

ECMWF Copernicus Procurement

Invitation to Tender



Copernicus Climate Change Service

Enhanced C3S Energy Service

Lot 1: Co-development of online seasonal demonstrators and tools with champion energy users

Lot 2: Maintenance of Operational Services for the Energy Sector

Volume II: Specification of Requirements

ITT Ref: C3S2_412_bis
ISSUED BY: ECMWF Administration Department Procurement Section
Date: 20 October 2025
Version: Final



Funded by the European Union

Implemented by



Table of Contents

1	Introduction.....	4
2	Context	4
2.1	The Climate Data store	4
2.2	Earthkit	5
3	Contract summary	5
4	Lot 1: Co-development of online seasonal demonstrators and tools with champion energy users	5
4.1	Specific background.....	5
4.2	Scope of the Service	6
4.3	Technical requirements.....	6
4.3.1	Mapping of existing seasonal activities and gap analysis.....	6
4.3.2	User Engagement strategy and identification of champion users	7
4.3.3	Co-development of seasonal case studies with champion users.....	7
4.3.4	Co-development of online demonstrators with champion users.....	8
4.3.5	Best practices, Lessons-learned and scale up of demonstrators.....	8
4.3.6	Co-design of dissemination material, training elements and EQC.....	8
4.4	Deliverables	9
5	Lot 2: Maintenance of Operational Services for the Energy Sector	9
5.1	Specific background.....	9
5.2	Scope of the service.....	9
5.3	Technical requirements.....	10
5.3.1	Debug and Maintenance of the Global and European Climate and Energy indicators.....	10
5.3.2	Debug and Maintenance of the Pan-European Climate Database (PECD)	10
5.3.3	Leading the preparation of the energy chapter of the C3S ESOTC for delivery to the Climate Intelligence Team	11
5.3.4	Support to ENTSO-E in the extension of the Pan-European Climate Database (PECD).....	11
5.3.5	Support Copernicus Communication and User Engagement teams for selected activities	12
5.4	Deliverables	12
6	General Requirements.....	12
6.1	Implementation Schedule	12
6.2	WP0: Management and Coordination.....	13
6.3	Deliverables and Milestones	14
6.4	Contribute to L2 support to Copernicus User Support Team.....	15
6.5	Communication	15

6.6	Key Performance Indicators	15
6.7	Payment Plan.....	16
7	Tender Format and Content.....	16
7.1	Page limits	16
7.2	Specific additional instructions for the Tenderer’s response.....	16
7.2.1	Executive summary.....	16
7.2.2	Track Record	17
7.2.3	Quality of Resources to be Deployed	17
7.2.4	Technical Solution Proposed	17
7.2.5	Management and Implementation	17
8	Additional Information	17
8.1	Acronyms.....	17

1 Introduction

Copernicus is the European Union's flagship Earth-observation programme created to achieve operational monitoring of the atmosphere, oceans, and continental surfaces. It aims to provide reliable, validated information services for a range of environmental and security applications. The Copernicus Climate Change Service (C3S) responds to environmental and societal challenges associated with climate change. The service gives access to information for monitoring and predicting climate variability and change and thus helps support adaptation and mitigation. C3S produces and brokers a wide range of data and products describing the past, present and future of the climate system. This includes global and regional reanalyses, Essential Climate Variables (ECVs), near-term climate predictions, climate projections and a variety of sectoral climate information. The data are offered to users through the C3S Climate Data Store (CDS).

2 Context

The increasing share of renewable generation from wind, solar and hydropower energy makes this sector vulnerable to climate variability and climate change. During the first phase of Copernicus (COP1), the Copernicus Climate Change Service (C3S) focused on addressing the needs of various sectors, including energy. Through the Sectoral Information System (SIS) initiatives, C3S provided tailored climate-related information and services to a global audience, ensuring valuable support beyond Europe.

During the second phase of Copernicus (COP2), C3S established the operational energy service in the C3S SIS, aiming to address the needs of users who want to assess the impact of climate on energy operations, management and planning, as well as the needs of the community of energy modelers and Transmission System Operators, needing user-friendly datasets for their assessment studies.

The Global operational energy service encompasses climate indicators that describe historical and future climate conditions, alongside seasonal forecasts. These climate datasets are integrated into state-of-the-art energy models to generate renewable energy indicators—covering wind, solar, and hydropower—as well as demand indicators enabling global assessments of the temporal evolution and spatial variability of climate and renewable energy resources across multiple time scales and regions.

In parallel to those activities, C3S started the co-production of the Pan-European Climate Database (PECD) with the European Network of Transmission System Operators for Electricity (ENTSO-E), which provides high-quality climate and renewable energy variables to support Transmission System Operators (TSOs) in both operational tasks and long-term planning.

2.1 The Climate Data store

The backbone of the C3S is the cloud-based Copernicus Climate Data Store (CDS; <https://cds.climate.copernicus.eu/>) that provides users with a single point of access to quality assured climate and meteorology data. The datasets may be stored in different data centres worldwide or in remote servers, but this complexity will be transparent to CDS users. C3S data is offered with open access and is free to use under the Copernicus data licence. Data are properly documented and enriched by appropriate quality attributes provided by the EQC (Evaluation & Quality Control). All CDS data and tools are accessible from the C3S website as well as via open Application Programming Interfaces (APIs).

The CDS data catalogue provides access to climate datasets via a searchable catalogue. Categories of data include Climate Data Records (CDRs) and Interim Climate Data Records (ICDRs), quality-controlled archives of in-situ climate observations, reprocessed satellite data records, data from climate reanalysis, seasonal forecasts, climate model simulations, and a variety of derived climate impact indicators. Multiple datasets will be available in each category, e.g., for most of the Global Climate Observing System (GCOS) Essential Climate Variables (ECVs), on global or regional domains, with varying spatial resolutions and temporal

coverage, from different data providers, based on different methodologies, etc. Several entry catalogues are relevant in the context of this tender, including: the ERA5 and ERA5 Land global reanalysis, CERRA European regional reanalysis, WFDE5 bias-corrected reanalysis, different river discharge information at the historical timescale and seasonal forecast timescale, and related indicators at the climate projection timescale.

2.2 Earthkit

EARTHKIT is an open-source python project led by ECMWF which provides powerful and easy-to-use tools for working with earth system data. Earthkit is designed to accelerate weather and climate science workflows by simplifying tasks such as data access, processing, analysis, and visualisation. It offers a modular suite of interoperable components built on trusted Python libraries such as NumPy, Pandas, and Matplotlib, while also integrating smoothly with ECMWF's operational software stack. Earthkit users can access CDS and ADS datasets directly and use a range of processing, analysis and visualisation tools without having to worry about data formats. The development design of earthkit is modular and open source to encourage contributions from the wider community and contracted partners. The packages are fully documented and available for the whole world to use. Initial documentation is available in the following link <https://earthkit.readthedocs.io/en/latest/index.html>.

3 Contract summary

This ITT invites Tenders for two distinct Lots, as follows: co-development of online seasonal demonstrators and tools with champion energy users (Lot 1), and maintenance of operational services for the energy sector (Lot 2). Specific details on each Lot can be found in the following sections of this document.

Tenderers are invited to submit their Tenders for either one or both Lots. Please note that the expertise required for each Lot strongly differ. In cases where a Tenderer opts to submit Tenders for the two Lots, it is mandatory that each Tender is presented as a separate submission, with its own set of documents, including but not limited to, technical proposals, pricing tables and any required supporting documents. Tenderers must ensure that the submissions for each Lot are independently viable and stand on their own merits.

4 Lot 1: Co-development of online seasonal demonstrators and tools with champion energy users

The aim of Lot 1 is to co-develop case studies and demonstrators including tailored seasonal climate and energy products, forecast quality metrics, software tools and graphic visualisations with champion energy users to support their decision-making processes several months in advance. Lot 1 will work closely with champion energy users to foster the uptake of seasonal products, understanding in depth their requirements, co-developing energy-related information and creating capacity building through trainings, software tools and outreach materials. The information provided will be open, timely and grounded in scientific research, facilitating informed decision-making for stakeholders.

4.1 Specific background

Since 2016, C3S has included a service component based on seasonal predictions, at first placing the focus on graphical products published on the C3S website. In 2018 the seasonal prediction component became operational and added to its content a data service through the C3S CDS.

C3S offers its users multi-system global ensemble climate predictions, updated each month, each extending for at least 6 months. At a predetermined date every month, a large set of data at a variety of temporal resolutions is published in the CDS, alongside a number of higher-value data products. Example graphical products are derived at C3S and published through its website for free and open access

(https://climate.copernicus.eu/charts/packages/c3s_seasonal/). The data used as input to this service is produced by a number of institutions from around the world, all operators of state-of-the-art seasonal prediction systems; indeed, all current participants in the C3S multi-system are designated by WMO as Global Producing Centres of long-range forecasts. Once transferred to C3S, this data is further processed, archived and published in the CDS, for users to download. Like all CDS catalogue entries, the seasonal forecast data is accompanied by detailed documentation, and its use is supported with expert advice. The operational procedures and schedule – with reliable timing, standardised and well documented formats – offer a valuable tool in decision-making supporting adaptation to climate variability and change.

ERA5 is the fifth generation ECMWF reanalysis for the global climate and weather for the past 8 decades, replacing the previous ERA-Interim reanalysis. Data is available from 1940 onwards. ERA5-Land, which has been produced by replaying the land component of the ECMWF ERA5 climate reanalysis, provides a consistent view of the evolution of land variables over several decades at an enhanced resolution compared to ERA5. Both reanalyses combine model data with observations from across the world into a globally complete and consistent dataset using the laws of physics.

Lot 1 will build on top of the above mentioned C3S seasonal predictions products, the C3S Reanalyses, and other relevant observational datasets, following the technical requirements described in the below sections.

Tenderers are encouraged to submit proposals that demonstrate their ability to deliver high-quality operational seasonal services with a strong foundation in science, research and development. The proposals will be evaluated based on criteria related to scientific quality, documented expertise and ability to fulfil operational requirements. Proposals are strongly encouraged from Tenderers with a proven track record specifically in the co-development of products and services based on seasonal climate predictions.

4.2 Scope of the Service

The main objectives of the service are as follows:

- Mapping of existing seasonal activities and C3S seasonal products, and conducting a gap analysis, to develop tailored C3S seasonal products for the energy sector.
- Development of a user engagement strategy, including collection of user requirements and identification of energy users interested in co-developing seasonal products relevant to their decision-making processes.
- Co-development of case studies with champion users that document both the added value and the limitations of seasonal forecasts for specific cases, based on their real requirements.
- Based on successful case studies, delivery of seasonal online demonstrators (e.g. graphical products, web applications). These will demonstrate operational seasonal products, which will be updated at least a few times per year with real-time forecasts.
- Collection of lessons learnt and best practices that enable the scaling up of demonstrators.
- Co-design of various dissemination and training materials with users to empower them on the use of seasonal forecast products and forecast quality metrics, and to enable them to make informed decisions.

4.3 Technical requirements

Tenderers are invited to propose a set of work packages, including at least the following activities:

4.3.1 Mapping of existing seasonal activities and gap analysis.

- Overview of the existing seasonal forecasting initiatives relevant for the energy sector and gap analysis. The focus will be on identifying key lessons to inform the development of tailored C3S seasonal products for the energy sector and avoid duplications. This includes a thorough evaluation of existing C3S seasonal products to identify gaps and the main barriers of the renewable energy sector for adopting seasonal

information in their decision-making. The output will be able to differentiate between the different subsectors, such as wind, solar and hydro.

- The analysis should also address the gaps introduced by the operationalisation of seasonal forecast from academical and research exercises into a real-time service without discontinuities. The current operational constraints of the C3S seasonal forecast multi-system service should be considered.

4.3.2 User Engagement strategy and identification of champion users

- Development of a user engagement strategy, with the identification of energy user communities (e.g., DG ENER, ENTSO-E or equivalent policymakers, international energy agencies and energy practitioners) interested in the adoption of seasonal climate and energy information, that ensure stakeholder interaction, collection of user requirements and evolving needs along the contract, as well as ensuring the engagement.
- Identification together with ECMWF of relevant champion users (e.g. ENTSO-E and energy practitioners) who actively participate during the contract in the co-development of real case studies and demonstrators relevant for their decision-making processes months and seasons ahead, as described in the following sections.

4.3.3 Co-development of seasonal case studies with champion users

- Co-development of specific seasonal case studies that meet the champion's real requirements in terms of climate and energy information months and seasons ahead. These case studies will serve to evaluate the benefits or limitations in the use of retrospective seasonal forecasts (hindcasts) for the specific cases. In the design phase of these cases, the Tenderer should consider the following aspects:
 - o These case studies should build on the C3S multi-system ensemble of seasonal climate predictions and, where appropriate, propose case-specific post-processing (e.g. bias adjustments, downscaling, spatial aggregations, conversion into indicators, ML approaches, clustering and/or ensemble member sub-selection, etc.). The design iterations with the users would ideally accommodate benchmark prototypes based on observed data (e.g. reanalysis) to showcase the users the upper limit of the expected forecast performance.
 - o In the conception of the use cases, it is strongly recommended to exploit the fact that the C3S multi-system ensemble of seasonal climate predictions are global.
 - o The co-designed climate and energy products delivered in each case study should be accompanied by their corresponding forecast quality metrics. The adequate observational datasets, and its availability, specifically in relation to the energy indicators, would need to be clearly identified during the co-development.
 - o The case studies should be designed in a way that allow to run them, at a later stage, in an operational environment using real seasonal forecasts.
 - o Due to the constraints of C3S seasonal provision of forecasts, the case studies should be designed in a way that allows adaptation to future versions of the current prediction systems and to potential new prediction systems included in the future.
- The findings from the analyses of the previous case studies must be clearly communicated to champions and thoroughly documented, regardless of whether the results are positive (indicating an added value in the use of seasonal predictions for the specific case study) or negative (indicating a limitation in the use of seasonal predictions for the specific case study). It is equally important to capture and describe situations where user needs cannot be effectively met using these types of forecasts, as such insights are highly valuable.
- Building up on the Tenderer's previous experience with users, it is required that the Tender includes an example of a potential case study that would fit the previous requirements. This example would be simply used to facilitate the evaluation of the proposal.

4.3.4 Co-development of online demonstrators with champion users

For those case studies that demonstrate an added value in the use of retrospective seasonal forecasts, the results should be transformed into online demonstrators, following next specifications:

- They should delivery operational seasonal products that are updated at least a few times per year, with real-time forecasts.
- They should contain a visual component (e.g. graphical products, web-application, etc) for the climate and energy products and their respective forecast quality metrics. This application should be co-designed with champions users and ECMWF in a way that bring value to their decision-making process, illustrating the different outputs coming from individual ensemble members.
- The dataset behind the products and metrics visualised through the online demonstrator should be delivered to C3S via CDS. This delivery of data should be designed in a way that it can be automatically maintained even after the contract ends.
- The workflows and methodologies for analysing prediction outputs, evaluating forecast skill, and generating related products behind the demonstrators should be accessible to users and must include complete documentation. The software developed should be delivered via GitHub at ECMWF, fully documented and consistent with ECMWF's software development strategy (<https://www.ecmwf.int/en/elibrary/81334-software-strategy-and-roadmap-2023-2027>). Whenever possible, they should make use of ECMWF's existing software frameworks, such as Earthkit. Where feasible, these workflows should be designed in a way that enables other users to reproduce and modify them, ideally through C3S-hosted Jupyter Notebooks.
- Additionally, to ensure long-term production of online demonstrators, the processing workflows will need to be integrated into the ECMWF computing environment. This technology transfer would be the responsibility of the Successful Tenderer, in close collaboration with ECMWF staff, and adhere to the previously described principles.

4.3.5 Best practices, Lessons-learned and scale up of demonstrators

- Delivery of lessons learned and best practices in the use of seasonal forecasts for the energy sector from the online demonstrators, including what can and cannot be achieved with them, along with recommendations on how to scale these up to provide a seasonal energy service that meets the needs of a wider community of energy users. This should include recommendations on the applicability of, and modifications required by, the demonstrators for those different decision-making needs.

4.3.6 Co-design of dissemination material, training elements and EQC

- Delivery of training and dissemination materials co-defined with champion users and ECMWF, that might include interactive webinars, fact sheets, training events and any other material that covers gaps identified during the contract. The aim of these materials is to provide energy users with knowledge in the use of seasonal forecasts empowering them to make informed decisions.
- The Tenderer shall accommodate for eventual needs in providing technical and scientific expertise in support to ECMWF training activities. Requests to support activities may be raised to contribute with content specific input to training, education and capacity building material: development and/or review of learning resources in the domain of the contract, participation in train-the-trainer events and MOOCs.
- Additionally, the Successful Tenderer is expected to also liaise with the contractors in charge of the C3S Evaluation and Quality Control (EQC) component. Specifically, it would be interesting to explore the suitability of the materials developed in this contract as EQC quality assessments of the C3S seasonal forecasts datasets.
- Additionally, the Successful Tenderer should provide content (including text, tools, and materials developed within the contract) for a C3S website demonstrating how seasonal predictions can be used in energy applications.

4.4 Deliverables

Tenderers are invited to propose a set of deliverables which achieve the key outcomes described above, following the guidelines in section 6.3 of this document.

5 Lot 2: Maintenance of Operational Services for the Energy Sector

This Lot 2 aims to maintain and further develop selected climate and energy products, as well as related C3S reports. Two ongoing contracts are currently delivering datasets, Jupyter Notebooks, software, and web applications to the CDS and C3S users. This new activity is intended to ensure the continued maintenance and, where necessary, the updating of those outputs.

5.1 Specific background

Lot 2 will build on the outputs of the previous two energy contracts:

- The C3S2_412 'Lot 1: Enhanced Energy Service' contract aimed to deliver an enhanced operational energy service on a global scale. The main outputs covered: (i) a global climate and energy indicators dataset based on ERA5, seasonal forecasts and climate projections; (ii) training Jupyter notebooks to obtain: wind power law; exclusion layers to gridded energy indicators; Energy Degree Days (EDD) index as a proxy for energy demand; (v) software to obtain global climate and energy indicators at several time scales; (vi) Climate and Energy Explorer application to visualise the 'Global Climate and Energy Indicator' datasets.
- The C3S2_412 'Lot 2: Support to ENTSO-E in preparing the Pan-European Climate Database (PECD)' contract aimed to improve the PECD to support European Resource Adequacy Assessments (ERAA). The main outputs are as follows: (i) the PECD Dataset. The dataset comprises both PECDv4.1 and PECDv4.2 versions. This dataset provides information on climate and renewable energy variables for historical and future time periods that are relevant to ENTSO-E studies. (ii) A collection of Jupyter notebooks (<https://github.com/ecmwf-training/2025-entsoe-training>) showcasing how to download, access, plot and illustrate different aspects of the PECD v4.2 dataset. (iii) Software for obtaining PECDv4.1 and PECDv4.2, including the PECDv4.2 operational stream to update the part of the dataset based on ERA5.

5.2 Scope of the service

The scope of the service is as follows:

- Debug and Maintenance of the Global and European Climate and Energy indicators within the CDS, including related software and Jupyter Notebooks. Sustain current service operations and provide responsive technical and user support.
- Debug and Maintenance of the Pan-European Climate Database (PECD) within the CDS, including related software and Jupyter Notebooks. Sustain current service operations and provide responsive technical and user support.
- Prepare analysis and draft the content for the energy section of the ESOTC report, ensuring it is ready for publication.
- Update the Pan-European Climate Database (PECD) in support of the European Network of Transmission System Operators for Electricity (ENTSO-E), including related training materials.
- Support eventual needs of Copernicus Communication and User Engagement teams for selected activities.
- Propose a service evolution strategy.

5.3 Technical requirements

Tenderers for Lot 2 are invited to propose a set of work packages for carrying out the following main tasks.

5.3.1 Debug and Maintenance of the Global and European Climate and Energy indicators

- Ensure the continuous operational delivery and provide ongoing maintenance and troubleshooting for the products listed below. This includes ensuring timely updates for regularly maintained products, as well as identifying and resolving issues in the datasets, their CDS entry, their documentation, and the underlying code and Notebooks.
- List of products to be maintained:
 - The 'Global Climate and Energy Indicators Derived from ERA5' dataset, its catalogue in the CDS entry, its documentation, and the underlying code. As this dataset is updated every month, maintenance should ensure that operational delivery is up and running at all times. Monitoring is required to avoid gaps and resolve issues in agreement with CUS.
 - The 'Global Climate and Energy Indicators derived from CMIP6 Climate Projections' dataset, its CDS entry catalogue, its documentation and the underlying code. Maintenance will also include updating the current climate models used in the dataset if major updates happened, in line with the C3S strategy.
 - Jupyter Notebooks developed based on the previous datasets, namely, (i) the wind power law notebook, (ii) the Exclusion Layers notebook and (iii) the Energy Degree Days (EDD) index notebook. Updates to the notebooks will be made following the maintenance, in the event of any changes being required. These changes may come from CUS, training ECWMF, or from any alterations to the previous datasets that impact the notebooks' functionality.
 - The C3S Climate and Energy Explorer app. Maintenance should ensure that the app is updated after changes to the above-mentioned datasets occur. It should also keep the app up and running at all times, resolve issues in coordination with C3S, and ensure the app is fully back online once the issues have been solved.
 - The 'Climate and energy indicators for Europe from 2005 to 2100 derived from climate projections' dataset available at the CDS in the following link <https://cds.climate.copernicus.eu/datasets/sis-energy-derived-projections?tab=overview>.
- Provide Level2 support by responding to user queries, when asked by the User Support team.
- Preparation to migrate the 'Global Climate and Energy Indicators derived from ERA5' CDS catalogue entry to use ERA6.
- Relevant code developed during this activity will be submitted to a repository at ECMWF with comprehensive documentation to allow ECMWF production staff to run in a continuous operational environment and/or delivered as a set of standalone python packages, to be placed within an ECMWF GitHub repository.

5.3.2 Debug and Maintenance of the Pan-European Climate Database (PECD)

- Ensure the continuous operational delivery of PECDv4.2 and provide ongoing maintenance and troubleshooting for the products listed below. This includes ensuring timely updates for regularly maintained products, as well as identifying and resolving issues in the datasets, their CDS entry, their documentation, and the underlying code and Notebooks.
- List of products to be maintained:
 - The 'Climate and energy related variables from the Pan-European Climate Database derived from reanalysis and climate projections' dataset. It contains both PECDv4.1 and PECDv4.2 and it's available at the Climate Data Store (CDS) in the following link: <https://cds.climate.copernicus.eu/datasets/sis-energy-pecd?tab=overview>.
 - Jupyter Notebooks developed based on the previous dataset, available at <https://ecmwf-training.github.io/2025-entsoe-training/>. Updates to the notebooks will be made following the

maintenance, in the event of any changes being required. These changes may come from CUS, training ECWMF, or from any alterations to the previous datasets that impact the notebooks' functionality.

- Provide Level2 support by responding to user queries, when asked by the User Support team.
- Preparation to migrate the 'Climate and energy related variables from the Pan-European Climate Database derived from reanalysis and climate projections' CDS catalogue entry to use ERA6. This includes a strategy for merging and/or not duplicating efforts to produce the PECD ERA6 part dataset and the 'Global Climate and Energy Indicators derived on ERA6' dataset, to the possible extent.
- Relevant code developed during this activity will be submitted to a repository at ECMWF with comprehensive documentation to allow ECMWF production staff to run in a continuous operational environment and/or delivered as a set of standalone python packages, to be placed within an ECMWF GitHub repository.

5.3.3 Leading the preparation of the energy chapter of the C3S ESOTC for delivery to the Climate Intelligence Team

- The Successful Tenderer is expected to begin reviewing and analysing the relevant datasets well in advance of the ECMWF ESOTC team's first general meeting, which usually takes place in October or November each year. They should take the lead in drafting the energy chapter, closely following the recommendations of the ECMWF team and actively engaging with ENTSO-E experts to propose the content. The Successful Tenderer is also responsible for organising meetings with these experts to discuss key topics for the chapter. The draft text must be completed by the deadline set by the ESOTC editorial team, which will make the final decision on the published version. The work further involves attending relevant meetings organised by the ESOTC leadership team, as well as any other meetings essential to the success of the energy chapter.

5.3.4 Support to ENTSO-E in the extension of the Pan-European Climate Database (PECD)

- Following ENTSO-E's engagement with the MEDTSOs, the PECDv4.2 spatial domain will need to be enlarged to cover the MEDTSO region, particularly in Africa and the Middle East. The wind and solar exclusion layers must be adapted to align with the existing power network and include new variables, such as relative humidity and temperature in cities (in this case, the list will be expanded from PECDv4.2).
- Enhance the granularity of data for wind, solar energy, and hydro capacity factors. This involves providing gridded data on wind and concentrated solar capacity factors, which allows users to assess the potential for renewable energy across the domain with greater spatial resolution. Providing more regional aggregation levels (such as NUTS 1, NUTS 2, and NUTS 3) can also ease the transition to higher-resolution energy planning models.
- In the PECD v4.2 projected stream, only the CMIP6 climate projection simulations are available at the CDS. To allow for more reliable energy system adequacy planning in research projects and operational processes, this stream needs to be complemented with the publication of the historical simulations from the CMIP6 climate models. The CMIP6 models used for this task must be consistent with the C3S strategy on operationalisation of climate projections.
- Delivery of an algorithm for Climate Year Selection: This task addresses the need to identify a representative subset of climate years from the full historical dataset. While one motivation is the practical limitation of processing very large datasets, the primary reasons are to ensure methodological robustness, computational efficiency, and consistency across assessments. Selecting representative years allows TSOs to capture the key variability in weather-dependent demand and generation while keeping the simulations tractable and comparable. These algorithms would require an active co-development with ENTSO-E during the contract to ensure a deep understanding of TSOs' operational needs and constraints.
- The current hydropower modelling operates at country or PECD level. However, ENTSO-E currently requires modelling at a finer scale. During the execution of the contract, the Successful Tenderer should

follow ENTSO-E guidance on the modelling approach to follow, allowing more accurate modelling of hydropower potential at the plant level. As far as possible, this task will use the outputs from the ongoing C3S2_411 'Operational Copernicus Climate Change Water Service' project to update the current approach used in PECDv4.2. Whenever possible, ML approaches could be considered.

- Inclusion of climate-driven electricity demand indicator within the PECD dataset.
- To improve accessibility to the methodologies and code developed for PECD, this contract will deliver the code developed during this activity to a repository at ECMWF with comprehensive documentation to allow ECMWF production staff to run in a continuous operational environment and/or delivered as a set of standalone python packages.
- Additionally, the contract will provide extra Jupyter Notebooks closely defined with ENTSO-E, in addition to those already maintained.
- Following ENTSO-E validation of current PECDv4.2 with the TSO's observational datasets, the Successful Tenderer, in agreement with ENTSO-E, should propose refinements to the energy products within PECDv4.2.
- The current PECD version is based on selected available multi-model climate projections. This dataset is used by ENTSO-E, among other purposes, to assess the adequacy of electricity resources in Europe over the next 10 years. However, the fitness for purpose of the current and forthcoming climate projections for this time horizon is not yet fully established. Decadal predictions and observational data could also be used in parallel, for example, to improve the forecast quality of near-term climate projections. Guidelines on how to implement such approaches for a service evolution, based on literature review or short analyses, are expected to be provided.
- If requested by ENTSO-E, a simple visualisation tool for compound events, for instance cold weather (high demand) and wind and/or solar droughts (low renewable generation), based on the PECD dataset, will be delivered.

5.3.5 Support Copernicus Communication and User Engagement teams for selected activities

While broader user engagement and training activities are not part of the scope of this contract, the contractor shall accommodate the following eventual needs in their proposal:

- Presentation of the above-listed products at specific events, e.g. related to the Copernicus energy Hub. Only one event per year is expected and it will be chosen by C3S.
- Prepare and update the C3S energy-related webpages as necessary.

5.4 Deliverables

Tenderers are invited to propose a set of deliverables which achieve the key outcomes described above, following the guidelines in section 6.3 of this document.

6 General Requirements

6.1 Implementation Schedule

For each Lot, ECMWF intends to award a single Framework Agreement for a period of maximum 33 months, which shall be implemented via a single multi-annual Service Contract expected to commence in April 2026.

Tenderers are expected to provide a detailed time plan and schedule as part of the tender response. The proposed time plan and schedule shall address the main tasks, inputs, outputs, intermediate review steps, milestones, deliverables and dates. Regular progress meetings will be held with ECMWF during the contract to assess project status, risks and actions.

6.2 WP0: Management and Coordination

This work package includes overall responsibility for day-to-day service management and coordination.

The following contract management aspects shall be considered and as needed briefly described in the proposal:

Plans for the mandatory reporting on implementation and forward planning.

Meetings (classified as tasks and listed in a separate table as part of the proposal):

- Organise quarterly teleconference meetings to discuss C3S service provision, service evolution and other topics, prepare corresponding summary minutes of these meetings and maintain a list of agreed actions and their status.
- ECMWF organises annual C3S General Assemblies. The Successful Tenderer is expected to attend these meetings with maximum 2 team members and contribute to discussions related to the topic of this ITT.
- Tenderers can propose additional contract internal meetings (e.g. kick-off meeting, regular meetings to monitor contract performance) as part of their response. Most such meetings should be held by remote participation.
- **Travel Prices:** Travel prices should be based on the [European Commission's calculator](#) [Table 3: Unit cost per distance band for air or combined air/rail travel, Commission Decision C(2024)5405], and consider a daily subsistence allowance not to exceed €300. Travel prices must reflect estimated actual costs and **must not include any profit margin**. If the proposed travel prices deviate from these reference values, a clear justification must be provided.

Quality assurance and control: the quality of reports and Deliverables shall be equivalent to the standard of peer-reviewed publications. The timely delivery as well as final quality check of the deliverables shall be ensured by the Successful Tenderer (in terms of content, use of ECMWF reporting templates for deliverables and reports (Microsoft Word), format, deliverable numbering and naming, typos...); all reports in this project shall be in English. Unless otherwise specified the specific contract Deliverables shall be made available to ECMWF in electronic format.

Communication management (incl. external and internal communication). Any external communication activity must be agreed with the ECMWF Copernicus Communication team in advance. This includes, but not exhaustively, communication planning, branding and visual style, media outreach, website and social media activity, externally facing text and graphical content and events. Agreed activity would also need to be evaluated and reported on once complete so that success measures and KPIs could be provided to the European Commission (cf. Clause 2.4.6 of the Framework Agreement).

Set of Key Performance Indicators (KPIs) suitable for monitor contract performance. The proposed KPIs shall be SMART (specific, measurable, actionable, realistic and time bound). The Successful Tenderer shall report to ECMWF on these KPIs as part of the Quarterly and Annual Implementation Reports. The proposed set of KPIs is expected to be updated regularly with ECMWF during the contract.

Risk Management: The proposal shall include a risk register that describes identified risks for each work package, along with a mitigation strategy for each of the identified risks. This mitigation strategy shall be composed by both preventive and corrective measures. The risk register shall be updated regularly by the Successful Tenderer, and any update (related to new risks, likelihood or impact) shall be reported during the progress review meeting, as well as part of the quarterly and annual implementation reports.

Resources planning and tracking using the appropriate tools.

Subcontractor management, including conflict resolution, e.g. the prime contractor is responsible for settling disagreements, although advice/approval from ECMWF may be sought on the subject. A list of subcontractors describing their contribution and key personnel shall be provided, as well as backup names

for all key positions in the contract. Tenderers shall describe how the Framework Agreement; in particular Clause 2.9 on Sub-contracting has been flowed down to all their subcontractors.

Management of personal data and how this meets the requirements of Clause 2.8 on Personal Data Protection and Annex 6 of the Framework Agreement.

List of minimum deliverables and milestones required as part of WPO, covering the contractual and financial reporting obligations towards ECMWF in line with the Terms and Conditions of the Framework Agreement (cf. Clause 2.3 and Annex 5):

WPO Deliverables				
<i>Deliverable#</i>	<i>Responsible</i>	<i>Nature</i>	<i>Title</i>	<i>Due</i>
D0.y.z-YYYYQQ	Tenderer	Report	Quarterly Implementation Report QQ YYYY <i>QQ YYYY being the previous quarter</i>	Quarterly on, 15/04, 15/07 and 15/10
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY [Part 1] <i>YYYY being the Year n-1. Shall include:</i> - Quarterly Implementation Report Q4 YYYY ; <i>YYYY being the Year n-1</i> <i>Preliminary financial information YYYY ; YYYY being the Year n-1</i>	Annually on 15/01
D0.y.z-YYYY	Tenderer	Report	Annual Implementation Report YYYY [Part 2] <i>YYYY being the Year n-1</i>	Annually on 28/02
D0.y.z-YYYY	Tenderer	Report	Annual Implementation plan YYYY <i>YYYY being the Year n+1</i>	Annually on 30/09
D0.y.z-YYYY	Tenderer	Other	Copy of prime contractor's general financial statements and audit report YYYY <i>YYYY being the Year n-1</i>	Annually around June (no associated cost)
D0.y.z	Tenderer	Report	Final report	At the end of the contract

Table 1: WPO Deliverables

WPO Milestones			
<i>Milestone#</i>	<i>Title</i>	<i>Means of verification</i>	<i>Due</i>
M0.1.1.MX	Progress Review meeting with ECMWF / Payment milestones	Minutes of meeting	At each Payment Milestone due date (~every 6 months)
M0.1.2.MX	Kick off meeting	Minutes of meeting	Month 1
M0.1.3.MX	Attendance to XXX meeting (e.g. General Assembly)	Minutes of meeting	Due one month after the meeting

Table 2: WPO Milestones

6.3 Deliverables and Milestones

Deliverables should be consistent with the technical requirements specified in this document. A deliverable is a substantial, tangible or intangible good or service produced as a result of the contract. In other words, a deliverable is an outcome produced in response to the specific objectives of the contract. Deliverables are subject to acceptance by the technical contract officers at ECMWF. All contract reports and documentation for this ITT shall be produced in English. The quality of reports and deliverables shall be equivalent to the standard of peer-reviewed publications and practice. Unless otherwise specified in the specific contract, deliverables shall be made available to ECMWF in electronic format (PDF/Microsoft Word/Microsoft Excel or HTML) via the Copernicus Deliverables Repository portal. The details will be agreed at the negotiation stage.

Each Deliverable shall have an associated resource allocation (person-months and financial budget). The total of these allocated resources shall amount to the requested budget associated with payroll.

Milestones should be designed as markers of demonstrable progress in service development and/or quality of service delivery, as applicable. They should not duplicate deliverables.

Tenderers shall complete the relevant table in Volume IIIA as part of their Tender, which includes the details of deliverables and milestones for all work packages and the schedules for each work package. Volume IIIA will be used by Tenderers to describe the complete list of deliverables, milestones, and schedules for each work package. All milestones and deliverables shall be numbered as indicated. All document deliverables shall be periodically updated and versioned as described in the tables.

ECMWF will provide the templates for reports and plans at the beginning of the contract. Reporting documents should be short and factual, following the guidance which will be provided by ECMWF during negotiations with the Successful Tenderer. Contract management and technical coordination is expected to amount to approx. 7-10% of the planned use of the resources.

6.4 Contribute to L2 support to Copernicus User Support Team

The objective of this task is to provide specialised support to users of the delivered products and services.

ECMWF has a well-established centralised User Support to provide multi-tiered technical support to all users of C3S data, products, tools and services. A service desk system is used for ticketing user requests and distributing these requests to specialists as needed. Dedicated staff at ECMWF promote and maintain self-help facilities (Copernicus Knowledge Base (CKB), user forum, FAQs and tutorials, etc.) and also provide individualised support on technical queries related to the CDS, data formats, data access, etc. In addition, ECMWF staff members provide specialised scientific support to address questions related to its industrial contributions to C3S, e.g., in the areas of global reanalysis and seasonal forecasting.

All C3S contractors are expected to contribute to the delivery of multi-tiered technical support for the data and/or services they provide. The Successful Tenderer shall provide expert (Level-2) support through a) the Jira ticketing system with agreed KPIs (for example, 85% of Level-2 tickets should be resolved within 15-business days), and/or b) the [user forum](https://forum.ecmwf.int/)¹ by monitoring topics and providing responses. The Successful Tenderer shall provide an email address which acts as the single contact point.

6.5 Communication

The Successful Tenderer shall support ECMWF in its communication activities for the C3S services, where they are related to the activities described in this ITT. Additional activities such as C3S website news items, C3S brochures and flyers, may be discussed on a case-by-case basis during the contract implementation.

6.6 Key Performance Indicators

The Successful Tenderer shall report to ECMWF on a set of Key Performance Indicators (KPIs) suitable for monitoring various aspects of service performance (by using the template included in Volume IIIB). The KPIs shall be designed to quantify various aspects of quality of service against the requirements described in this document. As part of the Tender, Tenderers shall specify a proposed set of KPIs appropriate for the service, e.g., relating to operational service delivery, quality, data access, user support, user satisfaction, etc., aligned with the requirements expressed above. These initial specifications shall be refined together with ECMWF during the first 6 months of the contract.

¹ <https://forum.ecmwf.int/>

6.7 Payment Plan

Tenderers can propose a Payment Plan in ITT Volume IIIA “Pricing and deliverables” (cf. Excel spreadsheet “Payment Plan preparation”):

- The Payment Milestones should relate to the deliverables and milestones delivered during the corresponding Payment Milestone period (e.g. the payment covering the period January-June would only relate to the deliverables and milestones whose due dates are part of the same period).
- The frequency of Progress Review Meetings might be adapted to synchronise with the anticipated date of completion of each Payment Milestone.
- In case of request for a payment at contract signature, please note that this should be duly substantiated (e.g. in terms of necessary investment prior to implementation or during first weeks/months for ensuring the initial set up of the project). It is necessary to relate this payment to activities subject to other Payment Milestones.

7 Tender Format and Content

General guidelines for the Tender are described in Volume IIIB of this ITT. This section describes specific requirements to prepare the proposal for this particular Tender, along with guidelines for minimum content expected to be included in the proposal, additional to the content described in the general guidelines of Volume IIIB. This is not an exhaustive description and additional information may be necessary depending on the Tenderer’s response.

7.1 Page limits

As a guideline, it is expected that individual sections of the Tenderer’s response do not exceed the page limits listed below. These are advisory limits and should be followed wherever possible, to avoid excessive or wordy responses.

<i>Section</i>	<i>Page Limit</i>
<i>Executive Summary</i>	2
<i>Track Record</i>	2 (for general) and 2 (per entity)
<i>Quality of resources to be Deployed</i>	2 (excluding Table 1 in Volume IIIB and CVs with a maximum length of 2 pages each)
<i>Technical Solution Proposed</i>	2 + 3 per Work package (Table 2 in Volume IIIB, the section on references, publications, patents and any pre-existing IPR is excluded from the page limit and has no page limit)
<i>Management and Implementation</i>	6 (excluding Table 4 and Table 5 in Volume IIIB) + 2 per each Work package description (Table 3 in Volume IIIB)
<i>Pricing Table</i>	No limitation

Table 3: Page limits

7.2 Specific additional instructions for the Tenderer’s response

The following is a guide to the minimum content expected to be included in each section, additional to the content described in the general guidelines of Volume IIIB. This is not an exhaustive description and additional information may be necessary depending on the Tenderer’s response.

7.2.1 Executive summary

The Tenderer shall provide an executive summary of the proposal, describing the objectives, team and service level.

7.2.2 Track Record

The Tenderer shall demonstrate for itself and for any proposed subcontractors that they have experience with relevant projects in the public or private sector at national or international level. ECMWF may ask for evidence of performance in the form of certificates issued or countersigned by the competent authority.

7.2.3 Quality of Resources to be Deployed

The Tenderer shall propose a team that meets at least the following requirements:

- A senior team member with more than 5 years of experience in managing activities related to this ITT (referred to as Service Manager). This person will be the point of contact on technical matters.
- A team member with experience of managing projects and contracts of this type and size (referred to as Contract Manager). This person will be the main point of contact for administrative matters.
- Team members with demonstrated experience in performing activities related to the various aspects of this ITT.

These team members shall be involved in the activities of this ITT at a minimum level of 10% of their total working time.

7.2.4 Technical Solution Proposed

The Tenderer shall give a short background to the proposed solution to demonstrate understanding of that solution and of the C3S context. This section shall also include information on any other third-party suppliers that are used as part of the technical solution, and a statement of compliance for each requirement formulated throughout this document, describing how the proposed solution maps to the requirements.

7.2.5 Management and Implementation

As part of the general project management description, and in addition to the guidance provided in Volume IIIB, Tenderers shall consider the elements described in section 6.2 above.

8 Additional Information

8.1 Acronyms

API	Application Programming Interface
C3S	Copernicus Climate Change Service
CDS	Climate Data Store
CDR	Climate Data Records
CKB	Copernicus Knowledge Base
COP1	Copernicus Phase 1
COP2	Copernicus Phase 2
ECMWF	European Centre for Medium-Range Weather Forecasts
ECV	Essential Climate Variable
ENTSO-E	European Network of Transmission System Operators for Electricity
EQC	Evaluation & Quality Control
FAQ	Frequent Asked Questions
GCOS	Global Climate Observing System
KPI	Key Performance Indicator
ICDR	Interim Climate Data Records
ITT	Invitation To Tender
SIS	Sectorial Information System