NANOSOLARCELLS

LEAP-RE

Long-Term Joint EU-AU Research
and Innovation Partnership on Renewable Energy

The LEAP-RE project has received funding from the European Union's Horizon 2020 Research and Innovation Program under Grant Agreement 963530.

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Consortium

Project coordinator:
- Conchi Ania (*aka* Maria Concepcion Ovin Ania), CNRS-CEMHTI, **France**

Project partners:

- Unité de Développement des Equipements Solaires, UDES (**Algeria**)

- Mansoura University, MU-EG, (**Egypt**)

- Cadi Ayyad University, IMED (**Morocco**)

- Gheorghe Asachi Technical University of Iaşi (**Romania**).

Aim of the project

NANOSOLARCELLS aims to increase the efficiency of conventional photovoltaic solar cells by incorporating photonic down-conversion layers based on photoemissive nanostructured materials (carbon nanostructures and polymers). Such photonic layers are capable of harnessing such UV fraction of sunlight and can be easily implemented on existing PV cells. We expect and overall conversion efficiency increase between 2-3%, due to a better exploitation of the solar spectrum.

NANOSOLARCELLS will integrate these materials in electrodes of large dimensions to evaluate the performance in real conditions (outdoor illumination). The materials will be tested for durability in aggressive environmental conditions in African countries.

Relevance vs MARs

NANOSOLARCELLS focuses on Topic 1 "Mapping joint research and innovation actions for next-step development of RES and integration of RES in sustainable energy scenarios" of Pillar 1 within PRE-LEAP-RE. We propose to develop a sustainable and endogenous system for renewable electricity production based on the conversion and efficient harvesting of solar UV photons by means of radiative processes occurring in photoemissive materials.

The challenge is to integrate theses up-conversion layers in existing solar cells, optimizing the parameters of sustainability, effectiveness, and performance in aggressive environments (e.g., stress imposed by high UV radiation high temperature, atmospheric pollutants, rain, dust, wind, etc).

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Key challenges addressed by the project

1. *Solar UV photonic down-conversion based on photoemissive materials.*
2. *Establish the best operative parameters of photonic conversion layers to incorporate them on current layout of commercial solar cells*
3. *Assure low cost of the photonic conversion layers (based on local precursors)*
4. *Exploring aging mechanisms as a function of exposure to UV radiation,*
5. *Durability of devices in aggressive environmental conditions (e.g., dust, high level of irradiation) in African countries.*

Expected results :

- ***Mid-term expected results (end 2023)***
  - *To achieve at least 3% increased efficiency of hybrid solar cells*
  - *To construct a prototype of hybrid solar cells for long-term operation and validation of the approach*
  - *To contribute to train young researchers in a multidisciplinary environment (joint PhD thesis; exchange of masters & postgraduates)*
- ***End of project expected results (2025)***
  - *To achieve at least 10 % increased lifetime*
  - *To achieve al least 5 % reduced cost of solar energy or solar module*
  - *To improve the stability of the cells in outdoor conditions and harsh environments compared to conventional cells.*

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Expected outcomes in case of success of the project (2030)

What could be the impact of the project at 2030 on the economy and/or society in case of scaling up the results of the project ?

- *To achieve at least 10 % increased lifetime of solar cells with the coating layers*
- *To achieve al least 5 % reduced cost of solar energy of solar modules with our coating layers.*

Which main risks of failure during project implementation ?

Describe the main risks identified for project implementation

1. *Low down-conversion efficiency of the nanostructured materials to be used in the coating layers*
2. *Coating layers are not stable/compatible with electrodes of solar cells*
3. *Incorporation of the active materials in the coating layers do not significantky reduce the cost of solar modules*

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Contribution of the project to AU – EU R&D cooperation

Innovation: provide new solutions to exploit the enormous energy potential in Africa

Capacity building: (i) skill transfer through training of personnel; (ii) favoring the use of local renewable sources (local circular economy).

Cooperation: know-how share: towards energy transition in Europe and Africa, providing energy access in isolated areas.

Interest of Consortium members in participating in LEAP-RE clustering activities

Which thematic (MARs technologies…) or methodology (modelling, on site experimentation…) members would be interested to share with other LEAP-RE projects ?

Topic 1: Mapping joint research and innovation actions for next-step development of RES and integration of RES in sustainable energy scenarios

Topic 3: Smart stand-alone systems