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661.0 PURPOSE

This Chapter establishes Bonneville Power Administration's (BPA) policy and framework for developing and reviewing, and maintaining asset management strategies.

661.1 DEFINITIONS

- A. Assets:** Plant, machinery, property, buildings, vehicles, software applications and other items that have a distinct value to BPA and its Federal Columbia River Power System (FCRPS) partners.
- B. Asset criticality:** Relative importance of an asset or asset system to meeting the agency's reliability, availability, adequacy and other objectives and standards.
- C. Asset system:** Set of assets that interact and/or are interrelated so as to deliver a required business function or service.
- D. Life cycle:** The phases of an asset's life, beginning with identifying the need for an asset and ending with disposal (decommissioning, retirement, sale) of the asset. The main stages of an asset's life cycle include: create/acquire, operate, maintain and renew/dispose.
- E. Planning levels:** Forecasted capital and expense spending levels to implement the investment, maintenance, and other components of asset management strategies.

661.2 POLICY


BPA and its FCRPS partners must manage capital investments and maintenance with a comprehensive understanding of the long-term costs, benefits and risks to the agency and the region. Asset management strategies are key to ensuring that critical assets operate reliably, meet availability requirements, and provide adequate capacity into the future, and that long-term asset costs will be prudent and economic.

Asset management strategies must be developed and maintained for Transmission, Federal Hydro, Facilities, and Information Technology (IT) at minimum, and category asset managers are assigned the lead role. The strategies must be directed at meeting the agency's Asset Management Policy¹, which calls for BPA to invest in, maintain, and operate assets to enable reliability standards, availability requirements, regional adequacy guidelines, efficiency needs, environmental requirements, safety and security standards, and other requirements to be met. It also calls for minimizing the life cycle cost of assets when practical. The policy refers to these goals as *long-term outcomes*, and they are derived from the agency's mission, vision and strategic objectives.

Asset management strategies should answer these questions:

- Which assets are critical to achieving the long-term outcomes?
- What performance objectives should we set for critical assets?
- How are our critical assets performing today?
- What are the performance gaps to meeting the objectives, and which gaps should we close?

¹ See BPA Manual Chapter 660

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- What are the risks to closing the gaps, and which risks should we manage?
- What should our strategies be?
- What are the anticipated costs?

Specifically, the asset management strategies must:

- Assign priority to the most critical assets that are at greatest risk of operating failure, capacity inadequacy, environmental damage or noncompliance, security breach or noncompliance, health and safety issues, or obsolescence. Example factors for determining the criticality of assets are included at Appendix A;
- Cover all four phases of asset life (create/acquire (investment), operate, maintain, and renew/dispose), with particular focus given to the investment and maintenance phases;
- Cover a 10-year planning horizon at minimum. A 7-year planning horizon for information technology assets is acceptable due to the shorter lives of these assets;
- Be driven by long-term, results-oriented performance objectives for assets and by assessments of risk to meeting the objectives. Asset performance objectives must be aligned with the agency's strategic objectives and with the long-term outcomes;
- Identify and evaluate alternative approaches to meeting the asset performance objectives, with justifications provided for the selection of preferred approaches. The preferred approach should normally be the lowest life cycle cost solution among alternatives that are viable. "Viable" is defined as operationally sound and achievable in terms of meeting the reliability, availability, adequacy or other asset performance objectives that have been set;
- Take into account staffing, supply chain, and other constraints on strategy delivery; and
- Apply the agency's common planning assumptions, such as inflation rate, market price forecast, and load forecast assumptions.

Strategies should include an integrated approach to maintenance, equipment sparing, and replacements that seeks to minimize life cycle costs. The integrated approach should be condition-based, with priority assigned to the most critical assets at greatest risk of operating failure, environmental damage or noncompliance, or health and safety issues. Assets should be considered for replacement if:

- Asset health poses an unacceptable risk of operating failure, and the life cycle cost of replacement is lower than the life cycle cost of repair;
- Asset capability does not meet acceptable performance standards due to premature wear, design problems, changed usage patterns, or changes in system operations;
- Asset technology is inferior or obsolete, and the life cycle savings from early replacement outweigh the cost of replacement;
- Replacement parts or technical expertise are no longer available to ensure asset performance to acceptable standards;
- Security risks, health and safety risks, or environmental risks are unacceptable, and the life cycle cost of replacement is lower than the life cycle cost of refurbishment, repair, or other, viable alternatives; or

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- The agency's business continuity objectives would not otherwise be met, and the life cycle cost of replacement is lower than the life cycle cost of other, viable alternatives; or
- Risks to meeting statutory, regulatory or other legal obligations are unacceptable, and the life cycle cost of replacement is lower than the life cycle cost of other, viable alternatives.

Asset management strategies must be developed using the Framework for Developing Asset Management Strategies at Appendix A. The Framework is designed to meet the policy requirements in this Chapter, and it is based on leading practices and the agency's risk management approach.

661.3 RESPONSIBILITIES

Key responsibilities for implementing this Chapter follow:

A. Category Asset Managers

BPA has identified seven asset categories: Transmission, Federal Hydro, Facilities, IT, Columbia Generating Station, Energy Efficiency, and Fish & Wildlife. Asset categories are led by Category Asset Managers. Category Asset Managers, along with their staffs, develop and implement asset management strategies, plans, processes, and policies for their asset categories. With regards to this Chapter, Category Asset Managers are responsible for (1) ensuring that their asset category follows this Chapter, including the Framework at Appendix A, (2) presenting and communicating strategies and obtaining approvals, and (3) managing the implementation of strategies.

B. Asset Management Executive Sponsors


Asset Management Executive Sponsors are comprised of Vice Presidents from each asset category, the Chief Financial Officer, the Chief Risk Officer, and the EVP-Corporate Strategy Officer. With regards to this Chapter, sponsors provide direction to the Agency Asset Manager and Category Asset Managers on developing asset management strategies and on making changes to Appendix A of this Chapter.

C. Capital Allocation Board (CAB)

The CAB is chartered and comprised of the Administrator, Deputy Administrator, Chief Operating Officer, the Chief Financial Officer, and the Chief Risk Officer, and the EVP-Corporate Strategy. The CAB reviews proposed asset strategies, and determines the applicability of this Chapter to the agency's asset categories.

D. Agency Asset Management (AAM)

The Agency Asset Management team is comprised of the Agency Asset Manager and staff. The AAM leads the development and monitors implementation of agency-level policies and processes. The AAM advises Category Asset Managers on developing their asset management strategies, establishes the schedule and coordinates the agency-level review process for strategies, and communicates the agency's common planning assumptions.

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661.4 PROCESS


- A. Applicability.** This Chapter applies to the Transmission, Federal Hydro, Facilities and IT asset categories at minimum. The CAB, in consultation with affected business units and the Asset Management Executive Sponsors, determines whether and how this Chapter should apply to additional asset categories.
- B. Submitting strategies.** Agency Asset Management will establish a schedule for submitting strategies for agency-level review, normally on a 2-year cycle. The strategy document that Category Asset Managers submit for corporate and external stakeholder review should include:
- o A description of business environment;
 - o A summary of asset criticality, including rationale;
 - o Asset performance objectives, measures and end-stage targets;
 - o A summary of current asset performance (gap analysis);
 - o Summary results from risk assessments;
 - o Strategies;
 - o Proposed planning levels; and
 - o Continuous improvement plan.
- C. Approving strategies.** An asset category's strategy document must be formally approved by the Category Asset Manager and the business unit's VP-Asset Management or VP-Internal Business Services. The strategy is also subject to concurrence by the Capital Allocation Board.

Strategies are subject to review and comment by customers and other stakeholders through the agency's Integrated Program Review or similar public process.

- D. Maintaining this Chapter.** At minimum, this policy will be reviewed at the beginning of the agency's 2-year planning cycle. The Asset Management Executive Sponsors are authorized to modify and re-issue the Framework at Appendix A to this Chapter.

661.5 REFERENCES

- A. Asset Management Policy, BPAM 660**
- B. Publicly Available Specifications, PAS 55-1 & PAS 55-2, November 2008**
- C. Asset Management Strategy, September 30, 2007**
- D. OMB Circular A-123, December 21, 2004**
- E. GAO Cost Estimating and Assessment Guide, "Best Practices for Developing and Managing Capital Program Costs, March 2009**

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Appendix A Framework for Developing Asset Management Strategies

Asset management strategies chart the course for achieving the agency's long-term outcomes for assets by setting asset performance objectives, prioritizing risks, developing strategies, and forecasting costs and cost uncertainties. The strategies also serve to:


- Inform, and ensure consistency with, the agency's strategic direction, key agency targets, and balanced scorecards;
- Inform and involve customers and other stakeholders on proposed investment and maintenance levels; and
- Provide concrete direction on the priorities, approaches, and methods to be followed for developing asset management plans.

Asset management strategies must be developed for the Transmission, Federal Hydro, Facilities, and IT asset categories at minimum, and Category Asset Managers play the lead role. The strategies must be developed through the seven iterative steps that follow. These steps are designed to:

- Fulfill the policy requirements of this Chapter (see section 661.2);
- Establish in a clear line-of-sight between the agency's strategic direction, the agency's Asset Management Policy (BPA Manual Chapter 660), and its asset management strategies; and
- Implement leading practice guidelines and the agency's risk management framework.

Steps	<i>Questions answered</i>
1. Describe the business environment	<i>What demands will be placed on our assets?</i>
2. Identify assets and asset systems and Determine their criticality	<i>Which assets are critical to achieving the long-term outcomes?</i>
3. Specify key standards for managing assets and Establish asset performance objectives, measures and targets	<i>What performance objectives should we set for critical assets?</i>
4. Assess the current state of assets	<i>How are our critical assets performing today? What are the gaps to meeting the performance objectives, and which gaps should we close?</i>
5. Assess risks to meeting the objectives and performance measures	<i>What are the risks to closing the gaps, and which risks should we manage?</i>
6. Prepare strategies	<i>What should our strategies be?</i>
7. Forecast planning levels	<i>What are the anticipated costs?</i>

Each of the seven steps is described below. Importantly, step 6 includes a test for assessing the adequacy of draft strategies. The agency's common planning assumptions should be employed, particularly in steps 1, 5, 6, and 7. The planning assumptions may be found at: <http://internal.bpa.gov/sites/asset-mgt/CommonPlanning/default.aspx>. The results from each of the seven steps must be documented.

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Step 1 -- Describe the business environment. Step 1 summarizes the business environment in which the asset category operates and describes the asset base. This includes such information as:

- Description of the asset category (characteristics of assets covered and functions they perform).
- Customers and stakeholders served, and what they are seeking.
- Products and services the assets make possible.
- Owner/operator/funding roles (if owner/operator is not BPA).
- Strategic environment, including demands anticipated to be placed on assets:
 - Future load growth;
 - Generation integration requirements for new resources;
 - Evolving regulatory standards and other legal requirements;
 - Evolving national energy policies;
 - Evolving state energy policies;
 - Future market (energy) price uncertainty;
 - Commodity material availability and cost uncertainty (steel, copper, etc.);
 - Strategic issues and management challenges for maximizing the long-term value of assets; and
 - Staffing/skills constraints.

Step 2 – Identify assets and asset systems and determine their criticality. Step 2 identifies assets and asset systems for strategy development and asset plan purposes. It also delineates more critical assets from less critical assets.


Identify assets. Assets must be identified consistent with the definition at 661.1. Typically, components of machinery, structures, and other plant normally do not have value to BPA and its FCRPS partners unless they operate together to meet a business purpose or need. For example, wood poles, high voltage line, conductors and other components have value to BPA only when they are installed and operated as a transmission line. Transmission lines are examples of assets, as are hydroelectric plants and software to provide integrated customer billing and contracts functions.

Group assets into asset systems. For purposes of developing strategies, it is often useful to group assets into systems, or strategic classes. Asset systems are sets of assets that have similar functional importance to BPA, or together deliver a business function or service. Examples of asset systems are:

- Transmission paths, comprised of transmission lines, substation equipment, and other assets that, operating together, integrate generation and transmit power to load or market;
- Willamette Valley hydroelectric plants;
- General office facilities in the Portland/Vancouver area; and
- Desktop hardware.

Designate critical from non-critical assets. Assets and asset systems have different levels of importance when it comes to meeting reliability, availability, adequacy and other long-term outcomes. Therefore, each organization should identify key importance factors and establish the criticality of the assets and asset systems under its purview.

Asset criticality identifies the relative importance of an asset or asset system to meeting the reliability, availability, adequacy and other standards in the long-term outcomes. For example, Main Stem Columbia

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hydroelectric plants are the backbone of the federal hydro system, contributing the majority of energy, ancillary services, and non-power benefits to the Pacific Northwest. Further, the value of availability at the margin is higher at some Main Stem plants than for plants in other strategic classes, making these the most critical plants in terms of meeting reliability and availability outcomes.

To determine the criticality of an asset or asset system, Category Asset Managers should consider such factors as:

- The impact on regulatory compliance if asset failure (e.g., forced outage) occurs;
- The load service impact if failure occurs;
- The energy, storage, or ancillary service contribution of the assets;
- The revenue or cost impacts that would result from a failure;
- The disruption to business continuity and critical business processes that would result from failure; and
- The safety or security impact that would result from failure.

Ideally, asset criticality will be determined on a rank scale, but simple critical/non-critical designations may also suffice. The criticality of assets must be documented and kept secure while also providing ready access to those who develop and execute asset strategies and plans. The designations should normally be maintained in the asset category's asset register. An asset category's strategy should document the basis and rationale for designating the criticality of its assets.

In later steps, priority will be assigned to the most critical assets that are at greatest risk of operating failure, capacity inadequacy, environmental damage or noncompliance, security breach or noncompliance, health and safety issues, or obsolescence.

Step 3 -- Specify key standards and requirements for managing assets and asset systems. Key standards and requirements referred to in the long-term outcomes must be singled out so that strategies and asset plans can be developed and executed to meet them. This includes key statutory, regulatory, Federal directives/policy, contractual, and internal standards and requirements that are important to investing, maintaining, and operating the asset category's assets.

The standards must be readily accessible to those responsible for developing and executing asset strategies and plans, and they are preferably maintained in the agency's Governance Risk Control electronic system or other repositories.

Establish performance objectives, measures, and end-stage targets. The key standards must then be translated into performance objectives, measures and end-stage targets for assets and asset systems. Taken together, the objectives, measures, and targets should answer the question: What performance objectives should we set for critical assets?

Asset or asset system objectives are statements of the results that assets and asset systems must be managed to achieve in order to meet the long-term outcomes in the asset management policy. An example of an asset management objective is "Transmission path X meets risk tolerances for unplanned outages." At

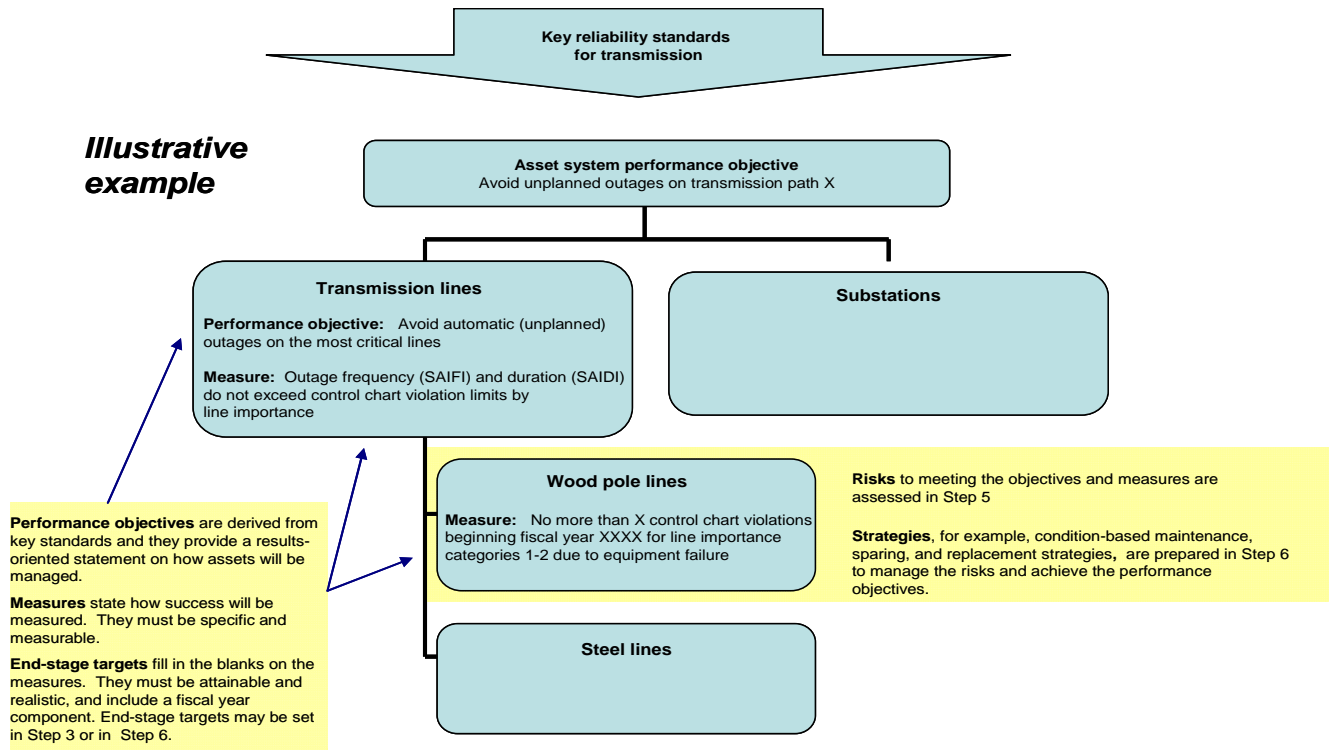
minimum, asset performance objectives must be set at the asset category level, but business units are encouraged to set them at the critical asset or asset system levels as well.

Asset or asset system performance measures specify how achievement of the objectives will be measured and tracked. Measures provide the metric, or unit of measure, that will be used to determine success or failure in meeting the objectives. Quantitative measures are strongly preferred over qualitative measures. Consideration should be given to including leading as well as to lagging indicators.


An *end-stage target* must be set for each performance measure. The end-stage targets may be set in Step 3, or later, when strategies are developed in Step 6. End-stage targets should capture the “future state” level of performance needed to meet the objectives.² End-stage targets should be ambitious but achievable, with cost and other risk factors taken into account. They should normally be stated as a range of acceptable results as of a specific fiscal year.

The objectives, measures and end-stage targets that are set in Step 3 are subject to adjustment as risks are assessed (Step 5) and as strategies are developed (Step 6).

Asset performance objectives, measures and end-stage targets must be documented so that they can be measured efficiently and readily understood by a range of audiences. Documentation should normally include such information as measure definition, sources of data, units of measure, algorithm or formula, and measure owner. See Appendix B for sample documentation of a measure and end-stage target.



² End-stage targets are not the same as progress indicators. Progress indicators are intermediate targets to monitor progress toward meeting the end-stage targets, and they may extend over a period of years. Progress indicators are set later, after asset strategies are completed and as asset plans are developed.

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Step 4 - Assess the current state of assets. Step 4 assesses the health, performance history and cost history of assets as they now exist. Normally, current state assessments address:

- Asset demographics;
- Condition of assets, with gaps in condition assessment information noted;
- Asset performance issues, for example, failure trends, capacity shortfalls, replacement and maintenance backlogs, key pollution abatement issues, and key security needs; and
- Historical costs and source.

Importantly, Step 4 must also determine the current performance level of assets in terms of the objectives, measures and end-stage targets that were set previously. The gap between current performance levels and desired “future state” performance will be the focus of the risk assessment and strategy development steps that follow.

Step 5 -- Assess risks to meeting the objectives and measures. Step 5 entails identifying, analyzing, and prioritizing risks to closing gaps between current levels of asset performance and the objectives, measures, and end-stage targets that are set in Step 3.

The agency’s risk management framework must be applied in the risk assessment process. Subject matter experts should play a central role in assessing asset risks, including experts who plan, procure, maintain and operate assets.

Risk assessments set the stage for developing well informed strategies in Step 5.

Identifying risks

Risks are identified with particular attention given to the most critical assets. All key obstacles and opportunities to meeting the objectives and measures should be identified and defined by answering two basic questions:

1. What can happen (e.g., equipment failure or capacity shortfall)?
2. How can it happen (i.e., the event or circumstance that led to the failure or shortfall, the causes of what happened)?

Asset risks typically include:

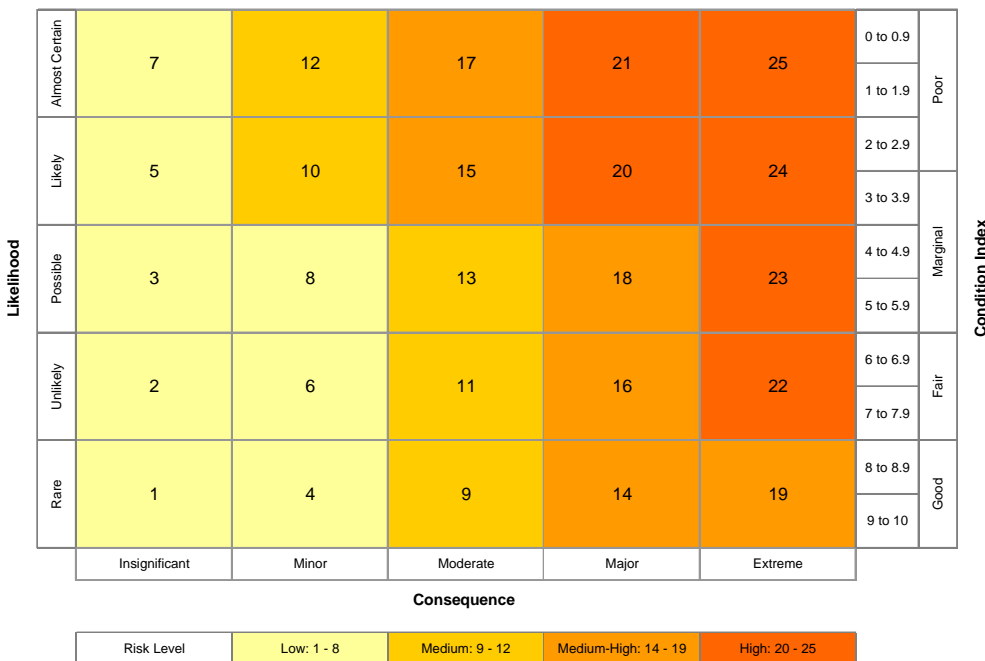
- Risk of equipment or facility failure;
- Risk of capacity inadequacy;
- Risk of equipment or software obsolescence;
- Risk of environmental damage or noncompliance;
- Risk of security breach or noncompliance; and
- Risk of health issue or safety mishap (injury).

Analyzing risks

Once identified and defined, the likelihood and consequences of risks to meeting the asset performance objectives are analyzed. The analysis is driven by subject matter expert judgment and such factual information as:


- Condition assessments, or if condition assessment information is unavailable, asset age;
- Historical failure trends;
- Asset utilization history and forecasts;
 - Assessments of technological obsolescence/opportunities;
 - Load forecasts and congestion/congestion cost studies; and
 - Asset criticality.

Normally, the greatest consequences should be assigned to assets that have been designated to be the most critical (Step 2). Typically, the results from this analysis are mapped such as in this sample.



Evaluating risks

Once the likelihood and consequences of risks have been determined, the risks are then prioritized. A consistent framework for prioritizing risks should be used across the asset category; often, trade-offs and iterations are needed to reach an integrated set of priority risks for the asset category as a whole. The basis for the prioritization must be documented.

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Step 6 -- Prepare strategies. In this step, strategies are developed to close the gap between end-stage performance targets and current asset performance levels.

To be successful, strategies should establish a clear line-of-sight between (1) asset performance objectives, (2) priority gaps to be closed between objectives and current levels performance, (3) priority risks to be managed, and (4) investment, maintenance and other actions to close the gaps. Strategies must:


- Assign priority to the most critical assets that are at greatest risk of operating failure, capacity inadequacy, environmental damage or noncompliance, security breach or noncompliance, health and safety issues, or obsolescence. Example factors for determining the criticality of assets are included at Appendix A;
- Cover all four phases of asset life (create/acquire (investment), operate, maintain, and renew/dispose), with particular focus given to the investment and maintenance phases;
- Cover a 10-year planning horizon at minimum. A 7-year planning horizon for information technology assets is acceptable due to the shorter lives of these assets;
- Be driven by long-term, results-oriented performance objectives for assets, and by assessments of risk to meeting the objectives. Asset performance objectives must be aligned with the agency's strategic objectives and with the long-term outcomes;
- Identify and evaluate alternative approaches to meeting the asset performance objectives, with justifications provided for the selection of preferred approaches. The preferred approach should normally be the lowest life cycle cost solution among alternatives that are viable. "Viable" is defined as operationally sound and achievable in terms of meeting the reliability, availability, adequacy or other asset performance objectives that have been set;
- Take into account staffing, supply chain, and other constraints on strategy delivery; and
- Apply the agency's common planning assumptions, such as inflation rate, market price forecast, and load forecast assumptions.

In addition, strategies should state, or make reference to, the principal methods to be followed in developing and executing asset plans. For example, a strategy would include:

- The method for determining the life cycle cost of assets;
- The method for determining whether to repair or replace an asset; and
- The process and method for prioritizing and selecting capital projects.

Finally, strategies should be:

- Durable and adaptable to changing circumstances and new information over time;
- Documented sufficiently to drive the development of planning levels (Step 6) and the development and execution of asset management plans; and
- Well articulated, so that knowledgeable stakeholders can readily understand.

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Step 7 -- Forecast planning levels. The final step entails forecasting capital and expense requirements in dollars necessary to carry out the strategies developed in Step 6.

In this step, asset categories must draw a clear, compelling line of sight between the investment, maintenance and other actions called for in the strategies and the forecast of the cost requirements, which are known as planning levels. The nexus between strategies and planning levels is what justifies a spending proposal. For example, the planning levels should demonstrate that the critical assets that carry the greatest risk of failure or the greatest risk of capacity inadequacy will be given priority attention.

Planning levels must be developed with greater granularity for near-term years through the end of the next rate period. Annual capital expenditures should be estimated by capital project³ if the project's total direct capital cost is \$7 million or more. The planning levels must reflect the agency's common planning assumptions, with any exceptions documented.

The planning levels should include an expected value forecast (i.e., ~50 percent probability) for the full planning horizon and a reasonable high and low range (e.g., 80 percent and 20 percent probabilities) of potential annual costs for years through the end of the next rate period. The high and low range of annual costs should consider, for example:


- Project schedule uncertainties;
- Commodity price uncertainties;
- Technology price uncertainties;
- Supply chain constraints;
- Resource constraints and resource cost uncertainties; and
- Available outage time uncertainties.

Key assumptions must be documented, including contingency assumptions.

The expected value planning levels that are developed in this step are submitted through the internal multi-year budget process, the external stakeholder review process (Integrated Program Review), and the Federal budget process. If significant changes are made to the planning levels during these review processes, conforming changes should then be made to the strategies. The planning levels are subject to further update and adjustment prior to, and even during, the year in which actual spending occurs.

Establish an improvement plan going forward. The requirements in this policy likely cannot be met in full without a sustained, continuous improvement effort over time. An asset category's strategy document should recognize any shortcomings, and be accompanied by an improvement plan. The improvement plan should include objectives, priority actions, and key milestones for process improvements.

³ Includes capital programs as well as capital projects.

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Appendix B
Sample Documentation
Asset Performance Measure and End-stage Target

BPA Transmission Reliability (Lines)

- Measure:** Outage frequency (SAIFI) and duration (SAIDI) for transmission lines, by line importance rank, do not exceed control chart violation limits.
- Background:** Maintaining system reliability is a critical BPA responsibility. Reliability measures are monitored to help minimize both the frequency and duration of automatic (unplanned) line outages on the BPA system. SAIFI and SAIDI data are used in developing Transmission's asset management strategies and plans, and in its capital and expense planning levels.
- Methodology:** Reliability assessment is based on IEEE-standard measures of outage frequency (SAIFI) and duration (SAIDI). Control chart techniques, closely mirroring transmission reliability methodology adopted by the California Independent System Operator (ISO), are used to establish allowable performance levels for each line importance category (1-4). Control charts are statistically-based graphs which illustrate the natural range of variability in performance, based on the most recent 10 years of historical data (FY 1998 - FY 2007). In general, the Control Limit is calculated as the 3-standard deviation band, and the Warning Limit as the 2-standard deviation band, based on historical line performance. Actual SAIFI and SAIDI results from the past year are then compared to the control chart limits to gauge the adequacy of system reliability.
- End-stage target:** No control chart violations for line importance categories 1 & 2, and not more than one violation per year for line importance categories 3 & 4. Control chart violations are defined as follows:
- Latest FY above the Upper Control Limit (short-term degradation)
 - 2 of last 3 FYs above the Upper Warning Limit (mid-term degradation)
 - Continuous worsening trend in the last six FYs (long-term degradation)
- Inclusions/exclusions:**
- Reliability monitoring is based on automatic (unplanned) outages to transmission lines (not points-of-delivery)
 - Duration of any single outage is capped at 4,320 minutes (72 hours)
 - Momentary outages are excluded
 - Outages to lines with all or part non-federal ownership are excluded
 - Outages in the year in which a line may have been energized or retired are excluded (i.e., line must have "full year" availability)
 - Outages with a cause attributed to a foreign utility are excluded

Measure owner: Transmission Technical Operations (TOT)