BONNEVILLE POWER ADMINISTRATION

Transmission Planner (TP) - Generator Owner (GO)
&
Transmission Operator (TOP) - Generator Operator (GOP)-Mappings

December 18, 2018

Vancouver, WA

Welcome Generator Owners and Operators

Role Call

Safety Moment

Functional Mapping Background

WECC Functional Mapping 2013-2019:

2013/14 – BPA confirmed role as PC for other entities

2016 – TOs must map to a TP and TOP

Result = TOP Project and TP CFR

2018/19 – GOs must map to a TP and GOPs must map to a TOP

Result = TP-GO and TOP-GOP Implementation Plans

Mapped Facilities 12/18/2018:

BPA PC	TOP-GOP	TO-GO
70	62	61

Transmission Operator (TOP) to Generator Operator (GOP)

TOP-GOP Timeline

TOP-GOP High level Plan

11/5/2018	Accept TOP-GOP mappings
2/1/2019	Assess indication and control
7/1/2019	Update LGIAs to capture TOP-GOP
12/1/2019	Achieve full TOP compliance (exc. Fed)

TOP Processes

- In addition to all requirements under the Mandatory Reliability Standards, BPA will specify Operational Requirements
  - Outage Coordination
  - Real-time Procedures
  - Event Reporting (EOP-004)
  - Changes in equipment
  - Loss of visibility or control repair expectations

TOP Processes: Outage Coordination

- GOPs will be required to follow BPA's Outage Coordination Policy for all mapped generators.
  - BPA Outage Coordination Policy
- Transition to CAISO RC:
  - BPA's 45-day process will change to 60 days to align with CAISO's Mid-Range process. Change will be implemented in May-June timeframe.
  - Data submission requirement changes *may** include:
    - Estimated time to restore: This is a required field for CAISO.
    - Switching Devices: Must be submitted with every outage.
    - Unit outages must be submitted if the unit is unavailable.
    - Derates as separate requests: Currently some transmission outages are submitted with derates.

*BPA is in discussions with CAISO about these changes. They are not yet final.

TOP Processes: Real-time Procedures

- Real-time Procedures will be closely tied to Standards but may call out additional notification requirements or specific timelines that are not captured within the Standards.

TOP Processes: Event Reporting (EOP-004)

- Both TOP and GOP are responsible for reporting several event types in the EOP-004 table.
- BPA will clarify which Entity should report for each event type.
- BPA will require that GOPs provide a copy of any reports they file to BPA, and BPA will share copies of any reports it files to impacted GOPs.

TOP Processes: Changes in equipment

- BPA requires that GOPs notify us prior to making changes to equipment.

TOP Processes: Loss of Visibility and/or Control - Repair Expectations

- If BPA loses a single piece of data or a single control point on a generator for which BPA is TOP, BPA may consider allowing response/repair to wait until normal working hours, based on BPA dispatcher judgment.
- Should BPA lose more than a single piece of data or a single control point but less than an entire station, the appropriate response would be up to the judgment of the BPA's Senior Dispatcher dependent upon system conditions.
- In the event that BPA loses visibility and/or control of an entire station or group of stations for which BPA is TOP, BPA requires an immediate response (24/7) from Customer to troubleshoot and initiate corrective action and may require Customer to call out operations staff to man the station(s) that were lost.

Transmission Planner (TP) to Generator Owner (GO)

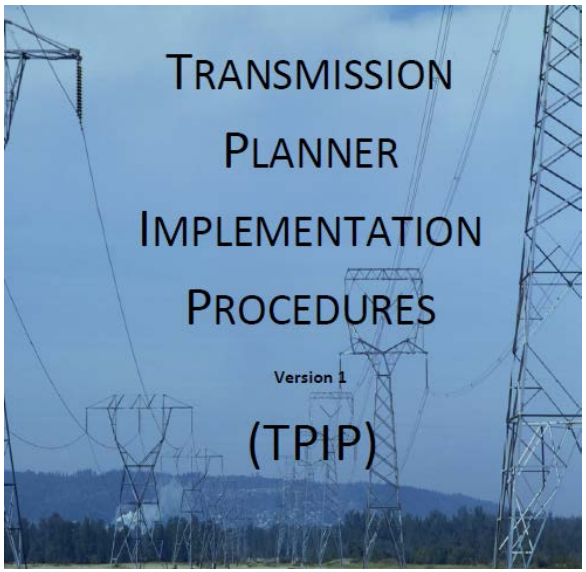
TP-GO Timeline

TP-GO High level Plan

11/5/2018	Accepted TP-GO mappings
Nov-Dec	Further refinement of project scope
1/30/2019	Determine appropriate contract vehicle
5/1/2019	BPA fully compliant

TP-GO Processes

- Transmission Planning Implementation Procedures (TPIP)
- TPL-001-4: Annual data request for Planning Horizon > 6 month outages (R1.1.2)
- MOD-026/027



MOD-026/027

- MOD-026: Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions:

- MOD-027: Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions

BPA's TP Criterion

- WECC Wind Plant Dynamic Modeling
- BPA's Wind Power Plant Data Requirements
- BPA's Generation Model Verification Process
- Adhere to BPA's Testing Schedule
- What does BPA require in a complete GDR?

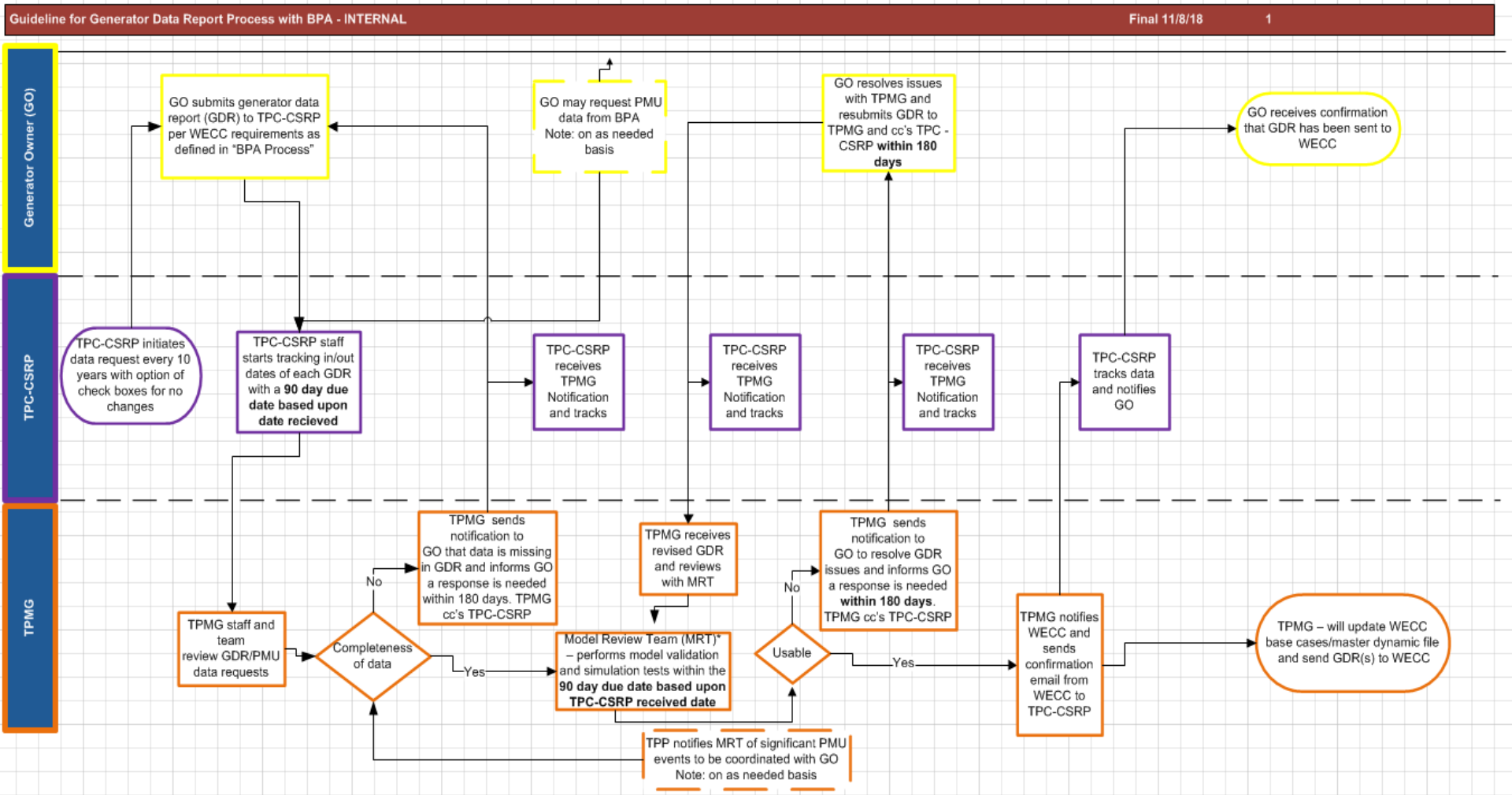
What does a TP do with a Generator Data Report (GDR)?

Data Report Testing Procedure

Model Data Review (Transmission Planner actions):

- TP will test the data by performing the following simulations:
  - John Undrill's Data Checker 3ic/4ia
  - Infinite Bus Oscillation
  - Infinite Bus Line Fault
  - Infinite Bus Under Frequency
  - Infinite Bus Voltage Step
  - Infinite Bus Governor Step
  - WECC approved case- 90 second no disturbance run
  - WECC approved case- Chief Jo Break Insertion
  - WECC approved case- Double Palo Verde Outage
  - *WECC approved case- John Day-Grizzly 1 & 2 500kV outage
  - *High Gen Drop

- TP will inform the GO whether the model is usable or not usable based on the simulations specified above within 90 days of the report receipt date from the GO.
- TP will submit the verified GDR to WECC's staff associated with an indication of complete or incomplete and notice to GO.


Guideline for Generator Data Report Process with BPA - INTERNAL
Final 11/8/18
1
Generator Owner (GO)
TPC-CSRP
TPMG
GO submits generator data report (GDR) to TPC-CSRP per WECC requirements as defined in "BPA Process"
GO may request PMU data from BPA Note: on as needed basis
GO resolves issues with TPMG and resubmits GDR to TPMG and cc's TPC - CSRP within 180 days
GO receives confirmation that GDR has been sent to WECC
TPC-CSRP initiates data request every 10 years with option of check boxes for no changes
TPC-CSRP staff starts tracking in/out dates of each GDR with a 90 day due date based upon date recieved
TPC-CSRP receives TPMG Notification and tracks
TPC-CSRP receives TPMG Notification and tracks
TPC-CSRP receives TPMG Notification and tracks
TPC-CSRP tracks data and notifies GO
TPMG staff and team review GDR/PMU data requests
Completeness of data
No
Yes
TPMG sends notification to GO that data is missing in GDR and informs GO a response is needed within 180 days. TPMG cc's TPC-CSRP
TPMG receives revised GDR and reviews with MRT
Model Review Team (MRT)* – performs model validation and simulation tests within the 90 day due date based upon TPC-CSRP received date
Usable
No
Yes
TPMG sends notification to GO to resolve GDR issues and informs GO a response is needed within 180 days. TPMG cc's TPC-CSRP
TPMG notifies WECC and sends confirmation email from WECC to TPC-CSRP
TPMG – will update WECC base cases/master dynamic file and send GDR(s) to WECC
TPP notifies MRT of significant PMU events to be coordinated with GO Note: on as needed basis

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MOD-026-1/MOD-027-1 Requirements

R1: Each TP provides information to the GO upon request:

- List of models acceptable to TP
- Block diagrams and/or data sheets for acceptable models
- Model data for GO's existing units

R2: GO provides verified generator dynamic model(s) for each unit

- Model verified by GO using one or more models acceptable to TP
- Each verification includes the following:
  - Unit's model response matches recorded response (*next page*)
  - Manufacturer, model number (if available), and type of system
    - e.g., digital vs. analog, static vs. rotating exciter, plant controls
    - e.g., turbine type, boiler type, fuel type, manufacturer and controls
  - Model structure and data
    - e.g., block diagram, time constants, gains, limits, generator data
  - Outer loop controls – blocked or nonfunctioning controls or modes of operation that limit response

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MOD-026-1/MOD-027-1 Requirements

R3: GO provides written response to TP after receiving from TP:

- Notification that model is not usable
- Comments identifying technical concerns with verification documents
- Comments and supporting evidence indicating modeled response does not approximate recorded response for three or more events
- Response will include either technical basis for maintaining model, model changes, or plan to perform verification

R4: GO provides revised model or plans to perform PPMV within 180 days of making changes to controls or equipment that alters response characteristic.

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MOD-026-1/MOD-027-1 Requirements

MOD-026-1:

R5: GO provides response to TP within 90 days following receipt of technically justified* request to perform model review, including:

- Details of plans to verify model
- Corrected model data including source of revision

* TP demonstrates simulated vs. measured response does not match

MOD-027-1 / MOD-026-1:

R5/R6: TP provides written response to GO within 90 days of receiving verified model that model is usable or not usable, including:

- Initializes without error
- No-disturbance simulation results in negligible transients
- Exhibit positive damping

Formalize Agreement

- LGIA – Appendix H
  - Additions will formalize the TP-GO and the TOP-GOP relationship including requirements for following BPA procedures

Next Steps

Early Spring 2019:

- Share draft LGIA Appendix H
- Draft generator specific information processes and procedures

Late Spring 2019:

- Update LGIA Appendix H

Questions and Answers

Appendix

- MOD-026 and MOD -027
  - Excitation System Models
  - Governor Models
  - Effective dates including phased in implementation

Version May 2018: Effective date is 5/11/18

NOTES:

WECC needs to input the data to the PSLF program, with conversion to the PSS/E program. Therefore, model data must be submitted that can be input to PSLF.

* The PSLF models are converted to these PSS/E models by PTI's conversion program

Where different variants of the same model exist, the preferred version for submittal to WECC is highlighted in green. Where only one model is available for a certain piece of equipment, no highlighting is used.
These models currently are not converted from PSLF to PSS/E.
These models are not approved for use in WECC.

MOD-026

EXCITATION SYSTEM MODELS (Volt/Var Control Models)

GE PSLF	PTI PSS/E*	PowerWorld Simulator	IEEE Standard	Status	Comments	Modifications/Actions Needed	PTI/GE/PowerWorld Comments
exac1	EXAC1	EXAC1	AC1A	approved 8/11/06	Brushless AC		Differs from IEEE AC1A -- does not have OEL/UEL inputs and m
esac1a	ESAC1A	ESAC1A	AC1A	approved 1/21/11	2005 IEEE standard - updated AC1A with OEL/UEL inputs		In all programs
exac1a	EXAC1A	EXAC1A		approved 8/11/06	exac1 with altered rate feedback source		
exac2	EXAC2	EXAC2		approved 8/11/06	HIR Brushless		Differs from IEEE AC2A -- no OEL/UEL inputs; different field curr
esac2a	ESAC2A	ESAC2A	AC2A	approved 1/21/11	2005 IEEE standard - updated AC2A		In all programs
exac3	EXAC3	EXAC3		never approved	Not used in WECC database		In all programs
exac3a	ESAC3A	EXAC3A	AC3A	approved 8/11/06	GE Alterrex (rare)		Differs from IEEE AC3A -- no OEL/UEL inputs; different field curr
esac3a	ESAC3A	ESAC3A	AC3A	approved 1/21/11	2005 IEEE standard - updated AC3A		In all programs
exac4	EXAC4	EXAC4	AC4A	approved 8/11/06	Rotating AC with controlled rectifier (Althyrex) (rare)		Differs from IEEE AC4A -- no OEL/UEL inputs
esac4a	ESAC4A	ESAC4A	AC4A	approved 1/21/11	2005 IEEE standard - updated AC4A		In all programs
esac5a	ESAC5A	ESAC5A	AC5A	approved 1/21/11	Simplified brushless exciter		In all programs
exac6a	ESAC6A	EXAC6A	AC6A	never approved	Alternator, noncontrolled rectifier, lead-lag		Differs from IEEE AC6A -- no OEL/UEL inputs; speed multiplier, n
esac6a	ESAC6A	ESAC6A	AC6A	approved 1/21/11	2005 IEEE standard - updated AC6A		In all programs
esac7b	AC7B	ESAC7B and AC7B	AC7B	approved 1/21/11	2005 IEEE standard - new		In all programs
exac8b	ESAC8B	EXAC8B	ESAC8B	approved 8/11/06	Brushless exciter with PID voltage regulator		Differs from IEEE AC8B -- no exciter upper limit; added input limi
esac8b	AC8B	ESAC8B_GE and AC8B	AC8B	approved 1/21/11	2005 IEEE standard - updated AC8B		In all programs
exbbc	BBSEX1	EXBBC and BBSEX1		approved 8/11/06	Static with ABB regulator		In all programs
exdc1	IEEEX1	EXDC1 and IEEEX1	DC1A	approved 8/11/06	Rotating DC		Differs from IEEE DC1A -- no UEL inputs; speed multiplier
esdc1a	ESDC1A	ESDC1A	DC1A	approved 1/21/11	2005 IEEE standard - updated DC1A		In all programs
exdc2	EXDC2	EXDC2_GE and EXDC2_PTI		approved 8/11/06	Rotating DC with terminal fed pilot, alternate feedback		
exdc2a	EXDC2	EXDC2A and EXDC2_PTI	DC2A	approved 8/11/06	Rotating DC with terminal fed pilot		Differs from IEEE DC2A -- no UEL inputs; speed multiplier
esdc2a	ESDC2A	ESDC2A	DC2A	approved 1/21/11	2005 IEEE standard - updated DC2A		In all programs
exdc4	IEEET4	EXDC4 and IEEET4	DC3A	approved 8/11/06	Rotating, noncontinuous - minor differences between models		If Kr = 0, should convert to IEEEX4 (IEEE DC3A).Model added in
esdc3a	DC3A	ESDC3A and DC3A	DC3A	approved 1/21/11	Rotating, noncontinuous		In all programs
esdc4b	DC4B	ESDC4B	DC4B	approved 1/21/11	Rotating DC with PID		In all programs
exeli	EXELI	EXELI		approved 8/11/06	Static PI transformer fed excitation system		
exst1	EXST1	EXST1_GE and EXST1_PTI	ST1A	approved 8/11/06	Static with double lead/lag		Differs from IEEE ST1A -- no OEL/UEL inputs; added Xe lfd load
esst1a	ESST1A	ESST1A and ESST1A_GE	ST1A	approved 1/21/11			In all programs
exst2	EXST2	EXST2		approved 8/11/06	SCPT - lead/lag block (Tc, Tb) added		
exst2a	ESST2A	EXST2A	ST2A	approved 8/11/06	lead/lag block (Tc, Tb) is included to match the WECC FM		Differs from IEEE ST2A -- no UEL inputs; added lead/lag.
esst2a	ESST2A	ESST2A	ST2A	approved 1/21/11	2005 IEEE standard - updated ST2A		
exst3	EXST3	EXST3	ST3	approved 8/11/06			
exst3a	ESST3A	EXST3A	ST3A	approved 8/11/06	Use for GE Generex		Differs from IEEE ST2A -- no UEL inputs; fewer time constants.
esst3a	ESST3A	ESST3A	ST3A	approved 1/21/11	2005 IEEE standard - updated ST3A		
exst4b	ESST4B	EXST4B	ST4B	approved 8/11/06	GE EX2000 bus fed potential source, static compound and Generrex-PPS or -CPS, and SILCOmatic 5 excitation systems, with proportional plus integral (PI) voltage controller		Differs from IEEE ST2A -- no OEL/UEL inputs
esst4b	ESST4B	ESST4B	ST4B	approved 1/21/11	2005 IEEE standard - updated ST4B		In all programs
esst5b	ST5B	ESST5B and ST5B	ST5B	approved 1/21/11	Variation of ST1A (New IEEE Model)		In all programs
esst6b	ST6B	ESST6B and ST6B	ST6B	approved 1/21/11	Variation of ST4B with field current limit (New IEEE model)		In all programs
esst7b	ST7B	ESST7B and ST7B	ST7B	approved 1/21/11	Static with limiters (Alstom) (New IEEE model)		In all programs
ieeet1	IEEET1	IEEET1		approved 8/11/06	Old type 1		
mexs	Not used	mexs		never approved	Manual excitation control with field circuit resistance		
pfqrg	Not used	PFQRG		never approved	Power factor / Reactive power regulator		The output of this model feeds into an exciter as the stabilizer inp
rexs	REXSYS	REXS		approved 8/11/06	General Purpose Rotating Excitation System Model		
scrx	SCRX	SCRX		approved 8/11/06	intended for use where negative field current may be a problem		
sexs	SEXS	SEXS_GE and SEXS_PTI		never approved	for use where details of the actual excitation system are unknown and/or unspecified		PSS/E has a SEXS (simplified excitation system) model (which is
texs	Not converted (9)	TEXS		never approved	Transformer Fed Excitation System Model	replace with esst6b	we don't convert this. Per our notes from previous M&V meeting
oel1	Not converted (277)	OEL1		approved 4/27/12	Over excitation limiter		Please note that this is not an IEEE standard model. GE develop we have to get the block diagram from GEPresentation at March
uel1	UEL1	uel1	UEL1	approved 4/27/12	Under excitation limiter		
uel2	UEL2	uel2	UEL2	approved 4/27/12	Under excitation limiter		

WECC- APPROVED Governor Models

MOD-027

TURBINE/GOVERNOR MODELS

GE PSLF	PTI PSS/E*	PowerWorld Simulator	IEEE Standard	Status	Comments	Modifications/Actions Needed	PTI/GE/PowerWorld Comments
g2wscc	WSHYDD	G2WSCC and WSHYDD		approved 8/11/06	Use hyg3 for new models		
gast	URGS3T	GAST_GE and URGS3T		retired 5/11/18			
ggov1	GGOV1	GGOV1		approved 8/11/06			
gpwscc	WSHYGP	GPWSCC and WSHYGP		approved 8/11/06	Use hyg3 for new models		
h6b		H6B		retired 6/15/16	Replaced by h6e		
h6e		h6e		approved 5/11/18	Model not yet implemented in PSS/e		
hyg3	WSHYGP	HYG3		approved 8/11/06		Check WSHYGP conversion	
hygov	HYGOV	HYGOV		approved 8/11/06			
hygov4	IEEEG3	HYGOV4		approved 8/11/06		Need new acceptable model in PSS/E	
hygovr	HYGOVR	HYGOVR		approved 2008	Added in 2008		
ieeeg1	WSIEG1	IEEEG1 and WSIEG1		approved 8/11/06			
ieeeg3	IEEEG3	IEEEG3		approved 8/11/06	Use hygov 4 for new models		
lcfb1	LCFB1	LCFB1 and LCFB1_PTI		approved 8/11/06			
pidgov	PIDGOV	PIDGOV		approved 8/11/06	Use hyg3 for new models		
tgov1	TGOV1	TGOV1		approved 8/11/06			
ggov2		GGOV2		never approved	new in GE PSLF		We have the new GGOV2 model in a us to make it a standard model for the next
ggov3		GGOV3		approved 2010	new in GE PSLF		

MOD-026/-027 Effective Dates

Standard	Requirement	Effective Date	% of Applicable Facilities
MOD-026	R1.,R3-R5.	7/1/2018 7/1/2020 7/1/2024	30% 50% 100%
MOD-027	R1.,R3-R5.	7/1/2018 7/1/2020 7/1/2024	30% 50% 100%