

Guidelines for Life Cycle Cost Analysis

Capital Projects Advisory Review Board
Committee on Life Cycle Cost Analysis & Energy Efficiency

I. INTRODUCTION

A. OPPORTUNITIES

1. Life cycle cost analysis (LCCA) is a tool that can contribute to the process of designing facilities that meet the needs of their owners.
 - a. Evaluating capital and operating costs enables the client agency, the architect/engineer and the contractor to make decisions that can reduce the total cost of ownership.
 - b. Identifying the Owner's Project Requirements (OPR) early in the planning process ensures that design decisions are made in relation to the owner's goals for the project.
 - c. Modeling energy and operational performance of the design can lead to projects that conserve resources.
 - d. Commissioning, measurement and verification of the completed project can improve the performance, operations and maintenance of the facility.
2. The LCCA process should be organized to serve the specific needs and circumstances of each project.
 - a. Identifying the project elements that would benefit from a life cycle cost analysis early in the process enables LCCA to be applied in an efficient, cost-effective manner.

B. RELATION TO EXISTING STATE GUIDELINES

1. The proposed LCCA guidelines are built on the foundation of the State's existing ELCCA guidelines and assumes that the Washington State Life Cycle Cost Tool (WA LCCT) developed by OFM will be utilized.
2. LCCA and ELCCA should be integrated into a single process to maximize outcomes, avoid redundancy and eliminate conflicts.
3. Under these guidelines, life cycle cost analysis starts earlier in the process to ensure that development and design alternatives are evaluated before decisions are made.
 - a. Evaluate development options in capital request.
 - b. Establish OPR and make initial evaluation of life cycle costs in predesign.
 - c. Utilize LCCA early in the design process to inform critical decisions.
4. Under these guidelines, measurement and verification continues beyond completion of the construction phase to ensure a successful transition from the contractor to the client agency's facilities team.
 - a. Provide ongoing participation of commissioning agent, architect/engineer and contractor in the Warranty and/or Energy Performance Contract Phases.

C. PROJECT DELIVERY MODEL

1. General principles of incorporating life cycle cost analysis into a project apply to Design Bid Build, General Contractor Construction Manager and Design Build, however the details and sequence of the process may vary and should be modified to specific circumstances.

D. TEAM

1. An effective LCCA process involves the client agency, the commissioning agent, the architect/engineer and the contractor or cost estimator.
 - a. For projects managed by the Department of Enterprise Services (DES) representatives of Engineering and Architectural Services and Energy Services should be involved.
2. Commissioning Agent
 - a. The commissioning agent (CxA) is a representative of the client agency.
 - b. The CxA may work with the client agency to prepare the OPR and should review the design documents to ensure they convey its intent.
 - c. The CxA coordinates, oversees and/or performs the commissioning testing.
 - d. The CxA participates in the post-occupancy measurement and validation process.
3. LCCA Analyst
 - a. The LCCA analyst is typically part of the architect/engineer design team and may be an architect, engineer or cost estimator.
 - b. The LCCA analyst must have the skills and experience necessary to coordinate the consultants required to evaluate the initial and life cycle costs, and to utilize the coordinated information in an LCCA model.

II. CAPITAL REQUEST

IDENTIFY PROJECT NEED

A. ESTABLISH OVERALL GOALS

1. Identify high level performance goals for the project including LEED certification, and energy and water use targets.

B. DEVELOPMENT OPTIONS

1. Analyze alternative strategies for the development of the project.
2. Options may include doing nothing, leasing space, renovating and/or expanding an existing facility or new construction.
3. Consider financial impact on operations and programs in addition to facility costs.

III. PREDESIGN

ESTABLISH PROJECT GOALS

A. ROLES AND RESPONSIBILITIES

1. Document roles and responsibilities for the client agency, Department of Enterprise Services or other appropriate agency, commissioning agent, architect and/or engineer and general contractor or cost estimator.

B. OWNER'S PROJECT REQUIREMENTS (OPR)

1. Document project goals for performance, operations and maintenance.
 - a. Owner and user requirements.
 - b. Systems and equipment performance.
 - c. Training, operations and maintenance requirements.
 - d. Confirm LEED certification type and level, and energy and water use targets.
 - e. Sustainability and environmental stewardship goals.
 - f. Energy performance guarantees.
 - g. Indoor air quality, occupant productivity, daylighting, ventilation, etc.

C. PLANNING LEVEL EVALUATION OF LIFE CYCLE COSTS

1. Develop predesign work plan identifying project elements to be analyzed for review and approval by OFM.
2. Evaluate proposed site and building systems per the WA LCCT.
3. Complete applicable portions of the ELCCA Environmental Design Considerations checklist.

IV. DESIGN

UTILIZE LIFE CYCLE COST ANALYSIS AS A DESIGN TOOL

A. SCHEMATIC DESIGN

1. Develop a design phase LCCA work plan.
 - a. Design Bid Build and General Contractor Construction Manager: client agency, commissioning agent and architect/engineer develop work plan and identify project elements for review and approval by OFM, Department of Enterprise Services Energy Services and/or other appropriate agency.
 - b. Design Build: identify minimum requirements for the LCCA work plan in the predesign and/or the Design Build Request for Proposals.
 - c. For guidance on project elements to assess, reference the LEED v4 Integrative Process credit.
 - d. Identify opportunities for utility incentives, grants and government loans.
2. Identify elements that are most likely to reduce life cycle cost impacts and/or yield energy savings.
3. Provide "simple box" modeling of energy and operational performance to test alternative design strategies.
4. Conduct a water budget analysis to identify opportunities for reducing system water use.

B. VALUE ENGINEERING

1. Include LCCA report in submittal to value engineering team.
2. Value engineering recommendations should optimize life cycle costs and functionality.

C. DESIGN DEVELOPMENT

1. Provide final modeling of energy and operational performance of preferred options to establish criteria for the commissioning plan, energy and water use, operations and maintenance.
2. Utilize LCCA to make decisions about specific equipment alternatives.
3. Conduct a comprehensive document review by the CxA.

D. CONSTRUCTION DOCUMENTS

1. Prepare Performance Evaluation Plan.
 - a. Establish Key Performance Indicators (KPI), which allow performance requirements to be measured and verified in the completed facility.
2. Design KPI data collection system.
 - a. Incorporate measurement systems into the design.
3. Provide Commissioning Plan.
 - a. Incorporate commissioning requirements into the Bid Documents.
 - b. Identify systems and equipment to be commissioned.
4. Conduct a comprehensive document review by the CxA.

V. CONSTRUCTION

INSTALL AND TEST SYSTEMS & EQUIPMENT

A. CONSTRUCTION COORDINATION

1. CxA reviews shop drawings and submittals, evaluates change orders for impact on KPIs and OPR and updates both as necessary.
2. Identify testing requirements for the contractor including scheduling.

B. SYSTEMS AND EQUIPMENT START UP

1. Contractor start up, testing and balancing of systems and equipment.

C. PERFORMANCE VERIFICATION

1. CxA conducts final sign off on key performance indicators. CxA measures and verifies performance of as-built systems and equipment.
2. CxA provides summary Commissioning Report.

D. INITIAL TRAINING

1. Contractor trains client agency's personnel in operation of systems and equipment.

VI. POST-OCCUPANCY

VALIDATE PERFORMANCE OF COMPLETED PROJECT

A. WARRANTY AND/OR ENERGY PERFORMANCE CONTRACT PHASE MEETINGS

1. Monthly meetings of the client agency's facilities team, CxA, architect/engineer and contractor to evaluate systems and equipment performance.
 - a. Hold meetings for a minimum of one year to monitor the performance of mechanical systems during at least one heating and cooling season.
2. Track facility performance in relation to OPR and other performance criteria.
3. Optimize systems performance based on KPI monitoring.
4. Identify opportunities to enhance operations and maintenance.
5. Provide ongoing tracking of systems performance to ensure energy efficiency and reduce operational risks.
6. Provide ongoing training of client agencies' facilities team.
7. Update commissioning report two months prior to expiration of warranty period to identify items to be corrected.

B. DATA COLLECTION

1. Report annually on systems and equipment performance, and energy use to OFM and DES Energy Services.

