Automated photovoltaic cell and Module industrial Production to regain and secure European Renewable Energy market

Rendicontazione

Informazioni relative al progetto

AMPERE

ID dell'accordo di sovvenzione: 745601

Sito web del progetto

DOI
10.3030/745601

Progetto chiuso

Data della firma CE
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30 Aprile 2020

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SOCIETAL CHALLENGES - Secure, clean and efficient energy

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€ 26 557 003,75

Contributo UE
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Coordinato da
ENEL GREEN POWER SPA
Italy

Questo progetto è apparso in...

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Periodic Reporting for period 2 - AMPERE (Automated photovoltaic cell and Module industrial Production to regain and secure European Renewable Energy market)

Periodo di rendicontazione: 2018-11-01 al 2020-04-30

Sintesi del contesto e degli obiettivi generali del progetto

Worldwide, photovoltaic energy is rapidly becoming a pillar of the energy transition as it is a secure, competitive and sustainable source of energy. Despite the fact that European Union is setting out ambitious goals in the framework of Strategic Energy Technology Plan (SET plan), the rapid growth of the PV market in Europe has not resulted in a recovery of the EU PV value chain manufacturing capacity.

Thankfully European players have still strong resources: the unique AMPERE consortium merged the technological competences on PV developed by research institutes, with the manufacturing know-how of key EU companies in the sector, from materials and equipments manufacturers to energy producers.

The aim of AMPERE was to produce heterojunction technology (HJT) silicon solar cells and modules, as HJT is a very attractive candidate in terms of both performances and module reliability. HJT solar cells are intrinsically bifacial with high ratio between back side and front side efficiency. This feature, coupled with reduced losses, due to low temperature coefficient, enable to achieve higher annual energy production and hence significantly lower energy production costs than conventional technologies.

The technologies developed in the project represent an innovation with respect to the market situation and with respect to the current practice in Industry. The major project impact has been to demonstrate the competitiveness of entire EU PV value chain, through the set-up of an innovative full-scale automated 200 MWp/year manufacturing line at the EGP in Catania, successfully qualified and started in 2019. The project responded to the EU requirements to support a sustainable growth addressing all the pillars of the sustainability concept: People, Planet and Profit. Technical, Economic, Social and Environmental sustainability of the technology and of production line have been assessed, demonstrating the sustainability of first GWp factory in Europe in 2022.

Lavoro eseguito dall'inizio del progetto fino alla fine del periodo coperto dalla relazione e principali risultati finora ottenuti

In the AMPERE 3 years timeframe, three Work Packages managed the non technical activities: the project management and coordination; the project cost-benefit analysis, demonstrating project cost competiveness and assessing the social environmental and economic sustainability; the project exploitation, developing the business models and industrial prospective scenarios and assessing the GW scaling up.
AMPERE Dissemination and Communication Work Package promoted internal workshops, project meetings, International Conferences participation, publications with high impact factor and managed the communication activities, through AMPERE website, Facebook and LinkedIn pages, and a Youtube video channel. AMPERE organized in November 2019 an European workshop to show its main achievements; and two Training and School stages at CEA-INES in 2018 and at EGP-3SUN in 2019. Press Releases have been produced and the news relaunched by more than 100 among radio, TV, newspapers and sectorial magazines.
Four core technical work packages developed HJT innovative solutions, covering the whole HJT Module process fabrication, from silicon manufacturing to cell and module manufacturing processes, as well as materials and new design concepts. All the efforts concluded in outstanding efficiencies produced by different partners directly transferable or already transferred to industry, demonstrating the technology efficiency and cost advantages and showing the path for the next generation of HJT in Europe.
The main highlight was the installation and ramp-up of EGP Catania HJT cell and module production line, fully automated and optimized in terms of performance, qualified in the second half of 2019, and currently in production ramp-up to its maximum nominal capacity of 200 MWp/y. Customized automation tools and manufacturing equipment have been designed and qualified, fulfilling the HJT challenging specificities. In order to measure and improve the product qualityand the production line performance, in terms of efficiency, throughput and scrap, innovative Manufacturing Execution System and Advanced Statistical Process solutions have been deployed.
Reliability tests and simulations have been performed to evaluate the long term impact of these new concepts. The validation of material selection has been demonstrated via outdoor monitoring in two sites in Italy and France, to evaluate performances in different climates, demonstrating the superior production of HJT modules. Various models have been developed to predict the module degradation.

Progressi oltre lo stato dell'arte e potenziale impatto previsto (incluso l'impatto socioeconomico e le implicazioni sociali più ampie del progetto fino ad ora)

The rebirth of a new photovoltaic industry has been demonstrated by Enel Green Power in its innovative production site in Catania-Italy.
AMPERE showed the HJT potential cost and performance competitiveness, targeting a LCOE reduction of at least 15% if compared to conventional PV mc-Si technology. Basing on financial estimations and on manufacturing line first results the project delivers the roadmap for the exploitation

at GWp level.
Moreover, many AMPERE developments in PV technology can be highlighted: the industrialization of innovative wafer technologies, the qualification of innovative HJT cell processes, module innovative materials and new module designs. Innovative equipments and highly automated systems for PV industrial manufacturing line, including Advanced Process Control and Manufacturing and higher TRL developments have been successfully developed and transferred to the manufacturing line, whereas other promising ones are ready for industrialization phase beyond the project.
The evolution of the certified records on full wafer solar cells has been impressive: R&D efficiencies in industrial environment over 24% were obtained by Research Centers, whereas EGP demonstrated HJT Technology outstanding capability of industrial production of cells at >23.5% Efficiency and module at >20% power (measured in standard conditions).
During the project execution some different HJT PV module designs have been certified. An outstanding PV module lifetime of at least 30 years has been demonstrated, leading to a reduced cost and climate change impact compared with PV market mainstream technologies. A significant project outcome, proving AMPERE module reliability, is the TÜV Rheinland certification of AMPERE Final Generation Module, enabling its fabrication and commercialization by EGP in its production line.
Moreover, the project developed innovative procedures for performance measurement and reliability testing of bifacial PV Cells and Modules, highlighting the advantages of AMPERE technologies.
Innovative mathematical models to calculate the module losses of a certain technology and the energy yield on a specific location, and Bifacial PV Systems producibility have been developed and tested.
Several measures were taken to reduce the industrial costs, giving in the same time important contribution on the environmental and social impact: use of thinner wafers, reduction of Critical Raw Materials consumption (In, Ag, etc.), reliability improvements, efficiency increase.
The important development of HJT market and the synergistic ecosystem between the research world and the entrepreneurial side will facilitate the process of new job creation in the future, and allowed to secure and create more than 200 jobs presently. Moreover, the result of 3 years of cooperation pave the way to future projects or collaborations between partners at EU and local level, aiming to develop innovation beyond the project.

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