SOLAR ENERGY IN SLOVAKIA

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ABSTRACT

This article deals with the renewable energy sources in Slovakia. More concretely it deals with the photovoltaic cells and solar energy. The article describes how the solar cell works. The article show how many solar radiation we have in Slovakia.

1. INTRODUCTION

Presently the Slovakian energy supply depends for more than 70% on import of fossil fuels. As Slovakia only has limited natural fossil energy resources a transmission towards renewable energy supply is important to guaranty a long term energy and therewith political independence. Furthermore, the EU directive on the promotion of electricity produced from renewable energy sources sets a target that by 2010 31 % of the overall Slovak electricity consumption should come from renewable electricity production plants. Given the geographical and geological situation, four renewable electricity production technologies appear to be most applicable for Slovakia: 1) Hydropower, 2) Photo-Voltaic solar energy, 3) Wind and 4) Biomass.

2. ENERGY FROM THE SUN

The Earth receives 174 petawatts (PW) of incoming solar radiation (insolation) at the upper atmosphere. Approximately 30% is reflected back to space while the rest is absorbed by clouds, oceans and land masses. The spectrum of solar light at the Earth's surface is mostly spread across the visible and near-infrared ranges with a small part in the near-ultraviolet.
Earth's land surface, oceans and atmosphere absorb solar radiation, and this raises their temperature. Warm air containing evaporated water from the oceans rises, causing atmospheric circulation or convection. When the air reaches a high altitude, where the temperature is low, water vapor condenses into clouds, which rain onto the Earth's surface, completing the water cycle. The latent heat of water condensation amplifies convection, producing atmospheric phenomena such as wind, cyclones and anti-cyclones. Sunlight absorbed by the oceans and land masses keeps the surface at an average temperature of 14 °C. By photosynthesis green plants convert solar energy into chemical energy, which produces food, wood and the biomass from which fossil fuels are derived.
The total solar energy absorbed by Earth's atmosphere, oceans and land masses is approximately 3,850,000 exajoules (EJ) per year. In 2002, this was more energy in one hour than the world used in one year. Photosynthesis captures approximately 3,000 EJ per year in biomass. The amount of solar energy reaching the surface of the planet is so vast that in one year it is about twice as much as will ever be obtained from all of the Earth's non-renewable resources of coal, oil, natural gas, and mined uranium combined.
From the table of resources it would appear that solar, wind or biomass would be sufficient to supply all of our energy needs, however, the increased use of biomass has had a negative effect on global warming and dramatically increased food prices by diverting forests and crops into biofuel production.

Solar energy can be harnessed in different levels around the world. Depending on a geographical location the closer to the equator the more "potential" solar energy is available.

3. WHERE WE CAN SOLAR FOUND

Solar energy is everywhere the sun shines. Solar energy is by far the Earth's most available energy source. Solar power is capable of providing many times the total current energy demand. But it is an intermittent energy source, meaning that it is not available at all times. However, it can be supplemented by thermal energy storage or another energy source, such as natural gas or hydropower. According to the energy budget, our earth is able to receive around 51% of the sun’s solar energy. The rest is either absorbed by clouds and the atmosphere or radiated back into space.

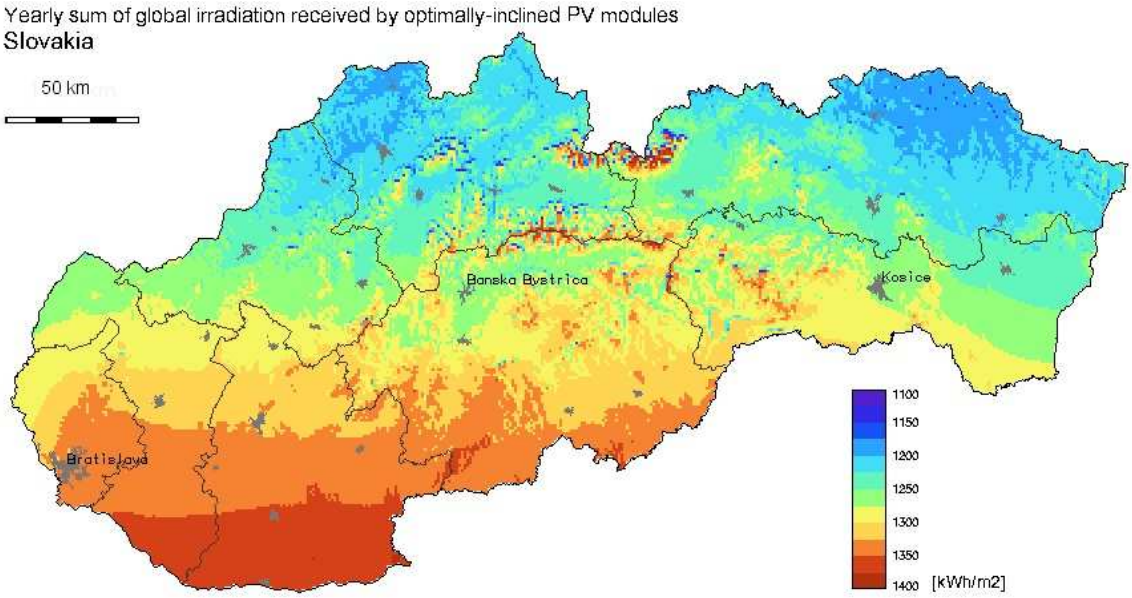

Figure 1 – Slovakia horizontal irradiation at the optimum angle

4. SOLAR PHOTOVOLTAIC CELL

A photovoltaic cell, commonly called a solar cell or PV, is the technology used to convert solar energy directly into electrical power. A photovoltaic cell is a nonmechanical device usually made from silicon alloys. Sunlight is composed of photons, or particles of solar energy. These photons contain various amounts of energy corresponding to the different wavelengths of the solar spectrum. When photons strike a photovoltaic cell, they may be reflected, pass right through, or be absorbed. Only the absorbed photons provide energy to generate electricity. When enough sunlight (energy) is absorbed by the material (a semiconductor), electrons are dislodged from the material's atoms. Special treatment of the material surface during manufacturing makes the front surface of the cell more receptive to free electrons, so the electrons naturally migrate to the surface.

When the electrons leave their position, holes are formed. When many electrons, each carrying a negative charge, travel toward the front surface of the cell, the resulting imbalance of charge between the cell's front and back surfaces creates a voltage potential like the negative and positive terminals of a battery. When the two surfaces are connected through an external load, such as an appliance, electricity flows.

4.1. How photovoltaic systems operate

Photovoltaic is the direct conversion of light into electricity at the atomic level. Some materials exhibit a property known as the photoelectric effect that causes them to absorb photons of light and release electrons. When these free electrons are captures, an electric current results that can be used as electricity.

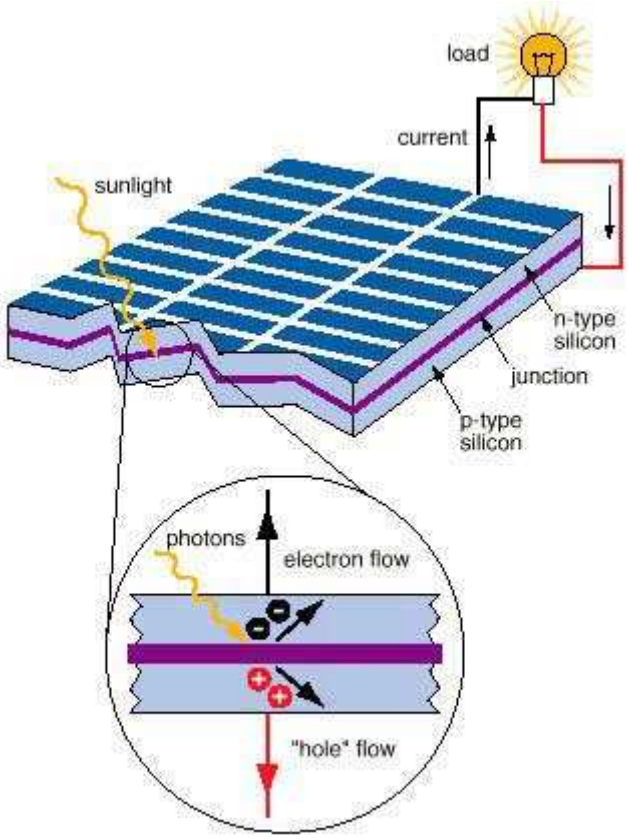

Figure 2 – Photovoltaic cell construction

The photoelectric effect was first noted by a French physicist, Edmund Bequerel, in 1839, who found that certain materials would produce small amounts of electric current when exposed to light. In 1905, Albert Einstein described the nature of light and the photoelectric effect on which photovoltaic technology is based, for which he later won a Nobel prize in physics. The first photovoltaic module was built by Bell Laboratories in 1954. It was billed as a solar battery and was mostly just a curiosity as it was too expensive to gain widespread use. In the 1960s, the space industry began to make the first serious use of the technology to provide power aboard spacecraft. Through the space programs, the technology advanced, its reliability was established, and the cost began to decline. During the energy crisis in the 1970s, photovoltaic technology gained recognition as a source of power for non-space applications.

Photovoltaic cells, like batteries, generate direct current (DC), which is generally used for small loads (electronic equipment). When DC from photovoltaic cells is used for commercial applications or sold to electric utilities using the electric grid, it must be converted to alternating current (AC) using inverters, solid state devices that convert DC power to AC.

5. CONCLUSIONS

In these days topic about renewable energy sources is most actual and discussed. As we are getting out of fossil fuels, we need to find new sources of electricity. When our country joined the EU we pledge to produce 20% of electricity from the renewable sources by 2020. As Slovak republic has only few stores of fossil fuels question about renewable energy sources is the most important. Finally, there is the need for reducing the emissions and cutting-down environmental pollution. Solar energy is one of the ways how we can reach this aim.

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