

# Consideration of Addition Functions for Demand Response to Version 5 of the NERC Reliability Functional Model

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## Introduction

The Functional Model Working Group, FMWG, reviewed at its November 3-4, 2008 meeting a proposal from the industry for adding to the Model:

- a Demand Resource Operations Function and a corresponding Demand Resource Operator Functional Entity, and
- a Demand Resource Ownership Function and corresponding Demand Resource Owner Functional Entity.

The FMWG commissioned an initial review of the proposed changes, for discussion at its next meeting. This draft discussion paper documents that initial review.

## Summary of Conclusions

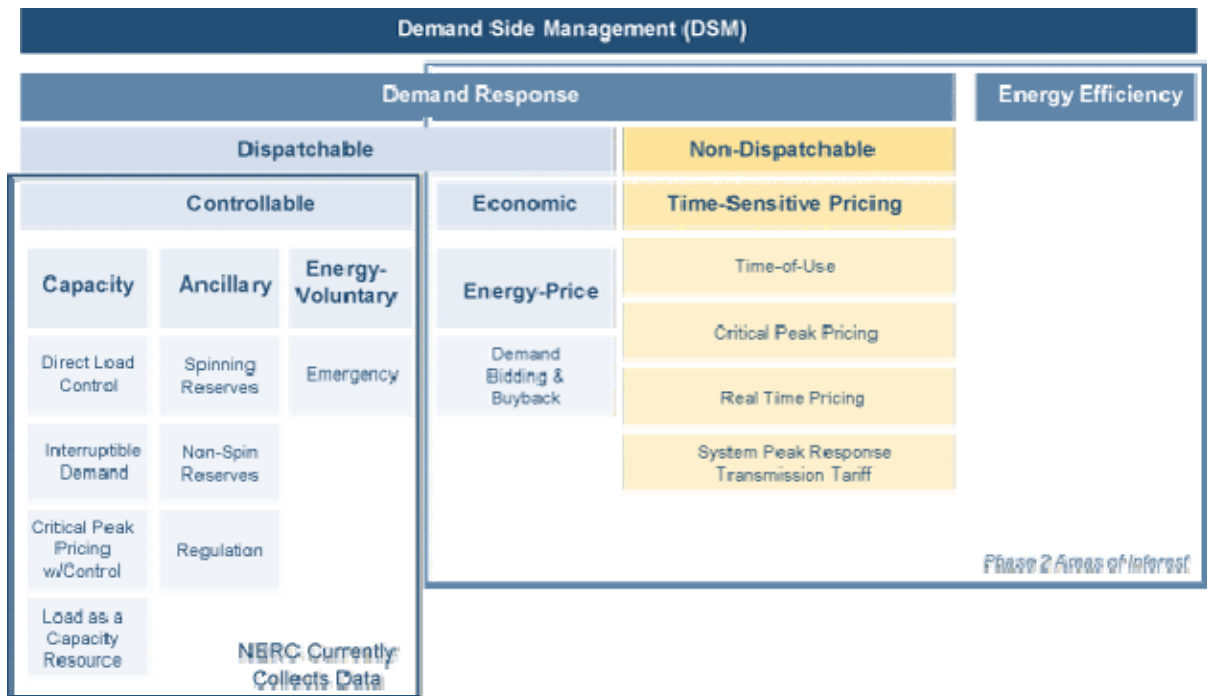
- Demand Response (DR) resources are recognized by NERC as having a role in maintaining reliability, and DR programs have become widespread
- It can be anticipated there will be a need identified to develop standards requirements that would apply to the owners and operators of DR resources
- At present there is no capability to develop such standards requirements because of the lack of a suitable Functional Entity
- The recent industry proposal to create two new Functional Entities and corresponding Functions would remedy this lack
- An alternative of adapting the Generator Owner and Generator Operator to include DR resources could also enable the assignment of DR standards requirements. However, this paper concludes that the development of new Functional Entities is to be preferred.
- The industry proposed Functions (Demand Resource Ownership and Demand Resource Operations) and Functional Entities (Demand Resource Owner and Demand Resource Operator) are should in conjunction with the current Generator Ownership and Generator Operation Functions and the Generator Owner and Generator Operator Functional Entities. This paper, however, did not examine the specifics of the industry proposal, leaving that to a subsequent phase of the development of Version 5 of the Model should the FMWG decide to consider further the addition of new Functions for DR.

## NERC's Recognition of Demand Response Resources

NERC has recognized demand response (DR) as one of its key issues.<sup>1</sup>

*Demand response is an important component of industry efforts to meet the growing demand for electricity in North America. Demand response is a subset of the broader category of end-use customer energy solutions known as Demand-Side Management (DSM). In addition to demand response, DSM includes energy efficiency programs. This DSM evaluation is concentrated on the influence of demand response on reliability assessment and; therefore, focused on peak demand reduction rather than overall energy efficiency.*

*Demand response benefits reliability by reducing customer demand for power, which in turn can alleviate strain on supply-side and transmission resources. Demand response comes in a multitude of varieties, as shown in the chart below:*



NERC's 2008 Long Term Reliability Assessment lists as one of its key findings for 2008-2017 the growing role of demand response in reliability:<sup>2</sup>

### ***4. Demand Response Increasingly Used to Meet Resource Adequacy Requirements***

<sup>1</sup> <http://www.nerc.com/page.php?cid=4%7C53%7C56>

<sup>2</sup> Page 18. See <http://www.nerc.com/files/LTRA2008.pdf>

*Demand response programs increased significantly in this year's projections. The long-term sustainability of these impacts will need to be monitored closely as these programs are used to meet reliability requirements more frequently.*

*Significant increases in demand response programs over the next ten years are projected to reduce growth in demand and provide ancillary services across North America.*

NERC has established the Demand Response Data Task Force (DRDTF).<sup>3</sup>

In summary, NERC has recognized the growing importance of demand response; it can be anticipated this ultimately lead to the development of demand response data, processes and standards requirements. The prospect of having DR standards requirements raises the question of the adequacy of the Functional Model in providing the Functional Entities to which the standards requirements would be assigned. As discussed in the following section, the Model does not have a Functional Entity for the owner or operator of a DR resource to which standards requirements could be assigned.

## **Status of Demand Response Resources in Version 4 of the Functional Model**

The Model's Functional Entities do not reference the owner or operator of demand response resources. The three planning Functions and corresponding Functional Entities contain a number of references to demand response resources themselves, in a manner that shows parallelism between supply resources (generation) and demand resources.

The Model's Technical Document does recognize the potential for demand response resources in maintaining reliability. For example, the discussion for Balancing Authority (i.e., an operating Function) states at p. 9:

***Load-following through generator dispatch and demand-side management.***

*The organization that serves as the Balancing Authority will in general also perform the generator commitment and economic dispatch. Included in the commitment and dispatch tasks is the designation of those resources, both load and generation resources, that are available for reliability-related services.*

Further, on p. 11, on the section for Resource Planner, it is stated:

*The term "resource" is to be understood to include supply resources (real and reactive power) and demand resources (such as dispatchable loads).*

On p. 39 of the Technical Document, in the context of reliability-related services, it is stated:

*...In addition, loads may provide reserves through load-shedding or demand-side management, and may also provide frequency response.*

In summary, it can be said that Version 4 of the Model and its Technical Document recognize the DR resource itself, but not its owner or operator.

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<sup>3</sup> [http://www.nerc.com/docs/pc/drddf/Draft\\_Demand\\_Response\\_Data\\_Task\\_Force\\_121807.pdf](http://www.nerc.com/docs/pc/drddf/Draft_Demand_Response_Data_Task_Force_121807.pdf)

The present industry proposal could therefore be viewed as a natural extension of the Model to provide Functional Entities for DR resource ownership and operation. However, the alternative of adapting the Generator Owner and Generator Operator to include DR resources should also be considered. This is addressed below.

## Industry Practice in Demand Response Programs

The April 2008 report of the DRDTF, Appendix III, provides a number of DR case studies.<sup>4</sup> These include:

- *PJM's Demand Response (DR) / Interruptible Load For Reliability (ILR) service*
  - DR is load management that actively participates in the RPM auction by bidding into the Base Residual Auction three years in advance of the delivery year. If cleared in the auction, DR receives the auction clearing price.
  - ILR is load management that certifies shortly before the start of the delivery year. ILR receives a price that is a blend of the auction clearing prices less any congestion charges.
- *ERCOT's Load Acting as a Resource (LaaR) service*
  - LaaR refers to loads with interruptible or dispatch capabilities that are qualified with ERCOT to provide certain Ancillary Services.
  - LaaR are eligible for capacity payments from ERCOT's day-ahead Ancillary Services markets regardless of whether the resource is actually deployed. The value of a LaaR's consumption reduction is equal to an increase in generation by a generating plant.
  - A load's participation in the ERCOT market must be conducted through a Qualified Scheduling Entity (QSE) under contract with the customer
- *NYISO Day-Ahead Demand Response Program (DADRP)*
  - The DADRP provides retail customers with an opportunity to bid their load curtailment capability into the day-ahead spot market as energy resources.
  - Load scheduled in the Day-Ahead Market (DAM) is obligated to curtail the next day. Failure to curtail results in the imposition of a penalty
  - **Individual or Aggregated demand-side resources** with a minimum of 1 MW of load reduction capability are eligible to participate. Load reduction through on-site generation is not permitted in this program.
  - **Small Customer Aggregation** – Aggregations must be at least 1.0 MW for DADRP. The NYISO will establish an up-front means of certifying that the aggregation has an expectation of meeting this requirement. ...Aggregators must accept full responsibility for payments to and penalties levied against the members of the aggregation.

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<sup>4</sup> [http://www.nerc.com/docs/pc/drdtf/NERC\\_DSMTE\\_Report\\_040308.pdf](http://www.nerc.com/docs/pc/drdtf/NERC_DSMTE_Report_040308.pdf)

- *Kansas City Power & Light, TVA, Westar Energy Traditional Interruptible/Curtailable Service*
  - A customer agrees to one or more curtailment options in addition to the terms and conditions of the applicable retail tariff. The service is voluntary and usually executed by means of a tariff rider and/or with a bilateral contractual agreement. Customer is given a rate discount or bill credit from firm demand charges as an incentive for agreeing to reduce its load during system contingencies or other events as specified in the tariff rider or contract. Curtailment is usually initiated by verbal dispatch. The customer is usually allowed to designate only a portion of its total load (“Contracted Demand Reduction”) that is exposed to curtailment. Failure to curtail may result in a penalty, although some tariff riders provide for a “buy-through” of the curtailment. Utility usually reserves the right to limit the total capacity (load in MWs) exposed to curtailment.
- *Florida Power & Light’s Residential Load Management Program*
  - This program, known as the On Call Program, is available to all residential customers who are individually metered (i.e., who do not receive service through commonly owned facilities of condominium, cooperative or homeowners' associations) and who have one or more of the following electrical appliances/equipment: central electric air conditioners, central electric space heaters, conventional electric water heaters, and swimming pool pumps.
  - Once the customer signs up for the program, the installation is performed by a contractor. Upon installation and inspection of the equipment, the customer receives a monthly credit, which may vary seasonally, on his/her electric bill.
  - Actual performance of load management is effected via FPL’s Load Management System (LMS). The LMS uses a Master Station (computer) to send a signal through telephone lines to equipment installed at the substations. From the substation, a signal is transmitted through the power lines and received by a transponder (transmitter/receiver) installed at the customers home. The transponder in turn activates its relay to interrupt the appliance circuit for the specified period of control time.
  - Consideration will be given to giving customers the option of overriding FPL control of their loads, through a new generation of communication and control technologies.

While there are other DR programs in existence,<sup>5</sup> the above list adequately demonstrates for present purposes that DR programs are widespread and involve a range of characteristics, such as:

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<sup>5</sup> For example, Baltimore Gas & Electric's DRI program is described at [http://tdworld.com/customer\\_service/demand\\_response\\_delivers\\_results/](http://tdworld.com/customer_service/demand_response_delivers_results/). The Ontario Power Authority's DR1, DR2 and DR3 are described at

- individual large loads and aggregated small loads
- loads that are bid voluntarily into a market auction and loads that are directly controlled at the discretion of the system operator
- participants may or may not use self-generation as part of the DR program.

## **Do standards requirements suggest there a need for new Function(s)?**

This section examines the question of whether new Functional Entities are required for DR owners and operators, or whether existing generator entities can be adapted. To this end it was judged instructive to review the manner DR is currently referenced in the current set of standards requirements.

### *Standards requirements respecting Demand-Side Management (DSM)*

NERC standards were searched for instances of Demand-Side Management and DSM.<sup>6</sup> The results include:

- EOP-002-2, Capacity and Energy Emergencies, references the role of Reliability Coordinators respecting DSM measures during a Level 2 Alert
- MOD-016-1, Actual and Forecast Demands, Net Energy for Load, Controllable DSM, references DSM as applicable to Planning Authorities and Regional reliability organizations
- MOD-017-0, Aggregated Actual and Forecast Demands and Net Energy for Load, references DSM program information, and is applicable to RC, RP and LSE.
- TPL-006-0, Assessment Data from Regional Reliability Organizations, requires the RRO to have detailed information on DSM programs.

From the above it is seen that DSM programs are referenced in both the operating and planning timeframes. Responsibility for compliance is assigned to third parties, such as the LSE, BA or LSE, not to the DR owner or operator. The Model in its present form does not support such an assignment to a DR owner or operator.

### *Standards requirements respecting Generator Operator*

As noted, one possibility would be to broaden the GOP to include DR. This would be consistent with the concept of the ERCOT DR program "Load Acting as a Resource". This would enable future standards for DR to be written directly to the load supplying the DR and do so without creating a new Function. The results for searching on "Generator Operator"<sup>7</sup> in

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<http://www.powerauthority.on.ca/Page.asp?PageID=1212&SiteNodeID=147>. ISO-New England's DR programs are described at <http://www.demandresponsecommittee.org/id203.htm>.

<sup>6</sup> The link to standards is

[http://www.nerc.com/files/Reliability\\_Standards\\_Complete\\_Set\\_21Jul08.pdf](http://www.nerc.com/files/Reliability_Standards_Complete_Set_21Jul08.pdf).

<sup>7</sup> The search was conducted on Generator Operator and not Generator Owner (GO, which could also be broadened to include DR). It was judged that the single search was adequate for present purposes because standards referencing GO tended to also reference GOP. Thus when conclusions are made in this paper respecting GOP, they should be viewed as applying also to GO.

the existing standards include:

- BAL-005-0b - Automatic Generation Control - which is ultimately based on the AGC provided by the GOP.
- CIP-011-1 - Sabotage Reporting - which requires GOPs and others to report and have the capability to report sabotage-related disturbances or occurrences
- CIP-002-1 - Cyber Security Asset Identification - requiring GOPs and others to identify Critical Assets. Other standards in this series identify other aspects of the Critical Asset framework.
- COM-00202 - Communication and Coordination - requiring the GOP and others to have adequate communications and communications capabilities for addressing real-time emergency conditions.
- EOP-004-1 - Disturbance Reporting - requiring the GOP and others to analyze and report on disturbances.
- EOP-009-0 - Documentation of Blackstart Generating Unit Test Results - requiring the GOP to test the blackstart capability of a blackstart generating unit, and requiring the GOP to provide the test results to the RRO upon request.
- IRO-001-1 - Reliability Coordination — Responsibilities and Authorities - requiring the GOP to comply with RC directives and maintain associated documentation
- IRO-004-1 - Reliability Coordination — Operations Planning - requiring the GOP to provide information for system studies respecting the RC's day-ahead reliability analyses
- IRO-005-2 - Reliability Coordination — Current Day Operations - requiring the GOP to provide upon request operating records in the event of disagreement on a derived limit.
- MOD-024-1 - Verification of Generator Gross and Net Real Power Capability - requiring a GO (Generator Owner) follow RRO procedures
- MOD-025-1 - Verification of Generator Gross and Net Reactive Power Capability - requiring a GO (Generator Owner) follow RRO procedures
- NUC-00101 - Nuclear Plant Interface Coordination - specifying the Nuclear Plant GOP role in providing Nuclear Plant Interface Requirements (NPIRs) to transmission entities.
- PRC-001-1 - System Protection Coordination - requiring a GOP to notify others of relay or equipment failures, and coordinate new protective systems and changes
- TOP-001-1 - Reliability Responsibilities and Authorities - requiring the GOP to comply with RC and TOP directives and render emergency assistance upon request
- TOP-002-2 - Normal Operations Planning - requiring the GOP to notify the BA and TOP of changes in capabilities and characteristics
- TOP-003-0 — Planned Outage Coordination - requiring the GOP to provide outage information.
- TOP-006-1 — Monitoring System Conditions - requiring the GOP to inform the BA and TOP of generation resources available for use

- VAR-002-1 — Generator Operation for Maintaining Network Voltage Schedules - requiring the GOP to operate each generator connected to the interconnected transmission system in the automatic voltage control mode (automatic voltage regulator in service and controlling voltage) unless the GOP has notified the TOP. The GOP is also required to maintain the generator voltage or Reactive Power output (within applicable Facility Ratings<sup>1</sup>) as directed by the TOP.

The following observations are made on the above GOP requirements:

- Some GOP standards requirements would seem able to be accommodated without undue negative impact if GOP was replaced by a broadened Functional Entity that included both generator and load facilities - for example the CIP standards requirements.
- Other GOP standards requirements do not appear amenable to such replacement, in particular those that relate to specific generator equipment such as that for AGC or AVR, or generator functions such as blackstart.
- There would also be potential for confusion by losing a term as central to reliability as "generator" in the Functional Entity name
- A more fundamental aspect is that while generation and load reduction have comparable roles with respect to resource adequacy, this may not apply all aspects of reliability. As a result, standards requirements applicable to generators may, for example, not be necessary in the case of loads.

The conclusion is that replacing the GOP to incorporate DR in the Model and in existing standards requirements would have a number of negative consequences. Qualifications would need to be inserted to indicate where a requirement applied only to a generator and not a load. Moreover, it can be anticipated that the need for standards that would apply only to DR, and not generation, may emerge in the future.

This suggests that it is preferable to introduce a new Function or Functions into the Model, providing for the future development of standards requirements specific to the corresponding new Functional Entities.

## **Changes Proposed to the FMWG re Adding Demand Resource Operations and Demand Resource Ownership Functions**

In the following table, the first column shows the proposal received from the industry for the two new Functions and corresponding Functional Entities. The second column shows the current (Version 4) Generator Operation and Generator Ownership Functions, and corresponding Functional Entities.

A high degree of alignment is seen between the industry proposal for DR and the current generator Functions. Also shown are proposed changes to other Functions / Functional

Entities. Consideration of the specifics of the proposed changes is left for a future phase on the Version 5 development.

<b>Comparison of Proposed Demand Resource Functions<sup>8</sup> and Existing Generator Functions</b>	
<p><b>Function – Demand Resource Operations</b></p> <p><b>Definition</b></p> <p>Operate demand resource(s) to provide reductions in load.</p> <p><b>Tasks</b></p> <ol style="list-style-type: none"> <li>1. Formulate daily demand resource plan.</li> <li>2. Report operating and availability status of demand resources.</li> <li>3. Develop annual maintenance plan for demand resources and perform the day-to-day maintenance.</li> <li>4. Operate demand resources generators to provide load reductions per contracts or arrangements.</li> <li>5. Monitor the status of facilities classed as demand resources.</li> </ol> <p><b>Responsible Entity – Demand Resource Operator</b></p> <p><b>Introduction to the Demand Resource Operator</b></p> <p>The Demand Resource Operator is responsible</p>	<p><b>Function – Generator Operation</b></p> <p><b>Definition</b></p> <p>Operates generating unit(s) to provide real and reactive power.</p> <p><b>Tasks</b></p> <ol style="list-style-type: none"> <li>1. Formulate daily generation plan.</li> <li>2. Report operating and availability status of units and related equipment, such as automatic voltage regulators.</li> <li>3. Develop annual maintenance plan for generating units and perform the day-to-day generator maintenance.</li> <li>4. Operate generators to provide real and reactive power or reliability-related services per contracts or arrangements.</li> <li>5. Monitor the status of facilities classed as generating assets.</li> <li>6. Support Interconnection frequency.</li> </ol> <p><b>Responsible Entity – Generator Operator</b></p>

<sup>8</sup> Version v2 distributed by Dana Showalter, Nov. 21, 2008 (email).

for the implementation, operation and maintenance of demand resources under its purview within a Balancing Authority Area. The Demand Resource Operator has the authority to take certain actions to ensure that its demand resources operate reliably.

### **Relationships with Other Responsible Entities**

#### **Ahead of Time**

1. Provides demand resource commitment plans to the Balancing Authority.
2. Provides Balancing Authority and Transmission Operators with requested amount of reliability-related demand resources.
3. Provides operating and availability status of demand resources to Balancing Authority and Transmission Operators for reliability analysis.
4. Reports annual maintenance plan for demand resources to Reliability Coordinator, Balancing Authority and Transmission Operators.
6. Provides operational data to Reliability Coordinator.
7. Revises demand resource maintenance plans per directive of Reliability Coordinator.
8. Receives reliability analyses from Reliability Coordinator.

### **Relationships with Other Responsible Entities**

#### **Ahead of Time**

1. Provides generation commitment plans to the Balancing Authority.
2. Provides Balancing Authority and Transmission Operators with requested amount of reliability-related services.
3. Provides operating and availability status of generating units to Balancing Authority and Transmission Operators for reliability analysis.
4. Reports annual maintenance plan for generating units to Reliability Coordinator, Balancing Authority and Transmission Operators.
5. Reports status of automatic voltage regulators to Transmission Operators.
6. Provides operational data to Reliability Coordinator.
7. Revises generation maintenance plans per directive of Reliability Coordinator.
8. Receives reliability analyses from Reliability Coordinator.
9. Receives notice from Purchasing-Selling Entity if Arranged

<p>10. Receives reliability alerts from Reliability Coordinator.</p> <p><b>Real Time</b></p> <p>12. Provides real-time operating information on demand resources to the Transmission Operators and the required Balancing Authority.</p> <p>13. Adjusts load reductions as directed by the Balancing Authority and Transmission Operators.</p> <p><b>Function – Demand Resource Ownership</b></p> <p><b>Definition</b></p> <p>Owns and provides for maintenance of demand resources.</p> <p><b>Tasks</b></p> <p>1. Establish demand resource load reduction ratings, limits, and operating requirements.</p> <p>2. Authorize maintenance of owned facilities classified as demand</p>	<p>10. Receives reliability alerts from Reliability Coordinator.</p> <p>11. Receives notification of transmission system problems from Transmission Operators.</p> <p><b>Real Time</b></p> <p>12. Provides real-time operating information to the Transmission Operators and the required Balancing Authority.</p> <p>13. Adjusts real and reactive power as directed by the Balancing Authority and Transmission Operators.</p> <p><b>Function – Generator Ownership</b></p> <p><b>Definition</b></p> <p>Owns and provides for maintenance of generating facilities.</p> <p><b>Tasks</b></p> <p>1. Establish generating facilities ratings, limits, and operating requirements.</p> <p>2. Design and authorize maintenance of generation plant</p>
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3. Provide verified performance characteristics / data on demand resources.

**Responsible Entity – Demand Resource Owner**

Introduction to the Demand Resource Owner

Owns and provides for maintenance of demand resources.

**Relationship with Other Responsible Entities**

1. Coordinates with Transmission Planners and the Planning Coordinator, Distribution Providers, Load-Serving Entities, Balancing Authority, to implement demand resources with the bulk power system.
2. Develops agreements or procedures with the Balancing Authority.
3. Develops operating agreements or procedures with the Balancing Authority, Reliability Coordinators and Distribution Providers.
4. Provides demand resource expansion plans and changes to the Planning Coordinator and

3. Authorize maintenance of owned facilities classified as generating assets.

4. Provide verified generating facility performance characteristics / data.

**Responsible Entity – Generator Owner**

**Relationships with Other Responsible Entities**

1. Provides generator information to the Transmission Operator, Reliability Coordinator, Balancing Authority, Transmission Planner, and Resource Planner.
2. Provides unit maintenance schedules and unit retirement plans to the Transmission Operator, Balancing Authority, Transmission Planner, and Resource Planner.
3. Develops an interconnection agreement with Transmission Owner

<p>5. Provides demand resource ratings and performance characteristics to Transmission Operators, Reliability Coordinators, Transmission Service Providers, Distribution Providers, Transmission Planners, and Planning Coordinator.</p> <p>6. Provides demand resource construction plans and schedules to the Balancing Authority.</p> <p>7. Provides demand resource maintenance plans and schedules to the Balancing Authority.</p> <p>8. If appropriate for the demand resource, develops interconnection agreements with the Distribution Providers for connecting to the bulk power system.</p> <p><b>Changes to Sections for Planning Coordinator, Transmission Planner, Resource Planner</b></p> <p><b>Relationships with Other Responsible Entities:</b></p> <p>Collects information including:</p> <p>a. Transmission facility characteristics and ratings from the Transmission Owners, Transmission Planners, and Transmission Operators.</p> <p>b. Demand and energy forecasts, capacity resources, and demand response programs from Load-Serving Entities, and Resource Planners.</p> <p>c. Generator unit performance characteristics and capabilities from</p>	<p>4. Receives approval or denial of transmission service request from Transmission Service Provider.</p> <p>5. Provides reliability related services to Purchasing-Selling Entity pursuant to agreement.</p>
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Generator Owners.

d. Demand Resource performance characteristics and capabilities from Demand Resource Owners, Load-Serving Entities, and Distribution Providers.

d. Long-term capacity purchases and sales from Transmission Service Providers.

## **Changes to Sections for Balancing Authority**

### **Tasks**

1. Control any of the following combinations within a reliability area:

a. Load and generation (an isolated system)

b. Load and scheduled Interchange

c. Generation and scheduled Interchange

d. Generation, load, and scheduled Interchange

2. Calculate area control error within the reliability area.

3. Operate in the reliability area to maintain load-interchange-generation balance.

4. Review generation and demand resource commitments, dispatch, and load forecasts.

5. Formulate an operational plan (generation and demand resource commitment, outages, etc.) for reliability evaluation.

6. Approve, Interchange Transactions from ramping ability perspective

7. Implement Interchange schedules by incorporating those schedules into its ACE calculation.

8. Operate the reliability area to support Interconnection frequency.

9. Monitor and report control performance

and disturbance recovery.

10. Provide balancing and energy accounting (including hourly checkout of Interchange schedules and actual interchange), and administer inadvertent energy paybacks.

11. Determine needs for reliability-related services.

12. Deploy reliability-related services.

13. Implement emergency procedures.

**Relationships with Other Responsible Entities:**

**Ahead of Time**

1. Receives operating and availability status of generating and demand resource units and operational plans and commitments from Generator Operators, Demand Resource Operators, Load-Serving Entities, and Distribution Providers. (including annual maintenance plans) within the Balancing Authority Area.

2. Receives reliability evaluations from the Reliability Coordinator.

3. Receives approved valid, and balanced Interchange Schedules from the Interchange Authorities.

4. Compiles load forecasts from Load-Serving Entities.

5. Develops agreements with adjacent Balancing Authorities for ACE calculation parameters.

6. Submits integrated operational plans to the Reliability Coordinator for reliability evaluation and provides balancing information to the Reliability Coordinator for monitoring.

7. Confirms Interchange Schedules with Interchange Authorities.

8. Confirms ramping capability with Interchange Authorities.

<p>9. Implements generator and demand resource commitment and dispatch schedules from the Load-Serving Entities, Demand Resource Operators, Distribution Providers and Generator Operators who have arranged for generation within the Balancing Authority Area.</p> <p>10. Acquires reliability-related services from Generator Operator and Demand Resource Operator.</p> <p>11. Receives dispatch adjustments from Reliability Coordinators to prevent exceeding limits.</p> <p>12. Receives generator information from Generator Owners including unit maintenance schedules and retirement plans.</p> <p>13. Receives demand resource information from Demand Resource Owners, Load Serving Entities and Distribution Providers including resource maintenance schedules and retirement plans.</p> <p>13. Receives information from Load Serving Entities on self-provided reliability-related services.</p> <p>14. Coordinates system restoration plans with Transmission Operator.</p> <p>15. Provides generation and demand resource dispatch to Reliability Coordinators.</p> <p>16. Receives final approval or denial of Interchange Schedules from Interchange Authority.</p> <p>Real Time</p> <p>17. Coordinates use of controllable loads with Demand Resource Operators, Distribution Providers and Load-Serving Entities (i.e., interruptible load that has been bid in as a reliability-related service or has agreed to participate in voluntary load shedding program under resource/reserve deficiency situations).</p>	
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<p>18. Receives loss allocation from Transmission Service Providers (for repayment with in-kind losses).</p> <p>19. Receives real-time operating information from the Transmission Operator, adjacent Balancing Authorities, Generator Operators and Demand Resource Operators.</p> <p>20. Receives operating information from Generator Operators and Demand Resource Operators.</p>	

### **Implications for NERC's standards and registration process of the proposed new Functions and Entities**

It is recognized that standards and registration processes are conducted outside of the Model. Nevertheless, the Model provides a framework for NERC's standards development and compliance processes, including registration, and it would seem appropriate to recognize high-level implications for these processes at the time that changes to the Model's Functions are being contemplated. The considerations given below suggest that extending standards requirements to DR owners and operators would require considerable effort regarding registration and standards development processes, but that there are no "show stoppers".

#### *Implications for Registration*

Potential implications include:

- A large load that provides DR directly, i.e., without an intermediary, would seem to qualify as a Demand Resource Operator (DRO) (assuming the load met other conditions such as being BES reliability impactful).
- Where there is an aggregator of DR resources, and where the intervention of the aggregator is required for the DR resource to be delivered, it would seem that such an aggregator would qualify as a DRO (subject to the total load under the total load in question being BES impactful, etc.)
- A large load qualifying as DRO would appear to qualify as a Demand Resource Owner (DRO).
- It is not clear that there would be a DRO in the case of an aggregator of small loads that qualified as a DRO, but where none of the individual loads would be BES impactful. The term "owner" is used in the Model to denote legal title to a physical BES facility. In the case of an aggregator of small loads there is no such facility. It is noted that a comparable situation could arise in the case of an aggregator of small distributed generation units.

- In some case where there is an intermediary that is not necessarily an aggregator, the organization serving as DROP may well be the organization registered as LSE or Distribution Provider.

While there are seen to be outstanding registration questions, none appears to be of a magnitude to justify rejection of the proposed Functions/Entities.

*Implications for Standards*

The decision to develop standards requirements for DR owners and operators would represent a fundamental change in standards, and would seem to indicate the need to review all existing standards to determine instances where reference should be made to the DR owner or operator. It is recognized this could be a major effort.

With the introduction of a DROP and DRO, there would be potential for new standards specific to those entities, and potential to modify existing standards by adding and assigning requirements to these two entities as judged appropriate. In both cases the normal SAR process would seem appropriate.

## Response to Frequently Asked Questions Regarding NERC Functional Model

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### **1. The Functional Model continues to confuse functions with organizations. What can be done to fix this?**

We reformatted the Functional Model document to distinguish between *functions*, which are defined as tasks, and *responsible entities*, who are organizations that register with NERC to perform the functions. Version 4 of the Functional Model lists the tasks associated with each function separately from the interrelationships among the responsible entities. The NERC Reliability Standards will specify what responsible entities must do or achieve to maintain electric system reliability.

We developed a Technical Discussion document that contains the explanations, opinions, and discussions of the Functional Model Working Group (FMWG) and contains examples of how functions can be rolled up in an organization..

### **2. Is the Functional Model a Reliability Standard?**

The Model provides the foundation and framework for NERC's Reliability Standards, but is not a standard itself. In that regard, it is similar to the Reliability Principles and Market Interface Principles in NERC's Reliability Standards Process Manual. The Model defines the basic functions that must be performed to ensure that the bulk electric systems are planned and operated reliably. The Model also describes the interrelationship between the responsible entities. However, the Model does not include compliance measures or requirements.

A "Purpose" statement is in the Functional Model document that further explains how the Model is used within NERC and by other organizations that write standards and business practices, and a "Guiding Principles" section to clearly explain the basis for the Model.

### **3. How can the Functional Model be revised?**

The FMWG is responsible for revisions to the Functional Model. The FMWG reviews annually need to revise the Functional Model based on input from NERC Standing Committees, Standards Drafting Teams and the industry at large. New version of the Functional Model is provided for public review and comment, with final consideration and approval by the standing committees.

### **4. Why doesn't the Functional Model mention the Regional Entities?**

Because the Regional Entities are organizations, not functions. The Regional Entities may perform some of the functions defined in the Model. For instance, some Regional Entities perform the Reliability Operations function (Reliability Coordinator), some the Planning Reliability functions (Planning Coordinator), and all perform the Compliance Enforcement (Compliance Enforcement Authority) function.

### **5. Does the Planning Coordinator consider the Regional Council's planning standards when assessing the "plan?"**

The Planning Coordinator assesses plans against NERC Reliability Standards. The Planning Coordinator *may also* assess plans against other industry reliability standards; however, NERC compliance will be based on NERC Reliability Standards.

**6. Why doesn't the Functional Model include the FERC-defined Transmission Provider from Order 888?**

For two reasons. First, many organizations are not FERC-jurisdictional, and their provision of transmission services may not align with FERC's Transmission Provider. Second, FERC defines the Transmission Provider as an organization, not a function:

“The public utility (or its Designated Agent) that owns, controls, or operates facilities used for the transmission of electric energy in interstate commerce and provides transmission service under the Tariff.” (from *pro forma* tariff)

Thus, the FERC-defined Transmission Provider has actually “bundled” several functions that can today be performed by separate organizations. For instance, one can envision an organization that owns transmission and a separate organization that operates the transmission system. Both of these organizations could be within an RTO that provides transmission service through its tariff.

**7. It appears that the revisions to the Functional Model are trying to align the Model with the Commission's proposed Standard Market Design and RTO structures. Is that true?**

No. The Functional Model is designed to accommodate any market design, and does not assume any particular organization structure. It's designed for traditional vertically integrated utilities, regional transmission organizations, independent system operators, and so on.

**8. Why are the Transmission Owner and Transmission Operator separate functions? Similarly, why are the Generator Owner and Generator Operator separate functions?**

Because these are separate, fundamental functions that comprise sets of related tasks that can be performed by separate organizations. For instance, some organizations, such as an RTO, provide the Transmission Operations function for their members who are individual Transmission Owners. However, other organizations have bundled the Transmission Ownership and Transmission Operations functions. Similarly, a Generator Owner can arrange for a Generator Operator to operate its facilities.

**9. Why is the Interchange Authority's role restricted to bilateral transactions?**

Because the sole purpose of the Interchange Authority is to bring the financial “deal” between Purchasing-Selling Entities across Balancing Areas to *physical implementation*. Financial transactions within markets are handled by the Market Operator and do not need the services of the Interchange Authority.

**10. Why does the model include the Market Operator?**

This function in the Functional Model recognizes that it provides energy and capacity products in some markets. The Market Operator is also an interconnection point between the NERC Functional Model and models that other organizations may create as a framework for market structures and business practices.