

10-Minute Non-Spinning Reserve Service

Executive Summary

In response to the PUCT Workshop¹ related to the impact of wind in ERCOT and recommendations in the GE Wind Report, Topaz proposes the development of a 10-Minute Non-Spinning Reserve Service (10MNSRS) for Off-line Resources to equip ERCOT with an additional mechanism to ensure the reliability and adequacy of the ERCOT Transmission Grid. The new Ancillary Service, which has precedent in the Zonal Market and would implement recommendations from the GE Wind Report and principles from other electricity markets, would avoid costs associated with providing reliability reserves.

Benefits

The benefits of 10MNSRS include the following:

1. The Off-line reserved capacity would avoid costs related to sub-optimal operation of On-line reserved capacity (i.e. fuel, water, emissions).
2. The reserved capacity would provide an intermediate mechanism to ensure reliability, between Responsive Reserve Service (RRS) and Non-Spinning Reserve Service (NSRS).
3. The market would encourage investment in innovative technology.

Operational Challenges

ERCOT has over 8,300 MW of Wind Generation Resources with almost 48,000 MW of wind with active interconnection requestsⁱ. By 2012, ERCOT expects over 10,900 MW of installed Wind Generation Resources (WGR), based on signed Interconnection Agreements. Various development scenarios, which consider the implementation of CREZ transmission lines, include 15,000 MW of WGR by 2015.

Although WGRs provide low-cost energy, wind is “inherently variable and incompletely predictable”². Because electricity cannot currently be economically stored on a large-scale basis, the characteristics of wind will present operational challenges to meet the constraint of instantaneously matching generation and load.

Proposal

Today, there exist Generation Resources, commercially viable technologies and market rules, both in the current ERCOT Zonal Marketⁱⁱ and other electricity markets, which address these operational challenges. However, the Texas Nodal Market does not incorporate many existing Zonal Protocol mechanisms to fully utilize these existing Generation Resources. To facilitate ERCOT ensuring

¹ PUCT Project Number 37339, August 20, 2009.

² Analysis of Wind Generation Impact on ERCOT Ancillary Services Requirements, GE Energy, March 30, 2008. Section 1.1.

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the reliability and adequacy of the ERCOT Transmission Grid³, Topaz proposes the development of a 10-Minute Non-Spinning Reserve Service.

Current Generation Resources

Quick Start Units represent solutions to address current and future operational challenges. These Generation Resources are capable of synchronously interconnecting to the ERCOT System and ramping to an instructed output level within ten minutes.

Appendix A lists over 900 MW of existing thermal Generation Resources capable of reaching the High Sustainable Limit in 10 minutes. Appendix B lists over 550 MW of announced thermal Generation Resources with similar capabilities. These Generation Resources are expected to be commercially operable before the Texas Nodal Market Implementation Date.

Current Technology

Leveraging significant experience in the aviation, marine, defense and transportation industries, several original equipment manufacturers (OEM) have heavily invested research and development resources to adapt mature technologies for the electric power industry. A sample of these OEMs includes Cummins, General Electric, Pratt-Whitney, Rolls-Royce, Siemens and Wärtsilä. The solutions currently available from these OEMs are generally categorized as Otto cycle reciprocating engines or Brayton cycle aeroderivative turbines. Appendix C lists products currently available from these OEMs. The range of commercially viable products from experienced OEMs demonstrates that competitive forces are driving innovative solutions to address operational challenges in the electric power industry.

Current Zonal Mechanisms

In the current Zonal market, ERCOT utilizes Quick Start Units through the following mechanisms to ensure reliability.

Non-Spinning Reserve Service (NSRS)

NSRS, which includes two types⁴, is an Ancillary Service for the portion of Off-line generation capacity capable of being synchronized and ramped to a specified output level within thirty (30) minutesⁱⁱⁱ. ERCOT deploys NSRS for the following reasons:

- a) Replacement of lost generating capacity^{iv};
- b) Compensation for load forecast and/or wind forecast errors^v;
- c) Projection that 95% or more of Balancing Energy capacity will be utilized^{vi};
- d) Declaration of EEA Level 1^{vii}; or

³ ERCOT Nodal Protocols, Section 1.2, Functions of ERCOT, paragraph (1)(b).

⁴ PRR776, Automatic MCPE Adjustment During Intervals of Non-Spinning Reserve Service Deployment, split the NSRS Ancillary Service into 30-Minute Non-Spinning Reserve Service (30MNSRS) and BES-Capable Non-Spinning Reserve Service (BECSNSRS), both of which clear at the a common price.

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- e) Minimization of Responsive Reserve deployment^{viii}.

Although 30MNSRS also exists under the Texas Nodal Market in the form of Non-Spinning Reserve Service, *there are no comparable mechanisms to the Zonal Balancing Energy Capable NSRS or Quick Start Balancing Energy Service.*

Out-of-Merit (OOM) Dispatch Instructions

ERCOT utilizes OOM Dispatch Instructions to deploy Quick Start Units for the following reasons:

- a) Resolution of Local Congestion^{ix};
- b) Provision of reliable ERCOT System Operation or effective management of Local Congestion^x;
- c) Maintenance of ARR above 2,500 MW^{xi}; or
- d) Maintenance of PRC above 2,300 MW⁵.

ERCOT issues OOME Dispatch Instructions to Quick Start Units to synchronously interconnect with the ERCOT System (a) in advance of a 15-minute Settlement Interval in the same timeframe as Balancing Energy Service, (b) after BES Dispatch Instructions but before the beginning of a 15-minute Settlement Interval as Verbal Dispatch Instructions (VDI) or (c) within the desired 15-minute Settlement Interval as VDIs.

Out-of-Merit Dispatch Instructions, including OOM Capacity and OOM Energy, are intentionally absent from the Texas Nodal Market. The allegorical mechanism for ERCOT to instruct Generation Resources to synchronously interconnect with the ERCOT System for reliability purposes is Reliability Unit Commitment (RUC). The Texas Nodal Market retains the Verbal Dispatch Instruction^{xii}, which is the only mechanism for ERCOT, at its sole discretion, to commit Generation Resources in the ten minutes preceding Real Time. The development of 10MNSRS would ensure ERCOT retains existing mechanisms and procures enhanced tools to address future operational challenges.

Precedent

In addition to the Zonal mechanisms of BESCNSRS and OOME Dispatch Instructions, there exists other relevant precedent to support the development of 10MNSRS. For example, the GE Wind Report recommends the development of an additional service for Quick Start Units to mitigate wind generation drop risk⁶.

⁵ ERCOT Protocols, Section 5.6.7, EEA Levels, EEA Level 1 ERCOT action (3).

⁶ Analysis of Wind Generation Impact on ERCOT Ancillary Services Requirements, GE Energy, March 30, 2008.

Section 8.2, Tradeoffs Between RRS and NSRS: "... A possible solution is to develop an additional "quick-start non-spinning reserve" service with a shorter startup criterion. Units that are capable can participate in this market, and this will incent future generating unit additions or modifications that permit quick starting."

Section 9.4, Recommendations: "... ERCOT should consider introducing a new non-spin reserve service with a startup time of ten to fifteen minutes. This can significantly reduce the amount of responsive reserves needed for identified periods of wind generation drop risk. ..."

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The GE Wind Report also states that other operating areas have “shorter startup times for non-spinning reserves^{xiii}.” Indeed, five other domestic electricity markets have such Ancillary Services with 10-minute timeframes as follows:

- PJM Interconnection^{xiv} Quick Start Reserve
- California ISO^{xv} Non-Spinning Reserve
- Midwest ISO^{xvi} Supplemental Reserve
- ISO New England^{xvii} Ten-Minute Non-Spinning Reserve
- New York ISO^{xviii} 10-Minute Non-Synchronized Reserve

The development of 10MNSRS would implement the GE Wind Report recommendation and principles from several other electricity markets.

Proposed Procedures

In order for 10MNSRS to provide an effective tool for ERCOT, Market Participants must develop and approve specific guidelines for the procurement and deployment of the Ancillary Service. Although the exact terms would remain subject to the Technical Advisory Committee approval, Market Participants should consider the following principles.

Procurement

The expected outcome of these Market Participant driven activities includes specification of procedures and quantities of 10 MNSRS to procure in the context of other Ancillary Service procurement. Although the quantity could fluctuate based on forecast ERCOT System conditions, Market Participations should consider the difference between the EEA Alert Level and EEA Level 1, which is 700 MW, as a starting point. The 900 MW of existing Generation Resources and additional announced 550 MW would provide desired competition if this quantity were procured.

ERCOT currently procures sufficient NSRS and Regulation Up to ensure their sum is larger than 95 percent of Net Load forecasting errors^{xix}. The procedure should be revisited to consider 10MNSRS.

Deployment

The same activities would specify the conditions under which 10MNSRS would be deployed. Because 10MNSRS would be an intermediate service between RRS and NSRS, the expectation is that 10MNSRS would be deployed before either RRS or NSRS at EEA Level 2 to maintain Physical Responsive Capability (PRC) levels, thereby not compromising system reliability. The PRC level and condition of 10MNSRS would need to be carefully considered.

In addition to reliability considerations, Market Participants may also want to consider an economic deployment of 10MNSRS as well. For example, the Zonal Protocols allow Generation Resources with BESCNSRS awards to synchronize when the Market Clearing Price of Energy exceeds 18 times the Fuel Index Price. Similar market deployment may be appropriate under the Texas Nodal Market as well.

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In addition to revisiting the NSRS deployment reasons, as specified above, Market Participants must carefully balance reliability and economic concerns throughout the development of deployment procedures.

Conclusion

The future will bring significant changes to the electric power industry, including variable renewable generation, demand response, distributed generation and other disruptive technologies. Market Participants must equip ERCOT with the tools they need ensure reliability. Topaz believes 10MNSRS, in addition to implementing recommendations from the GE Wind Report and principles from Zonal and other electricity markets, would provide such a tool and would enable other market-based solutions to address future operational challenges.

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Appendix A: Existing 10-minute thermal Generation Resources

Unit	Owner	HSL (MW)	Technology
Decker Unit 1	Austin Energy	52	
Decker Unit 2	Austin Energy	52	
Decker Unit 3	Austin Energy	52	
Decker Unit 4	Austin Energy	52	
Laredo Energy Center Unit 4	Topaz	100	LMS100
Laredo Energy Center Unit 5	Topaz	100	LMS100
Leon Creek Unit 1	CPS	46	LM6000 PC Sprint
Leon Creek Unit 3	CPS	46	LM6000 PC Sprint
Leon Creek Unit 4	CPS	46	LM6000 PC Sprint
Sand Hill Unit 1	Austin Energy	46	LM6000 PC Sprint
Sand Hill Unit 2	Austin Energy	46	LM6000 PC Sprint
Sand Hill Unit 3	Austin Energy	46	LM6000 PC Sprint
Sand Hill Unit 4	Austin Energy	46	LM6000 PC Sprint
Winchester Unit 1	LCRA	45	LM6000
Winchester Unit 2	LCRA	45	LM6000
Winchester Unit 3	LCRA	45	LM6000
Winchester Unit 4	LCRA	45	LM6000
Total		905	

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Appendix B: Announced 10-minute thermal Generation Resources

Unit	Owner	HSL (MW)	Technology
Dansby Unit 2	BTU	46	LM6000 PC Sprint
Greenville	GEUS	24	20V34SG
Pearsall Units 1-24	STEC	203	20V34SG
Sand Hill 5	Austin Energy	47	LM6000 PC Sprint
Sand Hill 6	Austin Energy	47	LM6000 PC Sprint
V.H. Braunig Unit 5	CPS	46	LM6000 PC Sprint
V.H. Braunig Unit 6	CPS	46	LM6000 PC Sprint
V.H. Braunig Unit 7	CPS	46	LM6000 PC Sprint
V.H. Braunig Unit 8	CPS	46	LM6000 PC Sprint
Total		551	

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Appendix C: Current 10-minute Technologies

OEM	Model	MW in 10-minute
Cummins ^{xx}	1750GQPB	1.75
Cummins	2000GQPC	2
General Electric ^{xxi}	LM6000PC Sprint	50
General Electric	LM6000PC	43.4
General Electric	LM6000PD Sprint	46.8
General Electric	LM6000PD	42.3
General Electric	LM2500PK	30.7
General Electric	LM2500PV	30.5
General Electric	LM2500PH	27.8
General Electric	LM2500PE	22.7
General Electric	LM2500	21.5
General Electric	LM2500+	30.5
General Electric	LM2000	18
General Electric	LM1600	13.7
General Electric	LMS100	100
Pratt-Whitney ^{xxii}	FT8 SWIFTPAC	60
Rolls-Royce ^{xxiii}	501	4
Rolls-Royce	RB211-6562	27.5
Rolls-Royce	RB211-6762	29.5
Rolls-Royce	RB211-6761	32.1
Rolls-Royce	Trent 60	48
Siemens ^{xxiv}	SGT6-5000F	150
Siemens	SCC6-5000F	150
Wärtsilä ^{xxv}	9L34SG	3.8
Wärtsilä	16V34SG	6.9
Wärtsilä	20V34SG	8.7

ⁱ Monthly Status Report to Reliability and Operations Subcommittee for August 2009, System Planning Division, ERCOT, September 10, 2009.

ⁱⁱ The Zonal mechanisms include OOME Dispatch Instructions (OOME and OOMEVDI), Quick Start Balancing Energy Service, Balancing Energy Capable Non-Spinning Reserve Service (BESCNSRS) and 30-minute Non-Spinning Reserve Service (30MNSRS).

ⁱⁱⁱ ERCOT Protocols, Section 2, Definitions and Acronyms.

^{iv} 2009 ERCOT Methodologies for Determining Ancillary Service Requirements.

^v 2009 ERCOT Methodologies for Determining Ancillary Service Requirements.

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^{vi} ERCOT Protocols, Section 6.7.4, Deployment of Non-Spinning Reserve Service, paragraph (1); 2009 ERCOT Methodologies for Determining Ancillary Service Requirements.

^{vii} ERCOT Protocols, Section 5.6.6.2, General Procedures Prior to EEA Operations, paragraph (3).

^{viii} ERCOT Protocols, Section 6.7.3, Deployment of Responsive Reserve Service, paragraph (5).

^{ix} Transmission & Security Desk, Operating Procedure Manual, 2.1.3 OOME – VDI Guidelines, Step 6; 2.2.2 Real Time Constraint Activity Manager, Step 7.

^x ERCOT Protocols, Section 6.5.10, Out of Merit Capacity and Out of Merit Energy Services, paragraph (1).

^{xi} Frequency Control Desk, Operating Procedure Manual, 2.6.6 Provide Advance Notice of Diminishing Responsive Reserve, Step 7.

^{xii} ERCOT Nodal Protocols, Section 6.5.8, Verbal Dispatch Instructions.

^{xiii} Section 8.2, Tradeoffs Between RRS and NSRS.

^{xiv} PJM Manual 35: Definitions and Acronyms, April 17, 2009.

“Quick Start Reserve” Reserve capability that can be converted fully into energy within **10 minutes** of PJM’s request and is provided by equipment not electrically synchronized to the power system.

^{xv} California ISO, Business Practice Manual for Definitions & Acronyms, March 16, 2009.

“Non-Spinning Reserve” The portion of the generating capacity that is capable of being synchronized and Ramping to a specified load in **ten minutes** (or Load that is capable of being interrupted in ten minutes) and that is capable of running (or being interrupted). [T]

^{xvi} Midwest ISO, Business Practice Manual, List of Business Practices Manuals and Definitions, Manual No. 100, July 25, 2008.

“Supplemental Reserve” Spare capacity (other than Spinning Reserve) that can be made available within a specified time period, e.g., **10 minutes** for the Midwest ISO. Supplemental Reserve includes on-line but unloaded generators, quick-start generators, and interruptible load. Refer to Schedule 6 of the EMT.

^{xvii} ISO New England, Market Rule 1.

“Ten-Minute Non-Spinning Reserve” or “TMNSR” is the reserve capability of a generating unit that can be converted fully into energy within ten minutes from the request of the ISO, and is provided by generating units that are either electrically synchronized or not electrically synchronized to the New England Transmission System or the reserve capability of a Dispatchable Asset Related Demand that can be fully utilized within **ten minutes** from the request of the ISO to reduce consumption.

^{xviii} New York Independent System Operator, Ancillary Service Manual, Manual 2, September 2008.

“10-Minute Non-Synchronized Reserve (10-minute NSR)” Operating Reserves provided by Generators that can be started, synchronized and loaded within **10 minutes**. These reserves are carried on quick-start units, such as jet engine type gas turbines. Operating Reserves may also be provided by Demand Side Resources where demand response is provided by a Local Generator.

^{xix} 2009 ERCOT Methodologies for Determining Ancillary Service Requirements.

^{xx} <http://www.cumminspower.com/en/solutions/peakingpower/>

^{xxi} http://www.gepower.com/prod_serv/products/aero_turbines/en/index.htm

^{xxii} <http://www.pw.utc.com/Products/Power+Systems>

^{xxiii} <http://www1.rolls-royce.com/energy/products/powergen/gasturb.jsp>

^{xxiv} <http://www.powergeneration.siemens.com/>

^{xxv} <http://www.wartsila.com/>