

## HESiTSC

### High efficiency silicon based tandem solar cell PV module

*Project Duration: 06.2015 to 12.2018*

*Final report submitted: 02.2019*

#### **Publishable Summary**

Crystalline Si PV cell is the dominating technology on solar energy market. The declining of Si PV cell cost helps the solar energy to become as competitive as the conventional energy source. In order to replace the fossil fuel in electricity generation, the levelized cost of energy (LCOE) of Si PV cell technology has to be further reduced, which can be realized by aggressively increasing the conversion efficiency of Si PV cell. However, the Si PV cell efficiency is approaching the maximum theoretical efficiency of c-Si solar cells, which is about 30% due to the Shockley–Queisser limit. Si PV industry is pursuing the cost effective and future proof high efficiency Si PV cell technology. In order to make c-Si solar cell more efficient and competitive than other electricity generation solutions, disruptive device architectures and innovations in process technology are required. The success of such objectives requires the transnational collaboration among European research institutes and industry. In this project, Swedish universities KTH-Royal Institute of Technology and Karlstad University, the Swedish start-up company Tandem Sun AB and Spanish research institute FUNDACIÓN CENER-CIEMAT have collaborated to develop the high efficiency c-Si based tandem solar cell (SiTSC) technology by exploiting the innovative direct III-V/Si heterojunction concept. The fabrication technology of dual junction solar cell consisting of 1.8 eV GaInP top cell and Si bottom cell was developed by using the proprietary corrugated epitaxial lateral overgrowth (CELOG) method in the hydride vapour phase epitaxy (HVPE) reactor. The efficiency enhancement by the tandem solar cell structure was investigated in GaInP/Si dual junction solar cell. The complementary experience and expertise of our transnational consortium in c-Si and III-V photovoltaic technology were asset of the project. At the end of the project, a pilot production of SiTSC based on HVPE technology was established at KTH Electrum Lab, which will facilitate the SiTSC technology development for continuous efficiency improvement and the introduction of SiTSC product to market. The outcomes of the project will pave the way for an aggressive cost reduction of SiTSC in industrial scale production, which will lead to the cost competitive solar electricity in the near future.

## Project consortium

Coordinator and contact details:

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Participating countries and financing:

Country	Number of organisations involved	Project costs in EUR	Public funding in EUR
Sweden	3	457'039	442'106
Spain	1	75'000	50'000
<i>Total</i>	<i>4</i>	<i>532'039</i>	<i>492'106</i>

## Funding agencies involved and contracts

Funding Agency	Contract N° and Title
Swedish Energy Agency	40176-1 Hogeffektiv kiselbaserad tandemsolcell PV modul
Ministry of Economy and Competitiveness	PCIN-2015-231 CELULAS TANDEM DE ALTA EFICIENCIA BASADAS EN SUSTRATOS DE SILICIO
Swedish Energy Agency	40176-1 Hogeffektiv kiselbaserad tandemsolcell PV modul
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