RTP – Load Forecasting

1 Descriptions of Function

All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work should be so noted.

1.1 Function Name

Real Time Pricing – Load Forecasting

1.2 Function ID

IECSA identification number of the function

C-4,C-7

1.3 Brief Description

Describe briefly the scope, objectives, and rationale of the Function.

The Load Forecasting function of RTP uses transmission and distribution information, energy schedules, weather, and past history to forecast loads on and interval-by-interval basis. The forecast is used, in part, to develop the Base RTP calculation.

1.4 Narrative

A complete narrative of the Function from a Domain Expert's point of view, describing what occurs when, why, how, and under what conditions. This will be a separate document, but will act as the basis for identifying the Steps in Section 2.

Periodically, the Market Timer, (the RTO/ISO market operations system or other market entity, depending upon the market design) forecasts power system conditions for a specific period, say the next 24 hours, based on energy schedules and prices already submitted, ancillary services available, weather conditions, day of the week, scheduled outage information from transmission and distribution operations, and real-time information from transmission and distribution operations, etc.

The Load Forecasting function uses historical load forecasts databases and combines that information about the energy generation schedules, transmission and distribution system constraints and ancillary services bids to estimate the load for areas within the system studied. Various load forecasting packages approach the problem in different ways but all use these input and combine weather, time of the year, day of the week and other correlated variables to predict customer behavior for the specific settlement periods being forecasted.

1.5 Actor (Stakeholder) Roles

Describe all the people (their job), systems, databases, organizations, and devices involved in or affected by the Function (e.g. operators, system administrators, technicians, end users, service personnel, executives, SCADA system, real-time database, RTO, RTU, IED, power system). Typically, these actors are logically grouped by organization or functional boundaries or just for collaboration purpose of this use case. We need to identify these groupings and their relevant roles and understand the constituency. The same actor could play different roles in different Functions, but only one role in one Function. If the same actor (e.g. the same person) does play multiple roles in one Function, list these different actor-roles as separate rows.

Grouping (Community)		***Group Description***
Market Operations		
Actor Name	***Actor Type (person, device, system etc.)***	***Actor Description***
Market Timer	System	Timer to trigger application execution at specific times of the day, week, month, etc
Forecast Loads	Database	Load forecasts, based on different inputs and possible market scenarios
EnergySchedule Database	Database	Energy schedules submitted to Market Operations
Ancillary Services Bids/Offers	Database	Ancillary Services bids and offers submitted to Market Operations

Grouping (Community)		*Group Description*
Market Operations		
Actor Name	*Actor Type (person, device, system etc.)*	*Actor Description*
HistoricLoadDatabase	Database	Provides historical load data for the system
WeatherService	System	Provides weather forecasts
LoadForecaster		

Grouping(Community)		*Group Description*
Transmission Operations Systems		Provides power system configuration and real-time data to market operations
Actor Role Name	*Actor Type (person, device, system etc.)*	*Role Description*
Transmission System Data	System	Transmission power system data, including scheduled outages, transmission constraints, and real-time information

Grouping(Community)		*Group Description*
Distribution Operations Systems		Provides real-time data to market operations and monitors (larger) DER devices
Actor Role Name	***Actor Type (person, device, system etc.)***	***Role Description***
Distribution System Data	System	Distribution power system data, including scheduled outages, distribution constraints, and real-time information

Replicate this table for each logic group.

1.6 Information exchanged

Describe any information exchanged in this template.

Information Object Name	*Information Object Description*
EnergyScheduleDatabase	Energy scheduled for the settlement period from generation facilities
Ancillary Services Bids	Bids offered and accepted for ancillary services
Weather Forecasts	Weather forecast data for the settlement period.
Transmission outage and constraint data	Transmission power system data, including scheduled outages, transmission constraints, and real-time information
Distribution outage and constraint data	Distribution power system data, including scheduled outages, distribution constraints, and real-time information
Historical Load Data	Database of historical load information used by forecasting algorithms.

Information Object Name	*Information Object Description*
Load Forecast	Prediction of load at significant points throughout the system for the settlement period.

1.7 Activities/Services

Describe or list the activities and services involved in this Function (in the context of this Function). An activity or service can be provided by a computer system, a set of applications, or manual procedures. These activities/services should be described at an appropriate level, with the understanding that sub-activities and services should be described if they are important for operational issues, automation needs, and implementation reasons. Other sub-activities/services could be left for later analysis.

Activity/Service Name	*Activities/Services Provided*
Load forecast function	Function uses transmission and distribution information, energy schedules, weather, and past history to forecast loads
ESP ancillary services aggregation function	Function that aggregates ancillary service bids/offers and manages the submittal to the market operations system
Market operations energy services function	Function that capture and analyze energy schedules to ensure all power system constraints are met
Market operations ancillary services function	Function that captures offers/bids of ancillary services and categorizes them for use during the “settlement” period

1.8 Contracts/Regulations

Identify any overall (human-initiated) contracts, regulations, policies, financial considerations, engineering constraints, pollution constraints, and other environmental quality issues that affect the design and requirements of the Function.

Contract/Regulation	*Impact of Contract/Regulation on Function*
Utility operations	FERC and state regulators oversee utility operations

Policy	*From Actor*	*May*	*Shall Not*	*Shall*	*Description (verb)*	*To Actor*

Constraint	*Type*	*Description*	*Applies to*
Laws of physics	Environmental	Laws of physics for power system operations	All

2 Step by Step Analysis of Function

Describe steps that implement the function. If there is more than one set of steps that are relevant, make a copy of the following section grouping (Preconditions and Assumptions, Steps normal sequence, and Steps alternate or exceptional sequence, Post conditions)

2.1 Steps to implement function

Name of this sequence.

2.1.1 Preconditions and Assumptions

Describe conditions that must exist prior to the initiation of the Function, such as prior state of the actors and activities

Identify any assumptions, such as what systems already exist, what contractual relations exist, and what configurations of systems are probably in place

Identify any initial states of information exchanged in the steps in the next section. For example, if a purchase order is exchanged in an activity, its precondition to the activity might be 'filled in but unapproved'.

Actor/System/Information/Contract	***Preconditions or Assumptions***
EnergyScheduleDatabase	Energy scheduler have been determined for the settlement period.
Transmission Operations Systems	Transmission power system data, including scheduled outages and transmission constraints have been determined for the settlement period.
Distribution Operations Systems	Distribution power system data, including scheduled outages have been determined for the settlement period.

2.1.2 Steps – Normal Sequence

Describe the normal sequence of events, focusing on steps that identify new types of information or new information exchanges or new interface issues to address. Should the sequence require detailed steps that are also used by other functions, consider creating a new "sub" function, then referring to that "subroutine" in this function. Remember that the focus should be less on the algorithms of the applications and more on the interactions and information flows between "entities", e.g. people, systems, applications, data bases, etc. There should be a direct link between the narrative and these steps.

The numbering of the sequence steps conveys the order and concurrency and iteration of the steps occur. Using a Dewey Decimal scheme, each level of nested procedure call is separated by a dot '.'. Within a level, the sequence number comprises an optional letter and an integer number. The letter specifies a concurrent sequence within the next higher level; all letter sequences are concurrent with other letter sequences. The number specifies the sequencing of messages in a given letter sequence. The absence of a letter is treated as a default 'main sequence' in parallel with the lettered sequences.

Sequence 1:

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1.1 - Do step 1
1.2A.1 - In parallel to activity 2 B do step 1
1.2A.2 - In parallel to activity 2 B do step 2
1.2B.1 - In parallel to activity 2 A do step 1
1.2B.2 - In parallel to activity 2 A do step 2
1.3 - Do step 3
1.3.1 - nested step 3.1
1.3.2 - nested step 3.2
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Sequence 2:

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2.1 - Do step 1
2.2 – Do step 2
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#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
#	*Triggering event? Identify the name of the event.*[1]	*What other actors are primarily responsible for the Process/Activity? Actors are defined in section0.*	*Label that would appear in a process diagram. Use action verbs when naming activity.*	*Describe the actions that take place in active and present tense. The step should be a descriptive noun/verb phrase that portrays an outline summary of the step. "If …Then…Else" scenarios can be captured as multiple Actions or as separate steps.*	*What other actors are primarily responsible for Producing the information? Actors are defined in section0.*	*What other actors are primarily responsible for Receiving the information? Actors are defined in section0.* *(Note – May leave blank if same as Primary Actor)*	*Name of the information object. Information objects are defined in section 1.6*	*Elaborate architectural issues using attached spreadsheet. Use this column to elaborate details that aren't captured in the spreadsheet.*	*Reference the applicable IECSA Environment containing this data exchange. Only one environment per step.*
1.1	Market Timer initiates the forecast power system condition	Market Timer		Forecast power system conditions for the next "settlement" periods					Intra-Control Center
1.1.1		LoadForecaster		Load energy schedules from EnergyScheduleDatabase.	EnergySchedule Database		Energy schedules	APIs needed between databases and application	Intra-Control Center
1.1.2		LoadForecaster		Load Ancillary services bids/offers from database	Ancillary Services Bids/Offers		Ancillary Services Bids	APIs needed between databases and application	Control Centers / ESPs
1.1.3		LoadForecaster		Load weather forecasts from WeatherService	WeatherService		Weather forecasts	Existing weather protocol and weather format must be used	Intra-Control Center
1.1.4		LoadForecaster		Load historical load data a from historical load database	HistoricLoadDatabase		Historical load data	APIs needed between databases and application	Intra-Control Center

[1] Note – A triggering event is not necessary if the completion of the prior step – leads to the transition of the following step.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments
1.1.5		LoadForecaster		Load transmission system information for outages and constraints	Transmission System Data		Transmission outage and constraint data	Inter utility communications must be supported	Intra-Control Center
1.1.6		LoadForecaster		Load distribution system information for outages and constraints	Distribution System Data		Distribution outage and constraint data	Inter utility communications must be supported	Intra-Control Center
1.2	Completion of Load Forecasting application	LoadForecaster		Post results of load forecast to load forecast database for other applications to access (RTP base rate calculator)	LoadForecaster	Forecast Loads	Load Forecast	APIs needed between databases and application	Control Centers / ESPs

2.1.3 Steps – Alternative / Exception Sequences

Describe any alternative or exception sequences that may be required that deviate from the normal course of activities. Note instructions are found in previous table.

#	Event	Primary Actor	Name of Process/Activity	Description of Process/Activity	Information Producer	Information Receiver	Name of Info Exchanged	Additional Notes	IECSA Environments

2.1.4 Post-conditions and Significant Results

Describe conditions that must exist at the conclusion of the Function. Identify significant items similar to that in the preconditions section.

Describe any significant results from the Function

Actor/Activity	*Post-conditions Description and Results*
LoadForecaster	Post results of load forecast to load forecast database for other applications to access (RTP base rate calculator)

2.2 Architectural Issues in Interactions

Elaborate on all architectural issues in each of the steps outlined in each of the sequences above. Reference the Step by number..

Microsoft Excel Worksheet

2.3 Diagram

For clarification, draw (by hand, by Power Point, by UML diagram) the interactions, identifying the Steps where possible.

3 Auxiliary Issues

3.1 References and contacts

Documents and individuals or organizations used as background to the function described; other functions referenced by this function, or acting as "sub" functions; or other documentation that clarifies the requirements or activities described. All prior work (intellectual property of the company or individual) or proprietary (non-publicly available) work must be so noted.

ID	Title or contact	Reference or contact information
[1]		
[2]		

3.2 Action Item List

As the function is developed, identify issues that still need clarification, resolution, or other notice taken of them. This can act as an Action Item list.

ID	Description	Status
[1]		
[2]		

3.3 Revision History

For reference and tracking purposes, indicate who worked on describing this function, and what aspect they undertook.

No	Date	Author	Description
1.0	2/6/2004	Jack King	Version 1.0 in template version 28

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