



“Innovative and sustainable materials solutions for the substitution of critical raw materials (CRM) in the electric power systems, in particular CRM in materials used in photovoltaic cells”



Grant Agreement: H2020-NMBP03-2016-720907

D6.2. Project Website



Grant Agreement no: 720907	Project Acronym: STARCELL	Project title: <i>Advanced strategies for substitution of critical raw Materials in photovoltaics</i>
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Introduction

This deliverable describes the **STARCELL** website (www.starcell.eu), which is a key point to disseminate the main project outputs, such as scientific results and linked events (i.e. seminars, workshops & open days), providing at the same time relevant data about the project scope and involved partners and stakeholders.

An eye-catching and attractive design of the web page is very relevant for enticing possible visitors. In this sense, the website was inspired in the colours and design of the **STARCELL** logo. An external professional designer was selected to carry out the design on the basis of the best value for money approach in agreement with the tendering procedures of IREC. From now on, the website contents will be maintained and regularly updated by the Project Coordinator.

The preliminary structure of the website, which is described in detail in this document, includes the following sections:

- *About*
- *Partners*
- *News and Events*
- *Publications*
- *Public Documents*
- *Useful Links*
- *Contacts*

The website has been first launched on 23rd January 2017, in parallel to the kick-off meeting of the project. It is expected that it will be regularly updated, being online for at least two years after the end of the project. In Figure 1, an schema of the design of the website is presented.

Finally, it should be pointed out that in the lowest right hand part of the website a private access to the “Partner Zone” is available, for an easy access to the intranet section that is still under construction. The intranet contents will be described in the deliverable D7.3 at month M3 (March 2017).

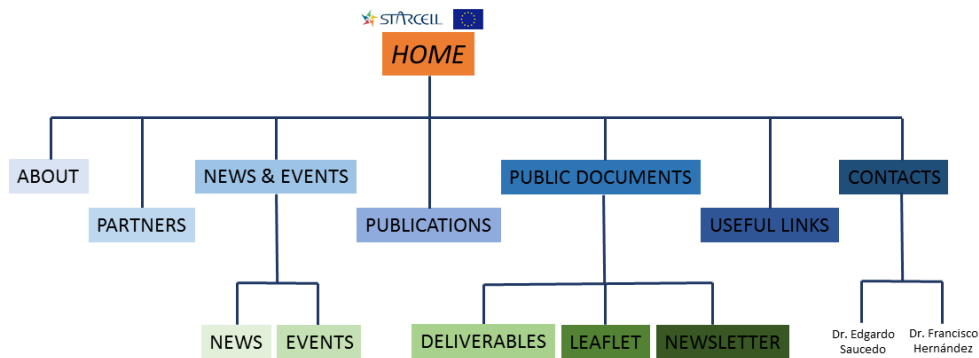


Fig. 1. Schema of the design of the STARCELL webpage.

Structure and Content of the Website

In this section, the contents of the public web are briefly presented.

Home

The “Home” section provides the necessary links for an easy navigation through the site, and the most relevant information about the project. This later includes the project and partners logos, acknowledgements to the European Commission for the given support, and access to STARCELL’s *Twitter* and *LinkedIn* profiles.

STARCELL: ADVANCES STRATEGIES FOR SUBSTITUTION OF CRITICAL RAW MATERIALS IN PHOTOVOLTAICS

STARCELL will develop a cost effective material to substitute CRMs in PV technologies, based on earth abundant elements with very low toxicity.

Imperial College, HZB, EMPA, CCA, IMREC, MIRA, COURSE, ANST, DLR

Fig. 2. Upper-front end of the “Home” section of the STARCELL website



NEWS

STARCELL Project (H2020-NMBP-03-2016-720907) organizes the Kick-off Meeting on next 24th and 25th of January in the COST Association Building in Brussels, Belgium



STARCELL will organize the Kick-off Meeting on next 24th and 25th January 2017 in the Headquarters of the "Generalitat de Catalunya" in Brussels, Belgium.

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- ▶ NEWS & EVENTS
- ▶ PUBLICATIONS
- ▶ PUBLIC DOCUMENTS
- ▶ USEFUL LINKS
- ▶ CONTACTS
- ▶ PARTNER ZONE

Fig. 3. Bottom-front end of the "Home" section of the STARCELL website

About

In this section, a brief description of STARCELL is shown listing the main Innovation activities and objectives proposed in the project, together with the conversion efficiency roadmap. This part is presented in an eye-catching manner, using attractive schematic representations. Besides, the details of the different work packages are also included, with the contact details of the WP leaders.

ABOUT STARCELL

Photo credit: one of the main technologies to achieve the targets defined by the EU Energy Roadmap 2050, to reduce the greenhouse emissions to 80% below 1990 levels, and increase the share of renewables in energy production to 70%. In addition, the first PV technologies will be at low temperature in the future integration of PV in residential and industrial commercial buildings (BIPV) as well as in the automotive sector (APV). This first PV production technology can be used in the future as a base for other PV technologies (such as thin-film, heterojunction, and tandem) and as a base for other PV technologies (such as thin-film, heterojunction, and tandem) and as a base for other PV technologies (such as thin-film, heterojunction, and tandem).

STARCELL ROADMAP

STARCELL integrates fundamental studies of material synthesis with the most advanced cell and module fabrication techniques, including validation of the technology in a relevant industrial environment, and the definition of the steps to reach the market. In short, the project proposes a multidisciplinary working concept based on 4 pillars with an ambitious but realistic efficiency goal map.

Year	Cell efficiency (%)	Module efficiency (%)
2016	12.6%	11.8%
Year 1	15.0%	13.5%
Year 2	17.5%	15.5%
Year 3	20.0%	17.5%

STARCELL TARGET

Optimize materials, processes and devices to achieve a stable solar cell with 18% efficiency (20% at the module level) at a competitive cost of 0.25 \$/Wp.

STARCELL builds on the successful foundations of the knowledge and experience of the project partners, all of them with a high level of reliability and commitment. The consortium has been designed with a very good balance between academia and industry, and each partner brings to the project unique and highly necessary expertise skills. Moreover, STARCELL was conceived to consider economic optimization, and from the beginning the consortium was built with the aim to cover the whole value chain, from the more fundamental aspects relating with basic properties of the materials, to the most applied ones solving problems related to PV devices, and finally considering the key aspects of Future Exploitation of the technology.

ACTIVITIES

WIP1: Scale-up, cells, validation
 WIP2: Device re-design
 WIP3: Recycle PV absorber materials
 WIP4: Materials and Device Simulation
 WIP5: Coordination & Management
 WIP6: Dissemination and Exploitation

OBJECTIVES

STARCELL aims to address two critical issues related to first generation thin film photovoltaic (PV) technologies, via the introduction of innovations in the Cu₂Sn, Zn, Sn, Sb, Se, and Te.

STARCELL MAIN OBJECTIVE

Eliminate all materials classified as CRF from cost effective thin film PV technologies through development and use of earth abundant base materials from Cu, Zn, Sn, Sb, Se, and Te.

STARCELL TARGET

Optimize materials, processes and devices to achieve a stable solar cell with 18% efficiency (20% at the module level) at a competitive cost of 0.25 \$/Wp.

STARCELL builds on the successful foundations of the knowledge and experience of the project partners, all of them with a high level of reliability and commitment. The consortium has been designed with a very good balance between academia and industry, and each partner brings to the project unique and highly necessary expertise skills. Moreover, STARCELL was conceived to consider economic optimization, and from the beginning the consortium was built with the aim to cover the whole value chain, from the more fundamental aspects relating with basic properties of the materials, to the most applied ones solving problems related to PV devices, and finally considering the key aspects of Future Exploitation of the technology.

Fig. 4. Views of the "About" section with different schemes about scientific objectives, roadmaps and work packages.



WP1. CRM-free PV absorber materials

WP1 is divided into 5 tasks to address main absorber challenges through the study and modification of the material's intrinsic properties, improving the current electrical and transport charge parameters toward values comparable to those reported for CIGS. Task T1.1 is dedicated to the optimization of reactive thermal processes; task T1.2 to the analysis of the impact of order/disorder effects and to propose possible technological solutions; task T1.3 is devoted to the analysis of extrinsic doping of the material; task T1.4 deals with the introduction of graded band-gap concepts; and finally task T1.5 gives support to all the previous tasks with the required advanced characterization methodologies. The main targets of this WP are:

- › Increase the **minority carriers life time** to values larger than **20 ns**
- › Reduce the **deep defect density** below **10^{13} cm^{-3}**
- › Reduce the **Urbach Energy** below **20 meV**
- › Increase the **minority diffusion length** to values larger than **5 μm**

WP1 Leader contact details:

Dr. Marcel Placidi (IREC)
e-mail: mplacidi@irec.cat
Tel.: +34 933 56 26 15

Fig. 5. Example of the WP1 description

Partners

This section contains the general description of the 13 partners involved in STARCELL. The details of the institutions and scientific groups, the contact details of each one, and their specific contribution to the project are clearly given with a direct link to the own websites. The aim is to raise the public awareness about the contributions of the partners to the project as well as their background in the associated technologies.



PARTNERS



IREC

Country: Spain
Main Role: Coordinator, Absorber, Interfaces, devices.
Principal Investigator: Dr. Edgardo Saucedo / E-mail: esaucedo@irec.cat

The Catalonia Institute for Energy Research, IREC (Institut de Recerca en Energia de Catalunya) was founded in 2008, and began its R+D activities in 2009. Since then IREC has been involved in several European and industrial projects. The main efforts of IREC have been centred on the improvement of the industrial competitiveness, not only by bringing new knowledge on materials science, physical chemistry of processes, heat and mass transfer phenomena, electrical and electronic engineering for energy devices and systems but also on transferring knowledge and technologies to disruptive innovations for relevant novel energy systems and smart energy management models increasing efficiency of the used energy.

The Group of Solar Energy Materials and Systems (SEMS), headed by Prof. Dr. Alejandro Pérez-Rodríguez (aperez@irec.cat) belongs to the Area of Advanced Materials for Energy of IREC. The SEMS Group has a strong know-how and experience in the synthesis of kesterite semiconductors and a deep expertise in the development, fabrication and characterization of kesterite based PV devices, being one of the three leading European groups reporting the highest kesterite efficiencies without the use of hazardous compounds.

The main role of the IREC-SEMS group in STARCELL will be centred in the development of materials solutions for high efficiency kesterite based solar cells including investigation of doping strategies and alloying routes, the optimisation of the absorber/back contact interface, the modification of thermal routes, etc.

[Visit website >>](#)

Fig. 6. Example of the information presented in the Section Partners.



News and Events

This section is specifically designed for the dissemination of the most relevant news related to STARCELL; project meetings, events, relevant scientific results, scientific publications, and others. In the right part of the screen, the three latest releases are displayed, while in the left hand of the section the most relevant events organized in the frame of the project are highlighted, such as workshops with pre-registration, seminars and conferences.

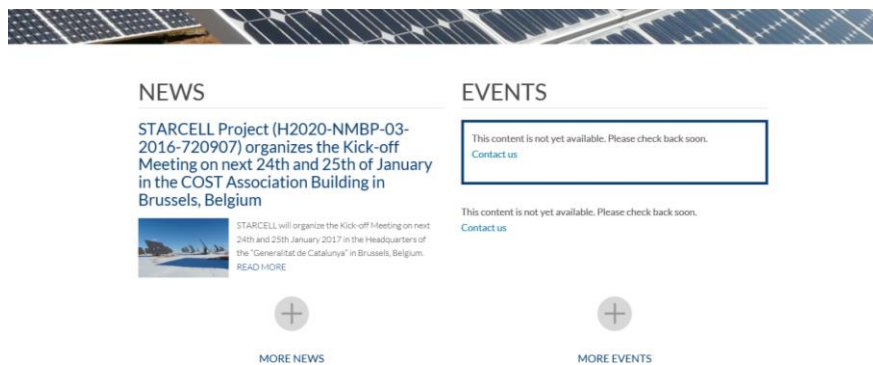


Fig. 7. Screenshot of the “News and Events” section

Publications

In this section, the complete list of scientific publications done during the project will be public. For those ones selected for “Open Access”, the manuscript will be available for downloading.

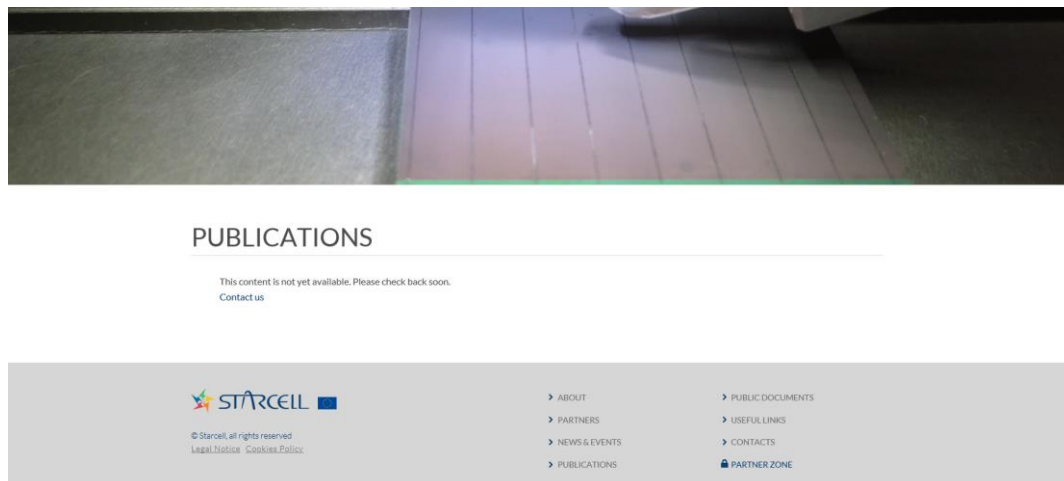


Fig. 8. General view of the “Publications” section



Public Documents

This section provides a link to the public documents (not scientific publications) available at STARCELL website; (i) Deliverables labelled as Public, (ii) Promotional leaflet and (iii) up to 4 Newsletters produced during the project implementation.

PUBLIC DOCUMENTS

DELIVERABLES LEAFLET NEWSLETTER

List of Deliverables

Del. #	Del. Name	WFP	Lead partic.	Type	Del. level	Del. Del.
DL1.1	Reactive thermal annealing procedure for optimal absorber with improved electrical and charge transport properties	1	IREC	R	CO	12
DL1.2	Demonstration of kesterite absorbers with reduced band tailing ($I_{sc} > 20 \text{ mA/V}$) (M12)	1	IMRA	R	CO	18
DL1.3	Optimized alkaline etching processes allowing accurate control of carrier concentration in the range 10^{18} - 10^{19} cm^{-3}	1	EMPA	R	CO	24
DL1.4	Demonstration of a Cu -graded band gap with: rear band gap in the range of 1.5-1.7 eV, bulk band gap in the range of 1.3-1.6 eV, and front band gap in the range of 1.3-1.5 eV	1	CEA	R	CO	24
DL1.5	Demonstration of CZTSSe absorber with minority carrier lifetime $> 20 \text{ ns}$, defect density $< 10^{17} \text{ cm}^{-3}$, and minority diffusion length $> 7 \mu\text{m}$	1	HZB	R	CO	30
DL2.1	Report on new material strategy for back contact optimization	2	EMPA	R	CO	30
DL2.2	Report on impact of new materials and processes optimization for Cd-free buffer layers	2	CEA	R	CO	24
DL2.3	Report on efficiency of surface passivation for Kesterite solar cells	2	IREC	R	CO	18
DL2.4	Report of the structural characterization activities at front and back interfaces in Kesterite solar cells	2	UJ	R	CO	36
DL2.5	Demonstration of CZTSSe based device with $R_{sh} < 0.4 \text{ m}\Omega/\text{cm}^2$, $R_{sc} < 4.6 \text{ k}\Omega/\text{cm}^2$ and Voc deficit at the same level of CHG high efficiency devices ($< 400 \text{ mV}$)	2	IMRA	R	CO	24
DL2.6	CZTSSe based solar cell with Cd-free buffer layer and efficiency exceeding 18% in small area (0.2 cm^2)	2	EMPA	DEM	PU	24
DL3.1	Equilibrium phases diagram including all known phases	3	ICL	R	CO	18
DL3.2	Report on the role of disorder in kesterite solar cells	3	ICL	R	CO	24
DL3.3	List of most promising alternative absorber materials	3	ICL	R	PU	30
DL3.4	Report on surface / interface states and recombination	3	ICL	R	CO	24
DL3.5	Development of a 2D model for the simulation of kesterite based solar cells. Benchmarking with devices developed in WFP	3	MLU	R	CO	24
DL3.6	Implementation of band-gap grading concepts in the solar cell simulation tools	3	CEA	R	CO	30

Fig. 9. Main characteristics of the section Public Documents

Useful Links

In this section, other relevant links to websites linked to STARCELL are displayed.

USEFUL LINKS

Links to the websites of partner institutions

- www.irec.cat
- www.cea.fr
- www.empa.ch
- www.cea.es
- www.impra.ac.uk
- www.helmholtz-berlin.de
- www.uzf-halle.de
- www.cea-europe.com
- www.mldummer.de
- www.irec.es
- www.unica.com
- www.ahf.gy.jp
- www.dtu.dk

STARCELL

IREC | IMRA | EMPA | UJ | HZB | ICL | MLU | CEA | CEA-EUROPE | MLDUMMER | UNICA | AHF | DTU


Fig. 10. Main view of the section "Useful Links"




Contacts

The final section of the STARCELL webpage includes the contact information of the Project Coordinator (Dr. Edgardo Saucedo, IREC) and the Project Manager (Dr. Francisco Hernández Ramírez, IREC).


CONTACTS

Project coordinator:
 **Dr. Edgardo Saucedo**
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Fig. 11. Main characteristics of the section “Contacts”.