Developing an Energy Cost Calculator for Solar

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Energy Cost Calculator Software of Solar

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Abstract. One of the most important variables affecting a country's socioeconomic maturity is access to electricity. Bangladesh is now suffering from a severe electrical shortage. Around 65 percent of people do not have access to power, and most of them live in villages. The generated electricity was unable to meet demand, resulting in load shedding of up to 1500MW. Solar Home Systems technology can be a wise effort to fix this problem in this case by harnessing energy from the country's free-flowing renewable source.[1] The main purpose of this paper is to make people more aware of use solar system.

Keywords: Socioeconomic maturity, severe electrical shortage, load shedding, solar home system, home system technology.

1 Introduction

According to Department of Energy estimates, energy consumption in the average home may be reduced by 60% by using conservation strategies and investing in new items that improve consumption efficiency. According to DOE (Department of Energy - 1980) survey results, 50 percent of housing units eligible for Federal energy tax credits in 1977-78 had some type of conservation-related technology or insulating material installed. In 1980, homeowners sought tax credits for an estimated $4 billion in energy-saving equipment, mostly linked to home heating. According to analysts, this investment rate might reach $30 billion per year by 1990. (Business Week 1981).[2] This electricity problem is having whole over the world. Though many countries are trying cope with it and Bangladesh is also in this list.

1.1 Background

All types of power generating have an impact on the environment, including the air, water, and land. Producing and using energy more effectively minimizes the quantity of fuel used to generate electricity, as well as the amount of greenhouse gases and other air pollution emitted. Because no fuels are combusted, electricity generated from renewable resources such as solar does not contribute to climate change or local air pollution. For making people more conscious about the cost different between usual method and solar system. So, we have built a software by which people can visually see the difference.

1.2 Research Questions

At present, making an organization or apartment fully based on solar system is a very challenging issue. But many apartments and organization are trying their best to move on the solar system. In this scenario, our research question is:

- How much power consumed in our targeted building per year?
- How can we visualize the difference of cost?

1.3 Research Objectives

The principal objective of this study is to make organizations and apartments fully depend on solar system. The central focus points are:

- Determining the cost calculation of solar system per year.
- To develop a cross-platform software to visualize the difference of cost.

1.4 Focus

The focus is to make people aware of using solar system instead of as usual wired distributors' system. We developed a software to visually show the cost difference.

1.5 Limitations

Our main limitations are that we didn't implement our proposed model in real life. But we have talk with a company which sub-branch was in Dhaka named Betawatt Solar which motive is to make every house solarize. We have taken their requirements and proposed our software model design which they liked a lot

2 Related Works

The sun is a magnificent and renewable resource that can sustain life on Earth by providing clean, renewable energy to all its inhabitants. In fact, the sun sends more energy to our planet in an hour than the entire world's population uses in a year. Solar photovoltaic (PV) modules turn the sun's energy into electricity (photo = light, voltaic = electricity). We can move away from other polluting and unsustainable energy sources by designing and installing PV systems on a broad scale. Because the solar sector is expanding, the demand for experienced people is increasing as well!

Solar panels offer minimal operating costs compared to other kinds of energy generation once they are installed. Because no fuel is required, solar power can generate vast volumes of electricity without the risk or price of ensuring a fuel supply. But there is no visual representation of this difference between usual method and solar system. For this reason, we are building a software to visualize this difference by which people may more conscious.

Besides, we have talk with an Australian company which sub-branch was in Dhaka named Betawatt Solar. We have taken their requirements and proposed our software model design which they liked a lot.

3 Material and Method

3.1 Design

Our goal is to make people more conscious about using solar panel instead of regular wire distributed line. For that reason, we generated a business model of our proposed software. The as if and to-be model are given below:

Here as-if means the as usual method people usually do. The to-be model is our proposed model. Before our proposed model people usually go to the market and justify the solar components prices but in our model, they can see the full statement easily from their home.

As-if model:

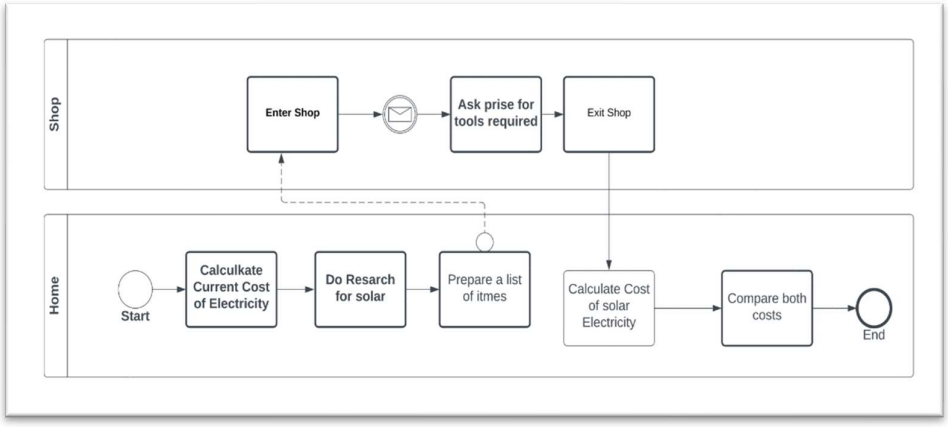

Figure – 1.0: As-if Model

To-be model:

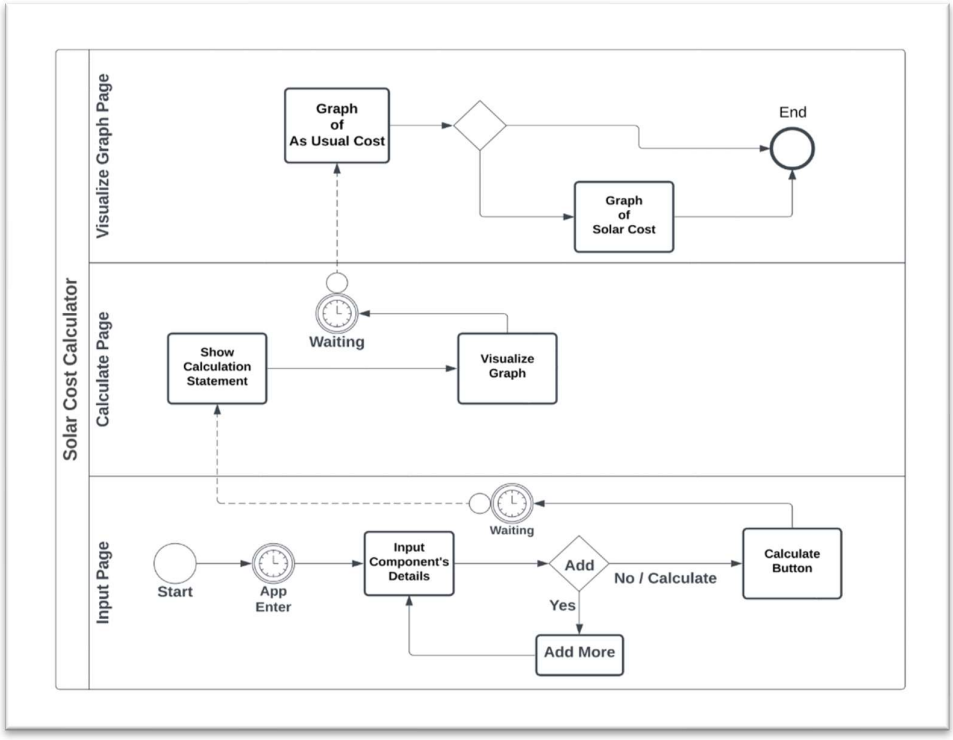

Figure – 2.0: To-be Model

3.2 Method

We had built a cross platform software, that means it will run on android, iOS, macOS, windows, web and Linux platform. This software will visually represent the cost of the whole month of the general electricity supplier method vs our planned method of solar system. Our software interface will look like this.

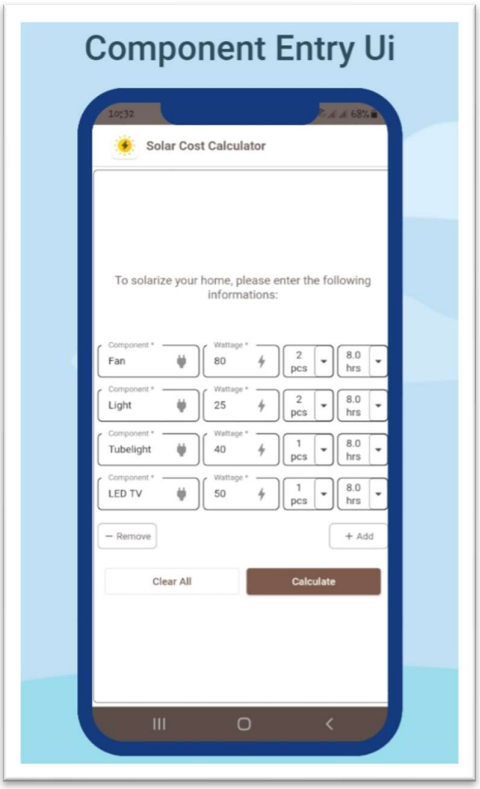

Figure – 3.0: Component Entry Ui

First, we are taking components' name, wattage of each component, number of each component and total running time of each component. For Example: we are taking two fan, two energy light, one tube light and one led tv. Each electric fan consists of 80w, each energy light consists of 25w, tube light consists of 40w and led tv consist of 50w.

We have to find out wattage of UPS/inverter, battery size (amp hours), number of solar plats.

We can easily get the total of inverter by adding the components' wattage. That means total wattage (80*2 + 25*2 + 40 + 50) = 300w.

Then for calculating total current we know a formula:

$$P = VI$$

Where, P = 300 and V = 12v. (we are using 12 voltage battery). From the formula we can get the current which is

$$I = 300/12 = 25 \text{ Amp.}$$

Now, for calculation battery size, we know a formula which is:

$$(W \times H) / V$$

Where, W = total load, H = backup time in hours and V = voltage of battery. Let every component's needs 8 hours of battery backup. And the voltage of the battery is 12v. So, the multiplication of total load and backup time is 2400. So, the battery size required 2400/12 = 200 AH (Amp Hour).

Now, we have to find out the current of charging the battery. There are many chargers available in the market of fast charging. We are considering the minimal charger to make the model sustainable. Our proposed model's charger will require 10 hours to charge the battery. So, the current required to charge the battery is: 200/10 = 20 Amp.

Now, we need to find out the number of total solar plates. The total current required = Home Load Current + Battery Charging Current = (25 + 20) = 45Amp.

Solar power required = VI = 12 * 45 = 540w. There are many solar plates available in the market. We are considering 125w and 150w. After calculating call this calculation, we get the calculated value in the mobile screen automatically.

Figure – 4.0: Calculation Screen

The price of each battery and solar plates are taken from online store: AliExpress [5] and India Mart [6].

After calculation of this part, we are calculation the monthly electricity bill of the calculated wattage based on the running time. (Let, the electricity per unit cost 6 taka/-) which we collect from DESCO.

After calculating the monthly cost, we have calculated the annual cost of as usual electricity system. On the other hand, the maintenance cost of solar system is assuming around approximately 1000/- taka (which we getting from online research) [7]. After all this calculation, we are plotting a graph just to visualize the people about the cost of both as usual model and our proposed model).

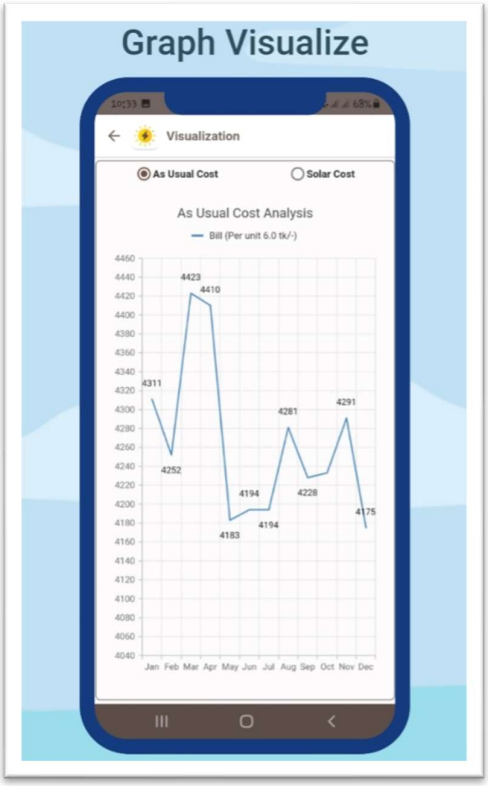

Figure – 5.0: Graph Visualization

4 Result and Discussion

Our main purpose of this paper is to make people more aware of the sustainable energy system. We have taken two steps to make our motive successful. We had built a software to make this more attractive. First, we have shown people the cost calculation part of solar then we have visualized them the cost difference by a graph.
We have already taken a survey in our own house and relatives. The most interesting matter is we have got a mixed review. Some of them are not supporting because of the initial cost. But most of them support our model because of the annual cost maximize.

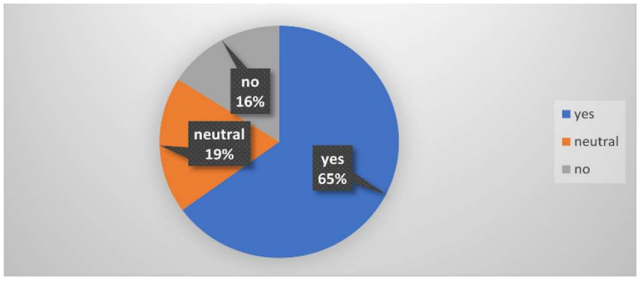

Figure – 6.0: Survey Result

Last of all we got many reviews, we will also work on it in future. We have got our expected result, and this encourage us to work on it in future.

Figure – 7.0: Software Mockup

We have already taken a survey in East West University's Data Center. We taught with the Mahfujur Sir of ICS Department and he help to get the components details of east west university's data center's logistics. In the data center there are total 30 server of 730w, 15 switches of 350w, 2 AC of 7000w, 10 light of 25w and 4 enviers of 350w. The graph of those components in our proposed model is:

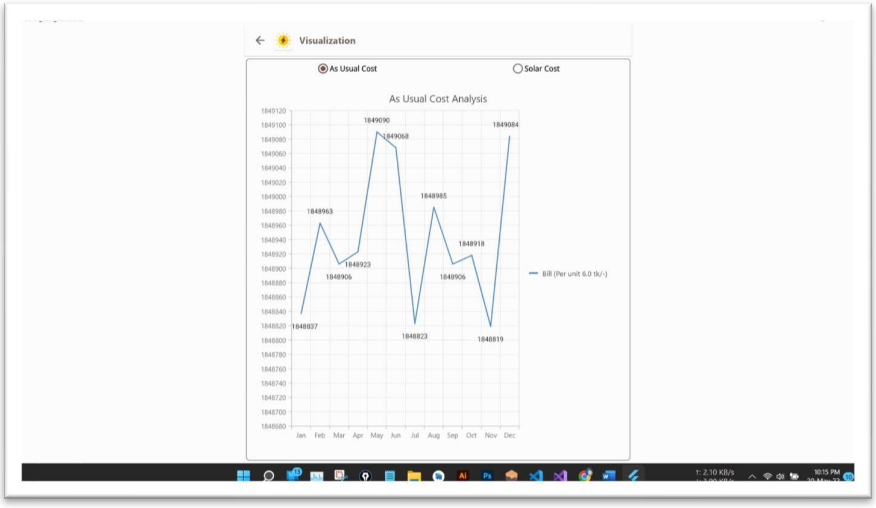

Figure – 7.0: Wired Bill Statement

We have also made this source code open. So that people can also contribute to this project. The GitHub Source Code Repository Link:

https://github.com/sabikrahat/solar_cost_calculator

People can also download apk by scanning this:

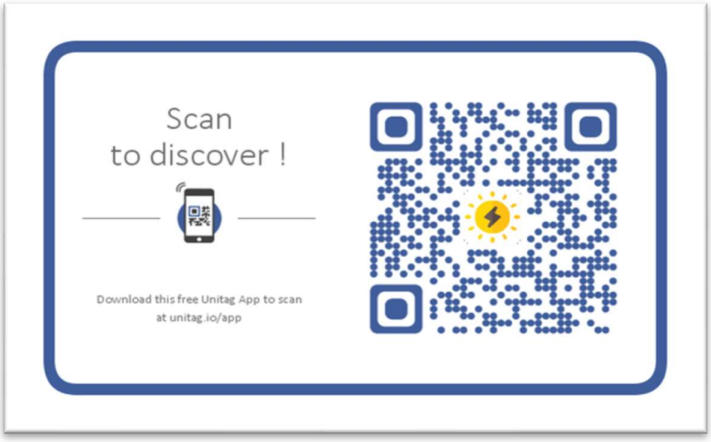

Figure – 7.0: Scanner to Download apk

5 Conclusion

By using this software, we can easily measure the power consumption of a building. We can get the visualization of the difference between the solar system and the usual system. Our main limitations are that we didn't implement our proposed model in real life. We will try to implement our model in real life in the future so that people can be moved toward the solar system as much as possible.

Reference

1. (N.d.). Researchgate.Net. Retrieved May 10, 2022, from https://www.researchgate.net/publication/271647041_Solar_Power_as_Renewable_Energy_for_Home_Systems_in_Bangladesh
2. Frey, C. J., & LaBay, D. G. (1983). A comparative study of energy consumption and conservation across family life cycle. ACR North American Advances, NA-10. https://www.acrwebsite.org/volumes/6198/volumes/v10/NA-10
3. Remote Energy. "What Is Solar Energy? What Are Some Advantages of Solar Energy? — ." Remote Energy, 7 July 2021, https://remoteenergy.org/blog/what-is-solar-energy.
4. "Solar Power - Unlimited Source of Energy." Fortum, https://www.fortum.com/about-us/our-company/our-energy- production/solar-power-unlimited-source-energy. Accessed 17 Apr. 2022.
5. AliExpress - Compra online de Electrónica, Moda, Casa y jardín, Deportes y ocio, Motor y seguridad, y más. - AliExpress. (n.d.). AliExpress. Retrieved May 10, 2022, from https://www.aliexpress.com/
6. IndiaMART - Indian manufacturers suppliers exporters directory,India exporter manufacturer. (n.d.). IndiaMART. Retrieved May 10, 2022, from https://www.indiamart.com/
7. Thumbtack Editors. (2017, September 28). 2022 solar panel maintenance cost. Thumbtack. https://www.thumbtack.com/p/solar-panel-maintenance-cost