LUMA

Interconnected Facilities Capabilities

INTERCONNECTED FACILITIES CAPABILITIES

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1.0 Executive Summary

The Interconnected Facilities Capability procedure is a tool utilized by the LUMA Systems Operations that requires the Interconnected Facilities to communicate their specific performance and capabilities on a regular basis. System Operations **shall** use the following characteristics to prioritize and properly dispatch generating assets based on varying load and system conditions:

- Cost to operate
- Heat rate
- Start-up time
- Start-up costs
- Ramp rates
- Limitations on start
- Maximum available output
- Regulation capability

The communication of this data helps the System Operator prioritize the dispatching of generating assets based on multiple priorities. The goal is that the Generation Company Facility Operator operates each generation unit based on the priorities of the Transmission Operator.

2.0 Objective/Scope/Roles

2.1 Objective

This Interconnected Facilities Capabilities Procedure provides a framework for the Generation Facility Operator to provide accurate information regarding the performance capabilities of the Interconnected Facilities that is verifiable based on standard tests. These Procedures also establish the requirements by which periodic and real-time capability data **shall** be transmitted to LUMA Energy, LLC (Systems Operations), in a clear and concise manner, as well as the guidelines by which capability and operating data **shall** be documented and exchanged between Generator Facility Operator and Systems Operations.

2.2 Scope

This procedure **shall** outline the data requirements for each interconnected facility and each corresponding Generator Facility Operator **shall** provide to Systems Operations, a brief non-exhaustive sample description of these generation sites as provided in Appendix B – Legacy of Generation Assets or Interconnected Facilities which **shall** be periodically updated by the Generator Facility Operator and supplied to the Senior Shift Engineer per the procedure.

2.3 Roles and Responsibilities

2.3.1 Manager Control Center Operations (MCCO)

MCCO is responsible for the oversight of the Reserve Policies for System Operator.

2.3.2 Manager Control System Support (MCCS)

The Manager Control System Support is responsible for setting and justifying reserves requirements in and implementing the Reserve Policies.

2.3.3 Senior Shift Engineer (SSE)

The SSE is responsible for:

Appendix A: The overall operation of the Bulk Power System (BPS) and works directly with the SSE and TO's to manage the overall technical operation of all interconnected facilities in a real-time setting.

Appendix B: The operation of both the Transmission Operations Center (TOC) in Monacillo and the Ponce control centers.

Appendix C: Supervisor of the SSE and the TO during the course of the shift.

Appendix D: Receiving and disseminating information received by the GFO under this procedure.

2.3.4 Senior Transmission Operator (STO)

The STO is responsible for:

Appendix E: The routing and balance of real and reactive power through the 230/115kV transmission lines and working with the SSE to jointly manage energy needs.

Appendix F: Coordinating with the SSE regarding frequency regulation, transmission flows and the current state of outages and recall times for assets and interacts with SSE.

2.3.5 Transmission Operator (TO)

The TO is responsible for:

Appendix G: The routing and balance of real and reactive power through the 38 kV transmission lines and working with the SSE to jointly manage energy needs.

Appendix H: Coordinating with the SSE regarding frequency regulation, transmission flows and the current state of outages and recall times for assets and interacts with SSE.

2.3.6 Generation Facility Operator (GFO)

The main Plant contact at the generation facility The GFO is responsible for communicating with System Operations in accordance with these procedures to allow System Operations personnel to safely implement these procedures.

3.0 Procedure

- This Procedure defines the data, testing, reporting cycles and methods related to the generator capabilities of the Interconnected Facilities to be communicated by the GFO to the System Operator, including:
- Identifying generator capability data required by Systems Operations.
- Testing procedures required to validate generator capability data.
- Methods and timing for reporting generator capability data.
- Critical informational reporting during Interconnected Facilities outages.
- The process illustrates in detail how to complete each of these functions to allow System Operations to safely, reliably and economically operate the Transmission System and dispatch available generation resources.

3.1 Data

This section defines the methods and practices related to specific data, the transmittal and regularity of data transmittals, and communication of any operational capability changes.

3.1.1 Initial Operating Capabilities

At the beginning of each scheduled shift, the GFO **shall** provide the SSE the operating capabilities of each Generation Unit at each Interconnected Facility for each operating Generation Unit on a current basis via the applicable form titled Generation Capability Checklist (Appendix D).

3.1.2 Exchange Information

The GFO and SSE **shall** promptly exchange all information relating to any change in Interconnected Facility operational condition that affects (or could affect) the operating capability of any Interconnected Facility. This information **shall** be reported via documented phone contact upon stabilizing the Interconnected Facility's operation.

3.1.3 Maintain the Data Link

In addition to SCADA real-time data, the GFO **shall** maintain and be responsible for the PI Server at each Interconnected Facility and **shall** maintain the data link to a central location identified by System Operator, currently located at the Santurce Puerto Rico, offices.

3.1.4 Alarm State Notification

The GFO **shall** provide data that is to be inputted to the Supervisory Control and Data Acquisition (SCADA) system via the RTUs and **shall** communicate with the SE to confirm alarm status at the Interconnected Facility after an alarm has been acknowledged by the SE. This communication currently is provided by phone and entered by the SE at the TOC. This procedure requires the forms contained within these Procedures to be completed by the GFO and SE and electronically submitted to the SE at the beginning of each shift.

3.1.5 Data Transmission Policy

The GFO **shall** correct any problems associated with the failure of data-transmission equipment within 30 days, in the event of further delay, the interconnected facility **shall** be deemed unavailable.

3.1.6 Data Communication Outage

The GFO **shall** communicate the outage of any data communication equipment connecting an Interconnected Facility to the Transmission System in accordance with the following requirements:

- Each Interconnected Facility **shall** be assigned to one of the District Operating Centers (DOC) as its primary contact unless arrangements are made to communicate information directly to the SE.
- The GFO **shall** request in writing any need for planned or maintenance outage of data communication equipment.

3.2 Testing

Annual Plant Performance Tests of the Interconnected Facilities **shall** be conducted to support System Operations need to plan for resource adequacy, system load forecasts and real-time dispatch. The GFO **shall** conduct a Plant Performance Test annually or otherwise as may be reasonably requested by System Operator to provide System Operator with a completed Generation Capacity Checklist (Appendix D).

3.2.1 Unit Reactive Capability Reserve

To maintain adequate transmission system control, the System Operator must have:

- Generation asset data that reflects the true amount of MVAR reserves available at each point in time.
- The realistic usable reactive output that a generating unit is capable of delivering to the system Interconnection and sustaining over the steady state operating range of the unit –vs- “D”-curve theoretical capability for the unit.

This data, provided through periodic coordinated unit testing with the System Operator, ensures safeguards that preclude system reliability problems including voltage collapse. The results of each test are compiled by the Interconnected Facility and submitted to the System Operator.

Testing **shall** be conducted:

- For baseline measurement.
- Any time the Interconnected Facility Unit capability has been modified.

3.2.2 Methods and Timing

Changes in Communication methods and timing may be required in the event of:

- Planned Outage
- Maintenance Outage
- Forced Outage
- Generating Unit Reactive Capability Reporting

3.2.3 Planned Outage

A Planned Outage is the scheduled removal from service, in whole or in part, of a Generating Unit for inspection, maintenance, or repair with the approval of the System Operations in accordance with the Outage Execution and Closeout Procedure.

- The GFO **shall** provide the System Operator with written notice of its intent at least thirty (30) days prior to performing planned maintenance to any Interconnected Facilities.
- All Planned Outages **shall** comply with the Outage Execution and Closeout Procedure.

3.2.4 Maintenance Outage

A Maintenance Outage is the scheduled removal from service, in whole, or in part, of a Generating Unit to perform necessary repairs on specific components of the Interconnected Facility with the approval of System Operations. A Maintenance Outage is an outage that may be deferred beyond the next weekend but requires that the Capacity Resource be removed from service before the next Planned Outage. Characteristically, Maintenance Outages may occur throughout the year, have flexible start dates, are much shorter than Planned Outages, and have a predetermined duration established at the start of the outage. The duration of Maintenance Outages is normally limited during the peak period season. All Maintenance Outages **shall** comply with the Outage Execution and Closeout Procedure.

3.2.5 Forced Outage

A Forced Outage is an eminent failure or immediate reduction in output or capacity or removal from service, in whole or in part, of a Generating Unit by reason of an emergency or threatened emergency, unanticipated failure, or other cause beyond the control of the owner or operator of the Interconnected Facility. The GFO may not remove any equipment from service without prior notification to SSE, except in the case where equipment must be disconnected to prevent injury to personnel or damage to equipment. All Forced Outages **shall** be documented in accordance with the Forced Outage Procedure and Outage Execution and Closeout Procedure.

However, if the GFO has any advanced knowledge of a Forced Outage, the GFO **shall** notify the SSE with as much lead-time as practical. For reliability reasons, the GFO **shall** notify the SSE of the following as soon as reasonably possible:

- The starting time of the Forced Outage.
- The energy reduction resulting (or expected to result) from the Forced Outage.
- The expected estimated time for the equipment incurring the Forced Outage to return to service.
- The estimated time until the Generation Unit is returned to service.
- The reason for the Forced Outage.
- Equipment failures causing a reduction in plant capacity.

3.2.6 Generating Unit Reactive Capability Reporting

Generating Unit reactive power is a primary method of providing voltage support for the System Operator. A lack of deliverable Generating Unit reactive power, which is relied upon to be available based on reported reactive Capability, can result in Transmission System reliability problems including voltage collapse. Proper reporting can result in controlled measures, such as generation adjustment in lieu of unanticipated load shedding to address inadequate reactive power reserves.

The GFO **shall** notify SSE as soon as practical, but within thirty (30) minutes of any temporary Generation Unit performance issues, including reactive capability derates or status or capability change on any generator reactive power resource, such as the status of each automatic voltage regulator and power system stabilizer and the expected duration of the change in status or capability.

The above reporting **shall** be recorded on the Generator Capability Checklist and any changes to an Interconnected Facility's data **shall** be communicated immediately via phone call from the GFO to the SSE.

3.3 Generator Capabilities Reporting

Interconnected Facilities must comply with the following reporting requirements.

3.3.1 Required Baseline Capabilities

All Interconnected Facilities **shall** provide a Baseline Set of Capabilities, consisting of:

- Unit capacity
- Efficiency
- Automatic generator control capability
- Ramp rate
- Frequency response capability
- Minimum load
- Maximum available load
- Fuel type
- Any current permanent capability limitations
- Any current temporary capability limitations
- Environmental permit limitations
- An updated outage schedule including major capital projects planned
- Any other material data which could limit or restrict the delivery of reliable capability from the Interconnected Facilities
- Primary and secondary response capabilities

In addition to the data listed above, GFO **shall** provide SSE the date of, and reports related to, the last generally accepted standardized testing report on which the baseline set of generator capabilities submitted was based.

System Operations **shall** be permitted to witness capabilities testing upon request.

3.3.2 Daily/Weekly/Monthly Data Requirements

The GFO **shall** provide reports to the SSE. These reports **shall** be in accordance with the installed technology that best matches the following appendices:

Appendix B – Legacy Generation Assets or Interconnected Facilities

Appendix E – Baseline Unit Capability

Appendix F – Combined Cycle Capability

Appendix G – Simple Cycle Capability

Appendix H – Boiler/STG Capability

If the GFO does not provide the testing data requested in this procedure, they **shall** be considered noncompliant with the data requirements resulting in a notice of violation to the GFO.

3.3.3 Real-Time Data Requirements

System Operations **shall** require the continuous transmittal of SCADA data as historically has been transmitted from the Interconnected Facilities to the SSE and the TO. This interconnectivity **shall** provide Interconnected Facility operating data and performance data critical to the safe, reliable and economic dispatch of power generation, and **shall** provide important information facilitating System Operations personnel with the appropriate situational awareness.

All Interconnected Facilities **shall** maintain SCADA, RTUs, associated communication in accordance with System Operations information technology standards. Compliance to these standards **shall** be on a continuous basis, which includes compliance with all System Operations hardware and software. If at any time the devices, hardware or software are not in operation, or not providing real-time data, the GFO **shall** notify the System Operator and use best efforts to return any device to operation as soon as practicable. These tools transmit Generation Unit specific data that allows the System Operator to anticipate potential changes to generator supply

in advance of a specific incident due to real time monitoring of such data and how each are trending.

3.3.4 SCADA

Certain data is compiled via the use of RTUs, located at each of the Interconnected Facilities. The data **shall** be maintained in accordance with Prudent Utility Practices and that will continually transmit Interconnected Facility performance data for the duration of the AOP. This data will allow System Operations to monitor the operation of each Generating Unit connected to the BPS and provide insight into the operating status of each Generating Unit to better anticipate any generator disruption.

Interconnected Facilities **shall** work with System Operations on future SCADA interface with plant control systems, interface hardware and software maintenance, and system calibration.

3.3.5 Required Capability Report Compliance

The GFO **shall** comply with this procedure related to the timely delivery of critically important unit-specific data including any baseline data, daily/weekly data and immediate notification of changes in data or data communications. This Generation Unit-specific data **shall** be communicated to System Operations on a daily basis.

Appendix A: Glossary

Term	Definition
Accepted Operational Procedure (AOP)	Plant Level Communications document between Genco and Gridco.
Bulk Power System	Refers to the transmission and distribution system and related facilities, equipment and other assets related to the transmission and distribution system.
Genco	Refers to the Owner of the Legacy Generation Assets in Puerto Rico.
Generator Facility Operator (GFO)	The Interconnected facility's designee, in accordance with the PLA, responsible to conduct activities for each Interconnected Facility related to system operations principals and procedure. More specifically is contact person for reporting of generator capability and main point of communication between System Operator and Interconnected Facility.
Senior Shift Engineer (SSE)	Is responsible for the overall operation of the transmission system and works directly with the STO and TO to manage the overall technical operation of all Interconnected Facilities in a real-time setting. The operation of the TOC and Ponce control centers. Supervisor of the SE, STO and TO during the shift.
Shift Engineer (SE)	Dispatches real and reactive power, as well as ancillary services, for all Interconnected Facilities. Communicates with primary contacts for all power plants and Transmission Control Supervisors
Generation Gridco Operating Agreement (GGOA)	Puerto Rico Thermal Generation and Gridco Operation Agreement
Generation Unit(s)	Refers to each of the units providing electric generation or ancillary services to the BPS.
Gridco	Refers to the LUMA or the agent of PREPA who the owner of the transmission and distribution assets in Puerto Rico is.

INTERCONNECTED FACILITIES CAPABILITIES

Term	Definition
Outage Execution and Closeout Procedure	Refers to specific policies related to LUMA Energy, Inc. procedures and policies related to Policies on Reserves included as a System Operations Principles Procedure.
Plant Performance Test	Refers to Interconnected Facility(ies) procedural requirements as applicable to the Interconnected Facility(ies) installed technology, and in accordance with the best practices of the significant portion of the geothermal powered electric generation industry...
Procedures	Refers to these LUMA Energy, Inc. System Operations Principles Procedures.
Prudent Utility Practice	Refers to those practices, methods, and acts, that are commonly used by a significant portion of the geothermal powered electric generation industry in prudent engineering and operations to design and operate electric equipment (including geothermal powered facilities) lawfully and with safety, dependability, reliability, efficiency, and economy. Each may be amended from time to time, and all applicable Requirements of Law.
Reserve Policies	Refers to specific policies related to LUMA Energy, Inc. procedures and policies related to Policies on Reserves included as a System Operations Principles Procedure.
Supervisory Control and Data Acquisition (SCADA)	The SCADA system allows bi-directional exchange of analog data, digital data, and in some cases, accumulator data between GFOs and the System Operator. The data may be processed immediately or stored in local historians for later analysis. The system provides both digital and analog data to the System Operator for each Interconnected Facility and the transmission system.
System Operations	Department in LUMA that operates the bulk power system.

Appendix B: Legacy Generation Assets or Interconnected Facilities

AGUIRRE

The Aguirre Power Plant Complex (Aguirre Plant") is located on the south coast of Puerto Rico in the Salinas municipality and is owned and operated by PREPA. The Aquirre Plant has two 450 MW thermal steam power generation units, two 296 MW combined-cycle (CC) power generation units that can also operate in simple-cycle mode, and two 18-MW black start capable gas turbines (GT). The nameplate capacity of the Aquirre Plant is 1,528 gross MW, including the one CC GT and one black start GT

Two John Brown 18-MW black start GTs for the thermal units were installed in the 1970s burn No. 2 fuel oil. They are owned and operated by the PREPA Hydro-Gas division. The CC units no longer have black start engines.

Costa Sur is located on the southern coast of Puerto Rico in Guayanilla and is owned and operated by PREPA. The Plant has two operational steam power generation units with a combined nameplate generation capacity of 820 megawatts (MW).

In addition to the steam power generation units, two John Brown 22-MW GT generators were installed in 1972. They operate on No. 2 diesel oil and can be used for peaking operation or black start of the Costa Sur facility. They are owned, maintained and operated by PREPA'S Hydro Power division. The GTs connect to the 115-kV switchyard.

INTERCONNECTED FACILITIES CAPABILITIES

MAYAGUEZ

At Mayagüez, eight Pratt & Whitney® FT8-3 aero-derivative simple-cycle gas turbines went into service between 2008 and 2009 (in Fiscal Year 2009). The aero-derivative turbines are part of the Hydro Gas Plant.

The Hydro Gas turbine generators at Mayagüez are arranged in a TWINPAC™ configuration with two aero-derivative gas generators, each driving a free power turbine (PT), which are each direct coupled to a single generator from opposite ends. The term twin pack describes two PTs connected to a single generator that includes a central shaft coupled and is driven from both ends. The gas turbines are manufactured by Pratt & Whitney and were installed between 2008 and 2009. Each of the four TWINPACs has two PTs rated by megawatts (MW) and coupled to a single 55-MW generator. The turbine units themselves are called SWIFTPAC® by the original equipment manufacturer (OEM) with reference to their drop-in-place arrangement, which is easily installed and connected. Equipment and facilities are dedicated to the function of the simple-cycle units with redundancy and unit-specific systems for independent operation as required.

PALO SECO

The Palo Seco Steam Plant is located on the northern coast of Puerto Rico in the Cataño municipality near San Juan. The Palo Seco Steam Plant consists of four thermal steam units and six gas turbines with a total original nameplate capacity of 728 MW. Palo Seco has been a major generator in the PREPA fleet and continues to serve on a limited basis as current power distribution challenges face the island.

Palo Seco Steam Plant Units 3 and 4 are tangentially fired CE HFO-fired boilers with a nameplate capacity of 216 MW each. The steam turbines are rated 1,800 psi and the boilers are 1,971 MMBtu/hr. Additional details about the boilers and turbines were not provided for review. The units began commercial operation between 1967 and 1968.

INTERCONNECTED FACILITIES CAPABILITIES

There are also three blocks of diesel-fueled gas turbine generators that began commercial operation in 1972 and 1973. Each block is composed of two 21 MW (nominal) Hitachi-GE (PB5341) gas turbine generators. In total, the three blocks have a nameplate capacity of 126 MW.

SAN JUAN

The San Juan Power Plant (San Juan Plant) has two main types of power generation units: conventional steam plants (four units: 7, 8, 9 and 10) and combined-cycle power blocks (two units: 5 and 6).

The San Juan Plant is one of PREPA's newest power plants, beginning commercial operation in October 2008. The San Juan Plant comprises two combined-cycle units (Units 5 and 6) in a 1x1 configuration. Each unit includes a combustion turbine generator rated at 218 megavolt amperes (MVA), a heat recovery steam generator, and an ST generator (STG) rated at 80 MVA with a total nameplate generating capacity of 232 MW. PREPA originally awarded Abengoa, Sevilla, SA (Abengoa) an engineering, procurement and construction (EPC) contract for the two units in 1997. In 2000, Abengoa withdrew from the contract and Washington Group was appointed as the EPC contractor in 2004 to complete the combined-cycle installations.

COSTA SUR

The Costa Sur Plant is located on the southern coast of Puerto Rico in Guayanilla and is owned and operated by PREPA. The Costa Sur Plant has two operational steam power generation units with a combined nameplate generation capacity of 820 MW. There are four non-operational steam units that are no longer in service. The two black-start capable gas turbine (GT) generators on site are considered irreparable.

The two remaining operational steam units, 5 and 6, are each rated at 410 MW; they began commercial operation in 1972 and 1973, respectively. Their boilers are tangentially fired Combustion Engineering (CE – now General Electric (GE) Power), retrofitted in 2011 to burn natural gas, a combination of natural gas and No. 6 fuel oil, or only No. 6 fuel oil as originally designed. Fired with natural gas they can meet their original maximum continuous rating (MCR)

design conditions: 2,970 kilo pounds per hour (klb./hr.) main steam flow and outlet steam conditions of 2,620 psig1 and 1,005°F. The boilers also have a reheat circuit designed to provide 2,371 klb./hr. steam flow at 451 PSIG and 1,000°F to the intermediate pressure (IP) section of the GE turbines at the rated output of 410 MW.

CAMBALACHE

PREPA currently operates a 248 MW combustion turbine simple-cycle electric generating station on a 52-acre site in Cambalache, in the Municipality of Arecibo. The Interconnected Facility produces electricity from three ABB GT 11N distillate oil-fired combustion turbines, each with a power output of 83 MW. Currently, only two combustion turbines are deemed available for service. Each combustion turbine consists of a compressor, combustor and turbine. Energy is generated at each of the combustion turbines by drawing in ambient air with the compressor, heating the air by means of burning fuel oil and expanding the hot combustion gases in a 5-stage turbine. Each combustion turbine burns No. 2 fuel oil having a maximum sulfur content of 0.15 percent by weight. In addition, the Interconnected Facility is allowed to operate in a spinning reserve mode (60 percent load) for up to 6,000 hours/365-days for the entire power plant.

VEGA BAJA

The Vega Baja facility is a two (2) unit Interconnected Facility consisting of two Frame 5 peaking gas turbines fired with diesel fuel. Currently one (1) unit is in operation and use occasionally as an intermediate/voltage support asset. The main use of Vega Baja is peaking operation.

Appendix C: Procedure Cross-Reference Matrix

Procedure Reference Matrix, Part 1 of 2	Short Term Load Forecasting	New Facility Interconnection	Resource Adequacy Planning	Interconnected Facility Retirements	Legacy T&G Demarcation	Interconnected Facilities Capabilities	Black Start	Telemetry	Cybersecurity	Root Cause Analysis & Corrective Actions	Public Reporting	Performance Reporting	Stakeholder Management	Policy on Reserves
Short Term Load Forecasting														
New Facility Interconnection														
Resource Adequacy Planning														
Interconnected Facility Retirements														
Legacy T&G Demarcation														
Interconnected Facilities Capabilities														
Black Start														
Telemetry														
Cybersecurity														
Root Cause Analysis & Corrective Actions														
Public Reporting														
Performance Reporting														
Stakeholder Management														
Policy On Reserves														
Reducing Risk Exposure to Contingencies														
Critical Loads														
Load Shedding														
Contingency and System Operating Limits Response														
Energy Dispatch, Scheduling and Merit Order														
Transmission Operations														
Plant Level Communications														
Balancing Frequency and Voltage														
Demand-Side Resources (Non-Wire Alternatives)														
System Operator Training														
Scheduling Planned T&G Outages														
Forced Outage														
Outage Execution and Closeout														
Emergency Response Execution														
Emergency Response Drills														

INTERCONNECTED FACILITIES CAPABILITIES

Procedure Reference Matrix, Part 2 of 2	Reducing Risk Exposure to Contingencies	Critical Loads	Load Shedding	Contingency & System Operating Limits Response	Energy Dispatch, Shedding & Merit Order	Transmission Operations	Plant Level Communications	Balancing Frequency & Voltage	Demand Side Resources (NWA)	System Operator Training	Scheduling Planned T&G Outages	Forced Outage	Outage Execution & Closeout	Emergency Response Execution	Emergency Response Drills
Short Term Load Forecasting															
New Facility Interconnection															
Resource Adequacy Planning															
Interconnected Facility Retirements															
Legacy T&G Demarcation															
Interconnected Facilities Capabilities															
Black Start															
Telemetry															
Cybersecurity															
Root Cause Analysis & Corrective Actions															
Public Reporting															
Performance Reporting															
Stakeholder Management															
Policy On Reserves															
Reducing Risk Exposure to Contingencies															
Critical Loads															
Load Shedding															
Contingency and System Operating Limits Response															
Energy Dispatch, Scheduling and Merit Order															
Transmission Operations															
Plant Level Communications															
Balancing Frequency and Voltage															
Demand-Side Resources (Non-Wire Alternatives)															
System Operator Training															
Scheduling Planned T&G Outages															
Forced Outage															
Outage Execution and Closeout															
Emergency Response Execution															
Emergency Response Drills															

Appendix D: Generation Capability Checklist

	Max Avail Capacity	Available Reserves	AGC Operational	Ramp Rate	Heat Rate	Operational Limits
San Juan 5						
San Juan 6						
Palo Seco 3						
Palo Seco 4						
Costa Sur 5						
Costa Sur 6						
Aguirre 1						
Aguirre 2						
CC 1-1						
CC 1-2						
CC 1-3						
CC 1-4						
CC 2-1						
CC 2-2						
CC 2-3						
CC 2-4						
Hydro-Gas						
Pattern						
Solar Plants						

Appendix E Baseline Unit Capability

Baseline Generation Unit Data

Name of Generation Facility and Unit Number
Name:
Unit #:

Technology Selection (check appropriate technology)	
Boiler/Steam Turbine Generator	
Combined Cycle Gat Turbine	
Simple Cycle Gas Turbine	
Reciprocating Engine	
Solar/Wind	
Storage	
VPP	

Please fill in information below for each unit.

Installed Capacity		MW
Fuel Type		
Heat Rate		btu/kWh
Control Range		MW min-max
Ramp Rate		
Minimum Loading		
Maximum Loading		
Permit Limits		% Available
Automatic Generator Control		yes/no

Permanent Capability Reduction
Update for any permanent capability reductions.

Temporary Capability Reductions
Update as soon as safely able any temporary capability reductions.

Appendix F: Combined Cycle Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING

Technology: COMBINED CYCLE COMBUSTION

File Update Date:
Generating Unit Name: San Juan Unit 5

Nameplate Capacity

Nameplate Capacity (MW):
220.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, PMin (MW):	160.00
PMax (MW):	220.00
AGC Available	Yes

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	Yes			Maximum Daily Run Hours	Yes	
Maximum Weekly Start-Ups	Yes			Maximum Weekly Run Hours	Yes	
Maximum Monthly Start-Ups	Yes			Maximum Monthly Run Hours	Yes	
Maximum Yearly Start-Ups	Yes			Maximum Yearly Run Hours	Yes	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	Worst Operational Ramp Rate (MW/min)	Best Operational Ramp Rate (MW/min)	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	Spinning Reserve Lower MW	Spinning Reserve Higher MW	Spinning Reserve Ramp Rate (MW/min)
0													
1													
2													
3													
4													
5													
6													
7													
8													
9													
10													
11													
12													
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18													
19													
20													
21													
22													
23													

Appendix G: Simple Cycle Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING

Technology: SIMPLE CYCLE

File Update Date:
Generating Unit Name: Combalache 2

Nameplate Capacity

Nameplate Capacity (MW):
77.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, PMin (MW):	50.00
PMax (MW):	77.00
AGC Available	No

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	Yes			Maximum Daily Run Hours	Yes	
Maximum Weekly Start-Ups	Yes			Maximum Weekly Run Hours	Yes	
Maximum Monthly Start-Ups	Yes			Maximum Monthly Run Hours	Yes	
Maximum Yearly Start-Ups	Yes			Maximum Yearly Run Hours	Yes	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	Worst Operational Ramp Rate (MW/min)	Best Operational Ramp Rate (MW/min)	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	Spinning Reserve Lower MW	Spinning Reserve Higher MW	Spinning Reserve Ramp Rate (MW/min)
0													
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Appendix H: Boiler/STG Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING RESTRICTIONS

Technology: BOILER

File Update Date:
Generating Unit Name: Aguirre 1

Nameplate Capacity

Nameplate Capacity (MW):
450.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, PMin (MW):	250.00
PMax (MW):	350.00
AGC Available	Yes

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	Yes			Maximum Daily Run Hours	Yes	
Maximum Weekly Start-Ups	Yes			Maximum Weekly Run Hours	Yes	
Maximum Monthly Start-Ups	Yes			Maximum Monthly Run Hours	Yes	
Maximum Yearly Start-Ups	Yes			Maximum Yearly Run Hours	Yes	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	Worst Operational Ramp Rate (MW/min)	Best Operational Ramp Rate (MW/min)	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	Spinning Reserve Lower MW	Spinning Reserve Higher MW	Spinning Reserve Ramp Rate (MW/min)
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Appendix I: Solar Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING RESTRICTIONS

Technology: SOLAR PLANT

File Update Date:
Generating Unit Name:

Nameplate Capacity

Nameplate Capacity (MW):
0.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, PMin (MW):	0.00
PMax (MW):	0.00
AGC Available	No

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	No			Maximum Daily Run Hours	No	
Maximum Weekly Start-Ups	No			Maximum Weekly Run Hours	No	
Maximum Monthly Start-Ups	No			Maximum Monthly Run Hours	No	
Maximum Yearly Start-Ups	No			Maximum Yearly Run Hours	No	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	[illegible]	[illegible]	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	[illegible]	[illegible]	[illegible]
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Appendix J: Battery Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING RESTRICTIONS

Technology: BATTERY ENERGY STORAGE SYSTEM

File Update Date:

Generating Unit Name:

Nameplate Capacity

Nameplate Capacity (MW):
0.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, P Min (MW):	0.00
PMax (MW):	0.00
AGC Available	No

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	No			Maximum Daily Run Hours	No	
Maximum Weekly Start-Ups	No			Maximum Weekly Run Hours	No	
Maximum Monthly Start-Ups	No			Maximum Monthly Run Hours	No	
Maximum Yearly Start-Ups	No			Maximum Yearly Run Hours	No	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	[illegible]	[illegible]	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	[illegible]	[illegible]	[illegible]
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Appendix K: Wind Capability

CAPACITY, ANCILLARY SERVICES AND OPERATING RESTRICTIONS

Technology: WIND POWER

File Update Date:
Generating Unit Name:

Nameplate Capacity

Nameplate Capacity (MW):
0.00

Total Unit Dispatchable Range Information for Control Reserve

Minimum Load, PMin (MW):	0.00
PMax (MW):	0.00
AGC Available	No

Unit Start Limitations

	Restricted	Number of Start-Ups			Restricted	Number of Run Hours
Maximum Daily Start-Ups	No			Maximum Daily Run Hours	No	
Maximum Weekly Start-Ups	No			Maximum Weekly Run Hours	No	
Maximum Monthly Start-Ups	No			Maximum Monthly Run Hours	No	
Maximum Yearly Start-Ups	No			Maximum Yearly Run Hours	No	

Hourly Generator Capability

Operating Hour	Minimum Generation Capacity (MW)	Maximum Generation Capacity (MW)	[illegible]	[illegible]	Regulation Up Lower MW	Regulation Up Higher MW	Regulation Up Ramp Rate (MW/min)	Regulation Down Lower MW	Regulation Down Higher MW	Regulation Down Ramp Rate (MW/min)	[illegible]	[illegible]	[illegible]
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Appendix L: Testing

TEST PROCEDURES

The Final Plant Performance Testing Protocol **shall** be prepared by the GFO and **shall** be in accordance with ASME PTC 46-2015 as well as any other applicable ASME PTC codes. The Final Plant Performance Testing Protocol is "Approved" when it is formally issued by the GFO and accepted by LUMA.

Witnesses

GFO **shall** provide 5 days' advance notice to the following parties of any Plant Performance Test as provided so that they may have an opportunity but not the obligation to witness the test: LUMA, LUMA's Engineer, and any others LUMA adds by providing notice.

Instrumentation and Data

- Plant Performance Test data **shall** be taken by permanent plant instrumentation including the PI system, Digital Control System (DCS) and/or by installing temporary test instrumentation. Temporary test instrumentation **shall** be used whenever an increase in accuracy or confidence of the measurement is deemed necessary. All primary instrumentation **shall** have a National Institute of Standards and Technology (NIST) traceable calibration no earlier than six (6) months prior to the test date (excluding permanent flow and power meters). All instrumentation requires a loop calibration.

- Data **shall** be collected electronically and **shall** be recorded in no greater than thirty (30) second intervals. Data collected manually **shall** be recorded in no greater than ten (10) minute intervals. Data **shall** not be subjected to compression or exception through the data collection system.

- Fuel samples **shall** be taken in general accordance with GPA 2166 and analyzed in accordance with ASTM D1945 for gas or D3712 for oil. Sample locations and extraction procedure **shall** be documented in the Final Plant Performance Testing Protocol and

subject to LUMA review. Heating value **shall** be determined in accordance with ASTM D3588, D396 and GPA 2145.

TEST MANAGEMENT

- The GFO technical advisor **shall** be present during all Plant Performance Testing activities and is responsible for representing the GFO during testing and providing technical guidance in the testing of the Facility equipment.

- With LUMA acceptance, GFO **shall** assign a performance test director who **shall** be responsible for the overall execution of the testing. The test director **shall** maintain authority for scheduling the test, setting operating conditions (with the assistance of the GFO technical advisor), coordinating acceptance of test deviations and verifying the readiness of the Facility for testing.

Emissions. All Plant Performance Tests **shall** be conducted with the Facility demonstrating compliance with all applicable limits in accordance with all Permits.

Facility Startup Time Tests

For combustion turbine plants, startup time **shall** be measured from the point in time when the first gas turbine rolls off turning gear, to the point where the gas turbines are at base load and steam turbine bypass valves are closed to demonstrate the cold, warm, and hot startup times.

For Boiler/Steam turbine plants, startup times should be determined from when the boiler is first fired. Once enough steam pressure is attained to roll the turbine, the time and fuel expended to get to that point **shall** be recorded. The boiler **shall** be fired to increase steam flow until minimum stable load is achieved. That load will be determined for each unit. The unit **shall** be operated between its minimum and maximum loads, by changing the amount of fuel added to the boiler and the corresponding ramp rates **shall** be measured and a curve developed.

INTERCONNECTED FACILITIES CAPABILITIES

FACILITY CONFIGURATION

All Plant Performance Tests **shall** be conducted under the following conditions:

- Without the use of any standby or temporary equipment or machinery.
- While the Facility is operated in its normal mode of operation, which **shall** consist of (x) the operation of the Facility as a whole, (y) the concurrent operation of Facility systems, and (z) the operation of all Facility systems within the manufacturers' specifications and without over-stressing, over-firing, or over-pressurizing any such systems.

DATA AND TEST REPORTS

All parties referenced in the preceding Section 3 **shall** be provided copies of test results as soon as available, but no later than seven (7) days after the receipt of the final fuel analysis. Preliminary corrected results **shall** be prepared and distributed within 2 days of the completion of testing Reports, which **shall** be in accordance with the requirements of the Final Plant Performance Testing Protocol.

ADDITIONAL GFO RESPONSIBILITY

On combustion turbine plants, GFO **shall** complete off-line water wash of the compressor prior to any Plant Performance Tests.

INTERCONNECTED FACILITIES CAPABILITIES

BLACK START FACILITIES

For each generation facility with a black start resource, the GFO **shall** prepare Black Start Resource specific testing procedures, perform Black Start Resource tests, and maintain records of such testing, in accordance with the testing requirements set by the System Operator to verify the unit's ability to, following a system-wide blackout, start up and fulfill its requirements without the availability of an outside electric supply.

The annual test requirements for each Black Start Resource **shall** include the ability to:

- Start with no support from the Bulk Electric System.
- Energize a transmission bus or a generating station switchyard element.
- Operate in a stable condition while isolated from the Bulk Electric System for a minimum of ten minutes.

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