m2 can provide five footsteps as in Fig (5).

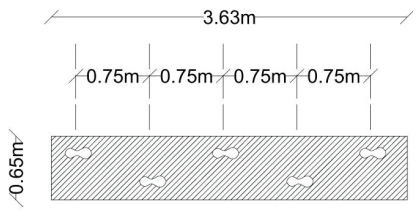

Fig (5): Plan showing the dimensions of the floor needed for five steps
Source: Researcher

6. Street lighting

The street lights are different according to the street function and the height of the light column and the type of light used in it ranging from 40 watts to 300 watts in highways and so on [9] For the purpose of the research, we will use light with (100) watt LED Fig (5).

7. Case study

7.1. Site

The objective of the research is to find the amount of energy that can be generated through the movement of visitors and employees to the two holy shrines of imam (Hussain and Abbas) in Karbala.

Since most visitors visit both shrines during the visitation, the number of visitors to the holey shrine of imam Abbas will be calculated only and then the same number will be considered for the holey shrine of imam Hussain. Because there are a small number of visitors visiting the Imam Hussain holy shrine without the Imam Abbas holy shrine. The probability of underwriting knowing that the number of visitors is variable and not fixed but the goal is to obtain general indicators. Figs. (6) & (7)

Fig (6): the holy shrine of imam Abbas [12]

Fig (7): the holy shrine of Imam Hussain [11]

7.2. Survey

It is known that the number of visitors to the holy shrines throughout Iraq in general and in Karbala in particular is variable and unstable, sometimes reaching millions of visitors (such as visiting the days of Ashura and visiting the half of Shaaban), while the number of visitors in other days reaches tens of thousands. Therefore, in order to obtain the general average number of daily visitors, the number of visitors and employees entering the holy shrine of imam Abbas in the first week for eight months was taken in a series that included the summer, autumn and winter months also a part of the summer holidays for students and colleges, the purpose is to get a general average for the number of daily arrivals (pedestrian) of the holy shrine of imam Abbas as in Table (1).

Table (1): Number of entrants to the holey shrine of imam Abbas [13]

Date	No. of visitors	Date	No. of visitors
1-7-2018	22919	1-11-2018	313625
2-7-2018	24962	2-11-2018	264049
3-7-2018	25155	3-11-2018	185574
4-7-2018	25527	4-11-2018	112710
5-7-2018	63750	5-11-2018	60518
6-7-2018	47473	6-11-2018	110436
7-7-2018	38947	7-11-2018	125595
Date	No. of visitors	Date	No. of visitors
1-8-2018	53219	1-12-2018	78518
2-8-2018	116930	2-12-2018	44437
3-8-2018	99160	3-12-2018	50269
4-8-2018	79708	4-12-2018	50752
5-8-2018	55393	5-12-2018	48420
6-8-2018	57336	6-12-2018	114827
7-8-2018	55906	7-12-2018	124632
Date	No. of visitors	Date	No. of visitors
1-9-2018	80079	1-1-2019	117645
2-9-2018	59825	2-1-2019	34203
3-9-2018	62073	3-1-2019	68113
4-9-2018	62756	4-1-2019	79746
5-9-2018	65925	5-1-2019	85790
6-9-2018	122136	6-1-2019	50983
7-9-2018	108008	7-1-2019	25373
No. of visitors	Date	No. of visitors	Date
1-10-2018	60850	1-2-2019	84933
2-10-2018	66800	2-2-2019	90912
3-10-2018	62861	3-2-2019	66794
4-10-2018	135455	4-2-2019	72394
5-10-2018	152656	5-2-2019	77959
6-10-2018	123206	6-2-2019	85709
7-10-2018	54814	7-2-2019	122052
The average is (84478) person / day			

7.3. Distribution of tiles that generate power

To ensure that the steps of all visitors and employees are included in the generation of clean electricity we will distribute tiles of floor that generate power of electricity at the gates (entrances) to the holy shrine we will.

Therefore, the ten-step floors can be placed in the front of the gates, while the five-step floors will be placed at the other side of gates, which means that the tiles of floors will be in both sides of every gate in the holy shrine. Fig (8) & (9).

Fig (8): Imam Hussain Gate in holy shrine of Imam Abbas [17]

Fig (9): Al-karama Gate in holy shrine of Imam Hussain [16]

The area of tiles can be calculated after installing the width of entries in the two holy shrines approximately –that the widths of gates are different according to field visit to the researcher - considered is (3) meters, thus the provision of (4) tapes path with five footsteps or the path of ten footsteps the Width will be:

- $(0.65 \times 4 = 2.6)$ m.

This means the width of two paths will be (2.6) m. and therefore the spaces are as follows:

• The 10-footsteps path area is: (7.25 x 2.6 = 18.85) m2.

• The 5-footsteps path area is: (3.63 x 2.6 = 9.44) m2.

• The total area of the tiles in one gate (entrance) is (18.85 + 9.44 = 28.29) m2

The number of gates (entrances) to the holy shrine of Imam Hussain are (7) gates [14] and in the holy shrine of imam Abbas are (10) gates [15]. So that the total area of tiles of floors in the two holy shrines is:

• (17 × 28.29 = 481) m2

7.4. Calculate generated energy

We can now calculate the approximate electric power generated by the movement of human who inter to the holy shrine of imam Abbas (visitors and staff) as this outline procedure:

• 84478 (person per day inter to the shrine as shown in Table (1)) × 2 (person per day leave the shrine) × 15 (for the ten and five footsteps floors) × 4 (Joules per step energy generated × 2 (for the holy shrines) = 20274720 joules/second

This main we can generate in one day about (20) million joules/ second.

As in cost of tiles there is a large different between companies also the type of battery there is a large different between companies depending on the cost of employs, material, taxes and so many other elements that effect of the final cost of battery, but –in general- if we know that the process of energy storage and reprocessing will cost us a loss depending on the type of battery and the method of conversion used, ranging from (5%) and up to (70%) in some cases or more, we can adopted a general rate which is (30%) of the amount of energy lost [18] then we can calculate the amount of electrical energy - the approximate - obtained as follows:

• The energy that can be stored and reproduced - after the deletion of lost energy - represents the proportion of (70%) of the total energy and thus equal to:

(20000000 × 0.7 = 14) million joules/ second in one day (24) hours

• We have (14) million Jules from the first day to run the system, so if we do storage for period of (10) days and not for one day will be our total:

(10) days × (14) million joules = (140) million joules for the first (10) days of operation of the system, where each day will be compensated for the use of a day to store the energy and thus keep the figure almost constant. That is, this storage process takes place only once when the system first starts.

• The amount of electrical energy achieved in the second (joule represent energy for one second) and stored for ten days thus we can convert it to a number of hours of operation as follows:

140000000 ÷ 60 (second) = 2333333 joule / minute

2333333 ÷ 60 (minute) = 38888 joule / hour

• If we know that: (1) watt = (1) joule / sec [19] this means that we have electric power

can occupy (38888) watt / hour and since the street lighting proposed by the (LED) is (100) watts then:

(38888) ÷ (100) watts = 388 streets light worked (one hour/day).

• Since the work hours of night lighting varies according to the seasons of the year and ranges from (8-12) hours therefore it can be adopted a general rate is (10) hours per day: The result is therefore:

(388) watts ÷ (10) hours = (38) street light column works for (10) hours per day at night. Therefore, it is possible to provide clean electricity to supply street light columns which works for (10) hours per day for (38) columns of street light with (19) columns on each side between the two holy shrines in Karbala.

If the distance between one column and another is (10) meters, then this column will cover the two sides at a distance of (190) meters between the two shrines. If we knowing that the distance between the outer fence of the two shrines is about (250) meters, while the distance for the pedestrian walking and sitting between the two holy shrines is about (190) meters [20], this means that street light columns will cover (100%) for the need of external lighting. Fig. (10).

Fig (10): An aerial photo of the two holy shrines in Karbala [21]

8. Conclusions

1. The possibility of providing clean electrical energy from the traffic of visitors and in quantities that allows the work of street lighting and electric billboards at the holy shrines of Karbala.

2. There are a number of occasions where the number of visitors to millions and here can generate a large clean electric power which can be sold to the public electricity network.

3. The amount of clean electricity obtained depends on the amount of storage that can be stored from the first few days of operation.

9. Recommendations

1- The work of additional research concerning the rest of the holy thresholds and how to benefit from the traffic of visitors in the generation of clean electricity.

2- Further research on the use of traffic in the generation of clean electricity in crowded places in Baghdad and Iraq.

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