



ΤΕΥΧΗ ΔΗΜΟΠΡΑΤΗΣΗΣ ΔΔΠΕΑ – 41801

ΓΙΑ ΤΗΝ ΠΑΡΟΧΗ ΥΠΗΡΕΣΙΩΝ ΜΕ ΑΝΤΙΚΕΙΜΕΝΟ:

«Παροχή υπηρεσιών πρόβλεψης και ιστορικών μετεωρολογικών δεδομένων»

ΤΕΥΧΟΣ 6

ΤΕΧΝΙΚΕΣ ΠΡΟΔΙΑΓΡΑΦΕΣ



INDEPENDENT POWER TRANSMISSION SYSTEM OPERATOR

Department of Systems and Infrastructure

Technical Requirements

FOR THE PROJECT

«Provision for Weather forecast service and weather historical observations»

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1. Introduction and Project Scope

1.1 The role of ADMIE

ADMIE is the Greek Transmission system Operator (TSO) and has the role of transmitting electrical power at a national level via the power grid. Among the responsibilities of ADMIE is the production of optimal generation schedules on a daily basis (Day Ahead Scheduling and Dispatch Schedules) in the context of the Greek energy market. Those schedules are produced by an optimization engine that takes into account information that typically includes load forecasts, renewable sources forecasts, bid quantities and prices submitted by the market participants, interchange schedules and technical information of generation units.

1.2 The requirement for a weather forecast

The Operation Planning Section (OPS) of the Department of System Operation and Control is responsible for providing forecasting information to the market platform, which produces the optimal schedules.

Among the forecast data provided by OPS is the system load forecast and the forecast of power produced by renewable sources. System load forecast and forecast of power produced by solar renewable sources (for brevity we shall refer to both as load forecast models) are produced by ADMIE utilizing proprietary software tools owned by ADMIE.

Once the market is cleared the system marginal prices are produced. Inaccurate forecasts may lead to sub-optimal schedules and it turns out that this has a significant impact in the economic cost of the operation schedules. More specifically, under-forecasts may lead to purchase of expensive services to deal with peaks and over-forecasts may lead to unnecessary capacity being committed.

In effect, load forecasting is fundamental in utility operation and increasing penetration of renewable sources has caused a significant change in the resource mix making the use of accurate forecasts necessary. These changes have constituted load forecasting to be a dynamic process that should continuously be improved.

Weather conditions are among the predominant factors that affect electrical power consumption, and are therefore used as predictors in short-term load forecasting (the weather variables are used differently in long term load forecasting – many important weather variables are hard to be predicted beyond two weeks) . Large penetration of solar generation at the distribution network has created new challenges for load forecasting, as the negative load from distributed energy sources has to be taken into account. This has created the need to incorporate weather factors such as light intensity or cloud coverage to accommodate for these effects and divert away from the traditional load forecasting models that used only temperatures or humidity.

The accuracy of the weather forecasts affects the load forecasts and it is therefore important for the load forecast to be provided with reliable weather forecasts, which are updated at regular intervals throughout the day.

1.3 Weather variables used currently

Currently ADMIE uses two models for short term forecasting. One model is used to predict the short-term system load forecast and the other is used to predict solar energy production.

The weather variables used by short-term system load forecast are:



1. The daily minimum and maximum forecast temperatures.
2. Historical temperature observations (for the previous day)
3. Forecast temperatures
4. Forecast light intensity

1.4 Requirement for a new Weather Forecast

There are three factors that drive the upgrade and reengineering of the requirement according to a new weather forecast engine:

1. The large penetration of solar energy sources both at the system and the distribution. The light intensity measures that are currently available for four areas in Greece, used by the solar energy prediction model are not sufficient to capture the dispersed nature of solar production.
2. The need for a realistic, accurate and integrated consideration in the forecast of all renewable sources, so that, together with the production by the conventional units the actual load demand can be forecasted.

Latest amendments in the Greek Grid and Exchange Code require renewable sources to participate in the electricity market. This has significant effects in the load forecast as the power produced by these sources will no longer be treated as negative load.

The aforementioned factors impose ADMIE to proceed with a tender in order to purchase a weather forecast service that will provide a reliable and unified weather data source to cope with the new requirements.

The objective of this document is to describe the requirements for the weather forecast in terms of:

1. The weather variables i.e. the meteorological elements that will be required by the load forecast models.
2. Accessibility to the service (API, format of the data).
3. The availability of the weather forecast (service availability, weather forecast updates).
4. Historical information of weather observations.

2. Service API and Accessibility

2.1 Access to Weather Forecast Data

Access to the weather forecast data shall be provided by an online API which upon request will respond with structured text in JSON or XML format. It will be possible to request weather forecast or observations by providing a list of parameters to the API. The list of parameters shall contain:

- A location, specified as a pair of geographical coordinates (longitude and latitude). If the coordinates specified correspond to a location for which a weather station is not available, then the response to the API request should contain a message indicating that data for the requested location is unavailable.



- A date parameter or a range of dates. In the first case, where a single date is specified, the response should return the weather forecast for that particular date or the weather observations if the date specified refers to the past.

Information about required geographical locations will be provided by ADMIE.

2.2 Data availability and weather forecast updates

Uninterruptible access to the service is crucial as the weather forecast will be used by the OPS in its daily operations. The base requirement is that a weather forecast shall be available every day, for next day (day ahead) before 07:30 (Athens time zone). The forecast horizon for the weather variables shall be 7 days. Since the load forecast is executed by OPS multiple times every day, the service provider will be required to make available forecast updates of the time series every hour of the day. This does mean necessarily that the forecast model algorithm should be executed on an hourly basis. The weather forecasts should contain values in 1 hour intervals and daily summaries.

In the extreme case of loss of service, the service provider shall have the responsibility to deliver the weather forecast by using alternative means, that will be specified (for instance by e-mail).

The data returned by the API call should be in a structured format (JSON or XML– preferably JSON) to facilitate parsing. The weather measurement values should be in SI units

3. List of weather variables and areas

3.1 Weather variables

The following is a list of weather variables the weather forecast is required to contain in hourly time intervals (in SI units):

- Air Temperature (°C)
- Wind Speed (m/s)
- Wind Direction (degrees)
- Relative Humidity (%) and/or Dew Point (°C)
- Light Intensity/Solar Radiation (W/m²) and/or Cloud Cover (%)

In addition, the following daily summaries should be provided:

- Max/Min Air Temperature
- Sunrise timestamp
- Sunset timestamp

3.2 Geographical Locations

The weather forecasts (and historical information) should be available for all prefectures (geographical areas) that are related to the interconnected system of Greece. This includes mainland Greece, some interconnected islands and Crete (see map in the Appendix). As a minimum requirement, measurements/forecast for at least one (1) station should be provided for each prefecture.



The load forecast models are continuously refined and thus more weather stations will be incorporated in the models in the near future. Also, some islands may be incorporated in the interconnected system thus requiring more weather data. Accessibility to data from all weather stations available from the service provider will not incur additional costs. In other words, ADMIE shall have the capability to incorporate data from additional weather stations at any given time.

4. Historical Information

4.1 Long term historical data

The successful bidder shall provide historical information of weather observations (not forecasts) for the specified areas and variables.

The purpose of obtaining historical information is to train load forecast models.

Historical data shall be provided from January 2016 up to the date the service is operational for ADMIE. The historical information will contain data in hourly time intervals for all the required regions.

The historical data may be provided as a batch file or via the API of the service.

4.2 Short term weather observations

In addition to the long term historical information ADMIE requires access to short term past weather observations. These observations shall be provided in a similar manner to the weather forecast values (variables of section 3.1, regions of section 8). If a past date is passed as a parameter then the response shall contain weather observations for the specified date. It is not a requirement for the historical data to have been collected exclusively from weather stations certified by the World Meteorological Organization.

5. Demonstration of credentials

The bidders shall be required to provide proof of weather forecast enterprise services. More specifically, bidders shall be required to provide for a minimum of 3 letters from enterprise clients (not educational or research institutions) for the past 5 years to whom they have provided equivalent services.

6. Duration of Service

The service will be provided for three (3) years (2+1).



7. Compliance list

The services offered shall be in accordance with the compliance table below. This table should be completed by all bidders. Each entry in the compliance list corresponds to a section in the document.

Item Number	Description	Section	Requirement	Notes by Bidder	Compliance (Yes/No)
1	Access to weather forecast service will be provided via an API access. The requests to the API shall contain all the necessary parameters to retrieve the forecast (or history) regarding a particular location and time period.	2.1	Required		
2	The weather forecast shall be updated every hour	2.2	Required		
3	The forecast horizon shall be 7 days	2.2	Required		
4	In case of loss of service the provider shall be responsible for delivering the weather forecast to ADMIE by alternative means (e.g. by email)	2.2	Required		
5	The measurements shall be provided in SI units	2.2	Required		
6	The weather forecasts shall contain hourly predictions	2.2	Required		
7	The weather forecasts shall contain daily summaries	2.2	Required		
8	The weather forecasts shall be provided in a structured format (JSON, XML)	2.2	Required		
9	The following weather variables are provided: <ul style="list-style-type: none">• Air Temperature (°C)• Wind Speed (m/s)• Wind Direction (degrees)• Relative Humidity(%) and/or Dew Point (°C)• Light Intensity/Solar Radiation(W/m²) and/or Cloud Cover (%)	3.1	Required		



	<ul style="list-style-type: none">• Min/Max temperatures• Sunrise timestamp• Sunset timestamp				
10	Weather forecasts for the regions (mainland Greece, some interconnected islands and Crete) shown in the map in the Appendix are provided. ADMIE will have access to data from all weather stations in every area if necessary.	3.2	Required		
11	Long term historical data shall be provided to ADMIE from January 2016 and the historical information shall contain data in hourly intervals, for all required regions.	4.1	Required		
12	Short term historical data will be available via API calls.	4.2	Required		
13	Proof of services shall be provided by means of recommendation letters from enterprise clients (not educational or research institutions), for the past five years (at least 3 recommendation letters are required).	5	Required		



8. Appendix : Map of Greece

The prefectures of interest for weather forecast are related to the interconnected system of Crece: mainland Greece, the islands of the western coast, the island of Euboea, the island of Crete (to be incorporated in the interconnected system) and the group of islands named "Cyclades"

