Cost Estimating Methodology Workshop

vermont electric power company

VELCO

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SHEI Estimates

Objective: To develop consistent cost estimating methodology in order to ensure comparable estimates on all SHEI project options

- Order of Magnitude cost estimates are being prepared for project alternatives
  - For VELCO, these estimates will include 50% contingency, which will be appropriate at this stage due to the minimal scope definition of solution options
- Conceptual cost estimates will be prepared for the few (2 or 3) options that are selected for further evaluation
- A Planning grade cost estimate will be prepared for the preferred option

Class	Description	Accuracy	Project Definition	Study Stage
A	Order of Magnitude	-50% to + 200%	0%-15%	All potential upgrades
A	Conceptual	-25% to + 50%	15%-40%	Subset of options selected for further evaluation
B	Planning	-25% to + 25%	40%-70%	Preferred option
C	Engineering	-10% to + 10%	70%-90%	To support 248 filing
D	Construction	-10% to + 10%	80%-100%	To support ISO-NE TCA filing

Project Definition Descriptions

- **Order of Magnitude (0%-15%)**
  - Voltage class
  - Line mileage
  - Approximate site location
  - Major equipment need assumed
  - Assumed green field construction site
- **Conceptual (15%-40%)**
  - Some preliminary engineering
  - Project alternatives developed
  - Approximate in-service date developed
  - Major equipment needs determined
- **Planning (40%-70%)**
  - Preliminary engineering design in progress
  - One line diagrams
  - Proposed location
  - Proposed equipment specifications
  - Approximate number of structures on a line
  - Approximate general arrangement of substation
  - Project management and administration plan developed
- **Engineering (70%-90%)**
  - Some contracts in place
  - Finalized engineering and design
  - Some “take-off” quantities available for above and below grade construction
  - Environmental impact determined
- **Construction (90%-100%)**
  - All design quantities available
  - Construction contracts awarded
  - Major permits received

Purpose & Importance:

- To develop a link between the level of project scope definition and the level of accuracy in the project estimate.
- Provides ability to rank each alternative accurately and competitively.
- Establishes a method to categorize cost estimates based upon project scope to create consistency amongst various project estimates.

Examples:

Project	Estimate Class	Accuracy	Estimated Cost	Low Cost	High Cost
Alternative #1	Order of Magnitude	0%-15%	$10M	$5M	$20M
Alternative #2	Conceptual	15%-40%	$12M	$9M	$18M
Alternative #3	Planning	40%-70%	$8M	$6M	$10M

Cost Basis

Where the costs within the estimate originate from. Accuracy dependent on the legitimacy of the costs included

- Material, Labor, and Equipment costs are broken down into unit costs
- Use of historical unit costs from past projects, both recent and historical. An escalation factor is used for those unit costs which are more dated
  - For historical unit cost data, 5% escalation per year is applied to bring to current dollar value
- Sales tax is added to the estimated material amount. 6% or 7% is applied depending on the town that the material will be delivered to

Unit Quantity Basis

Where the quantity of scope items within the estimate originate from. Accuracy dependent on the legitimacy of the quantities included

- Basis for unit quantities in estimates can depend on the scope and development stage of a project
- Conceptual projects will typically use a variety of historical project's data and engineering quantities from similar assets and projects
- Project specific engineering take-off quantities are used when they are available, typically during the filing/engineering grade estimate stage (70%-90% scope definition)

Cost Components

Categories that costs get grouped into within an estimate. Helps to organize costs and calculated overheads, interest, etc…

- Material
  - Estimated project material cost and sales tax
- Direct Labor
  - All construction labor (boots on the ground for both VELCO and Contractors)
- Equipment
  - Specialized equipment needed for the project, such as drill rigs, barges, helicopters, etc…
- Indirect costs
  - Includes labor for project management, engineering, environmental, and ROW. Overheads and miscellaneous costs, such as collateral damages, temporary work-around costs, and mobilizations, are included in this category as well.

Escalation and Capital Interest

Costs to account for inflation and interest costs on project loans

- Escalation is calculated by categorizing estimated costs per cost element and using the Handy Whitman cost index to apply the inflation rate per year per project cost element.
- Capital Interest is calculated using an estimated project timeline, spend plan, and a calculated capital interest rate per year for the duration of the project.

Contingency & Scope

- The application of contingency on a project is dependent on the level of scope definition of the project. VELCO's estimating process is based upon the ISO-NE cost estimating guidelines (Attachment D to ISO-NE Planning Procedure 4)
- As project scope definition is increased, contingency amount is decreased. See table below

Class	Description	Contingency
A	Order of Magnitude	30%-50%
A	Conceptual	30%-50%
B	Planning	15%-30%
C	Engineering	10%-20%
D	Construction	5%-10%

SHEI Options Summary

Option	Upgrade elements	Responsible Entity
1	Reconductor B20 Lowell-Johnson 34.5 kV line and upgrade the Lowell 46/34.5 kV transformer	GMP
2	Enable the Sheffield AVR	GMP
3	Recognize Jay synch condenser 1.15 service factor	GMP
4	Enable the Sheldon Springs AVR	GMP
5	Install a 15 MVAr synchronous condenser at Highgate 115 kV	VELCO
6	Reconductor K42 Highgate-St Albans 115 kV line	VELCO
7	Install a 2nd K39 Sheffield-Lyndonville 115 kV line	VELCO
8	20 MVA (16 MW / 12 MVAr) Battery Storage at Highgate 115 kV	VELCO/DUs
9	Reconductor K41 Highgate-Jay 115 kV line	VELCO
10	Install a new Irasburg to Stowe 115 kV line	VELCO
11	Install a new Irasburg to East Fairfax 115 kV line	VELCO
12	Close the normally open Lowell C53 switch	VEC
13	Close the normally open Richford 14W switch and reconductor from Richford to Highgate 46 kV	VEC
14	20 MVA (16 MW / 12 MVAr) Battery Storage at Sheffield 115 kV	VELCO/DUs
15	Install a 2nd 115 kV line alongside the K42 line	VELCO
16	Upgrade 1.7 miles of B22 line for 39 MVA LTE rating	GMP/Morrisville
17	Open B20 line at Johnson	GMP

Suggestions for Consistency

- Capital Interest
  - Each entity to use their own rate of capital interest as it varies per company
- Escalation
  - Flat rate of escalation for all projects?
- Contingency
  - Compare without contingency to ensure equal comparison purposes?
- Project Scope
  - All agree that estimates should be assigned a scope definition stage (order of magnitude, conceptual, etc…)
  - Estimates all rounded with high low range
- Next Steps
  - Peer reviews?
  - Data sharing?