

144 ALCHEMI

A Low Cost, High Efficiency, Optoelectronic HCPV Module for 1000 Sun Operation

Project duration: from 02.2017 – 01.2020

Report submitted: 04.2020

Publishable Summary

Project ALCHEMI demonstrated a new type of low cost, high concentration photovoltaic (HCPV) module which has a DC module efficiency (η) >37% (at Concentrator Standard Test Conditions (CSTC) of 25°C cell temperature and a DNI of 1000W/m²), which operates at a concentration factor of ~1000x. This module efficiency value will be achievable in manufacturing volumes, and not just as a hero result. The module uses small III-V multijunction solar cells (~1mm x 1mm), no external heat-sinking, and refractive optics – Fresnel Primary Optical Element (POE) and a Silicone Secondary Optical Element (SOE). The receiver element of the module is a surface mount device (SMD), and the module takes full advantage of cost reductions associated with the LED industry by only using surface mount devices and components, using pick and place assembly. In this respect, this project demonstrated a low-cost route to high concentration photovoltaics, by exploiting existing assembly equipment and processes of the well-established optoelectronic industry. Modules were tested, both on-sun for around two months to establish performance and reliability, and using environmental testing in-line with the CPV module standard IEC62108. In testing, the performance of these modules was compared with conventional flat plate c-Si modules and other lower concentration HCPV modules geographically situated at the same location, to demonstrate the performance and energy yield advantage of the modules that were developed.

Project consortium

Coordinator and all contact details:

| | |
|---------------------------------------|---|
| Full name of organisation | IQE plc |
| First and family name of coordinator: | Iwan Davies |
| Full address: | Pascal Close, Cardiff CF3 0LW, United Kingdom |
| E-mail: | idavies@iqep.com |

Participating countries and financing:

| Country | No. of org's involved | Project costs in EUR | Public funding in EUR |
|--------------|-----------------------|----------------------|-----------------------|
| UK | 1 | 567'183 | 283'592 |
| Spain | 1 | 143'000 | 143'000 |
| Germany | 1 | 250'000 | 250'000 |
| Cyprus | 1 | 100'000 | 0 |
| <i>Total</i> | <i>4</i> | <i>1,109,183</i> | <i>725,592</i> |

Funding agencies involved and contracts

| Funding Agency | Contract N° and Title |
|--|--|
| Innovate UK | Reference: 620125 Project Title: ALCHEMI - A Low Cost, High Efficiency, Optoelectronic HCPV Module for 1000 Sun Operation Date: 18th January 2017 |
| Ministerio de Economía y Competitividad | Contract No. PCIN-2015-246 "Modulo Optoelectronico HCPV para operacion a 1000 soles con Alta Eficiencia y bajo coste" |
| Federal Ministry for Economic Affairs and Energy | Contract: 0324127. Project Title: "ALCHEMI - Kostengünstiges, hoch effizientes optoelektronisches Modul der konzentrierenden Photovoltaik für 1000-Sonnen-Betrieb" |