BPA's Annual Joint Operating Committee Annual Meeting

February 2, 2022

Agenda

1. Welcome and Introductions (10 min) Cherilyn Randall
2. NERC IRPTF Recommendations, IEEE P2800, and implications for new generator interconnections – (30 to 45 min) Ryan Quint (NERC)
3. BPA Generator Interconnection checklist (15 min) – Dave Kirsch
4. Test requirements , what we expect from GOs (15-20 min) – Elliott Mitchell-Colgan
5. Q&A (15 min)
6. Break (10 min)
7. Upcoming EMT modeling (10 min) – Jeff Barton
8. Oversupply Management Protocol (30 min) Sarah Arison
9. Long term outages for this upcoming year (15 min) Cherilyn Randall
10. Q&A (15 min)

Introduction & JOC Rules

JOC Rules

- JOC meetings are open meetings to all interested parties, though they are targeted towards generation owners/operators.
- Non-JOC member participation can be limited to ensure JOC members (BPA and generator owners/operators) are able to address all issues.

JOC Rules Continued

- JOC members (BPA and generator owners/operators) may propose agenda items, recurring or non-recurring, for future JOC meetings.

- JOC meetings are for discussing and reporting on operational issues that affect large portions of the generation fleet. Development of new policies or procedures may require a series of meetings outside the JOC meetings. Issues that affect only one or two generators will be handled outside the JOC.

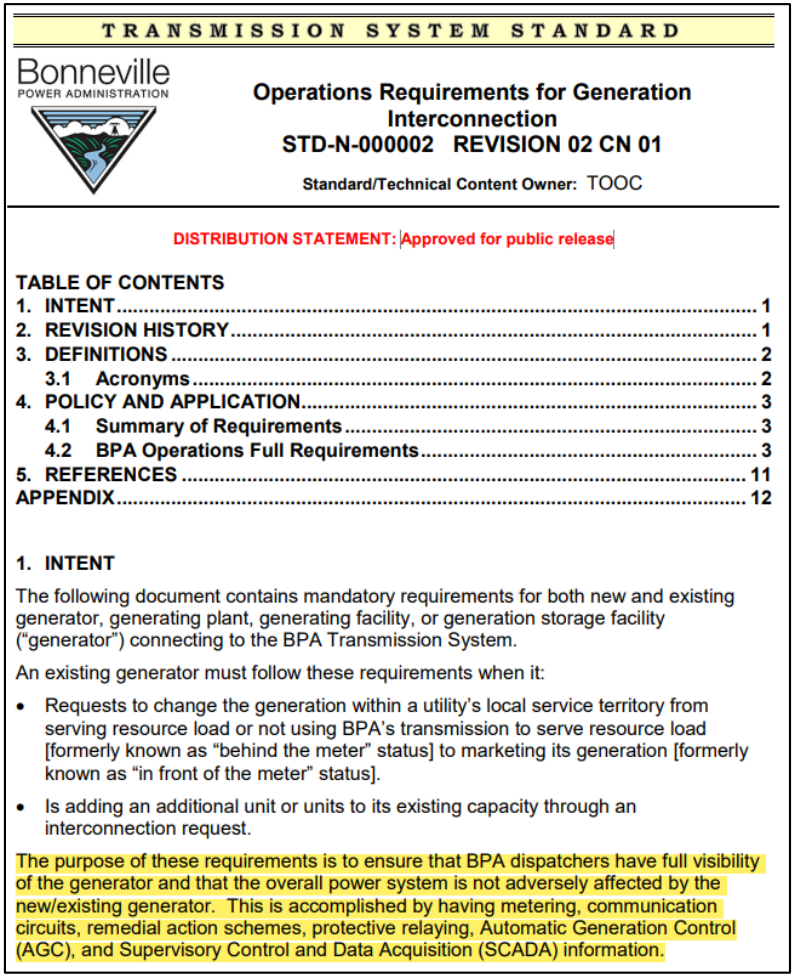
NERC IRPTF
Ryan Quint, NERC

Generator Interconnection Checklist

Generator Interconnection Checklist

- Standard was created in the Technical Operations workgroup.
- Replaces the older “Operations Requirements for Generation Interconnection, STD-N-000002” standard.
- Supporting document to the BPA STD-N-000001 “Technical Requirements for Interconnection to the BPA Grid”.
- Details a process required by BPA for a generator commencing operations approximately 180 days prior to Commercial Operations.

Old BPA Standard: *"Operations Requirements for Generation Interconnection, STD-N-000002"*



TRANSMISSION SYSTEM STANDARD

Bonneville POWER ADMINISTRATION

Operations Requirements for Generation Interconnection
STD-N-000002 REVISION 02 CN 01

Standard/Technical Content Owner: TOOC

DISTRIBUTION STATEMENT: Approved for public release

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1. INTENT

The following document contains mandatory requirements for both new and existing generator, generating plant, generating facility, or generation storage facility ("generator") connecting to the BPA Transmission System.

An existing generator must follow these requirements when it:

- Requests to change the generation within a utility's local service territory from serving resource load or not using BPA's transmission to serve resource load [formerly known as "behind the meter" status] to marketing its generation [formerly known as "in front of the meter" status].
- Is adding an additional unit or units to its existing capacity through an interconnection request.

The purpose of these requirements is to ensure that BPA dispatchers have full visibility of the generator and that the overall power system is not adversely affected by the new/existing generator. This is accomplished by having metering, communication circuits, remedial action schemes, protective relaying, Automatic Generation Control (AGC), and Supervisory Control and Data Acquisition (SCADA) information.

- Created in 2010 to add clarification to wind generators integrating onto the grid.
- Focused primarily on BPA Control Center needs 6 weeks prior to Commercial Operations (metering, SCADA displays, AGC controls, RAS).
- New controls, design and operating requirements were created specific to variable generation. Those items were mentioned for coordination.

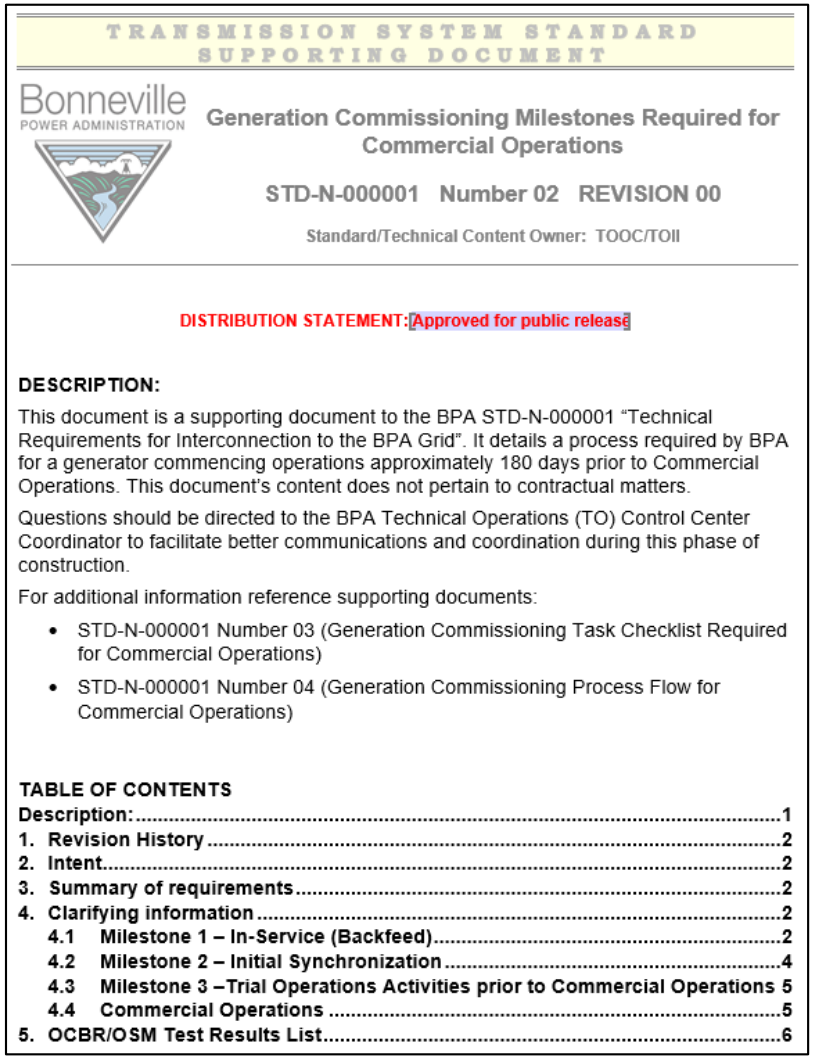
Old BPA Standard: *"Operations Requirements for Generation Interconnection, STD-N-000002"*

- The standard required updating:
  - New technology developed since 2010
  - Clarify unclear expectations and requirements (customers and internal BPA organizations).
  - Use milestones consistent with FERC LGIA definitions (In-Service/Backfeed, Initial Synchronization, Trial Operations, Commercial Operations).
  - Addition of generator Trial Operations testing period as a requirement to Commercial Operations.

New Standard

- Three documents were created, all inter-related (Excel for worksheet through process, Word and Visio for clarity)
  - *Generation Commissioning Milestones Required for Commercial Operations, STD-N-000001, Number 02* (Word Document)
  - *Generation Commissioning Task Checklist Required for Commercial Operations, STD-N-000001, Number 03* (Excel Document)
  - *Generation Commissioning Process Flow for Commercial Operations, STD-N-000001, Number 04* (Visio Document)

STD-N-000001, Number 02 (Word Document)



TRANSMISSION SYSTEM STANDARD SUPPORTING DOCUMENT

Bonneville POWER ADMINISTRATION

Generation Commissioning Milestones Required for Commercial Operations

STD-N-000001 Number 02 REVISION 00

Standard/Technical Content Owner: TOOC/TOII

DISTRIBUTION STATEMENT: Approved for public release

DESCRIPTION:

This document is a supporting document to the BPA STD-N-000001 "Technical Requirements for Interconnection to the BPA Grid". It details a process required by BPA for a generator commencing operations approximately 180 days prior to Commercial Operations. This document's content does not pertain to contractual matters.

Questions should be directed to the BPA Technical Operations (TO) Control Center Coordinator to facilitate better communications and coordination during this phase of construction.

For additional information reference supporting documents:

- STD-N-000001 Number 03 (Generation Commissioning Task Checklist Required for Commercial Operations)
- STD-N-000001 Number 04 (Generation Commissioning Process Flow for Commercial Operations)

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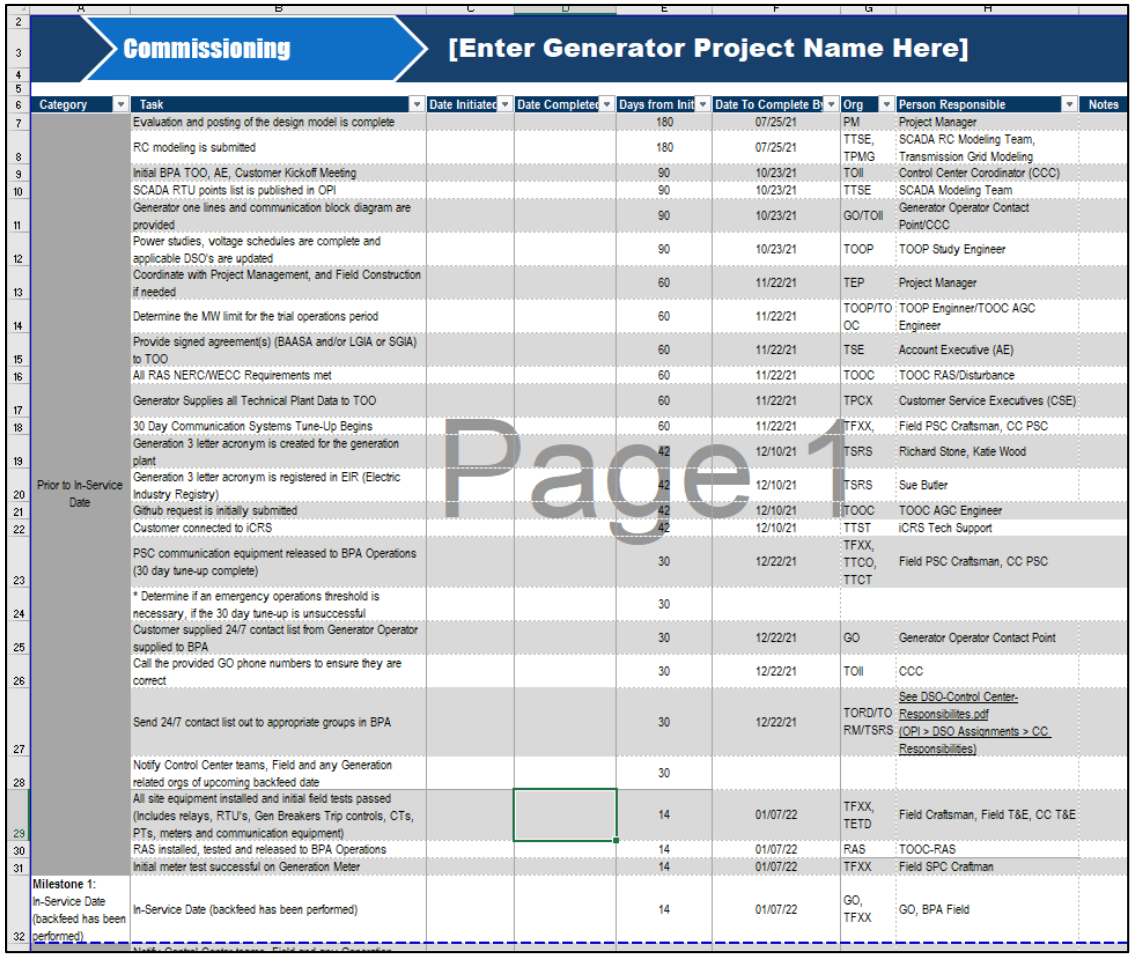
- Intent is to provide clarifications for common questions and misunderstandings.
- Layout aligns with other two documents.
- Key milestones outlined showing steps towards Commercial Operations.

STD-N-000001, Number 03 (Excel Document)



Commissioning | **[Enter Generator Project Name Here]**

Category	Task	Date Initiated	Date Completed	Days from Init	Date To Complete By	Org	Person Responsible	Notes
Prior to In-Service Date	Evaluation and posting of the design model is complete			180	07/25/21	PM	Project Manager	
	RC modeling is submitted			180	07/25/21	TTSE, TPMG	SCADA RC Modeling Team, Transmission Grid Modeling	
	Initial BPA TOO, AE, Customer Kickoff Meeting			90	10/23/21	TOII	Control Center Corodinator (CCC)	
	SCADA RTU points list is published in OPI			90	10/23/21	TTSE	SCADA Modeling Team	
	Generator one lines and communication block diagram are provided			90	10/23/21	GO/TOII	Generator Operator Contact Point/CCC	
	Power studies, voltage schedules are complete and applicable DSO's are updated			90	10/23/21	TOOP	TOOP Study Engineer	
	Coordinate with Project Management, and Field Construction if needed			60	11/22/21	TEP	Project Manager	
	Determine the MW limit for the trial operations period			60	11/22/21	TOOP/TOOC	TOOP Enginner/TOOC AGC Engineer	
	Provide signed agreement(s) (BAASA and/or LGIA or SGIA) to TOO			60	11/22/21	TSE	Account Executive (AE)	
	All RAS NERC/WECC Requirements met			60	11/22/21	TOOC	TOOC RAS/Disturbance	
	Generator Supplies all Technical Plant Data to TOO			60	11/22/21	TPCX	Customer Service Executives (CSE)	
	30 Day Communication Systems Tune-Up Begins			60	11/22/21	TFXX,	Field PSC Craftsman, CC PSC	
	Generation 3 letter acronym is created for the generation plant			42	12/10/21	TSRS	Richard Stone, Katie Wood	
	Generation 3 letter acronym is registered in EIR (Electric Industry Registry)			42	12/10/21	TSRS	Sue Butler	
	Github request is initially submitted			42	12/10/21	TOOC	TOOC AGC Engineer	
	Customer connected to iCRS			42	12/10/21	TTST	iCRS Tech Support	
	PSC communication equipment released to BPA Operations (30 day tune-up complete)			30	12/22/21	TFXX, TTCO, TTCT	Field PSC Craftsman, CC PSC	
	* Determine if an emergency operations threshold is necessary, if the 30 day tune-up is unsuccessful			30				
	Customer supplied 24/7 contact list from Generator Operator supplied to BPA			30	12/22/21	GO	Generator Operator Contact Point	
	Call the provided GO phone numbers to ensure they are correct			30	12/22/21	TOII	CCC	
	Send 24/7 contact list out to appropriate groups in BPA			30	12/22/21	TORD/TORM/TSRS	See DSO-Control Center-Responsibilites.pdf (OPI > DSO Assignments > CC Responsibilities)	
	Notify Control Center teams, Field and any Generation related orgs of upcoming backfeed date			30				
	All site equipment installed and initial field tests passed (Includes relays, RTU's, Gen Breakers Trip controls, CTs, PTs, meters and communication equipment)			14	01/07/22	TFXX, TETD	Field Craftsman, Field T&E, CC T&E	
	RAS installed, tested and released to BPA Operations			14	01/07/22	RAS	TOOC-RAS	
	Initial meter test successful on Generation Meter			14	01/07/22	TFXX	Field SPC Craftman	
Milestone 1: In-Service Date (backfeed has been performed)	In-Service Date (backfeed has been performed)			14	01/07/22	GO, TFXX	GO, BPA Field	

- Intent is to provide specific tasks and ownership and is the tool used during coordination meetings.
- Key terms are defined in a sheet within the document.
- Layout aligns with other two documents.
- Steps can be added or removed as needed.
- Milestone 1 ends with In-Service and backfeed.

STD-N-000001, Number 03 (Excel Document)

42	**Milestone 2:** Initial Sync	Plant calls BPA Dispatch and syncs to grid				01/21/22	GO, TFXX	GO, BPA Field
43		Verify Final Relay In-Service Test				After Initial Sync	TFXX/TETD	Field Craftsman/T&E
44		Verify Final Meter In-Service Test				After Initial Sync	TOOC/TFXX/TETD	TOOC AGC Engineer/SPC Craftsman/T&E
45		The plant output is coordinated - The GO is aware of their generation MW limit during trial operations. As the GO is performing their testing in conjunction with BPA, coordination with the control center and/or the project manager (e.g. - voltage and frequency control) is required.				After Initial Sync	TOOP/TOOC	TOOP Enginner/TOOC AGC Engineer
46		GO has been made aware:				After Initial Sync	TSE	Account Executive (AE)
47		• How to call on Contingency Reserves				After Initial Sync	TSE	Account Executive (AE)
48		• How to schedule				After Initial Sync	TSE	Account Executive (AE)
49		• Points of contact for BPA operational requirements				After Initial Sync	TSE	Account Executive (AE)
50		Successful validation of meter to control center systems				After Initial Sync	TOOC	TOOC AGC Engineer
51	**Milestone 3:** Trial Operations	Successful test of the OCBR/OSM response				After Initial Sync	TOOC, TTSE	AGC Renewables Team, AGC Modeling Team
52		All field equipment has been released to BPA Operations				After Final Testing	TFXX, TETD	BPA Field Craftsman, T&E
53		Voltage and Frequency Control testings is completed and approved per "Required Voltage and Frequency Control Performance Commissioning Tests" supplemental document to Standard N-000001				After Final Testing	GO, TOOC, TPXX	TOOC AGC Engineer, Plng Engineer, Customer Service Engineer (CSE)
54		Voltage and Frequency Control tests are submitted to and validated by BPA Ops & Transmission Planning				After Final Testing	TOOC, TPXX	TOOC AGC Engineer, Plng Engineer, Customer Service Engineer (CSE)
55		Any other project specific requirements				After Final Testing	TOII	CCC
56		Close out meeting				After Final Testing	TOII	CCC
57	**Milestone 4:** Commercial Operations	Commercial Operations letter is sent to the customer from the AE. GO is allowed to schedule power for sale.				After Final Testing	TSE	Account Executive (AE)

- Milestone 2 ends with Initial Sync of the generator.
- Milestone 3, Trial Operations, is new.

- The main activity in Milestone 3 is testing the Voltage and Frequency controls.
- Tests are outlined in Required Voltage and Frequency Control Performance Commissioning Tests, STD-N-000001, Number 01.
- If future test requirements are added, this standard will outline them.

STD-N-000001, Number 03 (Excel Document)

42	**Milestone 2:** Initial Sync	Plant calls BPA Dispatch and syncs to grid				01/21/22	GO, TFXX	GO, BPA Field
43		Verify Final Relay In-Service Test				After Initial Sync	TFXX/TETD	Field Craftsman/T&E
44		Verify Final Meter In-Service Test				After Initial Sync	TOOC/TFXX/TETD	TOOC AGC Engineer/SPC Craftsman/T&E
45		The plant output is coordinated - The GO is aware of their generation MW limit during trial operations. As the GO is performing their testing in conjunction with BPA, coordination with the control center and/or the project manager (e.g. - voltage and frequency control) is required.				After Initial Sync	TOOP/TOOC	TOOP Enginner/TOOC AGC Engineer
46		GO has been made aware:				After Initial Sync	TSE	Account Executive (AE)
47		• How to call on Contingency Reserves				After Initial Sync	TSE	Account Executive (AE)
48		• How to schedule				After Initial Sync	TSE	Account Executive (AE)
49		• Points of contact for BPA operational requirements				After Initial Sync	TSE	Account Executive (AE)
50		Successful validation of meter to control center systems				After Initial Sync	TOOC	TOOC AGC Engineer
51	**Milestone 3:** Trial Operations	Successful test of the OCBR/OSM response				After Initial Sync	TOOC, TTSE	AGC Renewables Team, AGC Modeling Team
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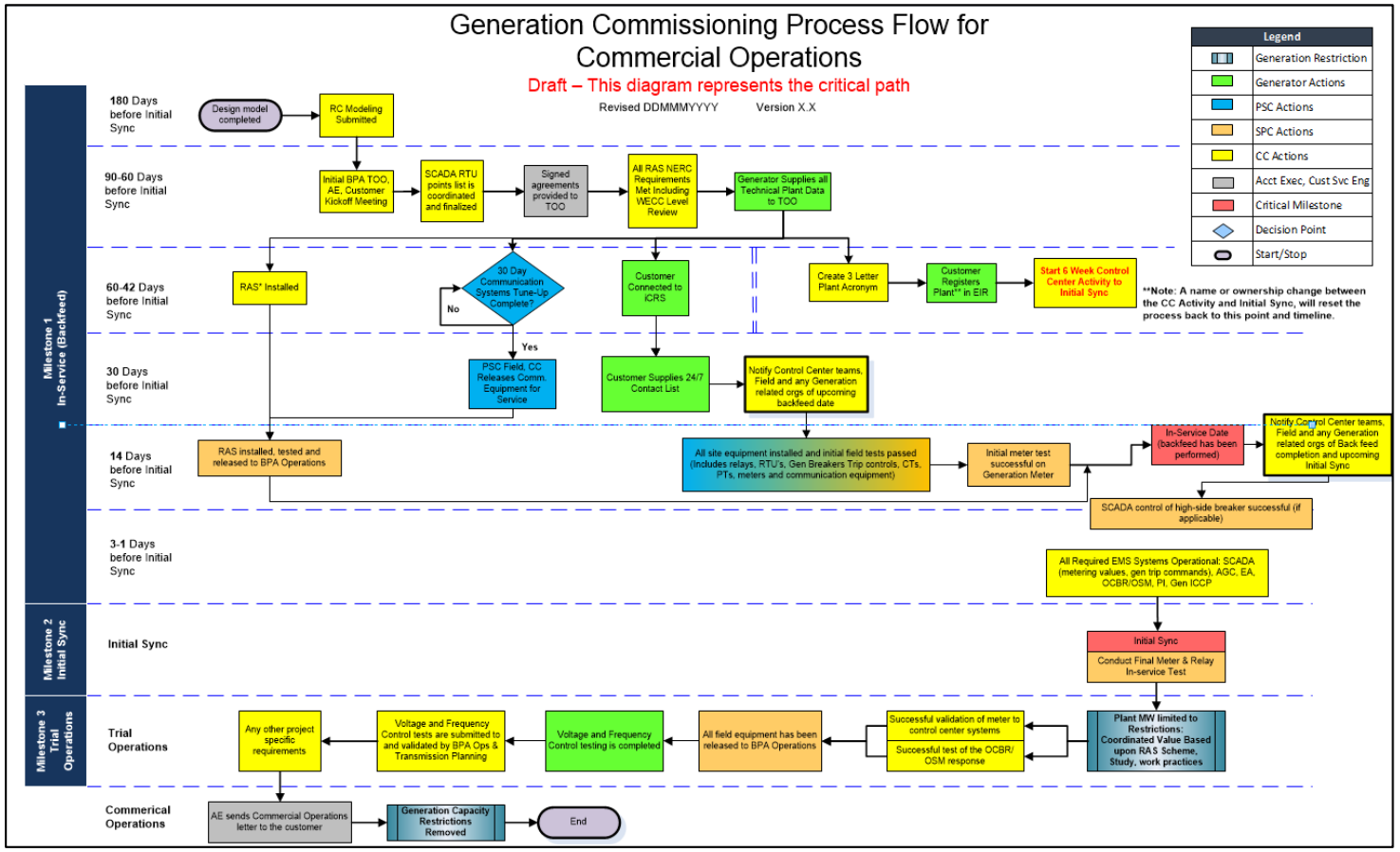
54		Voltage and Frequency Control tests are submitted to and validated by BPA Ops & Transmission Planning				After Final Testing	TOOC, TPXX	TOOC AGC Engineer, Plng Engineer, Customer Service Engineer (CSE)
55		Any other project specific requirements				After Final Testing	TOII	CCC
56		Close out meeting				After Final Testing	TOII	CCC
57	**Milestone 4:** Commercial Operations	Commercial Operations letter is sent to the customer from the AE. GO is allowed to schedule power for sale.				After Final Testing	TSE	Account Executive (AE)

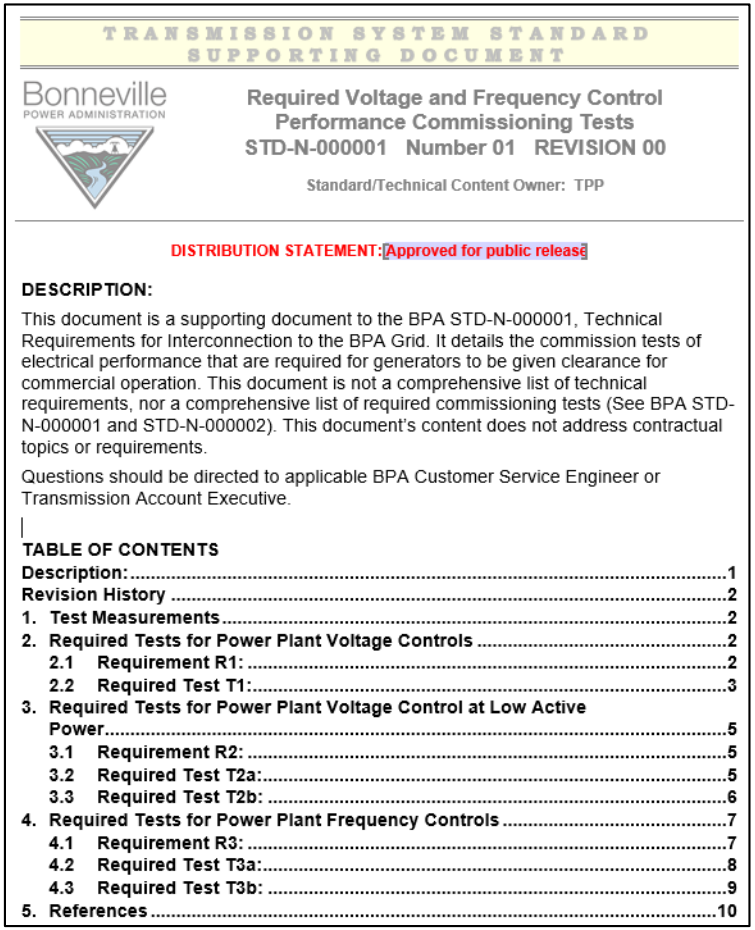
- Trial Operations test results are required and will be reviewed by BPA.
- Milestone 4 is the Commercial Operations designation for the generator. This will be communicated through the Account Executive after all tasks are complete to BPA's expectations.

STD-N-000001, Number 04 (Visio Document)



- Intent is to show high level process flow for quick glance and as an aid during coordination meetings.

Voltage and Frequency Control Testing



TRANSMISSION SYSTEM STANDARD SUPPORTING DOCUMENT

Bonneville POWER ADMINISTRATION

Required Voltage and Frequency Control Performance Commissioning Tests
STD-N-000001 Number 01 REVISION 00

Standard/Technical Content Owner: TPP

DISTRIBUTION STATEMENT: Approved for public release

DESCRIPTION:

This document is a supporting document to the BPA STD-N-000001, Technical Requirements for Interconnection to the BPA Grid. It details the commission tests of electrical performance that are required for generators to be given clearance for commercial operation. This document is not a comprehensive list of technical requirements, nor a comprehensive list of required commissioning tests (See BPA STD-N-000001 and STD-N-000002). This document's content does not address contractual topics or requirements.

Questions should be directed to applicable BPA Customer Service Engineer or Transmission Account Executive.

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- Required Voltage and Frequency Control Performance Commissioning Tests, STD-N-000001, Number 01.
- These tests are referred to during the Milestone 3, Trial Operations phase.
- This supporting document and the three generator commissioning discussed are referred to in BPA's Technical Requirements for Interconnection to the BPA Transmission Grid standard.

Questions?

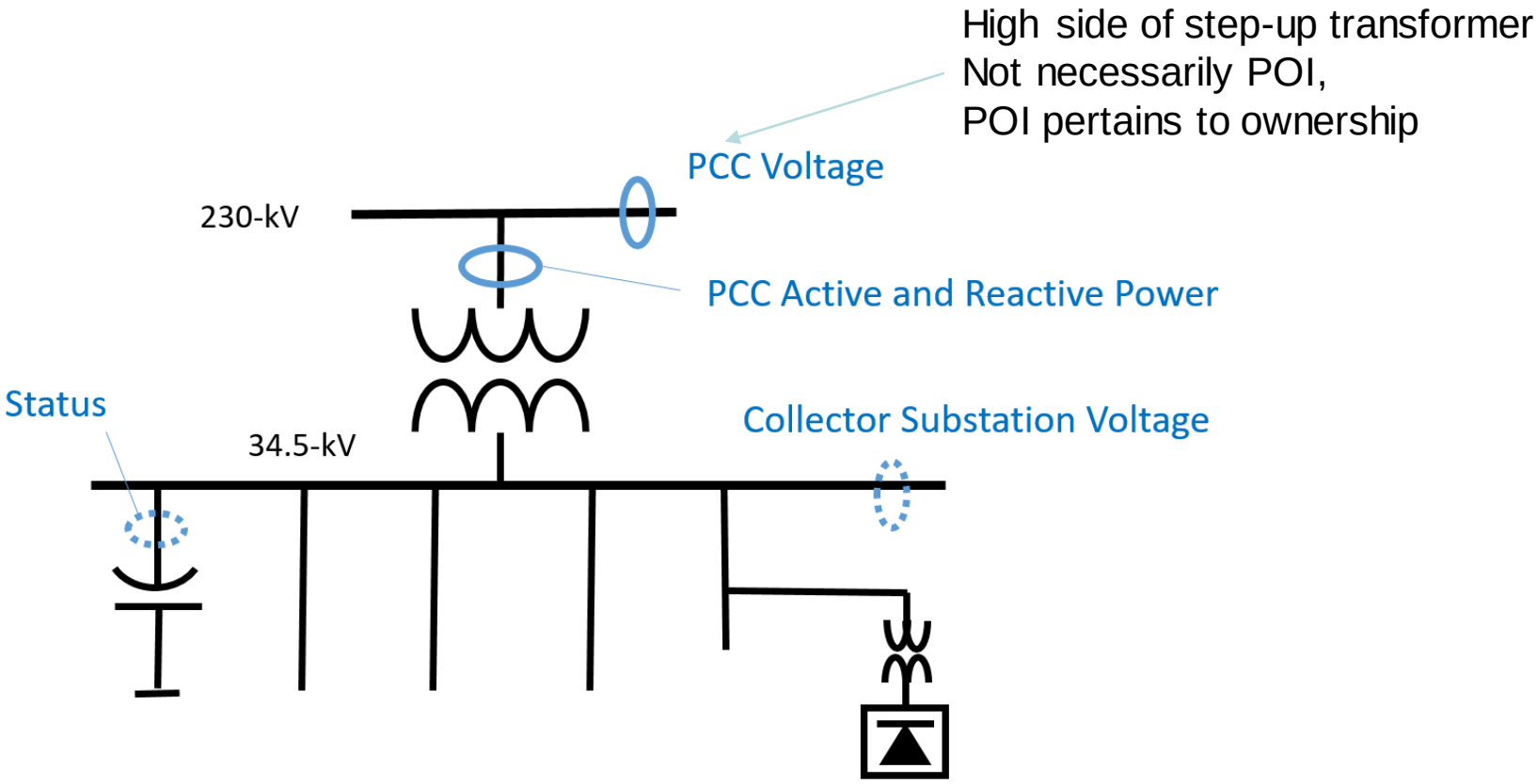
Commissioning Tests for Voltage & Frequency Control

Commissioning Tests for Voltage and Frequency Control

- Purpose of Testing:
  - Verify voltage control performance, frequency control performance, and plant reactive capabilities prior to releasing the plant to commercial operation

- Scope of commissioning test requirements
  - Voltage control
  - Plant reactive capability at low active power output
  - Frequency tests

Measurements and Terminology



Voltage Control Requirements R1

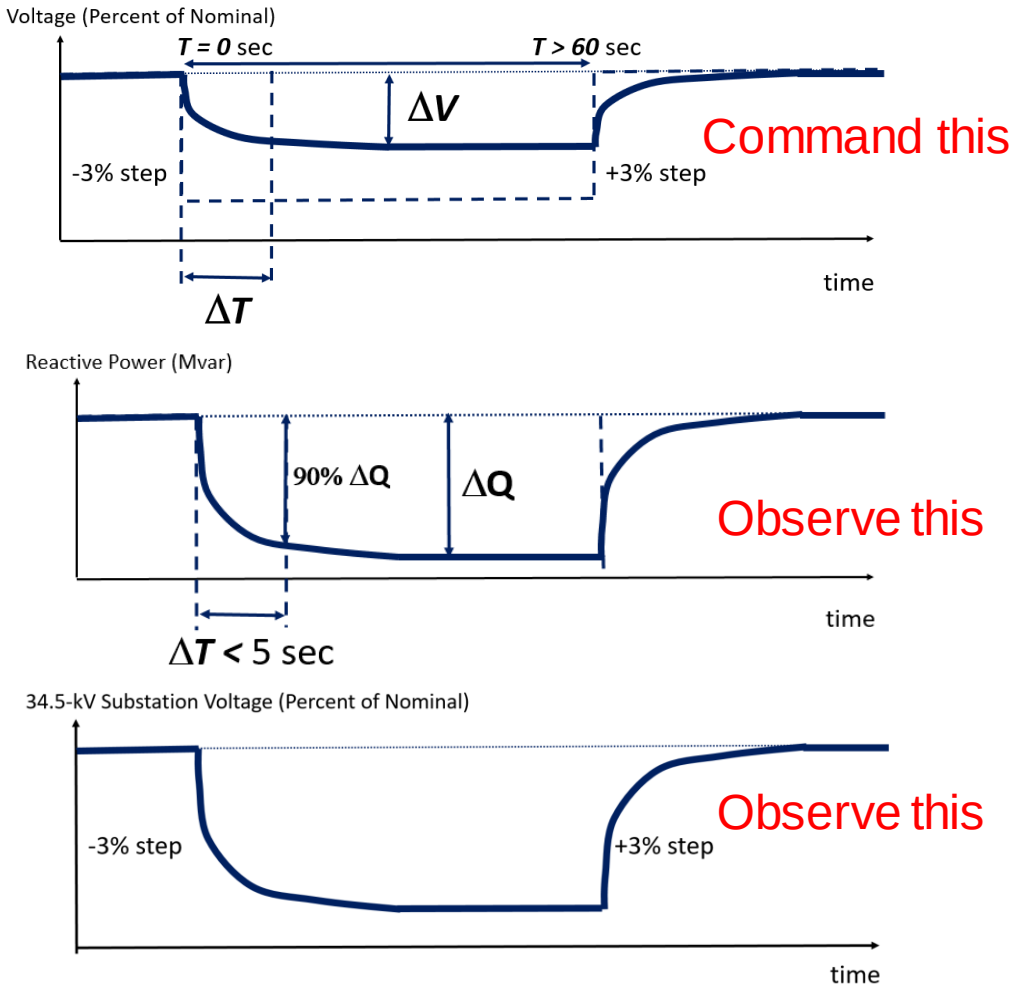
According to Technical Requirements for Interconnection to the BPA Transmission Grid STD-N-000001:

- The power plant shall operate in **voltage control mode with no dead-band.**
- The power plant shall demonstrate effective **reactive power droop of 7-12%**
  - The reactive droop requirement applies at the Point of Common Coupling.
- Required reactive power rise time is **less than 5 seconds**
- The power plant voltage controller shall coordinate control of all plant level shunt capacitors and reactors where they are required by interconnection requirements.

Voltage Control Test T1

- Expected performance in figures

$$Reactive\ Droop = -(V_{step,pu} - \Delta V_{pu}) / (\Delta Q_{MVAR} / PlantMW_{base})$$



Sample Calculation of Reactive Droop

Description / Variable Name	Initial	@ 5[s]	@ 30[s]	Delta (Δ)
Input Voltage Step (PU) / $V_{step,pu}$	N/A	N/A	N/A	-0.03
PCC Voltage V (PU of 230 kV) / V_{pu}	1.045		1.033	-0.012
Plant PCC Reactive Power Q (Mvar) / Q_{MVAR}	-5	-28	-30	-25
MW Base / MW_{base}	125	125	125	125
Droop				0.09
Change in Q within Rise Time as a % of total change	0	-23	-25	92%

Example: 125 MW wind power plant

A 3% voltage step down test resulted in a 1.2% voltage decrease and -25 Mvar reactive power decrease at the PCC.

Reactive Droop = (– 0.03 – (– 0.012)) / (– 25 / 125) = 0.09, *or* 9%

Reactive Capability Requirement R2

- BPA requires capability of providing the Minimum Plant Reactive Capability
- Minimum Plant Reactive Capability is defined as +/-33% of the plant's nameplate MW in dynamic MVARs at the POM.
- Reactive capability verification is also required by the NERC MOD-025 Standard

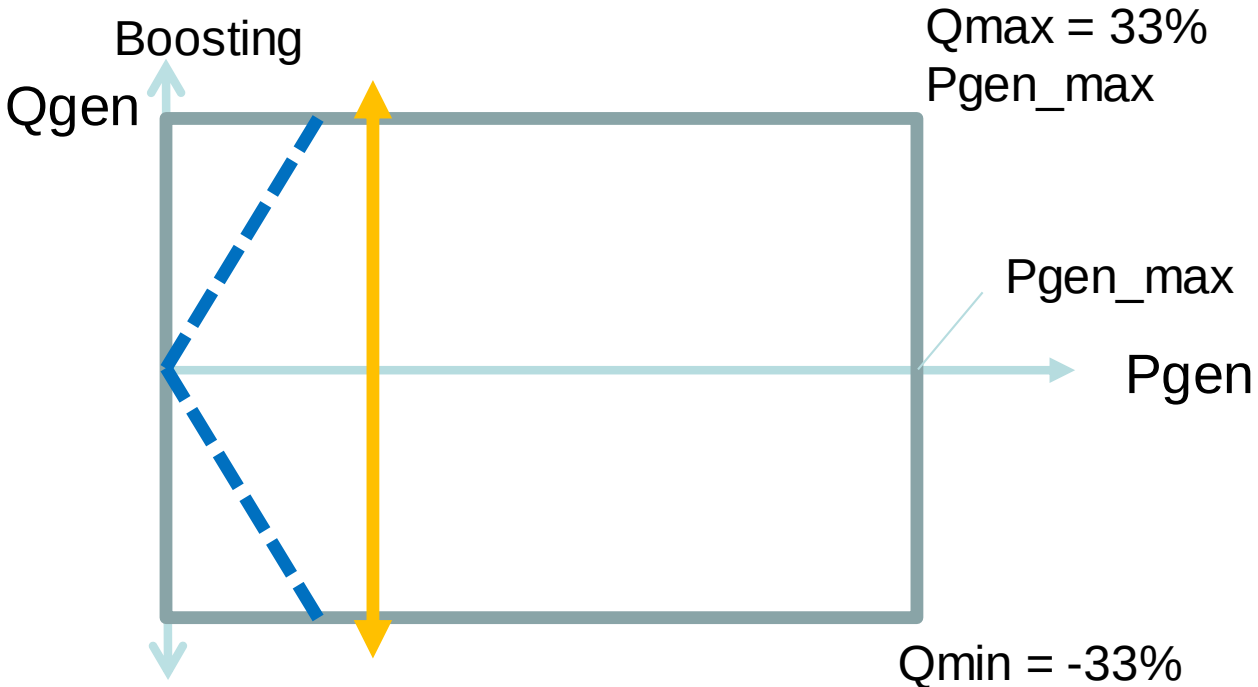


Figure: rectangular PQ requirement.

Sample Q at Low Power Output Calculation

Description / Variable Name	Final
Cumulative Input Voltage Reference Step (PU) / $V_{step,pu}$	4%
MW Base / MW_{base}	125
Reactive Power Absorbed at PCC (Mvar) / Q_{min}	47
Plant PCC Reactive Power Q (%) / Q_pu	37.6%

Example: 125 MW wind power plant

The plant is producing 0 MW and 0 Mvar. Then a 2% voltage step down, and 4 additional 0.5% steps test resulted in the plant absorbing (bucking) 47 Mvar at the PCC.

Reactive Capability at Low Power Output $= 47/125 * 100 = 37.6\%$. *This exceeds 33%, and thus passes the test.*

Frequency Control Requirements R3

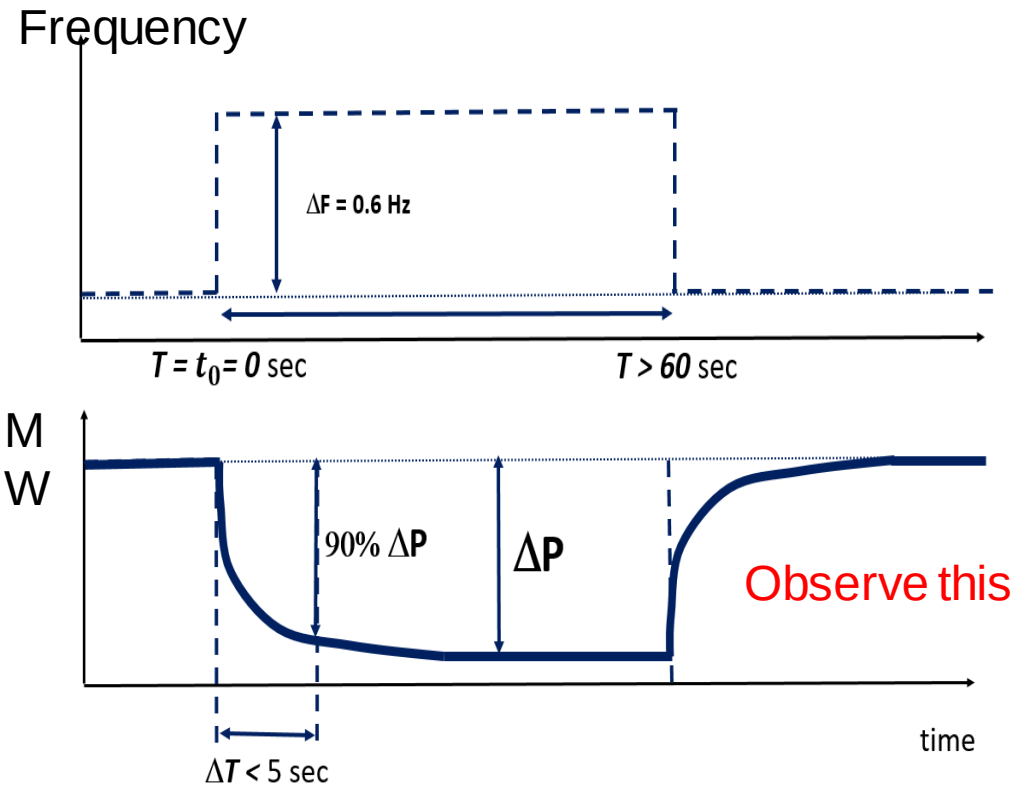
According to Technical Requirements for Interconnection to the BPA Transmission Grid STD-N-000001:

- Power-frequency controller governor droop should be set between 3% and 5%
- The total governor dead band (intentional plus unintentional) not to exceed +/-0.06% of 60HZ (+/-36 mHZ).
- Plant secondary controls, such as load controllers, when used, must have a frequency bias setting, ensuring that plant controls do not restrict frequency response.

Frequency Control Performance Test R3

- Expected performance in figures

$$Governor\ Droop = (\Delta f_{pu}) \ / \ (\Delta P_{MW} \ / \ PlantMW_{base})$$



Sample Calculation of Frequency Droop

Description / Variable Name	Initial $t=t_0=0$[s]	t = 5[s]	t = 30[s]	Delta
Frequency Step (MW) / $-F_{step,pu}$	N/A	N/A	N/A	0.01
Plant PCC Active Power (MW) / P_{MW}	90	70	68	-22
MW Base / MW_{base}	125	125	125	125
Droop				0.0568
MW Change within Rise Time as a % of total change	0	20	22	90.9%

A 125 MW wind power plant was operating at 90 MW on average prior to the step in frequency setpoint. Following the 1% step in frequency setpoint, the plant MW output reduced to 68 MW on average (at $t_0 + 30$*[s]).*

Active Droop = $- 0.01 / \left(\frac{68 - 90}{125}\right) = 5.68\%$*, which is within the test accuracy accounting for generation variability, and therefore would be considered to pass the 5% requirement.*

Submit to BPA Transmission Customer Service Engineer

Provide CSV file with test recordings with the following specifications:

- minimum sample rate of 30 samples per second
- PCC voltage (kV or per unit)
- PCC Active power (MW)
- PCC Reactive power (Mvar)
- 34.5 kV voltage (kV or per unit)
- shunt capacitor and reactor status/Mvars, if applicable

Links and References

- BPA Standard STD-N-000001 “Technical Requirements for Interconnection”: https://www.bpa.gov/transmission/Doing%20Business/Interconnection/Pages/default.aspx
- NERC Guidelines: https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Inverter-Based_Resource_Performance_Guideline.pdf
- IEEE P2800: https://standards.ieee.org/project/2800.html
- FERC Orders:
  - Order 827: https://www.ferc.gov/sites/default/files/2020-06/RM16-1-000.pdf
  - Order 842: https://www.ferc.gov/sites/default/files/2020-06/Order-842.pdf
- NERC MOD-025/026/027
  - https://www.nerc.com/files/MOD-025-2.pdf
  - https://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-026-1.pdf
  - https://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-027-1.pdf

Questions?
Or email your Customer Service Engineer

- Topics covered:
  - Voltage Control at normal active power output
  - Plant reactive capability at low active power output
  - Frequency control tests
  - Submission requirements

Appendix: Commissioning Tests for Voltage and Frequency Control

Testing is required in STD-N-000001 Technical Requirements for Interconnection:

- STD-N-000001 Governs Interconnections of:
  - Small Generators
  - Large Generators
  - Loads
- STD-N-000001 Covers:
  - Voltage control
  - Frequency control
  - Disturbance ride-through
  - Model submission
  - Others

Sample Calculation of Rise Time

Description / Variable Name	Initial	@ 5[s]	@ 30[s]	Delta (Δ)
Input Voltage Step (PU) / $V_{step,pu}$	N/A	N/A	N/A	-0.03
PCC Voltage V (PU of 230 kV) / V_{pu}	1.045		1.033	-0.012
Plant PCC Reactive Power Q (Mvar) / Q_{MVAR}	-5	-28	-30	-25
MW Base / MW_{base}	125	125	125	125
Droop				0.09
Change in Q within Rise Time as a % of total change	0	-23	-25	92%

The power plant reactive power decreases by 23 Mvar within 5[s] after the voltage step and 25 Mvar within 30[s].

Percent change $= 23/25 * 100\% = 92\%$ *exceeds the 90% definitional to rise time. Thus the plant passes the test.*

Sample Calculation of Rise Time

Description / Variable Name	Initial t=t_0=0[s]	t = 5[s]	t = 30[s]	Delta
Frequency Step (MW) / $-F_{step,pu}$	N/A	N/A	N/A	0.01
Plant PCC Active Power (MW) / P_{MW}	90	70	68	-22
MW Base / MW_{base}	125	125	125	125
Droop				0.0568
MW Change within Rise Time as a % of total change	0	20	22	90.9%

The plant had achieved 20 MW change within the first 5[s] of the frequency step and 22MW in 30[s].

Change during allowable Rise Time window: 20/22 = 90.9%, which exceeds the 90% definitional to rise time, and thus the plant passes the test.

EMT Modeling

Regulatory Requirement

BPA is required under FAC-002 to ensure the reliability of generation interconnections

R1. Each Transmission Planner and each Planning Coordinator shall study the reliability impact of: (i) interconnecting new generation, transmission, or electricity end-user Facilities and (ii) materially modifying existing interconnections of generation, transmission, or electricity end-user Facilities. The following shall be studied: [Violation Risk Factor: Medium] [Time Horizon: Long-term Planning]

Inverter Based Resources

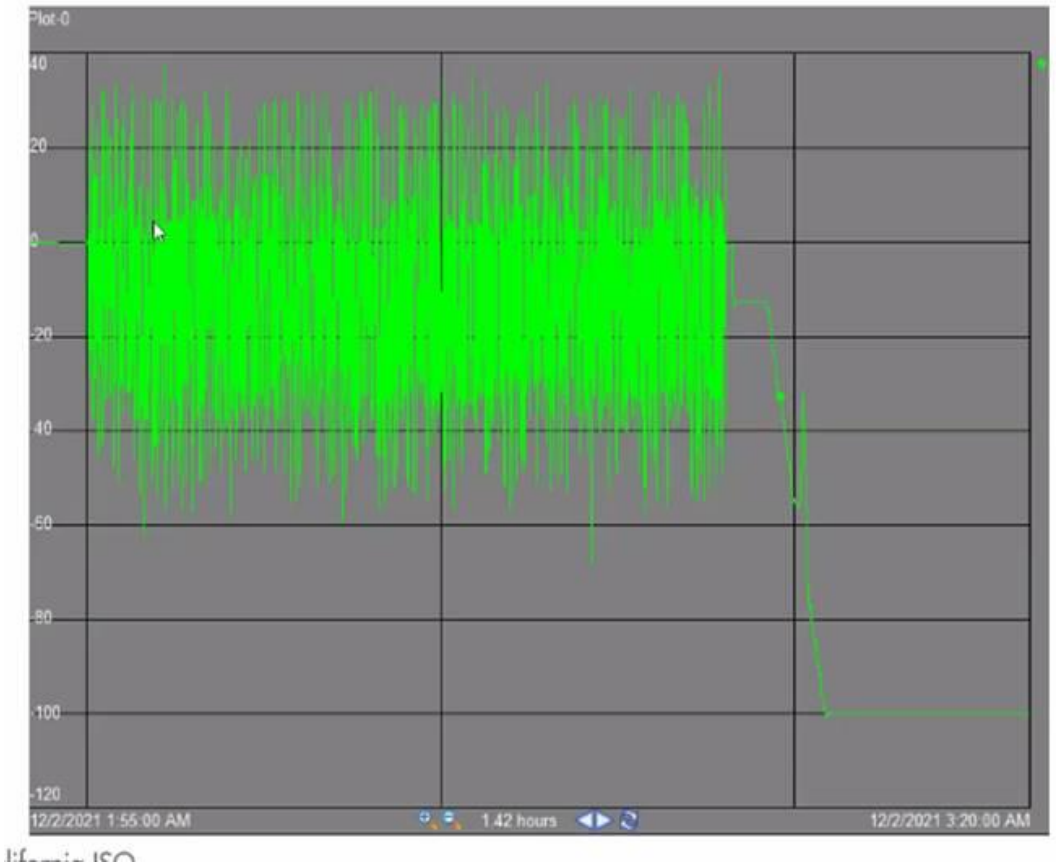
Recent experience has shown that positive sequence modelling alone is not sufficient to ensure reliability

- Odessa event report described various plant performance deficiencies that compromised reliability
- Other events, especially in California, have shown significant performance problems with inverter based resources

Inverter Based Resources

Very recent California event

- Incident occurred in December, 2021
- 400 MW battery had oscillations up to 100 MW for about an hour.
- Plant operators took manual action to stop the oscillation by going to manual mode.



Performance Based

BPA will expect that generators will ride through expected system events

- Common disturbances
  - single and multi-phase faults
  - loss of generation on the system
  - step changes in frequency for any reason
- Normal switching
  - line switching
  - shunt switching
  - generator switching
- Expected topology changes
  - Maintenance or construction outages
  - Other changes that affect Short Circuit Ratio
- Non-interaction with nearby equipment
  - other generators
  - active or passive reactive devices

BPA EMT Requirements

BPA is discussing possible requirements

- EMT models to be submitted as part of the interconnection process
- Attestation or verification that the equipment will have acceptable performance per expected system events and conditions
- Verification of correct model and correct parameters at the time of interconnection
- Changes to equipment or parameters require a data submission
- Process for modelling and testing to resolve performance issues that arise during operation

Modeling Details

Models should be sufficient to capture common operational issues

- PLL Loss of synchronization
- Feeder protection operation
- Plant controller operation
- Inverter controls
- Negative interactions between all of the above controls
- Performance with expected Short Circuit Ratios
- Interactions with nearby equipment

Testing and Verification

BPA will seek to verify that the equipment installed will not compromise reliability

- Attestation, modelling results, type testing, field tests may be requested in some combination to prove performance
- Performance based requirements apply
- BPA may request data to resolve system problems that arise after interconnection

Data Requirements

NERC experience has shown that sufficient data is invaluable to resolving problems

- NERC has made data requirements recommendations based on event analysis
- BPA is discussing standards to ensure sufficient post-event data is available
- Data requirements may include:
  - DFR data (from controllers or dedicated devices)
  - DDR data (from controllers dedicated devices)
  - PMU data (relay data or dedicated PMU)
  - Fault codes (controllers)
- Data retention should be sufficient so that fault data is not overwritten before collection

Thank You!

Additional resources

NERC - IRPWG work plan:
https://www.nerc.com/comm/RSTC/IRPWG/IRPWG%20Work%20Plan.pdf

IEEE - P2800.2 kickoff meeting:
https://sagroups.ieee.org/2800-2/wp-content/uploads/sites/478/2022/01/IEEE-P2800.2-kickoff-meeting.pdf

NERC Odessa Disturbance Report:
https://www.nerc.com/pa/rrm/ea/Documents/Odessa_Disturbance_Report.pdf

NERC Major Event Analysis Reports:
https://www.nerc.com/pa/rrm/ea/Pages/Major-Event-Reports.aspx

NERC Inverter Based Resources Reliability Guideline (2018):
https://nerc.com/comm/oc_reliability_guidelines_dl/inverter-based_resource_performance_guideline.pdf

NERC IBR Interconnection Improvements Guideline (2019):
https://www.nerc.com/comm/OC_Reliability_Guidelines_DL/Reliability_Guideline_IBR_Interconnection_Requirements_Improvements.pdf

Additional resources continued

P2800.2 PAR Summary

- Title:
  - Recommended Practice for Test and Verification Procedures for Inverter-based Resources (IBRs) Interconnecting with Bulk Power Systems
- Scope:
  - Define **recommended practices** for test and **verification procedures to confirm plant-level conformance** of IBRs interconnecting with bulk power systems in compliance with IEEE Std 2800
  - Applies to IBRs in transmission and sub-transmission systems
  - May also apply to isolated IBRs interconnected to an AC transmission system via dedicated voltage source converter high-voltage direct current (VSC-HVDC) transmission facilities, e.g., offshore wind farms
  - Specifications for the equipment, conditions, tests, modeling methods, and other verification procedures that should be used to demonstrate conformance with IEEE P2800
- Includes:
  - Type tests (unit level, not full compliance)
  - Design evaluation, including modeling
  - As-built evaluation and commissioning tests
  - Post-commissioning model validation, monitoring, periodic tests, and periodic verifications
- Recommended practice: Uses “should” language, not “shall” language.
  - In recognition that prescribing uniform procedures across all IBR types and utility locations would be very challenging

IEEE PES Power & Energy Society®

IEEE IEEE

Oversupply 2021 Season Overview

2021 OMP Recap

- The Jan-Jul water volume for 2021 was 82.2 MAF vs 2020 which was 101.6 MAF. Typically, the Jan-Jul water volume average is 103.3 MAF. Its hard to say what this year's runoff will yield.
- In 2021, there were no OMP triggered events.
- Since there were no OMP events, BPA did not waive any losses.
- No generators were displaced.
- No displacement costs to report.

Upcoming OMP Generator Costs 2022 Submittal Period

- The submittal period for generators to provide their facility's displacement costs will begin March 1, 2022.
  - Generators must register on the Accion site.
  - Accion will email current year participants when site is live.
  - Submissions must be completed by March 15.
- Per Attachment P, generators must submit their facility's displacement costs for inclusion in the Least-Cost Displacement Curve. Before submitting displacement costs, please ensure they are eligible for reimbursement.
  - Failure to submit displacement costs will result in a displacement cost of $0/MWh for that facility.

Minimum Generation Reminders

- Minimum Generation Values are entered into the Customer Data Entry (CDE) System.
  - Min Gen levels are equal to or less than a resource's schedule or generation estimate.
  - Hourly values may be modified until 57 minutes before the operating hour.
  - Resources may follow their maximum ramp rate when following a Dispatch Order to reduce to their Min Gen.
  - See BPA's OMP Business Practice for more information at: https://www.bpa.gov/transmission/Doing%20Business/bp/tbp/Oversupply-Management-Protocol-BP.pdf

Loss Waivers

- Waiving Loss Obligations
  - BPA will make the determination to waive losses on the day prior to the WECC preschedule trading day.
  - Loss obligations will be cleared from the OATI Loss Module/CDE by 5am on the WECC preschedule trading day.
  - If a transmission customer schedules loss returns for a waived hour, then its loss tags will be curtailed for that hour.
  - No changes were made to last year's loss waivers program.

OMP Annual System Test

- OMP Annual System Test was conducted the week of January 24th.
- OMP was tested for multiple hours due to testing of new OMP systems for EIM readiness.
- No displacement of generation below schedules was required.
  - All Generators should have limited to Schedule (or Generation Estimate for behind-the-meter).
  - No Cost Generators were not required to reduce to Minimum Generation
- No OMP credits or FTC will applies during the test period(s)
  - Generators that failed to respond, will likely receive follow up after the fact from BPA.
  - Compliance with other Dispatcher directives is always necessary.

Where to Find More Information

- Questions regarding the Accion website should be directed to: https://oversupply.accionpower.com/_bpa_1901/accionhome.asp
- For BPA's OMP Business Practice, go to: https://www.bpa.gov/transmission/Doing%20Business/bp/Pages/Business-Practices.aspx
- For BPA's OATT Attachment P, go to: https://www.bpa.gov/transmission/Doing%20Business/Tariff/Pages/default.aspx
- For other questions on BPA OMP, email techforum@bpa.gov with "Oversupply" in the subject heading.

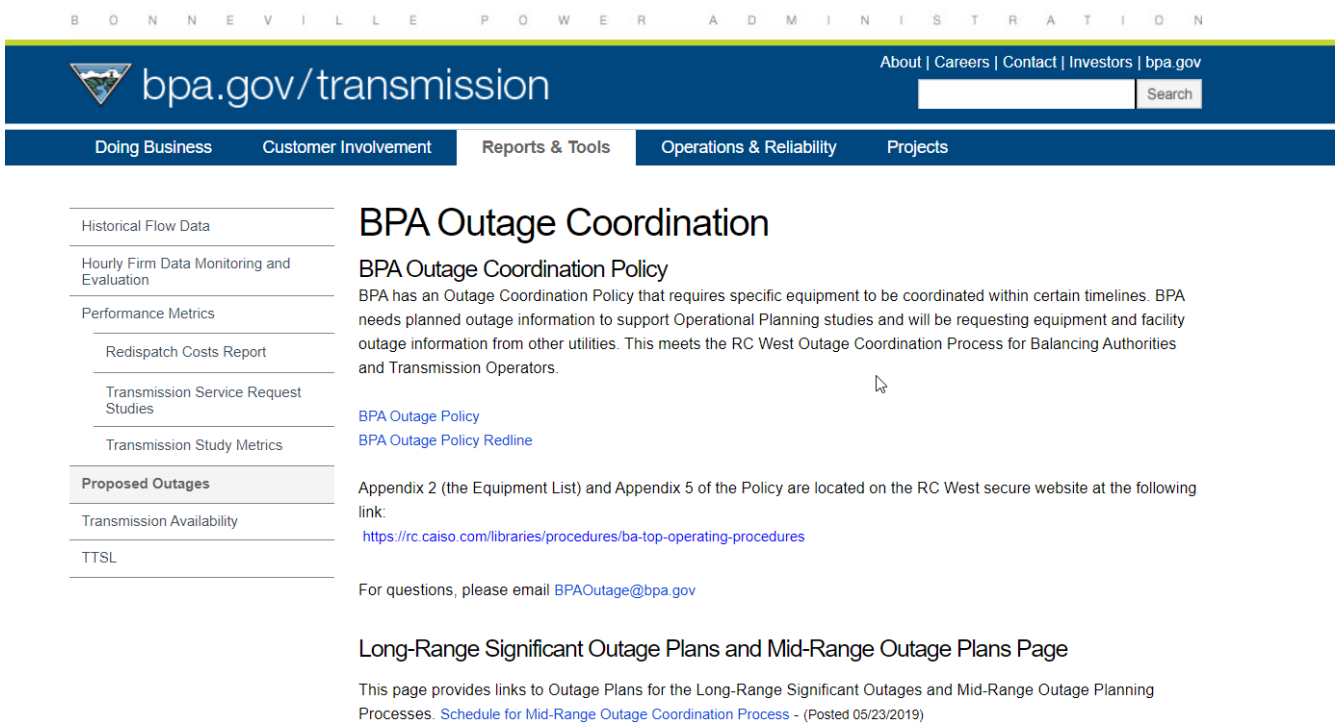
2022 Outages

2022 Outages

Start Time	Stop Time	Description	Paths
Fri 04/01/2022 00:01:00 PPT	Tue 05/31/2022 23:59:00 PPT	SLATT: 500/230KV TRANSFORMER 1 (SPRING DERATE)	GEN
Mon 05/02/2022 08:00:00 PPT	Thu 05/05/2022 15:00:00 PPT	CENTRAL FERRY: PCB 5388 RELAYS	GEN
Mon 05/02/2022 08:30:00 PPT	Fri 06/03/2022 16:00:00 PPT	JONES CANYON-TUMBLE CREEK SECTION OF JONES CANYON-SANTIAM NO 1 230KV LINE	GEN,WOCS,WOM
Mon 05/09/2022 08:00:00 PPT	Fri 05/13/2022 15:00:00 PPT	JOHN DAY: 500/230KV TRANSFORMER 1	GEN,JDAY,WOJD
Mon 05/09/2022 08:00:00 PPT	Thu 05/12/2022 15:00:00 PPT	CENTRAL FERRY: PCB 5391 RELAYS	GEN

BPA Outage Coordination Webpage

- https://www.bpa.gov/transmission/Reports/Pages/Proposed-Outages.aspx



Long Range Significant Outages

Long-Range Significant Outages

The following outages are for information purposes only. Outages are still being adjusted and/or moved. These outages are subject to change.

NOVEMBER 2021-JANUARY 2022(08/11/2021)
DECEMBER 2021-FEBRUARY 2022 (09/03/2021)
JANUARY 2022-MARCH 2022 (10/01/2021)
FEBRUARY - APRIL 2022 (12/03/2021)
APRIL 2022 - JUNE 2022 (01/04/2022)

APRIL 2022 (02/04/2021)
MAY 2022 (03/03/2021)
JUNE 2022 (04/01/2021)
JULY 2022 (05/05/2020)
AUGUST 2022 (06/01/21)
SEPTEMBER 2022 (07/02/2021)
OCTOBER 2022 (08/11/2021)
NOVEMBER 2022 (09/02/2021)
DECEMBER 2022 (10/01/2021)
JANUARY 2023 (12/02/2021)
FEBRUARY 2023 (12/01/21)
MARCH 2023 (01/04/22)

Monthly Spreadsheets

Look for your POI Substation or Line name

	A	B	C	D	E	F	G
						APRIL 2022	
	Id	**Foreign IDs**	**DART**	**Start Time**	**Stop Time**	**Description**	**Paths**
	1		1126434	Fri 08/25/2017 16:30:00 PPT	Fri 04/01/2022 18:00:00 PPT	MCC - OLYMPIA-GRAND COULEE NO 1 287KV LINE - OPERATING AT 230KV	BCHT,BCHW,IROL,NOEL,NOH,RP,SOC,WOCN
	2		1400384	Sat 10/10/2020 08:00:00 PPT	Sun 04/10/2022 16:00:00 PPT	BCH - MICA CREEK: 500KV REACTOR 4 (MCA 5RX4)	NI,BCHW,BCHT
	3	To RC West ID: 9741845	1421102	Wed 02/03/2021 09:00:00 PPT	Fri 04/01/2022 17:00:00 PPT	-USBR- GRAND COULEE 287/230KV TRANSFORMER KX-17-A (OLYMPIA-GRAND COULEE NO 1 287KV LINE OPERATING AT 230KV)	BCHT,BCHW,IROL,NOEL,NOH,RP,SOC,WOCN,OKLA,PA
	4	To RC West ID: 9283721	1405060	Mon 05/10/2021 07:00:00 PPT	Sun 05/22/2022 17:00:00 PPT	BIG EDDY-QUENETT CREEK NO 2 230KV LINE	
	5	To RC West ID: 9464728	1398248	Tue 07/06/2021 09:30:00 PPT	Tue 07/19/2022 14:00:00 PPT	-HEW- 451-B SUBSTATION AND DOE 451B: B-1409 LINE SECTIONALIZING DISC, PCB B-1413, PCB B-1418	
	6	To RC West ID: 9708685	1402616	Mon 08/02/2021 08:00:00 PPT	Fri 08/05/2022 13:00:00 PPT	CAPTAIN JACK: 500KV CAP GROUP 3 INCLUDING PCB 4928	COI,NWACI,PDCI
	7		1419000	Mon 11/01/2021 08:00:00 PPT	Fri 04/01/2022 16:00:00 PPT	-AVA- LOLO-OXBOW 230KV LINE	ID-NW
	8	To RC West ID: 9610658	1403228	Fri 01/28/2022 17:00:00 PPT	Thu 04/14/2022 06:30:00 PPT	HANFORD: PCB 4092 INCLUDING MODS 4091 & 4093	NJD,NOH,NWACI,PDCI
	9	To RC West ID: 8864973	1391516	Fri 04/01/2022 18:00:00 PPT	Fri 04/01/2022 19:00:00 PPT	OLYMPIA-GRAND COULEE NO 1 287KV LINE	BCHT,BCHW,IROL,NOEL,NOH,RP,SOC,WOCN
	10	OTS Ticket # 7076 To RC West ID: 8864973	1391516	Fri 04/01/2022 18:00:00 PPT	Fri 04/01/2022 19:00:00 PPT	-USBR- GRAND COULEE 287/230KV TRANSFORMER KX-17-A (OLYMPIA-GRAND COULEE NO 1 287KV LINE)	BCHT,BCHW,IROL,NOEL,NOH,RP,SOC,WOCN,PA,OKLA,NJD
	11	OTS Ticket # 8540 To RC West ID: 9547075	1413840	Mon 04/04/2022 01:00:00 PPT	Fri 04/15/2022 17:00:00 PPT	GRAND COULEE: PCB 2392, PCB 2396	COI,GEN,NJD,NOH,NWACI,PDCI,WOCN
	12	OTS Ticket # 7743 To RC West ID: 9556156	1405216	Mon 04/04/2022 05:00:00 PPT	Thu 04/14/2022 17:30:00 PPT	CHIEF JOSEPH: A-592 TERMINAL OF CHIEF JOSEPH PH-CHIEF JOSEPH NO 3 230KV LINE	GEN,NOH
	13	To RC West ID: 9413409	1408888	Mon 04/04/2022 08:00:00 PPT	Thu 04/07/2022 14:30:00 PPT	-H.E.W.- A-8-A-6 SECTION OF MIDWAY-HEW NO 2 230KV LINE	TCLA

Look for “Gen” in “Paths” column

Reminders

Reminders

- Sign up for Tech Forum notifications at
  - https://www.bpa.gov/contact/forms/pages/transmission-contact-information.aspx
- Background information on BP's Rate Case (BP-24) and/or Transmission Terms and Conditions (TC-24) is available at:
  - https://www.bpa.gov/Finance/RateCases/Pages/default.aspx
- Stay tuned for Tech Forum notification of upcoming proposed changes to BPA's Business Practices.