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New Technology to Improve the Efficiency of Photovoltaic Cells for Producing Energy

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Abstract

Due to increasing worldwide energy needs, several technologies have been elaborated to meet this demand. One of these developments concerns solar energy, which has already been in use for several decades. The main solar technologies were developed in the sixties and seventies with monocrystalline and multicrystalline technologies. Subsequently, a new, more efficient, technology with a ribbon system became available.

These different technologies have similar processes and applications. Several Life Cycle Assessment (LCA) studies have been carried out to identify and to compare the environmental impacts of photovoltaic systems and nuclear systems, lignite systems etc. These studies have shown that the main problem with photovoltaic technologies is the decreasing efficiency during the using phase, and that is why some impacts appear higher when compared to other technologies.

However, in order to justify the benefits of this new technology, it is necessary to assess environmental impacts and to compare them with the conventional technologies. The second challenge in this research work is to carry out the LCA. Our proposal shows the preliminary LCA results of this technology, but it also indicates the difficulties and the limitations of assessing the environmental impact of such products. Even if standards, tools and databases exist for completing the LCA, nano-products are quite new and a full LCA study is difficult to conduct due to the lack of information in the actual databases of the Life Cycle Inventory and the characterization factors in the calculation methods.

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1. Introduction

World energy consumption has undergone rapid growth and increased by almost 1400 % over the last 20 years. Nearly four-fifths of the energy consumed today comes from fossil fuels, resulting in an increase of around 6% in

CO2 emissions in 2010. Taking into account the fact that the fossil fuels are limited and highly polluting, the application of renewable energy sources seems to be inevitable.

Many technologies propose “green energy” such as wind power, water power and so on. In this study, we propose assessing the environmental impact of different technologies of solar panels. The efficiency can differ between different technologies; therefore an environmental assessment can be relevant in order to identify the best product.

In recent decades, 3 main categories of solar panels were identified:

- Solar thermal panels;
- Photovoltaic solar panels;
- Photovoltaic thermal panels.

The study made by the NREL (Renewable Energy Laboratory) research team showed the efficiency of different solar cells (figure 1).

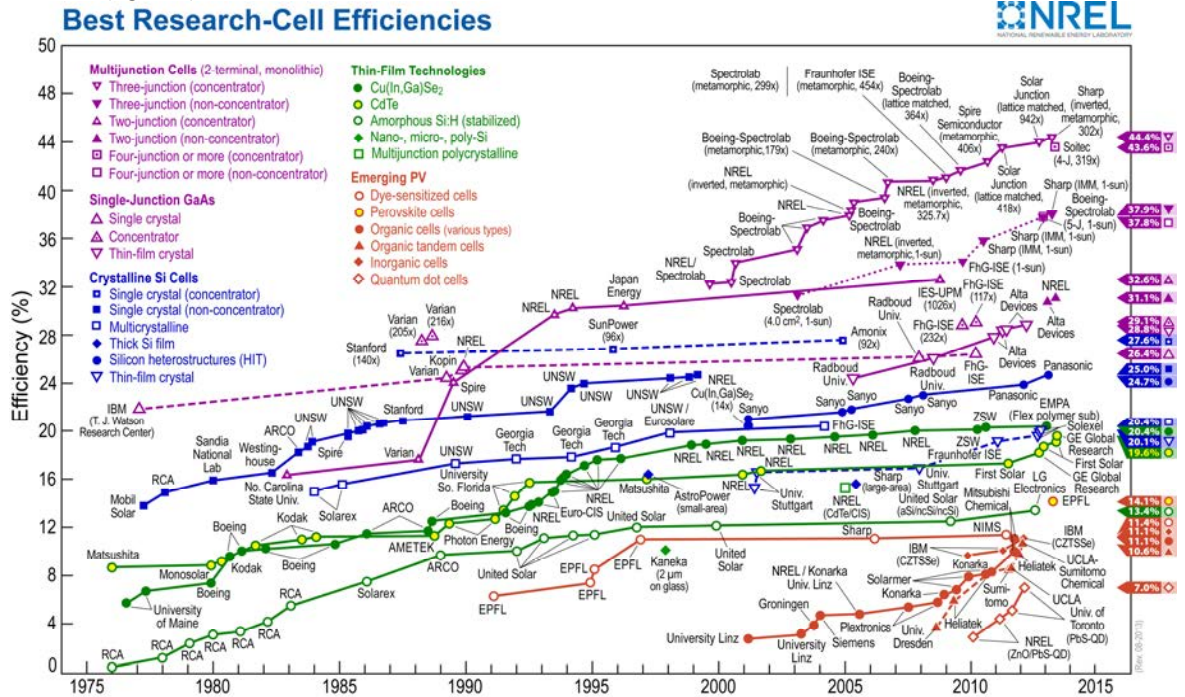


Fig. 1. Best Research-Cell Efficiencies [1]

The University of Technology of Troyes, in collaboration with the University of Reims Champagne-Ardenne, has been developing a new technology with nano yarn for 3 years. This new material could be more efficient than the others. However, the main challenge is reducing the environmental impact.

2. Objectives

The main problem in the evaluation of environmental impact is to determine all the components of products used (known as the inventory). However, some studies have already been done [2]. The objective of the project is to provide a new solution to produce solar energy by guaranteeing the minimum impact of the technical solution. This new technology will ensure higher efficiency compared to existing ones, and will probably be more expensive. The panel could find its use in critical services, e.g. safety systems in mountains or in express-ways.

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