

Electricity supply of an industrial building

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Abstract

Electricity is one of the greatest gifts that human beings possess. The era in which we live has a high level of development and as a result the use of electricity is very necessary. One of the main sources of electricity production in our country are hydropower plants, which make it possible to convert water energy by means of a turbine into mechanical energy, where the mechanical energy is then transformed by the generator into electrical energy. Electricity is produced by the movement of particles, which we know as electrons. It can also be defined as the energy which is transferred when the electric current passes through the conductor. Electricity is measured in kW (kilowatt hours $1kW \cdot h = 3.6MJ$). It can also be produced from a variety of energy sources and different types of technology. The supply of electricity to the consumer is carried out by the Electric Power System, where its constituent parts are Generation, Transmission and Distribution of electricity. Recently, an increase in electricity costs has been observed, so this will bring more consumers who are interested in reducing energy costs.

In this topic, the way Albania is supplied with electricity is examined, taking a specific case of a fashion factory. The topic includes the following aspects:

- The method of electricity production in Albania.*
- Supplying a factory with electricity.*
- Solar energy production and photovoltaic plants.*
- Assessment of the possibility of reducing energy consumption in an industrial facility.*

Key words: *Direct Current, Alternative Current, Photovoltaic, Kilo Watt hour (unit of energy spent in one hour), Kilo Volt Ampere(kVA), Mega Watt, On-Grid, Off-Grid, Hybrid, V (volt), Kilo volts (Kv)*

Introduction

The way of electricity production in Albania and the main hydropower plants

Electricity is a mysterious power, without its life would not be so easy. Some of the greatest and most unique inventions have been made using electricity. In our country, electricity is dominated by hydropower plants; Fierze, Koman and Vau i Deja with a capacity of 1,350 MW. On the other hand, power plants balance the transmission of electricity. Solar energy is renewable energy and mainly in recent years its use is being noticed. It can be used directly. The use of Renewable Energy Sources can contribute to the reduction of primary energy consumption. All consumers think that a single device that is set to work does not consume much electricity, but when several of them are in working condition, consumption will be a real problem. Every consumer should be informed not only about the ways of using electricity but also about managing or reducing its losses. (Ravi) (Wikipedia, 2022) (Shivane)

Electricity can be produced from different sources. Renewable energy is the buzzword of today's times. Renewable energy in our country varies from solar, wind, geothermal, biomass and hydroelectric energy. Albania is a small country which has as its source the energy produced by hydropower plants, which have a determining role, where they have provided more than 90% of the country's annual production. Hydroelectric energy may not be effective enough when the water level is low, because as a result problems will be encountered in the production of electricity. Since Albania offers a Mediterranean climate, solar energy can also be seen as a good alternative. Albania's transition from the system of the concentrated economy to the free-market economy largely changed the structure of consumption and, therefore, of the energy supply to the consumer. The previous ratio through the use in industry and family and public use of energy, changed because of the closure of many businesses and the massive growth of the services market (restaurants, bars, industrial units, etc.) as well as the change in the direction of growth household use of electricity. The construction of hydropower works requires a relatively long time, therefore both optimal utilization and the re-commissioning of existing power works of any capacity should be evaluated and encouraged.

In Albania, hydropower plants have started to be built since 1936, its capacity has been 386 kW. The small hydropower plant was in the village of Vithkuq in Korçë. In 1951, the first real hydropower plant was built in Lanabregas in Tirana, with a power of 5MW. Electricity through power lines will travel to our homes. As mentioned above, the source of electricity in Albania is hydropower plants. Some of the main hydropower plants in Albania are:

Ulza, Shkopet, Bistic 1 & 2, Vau i Deja, Koman, Fierza, Banja and Kaskada over Devoll hydropower plants. Some of the problems that are neglected during the control of HPPs are those of protection from direct atmospheric shocks but also those from the damaging action of other high voltage waves. A good knowledge of the physical side of the action of lightning helps us to realize an effective protection from lightning strikes on the electromechanical equipment of a hydropower plant. It is also important to know the area where the hydropower plant is being built (Paloka, 2006).

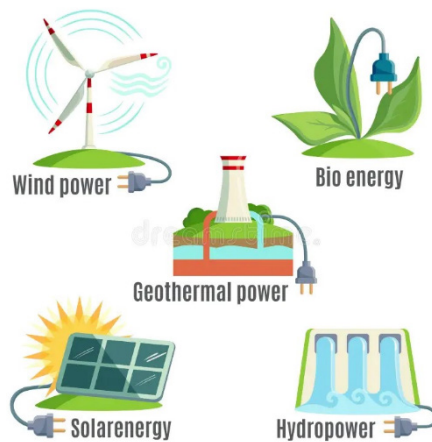


FIGURE 1: Alternative energy sources (Illustration of windmills, bio energy, solar energy, hydropower plants, thermal sources)

The aim, objectives, and hypothesis

Aim

The main goal is the analysis of an industrial building in terms of electricity supply, considering an industrial building in Albania.

Objectives

The objective is to show the way of production and distribution of electricity. Research efforts are aimed at the possibility of reducing electricity costs in an industrial facility by providing recognition of solar panels and their use.

Hypothesis

The use of photovoltaic plants is a good opportunity for reducing electrical energy.

The use of solar energy

The sun's energy is vital to life on Earth. It determines the temperature on the Earth's surface, and supplies all the energy that drives the global natural system and cycles. Every second the sun releases a large amount of radiant energy into the solar system. The solar energy system is a source of energy without pollution and is known as renewable energy. In recent years, it has been noticed that the solar energy system is being seen as the main and primary source of energy that is converted into electricity. Solar energy has as its main benefit the fact that it is free of cost and anywhere on Earth, it is also known as the technology that harnesses the sun to harness solar energy and use it in other forms. Some of them are known as photovoltaic cells or solar panels. There are always several solar cells that are connected and form a solar module. Electrons are stripped from atoms when sunlight hits cells. As electrons move through the cell, they generate electricity. (national geographic) (Gary Cook) (Electrical4U, 2023) (BoxWell)

- Solar energy can be used to heat buildings. In this case, the solar wall is used, where it is more cost-effective in northern countries. Sunlight is reflected by snow to improve solar gain. Solar water heaters work in the same way. They collect solar energy for heating water, which is then used according to internal use such as washing, cooking, etc.
- Passive solar systems. This system uses solar radiation through materials that absorb, reflect and store solar radiation in order to regulate temperatures inside the building. Important factors for evaluating the feasibility of renewable energy technology we will consider the number of hours of sun on a daily basis and the intensity of solar radiation.

Power supply of a factory and reduction of electricity consumption by means of solar panels

Electricity reaches the consumer through three stages. These three stages are production (generation), transmission and distribution.

First, to get electricity, we need to produce it. The place where electricity is produced is known as the production station or thermal power plant, hydropower plant, nuclear power plant, etc. So, everyone has the task of producing a high amount of energy. As we know, in thermal power plants, electricity is produced from the heat produced by burning oil, coal or natural gas. While in hydropower plants, the energy of moving water is converted into electricity by means of large hydraulic turbines, coupled with generators. On the other hand, in nuclear power plants, electricity is produced from the heat released by the nuclear reaction. Solar energy, wind energy, biomass and hydro are all known as green sources. This is because they do not cause pollution.

The transmission system makes the transmission of high voltage for the conductor to have economic parameters, as the currents and losses are small.

So, the second stage is the transmission of energy to the consumer. Once the energy is produced, it will be transmitted to urban and rural areas. Power stations generate electricity at low voltage, but when transmission occurs the voltage will be increased using a step-up transformer, because high voltage power supply has more priority than low voltage power supply.

About 30,000 km of high-voltage transmission lines connect power plants or generating hydropower plants with transmission stations. An example of an energy system can be the electrical network, which provides energy for homes or industrial buildings within an extended area. The transmission voltage depends on the amount of power to be transmitted. The surge resistance load is a parameter that determines the voltage level of the system for the transmission of an amount of energy.

The electricity supply of the industrial building for tailor's building is expected to be at Medium Voltage, from the electricity connection point, after approval by OSHEE, Lezhe area, a point discussed in advance with the electrical specialist on the ground, which is Shtylla b/ a of the 10KV Medium Voltage overhead line, which is located on the highway near the investor's property. From this point, it is envisaged to extend the incoming line for TM-20KV and the outgoing line for TM-20KV, directly underground according to the relevant section approved by OSHEE, this proposed to serve in the perspective, in the distribution implementation phase of TM-20KV, also in Lezhë Municipality.

The installed electrical power, in all the premises of the industrial building, for normal work is expected to be 471.6 kW, divided into consumer groups:

- 29.0 kW for lighting
- 4.0 kW for surrounding lighting
- 153.7 kW for plugs and electrical equipment
- 2237.2 kW for the aspiration and air conditioning system
- 34.7 kW for sanitary water and fire extinguishing pumps
- 4.4 kW for emergency lighting from UPS,
- 6.0 kW for the elevator system.

Considering the simultaneity coefficient in these industrial environments approximately 0.63, the required power is calculated around 300.0 kW.

Electricity experts have predicted an increase in prices, not only in Albania but also in many other European countries. Currently, some states are aiming to build some packages that help to save electricity. The moment electricity management is achieved, crises will begin to be faced, costs and restrictions will be reduced. There are several ways that can contribute to reducing electricity costs. These methods can be used at home or in industrial buildings. To make a connection with the case study, one of the best ways to save electricity, thus reducing costs, would be to install photovoltaic panels.

Solar panels are mechanisms that make it possible to transform the sun's rays into electrical and thermal energy. As we know, solar energy is a clean source of energy production. The types of solar panels are:

- Hybrid solar panel
- Thermal solar panel
- Photovoltaic solar panel

Hybrid solar panel

Thanks to solar energy, hybrid panels can be able to generate electricity and hot water. For this there is a hydraulic system that heats the water and photovoltaic cells that produce energy. Thus, photovoltaic production is maximized, and losses are minimized. Hybrid solar systems use special batteries and inverters to store energy for later use.



FIGURE 2 : View of a house that uses solar systems.

Solar thermal panel

For the first time in 1910, the installation of solar thermal energy equipment was done in the Sahara. This technology makes it possible to turn the sun's rays into heat. These panels help to reduce the savings on monthly bills by using a renewable energy source thus covering the heating needs.

Photovoltaic energy systems are classified according to their component configurations, their operational and functional requirements, and how the equipment is connected to electrical loads and other energy sources (Murty, 2017)

- **On-Grid System** An on-grid system is a photovoltaic system that generates electricity. It is this solar energy that will be fed into an existing public grid.
- **Off-Grid System**
An off-grid system is an island system. This photovoltaic system is not connected to a public power grid. If it produces more energy than needed, then the excess energy is stored in the battery. It only works with energy storage.
- **Hybrid system (HYBRID)**
In the hybrid system, in addition to the integration with the network, batteries are also integrated. So, a special inverter is needed for it. This system is programmed according to the options, but the special thing is that after the batteries are charged, the excess energy produced by the panels will be injected into the network. This system normally works like the On-Grid system, but the only difference is that this system does not shut down when there is no electricity but continues to produce energy or consume what has been accumulated in the battery.

Calculation of the photovoltaic plant in Albania

Knowing that the power required in the appliance is up to 300 kW, we will calculate how much the price of the electricity bill will vary in a month, considering the building of an Tailor.

150 kWh (daily) - **Required energy**

For 6 hours of work per day – 900 kWh

In 20 working days (5 days a week) – 18000 kWh

Monthly energy consumption = 18,000 kWh × 11.4 ALL = 205200 Lekë

Based on consumption, you need: **90 Kw panels**

The minimum area must be: **540 m²**

Kwh/ production month. Money that you can save in months.

4680 kwh	101,088 Lekë
7110 kwh	153,576 Lekë
9630 kwh	208,008 Lekë
11340 kwh	244,944 Lekë
13320 kwh	287,712 Lekë
14400 kwh	311,040 Lekë
15300 kwh	330,480 Lekë
14310 kwh	309,096 Lekë
11250 kwh	243,000 Lekë
8280 kwh	178,848 Lekë
5940 kwh	128,304 Lekë
4680 kwh	101,088 Lekë
120240 kwh	2,597,184 Lekë

At the end of the year, the amount that can be saved is: 20,200,320 Leke. So, it is obvious that the benefit that this tailor's building will have if it installs photovoltaic plants.

Conclusions

This thesis shows us the way of electricity supply in Albania. Within this paper, information is presented on how a hydropower plant works and some of the main hydropower plants in Albania. The case study was intended to show, in a simple way, the electricity supply of a factory. Referring to the issues discussed above, even though in our country electricity production is mainly done by hydropower plants, another good alternative is the use of renewable energies. Favored by a high number of sunny days, Albania seems to be a suitable place for the installation of solar panels for energy production.

Special importance has been given to solar panels, through which solar energy is obtained. These are dealt with in detail starting from the history when they were used for the first time. Continuing thus to the different types of photovoltaic plants. All the components of a photovoltaic system are also presented and treated. Photovoltaic systems are somewhat complex to understand. The demand for solar

energy is constantly increasing. Consequently, the number of installed systems using renewable energy is increasing.

Normally this paper encourages to increase the use of alternative energies. Clean electricity produced by solar energy can help light our future.

Recommendations

The use of solar panels is a technique that can be used not only by families but also by businesses or industrial buildings.

Albania, as a connecting part with Europe, using its geographical position, should use the production of solar energy.

It is recommended that not only in the family economy, but also in various businesses, the use of alternative energies, specifically solar energy, be widely used. This means that after the initial investment, the energy produced for at least the next 25 years will be at zero cost.

The use of photovoltaic plants will not only be a good opportunity for reducing electrical energy costs, but it will also be an even better opportunity for reducing environmental pollution. Unlike hydropower plants, photovoltaic plants do not have any negative impact on the environment.

Another recommendation that can be made regarding the case study is the installation of photovoltaic plants. The surface of the terrace can be used very well, knowing that 1 kW at the end of the year will give 1300 - 1500 kW/h. They also have a limited energy warranty of 10 years at 91.2% of the minimum rated energy output. Cost is one of the main factors that people notice. Starting from this factor, the investment in photovoltaic plants is an investment that will return within a few years.

So solar energy is cheap and affordable, and photovoltaic systems work as autonomous systems and do not have access to the electricity grid.

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