

Background:

The Frequency Response SAR Drafting Team thanks all commenters who submitted comments on the first draft of the SAR for Frequency Response. This SAR was posted for a 30-day public comment period from April 4, 2006–May 3, 2006. The SAR DT asked stakeholders to provide feedback on the SAR through a special SAR Comment Form. There were 16 sets of comments, including comments from more than 59 different people from more than 41 companies representing 6 of the 9 Industry Segments as shown in the table on the following pages.

The primary changes to the SAR were made based on comments:

- Clarification on the role of the LSE and Generator Operator.
- Inclusion of the applicability of Reliability Principles 3, 5 and 6.
- Reduced the scope to address only the collection of data needed to model Frequency Response in North America.

In this ‘Consideration of Comments’ document stakeholder comments have been organized so that it is easier to see the responses associated with each question. All comments received on the SAR can be viewed in their original format at:

http://www.nerc.com/~filez/standards/Frequency_Response.html

If you feel that your comment has been overlooked, please let us know immediately. Our goal is to give every comment serious consideration in this process! If you feel there has been an error or omission, you can contact the Vice President and Director of Standards, Gerry Adamski at 609-452-8060 or at gerry.adamski@nerc.net. In addition, there is a NERC Reliability Standards Appeals Process.¹

Update:

The original SAR on Frequency Response was submitted in large part due to a study that showed a 10+% decline in Eastern Interconnection Frequency Response over a 5 year period, when response should be increasing over time as an Interconnection grows. The drafting team posted a whitepaper along with the SAR to outline the need for a standard.

The NERC Resources Subcommittee recently updated their estimate of Eastern Interconnection Frequency Response and found it to be on the order of 2800MW/0.1Hz and still trending downward.

¹ The appeals process is in the Reliability Standards Process Manual: <http://www.nerc.com/standards/newstandardsprocess.html>.

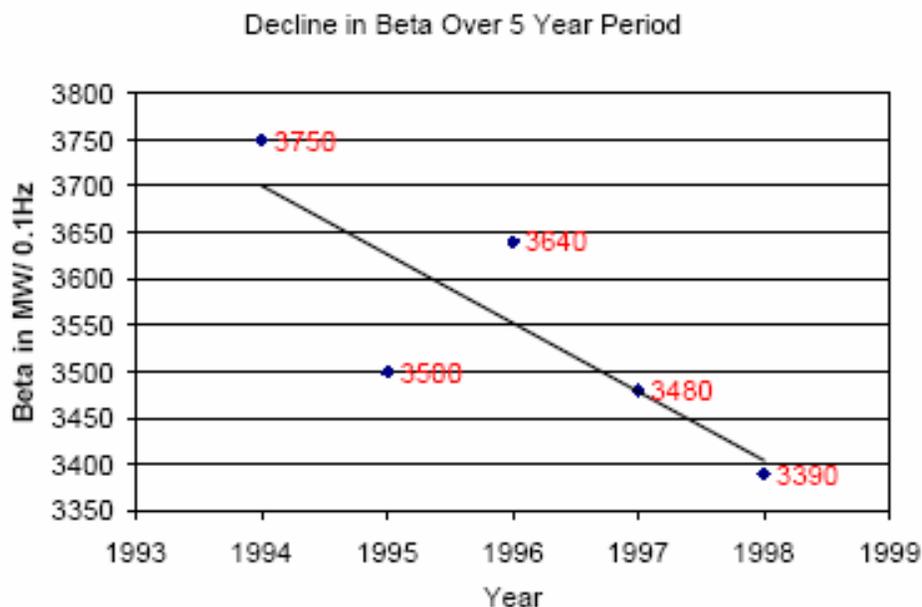


Figure 1 Original Eastern Interconnection Frequency Response Study (Ingleson and Nagle)

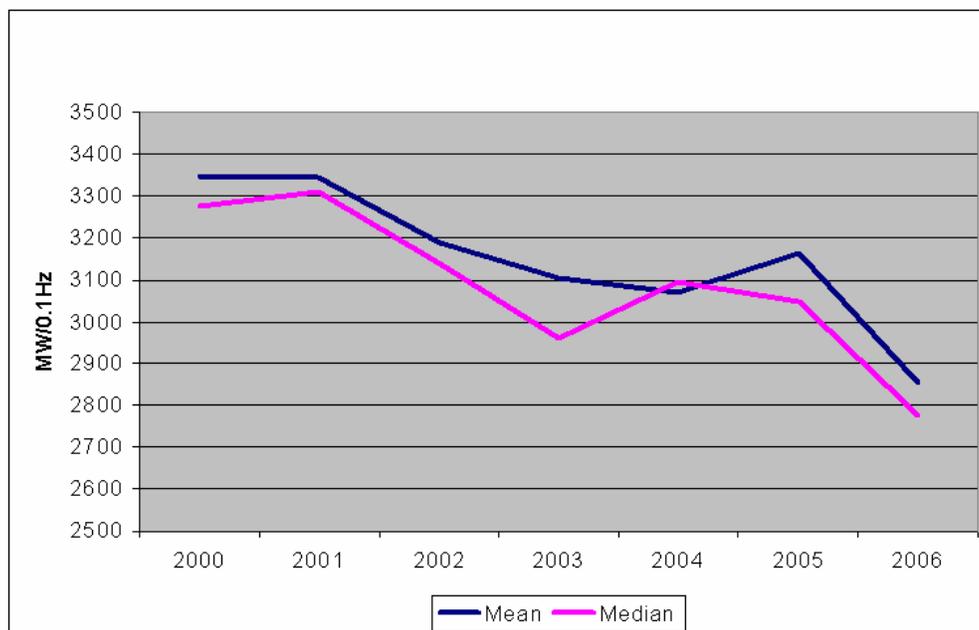


Figure 2 Updated Eastern Interconnection Frequency Response (NERC Resources Subcommittee)

Based on these observations, at its June, 2006 meeting, the NERC Operating Committee endorsed developing a frequency response standard that includes the following goals and objectives:

- Improving Interconnection frequency response event cataloging and benchmarking
- Calculating balancing authority frequency response and requiring balancing authorities to analyze those cases where the response is significantly below the norm
- Establishing time limits to complete the analyses

- Tabulating non-responsive generators
- Measuring generator response (including those units on line)
- Including regional participation and review

Unfortunately, the stakeholders who responded to the second draft of the proposed SAR offered a wide range of opinions on what should be in the standard, without a clear consensus. Given this, the drafting team revised the SAR to only require collection of data needed to model frequency response in each of the interconnections. Once frequency response has been modeled and analyzed, the Resources Subcommittee and the industry will be in a better position to recommend specific frequency response targets for each Interconnection.

This revised SAR was reviewed and supported by the NERC Resources Subcommittee on December 4, 2006.

Consideration of Comments on Second Draft of Frequency Response SAR

Commenter	Organization	Industry Segment								
		1	2	3	4	5	6	7	8	9
Ken Goldsmith	ALT		x							
Baj Agrawal	APS	x				x				
Bert Peters	APS	x								
Dave Rudolph	BEPC									
Bart McManus	BPA	x		x		x	x			
John Anasis	BPA	x		x		x	x			
Lynn Aspaas	BPA	x		x		x	x			
Mike Viles	BPA	x		x		x	x			
Greg Tillitson	CMRC		x							
Edwin Thompson	ConEdison	x								
Rhett Trease	Duke (NERC RS)									
Tom Pruitt	Duke Energy Carolinas	x		x		x	x			
Jeffrey T. Baker	Duke Energy Midwest	x		x		x	x			
Howard Illian	Energy Mark, Inc.								x	
Dick Pursley	GRE									
David Kiguel	Hydro One Network	x								
Anita Lee	IESO	x								
Ron Falsetti	IESO (Ontario)		x							
Kathleen Goodman	ISO-New England		x							
Bill Shemley	ISO-New England		x							
Jim Cyrulewski	ITC Transmission	x								
Dennis Florom	LES		x							
Donald Nelson	MA Dept of Energy and Tele.		x							
Tom Mielnik	MEC		x							
Robert Coish	MHEB		x							
Terry Bilke	MISO		x							
Pete Lebro	National Grid	x								
Sydney Niemeyer	NRG Texas LP (NERC RS)									
Alden Briggs	NBSO									
Greg Campoli	New York ISO		x							
James W. Ingleson	New York ISO		x							
Alan Adamson	New York State Rel. Council		x							
Don Badley	NWPP (NERC RS)									
Brian Hogue	NPCC		x							
Guy Zito	NPCC		x							
Alan Boesch	NPPD	x								
Murale Gopinathan	NU		x							

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Commenter	Organization	Industry Segment								
		1	2	3	4	5	6	7	8	9
Mark Kuras	PJM		x							
Joe Willson	PJM		x							
Al DiCaprio	PJM		x							
Robert Johnson	PSC	x								
Rich Cornelius	RDRC		x							
Wayne Guttormson	SaskPower	x								
Tom Botello	SCE	x								
Jim Busbin	Southern Company Services	x								
Jim Viikinsalo	Southern Company Services	x								
Marc M. Butts	Southern Company Services	x								
Raymond Vice	Southern Company Services	x								
Roman Carter	Southern Company Services	x								
J.T. Wood	Southern Company Services	x								
Wayne Guttormson	SPC		x							
John Tolo	TEP (NERC RS)									
Roger Champagne	TransEnergie (Quebec)	x								
Bruce Sembeck	Tri-State Generation and Transmission Association, Inc.	x								
Nancy Bellows	WACM	x								
Darrick Moe	WAPA									
Terry Baker	WECC Reliability Coordination Subc.		x							
Jim Maenner	WPS		x							
Pam Oreschnick	XEL		x							

Index to Questions, Comments and Responses

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2. Do you agree with the list of proposed requirements included in the detailed description of the revised SAR?..... 12

3. Do you agree that the proposed standard(s) would be applicable to the Reliability Coordinator, Balancing Authority, Generator Owner, and Load-serving Entity? 22

4. The current standard on Bias requires a Balancing Authority to carry a minimum bias equal to 1% of peak load. As an example, in the Eastern Interconnection, this value is double current natural frequency response. Should the standard provide an incentive, such that a Balancing Authority can use a bias equal to their natural response, but less than 1% of peak, if the response is above an acceptable target? 25

5. Several commenters suggested response should be measured for an extended period after a frequency excursion, up to the point where automatic generation control (AGC) would take over. This was to ensure initial response wasn't withdrawn prematurely. Should the standard measure out to 60 seconds following an excursion?..... 28

6. Do you have other comments on the SAR? 32

Consideration of Comments on Second Draft of Frequency Response SAR

1. Do you agree that comments from the first posting of the SAR were adequately addressed?

Summary Consideration: Most commenters indicated that the SAR drafting team did provide an adequate response to the comments submitted with the first posting of the SAR.

Commenter	Yes	No	Comment
Energy Mark, Inc. (8) Howard F. Illian		✓	There is an expectation apparent in the first set of responses that indicates that the drafting team believes they have more knowledge of the solutions that will be required than the final standard will contain. The two greatest areas of insufficient understanding lie in the measurement of Frequency Response at less than the full interconnection level and the effect of the standard as envisioned on markets. These two problems are addressed in the comments to later questions in this comment form.
<p>Response: There were varying opinions on the scope of the second draft of the SAR. The drafting team revised the scope of the SAR again to focus solely on collection of data needed to model frequency response in each of the interconnections. Once that data is collected and analyzed, a standard can be proposed that includes performance requirements that will motivate entities to operate in ways that keep frequency response within an acceptable range.</p>			
NPCC CP9 Reliability Standards Working Group K. Goodman – ISONE Edwin Thompson – ConEd Pete Lebro – Ngrid Alan Adamson – NYSRC Bill Shemley – ISONE Ron Falsetti – IESO Murale Gopinathan – NU Ralph Rufrano – NYPA R. Champagne – TransÉnergie David Kiguel – Hydro One Greg Campoli – NYISO Jim Ingleson – NYISO Alden Briggs – NBSO Don Nelson – MA Dept. of Tel. and Energy Brian Hogue – NPCC Guy Vito – NPCC		✓	No - The intent of this SAR is unclear which highlights that this issue requires additional studies and investigation. In the future, it may be beneficial to develop a standard after a reliability issue is identified, and a specific standard can be developed and implemented to address the issue.

Consideration of Comments on Second Draft of Frequency Response SAR

Commenter	Yes	No	Comment
<p>Response: We agree that there needs to be additional studies and investigation. There were varying opinions on the scope of the second draft of the SAR. The drafting team revised the scope of the SAR again to focus solely on collection of data needed to model frequency response in each of the interconnections. Once that data is collected and analyzed, a standard can be proposed that includes performance requirements that will motivate entities to operate in ways that keep frequency response within an acceptable range.</p>			
<p>PJM Corporate Development Div. (2) Al DiCaprio Joseph D. Willson Mark Kuras</p>		<p>✓</p>	<p>The Resources Subcommittee in a response to the first draft states "A primary purpose of this standard is to collect information so informed decisions can be made before there is a problem." It is clear from that reply that the Resources Subcommittee wishes to undertake an analysis of the system and needs to collect additional information. This data collection effort may be laudable but it does not rise to the level of being a federally enforced mandatory standard. What if later on the 'data' were to show there is no problem, then there will be a need to rescind the standard and repay those who were non-compliant to a data collection effort.</p> <p>In their response to the first draft, the Resources Subcommittee cite a WECC study. But they have no similar study for the East. The Resources Subcommittee still has not shown that the decrease in sub-minute response is either (1) a problem or (2) nothing more than an indication that a larger system has more inertia and therefore less response than the smaller system in the past.</p> <p>This SAR, with its present theoretical focus, posits the BA as the responsible entity for governor response. Even those who agreed with the first posting that Frequency Response is an important issue - stated that a standard cannot define fixed norms (MRO, NYISO, IESO (2)). The BA is not responsible to instantaneous response -at best it can establish a capacity obligation but it can't guarantee continuous response.</p>
<p>Response: There were varying opinions on the scope of the second draft of the SAR. The drafting team revised the scope of the SAR again to focus solely on collection of data needed to model frequency response in each of the interconnections. Once that data is collected and analyzed, a standard can be proposed that includes performance requirements that will motivate entities to operate in ways that keep frequency response within an acceptable range.</p>			
<p>IESO (2) Ron Falsetti</p>	<p>✓</p>	<p>✓</p>	<p>Yes, with respect to the responses to the IESO's comments. However, the revised SAR appears to get somewhat mixed up between sub-minute frequency response performance with a longer term (> 1 minute) performance, and lacks clarity on what the proposed standard is intended to stipulate.</p> <p>Is the proposed standard intended to stipulate:</p> <ul style="list-style-type: none"> (a) a minimum frequency response performance level with which to determine if follow-up analysis is to be conducted, or, (b) requirements for calculating, measuring, reporting and analyzing frequency response, or, (c) both, in addition to, (d) requirements for generators to be equipped with governors and if so, the target to be responding to?

Consideration of Comments on Second Draft of Frequency Response SAR

Commenter	Yes	No	Comment
			<p>If (a) is not specified in the standard, we see a difficulty in stipulating the threshold for (b) and the target for (d).</p> <p>From the SDT's response to our previous comments ("The new requirements may need to be field tested for an extended duration before compliance with the requirements becomes mandatory. A long field test with extensive data collection may be needed before justifiable minimum performance standards can be identified"). It is our belief the standard is intended to stipulate (b) only. We see this as a necessary first step. However, it may then beg the question of the need of having a standard to develop the basis for a future standard. Might there not be other alternatives to achieve (b) such as by means of a request from the standing committees or NERC to the BAs and the regions to compile this information?</p>
<p>Response: There were varying opinions on the scope of the second draft of the SAR. The drafting team revised the scope of the SAR again to focus solely on collection of data needed to model frequency response within each interconnection. Once that data is collected and analyzed, a standard can be proposed that includes performance requirements that will motivate entities to operate in ways that keep frequency response within an acceptable range.</p>			
<p>BPA (1, 3, 5, 6) Bart McManus John Anasis Lynn Aspaas Mike Viles</p>	✓		<p>We are still concerned with a NERC standard countering some aspects of the standard we are in the process of drafting in WECC, so will continue to be active on the drafting team to insure it does not adversely impact the WECC standard.</p>
<p>Response: We encourage WECC to be actively involved in the drafting of the standard. Note that the drafting team revised the scope of the SAR so that the SAR focuses solely on the collection of data needed to model frequency response in each interconnection. This should not conflict with WECC's work on its frequency response standard.</p>			
<p>ITC Transmission (1) Jim Cyrulewski Beth Howell Mike Moltane Van Greening</p>	✓		
<p>ATC LLC (1) Jason Shaver</p>	✓		
<p>NERC Resources Subcommittee Raymond Vice – SOCO John Tolo – TEP Rhett Trease – Duke Sydney Niemeyer – Texas</p>	✓		

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Commenter	Yes	No	Comment
Don Badley – NWPP Carlos Martinez – CERTS Robert Rhodes – SPP Tom Vandervort – NERC Terry Bilke – MISO Bill Herbsleb – PJM Larry Akens – TVA Bart MaManus – BPA Mike Pitishnak – ISONE Gerry Beckerle – Ameren			
IESO (1) Anita Lee	✓		
Midwest Reliability Organization (2) Terry Bilke Wayne Guttormson Jim Maenner Al Boesch – NPPD (2) Terry Bilke – MISO (2) Bob Coish – MHEB (2) Dennis Florom – LES (2) Ken Goldsmith – ALT (2) Todd Gosnell – OPPD (2) W. Guttormson – SPC (2) Tom Mielnik – MEC (2) Darrick Moe – WAPA (2) P. Oreschnick – XEL (2) Dick Pursley – GRE (2) Dave Rudolph – BEPC (2) Joe Knight – MRO (2)	✓		
Southern Company Transm. (1) Marc Butts	✓		

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Committer	Yes	No	Comment
Raymond Vice Jim Busbin Roman Carter J.T. Wood Jim Viikinsalo			
Southern Company Transm. (1) Marc Butts Raymond Vice Jim Busbin Roman Carter J.T. Wood Jim Viikinsalo	✓		

2. Do you agree with the list of proposed requirements included in the detailed description of the revised SAR?

Summary Consideration: Most commenters disagreed with the proposed requirements included in the second draft of the SAR. The drafting team revised the SAR to focus solely on the collection of data needed to model frequency response in each interconnection. Additional SARs may be proposed in the future to propose requirements for operating in ways that support frequency response.

Committer	Yes	No	Comment
Arizona Public Service Co. (1, 5) Baj Agrawal			<p>The requirements on individual generator are unnecessary. The requirements should be on a group of generators in a control area to achieve a desired response. Thus, one could have some generators which are being operated as non responsive and the others which are responding well to offset for those which are not responsive.</p> <p>Additionally, the 10 MW size requirements are too restrictive and unnecessary. It should be plant based and should apply to plants of 100 MW or more aggregate capacity. In any realistic scenario, the smaller plants are not expected to contribute much to frequency response and hence subjecting them to frequency response requirements is uneconomic.</p>
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional SARs may be proposed with specific performance requirements for generators.</p>			
IESO(1) Anita Lee		✓	<p>The purpose is definitely suggested for under frequency conditions. However, when specifying that the generators shall have governors with droop etc... the role of the governor is for both high and low frequency conditions and not just underfrequency FRR. In a market environment it is very possible that not every generator will provide FRR services. Thus, the governor and governor deadband should be a requirement to interconnect to a power system. Generators that provide FRR shall have responsive governor and prime mover.</p> <p>The standard is based on balancing area response which will include generators and in some jurisdictions will include load. So is the intent that whatever load is considered, additional FRR resources such as generators are used to provide the required FRR?</p> <p>What about load as FRR providers? Some industrial facilities are capable to dynamically vary the load of the facility to frequency (ie virtual governor). The standard should apply to FRR providers which can be generators and loads.</p> <p>We agree that generator owners have an obligation to have working governors or provide explanations why not. The "10 MW" requirement should be evaluated for consistency with other standards. This should not hold up the progress of the SAR, but should be evaluated by the ultimate standard drafting team.</p>
<p>Response: The SAR drafting team agrees that governors must work for both high and low frequency events. One methodology under discussion would monitor both high and low events. The logic behind capturing low frequency (typically associated with trips of large generators) is that these events are much more common than large loss of load.</p>			

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Commenter	Yes	No	Comment
			<p>Any resource (load or generation) within the BA can provide frequency response. As envisioned, the standard would have provided a methodology whereby a BA could monitor its FRR providers. Load, by default, would have been measured along with generators when the BA calculated its performance.</p> <p>We agree that all generators may not need to provide frequency response. As envisioned, as long as the BA had adequate response, it would have had some flexibility under the proposed standard. Note, however, that the SAR has been revised and no longer includes these performance requirements. The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional SARs may be proposed with specific performance requirements for generators.</p> <p>As each new standard is developed, greater attention will be paid on the 'applicability'. The threshold of '10 MW' will need to be reviewed from a reliability-related perspective rather than 'consistency across all standards' perspective.</p>
<p>IESO (2) Ron Falsetti</p>		<p>✓</p>	<p>The intent of some of the requirements is again unclear to the IESO, for example.</p> <p>(i) Does Bullet #2 mean the flexibility in the calculation and reporting process or in the target/minimum frequency response level?</p> <p>(ii) Assuming Bullet #4 a requirement, and one which relates to the minimum level of frequency response, how is this requirement stipulated at this time while data collection and follow-up analysis are to be proposed as standard requirements and field testing has yet to commence? Same comment applies to Bullet #9.</p> <p>(iii) Bullet #6 appears to go beyond the sub-minute time frame. Further, we are unable to understand the leading sentence "Will not mandate a given amount of frequency response". We feel it is important that if poor frequency response performance in the sub-minute time frame is to be assessed and improved, specific target which may well be the minimum amount of frequency recovery would need to be stipulated.</p> <p>(iv) Bullet #7 also appears to be beyond the sub-minute time frame, which is to mandate AGC but which should be covered by other BAL standards.</p> <p>(v) Bullets #8 and #1 appear to be the main requirements for the proposed standard that are achievable at this time.</p> <p>(vi) As mentioned in (ii) above, we are unable to visualize how the range and target of response be stipulated in the standard before Bullets #1 and #8 are implemented.</p> <p>(v) If generators are allowed to seek exception, the standard should provide some basic premise that bounds the exception cases rather than leaving the door wide open and the decision solely to the judgment of the BAs and RROs.</p>
<p>Response: "Flexibility to meet the needs of each Interconnection" was intended to mean some flexibility in calculation (for example ERCOT is interested in "point C" (the extreme) of an event, but this point is not observable and has little value in the East. The WECC has expressed</p>			

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Commenter	Yes	No	Comment
			<p>concern for extended contribution of response (perhaps out several minutes). As envisioned, there would have been different target levels in each Interconnection. Interconnections would have been able to choose to have a tighter target droop setting.</p> <p>Bullet 4 relates to a statistically-sound measurement of frequency response at both the Interconnection and BA level. The data would have been collected and reported each year of the standard. In effect, the data collection in the first year of the standard would have served as the field test.</p> <p>“Long term target measure” intended to imply that the BA would be measured on many events over the year and its performance would have been evaluated on the whole, not on single events.</p> <p>It is true operation of AGC goes beyond the sub-minute window of time. The intent of this bullet was that the bias a BA provides should match its natural frequency response. Just as was originally intended in Policy 1, a BA calculates its natural response in one year and uses those observations to operate in the next year. The drafting team envisioned the same would occur in the originally proposed standard. The establishment of the “12 month basis” either on a calendar year or on a rolling 12 month period like CPS1 would have been determined during standard drafting.</p> <p>Note, however, that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional SARs may be proposed with specific performance requirements for generators.</p>
<p>NPCC CP9 Reliability Standards Working Group</p>		<p>✓</p>	<p>The proposed requirements nor the White Paper adequately make the case that there is a need for a frequency response standard at this time. However, it is recommended that the subject be further investigated. The analysis should evaluate if a frequency response standard that addresses the three major short term frequency control components (inertial response, governor response, and automatic generation control) are required. The report writers should include a broad range of participants including (at least) 3 OEM's (original equipment manufacturers) representing steam, gas and hydro generation control. Some specific issues that should be addressed are:</p> <ol style="list-style-type: none"> 1. Inertial Response: Evaluate historical changes in the inertial response of the electric grid as a result of changing power equipment designs and types of load. For example, the addition of new industrial and aero-derivative turbine-generators have lower inertia-power ratios than traditional nuclear/fossil units and, in addition, they are not base loaded (as a result of more efficient dispatching and improved power plant controls). 2. Governor Response: Evaluate generation governor performance as a result of newer, more configurable prime mover controls. Digital controls provide increased plant reliability, however, this may be at the expense of decreased governor response. For example, the use of main steam pressure controls on steam units and low NOx controls on gas turbines may

Consideration of Comments on Second Draft of Frequency Response SAR

Commenter	Yes	No	Comment
			<p>produce unexpected droop output responses.</p> <p>3. Automatic Generation Control (AGC): Perform a control area survey to determine if there is sufficient regulation capacity within control areas to maintain generation and load balance. Include a review of incentives and penalties for generators to respond accurately and reliably to AGC signals.</p>
<p>Response:</p> <p>When the first draft of the SAR was posted for comment, the drafting team asked stakeholders if they felt that there was a reliability-related need for a standard that focuses on frequency response, and most stakeholders indicated there is a reliability-related need for a frequency response standard.</p> <p>While we don't know the exact amount of frequency response needed for each interconnection, a 12 year decline in response when it is expected to be increasing and without knowledge of where the response is low is a reliability concern.</p> <p>Failure of generators to follow AGC signals would appear to be either a CPS issue or a business practice.</p> <p>The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>			
<p>Energy Mark, Inc. (8) Howard F. Illian</p>		<p>✓</p>	<p>Requirements that apply to individual generators cannot be implemented as indicated in the standard without failing to comply with Market Interface Principle 2. Frequency Response (Governor Response) have economic costs associated with standing ready to supply. These costs have been documented in EPRI Reports on Ancillary Services. If any generator is given an exception to not provide a response, that generator will also be given a market advantage resulting from the savings they will receive by not providing a response. The SAR as currently written will create a market advantage for all generators below 10 MW and all generators that are given an exception to the governor response requirement. The alternatives to these generator requirements are either not have a competitive market and decide the provision of frequency response administratively (the old VIU method), or determine who provides frequency response through a competitive market process.</p>
<p>Response: We appreciate the comments on Market Interface Principle 2. As envisioned the original SAR proposed measuring the approximately 140 Balancing Authorities rather than the roughly 4000 individual generators (<i>NERC 2004 Generating Unit Statistical Brochure</i>). The SAR intended to be indifferent to what entity provides response (whether load, large generator or small generator). It was intended to measure the BA, with the expectation that the BA would have had to document exceptions that would have been reviewed by the BA and the Region for reliability implications. As envisioned, the drafting team did not expect owners to install many small generators rather than one larger generator to avoid providing data for the standard.</p>			

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Commenter	Yes	No	Comment
<p>Note that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators.</p>			
<p>Duke Energy Midwest (1, 3, 6) Jeff Baker</p>		<p>✓</p>	<p>Not totally, I need to understand more of what would be required to meet the obligation of Generator owners to equip generating units with nameplate ratings of 10 MW or greater, with a governor capable of providing immediate and sustained response to frequency deviations.</p>
<p>Response: As envisioned, all generators would have governors that respond to frequency deviations. The BA and the Region would need to be aware of exceptions for study purposes. If the BA's performance were significantly below the norm, an analysis and assessment would have been required.</p> <p>Note, however, that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators.</p>			
<p>BPA (1, 3, 5, 6)</p>		<p>✓</p>	<p>RE: bullet 2: Instead of flexibility to meet interconnection needs, each interconnection should have its own requirements on frequency response, this is due to the unique frequency response of each interconnection.</p> <p>re bullet 4: This Standard will need to measure frequency response for the duration of the frequency deviation. Measuring it until frequency recovers will overlap with the Balance Resources and Demand standard slightly, but will give much better results than simply going out a few minutes.</p> <p>re bullet 6: Target levels should be BA specific to insure there is not an incentive to lean on other BA's. How will the target levels be calculated?</p> <p>Re bullet 7: BAs must be free to operate their automatic generation control in any method they desire. The tie-line frequency bias is used for compliance monitoring, but must not be a requirement for the actual automatic generation control algorithm. Recommend this be modified to state: Balancing Authorities will calculate an Area Control Error for monitoring purposes using tie-line frequency bias.</p> <p>re bullet 8: WECC should call FRC surveys for WECC instead of NERC.</p> <p>re bullet 9: Recommend generating unit nameplate of 10 MW plus multi-unit installations of 10 MW or greater be required to have a governor(s) capable of providing immediate and sustained response to frequency deviations.</p> <p>Re bullets 9 and 10: Currently wind generation does not have governor response capability. Due to the amount of wind integration planned in the next decade, new installations should have a requirement for frequency responsive units. Historically, requirements have provided incentive for manufacturers to modify machine design (low-voltage ride-through capability, voltage control capability) to meet the requirements.</p>

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Commenter	Yes	No	Comment
			<p>Response: We agree – the proposed standard would have assumed that each interconnection had a unique frequency response. Regarding bullet 4, some thought would have to be given on how to measure over the entire duration of a frequency disturbance (typically up to 15 minutes for a DCS event) and how to remove AGC response from the estimate of frequency response. Suggestions are welcome. However, the Interconnection would be able to define specific requirements.</p> <p>Regarding bullet 8, WECC has the right to call FRC Surveys for WECC, as does NERC (historically through the NERC OC and Resources subcommittee)</p> <p>We agree with your comment regarding bullet 9.</p> <p>Regarding wind generation, governor response is normally provided by calling on more energy from the prime mover when frequency drops. We are unsure how this would normally be done with wind, unless the goal would be to under-utilize the wind during normal operation and then call for full available energy when the frequency drops. Again, this standard as originally proposed, was intended to measure BA response- as long as the pool of generation within the BA provided adequate response, it would have allowed the BA flexibility on which generators provide that response.</p> <p>Note, however, that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>
<p>ATC LLC (1) Jason Shaver</p>		<p>✓</p>	<p>The SAR identifies Load-Serving Entities as a function that will be affected by any requirements that are developed from this SAR. Question three, on this comment form, goes one step further and asked the industry if the proposed standard would be applicable to Load-Serving Entities. ATC was unable to determine from the detailed description section any requirements that would apply to a Load-Serving Entity. With that being said ATC suggests that language be added to the SAR that would require the Load-Serving Entities to be responsible for procurement of adequate frequency response.</p> <p>ATC found bullet number six lacks a clear description of the standard that could be developed. ATC recommends that this bullet be rewritten to better inform the industry of the type of standard the SAR requestor wants developed. Is the SAR requestor requesting a standard that will not mandate frequency response, but instead recommend a frequency response? ATC, in general, feels that standards should require something not make recommendation. or, Is the SAR requestor requesting that a standard be develop that would set long-term Interconnection target levels and then require the industry to meet those target-levels? ATC is in support of a standard that would require entities to set long-term target levels and require other entities to meet the determined target levels. ATC is not in support</p>

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Commenter	Yes	No	Comment
			<p>of a standard that requires functions to set long-term target levels but not require other entities to meet those levels. Lastly, this bullet should clearly identify who are the responsible entities.</p> <p>ATC is concerned that Generator Owners could be allowed to categories the same generating units differently. A Generator Owner that aggregates their units for purposes of determining a voltage schedule (VAR-001-1) should then not be allowed to individualize their units for this standard to escape under the nameplate rating of 10 MW.</p>
<p>Response: We agree that the LSE is the ultimate beneficiary of frequency response. However, since the standard isn't mandating a particular amount of frequency response for individual events, it would seem inappropriate to have the LSE obtain a given amount of frequency response for any specific event.</p> <p>As originally proposed, this standard would have been primarily a technical/preparedness standard. Initially, the target levels of frequency response would have been based on observed interconnection history.</p> <p>We agree that bullet # 6 needs additional clarification for it to be understood. The long-term measure was envisioned to be an annual metric, based on a calendar year or on a rolling 12 month basis like CPS1 that captures many events over the year to come up with a composite estimate of performance. It was expected that the standard would allow interconnections to set their own frequency response limits. Absent specific frequency response bounds for an interconnection, the standard would have used recent history. The standard was intended to focus on the frequency response needs of each interconnection, and would have allocated a portion of each interconnection's frequency response responsibility to each of the interconnection's Balancing Authorities.</p> <p>Note that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>			
PJM Corporate Development Div. (2)		✓	<p>The SAR is still not clear about what is to be developed in the standard. Of the ten bulleted items several seem to show a misunderstanding between a sub-minute frequency response obligation and Automatic Generation control. The RS must make clear what it wants to do. Sub-minute frequency response occurs with or without frequency bias; sub-minute frequency response is not helped or hurt by having AGC. This is a major problem with the proposal. It is not clear and it is not definitive.</p> <p>Item 1 indicates the standard will be a Report</p> <p>Item 2 states the standard will be flexible (that is mandated in the Process Manual)</p> <p>Item 3 seems to indicate that non-compliance will be met with a requirement to analyze the incident (if this is standard is so important why isn't every event critical?)</p> <p>Item 5 is the most unusual - the standard will not mandate a response but will provide</p>

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Commenter	Yes	No	Comment
			<p>"LONG-TERM" targets (how is it that a sub-minute response gets translated into a long-term target?)</p> <p>Item 6 is to mandate AGC. This is not related to sub-minute frequency response.</p> <p>Item 7 is to mandate a post-incident survey. Again this is a good idea but it a data collection mandate - it is not a frequency response standard. The RS has the tools to collect that information today, without the need to resort to mandatory penalties.</p> <p>Item 10 will allow generators to seek exceptions (which means that the RS will allow a generator to opt out and still require the BA to comply. In the absurd case that all generators opt out (let's say the BA has only nuclear units) then according to the RS, the BA is held non-compliant. This is just not a good idea.</p> <p>In summary: #1 is a calculation and report on response but no measure of performance; #3 requires a BA and the RRO to perform an analysis if response is measurable (by what amount) below the norm (which is a constantly moving value); #4 is the only possibility for true standard; #9 generators must have governors is more a certification issue than a BA standard. Three of the bullets are not requirements (#2, #5, and #10). Two of the bullets are already in other standards while two of the bullets duplicate each other. The SAR team needs to better describe exactly what is being proposed to be in the standard so that the industry can evaluate the proposal. The industry does not need to get involved in a research project.</p>
<p>Response: The standard was intended to measure response within the first minute (or longer if determined it was needed by the interconnection) following a frequency disturbance (which is prior to the timeframe when AGC contributes to frequency stabilization). Since natural frequency response is much less than Bias for most control areas, AGC will make a contribution to frequency stabilization over a period of time.</p> <p>Regarding item 1, part of this technical/readiness standard was envisioned as a report, much as BAs are responsible to calculate and report CPS or DCS. Refer to the <i>NERC Reliability Standards Process Manual</i> for the different types of standards.</p> <p>Regarding item 2, thank you.</p> <p>Regarding item 3, the standard would not have required analysis of single events, but rather performance over a 12-month period.</p> <p>Regarding item 5, as envisioned, the BA would have calculated its response based on several events over the long term (12 months). Interconnection performance is tracked by the Regions and NERC over years.</p> <p>Item 6 refers to using a bias in AGC that is reflective of the BA's natural frequency response. However, based on comments, the Resources Subcommittee agrees this requirement more appropriately belongs in the AGC standard.</p>			

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Commenter	Yes	No	Comment
			<p>Regarding item 10, the SAR was not proposing that generators may opt out of participation. As envisioned, generators were expected to have governors that respond to frequency. Exceptions would have been documented. Nevertheless, the standard would have measured overall BA response.</p> <p>Note, however, that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>
<p>Duke Energy Carolinas (1, 3, 5, 6) Tom Pruitt</p>	<p>✓</p>	<p>✓</p>	<p>Generally, yes, but more clarity is desired on a number of points, e.g., who decides which generators will be granted exemptions - the BA or the RRO; who sets the criteria - BA or RRO. In addition, I think some of the proposed requirements may conflict with each other as details are driven out; if a number of a BA's generators applied for and were granted exemptions from governor response, the (anticipated) 5% droop range may need to be adjusted for the generators which do provide governor response for the BA.</p> <p>Governor response is not the only equipment consideration at the plant/unit. Plant/unit control systems also should be operated so that the desired unit response will occur and be sustained.</p>
			<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>
<p>NERC Resources Subcommittee</p>	<p>✓</p>		<p>Re Bullet 7 - BAs must be free to operate their automatic generation control in any method they desire. The tie-line frequency bias is used for compliance monitoring, but should not be a requirement for the actual automatic generation algorithm. Recommend this be modified to state : Balancing authorities will calculate an Area Control Error for compliance reporting purposes using tie-line frequency bias.</p>
			<p>Response: Based on comments, the Resources Subcommittee recommends this requirement more appropriately belongs in the AGC standard.</p> <p>The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>
<p>ITC Transmission (1) Jim Cyrulewski</p>	<p>✓</p>		<p>However some bullets need further clarification</p> <p>Bullet 2: The standards process allows for regional differences. What more flexibility is needed?</p>

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Commenter	Yes	No	Comment
Beth Howell Mike Moltane Van Greening			<p>Bullet 6: Keep this bullet simple by simply stating target levels will be set for BAs and RROs to take actions cited. Also a sub-bullet needs to be added on what are options to get additional frequency response; specifically for the BAs. In particular what can the BAs do if the Generation Owners do not provide adequate response. The BAs don't have generation interconnection agreements, the transmission owners do.</p>
<p>Response: As originally envisioned, the primary differences would have been at the Interconnection level. For example, it was envisioned that there might be more than one authorized method that could be used by a BA to calculate response.</p> <p>We agree that transmission owners have interconnection agreements that provide leverage to get generators to perform through “good utility practices” provisions.</p> <p>The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p>			
Midwest Reliability Organization (2)	✓		<p>In particular we agree that generator owners have an obligation to have working governors or provide explanations why not. The 10 MW requirement should be evaluated for consistency with other standards. This should not hold up the progress of the SAR, but should be evaluated by the ultimate standard drafting team.</p>
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. Once more is known about frequency response, additional standards may be proposed with specific performance requirements for generators. This will allow analyses to focus on the different types of response and should, eventually, facilitate the development of another standard that includes performance requirements aimed at providing a specified amount of frequency response.</p> <p>With respect to the 10 MW threshold - As each new standard is developed, greater attention will be paid on the ‘applicability’. The threshold of ‘10 MW’ will need to be reviewed from a reliability-related perspective rather than ‘consistency across all standards’ perspective.</p>			
Southern Company Transm. (1)	✓		

3. Do you agree that the proposed standard(s) would be applicable to the Reliability Coordinator, Balancing Authority, Generator Owner, and Load-serving Entity?

Summary Consideration: Although most commenters agreed with the proposed applicability, the drafting team has reduced the scope of the proposed standard, and the proposed applicability has been changed. The revised SAR shows that, in addition to the functional entities listed above, the Generator Operator may have some requirements in the proposed standard.

Commenter	Yes	No	Comment
Tri-State G&T (1) Bruce Sembeck		✓	Since the standard is concerned with governor regulated frequency response of generating units that applicability should also apply to the Generator Operator (currently this box is not checked). It will ultimately be the Generator Operators responsibility to ensure frequency responsiveness of the units, e.g. ensuring that the unit is not operating in Valve Wide Open mode.
<p>Response: Note that the SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. We will include generator operator as an applicable entity.</p>			
PJM Corporate Development Div. (2)		✓	This question would require an assumption of what the standard would be. If the standard is to provide sub-minute frequency response, then the only entity should be the generator owner.
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection.</p>			
IESO. (2) Ron Falsetti		✓	Not having a good handle on what the standard is intended to achieve and stipulate, we are unable to comment on whom the standard should apply to. Among the ones included in the question, we are unclear on the role of the RC in requiring anyone to install devices or take actions to improve frequency response in day to day operation.
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. We expect the Reliability Coordinator's role to be limited (most likely only alerting other Reliability Coordinators of generation or load events causing significant frequency excursions)</p>			
Duke Energy Midwest (1, 3, 6) Jeff Baker		✓	
IESO (1) Anita Lee	✓	✓	The Generator Operator may also have some responsibilities, such as the selection of control modes. We're not sure what the LSE can do regarding the standard. They cannot control response from load. The exception may be coordination of frequency response with UFLS. Planners may have some responsibilities with regard to new interconnections and also using observed frequency response in models as opposed to theoretical response.

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Commenter	Yes	No	Comment
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The LSE does need to provide some of this data and is listed as an applicable entity in the revised SAR.			
BPA (1, 3, 5, 6)	✓	✓	The only portion we can think of that would applicable to the Load-serving entity is for the load-serving entity to report their underfrequency load shedding settings. We believe LSEs should be removed as applicable entities.
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The LSE does need to provide some of this data and is listed as an applicable entity in the revised SAR.			
Duke Energy Carolinas (1, 3, 5, 6) Tom Pruitt	✓		However, the standard applies to each entity in different ways. The lion's share of responsibility lies with the BA to insure that the aggregate of the Gen Owners responses provide the response needed.
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection.			
WECC Reliability Coordination Subc.	✓		The only portion we can think of that would applicable to the Load-serving entity is for the load-serving entity to report their underfrequency load shedding settings. We believe LSEs should be removed as applicable entities.
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The Load-serving Entity does need to provide some of this data and is listed as an applicable entity in the revised SAR.			
ATC LLC (1) Jason Shaver	✓		Please see comment in questions two about the Load-serving Entity.
Response: Please see the response to your comment on question 2.			
Midwest Reliability Organization (2)	✓		The Generator Operator may also have some responsibilities, such as the selection of control modes. We're not sure what the LSE can do regarding the standard. They cannot control response from load. The exception may be coordination of frequency response with UFLS. Planners may have some responsibilities with regard to new interconnections and also using observed frequency response in models as opposed to theoretical response.
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The Load-serving Entity does need to provide some of this data and is listed as an applicable entity in the revised SAR.			
NERC Resources Subcommittee	✓		The proposed standards may apply to LSEs when demand side resources are utilized for frequency control, but will not apply to many of the LSEs. There may also be cases where Generator Operators have obligations under the standard.
Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The Load-serving Entity does need to provide some of this data and is listed as an applicable entity in the revised SAR.			
Energy Mark, Inc. (8)	✓		The requirements applicable to the Generator Owner and Load-serving Entity may only

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Commenter	Yes	No	Comment
Howard F. Illian			include requirements for measurement processes, not necessarily requirements to provide any frequency response.
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. The Load-serving Entity does need to provide some of this data and is listed as an applicable entity in the revised SAR.</p>			
NPCC CP9 Reliability Standards Working Group	✓		If required.
<p>Response: Thank you.</p>			
ITC Transmission (1) Jim Cyrulewski Beth Howell Mike Moltane Van Greening	✓		Also pertains to Generator Operator.
<p>Response: The SAR was revised and will address only the collection of data needed to model frequency response in each interconnection. In the revised SAR, the Generator Operator is responsible for providing data when the BA's performance is below an Interconnection target.</p>			
Southern Company Transm. (1)	✓		

4. The current standard on Bias requires a Balancing Authority to carry a minimum bias equal to 1% of peak load. As an example, in the Eastern Interconnection, this value is double current natural frequency response. Should the standard provide an incentive, such that a Balancing Authority can use a bias equal to their natural response, but less than 1% of peak, if the response is above an acceptable target?

Summary Consideration: While most commenters supported this suggestion, there was not consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. The drafting team will forward these comments to the Director of Standards Development so that they can be addressed by the Balance Resources and Demand standard drafting team or another drafting team. This shall serve as a summary response to all comments provided.

Commenter	Yes	No	Comment
IESO. (2) Ron Falsetti		✓	(i) The question seems to get the sub-minute and longer-term targets intertwined. We are unclear on which "standard be provided an incentive". Is it the proposed sub-minute standard which has yet to be determined or the current standard on Bias? If it is the former, then this question seems a bit premature as we don't even know what the performance target for sub-minute response should be. If it's the latter, then the issue belongs to other BAL standards.
		✓	The RS again is avoiding the issue of what sub-minute frequency response it MUST mandate. The 1% is related to the frequency bias setting (basically a long term average response). The BRD deals with the longer term issue of frequency response - this standard was designed for the shorter-term response. If the RS is willing to accept under-biased systems then it would seem to be going against conventional wisdom, and should explain why it would even consider such an idea. If the real intent of this frequency SAR is to establish a minimum frequency response value then the SAR needs to state that. Perhaps the SAR should establish a minimum 1 minute response for every generator (if they can't provide it they are obligated to contract for it from another unit) and maybe a 1 minute average over a week, month, or year if a longer term value is needed. However, since the SAR authors state the problem is sub-minute response, it is suggested that the long term response is better be addressed by the BRD standard. In addition the SAR does not adequately address the load portion of the frequency response. The standard seems to presuppose the solution is having governors.
BPA (1, 3, 5, 6)	✓	✓	The standard should not provide an incentive, but the standard should provide a methodology that would allow a Balancing Authority to calculate a bias based on their natural response, provided that response is above an acceptable target.

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Commenter	Yes	No	Comment
Southern Company Transm. (1)	✓		The 1% minimum frequency bias is obsolete and does not take into account the changes in interconnection frequency response over recent years. If not modified, it will lead to increased frequency oscillations within the interconnections and needless maneuvering of generating assets with associated wear and tear on these assets.
IESO(1) Anita Lee	✓		There should be a safeguard in place, such that if frequency performance declines, the industry reverts to the 1% minimum.
Midwest Reliability Organization (2)	✓		There should be a safeguard in place, such that if frequency performance declines, the industry reverts to the 1% minimum.
Energy Mark, Inc. (8) Howard F. Illian	✓		There is a minimum frequency response below which the interconnection will be less reliable than acceptable. We currently do not know what this value is but we do know that a value exists. We also know that this value is less than the 1% of peak load specified in the current standards. A standard that arbitrarily requires a 1% of peak load response without a technical justification based on reliability cannot be called a reliability standard. However, even though we do not know the minimum frequency response below which the interconnection will be less reliable than acceptable, we can perform the work necessary to estimate a reasonable value for a minimum frequency response and assign responsibility for that response among the Balancing Authorities on an interconnection. A Frequency Response Standard without this characteristic cannot maintain reliability of the interconnection.
Duke Energy Midwest (1, 3, 6) Jeff Baker	✓		I believe that an incentive should be included in the standard.
Duke Energy Carolinas (1, 3, 5, 6) Tom Pruitt	✓		Calculation of each BA's bias should be based on a rigorous analysis which demonstrates that the BA can provide the expected response, regardless of peak load. This is consistent with the proposed requirements - 'technically-sound calculation and report of frequency response' and 'Will not mandate a given amount of frequency response'.
ATC LLC (1) Jason Shaver	✓		Although ATC is in support of this recommendation, we feel that it should be classified as an "allowable exemption" not an "incentive".
NERC Resources Subcommittee	✓		The 1% minimum frequency bias should be evaluated to take into account the reliability requirements of the interconnections. frequency response over recent years. We suggest that the minimum bias be addressed during the development of the Frequency Response Standard. It is unclear what the word "incentive" means above.
ITC Transmission (1) Jim Cyrulewski Beth Howell	✓		However this requirement still does not address the need for enough frequency response on the system.

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Commenter	Yes	No	Comment
Mike Moltane Van Greening			

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5. Several commenters suggested response should be measured for an extended period after a frequency excursion, up to the point where automatic generation control (AGC) would take over. This was to ensure initial response wasn't withdrawn prematurely. Should the standard measure out to 60 seconds following an excursion?

Summary Consideration: There was not consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. The drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This window may be reduced during the standard drafting phase. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by Automatic Generation Control action.

Commenter	Yes	No	Comment
Duke Energy Midwest (1, 3, 6) Jeff Baker			I did not provide an answer but believe that this is a decision that could be made over time and not necessarily with the inception of the standard.
Response: We agree.			
Arizona Public Service Co. (1, 5) Baj Agrawal		✓	Most of the frequency recovery happens in first 30 seconds. Thus anything more than 30 seconds is unnecessary. It is also seen that the response of a unit varies greatly within that 30 seconds period. Thus, it is very important that the measured response be the average response over the 30 seconds period and not be the response at 30 seconds.
Response: We agree that frequency response should be measured over a period of time (as opposed to a measure for a single event).			
Southern Company Transm. (1)		✓	AGC response begins within only a few seconds after the disturbance with a maximum ramp rate achieved within three to five minutes. Governor response and load frequency response typically peak within 30 seconds. There is some logic to monitoring governor response for sustainability past its initial peak, but we have not seen anything about that in this SAR.
Response: There was no consensus on this matter. The drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.			
		✓	The standard should measure out to when the frequency recovers. This could be up to the 15 minute DCS limit. AGC control may or may not kick in within 60 seconds depending on deadbands, etc. However, generators on setpoint control may hold for between 10 and 60 seconds then drop back off prior to AGC pulses reaching the generator. In order to see the full response of a BA it is necessary to see data for the full event rather than just the first minute. Rather than overlapping the BRD standard, this will work hand-in-hand with this standard.
Response: There was no consensus on this matter. The drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window			

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Commenter	Yes	No	Comment
of time where frequency response appears to be masked by AGC action.			
NPCC CP9 Reliability Standards Working Group		✓	This question is not clear. AGC control pulses generation every 5 seconds, therefore, the measurement should be based on the amount of time it takes to restore the generation load balance.
Response: In general, following a unit trip, frequency will not recover until the contingent BA has replaced the energy that was lost. This typically takes up to 15 minutes. Unless over-biased, a non-contingent BA will not contribute AGC response to a frequency event.			
PJM Corporate Development Div. (2)		✓	Unsure as to what is being suggested here. The SAR drafters need to be specific about what requirements are needed and how they will be measured. The details contained in the white paper are supporting information but they do not define the standard that is being proposed.
Response: There was no consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections.			
NERC Resources Subcommittee	✓	✓	AGC response begins within only a few seconds after the disturbance with a maximum ramp rate achieved within three to five minutes. Governor response and load frequency response typically peak within 30 seconds. There is logic to monitoring governor response for sustainability past its initial peak and this should be investigated during standard development.
Response: We agree with this comment. The drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.			
IESO(1) Anita Lee	✓		Sixty seconds is a reasonable balance to capture the period prior to AGC response.
Response: Agree – However, several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.			
IESO. (2) Ron Falsetti	✓		This should cover the entire spectrum of immediate response before AGC kicks in.
Response: Agree However, several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.			
Energy Mark, Inc. (8) Howard F. Illian	✓		There are two issues associated with this question. The first is that the change in instantaneous frequency be limited to within a range that limits the risk of a cascading outage on the interconnection. The second is that each generation technology provides a different response characteristic within the first minute after a sudden frequency excursion. Work

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Commenter	Yes	No	Comment
			performed at NIPSCo and published by IEEE indicated that a measurement interval of one to two minutes worked well for the measurement of frequency response. Without specific knowledge of the nature of the individual responses that make up the sustained frequency response to an excursion, it may be difficult to justify the selection of a measurement interval shorter than one-minute that might put some generation technologies at a disadvantage with respect to the measurement method. This is a subject that the drafting team should technically evaluate before including a specific measurement period in the standard.
<p>Response: Several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.</p>			
Duke Energy Carolinas (1, 3, 5, 6) Tom Pruitt	✓		At least. Based on the words in the SAR Purpose statement, 'this proposed standard coordinates with and complements the Balance Resources and Demand standards, which addresses Interconnection frequency control generally 5 minutes and longer', it seems that this standard should cover out to the 5 minute mark of an event. AGC actions will commence at the first scan cycle or two after the event (5 -15 secs), but the actual generation response may not settle out for several minutes, depending on the type and amount of generation on AGC at the time.
<p>Response: Several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.</p>			
Midwest Reliability Organization (2)	✓		This is a significant issue, because if the governor system withdraws the unit's support prior to the recovery of frequency, this does have a problematic impact. A period of at least 60 seconds should be considered, and 60 seconds may not be adequate as often frequency recovery of the interconnection extends beyond the initial 60 seconds.
<p>Response: Several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action.</p>			
ITC Transmission (1) Jim Cyrulewski Beth Howell Mike Moltane Van Greening	✓		Needs to be verified with a field trial.
<p>Response: Several commenters indicated there may be value in analyzing response for several minutes and the drafting team modified the SAR to specify that data will be collected to measure response over a period up to 5 minutes. This should provide sufficient data to analyze frequency response and should help identify the window of time where frequency response appears to be masked by AGC action. Note that the</p>			

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Commenter	Yes	No	Comment
			drafting team modified the scope of the entire SAR to focus solely on collecting data needed to model frequency response in each of the interconnections.
ATC LLC (1) Jason Shaver	✓		

6. Do you have other comments on the SAR?

Commenter	Comment
ITC Transmission (1) Jim Cyrulewski Beth Howell Mike Moltane Van Greening	Reliability and Market Interface Principles 3, 5 and 6 should be checked as well.
<p>Response: We made this change.</p>	
PJM Corporate Development Div. (2)	Please be clear about the terminology. Frequency response comes in many flavors - sub-minute; several minutes; and hours. The RS seems to touch on all of them in this proposal.
<p>Response: There was no consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. The data collection will include data to model and analyze frequency response up to five minutes.</p>	
Southern Company Transm. (1)	In our opinion, this SAR, or one like it, is required to ensure that the primary frequency response of the interconnections and the BAs do not deteriorate to a point where 1) the interconnection can not adequately respond to major generator trips (including potential multiple contingencies which, though rare, do happen) and 2) primary frequency response of the BAs is inadequate to support islanding during severe local disturbances, thus allowing local disturbances to cascade into regional or interconnection wide disturbances. Primary frequency response is declining in at least the Eastern and Western Interconnections. WECC has taken a proactive approach to addressing this problem, but there is no similar work being done in the Eastern Interconnection. This SAR, or one like it, is needed to take the best practices in the industry, wherever they may be found, and utilize them to protect the interconnections from disturbances that could be avoided if we take action now rather than waiting until the problems actually occur.
<p>Response: There was no consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. Your support is very much appreciated.</p>	
IESO. (2) Ron Falsetti	(i) The SAR does not address the load portion of the frequency response but it indicates that the standard would apply to the LSEs as well. Please clarify or eliminate LSE from the Reliability Function check list. (ii) We feel that the SAR needs to be very clear on what the proposed standard is intended and what will be included. Conducting calculation, measuring and report on frequency excursion events followed by analysis would help to ascertain whether or not poor performance exists. However, the determination of poor performance also relies on having a minimally acceptable level to gauge. If the standard is to provide requirements for calculation, reporting and conducting analysis only, then there

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Commenter	Comment
	needs to be some general guideline on the threshold for reporting and analyzing, which in turn begs the question of should this "guideline" be included as the initial standard, whose compliance would not be enforced until sufficient experience has been gained and field test conducted, with possible revision as experience and field test so suggest. Absent a minimum performance level, the requirements for governor setting would be difficult to determine.
<p>Response: There was no consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. The Load-serving Entity will need to provide some of the data needed to model frequency response.</p>	
<p>Energy Mark, Inc. (8) Howard F. Illian</p>	<p>The current measurement methods for determining individual Balancing Authority Frequency Response may not be reliable. This is because the current measurement methods only capture a small sample of the frequency responses provided limited to only several minutes per year. The metering methods we currently use on the interconnection can shed some light on this problem. Since the each BA measures its Tie Line Error with common metering with adjacent BAs, the sum of the Tie Line Errors over the total interconnection must equal zero at all times. Each tie line has a positive error for one BA and a negative error of equal value to the other BA that the tie line connects. If the errors must sum to zero, then the change in errors must also sum to zero between any two points in time. Since the Frequency on an interconnection is the same throughout the interconnection at any point in time for the purpose of the frequency response measurement, the change in frequency between two points in time must also be the same throughout the interconnection. Therefore, the change in tie-line error divided by the change in frequency must indicate a total frequency response for the interconnection as measured by the sum of the individual BA frequency responses must be equal to zero. In other words, there is a BA or a set of BAs that cause each frequency response on the interconnection. Only knowledge of the distribution of individual frequency responses among BAs will provide the necessary information to determine whether or not the frequency response indicated by current measurement methods will maintain adequate reliability. It may not be the average frequency response to large events that indicates interconnection reliability, but the distribution of frequency responses among BAs including both the positive and negative responses. Therefore, the measurement methods included in the standard should have the goal of capturing the distribution of both positive and negative frequency responses over the entire range of frequency operation should be a goal of standard. The measurement methods suggested will not accomplish this goal.</p>
<p>Response: We agree with the concerns on errors induced in the measurement process. The standard will be designed to capture enough events to provide a statistically-sound estimate of Balancing Authority response. We also agree that the distribution of responses needs to be considered.</p>	
<p>Duke Energy Midwest (1, 3, 6) Jeff Baker</p>	<p>I believe we have to address the frequency issue, but feel that it can be developed over time proactively.</p>
<p>Response: The revised SAR focuses solely on the collection of data needed to model frequency response. The data can be analyzed and additional standards can be developed that build on the results of those analyses. This supports your suggestion that the standard(s) be</p>	

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Commenter	Comment
developed proactively over time.	
NERC Resources Subcommittee	In our opinion, this SAR, or one like it, is required to ensure that the primary frequency response of the interconnections and the BAs do not deteriorate to a point where 1) the interconnection can not adequately respond to major generator trips (including potential multiple contingencies which, though rare, do happen) and 2) primary frequency response of the BAs is inadequate to support islanding during severe local disturbances, thus allowing local disturbances to cascade into regional or interconnection wide disturbances. Primary frequency response is declining in all Interconnections, Eastern, Western and ERCOT. WECC and ERCOT have taken a proactive approach to addressing this problem, but there is no similar work being done in the Eastern Interconnection. This SAR, or one like it, is needed.
Response: There was no consensus on the scope of the proposed requirements, and the drafting team revised the SAR to focus solely on collecting data needed to model frequency response in each of the interconnections. Your support is very much appreciated.	