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Next – generation interdigitated back-contacted silicon heterojunction solar cells and modules by design and process innovations

NextBase - Deliverable report

D9.1 First Report on Global Cost Evaluation of NextBase Technologies

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Publishable summary

The objective of this work package is to economically and ecologically assess silicon heterojunction interdigitated back-contacted (SHJ-IBC) solar cells. This global task will include both a cost and life cycle analysis of SHJ-IBC solar cells, considering not only the solar cell, but at the end the whole system integration for such specific products (LCOE estimation).

The purpose of this 9.1 deliverable is to show progress firstly in the cost evaluation of silicon heterojunction interdigitated back-contacted (SHJ-IBC) solar cells. Indeed, this technology induces additional process complexity to be able to localize active layers on the back side of the cell, but also allows much higher cell and module efficiencies. All these aspects have to be taken into account in order to evaluate the overall production competitiveness of SHJ-IBC.

This evaluation has been achieved using a cost model developed by CEA INES within the context of the NextBase project. This model has been adapted from initial standard double side contacted SHJ one, and takes estimates on the bill of materials (BoM), capital expenditures (CapEx), staffing, operational expenditures (OpEx) as well as the scrap rate, the line throughput and the final efficiency of the solar cells and modules produced to output a cost of ownership (CoO) for SHJ-IBC Solar cells.

Some assumptions about the manufacture of SHJ-IBC solar cells needed to be made to perform the initial analysis. Here we assume that a **500MW plant is installed in Europe**. Current-day (2018) estimates are used to determine the cost per watt-peak (W_{pk}) of energy produced by SHJ-IBC modules. This is followed by a step by step analysis where we highlight the necessary cost reductions factors/process improvements needed to reach the target price of 0.35€/Wpk defined in the project. The process flow developed by Meyer Burger Research (MBR) in the industrial work package (WP6) is simulated in this work, as it is both the most promising one in terms of both efficiency and industrialization. Throughout the economic analysis detailed in this report, the MBR based SHJ-IBC solar cells are compared to a standard, both side contacted 4-busbar SHJ solar cell.

Surprisingly, the CoO of SHJ-IBC solar cells is shown to be favourable when compared to standard SHJ solar cells even without considering any efficiency gain from moving to the IBC configuration. This is primarily due to the decrease in use of ITO in the IBC configuration, along with slight reduction in silver paste consumption. However, SHJ-IBC modules remain up to now more expensive at a given cell efficiency than standard SHJ modules, because of the additional process complexity (two polarities to connect independently on the same side of the cell). In order to be cost competitive, SHJ-IBC modules need to be around 1.5% more efficient than an equivalent standard SHJ module.