Reliability Functional Model

Function Definitions and Functional Entities

Version 65

Prepared by the Functional Model Advisory Group
Approved by the Standards Committee: [Month, Year]
# Table of Contents

**Section I: Purpose of the Functional Model**
- Executive Summary

**Section II: Overview of the NERC Registration Process**
- Introduction
- Purpose of the Functional Model (combine with Clarification Service section)
- Background
- Functional Model Diagram
- Revision Summary
- Guiding Principles of the Functional Model

**Section III: Functions and Functional Entities**
- Standards Development and Standards Developer
- Compliance Enforcement and Compliance Enforcement Authority
  - 1. Reliability Assurance and Reliability Assurer
  - 2. Planning Reliability and Planning Coordinator
  - 3. Transmission Planning and Transmission Planner
  - 4. Resource Planning and Resource Planner
  - 5. Reliability Operations and Reliability Coordinator
  - 6. Balancing and Balancing Authority
  - 8. Transmission Operations and Transmission Operator
  - 9. Interchange and Interchange Coordinator
  - 10. Transmission Service and Transmission Service Provider
  - 11. Transmission Ownership and Transmission Owner
  - 12. Distribution and Distribution Provider
  - 13. Generator Operation and Generator Operator
  - 14. Generator Ownership and Generator Owner
  - 15. Purchasing-Selling and Purchasing-Selling Entity
  - 16. Load-Serving and Load-Serving Entity

**Section IV: Version History**
Section I: Purpose of the Functional Model

Part 1: Foreword

The functional model (FM) is a guideline that identifies the functions that must be performed to ensure that the Bulk Power System is planned and operated in a reliable manner. The FM describes, in general terms, the functions that must be performed to ensure reliability, the specific tasks that are necessary to perform each function, and the relationships between functional entities that perform the various tasks. In its capacity of a guideline, the FM serves to provide a framework for NERC Reliability Standards as they are developed through the standard development process. The FM is independent of any particular organizational or market structure. The focus of the FM is solely on identification of reliability-related functions and the associated tasks and relationships.

Equally important to explaining what the FM does do, is a clear explanation of what the FM does not do. The FM is not a mandatory and enforceable document. The FM is not a “standard” and does not have compliance effects. If there is a conflict between the FM and Reliability Standards, the Reliability Standards always take precedence. The FM is only a guideline serving to provide details on how the different functions work together to ensure the reliability of our BPS. Also, the FM is not intended to identify the entities responsible for NERC registration. The NERC registration process is undertaken by NERC (and the Regional Entities) pursuant to authority from FERC, ultimately derived from the Federal Power Act. The FM has no authority, ability, or intent to impact or influence the NERC Registration process. Below is an overview of the NERC Functional Model (FM).

This document replaces version 4 of the NERC Reliability Functional Model that the NERC Standing Committees approved in September 2008.

Historically, Control Areas were established by vertically integrated utilities to operate their individual power systems in a secure and reliable manner and provide for their customers’ electricity needs. The traditional Control Area operator balanced its load with its generation, implemented Interchange Schedules with other Control Areas, and ensured transmission reliability.

As utilities began to provide transmission service to other entities, the Control Area also began to perform the function of Transmission Service Provider through tariffs or other arrangements. NERC’s Operating Policies reflected this traditional electric utility industry structure, and ascribed virtually every reliability function to the Control Area.

Beginning in the early 1990s with the advent of open transmission access and restructuring of the electric utility industry to facilitate the operation of wholesale power markets, the functions performed by Control Areas began to change to reflect the newly emerging industry structure. These changes occurred because:

1. Some utilities were separating their transmission from their merchant functions (functional unbundling), and even selling off their generation;
2. Some states and provinces were instituting “customer choice” options for selecting energy providers; and,
3. The developing power markets were requiring wide-area transmission reliability assessment and dispatch solutions, which were beyond the capability of many Control Areas to perform.

As a result, the NERC Operating Policies in place at that time, which centered on Control Area operations, were beginning to lose their focus, and become more difficult to apply and enforce.

The NERC Operating Committee formed the Control Area Criteria Task Force (CACTF) in 1999 to address this problem. The task force began by listing all the tasks required for maintaining electric system reliability and then
organizing these tasks into basic groups that it called “functions.” Ultimately, the Task Force decided to build a “Functional Model.” This involved breaking down the previous reliability functions more finely, such that all organizations involved in ensuring reliability—whether they are traditional, vertically integrated control areas, regional transmission organizations, independent system operators, independent transmission companies or so on—can identify those functions they perform, and register with NERC as one or more of the functional entities. Initially the Model dealt with operating functions, but it was subsequently expanded in Version 2 to incorporate planning-related functions. This Functional Model framework provides guidance to NERC standards drafting teams to write reliability standards in terms of the functional entities who perform the reliability functions.

Section II: Overview of the NERC Registration Process

Part 2: Introduction

The NERC Registration process consists of several elements, including the NERC Registry Criteria and the NERC Compliance Registry, and involves both the Regional Entities and NERC. The process for registration is described in the NERC Rules of Procedure, Section 500 (Appendix 5A: Organization Registration and Certification Manual and Appendix 5B: Statement of Compliance Registry Criteria).

The starting point for the NERC program for monitoring and enforcing compliance with FERC-approved Reliability Standards is the process for comprehensively identifying and registering owners, operators, and users of the Bulk Power System that are responsible for performing reliability-related functions in accordance with the approved Reliability Standards.¹ The NERC Registry Criteria provides for Bulk Power System users, owners and operators that perform a function identified in Section II of the Registry Criteria, and have a material impact on Bulk Power System reliability (which is generally determined by whether they meet the threshold criteria in Section III of the Registry Criteria) to register as one or more of fifteen functions. NERC and the Regional Entities identify such entities, which are then obligated to comply with Commission-approved Reliability Standards.² Identified entities are registered and included on the NERC Compliance Registry.³ The NERC Compliance Registry identifies the reliability functions that each registered entity is responsible for meeting pursuant to the requirements of Reliability Standards. Organizations listed in the NERC Compliance Registry are responsible for knowing the contents of, and complying with, Reliability Standards applicable to the reliability function(s).⁴ The registration criteria for the reliability functions are specified in the NERC Statement of Compliance Registry Criteria.⁵

The potential costs and effort of registering every organization potentially within the scope of “owner, operator, and user of the BPS,” while ignoring their impact upon reliability, would be disproportionate to the improvement in reliability that would reasonably be anticipated from doing so. Therefore, the two stated goals for registration are: (1) consistency between and among Regional Entities and across the continent in the application of the criteria for registering entities; and (2) registration of any entity whose facilities or operations are deemed material to the reliability of the Bulk Power System, irrespective of other considerations.⁶

The NERC Reliability Functional Model provides the framework for the development and applicability of NERC’s Reliability Standards as follows:

- The Model describes a set of Functions that are performed to ensure the reliability of the Bulk Electric System. Each Function consists of a set of related reliability Tasks. The Model assigns each Function to

¹ See, Order on Electric Reliability Organization Risk Based Registration Initiative and Requiring Compliance Filing, Docket No. RR15-4-000, 150 ¶ 61,213 (March 15, 2015).
² Section 215(b)(2) of the Federal Power Act (FPA) requires all users, owners and operators of the Bulk Power System to comply with Reliability Standards approved by the Commission. Similarly, the Commission’s regulations at 18 C.F.R. §39.2 and §40.2 require all users, owners, and operators of the Bulk-Power System to comply with applicable Reliability Standards and applicable rules of the ERO and Regional Entities approved by the Commission.
³ NERC Statement of Compliance Registry Criteria (Registry Criteria) at 2 (“Organizations will be responsible to register and to comply with approved Reliability Standards to the extent that they are owners, operators, and users of the Bulk Power System, perform a function listed in the functional types identified in Section II of this document, and are material to the Reliable Operation of the interconnected Bulk Power System as defined by the criteria and notes set forth in this document.”).
⁴ See, NERC Rules of Procedure §501. The current categories of reliability functional entities are listed in Rules of Procedure Appendix 5B, Statement of Compliance Registry Criteria.
⁵ See, NERC Rules of Procedure, Appendix 5B.
⁶ See, NERC Rules of Procedure, Appendix 5B at 4.
a functional entity, that is, the entity that performs the function. The Model also describes the interrelationships between that functional entity and other functional entities (that perform other Functions).

- NERC’s Standards Development Teams develop Reliability Standards that assign each reliability requirement within a standard to a functional entity (that is defined in the Model and NERC’s Glossary). This is possible because a given standard requirement will typically be related to a Task within a Function. A standard requirement will be very specific, whereas a Task in the Model will be more general in nature.

- NERC’s compliance processes require specific organizations to register as the entities responsible for complying with standards requirements assigned to the applicable entities.

- The Model’s Functions and functional entities also provide for consistency and compatibility among different Reliability Standards.

The Model is a guideline for the development of standards and their applicability. The Model is not a Standard and does not have compliance requirements. Standards developers are not required to include all tasks envisioned in the model, nor are the developers precluded from developing Reliability Standards that address functions not described in the model. Where conflicts or inconsistency exist, the Reliability Standards requirements take precedence over the Model.

The Model is independent of any particular organization or market structure. An organization may perform more than one Function.

The Functional Model describes a functional entity envisioned to ensure that all of the Tasks related to its Function are performed. The Model, while using the term “functional entity”, is a guideline and cannot prescribe responsibility. It is NERC’s compliance processes, backed by regulatory authority, that specify the manner in which, a functional entity is “legally responsible” for meeting the standards requirements assigned to that functional entity.

The work performed to meet the requirements may be self-performed or performed by others.

**Functional Model maintenance.** The Functional Model is maintained by the Functional Model – Working Group (FMWG) under the direction of the NERC Standards Committee, with technical content in the Model and accompanying technical document approved by the Standing Committees (OC, PC and CIPC).

**Technical discussions.** The companion document, “Functional Model — Technical Discussions,” provides additional details on the Functions themselves, how organizations can “roll up” those Functions they wish to perform, and how organizations as “functional entities” interrelate.

**The following terms are used in the Functional Model and do not appear in the NERC Glossary.**

- **Functional Entity.** The term used in the Functional Model which applies to a class of entity that carries out the Tasks within a Function.

- **Function.** A set of related reliability Tasks.

- **Task.** One of the elements that make up a Function in the Functional Model.

- **Customer.** The term applies to a customer for transmission, capacity or energy services (a Purchasing-
Selling Entity, Generator Owner, Load-Serving Entity, or End-use Customer).

End-use Customer. The party served by a Load-Serving Entity (energy) and Distribution Provider (wire service).

**Purpose of the Functional Model**

The purpose of the NERC Reliability Functional Model is to:

1. Provide a framework for Reliability Standards developed through the NERC standards development process that will apply to certain Tasks defined in the Functional Model.

2. Describe in general terms each Function and the relationships between the entities that are responsible for performing the Tasks within the Functions. The framework for developing the Function definitions is:

   — The Functions are independent of the organization structure performing the functions, and

   — The Functions provide flexibility to accommodate the range of presently conceivable organization structures, as well as accommodate alternative tools, procedures and processes.
Functional Model Diagram

<table>
<thead>
<tr>
<th>Function-Name</th>
<th>Functional-Entity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Balancing</td>
<td>Balancing Authority</td>
</tr>
<tr>
<td>Compliance Enforcement</td>
<td>Compliance Enforcement Authority</td>
</tr>
<tr>
<td>Distribution</td>
<td>Distribution Provider</td>
</tr>
<tr>
<td>Generator Operations</td>
<td>Generator Operator</td>
</tr>
<tr>
<td>Generator Ownership</td>
<td>Generator Owner</td>
</tr>
<tr>
<td>Interchange</td>
<td>Interchange Coordinator</td>
</tr>
<tr>
<td>Load-Serving</td>
<td>Load-Serving Entity</td>
</tr>
<tr>
<td>Market Operations</td>
<td>Market Operator (Resource Integrator)</td>
</tr>
<tr>
<td>Operating Reliability</td>
<td>Reliability Coordinator</td>
</tr>
<tr>
<td>Planning Reliability</td>
<td>Planning Coordinator</td>
</tr>
<tr>
<td>Purchasing-Selling</td>
<td>Purchasing-Selling Entity</td>
</tr>
<tr>
<td>Reliability Assurance</td>
<td>Reliability Assurer</td>
</tr>
<tr>
<td>Resource Planning</td>
<td>Resource Planner</td>
</tr>
<tr>
<td>Standards Development</td>
<td>Standards Developer</td>
</tr>
<tr>
<td>Transmission Operations</td>
<td>Transmission Operator</td>
</tr>
<tr>
<td>Transmission Ownership</td>
<td>Transmission Owner</td>
</tr>
<tr>
<td>Transmission Planning</td>
<td>Transmission Planner</td>
</tr>
<tr>
<td>Transmission Service</td>
<td>Transmission Service Provider</td>
</tr>
</tbody>
</table>
Guiding Principles of the Functional Model

As explained in the Introduction, the Model provides the framework on which the NERC Reliability Standards are developed and applied. To ensure that this framework remains viable, the Model itself is governed by a set of “guiding principles” that define a Function’s Tasks and establish the relationships between the functional entities which are responsible for meeting the requirements in the NERC Reliability Standards that correspond to these Tasks. These principles serve as a guideline to those revising or interpreting the Model.

For further details, refer to the Technical Discussions section in the Functional Model Technical Document.

0. The Model must be complete, that is, it must include all reliability Tasks and interrelationships between entities performing them. This helps ensure that any reliability requirement arising in a Reliability Standard will generally be related to a Task in the Model and therefore be assignable to a particular functional entity.

0. The Model must group these Tasks into a set of Functions, such that:

• There are enough Functions (and corresponding functional entities) to accommodate the full range of organization structures and responsibilities within the industry, and

• The number of Functions is developed based on logical grouping of the Tasks and kept low as reasonably possible.

• In particular, where a number of organizations that perform a given Function form a single group, the Model recognizes this as a business arrangement among organizations, not a new Function and corresponding new functional entity. That is, the fundamental reliability Tasks, and hence the Function, remain the same—all that has changed is how the Function is performed. Examples of such groups are a reserve sharing group (a collection of entities that are Balancing Authorities), or a planned resource sharing group.

0. The Model is structured to ensure there are no gaps or overlaps in the performance of operation Tasks in the operating timeframe anywhere in the Bulk Electric System. This is achieved in part by associating an “area” of purview for each functional entity. Areas are defined in terms of the individual transmission, generator and customer equipment/assets that collectively constitute the Bulk Electric System. For example, each Bulk Electric System asset has one Reliability Coordinator, one Balancing Authority, and one Transmission Operator.

Regarding overlaps for planning, as described in the Technical Document, it is not always possible to achieve this in the case of planning Functions, where there may be overlapping levels of responsibility for given assets. Questions regarding relationships between the areas of different functional entities, such as whether one type of area must be totally within another type of area, will be defined in Reliability Standards or the Rules of Procedure, not the Model.

0. Tasks describe what is to be done, not how it is to be done.

0. The Model is a guideline that describes reliability Tasks and interrelationships between the entities that perform them—it is not prescriptive. In particular, the Model does not address requirements for registering or becoming certified as a functional entity, or the delegation or splitting of responsibility for meeting standards requirements.
Clarification Service

The Functional Model is a reference tool that links functional entities with associated reliability-related functions and respective Tasks. Drafting teams use the Functional Model to help them determine which functional entity should be required to comply with each requirement in a reliability standard.

From time to time questions of clarification and interpretation arise. The FMWG is following the process described below for handling requests for clarification of the Functional Model. This process, which has been approved by the Standards Committee, is accessible to all drafting teams as well as any other interested stakeholders. If a drafting team needs help in understanding Tasks that make up a Function and/or in determining which functional entities should be responsible for particular standards requirements, the drafting team’s coordinator will send an e-mail to the NERC Staff assigned as the FMWG facilitator with a request for clarification.

0. The NERC Staff assigned as the FMWG facilitator will convene a conference call/meeting of available members of the FMWG to review the question(s) and provide a clarification.

▪ If the question(s) need more detailed discussion with the drafting team, the two coordinators will organize a conference call/meeting with available members of the FMWG and available members of the drafting team to discuss the issues in more detail.

0. Each FMWG request for clarification and the associated response will be posted on the NERC Functional Model Web Page under a Frequently Asked Questions section.

▪ If the questions result in changes to the model, the changes will be added to a change summary table used to develop the next updated version of the Functional Model document.
Section III: Part 3—Functions and Functional Entities

This section defines the reliability-related functions and functional entities that perform the associated tasks that are necessary to plan and operate the Bulk Electric System in a reliable manner. This section also identifies the relationships between various functional entities that are formed in order to perform the reliability-related tasks. It characterizes the functional entities that perform these tasks, and provides examples of the interrelationships that take place between entities to ensure reliability. As standards are developed, the Model may be revised to add and remove tasks under specific functions to aid in the development of standards. Relationships between functional entities in the Model are reciprocal. Where in some instances, a one-to-one relationship may exist between two functional entities; in other instances, there may be, the Model will include the reciprocal relationship specifically; and where a one-to-many relationship exists, the reciprocal relationships are implied.

Functional Model Diagram
Standards Development and Standards Developer

Standards Development

Tasks

0. Develop and maintain a standards development process.
0. Develop Reliability Standards for the planning and operation of the Bulk Electric System.
Standards Developer

Definition
The functional entity that develops and maintains Reliability Standards to ensure the reliability of the Bulk Electric System.

Introduction to the Standards Developer
The Model addresses Reliability Standards created at NERC using the NERC Reliability Standards Development Procedure and Regional Standards that are created through an open Regional process and approved by NERC for enforcement. The Functional Model is intended to serve as the framework for the development and application of these Reliability Standards.²

Relationships with Other Functional Entities

- Receives request for Reliability Standards through the public process.
- Sends Reliability Standards to the Compliance Enforcement Authority.

² There are also Regional Criteria that are requirements that Regions create and enforce, that are not included in the Model.
Compliance Enforcement and Compliance Enforcement Authority

Compliance Enforcement

Tasks

0. Develop, maintain and implement a compliance enforcement process.
0. Evaluate and document compliance.
Compliance Enforcement Authority

Definition
The functional entity that monitors, reviews, and ensures compliance with Reliability Standards and administers sanctions or penalties for non-compliance to the standards.

Relationships with Other Functional Entities

2. Receives Reliability Standards from the Standards Developer.

3.1. Administers the compliance enforcement process for all functional entities as required by Reliability Standards.
Reliability Assurance and Reliability Assurer

Reliability Assurance

Tasks

1. Develop and maintain Reliability Standards that apply to Bulk Power System owners, operators, and users and that enable the Reliability Assurer to measure the reliability performance of Bulk Power System owners, operators, and users; and to hold them accountable for Reliable Operation of the Bulk Power Systems.

2. Develop and implement a compliance and enforcement program to promote the reliability of the Bulk Power System by enforcing compliance with approved Reliability Standards in those regions of North America in which the Reliability Assurer has been given enforcement authority.

3. Develop and maintain a program for identifying and registering those entities that are responsible for compliance with the governmental-approved Reliability Standards.

4. Provide for certification of all entities with primary reliability responsibilities requiring certification.

5. Provide a mechanism to ensure system operators are provided the education and training necessary to obtain the essential knowledge and skills and are therefore qualified to operate the BES.

6. Provide reliability readiness evaluation and improvement, and formation of sector forums if necessary for reliability.

7. Develop a reliability assessment and performance analysis program that conducts reviews and assessments of the overall reliability of the interconnected BPS, including:
   • Review, assess, and report on the overall electric generation and transmission reliability (adequacy and operating reliability) of the interconnected Bulk Power Systems, both existing and as planned.
   • Assess and report on the key issues, risks, and uncertainties that affect or have the potential to affect the reliability of existing and future electric supply and transmission.
   • Review, analyze, and report on Regional Entity self-assessments of electric supply and bulk power transmission reliability, including reliability issues of specific regional concern.
   • Identify, analyze, and project trends in electric customer demand, supply, and transmission and their impacts on Bulk Power System reliability.
   • Investigate, assess, and report on the potential impacts of new and evolving electricity market practices, new or proposed regulatory procedures, and new or proposed legislation (e.g. environmental requirements) on the adequacy and operating reliability of the Bulk Power Systems.

8. Provide leadership, coordination, technical expertise, and assistance to the industry in responding to a major event.

9. Provide the education and training necessary for Bulk Power System personnel and regulators to obtain the essential knowledge necessary to understand and operate the BES.

10. Through the use of appropriate functional entities and available tools, monitor present conditions on the Bulk Power System and provide leadership coordination, technical expertise, and assistance to the industry in responding to events as necessary.
11. Coordinate electric industry activities to promote Critical Infrastructure protection of the Bulk Power System in North America by taking a leadership role in Critical Infrastructure protection of the electricity sector so as to reduce vulnerability and improve mitigation and protection of the electricity sector’s Critical Infrastructure.

1. Coordinate reliability assurance among adjacent Reliability Assurers through the development of necessary protocols and processes.

1. Coordinate the activities related to maintaining critical infrastructure protection.

1. Establish reliability assurance processes and documentation related to planning and operations within the Reliability Assurer’s area including such things as a regional reliability plan or a Reliability Coordinator plan.

1. Identify and address gaps in reliability processes and responsibilities.
Reliability Assurer

Definition
Subject to oversight by the Federal Energy Regulatory Commission and governmental authorities in Canada, assure the reliability of the Bulk Power System in North America by developing and enforcing Reliability Standards; annually assessing seasonal and long-term reliability; monitoring the Bulk Power System through system awareness; and, educating, training, and certifying industry personnel. The functional entity that monitors and evaluates the activities related to planning and operations, and coordinates activities of functional entities to secure the reliability of the Bulk Electric System within a Reliability Assurer area and adjacent areas.

Relationships with Other Functional Entities


3. Obtain the information necessary to complete registration from the appropriate functional entities, including: Reliability Coordinators, Balancing Authorities, Transmission Operators, Transmission Owners, Generator Operators, Generator Owners, Transmission Service Providers, Planning Coordinators, Transmission Planners, Resource Planners, and Distribution Providers.

0. Coordinates reliability assurance activities of the functional entities within the Reliability Assurer area.

0. Coordinates reliability assurance activities with adjacent Reliability Assurers.

0. Coordinates critical infrastructure protection programs with functional entities.

0. Collects information from functional entities related to Reliability Assurance processes.
Planning Reliability and Planning Coordinator

**Planning Reliability**

**Tasks**

1. **Establish data requirements necessary to develop power system models for analysis within the Planning Coordinator area.** Develop and maintain methodologies for the analysis and simulation of the transmission systems in the evaluation and development of transmission expansion plans and the analysis and development of resource adequacy plans.

2. **Collect and validate information from Transmission Planners, such as modeling data, to perform a Transmission assessment of the Planning Coordinator area.** Define information required for planning purposes, and facilitate the process for consolidating and collecting or developing such information, including:
   - Transmission facility characteristics and ratings.
   - Demand and energy forecasts, capacity resources, and demand response programs.
   - Generator unit performance characteristics and capabilities.
   - Long-term capacity purchases and sales.

3. **Assess the performance of the Transmission system, with the loads, resources, and proposed projects included in the Transmission Planner’s Planning Assessment (including any Corrective Action Plan(s)).** Evaluate, develop, document, and report on resource and transmission expansion plans for the Planning Coordinator area. Integrate the respective plans, evaluate the impact of those plans on and by adjoining Planning Coordinator’s integrated plans and assess whether the integrated plan meets reliability needs, and, if not, then to report on potential transmission system and resource adequacy deficiencies and suggest or facilitate the process for developing alternative plans to mitigate identified deficiencies.
   - Evaluate the plans that are in response to long-term (generally one year and beyond) customer requests for transmission service.
   - Review transmission facility plans required to integrate new (End-use Customer, generation, and transmission) facilities into the Bulk Electric System.
   - Review and determine transfer capability (generally one year and beyond) as appropriate.
   - Monitor and evaluate transmission expansion plan and resource plan implementation.
   - Coordinate projects requiring transmission outages that can impact reliability and firm transactions.

4. **Coordinate with adjoining Planning Coordinators to develop interconnection models with appropriate loads, resources, and System topology, so that system models and resource and transmission expansion plans take into account modifications made to adjacent Planning Coordinator areas.**

5. **Evaluate and report on the performance of the consolidated Transmission assessments.** Develop and maintain transmission and resource (demand and capacity) system models to evaluate transmission system performance and resource adequacy.

6. **Evaluate interconnection reliability concerns among affected Planning Coordinators.**
Planning Coordinator

Definition
The **functional responsible** entity that coordinates, facilitates, and integrates and evaluates (generally one year and beyond) transmission facility and service plans, and resource plans, and Protection Systems, within a Planning Coordinator area and coordinates those plans with adjoining Planning Coordinator areas.

Introduction to the Planning Coordinator
By its very nature, BES planning involves multiple entities. Since all electric systems within an integrated network are electrically connected, whatever one system does can affect the other systems. The Planning Coordinator is responsible for coordinating the assessment of the BES within its longer-term reliability of its Planning Coordinator area. The PC assessment includes the collection of Transmission assets over which the Planning Coordinator is responsible for coordinating planning ("PC Area"). The PC Area is normally comprised of more than one Transmission Planner; however, while the area under the purview of a Planning Coordinator may include as few as one Transmission Planner, and one Resource Planner, the Planning Coordinator’s scope of activities is intended to span a broader area that may include BES assets of multiple Transmission Planners. All BES Facilities should be assigned to a Transmission Planner and to a Planning Coordinator, so that there are no gaps in the assessment of the BES. May include extended coordination with integrated Planning Coordinators’ plans for adjoining areas beyond individual system plans. It is, at its very nature, Bulk Electric System planning involves multiple entities. Since all electric systems within an integrated network are electrically connected, whatever one system does can affect the other systems. Planning Coordinators work through a variety of processes/mechanisms to conduct facilitated, coordinated, joint, centralized, or regional planning activities to the extent that all portions of the interconnected BES network areas with little or no ties to others’ areas, such as interconnections, are completely coordinated for planning activities.

Relationships with Other Functional Entities

1. **Establish Coordinates** power system modeling data requirements in conjunction with interconnected and collects data for system modeling from Transmission Planners, Resource Planners, and other Planning Coordinators.

2. Collect data for power system modeling and assessments from the Transmission Planner.

3-4. **Determine Coordinates** transfer capability (generally one year and beyond) with Transmission Planners, Reliability Coordinator, Transmission Owner, Transmission Operator, Transmission Service Provider, and neighboring Planning Coordinators.

3-4. **Exchange information on Coordinates** Contingencies, criteria, System Operating Limits (SOLs), Remedial Action Schemes (RAS), automatic load-shedding schemes, and plans with the Reliability Coordinator and other Planning Coordinators on reliability issues.

4-5. **Assess the performance of the Transmission system, in coordination with Transmission Planners** Receives plans from Transmission Planners and Resource Planners.

5. **Collects information including:**

   - Transmission facility characteristics and ratings from the Transmission Owners, Transmission Planners, and Transmission Operators.

   - Demand and energy forecasts, capacity resources, and demand response programs from

---

8 Definition of Planning Authority from the NERC Glossary of Terms (as of May 15, 2016). In the Glossary, Planning Coordinator and Planning Authority are defined interchangeably.
Section III: Part 3: Functions and Functional Entities

Load-Serving Entities, and Resource Planners.

— Generator unit performance characteristics and capabilities from Generator Owners.
— Long-term capacity purchases and sales from Transmission Service Providers.

10.6. Collects and reviews reports on transmission, loads and resource plans implementation from Resource Planners and Transmission Planners.

11. Submits and coordinates the plans for the interconnection of facilities to the Bulk Electric System within its Planning Coordinator area with Transmission Planners and Resource Planners and adjacent Planning Coordinator areas, as appropriate.

12. Provides and informs Resource Planners, Transmission Planners, and adjacent Planning Coordinators of the methodologies and tools for the simulation of the transmission system.

13.7. Facilitates the integration of the respective plans of the Resource Planners and Transmission Planners within the Planning Coordinator area, and adjacent Planning Coordinator areas, as appropriate.

a. Reviews the integrated plan with respect to established reliability needs considering the impact on and by adjoining systems.

b. In coordination with the Resource Planners and Transmission Planners, facilitates the development of alternative solutions for plans that do not meet those reliability performance criteria needs.
Section III: Part 3: Functions and Functional Entities

Transmission Planning and Transmission Planner

Transmission Planning

Tasks

1. **Develop and Maintain** and develop, in cooperation with adjacent and overlapping Transmission Planners, methodologies, criteria and tools for the analysis and simulation of the transmission systems in the evaluation and development of transmission expansion plans related to resource adequacy plans.

2. **Define, consolidate and collect** or develop, acquire and validate, in cooperation with adjacent and overlapping Transmission Planners, information required for Transmission assessments planning purposes including:
   - Transmission facility characteristics and ratings.
   - Demand and Electrical energy forecasts, capacity resources, and Demand-Side Management (DSM) demand response programs.
   - Generator unit performance characteristics and capabilities.
   - Commitments for firm Transmission Interchange. Long-term capacity purchases and sales.
   - Load forecasts and generation dispatch scenarios.

3. **Develop and Maintain** transmission power system models (steady state, dynamics, and short circuit) necessary for the assessment of Transmission System to evaluate Bulk Electric System performance for identified scenarios.

4. **Exchange information with other Coordinate with adjacent and overlapping Transmission Planners and the Planning Coordinator to achieve an interconnected so that system models and resource and transmission expansion plans take into account modifications made to adjacent and overlapping Transmission Planner areas.

5. **Evaluate, develop, document, and report** on expansion plans for the Transmission Planner area. Assess the performance of the Transmission system with the anticipated topology and scenarios of loads and resources whether the integrated plan meets reliability needs, and, if not, report on potential network conditions or configurations that do not meet performance requirements and provide potential alternative solutions to meet performance requirements.
   - Evaluate the plans that are in response to long-term (generally one year and beyond) customer requests for transmission service.
   - Evaluate and plan for all requests required to integrate new (End-use Customer, generation, and transmission) facilities into the Bulk Electric System.
   - Determine transfer capability values (generally one year and beyond) as appropriate.
   - Monitor, evaluate and report on transmission expansion plan and resource...
plan implementation.

Coordinate projects requiring transmission outages that can impact reliability and firm transactions.

5. Notify Generation Owners, Resource Planners, Transmission Planners and Transmission Owners of any planned transmission changes that may impact their facilities.

5. Define system protection and control needs and requirements, including special protection systems (remedial action schemes), to meet reliability needs.
Definition
The functional entity that develops a long-term (generally one year and beyond) plan for the reliability (adequacy) of the interconnected bulk electric transmission systems within its portion of the Planning Authority a Transmission Planner area.  

Introduction to the Transmission Planner
The Transmission Planner is responsible for assessing the longer-term (generally one year and beyond) Transmission system performance within reliability of its Transmission Planner area. The TP assessment includes the collection of Transmission assets over which the Transmission Planner is responsible for planning (“TP Area”). By its very nature, BESulk Electric System planning involves multiple entities. Since all electric systems within an integrated network are electrically connected, changes planned in whatever one part of the system does can affect the other parts of the systems. Transmission Planners coordinate their plans with the adjoining Transmission Planners to assess impact on or by those plans. The area under the purview of a Transmission Planner may include one or more Resource Planner areas and overlap one or more adjacent Transmission Planners. All BES Facilities should be under the purview of at least one Transmission Planner.

Relationships with Other Functional Entities

2. Collects information including:
   b. Demand and Electrical Energy forecasts, capacity resources, and Demand-Side Management response programs from Load-Serving Entities, and Resource Planners.
   c. Generator unit performance characteristics and capabilities from Generator Owners.
   d. Commitments for firm Transmission Interchange Long-term transmission capacity purchases and sales from Transmission Service Providers.

3. Informs Resource Planners and other Transmission Planners of the methodologies and tools for the simulation of the Transmission system.


---

9 Definition of Transmission Planner from the NERC Glossary of Terms (as of May 15, 2016).
7-6. **Notifies** other Transmission Planners, Transmission Owners, Transmission Operators and other entities that may be impacted by any planned Bulk Electric System changes.

8-7. **Coordinates** with Distribution Providers, Transmission Owners, Generator Owners and Load-Serving Entities in the evaluation and plans for all requests required to integrate new (End-use Customer, generation, and Transmission) facilities into the Bulk Electric System.

9-8. **Submits** and coordinates the plans for the interconnection of facilities to the Bulk Electric System within its Transmission Planner area with other Transmission Planners and the Planning Coordinator, Resource Planners, as appropriate.


11-10. **Coordinates** with Transmission Owners and Generator Owners to define system protection and control needs and requirements, including special protection systems (Remedial Action Schemes), to meet reliability needs.

11. **Receives** maintenance schedules and construction plans from Transmission Operator or Transmission Owner for input into and evaluation of Bulk Electric System expansion plans.
Resource Planning and Resource Planner

Resource Planning

Tasks

1. Consider generation capacity from resources both within and outside of the Resource Planner area for assessing resource adequacy.

2. Monitor and report, as appropriate, on its resource plan implementation.

3-1. Develop and maintain resource (demand and capacity) models. Acquire or develop the tools needed to evaluate long-term resource adequacy for a specific set of loads.

4-2. Collect-Acquire or develop the data and information required for performing periodic resource adequacy purposes assessments, including:

   — demand and energy forecasts, capacity resources, and demand response programs;
   — generator unit performance characteristics and capabilities, and
   — long-term capacity purchases and sales and
   — transmission (interface) limits.

3. Determine the reliability criteria used as the basis for assessing long-term resource adequacy.

9-4. Perform periodic resource adequacy assessments and document the results.

5. Evaluate future, develop, document, and report on a resource alternatives, adequacy plan for its portion of the Transmission Planner and Planning Coordinator area.

10-6. Create and periodically update a long-term resource plan Assist in the evaluation of the deliverability of resources.
Resource Planner

Definition
The functional entity that develops a long-term (generally one year and beyond) plan for the resource adequacy of specific loads (customer demand and energy requirements) within a Planning Authority Resource Planner area.

Relationships with Other Functional Entities

1. Collect data and information required for performing periodic resource Adequacy assessments from one or more of the following entities as necessary: Load-Serving Entity, Generator Owner, Generator Operator, Transmission Planner, Planning Coordinator, and Transmission Service Provider.

2-2. Provide long-term coordinates the resource plan information models with to the its Transmission Planner for power system modeling and Planning Assessments.

2-3. Receive information from Planners regarding submitted resource plan on the deliverability of resources to customers.

3-4. Provide resource plan recommendations to the affiliated Coordinators with and collects data for resource planning from the Load-Serving Entities, Generator Owner and Load-Serving Entities, Generator Operators, Transmission Planners, Transmission Operators, Interchange Coordinators, and Reliability Assurers.

4-5. Coordinates with Transmission Planners, and Transmission Service Providers, Reliability Coordinators, and Planning Coordinators on resource adequacy plans.

5. Coordinates with adjoining Resource Planners within the Planning Coordinator area to avoid the double-counting of resources.

6. Reports its resource plan to the Transmission Planner and Planning Coordinator for evaluation and compliance with Reliability Standards.

7-6. Assess alternative Works Plans with the Planning Coordinator and Transmission Planners to identify potential alternative transmission solutions to meet Resource Planner resource Adequacy plans requirements.

8. Applies methodologies and tools for the analysis and development of resource adequacy plans from the Planning Coordinator.

10 Definition of Resource Planner from the NERC Glossary of Terms (as of May 15, 2016).
Reliability Operations and Reliability Coordinator

Reliability Operations

Tasks

1. Monitor all reliability-related parameters within the reliability area, including generation dispatch and generation/transmission maintenance plans for generation and transmission.

2. Identify, communicate, and direct actions if necessary to relieve reliability threats and limit violations in the reliability area.

3. Develop Interconnection Reliability Operating Limits (to protect from instability and Cascading).

4. Assist in determining Interconnected Operations Services (IOS) reliability-related services requirements for:
   a. balancing generation and load,\(^{11}\) and
   b. transmission-reliability of Transmission (e.g., reactive requirements, location of operating reserves).

5. Perform reliability analysis (actual and contingency) for the reliability area.

6. Direct revisions to transmission maintenance plans as permitted by agreements.

7. Direct revisions to generation maintenance plans as permitted by agreements.

8. Direct implementation of emergency procedures including load-shedding.

9. Direct and coordinate restoration of the BES for its RC Area system restoration.

10. Curtail Confirmed Interchange that adversely impacts reliability.

11. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

11,12. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.

---

\(^{11}\) The Glossary definition of “Load” is not appropriate because the Glossary definition refers to end-use customer or end-use device; the Glossary definition does not incorporate the concept of quantity.

\(^{12}\) The Glossary definition of “Emergency” is not appropriate because the definition is limited in application to the BES. In this context, the RC may encounter an emergency situation that is broader than the circumstances described in the Glossary definition.
Reliability Coordinator

Definition
The functional entity that maintains the Real-time operating reliability of the Bulk Electric System within a Reliability Coordinator Area. The entity that is the highest level of authority who is responsible for the Reliable Operation of the Bulk Electric System, has the Wide Area view of the Bulk Electric System, and has the operating tools, processes and procedures, including the authority to prevent or mitigate emergency operating situations in both next-day analysis and real-time operations. The Reliability Coordinator has the purview that is broad enough to enable the calculation of Interconnection Reliability Operating Limits, which may be based on the operating parameters of transmission systems beyond any Transmission Operator’s vision.\(^\text{13}\)

Introduction to the Reliability Coordinator
The Reliability Coordinator maintains the Real-time operating reliability of its Reliability Coordinator Area and in coordination with its neighboring Reliability Coordinator’s wide-area view. Wide-Area view means the entire Reliability Coordinator area as well as the critical flow and status information from adjacent Reliability Coordinator Areas as determined by detailed system studies to allow the calculation of Interconnected Reliability Operating Limits.\(^\text{14}\) The wide-area view includes situational awareness of its neighboring Reliability Coordinator Areas. Its scope includes both transmission and balancing operations. The RC and it has the authority to direct other functional entities to take certain actions to ensure that its Reliability Coordinator Area operates reliably. Its scope includes both:

1. **Transmission operations.** With respect to transmission operations, the Reliability Coordinator and Transmission Operator have similar roles, but different scopes. The Transmission Operator directly maintains reliability for its Transmission Operator Area. However, the Reliability Coordinator also maintains reliability, in concert with the other Reliability Coordinators, for the Interconnection as a whole. Thus, the Reliability Coordinator needs a "wide-area" view that reaches beyond its boundaries to enable it to operate within Interconnection Reliability Operating Limits. The Transmission Operator may or may not have this “wide-area” view, but the Reliability Coordinator does have it. The Reliability Coordinator may direct a Transmission Operator within its Reliability Coordinator Area to take whatever action is necessary to ensure that Interconnection Reliability Operating Limits are not exceeded.

2. **Balancing operations.** The Reliability Coordinator ensures that the generation-demand balance is maintained within its Reliability Coordinator Area, which, in turn, ensures that the Interconnection frequency remains within acceptable limits. The Balancing Authority has the responsibility for generation-demand-interchange balance in the Balancing Authority Area. The Reliability Coordinator may direct a Balancing Authority within its Reliability Coordinator Area to take whatever action is necessary to ensure that this balance does not adversely impact reliability.

Relationships with Other Functional Entities

**Ahead of Time**

1. Coordinates with other Reliability Coordinators, Transmission Planners, and Transmission...
Service Providers on Transmission system\textsuperscript{15} limitations.

2. Receives facility\textsuperscript{16} and operational data from Generator Operators, Distribution Providers, Load-Serving Entities, Transmission Owners, Generator Owners, and Transmission Operators.

3. Receives generation dispatch from Balancing Authorities and issues dispatch adjustments to Balancing Authorities to prevent exceeding limits within the Reliability Coordinator Area (if not resolved through market mechanisms).

4. Receives integrated operational plans from Balancing Authorities for reliability analysis of Reliability Coordinator Area.

5. Receives Transmission and generation maintenance plans from Transmission Owners and Generator Owners, respectively, for reliability analysis.

6. Develops/Provide Interconnection Reliability Operating Limits (IROLs)-based on Transmission Owners’ and Generator Owners’ specified equipment ratings, and provides them to those functional entities with a reliability-related need.


8. Provides reliability analyses to Transmission Operators, Generator Operators and Balancing Authorities in its area as well as other Reliability Coordinators.

9. Directs Generator Owners and Transmission Owners to revise generation and Transmission maintenance plans that are adverse to reliability.

10. Receives balancing information from Balancing Authorities for monitoring.

11. Receives final approval or denial of Arranged Interchange from Interchange Coordinator.

12. Provides IROLs and TTC to the Transmission Service Provider for ATC calculation.

13-12. Develops operating agreements or procedures with Transmission Owners.

14-13. Coordinates with Transmission Operators on system restoration plans, contingency\textsuperscript{17} plans and Interconnected Operations Services (IOS) reliability-related services.

**Real-time**

15-14. Coordinates reliability processes and actions with and among other Reliability Coordinators.


17-16. Issues reliability alerts to Generator Operators, Transmission Operators, Transmission Service Providers, Balancing Authorities, Interchange Coordinators, Regional Entities and NERC.

18-17. Issues corrective actions and Emergency procedures directives (e.g., curtailments or load shedding) to Transmission Operators, Balancing Authorities, Generator Operators, Distribution Providers, and Interchange Coordinators.

\textsuperscript{15} The Glossary definition of “System” is not appropriate in this context because the limitations may not always include a combination of generation, transmission, and distribution.

\textsuperscript{16} The Glossary definition of “Facility” is not appropriate because the definition is limited in application to BES Elements. In this context, the intent is to have broader application to include non-BES elements (e.g., industrial equipment).

\textsuperscript{17} The Glossary definition of “Contingency” is not appropriate because application in this context is not limited to power system contingency (i.e., N-1 event); in this context, intended to have broader meaning.
19.18. **Specifies** reliability–related requirements to Balancing Authorities.


21.20. **Receives** notification ofConfirmed Interchange changes from Balancing Authorities.

22.21. **Orders** re-dispatch of generation by Balancing Authorities.

23.22. **Directs** use of flow control devices by Transmission Operators.

24.23. **Responds** to requests from Transmission Operators to assist in mitigating equipment overloads.
Balancing and Balancing Authority

Balancing

Tasks

1. Control any of the following combinations within a Balancing Authority Area:
   a. Load and generation (an isolated system) Demand and resource
   b. Load Demand and Confirmed Interchange
   c. Generation and Confirmed Interchange
   d. Generation, load Demand, and Confirmed Interchange

2. Calculate Area Control Error (ACE) within the reliability area.

3. Operate in the Balancing Authority Area to maintain Demand and resource load-interchange-generation balance.

4. Review generation commitments, dispatch, and load Demand forecasts.

5. Formulate an operational plan (e.g., generation commitment, outages, etc.) for reliability evaluation.

6. Approve Arranged Interchange from Ramping ability perspective.

7. Implement Confirmed Arranged Interchange.

8. Operate the Balancing Authority Area to contribute to Interconnection frequency.


10. Provide balancing and energy accounting (including hourly checkout of Confirmed Arranged Interchange, Implemented Interchange and actual Interchange), and administer inadvertent energy paybacks.

11. Determine needs for Interconnected Operations Services reliability-related services.

12. Deploy Interconnected Operations Services (IOS) reliability-related services.

13. Implement Emergency procedures.

14. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

14-15. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.

---

The Glossary definition of “Contingency” is not appropriate because the definition is too broad.
Balancing Authority

Definition

The functional-responsible entity that integrates resource plans ahead of time, maintains load-interchange-generation balance within a Balancing Authority Area, and supports contributes to Interconnection frequency in real time.19

Relationships with Other Functional Entities

Ahead of Time

1. Receive generator Facility plans from Generator Operators within the Balancing Authority Area.
2. Receive operational data from Generator Operators within the Balancing Authority Area.
3-4. Receives operating and availability status of generating units and operational plans and commitments from Generator Operators (including annual maintenance plans) within the Balancing Authority Area.
5. Receives annual maintenance plans from Generator Owners within the Balancing Authority Area.
6. Receives reliability evaluations from the Reliability Coordinator.
7. Receives final approval or denial of a request for an Arranged Interchange from the Interchange Coordinators.
8. Receives loadDemand forecasts from Load-Serving Entities.
10. Submits integrated operational plans to the Reliability Coordinator for reliability evaluation and provides balancing information to the Reliability Coordinator for monitoring.
11. Compiles loadDemand forecasts from Load-Serving Entities.
12. Receives reliability related services from Generator Operators.
13. Receives dispatch adjustments from Reliability Coordinators to prevent exceeding limits.
14. Receives generator information from Generator Owners including unit maintenance schedules and retirement plans.
15. Receives reports on frequency regulating equipment from Generator Operators within the Balancing Authority Area.

19 Definition of Balancing Authority from the NERC Glossary of Terms (as of May 15, 2016).
14. Receives information from Load-Serving Entities on self-provided Interconnected Operations Services (IOS) reliability-related services.

15. Coordinates system restoration plans (i.e., any combination of generation, Transmission or distribution components) with the Transmission Operator.

16. Provides generation resource dispatch to Reliability Coordinators.

**Real-time**

17. Coordinates use of Interruptible Demand controllable loads with Load-Serving Entities (i.e., interruptible load that has been bid as a reliability-related service or has agreed to participate in voluntary load shedding program under resource/reserve deficiency situations).

18. Receives loss allocation from Transmission Service Providers (for repayment with in-kind losses).

19. Receives Real-time operating information from the Transmission Operator, adjacent Balancing Authorities and Generator Operators.

20. Receives operating information from Generator Operators.

21. Provides Real-time operational information for Reliability Coordinator monitoring.

22. Receives reliability alerts from Reliability Coordinator.

23. Complies with reliability-related requirements (e.g., reactive requirements, location of operating reserves) specified by Reliability Coordinator.

24. Verifies implementation of Emergency procedures to Reliability Coordinator.

25. Informs Reliability Coordinator and Interchange Coordinators of Confirmed Interchange changes (e.g., due to Demand generation or resource load interruptions) involving its Balancing Authority Area.

26. Receive Confirmed Interchange revisions (including Curtailments) from Interchange Coordinators.

27. Directs resources (Generator Operators and Load-Serving Entities) to take action to ensure balance in Real-time.

28. Request Directs Transmission Operator (or Distribution Provider) to reduce voltage to lower Demand or shed load if needed to ensure balance within its Balancing Authority Area.

29. Directs Generator Operators to implement re-dispatch for congestion management as directed by the Reliability Coordinator.

30. Implements corrective actions and Emergency procedures as directed by the Reliability Coordinator.

31. Implements system restoration plans (i.e., any combination of generation, Transmission or distribution components) as directed by the Transmission Operator.

32. Directs Transmission Operator to implement flow control devices.

33. Receives information of Implemented Interchange and Confirmed Interchange curtailments from Interchange Coordinator.

**After the hour**

34. Confirms Implemented Interchange with Confirmed Interchange provided by the Interchange Coordinators after the hour for “checkout.”

35. Confirms Implemented Interchange and Confirmed Interchange with adjacent Balancing Authorities
after the hour for “checkout.”

33-37. Request record of individual Confirmed Interchange from Interchange Coordinator.
Market Operations and Market Operator (Resource Integrator)

Market Operations

Tasks

1. The Market Operations function, its tasks, and the interrelationships with other entities are included in the Functional Model only as an interface point of reliability functions with commercial functions.
Market Operator (Resource Integrator)

Definition
The market entity whose interrelationships with other entities are included in the Functional Model only as an interface point of reliability functions with commercial functions.

Relationships with Other Functional Entities
Market Operator tasks and relationships are specific to a particular market design and will depend on the market structure over which the Market Operator presides.
Transmission Operations and Transmission Operator

Transmission Operations

Tasks

1. Monitor and provide telemetry (as needed) of all reliability-related parameters within the reliability area.

2. Monitor the status of, and deploy, facilities\textsuperscript{20} classed as \textit{Transmission assets}, which may include the transmission lines connecting a generating plant to the \textit{Transmission system}, associated protective relaying systems and \textit{Remedial Action Schemes, Special Protection Systems}.

3. Develop system limitations \textit{(e.g., such as System Operating Limits)} and \textit{Total Transfer Capabilities}, and operate within those limits.

4. Develop and implement emergency procedures.

5. Develop and implement \textit{System restoration plans}.

6. Operate within established Interconnection Reliability Operating Limits.

7. Perform reliability analysis \textit{(actual and contingency)} for the Transmission Operator Area.

8. Adjust \textit{Real Power, Reactive Power and voltage flow control devices within the transmission area to maintain reliability}.

9. Deploy reactive resources to maintain transmission voltage within defined limits.

10. Determine the \textit{Transmission capability that supports the Reliable Operation of the Transmission Operator Area}.

11. Operate or direct the operation of Transmission Facilities in its TOP Area.

12. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

13. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.

\textsuperscript{20} The Glossary definition of “Facility” is not appropriate because the definition is limited in application to BES Elements. In this context, the intent is to have broader application to include responsibilities for non-BES elements.
Transmission Operator

Definition
The entity responsible for the reliability of its “local” transmission system, and that operates or directs the operations of the transmission Facilities.21 The functional entity that ensures the Real-time operating reliability of the transmission assets within a Transmission Operator Area.

Introduction to the Transmission Operator
The Transmission Operator is responsible for the Real-time operating reliability of the Transmission assets under its purview, which is referred to as the Transmission Operator Area. The Transmission Operator has the authority to take certain actions to ensure that its Transmission Operator Area operates reliably.

The Transmission Operator and Reliability Coordinator have similar roles with respect to the reliability of the Transmission system operations, but have different responsibilities scopes. The Transmission Operator shares a role in monitoring the Transmission system with the Reliability Coordinator and additionally, has the operational responsibility for the Transmission system area under its purview and the Transmission Operator does not necessarily “see” very far beyond its own boundaries. Therefore, The Transmission Operator can calculate System Operating Limits, but does not necessarily have the Wide-area view of the Reliability Coordinator which requires the wider scope of the Reliability Coordinator.

Relationships with Other Functional Entities
Ahead of Time
2. Receives maintenance requirements and construction plans and schedules from the Transmission Owners and Generation Owners.
3. Receives Interconnection Reliability Operating Limits as established by the Reliability Coordinator.
4. Receives reliability evaluations from the Reliability Coordinator.
5. Develops agreements (Operating Plans, procedures, and processes) with adjacent Transmission Operators for joint transmission facilities.
6. Defines Total Transfer Capabilities and System Operating Limits based on facility22 information provided by the Transmission Owners and Generator Owners and assistance from Reliability Coordinator.
7. Arranges for Interconnected Operations Services (IOS) reliability-related services from Generator Operators (e.g., voltage schedules, VAR Demand schedule).
8. Develops contingency plans, and monitors operations of the Transmission facilities within the Transmission Operator Area control and as directed by the Reliability Coordinator.
9. Provides facility and operating information to the Reliability Coordinator.
10. Provides to the Transmission Planner information on the capability to Curtail (reduce) and shed load during emergencies.

21 Definition of Transmission Operator from the NERC Glossary of Terms (as of May 15, 2016).
22 The Glossary definition of “Facility” is not appropriate because the definition is limited in application to BES Elements. In this context, the intent is to have broader application to include responsibilities for non-BES elements.
11. Provides Total Transfer Capabilities, and System Operating Limits, and methodology for calculating to, and coordinates Available Transfer Capability for respective Transmission paths to, with Transmission Service Provider.

12. Receives operating and availability status of generating units from Generator Operators including status of automatic voltage regulators and power system stabilizers.

12-13. Receive operational data from Generator Operators.

13-14. Develops operating agreements or procedures with Transmission Owners.

Real-time

14-15. Coordinates load shedding with, or as directed by, the Reliability Coordinator.

15-16. Provides Real-time operations information to the Reliability Coordinator and Balancing Authority.

16-17. Notifies Generator Operators of Transmission system problems (e.g., voltage limitations or equipment overloads that may affect generator operations).

17-18. Requests Reliability Coordinator to assist in mitigating equipment overloads. (e.g., re-dispatch, transmission loading relief).

18-19. Deploys reactive resources from Transmission Owners, and Generator Owners, and Distribution Providers, to maintain acceptable voltage profiles.

19-20. Directs Distribution Providers to shed load if needed to ensure reliability within the Transmission Operator Area.

20-21. Implements flow control device operations for those ties under the Transmission Operator’s purview as directed by the Balancing Authorities or Reliability Coordinator.

21-22. Receives reliability alerts from Reliability Coordinator.

22-23. Directs Balancing Authorities and Distribution Providers to implement system restoration plans.

Interchange and Interchange Coordinator

Interchange

Tasks

1. Receive completed Request for Interchange (RFI) (i.e., valid source and sink, Transmission arrangements) an Arranged Interchange.

2. Transition RFI to Ensure an Arranged Interchange is balanced and valid (Balancing Authority and Transmission Service Provider validation of sources and sinks, transmission arrangements, reliability-related services, etc.).

3. Forward Arranged Interchange to entities for Coordinate (i.e., collect and consolidate) approval, change, or denial requests for an Arranged Interchange to become Confirmed Interchange. Approvals may be explicit or by exception.


5. Communicate status of an Arranged Interchange that becomes Confirmed Interchange or otherwise.

6. Communicate Confirmed Interchange information to the appropriate reliability assessment tools (e.g., the interchange distribution calculator in the Eastern Interconnection).

7. Submit Arranged Interchange for Curtailments and re-dispatch implementation requests.

7-8. Maintain record of an individual Confirmed Interchange.

8.9. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

9-10. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.
Interchange Coordinator

Definition
The functional responsible entity that authorizes ensures communication of Arranged Interchange for reliability evaluation purposes and coordinates implementation of valid and balanced Interchange Schedules — Confirmed Interchange between Balancing Authority Areas, and ensures communication of Interchange information for reliability assessment purposes.

Relationships with Other Functional Entities

Ahead of Time
1. Receives Requests for Arranged Interchange from Generation Owner, Purchasing-Selling Entity, and Load-Serving Entities.
2. Submits request for an Arranged Interchange to become Confirmed Interchange to the Balancing Authorities and Transmission Service Providers for approvals.
3. Receives approval or denial from Transmission Service Providers of Transmission arrangement(s) for Arranged Interchange.
4. Receives approval or denial from Balancing Authorities of the ability to meet Ramping requirements for submitted Arranged Interchange.
5. Receives approval from Generation Owners, Purchase-Selling Entities, or Load-Serving Entities for any revised Arranged Interchange.
6. Communicates final approval or denial of a request for an Arranged Interchange to become Confirmed Interchange to the Reliability Coordinator, Balancing Authorities, Transmission Service Providers, Generation Owners, and Purchasing-Selling Entities, and Load-Serving Entities for implementation and NERC identified reliability analysis services.

Real-time
7. Receives reliability alerts from the Reliability Coordinators.
8. Receives Curtailments and re-dispatch implementation requests from Reliability Coordinators and submits for an Arranged Interchange.
9. Receipts information on Confirmed Interchange interruptions from the Balancing Authorities and communicates the Confirmed Interchange status to Balancing Authorities, Transmission Service Providers, Reliability Coordinators, Generation Owner, and Purchasing-Selling Entities, and Load-Serving Entities.
10. Informs Reliability Coordinators, Balancing Authorities, Transmission Service Providers, Generation Owners, Purchasing-Selling Entities, and Load-Serving Entities of Confirmed Interchange revisions (including Curtailments).

After the hour
11. Maintains and provides a record of individual Confirmed Interchange to requesting for which it coordinated with the Balancing Authorities.

---

23 Definition of Interchange Authority from the NERC Glossary of Terms (as of May 15, 2016). The Glossary uses the term “Interchange Authority” whereas the Functional Model uses the term “Interchange Coordinator.”
Coordinates Confirmed Interchange with Balancing Authorities after the hour for “checkout.”
Transmission Service and Transmission Service Provider

Transmission Service

Tasks

1. Receive transmission service requests and process each request for service according to the requirements of the tariff.
   
   a. Maintain commercial interface for receiving and confirming requests for transmission service according to the requirements of the tariff (e.g., OASIS).

2. Determine and post available transfer capability values.

3. Approve or deny transmission service requests.

4. Approve or deny arranged interchange from transmission service arrangement perspective.

5. Allocate transmission losses (MWs or funds) among Balancing Authority Areas.

6. Acquire Ancillary Services to support Transmission Service.

5-7. Update information that is relevant to a long-term Transmission Service arrangement.
Transmission Service Provider

Definition

The functional entity that administers the transmission tariff and provides Transmission Service to Transmission Customers under applicable Transmission Service agreements.

Relationships with Other Functional Entities

Ahead of Time

1. Receive the methodology to determine available transfer capacity from the Transmission Operator.

1-2. Receives Total Transfer Capabilities, System Operating Limits and Interconnection Reliability Operating Limits from Planning Coordinator, the Transmission Planner, Transmission Operator and Reliability Coordinator, and coordinates Available Transfer Capacity with these entities and other Transmission Service Providers.

2. Receives transmission Facility Ratings from Transmission Owners.

3. Receives Transmission expansion plans identified by the Transmission Planner(s) Planning Coordinator to help determine ability to accommodate long-term Transmission Service requests.

4. Arrange for providers of Ancillary Services, and notify the Transmission Operator and Balancing Authority.

5. Approves Accept or denies decline Transmission Service requests from Purchasing-Selling Entities, Generator Owners, and Load-Serving Entities.

6. Confirms validity of transmission service requests indicated in the Arranged Interchange with Interchange Coordinators.

7-6. Develops Agreements or procedures with Transmission Owners.

7. Receives final approval or denial of Arranged Interchange from Interchange Coordinator.

8. Send approval or denial of Arranged Interchange to Interchange Coordinator based on meeting Transmission Service arrangements.

9. Receive notice of final approval or denial of Arranged Interchange becoming Confirmed Interchange from Interchange Coordinator.


Real-time

8-11. Receives Confirmed Interchange revisions implementation (including Curtailments) from the Interchange Coordinators.

12. Receive Confirmed Interchange Interruption status from Interchange Coordinator.

9-13. Receives reliability alerts from Reliability Coordinator.

14. Provides loss allocation to Balancing Authorities.

---

24 Definition of Transmission Service Provider from the NERC Glossary of Terms (as of May 15, 2016).
15. Notify the Transmission Operator and Balancing Authority of changes to Ancillary Services.
Transmission Ownership and Transmission Owner

Transmission Ownership

Tasks

1. Develop interconnection agreements.
2. Establish ratings of transmission facilities.\(^{25}\)
4. Design and install owned facilities classified as transmission and obtain associated rights-of-way.
5. Design and authorize maintenance of transmission protective relaying systems and special protection systems remedial action schemes.
6. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.
7. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.

\(^{25}\) The Glossary definition of “Facility” is not appropriate because the definition is limited in application to BES Elements. In this context, the intent is to have broader application for non-BES elements.
Transmission Owner

Definition
The functional entity that owns and maintains transmission facilities.26

Relationships with Other Functional Entities

1. Coordinates with Transmission Planners, and the Planning Coordinator, Generator Owners, and other Transmission Owners, and Load Serving Entities desiring to connect with the Transmission system under the purview of the Transmission Owner, the Bulk Electric System.
2. Receives approved Transmission expansion plans from the Transmission Planner.
3. Develops agreements or procedures with the Transmission Service Providers.
4. Develops operating agreements or procedures with the Transmission Operators, Reliability Coordinators, and Distribution Providers.
5. Develops agreements with adjacent Transmission Owners for joint Transmission facilities.
6. Provides Transmission expansion plans and changes to the Planning Coordinator and Transmission Planners.
8. Provides maintenance and construction plans and schedules to the Reliability Coordinator, Transmission Operator, and Transmission Planner.
9. Coordinate and Develops interconnection agreements with the Distribution Providers, and Generation Owners, and Load Serving Entities desiring to connect with the Transmission system under the purview of the Transmission Owner for connecting to the Bulk Electric System.
10. Provides reactive resources to Transmission Operators.
11. Revises Transmission maintenance plans as requested by a Transmission Operator or the Reliability Coordinator.

26 Definition of Transmission Owner from the NERC Glossary of Terms (as of May 15, 2016).
Distribution and Distribution Provider

**Distribution**

**Tasks**

1. Provide and operate electrical delivery facilities between the transmission system and the end-use customer or distribution-connected energy resource.

2. Identify and characterize its connected load and energy resources.

3. Implement voltage reduction.

4. Design and maintain protective relaying systems, under-frequency load-shedding systems, under-voltage load-shedding systems, and Remedial Action Schemes Special Protection Systems that interface with the transmission system.

5. Provide and implement load-shed capability.

6. Maintain voltage and power factor within specified limits at the interconnection point.

7. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

8. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.
Distribution Provider

**Definition**
The functional entity that provides and operates the “wires” between the transmission system and the end-use customer. For those end-use customers who are served at transmission voltages, the Transmission Owner also serves as the Distribution Provider. Thus, the Distribution Provider is not defined by a specific voltage, but rather as performing the distribution function at any voltage. The functional entity that provides facilities that interconnect an End-use Customer load and the electric system for the transfer of electrical energy to the End-use Customer.

**Introduction to the Distribution Provider**
The Distribution Provider delivers electrical energy to the End-use Customer from the Transmission system to the End-use Customer. For those End-use Customers who are served at transmission voltages, the Transmission Owner may also serve as the Distribution Provider. Thus, the Distribution Provider is not defined by a specific voltage, but rather as performing the Distribution function at any voltage. The Distribution Provider provides the switches and reclosers that could be used to shed load for emergency action.

**Relationships with Other Functional Entities**

**Ahead of Time**
1. Coordinates with Transmission Planners on interconnected load and energy resources to support transmission analysis and expansion.
2. Coordinates System restoration plans with Transmission Operator.
3. Coordinates with End-use Customers, distributed energy resources, and Load-Serving Entities to identify new facility connection needs.
4. Develop interconnection agreements with Transmission Owners on a facility basis.
5. Provides operational data to Transmission Operator.
6. Coordinate with Load-Serving Entities to identify critical loads that are to be precluded from load-shedding where avoidable.
7. Provide protective relaying systems, under-frequency load-shedding systems, under-voltage load-shedding systems, and Remedial Action Schemes as defined by the Transmission Planner and Planning Coordinator.

**Real-time**
8. Obtain voltage and power factor requirements from the Transmission Operator.
6-9. Implements voltage reduction and sheds load as directed by the Transmission Operator or Balancing Authority.
7-10. Implements System restoration plans as coordinated by the Transmission Operator.
8-11. Directs Load-Serving Entities to communicate requests for voluntary load curtailment.

---

27 Definition of Distribution Provider from the NERC Glossary of Terms (as of May 15, 2016).
Generator Operation and Generator Operator

Generator Operation

Tasks

1. Formulate daily generation plan.
2. Report operating and availability status of generator Facility(ies) units and related equipment, such as automatic voltage regulators, power system stabilizer equipment and frequency regulating equipment.
3. Operate generators Facility(ies) to provide Real Power and Reactive Power or Interconnected Operations Services reliability-related services in accordance with per-contracts or arrangements.
5. Support Interconnection frequency and voltage.
6. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.
7. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.
Generator Operator

**Definition**
The functional entity that operates generating unit(s) and performs the functions of supplying energy and Interconnected Operations Services reliability related services.\(^{28}\)

**Relationships with Other Functional Entities**

**Ahead of Time**

1. Provides generation commitment plans to the Balancing Authority.
2. Provides Balancing Authority and Transmission Operators with requested amount of Interconnected Operations Services (IOS) reliability related services.
3. Provides availability and operating and availability status of generating units Facility(ies) to Reliability Coordinator, Balancing Authority and Transmission Operators for reliability analysis.
4. Reports status of automatic voltage regulating equipment and power system stabilizer equipment or frequency regulating equipment to Transmission Operators.
4.5. Reports on frequency regulating equipment to Balancing Authority.
5.6. Provides operational data to Reliability Coordinator, Balancing Authority and Transmission Operator.
6. Receives reliability analyses from Reliability Coordinator.
7. Receives notice from Purchasing-Selling Entity if Arranged Interchange approved or denied.
8.9. Receives reliability alerts from Reliability Coordinator.
9.10. Receives notification of Transmission system problems from Transmission Operators.

**Real-time**

10.11. Provides Real-time operating information to the Transmission Operators and the required Balancing Authority.
11.12. Adjusts Real Power and Reactive Power as directed by the Balancing Authority and Transmission Operators.

\(^{28}\) Definition of Generator Operator from the NERC Glossary of Terms (as of May 15, 2016).
Generator Ownership and Generator Owner

Generator Ownership

Tasks

1. Establishes generation facilities’ ratings, limits, and operating requirements.

2. Designs and authorizes maintenance of the generator plant’s protective relaying systems, protective relaying systems on the transmission lines connecting the generator plant to the transmission system, and Remedial Action Schemes (RAS) Special Protection Systems related to the generator.

3. Performs or authorizes maintenance of owned generating facilities.

4. Provides verified generation facility performance characteristics / data.

5. Provide appropriate security protections for cyber assets and physical assets, and their related support systems and data.

6. Communicate to appropriate authorities and relevant functional entities of an actual or suspected attack on cyber assets and/or physical assets.
Generator Owner

Definition
The functional entity that owns and maintains generating Facility(ies) units. 28

Relationships with Other Functional Entities

Ahead of Time
1. Provides generator Facility(ies) information to the Transmission Operator, Reliability Coordinator, Balancing Authority, Transmission Planner, and Resource Planner.
2. Provides generator Facility(ies) unit-maintenance schedules and generator Facility(ies) unit retirement plans to the Reliability Coordinator, Transmission Operator, Balancing Authority, Transmission Planner, and Resource Planner.
3. Develops an interconnection Agreement(s) with Transmission Owner on a Facility basis.
4. Receives approval or denial of Transmission Service request from Transmission Service Provider.
5. Provides Interconnected Operations Services reliability related services to Purchasing-Selling Entity pursuant to agreement.
6. Reports the annual maintenance plan to the Reliability Coordinator, Balancing Authority and Transmission Operator.
7. Revises the generator maintenance plans as requested by the Balancing Authority, Transmission Operator, and Reliability Coordinator.
8. Submit Request for Interchange to the Interchange Coordinator.
9. Submit approval for original or revised Arranged Interchange to the Interchange Coordinator.
10. Receive communication that Arranged Interchange has become Confirmed Interchange from the Interchange Coordinator.

Real-time
11. Receive Confirmed Interchange Interruptions status from the Interchange Coordinator.
12. Receive Confirmed Interchange revisions (including Curtailments) from the Interchange Coordinator.

28 Definition of Generator Owner from the NERC Glossary of Terms (as of May 15, 2016).
**Purchasing-Selling and Purchasing-Selling Entity**

**Purchasing-Selling**

**Tasks**

1. Purchase and sell energy or capacity.
2. Arrange for transmission service that is required to implement an Interchange Transaction by tariffs.
3. Request implementation of Arranged Interchange.
### Purchasing-Selling Entity

**Definition**
The functional entity that purchases or sells, and takes title to, energy, capacity, and Interconnected Operations Services reliability-related services. Purchase-Selling Entities may be affiliated or unaffiliated merchants and may or may not own generating facilities.\(^{30}\)

**Relationships with Other Functional Entities**

#### Ahead of Time

1. **Arrange for energy and capacity from Generator Owners.**
2. **Arranges for Transmission Service from Transmission Service Providers and makes arrangements for self-provided Interconnected Operations Services reliability-related services with Generator Owners or Load-Serving Entities.**
3. **Submits Requests For Interchange to Interchange Coordinators.**
4. **Submits approval for original or revised Arranged Interchange to Interchange Coordinator.**
5. **Notifies Generator Operators and Load-Serving Entities if Arranged Interchange requests are approved or denied.**
6. **Submits requests for Interchange to Interchange Coordinators of Confirmed Interchange and Implemented Interchange cancellations or terminations.**
7. **Receives load-Demand profiles and forecasts from Load-Serving Entities.**

#### Real-time

7. **Receive notice of Confirmed Interchange Interruptions from Interchange Coordinator.**
8. **Receive notice of Confirmed Interchange revisions (including Curtailments) from Interchange Coordinator.**
7-9. **Notifies Interchange Coordinators of Confirmed Interchange and Implemented Interchange cancellations or terminations.**
8-10. **Receives notice of Confirmed Interchange Curtailments from Interchange Coordinator.**

---

\(^{30}\) Definition of Purchasing-Selling Entity from the NERC Glossary of Terms (as of May 15, 2016).
Load-Serving and Load-Serving Entity

Load-Serving

Tasks

1. Collect individual load profiles and characteristics.
2. Identify capability for and communicate requests for voluntary load Curtailment.
3. Identify and communicate Participate in under-frequency load shedding systems and under-voltage load shedding systems through identification of critical customer loads that are to be excluded from the load-shedding systems.
4. Identify the resources needed for facilities and provide capability of self-provided Interconnected Operations Services (IOS)-related services for its load.
5. Develop overall load profiles and forecasts of end-user energy requirements.
6. Acquire necessary Transmission Service, and provide for Interconnected Operations Services reliability-related services.
7. Arrange for Submits Requests For Interchange to Interchange Coordinators.
8. Manage resource portfolios to meet demand-Demand and energy delivery requirements of End-use Customers.
Load-Serving Entity

Definition
The functional entity that secures energy and transmits service (and interconnected operations services) to serve the electrical demand and energy requirements of its end-use customers.\(^\text{31}\)

Relationships with Other Functional Entities

Ahead of Time
1. Submits data profiles and characteristics, plans, and forecasts as needed to the appropriate entity (e.g., Balancing Authorities, purchasing-selling entities, planning coordinator, and resource planners, and transmission planners service provider) in accordance with applicable tariffs, interconnection agreements or other arrangements.
2. Coordinate with distribution provider to identify critical loads that are to be excluded from load-shedding. Identifies new facility connection needs for end-use customers.
3. Provides generation commitments and dispatch schedules to the Balancing Authority.
4. Provides information regarding self-provided interconnected operations services reliability-related services to the Balancing Authority.
5. Provides necessary data planned purchases to the resource planner and transmission planner for system modeling and reliability evaluation.
6. Arranges for transmission service from transmission service providers and makes arrangements for ancillary services reliability-related services with generator owners or load-serving entities.

7. Submits Requests For Interchange to Interchange Coordinators.
8. Submit approval for original or revised arranged interchange to interchange coordinator.
9. Receive communication that arranged interchange has become confirmed interchange from the interchange coordinator.
10. Notifies generator operators if arranged interchange requests are approved or denied.
11. Receives final approval or denial of arranged interchange from interchange coordinator.
12. Coordinates with distribution provider on identifying new facility interconnection needs.
13. Receives notification from purchasing-selling entity if arranged interchange requests approved or denied.

Real-time
11-12. Receives requests from the reliability coordinator, balancing authority, transmission operator, and distribution provider for voluntary load curtailment.
12-13. Communicate requests for voluntary load curtailment to end-use customers as directed by the reliability coordinator, balancing authority, transmission operator, and distribution provider.

\(^{31}\) Definition of Load-Serving Entity from the NERC Glossary of Terms (as of May 15, 2016).
13. Notifies Interchange Coordinators of Confirmed Interchange cancellations or terminations.

14. Receives notice of Confirmed Interchange revisions (including Curtailments) from Interchange Coordinator.

14-15. Receive notice of Confirmed Interchange Interruptions from Interchange Coordinator.
Section IV: Version History

[This section will be completed prior to seeking final approval from the Standards Committee.]