ARTES Applications Project Web Page (PWP) Template

Please use the template below to prepare your Project Web Page by replacing all the text in **blue** with your own. Once completed, save to disk and then send by electronic mail or via Daptiv to the ESA Technical Officer in charge of the project.

Please note that this template has to be used only for the first submission of the project web page or for major subsequent redesign.

For the provision of the updates on the Current Status, please use the relevant paragraph in the Monthly Progress Report, and not this template.

Note:
Please include **images wherever suitable in JPG/JPEG/PNG format (no transparency) with 100% size and quality in high resolution** for use on the web and in print, and state who shall be credited for these images.

If you are not the sole contractor, please co-ordinate your PWP with the sub-contractor(s) and/or project partner(s). Only the prime contractor is entitled to deliver the PWP to ESA.

Strictly avoid the use of the future tense, e.g. “The service will provide the following features…” or “The following tasks will be carried out…”.
Instead use forms for the text such as “The following tasks are covered by the project activities…”, which will remain valid even after the project has been completed.

This PWP template is only applicable for projects within ARTES 20 IAP, ARTES 3-4 SATCOM-APPS and ARTES 21 2C SAT-AIS. For PWPs from other ARTES programmes, please use the ARTES PWP template.

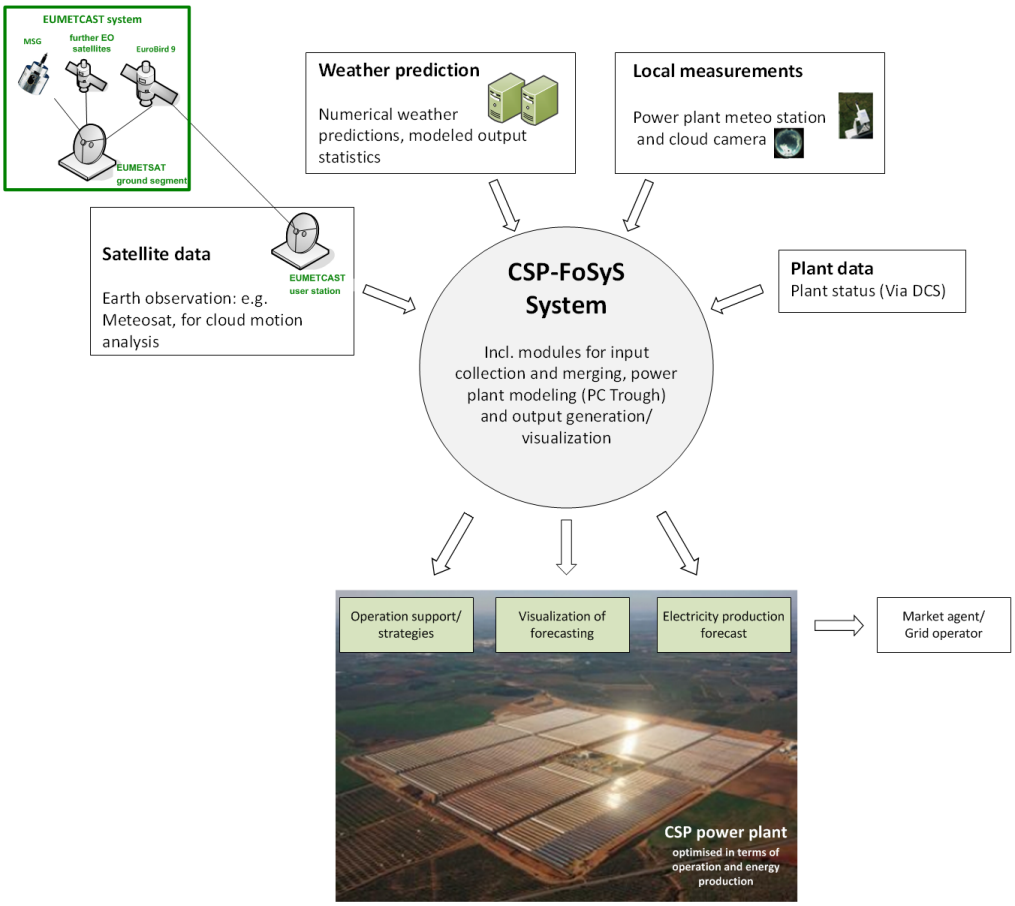
ARTES Element and Type of Activity **Please enter an X as appropriate into the cells of the right hand column.** **A project can not belong in more than one element.**		
ARTES 3-4 SATCOM-APPS	Satcom Applications Project	
	Study Activity	
	Newcomers Initiative	
ARTES 20 IAP	Fast Track Feasibility Study	
	Feasibility Study	
	Demonstration Project	
	Demonstration Project (follow on from Feasibility Study)	X
ARTES 21 2C SAT-AIS	Feasibility Study	
	Demonstration Project	

Overall Thematic Domains **Please enter an X as appropriate into the cells of the right hand column**	
Environmental Resource Management (Forestry, Water Management, Raw Materials…)	
Food & Agriculture	
Maritime & Offshore	
Health	
Energy	X
Safety & Security	
Aviation & RPAS	
Transport & Logistics	
Media & Broadcasting	
Education & Development	
Tourism	
Finance, Investment & Insurance	
Infrastructure & Smart Cities	
Space Assets	
Satellite Communications	X
Satellite Navigation	
Earth Observation	X
Satellite AIS	
Human Spaceflight Technologies	

Project Header Information	
Title:	CSP-FoSyS
Full Project Name:	Concentrating Solar Power Forecast System for Participation in the Spanish Electricity Market using EO and COM Technologies (CSP-FoSyS)
Project Logo:	 FoSyS
Teaser:	Concentrating solar thermal power plants with an electricity production of up to 250 MW have to be integrated into the electricity grid. Both day-ahead and intra-day forecasting of the production and therefore direct solar irradiance forecasting is needed. During the demonstration project, a forecasting system based on the use of satellite data, cloud cameras, numerical weather prediction models and plant model was developed. The system was installed, tested and demonstrated in La Africana CSP power plant in Spain.

High-Level Executive Summary (in common language for general audience)	
Objectives of the Service:	The integration of concentrating solar thermal power plants into the electricity grid requires both day-ahead and intra-day forecasting of the energy production. Direct solar irradiance forecasting is needed together with temperature and wind speed forecasts. Based on the results of the Pre-Feasibility and Feasibility Study as well as on the user feedback from the prototype implementation, this Demonstration project aimed to develop FoSyS service as a commercial product with following objectives: • Increase the quality of weather and energy production forecasts • Develop reliable sales strategies to implement the service in future CSP plants • Increase the amount of potential users through the extension to further application areas • Prepare the implementation in countries where the EUMETCast system cannot be used, such as USA, China, India, Australia, etc. The planned demonstration system is was installed and demonstrated at La Africana 50 MW CSP power plant, in Andalusia, Spain.
Low-Level Description (detailed and factual for target users)	

Users and their Needs:	Solar-thermal projects are large-scale and complex projects. Therefore different end users are taken into account for the solar forecasting FoSyS system: - The owner of the power plant who is the owner of the forecasting system. - The operator of the power plant, contracted by the owner who is operating the plant and will be the main user of the forecasting system. - The grid operator who transfers the plant electricity production to the customers. - The market agents who will use the FoSyS forecasts in order to sell the solar plant electricity production at the best price. Three user needs definitely requires such a forecasting service: 1) Participation in the Spanish electricity market. The participation requires a forecast of the production (dah-ahead and intra-day). High-quality forecasts reduce the risk of high penalty payments due to inaccurate production forecasting. 2) Application for the license for the grid access. As a predictable and reliable renewable energy source, CSP is preferred against other renewable power production. A forecast system will help to meet the requirements. 3) Optimization of the power plant operation process with its different aspects of maintenance, solar field operations, operation planning and wind security shutdowns. A system like CSP FoSyS does not only offer support for the operator of CSP plant but is currently a pre-requisite for EPC companies during tender phases of new projects.

Service/ System Concept:	The key parameter for operating concentrating solar power plants (CSP) is the weather condition (solar radiation, clouds, etc.). Reliable weather forecasts lead to a better operation of CSP plants. Short, medium and long term weather forecasts can be provided using: • Earth observation satellite data delivered by telecommunication satellites for cloud motion analysis • Numerical weather predictions for long term forecasting of weather conditions, • Local measurements from the plant (power plant meteo stations and cloud cameras) to provide short term forecasting range A reliable weather forecast is vital for the power plant's production prediction, since weather conditions are the major inputs for calculating the energy production through the power plant model. The plant data provided by the power plant's decentralized control system (DCS) besides the weather forecast data are used as inputs for the power plant model in order to predict the power delivered by the plant. Such a system would allow the CSP plants to participate in the electricity market while reducing false production predictions and increase the efficiency of power plant through optimization of plant operation. 

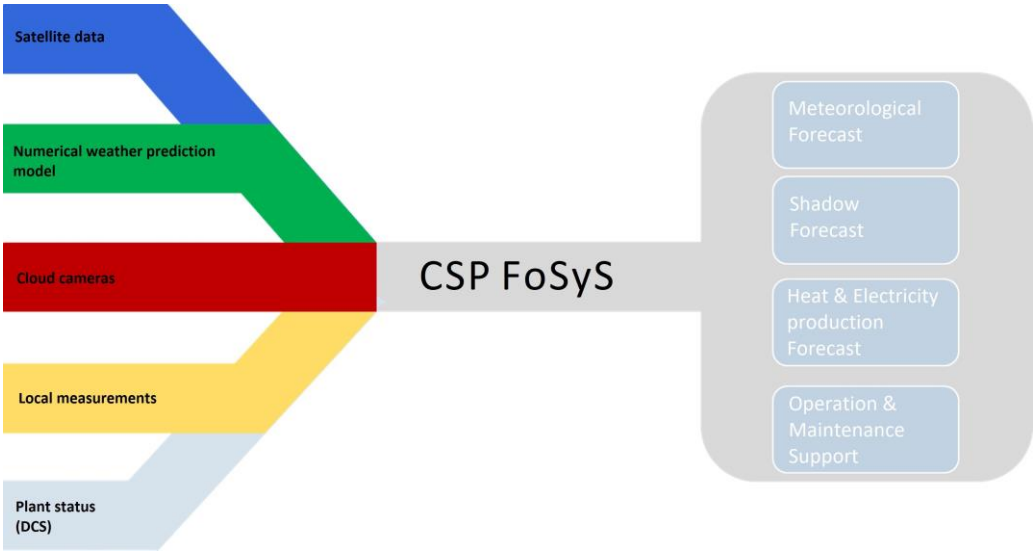
Space Added Value:	**Satellite earth observation (EO):** - EO is of high added value since it provides a high-quality data used for cloud motion analysis with large spatial coverage. - The EUMETCast system is a critical component as EO information products are only valuable if they can be provided as fast as nowadays realised in the EUMETCast. - The use of EO data includes EUMETSAT data products, MSG-based parameters and raw data. Additionally, aerosol monitoring from space is necessary for appropriate direct irradiance retrieval. **Satellite communication (SATCOM):** - SATCOM is essential for the use of the EUMETCast service. - Further use of satellite based communication is needed to integrate remote ground measurement stations in areas without telephone or mobile connection. - Satellite based communication can be used as backup communication between several parts of the FoSyS system and to increase the security of the service.

Project Details

Current Status:

This project follows the FoSyS Pre-Feasibility and Feasibility study. The feasibility study comprised the analysis of the state of the art, appropriate technologies and the implementation of a prototype in a commercial CSP power plant (Andasol 3 in Spain), where positive feedback and fruitful comments to the prototype system from the operators/shift leaders and owners were received.

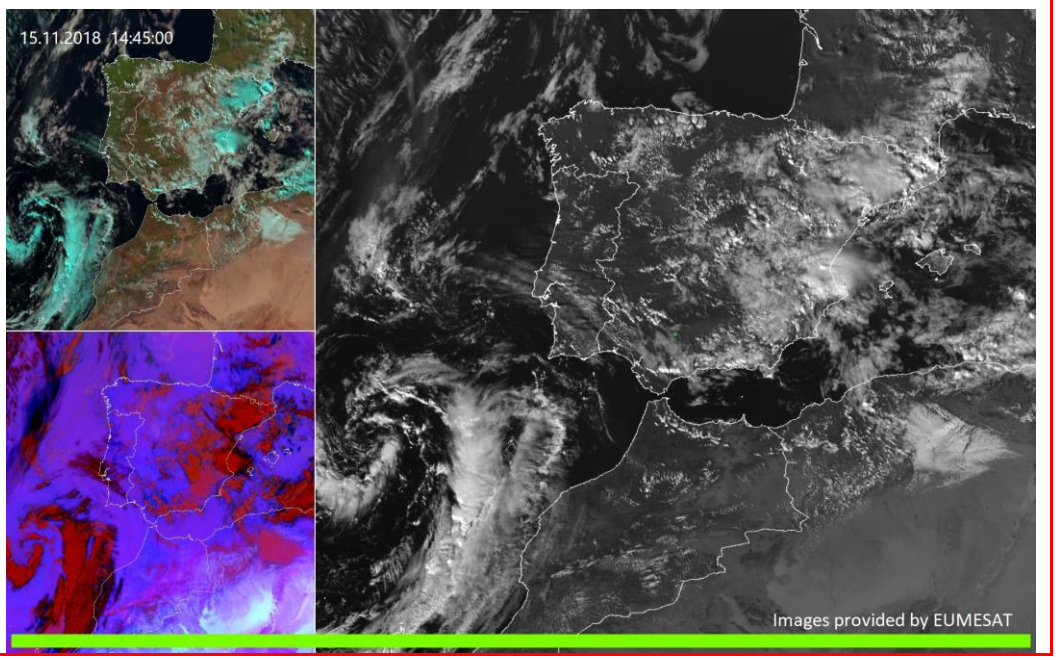
CSP FoSyS system is installed, tested and demonstrated in La Africana, a 50 MW CSP power plant with 7 hours of storage located in the south of Spain.



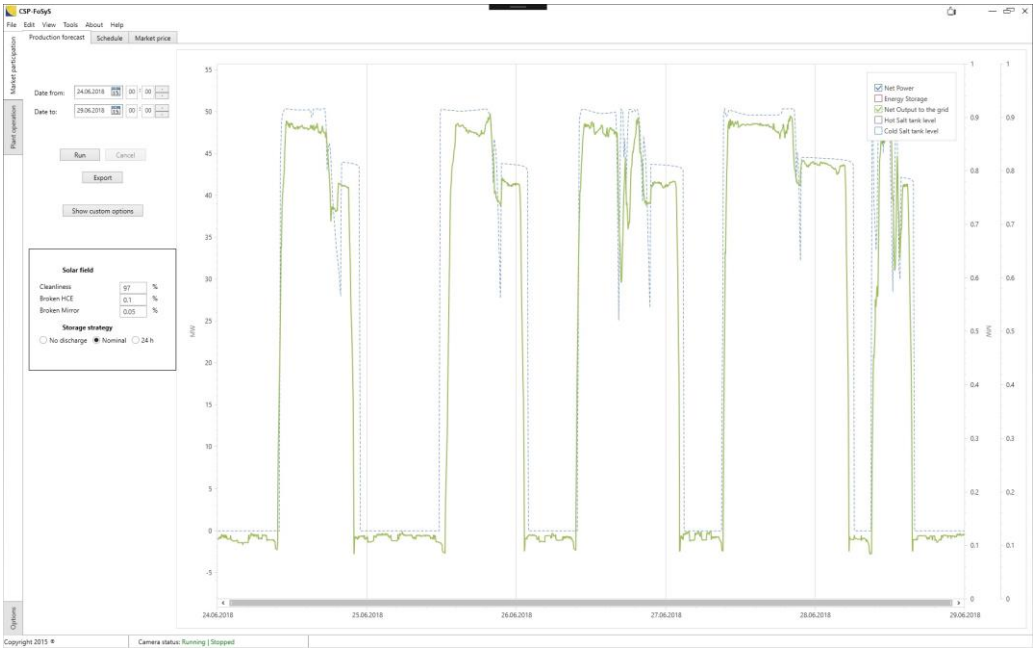
The system provides:

- DNI (direct normal irradiance) nowcast using satellite data up to 7 hours, including percentiles which estimates of the expected radiation range.

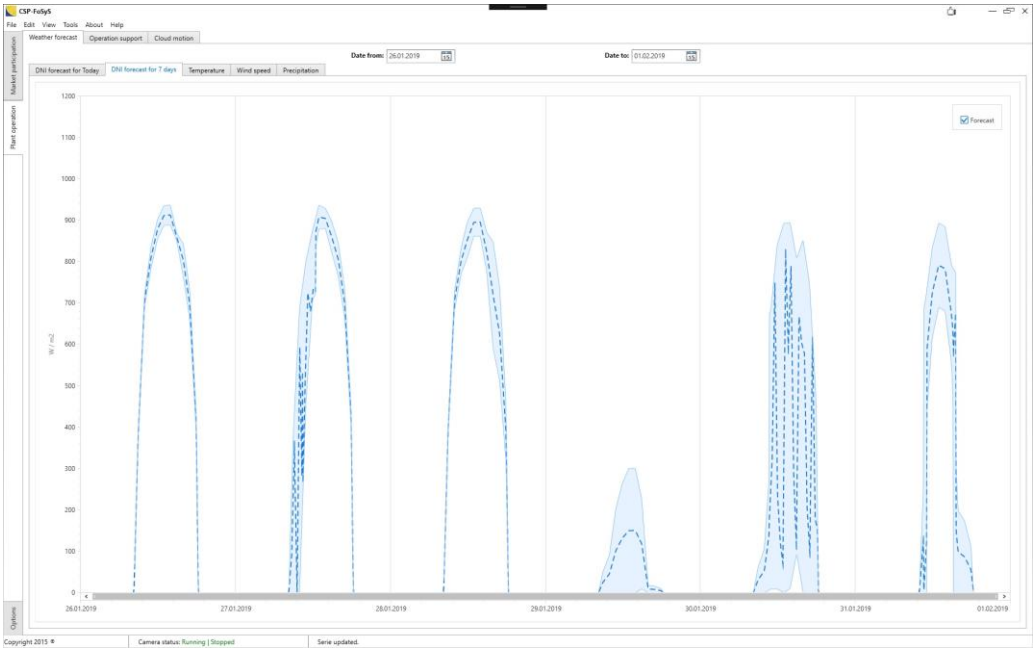
- Satellite images for cloud motion monitoring, including an infrared channel to monitor the movement and concentration of the aerosols.



- The system includes a plant model that can simulate the plant performance and provides energy forecast for the intra-day and day ahead market, by using the radiation forecast as an input to the model.

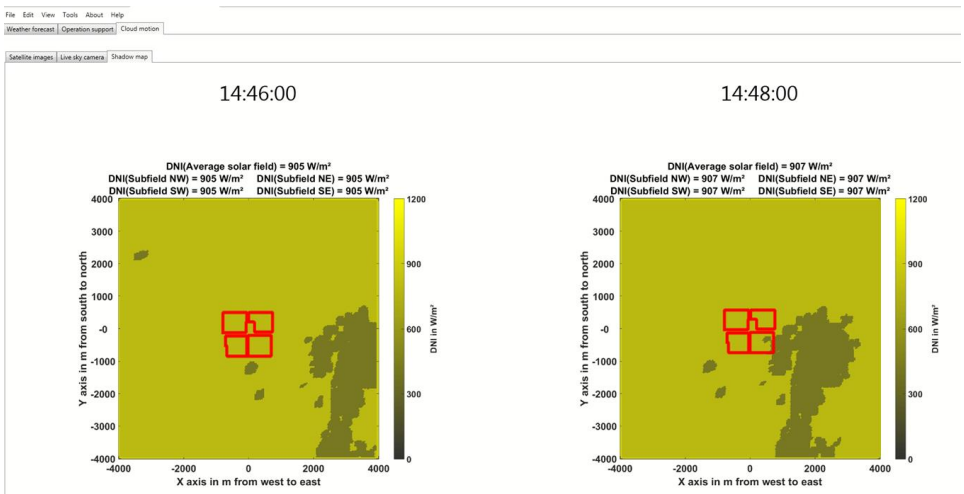


- DNI forecast up to 14 days by using NWP model (numerical weather prediction model).



- High temporal and spatial resolution cloud motion monitoring by sun tracking cloud camera.

A full cloud camera system was integrated to CSP-FoSyS within another R&D project (WobaS) funded by the German federal ministry for economic affairs and energy, in order to provide a shadow map, to monitor and forecast the shadow movement over the solar field for 15 minutes in advance.



CSP FoSyS has successfully passed the site acceptance test in June 2018 that took place in La Africana CSP plant and was demonstrated on site. Currently FoSyS is being extended for PV applications within the activities of a new R&D project.

Project Team				
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Related Content		
Related links:		
	Link to CSP-FoSyS “Feasibility Study”	https://artes-apps.esa.int/projects/csp-fosys
Related Documents:	Final Report of Feasibility Study	