

April, 27<sup>th</sup> 2009

# **PROJECT COST ESTIMATING GUIDELINES**

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REVISION No. 2

Terms & Definitions

Process Flow

Templates

**DRAFT ONLY**

# Project Cost Estimating Guidelines

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## 1 **PURPOSE**

Project cost estimates are a key component of the regional system planning process and provide a basis for key decisions to address both regional and local transmission system upgrade needs. The purpose of this document is to provide consistent cost engineering terms and definitions and a standardized approach to cost estimating in the region.

This document also outlines the active review and reporting of cost estimates throughout the project life cycle. The proposed process covered in this document will improve the ability for transmission owners in the region to provide common estimates, increase project costs transparency and provide regular information about the transmission investments made in the region and their impact to rates.

This document complements the current regional planning process and provides additional level of detail to the project cost estimates. These guidelines have been assembled with the collaboration of the New England Transmission Owners and will serve as supporting document to the existing planning procedure.

## 2 TERMS AND DEFINITIONS

### 2.1 Cost engineering definitions<sup>i</sup>

- **Cost Estimate**: A prediction of quantities, cost, and/or price of resources required by the scope of an asset investment option, activity, or project. As a prediction, an estimate must address risks and uncertainties. Estimates are used primarily as inputs for budgeting, cost or value analysis, decision making in business, asset and project planning, or for project cost and schedule control processes. Cost estimates are determined using experience and calculating and forecasting the future cost of resources, methods, and management within a scheduled time frame.
- **Escalation**: The provision in actual or estimated costs for an increase in the cost of equipment, material, labor, etc., over that specified in the purchase order or contract due to continuing price level changes over time. Inflation may be a component of escalation, but non-monetary policy influences, such as supply-and-demand, are often components.
- **Contingency**: An amount added to an estimate to allow for items, conditions, or events for which the state, occurrence, or effect is uncertain and that experience shows will likely result, in aggregate, in additional costs. Typically estimated using statistical analysis or judgment based on past asset or project experience. Contingency usually excludes:
  - Major scope changes such as changes in end product specification, capacities, building sizes, and location of the asset or project;
  - Extraordinary events such as major strikes and natural disasters;
  - Escalation and currency effects.

Some of the items, conditions, or events for which the state, occurrence, and/or effect is uncertain include, but are not limited to, planning and estimating errors and omissions, minor price fluctuations (other than general escalation), design developments and changes within the scope, and variations in market and environmental conditions. Contingency is generally included in most estimates, and is expected to be expended.

**Project**: Based on commonly used Project Management terminology, Project's definition is as follow: *"A temporary endeavor with a specific objective to be met within the prescribed time and monetary limitations and which has been assigned for definition or*

*execution*" (AACE / PMI). Regional Transmission projects are typically defined by the transmission owner as a result of the solution study. Projects are broken down by components in the RSP listing (Lines & Substations) but are typically permitted and reviewed as a whole for efficiency and resource/costs savings.

- **Project Scope**: The sum of all that is to be or has been invested in and delivered by the performance of an activity or project. In project planning, the scope is usually documented (i.e., the scope document).
- **Change in Scope**: A change in the defined deliverables or resources used to provide them.
- **Right of way cost**: All costs associated with the acquisition of new right of way including easements, land purchases, and associated agent, surveying (relative to land acquisition) and recording fees (as defined by FERC 350 account definition).
- **Level of Project Definition**: This characteristic is based upon percent complete of project definition (roughly corresponding to percent complete of engineering). The level of project definition defines maturity or the extent and types of input information available to the estimating process. Such inputs include project scope definition, requirements documents, specifications, project plans, drawings, calculations, learning's from past projects, reconnaissance data, and other information that must be developed to define the project.

## 2.2 Project planning stage<sup>ii</sup>

The RSP (Regional System Planning) project list identifies regulated transmission solutions proposed in response to the needs identified in a RSP or Needs assessment conducted pursuant to Section 4.1 of Attachment K of the Open Access Transmission Tariff (OATT). The RSP Project List identifies the proposed regulated transmission solutions separately as either a Reliability Transmission Upgrade or a Market Efficiency Transmission Upgrade. Every project evolves through various stages of development. These stages are as follow:

- **Concept**: include transmission projects that are being considered by its proponent as a potential solution to meet a need identified by the ISO in a Needs Assessment or the

RSP, but for which there may be little or no analysis available to support the transmission project. A project charter is developed at this stage.

- **Proposed**: include a regulated transmission solution that (i) has been proposed in response to a specific need identified by the ISO in a Needs Assessment or the RSP and (ii) has been evaluated or further defined and developed in a Solutions Study, as specified in Section 4.2(b) of Attachment K of the OATT, such that there is significant analysis that supports a determination by the ISO, as communicated to the Planning Advisory Committee, that the proposed regulated transmission solution would likely meet the need identified by the ISO in a Needs Assessment or the RSP, but has not received support by the ISO under Section I.3.9 of the Tariff.
- **Planned**: include a Transmission Upgrade that has been approved by the ISO under Section I.3.9 of the Tariff.
- **Under Construction**: include a Transmission Upgrade that has received the approvals required under the Tariff and engineering and/or construction is underway.
- **In-Service**: shall include a Transmission Upgrade that has been placed in commercial operation and control jurisdiction turned over the local control center.

### 2.3 Examples of Contingency & Scope Change

The variance to the cost estimate baseline falls into the two categories defined in section 2.1, contingency or scope changes. Contingency typically reflects the risks associated with some of the project elements. These risks are identified, quantified and a cost is associated with these risks. Scope changes on the other hand accounts for project costs incurred as a result of changes to the project itself. The following list gives a few examples of each of these cost categories.

Some examples for transmission project contingency are:

- Field condition design adjustment (e.g. field conflict)
- Incremental change to cost estimate (e.g. unit price increase) excluding general escalation.
- Estimating variances (e.g. quantity, equipment)

- Design development and changes within the original scope (e.g. pole placement less than 50ft)
- Market & vendor variations (e.g. price delta between vendors)
- Reasonable environmental condition or customer request adjustments (e.g. avoiding stream)
- Weather impact on construction (limited to minor delays of few days or less)
- Permitting requirements (e.g. working hour restrictions, rare plants and species protection measures)

Some examples for transmission project Scope changes are:

- Substation site relocation
- Design criteria change
- Currency effects
- Regulatory & permitting project definition changes (e.g. undergrounding transmission or distribution lines, army core of engineer construction requirements)
- Project re-Routes or relocation from the original Scope
- Changes to the project to accommodate compliance measures (Environmental, Land impact mitigation)
- Significant project delays (cost incurred through the escalation cost and the carrying charges for the project, including capital interest)
- Major schedule changes

### 3 **COST ESTIMATING PROCESS**

#### 3.1 Development of the cost estimate

The development of initial cost estimates takes place early in the regional planning process to allow for alternative comparison as well as alternative cost/benefit evaluation. As the project goes through its life cycle, different grade of estimates are developed and released. The different types of estimates are:

- Order of Magnitude Estimate
- Conceptual Estimate
- Planning Estimate
- Engineering Estimate
- Construction Estimate

The level of detail in the estimate will increase as the project develops. The level of project definition also varies depending on the stage of the project. The following shows the expected level of definition on various project phases and the corresponding estimate types:

Project Stage	Level of Project Definition	Estimate Class	Estimate Type	Regional Review	RSP Listing Target Accuracy
<b>Project Initiation</b>	0% to 15%	-	Order of Magnitude	Need Approval (RSP Listing)	-50% to +200%
<b>Proposed Project</b>	15% to 40%	A	Conceptual Estimate	Cost Review / Retain Proposed Solution	-25% to +50%
<b>Planned Project</b>	40% to 70%	B	Planning Estimate	PPA Approval	-25% to +25%
<b>Final Project Design</b>	70% to 90%	C	Engineering Estimate	Cost Review / TCA Approval	-10% to +10%
<b>Under Construction</b>	80% to 100%	D	Construction Estimate		-10% to +10%

**Table 1:** Cost Estimate types per project phase (From AACE definition & customized for Transmission Project)

##### 3.1.1 Cost estimate components

#### **Base Estimate Development**

The project estimate depends on the level of project definition as well as the type of estimate being developed. At a minimum the cost estimate should be broken down by project elements (e.g. line segments, substations etc...). The estimate shall conform to the template as described

in section 4 of this document. The following information and level of details should be provided at the different project stages of the estimate development process:

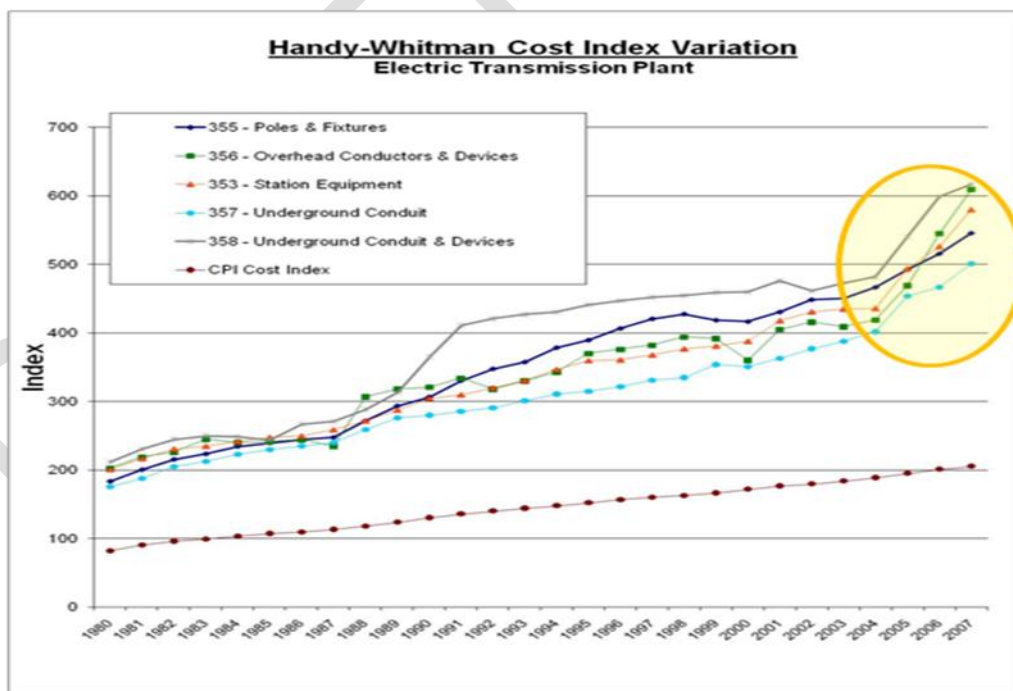
- Concept project: Cost broken down by project elements (lines, substations, etc...). Analogous cost estimating practices may be used to developed conceptual stage estimates (using similar past projects as a reference).
- Proposed Project: Project characteristics should be refined (e.g. line mileage, major equipment specifications, etc...) so to achieve a project level of definition sufficient to achieve the level of accuracy targeted. Some preliminary engineering, field recognition may be necessary to refine project knowledge.
- Planned Project: One line diagrams and preliminary design with proposed project location and equipment specifications need to be developed in order to increase the level of project definition. These requirements are already in place to enable Proposed Plan Application (PPA) approval and for the ISO-NE to authorize the project to proceed.
- Transmission Cost Allocation (TCA): For TCA approval final design should be developed to achieve the +/- 10% accuracy level targeted. Detail estimate should be developed and broken down by the following cost categories:
  - Right of way costs
  - Material
  - Labor
  - Equipment
  - Permitting (Including administrative & legal cost)
  - Engineering & Surveying
  - Project Management & Construction Supervision
  - Financing cost (AFUDC & Interest Costs)
  - Escalation (using Handy Whitman or similar)
  - Contingency

At a minimum the project scope of work shall be developed and provided with the estimate (See reporting template for details in section 4 of this document)

**Escalation**

At each of these stages costs should be calculated and the estimate expressed in year-of-expenditure dollars to reflect escalation. This can be done by assigning an inflation rate per year for the different project cost elements. The selected year-of-expenditure should reflect a realistic scenario, taking into account project planning and permitting durations, as well as construction timeframe. Inflation rates may be different for specific cost elements (e.g. substation vs. transmission lines). Handy Whitman is a custom tailored index for the utility industry which updates are released twice a year. This index follows the Uniform System of Accounts as defined by the Electric Code of Federal Regulations (Title 18) and is used by the utility companies for tax preparation and depreciation purposes. Despite its historical basis it does provide accurate trends that may be used to anticipate inflation rates. Estimates should clearly specify how inflation is considered in the estimate and clearly state that the estimate is expressed in year-of-expenditure dollars. Multiple sources may be used for determining the inflation rate, including other nationwide and local references. Establishing the cost estimate in year-of-expenditure dollars will greatly reduce public perception of cost growth.

The following graph illustrates - Handy Whitman trend from 1980 to 2007:



**Graph 1: Handy Whitman Cost Index from 1990 to 2007**

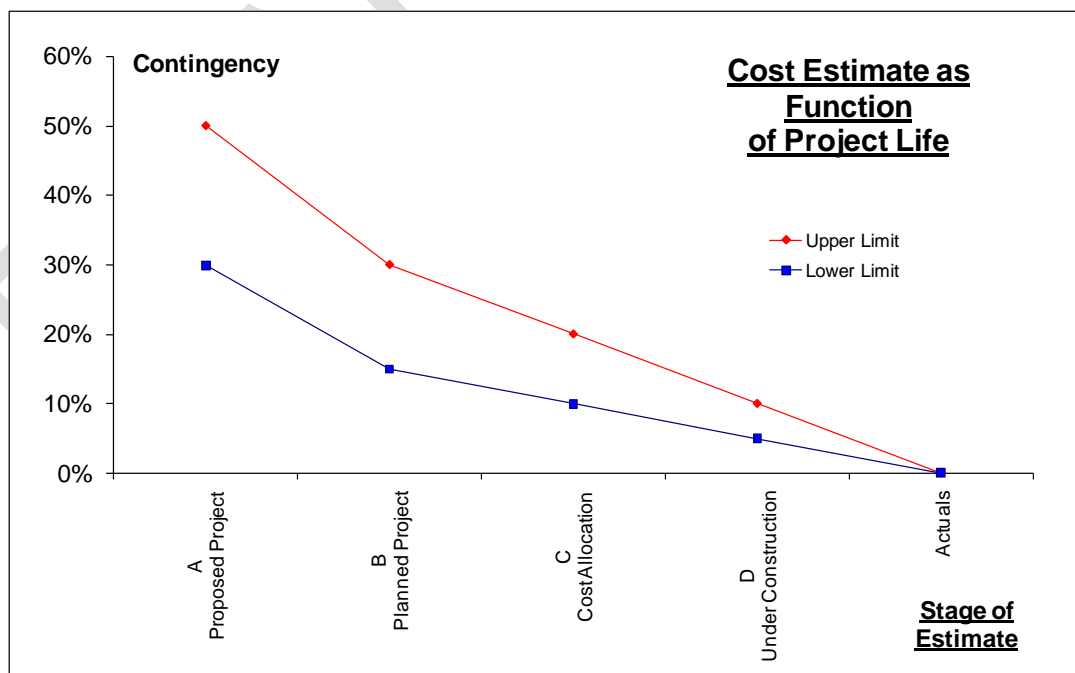
### Contingency

Reasonable contingencies should be developed and evaluated for each project cost estimate. Contingency captures uncertainties and cost risks within an estimate. The contingency should adhere to the definition as provided in Section 1 of this document and is dependent on the level of project definition. Some general guidelines for contingency have been developed based on AACE definitions by EPRI and the Department of Energy and are as follow:

Estimate Class	Descriptive (AACE / EPRI)	From AACE		From EPRI
		LEVEL OF PROJECT DEFINITION Expressed as % of complete definition	EXPECTED ACCURACY RANGE Typical variation in low and high ranges	Suggested Contingency
A	Study / Simplified Estimate	1% to 15%	L: -15% to -60% H: +30% to +120%	30-50 %
B	Budget, Authorization or Control / Preliminary Estimate	10% to 40%	L: -10% to -30% H: +20% to +60%	15-30%
C	Control or Bid / Detailed Estimate	30% to 70%	L: -5% to -15% H: +10% to +30%	10-20%
D	Check Estimate or Bid / Finalized Estimated	50% to 100%	L: -5% to -5% H: +10% to +10%	5-10%

**Table 2:** Cost Estimate types and relevance based on level of project definition

The following graph illustrates the typical evolution of the contingency based on the project level of definition according to the Regional System Planning stage:



**Graph 2:** Estimate Contingency as a function of the project stage

Major and more complex projects may include higher contingency levels based on increased project risks and challenges. Typically, as the project is refined, the contingency should reflect the shift of contingencies into actual cost categories. Transmission Owners should manage risks and uncertainties to reduce the contingency used. However, per the AACE definition, historically, contingency is expected to be expended and should be included in the estimates.

### *3.1.2 Cost estimate release*

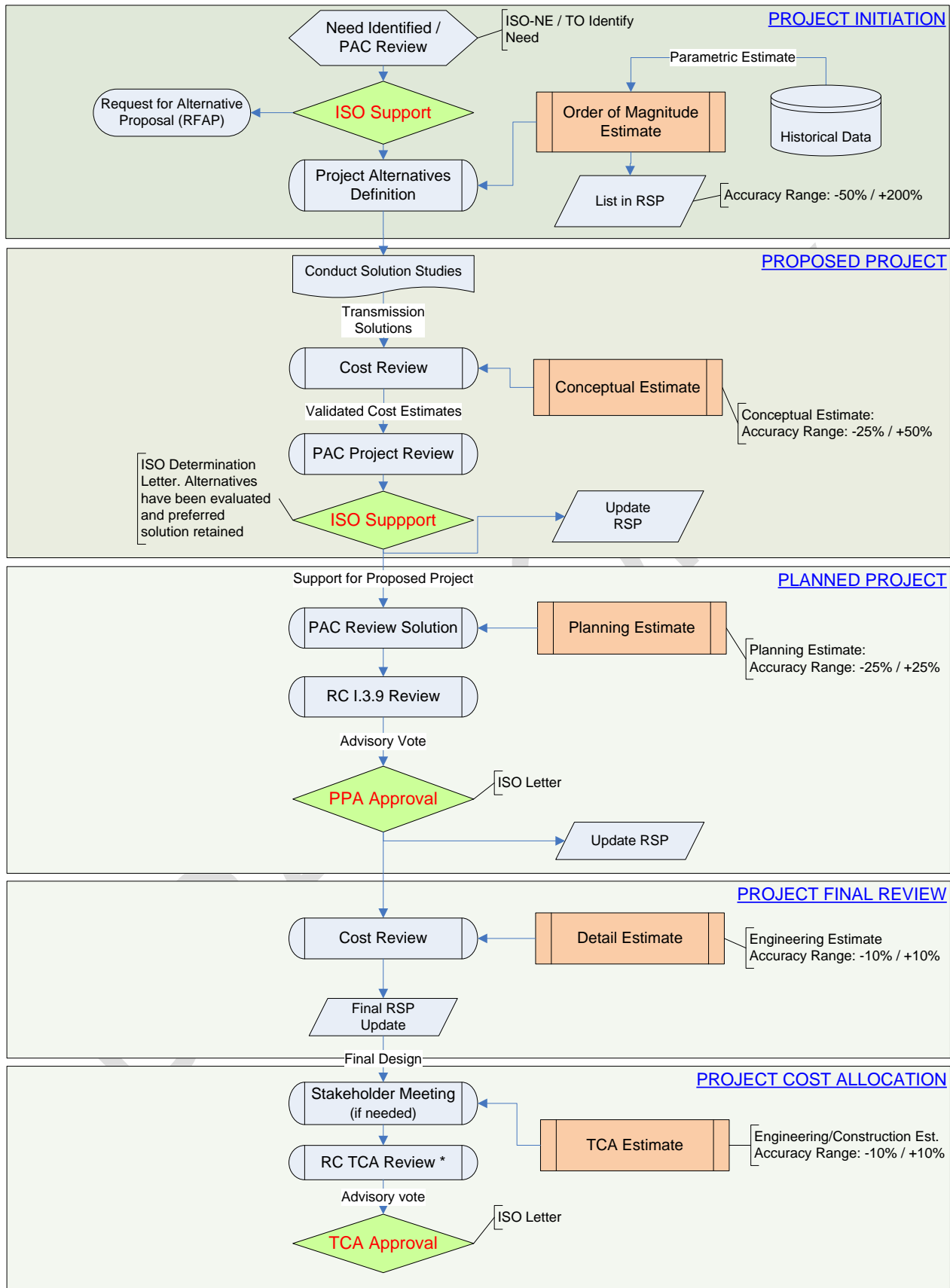
The project cost estimates will be developed and listed in the RSP per Planning Procedure #4. Section 3.3 of this document illustrates the various estimating stages in the regional project planning life cycle. For each of the estimate releases, a clear project scope & prior estimated costs should be indicated. The template in Section 4 of this document provides a one page summary document for estimate release purposes.

### 3.2 Cost estimate updates

Cost estimates shall be updated in accordance to Planning Procedure #4 and provide the details as listed in section 3.1 of this document. The Regional System Plan Project Listing is updated 3 times a year, in April, July and October. Estimate updates should then be provided to the ISO New England prior to the release of the revised project listing and formatted according the template provided in this document. Key information will be included in the Regional System Plan Project Listing and used appropriately for cost review purposes, as well as regional rate forecasting.

### 3.3 Cost Estimate Process (Flowchart)

The following process outlines the estimating requirements according to the regional system planning procedures.



RC: Reliability Committee  
PAC: Planning Advisory Committee

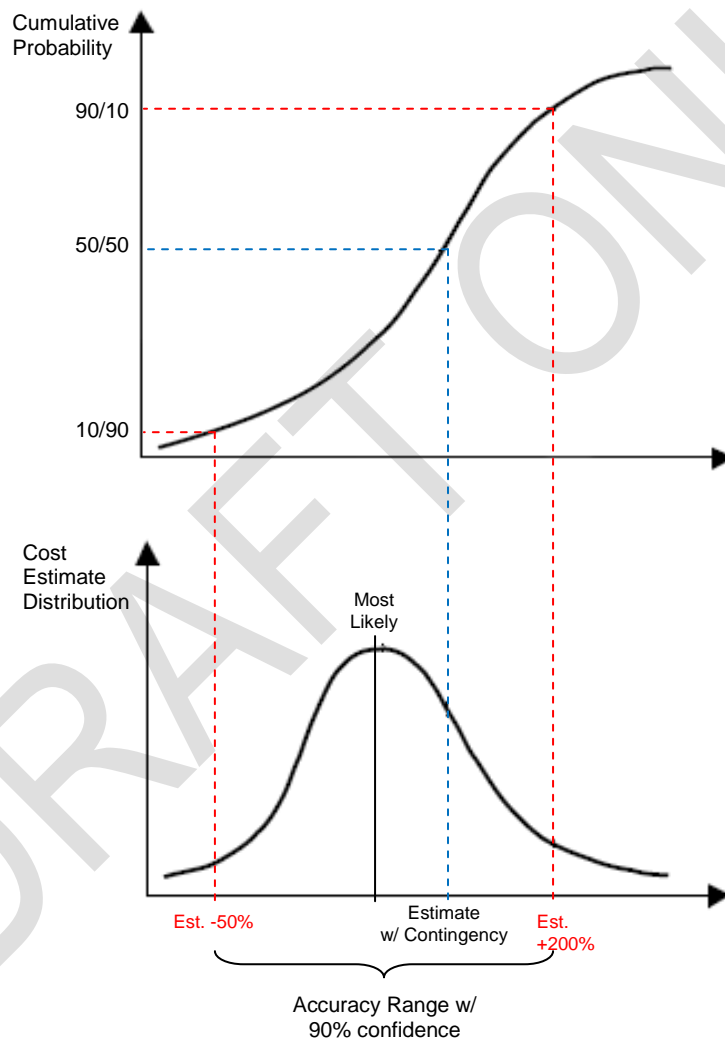
PPA: Proposed Plan Application  
TCA: Transmission Cost Application

(\*) : If cost increase by more than 10% of PTF funding refer to PP4 for details

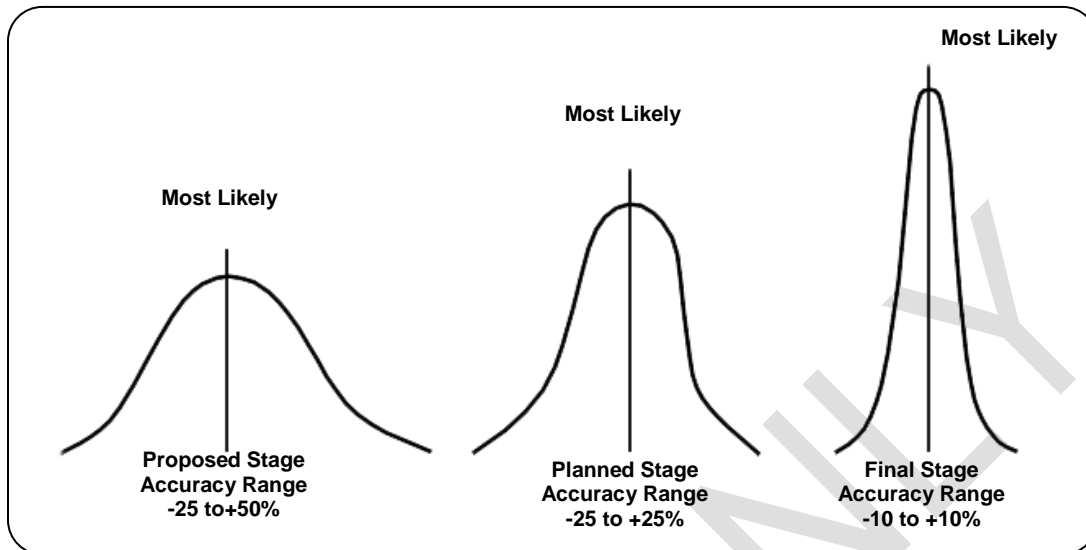
### 3.4 Cost Estimate Accuracy & Contingency

Contingency and accuracy should not be confused. Where contingency reflects an amount added to a project cost estimate for project unknown and risks identified, accuracy reflects the probability that the estimate will come within a predefined parameter (e.g. 90% confidence). Accuracy is defined by the width of the bell curve distribution of the cost estimate. Contingency is fully part of an estimate.

Example of cost estimate accuracy at Initial Stage:



As the project evolves thru the RSP, the cost estimate is refined and the accuracy changes as follow:

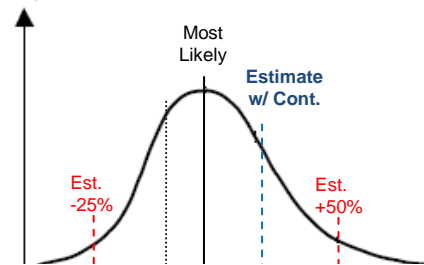


**Example:**

**Proposed Stage (Accuracy -25% to +50%):**

- Base estimate: \$1M (Most Likely \$1.2M)
- Contingency (40%): \$1.4M (Based on Risk)

The Accuracy Range: \$0.9M – \$1.8M using most likely cost



**Planned Stage (Accuracy -25% to +25%):**

- Base estimate: \$1.2M (Most Likely \$1.3M)
- Contingency (25%): \$1.5M (Based on Risk)

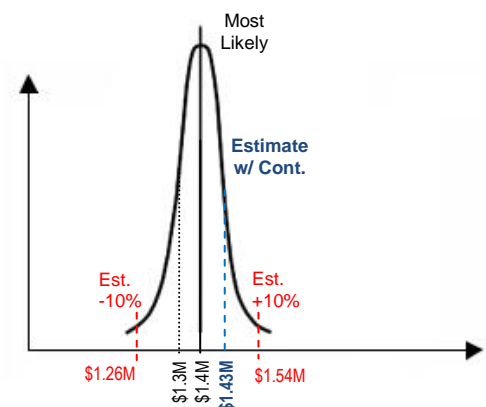
The Accuracy Range: \$0.98M – \$1.63M:



**Final Stage (Accuracy -10% to +10%):**

- Base estimate: \$1.3M (Most Likely \$1.4M)
- Contingency (10%): \$1.43M (Based on Risk)

The Accuracy Range: \$1.26M – \$1.54M:



### 3.5 Committee

*This section is currently being developed by the Cost Working Group which will define the composition of the committee along with its role and responsibilities in the regional planning process.*

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#### 4 **PROJECT COST ESTIMATES UPDATES**

##### 4.1 Project Cost Estimate Template

See attachment 1 for details.

##### 4.2 Project Cost Estimate Change Reporting Template

See attachment 2 for details.

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## PROJECT COST ESTIMATE & SCHEDULE SHEET

Transmission Owner:

RSP Project #:

Project Name:

Date:

Estimate Grade:

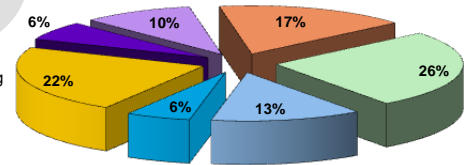
### 1. Project Scope Summary

### 2. Project Cost Summary

Prior Estimated Cost:

Project Cost Summary			
Cost Category	PTF	Non-PTF	Total
Material			
Labor			
Equipment			
Engineering / Permitting / Indirects			
Escalation			
AFUDC			
Contingency			
<b>Total Project Cost</b>			

- Material
- Labor
- Equipment
- Engineering / Permitting / Indirects
- Escalation
- AFUDC
- Contingency



Detailed Cost Summary By Project Element									
	Material	Labor	Equipment	Indirects	Escalation	AFUDC	Contingency	Total	PTF Amount
2.2.1 Component A (Substation)									
2.2.2 Component B (Line)									
<b>Total</b>									

### 3. Project Milestone Schedule

### PROJECT COST ESTIMATE UPDATE SHEET

Transmission Owner:

RSP Project #:

Project Name:

Estimate Grade:

Base Estimate:

PPA Approval:

TCA Application #:

Date:

#### 1. Project Scope Summary

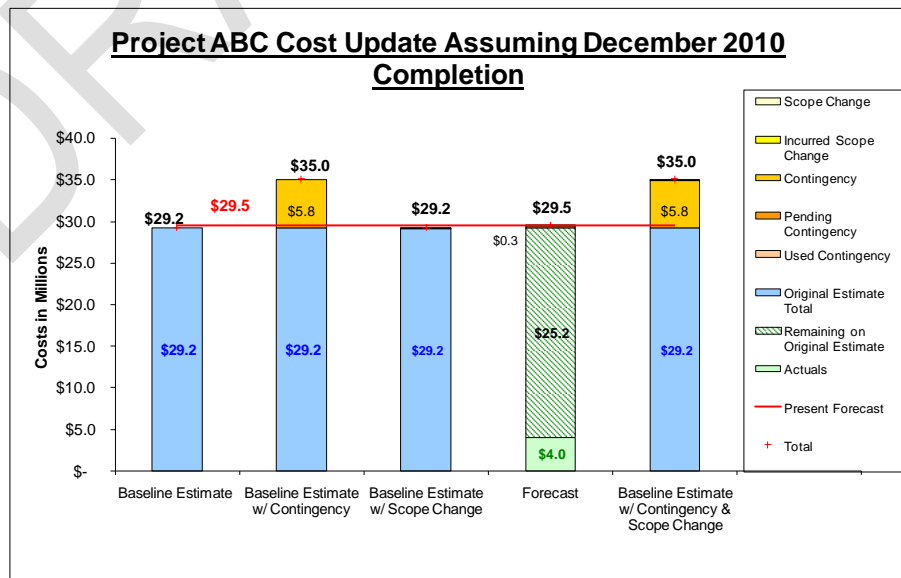
#### 2. Project Update

#### 3. Project Cost Summary

Project ABC							
Project ABC Components	Base Estimate	Base Estimate With Contingency	Scope Change	Actuals Cost	Project Forecast	Estimated % Completion	Forecast vs. Estimate
Substation A							On Track
Line B							Off Track
<b>Grand Total</b>							On Track

**Note:** On track & Off Track are indicators comparing forecasted cost to the baseline estimate for PTF funding in accordance to PP-4.

#### 4. Project Forecast



5 **DOCUMENT REFERENCES**

<sup>i</sup> Source: Copyright 2007, AACE International, Inc., *AACE International Recommended Practices, Number 10S-90*

<sup>ii</sup> Source: *OATT Attachment K – Regional System Planning*

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