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Warehouses Energy Consumption using Solar Energy with the help of Blockchain

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Abstract *- **Warehouse** volumes have expanded several times in the last decade, necessitating the demand for larger and better facilities, which has fueled the **warehouse** industry's expansion. As a result, the amount of electricity consumed has grown. Usually, for a normal **warehouse**, the total electricity consumption accounts for 15 percent of the total cost. Globally, at least 40% of CO2 emissions are emitted from electricity generation. The combustion of fossil fuels generates the heat needed to power steam turbines. Carbon dioxide, the major heat-trapping "greenhouse gas" responsible for global warming, is produced when these fuels are burned. Solar panels, unlike fossil fuels, provide power without polluting the air or emitting carbon dioxide. Furthermore, there is no ash or other waste products, and no other inputs beyond sunlight. **Blockchain** technology can be used to track the amount of **solar energy** generated. The overall traceability of energy consumption could be accomplished. By enabling transparent, secure, and efficient electrical energy transactions, **blockchain** has the potential to change the energy sector. **Blockchain** also aids in the creation of transactional energy systems, in which distributed entities can trade and interact directly with one another in a decentralized and flat trading market. If there is extra energy, **peer-to-peer** trade can be done. Distributed ledger technology has the probability to improve the efficiencies of the electricity grid. In addition to provenance tracking, **blockchain** offers unique opportunities for renewable energy delivery.*

Key Words: Blockchain, Warehouse, Solar energy, peer-to-peer

1. INTRODUCTION

The conventional four-walled godown has given way to modern and sophisticated multi-purpose storage and warehousing structures. Many warehouses use nonrenewable energy sources, which has a negative impact on the environment and raises costs as consumption rises.

More and more warehouses are recognizing the benefits of solar PV as energy efficiency moves to the top of the agenda. Installing solar PV on warehouse rooftops allows the warehouse and surrounding buildings, such as offices, to generate free electricity.

A solar PV system can help warehouses save money on their energy expenses. Due to temperature control systems and lighting, energy bills typically account for roughly 15% of operating costs in a warehouse facility. These energy expenditures can be significantly lowered by installing solar panels, which generate their free electricity.

Factory roofs are frequently the best places to put solar panels. Because factories are energy-intensive structures, placing a solar PV system on the roof assures that free electricity can be generated to power everything below it.

The technology of blockchain holds a lot of potential. It could also serve as the foundation for metering, billing, and clearing operations, in addition to executing energy supply transactions. Other conceivable applications include ownership documentation, asset state (asset management), origin guarantees, emission permits, and renewable energy certificates. By starting with different sectors and eventually transforming the entire energy industry, blockchain technology has the ability to drastically reshape energy as we know it.

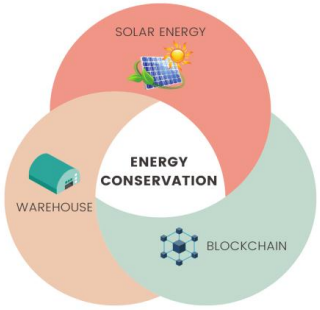

Figure 1. Energy Conservation

1.1 Analysis

1. Environmental Scanning

This process included aggregation of all the information. The following way has been done in the environmental scanning process

Calculated the overall consumption of electricity by assuming a storehouse

Electric energy drives most storage, and its operation is regulated by design-related factors and control systems. Warehousing costs can be regarded for nearly 10 of a company's profit, with heating and lighting as the two largest energy druggies. A storehouse with regular electrical appliances has been considered. Considering the below hypotheticals and the data including power in watts, the number of appliances and a number of working hours, the overall estimated power consumption of a storehouse per month has been calculated in KWh or Unit.

ENERGY CONSUMPTION							
Sr No	APPLICATIONS	POWER	No. OF APPLICATIONS	TOTAL WATTS	No. OF HOURS	ENERGY	CONSUMPTION PER MONTH
		watts (W)	(nos)	(W*nos)	(nos)	(total watts*no of hours)	Wh or KWh or Unit
1	LIGHTING	40	250	10000	20	200000	
2	ILLUMINATING SURFACE	40	50	2000	12	24000	
3	VENTILATION	70	50	3500	24	84000	
4	HEATING	400	10	4000	10	40000	
5	COOLING	700	20	14000	16	224000	
6	IT NETWORKS AND EQUIPMENTS	50	50	2500	12	30000	
7	OTHER	150	20	3000	12	36000	
8	MAINTENANCE	70	50	3500	6	21000	
						659000	19770000
							19770

Figure 2. Energy Consumption

The estimated energy demand of the storehouse structure per month is roughly 19770 KWh or Units. Refrigeration is generally the primary motorist of peak demand in refrigerated storage. And in non-refrigerated storages lighting generally makes the largest donation. The HVAC system is a huge drain on energy in a storehouse.

Energy consumption as per the appliances in the examined storehouse system is shown below:

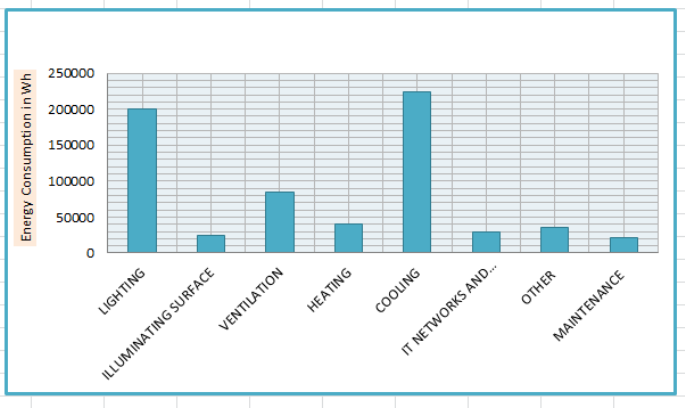

Figure 3.

According to the below data, Lighting and HVAC makes the largest donation of peak demand to electricity.

Learn about the process of electricity generation by solar panels

Solar Energy produced by the Sun is a non-vanishing renewable source of energy. Everyday earth receives sun above (1366W approx.) This is an unlimited source of energy that's available at no cost. The major benefit of solar energy over other conventional power creators is that the sun can be directly converted into solar energy with the use of photovoltaic (PV) solar cells. The conversion of solar energy to electric energy is nominated for the photovoltaic effect. An introductory element of a photovoltaic system is a solar cell. A single solar cell has a capacity to induce a voltage up to0.5V. It's made up of Silicon and has 3 layers. The solar panel is a combination of solar cells connected in series. 30 solar cells connected in series can induce a voltage up to 15V. A solar array or solar module is a combination of solar panels.

Blockchain technology

The energy sector has the potential to be transformed by blockchain technology. The use of blockchain technology to track energy consumption can be eye-opening. Any firm can start moving toward more sustainable decisions by using a third-party standard to comprehend the difference between energy use and a fossil-fuel-powered electrical grid. Furthermore, peer-to-peer energy trading has the potential to radically transform the electricity distribution business.

Improving Transparency and Traceability in Supply Chains

Warehouse inventory management may use blockchain to monitor provenance and estimate demand correctly, ensuring that the right sort and quantity of product is always available to meet expected demand. The technology allows businesses to increase revenue and profits while lowering the risk of lost sales. As a consequence, the data becomes permanent and easily shared. It also provides supply chain participants with more expansive track-and-trace capabilities than ever before. Companies might utilize this data to prove the validity of their products. Consumers benefit from these projects because they can learn more about the things they are buying, such as if a piece was ethically sourced, is an original item, and has been kept in proper conditions.

Electricity data management

Green energy sources can be included in any industrial system to help a company move toward sustainability. Using a smart contract system, a corporation can document and verify its sustainability measures, such as carbon emissions reduction. This opens up the possibility of a new sustainability metric. Tracking can help organizations build value based on carbon reductions and illustrate how to use renewable energy sources more effectively using distributed ledger technology. When the value of an end product improves as a result of sustainability measures implemented throughout the manufacturing process, this is referred to as added value. It has the potential to be a cost-effective approach to

increase the usage of renewable energy and other environmental measures. Secure and real-time updates of energy usage data are provided by an immutable ledger. The blockchain will assist in the recording, storage, and tracking of energy data.

Smart contracts are used to track, document, and validate the cumulative carbon reductions and sustainability that result from the usage of solar energy and industrial operations. Smart contracts are transaction protocols that automatically document legally significant occurrences and carry out actions in accordance with contract requirements. The deal is regarded as secure and unchangeable because tracking smart contracts is done by distributed ledger technology driven by blockchain, and we see great value in demonstrating a value for sustainability. Data is constantly modified, either purposefully or unintentionally, and misreported & withheld. Intentional corruption and unintentional accounting errors can have a significant financial impact on corporations and governments.

Peer-to-peer energy trade

A peer-to-peer energy request is a community of people who trade and buy redundant energy from one another. Consumers can use the system to profit from other druggies who produce further energy than they bear. Those that have redundant electricity can vend it for a profit.

The main advantages are

§ No middle medium – people make deals on their own terms

§ Everyone saves plutocrat

§ Transparent dealings directly with other consumers

§ Admired as much as large businesses

Electricity trading on a peer-to-peer (P2P) base empowers prosumers and consumers, performing in increased renewable energy development and system inflexibility. In addition to balancing and traffic operation, P2P networks can also give supplementary services.

The main advantages of blockchain in the energy sector are:

- Reduced costs
- Environmental sustainability
- Increased translucency for force chain

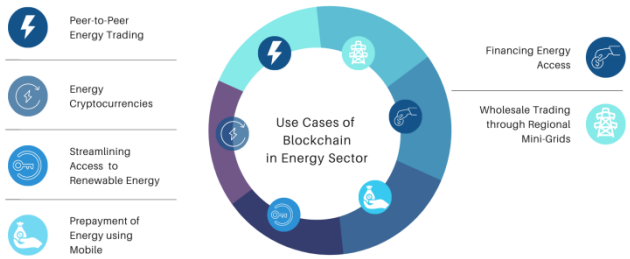

Figure 4. Uses of Blockchain in Energy Sector

1.2 Strategy Formulation

Based on the information gathered during environmental scanning, we have a clear picture of what needs to be addressed in order to accomplish the goal

With the use of blockchain, the major goal is to lower overall energy consumption costs by employing green manufacturing techniques using solar panels.

The warehouse's energy use and distribution will be tracked via blockchain technology. This method will ensure that the energy created is properly used and stored. If there is extra energy, peer-to-peer trade can be done.

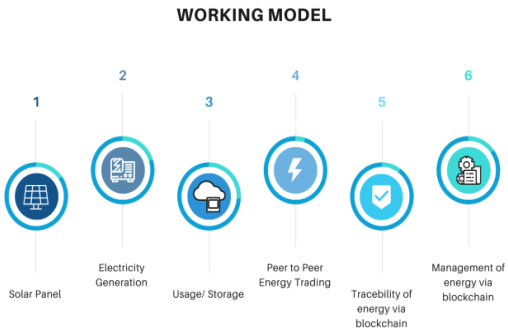

Figure 5. Working Model

2. Blockchain

Blockchains are a new type of network infrastructure that introduces distributed verifiability, auditability, and consensus to networks, hence increasing trust.

Blockchain technology is anticipated to find various applications in the energy sector. Individual households could sell extra energy (self-generated by solar panels) to their neighbors, for example, enabling the functioning of self-managing utility systems and facilitating peer-to-peer energy exchanges. Data transparency, security, asset management, and smart contracts are just a few of the

technology's important features, all of which can be applied to warehouse management.

3. CONCLUSIONS

As a result, solar panels generate electricity without damaging the environment or emitting CO2. The amount of solar energy generated may also be tracked with blockchain technology, as there is no ash or waste products. Blockchain technology can be used to achieve energy consumption traceability. Blockchain transactions for electrical energy are transparent, secure, and efficient. Blockchain technology also allows distributed entities to trade and interact in a decentralized and flat trading market, helping to create transactional energy systems. With its distributed ledger technology, which provides an open, unchangeable record of transactions that is freely accessible by all relevant parties, blockchain has the ability to address these supply chain management concerns. Smart contracts - self-executing agreements - deployed on the blockchain, in particular, can help to boost transparency, traceability, and efficiency throughout a supply chain. This contributes to the development of confidence among supply chain partners while also reducing the time and cost inefficiencies associated with overlapping effort and additional verification processes. Because real-time data can be used to assist decision-making, it also speeds up the supply chain and makes it more nimble in handling risks and interruptions.

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