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THE POTENTIAL OF SOLAR ENERGY IMPLEMENTATION IN LIBYA: AZZAWIA SOLAR ENERGY PROJECT

MOGUĆNOSTI PRIMENE SOLARNE ENERGIJE U LIBIJI NA PRIMERU PROJEKTA U GRADU AZAVIJA

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Field – ENGINEERING MANAGEMENT

Abstract – *Libya has had serious political and security challenges since 2011, then Ukraine war, but solar energy poses a significant threat to the country's electrical supply. Solar energy is meant to be used to power Libyan houses since it is affordable, clean, and the country enjoys a sunny environment. This study's goal is to determine how much clean solar energy can be used in Libyan factories and households.*

Keywords*: Solar energy, Libyan homes, Libyan facories, solar energy panels*

Abstrakt – *Libija se nalazi pred velikim izazovima još od 2011. godine, kako političkim, tako i bezbednosnim. Pored velikih poteškoća kroz koje je prolazio narod u ovo zemlji, Libija je pridala veliki značaj implementaciji solarne energije u fabrikama i domaćinstvima – pokušavajući da reši još jedan od problema, snabdevanje elektičnom energijom. Klima u ovom zemlji značajno doprinosi stvaranju mogućnosti da solarna energija bude odličan izvor električne energije za veliki deo stanovništva. Cilj istraživanja u ovom radu je da utvrdi potencijal čiste sunčeve energije za proizvodnju električne energije u kompanijama i domaćinstvima u Libiji*

Ključne reči: *Solarna energija, libijska domaćinstva, libijske kompanije, solarni paneli*

1. INTRODUCTION

Solar energy is the energy that is produced by nuclear reactions inside the sun, the star that is closest to us. If properly harnessed and utilized, solar energy might supply all the world's energy needs in the future. The following is a collection of the most significant recommendations for increasing investment in and facilitating decentralized solar energy systems. The recommendations are based on in depth study in which various stakeholders were interviewed to comprehend existing practice and identify adjustments that would contribute to increasing investment in these systems. Enhance the clarity of long-term renewable energy objectives and associated plans while ensuring the stability of the regulatory and legislative structures that regulate this industry. Work on the sustainability of the support offered through public funding programmers, and prepare public financing programmers in collaboration with stakeholders, while enhancing access to public funding programmes, by streamlining the application process for utilizing company services. Establishing a digital canopy that unites all parties interested in financing renewable energy projects in Libya. It consists of a database of existing programmers, progress methods, and beneficiaries.

Policymakers in LIBYA and elsewhere are placing a high priority on the energy sector as a source of economic growth. Solar energy is becoming increasingly appealing because of the fundamental economics of energy and technological advancements. ASEP is well positioned for growth in this market segment.

This market segment has enormous potential, according to sector studies. Numerous well known investors have made long-term commitments to the sector. The ASEP project addresses this constraint.

We need to reply to a variety of research issues, such as: What are the fundamentals of residential solar power?

What part does solar energy play in increasing a home's value?

What are the social and economic effects of the switch to solar energy?

What are the societal advantages of the shift to solar power?

This necessitates a customer-focused strategy, as well as suitable organisational adjustments and staff activities to transition to solar energy. As a result, it is worthwhile to examine these phrases in the context of a real situation, the azzawia solar project. The author offers the theoretical underpinnings of the work in the next chapter, followed by the practical component of the work, research results, and discussion.

2. THEORETICAL BACKGROUND

2.1. Photovoltaic Technology Fundamentals

This method uses photovoltaic cells to directly turn sunlight into power. Therefore, these devices aim to be as user-friendly as possible [1]. As an added bonus, they could be able to maximise output while decreasing inputs. They have several uses, hence they are widely used. The system needs improvements, though, if it's going to deliver on its promise. Energy is produced by photovoltaic devices by means of semiconductor material, the most common of which is silicon. This device is effective because it supplies more energy to stimulate electrons. By absorbing and re-emitting solar radiation, this gadget boosts the energy level

NAPOMENA:
Ovaj rad proistekao je iz master rada čiji mentor je bio dr Bojan Lalić.

of its electrons from a lower to a higher energy state. By freeing electrons trapped in the semi-conductor, this acti–vation produces electricity [2]. Silicon, polysilicon, micro–crystalline silicon, copper indium diselenide, and cadmium telluride are all examples of semiconductors commonly used in solar systems. The criteria for choosing these reso–urces are somewhat broad [3]. The many power-producing parts of PV systems include cells, modules, and arrays. What's more, for improved operational efficiency, nume–rous techniques of regulating and controlling structures, electronic devices, electrical connections, and Mechanic tools are used. In clear weather, a PV system's output is measured in peak kilowatts (kWp) [4]. Long before now, several research had been undertaken in PV devices to improve their efficiency; today, it is said that the industry is quickly increasing, doubling its production every two years, with an average increase of 48% since 2002 [5].

PV technology is used with concentrating solar thermal power (CSP) and concentrating photovoltaic technology (CVT) to convert solar energy into electricity [6]. An example of CSP is shown in Figure 3. However, solar technology can provide electricity that can be fed into grid systems. More than 90% of the solar energy used in the United States is plugged into the grid. Grid field insulation can be put on the roof or the ground to increase the efficiency of a PV system's ability to provide light for a building. Solar photovoltaic systems should be properly labelled to show their performance and lifespan. Usually, their output is between 10 MW and 60 MW [7]. Depen-ding on care and use, their lifespans might be different. When properly built, a PV panel may maintain 90% of its original power output for up to 10 years.Its effectiveness is inconsistent since it is affected by a wide variety of environmental conditions, most significantly the quantity of available sunshine. As a result, a great number of research avenues have been explored in an effort to secure a reliable source of constant energy with no interruptions.

2.2. Ways to increase the effectiveness of solar panels

Solar flux can vary from day to day, which can lead PV systems to fail to efficiently harvest all of the sun's obtainable energy. Solar tracking is a method that is typically utilised to enhance the amount of accessible solar energy that is captured [9]. Utilizing either a single axis or a dual axis sun tracking device can successfully accomplish solar tracking. A tracker is a device that keeps PV photo thermal panels in an optimal position during daylight hours, where they are perpendicular to solar radiation. This maximises the amount of energy that is collected. It is not necessary for trackers to point precisely towards the sun for them to work. Even with an aiming error of 10 degrees, the output is still 98.5% of what it would be at full tracking maximum. The sun tracking system that Abdullah and his colleagues devised and built features two axes and is controlled by an open loop PLC. They came to the conclusion that making use of tracking surfaces with two axes led to an increase in total daily collection of around 41.34% when compared to the collection made using a fixed surface. When solar trackers and solar concentration are used to grid photovoltaic (PV) panels according to the movements of the sun, the result is significantly more solar energy collection than with fixed PV panels. CSP (or concentrated solar power) systems, of which parabolic trough solar thermal systems are a part, are readily accessible. This system utilises parabolic reflectors in the shape of troughs to concentrate the sun's rays on tubes that have been designed to be thermally efficient and are positioned to receive concentrated sunlight. These tubes are filled with a heat transfer fluid, which is then heated to 734 degrees Fahrenheit before being pushed through a series of heat exchanges to produce super-heated steam, which is then used to power turbine generators and generate energy [8]. Solar collectors, such as flat plate and evacuated tube, have been created for heating and cooling applications in a manner that is non-concentrated. This is in contrast to technology that focuses the sun's rays on a smaller area. The efficacy and low cost of this method have contributed to its meteoric rise in popularity in a relatively short amount of time. It is possible to make use of it in regions where the meteorological conditions are bad and the sun intensity is low. This system makes use of three different techniques, such as absorbing light, converting it, and storing it. Copper tubes that have been insulated are utilised for the absorption of solar energy; inside of these tubes, water or air is heated as it is cycled before being returned to the storage system. This system may be modified to make it more effective by adding an evacuated tube collector. These collectors have heat pipes that are vacuum shielded and are 20–45% more efficient than flat plate collectors. In regions where solar photovoltaic panels fail to provide sufficient consistent electricity for consumption, hybrid power systems are occasionally deployed. PV systems are frequently paired with other types of energy generation, most frequently a diesel-powered generator but sometimes also a hydro turbine or a wind turbine. This helps to reduce the amount of fossil fuels that are used while maintaining a continuous supply of electricity.

2.3. Production of solar power

Solar panels, modules, and other electrical and mechanical connections are only some of the many parts that make up a photovoltaic power plant. The design of this technology allows for higher conversion efficiency. Because of the widespread use of grid-connected systems to supply elec-tricity to the public electrical grid, this technology enables distributed power generation. Following are some quick thoughts on the study done to boost solar power generation for a more sustainable energy environment. Barton and Infield developed an alternative way to time-stepping for modelling an energy structure that might be used to match the power output of a wind turbine and a solar PV array to a varying electrical load. It showed very high agreement over a wide range of storage capacities, efficiency levels, wind turbine output, and photovoltaic (PV) output. Because of the high demand for electricity in remote areas, Katti and Khedkar thoroughly analysed the feasibility of deploying hybrid power production facilities that combine wind turbines with PV panels. They tried out pure wind power and pure solar electricity and compared them to a mixed system. The methods for modelling the design and evalu-ation of components of hybrid renewable energy systems were presented by Deshmukh and Deshmukh. Furthermore, they proved that hybrid PV/wind energy systems are rising in popularity because of their reliability in providing constant power output. Presently, it is being incorporated into various power networks to boost overall efficiency.

3. RESEARCH METHODOLOGY

This study presents the results of a survey designed to address the research question of whether residential solar power conversion in Libya has increased electricity availability beyond that of the national grid.

The author performed research on a selection of Libyan homes by posing basic questions on the issue. By compiling the data and information pertaining to these inquiries, the issue in the Libyan case might be resolved in reverse order of importance.

The author decided to do some digging to get in closer with Libyan homeowners and hear what they had to say.

The residences in Azzawia, Libya, were selected at random to gather the data. Overall, there are 120 data points in our sample.

Between September 1 and October 3, 2022, we mailed out surveys. One month after distributing the questionnaire, we either personally visited the homes in issue or gathered the data online. However, several seemingly finished surveys were discarded because of inconsistencies or lack of information.

As a preliminary step in developing the questionnaire, we looked for ways to categorize the homeowners we spoke with based on their business's size and industry. We also inquired as to the respondent's demographics, such as their age, marital status, and occupation. Step two is an attempt to define the solar energy plan and its effects on homes and environmental management through a series of suggestions.

To make it easier on the respondents and provide more specific and focused responses, the questionnaire is made up of closed questions, which have a finite number of possible responses. Based on the theoretical analysis completed prior to question development. A mix of Likert-scale and multiple-choice items make up this section of the survey.

- Questions based on a Likert scale.

Questions like these help us determine the extent to which a respondent endorses a claim. In this scale, the respondent selected an answer between "not at all" (completely disagree) and "absolutely yes" (totally agree).

- Multiple-choice tests with no correct answers:

These are questions that may be answered with a yes or no answer and don't involve much thought on the part of the reply (thus the name "attractive questions"). The selection of solutions is grounded in the research that has been done on the topic.

To conduct the descriptive analysis, we utilized "Excel" to synthesize the responses supplied by the completed questionnaires. Then, graphs that allow us to identify the responses concentration around a certain answer were derived.

4. MAIN RESEARCH FINDINGS, DISCUSSION AND RECOMMENDATIONS

Our practical investigation on a sample of Libyan residences has yielded some intriguing results, which may be summarised in the following points:

In Libya, a dynamic of solar power transition has occurred over the last two years, fueled by the government's power outage. This solar power transformation is primarily affecting the wealthy community and aims to allow other layers to approach it in order to be closer to more and more connected consumers.

Many components, such as the manufacturing process and administration, are not covered by solar power. The reason for this is because the production content is not as technologically demanding, and management is still conservative and resistant to change.

The influence of solar power remains restricted to increased sales, with little effect on added value per unit or product technological content.

According to our findings, solar power is being developed at varying rates across industries and sizes. The more the sector's investment in solar power and the larger the firm, the greater the impact of solar transformation.

Based on these findings, we may make some suggestions to the government and to the corporations.

For the Government:

Creating a conducive atmosphere to make solar power transition more widespread and easier with appropriate digital infrastructure. Many dispositions might be made, such as strengthening and generalising the internet.

tranforming solar electricity into government services notably those firms orientated.

Some fiscal and financial dispositions encourage enterprises involved in a solar transition process.

For businesses: Improving communication and training regarding the usage of solar power, particularly for employees who are resistant to change.

Generalize the usage of solar electricity in the manufacturing process.

Creating additional roles connected to solar power transformation and transitioning to a more flexible organisation through increased promotion and continuous government backing

Because of the circumstances, we were compelled to make some suggestions to both the government and private businesses in Libya about how the conversion of solar energy may be made more efficient. Specifically, enhancing the infrastructure surrounding solar energy.

5. CONCLUSION

The purpose of this dissertation is to get a deeper comprehension of the prerequisites for a successful solar power transformation and to analyse the predicament of a selection of residences located in Libya. To begin, the solar transformation is a relatively new infrastructure in Libya, particularly in Azzawia.

However, current work focuses on the influence of solar power on the connection between the firm and its consumers, demonstrating many benefits like as tighter relationships, lower buying costs, and increased safety in relation to Covid.

Despite these enormous benefits of solar power transformation, the research identifies a number of restrictions. The most significant two obstacles are connected to the high expense of this transition in terms of technological infrastructure and change resistance, in addition to the training requirements.

More intriguingly, solar power revolution necessitates the incorporation of new corporate culture paradigms into everyone's behaviour, such as openness, flat organisation...

Our practical investigation of a selection of Libyan homes yielded some intriguing facts regarding the solar power behaviour of these residences. First, the atmosphere typified by Covid 19 compelled them to devise a strategy to rescue their clients while allowing the activity to continue. Despite the country's lack of solar power infrastructure, solar electricity was the greatest alternative. Then, performing online shopping became a habit for Libyan customers, so many businesses increased their exposure on the internet and used solar power transformations.

However, the influence of this change was limited to the commercial stage and did not extend to other critical parts of a company's life, such as management mode. We believe that in order to get the greatest benefits from the solar power revolution, a proper corporate culture must be established, which will take time.

Actually, solar power transformation is a critical component of business intelligence, and it should aid in gathering and analysing massive amounts of data, transforming corporate governance from a traditional hierarchical style to a more flat turned to projects style, and getting closer to customers through an appropriate communication strategy...

Libyan houses began using solar energy to survive a life-threatening crisis, but there has been no further progress. In this case, the government's participation is critical in encouraging firms to convert to solar power through particular incentives such as tax breaks or cash incentives. The government should lead the way in solar power transition by solarizing some services. As a result, a synergy may be established between the government and businesses to transform the economic climate into a more efficient and solar-powered environment.

6. LITERATURE

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Short Biography:

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