S2S4E
Climate Services for Clean Energy

# MIDWAY STATUS REPORT

www.S2S4E.eu



## About the S2S4E project

S2S4E (Sub-seasonal to Seasonal climate forecasting for Energy) is a three-year project (from December 2017 to November 2020) funded by the European Union H2020 Framework Programme for Research and Innovation. The project is led by the Barcelona Supercomputing Center and brings together five European research centers, four industrial companies and three small to medium sized enterprises (SMEs).

Renewable energy generation and operational planning are strongly affected by weather and climate. Varying climatic conditions causes wide differences in energy demand and supply, which constitute a challenge for the integration of renewable energy in the energy mix. To help solve this problem, the S2S4E project will launch on June 20th 2019 a Decision Support Tool (DST) that for the first time will integrate sub-seasonal to seasonal climate predictions for renewable energy production and electricity demand. Together with energy users, S2S4E has co-produced an operational climate service that will enable renewable energy producers and providers, electricity network managers and policymakers to design better-informed strategies a few weeks and months in the future.

## Project status report

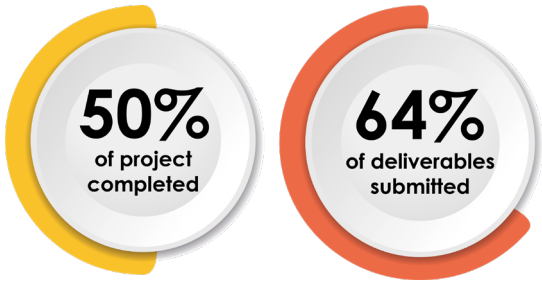
During this first half of the project, the eight S2S4E work packages (WP) have advanced according to the plan, producing 25 deliverables, many of them building the knowledge and technical base for the creation of the climate service (the DST) that will be operational and enhanced with users and stakeholders in the next 18 months. The core outputs of the project, from WP 2 to WP 7, are briefly summarised in the following sections. WP 1 and 8 correspond to management and ethics requirements.

**12** partners

**5** research centres

**4** industrial partners

**3** SMEs




*This project has received funding from the Horizon 2020 programme under grant agreement n°776787.*

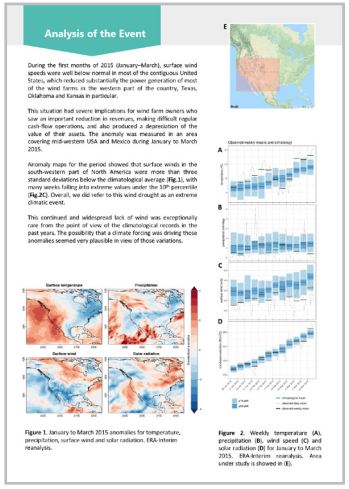
WP 2

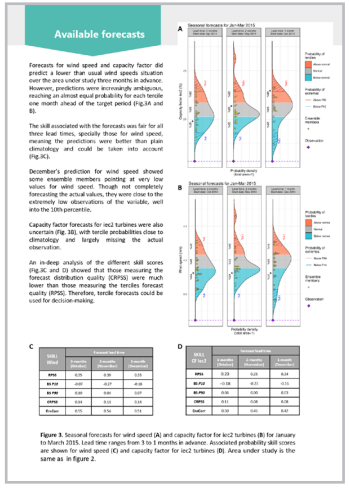
## Defining user needs and S2S forecasts value

The first task in WP 2 was to define user needs and the role sub-seasonal to seasonal (S2S) forecasts can play in the decision-making process. For this goal, a three-step approach has been followed and reported in Deliverable 2.1: 1) review past efforts in user engagement from previous projects, 2) update and validate results from step one directly with target users through interviews and focus groups and 3) describe the steps of the decision-making process (decision maps) of specific weather and climate dependent decisions.

The outputs of these steps have been compiled into D2.1, offering a broad perspective of what the general needs of energy users are, how specific companies use climate information in their internal decision-making and what information is most relevant for them in terms of the added value S2S4E can provide.

In parallel, interviewed users were asked to suggest new case studies to be included in the analysis of WP 4. Some of the case studies identified have been used to work closely with the S2S4E energy partners to estimate the impact of S2S forecasts on decision-making under extreme weather events. The results of this first attempt to assess potential economic value are available in Deliverable 2.2


*WP2, 4 and 7 have collaborated to create case studies factsheets that present the potential of S2S forecasts to predict past extreme weather events.*

WP 3

## Observational datasets

All objectives and deliverables set forth in WP 3 have been completed up to this point. WP 3 purpose was to obtain a better understanding of the climate dynamics affecting Europe to improve the predictability of S2S forecasts. Two deliverables have been completed during the first year of the project, D3.1 and D3.2. Deliverable 3.1 compares available reanalysis datasets to determine which is best to use in decision-making. Performance of each reanalysis has been assessed against a variety of observations for each climate variable. The output of D3.1 is, therefore, a thorough evaluation of the most common datasets and recommendations on the strengths and weaknesses of each, for a given variable. As a general conclusion, ERA5 reanalysis seems to be the best choice as the observational dataset for the DST, taking into account its quality, geographical scope, real-time production and available variables.

Deliverable 3.2, on the other hand, deals with identifying climate variability as an effect of the most relevant teleconnections and circulation patterns, known as weather regimes. Overall skill in predicting the future teleconnection status, or the forthcoming weather regime, can enhance the performance of S2S forecasts. In addition, impact regimes have been developed from nationally-aggregated energy variables, instead of climate variables, to show an alternative perspective on the meteorological drivers of the power system, compared to traditional teleconnection or weather regime analysis.

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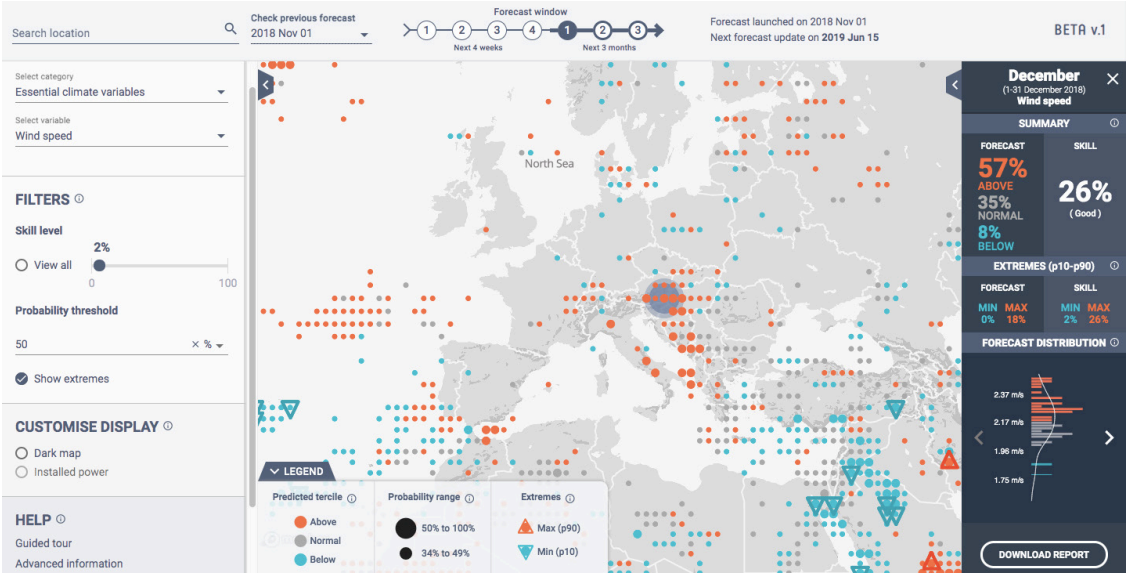
WP 4

## S2S climate predictions

Skill is one of the key parameters reflecting the overall reliability of an S2S forecast. WP 4 has been searching for methods to improve the skill of current models at predicting climate variables and indicators. A systematic benchmarking has been condensed in Deliverable 4.1, containing an in-deep analysis of two ECMWF forecast systems: SEAS5, the latest long-range forecasting system for seasonal predictions and ECMWF Monthly Prediction System, the biweekly system for sub-seasonal forecasts.

In addition to the skill analysis, eight relevant historical case studies have been selected by our industrial partners to support the proof of concept. In D4.1 each case has been exhaustively described and re-forecasted, to understand how potential users could have managed the information from S2S forecasts in those contexts. This information has been summarised in 8 public factsheets along with a guide to interpret the factsheets available on the S2S4E website.




*Interface of the S2S4E Decision Support Tool (DST), showing seasonal predictions for wind speed. Available at: s2s4e.eu/dst.*

WP 5

## Decision Suppot Tool (DST) implementation

One of the main outputs from S2S4E will be the DST, co-produced with the three industrial partners of the project and tailored to their needs and specifications. WP 5 is in charge of the design and implementation of the DST. In the first half of the project, six deliverables have been submitted: D5.1 with the conceptualisation, requirements and testing of the DST, D5.2 and D5.3 with the overall data management plan for both scientific and personal information obtained, D5.5 with the validation and verification plan and details on how the Agile methodology is being implemented, and D5.6 with the architecture design of the DST.

Deliverable 5.1 was a key initial landmark of S2S4E, defining all the functionalities and visual elements of the DST. That deliverable has led the work towards D5.7, the actual deployment of the operational version of the DST. Its production has involved a large multidisciplinary team to move from the low-fidelity wireframes of the tool to the high-fidelity interactive prototype and the final product. The whole process required the use of a diversity of techniques, like stakeholder mapping, workshops, interviews, user journey and user stories mapping, task workflow analysis, and user tests including eye-tracking tests.

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WP 6

## Positioning, exploitation and business models

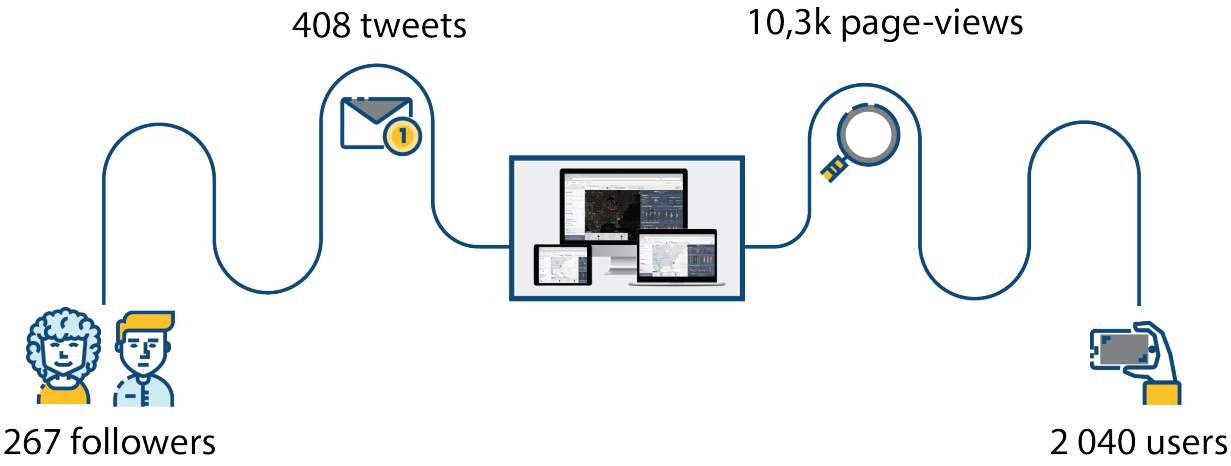
The DST aims to be a long-lived operational tool and, as such, an exploitation and business plan will be developed to assure its sustainability. The definition of this plan will be the main task of WP 6 in the next half of the project. Two deliverables setting its grounds have been issued during the first year of the project: D6.1 and D6.2. Deliverable D6.1 summarised the comprehensive benchmarking and positioning of the tool in a competitive background. Major weather agencies, research groups in climate services and well-established global private companies were reviewed, to help defining the market positioning of the tool being developed in S2S4E and identifying key success features.

Deliverable 6.2, on the other hand, assessed the consideration of S2S (and more generally of climate services) in European energy policies, both at EU and member state levels and issued recommendations on how to foster the uptake of climate services, including tools such as the DST.

WP 7

## Dissemination, communication and user engagement

A work package on communication and dissemination is essential to reach the various audiences interested in our activities, external and internal, like energy market stakeholders, policymakers and our consortium partners. During the first half of the project, WP 7 has defined the overall communication plan (deliverable 7.1) and set S2S4E's main visual identity and common public relations materials for both external and internal use. External audiences have been addressed using different channels, like the project's website, containing basic information, public deliverables and relevant news, an email-based newsletter (opted-in by interested users) and our dedicated social media profiles in Facebook and Twitter (@S2S4E) to have a more vivid daily presence.




*Current status of Key Performance Indicators of project website and Twitter page.*

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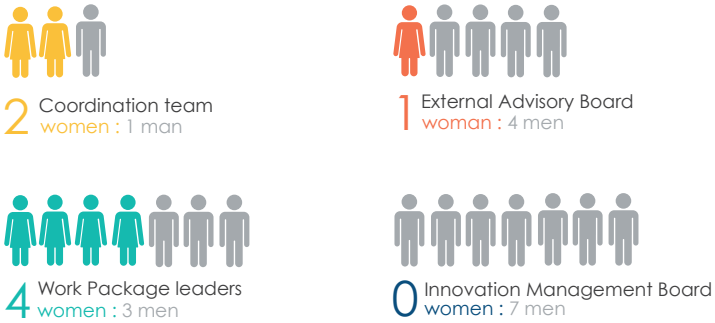
WP 1 & 8

## Project mangement and ethics requirements

WP 1, project management, has worked on providing timely and efficient coordination of the S2S4E project by:
- Providing effective administrative, financial and contractual management to achieve objectives on time, to cost and at the highest quality level.
- Ensuring that the project submits all results and deliverables in due time and good quality.
- Ensuring an efficient interaction with the European Commission, by facilitating the consultation with the External Advisory Board and the internal communication within the consortium.

WP 8 has dealt with ethics requirements, which relates to protection of the personal data collected during the project lifetime. Beyond S2S4E partners, these privacy issues affect users and stakeholders interested in the project results. Procedures have been designed according to current regulations. In addition, S2S4E notably has strived to maintain gender balance in the main management structures, as seen in the figure below.




*Gender balance in S2S4E management structures*

## Project consortium

Barcelona Supercomputing Center – Centro Nacional de Supercomputación · Capgemini · CICERO Center for International Climate Research · EDF · EDP renewables powered by nature · ENEA Agenzia nazionale per le nuove tecnologie, l'energia e lo sviluppo economico sostenibile · EnBW Energie braucht Impulse · LGI sustainable innovation · Nnergix Energy Forecasting Services · the climate data factory · SMHI · University of Reading

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