

## FP7-CHEETAH PROJECT KNOWLEDGE EXCHANGE PORTAL: AN ADVANCED TOOL TO EFFICIENTLY BRING INFORMATION TO THE EUROPEAN PHOTOVOLTAIC RTD COMMUNITY

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**ABSTRACT:** FP7-CHEETAH is a combined collaborative project (CP) and coordination and support action (CSA) funded under the European Commission's 7th Framework program and coordinated by ECN, NL with the aims to solve specific R&D issues and to overcome fragmentation of European PV R&D by intensifying the collaboration between R&D providers and industry to accelerate the industrialization of innovations. The project is also tightly linked to the EERA-PV Joint Program. The CHEETAH Knowledge Exchange Area Portal (KEAP), in parallel to the project web site and other dissemination activities (newsletter, communication, etc), constitutes the pillar of the project to distribute information in a uniform and simple way. It is based on several very efficient ICT procedures by operating from the collection to management of information by dynamic data base matrix: any uploaded information is linked to all others. All interested browsers/readers can have efficient access to any stored data thanks to the utilization of a search engine/query keywords and user friendly graphic interfaces. Based on the implementation of SOPHi@webinar platform, the portal also offers its own e-learning platform.

CHEETAH KEAP represents for its peculiarities a major breakthrough in the field with highly innovative contents and a substantial improvement in comparison with the state of the art of knowledge exchange on PV RTD.

**Keywords:** E-Learning, Education and Training, Dissemination, Qualification and Testing, Stability, PV Technologies

## 1 INTRODUCTION

FP7-CHEETAH "*Cost-reduction through material optimisation and higher Energy output of Solar Photovoltaic Modules - joining Europe's research and development efforts in support of its PV Industry*" coordinated by ECN, NL is a combined collaborative project (CP) and coordination and support action (CSA) funded under the European Commission's 7th Framework program with the aims to solve specific R&D issues and to overcome fragmentation of European PV R&D by intensifying the collaboration between R&D providers and industry to accelerate the industrialization of innovations. The project is also tightly linked to the EERA-PV Joint Program.

The CHEETAH Knowledge Exchange Area Portal (KEAP), in parallel to the project web site and other dissemination activities (newsletter, communication, etc), constitutes the pillar of the project to bring information from different sources in a uniform and simple way to any interested CHEETAH partner and external organization on availability of infrastructures, equipment, expertise, technical documents.

CHEETAH KEAP operates from the collection of availability of expertise/infrastructure (supply site), to its elaboration (management) and its final offer to project partners (demand site) by utilizing user-friendly dedicated tools having a very effective potential to share expertise.

The web portal operates as a dynamic data base matrix: any uploaded information is dynamically linked to all others by logic connections that allow access to any individual information as well as to information

already uploaded by improving the informative content (Available equipment? Expertise? Where are they located? Who could I contact? etc).

It is also based on the utilization of structured cataloguing criteria applied to PV technologies/PV RTD topics and CHEETAH involved organizations.



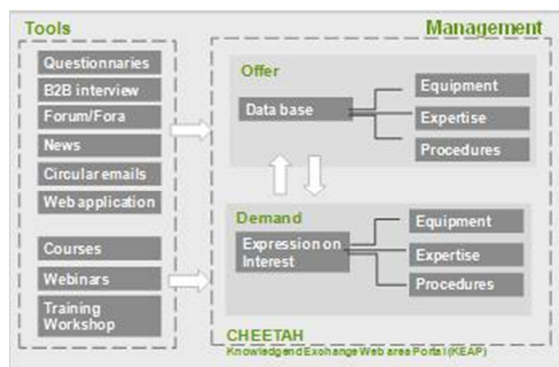
**Figure 1:** FP7-CHEETAH project web site (<http://www.cheetah-project.eu>) and CHEETAH Knowledge Exchange Area Portal (KEAP) web site (<http://www.cheetah-exchange.eu>)

All interested browsers/readers can have efficient access to stored data thanks to the utilization of search

engine/query keywords used in connection with the more diffuse and efficient ICT procedures and user friendly graphic interfaces.

From this point of view, the procedure to collect and offer information to CHEETAH partners and other project consortia represents a major breakthrough in the field with highly innovative content and a substantial improvement in comparison with the state of the art of knowledge exchange on PV RTD and it makes CHEETAH KEAP unique in its approach.

Furthermore, based on the fruitful results and experiences of SOPHi@Webinar, the internal e-learning platform of FP7-SOPHIA project, CHEETAH KEAP developed its own e-learning platform, which is proposing online courses/seminaries/guest lectures and, for the first time, also live experiments in parallel to more conventional training initiatives held physically.



**Figure 2:** CHEETAH KEAP Rationale

## 2. CHEETAH KEAP Rationale and organization

The strategic goal of CHEETAH is on the one hand, to identify currently running technical-scientific needs of the European PV RTD sector and, on the other hand, to establish the best way of taking profit from the strength owned by each CHEETAH partner in terms of facilities and expertise, in order to improve collaboration inside the European PV Research and Industrial community. This goal is the practical translation of the objective of EERA.

CHEETAH KEAP define the facilities and expertise needed to achieve those goals based on a multistep process (see figure 2).

### 2.1 Collection of information

Information on partners knowledge needs is realized by circulating questionnaires, business-to-business interviews, discussion among partners by fora/circular emails, and news. It is further elaborated in connection with other parallel initiatives launched by the European and international photovoltaic community such as PV road maps [3,4,5,6]

### 2.2 Knowledge necessities: demand side

The CHEETAH knowledge exchange necessities inventory is based on assuming that for each of the indicated topics (PV Technologies, PV RTD topics, Equipment) the interest shown by each respondent is strongly influenced by his/her role, typology and level of expertise, and clearly involvement in the project. This imposes that the category to which the respondent corresponds needs to be identified at least for statistic

motivations. The following categories of respondent are defined

- i. *Organization Contact points*: they are the respondents for their organization (at all) and they assign the relevance of their organization to the specific topic.
- ii. *WP/task leaders*: they offer evaluation specific for their own field of expertise within the CHEETAH project.
- iii. *Group leader*: they offer an evaluation of relevance of their own laboratory/group of activities, and the elaboration will be based on the coherence of the group they belong to. Just as example it could be the relevance assigned to a specific equipment by a group of laboratories having the same objective
- iv. *Student/younger researcher*: they express the interest of researchers, on specific topic mainly at their initial stage of career.

The elaboration of received questionnaires offers different points of view on the relevance assigned to each topic depending on the role of respondents and it will be also be a very useful tool to be shared towards a global European strategic vision of different categories.

Furthermore, the respondents express actually the intensity of his/her personal interest or on behalf of his/her organization on the specific PV RTD technology/topic/ and/or on the equipment utilization by indicating a score ranging from no-interest (=0) , moderately involved (=1), widely involved (=2) ; to strongly involved (=3).

The collected information takes also in consideration the evolution in time of the specific interest of each researcher/scientist . In fact the respondents assign also a score expressing interest on today, but also in perspective for the short, medium and long term. This offers opportunities to also draw some road map on the evolution of the interest in each specific PV RTD technology/topic.

It has also been evaluated the opportunity to extend the questionnaires outside of the CHEETAH consortium, mainly to improve the population for statistic evaluation and to serve the PV RTD community with useful tools for evaluation of knowledge exchange needs.

### 2.2 Knowledge necessities: offer side

Based on the FP7-SOPHIA experience, this step focuses on the available inventory of infrastructures and expertise and technical/scientific documentation (papers, reports, strategic position documents, etc). It also concerns the development of tools and procedures to optimize the exchange process in order to adequately sustain demand/supply of expertise and infrastructures,

The large number of outstanding research organizations working together via the CHEETAH project can avoid the useless replication of a large number of small efforts by sharing information on the availability of knowledge. The CHEETAH Knowledge Exchange Portal (KEAP) aims at widely distributing information among partners on available expertise, infrastructures, equipment and technical documents, to provide the scientific community with a common data base/catalogue. A list of useful information is associated to each CHEETAH organization (expertise, infrastructures, technical documents, courses, webinars, discussion, news, etc.) and currently uploaded on CHEETAH KEAP web site.

### 2.3 Data elaboration

The detailed and statistic elaboration of information on the main interest in PV technologies, PV RTD topic and equipment of CHEETAH partners is fundamental for several reasons:

- I. In this way the expertise and the experimental facility needs can be evaluated to be shared with the full services available
- II. It can be offered at the European level and the indication of different facilities/equipment could be used for different technological topics
- III. Experts, students stages and courses/webinar can focus on the field of main interest to optimize depending on constraints on financial budgets and time availability of the experts and participants

### 2.2 Data Management

The core of data management is represented by the CHEETAH KEAP web site.

It uses the same graphic frame as the main project web site, but it is based on a different ICT organization. In fact the content is periodically revised and implemented on daily/weekly/monthly basis to adapt the web portal to new necessities of information on PV RTD fields/topic cataloguing/search criteria.

The updating process isn't just an updating of information content but it deeply involves the development of new procedures and new and advanced ICT tools. For that reason CHEETAH KEAP cannot be managed by utilizing the main project web site, but it needs to exploit a dynamic ICT environment that is totally different from any conventional html web site approach for the following motivations:

- All key participants are directly involved in the process and in real time, as it usually happens in exchange web site like linked-in, research-gate, google-scholar.
- It offers a more user-friendly shorthand approach . The technical/scientific content among WP/task leaders, webmaster and end-users and the scientists/researchers/experts/students interested in accessing the information are defined by focusing mainly on technical aspects and their needs, more than formal procedures to approve amendments in web site content, as it is typically requested by any "official" project Web Site,

The utilization of a different area also reduces any technical ICT difficulty which could be caused to the main project web site by the very frequent revision/maintenance/implementation requested by very frequent periodical updating.

## 3. CHEETAH KEAP WEB SITE DESCRIPTION

In the following paragraph we summarize information on the main facilities offered by the CHEETAH Exchange Area web portal by leaving to the browser/reader the opportunities to directly access them by browsing on the web site

### 3.1 CHEETAH KEAP PV Technologies

Photovoltaic (PV) technology steadily progresses thanks to both research and development at laboratory level and the technological deployment and experience from the market place. Research and Development – "R&D" – is crucial to sustain in mid and long-terms the further

development of PV technology. Performing joint research addressing well-chosen issues plays an important role in achieving the critical mass and effectiveness required to meet the sector's ambitions for definitive technology implementation and industry competitiveness,

Following indications of the "Strategic Research Agenda for Photovoltaic Solar Energy Technology" EU PV Technology Platform and indications of CHEETAH experts, a range of technologies and topics has been determined the development of which is expected to significantly contribute to reach the overall targets and can be the objective of knowledge exchange:

- cSi Wafer Based Technology
- Si Ultrathin Wafer development & Ribbon
- TFSi-Thin Film Silicon
- CIGSS- Copper indium gallium diselenide
- CdTe-Cadmium telluride
- Emerging/Novel Inorganic, Hybrid PV Materials & Nanotechnologies (Perovskite, Kesterite, quantum dot/quantum wire SC, Intermediate band SC, etc)
- Organic Photovoltaics
- DSSC- Dye Sensitized Solar Cells
- Material and Device Characterisation
- Materials, devices, system modelling
- PV Module realization & Development
- PV Module qualification & testing
- PV Components, Systems & Interface to grid
- CPV Concentration Photovoltaics
- BIPV Building Integration Photovoltaics
- Education & training
- Socio-economic aspects & market
- Environmental impact, waste reduction and recycling
- PV RTD Networks, coordination of research efforts, strategy and PV RTD projects management

The CHEETAH Knowledge Exchange portal uses them as the base to catalogue the offer/demand among consortium partners of requested expertise, infrastructures, equipment, courses, technical documents, by promoting further development of knowledge in the same field of interest also outside of the consortium.



**Figure 3 - PV RTD TECHNOLOGIES web page**  
[http://www.cheetah-exchange.eu/pv\\_technologies.asp](http://www.cheetah-exchange.eu/pv_technologies.asp)

### 3.2 PV RTD TOPICS

Based on the CHEETAH catalogue of main PV RTD Technologies, a list of relevant R&D topics is proposed for the main existing technologies. The main R&D topics per technology area are summarized in the CHEETAH web site and consist of around 120 topics ranging from



basic science to applications.

It is a tentative list that is dynamically updated following the indication of CHEETAH experts. The PV RTD Topic can be sorted by utilizing different criteria. To each specific PV RTD topic is associated, when applicable, the list of available CHEETAH experts, infrastructures, equipment, courses, technical documents with the aim of intensifying the collaboration and the knowledge sharing among CHEETAH R&D providers.



**Figure 4:** PV RTD TOPICS web page  
<http://www.cheetah-exchange.eu/tags.asp>

### 3.3 CHEETAH KEAP: Expertise and infrastructures

The main goal of dissemination of the information on existing infrastructures of the CHEETAH partners is to make available some of the existing top-class PV Research Infrastructures and scientists for the benefit of the whole European photovoltaic community.

This is proposed on the basis of the establishment of reciprocal collaboration framework within funded European Community collaborative projects or in perspective of some projects based on agreements between parties by business-to-business approach or bilateral/multilateral public/private funded project.

The extended database with the description of CHEETAH experts is available to comment/interact on a wide range of PV RTD topics.



**Figure 5** - CHEETAH Infrastructures web pages  
<http://www.cheetah-exchange.eu/infrastructure.asp>

A list is offered in alphabetical order and searching criteria can be utilized by typing names or keywords, such as PV Technology/ PV RTD/Topic/ Involved Organization/ Equipment.

The research facilities are classified according to several criteria (research organisation, technical topic, category of infrastructure) and they are periodically updated. It serves to prevent duplication by stimulating access and to promote future developments in the

circumstance of necessity of demand and lack of availability on the other side.

#### 4. CHEETAH WEBINARS

Based on the success and the fruitful results and experiences of the SOPHi@Webinar, the internal e-learning platform of FP7-SOPHIA, CHEETAH KEAP is also proposing a set of interactive training courses and webinars planned in collaboration with all Joint Research Activity leaders, mobility and international cooperation activities and dissemination, internal-external communication responsables.

Electronic conferencing is very powerful for knowledge exchange. It requires no more than a set of interconnected computers with suitable software and hardware. Participants can connect with conferences and workshops at their convenience, regardless of their time zone and geographical location [7,8,9]-

Web conferencing is time saving, it reduces travel costs, video conferences enhance the possibilities for all to interactively review a subject, allowing them to share efficiently ideas, documents, conclusions and concerns.

There are no limitations on event location and it can be realized by laptops, tablets and mobile phones and can be followed from everywhere.

Involvement of participants can focus on the topic issues of direct interest, saving time from topics in which they are not involved or interested. Storage and streaming of produced output is very useful also to review the informative content. In fact the acquired material (i.e. slides and video presentations ) can be easily distributed by webcasting them even after the event

The targeted audience ranges from 5-10 to maximum 20 participants, for short on line courses, in order to enable a large number of them to effectively interact with experts, up 100-200 participants for lectures.

Very soon the platform will also offer on-line live experiments: scientists/researchers operating in a test site or by remote equipment can interact live with other researchers interested in the characterization/measurements.

#### 4 Web Area Access to non-CHEETAH External partners

The CHEETAH Knowledge Exchange web area Portal is an open source portal open on request to any interested non-CHEETAH organization. Any public, private research centres and universities actively involved in PV energy research and located in the European Union or associated countries can propose its access to CHEETAH KEAP but the elective members are EERA-PV and EU-PV platform partners. Non-CHEETAH partners could be also interested to participate in project activities .

A set of useful information can be uploaded on the web site which is also associated to each external organization (expertise, infrastructures, technical documents, courses, webinars, discussion, news).

Access of the portal to external non-CHEETAH partners has imposed that some special areas of CHEETAH KEAP can be reserved to project partners only. For instance, info concerning maintenance, or some relevant results or information related to the project management.

Access to CHEETAH KEAP is offered by a registration procedure by user name (email) /password. Three different access right levels are arranged depending on the project necessities to access to the information content. The registration procedure offers also the opportunity to collect statistic data (role, gender, nationality, etc) on registered users and the procedure includes also the opportunity to recover forgotten passwords.



**Figure 6.** CHEETAH External partners web Log-in area

## CONCLUSION

The CHEETAH Knowledge Exchange Portal constitutes a very useful tool to bring information from different sources in a uniform and simple way to all CHEETAH and non-CHEETAH partners, as permanent channel fostering the use of existing facilities and Expertise.

It is very useful to identify the current European PV RTD Community's technical-scientific needs and efficiently establish and promote channels and procedures to transfer information among each partner in order to enforce potential and effectiveness of RTD activities held by each organization.

The portal is also accessible to non CHEETAH partners offering them information on the availability of infrastructures, equipment, expertise, technical documents to widely foster the interaction and collaboration among organizations involved.

In addition, the web area provides dedicated tools to share expertise by organizing also on-line meetings, webinars and on-line tests. Such tools have been realized with the aim of promoting individual and collective knowledge exchange actions among experts and trainees from beneficiary organizations. CHEETAH KEAP represents a major breakthrough in the field with highly innovative contents and a substantial improvement in comparison with the state of the art of knowledge exchange on PV RTD.

## Acknowledgement

We would like to thank all CHEETAH members for their continuous support and their contribution in helping to enrich the web site of information and technical – scientific content to make the CHEETAH KEAP initiative possible and successful.

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