



AUTHOR(S):

TITLE:

YEAR:

Publisher citation:

OpenAIR citation:

Publisher copyright statement:

This is the _____ version of an article originally published by _____
in _____
(ISSN _____; eISSN _____).

OpenAIR takedown statement:

Section 6 of the "Repository policy for OpenAIR @ RGU" (available from <http://www.rgu.ac.uk/staff-and-current-students/library/library-policies/repository-policies>) provides guidance on the criteria under which RGU will consider withdrawing material from OpenAIR. If you believe that this item is subject to any of these criteria, or for any other reason should not be held on OpenAIR, then please contact openair-help@rgu.ac.uk with the details of the item and the nature of your complaint.

This publication is distributed under a CC _____ license.

Concentrating solar photovoltaic system: Where is it going now?

Abu Bakar Munir ^{a,b}, Firdaus Muhammad-Sukki ^{c,*}, Nurul Aini Bani ^d

^a University of Malaya Malaysian Centre of Regulatory Studies (UMCoRS), University of Malaya, 59990 Jalan Pantai Baru, Kuala Lumpur, Malaysia

^b Faculty of Law, University of Malaya, 50603 Kuala Lumpur, Malaysia
Email: abmunir@um.edu.my

^c School of Engineering, Faculty of Design and Technology, Robert Gordon University, Garthdee Road, Aberdeen, AB10 7GJ, Scotland, United Kingdom

* Corresponding telephone number: +44(0)1224262447. Email: f.b.muhammad-sukki@rgu.ac.uk, firdaus.sukki@gmail.com

^d UTM Razak School of Engineering and Advanced Technology, University Teknologi Malaysia Kuala Lumpur, Jalan Sultan Yahya Petra, 54100 Kuala Lumpur, Malaysia.
Email: nurulaini.kl@utm.my

Solar photovoltaic (PV) has seen a tremendous growth in the last decade, with a global cumulative installation exceeding 177 GW by the end of 2014 [1]. Despite this, PV only contributes to approximately 1.1% of the world's electricity requirement [1]. The high installation cost is still considered the main obstacle in promoting this technology.

An alternative to reducing the high cost is by incorporating an 'optical concentrator' in the solar PV module – a device that is capable of concentrating the sun energy from a large area into a smaller area where a PV cell is attached. The implementation of concentrator will cut the usage of expensive PV material in the PV module, hence reducing the cost, without compromising the electrical output generated from the PV module.

Specifically for building integration, a low concentration optical concentrator has been developed and studied in the past 30 years [2]. Some of the designs - the non-imaging concentrators – show some promising result, but the issues such as complex manufacturing and assembly process, addressing the presence of non-uniform hot spots on the cells as well as durability of the concentrator materials still hinder the adoption of these technologies. The luminescent solar concentrator (LSC) [3] is another good prospect for a low cost PV integration but its low electrical conversion efficiency discourages its commercialisation outlook. Besides the technical challenges, lack of policies and monetary incentive from the governments also hinders the uptake of these concentrating technologies.

With the diminishing global financial incentive towards solar PV, the interest in PV is now declining especially in Europe. The concentrators could pave the way to reducing the PV cost, but researchers, industries and the governments must work together to address the key issues surrounding these technologies. A wobbly response from all parties might be too late for these technologies to enter the market.

[1] IEA. *Trends 2015 in Photovoltaic Application*. 20th edn. (IEA, 2015)

[2] Gleckman, P., O'Gallagher, J. & Winston, R. 'Concentration of sunlight to solar-surface levels using non-imaging optics'. *Nature* 339, 198 - 200 (1989)

[3] Debije, M. 'Renewable energy: Better luminescent solar panels in prospect'. *Nature* 519, 298–299 (2015).