

The Journey of Light: From Photons to Eco-Security

Samia Subhan Qureshi, Saad Rashid, Zeeshan Sayed Shah, Irfan ul Haq Qureshi and Muhammad Subhan Qureshi

Dairy Science Park, 3-A, Industrial Estate, Hayatabad, Peshawar-25000, Pakistan

Corresponding email: qureshi@dairysciencepark.org

Abstract

Light, a divine blessing, forms the foundation of life on Earth. Originating from nuclear fusion in the Sun, photons travel vast distances through space, eventually interacting with matter on our planet. Their fate—reflection, absorption, refraction, or conversion—establishes the basis of natural ecosystems and modern technological applications. Among these, the conversion of light into electricity through photovoltaic systems offers a sustainable pathway to address humanity's growing energy needs, supporting food security, public health, and ecological balance. This paper reflects upon the journey of light and its role in the framework of the National Eco-Security System (NESS) and Dairy Science Park (DSP), linking scientific understanding with the divine gift of renewable energy for humanity.

1. Introduction

Since the beginning of human consciousness, light has been regarded as a symbol of life and guidance. Beyond its spiritual significance, light underpins biological, ecological, and technological systems. The Sun continuously emits photons, which traverse the vacuum of space until they interact with Earth's atmosphere and surface. This interaction fuels photosynthesis, regulates climate, and sustains biodiversity. In the modern age, humanity has learned to harness photons more directly through photovoltaic technology, to generate electricity, a development of profound importance for sustainable livelihoods.

2. The Physics of Photons

Photons are quanta of electromagnetic radiation, massless particles traveling at the speed of light (299,792 km/s). Their "shelf life" is indefinite in empty space, continuing their journey for billions of years unless absorbed or scattered. Upon encountering matter, photons may:

- Reflect, providing visibility and color.
- Refract, enabling optical technologies.
- Scatter, creating phenomena such as blue skies and red sunsets.
- Absorb, transferring energy into heat, chemical reactions, or electron excitation.

It is this absorption and excitation that forms the foundation of photovoltaic energy conversion.

3. Photons to Electricity: The Solar Revolution

Einstein's explanation of the photoelectric effect laid the foundation for solar technology. When photons strike a semiconductor surface (e.g., silicon), they excite electrons, freeing them to flow as an electric current. This process powers photovoltaic (PV) devices, now deployed worldwide.

Solar energy is:

- **Renewable** – an endless supply during the lifetime of the Sun.
- **Clean** – free from greenhouse gas emissions.
- **Accessible** – reaching both metropolitan and rural communities.
- **Sustainable** – a pathway to resilient livelihoods.

Thus, photons serve as carriers of divine energy, transformed by human ingenuity into usable electricity.

4. Role of SunSaviour in Solarization of Pakistan

The journey of SunSaviour commenced with the graduation in Electrical Engineering, of the founders of GreenWend Energy Private Limited Peshawar, Engr Zeeshan Saeed Shah, Engr Samia Subhan Qureshi and Engr Saad Rashid from the University of Engineering and Technology (UET), Peshawar. They got Masters from USPCAS-E and were part of the last cohort of USPCAS-E exchange scholars to visit the U.S. They continued research work at the Photovoltaic Reliability Laboratory of Arizona State University (PRL-ASU). Engr Samia was described as a startup founded by the Arizona State University, USA (Sano 2019).

When asked to describe the importance of her research, she suggested that by eliminating the use of pyranometers, pyrhemometers and two-axis trackers for an outdoor angle of incidence (AOI) measurement, their proposed model offers a cost-effective outdoor AOI measurement. She helped Engr Zeeshan, her husband, in conceptualising and establishing GreenWend Company as a private company. Her success story was presented at a high-level meeting between the Government of Khyber Pakhtunkhwa and USAID, chaired by Mr Donald Blome, the U.S. Ambassador to Pakistan on April 11, 2022.

Engr Zeeshan, after graduating from UET Peshawar, desired to establish his own business setup rather than joining some government organisation for a job, as per practice of the youth in the country. He went through prolonged consultation and feasibility studies and joined a local company to evaluate the prevailing practices in the market. He invited his colleagues to establish a solar energy company for providing services to the residential and commercial clients. GreenWend Energy Pvt Ltd Peshawar was registered as a company under a partnership deed with GoKP, PEC and SECP.

The R & D Team of GWE, headed by Engr Saad Rashid, designed an inverter, green energy metres and lithium ion batteries, produced in Chinese factories and marketed in various cities with the name SunSaviour. Technical cooperation with German and US Universities and Companies was established by Irfan ul Haq Qureshi, Strategic Planner GWE. Various commercial companies, Universities and R&D Organizations were engaged under the ISE2024 for interaction through stalls, panel discussions, and poster presentations.

The International Solar Expo 2024 (ISE2024) was held to facilitate various stakeholders for interaction and find solutions for the issues they are facing. Policy Recommendations were prepared for overcoming the energy crises, unemployment issues, environmental threats and the increasing import bills of the government.

5. Light and Eco-Security

The National Eco-Security System (NESS) emphasizes environment protection, biodiversity conservation, food security, public health, and livelihood security. Harnessing solar energy directly supports these pillars by:

- Reducing dependence on fossil fuels and mitigating climate change.
- Powering agricultural and livestock value chains with clean energy.
- Supporting eco-tourism and biodiversity conservation in protected areas.
- Empowering local communities with decentralized, affordable electricity.

In this framework, light is not only a natural phenomenon but a strategic resource for sustainable development. Harnessing of solar energy through photovoltaic systems demonstrates the harmony of faith, science, and human creativity.

6. Reflections

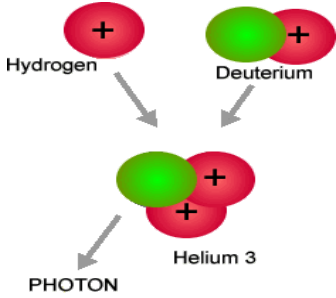
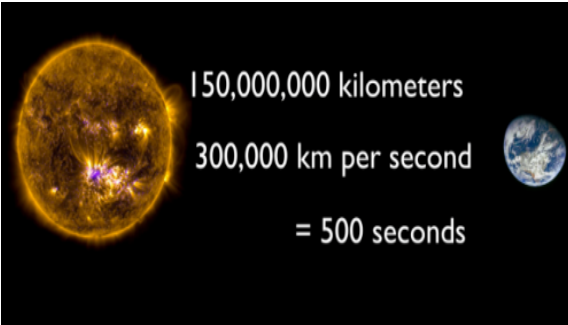
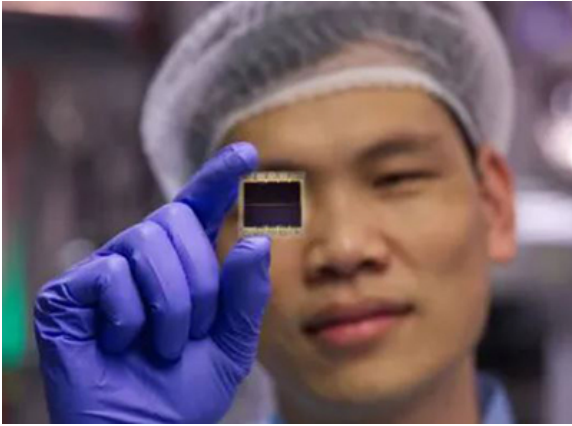
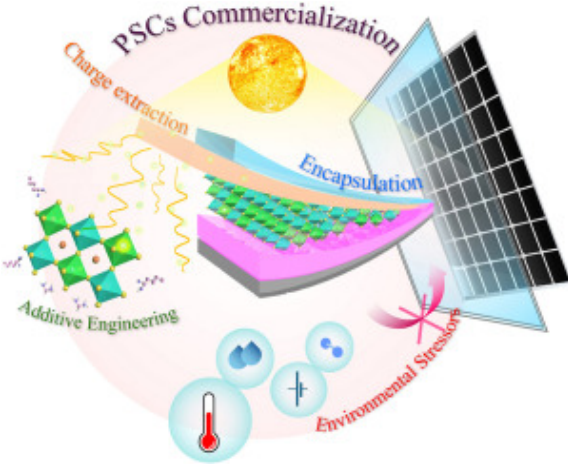
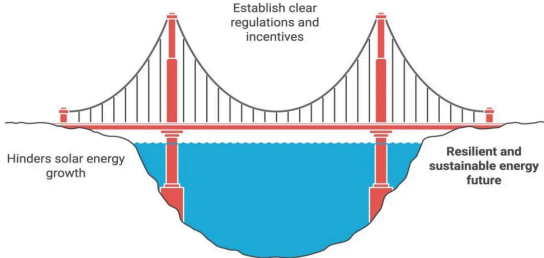

The Qur'an describes light (An-Nur) as a symbol of divine guidance: *“Allah is the Light of the heavens and the earth.”* (24:35). Scientifically, photons sustain life; spiritually, they remind humanity of higher purpose. The harnessing of solar energy through photovoltaic systems demonstrates the harmony of faith, science, and human creativity.

7. Conclusion

The journey of light—from photons produced in the Sun to electricity generated on Earth—illustrates a continuum of divine blessing and scientific exploration. By integrating this understanding into the vision of the Dairy Science Park and NESS, we recognize solar energy as a cornerstone of eco-security for present and future generations.



Concluding Session of the International Solar Expo 2024

	
<p>1. Birth of Photons in the Sun</p> <p><i>Deep inside the solar core, nuclear fusion gives birth to photons</i></p>	<p>2. The Voyage to Earth</p> <p><i>Traveling across space, sunlight reaches our planet, nurturing life and supply of energy.</i></p>
	
<p>3. Scientific Breakthroughs</p> <p><i>Through discoveries in physics and material science, photovoltaic technologies now allow us to harness sunlight with increasing efficiency.</i></p>	<p>4. Commercialization of Solar Power</p> <p><i>Once a scientific curiosity, solar energy is now powering homes, industries, and cities.</i></p>
<p>Stable Solar Policy Drives Pakistan's Energy Sustainability</p> 	
<p>5. SunSaviour's Role in Pakistan</p> <p><i>SunSaviour has led Pakistan's solarization, enabling households and businesses to adopt sustainable energy solutions.</i></p>	<p>6. Ensuring Eco-Security</p> <p><i>By replacing fossil fuels with solar energy, we secure cleaner air, resilient communities, and a sustainable energy future.</i></p>