INTERNATIONAL ENERGY AGENCY
Solar Heating & Cooling Programme

SHC Task 36

Solar Resource Knowledge Management

Task Work Plan and Task Information Plan

Version 1

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Prepared for IEA SHC Programme by

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INTRODUCTION

Vision

The IEA Task "Solar Resource Knowledge Management" provides the solar energy industry, the electricity sector, governments, and renewable energy organizations and institutions with the most suitable and accurate information of the solar radiation field at the Earth's surface, ranging from historic data sets, to precise current products and towards forecasts and scenarios on to future availability of solar resources in a changing climate.

Rationale

The use of satellite imagery, in conjunction with quality ground data sets and other meteorological information, has become an increasingly important and effective way of developing site-time specific solar resource assessments over large areas. The advantage of the satellite approaches is that large areas of the earth's surface can be assessed at high spatial and temporal resolutions using uniform and consistent methodologies at relatively low costs, when compared to developing the same information using a ground-based network. The satellite-based methods leverage significant taxpayer investments in earth observing and weather monitoring satellite technology, offering highly cost-effective products that are of critical need to the solar energy planning and development community. However, although a number of organizations around the world have developed various approaches for producing these assessments, the individual methods have not been cross-compared and benchmarked with each other. In addition, access to these data sets, particularly by organizations outside of the countries that have developed them, is difficult and sometimes impossible. Finally, by assembling the experts from around the world to address these issues, significant opportunities to enhance the methods and to move into areas such as solar resource forecasting are now possible by leveraging R&D resources across the task members. Many of these experts participated in the United Nations Environment Programme's (UNEP's) Solar and Wind Resource Assessment (SWERA) Project; this IEA tasks affords the opportunity to maintain these activities and knowledge-sharing as the SWERA project comes to a conclusion in 2005.

Definition

"Solar resource information" is defined as all data describing site- and time-specific physical parameters of solar radiation at the Earth's surface needed for the proper design and operation of solar energy systems. Relevant solar applications include building heating and cooling (SHC), photovoltaic (PV), and concentrating solar power (CSP) systems for producing electricity and process heat. "Knowledge management" is of critical importance for the reliable flow of information to serve the evolving applications of these technologies, including their role in distributed energy networks.

Objective

The objective of Task XXXVI is to provide further standardization, better data reliability and availability, and improved spatial and temporal coverage, with customized solar resource products, including reliable solar radiation forecasts that are easily accessible to industry. Achieving these objectives would reduce the cost of planning and deploying solar energy systems, improve efficiency of solar energy systems by more accurate and complete solar

resource information, and increase the value of the solar energy produced by solar systems. This objective will be met by accomplishing three subtasks:

- Standardization of solar resource products to insure worldwide intercomparability and acceptance;
- Development of a common structure for archiving, processing and accessing solar resource information, such as through a single portal;
- Improved techniques for solar resource characterization and forecasting

Approach

An integrated multidisciplinary approach, involving key stakeholders will be used in carrying out the work in Task XXXVI. The task aims to provide globally comparable products based on data and methods from all over the world, which makes international cooperation in this field absolutely necessary. IEA provides an ideal framework to foster and guide such an international effort, which is of importance for three of its Implementing Agreements in the Renewable Energy Working Party.

The SHC Program will be the managing Implementing Agreement for the Task, but to assure the results contribute effectively to the broader needs of the solar technology industry, the Task will actively coordinate with several IEA Implementing Agreements, particularly PVPS and Solar PACES. To keep the task manageable collaboration with Solar PACES and PVPS should be on minimal level, which means that these 2 ExCos will be kept informed regularly on the tasks' progress, but do not steer the task. Nevertheless the task takes care to serve best also to the needs of these user communities.

Stakeholders

Following are the key stakeholders whose needs Task XXXVI will be designed to meet:

- **Industry:** Building sector, PV industry, CSP industry, SWH Industry
- **Planners:** Consultants, design engineers, developers
- **Finance and Insurance Sector; bi**-lateral banks, donors, venture capital, fund managers and re-insurance companies
- **Electricity Sector:** network and retail utilities; rural electrification authorities, independent power producers
- **Government:** National, regional, local planning and regulatory agencies
- **NGOs** and other promoters of solar energy
- **Researchers**

The interests of stakeholders are gathered through questionnaires. Stakeholders will be informed on the results of the Task through the website, a newsletter, presentations at conferences and by holding public workshops for industry and other parties.

SUBTASKS

There will be three subtasks in Task XXXVI. The total range of deliverables has been designed to be comprehensive such that they include and meet the various needs of the stakeholders who have been identified as users of solar resource information. Each of the deliverables is a separate product, which can be developed relatively independently from all the other deliverables. Through developing and producing these deliverables, Task XXXVI will contribute to achieving the vision of fast and easy access to relevant, qualified, and reliable solar resource information that has been benchmarked to international standards.

Subtask A: Standard qualification for solar resource products

This subtask will develop and produce deliverables designed to provide:

- Coherence and benchmarking of models producing surface irradiance values from satellite data
- Accessibility and coherence of ancillary model input data such as atmospheric conditions and land surface parameters
- Sensitivity analyses
- Ground truth validations with high quality data
- Definition of validation protocols and measures of end-product confidence
- Cross-satellite platform and cross-model comparisons

Subtask B: *Common structure for archiving and accessing resource products*

This subtask will develop and produce deliverables designed to provide:

- Development of worldwide networking between distributed data centers resulting in a global coverage for high-quality solar resource data
- Development of information and data exchange protocols
- Reliable and fast end-user access
- Preparation of data documentation for specific end-user applications

The main outcome of Subtask B will be a unique Web entry point that performs a smart networking of resources and products. More specifically, Subtask B will build upon the existing knowledge and precursor Web services, such as the portals SoDa or NASA services, to construct an advanced prototype of the information system. Resources (e.g., a database) will comprise a Web server and will be connected on a voluntary basis to this information system. Providers of such resources (e.g., NASA, DLR) are deemed to have a strong strategic interest in maintaining these resources, whether on a free or commercial basis. In the latter case, other sources of revenues may be obtained by opening to other domains such as agriculture or tourism. The Web service (entry point) will be made of core software only, easy to maintain, transfer and operate and to duplicate to ensure reliability. This service will be maintained by motivated partners, such as Armines, with possible commercial revenues.

The providers retain the property rights on their products / databases / applications and grant a license of use, commercial or not, as it is usual on the Internet or in meteorology. The core software (intelligent system) will be

Open Source and as such, may be disseminated to third parties and implemented by these third parties for similar or different purposes. The access to the Web entry point will be free. Some resources and applications will be free, while others will be commercial. This co-existence already exists with the present databases (e.g., the free SSE dataset from NASA, the free results of the UNEP project SWERA and the data from National Meteorological Services that are mostly commercial) and is not a problem as shown by experience: their respective users have different requests and constraints. Actually, the commercial world is full of examples of co-existing services / products having dramatically different prices (e.g., air travels). Anyway, the creation of the network foresees co-operation between different providers. Accordingly, it will be necessary to establish agreements between them and a framework will be provided. This framework will also deal with copyright and other legal aspects that should be known to producers and customers; this will be an activity of the sub-task B, and the final procedures will be cleared through the IEA legal office.

Subtask C: Improved techniques for solar resource characterization and forecasts

This subtask mainly covers R&D work and will result in deliverables providing

- Short-term (hours) to medium-term (days) solar resource forecasting
- Climatological analysis of long-term variability and trends of solar resources
- Improved exploitation of existing satellite resources (e.g. very high spatial resolution for plant micro-siting)
- Adaptation of resource assessment techniques to the capabilities of new generations of satellites
- Development of new methods to provide improved products like spectrally or angular resolved information.

RESPONSIBILITY FOR CARRYING OUT THE WORK

The Operating Agent will have overall Task project management responsibility. The Subtask leaders will manage the Subtask activities as an overall project. Activity Leaders will have the primary responsibility for producing the deliverables for 'their' activity within an agreed timeframe. Specifically, the responsibilities for each project management tier will be:

Operating Agent – *US proposed, to be decided by SHC ExCo*

- Coordination, scheduling and communication between Subtasks, including Task level meetings.
- SHC Executive Committee reporting and comments integration/dissemination.
- Coordination with other related SHC Tasks.
- Coordination with other IEA implementing agreements, with particular emphasis on PVPS and Solar-PACES.

Subtask Leaders Coordination, scheduling and communication between Activities, including Subtask level meetings and assisting Activity Leaders with engaging stakeholder/participant experts, as well as the information required to complete the deliverables for each activity.

- Reporting and coordination at the Task level with other Task leaders and the Operating Agent.

Activity Leaders

- Primary responsibility for producing deliverables.
- The remaining countries, which participate in an activity, will be expected to respond to requests for information promptly and reasonably comprehensively.

Task-level Experts meetings chaired by the Operating Agent will take place every six months, either in person (usually in conjunction with a regional or national conference) or via telephone and video conference call. Task meetings will be concerned with reviewing progress and coordinating work at the 'whole of Task' level. Given that the Task stakeholders are a diverse group, participating countries should nominate experts to attend the Task-level meetings who will be able to represent the interests of all stakeholders competently and fairly. The three subtask leaders will attend and participate in the Task level meetings. In between the experts meeting the information flow will usually take place in electronic form.

SUBTASK DETAILS

Timing Schedule and Milestones

The time frame for the overall task is 5 years. Anticipated starting date is Jul. 1st 2005. The Operating Agent and Subtask Leaders will hold a telephone conference call to initiate the task (when approved by ExCo). Each subtask leader will then contact the experts to initiate their work. The first experts meeting of all participating countries will be held approx. 6 month after the start of the task.

Table 1 details the sub-tasks, their activities, deliverables and stakeholders. Table 2 describes the leaders, participants and the level of resources to perform the activities. In this table, 'Estimated elapsed time' is the time period over which the work required to complete an activity will be undertaken. 'Estimated work required' is the number of person months of work required to complete each activity: two numbers are given, one is the minimal amount to achieve goals in a decent manner, the second is the recommended amount.

No results can be expected from activities, for which the indicated budget still is below the minimum required effort. These activities are kept listed as the participants of the Task Definition Workshop recommended them and further discussions among the Task organizing team let to the decision to keep them as they are regarded as relevant. These activities should be conducted as soon as sufficient funding becomes available.

INDICATIONS OF INTEREST

Table 2 shows early indications of interests of individual countries in participating in Task XXXVI subtasks and activities (on a no commitment basis). Decisions about participation of countries in one or more of the Subtasks will be made by the SHC Executive Committee, along with indications of support from the PVPS and Solar PACES ExCos. Table 3 details the participation of each country per activity.

TABLE 1: SUBTASK A DETAILS – ACTIVITIES, DELIVERABLES, AND STAKEHOLDERS

OBJECTIVE: To provide further standardization, better data reliability and availability, improved spatial and temporal coverage, and customized solar resource products that are easily accessible to industry.

ACTIVITIES	**DELIVERABLES/APPROACH**	**OUTCOME**	**INFORMATION SOURCES**	**STAKEHOLDERS**						
SUBTASK A: STANDARD QUALIFICATION FOR SOLAR RESOURCE PRODUCTS *SUBTASK OBJECTIVE*: TO PROVIDE THE USER COMMUNITY WITH BENCHMARKED, STANDARDIZED, VALIDATED WORLDWIDE SOLAR RESOURCE DATA SETS				Industry	Planners	Finance & Insurance	Electricity Sector	Government	NGOs	Researchers
A.1. Select and Qualify Ground Data Sets A.1.1 Survey of Existing Data Sets A.1.2 Document Data Sets A.1.3 Production of data sets and report		• Qualified and documented datasets, designed for the use in benchmarking and model qualification procedures	• Traceable sets of ground measured solar radiation, e.g. measurement data sets from BSRN, GAW, SWERA, WRDC, GEBA	CSP PV SHC	**CSP** **PV** **SHC**					**X**
A.2 Measures of Model Quality Required for Product Validation A.2.1 Define Measures of Model Quality A.2.2 Establish inter-comparison procedures A.2.3 Documentation / Report		• Documented procedures to identify selected measures for the quality of solar radiation products	•	CSP PV SHC						X

A.3 Develop Methodology for Establishing Coherent Benchmarking of Products A.3.1 Define which products to benchmark A.3.2 Sensitivity Analysis in Terms of Applications A.3.3 Perform Example Using SWERA Dataset		• Documented and tested procedures for the benchmarking of solar radiation products • Case study report using results from the SWERA project • Test Meteotest Lo Fi Satellite Radiation model	• Data sets from the SWERA project, Helioat-3 validation procedure	CSP PV SHC						X
A.4 Application of the benchmarking procedures to products of the Task A.4.1 Application of the benchmarking procedures to the model as improved by subtask C A.4.2 Characterize model performance as function of input data sets		• Qualification of subtask C products • Ranking of procedures and input data sets • Documentation of Qualification and ranking	• Subtask c products	CSP PV SHC						X

TABLE 1 (cont'd): SUBTASK B DETAILS – ACTIVITIES, DELIVERABLES, AND STAKEHOLDERS

OBJECTIVE: To enable reliable and fast end-user access to solar resource information, thus facilitating the uptake of information by end-user.

ACTIVITIES	**DELIVERABLES/APPROACH**	**OUTCOME**	**DATA SOURCES**	**STAKEHOLDERS**						
SUBTASK B: COMMON STRUCTURE FOR ARCHIVING, PROCESSING, AND ACCESSING RESOURCE DATA *SUBTASK OBJECTIVE*: PROVIDE A USER-ORIENTED STRUCTURE FOR ARCHIVING AND ACCESSING RESOURCE DATA				Industry	Planners	Finance & Insurance	Electricity Sector	Government	NGOs	Researchers
B.1 Evaluate Legal Aspects	Legal aspects and property rights. Analyze copyright on data and any other property right. Conclude MOUs if necessary and appropriate. Remind information producers and users of these legal aspects and property rights. Ownership and license agreement should be mentioned for each product on the information system	Clearance on legal aspects about the use of data	Previous experiences in Envisolar, NASA, SoDa, WMO, EuMetSat, NREL's RReDC, SWERA Archive	**X** SHC CSP PV		**X** SHC CSP PV			**X** SHC CSP PV	
B.2 Identify Commonly-used Software by End-Users	Identification of simulators and other application software commonly used by industry and other users (info) Report documenting the energy weather inputs to these software and their attributes (format, unit...). A synthesis will be made that will serve as a specification to the development of the information system (info)	Specifications on format outputs of the information system	Participating Countries	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV		**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV
B.3 Develop Data Exchange Protocols and Meta-Data	Define data exchange protocols and description of the information Identify the various protocols, assess the amount of data to be exchanged and select one or more protocols. The products should be standardized / unified for their output formats. Metadata will be used to describe space and time properties, units, parameters, and uncertainties... Define metadata to describe the products. Adopt and adapt the WMO/XML. Produce documentation. Report documenting various standards and detailing the adopted standard (info) Documents on the XML (XSLT, schema) (info)	Document on how to exchange data	W3C Consortium, ISO standards, WMO proposal for a "meteorological" XML	**X** SHC CSP PV				**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV

B.4 Develop Prototype	The Web information system receives a request from users, organizes the flow exchange between various producers and constructs the answer to the user. Using specifications and defined protocols, establish a prototype of the information system. It should be a Web service, acting as a one-stop shop and smartly connecting and exploiting the various sources of information, offering the best possible answer to a request. Development of an intelligent system to organize the flow, to analyze the request of the customer and decide which resources to query and to combine, and how to combine them. Development of a set of output formats for ingestion by commercial software. The adoption of technologies for the realization of the prototype should take into account a possible commercialization of some products.	A Web service prototype, enabling smart networking of resources	Existing Web services and previous experiences: SoDa, Satel-Light, SOLEMI, NASA services, RETScreen, SWERA Archive, and SARERDS...	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV
B.5 Develop Network of Resource Providers	Develop a worldwide networking between product providers. Providers will enable the prototype to search their resources. Metadata should describe the resources, allowing the prototype to decide which resources to use and how. Make the technologies for data exchanges and description implemented by product providers. Organize meetings and training, produce documentation for product providers.	A network of resources, enabling the service to users	Existing Web service SoDa	**X** SHC CSP PV				**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV
B.6 Develop Use of Prototype by Users	Access to the prototype by users. Create awareness about the system. Prepare documentation for the use of the information system. Organize gauging of the prototype information system by users. Organize the feedback from the users about the system itself and the products collect and analyze feedbacks. This can be organized in a voluntary way (e.g., on-line short questionnaire) and/or passive way (e.g., monitoring access and traffic on the Web site).	Comments by users on products and information system	Previous experiences performed by NASA, Armines and other partners	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV
B.7 Define Automatic Access by Commercial Applications	Automatic access by commercial simulators and other applications software in use in industry. Enable automatic and fast access of resources by commercial applications, through the information system. Creates awareness among software producers, meetings and preparatory work and documentation.	Commercial Applications access to up-to-date weather data	Previous experiences in CD-ROMs products, NASA and SoDa.	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	
B.8 Example application using solar micro-siting in GIS	Exploiting the prototype and GIS tools to create a case study in micro-siting of a plant. Enhancing the benefits of the tools.	Demonstration benefits of the tool for micro-siting	Prototype, outcomes of Subtask C, GIS	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV	**X** SHC CSP PV

TABLE 1 (cont'd): SUBTASK C DETAILS – ACTIVITIES, DELIVERABLES, AND STAKEHOLDERS

OBJECTIVE: To improve and extend methods for deriving information on solar resources, develop new methods and conduct applied research for characterization of the nature of solar radiation at the Earth's surface in all spatial and temporal scales relevant for solar energy systems.

ACTIVITIES	**DELIVERABLES/APPROACH**	**OUTCOME**	**DATA SOURCES**	**STAKEHOLDERS**						
SUBTASK C: IMPROVED TECHNIQUES FOR SOLAR RESOURCE CHARACTERIZATION AND FORECASTING *SUBTASK OBJECTIVE:* CONDUCT ESSENTIAL R&D TO IMPROVE THE ACCURACY, AND SPATIAL AND TEMPORAL COVERAGE CURRENT TECHNIQUES AS WELL AS SOLAR RADIATION FORECAST PRODUCTS				Industry	Planners	Finance & Insurance	Electricity Sector	Government	NGOs	Researchers
C.1 Spectral solar radiation products	Specification of user needs for spectral solar radiation products (e.g. spectral response function of PV and other spectrally selective solar systems, ev. certain spectral bands for solar chemical reactions, ev. degradation of solar systems by UV or other spectral bands). Analysis of existing methods and input data for producing requested spectral solar radiation products. If necessary improvement development of new methods for requested solar radiation products	• Typical solar spectra for various atmospheric conditions • Sensitivity study on influence of spectral variability on output of solar energy systems for certain atmospheric conditions • New solar radiation products, describing actual spectral character of sunlight	• Spectral data bases • Radiative transfer models • Atmospheric profiles with special emphasis on aerosol load	PV	PV Solar chemistry and detoxification					**PV** **SHC** CSP Solar chemistry and detoxification
C.2 Angular distributed solar radiation products	Specification of user needs for angular solar radiation products (e.g. daylighting for buildings, angular distribution within 5° FOV for concentrating solar systems) Analysis of methods and needed input data for achieving requested angular solar radiation products; comparing satellite-derived and ground-derived angular quantities (tilted irradiances and radiances/luminances) produced via previously validated angular models. If required development of new methods for requested angular solar radiation products	• Typical angular distribution of solar radiation for various atmospheric conditions • Sensitivity study on influence of variability of angular distribution of sunlight on the output of solar energy systems • If relevant new solar radiation products, describing actual angular character of sunlight, e.g. for circumsolar radiation	• 3D radiative transfer models • Atmospheric profiles	CSP SHC PV	CSP SHC PV					**CSP** **SHC** **PV**

C.3 Improved Satellite Models	Quantify impact of various critical situations on accuracy for different satellite-derived solar radiation products (e.g. snow cover and other high reflective surfaces, temporal and angular variability of albedo, inaccurate aerosol data, multi-layer clouds) Prepare improved albedo information (e.g. from MODIS/MISR, Landsat, NASA surface reflection team), and aerosol information. Adapt satellite methods to better input and improve accuracy	• Better description of atmospheric conditions relevant for solar radiation on the ground leading to improved quality of broadband solar radiation products • Input to C.1, C.2, C.4)	• Satellite data and auxiliary data • Radiative transfer models	CSP PV SHC	**CSP** **PV** **SHC**	**CSP** **PV** **SHC**		**CSP** **PV** **SHC**	CSP PV SHC	CSP PV SHC
C.4 Solar Micro-Siting	Deriving 1 km cloud data sets including cloud optical properties and height for 3 D description from high resolution operational satellite imagers Improved albedo for more appropriate surface reflection data Provide high-resolution aerosol information. Adapt satellite methods to better input and improve accuracy. Handle accurate satellite navigation, point spread function of the sensors, scattering from neighboring pixels, shading from clouds and topography. Case study solar micro-siting by radiative transfer models (3D) and inter-comparison with very high resolution ground measurement network, compare results for different scales: 10 km - 1km - 100m	• Case study for solar micro-siting of CSP plant • Case study for solar micro-siting of big PV system • Approach for fast high resolution solar mapping	• High resolution cloud data in 1 km scale from MODIS, AVHRR, MSG • digital terrain model in 100 m scale • High resolution angular surface reflection • 3D-radiative transfer models	CSP PV	**CSP** **Big** **PV**	CSP PV				**X**
C.5 Climatological Long-term Analysis	Analysis of long-term measurements, satellite observations and reanalysis data sets from atmosphere models for variability of global and direct radiation. Scenarios of Global Climate Models for sensitivity of changes of the available solar resource Analysis of temporal variability on various spatial scales Recommendations to solar energy industry and decision makers for future market development based on expected regional climate changes	• Assessment of long-term quality and variability and • Impact on significance of solar radiation assessments based on shorter term of measurements (important for subtask A) (important for subtask A)	• Long-term high quality measurements • ISCCP and SOLEMI data set • Reanalysis data • Climate model data		**CSP** **Big** **PV**	**CSP** **Big** **PV**		CSP PV SHC	CSP PV SHC	X

C.6 Now- and Short-term Forecasting of Solar Radiation	Compare and improve existing now-casting Prototype products for forecasting periods up to 3-hour forecasts Compare existing now-casting and short term forecasting tools for up to 2 days based on different principles (statistical (MOS), numerical weather forecasts (LM, MM5, eta) capable of providing solar radiation products Improvement of models for solar radiation prediction by aerosol forecasting, ensemble forecasting, best member selection for probabilistic approach, model, assimilation by satellite data. Develop comprehensive forecasting scheme using best practice for each time frame. Identification of most-promising models and recommend best practice	• Optimized use of meteorological data and predictions • Up to 2 day forecasts for optimization of grid operations and day-trading of electricity	• For up to 6 h extrapolation of satellite observations • Regional models • Ensemble forecasts	CSP SHC PV	CSP SHC PV		**CSP** **SHC** **PV**			
C.7 Mid-term Forecasting of Solar Radiation	Evaluate existing mid-term forecasting (e.g. ensemble forecasts from ECMWF and NOAA) for solar irradiance prediction Prototype products for irradiance forecasting periods up to 10 days Identification of most-promising models and recommend best practice	• Forecast strategies for optimized filling of 10 day-storage	• Ensemble forecasts			**X**	**X**			
C.8 Seasonal to Inter-annual Forecasting of Solar Radiation	Compare neural network methods with meteorological model forecast by NASA Analysis of influences from El Nino, Northern Atlantic Oscillation, Quasi Biannual Oscillation etc.	• Forecast strategies for optimized filling of seasonal storage • Actual information on future resource needs	• NOAA SFM • NASA NSIPP seasonal prediction models			**X**	**CSP** **PV**			

TABLE 2 LEADS, PARTICIPANTS, AND RESOURCE REQUIREMENTS

SUBTASK A: Standard Qualification for Solar Resource Products		**Subtask Lead - Germany**	**Interested Participants – Canada, EC, France, Germany, Portugal, Spain, Switzerland, U.S.A.**
Activities	**Activity Lead** /Participants (Person months: secured / target)	**Total of Est. Work** (person months) (Minimal) **recommended**	**Estimated Elapsed Time** (Calendar months from start)
A.0 Coordination	**H2 Magdeburg, Germany (**8/10**)**	(6) **8**	**1-60**
A.1. Select and Qualify Ground Data Sets	NASA (1.5/1.5), NREL(3/3); Armines (0/2.5); CIEMAT (0/2.5); DLR (0/2), mc (1/2) ; Meteotest (0/1.75); INETI (0/1); Canada (1/1.25)	(11) **19.5**	**1-24**
A.2 Measures of Model Quality Required for Product Validation	**H2 Magdeburg** (0/1)**,** DLR (1/2); EHF (0,1) SUNYA (0/3.5), NREL (1/1); NASA (1.5/1.5) CIEMAT (0/3), INM (0/2); Armines (0/1.5);	(10) **17**	**1-24**
A.3 Develop Methodology for Establishing Coherent Benchmarking of Products	**NASA** (2/2), SUNYA (0/5), NREL (0/3); Armines (0/2); CIEMAT (0/1.5), INM (0/0.5); H2 Magdeburg (0/1), DLR (0/3), EHF (0/2); JRC (2/2)	(13) **21**	**12-48**
A.4 Application of the benchmarking procedures to products of the Task	**H2 Magdeburg** (0/5), DLR (0/1); Armines (0/2); JRC (2/2); NREL (2/2), SUNY (0/2), NASA (2/2); UPNA (1/2), CIEMAT (0/2)	(12) **20**	**36-60**
Total Subtask A		(52) **85.5**	**1-60**

SUBTASK B: Common structure for archiving, processing, and accessing resource data		**Subtask Lead - France**	**Interested Participants** Canada, EC, France, Germany, Spain, Switzerland, USA
Activities	**Activity Lead** /Participants (Person months: secured / target)	**Total of Est. Work** (person months) (Minimal) **recommended**	**Estimated Elapsed Time** (Calendar months from start)
B.0 Coordination	**Armines, France (20/20)**	(15) **20**	**01 - 60**
B.1 Legal Aspects	**Armines** (1/1), MSC (1/1), INM (0.5/1), DLR-DFD (1/1)	(2) **3**	**36 - 48**
B.2 Identification of Commonly-Used Software by end users	**SUNYA** (0.5/0.5), NASA (0.5/0.5), Meteotest (0.5/0.5), NREL (2/2), mc (1/1)	(2) **3**	**01 - 12**
B.3 Data Exchange Protocols and Meta-Data	**Armines** (3/3), JRC (1/1), NASA (3/3), DLR-DFD (1/2), NREL (2/2)	(4) **8**	**06 - 24**
B.4 Development of the Prototype	**Armines** (12/12), JRC (5/5), NASA (6/6)	(12) **20**	**13 - 30**
B.5 Networking of Resource Providers	**NASA** (3/3), DLR-DFD (1/1), Armines (2/2), INM (0.5/1)	(3) **6**	**15 - 30**
B.6 Use of Prototype by Users	**Armines** (3/3)**,** Meteotest (1/1.5), NASA (2/2), mc (1/3)	(3) **6**	**24 - 36**
B.7 Automatic Access by Commercial Applications	NASA (2/2)**,** Armines (2/2), Meteotest (1/1), DLR-DFD (1/3), mc (2/6)	(3) **5**	**36 - 60**
B.8 Example application using solar micro-siting in GIS	**JRC** (1/1), NREL (1/1), mc (0/12), DLR-TT (0/3)	(1) **2**	**36 - 60**
Total Subtask B		(45) **73**	**01 - 60**

SUBTASK C: Improved techniques for solar resource characterization and forecasts		**Subtask Lead: Germany**	**Interested Participant** Canada, EC, Germany, Spain, U.S.A.
Activities	**Activity Lead** /Participants (Person months: secured / target)	**Total of Est. Work** (person months) (Minimal) **recommended**	**Estimated Elapsed Time** (Calendar months from start)
C.0 Coordination	**DLR, Germany (3/15)**	(10) **20**	**01 - 60**
C.1 Spectral solar radiation products	**Environment Canada (30/42)** SUNY, US (5/5) NREL, US (1.5/1.5) CIEMAT, Spain (2/6) EHF (0/6) in coop. with CIEMAT DLR-IPA (0/4)	(12) **18**	**01-24**
C.2 Angular distributed solar radiation products	**SUNYA, US (5/5)** NASA (6/6) UPN; Spain (2/3)	**(12) 24**	**01-24**
C.3 Improved accuracy of satellite-derived solar radiation products under specific conditions	**SUNY, US (0/5)** NASA, US (6/6) EHF, Germany (20/20) DLR, Germany (3/22) NREL, US (2/2) UPN, Spain (1/2)	(20) **36**	**01-36**
C.4 Methodology for solar micro-siting to ideally place and adapt solar systems for the specific site	**DLR**, Germany (0/33) EHF, Germany (10/10) mc, Gernany (0/3) NASA, US (7/7) NREL, US (1/1) CIEMAT (1/2) JRC, EU (4/8)	(34) **66**	**12– 48**

C.5 Climatological analysis of very long-term solar radiation time-series	**DLR, Germany (9/24)** INETI, Portugal (TBD) INM, Spain (2/2) Meteotest, Switzerland (TBD) NASA, USA (7.5/7.5) NREL, USA (1.5/1.5) SUNY,USA (1/1)	(9) **37**	**01 - 36**
C.6 Now- and short-term forecasting of solar radiation (from present to 3 hours and up to 3 days)	**EHF, Germany (30/30)** CIEMAT, Spain (2/3) DLR-DFD, Germany (15/15), DLR-IPA, Germany (0/36) Meteotest, Switzerland (2/3) NASA, USA (5/5) NREL, USA (0.5/0.5) SUNY, USA (5/5)	(48) 60	01 – 36
C.7 Mid-term solar radiation forecasting for up to 2 weeks	**SUNY, USA** (0/6) NASA, USA (2/2) Meteotest, Switzerland (2/3)	(12) **24**	**12-48**
C.8 Adapt and test methods allowing seasonal and inter-annual solar radiation forecasts	**NASA (8/8), USA** NOAA, USA (TBD)	(12) **24**	**12-48**
Total Subtask C		(157) 285 (13.1 PY) 23.75 PY	01 – 48
Task Totals		**(254) 443.5 PM (36.9 PY)**	**01 – 60**

TABLE 3 RESOURCES (PERSON-MONTHS) PER COUNTRY AND PER SUBTASK

Three numbers are given: the first one is the resources already secured, the second is the recommendation (for total) or the target (for each country) and the third in parenthesis is the minimum.

Subtask A: resources secured/targeted (minimum required)

Activity **Country**	**A .0 Coordination**	**A .1 Select and qualify ground data sets**	**A.2 Measures of model quality**	**A.3 Develop methodology for establishing coherent benchmarking**	**A.4 Application of benchmarking procedures to products of Subtask C**	**Total**
Activity lead country	**Germany**	**USA? (TBD)**	**Germany**	**USA (NASA)**	**Germany**	
Canada		1 / 1.25				1/ 1.25
France		0.5/0.5	2/2	1.5/1.5		4/4
Germany	8/10	1 / 4	1 / 3	0 / 4	0 / 2	10 / 23
JRC/EU				2 / 2	2 / 2	4/ 4
Portugal		0 / 1				0/ 1
Spain		0 / 2.5	0 / 5	0 / 2	1 / 4	1/ 13.5
Switzerland		0 / 1.75				0/ 1.75
USA		4.5/4.5	2.5 / 6	2/10	4 / 6	13/ 26.5
Total	**8 / 10 (6)**	**9/ 19.0 (10)**	**4 / 16 (10)**	**4.5 / 21 (13)**	**5 / 20 (12)**	**33/ 75 (51)** **Secured: 33** **Targeted: 75** **Minimum: 51**

Subtask B resources secured/targeted (minimum required)

Activity **Country**	**B.0** **Coordination**	**B.1** Legal Aspects	**B.2** Identification of commonly used software by end-users	**B.3** Data exchange protocols	**B.4** Development of the prototype	**B.5** Networking of resource providers	**B.6** Use of Prototype by users	**B.7** Automatic Access by commercial applications	**B.8** Example application using solar micro-siting in GIS	**Total**
Activity lead	**France**	**France**	**USA (SUNY)**	**France**	**France**	**USA (NASA)**	**France**	**USA? (TBD)**	**European Commission**	
Canada		1/1								**1/1**
France	20/20	1/1		3/3	12/12	2/2	3/3	2/2		**43/43**
Germany		1/1	1/1	1/2		1/1	1/3	3/9	0/15	**8/32**
JRC/EU				1/1	5/5				1/1	**7/7**
Portugal										
Spain		0.5/1				0.5/1				**1/2**
Switzerland			0.5/0.5				1/1.5	1/1		**2.5/3**
USA			3/3	5/5	6/6	3/3	2/2	2/2	1/1	**22/22**
Total	**20/20 (15)**	**3.5/4 (2)**	**4.5/4.5 (2)**	**10/11 (4)**	**23/23 (12)**	**6.5/7 (3)**	**7/9.5 (3)**	**8/14 (3)**	**2/17 (1)**	**84.5 / 110 (45)** **Secured: 84.5** **Targeted: 110** **Minimum: 45**

Subtask C resources secured/targeted (minimum required)

Activity **Country**	**C.0** Coordination	**C.1** Spectral solar radiation products	**C.2** Angular distributed solar radiation products	**C.3** Improved accuracy of satellite-derived solar radiation	**C.4** Develop solar Micro-Siting	**C.5** Climatological analysis of very long-term radiation time-series	**C.6** Now- and short term forecasting of solar radiation	**C.7** Midterm solar forecasting for up to 2 weeks	**C.8** Seasonal and inter-seasonal solar forecasting	**Total**
Activity Lead	**Germany** (DLR)	**Canada** (Environment Canada)	**USA** (SUNY)	**USA** (SUNY)	**German** (DLR)	**Germany** (DLR)	**Germany** (EHF)	**USA** (SUNY)	**USA** (NASA)	
Canada		30/42								**30/42**
France										
Germany	3/15	0/10		23/42	10/46	9/24	45/81			**90/218**
JRC/EU					4/8					**4/8**
Portugal										
Spain		2/6	2/3	1/2	1/2	2/2	2/3			**10/18**
Switzerland							2/3	2/3		**4/6**
USA		6.5/6.5	11/11	8/13	8/8	10/10	10.5/10.5	2/2	8/8	**64/69**
Total	**3/15 (10)**	**38.5/64.5 (12)**	**13/14 (12)**	**32/57 (20)**	**25/66 (34)**	**21/36 (9)**	**59.5/97.5 (48)**	**4/5 (12)**	**8/8 (12)**	**202/361 (169)** **Secured: 202** **Targeted: 361** **Minimum: 169**

TASK 36 INFORMATION PLAN

The following documents are planned during the Task 36 work:

Information Brochure

An information dossier on “The Collaborative IEA Task on Solar Resource Knowledge Management” shall be published by the end of Year 1.

Newsletter

An electronic newsletter targeted to the solar industry and other stakeholders will be produced at the end of Years 2, 3 and 4. The Newsletter will be posted to a web site, and information on its availability will be sent through national channels (for instance, included in a solar industry or solar associations like ISES, ASES, ESTIF)

Semi-Annual Task Progress Reports

The OA will prepare progress reports on Task 36 activities, and submit these to the SHC ExCo approximately three weeks prior to each meeting of the ExCo. To the extent possible, the OA will also participate in the ExCo meetings and give an oral presentation on the task activities.

Stakeholder Workshops

Public international wworkshops mainly addressing stakeholders from industry will be held during the Task duration, usually in conjunction with annual Task meetings. It is intended to organize these workshops along with major solar conferences. All newsletter subscribers and target user groups will be invited. Additional National workshops can also be organised by Task participants using the information gathered during Task workshops and the material produced by the Task.

Scientific Publications

All Task Participants shall present and discuss their new results obtained in conjunction with the IEA Task at scientific conferences. Depending on the type of work this can either be solar energy, meteorology or remote sensing related conferences, depending on where the critical feedback from colleagues best suites the work. Results should be published in conference proceedings and preferably in peer-reviewed journals. IEA should be acknowledged in all cases, where there are strong connections to the work defined in this work plan.

Handbook on Solar Resources

One of the major products shall be a monograph on solar resources reviewing the state of the art. This book edited by the OA and subtask leaders with contributions from Task participants should be submitted in the course of the 5th year of the task.

Sub-Task Reports

The following major deliverables are anticipated from each of the Sub Tasks:

<u>Subtask A: Standard Qualification for Solar Resource Products</u>

A 1: Comprehensive List of Existing Data bases and information of traceable data quality.

A 2: Description of procedures to identify quality measures for radiation products

A 3: Definition of benchmarking procedures for solar radiation products with respect to application and end use accuracy

A 4: Report on the Benchmarking of the products developed by Subtask C including a ranking of both procedures and input data sets applied

Subtask B: Common Structure for Archiving, Processing, and Accessing Resource Data

B 1: Internal report to the SHC ExCo summarizing the method by which intellectual property and commercialisation of data are being addressed by the Task participants

B 2: Document Describing the Web Portal, including how data exchanges within the portal are to occur

Subtask C: Improved Techniques for Solar Resource Characterization and Forecasting

C 1: New solar radiation database products describing actual spectral and angular character of sunlight, incorporated into the Web Portal with documentation.

C 2: Case study report on solar micrositing for CSP and large grid-connected PV systems

C 3: Report describing results of short and medium-term forecasting studies, with recommendations on a strategy for implementing the forecasts in utility-scale applications.

Formal Issues

The following minimum information will be included in each major information product of the Task:

- Title (preliminary or final)
- Subtask connection
- Report Number (if known)
- Category: To be Published or Internal Working Document
- Purpose of report (or other product)
- Outline of contents
- Intended audience
- Production Schedule:
  - Expected date of distribution of the first draft to Task experts for review
  - Expected date of approval of final draft by Task experts
  - Expected date of Executive Committee review and approval
- Names and affiliation of those responsible for writing, editing, production, printing & distribution
- How information production and dissemination costs will be shared
- Dissemination & publicity plans
- Plan to assess impact of products

* Excluded from the Information Plan are "exchanged material"--any report, paper, brochure or software contributed by a participating country representing work performed outside of the Task, but which may be useful to the collaborative work or otherwise of interest to the other participants. A list of such material exchanged may be maintained, but such material is not part of the information plan.

DRAFT

ANNEX XXXVI

SOLAR RESOURCE KNOWLEDGE MANAGEMENT

DRAFT June 2005

SOLAR HEATING AND COOLING PROGRAMME

ANNEX XXXVI

SOLAR RESOURCE KNOWLEDGE MANAGEMENT

DRAFT: MAY, 2005

DESCRIPTION OF TECHNICAL SECTOR; DEFINITIONS

(a) Description of Technical Sector

The IEA Task "Solar Resource Knowledge Management" will provide the solar energy industry, the electricity sector, governments, and renewable energy organizations and institutions with the most suitable and accurate information of the solar radiation field at the Earth's surface. This information will be derived from historic data sets, from currently derived data products using satellite imagery and other means, and from short-term forecasts and scenarios on the future availability of solar resources in a changing climate.

(b) Definitions

"Solar resource information" is defined as all data describing site- and time-specific physical parameters of solar radiation at the Earth's surface needed for the proper design and operation of solar energy systems. Relevant solar applications include building heating and cooling (SHC), photovoltaic (PV), and concentrating solar power (CSP) systems for producing electricity and process heat. "Knowledge management" is of critical importance for the reliable flow of information to serve the evolving applications of these technologies, including their role in distributed energy networks.

2. RATIONALE FOR THE TASK

The use of satellite imagery, in conjunction with quality ground data sets and other meteorological information, has become an increasingly important and effective way of developing site-time specific solar resource assessments over large areas. The advantage of the satellite approaches is that large areas of the earth's surface can be assessed at high spatial and temporal resolutions using uniform and consistent methodologies at relatively low costs, when compared to developing the same information using a ground-based network. The satellite-based methods leverage significant taxpayer investments in earth observing and weather monitoring satellite technology, offering highly cost-effective products that are of critical need to the solar energy planning and development community. However, although a number of organizations around the world have developed various approaches for producing these assessments, the individual methods have not been cross-compared and benchmarked with each other. In addition, access to these data sets, particularly by organizations outside of the countries that have developed them, is difficult and sometimes impossible. Finally, by assembling the experts from around the world to address these issues, significant opportunities to enhance the methods and to move into areas such as solar resource forecasting are now possible by leveraging R&D resources across the task members. Many of these experts participated in the United Nations Environment Programme's (UNEP's) Solar and Wind Resource Assessment (SWERA) Project; this IEA tasks affords the opportunity to maintain these activities and knowledge-sharing as the SWERA project comes to a conclusion in 2005.

COLLABORATION WITH OTHER PROGRAMMES

The Solar Resource Knowledge Management Task has established a "Minimal" level of collaboration with both the Solar PACES (Solar Power and Chemical Energy Systems) Implementing Agreement and the PVPS (Photovoltaic Power Systems) Implementing Agreement according to the SHC Guidelines for Co-ordination with other Implementing Agreement.

At this level, experts selected by the Solar PACES Implementing Agreement and the PVPS Implementing Agreement participate in experts' meetings of the Task. The Task will be fully defined and managed by the Solar Heating & Cooling IA with appropriate input from the other Implementing Agreement.

4. OBJECTIVES

The objectives of this Task are to provide further standardization, better data reliability and availability, and improved spatial and temporal coverage, with customized solar resource products, including reliable solar radiation forecasts, which are easily accessible to industry. Achieving these objectives would reduce the cost of planning and deploying solar energy systems, improve efficiency of solar energy systems by more accurate and complete solar resource information, and increase the value of the solar energy produced by solar systems.

5. MEANS

The Participants shall share the co-ordinated work necessary to carry out this Task.

(a) Subtask Approach

The objectives shall be achieved by the following three Subtasks:

(1) Subtask A: Standard Qualification for Solar Resource Products

The objectives of this Subtask are to provide:

a) Coherence and benchmarking of models producing solar irradiance values from satellite data;
b) Accessibility and coherence of ancillary model input data such as atmospheric conditions and land surface parameters;
c) Sensitivity analyses;
d) Ground truth validations with high quality data;
e) Definition of validation protocols and measures of end-product confidence;
f) Cross-satellite platform and cross-model comparisons

(2) Subtask B: Common Structure for Archiving and Accessing Resource Products

The objectives of this subtask are to develop and produce deliverables designed to provide:

a) Development of worldwide networking between distributed data centres resulting in a global coverage for high-quality solar resource data;
b) Development of information and data exchange protocols;
c) Reliable and fast end-user access;
d) Preparation of data documentation for specific end-user applications.

(3) Subtask C: Improved Techniques for Solar Resource Characterization and Forecasts

The objectives of this Subtask are to develop and produce deliverables designed to provide:

a) Short-term (hours) to medium-term (days) solar resource forecasting
b) Analysis of long-term variability of solar resources
c) Improved exploitation of existing satellite resources (e.g. very high spatial resolution for plant micro siting);
d) Adaptation of resource assessment techniques to the capabilities of new generations of satellites;
e) Development of new methods to provide improved products like spectrally- or angular-resolved information.

(b) Responsibilities of the Subtask Leaders

The Subtask Leader for each of the three Subtasks will:

1) Co-ordinate the work performed under that Subtask;

2) Assist the Operating Agent in preparing the detailed program of work and budget;

3) Direct technical workshops and provide the Operating Agent with written summaries of workshop results; and

4) Edit technical reports from the Subtask and organise their publication.

Each Subtask Leader shall be a Participant which provides to the Subtask a high level of expertise and undertakes substantial research and development in the field of the Subtask. The Subtask Leaders shall be proposed by the Operating Agent, and designated by the Executive Committee, acting by unanimity of the Participants. The Executive Committee, acting by unanimity of the Participants, may agree to changes in the Subtask Leaders.

(c) Technical Advisory Committee

The Participants shall establish a Technical Advisory Committee consisting of the Subtask Leaders and the Operating Agent. The Technical Advisory Committee shall assist the Operating Agent in the co-ordination of the Task and advise the Operating Agent on the performance of the Task. The Subtask Leaders may designate other members of their Subtask (e.g. Activity Leaders) to assist them in this advisory capacity.

(d) Intellectual Property and Data Access Issues

Any issues associated with intellectual property and data rights will be covered under Subtask B. The main outcome of Subtask B will be a unique Web entry point that performs a smart networking of resources and products. More specifically, Subtask B will build upon the existing knowledge and precursor Web services, such as the portals SoDa or NASA services, to construct an advanced prototype of the information system. Resources (e.g., a database) will comprise a Web server and will be connected on a voluntary basis to this information system. Providers of such resources (e.g., NASA, DLR...) are deemed to have a strong strategic interest in maintaining these resources, whether on a free or commercial basis. In the latter case, other sources of revenues may be obtained by opening to other domains such as agriculture or tourism. The Web service (entry point) will be made of core software only, easy to maintain, transfer and operate and to duplicate to ensure reliability. This service will be maintained by motivated partners, such as Armines, with possible commercial revenues.

The providers retain the property rights on their products / databases / applications and grant a license of use, commercial or not, as it is usual on the Internet or in meteorology. The core software (intelligent system) will be Open Source and as such, may be disseminated to third parties and implemented by these third parties for similar or different purposes. The access to the Web entry point will be free. Some resources / applications will be free, others will be commercial. This co-existence already exists with the present databases (e.g., the free SSE dataset from NASA, the free results of the UNEP project SWERA and the data from National Meteorological Services that are mostly commercial) and is not a problem as shown by experience: their respective users have different requests and constraints. Actually, the commercial world is full of examples of co-existing services / products having dramatically different prices (e.g., air travels). Anyway, the creation of the network foresees co-operation between different providers. Accordingly, it will be necessary to establish agreements between them and a framework will be provided. This framework will also deal with copyright and other legal aspects that should be known to producers and customers; this will be an activity of the sub-task B, and the proposed approach will be cleared with the IEA legal office.

6. RESULTS

The products of work performed in this Annex are designed for use by a broad segment of the solar industry, including manufacturers, planners, engineers, technicians, and installers of solar electric and solar thermal systems, and for potential buyers and users of these systems (including trade and industry, utilities, domestic purchases). Results of the joint activity will include:

Subtask A:

a) Documented procedures to identify selected measures for the quality of solar radiation products

b) Documented and tested procedures for the benchmarking of solar radiation products

c) Case study reports using results from earlier projects, e.g. the United Nations Environment Programme's (UNEP's) Solar and Wind Energy Resource Assessment (SWERA) Project

d) Validation of models and methods using primarily existing measurement programs

Subtask B:

a) Evaluation of legal aspects and property rights to the data, using Memorandum's of Understanding (MoUs) as necessary, and noting the users of legal aspects and property rights. Ownership and property rights should be mentioned for each product on the information system.

b) Definition of data exchange protocols and the metadata needed to define products, and description of information needed to assess the amount of data to be exchanged.

c) Establishment of a prototype of a web-based information system serving as a one-stop shop, and connecting and processing the various distributed sources of information, offering the best possible response to a data query or the best output format to support commercial software. This will include the possible commercialization of some products.

e) Development of a worldwide network among product provides, including organization of meetings and training, and documentation for product providers.

f) Provision of access to the prototype by end users, including documentation on use of the system, and incorporation of feedback by the users.

g) Identification of simulation and application software commonly used by industry and other users.

h) Report documenting the energy weather inputs to these commonly used software.

i) Definition of automatic access to applications software in use by the industry, including fast access of resource information for commercial applications.

I) Example application using solar micro-siting methods in GIS.

k) Terms of reference for an operational solar forecasting service.

Subtask C:

a) Spectral solar radiation products including typical solar spectra for various atmospheric conditions, sensitivity studies on the influence of spectral variabi8lity on the output of solar energy systems for certain atmospheric conditions, and new solar radiation products describing the actual spectral character of sunlight.

b) Angular distributed solar radiation products including the angular distribution of solar radiation for various atmospheric conditions, sensitivity studies on the influence of variability of angular distribution of sunlight on the output of solar energy systems, and new solar radiation products describing the actual angular character of sunlight.

c) Improved satellite-derived solar radiation models that incorporate a better description of atmospheric conditions relevant to the amount of solar radiation reaching the earth's surface.

d) Development of solar micro-siting techniques using 3-dimensional radiative transfer models, including case studies for solar micro-siting of CSP systems and large-scale PV systems, along with an approach for fast high-resolution solar mapping.

e) Development of methods for forecasting solar radiation in several time scales.

Whether these results can be reached depends on the degree of funding made available by the participating governments for these activities.

7. TIME SCHEDULE

This Task will enter into force on July 1, 2005 and remain in force until June 30, , 2010. Within the limits of the term of Agreement, this Annex may be extended by two or more Participants, acting in the Executive Committees, and shall thereafter apply only to those Participants.

8. SPECIFIC OBLIGATIONS AND RESPONSIBILITIES OF THE PARTICIPANTS

In addition to the obligations enumerated in Articles 5 and 6 of this Agreement, each Participant shall:

a) Provide the Operating Agent with detailed reports on the results of the work carried out for each Subtask;

b) Collect, assess and report to the Operating Agent methods and procedures on solar resource assessments and data archiving in his/her countries; and

c) Participate in the editing and reviewing of draft reports of the Task and Subtasks.

9. Specific Obligations and Responsibilities of the Operating Agent

The Operating Agent shall:

a) Prepare and distribute the results mentioned in Article 6 above;

b) Prepare joint assessments of research, development and demonstration priorities for solar resource assessment and knowledge management;

c) At the request of the Executive Committee, organise workshops, seminars, conferences and other meetings;

d) Prepare the detailed Program of Work for the Task in consultation with the Subtask Leaders and the Participants and submit the Program of Work for approval to the Executive Committee of the SHC Programme, with input and feedback from the Solar PACES and PVPS Programmes.

e) Propose and maintain a methodology and a format for the submission of information on solar resource knowledge management which is collected by the Participants;

f) Provide semi-annually reports to the Executive Committee, with copies to the Solar PACES and PVPS Programmes, on the progress and the results of the work performed under the Program of Work;

g) Provide to the Executive Committee, within six months after completion of all work under the Task, a final report for its approval and transmittal to the Agency;

h) In co-ordination with the Participants, use its best efforts to avoid duplication with activities of other related programs and projects implemented by or under the auspices of the Agency or by other competent bodies;

i) Provide the Participants with the necessary guidelines for the work they carry out with minimum duplication;

j) Perform such additional services and actions as may be decided by the Executive Committee, acting by unanimity; and

k) Gather documents from Subtask Leaders, edit and distribute the output of the Task either as a printed handbook, on a CD-ROM or on a Web site.

10. MEETINGS

There will be Experts meetings of the Task at intervals of approximately 6 months. Subtask Leaders may arrange meetings in between or in association with Experts meetings of the Task. In order to save travel

costs, the use of telephone and video-conferencing technologies will be implemented to the extent possible. Participation at the Experts Meetings by the Subtask Leaders will be mandatory.

11. FUNDING

(a) Meetings

Each country will bear the costs of its own participation in the Task, including necessary travel costs. The cost of organising meetings will be borne by the host country. In lieu of face-to-face meetings, teleconferencing will also be considered for some of these meetings to minimize travel costs.

(b) Individual Financial Obligations

Aside from providing the resources required for performing the work of the Subtasks in which they are participating, all Participants are required to commit the resources necessary for activities which are specifically collaborative in nature and which would not be part of activities funded by national or international sources. Examples include the preparation for and participation in Task meetings, co-ordination with Subtask Participants, contribution to the documentation and dissemination work and Task related R&D work which exceeds the R&D work carried out in the framework of the national (or international) activity.

(c) Task-Sharing Requirements

Each country that wishes to participate shall commit a minimum of 3 person-months for each year of task operations. If the country is participating in a specific activity or activities whose expected elapsed time is less than the five-year Task period, the country shall commit a minimum of 3 person-months per year during the course of the activity or activities. The Operating Agent shall commit a further minimum of 0.25 person-year per year over the period of five years of this Task.

12. OPERATING AGENT

The Government of the United States of America, acting through the National Renewable Energy Laboratory, a laboratory of the U. S. Department of Energy, is designated as Operating Agent.

13. INFORMATION AND INTELLECTUAL PROPERTY

For purposes of this Annex, the following provisions shall prevail:

(a) For arising information regarding inventions the following rules shall apply:

1) Arising information regarding inventions shall be owned in all countries by the inventing Participant. The inventing Participant shall promptly identify and report to the Executive Committee any such information along with an indication whether and in which countries the inventing Participant intends to file patent applications;
2) Information regarding inventions on which the inventing Participant intends to obtain a patent protection shall not be published or publicly disclosed by the Operating Agent or the other Participants until a patent has been filed, provided, however, that this restriction on publication or disclosure shall not extend beyond twelve months from the date of reporting of the invention. It shall be the responsibility of the inventing Participants to appropriately mark Task reports which disclose inventions that have not been appropriately protected by filing a patent application.

(b) The inventing Participant shall license proprietary information arising from the Task for non-exclusive use as follows:

1) To Participants in the Task:
    a) On the most favourable terms and conditions for use by the participants in their own country; and
    b) On favourable terms and conditions for the purpose of sub-licensing others for use in their own country.

2) Subject to sub-paragraph above, to each participant in the Task for use in all countries, on reasonable terms and conditions; and

3) To the government of any Agency Member country and nationals designated by it, for use in such country in order to meet its energy needs.

4) Royalties, if any, under licenses pursuant to this paragraph shall be the property of the inventing Participant.

14. PARTICIPANTS IN THIS TASK

The Contracting Parties, which are Participants in this Annex at the time of its establishment, are the following:

Department of Natural Resources, Canada
The Commission of the European Communities
ADEME, France
Forschungszentrum Jülich PTJ, Germany
Instituto Nacional de Engenharia e Technologia Industrial (I.N.E.T.I.), Portugal
The Ministerio de Industria - Centro de Estudios de la Energia, Spain
The Office Fédéral de l'Economie Energétique, Switzerland
U.S. Department of Energy

Other countries to be added when confirmed