NRI 72-Hour Test Procedure

Version 1.0
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Approved by:

Priyanka Namburi 10/07/25

REVISION HISTORY

VERSION NO.	DATE REVIEW STARTED	EFFECTIVE DATE	REVISED BY	DESCRIPTION
1.0	7/16/2025	10/7/2025	Jakob Helsher	Initial Release

TABLE OF CONTENTS

1.0 PURPOSE

The procedure is intended to verify that the New Resource Implementation (NRI) 72-hour test for each Generator Owner meets the requirements of the California Independent System Operator (CAISO, or “the ISO”).

2.0 INTRODUCTION

The NRI 72hr tests will be performed with the active participation of CAISO Energy Data Acquisition Specialists (EDAS) Team. However, the ISO's participation is limited to that of a facilitator and, as such, the ISO shall only be responsible for costs it may incur as a result of its participation in the process described herein.

The ISO expressly reserves the right to modify, or withdraw from, the process initiated and described herein. Additional requirements may be added or deleted by the ISO in its sole discretion at any time before, during or after the process. No rights shall be vested in any party, individual or entity by virtue of its preparation to participation in, or participation in, such process. The ISO shall be granted access rights as necessary to permit observation of the process. Successful completion of the process shall not in any way be deemed to affect any requirement of the ISO Tariff, including without limitation metering, certification and scheduling requirements. Validation of a RIG Unit by the ISO shall not exempt any affected person from participation in the process described herein. Participants are advised that this is an ISO document and hence ISO ADR Procedures apply to any dispute arising hereunder in accordance with Article 13 of the ISO Tariff.

3.0 DEFINITIONS

Unless the context otherwise indicates, any word or expression defined in the Master Definitions Supplement, Appendix A to the ISO Tariff, and capitalized herein has the same meaning where used in these principles. In addition, the following words and expressions used in these principles with initial capitalization have the meanings set forth below:

Automatic Generation Control (AGC): Generation equipment that automatically responds to signals from the ISO's EMS control in real time to control the power output of electric generators within a prescribed area in response to a change in system frequency, tieline loading, or the relation of these to each other, so as to maintain the target system frequency and/or the established interchange with other areas within the predetermined limits.

Battery Energy Storage System (BESS): Battery Energy Storage Systems, or BESS, are rechargeable batteries that can store energy from different sources and discharge it when needed. BESS consist of one or more batteries and can be used to balance the electric grid, provide backup power and improve grid stability. (Also ESS, or Energy Storage System).

Commercial Operation Date (COD): The commercial operation date is defined as the date after which all testing and commissioning has been completed and is the initiation date to which the seller can start participating in CAISO markets (i.e. when the project has been substantially completed). Often used in relation to COM: Commercial Operations for Market, as in 'COM/COD'.

Current Transformer (CT): A current transformer (CT) is a type of transformer that reduces or multiplies alternating current (AC), producing a current in its secondary which is proportional to the current in its primary. Current transformers, along with voltage or potential transformers, are instrument transformers, which scale the large values of voltage or current to small, standardized values that are easy to handle for measuring instruments and protective relays.

Distribution Compensation Factor (DCF): A multiplier programmed into the revenue meter used to increase, decrease, or leave unaffected the metered quantity for a resource of a CAISO Metered Entity that is electrically connected to a Distribution System to quantify the effect the resource has in relation to the Distribution System through which it must pass its measured energy to reflect the Point of Receipt at the CAISO Controlled Grid.

Distributed Network Protocol, (DNP 3.0) Version 3.0: A data processing application that runs on master and remote devices and is used for data exchange. (See www.dnp.org for more information on this protocol)

Energy Data Acquisition Specialists (EDAS): a Telemetry Real-Time Engineer (or the internal ISO group of such engineers), who provides technical support on activities related to the configuration, testing and implementation of revenue metering and telemetry equipment and processes.

Energy Communications Network (ECN): The Energy Communications Network (ECN) is a semi-private AT&T MPLS communications network option for telemetry from the Real-Time Device to the ISOCAISO's EMS. AT&T provisions access to the ECN. The ECN natively has no encryption. . AT&T can provision ECN connectivity either as a T1 circuit with a customer-provisioned router or as an ANIRA IPsec VPN tunnel to the ECN. The ANIRA gateway has Ethernet and cellular IP capability.

Energy Management System (EMS): The ISO's telemetry-based system for managing reliable operations of the ISO-controlled grid. The EMS system receives information every four seconds regarding the system load and generator operating levels. EMS also provides Automatic Generation Control (AGC) sending operating set points for units on regulation.

Remote Intelligent Gateway (RIG): The Real-Time Device is a system for collection and transmission of data between the ISOCAISO's EMS and Participating Resources. These devices provide the ability, in real time, to collect data and distribute supervisory control

commands to and from generators as well as transfer this data to and from multiple central monitoring and supervisory control sites.

Generator Resource Data Template (GRDT): The Generator Resource Data Template is one of several Excel spreadsheets, designed to capture data specific to a particular unit type, such as Wind, Biomass, Hydro, Solar, etc. The spreadsheet includes fields for dozens of data elements that describe the resource, including SCIDs, resource type, ramp rate, heat rate, startup requirements, forbidden operating regions, etc. - much of the data that is required for the ISO's MasterFile database.

Internet Service Provider (ISP): A commercial enterprise that supplies customers with access to the Internet.

Meteorological (MET) Data: Weather data. Also, MET data.

New Resource Implementation (NRI): The process by which a new resource joins the ISO. The New Resource Implementation (NRI) ensures that a resource meets all requirements before initial synchronization and commercial operations.

Operational Data: Data (such as, but not limited to kV, MW, MVAR, MWh, MVARh, status) collected at defined periods by ISO EMS Telemetry that is immediately available for ISO system operator's use in determining system conditions.

Public-Key Cryptography Standards (PKCS): A series of cryptographic standards, published by RSA Laboratories that define the syntax for implementing public key handling.

Primary Frequency Response (PFR): The immediate proportional increase or decrease in real power output provided by generating units/generating facilities and the natural real power dampening response provided by Load in response to system frequency deviation.

Resource Interconnection Management System (RIMS): Web application accessed by external entities to post changes to transmission equipment and/or generators that may affect the ISO. RIMS is a secure, web-based database application used to track and manage data from Interconnection Requests in the ISO queue through energizing the generating facility and requesting modifications post-commercial operation date of the generating facility. Electronic submission of interconnection requests and New Resource Implementation (NRI) data is accomplished via the user interface in RIMS.

Single Line Diagram (SLD): In power engineering, a one-line diagram or single-line diagram (SLD) is a simplified notation for representing a three-phase power system.

Supervisory Control and Data Acquisition (SCADA): SCADA is a computer-based system used for gathering and analyzing real-time data to monitor and control equipment that deals

with critical and time-sensitive materials or events. Data is gathered, processed and presented, often to issue warnings when conditions become hazardous by sounding alarms. Based on the information received from the remote stations, automated or operator-driven supervisory commands can be pushed to remote station control devices, which are often referred to as field devices.

Transmission Control Protocol / Internet Protocol (TCP / IP): IP is used at the network layer of the Objective Systems Integrators (OSI) stack for routing packets. TCP is used at the transport layer of the OSI stack and works with IP for packet routing.

Variable Energy Resource (VER): A Variable Energy Resource is a device for the production of electricity that is characterized by an energy source that is renewable, cannot be stored by the facility owner or operator, and has variability that is beyond the control of the facility owner or operator. For example: wind, solar thermal and photovoltaic, and hydrokinetic generating facilities.

4.0 PROCEDURE

As part of the final validation activities required for COD approval, all new resources must complete a 72-hour telemetry validation period as described herein. This section applies to all resources that enter the COD approval process and is to be executed following successful completion of point-to-point (P2P) testing and trial operations (SYNC).

4.1 NRI 72HR TELEMETRY VALIDATION TEST

The 72-hour test officially commences when the Resource Owner completes all Bucket 5 items and submits the COD request through RIMS. Submitting the COD request in RIMS constitutes the formal notice of test start and indicates that the Resource Owner attests to readiness for sustained telemetry performance validation.

EDAS reserves up to 10 business days to process a 72-hour test request. If EDAS performs the initial review within 72 hours of the COD request, the review period may include the test data prior to the COD request.

EDAS reserves the right to require extension or invalidation of the 72-hour test in any of the following circumstances:

1. Observed dropouts in DNP3 quality
2. Inadequate runtime data (e.g., extended periods of inactivity).
3. Inconclusive point behavior or signal validation.
4. Newly identified operational issues observed during EDAS review.

EDAS may extend or invalidate the test if current telemetry dropouts or new operational issues are observed during the time of review, regardless of whether 72 hours of historical data appear clean.

4.1.1 Data Requirements and Performance Criteria

During the 72-hour test period, the resource is required to operate in a sufficient manner to demonstrate telemetry functionality under expected operational conditions. The EDAS team will evaluate the following parameters throughout the 72-hour window:

1. Un-interrupted communication connection to ISO
2. Un-interrupted Real-Time Device connection to downstream devices such as Revenue meter, MET station, and SCADA systems.
3. All Analog and Digital data in good quality
4. All logic works as expected.

If, during the 72-hour telemetry validation period, an unexpected telemetry quality degradation occurs—such as an ISP outage, device reset, or loss of communication resulting in invalid or bad DNP3 quality flags—the 72-hour test clock shall be considered invalidated and will restart from the time that stable, valid telemetry is reestablished. This ensures that the resource demonstrates uninterrupted telemetry for a full continuous 72-hour period. Planned work at the site that impacts the DNP3 quality may be excluded from the review period if advance notice and a description of affected points is provided to EDAS prior to starting the work.

However, in cases where operational parameters deviate from expected ranges (e.g., State of Charge exceeding the Max Energy limit), but DNP3 quality remains intact and valid, the test clock does not automatically reset. Instead, the Resource Owner must provide corrected runtime data reflecting appropriate operational behavior, which may be appended to the existing telemetry record to support COD approval, at the discretion of EDAS.

4.1.2 Analog Points – Common Issues

The following table details common checks performed by EDAS on Analog points.

ANALOG POINTS	
HRT BT CTR_CNTX RIG HEARTBEAT COUNTER	• Check for consistent counts (should update every 4 seconds, every 1 second for BESS sites) • Value should not exceed 0-100

ANALOG POINTS	
AGG UGMW_GEN AGG UNIT GROSS MEGAWATTS	• Should report positive polarity when exporting to the grid • Should report slightly greater than UPMW unless there is a DCF or small losses • Check scaling is correct in comparison to HSIDE MW, UPMW • If resource has child UGMW, sum of Child/Feeder UGMW should equal AGG/Parent UGMW • Child/feeder UPMW should propagate bad quality to AGG/Parent UGMW
AGG UGMV_GEN AGG UNIT GROSS MEGAVARS	• Should report positive polarity when exporting to the grid • Should report slightly greater than UPMV in simple configurations (smaller sites) – check losses in MSVS to verify. VARS can also differ from UGMV to UPMV for more complex sites. The UPMV value can be affected by VARs from adjacent resources, the discrepancy between UGMV/UPMV is not always problematic. • Check scaling is correct in comparison to HSIDE MVAR, AGG UGMV • If resource has child UGMV, sum of Child/Feeder UGMV should equal AGG/Parent UGMV • Child/feeder UGMV should propagate bad quality to AGG/Parent UGMV
AGG_GEN_KV AGG GENERATOR TERMINAL VOLTAGE	• Should represent nominal terminal voltage of the site. Validated against the nameplate KV in the SLD. • May serve as input to UCON calculation, should propagate bad quality to UCON or set UCON to OPEN if voltage drops below 90% of nominal.

ANALOG POINTS	
AGG UPMW_GEN AGG POINT OF DELIVERY MEGAWATTS	• Check scaling is correct in comparison to HSIDE MW, UGMW • Should report positive polarity when exporting to the grid • Should report slightly less than UGMW unless there is a DCF or small losses. • If resource has child UPMW, sum of Child/Feeder UPMW should equal AGG/Parent UPMW • Child/feeder UPMW should propagate bad quality to AGG/Parent UPMW
AGG UPMV_GEN AGG POINT OF DELIVERY MEGAVARS	• Check scaling is correct in comparison to HSIDE MV, UGMV • Should report positive polarity when exporting to the grid • Should report slightly less than UGMV in simple configurations (smaller sites) – check losses in MSVS to verify. VARS can also differ from UGMV to UPMV for more complex sites. The UPMV value can be affected by VARS from adjacent resources, the discrepancy between UGMV/UPMV is not always problematic. • If resource has child UPMV, sum of Child/Feeder should equal AGG/Parent UPMV • Child/feeder UPMV should propagate bad quality to AGG/Parent UPMV
AGG HSLMW AGG HIGH SUSTAINABILITY LIMIT MEGAWATTS	• Check scaling is correct in comparison to HSIDE MW, UPMW • HSLMW should not report below UPMW • PAIRD should propagate bad quality to HSLMW if all available PAIRD inputs are bad quality • SPD should propagate bad quality to HSLMW if all available SPD inputs are bad quality

ANALOG POINTS	
HSIDE_BNK_MW TRANSFORMER HIGH SIDE MEGAWATTS	• Should report negative polarity when exporting to the grid • Uncompensated value (inverse of UGMW) • If multiple transformers, check that relevant units under each transformer are correctly summing to respective transformer.
HSIDE_BNK_MVR TRANSFORMER HIGH SIDE MEGAVARS	• Should report negative polarity when exporting to the grid • Uncompensated value (inverse of UGMV) • If multiple transformers, check that relevant units under each transformer are correctly summing to respective transformer.
HSIDE_BNK_KV TRANSFORMER HIGH SIDE VOLTAGE	• Should represent nominal HSIDE voltage of the site. Validated against the nameplate HSIDE KV in the SLD.
LIN_MW LINE MEGAWATTS	• Represents flow across a specific line – should represent sum of relevant transformer MWs • Should be sourced from a device CT on that line. • Value should be uncompensated value • Should report positive polarity when exporting to the grid
LIN_MVAR LINE MEGAVARS	• Represents flow across a specific line – should represent sum of relevant transformer MVARs • Should be sourced from a device CT on that line. • Value should be uncompensated value • Should report positive polarity when exporting to the grid

ANALOG POINTS	
AGG UNMW_GEN AGG UNIT NET MEGAWATTS	• Should report positive polarity when exporting to the grid • Should report slightly greater than UPMW unless there is a DCF or small losses • Should report slightly less than UGMW to represent AUX subtraction • Check scaling is correct in comparison to HSIDE MW, UPMW
AGG UNMV_GEN AGG UNIT NET MEGAVARS	• Should report positive polarity when exporting to the grid • Should report slightly greater than UPMV unless there is a DCF or small losses • Should report slightly less than UGMV to represent AUX subtraction • Check scaling is correct in comparison to HSIDE MV, UPMV
AGG UAMW_GEN AGG UNIT AUX MEGAWATTS	• AUX load should report positive. • Should subtract from UNMW value. • Required for sites with >1MW AUX load
AGG UAMV_GEN AGG UNIT AUX MEGAVARS	• AUX load should report positive. • Should subtract from UNMV value. • Required for sites with >1MW AUX load
AGG VERMW_GEN	• Required for hybrid resources with VER component • Represents component VER MW value • Component MW points should sum to a value roughly equivalent to UPMW. • Should be compensated for losses and DCF

ANALOG POINTS	
AGG BESSMW_GEN	• Required for hybrid resources with BESS component • Represents component BESS MW value • Component MW points should sum to a value roughly equivalent to UPMW. • Should be uncompensated for losses and DCF
AGG UOLL_GENX AGG LOW OPERATING LIMIT	• Operationally, the resource will not receive AGC setpoints if UPMW reports below UOLL while on regulation • UOLL should not report below PMIN
AGG UOHL_GENX AGG HIGH OPERATING LIMIT	• Operationally, the resource will not receive AGC setpoints if UPMW reports above UOHL while on regulation. • UOHL should not report above PMAX
AGG CTLFDBK_GENX AGG SETPOINT CONTROL FEEDBACK	• Not typically relevant in 72hr test, this is tested during P2P.
SOC_GEN_MWHX STATE OF CHARGE MEGA WATT HOUR	• SOC must never exceed MXENERGY • Represents a MWH value, not %. For example: If UPMW was charging 10MW for 1 hour, expectation would be that SOC increases approximately 10MWh. • The operator preference is that the SOC value is reported regardless of whether the resource is online/offline. • Should report a value that is available for CAISO market participation
MXENERGY_GEN_MWHX MAXIMUM ENERGY CHARGE MEGA WATT HOUR	• MXENERGY must never report below SOC • The operator preference is that the MXENERGY value is reported regardless of whether the resource is online/offline.

ANALOG POINTS	
DIR_WEA_DEGX WIND DIRECTION	• Should report between 0 and 360 degrees
PRES_WEA_HPAX BAROMETRIC PRESSURE	• Should report between ~800 and ~1200 HPA
SPD_WEA_MPSX WIND SPEED	• Should report between 0 and ~60 meters per second
TEMP_WEA_DGCX AIR TEMPERATURE	• Should report between ~-20 to ~60 degrees Celsius • Should report slightly below BPTMP
BPTMP_WEA_DGCX BACK PANEL TEMPERATURE	• Should report between ~-20 to ~60 degrees Celsius • Should report slightly above TEMP
PAIRD_WEA_WM2X PLANE OF ARRAY IRRADIANCE	• Should report between 0 and 1400 WM^2 • Check value does not go below 0
GOV DRP GOVERNOR DROOP	• Should report 0-5% (represented as 0.05 PCT)
GOV DB GOVERNOR DEADBAND	• Should report +-0.036Hz
OPER RR OPERATIONAL RAMP RATE	• Typically should not report 0 – validated against GRDT operational RR

4.1.3 Discrete Points – Common Issues

The following table details common checks performed by EDAS on Discrete points.

DISCRETE POINTS	
AGG UCON_GEN AGG UNIT CONNECTION STATUS	• Ensure correct state based on inputs // Check all equation inputs • Check that quality propagates from inputs to equation
[LSIDE]_CB 52F# LOW SIDE CIRCUIT BREAKER	• Validate correct status/quality in relation to UCON equation

DISCRETE POINTS	
AGG UCTL_GEN AGG UNIT LOCAL REMOTE CONTROL	• Validate correct status/quality in relation to UAGC equation
AGG UAGC_GEN AGG CALCULATED AGC STATUS	• Ensure correct state based on inputs // Check all equation inputs • Check that quality propagates from inputs to equation • Should not report true prior to COD unless conducting AS testing.
AGG ISO UASW_RIG AGG UNIT AUTHORITY SWITCH (ISO)	• Validate correct status in relation to UAGC equation. • Should not report true prior to COD unless conducting AS testing.
GOV BLK GOVERNOR BLOCK	• Validate correct status – CLOSED indicates NOT AVAILABLE for frequency response • Any SYNC resource is required to provide PFR.
AVR_GEN AUTOMATIC VOLTAGE REGULATOR	• Required for conventional units subject to WECC requirements. • Should report ON when site is running.
PSS_GEN POWER SYSTEM STABILIZER	• Required for conventional units subject to WECC requirements. • Should report ON when site is running.

4.1.4 Other Common Issues

Other issues may include, but are not limited to:

1. Failure or session timer issues on the ANIRA.
2. ISP related intermittent dropouts.
3. Session timers on the site firewall.
4. Issues with DNP polling frequency – there may be dead band on point that causes infrequent updates.

4.1.5 Completion and Approval

Upon satisfactory performance of all telemetry systems throughout the 72-hour test, as determined solely by EDAS, the telemetry validation requirement for COD approval shall be deemed fulfilled. Notification of completion and approval will be provided in writing.

5.0 CONTACTS

For any questions regarding this procedure, you may contact EDAS (edas@caiso.com).