

Annex XVI

SOLAR RESOURCE FOR HIGH PENETRATION AND LARGE SCALE APPLICATIONS

1. OBJECTIVE

As the penetration of PV increases, improved accuracy and finer spatial and temporal resolution of solar data sets are needed to optimize the performance of these technologies in the energy system of a particular region or country.

International collaboration and consensus on developing and managing these data sets will expedite the high penetration of solar technologies, and improve markets for these technologies. Large scale PV plants now need accurate resource and forecast data due to high investment costs. Therefore Task participants will focus on the following two scientific issues:

- High frequency variability and solar forecasts for managing grids with high penetration of PV and local storage
- High quality solar resource assessments and forecasts for solar installations notably in the multi MW class

High frequency variability and high quality needs are also important issues for the planning and the operation of Concentrating Solar Thermal facilities and CPV, which will be a focus of the Task as well. In addition, the development of bankable data sets for system sizing and accurate continuous data sets for performance evaluation are important to Solar Heating and Cooling technologies, and will also be a focus of this task.

2. GOALS

The main goals of Task 16 are to lower barriers and costs of grid integration of PV and lowering planning and investment costs for PV by enhancing the quality of the forecasts and the resources assessments. To reach this main goal the Task has the following objectives:

- Lowering uncertainty of satellite retrievals and Numerical Weather Prediction (NWP) models for solar resource assessments and nowcasting.
- Define best practices for data fusion of ground, satellite and NWP data (re-analysis) to produce improved datasets, e.g. time series or Typical Meteorological Year (TMY).
- Develop enhanced analysis of long-term inter-annual variability and trends in the solar resource.
- Develop and compare methods for
 - Estimating the spectral and angular distributions of solar radiation (clear and all-sky conditions)
 - Describing the spatial and temporal variabilities of the solar resource
 - Modelling point to area forecasts
 - Probabilistic and variability forecasting

Contribute to or setup international benchmark for data sets and for forecast evaluation.

As the scope of Task 16 is also directly linked to Concentrating Solar Power and solar thermal installations the collaboration with the two TCPs dealing with these topics is of great importance. IEA PVPS Task 16 will be a joint task with IEA SolarPACES (Task V) and will keep minimal collaboration with IEA SHC.

3. APPROACH

The work programme of the proposed Task 16 addresses on one side scientific meteorological and climatological issues to high penetration and large scale PV in electricity networks, but also includes a strong focus on user needs and for the first time a special dissemination subtask. Dissemination and user interaction is foreseen in many different ways from workshops and webinars to paper and reports.

The project requires the involvement of key players in solar resource assessment and forecasting at the scientific level (universities and research institutions) and commercial level (companies). A consortium of 54 institutions of 22 countries has been formed. This includes large science centres like DLR, NREL or Fraunhofer, universities like State Univ. of New York, Mines ParisTech or Univ. of Jaen, national weather services like DWD, BOM or DMI and data providers like Solargis, Vaisala or Meteotest. One Transmission system operator (energynet.dk), one utility (EDF) and one module manufacturer (Total Solar / Sunpower) are also participating.

The work plan is also focused on work that can only be done by international collaboration like definition and organization of benchmarks, definition of common uncertainty and variability measures. E.g. the measure P10/90 years, which is often used today, lacks a commonly accepted definition up to now.

4. SUBTASKS

The scope of the work in Task 16 will concentrate on meteorological and climatological topics needed to plan and run PV, solar thermal, concentrating solar power stations and buildings. As in the preceding Task IEA SHC solar resource assessment and forecasting are the main focus.

However the work of the new Task will be more focused on user viewpoints and on topics, which can only be handled with help of international cooperation, which is aside the international exchange of knowledge the major use of such a Task.

To handle this scope the work programme is organized into three main technical subtasks (subtasks 1 – 3) and one dissemination subtask (Subtask 4):

- Subtask 1: Evaluation of current and emerging resource assessment methodologies.
- Subtask 2: Enhanced data & bankable products
- Subtask 3: Evaluation of current and emerging solar forecasting techniques
- Subtask 4: Dissemination and Outreach

Whereas subtasks 1 and 3 are mainly focused on ongoing scientific work, subtask 2 and 4 are mostly focused on user aspects and dissemination.

(g) Subtask 1: Evaluation of Current and Emerging Resource Assessment Methodologies

This subtask is focusing on the evaluation of current and emerging resource assessment methodologies. Different methodologies are analysed and conclusions are formulated in the form of best practices guidelines and/or standards.

The three methods (ground based methods, Numerical Weather Prediction models (NWP) and satellite-based methods – are evaluated in this subtask. For each methodology a separate activity is defined:

- Activity 1.1 Ground based methods
- Activity 1.2 Numerical Weather models (NWP)
- Activity 1.3 Satellite-based methods
- Activity 1.4 Benchmarking framework

(h) Subtask 2: Enhanced Data & Bankable Products

Subtask 2 is mainly dedicated to end-users, notably in the PV domain. It is focusing on the main PV applications of the different types of solar resource products and datasets. End-users needs in concentrating solar thermal, solar heating and buildings will also be considered.

It consists of 5 activities:

- Activity 2.1 Data quality & format
- Activity 2.2 Merging of satellite, NWP and ground data
- Activity 2.3 Spatio-temporal high variability
- Activity 2.4 Long-term inter-annual variability
- Activity 2.5 Products for the end-users

(i) Subtask 3: Evaluation of Current and Emerging Solar Forecasting Techniques

Subtask 3 focusses on different aspects of forecast evaluation and comparison. In particular we will address the economic value of solar forecasting for a variety of different applications, the topic of regional forecasting important for transmission operators and variability and probabilistic forecasting. Depending of the application and the corresponding forecast horizon different models and input data are applied for solar irradiance and power forecasting. These include numerical weather predictions for several days ahead, satellite based cloud motion forecasts for several hours ahead, and sky imager forecasts for high resolution intra-hour forecasting as well as statistical models for measurement based forecasting and post-processing of physical model forecasts.

Each of the subtask 3 activities includes all of these different forecasting approaches.

- Activity 3.1: Value of solar power forecasts
- Activity 3.2: Regional solar power forecasting
- Activity 3.3: Variability forecasting and probabilistic forecasting

(j) Subtask 4: Dissemination and Outreach

This task focuses on dissemination of key results through routine reporting, conference presentations, webinars, and periodic newsletters.

- Activity 4.1: Produce a Task Brochure
- Activity 4.2: Produce a Periodic (6-month) Task Newsletter
- Activity 4.3: Conduct periodic (annual) Subtask-level webinars and/or conference presentations
- Activity 4.4 Update of solar resource handbook

5. OPERATING AGENT

Jan Remund, Meteotest, Fabrikstrasse 14, 3012 Bern, Switzerland (jan.remund@meteotest.ch) is the Operating Agent of Task 16.

From side of SolarPACES IA (Task V), Lourdes Ramirez (Ciemat, Spain) will be the Operating Agent.

6. RESPONSIBILITIES OF THE OPERATING AGENT

The Operating Agent shall be responsible for co-ordination of this Annex with other Annexes of this Agreement.

7. TIME SCHEDULE

This Annex shall remain in force for a period of 3 years from July 2017 till June 2020. It may be extended by agreement of two or more Participants, acting in the Executive Committee, taking into account any recommendation of the Agency's Committee of Energy Research and Technology concerning the term of this Annex, and shall thereafter apply only to those Participants.

8. FUNDING

Publications. The cost of publishing technical reports pursuant to the Subtasks of this Annex shall be met by such Subtask Leaders or Activity Leaders as Participants may agree upon.

Individual Financial Obligations. Each Participant shall bear all the costs it incurs in carrying out its obligations under this Annex, including reporting and travel expenses.

Task-Sharing Requirements. In total 54 institutions from 22 countries have indicated to invest a total of approximately 318 person-months in Annex XV, spread over the different Subtasks.

Meetings. Semi-annual meetings shall be hosted in turn by the Participants and the hosts will sustain the expenses of local organization of these meetings.

9. PARTICIPANTS

The Contracting Parties which have indicated that they plan to participate in this Annex are the following:

Name	Country	Confirmed
AF Consult	Sweden	yes
Blue Sky Wetteranalysen	Austria	yes
Bureau of Meteorology (BOM)	Australia	yes
CENER	Spain	
CIEMAT, Spain	Spain	(by SolarPACES, not yet by PVPS)
Clean Power Research	USA	yes
CSIRO	Australia	yes
DMI	Denmark	yes
DTU	Denmark	
Ecole Polytechnique à Palaiseau	France	yes
EDF R&D	France	yes
Energinet.dk	Denmark	
FH OOE Forschungs und Entwicklungs GmbH, Austria	Austria	yes
Fraunhofer ISE	Germany	
Fraunhofer IWES	Germany	
GeoModel s.r.o.	Slovakia	[not yet by SHC]
German Aerospace Center (DLR)	Germany	(by SolarPACES, not yet by PVPS)
Green Power Labs	Canada	
i-em	Italy	yes
Institut de Recherche en Energie Solaire et Energies	Morocco	(by SolarPACES)

Nouvelles (IRESEN)		
Irsolav	Spain	
ISES (NGO)	Germany	[SHC]
JRC	EU	yes
Laboratoire PIMENT/Univ. Réunion	France	yes
Masdar Institute	UAE	
Meteotest	Switzerland	yes
Mines ParisTech	France	yes
NASA Langley Research Center	USA	yes
National Renewable Energy Laboratory (NREL)	USA	yes
Peak Design	Great Britain	yes
Public Univ. of Navarra (UPNA)	Spain	yes
Reuniwatt	France	yes
Rina Consulting	Great Britain	(by SHC)
Solar Consulting Services	USA	yes
Solar Energy Research Institute of Singapore (SERIS)	Singapore	
South African Weather Service	South Africa	
SPF / HSR	Switzerland	yes
State University of New York/ Albany	USA	yes
Suntrace	Germany	(by SolarPACES, not yet by PVPS)
The University of the Faroe Islands	Denmark	
Total Solar / Sunpower	France	yes
Univ. Antilles	France	yes
Univ. Catolica de Chile	Chile	[not yet by SolarPACES]
Univ. Nacional Autónoma de México	Mexico	[not yet by SHC]
Univ. of California at San Diego (UCSD)	USA	yes
Univ. of East Anglia (UEA)	Great Britain	(by SHC)
Univ. of Jaen	Spain	
Univ. of Oregon	USA	yes
Univ. of Patras	Greece	(by SolarPACES)
Univ. of Sevilla	Spain	yes
Univ. of South Australia	Australia	yes
Univ. Utrecht	Netherlands	
Vaisala/3Tier	USA	yes
WEMC	Great Britain	(by SHC)

As of September 29th 2017 for PVPS IA a total of 46 institutions have applied for participation, 28 are confirmed, 18 are waiting on the confirmation. For SolarPACES IA 7 institutions have applied for participation, 5 are confirmed, 2 are waiting on it. 4 partners are confirmed by SHC, 1 is waiting on confirmation.