UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

Essential Reliability Services and the Evolving Bulk-Power System – Primary Frequency Response

Docket No. RM16-6-000

ADVICE OF THE WESTERN INTERCONNECTION REGIONAL ADVISORY BODY ON THE FEDERAL ENERGY REGULATORY COMMISSION’S NOTICE OF INQUIRY ON PRIMARY FREQUENCY RESPONSE

I. Introduction

The Western Interconnection Regional Advisory Body (‘‘WIRAB’’)\(^1\) appreciates the opportunity to submit advice to the Federal Energy Regulatory Commission (‘‘Commission’’ or ‘‘FERC’’) on the notice of inquiry (‘‘NOI’’) issued on February 18, 2016, in which the Commission seeks comment on the need for reforms to its rules and regulations regarding the provision and compensation of primary frequency response.\(^2\) WIRAB is comprised of representatives of Western states, Western Canadian provinces, and the area of Mexico with electric load in the Western Interconnection. The representatives are primarily Public Utility Commissioners or Energy Office Directors who understand the importance of interconnection-wide reliability and are deeply concerned with the reliability implications of the rapidly changing resource mix, especially in the West. The West has some of the most aggressive Renewable Portfolio Standards (‘‘RPS’’)\(^3\) in the United States and it may well see, over the next few years,

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\(^{1}\) WIRAB is authorized, pursuant to Section 215(j) of the Federal Power Act, to provide advice to Western Electricity Coordinating Council (‘‘WECC’’), the Electric Reliability Organization (‘‘ERO’’) (i.e., NERC), and the Commission on whether proposed reliability standards and the governance and budgets of the ERO and WECC are in the public interest, and on any other topic upon which the Commission requests guidance.

\(^{2}\) Notice of Inquiry re: Essential Reliability Services and the Evolving Bulk-Power System – Primary Frequency Response under RM16-6 (issued February 18, 2016) RM16-6-000

\(^{3}\) For example, California has a RPS target of 50 percent renewables by 2030
an acceleration of the changing resource mix from more synchronous generation to more non-synchronous generation like wind and solar photovoltaics (“PV”). Because of this, WIRAB supports the Commission’s proactive approach to considering reforms to its rules and regulations that govern the provision of primary frequency response. WIRAB offers five specific recommendations:

1. FERC should open a rulemaking to consider adopting definitions of “primary frequency response” and “fast frequency response” for the Western Interconnection. FERC should direct North American Electric Reliability Corporation (“NERC”) and Western Electricity Coordinating Council (“WECC”) to conduct annual assessments to determine whether there will be sufficient primary frequency response and fast frequency response over a ten year period under a wide range of futures and operating conditions in the Western Interconnection to avoid under-frequency load shedding.

2. FERC should open a rulemaking to consider adopting a requirement that all new generators have the “capability” to provide primary frequency response. FERC should consider a provision that would allow entities to request a waiver of the requirement, if installing such “capability” would result in the overall cost of construction being prohibitively high.

3. FERC should open a rulemaking to consider adopting default required governor dead band and control settings for all thermal generators larger than 20 MW to ensure robust frequency response, to address governor withdrawal issues, and to reduce uncertainty about the future frequency response of thermal generators in the Western Interconnection.
FERC should consider exempting generating units from this provision, if the dead band and control settings would be infeasible or result in safety concerns.

4. FERC should open a rulemaking to consider allowing Balancing Authorities to respond to a projected real-time shortfall in primary frequency response by curtailing generators that are not capable or able to provide primary frequency response ahead of similar resources that are able to provide primary frequency response.

5. FERC should open a rulemaking to consider allowing Balancing Authorities to provide higher compensation to generators that provide fast frequency response than to generators that provide primary frequency response. FERC should consider reforms allowing generators to set lower governor droop settings and other control improvements that can lead to faster frequency responses.

II. Recommendations

1. FERC should open a rulemaking to consider adopting definitions of “primary frequency response” and “fast frequency response” for the Western Interconnection. FERC should direct NERC and WECC to conduct annual assessments to determine whether there will be sufficient primary frequency response and fast frequency response over a ten year period under a wide range of futures and operating conditions in the Western Interconnection to avoid under-frequency load shedding.
FERC should continue to be proactive in its approach to ensuring sufficient arresting power is available from inertia, fast frequency response, and primary frequency response to avoid under-frequency load-shedding in the Western Interconnection. The concern is that as we add substantially more non-synchronous generation, there may be insufficient primary frequency response to arrest a decline in frequency and to avoid load shedding.

One approach to addressing this concern would be to establish a requirement that every committed generator operating during real-time be required to provide primary frequency response. Current studies of the Western Interconnection do not indicate that there is a shortage of primary frequency response and do not support this type of universal requirement. All generators do not need to provide primary frequency response all of the time.

A more cost-effective approach is to ensure that an adequate amount of primary frequency response is provided by a subset of generators at the lowest overall marginal cost. A rule of thumb is that at least 30% of the generators operating in real-time should provide primary frequency control. This targeted approach requires studies to determine the future requirement, or need, for primary frequency response over a ten year period and actions to address those concerns to mitigate short falls of frequency response.

FERC should direct NERC and WECC to conduct these studies for the Western Interconnection.

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6 Eto, J. et al.; *Use of Frequency Response Metrics to Assess the Planning and Operating Requirements for Reliable Integration of Variable Renewable Generation*; LBNL; (December 2010); available at: https://www.ferc.gov/industries/electric/indus-act/reliability/frequencyresponsemetrics-report.pdf
2. FERC should open a rulemaking to consider adopting a requirement that all new generators have the “capability” to provide primary frequency response. FERC should consider a provision that would allow entities to request a waiver of the requirement, if installing such “capability” would result in the overall cost of construction being prohibitively high.

Before a generator can respond to a deviation in system frequency it must be given the capability to respond, be enabled to respond, and have the headroom to respond. The capability to respond refers to installation of the necessary control equipment. Being enabled to respond means that the control equipment is activated or programmed to respond. Headroom means that the generator is operating at a point where it has the ability to increase or decrease its output in response to a change in system frequency. As indicated earlier, current studies of the Western Interconnection do not indicate that there is a shortage of primary frequency response and do not support requiring all generators to take all three of these steps to provide primary frequency response. All generators do not need to provide primary frequency response all of the time.

FERC should, however, require that all new generator owners install the control equipment needed to provide primary frequency response. The changing resource mix in the Western Interconnection and the associated uncertainty regarding the future provision

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7 Miller, N. et al.; Western Wind and Solar Integration Study Phase 3 – Frequency Response and Transient Stability; NREL; GE Energy; (December 2014); available at: http://www.nrel.gov/docs/fy15osti/62906.pdf
of primary frequency response support this requirement. The high cost of retrofitting existing generators to install the necessary control equipment supports limiting the requirement to new generators and taking early action now.

3. FERC should open a rulemaking to consider adopting default required governor dead band and control settings for all thermal generators larger than 20 MW to ensure robust frequency response, to address governor withdrawal issues, and to reduce uncertainty about the future frequency response of thermal generators in the Western Interconnection. FERC should consider exempting generating units from this provision, if the dead band and control settings would be infeasible or result in safety concerns.

The amount of primary frequency response has been on the decline for the past couple decades, even before there was significant change in the resource mix toward non-synchronous generation. A 2012 report from the North American Electric Reliability Corporation (“NERC”) revealed that many synchronous generators had wide generator dead band settings, disabled governor controls, or operated under set point controls that diminished primary frequency response. Governor withdrawal (or squelch) has been a

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8 Miller, N. et al.; Western Wind and Solar Integration Study Phase 3A: Low Levels of Synchronous Generation; NREL; GE Energy; (November 2015); available at: http://www.nrel.gov/docs/fy16osti/64822.pdf
10 NERC; Eastern Frequency Response Initiative Whitepaper; NERC; (October 2013); available at: http://www.nerc.com/pa/rrm/bpsa/Alerts%20DL/2015%20Alerts/EI%20Frequency%20Initiative%20Whitepaper.pdf
11 NERC; Frequency Response Initiative Report; NERC; (October 2012); available at: http://www.nerc.com/docs/pc/FRI_Report_10-30-12_Master_w-appendices.pdf
serious problem and a main contribution to the decline in primary frequency response.\textsuperscript{12} Withdrawal occurs when governors are set to only respond to extreme frequency excursions and only provide that response for a short amount of time. In the East, this has led to situations that instead of frequency declining to a minimum point (the nadir) and immediately bouncing back, the frequency remained at the nadir for tens of seconds before returning to more normal frequency.\textsuperscript{13}

NERC currently recommends that all thermal generators larger than 20 MW set governor controls to a dead band setting of +/-0.036 Hz.\textsuperscript{14} The NERC recommended dead band setting is not a requirement and generator operators are able to set wider dead bands to reduce wear and tear on the machine. This practice leads to a decline in frequency response. It also creates uncertainty about the frequency response of thermal generators in the Western Interconnection. This uncertainty complicates the assessment of the future need for additional primary frequency response from non-synchronous generation. FERC should open a rulemaking to consider adopting required dead band and control settings for all thermal generators larger than 20 MW to ensure robust frequency response, to address governor withdrawal issues, and to reduce uncertainty about the future frequency response of thermal generators in the Western Interconnection.

\textsuperscript{12} NERC: \textit{Generator Governor Frequency Response Advisory – Webinar Questions and Answers}; NERC; (April 2015); available at: http://www.nerc.com/pa/rrm/Webinars\%20DL/Generator_Governor_Frequency_Response_Webinar_QandA_April_2015.pdf

\textsuperscript{13} NERC: \textit{Frequency Response Initiative Report}; NERC; (October 2012); available at: http://www.nerc.com/docs/pc/FRI_Report_10-30-12_Master_w-appendices.pdf

4. FERC should open a rulemaking to consider allowing Balancing Authorities to respond to a projected real-time shortfall in primary frequency response by curtailing generators that are not “capable” or able to provide primary frequency response ahead of similar resources that and able to provide primary frequency response.

Experience outside the United States with high penetrations of non-synchronous generation has shown that generation that is not providing frequency response may need to be curtailed to maintain enough primary frequency response on the system to protect system reliability. In the Western Interconnection, non-synchronous generation – primarily wind and solar PV resources – have not been required to provide frequency response.

Developers and owners of non-synchronous generation should be encouraged to install the capability to provide primary frequency response. FERC can achieve this objective by allowing Balancing Authorities (“BAs”) to curtail generation that is not “capable” or able to provide primary frequency response ahead of similar resources that are on-line and able to provide the service, in order to ensure the availability of sufficient primary frequency response. In order to implement this recommendation, BAs in the Western Interconnection would need to develop real-time tools to determine whether they have sufficient primary frequency response to meet their frequency response needs at every instance.

5. FERC should open a rulemaking to consider allowing Balancing Authorities to provide higher compensation to generators that provide fast frequency response than to generators that provide primary frequency response. FERC should consider reforms allowing generators to set lower governor droop settings and other control improvements that can lead to faster frequency response.

FERC should open a rulemaking to consider adopting a regulatory framework that rewards the actuation of fast frequency response. Wind, solar PV, and battery storage can provide “fast” frequency response, measured in milliseconds, in response to a frequency disturbance.16 Such fast frequency response can help return the system to normal quicker and reduces the possibility of under-frequency load shedding or over-frequency generation tripping due to spikes in frequency.17 Fast frequency response can also achieve the same result as slower frequency response with fewer megawatts of capacity.18

On traditional synchronous generators, the speed of primary frequency response is based on the governor droop setting. The droop setting reduces or increases the governor reference speed as the load on the generator changes. NERC recommends a uniform droop setting not to exceed 5% (i.e. a 5% difference between the speed of the generator and the speed of the system), but lower droop settings lead to faster responses.19 Instead

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18 Matevosyan, J.; Future Ancillary Services Developments in ERCOT; NERC Essential Reliability Services Task Force presentation; (August 2014)
19 NERC; Reliability Guideline – Primary Frequency Control; NERC; (December 2015); available at: http://www.nerc.com/comm/OC/Reliability%20Guideline%20DL/Primary_Frequency_Control_final.pdf
of uniform governor droop settings for all generation resources, FERC should consider allowing lower droop settings that can lead to faster frequency response.

(Signature Block on the Following Pages)
Respectfully Submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Denver, CO this 25th day of April, 2016.

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