

Reclamation Manual

Directives and Standards

Subject: Ancillary Generation Services

Purpose: Establishes standards for ancillary generation services.

Authority: The Reclamation Act of 1902 (Act of June 17, 1902, 32 Stat. 388), the Town Sites and Power Development Act of 1906 (Act of April 16, 1906, ch. 1631, 34 Stat. 116), Reclamation Project Act of 1939 (Act of August 4, 1939, ch. 418, 53 Stat. 1187), the Flood Control Act of 1944 (Act of December 22, 1944, ch. 665, 58 Stat. 887), Energy Policy Act of 1992 (Act of October 24, 1992, Public Law 102-486, 106 Stat. 2776) and acts relating to individual dams or projects.

Contact: Power Resources Office, D-5400

1. **Introduction.** Historically, Reclamation projects have provided ancillary generation services. These have been “bundled” into the electric power provided for project use and for surplus sales by the Power Marketing Administrations (PMAs). The power system disturbances in the 1960s resulted in voluntary reliability criteria to be met by transmission grid participants. These criteria were related to how much of certain ancillaries had to be available to the Operating Authority. The changes in the electric power markets resulting from the Energy Policy Act of 1992, and the Federal Energy Regulatory Commission’s resulting regulations, have caused these ancillary generation services to be specifically identified.
2. **Scope.** As detailed in the definitions below, the identified ancillary services pertaining to generation that will be discussed in this directive and standard are:
 - A. Contingency Reserve (Spinning and Supplemental)
 - B. Frequency Response
 - C. Load Following
 - D. Regulating Reserve
 - E. System Black Start Capability
 - F. Reactive Power Supply
3. **Definitions.**
 - A. **Ancillary Services.** Ancillary Services are the services other than energy which are required to maintain power system reliability and meet Western Electricity Coordinating Council/North American Electric Reliability Council (WECC/NERC)

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operating criteria. These services are defined below and are part of NERC's "Interconnected Operations Services (IOS)".

B. Contingency Reserve. Contingency Reserve is the provision of capacity deployed by the Operating Authority to reduce area control error to meet the NERC Disturbance Control Standard and other NERC and WECC contingency requirements. There are two types of Contingency Reserves composed of (1) Contingency Reserve - Spinning and (2) Contingency Reserve - Supplemental. This is one of the NERC-defined IOS.

- (1) **Contingency Reserve - Spinning.** Contingency Reserve – Spinning is the portion of Contingency Reserve consisting of:
 - (a) Generation synchronized to the system and fully available to serve load at the time of the contingency event; or
 - (b) Load removable from the power system at the time of the contingency event.

This is also referred to as Spinning Reserve. Some Operating Authorities have a requirement that the capacity be capable of running (generating electricity) or being interrupted for a defined period. This is part of one of the NERC-defined IOS.

- (2) **Contingency Reserve - Supplemental.** Contingency Reserve – Supplemental is the portion of Contingency Reserve consisting of:
 - (a) Generation (synchronized or capable of being synchronized to the system) that is fully available to serve load within 10 minutes of the contingency event; or
 - (b) Load fully removable from the power system within 10 minutes of the contingency event.

This is also referred to as non-Spinning Reserve. Some Operating Authorities have a requirement that the capacity be capable of running (generating electricity) or being interrupted (not consuming electricity) for a defined period. This is part of one of the NERC-defined IOS.

C. Frequency Response. Frequency response is the provision of capacity that automatically stabilizes frequency following a significant and sustained frequency deviation on the transmission system. This is one of the NERC-defined IOS.

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- D. **Load Following.** Load following is the provision of generation (and load) response capability, including capacity, energy and Maneuverability that is dispatched within a scheduling period by the Operating Authority. This is one of the NERC-defined IOS. Reclamation determines the level of automatic generation control available at Reclamation facilities.
- E. **Interconnected Operations Services.** Interconnected Operations Services are the ancillary services defined by NERC. Although more than six are defined, the others are not strictly ancillary generation services. They are transmission services, operating authority services, or actions that require direct interaction with the Operating Authority to perform a function (i.e., load following service).
- F. **Maneuverability.** Maneuverability is the ability of a generator or load to change its real- or reactive-power output over time. Maneuverability is characterized by the Ramping rate (e.g., MW/minute or MVAR/minute) of a generator or load and, for Regulation, its acceleration rate (e.g., MW/minute² or MVAR/minute²).
- G. **Operating Authority.** An Operating Authority is an entity that:
- (1) Has ultimate accountability for a defined portion of the transmission system to meet one or more of three reliability objectives: generation/demand balance, transmission security, and/or emergency preparedness; and
 - (2) Is voluntarily accountable to NERC and WECC for complying with NERC and WECC Policies; and
 - (3) Has the authority to request certain operations of the generating resources, transmission facilities, or loads, to meet the NERC and WECC Policies
- H. **Ramping.** Ramping is changing the loading level of a generator in a constant manner over a fixed time (i.e., ramping up or ramping down). Such changes by the generator operator may be directed via computer or manual control.
- I. **Regulating Reserve.** Regulating Reserve is the provision of generation (and load) response capability, including capacity, energy and Maneuverability, that responds to automatic signals generated by the Operating Authority. This allows the Operating Authority to meet its NERC Control Performance Criteria. Regulating Reserve is also referred to as "Regulation." This is one of the NERC-defined IOS. (Some Operating Authorities separately identify "up" and "down" regulation.)
- J. **System Black Start Capability.** System Black Start Capability is the provision of generating equipment that, following a system blackout, is able to:
- (1) Start without an outside electrical supply; and

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- (2) Energize a defined portion of the transmission system.

System Black Start Capability serves to provide an initial startup supply source for other system capacity as one part of a broader restoration process to re-energize the transmission system. This is one of the NERC-defined IOS.

In general, plants that are considered part of the System Black Start Capability will be determined in cooperation with the Operating Authority. Other plants may have black start capability in order to satisfy safety of dams criteria, environmental conditions, and plant safety issues.

- K. **Reactive Power Supply.** Reactive Power Supply is the provision of reactive capacity, reactive energy, and responsiveness from generation (and load) available to control voltages and support operation of the transmission system. This is one of the NERC-defined IOS.
4. **Plant Types.** In general, Reclamation operates hydroelectric plants that are either operated as peaking or run-of-the-river.
 - A. **Run-of-the-River.** These plants have little allowed variation in their water release schedules. This, in general, will not allow them to operate to provide Regulating Reserve, Contingency Reserve - Spinning, Contingency Reserve - Supplemental or System Black Start Capability. However, local operating conditions may allow these plants to provide some IOS. These plants, in general, will be capable of providing some Reactive Power Supply.
 - B. **Peaking Plant.** In general, these plants have some flexibility in timing the release of their water and are capable of providing Regulating Reserve, Contingency Reserve - Spinning, Contingency Reserve - Supplemental and Reactive Power Supply. The plants may also provide System Black Start Capability, if so identified in coordination with the Operating Authority.
 5. **Use of Ancillary Services:** Reclamation self-provides ancillary services for its project loads. If it did not, the project function, including the irrigation function, would be impaired. This impairment would come in the form of damage to equipment due to voltage instability (Reactive Power Supply), frequency deviations (Frequency Response), and the inability to serve load (Regulating Reserve and Contingency Reserve - Spinning). Thus, Reclamation provides ancillary services for the beneficial use of the project loads. Once the needs of the project for ancillary services have been satisfied, any remaining ancillary services are surplus to Reclamation's needs and available to the PMAs for marketing. These surplus ancillary services have been sold with energy as a "bundled" commodity in the past as part of the marketing of surplus power.

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Reclamation interconnected with other transmission providers to improve the reliability of its own power system for the benefit of its project purposes. In addition, the interconnection facilitated the power marketing of the historically “bundled” commodities of energy and ancillary services.

Reclamation and the PMAs have voluntarily met criteria established to improve and maintain transmission system reliability. These criteria addressed how much Frequency Response capability was required, Reactive Power Supply requirements to control voltage deviations, and Regulating Reserve, Contingency Reserve - Spinning and Contingency Reserve – Supplemental (Non-Spinning) to maintain the system operations before, during and after a disturbance. This voluntary meeting of criteria was to avoid impairing the project purpose including the irrigation purposes and assist the reliability of the power system.

With the changes occurring due to the Energy Policy Act of 1992, ancillary services have become separately identified and, in some cases, markets for those services have come into existence. This change is resulting in a need to demonstrate that the ancillary services are actually provided.

6. **Determination, Provision, and Measurement of Ancillary Services:** Each Region shall determine which ancillary services each of its plants are supplying for project use, and which are being supplied to its PMA for sale as part of the marketing of surplus power. (Note that the act of supplying ancillary services to the PMA does not represent a sale and that they may be bundled into a package for sale and not separately identified by the PMA.)

Each ancillary service identified in accordance with the preceding paragraph will be measured, recorded and reported as per Paragraph C. below.

A. **Types of Quantification.**

- (1) **Historical utilization.** This is a calculated amount of an Ancillary Service (IOS) that was or could have been available to the Operating Authority.
- (2) **Scheduled usage.** This is an average for a month of the amount, of an Ancillary Service (IOS), scheduled to the Operating Authority each hour.
- (3) **Metered usage.** This is the total metered amount, of an Ancillary Service (IOS), delivered to the Operating Authority for a month. It may also be a real-time calculated or metered quantity.

B. **Measurement of Ancillary Services.**

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- (1) **Regulating Reserve.** This Ancillary Service will be measured using scheduled usage quantification. When sufficient experience is available from tracking this, a generalization can be made to feed into, and allow, historical utilization measurement to occur. Metered usage quantification measurement is the actual usage by the Operating Authority of the unit/plant/project capacity for regulation. Metered usage quantification measurements are harder to determine as they require that any Load Following being done be removed from the calculation.
 - (2) **Contingency Reserve - Spinning.** This Ancillary Service can be measured using historical utilization quantification and scheduled usage quantification.
 - (3) **Contingency Reserve - Supplemental.** This Ancillary Service can be measured using historical utilization quantification and scheduled usage quantification.
 - (4) **Reactive Power Supply.** This ancillary can be measured using all three quantification types. Metered usage quantification will be measured as kVar-hours (or MVar-hours) in and/or out of the machine, but not as a net measure.
 - (5) **System Black Start Capability.** If the plant is designated as having a System Black Start Capability, then the amount of capacity that could have been available for a System Black Start should be calculated. This would be the lowest capacity available at a given point in the month.
- C. **Reporting of Ancillaries.** Ancillary services will be reported to the Denver Power Resources Office (D-5400) for record-keeping purposes. In addition, this will serve as a clearinghouse to answer questions related to ancillaries provided, similar to what is now provided for energy generation. See FIST 1-3 for additional guidance on reporting of Ancillary Services.