

Development of Green Photonics Technologies Applicable In Hybrid Solar Energy Concentrators

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Abstract. Recently, the most abundant of the renewable energy source is solar energy. It has been developed rapidly both on domestic and large industry scale. Green photonic technologies have been taking part on a very important role producing hybrid solar energy concentrators in order to improve energy efficiency and to reduce our environmental impact significantly. Conventionally, the solar energy conversions are thermal heating, photovoltaic (PV) and thermal to electric. In thermal heating systems, water is heated directly or indirectly by the sun, typically insulated tubing on the rooftop solar collectors for domestic water heating are now common even in regions where direct sunlight is somewhat large installations for commercial electricity generation are supporting in our climates. In fact to the direct sustainable eco-benefits derived from the products themselves, green photonics will also impact the product design, manufacturing processes and performances employed. Our research aims to discuss covering holographic concentrators, solid state lighting (SSL), solar cells, photovoltaics, and optical communications. PV cells generate electricity directly and widely used in domestic and commercial. With a specially designed holographic optical element (HOE), a large portion of the expensive silicon photovoltaic cells in a solar panel can be replaced. With this Holographic Planar Concentrator (HPC) technology, the solar modules produce more energy in all conditions when compared to a standard module with an equal area of silicon PV cells. The importance of considering the full lifetime environmental impact of products will be discussed, including photomaterials, use, and end of life issues. Industrial and legislative strategies are reviewed, and a number of specific measures are presented for how to accelerate the development of green photonics technologies and promote their adoption into our society. Solar energy research will become a growing area of research in Indonesia and needs to increase the number of grid connected hybrid energy systems in the future.

Keywords: Green photonics, energy efficiency, eco-benefits, holographic optical element (HOE), and grid.

INTRODUCTION

Green photonic technologies have been applicable to produce electricity and to reduce the high cost of electric power source. For this purpose, many concentrating systems have been developed to concentrate the incident sunlight radiation onto the solar cells whose area is only a fraction of the concentrator area on which the sunlight falls such as parabolic mirrors or Fresnel lenses, and holographic lenses. There are two models of solar energy concentrators, thermal and PV includes its transmission grid and reflection respectively. Our paper is aimed to study and realize the holographic concentrators adjusting the spectral distribution of the photovoltaic cells to the solar spectrum by the dispersion of hologram. Photonics is the science of light and how it can be harnessed, embracing its generation, manipulation, and capture for utilisation in an enormous variety of applications, as evidenced by its increasing pervasiveness in our everyday lives. We use photonic technologies to light up our homes, offices and cities, to harvest renewable energy from the sun, to make telephone calls or surf the Internet, to enable early medical diagnosis and treatments, to establish clean and efficient manufacture of a

multitude of everyday products, or to provide reliable security systems to protect us as we travel. Already, over 90 percent of all the data transferred for telecommunications is transmitted by optical fibre. In microelectronics, storage media and microprocessors are produced using optical techniques and in production engineering, laser techniques are systematically gaining ground in metrology and manufacturing. Last but not least, photovoltaic solar energy systems provide clean electricity to millions of people.

GREEN PHOTONICS TECHNOLOGIES

Photonics makes use of advanced technology to realize high value products and services, but its roots lie in the fundamental source of our planet's energy – the capture of light from the sun by photosynthesis in plants. This fundamental 'photonic' process is the enabler for life on our planet.

1. 'Green photonics' [1] is the term used to encompass the application of photonics technologies that can generate or conserve energy, cut greenhouse gas emissions, reduce pollution, or yield environmentally sustainable outputs.