

ANALYZING OF ENERGY EFFICIENCY BY INSTALLING SOLAR PANELS ON RESIDENTIAL BUILDINGS AND STATE INSTITUTIONS

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ABSTRACT

In the face of the environmental crisis and the need to mitigate climate change, adopting clean and renewable energy sources, such as solar energy, in architectural projects is becoming increasingly imperative. As a country with abundant sunlight incidence throughout the year, Brazil has enormous potential to take advantage of this energy source, which has become an increasingly attractive and viable option in the Brazilian scenario. There are numerous benefits solar energy can provide to both residents and the environment that make it a popular choice for residential use. Building energy usage contributes to 43% of overall global energy consumption. Furthermore, the usage of fossil fuels in residential properties accounts for approximately 33% of global greenhouse gas emissions.

Key words: *energy efficiency, solar system, solar panels, quality of the panels, quantitative techniques, benefits of solar energy*

АННОТАЦИЯ

В условиях экологического кризиса и необходимости смягчения последствий изменения климата использование чистых и возобновляемых источников энергии, таких как солнечная энергия, в архитектурных проектах становится все более необходимым. Как страна с обильным солнечным светом в течение всего года, Бразилия имеет огромный потенциал для использования этого источника энергии, который становится все более привлекательным и жизнеспособным вариантом в бразильском сценарии. Существует множество преимуществ, которые солнечная энергия может принести как жильцам, так и окружающей среде, что делает ее популярным выбором для использования в жилых домах. На потребление энергии в зданиях приходится 43% общего мирового потребления энергии. Более того, на использование ископаемого топлива в жилых домах приходится примерно 33% мировых выбросов парниковых газов.

Ключевые слова: *энергоэффективность, солнечная система, солнечные панели, качество панелей, количественные методы, преимущества солнечной энергии.*

INTRODUCTION

In recent years, solar energy has gained popularity as a renewable energy source, and its incorporation into building design has emerged as a crucial element in creating sustainable and energy-efficient constructions. This manual explains the numerous facets of using solar energy into building design for architects and builders. This tutorial covers the crucial elements that must be considered when implementing solar energy into a building design, from comprehending the many types of solar technology to taking into consideration the orientation and shading of a structure. This guide covers the crucial elements that must be considered when implementing solar energy into a building design, from comprehending the many types of solar technology to taking into consideration the orientation and shading of a structure. To further assist architects and builders in better understanding the advantages of solar integration and how it may be successfully implemented in a range of building types, this guide also offers real-world examples and case studies.

A large amount of energy usage is mainly related to energy loss and gains through the building's structure. In Uzbekistan, the construction sector accounts for at least 43% of total electricity usage. In the twenty-first century, regulators and others are aware that retrofitting existing structures will offer sustainability for urban development. This precisely captures the existing sustainability challenge: a significant amount of research emphasizes the energy-saving possibility of future construction projects, whereas existing buildings account for most global energy end-use and are responsible for 40% of global energy demand. Thus, every design modification that improves the energy efficiency of a building will generate considerable economic, social, and environmental advantages, in addition to a reduction in energy use. Researchers have considered ways to improve the energy performance of buildings in various climatic zones to achieve thermal comfort. As a prime source of renewable energy, solar power has demonstrated to be a reliable sustainable power source that can save you money on energy bills. For residential homes and buildings, the sale and installation of solar panels has led to significant long-term financial and environmental benefits.

MATERIALS AND METHODS

Although the upfront cost of installation may be hefty, you can find many benefits and savings when you have solar panels on your roof. We'll go over how long the installation process takes, the difference between solar panel use for businesses and residents, and how the increased energy efficiency will save you on your monthly energy bills. Before you install solar panels on your roof, you'll have to consult with our expert installers and technicians. Some necessary visits, planning,

and evaluation of different solar panels should be done before going ahead with the installation. Afterwards, it should only take a few days of work to get those solar panels on your roof. Completion is often estimated because an exact time depends on a variety of factors to fall through (i.e. net metering) and the complexity of the system. A full installation from the time you sign an agreement to when you turn the system on will be between 2-3 months. The reason is that there may be holdups such as solar permitting and utility approval you have to go through. The timeline to get those done depends on where you live. Resident solar use generally powers your own home at a consistent size between 6-12 kilowatts. These rooftop solar panels attain energy upgrades that can provide electricity bill savings for homeowners with varying degrees of wealth. The return on investment for residential solar panels is high and you can get your money back very shortly, despite the initial expensive cost. The cost of residential solar panels largely depends on where you live and the size of your electrical system, but have become much more affordable within the last decade. The size and quality of the panels themselves should also be taken into account. Installation prices for these panels have dropped significantly in recent years and you can be assured our certified technicians will do an exceptional job in installing them to the highest standards. On the other hand, commercial solar panel use is a larger investment and process because you may be powering a town or a company's daily operations. This greatly changes the situation in terms of both scale and cost.

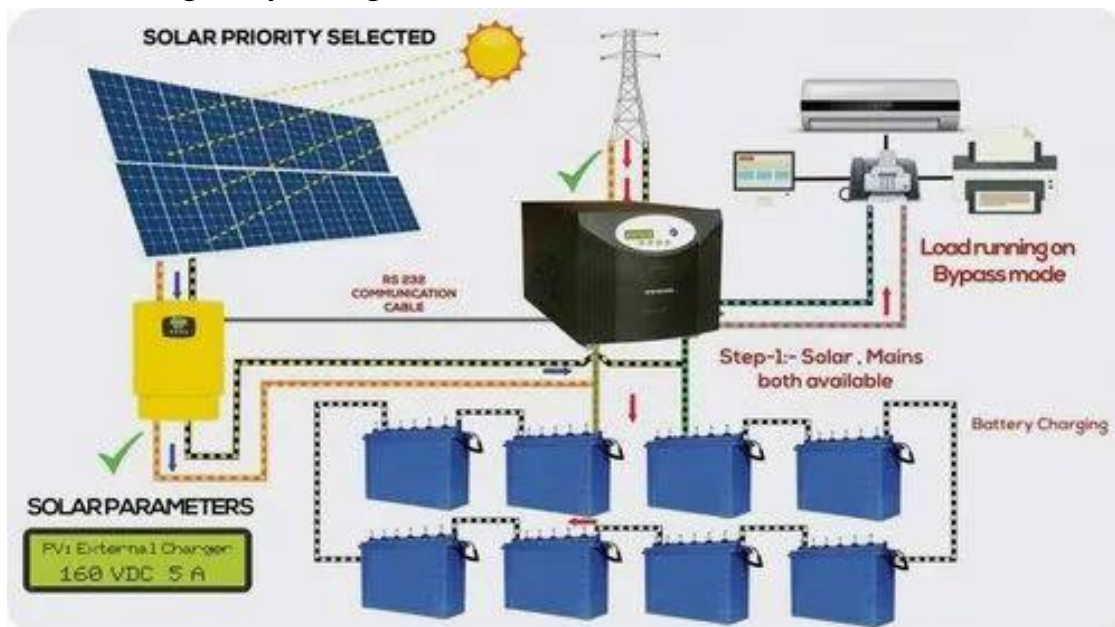


Figure 1. Solar power for residential

Solar panels have been used on residential buildings for many years, but it's only recently that they're becoming more common in commercial construction. Solar energy is a cost-effective, dependable, eco-friendly way to power a business. It can power lighting, heating, air conditioning and water heating in commercial buildings.

The panels can be installed on rooftops, parking lots and side yards. Sunlight is captured and converted into usable energy through different methods, some more efficient than others. Today, solar panels can convert 20% of the sunlight they capture into solar energy, making it a more viable source of power for commercial buildings. A solar panel, also known as a solar module, consists of silicon cell layers, a glass casing unit, a metal frame and wiring to transfer electric current from silicon. Silicon has conductive properties that absorb and convert sunlight into usable electrical power. The sunlight causes the silicon cell electrons to set in motion, creating an electric current. When solar energy is fed into an electrochemical battery, the chemical reaction on the battery components keeps the solar energy. In a reverse reaction, the current exits from the battery storage for consumption. It requires a major investment on your part and a collective group of people to invest, run, and facilitate how operations will run. When you install and rely on solar panels for energy, it's sustainable and energy efficient, which can lead to significant savings from energy bills in the long run. You can consistently heat your home throughout the winter and provide heated water whenever necessary. On the latter, heat is utilized from the sun and transferred to the water tank where the hot water will flow. Energy efficient heaters are also placed around your home to ensure its properly heated and no hot air leaks out. All this is done on the energy efficient solar panels that do not waste electricity. Huge numbers of buildings throughout the world have old, constructed roofs that are poorly insulated but have plenty of surface area that might provide significant renewable energy through solar energy, which reduces energy consumption. Photovoltaic panels are frequently retrofitted into existing structures as renovating existing buildings to reduce energy use is a key goal for mitigating climate change worldwide, regardless of their thermal integrity. Roofs, on the other hand, require periodic repairs because of weathering throughout their useful lives. The building envelope hence acts as an important communication channel between the building and its surroundings, whether this is perceived climatic change or intangible cultural patrimony. Therefore, at some point, the integration of energy efficiency strategies with renewable energy has become essential at different levels. In another study, two proposed scenarios were studied: PV inclination and PV area. Firstly, PV inclination was examined horizontally and inclined at a tilt angle of 30°.



Figure 2. System design for solar projects

The simulation demonstrated that PV inclined at such an angle yielded the best results; it has an annual daily insolation of 4.6 kWh/m², while horizontally installed solar panels have an annual daily insolation of 4.3 kWh/m². Moreover, a study used an integrated approach to envelope retrofitting by blending energy-efficient and financially viable retrofitting possibilities, based on an analysis of the suggested envelope retrofitting alternatives' prospective energy savings and beginning costs. The study used a mixed-approaches design approach that combined qualitative and quantitative techniques. These techniques included field monitoring of environmental parameters inside schools, questionnaires, national records, and physical assessments. The basic payback period analysis method was used for financial evaluation and energy simulation. The effectiveness of envelope retrofitting was evaluated using the results of the research methodologies, both before and after its implementation. There are several techniques in terms of reducing heating and cooling loads, including insulation materials that are used in roofs, walls, and floors, natural ventilation types through openings, and different types of shading elements in the facades. On the other hand, the technique that we investigated in our research is not better than any of the above-mentioned techniques, but every method is considered for certain building envelope elements.

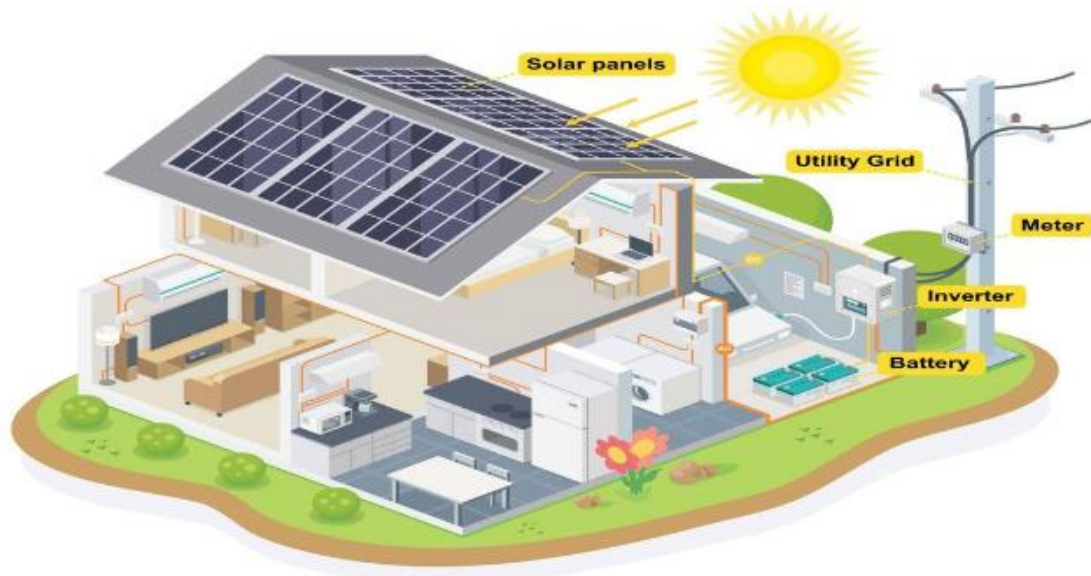


Figure 3. Integration of solar energy systems into building design

Thermal storage uses mediums such as molten salt or water to retain and absorb the heat from the sun. The heated mediums are then stored in an insulated tank until the stored energy is needed for consumption. Electricity is one of the biggest ongoing expenses that commercial buildings have. Solar panels significantly reduce energy costs. While the initial investment can be high, overtime the cost of installing solar panels is recouped by the money saved on electricity bills. Buildings that rely entirely on electric grids are vulnerable to power outages that occur during bad weather or electrical system malfunctions. Solar panels installed with battery systems allow commercial buildings to continue to function during power outages. Solar panels require very little maintenance throughout their lifespan—a wash every once in a while, depending on where you live and how much debris accumulates on the panels. They have no moving parts, so they're not likely to break down. Made of tempered glass and non-corrosive aluminum frames, solar panels can withstand rain, wind, hail and snow. The photovoltaic cells are designed to last 25 years or more. The advantages of using solar panels to power commercial buildings are likely to multiply as solar energy technology continues to develop. Rather than being an afterthought, solar panels should be considered during the design and construction phase of commercial projects. Energy efficiency and the usage of renewable energy sources are often prioritized by building rules and laws that support solar energy integration. They may, for instance, set a minimum standard for energy efficiency for new construction, or they might provide incentives for structures that use solar panels and other renewable energy sources. Additionally, certain laws and regulations may provide precise specifications for the installation of photovoltaic (PV) panels, such as the necessary size of the system, the building's orientation, and the panel spacing.

They may encourage architects and builders to experiment with fresh and cutting-edge ideas that contribute to a more sustainable future by establishing criteria for the integration of renewable energy sources into building design. The promotion of sustainable architecture and the incorporation of renewable energy sources into building design is greatly aided by solar energy building norms and standards.

In conclusion, solar powered buildings are quite efficient in preserving energy in various ways. By using the latest solar energy technologies buildings can save around 30-40% on their energy use. You can also become a net-zero energy building owner when you create more energy than you utilize. Solar energy building codes and regulations can encourage the development of new and innovative building technologies in addition to encouraging energy efficiency and the usage of renewable energy sources.

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