EC Grant Agreement n°609788

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

Deliverable

D2.8

Final evaluation of expertise and infrastructure exchange in CHEETAH consortium

and recommendations on how to exploit long term relationships and multidisciplinary collaboration among European RTD Community

WP2 - Fostering the use of existing facilities and expertise

Section 1 – Document Status

Document information

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Document history

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Section 2 – Table of content

Section 3 – Executive summary

Description of the deliverable content and purpose

Knowledge exchange, by transferring information between knowledge source and potential users, enables to bring together academic staff, research organizations, company members open to innovation and wider groups and communities. It allows enhancing mutual profit in learning thanks to complementary skills, and speeds up the achievement of the objectives and the impact of the research by avoiding duplicate or useless work.

For these reasons, CHEETAH project - since its first step - has defined a strategy to identify the current technical and scientific needs of European PV RTD sector. It was followed during all the project progress to foster collaboration among partners, relying on the strengths of CHEETAH partners in terms of facilities and expertise and reinforcing cooperation and synergies among the partners with dedicated measures and tools.

During the first 30 months of activities, CHEETAH focussed on the following actions:

- *Listing of existing research infrastructures* within the entire CHEETAH consortium (D2.1-M6), including a user-friendly selection tool and protocol for their use (D2.5-M12). This list has been updated until the end of the project. D2.2-M30 deeply revised the procedure to access.
- *Knowledge Exchange needs inventory*: in D2.11 report - postponed to M9 – we defined the background among project partners in terms of availability of expertise and infrastructures. For the first time in Photovoltaics, knowledge needs and potential offers have been evaluated by assigning a score/measurable unit.
- *KEP-Knowledge exchange platform*: the definitions of tools and procedures to foster knowledge Exchange by a KEP were provided in D2.16 (M7). Several tools and ICT procedures were developed to foster exchange and sharing, in a more efficient way than any other existing knowledge exchange interfaces; CHEETAH KEP-Knowledge Exchange Platform (formerly KEAP) and its e-learning platform for webinars have been major key stones for the success of CHEETAH project in fostering Knowledge Exchange.
- *Knowledge Exchange Actions plans*: we promoted actions towards exchanges and evaluated the intensity and effectiveness in individual and collective knowledge exchange actions among experts and trainees, so as to further improve the impacts and provide countermeasures if necessary (D2.7-M36).

The objective of this deliverable report (M24-M48) is to focus on the results achieved on expertise and infrastructure exchange particularly during the second half of project (M25-M48) with respect to the previous period (D2.6).

We will analyse the progress towards the main objectives of CHEETAH Knowledge Exchange:

- Number of new proposed research infrastructures;
- Increase of joint access to existing CHEETAH infrastructures and equipment;
- Effectiveness of CHEETAH knowledge Exchange area Portal;
- Quantity of offers of knowledge/expertise exchange (new expert profiles proposed; organization of internal courses/webinars; definition of test procedures and documents, forum / technical information requests / discussion launched among partners on PV RTD hot topics.

The quantity (number) and quality (career position, role in the organization, etc.) of persons participating to the training' offer at different stage of career is a joint KPI with WP3 objective as reported in D3.7-M48 report.

This report also offers indication on how to exploit long-term relationships and multidisciplinary collaboration among European RTD Community.

Brief description of the state of the art and the innovation brought

CHEETAH project proposed a new approach in fostering knowledge exchange, not only because it has proposed several tools to efficiently foster the transfer of technical information and skills (webinar, web platform, experts and infrastructures data base, etc.), but also because the intensity in knowledge exchange has been numerically characterized.

CHEETAH has introduced for the first time in PV RTD the benchmarking of knowledge exchange needs in PV technologies/PV RTD Topics/PV RTD equipment and procedures.

By analysing the access of the users to the platform, we evaluated the impacts that CHEETAH KEP platform had in the dissemination, i.e. a major step forward in the knowledge exchange in the PV RTD sector. These impacts will be still visible after project end, as the platform will be moved to EERA-PV.

We have compared the performance of exchange process during project progress by pushing best practices amongst partners and supporting them in overcoming the difficulties they could meet in transferring skill and information.

During the four years of the project, a collaborative spirit has been created among the partners as demonstrated by the numerous Knowledge Exchange initiatives launched and realized in 2016 and in 2017. The improvement in 2017 of KPI clearly states the achieved results

Finally, regarding the accessing procedures for the RI, a new procedure based on "measurable & credit/debts" approach was proposed and will be experimented in the frame of EERA-PV and other upcoming projects and joint initiatives.

Section 4 – Deliverable report

1. Introduction

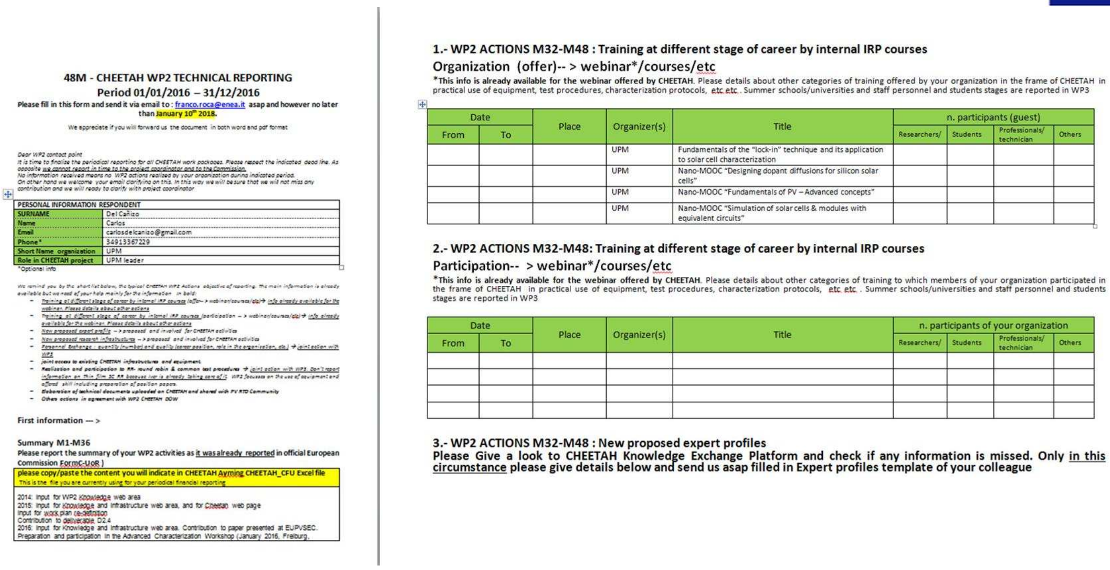
The European Commission is setting up relevant efforts to sustain specific platforms where the European scientific community and European industry can work and innovate together in each branch constituting pillars for the growth and job highlight in Europe.

For these reasons, CHEETAH project - since its first step - has defined a strategy to identify the current technical and scientific needs of European PV RTD sector. It was followed during all the project progress to foster collaboration among partners, relying on the strengths of CHEETAH partners in terms of facilities and expertise and reinforcing cooperation and synergies among the partners with dedicated measures and tools.

The proposed tools and measures developed were based on the two CHEETAH *Action Plans for Expertise and infrastructure exchange* and were continuously implemented during the full duration of the project. The results were monitored according to the Key Performance Indicator characterizing WP2:

- *Increase of joint access to existing CHEETAH infrastructures and equipment*: number of joint actions realized by CHEETAH partners based on Round Robin (RRs) procedures and bilateral/multilateral utilization of the infrastructures (KPI 2.1-- > tight interaction with KPI 2.5.d);
- *Number of new proposed research infrastructures. Inside/outside CHEETAH Project* and improved supply/demand among project partners (KPI 2.2);
- *Effectiveness of CHEETAH knowledge Exchange area Portal* (external and internal IRP partners) (KPI 2.4);
- *Quantity of offers of knowledge/expertise exchange* (KPI 2.5):
  - KPI 2.5.a: new expert profiles proposed;
  - KPI 2.5.b: organization of internal courses/webinars; focused on best practice in characterization and efficient and qualified use of infrastructure equipment;
  - KPI 2.5.c: participation to internal courses/webinars;
  - KPI 2.5.d: definition of test procedures and documents supporting technical position for the best practice in characterization and execution of experiments;
  - KPI 2.5.e Forum / technical information requests / discussion launched among partners on PV RTD hot topics.
- *Quantity (number) and quality (career position, role in the organization, etc.) of persons participating to the offer of training at different stage of career* by internal IRP courses (joint KPI with WP3) is an objective of D3.7 deliverable.

Data were collected using CHEETAH KEP platform and surveys launched among CHEETAH WP2 partners in 2016 and 2017. Last survey was launched on Dec. 29th 2017 to collect information about last knowledge exchange actions in the final part of the project.


1.- WP2 ACTIONS M32-M48 : Training at different stage of career by internal IRP courses

Organization (offer)-- > webinar*/courses/etc

2.- WP2 ACTIONS M32-M48: Training at different stage of career by internal IRP courses

Participation-- > webinar*/courses/etc

3.- WP2 ACTIONS M32-M48 : New proposed expert profiles

Figure 1: Survey launched within WP2 partnership to collect information about Knowledge Exchange Action

2. Increase of new CHEETAH infrastructures

New proposed infrastructures:

Several calls were launched in 2016 and 2017 among CHEETAH and EERA-PV partners to collect the offer of new infrastructures **[ENEA, All partners]**. This was realized by utilizing specific forms.

From the table below, it can be noted how this process has been particularly efficient in 2017 with +46% or RI proposed respect the existing infrastructures in our data base as Dec. 2016 .

Table 1: RI evolution during project years

	Description	2014	2015	2016	2017
KPI 2.2	**Number of new proposed research infrastructures. Inside/outside CHEETAH Project and improved supply/demand among project partners (cumulative number of access per month)**	33	38(+5 +15%))	41(+3+8%)	60(+19+46%)

This success can be mainly ascribed to the improved awareness of CHEETAH partners about the opportunity offered by KEP for the dissemination of the information **[ENEA, all partners]**. This is confirmed as well by the high increase in accessing to CHEETAH KEP Infrastructure web pages as reported in 2017 (+3270%). It is a combination of positive effects produced by the high interest in the CHEETAH webinars and - starting from September 2016 - by the use of more efficient dissemination channels (Linked In, ResearchGate, You Tube, Twitter) **[ENEA]**.

Table 2: CHEETAH KEP accesses evolution during project years

	Description	2014	2015	2016	2017
KPI 2.4	**Quantity of access to CHEETAH knowledge Exchange area Portal (external and internal IRP partners)**	DATA NOT AVAILABLE	Organisations: 7100 access Expertise: 32752 Infrastructures: 440 PV RTD Technologies (NA) PV RTD Topics (NA) PV RTD Equipment (NA)	Organisations 12821 (+81%) Expertise: 58789 (+80%) Infrastructures 652 (+48%) PV RTD Technologies 5897 PV RTD Topics 15890 PV RTD Equipment 10079	Organisations 19221 (+50%) Expertise: 90627(+54%) Infrastructures 21310 (+3270%) PV RTD Technologies 12816 (+117%) PV RTD Topics 31609 (+99%) PV RTD Equipment 20264 (+101%)

New Infrastructures proposed in 2016

CHEETAH INFRA#	Organization	Short name Infra	Description	Location
46	CNRS	iCUBE-MAPECV Research Infrastructures	Synthesis of material Realization of devices (diodes, transistors, memories, solar cells) Characterization and modeling	Strasburg, France
44	ENEA	ENEA-Indoor/outdoor characterization facilities for CPV solar cells. modules and optical elements	Characterization facility for electrical and optical performance analysis of solar cells, CPV modules and optical concentrators components.	Portici, Italy
43	UPM	UPM-CPV Lab test	Indoor/outdoor studies on CPV components (solar cells, module, optical element) in standard test and under different operating conditions, different uniform/non uniform concentrated light , spectrum, and operative temperature.	Madrid, Spain

New Infrastructures proposed in 2017

CHEETAH INFRA#	Organization	Short name Infra	Description	Location
65	CEA	CEA-INES Heterojunction Pilot line	CEA-INES *silicon cell platform* and *Heterojunction Pilot Line* It includes 1200m2 of multi technologies labscale clean-rooms and a 1500m2 50MW pilot line dedicated to the silicon heterojunction (SHJ) technology..	Le Bourget du Lac Cedex | France
2	CEA	CEA-INES Organic & Perovskite PV Module Platform	Platform for development of efficient and reliable organic & perovskite modules for specific applications Ageing behaviour of organic PV cells in accelerated conditions Barrier and ultra-barriers measurements with high sensitivity	Le Bourget du Lac Cedex | France
64	CEA et al	DURASOL Multisite Platform for testing the durability of Solar Materials and Systems	joint platform for testing the durability of solar materials and systems https://www.durasol.fr/ It aim is to increase the durability of any type of solar energy systems	Le Bourget du Lac Cedex | France
51	CENER	CENER-Photovoltaic Cells and Photovoltaic Systems	Characterization of photovoltaic cells and materials Analysis and optimization of production technologies for solar cells Development of photovoltaic cell technologies Consulting in production environments of cells and photovoltaic components	Sarriguren | Spain
58	CIEMAT	CIEMAT- Chalcogenide Lab	Preparation and characterization of thin-film TCOs (ITO, ZnO:Al, SnO2:Sb) and chalcogenides (CIGS, ZnS, SnSx).	Madrid| Spain

CHEETAH INFRA#	Organization	Short name Infra	Description	Location
56	CIEMAT	CIEMAT-Deposited-Silicon-Device Lab (DSD lab	Preparation and characterization of thin-film Si (a-Si, µ-Si) , TCOs, metallizations and interconnections	Madrid| Spain
63	EMPA	EMPA-Laboratory for Thin Films & Photovoltaics	CuIn1-xGaxSe2 – Flexible and Lightweight CdTe Solar Cells Solar cells made from Cu2ZnSn(Se,S)4 and Tandem Cells – Solar devices Alternative Materials and Processes Functional Inorganic Materials	Dübendorf| Switzerland
47	ENEA	ENEA-CHEETAH webinar facility	CHEETAH e-learning platform offers on- line workshop and webinars, on-line tests and experiments, on-line meetings with internal and external stakeholders The facility is open on request also to external users interested to share knowledge	Portici | Italy
57	ENEA	ENEA-PV Smart Laboratory	Characterization and testing of PV modules in indoor/outdoor operation	Portici | Italy
61	ENEA	ENEA-PV system and application lab	Development of device stacks and module structures for low cost, stable and highly efficient OPV	Portici | Italy
55	IFE	IFE Solar Cell Laboratory	Laboratory for the processing and characterization of solar cells and solar cell material	Kjeller | Norway
48	SINTEF	SINTEF-Laue scanner & Lateral Photovoltage Scanning LPS	Measuring crystal orientation on silicon samples on industrial bricks and standard wafer sizes (156×156 mm2) Lateral Photovoltage Scanning (LPS) to measure locally resistivity variations in silicon sample to detect dopant striations	Trondheim | Norway

CHEETAH INFRA#	Organization	Short name Infra	Description	Location
53	TECNALIA	TECNALIA-Facilities for BIPV systems	Capabilities, facilities and equipment (SW, characterization devices) to offer services in the field of BIPV systems: optical/mechanical/thermal simulations PV modules & devices characterization indoor and outdoor testing of BIPV modules and BOS, etc.	Donostia | Spain Derio | Spain
60	TECNALIA	TECNALIA-InGRID New Experimental Infrastructure for Smart Grids	advanced experimental infrastructure for the development, validation and commercialization of innovative products for renewable energies and smart grids	Derio | Spain
59	TECNALIA	TECNALIA-PV Module LAB	Laboratory for PV Module Manufacturing and testing	San Sebastián | Spain
54	TUBITAK	TUBITAK - Marmara Research Center, Fotonic Technologies Laboratory	Deposition systems and equipment for the fabrication, development and characterization of photovoltaic cell and modules.	Gebze, Kocaeli | Turkey
50	UPM	UPM-Cell manufacturing and characterization	Solar cell manufacturing and characterization facilities	Madrid | Spain
49	UPM	UPM-Epitaxial growth	Epitaxial growth of PV materials and cells Metal Organic Vapour Phase Epitaxy (MOVPE) and Molecular Beam Epitaxy (MBE).	Madrid | Spain
52	UPM	UPM-PV system quality control facilities	Testing, monitoring, failure detection and modelling of PV plans	Madrid | Spain
62	ZSW	ZSW-PV Module Encapsulation lab	Infrastructure for the realization and optimization of different types of encapsulations in glass-glass and other PV module types.	Stuttgart | Germany

3. Improved access to the CHEETAH infrastructures and equipment:

Access to the infrastructures has represented a weakness point in all previous reporting. As most CHEETAH partners were also involved in SOPHiA, which was a research infrastructure project, they were used to TNA access offers. In the case of CHEETAH, only RTD work or student secondments were considered. Within the RTD WP's, there was an extensive sample flow between the laboratories to fulfill the goals within a RTD Workpackage, without sending researchers to the receiving labs. For that reason, there were only a limited amount of research visit but only mobility exchange action of students and trainees with the foal of training and education as reported in WP3.

The Round Robin procedure (RR) and the use of direct access procedure (based on reciprocal exchange of infrastructures) have probably been the most successful results for CHEETAH in this activity.

During the M37-M48 period, relevant efforts were put to foster access to infrastructures by proposing new procedures. This was also a consequence of European Commission comments (D2.2 submitted in August 2016 was rejected). New solutions were then evaluated to overcome the difficulties met in previous periods.

Substantial efforts have been made in assessing existing protocols, and to implement a unified access protocol. This assessment was done in collaboration with CHEETAH partners [**HZB , CIEMAT, UPM-IES, TUT, SINTEF, UNIMIB, AIT , ECN , ENEA, IMEC, ZSW]** and using benchmarking (web browsing and direct contact, [**ENEA, UPVLC])** of running procedure to access @ INES , EPFL PV-LAB, Fraunhofer-ISE, CSEM, Plataforma Solar de Almería,, ERIGrid EU-SOLARIS, CERN etc.

We identified a wide disparity of formats and approaches. Two category of accesses have been then proposed by CHEETAH project to foster access to RI (D2.2):

- *Access by "project*", based on the presentation of a project, its evaluation and the payment of an access cost **[lead by UPVLC];**
- Smart "*direct access" procedure*, an innovative procedure relying on an innovative "measurable & credit/debts based approach". Host can get credits it could spent by accessing other infrastructures owning to same network **[lead by ENEA].**

[ENEA] improved CHEETAH KEP by including specific service provider with pop-up procedures and automatic email alerts, to make the monitoring of technology demand request to each KEP Research Infrastructure more efficient. Unfortunately this new service was not fully exploited by CHEETAH due to lack of remaining time to test new procedures .

Another action was launched by **[UPVLC]** in July 2017 under **[UPM]** scientific responsibility based on the "*access by project approach"*. It followed the paper presented @ 7th International Conference on Silicon Photovoltaics, SiliconPV 2017, and aimed at evaluating efficiencies that can be obtained using UMG as a starting material, when the thickness of the wafers is reduced. It was launched in July for N-type UMG wafers, but no material was then available, and a second experiment was launched in Nov, 2017 designed for p-type multi UMG wafers in Berlin. An informal meeting was organized in Berlin during last General Meeting, and in mid-December, wafers allocated and pilot line offer was confirmed by **[GUNAM].** Participant partners **[CIEMAT, GUNAM, SINTEF, TECNALIA, UPM, UPVLC]**. This activity will be completed outside CHEETAH reporting period.

The table in Annex II covers M25-M48 and summarizes the main accesses reported by CHEETAH partners.

The following categories of access were considered:

- JRA=Joint access for Research activity for the project objectives of WP6-WP7-WP8-WP9-WP10
- EXCHANGE=Access to external users for joint Research activity
- RR=Round Robin tests/procedures
- OTHER= Any other access not included in the previous ones

When data was made available, we also included the number of access, number of hours, number of samples/tests/procedures, number of realized samples, number of test/procedures based on the typical output of the infrastructures, etc.

4. Improvement in CHEETAH knowledge exchange platform and its impact

Another innovation brought by CHEETAH project, in relation to management of knowledge exchange, has been the development of its KEP- knowledge exchange Platform formerly named KEAP. https://www.cheetah-exchange.eu/

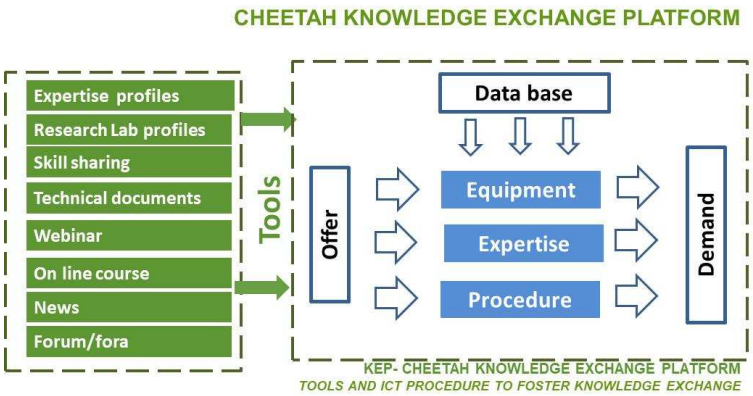


Figure 2: CHEETAH Knowledge exchange rationale

All interested web users/readers had full access to stored data, thanks to the utilization of search engine/query keywords combined and improved with efficient ICT procedures and user-friendly graphic interfaces. From this point of view, the procedure to collect and offer information to CHEETAH partners and external members represents a major breakthrough in the field, with very high innovative content and a substantial improvement in comparison with the state of the art of knowledge exchange on PV RTD.

It makes CHEETAH KEP unique in its approach comparable with largely used social/professional networks, with several points of additional strengths:

- first of all, the platform does not show the fragmentation of similar platforms as PV remains the central point of interest.
- Another point is that the platform does not have any commercial interest, typical of other platforms offering services against the acquisition of personal data.

- And finally, the KEP platform relies on platforms such as Linked In, Research Gate, utilizing links to published papers or to propose discussions on specific technical/scientific aspects in order to open to a wider community than CHEETAH.

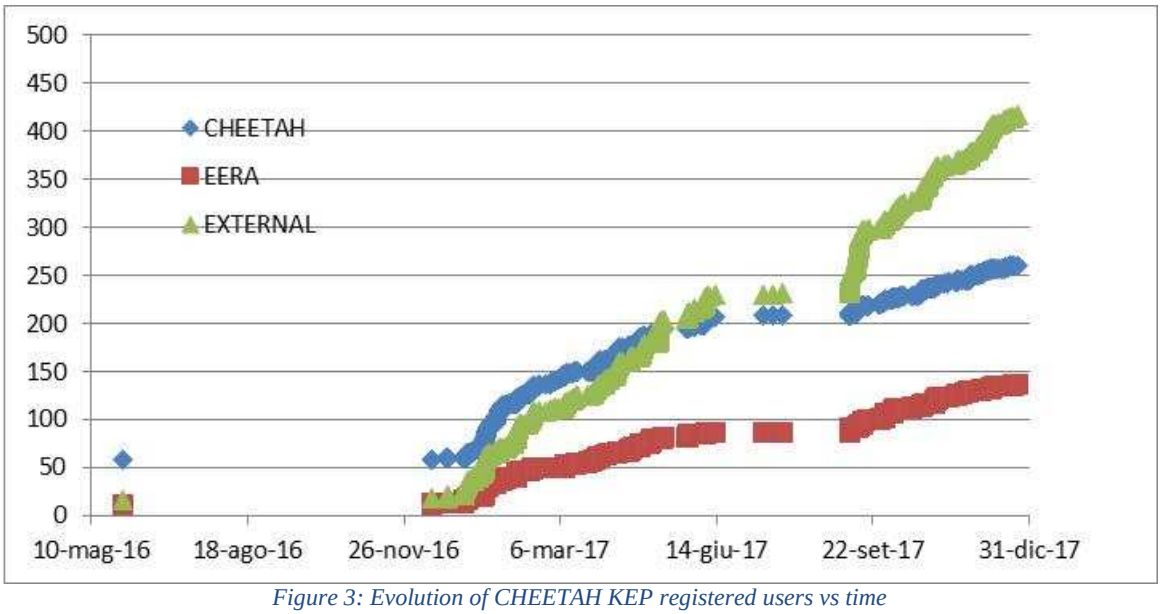


Figure 3: Evolution of CHEETAH KEP registered users vs time

CHEETAH KEP was launched in July 2015, and from that date, it was fully used as CHEETAH project internal Knowledge Exchange platform. CHEETAH KEP was opened to externals from autumn 2015, but was considered as an open access platform for externals only from November 2016, when we offered free access webinars to non-CHEETAH participants, imposing them only to register in the platform. This was also an opportunity to include them as active members, participating in knowledge exchange.

Around 900 users distributed in 60 countries worldwide were registered in CHEETAH KEP as Dec 2017:

- Italy 18%, Spain 13% Germany 12%, Netherland , UK, France 5%, Belgium, Switzerland, Greece, Norway, Turkey, India 3-4% each, USA, Australia 2% each.
- Around 17% of users are Research Scientist, 12% post Doc, 11% PhD Student, 9% Senior Scientist , 6% team leaders, 6-7% Research Engineer, 4% Full/Associate professors, 2% Responsibles of laboratories/technical units.

As Dec 2017 the platform counts:

- 47 organizations, 220 profiles of experts , 60 Research Infrastructures, 23 PV Technologies, 200 PV RTD topics, 160 PV RTD Equipment
- 19220 access to organization web pages, 90600 access to Expert web pages, 21960 accesses to Research Infrastructures web pages, 12820 accesses to PV technologies web pages and thousands and thousands of accesses to PV RTD Topic, and Equipment pages.

Figure 4: CHEETAH KEP Web pages

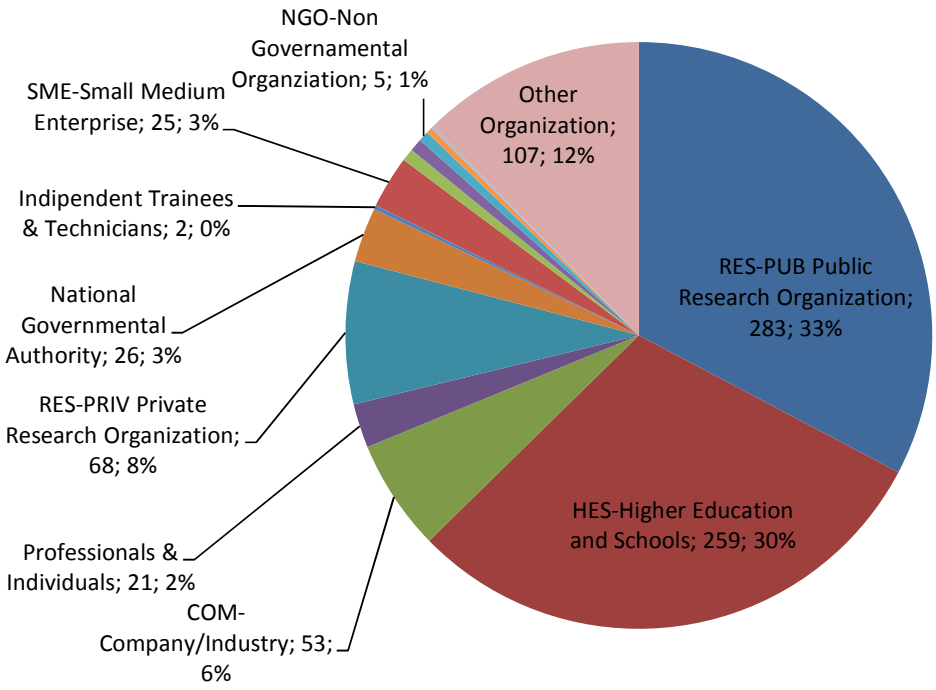


Figure 5: CHEETAH KEP REGISTERED USERS by category

In 2017, the following actions were realized:

- Finalization of the development of last ICT tools implemented the platform (registration procedures for the webinar, access to the video/slides, improved quality of the web pages) **[ENEA];**

- Better organization of web pages and optimization of keywords (less and more efficiently defined) **[ENEA];**

- Finalization of the description of missing topics in PV Technologies including references (2016 & 2017);

- Addition of the following web pages:
    - Crystalline Silicon Wafer base technology. Rannveig Kvande **[SINTEF]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=3
    - Ultra-thin and kerfless silicon wafer development Ivan Gordon **[IMEC]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=20
    - TFSi-Thin Film Silicon Paola Delli Veneri **[ENEA]** , Nicolas Wyrsch [**EPFL]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=4
    - *CIGSS- Copper indium gallium diselenid*e Simona Binetti, **[UNIMIB]** Martina Schmid [**HZB]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=18
    - *III-V Solar cells and Concentrator Arrays* Carlos del Cañizo,**[UPM]** *https://www.cheetah-exchange.eu/pv_technologies.asp?i=32*
    - Emerging/Novel concepts for high efficiency at low cost Carlos del Cañizo,**[UPM]** *https://www.cheetah-exchange.eu/pv_technologies.asp?i=7*
    - CPV Concentration Photovoltaics Carlos del Cañizo,**[UPM** https://www.cheetah-exchange.eu/pv_technologies.asp?i=13
    - *DSSC- Dye Sensitized Solar Cells* -Thomas Brown, Aldo Di Carlo **[UTV]** Alessandro Abbotto **[UNIMIB]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=16
    - *CH3NH3PbX3 –Perovskite* Aldo Di Carlo **[UTV]** . Alessandro Abbotto **[UNIMIB**] https://www.cheetah-exchange.eu/pv_technologies.asp?i=28
    - *CZTS-Kesterite* Alberto Mittiga **[ENEA**} https://www.cheetah-exchange.eu/pv_technologies.asp?i=31
    - *PV Module qualification & Reliability* George Halambalakis **[CRES]** https://www.cheetah-exchange.eu/pv_technologies.asp?i=10

- Improvement of the public awareness of the KEP by a more efficient use of circular mailing list and professional social networks (Linked In, Research Gate, Twitter) **[ENEA, All partners]**. Posts concerning the availability of webinars and information about CHEETAH KEP were periodically published by Linked In **[ENEA],** using Linked In group
    - Market Solar Energy Network 119.270 members,
    - Thin Film Solar 3190 members,
    - Horizon 2020, Framework Programme for Research and Innovation Group 121.439 members,
    - PhD Physicists 9.698 members,
    - Thin Film Forum24.257members,
    - Materials for Energy and Sustainable Development 3.157 members,

- Thin Film Solar 3.191 members.

- Use of other sources for boosting dissemination such as:
  - Researchgate https://www.researchgate.net/project/FP7-CHEETAH-Knowledge-Exchange-Platform
  - YouTUBE: https://www.youtube.com/channel/UCzaOGpmO139GXvJ23PHvxuw
  - Twitter channel: https://twitter.com/cheetah_kEAP/

- Implementation in January 2017 of CHEETAH KEP mailing list, having now more than 5500 different members:
  - 1950 KEP and webinar users,
  - 2000 extra Researchers/students/professionals,
  - 850 stakeholders,
  - 900 ENEA researchers and technicians involved in renewables.

- Launch of two surveys:
  - to check the level of satisfaction in CHEETAH KEP users https://ec.europa.eu/eusurvey/runner/cheetah_kep_survey
  - To evaluate the motivation of all who unsubscribed https://ec.europa.eu/eusurvey/runner/cheetah_webinar_what_went_wrong

  The number of respondents was not sufficient for establishing statistics, but it confirmed that the level of satisfaction of CHEETAH users was very high. People who unsubscribed to our mailing list found his/her motivation in the number of received emails or because he/she was not involved in PV, but not because of low quality of our offered services and opportunities. This number - less than 5% of a very wide mailing list - is however acceptable.

Full data are reported in Table 2.

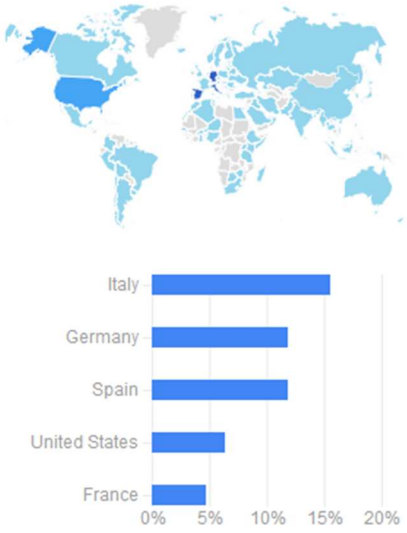


Figure 6: CHEETAH KEP accessing sessions by country.

This graph demonstrates a very wide distribution worldwide of people accessing to CHEETAH KEP with a high concentration in Italy, Germany, Spain, France, United States

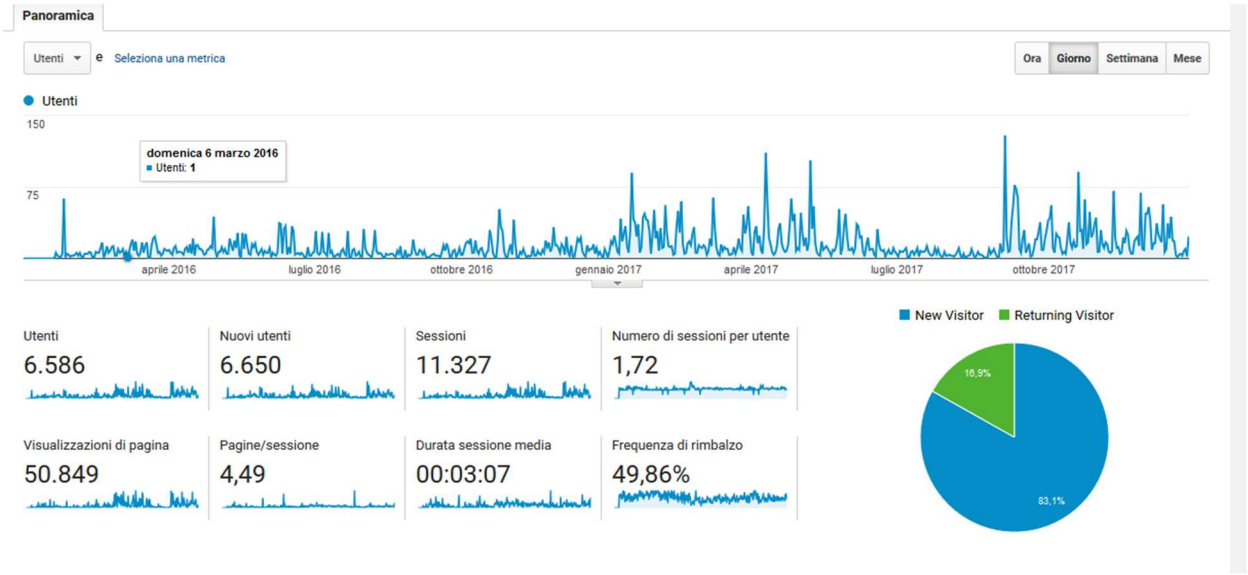


Figure 7: Google Analytics: distribution of CHEETAH KEP accesses during the period 01/01/2016-31/12/2017.

Except the peak in January 2016 (CHEETAH Workshop on Advanced tools), the accesses were very still at a relatively low level but improved significantly from September 2016.

	Paese	Utenti	% Utenti
1.	Italy	975	14,68%
2.	Germany	739	11,12%
3.	United Kingdom	629	9,47%
4.	United States	593	8,93%
5.	Spain	503	7,57%
6.	France	248	3,73%
7.	India	201	3,03%
8.	Netherlands	185	2,78%
9.	Greece	157	2,36%
10.	Belgium	151	2,27%

Figure 8: Distribution of the number of users by country

5. CHEETAH WEBINARS

A detailed analysis on CHEETAH webinars is provided in D4.10 - Summary report (minutes) on webinar activities. We have got a total of 2159 early registrations and 1182 participations, of whom 199 registered participants and 129 effectively participants in the events jointly organized with SOPHiA project in 2014.

During the period covered by CHEETAH webinar platform (Jan 30th-2015- Dec 31st 2017), 1065 different webinar users registered to CHEETAH webinars with 2124 views of which 1236 live views.

Indoor/outdoor characterizations of devices and PV modules (2017-09-14), Characterization of Multijunctions (2016-12-13), LockIn- Amplifier (2017-10-05), Device modeling (2017-12-06), Advanced tool workshop (2016-01-14) received the higher interest as confirmed by the number of participants and by the result of the survey launched within CHEETAH KEP users.

It can be also noted that by offering access by streaming, we significantly increased the total number of accesses, but we consequently decreased the percentage of webinar users registered but effectively participating. On other hand, access by streaming is however another opportunity to foster access to video-lectures.

Webinar #	Title	Date	Organizers	Speakers
21	CHEETAH Workshop on Advanced Characterization for PV*	14/01/16	FZ Jülich	speakers list: see minute
8	How technology innovation is anticipated to reduce the cost from PV installations	23/05/16	Solar Power Europe	Dr. THEOLOGITIS Ioannis, SPE Dr. SIMONOT Emilien, Kic Innoenergy Dr. PHILLIPS Simon, FhG-ISE Prof. SINKE Wim, ECN Dr. GORDON Ivan, IMEC
10	Realization and characterization of Micro-concentrator solar Devices	10/10/16	TUT ENEA	Dr. GROSSBERG Maarja, TUT Dr. NENNA Giuseppe, ENEA Dr. BITTKAU Karsten, FZ—Juelich (chairperson)
9	Nanotechnology in Photovoltaics	27/10/16	UPM	Prof. FUERTES MARRÓN , UPM Prof. DEL CAÑIZO Carlos (chairperson)

Webinar #	Title	Date	Organizers	Speakers
11	Short course on Electrical characterization of multijunction solar cells	13/12/16	UPM	Dr. LINARES Pablo García Prof. DEL CAÑIZO Carlos (chairperson)
14	UV-Fluorescence Analysis and comparison with other optical characterization methods	27/01/17	AIT	KUBICEK Bernhard, AIT ROCA Francesco, ENEA (chairperson)
17	Hybrid organic-inorganic photovoltaics: from molecules to devices characterization	16/02/17	UNIMIB	Dr. MANFREDI Norberto, UNIMIB Dr. DI LETTO Claudia, ENEA (Chairperson)
18	Overview of lift-off technologies for kerfless crystalline silicon material for PV applications	09/03/17	IMEC	Dr. SIVARAMAKRISHNAN RADHAKRISHNAN Hariharsudan, IMEC Dr. VAN NIEUWENHUISEN Kris, IMEC Dr. BANSEN Roman, IKZ (chairperson)
20	Solar Resource Knowledge for PV applications:current tools and needs	04/04/17	CIEMAT	Dr. POLO Jesús, CIEMAT Dr. CÁRABE Julio, CIEMAT (chairperson)
21	Hybrid Halide Perovskite for Photovoltaic Applications	28/04/17	UNIMIB	Dr. TRIFILETTI Vanira, UNIMI Dr. MANFREDI Norberto, UNIMIB
26	BFIRST Final workshop	27/04/17	CRES-ENEA-TECNALIA	Speakers list : see minute
23	Photovoltaic materials research in Tallinn University of Technology	03/05/17	ENEA-TUT	Dr. Maarja Grossberg,-TUT
22	Electrical characterization of thin film solar cells and absorbers	10/05/17	EMPA	Dr. Thomas P. Weiss, EMPA Dr. Stephan Buecheler, EMPA (chairperson)
24	Dislocations in multicrystalline silicon	09/06/17	SINTEF	Dr. RYNINGEN Birgit, SINTEF Dr. KVANDE Rannveig, SINTEF (chairperson)

Webinar #	Title	Date	Organizers	Speakers
45	Outdoor I-V characterization and Long term PV modules testing	14/09/17	CRES	Dr, HALABALAKIS Georgios, CRES, Dr. KYRITSIS Anastasios, CRES
46	Fundamentals of the “lock-in” technique and its application to solar cell characterization	05/10/17	UPM	Iñigo Ramiro González, ICFO/UPM Prof. Carlos del Cañizo UPM
47	Roll-to-roll printing processes for Organic PV	23/10/17	VTT	Dr. Jukka Hast , VTT Dr. Pälvi Apilo , VTT Mr. Sami Ihme, VTT
48	Kesterite Solar Cells: state of art and perspective	03/11/17	UNIMIB-TUT-EMPA	Prof. Simona Binetti, UniMIB (speaker & Chairperson) Dr. Maarja Grossberg,TUT Dr. Stefan Haass , EMPA
49	Advanced modelling of photovoltaic devices	06/12/17	IFE	Dr. Ørnulf Nordseth ,IFE Dr. Halvard Haug, IFE
50	nano-MOOC: Designing dopant diffusions in silicon solar cells	07/12/17	UPM-IES	Prof. Carlos del Cañizo UPM
51	nano-MOOC: Fundamentals of solar cells (advanced topics)	10/12/17	UPM-IES	Prof. Antonio Martí, UPM
52	nano-MOOC:Simulation of solar cells & modules with equivalent circuits	14/12/17	UPM-IES	Prof. FUERTES David, UPM
54	PV modelling: from cells to grid integration	21/12/17	ENEA-LNEG-TECNALIA	Dr.JOYCE Antonio, LNEG Dr. ROMAN Eduardo, TECNALIA (introduction) Dr. ROCA Francesco, ENEA (introduction)
55	Simulation of heterogeneous PV systems and storage in self-consumption scenarios	30/12/17	TECNALIA	Mr.ALONSO Ricardo, TECNALIA

In December 2017, CHEETAH webinar was enriched with two opportunities:

CHEETAH nano-MOOCs "Learning PV at CHEETAH Speed" [UPM]

- CHEETAH e-learning platform launched a series of nano-MOOCs Massive Online Open Courses "Learning PV at Cheetah speed" proposed and realized by Instituto de Energía Solar Universidad Politécnica de Madrid – **[IES-UPM]** under the leadership of prof. Carlos del Cañizo.
- These are independent courses so any interested student, younger researcher and also, Engineers, R&D staff can register for just one of them, of for the three of them if they like.
- Interested participants can follow at their own path, with an estimated student effort of around 20 hours hours of dedication from the student, including the presentations, readings and exercise.
- They are very specific beyond "Fundamentals of PV", focused on a relevant topic for researchers and PhD students, and accessible online, so that anyone can access based om his/her own needs and time availability.
- The following courses were launched, as a pilot experience,
    - Designing dopant diffusions in silicon solar cells prof. Carlos del Cañizo [UPM]
    - Circuit simulation of solar cells and modules prof. David Fuertes [UPM]
    - Advanced topics on solar cell prod. Antonio Martì [UPM]

CHEETAH PV Academy [ENEA]

The CHEETAH KEP now offers the whole set of lectures as complete "virtual" courses in PV, organized by topics in dedicated specific web pages under the tab named CHEETAH PVirtual Academy.

This enables:

- simplified searching criteria in catalogue of lectures,
- to attract interested web users, whether a younger researcher/student or skilled scientists or engineer in different technical-scientific areas than proposed topic, to learn more in different topics by "free" accessing to a full set of lectures constituting all together a PV Virtual course.

This PV academy will not only overcome the overlapping and fragmentation of the proposed day-by-day approach of the lectures, this will also constitute a nice opportunity to valorise the heritage that CHEETAH e-learning offered to PV RTD community by further enriching the offer.

The participation of EERA-PV members to CHEETAH KEP will further foster the opportunity to implement the catalogue of free access lectures in PV learning in the upcoming time.

The new tool was completed in December 2017 and tested for the first time by CHEETAH PV Virtual Academy pilot course titled "*Modelling PV: from conversion Technologies to Systems*" organized by **[ENEA, LNEG,TECNALIA**].

6. Expert profiles:

30 new experts profile were uploaded in CHEETAH KEP in 2016 and 45 in 2017:

- CHEETAH members: 27 in 2016 and 36 in 2017
    - 18 @ **ENEA**;
    - 8 @ **UPM;**
    - 5 @ **EMPA;**
    - 5 @ **CEA;**
    - 3 @ **AIT;**
    - 3 @ **FhG-ISE;**
    - 3 @ **CIEMAT;**
    - 3 @ **CRES;**
    - 1 @ **IMEC;**
    - 3 @ **IFE;**
    - 3 @ **TUT;**
    - 2 @ **UNIMIB;**
    - 2 @ **SINTEF;**
    - 2 @ **SPE;**
    - 2 @ **VTT;**
    - 1 @ **ECN.**
- EERA end External members: 3 in 2016 and 9 in 2017
    - 1 @ **CENER;**
    - 1 @ **UNIVR;**
    - 1 @ **UCY;**
    - 1 @ **UNISTRA;**
    - 1 @ **FCUL;**
    - 1 @ **CUT;**
    - 3 @ **UNIPI.**

They all gave authorization to publish their short bio in CHEETAH KEP, and offered their availability to share their own expertise and availability to foster Knowledge Exchange, with the aim to produce a benefit to the PV RTD Community as whole.

SURNAME Name	Role	Organization
RENNHOFER Marcus	Other Associated PV Experts/Scientists	AIT
SCHWARK Michael	CHEETAH & EERA Scientists & Experts	AIT
KUBICEK Bernhard	CHEETAH & EERA Scientists & Experts	AIT
VEIRMAN Jordi	Other Associated PV Experts/Scientists	CEA
DANEL Adrien	CHEETAH WP Leaders	CEA
MERTEN Jens	CHEETAH & EERA Scientists & Experts	CEA
ROUX Charles	CHEETAH & EERA Scientists & Experts	CEA
BERSON Solenn	CHEETAH & EERA Scientists & Experts	CEA
LAGUNAS Ana Rosa	Other Associated PV Experts/Scientists	CENER
ALONSO-GARCIA Carmen	CHEETAH & EERA Scientists & Experts	CIEMAT
POLO Jesús	CHEETAH & EERA Scientists & Experts	CIEMAT
MARTÍN CHIVELET Nuria	CHEETAH & EERA Scientists & Experts	CIEMAT
MATHAS Evangelos	Other Associated PV Experts/Scientists	CRES
RIKOS Evangelos	Other Associated PV Experts/Scientists	CRES
NIKOLETATOS John	CHEETAH & EERA Scientists & Experts	CRES
KALOGIROU Soteris	Other Contacts	CUT
SINKE Wim	CHEETAH & EERA Scientists & Experts	ECN
BISSING Benjamin	CHEETAH & EERA Scientists & Experts	EMPA
CORAZZA Michael	Other Associated PV Experts/Scientists	EMPA
WEISS Thomas Paul	CHEETAH & EERA Scientists & Experts	EMPA
HAASS Stefan G.	CHEETAH & EERA Scientists & Experts	EMPA
ROMANYUK Yaroslav	CHEETAH & EERA Scientists & Experts	EMPA

SURNAME Name	Role	Organization
GRADITI Giorgio	CHEETAH & EERA Scientists & Experts	ENEA
DE GIROLAMO DEL MAURO Anna	CHEETAH & EERA Scientists & Experts	ENEA
CANCRO Carmine	CHEETAH & EERA Scientists & Experts	ENEA
FUCCI Raffaele	Other Associated PV Experts/Scientists	ENEA
FIORENZA Giuseppe	CHEETAH & EERA Scientists & Experts	ENEA
APICELLA Felice	CHEETAH & EERA Scientists & Experts	ENEA
TAMMARO Marco	CHEETAH & EERA Scientists & Experts	ENEA
FALCONIERI Mauro	Other Associated PV Experts/Scientists	ENEA
DILETTO Claudia	CHEETAH & EERA Scientists & Experts	ENEA
GRILLI Maria Luisa	Other Associated PV Experts/Scientists	ENEA
BEONE Francesco	Other Associated PV Experts/Scientists	ENEA
LOFFREDO Fausta	CHEETAH & EERA Scientists & Experts	ENEA
MISCIOSCIA Riccardo	CHEETAH & EERA Scientists & Experts	ENEA
PELLEGRINO Michele	CHEETAH & EERA Scientists & Experts	ENEA
BRUNO Annalisa	CHEETAH & EERA Scientists & Experts	ENEA
DE LIA Francesco	CHEETAH & EERA Scientists & Experts	ENEA
VILLANI Fulvia	CHEETAH & EERA Scientists & Experts	ENEA
BRUNO Annalisa	CHEETAH & EERA Scientists & Experts	ENEA
SERRA João	Other Associated PV Experts/Scientists	FCUL
PHILLIPS Simon	CHEETAH & EERA Scientists & Experts	FhG-ISE
STEINER Marc	Other Associated PV Experts/Scientists	FhG-ISE
SIEFER Gerald	Other Associated PV Experts/Scientists	FhG-ISE

SURNAME Name	Role	Organization
HAUG Halvard	CHEETAH & EERA Scientists & Experts	IFE
SØNDENÅ Rune	Other Associated PV Experts/Scientists	IFE
YOU Chang Chuan	CHEETAH & EERA Scientists & Experts	IFE
SIVARAMAKRISHNAN RADHAKRISHNAN Hariharsudan	CHEETAH & EERA Scientists & Experts	IMEC
KVANDE Rannveig	CHEETAH & EERA Scientists & Experts	SINTEF
GOUTTEBROZE Sylvain	CHEETAH & EERA Scientists & Experts	SINTEF
ROESCH Alexandre	CHEETAH & EERA Scientists & Experts	SPE
HEISZ Máté	CHEETAH WP Leaders	SPE
Timmo Kristi	Other Associated PV Experts/Scientists	TUT
MATI Danilson	Other Associated PV Experts/Scientists	TUT
RAADIK Taavi	Other Associated PV Experts/Scientists	TUT
GEORGHIOU George Elias	Other Associated PV Experts/Scientists	UCY
MANFREDI Norberto	CHEETAH & EERA Scientists & Experts	UNIMIB
TRIFILETTI Vanira	CHEETAH & EERA Scientists & Experts	UNIMIB
BELLINA Fabio	Other Associated PV Experts/Scientists	UNIPI
DI BARI Lorenzo	Other Associated PV Experts/Scientists	UNIPI
PUCCI Andrea	Other Associated PV Experts/Scientists	UNIPI
SLAOUI Abdelilah	Other Associated PV Experts/Scientists	UNISTRA
ROMEO Alessandro	Other Associated PV Experts/Scientists	UNIVR
ANTÓN HERNÁNDEZ Ignacio	Other Associated PV Experts/Scientists	UPM
FUERTES MARRÓN David	CHEETAH & EERA Scientists & Experts	UPM
GARCÍA-LINARES Pablo	CHEETAH & EERA Scientists & Experts	UPM

SURNAME Name	Role	Organization
DOMINGUEZ César	Other Associated PV Experts/Scientists	UPM
NUÑEZ Ruben	Other Associated PV Experts/Scientists	UPM
REY-STOLLE Ignacio	CHEETAH & EERA Scientists & Experts	UPM
RAMIRO GONZÁLEZ Iñigo	Other Associated PV Experts/Scientists	UPM
Narvarte Luis	Other Associated PV Experts/Scientists	UPM
IHME Sami	CHEETAH & EERA Scientists & Experts	VTT
APILO Pälvi	CHEETAH & EERA Scientists & Experts	VTT

7. Technical documents:

During the parallel session led by HZB in Roskilde (General Assembly January 2017), involving CSA WPs (WP2, WP3, WP4, WP5), a list of technical position papers of joined interest for CSA activities has been launched for the final year of the project.

The following documents were finalized:

- Thin film Si tandem round robin. The final report was presented in 2017 **[HZB, JRC]**
- Perovskite RR was conducted and internal report within EERA/CHEETAH consortium was made **[DTU et al]**
- "Guidelines for encapsulation of OPVs and other similar technologies" were prepared and presented to the scientific and industrial community. Currently the guidelines are being further optimized with the help of the community prior to publication **[DTU, et al]**
- Best practice paper: "Best Practice Guideline for the determination of integral metal concentration ratios in Cu(In,Ga)Se2 thin films by X-ray Fluorescence Spectroscopy (XRF) **[EMPA,HZB,ZSW]**
- Best practice paper: Evaluation of the PMMA microlens efficiency for the realization of solar micro-concentrator array **[ENEA]**
- Technical Paper: PV imaging and inspection techniques **[AIT]** Draft Version is finished. The document will be published as a review or guideline after CHEETAH.

CHEETAH KEP offers different level of access right (CHEETAH project members, EERA members, External registered users, public access). Depending from the willingness of the authors and the level of dissemination, these documents might become available on CHEETAH KEP.

8. Conclusion and follow up:

- We have deeply investigated the current European PV RTD Community's technical-scientific needs.
- We have efficiently established and promoted the channels and procedures to transfer information in order to enforce potential and effectiveness of RTD activities and a collaborative spirit has been created within the project partners and external organization as demonstrated by the numerous actions in Knowledge Exchange.
- CHEETAH proposed a relevant step forward in defining advanced accessing procedure for the RI. Unfortunately the main limit faced by this task remained the unavailability of assigned budget from the project for this specific service, and the limited available time did not offer opportunity to experiment with the proposed procedure based on "measurable & credit/debts" approach. However, this will be experimented in the frame of EERA_PV and other upcoming projects and joint initiatives.
- CHEETAH KEP platform represents a significant step forward in the knowledge exchange in the PV RTD sector by using the user-friendly and dedicated ICT media tools comparable in their performance to more diffused social, scientific and professional networks.
- The access analysis by Google Analytics clearly highlights the wide interest of the platform, worldwide. Moreover, the survey launched within CHEETAH KEP membership clearly indicated that it helps members that often suggest it to their colleagues, co-workers, students. Most useful information are experts list, infrastructures, technical documents, webinars and career area, last one being particularly useful for younger scientists/engineers interested in PV.

  The survey also indicated suggestions for improvement of CHEETAH KEP:
  - Offer more efficient discussion,
  - Finalise pages about PV technologies/PV RTD topics,
  - Offer opportunities for virtual access to research premises and experiments,
  - Include information about R&D projects funded at national/regional level,
  - Propose new courses and modules in the PV Academy area,
  - Add a blog in the platform, where members can add questions and experts can provide answers.

  Concerning last point the CHEETAH KEP, final release is already offering this option.

Section 5 - ANNEX I

Full list of CHEETAH WP2 contact point

ORGANIZATION	NAME	SURNAME
AIT	Shokufeh	ZAMINI
CEA	Adrien	DANEL
CIEMAT	Juan Francisco	TRIGO
CRES	Georgios	HALAMBALAKIS
DTU	Suren	GEVORGYAN
ECN_OPV	Sjoerd	VEENSTRA
EMPA	Stephan	BUECHELER
ENEA	Franco	ROCA
EPFL	Nicolas	WYRSCH
HZB	Martina Iver	SCHMID LAUERMANN
IKZ	Franziska	RINGLEB
IMEC	Ivan	GORDON
IMPERIAL	James Jenny Zhe	DURRANT NELSON LI
JÜLICH	Karsten	BITTKAU
KIC_EN	Emilien	SIMONOT
LNEG	António	JOYCE
METU-GUNAM	Raşit	TURAN
NPL	Fernando	CASTRO
SINTEF	Rannveig	KVANDE
TECNALIA	Eduardo	ROMAN
TUT	Maarja	GROSSBERG
UNIMIB	Simona	BINETTI
UPM	Carlos	DEL CAÑIZO
UTV	Aldo	DI CARLO
VTT	Jukka	HAST
UPVLC	Guillermo	SANCHEZ
ZSW	Erwin	LOTTER

Section 6 - ANNEX II List of accesses to CHEETAH Infrastructures M25-M48

Infra#	Type Access*	HOST					GUEST					From	To	SHORT DESCRIPTION
		Organization	n. of involved personnel				Organization	n. of involved personnel						
			Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others		Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others			
	EXC	AIT	2	-	1	-	FhG-ISE	1	-	-	-	21/03/2016	25/03/2016	The FEM model (developed at ISE) was validated by mechanical load tests of frameless modules (in AIT). [AIT] accessed to [ISE] to validate a FEM model for module deflections during mechanical loads
	JRA	AIT	3		1							2016	2017	Thermal cycle testing, opto-electrical Characterization of 2x2 mini-modules and full-size modules from ECN
	JRA	AIT	3		1								2017	Thermal cycle testing, opto-electrical Characterization of full-size modules from CEA
	JRA	CEA	4	-	2	-	-	-	-	-	-	2016	2017	Realization of large amount of high performance heterojunction cell on thin substrates WP7
	RR	CIEMAT	1	-	-	1	-	-	-	-			2017	RR Perovskites Interlaboratory Studies (ISOS-D3 life testing) Organized by DTU in 2016. WP3
	JRA	DTU	2	-	-	-	-	-	-	-	-	2016	2017	Solar cell manufacturing and testing, development of protocols for encapsulation, testing of novel adhesive, indoor/outdoor measurements, WP10

Infra#	Type Access*	HOST					GUEST					From	To	SHORT DESCRIPTION
		Organization	n. of involved personnel				Organization	n. of involved personnel						
			Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others		Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others			
	EXC	DTU	1	-	_	-	NPL	-	-	_	-	2017		PEDOT:PSS hole transport layer tests WP10
	JRA	ECN	3	-	3	-						2016	2017	Cell Interconnection and encapsulation, use of characterization lab, climatic chamber, pilot solar cell WP8
	RR	ECN	1									2016	2017	RR on thin film Silicon solar cells
	RR	ENEA	1		1		-	-	-	_	-	2016		RR on thin film Silicon solar cells
	JRA	ENEA	2	2	1	-	-	-	-	_	-	2016	2017	Realization of Experimental campaigns to realize and optimize Barrier layers in OPV devices (task 10.3) WP10
	JRA	ENEA	2	2	1		-	-	-	_	-	2016	2017	Application of ISOS-3 guidelines to samples received by DTU/FhG-ISE WP10
	EXC	ENEA	4	2	_	-	TUT	1		_	-	02/05/2017	05/05/2017	Characterization of microlens in collaboration with TUT WP9
	JRA	IKZ	1	-	_	-	-	-	-	_	-	2016	2017	Development of defoliation process and characterization
	JRA	IKZ	1	-	_	-	-	-	-	_	-	2016	2017	Optimization of selenzation process and absorber characterization; optimization of insulator processing

Infra#	Type Access*	HOST					GUEST					From	To	SHORT DESCRIPTION
		Organization	n. of involved personnel				Organization	n. of involved personnel						
			Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others		Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others			
	JRA	ENEA	3	-	1	-	-	-	-	_	-	2016	2017	Realization by inkjet and characterization of PMMA microlens WP9
	JRA	FZ-Jülich	1	-	_	-	-	-	-	_			2017	Development and implementation of thin-films encapsulants for OPV WP8&WP10
	JRA	FZ-Jülich	2	-	_	-	-	-	-	_	-		2017	Development and implementation of technologies for IBC solar cells and modules WP8
	JRA	FZ-Jülich	3	-	_	-	-	-	-	_	-		2017	Implementation of optical and electrical characterizations technique WP9
	RR	HZB	1	-	_	-	-	-	-	_			2017	XRF round robin for CIGS absorber layers WP3
	JRA	TUT	5	-	_	-	-	-	-	_	-	2016	2017	Preparation , optimization and characterization of CZTS/CIGSe micro-cells, testing different concepts of microlenses, WP9
	EXC	TUT	2	-	1	-	UNIMIB	1				06/06/2017	09/06/2017	Best practice in the characterization of CZTS thin films by using µ-PL, PL in temperature, Raman, SEM and EDS (5 accesses 40 h 6 sample 2 procedures) WP3
	EXC	UNIMIB	2	-	_	-	LNEG	1	-	_	-	23/10/2017	27/10/2017	Best practice in the characterization of perovskite-based solar cells by using EQE, JV and PL (5 accesses 40h 10 samples1 procedure) WP3

Infra#	Type Access*	HOST					GUEST					From	To	SHORT DESCRIPTION
		Organization	n. of involved personnel				Organization	n. of involved personnel						
			Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others		Scientists & Research Engeneer	Young Researchers / Phd Students	Professionals/ technician	Others			
	OTH	TECNALIA	3	-	-	-	2 partners Spain/Japan	2	-	-	-	01/01/2017	31/12/2017	KUBIK- Outdoor tests of glass-glass curved BIPV modules with spherical silicon cells (400h). This access was produced by CHEETAH dissemination (no cost charged in CHEETAH)
	OTH	TECNALIA	2	-	-	-	2 partners (Greece)	-	-	-	-	01/10/2017	01/11/2017	INGRID-Anti-islanding tests of commercial PV inverters. Analysis of stratetgies. (100h) This access was produced by CHEETAH dissemination (no cost charged in CHEETAH)
	JRA/ RR	GUNAM	TBD	-	-	-	CIEMAT ,GUNAM, SINTEF,TEC NALIA, UPM,UPVLC	TBD				2018		Planning of common experiment on manufacturing and characterization of PERC solar cells on Upgraded Metallurgical Silicon substrates. Collaboration between several partners. The results will come outside CHEETAH Reporting period
	RR	ZSW	1		1		-	-	-	-	-	2017		Tandem solar cell round robin XRF round robin WP3

LEGEND: The following categories of access were considered

[1] JRA=Joint access for Research activity for the project objectives of WP6-WP7-WP8-WP9-WP10

[2] EXCHANGE=Access to external users for joint Research activity

[3] RR=Round Robin tests/procedures

[4] OTHER

[5] when indicated by the reporter, in each row is indicated the .* n of access n. of hours, , n. of samples/tests/procedures the number of realized samples, test/procedures based on the typical output of the infrastructures etc.

Note: The data concerning access to RI for JRAs are reported here mainly for statistical evaluation purpose . It is based on received WP2 reporting information, and might be incomplete, as example for CHEETAH partners that did not participate in WP2.