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TITLE: Risk Based Assessment Methodology (RBAM) for the Identification of Critical Assets

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I. INTRODUCTION

The primary objective of BPA’s Risk Based Assessment Methodology (RBAM) is to identify Critical Assets (CA) essential for the reliable operation of the Bulk Electric System (BES) as a whole. This critical asset list consists of Control Centers, substations, generation resources, special systems, and other assets.

The Critical Asset list is then refined to identify “essential Elements” such as lines, breakers and transformers. The purpose of this extended process is to provide granularity within and between Critical Assets. At this point each “essential Element” is evaluated to determine if connected cyber assets are critical or non-critical. Critical Cyber Assets (CCA’s) will then be identified in accordance with NERC CIP-002 R3.

BPA’s RBAM ensures that sufficient procedures, evaluation criteria, and supporting documentation are used to explain BPA’s determination of an asset as critical or not critical per FERC Order No. 706.

1. RBAM PROCESS

BPA’s RBAM uses a simplified approach and assumes that the potential for threats and vulnerabilities always exists (i.e., the probability of occurrence = 1.0). The risk-based assessment essentially becomes an impact analysis. Impacts can be intentional or unintentional, affecting not only an asset’s availability but also its functional integrity.

The impact analysis considers BES operations under different conditions. BPA considers the impact on the BES, not only from loss of an asset but also from misuse or mis-operation of an asset as the result of a possible compromise. Compromise may include effects that are not immediately apparent.

Assets are reviewed to determine whether they are required to support the reliable operation of the BES. Using documents developed from engineering analysis and power system studies that ensure an Adequate Level of Reliability, BPA Subject Matter Experts (SME) evaluate each asset using the criteria below and document the results. BPA SME reviews are a key process to validate the results of the RBAM application.

Assets are categorized by the following types: Control Centers, Substations, Generation, BPA Special Systems, and any other assets that support the reliable operation of the BES (CIP 002-3 R1.2.1 – R1.2.7). BPA applies a single RBAM to all categorized assets associated with BPA’s registered functions to which CIP-002-3, R1, applies ensuring that all assets have been considered.

The BPA CIP Senior Manager or his/her delegate shall approve this methodology and its resultant Critical Asset list at least annually.

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2. RBAM DEVELOPMENT

BPA utilized the following resources in the development of the RBAM:

- NERC – Security Guideline for the Electricity Sector: Identifying Critical Assets v1.0 Sept. 17, 2009
- NERC – 2010 NERC Sufficiency Review, CIP-002-3 Risk-Based Assessment Methodology Dec. 2010
- NERC Standard CIP-002-3 R1 – Cyber Security – Critical Cyber Asset Identification
- NERC Standard NUC-001-2.1 – Nuclear Plant Interface Coordination
- NIST: Special Publication 800-30 – Guide for Conducting Risk Assessments
- WECC CIP-101: CIP-002-3 Slides: January 2012. Joseph B. Baugh, PhD, PMP, CISSP, CRISC
- WECC Standard FAC-501- WECC-1, Transmission Maintenance

II. APPLICATION OF THE RBAM

BPA’s RBAM considers the following assets as required by CIP 002-3 R1.2.1 – R1.2.7:

R1.2.1 – Control centers and backup control centers performing the functions of the entities listed in the Applicability section of this standard.

R1.2.2 – Transmission substations that support the reliable operation of the Bulk Electric System.

R1.2.3 – Generation resources that support the reliable operation of the Bulk Electric System.

R1.2.4 – Systems and facilities critical to system restoration, including blackstart generators and substations in the electrical path of transmission lines used for initial system restoration.

R1.2.5 – Systems and facilities critical to automatic load shedding under a common control system capable of shedding 300 MW or more.

R1.2.6 – Special Protection Systems (SPS) that support the reliable operation of the Bulk Electric System.

R1.2.7 – Any additional assets that support the reliable operation of the Bulk Electric System that the Responsible Entity deems appropriate to include in its assessment.

BPA organized these assets into the following asset types per the NERC Security Guidelines for Identifying Critical Assets (the Guideline), which provided an understanding of what constitutes reasonable criteria for the evaluation of each asset type. The asset types covered in this RBAM include the following:

1. Control Centers (i.e., CIP-002-1, R1.2.1).
2. Transmission Substations (i.e., CIP-002-1, R1.2.2).
3. Generation Resources (i.e., CIP-002-1, R1.2.3).
4. Special Systems (i.e., CIP-002-1, R1.2.4, R1.2.5, and R1.2.6).
5. Other Assets (i.e., CIP-002-3, R1.2.7)

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III. CRITERIA FOR DETERMINING CRITICAL ASSETS

1. CIP-002-3 R1.2.1 CONTROL CENTERS AND BACKUP CONTROL CENTERS

Data Sources Used in This Section:

Data Source: BPA Facility Data Source

Process Used in This Section:

- Step 1: Identify Control Centers that are associated with BPA registered functions from the Data Source.
- Step 2: Evaluate the criteria below.
- Step 3: Designate those Control Centers that satisfy all four criteria as Critical Assets.

Criteria:

A. Essential for Supporting Reliability or Operability of the BES

The BES asset is a primary and/or a backup Control Center owned, operated, or under agreement between BPA and other entities within the BPA BAA, the loss or compromise of which would impact the reliable operation of the BES.

B. Essential for Providing Information used by BPA to Make Real-time Operational Decisions Regarding Reliability and Operability of the BES

The loss or compromise of any of the following functions associated with real-time status, value, or alarm data:

- collection,
- aggregation,
- processing or
- display

at primary and/or backup Control Centers determined by an engineering evaluation or other assessment method to impact reliability or operability of the BES (e.g., loss or compromise which would impact the reliable operation of the BES.)

C. Essential for Control or Data Acquisition for the BES

Loss or compromise of supervisory control or data acquisition functions of primary and/or backup Control Centers for the BES.

D. Real-time Inter-utility Data Exchange Critical to Reliable BES Operation

The loss or compromise of real-time inter-utility data exchange functions of primary and/or backup Control Centers determined by engineering evaluation or other assessment to impact the reliability or operability of the BES (e.g., loss or compromise which would impact the reliable operation of the BES.)

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2. CIP-002-3 R1.2.2 TRANSMISSION SUBSTATIONS

Data Sources Used in This Section:

Data Source 1: BPA Facility Data Source

It is used to populate the worksheet with facilities and determine the maximum line voltage values in Transmission Substation Criterion A – Voltage.

Data Source 2: BPA Restoration Plan

The BPA Restoration Plan is used to evaluate Transmission Substation Criterion B – Essential for BES Restoration.

Data Source 3: FAC-501 – WECC-1 SOL Engineering Evaluation

This worksheet is used to evaluate Transmission Substation Criterion D – Essential for Voltage, Frequency Support/Stability and System Operating Limits (SOL).

Process Used in This Section [See below for details and specific CA designation criteria]:

- Step 1: Populate the evaluation criteria worksheet with the facilities, lines, and voltages from the Data Source Filtered for Substations and Powerhouses.
- Step 2: Associate and enter the registered functions with each facility.
- Step 3: Identify and enter the line maximum voltage for each facility [Source: Export from Data Source; Lines, “Voltage Operating Kilovolt” Field].
- Step 4: Identify essential facilities that are contained in the BPA Restoration Plan.
- Step 5: Evaluation of Criterion C – Essential for Critical Generation must occur after the evaluation of the Generation Resource Criteria Worksheet.
- Step 6: Identify the facilities included in the FAC-501 – WECC-1 SOL Engineering Evaluation.

Criteria:

A. Voltage

Enumerate voltages for all assets located within the BPA BAA. Any Facility 345kV and above is a CA.

B. Essential to BES Restoration

Elements of Transmission critical to BES restoration, including transmission substations used for initial system restoration (i.e., identified as part of the likely to be used Cranking Path) as documented in the BPA Restoration Plan developed pursuant to the Emergency Preparedness and Operations standards (e.g., EOP-005-2), unless specifically excluded by available BPA engineering assessment(s).

BPA uses the following rules for identification of substations critical to BES restoration:

1. The station has Dead Bus Clearing.
2. The station has Remote Synchronizing.

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3. The station is associated with one of the Generation-Load Islands.
4. The station is in the table of synchronizing tie points between BPA and an external BA or Transmission Operator in the BPA Restoration Plan.
5. The station is associated with the offsite power station service to the nuclear Generating Station.
6. For purposes of determining Critical Assets, BPA will exclude facilities associated with the restoration of local system loads.

Note that Elements of Transmission critical to BES restoration may rely on transmission substations that are less than 100kV (e.g. blackstart generation connected at 69kV) which therefore should be evaluated.

C. Essential to Critical Generation for the BES

Criteria:

Elements of Transmission, the loss or compromise of which results in the loss of its connected generation identified in BPA RBAM CIP 002-3 R1.2.3-A as a Critical Asset for the BES. [This evaluation is performed after Section 3: CIP-002-3 R1.2.3 GENERATION RESOURCES.]

Elements of Transmission associated with critical generation may rely on substations that are less than 100kV (e.g., blackstart generation connected at 69kV) which therefore should be considered if not identified under BPA’s Restoration Plan.

Data Sources:

Data Source 1: Critical Assets identified by BPA in the RBAM Section 3 (Generation Resources Worksheet, Appendix A3)

Data Source 2: Bonneville Power Administration BPA System One-Line Diagram

Process:

- Step: Using the identified Generation Resources and the One-Line Diagram, indicate “yes” in the associated interconnection substations per the criteria provided above.

D. Essential for Voltage and Frequency Support and Stability and System Operating Limits of the BES

Criteria:

SOL are set to preserve reliability of the BES. BPA is required to plan its transmission system in accordance with the NERC Transmission Planning (TPL) Standards. These standards specify criteria for stability, adherence to voltage and thermal limits, cascading outages, and when load can be shed. BPA’s SOL methodology for the planning horizon is required under NERC Standard FAC-010-2. BPA is also required to determine SOL in the operating horizon in accordance with the WECC Reliability Coordinator’s (RC) SOL methodology, which is developed under NERC Standard FAC-011-2. This methodology also specifies acceptable system performance for stability,

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voltage and thermal limits, cascading outages, and load shedding. BPA establishes and communicates SOL for the operating and planning horizons under NERC Standard FAC-014-2. Therefore, for this criteria, BPA transmission substations that are considered to be Critical Assets are those facilities that impact the SOL of BPA’s Intra-Regional (internal) and Inter-Regional (external) Paths which it is the path operator within its Planning Authority or Transmission Planning Area.

If the loss of an Element is isolated locally and does not cause cascading outages then it is excluded as a CA due to this criteria.

The criteria below are addressed in the studies and subsequent results in the paragraph above.

- Voltage or frequency support:

Impacts to be considered include:

- Voltage collapse
- Voltage going below the under-voltage load shed points established to mitigate the risk of voltage collapse or voltage instability in the BES (e.g., PRC-010-1)
- Exceeding limits that result in a Category D event as discussed in TPL-004
- Frequency going below the under-frequency load shed points without recovering in a reasonable period (e.g., a half hour) once load is shed
- System collapse due to frequency-related instability

OR

- Stability:
 - The loss of generation, as determined by an engineering evaluation or other assessment method, resulting in an IROL violation (FAC-011-1)
 - Complete operational failure or shutdown of the BES within the BPA BAA causing BES instability
 - Separation or cascading outages affecting a wide area of the BES

Data Sources:

Data Source: FAC-501 – WECC-1 SOL Engineering Evaluation

Process:

- Step: Any substation which contains an Element from the FAC-501 is identified with a “yes” in the column of the RBAM Transmission Substation Worksheet, Appendix A2.

3. CIP-002-3 R1.2.3 GENERATION RESOURCES

Data Sources Used in This Section:

Data Source 1: BPA Generation Data Source

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Assumption: Data Source includes only generation sources within BPA’s BAA. However, specific facilities are also considered because BPA is the Transmission Operator even though those two generators are not in BPA’s BAA.

Data Source 2: BPA Restoration Plan

Data Source 3: BPA DSOs

Process Used in This Section:

- Step: Populate the Generation Resource Worksheet with plants identified in the Data Source Worksheet.

A. Essential Generation of the BES

Criteria:

A single unit or combination of units (i.e., failure due to Common Mode Impact) whose loss or compromise could violate any of the following regional obligations defined by Balancing Authority or Reliability Coordinator (refer to BAL-002-1a R1, BAL-002-WECC-2):

- Output exceeds Reserve Sharing Group obligation – the minimum for the last two years.
- Output exceeds Contingency Reserve obligation – BPA will use the Reserve Sharing Group NWPP.

A possible exception is generation that is tripped by a Remedial Action Scheme (RAS) or SPS only if the function of the RAS or SPS is to protect the BES connected generation.

Data Sources:

Data Source 1: BPA Generation Data Source

Data Source 2: The NWPP Total Contingency Reserve Obligation for the last two years

Process:

- Step 1: Obtain the obligation information from the NWPP to determine the minimum Reserve Sharing Group Obligation.
- Step 2: Referring to the Data Source list, any plants meeting the criteria above are identified with a “yes” in column A of the RBAM Generation Resource Worksheet, Appendix A3.

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B. Essential to Mitigate Known BES Constraints Including Voltage or Frequency Support or Stability

Criteria:

The Generation resources that BPA considers and include those generators that are synchronous and which can be placed on Automatic Generation Control (AGC) control or that are able to provide Base Load assist (i.e. PBL/B/R). These are the generators that are able to provide frequency regulation and load following, as well as contingency reserves to support reliable operation of the BES.

Generating units that provide voltage and reactive support at key locations in BPA’s 500kV and 230kV transmission grid will also be included, particularly those units that can operate in both generation and synchronous condense mode.

A single unit or combination of units (e.g., failure due to Common Mode Impact) that, if destroyed, degraded, or otherwise rendered unavailable, has been determined through a BPA engineering study to be essential to the BES reliability.

The criteria below are addressed in the studies and subsequent results in the paragraph above.

- Voltage or frequency support:

Impacts to be considered include:

- Voltage collapse
- Voltage going below the under-voltage load shed points established to mitigate the risk of voltage collapse or voltage instability in the BES (e.g., PRC-010-1)
- Exceeding limits that result in a Category D event as discussed in TPL-004
- Frequency going below the under-frequency load shed points without recovering in a reasonable period (e.g., a half hour) once load is shed
- System collapse due to frequency-related instability

OR

- Stability:
 - The loss of generation, as determined by an engineering evaluation or other assessment method, resulting in an IROL violation (FAC-011-1)
 - Complete operational failure or shutdown of the BES within the BPA BAA causing BES instability
 - Separation or cascading outages affecting a wide area of the BES

BPA will evaluate synchronous condensing in support of the 500kV grid

Data Sources:

Data Source: BPA Generation Data Source

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Process:

- Step 1: Using the criteria above, any plants identified in the Data Source Worksheet as PBL Basepoint/Response (PBL/B/R) are identified with a “yes” in column B of the RBAM Generation Resource Worksheet, Appendix A3.
- Step 2: Using the criteria above, any plants used for synchronous condensing to support the 500kV and 230kV systems are identified with a “yes” in column B of the RBAM Generation Resource Worksheet, Appendix A3.

C. Essential to BES Restoration

Criteria:

Blackstart Resources, which are essential to the initial BES restoration described in the regional restoration plan (consideration of generation as part of a cranking path is presented in BPA’s RBAM CIP 002-3 R1.2.2), unless specifically excluded by BPA engineering assessments.

BPA did not include the Lower Snake River generating plants noted below. They are not essential to restoration, but do provide reactive support as indicated in the BPA Restoration Plan.

Data Sources:

Data Source: BPA Restoration Plan

Process:

- Step: Using the criteria above, any plants identified as blackstart generation is identified with a “yes” in column C of the RBAM Generation Resource Worksheet, Appendix A3.

D. Must-Run Units

Criteria:

Certain generating units (must run units) are required to run during specific outage conditions in order to provide voltage support and/or to insure stability.

Data Sources:

Data Source: DSOs

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Process:

- Step: Using the criteria above, any plants identified in the referenced DSOs above, as Must Run generating units are identified with a “yes” in column D of the RBAM Generation Resource Worksheet, Appendix A3.

4. CIP-002-3 R1.2.4 SYSTEMS AND FACILITIES CRITICAL TO SYSTEM RESTORATION

Process Used in This Section:

- Determined under Substation evaluation process.

Criteria:

Systems and facilities critical to system restoration, including blackstart generators and substations in the electrical path of transmission lines used for initial system restoration.

Description attached previously in Section III item 2 *CIP 002-3 R1.2.2* parts B and C.

5. CIP-002-3 R1.2.5 SYSTEMS AND FACILITIES CRITICAL TO AUTOMATIC LOAD SHEDDING

Process Used in This Section:

- Determined under Special Protection Systems evaluation process.

Criteria:

Systems and facilities critical to automatic load shedding under a common control system capable of shedding 300 MW or more.

Description attached subsequently in Section III item 6 *CIP 002-3 R1.2.6* part B.

6. CIP-002-3 R1.2.6 SPECIAL PROTECTION SYSTEMS

Data Sources Used in This Section:

Data Source: PRC-017R1, List of BPA SPS

Process Used in This Section:

- Step 1: Populate the Special Protection Systems Worksheet with the list of BPA RAS/SPS.
- Step 2: Select those schemes that are Wide Area Protection Scheme (WAPS) – worksheet Criteria A.
- Step 3: Select those schemes that are critical to BPA Automatic Load Shedding as described below – worksheet Criteria B.
- Step 4: Evaluate other schemes as defined below – worksheet Criteria C.

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Criteria:

Special Protection Systems that support the reliable operation of the BES.

A. RAS or SPS Supporting the Reliability or Operability of the BES

Loss or compromise of RAS. BPA has two different classes of RAS, one is WECC-approved/sanctioned and the other is local RAS.

BPA will utilize the WECC defined WAPS. Local Area Protection Scheme (LAPS) will not be considered to be Critical Assets unless the scheme trips 300 MW load or greater.

B. Systems Critical to Automatic Load Shedding Supporting the Reliability or Operability of the BES

Systems, not already evaluated as part of another asset type, that are critical to automatic load shedding of 300 MW or more that support the reliability or operability of the BES.

C. Other Systems

Loss or compromise of centralized portion of the Demand-Side Management (DSM) or Direct Control Load Management (DCLM) system determined by an engineering evaluation or other assessment to impact the reliability or operability of the BES, e.g., loss or compromise of centralized portion of the DSM or DCLM that could cause Transmission or Generation to impact the reliable operation of the BES.

BPA uses engineering evaluations to determine that loss or compromise of the system or supporting system to impact reliability or operability of the BES, e.g., loss or compromise could cause Transmission or Generation to impact the reliable operation of the BES.

7. CIP-002-3 R1.2.7 OTHER ASSETS

Data Sources Used in This Section:

Data Source: TBD

Process Used in This Section:

- Step 1: Consider other assets from other studies and reports that may become available in the future.
- Step 2: Evaluate the assets to determine which have not already been identified as CAs. Any assets already identified as CAs will not be evaluated any further.
- Step 3: For those assets not already identified as CAs in Step 2 evaluate according to the criteria below and select as appropriate.

Criteria:

Any additional assets that support the reliable operation of the BES that the Responsible Entity deems appropriate to include in its assessment.

Refer to Section III item 2 *CIP-002-3 R1.2.2* part B.

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IV. CRITERIA DECISION TREES

The decision trees describe the flow of the application of the criteria resulting in the identification of Critical Assets. The RBAM as a whole is to be strictly followed as the authoritative document for the following:

- 1. CRITICAL ASSET IDENTIFICATION OVERVIEW**
- 2. CONTROL CENTER / BACKUP CONTROL CENTER CIP 002-3 R1.2.1**
- 3. TRANSMISSION SUBSTATIONS CIP 002-3 R1.2.2**
- 4. GENERATION RESOURCES CIP 002-3 R1.2.3**
- 5. SYSTEM RESTORATION CIP 002-3 R1.2.4**
- 6. SPECIAL SYSTEMS CIP 002-3 R1.2.5 and 1.2.6**
- 7. ANY OTHER ASSETS CIP 002-3 R1.2. (See Critical Asset Overview Decision Tree)**



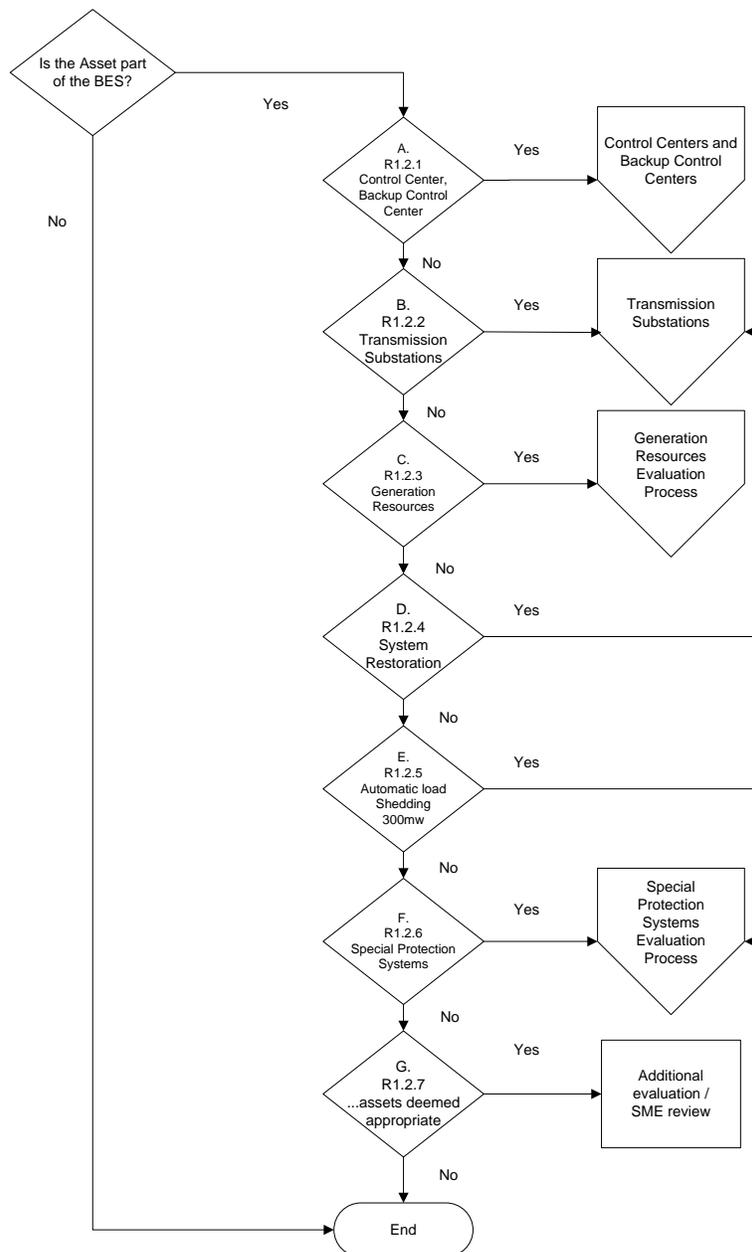
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1. CRITICAL ASSET IDENTIFICATION OVERVIEW





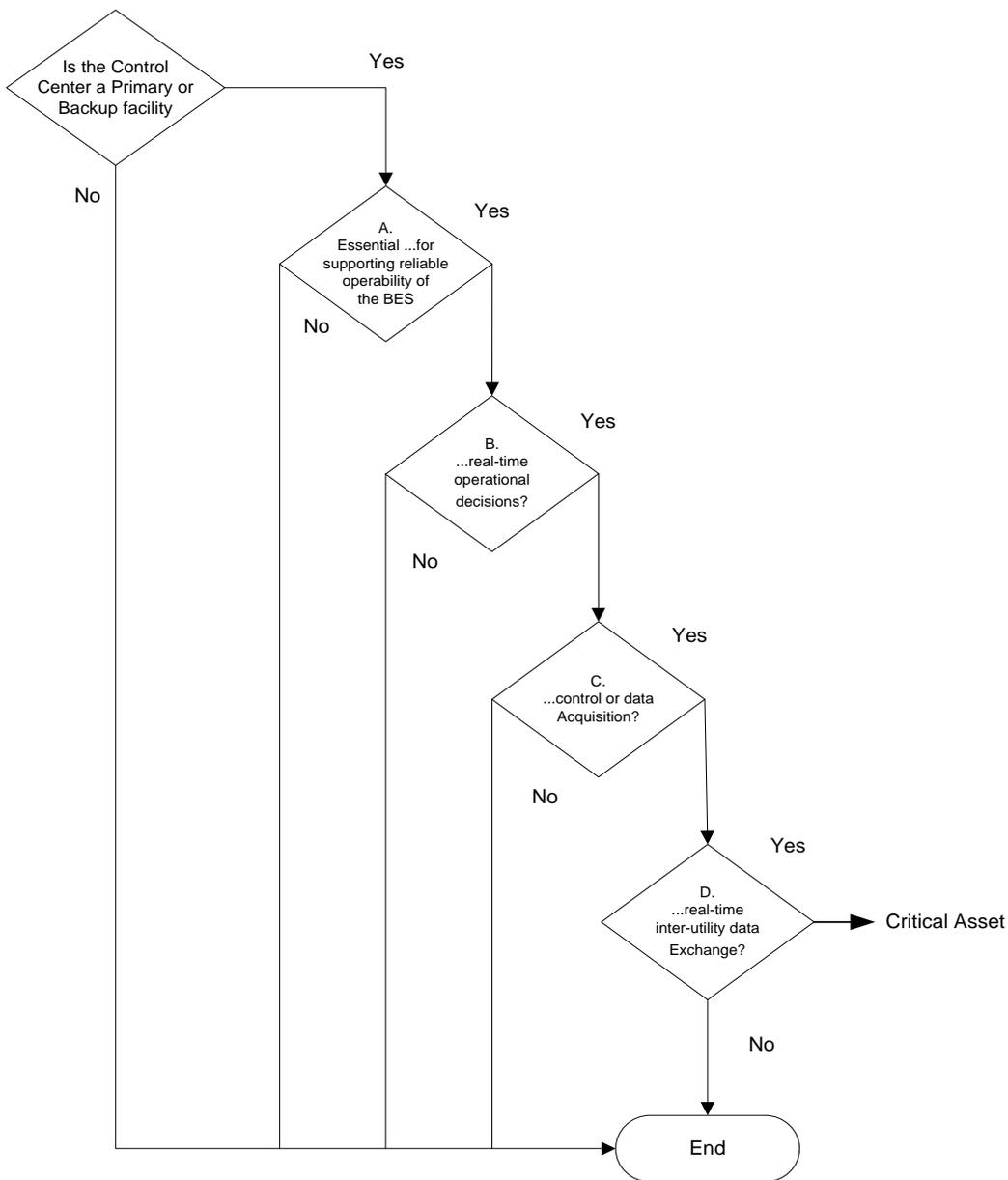
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2. CONTROL CENTER / BACKUP CONTROL CENTER CIP 002-3 R1.2.1





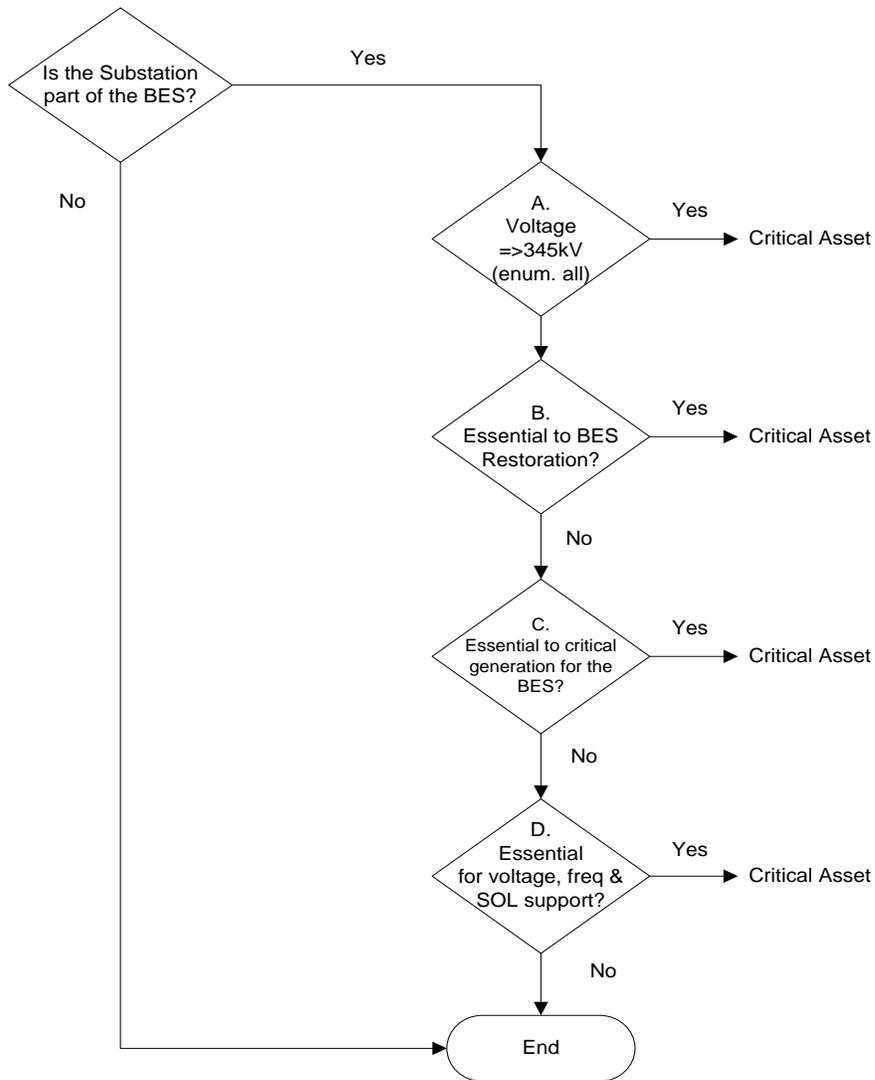
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3. TRANSMISSION SUBSTATIONS CIP 002-3 R1.2.2





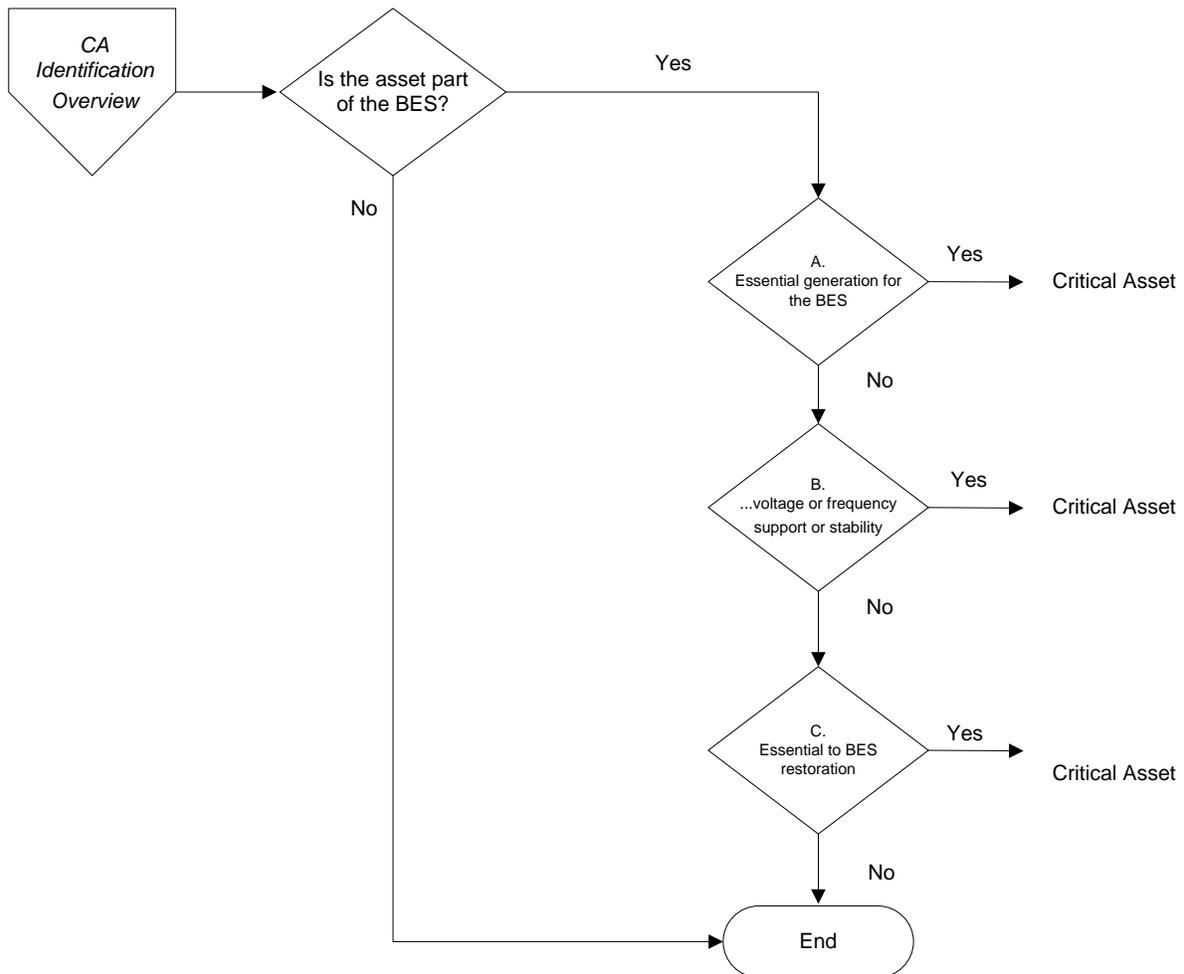
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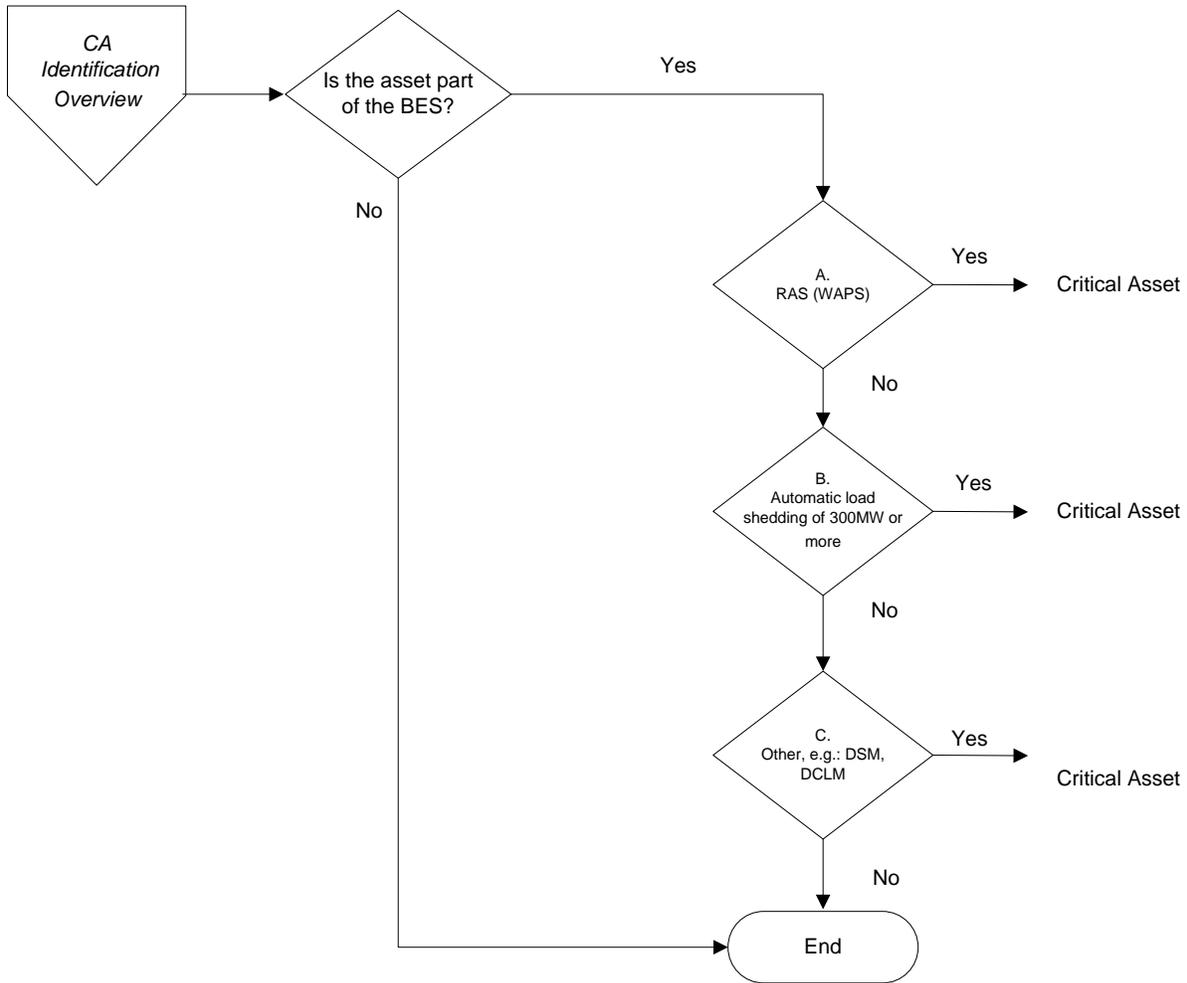
4. GENERATION RESOURCES CIP 002-3 R1.2.3



5. ESSENTIAL GENERATION FOR BES RESTORATION CIP 002-3 R1.2.4

Follow the decision tree in Section C *Transmission Substations CIP-002-3 R1.2.2*

6. SPECIAL SYSTEMS CIP 002-3 R1.2.5 AND 1.2.6



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V. RBAM APPLICATION RESULTS

A1. R1.2.1 Control Centers

Result summary of the Facilities considered in Control Center Critical Asset analysis

A2. R1.2.2 Transmission Substations

Result summary of the Facilities considered in the Transmission Substation Critical Asset analysis.

A3. R1.2.3 Generation Resources

Result summary of the Facilities considered in Generation Resources Critical Asset analysis.

A4. R1.2.4 System Restoration / Blackstart. R1.2.5 Load Shedding 300mw or more, and R1.2.6 Special Protection Systems

Result summary of the Systems considered in Special Systems Critical Asset analysis

A5. R1.2.7 Any additional Assets ... deemed appropriate

Result summary of other assets considered in Other Assets Critical Asset analysis.

B1. Critical Asset List

Summary Listing of BES Assets determined to be Critical Assets.

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VI. ACRONYMS

AGC	Automatic Generation Control
BAA	Balancing Authority Area
BES	Bulk Electric System
CA	Critical Asset
DCLM	Direct Control Load Management
DSM	Demand-Side Management
DSO	Dispatcher Standing Orders
IROL	Interconnection Reliability Operating Limit
LAPS	Local Area Protection Scheme
NWPP	Northwest Power Pool
RAS	Remedial Action Scheme
RBAM	Risk Based Assessment Methodology
RC	Reliability Coordinator
SME	Subject Matter Expert
SOL	System Operating Limits
SPS	Special Protection System
TPL	Transmission Planning
WAPS	Wide Area Protection Scheme

APPENDIX A: CRITICAL ASSET CRITERIA WORKSHEETS

A1. CONTROL CENTERS

		Control Centers 2013 Annual Approval CIP-002 R1.2.1 Critical Asset List CRITICAL INFORMATION - CONTROLLED DISTRIBUTION - Name/Org: _____ Date: _____					
BES Asset	Description	A. Supports Reliability or Operability of the BES	B. Provides Operational Information	C. Control or Data Acquisition	D. Critical Inter-Utility Data Exchange	Critical Asset?	Notes

A3. GENERATION RESOURCES

			Generation Resources 2013 Annual Approval CIP-002 R1.2.3 Critical Asset List CRITICAL INFORMATION - CONTROLLED DISTRIBUTION - Name/Org: _____ Date: _____					
Asset Name	Owner	Description	A. Provides Essential Generation	B. Essential Voltage Support and Frequency Response	C. Essential to System Restoration	D. Must Run Units	Critical Asset?	Notes

A4. SPECIAL SYSTEMS

			Special Systems 2013 Annual Approval CIP-002 R1.2.5 and R1.2.6 Critical Asset List CRITICAL INFORMATION - CONTROLLED DISTRIBUTION - Name/Org: _____ Date: _____				
BES Asset	Owner	Description	A. RAS/SPS	B. Automatic Load Shedding (UFLS, UVLS >300MW)	C. Other Systems	Critical Asset?	Notes

A5. OTHER ASSETS

			Any Other Assets 2013 Annual Approval CIP-002 R1.2.7 CRITICAL INFORMATION - CONTROLLED DISTRIBUTION - Name/Org: _____ Date: _____	
BES Asset	Owner	Description	Critical Asset	Notes

