ISO Planning Standards Remedial Action Scheme Guidelines Update

Straw
Proposal

September 19, 2022

Infrastructure & Operational Planning

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1 Introduction

The ISO resumed the Planning Standards – Remedial Action Scheme Guideline Update stakeholder process[1] in July 2022 to discuss potential revisions to the ISO Remedial Action Scheme (RAS) guidelines which are part of the California ISO Planning Standards (ISO Standards). The RAS guidelines, along with the other requirements in the Planning Standards, complement the existing NERC/WECC Reliability Standards and ensure a secure and reliable ISO infrastructure development. After the stakeholder meeting on July 22, 2022, the ISO received comments from various stakeholders[2]. The comments received are the following:

1) Support for removing redundant language that PRC-012-2 already covers;
2) Refinements to clearly illustrate when a RAS is considered “complex” and “unmanageable”;
3) Suggestions for clearer language in the RAS guidelines (i.e., local contingencies, system elements and variables, unnecessary actions, materially increases, exceptions, etc.);
4) Suggestion not to have specific guidelines for any specific fuel type resources as this could be discriminatory (i.e., technology neutral);
5) Caution in changing the 1150/1400 MW generation tripping limit for single-element and multiple-element contingency;
6) RAS with bi-directional flow is not recommended;
7) Weighing the benefits of RAS vs. RAS interaction, complexity of RAS design, long-term operating cost;
8) Considering RAS to be temporary measures to connect needed resources but should be phased out with implementation of permanent transmission upgrades;
9) Concerns about dynamic arming or disarming of generating units that make the RAS more complex;
10) N-0 RAS should be avoided;
11) Concerns about lowering the 1150 MW generation tripping limit for single element contingency could contribute to long-term curtailment of generation facility (i.e., 1150 MW is in the range of losing one major

[1] https://stakeholdercenter.caiso.com/StakeholderInitiatives/Planning-standards-remedial-action-scheme-guidelines-update
[2] https://stakeholdercenter.caiso.com/Comments/AllComments/c36dd6bb-4e13-48d2-99ba-ab7f14137591

transmission element or facility);

12) Concerns about how battery energy storage system (BESS) is implemented in the RAS design, specifically the following:
    a. RAS is not designed to recalculate arming due to rapid charging or discharging nature of BESS;
    b. RAS is not designed to take subsequent actions which BESS charging or discharging may cause;
13) Suggestion having minimum generation effectiveness factors (i.e., 2 to 3) rather than poor effectiveness factor (i.e., 20 to 1);
14) Concerns about monitoring facilities beyond the PTO's service territories which make the RAS more complex;
15) Concerns about RAS that started out as simple but grew to be complex with the additional generation interconnection projects.

While the comments received from the stakeholders varied, the central theme for improvements could be characterized in the following:

I. Removal of redundant language in the RAS guidelines that are also covered by the NERC PRC-012-2 standard: overwhelming majority of stakeholders expressed support for this action;
II. RAS design should not be overly complex: all the PTOs support RAS design consideration that is simple and feasible to implement;
III. Caution about changing the 1150/1400 MW generation tripping limit: the majority of stakeholders expressed concerns about changing the current limit for generation tripping in the RAS design as this could potentially impact existing RAS as well as potentially contribute long-term curtailment of generation facility;
IV. RAS guidelines should be technology neutral: the generation developers expressed concerns unduly impact to specific type of generation technology (i.e., inverter-based resources vs. other resource types).

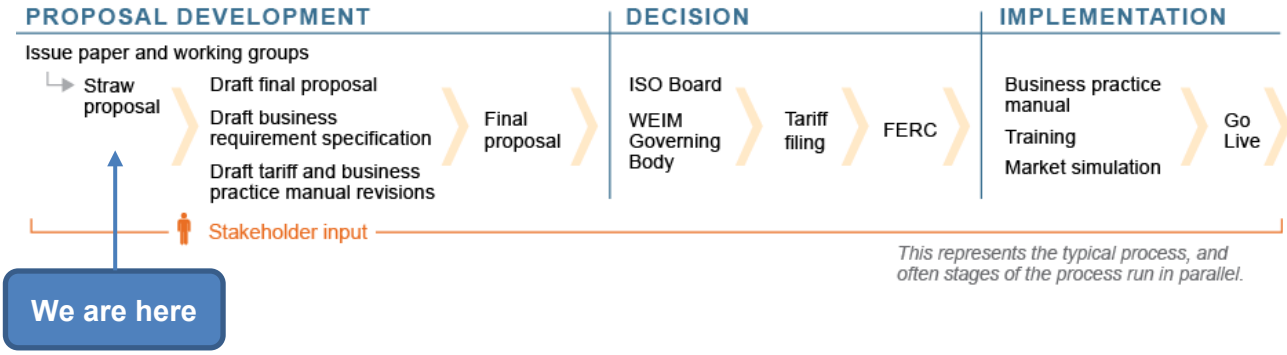
2 Stakeholder Process

The ISO is at the "straw proposal" stage in Planning Standards - RAS guidelines update (RAS) stakeholder process. Figure 1 below shows the status of the overall RAS stakeholder process.

The purpose of the straw proposal is to include updates to the RAS

guidelines in the ISO Planning Standards. The ISO will publish a number of straw proposals, and solicit stakeholder feedback after each iteration. The ISO will publish a draft final straw proposal, solicit stakeholder feedback and then conclude with a final proposal.

Figure 1 – A Typical Stakeholder Initiative Process



3 Straw Proposal

The ISO has included RAS guidelines in the Planning Standards for over a decade to help mitigate reliability concerns identified in the transmission planning process as well as generation interconnection process. Although these guidelines have helped the ISO extensively in designing multiple RAS, there is a need to update these guidelines considering several new drivers such as RAS modeling within the ISO Market, new updated reliability standards (TPL-001-5 and PRC-012-2), and a significant expected increase in the number of RAS proposed through planning processes.

In addition, the scope of this initiative is to review and update the current System Protection Schemes (SPS) guidelines in the current ISO Planning Standards to align with and complement NERC Reliability Standards and to ensure a secure and reliable ISO infrastructure development.

3.1 Removal of Redundant Language in the RAS guidelines

During this stakeholder process, the ISO received feedback that stakeholders supported removing redundant language that the NERC PRC-012-2 also covers. In addition, the ISO also replaced references to Special Protection System (SPS) with Remedial Action Scheme (RAS), which is now officially

used in NERC standards. The replacement of SPS with RAS occurs throughout the California ISO Planning Standards, which is included as Attachment A in the Straw Proposal.

The following are further discussions of SPS guidelines that are eliminated due to redundancy with the requirements from PRC-012-2 standards.

1) **ISO SPS 1** – "the overall reliability of the system should not be degraded after the combined addition of the SPS". This is eliminated as the PRC-012-2 Requirements R1, R2 and R3. The PRC-012-2 R1 requires the RAS-entity to provide documentation to support the proposed RAS. Requirement R2 requires that the Reliability Coordinator (RC) to review and provide feedback to the RAS-entity. Requirement R3 requires that the RAS-entity resolves issues that were identified by the RC to obtain approval from the RC prior to implementation of the RAS.

2) **ISO SPS 2** – "the SPS needs to be highly reliable. Normally, SPS failure will need to be determined to be non-credible. In situations where the design of the SPS requires WECC approval, the WECC Remedial Action Scheme Design Guide will be followed." This language is removed as the PRC-012-2 Requirements R1, R2, R3, R5, R6, R7 and R8. The PRC-012-2 Requirements R1, R2 and R3 indicated that the proposed RAS needs to obtain approval from the RC. The PRC-012-2 R5, R6 and R7 requires that the RAS-entity participates in the assessment to determine the causes of the RAS failure if it occurred, and to follow up with and implement the Corrective Action Plan (CAP). The PRC-012-2 R8 requires the RAS entity to perform functional test periodically to ensure proper operation of the RAS.

3) **ISO SPS4** – this guideline is removed as the language is redundant with the PRC-012-2 R1, R2 and R3 requirements for new RAS, or R4 requirement for the existing RAS.

4) **ISO SPS5** – this guideline is removed as it is covered by the PRC-012-2 R1 – R3 for new RAS and R4 for existing RAS.

5) **ISO SPS8** – this guideline is removed as the language is redundant with PRC-012-2 R1 – R3 for new RAS and R4 for existing RAS.

6) **ISO SPS9** – this guideline is removed as it is redundant with PRC-012-2 R1 – R3 requirements; the new RAS is to be reviewed and approved by the RC (i.e., RC West).

7) **ISO SPS11** – this guideline is removed as it is superseded with PRC-012-2 R1 –

R3 requirements when reviewing proposed new RAS.

8) **ISO SPS12** – this guideline is removed as it is superseded with PRC-012-2 R8 requirement where each RAS-entity shall participate in performing a functional test of each of its RAS to verify the overall RAS performance.

9) **ISO SPS13** – this guideline is removed as it is superseded by PRC-012-2 R1 and R9 requirements where the RAS-entity provides required document to the RC and the RC is to maintain and update a RAS database.

10) **ISO SPS14** – this guideline is removed as it is superseded by PRC-012-2 R4 where the ISO Planning Coordinator (PC) performs periodic review and evaluation of the existing RAS, as well as by TPL-001-5 and its subsequent version requirements where the ISO PC performs reliability assessment of its controlled transmission system in the annual transmission planning process.

11) **ISO SPS15** – this guideline is removed as it is redundant with PRC-012-2 R1 – R3 and R8 requirements where the RAS entity is responsible in providing its design and document of the proposed RAS, as well as periodic testing of the existing RAS.

12) **ISO SPS17** – this guideline is removed as it is redundant with PRC-012-2 R1 – R3 requirements in which the RAS entity provides required design and implementation of the proposed RAS to the RC for review and approval.

3.2 Refinements to Existing RAS Guidelines

The following includes proposed additions, changes and modifications of the SPS guidelines. Some guidelines are proposed to become standards while some remains as guidelines. New RAS standard is identified as S-RAS, whereas RAS guideline is identified as G-RAS.

1) **ISO S-RAS1** – New RAS implementation should meet the NERC PRC-012-2 (or subsequent version) requirements.

   With the above new standard, it supersedes the guidelines for new RAS proposals that were removed as discussed in Section 3.1 due to redundancy to PRC-012-2 and requires new RAS implementation to meet PRC-012-2 (or subsequent version) requirements.

2) **ISO S-RAS2** – The RAS should not be proposed for mitigating reliability concerns under normal conditions (i.e., Category P0).

   RAS is typically designed to mitigate reliability concerns under contingency

conditions. While it is rare to have RAS to mitigate reliability concerns under normal condition, the ISO would like to reinforce the design principles to have RAS designed for mitigating reliability concerns for contingency conditions only. Having RAS to mitigate reliability concerns under normal condition would increase the frequency of utilizing the RAS, increases the operational complexity as the system can become more difficult to operate due to proliferation of the RAS that may cause coordination concern among the RAS in close proximity with other RAS in the vicinity area. In addition, it may also increase the likelihood of curtailment of resources that are needed for resource adequacy.

3) **ISO G-RAS3** – The following are guidelines for optimizing resources to participate in the RAS design and implementation so that generation deliverability benefit is maximized:

   A. The RAS should be designed for simple operation to trip a fixed set of generation under specific contingencies[3]. It should not be implemented with complex design and operation that are conditioned on different flow levels on monitored transmission facilities to trip various amounts of generation.

   B. The RAS should trip load and/or resources that have the effectiveness factors greater than 10% on the constraints that need mitigation such that the magnitude of load and/or resources to be tripped is minimized. As a matter of principle, voluntary load tripping and other pre-determined mitigations should be implemented before involuntary load tripping is utilized. Involuntary load tripping should not be included in the RAS in the high density load area(s).

   This guideline is proposed as a result of stakeholder feedback for simple RAS. It is also based on feedback from the ISO Power System and Market Technology Division that complex RAS[4] is challenging to be implemented in the ISO market.

4) **ISO G-RAS4** –

   The RAS must be simple and manageable:

   A. There should be no more than 6 contingencies (P1 – P7) that would trigger the operation of a RAS.

   B. The RAS should not be monitoring more than 4 system elements or

[3] The generating facilities selected to participate in a generation dropping RAS should be optimized, so that generation deliverability and feasible congestion mitigation benefits are maximized.
[4] Complex RAS is referred to RAS that is designed to arm and trip different levels of generation or load based on various conditions of flows on monitored transmission facilities.

variables. A variable can be a combination of related elements, such as a path flow, if it is used as a single variable in the logic equation.

C. Overlapping RAS (i.e., two different RAS monitoring one or more of the same elements or contingencies) is not allowed.

D. A RAS that includes storage facilities and is implemented to operate when there is an excess of generation should not also be implemented to operate when there is an excess of charging. Similarly, a RAS that includes storage facilities and is implemented to operate when there is an excess of charging should not also be implemented to operate when there is an excess of generation. This set up will help make the RAS simpler for design, implementation, and modeling.

The following are examples that illustrate the above guideline:

1. **Example 1** – total resource with excess of generation output level that triggers reliability concerns

   For this example, let's assume that we a combined hybrid resource that consists of 200 MW solar generation and 105 MW of battery energy storage system (BESS). The reliability issue is identified with total aggregated generation output of or exceeding 100 MW under contingency condition. With BESS at 105 MW discharging, the total generation output for the hybrid facility is 305 MW. With BESS at 90 MW charging, the total generation output for the hybrid facility is 110 MW. The RAS will then need to trip both the solar generation and the BESS regardless of the BESS' operating mode.

   On the other hand, if the total hybrid facility aggregated output is -105 MW (i.e., BESS in maximum charging mode and solar generation is unavailable due to nighttime hours), the same RAS should not be designed to operate. This would simplify the RAS design, implementation and modeling in the ISO market.

   Ex**ample 2** – total resource with excess of charging output level that triggers reliability concerns

   For this example, let's assume that we have a 100 MW of solar generation and 205 MW of BESS. The reliability issue is identified with total aggregated charging load of 100 MW or more under contingency condition. The RAS would then be operated if solar generation is at 100 MW and BESS charging at 205 MW (for a total aggregated charging load of 105 MW), or if solar generation is at 0 MW (i.e., unavailable in

nighttime hours), and the BESS is charging at 205 MW (which could occur in early hours of the day) resulting in a total charging load of 205 MW.

On the other hand, if the total hybrid facility aggregated output is 0 – 100 MW due to solar generation output and BESS is at 0 MW output, the same RAS should not be designed to operate. Similarly to the above example, this setup would simplify the RAS design, implementation and modeling.

E. The RAS should only monitor overloading facilities no more than 1 substation beyond the first point of interconnection. The impact of generation or load dropping on a remote facility tends to be ineffective due to the electrical distance within the network between the generation or load to be dropped and the remote facility. Remote monitoring of facilities may also add substantial complexity to system operation and should be avoided.

F. A RAS should not require real-time operator actions to arm or disarm the RAS or change its set points.

G. A RAS should not include logics to dynamically arm and trip various generation level to achieve transmission facility flow objectives. Modeling of RAS dynamic arming and tripping of generation is not feasible in the ISO market.

The above RAS standard is an effort to simplify RAS design and implementation based ISO experience and on feedback from the Participating Transmission Owners, as well as from generation owners.

5) ISO S-RAS5

If the RAS is designed for new generation interconnection, the RAS should not include the involuntary interruption of firm customer load. Voluntary interruption of load paid for by the generator is acceptable.

The above is from the ISO SPS7 guideline, and is proposed to become a standard to ensure that firm customer load is not impacted with the addition of new generation, unless the load interruption is voluntary and paid for by the generator.

6) **ISO –G-RAS6**

“The total net amount of generation tripped by a RAS for a single contingency (P1) should not exceed the ISO’s largest single generation contingency

(currently one Diablo Canyon unit at 1150 MW). The total net amount of generation tripped by a RAS for multiple contingencies (P3 – P7) cannot exceed 1400 MW. These amounts should be based on the maximum capability of the generating facilities that are to be tripped rather than their current MW production. This amount is related to the minimum amount of contingency reserves that the ISO has historically been required to carry. The quantities of generation specified in this standard represent the current upper limits for generation tripping. These quantities will be reviewed periodically and revised as needed. In addition, the actual amount of generation that can be tripped is project specific and may depend on specific system performance issues to be addressed. Therefore, the amount of generation that can be tripped for a specific project may be lower than the amounts provided in this guideline."

The above guideline (originally ISO SPS3) is proposed to remain as a guideline due to retirement outlook for Diablo Canyon Power Plant (DCPP) remains fluid at this time. Originally, DCPP is scheduled to retire upon expiration of its operating licenses in November 2024 and August 2025. However, there has been other development in which the State of California is considering potential extension of the operation of DCPP to meet higher energy demand.

The current ISO guideline for the maximum amount of generation that can be curtailed for a single contingency via the use of RAS cannot exceed the maximum capacity of one Diablo Canyon unit at 1150 MW. The guideline for multiple contingency is 1400 MW and these limits were based on the minimum amount of contingency reserves that ISO has historically been required to carry. The other critical contingency that affects the ISO's contingency reserve requirements is the loss of the Pacific DC Intertie (PDCI), which is the transmission system that provides linkage between the Pacific Northwest and Southern California bulk electric system. The scheduling allocations on the PDCI to the ISO BAA is about 52.3% of the total flow, with the rest going to LADWP BAA. If the PDCI flow is at its maximum path rating limit of 3220 MW, the scheduling allocations to the ISO could be 1684 MW or higher to about 2000 MW if additional energy flows through LADWP system to the ISO. A review of the historical contingency reserves in the ISO BAA from January 1, 2018 to September 15, 2022 indicated that for 99% of the time, the amount of contingency reserves awarded in the ISO BAA are 1400 MW or higher. The mean value is estimated to be about 2261 MW. Thus 1400 MW is considered practically the minimum amount of contingency reserve in the ISO BAA.

7) ISO G-RAS7

"The ISO, in coordination with affected parties, may relax RAS requirements as a temporary "bridge" to system reinforcements. Normally this "bridging" period

would be limited to the time it takes to implement a specified alternative solution. An example of a relaxation of RAS requirement would be to allow 8 initiating events rather than limiting the RAS to 6 initiating events until the identified system reinforcements are placed into service."

The above guideline (originally ISO SPS10) is proposed to remain as a guideline. There are several reasons to keep this guideline to: provide flexibility to enable temporary "bridge" to system reinforcements. With the projected higher demand as well as increase in resource interconnections to the ISO-controlled grid, there needs to be flexibility in implementing temporary "bridge" to long-term system reinforcements.

4 Next Steps

The ISO requests additional feedback from stakeholders on the RAS guideline updates in this straw proposal. The ISO will host a stakeholder call on September 26, 2022 to review the straw proposal, and encourages all stakeholders to submit comments on the proposed RAS guideline updates. Comments will be due on October 10, 2022.

5 Schedule

The following schedule is updated to include the ISO Policy and Regulatory Committee (PRC) review and approval.

Table 1 Schedule

Item	Date
Post Straw Proposal	September 19, 2022
Stakeholder Call	September 26, 2022
Stakeholder Comments Due	October 10, 2022
Post Revised Straw Proposal (tentative)	October 26, 2022
Stakeholder Call (tentative)	November 2, 2022
Stakeholder Comments Due (tentative)	November 16, 2022

Post Draft Final Proposal	January 4, 2023
Stakeholder Call	January 11, 2023
Stakeholder Comments Due	January 25, 2023