Open Call Collection OC-2015-2

Proposal Reference OC-2015-2-20169

Title: **Forecasting for the Integration of Renewable Energies: User Information Platform**

Acronym: **FIRE-UIP**

Summary

The efficient integration of renewable energies requires accurate weather and production forecasts to be able to predict the amount of renewable energy that will be produced and transported/distributed through the electrical grids. This issue is handled by meteorologists, physicists and data scientists. End-users have to implement the forecast information in their operational strategies or in the design of future power plants and electrical grids. This aspect is mainly tackled by engineers. Finally, the economic aspects and the risk assessment are driving the decision-making and are analyzed by economists and/or politicians. The increased complexity of the energy system and the interdisciplinary nature of the quickly expanding available information make it difficult for the different stakeholders to access all required information for their decision making in terms of integration of renewable energies.

The Action will develop a dedicated, internet based and dynamic User Information Platform UIP within an intensive collaboration between scientists, service providers, end users and experts in new media technology. The UIP will collect and interconnect all aspects of forecasting for the efficient integration of renewable energies. FIRE-UIP will act as an information pillar for the actual knowledge linked to forecasts of renewable energy production and distribution and support the dissemination pillar to inter-connect the academic world and the end users. The possibility for all stakeholders to actively contribute to and benefit from the UIP with affordable investment in time and money is an attractive solution to boost cross-collaboration especially between industrial stakeholders.

Key Expertise needed for evaluation

Environmental engineering
Engineering of energy production and energy systems, energy distribution and application
Earth and related Environmental sciences
Meteorology, atmospheric physics and dynamics
Media and communications
Databases, data mining, data curation, computational modelling
Economics and business
Management of Technology and Innovation

Keywords

Integration of renewable energies

Production forecast and planning

User Information Platform UIP

Renewable energies economics

Risk assessment

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TECHNICAL ANNEX

1. S&T EXCELLENCE

1.1. Challenge

1.1.1. Description of the Challenge (Main Aim)

The political and economic worlds are presently focusing on the energy strategies which will have to be applied in the next decades, and it is today evident that Renewable Energies (RE) will play an increasingly important role in this upgraded configuration (e.g. Horizon 2020). In this landscape, accurate high resolution forecasting of the intermittent and spatially distributed RE production is becoming mandatory together with specific weather forecasts for local applications. Additionally, the importance of economics for the integration of RE in the power sector has to be further enhanced by quantifying and reducing weather, climate and financial risks to stimulate the development of improved private-sector risk management.

The efficient integration of renewable energies requires on one hand accurate weather and production forecasts in order to be able to predict the amount of renewable energy that will be produced. This issue is handled by meteorologists, physicist and data scientists. On the other hand, end users have to implement the forecast information in their operational strategies or in the design of future power plants and electrical grids. This aspect is mainly tackled by engineers. Finally, the economic aspects and the risk assessment are driving the decision-making and are analyzed by economists and/or politicians.

The latter two groups of stakeholders have already shown interest in these collaborations but are generally reluctant to invest their time and money to contribute to COST Actions without financial support. The result is a poor representation of industry and economy in such projects which consequently remain strongly focused on the scientific aspects. Thus, these three groups of stakeholders are today acting relatively isolated from each other. In addition, many research and demonstration activities are carried out on a national level while a European approach is clearly needed.

1.1.2. Relevance and timeliness

The key to overcome all these obstacles is the creation of a comprehensive intelligent internet based information platform able to collect and interconnect all aspects of the role of forecasting for the efficient integration of renewable energies. The possibility to actively participate to the network through such a platform offers an attractive tool for all stakeholders, which will boost cross-collaboration with relatively low investments in time and money.

Due to the increasing intricacy of the energy mix, experts need to have access to scientific and technical information from adjacent domains. Numerical weather forecast modelers have to understand the problems of power system operators and vice-versa. The latter group of specialists needs to have knowledge of the potential and accuracy of numerical models when attempting to increase the efficiency of the power systems with accurate production forecasts. Power plant operators have to deal with this weather-induced variability to accurately predict the amount of energy they will produce in the near future (hours to days). This is also a major challenge for the

power system operators who have to deal with variables amounts of electricity which must be time-matched and transmitted to meet the fluctuating users' demands.

Therefore, without robust forecasting of RE power production, the rapidly evolving power system will be increasingly vulnerable to the local weather and climate variability. In this landscape, the use of new tools – partly dependent on the weather conditions - such as demand –side management, local or regional energy storage facilities, forecast of icing on wind turbines and overhead lines in northern countries, increased electricity transmission efficiency based on overhead lines dynamic line ratings, specific applications for smart grids and urban areas etc. will have to be considered. Additionally, the relationship between Transmission System Operators (TSO) and Distribution System operators (DSO) is progressively changing as DSOs are starting to carry out forecasting activities taking into account the distribution network specifications (congestion and voltage constraints), especially in the case of high RE penetration [1]. Moreover, many of these tools are integrating probabilistic forecasting algorithms that remain difficult to apply at the operational level, which explains why many stakeholders currently do not incorporate quantifiable forecast uncertainty into their decision-making.

1.2. Objectives

1.2.1. Research Coordination Objectives

To support decision-making processes for RE operational and planning strategies from a supply, distribution and demand perspective, the proposed Action "Forecasting for the Integration of Renewable Energies - User Information Platform FIRE-UIP" will develop an information platform which displays and promotes the role of weather and climate forecast information and its impact on the power system as a whole including risk assessments and economic aspects. FIRE-UIP is meant to provide accurate information based on the modelers and end-users' experiences, requirements and challenges: in a first step as a survey platform to address the most pertinent issues with reports and publications; in a latter step as a Questions&Answers (Q&A) platform to analyze and provide comprehensive specific answers to incoming users' questions/requirements. For that purpose it will include a dynamic interface which gathers the requests, evaluates them and submits them to the specific experts' groups within the Action's working groups: their tasks are to prepare ad-hoc scientific and technical documents (e.g. position papers) to be uploaded on the information platform. These groups will evaluate all the requests from the scientific, technical and economic points of view. In this way, FIRE-UIP will attempt to fill the knowledge gaps between experts active in very different domains.

To fulfill these goals, FIRE-UIP will be developed around two main pillars:

- An information pillar including the most recent information covering all aspects linked to the forecast of short- and long-term RE production and distribution and its applications by end users. It will provide continuously updated information on the development and application of forecast models for all timescales - from weather to climate - relevant for the operational, investment and planning decision-making processes of the power system. It will focus on specific topics already mentioned above together with economic aspects relevant for all domains. It will provide links to related publications and a regularly updated list of running projects in this field (world, Europe, national). The information pillar content will be continuously supervised and reviewed by an ad-hoc Editorial Board including representatives of all communities.

- A dissemination pillar which will organize information workshops (forum for discussions), specific technical workshops, yearly training schools, bi-lateral exchanges to bridge the information gap between the academic world and the end users. It will also support educational activities such as webinars and/or Massive Online Open Courses (MOOCs). If requested, it could also support

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more technical activities such as data and code sharing in open source format and the organization of benchmarks in collaboration with other national/international bodies active in the field of forecasting.
Its structure and activities will be strongly focused on the "Generation Y" of coming young researchers and end users as they will be the protagonists to face the challenge of integrating large amounts of RE into the energy system: this will be achieved by implementing social medias such as Facebook, LinkedIn etc. as innovative networking tools to respond to their increasing dependency to Internet, mobile communication and open source information. Among others, the study of the propagation of information is a relatively young domain: building a comprehensive UIP users' group will allow to analyze the most efficient way to automatically select and distribute the knowledge contained in the UIP to the relevant experts based on their specific profiles: in other words, the information will be "pushed" to specific users and not "pulled" by them.

1.2.2. Capacity-building Objectives

Concerned end-users are public and private agencies responsible for national energy policies and programs (e.g. TSOs, DSOs, regulators...), service companies for the development and distribution of dedicated forecast products as well as managers of wind and solar power plants, Balance Responsible Parties BRP, energy investors, traders and the insurance sector.

The capacity-building objectives of FIRE-UIP will focus on:

- Continuous enhancement and update of the flow of information dedicated to the use of forecasting methods for applications in the energy sector.
- Information support for the improvement of operational and business practices for an increased acceptance threshold of stakeholders such as engineers, economists or politicians
- The growth of investments in the RE sector by providing tools for acquiring a better understanding of weather/climate-related business risks and for managing them effectively.

FIRE-UIP will contribute to the development of the local and regional projects in Europe (e.g. Smart Grid applications and related problems for urban areas) and to the support and extension of the already established network of scientists and end users.

For both research coordination and capacity building activities, FIRE-UIP will also benefit from close interaction with the WMO-sponsored fledgling World Energy & Meteorology Council [2]: WEMC is a non-profit organization devoted to promoting and enhancing the interaction between the energy industry and the weather, climate and broader environmental sciences community at the global scale. FIRE-UIP will also collaborate with other related COST Actions such as COST Action TU 1304 "WINERCOST – Wind Energy technology reconsideration to enhance the concept of smart cities".

1.3. Progress beyond the state-of-the-art and Innovation Potential

1.3.1. Description of the state-of-the-art

Before the introduction of large-scale power production from Renewable Energy (RE), the electrical power demand was matched by balancing outputs from schedulable generating plants, usually hydroelectric, nuclear and fossil fuel. The energy landscape has been changing rapidly over the past decade as RE power plants have become common across Europe with their power generation increasingly contributing to the total power supply, e.g. in 2014 solar energy production grew by 38.2% worldwide and RE use as a whole should reach 8% in 2035 [3].

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The share of RE is even exceeding the demand during short periods of time in some countries (e.g. Denmark) which have to export this excess electricity. Such situations illustrate the need of accurate forecasts both at the production level and at the transmission and distribution levels, at regional, national and transnational scales. In fact, the increasing penetration of RE implies the increasing use of backup facilities and bigger and more flexible, interconnected electrical grids to transport this energy: hence a European approach is mandatory, as more extended geographical coverage of the electrical grid means that the RE generated at one site can help meeting the demand elsewhere.

From a climate point of view, the goal to upgrade the power system towards the use of renewables is not challenged. However, the focus on RE generation only is not sufficient: the interdependence between the existing power system and the economic and political framework must also be considered: the whole power system has to be adapted, including new market structures and guidelines, the education of part of the population, innovations for infrastructures, new concepts for transmission and distribution of the electrical energy and its storage. These adaptations will take time and will need a multidisciplinary approach including the availability of forecasting related information on the multivariate components of the power system.

1.3.2. Progress beyond the state-of-the-art

Extensive information support must be provided to the decision-makers at the political, economic and technical levels. In addition, as the number of involved partners/experts from different landscapes is also extending in this domain, the networking and knowledge transfer aspects are getting increasingly mandatory: the formal establishment of a networking tool can only help to boost the efficiency of the move towards a society based on sustainable renewable energy sources.

Today's information availability is not anymore sufficient and enhanced knowledge transfer between the different actors of the power system is becoming necessary. For example, a major upgrade of the European electrical grids will be mandatory in the next decades, because of aging and also to make full benefit of renewable generation and avoid other related unpleasant side-effect [4]. This implies among others that RE production forecasts together with specific weather forecasts at all time-scales and spatial resolution are part of the efficient development of the future power systems. Another example may be found in the application of Dynamic Line Rating algorithms for increased efficiency of the transmission capacity of the electricity grid which requires reliable forecasts and forecast error estimation especially for very low wind speeds [5].

1.3.3. Innovation in tackling the challenge

FIRE-UIP will deal with all information requests at the scientific, technical and economic levels.
From the scientific point of view, RE production forecasts are based mainly on numerical weather forecasts which are post-processed to include the specifics of the power generators (e.g. power curves for wind turbines) and the environmental conditions (e.g. topography, climate). Many approaches may be considered for modeling: statistical, deterministic and probabilistic and combinations of them. The accuracy (or uncertainty) of the results has to be evaluated whenever possible with standards references (e.g. benchmarks [14]). Extreme events such as storms or wind ramps have to be handled in specific ways. The diversity of these approaches and their complexity makes it difficult to assimilate the specific knowledge: a related information platform together with "live" discussions (e.g. workshops, training schools) will represent a major support.

The situation is more difficult from the technical point of view. Apart from the specifics of the power generators and solar collectors, the electrical grids are extremely complex and it is often very

difficult to evaluate the potential of forecasts and their acceptability by the operators for their management requirements (e.g. for “smart grid” and storage efficiency).

Over the last decade, the practical relevance of weather and climate forecasting for various operational and planning decision-making processes such as site assessments, management of power flows/loads or monitoring of grid congestions/criticalities has been clearly demonstrated (e.g. NREL [6], EWEA [7]). Many investment, credit and insurance companies have been established with the purpose of offering financial/insurance services that could support the development of RE investments and help their clients understand and manage business risks. The key aspect of these services is the modelling of uncertainty and how this information can be used to the decision-maker’s advantage. Despite the emergence of these pioneering institutions and a growing body of research literature (e.g. probabilistic models for energy trading applications), there is still much R&D activities to be performed and published to bridge the gap between meteorology/climatology and finance/insurance practitioners.

1.4. Added value of networking

1.4.1. In relation to the Challenge

Apart from the improvements of the models in terms of accuracy and spatial resolution, FIRE-UIP will support dedicated R&D advancements and further networking activities in the fields of:

- Forecasting with focus on power generation: this includes forecasting for wind and solar energy, but ultimately also other forms of REs such as hydro, wave, tidal, geothermal and biomass energy generation.
- Forecasting with focus on infrastructures, e.g. icing on wind turbines and overhead power lines (OHL), solar panels, cable cars, etc.
- Forecasting with focus on power system and market integration to increase the system flexibility and efficiency.
- Forecasting focused on emerging challenges such as RE supply for smart grids, smart cities, big data, etc…
- Economic and financial decision-making for the RE integration at the European scale: state-of-the art, planning and design, assessment of the consequences of climate change for future developments

1.4.2. In relation to existing efforts at European and/or international level

There are many ongoing scientific research programs in Europe and in the US to improve the quality of RE forecasting, e.g. EWeLINE [8] in Germany, the WEMC (to be activated soon), the WMO GFCS Energy Exemplar [9] and in the US the Wind Forecast Improvement Program [?]. At the same time, technical research institutes develop new technologies to better manage the variability of RE production. Finally end users apply different approaches and collect important experiences while economists carry out risk calculations and set up risk management tools. What is needed to link all these activities is an innovative, flexible and user-friendly inter-disciplinary information platform in order to boost the information exchange.

2. IMPACT

2.1. Expected Impact

2.1.1. Short-term and long-term scientific, technological, and/or socioeconomic impacts

FIRE-UIP will be an Internet information retrieval platform which will allow the experts in different domains to have easy and immediate access to information from other related domains. It will contain basic and actual scientific and technical information on weather dependent energy sources. It will include (reviewed) documents directly submitted by the users' community and/or documents generated by the Action experts on forecasting, assessment and interpretation of forecast uncertainty. If requested, it will support the development of benchmark facilities applicable to RE forecasts, operational and planning strategies and their economic assessments to demonstrate their value in practice.

Access to information is only part of the problem. FIRE-UIP will support cross-domain activities between the different operators involved in production forecasting and related applications such as technical workshops, training schools, short term scientific missions, editorial meetings (review of the content of the information platform), discussion forum/platform and contacts with non-European partner.

By creating a network of the major actors in these domains, FIRE-UIP will support the elaboration and submission of national R&D programs for specific, local or regional applications. It will support the development of pilot studies to analyze the cost/benefits of alternative strategies using production forecasts. It will assist its members to disseminate their results at international and national conferences, workshops and training schools. Finally, it will focus on international collaboration with 1) technologically advanced countries and 2) technologically less advanced countries: for the latter group which often intends to implement an important share of energy supply with RE production as quickly as possible, FIRE-UIP will represent a major source of information which would be otherwise more complex to gather.

FIRE-UIP will differentiate from classical indexation engines such as Google by providing a filtered prioritized and usable set of knowledge validated by the editorial board. The documents will also be tagged and ranked to match the preferences and expertise of the users of the platform. FIRE-UIP will also differentiate from information repositories such as Wikipedia thanks to a dynamic dissemination of new and relevant information to its subscribed users. Finally, FIRE-UIP will boost the networking of the action through a question and answer mechanisms similar to the one of StackOverflow (in the IT world) where questions are asked and answered by its community of users, with the best answers voted up and raised to the top.

2.2. Measures to Maximise Impact

2.2.1. Plan for involving the most relevant stakeholders

Access to the information platform will provide all stakeholders with complete interdisciplinary basic, scientific and technical support at affordable price: for this purpose, specific state-of-the-art "position papers" containing historical and most recent references to the existing literature will be included for each domain to support/facilitate the users' browsing facilities.

This will be achieved by including stakeholders from different horizons in the development and operation of the UIP to provide the best possible information. At the modeling level, specialists in the RE power production forecasting are available (from universities, national weather institutions, forecast providers), including long-term forecasting for planning and designing tomorrow's

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electrical networks. At the grid integration level, experts in the management of power transmission and distribution grids will be contributing to the content of the platform (TSOs, DSOs, regulators, forecast providers), including e.g. specialists for local and/or regional storage developments and for the development of icing forecasts on structures such as wind turbines and power lines.

Last but not least, experts of the economic aspects of RE will contribute to the UIP with the essential expertise and viewpoints from the insurance, banking and investment industries. The Action is further strengthened by experts in new media technology in order to boost innovative ways of internet based networking and information exchange. A core group consisting of representatives of each group of stakeholders will lead the Action to ensure that all topics will be addressed.

2.2.2. Dissemination and/or Exploitation Plan

The dissemination pillar will provide the necessary environment to sustain a number of networking activities: organization of technical workshops and training schools, promotion of STSMs for Early Stage Researchers (ESR), participation to international conferences, organization of information workshops (Q&A), ad-hoc meetings on specific issues etc.

It will use social media tools as information interface to promote networking and discussions. In a first approach, the following interfaces will be investigated:

- Facebook for the announcement and description of the information pillar
- LinkedIn to create a users' group
- Teleconferences and Skype to organize (small) group conferences
- A template will be developed to allow the potential contributors to easily submit new material to be published in the information pillar.
- A specific template will be developed to allow the potential users to easily submit new questions/requirements to be handled by the WG1 experts.
- The development of modern educational tools by developing its own or referencing available dedicated videos, e-learning and MOOCs.

2.3. Potential for Innovation versus Risk Level

2.3.1. Potential for scientific, technological and/or socioeconomic innovation breakthroughs

The increasing contribution of RE power plants in the energy mix leads to an amplified complexity of the challenges linked to the integration of these new, intermittent weather dependent energy inputs and consequently to the request for specific scientific and technical cross-domain information. For example:

- European electrical grids were designed after World War II following the still prevailing "centralized" model. The upgrade of their topology will have to take into account the increasing importance of RE production forecasting tools and consequently the request for specific information.
- The availability of dedicated and specific cross-domain information related to the grid management and decision making based on weather and RE production forecasts will enhance the efficiency of the transmission grids in terms of improved storage coordination, reserves settings, congestion management, market bidding, etc…
- Considering the "near" future, the climate risk management for energy-sector applications is also part of the landscape. Currently the issue of climate variability is underappreciated and unquantified. However, in some sectors there has been recently considerable commercial uptake of these new approaches , particularly in insurance, hydrology and agriculture. The UIP

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will support the adoption of these more innovative approaches by the energy industry and help to highlight the value of these meteorological tools for grid management and policy design.

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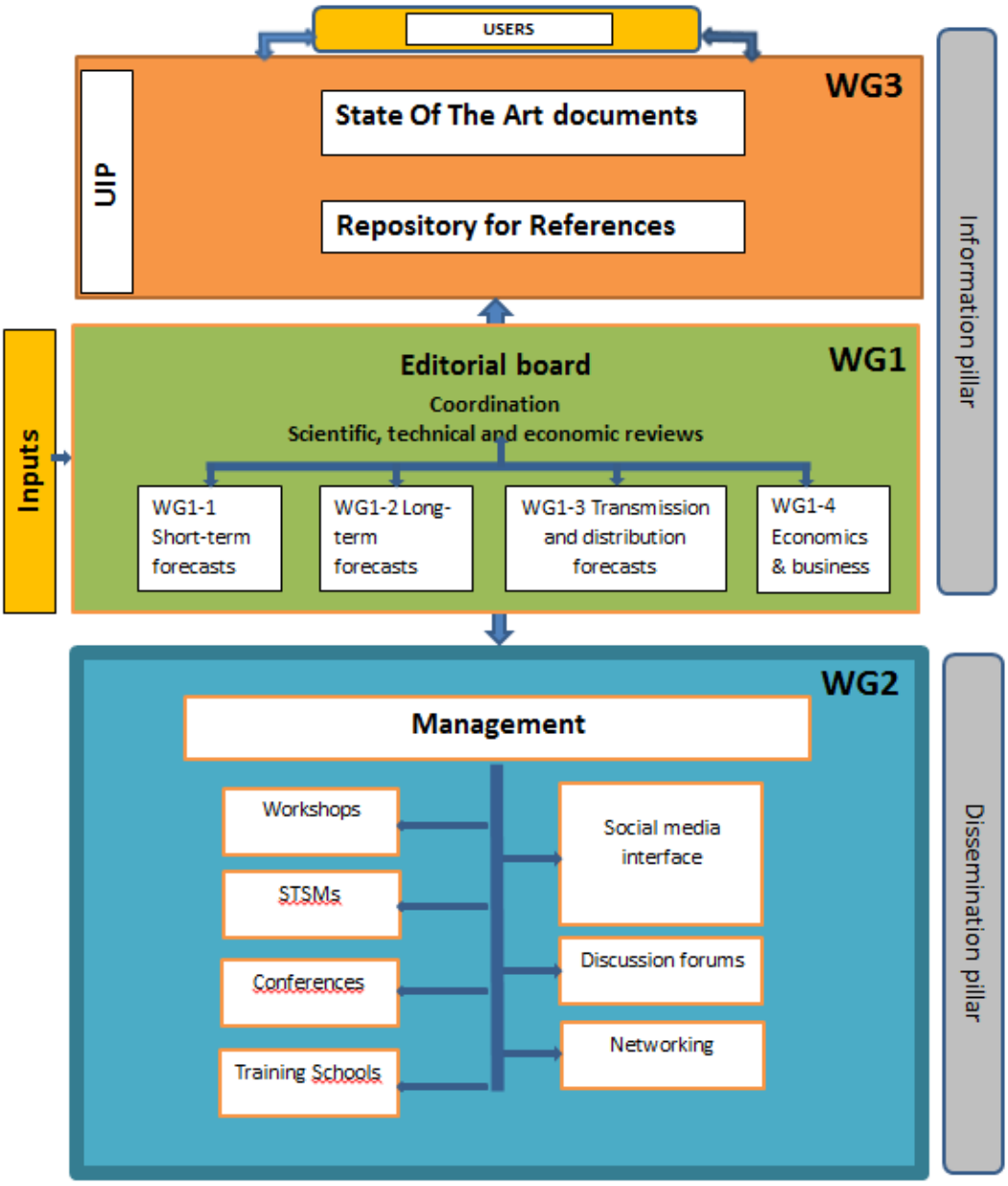
3. IMPLEMENTATION

3.1. Description of the Work Plan

3.1.1. Description of Working Groups

Text COST offers the optimal framework to support European networking activities. The FIRE-UIP goal will be fulfilled by three Working Groups whose tasks are displayed in figure 1.

Figure 1: Schematics of the organization of the Action WGs (**WG3**; **WG1**; **WG2**)



Working Group 1 (INFORMATION PILLAR)

The general task of WG1 will be to update and synchronize the whole information content of the UIP from the scientific, technical and economic points of view (Editorial Board EB).

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Each domain of the UIP will be introduced by a main State-Of-The-Art (SOTA) document which will summarize the actual knowledge available in the respective field and a brief description of the selected references. The references themselves will be saved in the repository part of the UIP and will contain the title of the paper, its summary, the authors' coordinates, key words, a link to the real publication and further references: this is the information that the UIP user will be able to look at. If more information or the complete article is needed, the user will have to follow the respective link(s).

From the input point of view, there are 2 possible paths:

- A paper is directly submitted to be inserted in the UIP. In this case, the respective sub-WG will review its content, adapt the summary if necessary, update the SOTA accordingly and submit the whole information to the EB which will allow the update the UIP.
- An information request is submitted to the UIP: in this case, the EB will forward it to the respective sub-WG which will prepare an appropriate update of the SOTA.

Therefore, the SOTA documents are the main constituents of the UIP. They will be dynamic and continuously updated by the respective sub-WGs:

- **WG1-1: Short term production forecasts**
  Tasks: Selection and analysis of information inputs/requests concerning short-term production forecasts for RE mainly for wind and solar energies, with potentially extended information for RE wave, tide, geothermal and biomass energy productions (at a later stage). If requested, it will support the organization of benchmark exercises for numerical forecast models.
- **WG1-2: Long term weather forecasts**
  Tasks: Selection and analysis of information inputs/requests concerning weather and production forecasts for the design and planning of the future energy mix and the related infrastructures. WG1-3 will establish a forum to explore and promote the evaluation and exploitation of very long term probabilistic meteorological forecasts (years to decades) for RE and power-system applications: robust long-term assessments of weather risk to RE output, use of statistical forecasting approaches (e.g. links to large-scale teleconnections), and exploitation of initialized probabilistic "decadal forecasts" and scenario-based "climate change projections".
- **WG1-3: Forecasts for electricity transmission**
  Tasks: Selection and analysis of information inputs/requests concerning weather and production forecasts for the design and planning of the future energy mix and the related infrastructures. WG1-3 will establish a forum to explore and promote the evaluation and exploitation of very long term probabilistic meteorological forecasts (years to decades) for RE and power-system applications: robust long-term assessments of weather risk to RE output, use of statistical forecasting approaches (e.g. links to large-scale teleconnections), and exploitation of initialized probabilistic "climate predictions" and scenario-based "climate change projections".
- **WG1-4: Economic and business aspects**
  Tasks: The main task of WG1-4 is to make full use of the UIP for promoting inter-disciplinary research and networking activities between the meteorologists and climatologists on one side and the economic/finance communities on the other. WG1-4 will further support the development of practical decision-support tools for the energy finance, insurance or banking sectors by focusing on specific case studies involving the use of state-of-the-art weather/climate forecasting techniques.

Working Group 2 (DISSEMINATION PILLAR)

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- **Task 1**: Evaluation of the information needs and requests of the stakeholders: power plant managers, forecast modelers, forecast providers, TSOs and DSOs, regulators etc… WG2 is based on the contributions of leading experts in the scientific, technological and economic fields.
- **Task 2**: Coordination of the Action networking activities in collaboration with the other WGs for the organization of information, scientific and technical workshops, training schools, short-term scientific missions (STSM), etc. A STSM manager will be nominated to take care of the procedures to select the STSMs, evaluate their results and publish the reports in a dedicated segment of the information platform.
- **Task 3**: Development and operation of social media tools for sharing documents and links, questionnaires, actual experiences, short educational videos, meeting announcements, open positions etc. in order to best address the generation Y of young researchers intensively communicating via social networks over the whole range of stakeholders: an expert in media environments will be nominated for this purpose.

Working Group 3 (UIP)

The objective of WG3 is to provide an UIP that acts as a repository of data and knowledge for the information pillar and supports the dissemination pillar with modern communication channels. The general strategy is to build a web platform that is accessible from standard PCs, smartphones and tablets via browser.

- **Task 1:** Creation of a web content repository dedicated for information related to forecasting for the present and future integration of RE. The repository will support dynamic (continuously updated by WG1) SOTAs as backbones for each main domain: these will cover all relevant present and future scientific, technical and economic aspects of the specific fields. The SOTAs will be created and updated online under supervision of the Editorial Board. A configurable Content Management System will be used for this task and configured to support the editorial flow defined by the WG1 and Editorial Board (including different roles such as author, moderator, publisher, etc.). The system should allow for tagging the different documents and parts of documents to build dedicated indexation and notification matching the profiles of the users (see task 2).
- **Task 2**: Integration of a dedicated indexation engine that will allow users to find rapidly information relevant to them. The search will be based on classical keywords and also on customized tags defined by the user (either online or through his/her profile). The search will target the SOTAs of Task 1 and a comprehensive database of scientific references including title, authors' list, date of publication, links to original documents and summary. For convenience, the tool should allow to import and export a variety of standard bibliographic formats such as BibTeX, Endnote or PubMed and to add citations in the dynamic SOTAs of Task 1.
- **Task 3**: Integration of interactive communication elements like Q&A, comments, and forums to provide comprehensive specific answers to incoming users' questions/requirements.
- **Task 4**: Integration of tools for automatic news digest and diffusion to registered users. The web platform will also be linked with social media including Facebook, LinkedIn and Twitter.

Tasks 1-3 will leverage free open source technology for web platforms such as MediaWiki, WordPress or other tools. They will cover the basic needs of the information pillar and the dissemination pillar.

As a potential extension, depending on the acquisition of external funding outside COST, the WG3 envisages an additional task that could greatly increase the impact of FIRE-UIP.

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- **Task 5 (optional):** Hosting of benchmark databases for RE forecasts and providing the infrastructure to execute forecasting methods on big data clusters. Such an infrastructure is based on Hadoop [10].

In parallel, WG3 will develop and manage the Action's internal webpage.

Deliverables and Milestones

Phase I (1st year):

- **WG1:**
  - Define the major domains to be integrated in the information pillar.
  - For each domain, edit specific state-of-the-art "position papers" containing historical and most recent references to the existing literature.
- **WG2:**
  - Preparatory networking activity to launch the UIP platform. This will be initiated during the Action kickoff workshop.
  - Preparation of the social media tools to advertise the UIP, to interact with potential contributors and to raise the interest of the whole RE community.
  - Set up of the editorial group of experts
  - Organization of an international information workshop at the end of phase I
  - Organization of the first STSMs
- **WG3:**
  - Definition of the structure of the UIP and development of a demonstration version which will be assessed continuously by the Action members. The final design will be selected at the end of Phase I.

Phase II (2nd & 3rd year):

- **WG1:**
  - Upgrade the content of the UIP by analyzing the requests prepared by WG2 in the different forecasting domains.
  - Evaluate the necessity/potential of collaborating with external experts.
  - Prepare the documents to be inserted in the UIP.
- **WG2:**
  - Extension of the contributors' network in order to "beef up" the UIP content. This will be achieved by activating personal contacts, by initializing dedicated meetings, ad-hoc technical workshops, training schools and STSMs with the intensive involvement of the stakeholders
  - Evaluation of new requests for information to be submitted to WG1.
  - Continuous review of the content of the information platform by the editorial board.
  - Organization of STSMs, ad-hoc workshops, training schools, MC and WG meetings.
  - Calls for contributions to the UIP through the social media network
- **WG3:**
  - Operation of the UIP
  - Upgrade of the UIP structure according to the requirements of WG1 and WG2.

Phase III (4th year):

- Consolidation of the information platform, including activities related to the review of its content.
- Final upgrade of the structure and of the browser.
- Organization of a Final Workshop.
- Editing of the Final Report.

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Last but not least, and if the audience meets the initial expectations, decisions will have to be met concerning the future implementation of the information platform if requested by the Action members and the stakeholders.

3.1.2. GANTT Diagram

Timetable of the Action for tasks and milestones, including MC and WG meetings and Training Schools.

	Phase I	Phase II		Phase 3
	Year 1	Year 2	Year 3	Year 4
WG1	Definition of UIP content and domains	Continuous upgrade of the content of the UIP following the requests from WG2		Final upgrade of the UIP. Review of content
WG1	Preparation of specific “position papers”	Increase collaboration with external experts		
WG2	Set-up of editorial group	Review the UIP content from the scientific, technical and economic points of view		Final review of the UIP content
WG2	Preparation of social media tools: select manager and tools	Broadcast information about the Action. Call for external contributions		
WG2	Organization of STSMs: select manager. Evaluate first requests	Organize new STSMs on request from WG1 or external sources.		
WG2	Organization of an international information Workshop	Organization of specific workshops and training school		Organize Final Workshop
WG2	Select STSM and Social Media managers	Increase the contributors’ network and evaluate new requests for information		
WG3	Definition of the UIP structure	Operation of the UIP		Consolidation of the UIP
WG3	Development of a demonstration version of the UIP	Upgrade of the UIP structure on request from WG1 and WG2		

3.1.3. PERT Chart (optional)

3.1.4. Risk and Contingency Plans

FIRE-UIP aims at building a bridge between the academic world (universities, national weather services, forecast providers) and the community of users and service providers. The latter group will be a priori reluctant to contribute to an open-access information system due to economic constrains and confidentiality requirements. Personal contacts, adapted confidentiality agreements and other similar actions are the mandatory tools to overcome this situation. A related difficulty stems from the European approach of the Action. Many companies will find it difficult, or even unattractive from a competition point of view to share problems, experiences and results with other similar institutions located in other countries, especially in today's situation of the electricity sector. This can be dealt with by organizing dedicated events and by e.g. looking for the sponsoring of international bodies such as ENTSO-E [11] (the European Network of Transmission System Operators which represents more than 40 TSOs from 34 countries across Europe), CEER [12] (the Council of European Energy Regulators), EDSO [13] (the European Distribution System Operators' Association for Smart Grids) and others.

End-users are often not aware of the latest scientific and technical developments in their fields of activity: the organization of ad-hoc scientific and technical workshops is the first step to overcome the reluctance of applying new, unfamiliar methodologies in the operational procedures. This can be solved by reporting about similar experiences on the UIP, enhancing networking activities and supporting tentative implementations of new algorithms or models in sponsoring the development of demonstration projects.

A further problem lies in the definition of COST which does not fund R&D activities. Working with private companies which have their own economic imperatives ("time is money") is recognized to be very difficult and the "COST" label is often not sufficient to open doors. However, the Action goal is to provide forums of value to the industry, independent of financial resources: research funding should be made available from other sources once the industry is engaged and this is where FIRE-UIP can help by providing the necessary environment to promote R&D through personal contacts, the demonstration of the potential of cooperation ("win-win" situations) and collaborations with other organizations such as IEA, ENTSO-E, GFCS, WEMC etc… together with guaranteed confidentiality agreements during the COST Action activities.

3.2. Management structures and procedures

- The Action Chair will be assisted by a Steering Group consisting of the Action vice-Chair, the WG and sub-WG Chairs and an Action secretary. The Steering Group will meet twice a year (or on request) either at dedicated meetings or through tele-conferences. External experts will be invited to these meetings if required.
- MC meetings will be organized once a year for the preparation of next year's work plan and budget. For efficiency purposes, WG meetings will be organized immediately before the MC meetings to allow the WG Chairs to synchronize their reporting. WG members are allowed to participate to the following MC meeting (without voting rights): this procedure will contribute to the motivations of all the Action's members and thus to the group's homogeneity.
- WG meetings are organized by the WG Chairs or in case of special requests by WG members.
- Information, scientific and technical workshops and training schools are organized on request by WG2. Financial organizational supports from stakeholders will have to be intensively looked for, especially in case of budget contingencies.
- WG2 will nominate a manager for the organization of STSMs. In principle, applications for STSMs are included in the yearly work plan and budget approved by the MC. However, for urgent situations, the steering group is authorized to approve an STSM proposal.
- WG2 will be responsible for the networking aspects of the Action through social networks and for the educational activities: for this purpose, it will nominate one or two specialists in these fields.

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- Former experiences showed that the maximum participation of females lies at around 30% in this domain. Fortunately, young female experts are more and more active in this field. Gender balance is considered as very important for the activities of the Action as female participants bring often new, innovative points of view and approaches. The Action will support strongly the contributions of female experts and they will be attributed leading positions as far as possible and available.

3.3. Network as a whole

The proposers' network consists of scientists, end-users, service providers and experts in intelligent web information solutions, bringing together the needed capacities to reach the goals of the proposed Action.

in order to reach the goal of developing a comprehensive, inter-connecting user information platform, a wide and large network of competences is required. This condition could already be met with a wide proposers network consisting of 49 co-proposers from 20 countries and a high potential for attracting new members. This network on one hand comprises all relevant types of stake-holders and communities (universitites, utilities, TSOs, DSOs, project developers, service providers, economists, new media experts etc.):

- 36.7% Earth and related Environmental sciences
- 24.5% Electrical engineering, electronic engineering, Information engineering
- 8.2% Environmental engineering
- 6.1% Mathematics
- 4.1% Computer and Information Sciences
- 6% Other
- 14.3% Unspecified

On the other hand, the network has a large geographical spread in order to enable a European aproach and to integrate less research-intensive countries as it is the mission of COST (coverage of COST Inclusiveness target countries: 47%). As the countries with the strongest progress related to the integration of renewable energy in Europe are also present in the network, the knowledge transfer from highly advanced to less intensive countries is guaranteed.

One of the key competences required to achieve the goals of the proposed Action to develop a modern, internet-based User Information Platform lies in the contribution of a team of motivated experts from different institutions in the field of new media technology. Their expertise and committments are guaranteed within the network of co-proposers.

The approach, the relevance and the timeliness of FIRE-UIP has been strongly confirmed by all stakeholders in the network.

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[9] http://gfcs.wmo.int/

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Network of Proposers - Features

COST Inclusiveness target countries
50.00 %

Number of Proposers
53

Gender Distribution of Proposers
75.5% Males
24.5% Females

Average Number of years elapsed since PhD graduation of Proposers with a doctoral degree
14.7

Number of Early Career Investigators
14

Core Expertise of Proposers: Distribution by Sub-Field of Science
35.8% Earth and related Environmental sciences
26.4% Electrical engineering, electronic engineering, Information engineering
7.5% Environmental engineering
5.7% Mathematics
3.8% Computer and Information Sciences
5.7% Other
15.1% Unspecified

Institutional distribution of Network of Proposers

65.4% Higher Education & Associated Organisations
23.4% Business enterprise
9.8% Government/Intergovernmental Organisations except Higher Education
1.4% Private Non-Profit without market revenues, NGO

Business enterprise:50

- Number by Market sector of unit of affiliation
  Professional, Scientific And Technical Activities:2
  Electricity, Gas, Steam And Air Conditioning Supply:6
  Information And Communication:1
- Number by Type
  Private enterprises:7
  Public enterprises:3
- Number by Ownership and International Status
  Independent Enterprise:9
  Enterprise owned by a national group:1
- Number by Size
  SME (EU Definition provided underneath after selection):6
  Large company:4

Higher Education & Associated Organisations:140

- Number by Field of Science of Department/Faculty of Affiliation

Electrical engineering, electronic engineering, Information engineering:6
Computer and Information Sciences:2
Physical Sciences:3
Earth and related Environmental sciences:15
Other engineering and technologies:3
Mathematics:2
Economics and business:1
Mechanical engineering:2

- Number by Type
  Education Oriented:18
  Research Oriented:17
- Number by Ownership
  Fully or mostly public:31
  Fully or mostly private:3
  50-50 Public and Private:1

Government/Intergovernmental Organisations except Higher Education:21

- Number by Level
  International:2
  Central and Federal Government:4
  Local government:1
- Number by Type
  R&D Funding and/or R&D Performing bodies:1
  Government department or government-run general public services:4
  Other Public Non-Profit Institution:2

Private Non-Profit without market revenues, NGO:3

- Number by Type
  Other:1
- Number by Level
  National:1

COST Country Institutions(20) : Belgium , Bosnia and Herzegovina , Bulgaria , Croatia , Cyprus , Denmark , France , Germany , Greece , Italy , Lithuania , Norway , Poland , Portugal , Romania , Serbia , Spain , Switzerland , Turkey , United Kingdom
International Organisations(1) : International Organisations
COST International Partners(1) : United States