North American Transmission FORUM

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NATF Guide Form Specification for Temperature Forecast Service Reference

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Version History

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09/15/2023	1.0	Original Issue

Review and Update Requirements

- Review: every 5 years
- Update: as necessary

Contents

1. Purpose

Organization is a public utility transmission provider that owns, operates, or controls facilities used for the transmission of electric energy in interstate commerce. In that role, ***organization*** offers transmission service under a transmission tariff that allows ***organization*** to recover certain costs of operating its transmission network. ***Organization*** is hereafter identified as the Transmission Provider.

The Federal Energy Regulatory Commission (FERC), in its Order 881 [1] and subsequent Order 881-A [2] (the Orders) require Transmission Providers to adjust the current-carrying capacity, or rating, used to operate certain transmission lines based on forecast ambient temperature. To comply with the Orders, the Transmission Provider must use ambient-adjusted ratings when evaluating requests for near-term transmission service, which means transmission service ending within 10 days (240 hours) of the date of request.

To fulfill this obligation, the Transmission Provider requires temperature forecast data for one or more locations within the area it serves. This document specifies requirements for a service that provides such forecast data. The organization providing this forecast service is hereafter identified as the Service Provider.

> **Usage notes:** This document is intended for Transmission Providers to use in developing a specification for temperature forecast services for FERC Order 881 compliance. Consider the purpose, background, and individual requirements when creating a specification that is appropriate for the Transmission Provider. Modify, add, and remove requirements as necessary to tailor the specification to work with the Transmission Provider's processes and systems.
>
> Text in ***bold italics*** indicates specification requirements that the Transmission Provider needs to modify or accept.
>
> Text shown in a shaded box (as is this text) is explanatory and may be removed from the final specification.

2. Background

The Transmission Provider operates a continuously staffed control center from which operators control various transmission system facilities. One requirement of operating the system is to ensure that transmission lines and other equipment do not carry more current than the equipment is safely able to carry. The current-carrying capability of transmission equipment depends on many factors, including equipment design, and in some cases, ambient temperature, windspeed, wind direction, and solar irradiation.

Operating each facility within its rating is the job of the system operator, assisted by computer-based tools collectively known as an energy management system (EMS). In general, the EMS or a related system provides information about the state of the transmission system, as well as information about the rating of facilities under current conditions, allowing the operator to manipulate the system so that it operates within its limits. In addition, to comply with the Orders, the EMS or a related system must determine the future ratings of the equipment for a period of 10 days and make those ratings available for evaluating requests for transmission service and for planning future operations. Since the Orders require that a new set of ratings be determined every hour, the process to determine ratings, and the methods used to obtain certain inputs to that process (including the ambient temperature forecast), must be automated.

3. Requirements

Forecast Location and Update Frequency

3.1 The Service Provider will provide dry-bulb temperature forecast data for the locations specified below.

> Transmission Provider to select one of the following options, or a variation thereof:
>
> A. Transmission Provider to add a list of locations by name, airport code, or another appropriate identifier. When using this method, the Transmission Provider may use forecast data from all the locations directly or may aggregate temperature forecast data from two or more of the specified locations to provide a representative temperature for a particular area.
>
> B. Transmission Provider to specify a method by which the Service Provider is to aggregate temperature forecast data from two or more locations within a designated area to provide a representative temperature for the area. Possible methods include calculating an average or selecting the maximum.

If data is not available for one or more of the specified locations, the Service Provider will propose alternative locations that the Service Provider believes represent the specified locations. If the Service Provider believes that forecast data for a location specified by the Transmission Provider does not represent the ambient temperature of the general area as well as would an alternative location, the Service Provider may propose the alternative location for approval by the Transmission Provider.

For example, the Service Provider might propose an alternate location if the Service Provider believes that the temperature at one of the locations specified by the Transmission Provider is typically higher or lower than the surrounding area. This might occur if placement of the data collection system at that location could lead to temperature forecasts that do not represent the surrounding area.

3.2 A temperature forecast dataset for each location will be provided at least ***once per hour***, 24 hours per day.

> Transmission Provider to modify the update cadence if more frequent update is required.

3.3 The temperature forecast dataset will contain a list of temperature forecasts for each of the locations determined according to requirement 3.1. Each list will consist of temperature forecasts for each of the next ***240 hours,*** starting with the hour following that in which the forecast dataset is provided.

> Transmission Provider to modify the duration if more than 240 hours are required. This requirement is such that forecast data will be provided before the hour in which the data will be used. This allows time to receive the forecast, calculate ratings, and communicate information to other Transmission Providers as needed. For example, if new forecast data is to be provided 15 minutes past each hour, the data provided at 12:15 pm will contain a forecast for the hour beginning at 1:00 pm and the 239 hours that follow.

3.3.1 Each list of temperature forecasts will be identified with a unique location label for each location. The Transmission Provider and the Service Provider will agree upon the location labels and the labels will not be changed without approval of the Transmission Provider.

3.3.2 Each temperature forecast will be time-stamped with the date and hour in which the forecast applies. The Transmission Provider and the Service Provider may agree on alternative methods for identifying the applicable date and time for each forecast.

> One alternative method could be to use a system of numerical indices (such as 1-240), along with the date and time of delivery of the dataset, to determine the date and time in which a given forecast applies.

3.4 Each temperature forecast will be the peak temperature expected within the applicable hour ***(or each fraction of an hour if requirement 3.2 calls for the data to be updated more frequently than once per hour).***

> Transmission Provider may remove fraction of the hour requirement if updates are only required every hour.

3.5 The Transmission Provider and the Service Provider will agree upon a consistent time for the new forecast dataset to be available each hour, ***or, if the forecast is updated more than once per hour, each fraction of the hour.*** Updated forecast information will be available within ***one minute*** before or after the designated time.

> Transmission Provider may modify the availability tolerance as needed and remove fraction of the hour requirement if updates are only required every hour.

Time stamps and time changes

3.6 The forecast dataset will include the date and time the dataset was made available or delivered.

3.7 Time data will be provided as Coordinated Universal Time (UTC) or in another agreed-upon format.

> Using UTC is a way to avoid confusion with time zones and daylight-saving time transitions.

3.8 If the Transmission Provider designates that a forecast location is in an area where daylight-saving time is observed, the time stamp of the “extra hour” in the fall will be unique. This unique time stamp will be used for the forecast time stamp specified by requirement 3.3.2 and for the dataset time stamp specified by requirement 3.6.

> For example, since daylight-saving time transition occurs at 2am, the system could provide a dataset time stamped “02:00" or similar, followed one hour later by a dataset time-stamped “02:00-D.”
>
> The Transmission Provider must designate whether daylight-saving time is observed.

Forecast Units and Precision

3.9 The temperature forecast will be specified ***in degrees Fahrenheit or degrees Celsius***.

Transmission Provider to modify to select the desired temperature scale.

3.10 The temperature forecast will be specified to the nearest ***one degree Fahrenheit or one degree Celsius.***

Transmission Provider to modify as needed to specify precision and units. FERC Order 881 does not specify forecast precision but requires that ambient adjusted ratings are updated with at least every five-degree Fahrenheit increment of forecast temperature change. This implies that the forecast should be more precise than five degrees Fahrenheit. Either one degree Fahrenheit or one degree Celsius is adequate to meet this condition.

Sunrise and Sunset Times

3.11 The Service Provider will provide sunrise and sunset times at the designated locations as described below.

Transmission Provider to specify one of the following options, or a variation thereof: A. The Service Provider will include in each dataset the date and time of each sunrise and sunset that will occur within the time window covered by the dataset. B. Upon request from the Transmission Provider (e.g., one time per year), the Service Provider will provide sunrise and sunset times for each of the days covered by the data request (e.g., the next year).

Seasonal Temperature Forecasts

3.12 The Service Provider will provide seasonal temperature forecasts at the designated locations.

3.12.1 There will be ***N*** seasons per year. The start and end dates of each season will be specified by the Transmission Provider. The seasons will start and end at ***12:00 am*** on the specified dates. The number of seasons and the start and end dates will change no more than one time per calendar year.

Transmission Provider to specify the number of seasons (*N*) and the start and end dates. Transmission Provider to modify the starting time for seasons if necessary.

3.12.2 The seasonal temperature forecast for each location will be the temperature that the Service Provider expects will not be exceeded during the season, with ***95%*** confidence.

Transmission Provider to modify confidence according to organization's risk tolerance.

3.12.3 Seasonal temperature forecasts will be provided as described below.

Transmission Provider to specify one of the following options, or a variation thereof: A. The Service Provider will include the seasonal temperature forecasts for the next *N* seasons on a rolling basis in each dataset. The format and labeling will be as agreed by the Transmission Provider and Service Provider. B. Upon request from the Transmission Provider (e.g., one time per year), the Service Provider will provide the seasonal temperature forecasts for the period covered by the data request (e.g., the next year).

Data Exchange Method

3.13 Forecast datasets will be provided by secure, encrypted means, such as ***(REST API, SOAP API)***. Access controls and other security requirements will be maintained as agreed between the Transmission Provider and the Service Provider.

Transmission Provider to provide a description of the preferred data transfer method and data security requirements.

3.14 If the dataset is provided via a file created by the Service Provider, the file will be named according to an agreed-upon naming convention.

For example, the file naming convention might include the date and time the file was created and made available.

Data Quality and Availability

3.15 Each month, the Service Provider will provide a system performance and availability report.

3.15.1 The report will include the actual peak temperature reported at each location for each hour of the past month.

3.15.2 The report will include an availability calculation for the service over the preceding 12 months (roughly 8760 hours). Availability is calculated as follows:

$$\left(1 - \frac{\text{Number of scheduled datasets not delivered at the scheduled time}}{\text{Number of scheduled dataset updates}}\right) * 100$$

3.15.3 Minimum availability calculated as specified in 3.15.2 will be ***99.97%.***

As defined, availability measures the ability of the Service Provider to deliver a new forecast dataset. It does not measure a situation in which the Service Provider provides the dataset as required but is unable to update the forecast in that dataset for one or more locations. Transmission Provider to modify the minimum availability according to Transmission Provider's process tolerance and the capability of the Service Provider. The specified availability equates to about three failed updates per year if updates are to occur once per hour.

3.16 The Service Provider will notify the Transmission Provider of any planned service outages that may cause the Transmission Provider to fail to receive a scheduled forecast update. The Service Provider will provide notification via the specified communication method ***two*** or more weeks before the start of the outage, and again not less than ***eight*** and no more than ***12*** hours before the start of the outage.

Transmission Provider to modify notification requirements if needed.

3.17 The Service Provider will notify the Transmission Provider of any unplanned service outages that have caused or may cause the Transmission Provider to fail to receive a scheduled forecast update. The Service Provider will provide notification within ***one hour*** of the start of the outage and will specify the estimated time when service will be available. The Service Provider will provide additional notifications if there is a change in the estimated time the service will be available.

Transmission Provider to modify notification requirements if needed.

3.18 The Service Provider will include one or more data quality indicators in the dataset. The data quality indicator(s) will identify conditions under which the underlying forecast model is not able to operate properly, such as might occur if temperature observations are not available from a required location. The Service Provider will provide descriptions of the quality control processes, explain how to interpret the values of the data quality indicator, and describe the impact on the forecast if data quality is less than expected.

The Transmission Provider may use the data quality indicators to trigger "fallback" to an alternative method of calculating ratings.

Communication

3.19 The Service Provider will maintain a list of email addresses to which the Service Provider will communicate all information about service performance and availability, including notification of planned and unplanned outages. The Service Provider will also provide notifications of an unplanned outage as specified in requirement 3.17 by telephone to a telephone number designated by the Transmission Provider.

3.20 The Service Provider will maintain a list of telephone numbers for designated Transmission Provider employees to be contacted in the event of returned email or other indication that email communication is not received. It is the responsibility of the Transmission Provider to ensure this contact information is current.

3.21 The Service Provider will participate in an annual verification of the email addresses and phone numbers. The Transmission Provider will initiate the verification.

Support

3.22 The Service Provider will provide on-call support on a 24-hour, seven-day basis to assist the Transmission Provider with issues retrieving data or incorrect data and to provide advice regarding the data quality indicator(s). If support is not immediately available, a call back to the Transmission Provider is required within ***60*** minutes.

> The Transmission Provider may modify the maximum response time and may specify a response time that varies depending on the time of day or nature of the request.

3.23 The Service Provider will notify the Transmission Provider of any changes to the telephone numbers to be used for support before those changes take place.

Data Storage and Recordkeeping

3.24 As specified by the Transmission Provider, the Service Provider will maintain certain records (e.g., hourly temperature forecast datasets) for a specified period and according to specified security and backup requirements. Upon request, the Service Provider will provide this data, in whole or in part, to the Transmission Provider, including in the event of termination of the contract for services.

> The Transmission Provider may decide to have the Service Provider maintain certain records that the Transmission Provider may need later. When making such a decision, the Transmission Provider should consider the risks associated with trusting this responsibility to an outside provider. The length of time the records are maintained should be determined based on the anticipated use, including use in as audit evidence. The Transmission Provider should specify how the records are to be maintained and backed-up to ensure integrity and availability.

Redundancy

3.25 Should the Transmission Provider decide to subscribe to more than one service to provide redundancy, the Service Provider will provide information that allows the Transmission Provider to verify the degree of redundancy provided by the services it has selected. However, the Service Provider will not be required to provide information that it considers proprietary or confidential.

> There is no requirement for a Transmission Provider to subscribe to multiple forecast services; however, Transmission Providers may decide to do so to mitigate the risk of losing access to temperature forecasts. This requirement gives Transmission Providers that subscribe to multiple services the right to information that will help verify that there is not a common source of information or common system used by both services that makes the services vulnerable to a common-mode failure.

4. References

[1] Federal Energy Regulatory Commission, "Order No. 881 Managing Transmission LIne Ratings," 21 December 2021. [Online]. Available: https://www.ferc.gov/media/e-1-rm20-16-000.

[2] Federal Energy Regulatory Commission, "Order 881-A: Managing Transmission Line Ratings," [Online]. Available: https://www.ferc.gov/media/e-1-rm20-16-000.