

1.011 Project Evaluation

Introduction

- Course Requirements & Overview
- Principles of Engineering Economy
- Assignment 1
- Civil Projects & Civilization
- What is a Successful Project?

Learning Objectives

- Methodology:
 - ▶ Apply the basic methods of engineering economics in evaluating major infrastructure projects
 - ▶ Develop and apply simple models for estimating costs and resources required for major infrastructure projects
 - ▶ Explain and critique the process used to evaluate major infrastructure projects
- Process:
 - ▶ Understand the life-cycle of major projects
 - ▶ Appreciate the complexity of major projects and the role for and limits of analysis in clarifying and resolving issues

Basic Concerns

(Sullivan et al., Engineering Economy)

- Basic questions for any project:
 - ▶ "Will its benefits exceed its costs?"
 - ▶ "Is this the best possible project?"
- Focus of "Engineering Economy"
 - ▶ "Systematic evaluation of the costs and benefits of proposed [or of potential] projects"
 - ▶ "Analysis of alternative uses of financial resources, particularly in relation to the physical assets and the operations of an organization"
 - ▶ "Tradeoffs among different types of costs and the performance provided"

What is Your Role as an Engineer?

- Build projects
- Design projects
- Evaluate projects
- Propose projects
- Define problems



- Increasing complexity
- Decreasing certainty
- More possibilities
- Greater need for imagination and leadership

Principles

(Sullivan et al., pp. 4-7)

- Develop the alternatives
- Focus on the differences
- Use a consistent viewpoint
- Use a common unit of measure
- Consider all relevant criteria
- Make uncertainty explicit
- Revisit your decision

"Most errors can be traced to some violation or lack of adherence to the basic principles"

What is a Successful Project?

- It is built
 - ▶ Engineering feasibility
 - ▶ Financial feasibility
 - ▶ Social feasibility
- The benefits are indeed greater than the costs
- This was an effective way to achieve those benefits
- The project was built in an efficient and effective manner
 - ▶ No clearly better options
 - ▶ No significant externalities
- Building this project did not foreclose other, even better projects

Elements of Project Evaluation

- Create a "story" for the project
- Estimate the time, resources, and other costs of building the project
- Determine how the project can be financed
- Support a comparison of costs and benefits
 - ▶ Financial
 - ▶ Non-financial
- Provide a process for dealing with controversies

How Do We Justify a Project?

- Is this project worthwhile?
 - ▶ *Are the benefits greater than the costs?*
- Is this the best way to achieve these benefits?
 - ▶ *Can similar benefits be achieved more efficiently by some other approach?*
- Is this the best place to allocate resources?
 - ▶ *Do other projects have greater payoff?*
 - ▶ *Are other types of benefits more important?*

What Does it Take to Sustain a Project?

- Financing
 - ▶ Sufficient income to cover expenses
 - User fees, subsidies, contractual payments
- Government approvals (inspections, licensing, etc)
- Engineering
 - ▶ Sufficient maintenance and renewal to perform at an acceptable level of service
- Resources
 - ▶ People and materials as required for maintenance and operations of infrastructure
 - ▶ As required by users of the project
- Public support (or tolerable opposition and interference)

Financial & Economic Issues

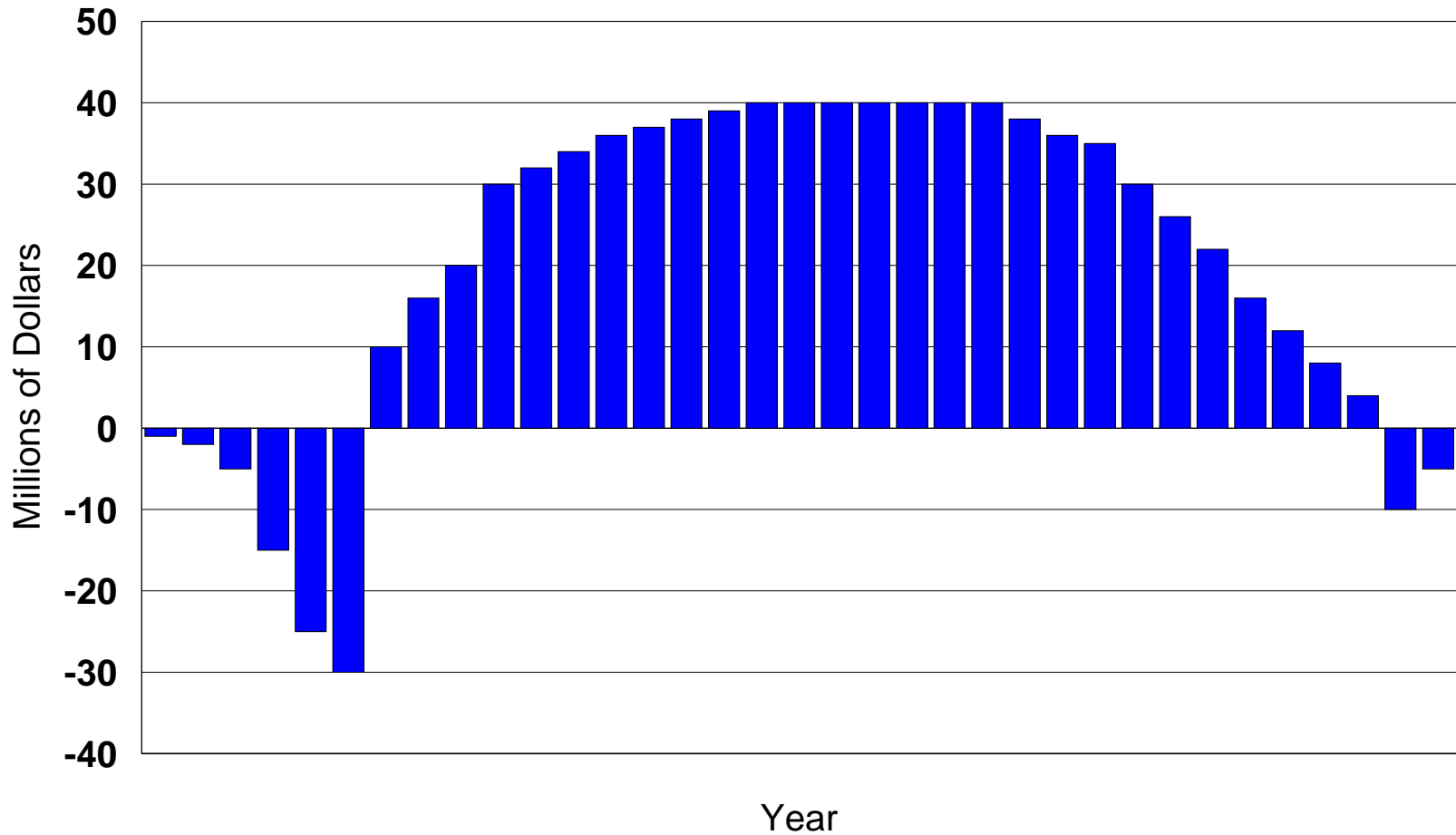
■ Financing

- ▶ Where does the money come from to cover the costs that are incurred?
- ▶ What returns are necessary to attract capital?
- ▶ How can we reduce life cycle costs?
- ▶ How much money can we make?

■ Economic

- ▶ How will the project affect jobs, personal income, gross regional product, ... ?
- ▶ How can we value non-monetary costs & benefits?

Cash Flow of a Typical CEE Project



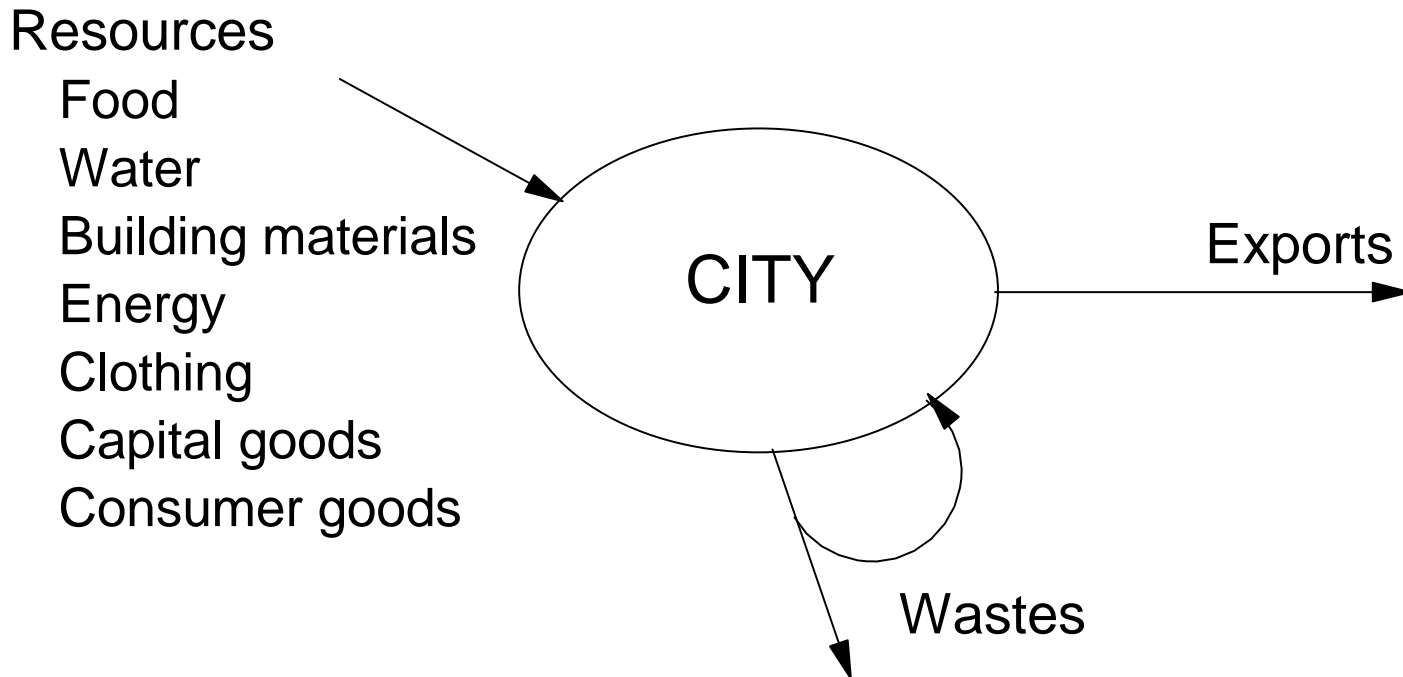
Finances Are Important, but They Aren't Everything

- Environmental Impact Assessment
 - ▶ Understand the expected impacts of the major alternatives on the environment
- Sustainability
 - ▶ Can (or should?) this project (or this program) be sustained indefinitely?
 - ▶ Three sets of concerns
 - Financial/economic
 - Social
 - Environmental

Common Steps in Project Evaluation

- Identification of problems and establishing objectives
- Identification of major options
- Design
- Financial analysis
- Economic analysis
- Environmental impact assessment
- Public hearings
- Agency approvals

Civil & Environmental Projects are the Key to Civilization



Benefits of Urbanization

- For people:
 - ▶ Diversity of lifestyles, opportunities, people
 - ▶ Frequency & quality of social events
 - ▶ Employment opportunities
 - ▶ Creation of enough time to enjoy the fruits of civilization
- For the system:
 - ▶ More efficient use of resources
 - Roads, buildings, water sources, etc.
 - ▶ Proximity of complementary activities
 - ▶ Efficiency in distribution of goods
 - ▶ Safety

CEE Capabilities Limit the Growth and Quality of Urban Life

Water supply Amount & quality	Dams, aqueducts, treatment systems
Food supply	Transportation & warehousing Land use near city
Density of living	Floor area ratio (FAR) Floor area per person
Local Transportation - Commuting; freight	Limits on time and money for commuting Capacity & performance of local freight
Land available for development	Bridges & transport capabilities Flood control
Quality of life (& options for moving)	Parks & open space Public facilities Air & water quality

Disbenefits of Urbanization

- Loss of self-sufficiency
 - ▶ Possibility of extreme poverty
- Dependency upon transport system for resources
- Susceptibility to disease (physical and mental)
- Congestion
- Pollution - inability to absorb wastes

CEE Projects Make Cities Possible and More Livable

