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Life Cycle Cost Estimation and Analysis

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Module 1: Introduction

Learning Objectives

By the end of this section, you will be able to:

- **Identify** the regulatory requirements and DOE orders governing life-cycle cost estimates (LCCE) and analyses (LCCA).
- **Evaluate** the seven generic life-cycle phases to ensure comprehensive cost capturing for a project or program.
- **Define** the appropriate boundaries for LCC scope, accounting for sunk costs and programmatic transfers.

Executive Summary: Reliable Life-Cycle Cost Estimates (LCCE) and Analyses (LCCA) are mandatory, critical functions for DOE decision-making, supporting everything from initial alternative selection at CD-1 to long-range portfolio management and federal budget submissions.

Design Fundamentals

Life-cycle costs represent a critical consideration for all Department of Energy (DOE) projects and programs. They serve as a primary communication tool for expectations and requirements to the Office of Management and Budget (OMB), Congress, and the Government Accountability Office (GAO).

Regulatory Framework

The core framework for these requirements is **DOE O 413.3B**, *Program and Project Management for the Acquisition of Capital Assets*. This order mandates that project selection at **Critical Decision 1 (CD-1)** must favor the alternative that provides essential capabilities at an **optimum life-cycle cost**.

Defining Life-Cycle Cost

According to DOE O 413.3B, life-cycle cost (LCC) is the sum of all:

- **Direct and Indirect costs**
- **Recurring and Nonrecurring costs**
- **Related costs** incurred during:
 - Planning and Design
 - Development and Procurement
 - Production and Construction/Renovation
 - Operations and Maintenance
 - Support and Recapitalization
 - Final Disposition



⚠ Safety Constraint: LCCEs must be updated continuously as new data becomes available or when plans and assumptions change to ensure effective out-year budget planning.

Federal Compliance

- **IT Investments:** The OMB requires LCCEs for capital assets related to Information Technology (Exhibits 53 and 300).
- **Value Engineering:** In accordance with **Circular A-131**, realistic LCC estimates and analyses are required.
- **Benefit-Cost Analysis:** **OMB Circular A-94** provides the required guidelines and discount rates.

Background

LCCE and LCCA provide management with a comprehensive view of true costs rather than focusing solely on project execution phases.

Life-Cycle Phases

The DOE standardizes the project life cycle into seven applicable phases:

Phase	Title	Description
Phase 1	Mission Need Assessment	Activities required before CD-0 approval.
Phase 2	Alternative Studies	Activities required before CD-1 approval.
Phase 3	Design	Preliminary and final design efforts, including CD-2 and CD-3.
Phase 4	Procurement/Construction	All costs needed to complete the project through CD-4 approval.
Phase 5	Operations/Maintenance	Costs from project completion through the end of useful life, including upgrades.
Phase 6	Surveillance/Long-Term Maintenance	Efforts after operations cease but before final disposition (includes deactivation).
Phase 7	Final Disposition	Decontamination, demolition, or return of site to grassroots condition.

💡 Design Tip: While the first four phases are structured under DOE O 413.3B, phases 5 through 7 are often less well-defined. Use this handbook to fill analytical gaps for these later stages.

Environmental Management (EM) Projects

Note that phases for **Environmental Management** and **Environmental Restoration (ER)** differ significantly from typical facility projects. Refer to Appendix A for the mapping of traditional life-cycle phases to EM/ER specific requirements.

Establishing Boundaries for LCC


Life-cycle cost does not necessarily cover "cradle to grave." It is defined by the earliest and latest activities included in the specific LCC scope.

Standard Boundaries

- **Start Point:** Begins with the mission needs assessment (leading to CD-0).
- **End Point:** Extends through the useful life and ends with the completion of final disposition.

Special Conditions

- **Programmatic Perspective:** Scope may narrow if liability is transferred to another program (e.g., transfer to legacy management).
- **Defined End:** Projects do not extend to eternity; they have a defined end even if liability remains.

 **Calculation Note:** When evaluating alternative scenarios going forward, **sunk costs** (costs already incurred) may be excluded from the LCCA. However, you must clearly document this exclusion in your reporting.

Checkpoint Quiz

1. At which Critical Decision (CD) point does DOE O 413.3B establish the requirement to choose an alternative based on optimum life-cycle cost?

- a) CD-0
- b) CD-1
- c) CD-2
- d) CD-4

Answer: (b). DOE O 413.3B establishes the framework at CD-1 for selecting the alternative with optimum life-cycle cost.

2. Which life-cycle phase includes deactivation and stabilization efforts initiated after operations have ceased?

- a) Phase 4: Procurement and Construction
- b) Phase 5: Operations and Maintenance
- c) Phase 6: Surveillance and Long-term Maintenance
- d) Phase 7: Final Disposition

Answer: (c). Surveillance and Maintenance (S&M) is initiated after operations cease and typically includes deactivation and stabilization.



3. When is it appropriate to exclude "sunk costs" from a Life-Cycle Cost Analysis?

- a) When calculating the total expected liability of a program.
- b) When submitting budget exhibits to the OMB for IT investments.
- c) When the effort is only intended to evaluate alternative scenarios going forward.
- d) Sunk costs can never be excluded from LCCA documentation.

Answer: (c). Sunk costs may not be relevant for future-facing alternative evaluations, provided the approach is documented.

Module 2: Life-Cycle Cost Estimation

Learning Objectives

By the end of this section, you will be able to:

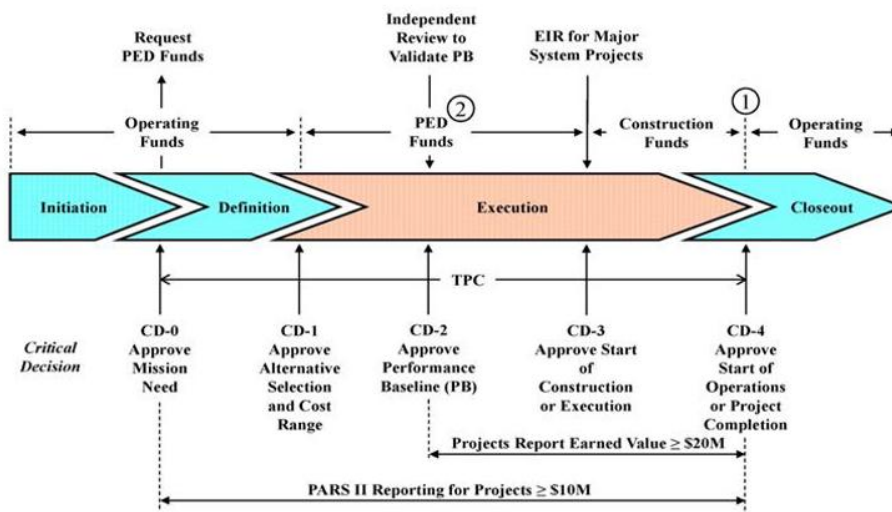
- **Identify** the specific cost estimate requirements and accuracy ranges for each DOE Critical Decision (CD) point.
- **Select** appropriate cost-estimating methodologies (Parametric vs. Definitive) based on project maturity and design detail.
- **Evaluate** O&M and Final Disposition cost elements to ensure a comprehensive and credible Life-Cycle Cost Estimate (LCCE).

Executive Summary: High-quality LCCEs must be credible, well-documented, accurate, and comprehensive. As a project matures from mission need (CD-0) to completion (CD-4), the estimating methodology shifts from stochastic/parametric models to deterministic, detailed unit costs to reduce risk and underfunding.

Framework for Life-Cycle Cost Estimates

The primary requirement for developing cost estimates for capital asset projects is **DOE O 413.3B**.

Various estimates are required throughout the project life cycle to support decision-making and budget formulation.



- NOTES:
1. Operating Funds may be used prior to CD-4 for transition, startup, and training costs.
 2. PED funds can be used after CD-3 for design.

CD = Critical Decision
 EIR = External Independent Review
 PARS = Project Assessment and Reporting System
 PB = Performance Baseline
 PED = Project Engineering and Design
 TPC = Total Project Cost

Figure 2-1: Typical DOE Acquisition Management System for Line-Item Capital Asset Projects



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