

11.165/11.477
Infrastructure and
Energy Technology
Challenges

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Class Description

Two Central Topics:

- 1. Infrastructure:** Economic and Social Issues Regarding Impact of Provision, Operation, and Finance of Infrastructure. Special attention will be paid to public infrastructure policies and infrastructure technologies.)
- 2. Energy Systems:** Economic and Social Policy of Production, Consumption, and Impacts on the Environment, and Energy Technologies.

Class Requirement

- Two to three readings for each session
- Active participation in the seminar
- Four two-page response papers
- One 25-page final research paper
- Graduates give one class presentation

Who are you?

- Your name, program, and year
- What infrastructure and/or energy issues interest you?
- What are your relevant research or work experiences?
- Have you lived or worked outside the United States?

INTRODUCTION

- Introduction to Energy and Infrastructure Issues
- General discussion questions

What is infrastructure?

- Hint: Infra = below or under
- Is it the basic capital foundation?
- The following slide shows the categories that the American Society of Civil Engineers(ASCE) include as “infrastructure”:

- **Aviation**
- **Bridges**
- **Dams**
- **Drinking Water**
- **Energy**
- **Hazardous Waste**
- **Inland Waterways**
- **Levees**
- **Public Parks and Recreation**
- **Rail**
- **Roads**
- **Schools**
- **Solid Waste**
- **Transit**
- **Wastewater**

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For information about
Massachusetts' infrastructure concerns,
and key infrastructure facts, go to:

www.infrastructurereportcard.org/state-page/massachusetts

Infrastructure: what to include and what to exclude?

- What about hospitals?
- What about government service facilities, i.e., public works, municipal offices, post offices?
- What about ports?

Infrastructure as Social Overhead Capital (SOC)

- Fixed cost, publicly funded.
- A mix of publicly and privately owned facilities as in the ASCE report.

Infrastructure as Public Goods

- “publicness“ of infrastructure in the economic sense.
- Distinguish private goods from public ones.
 - Rivalness
 - Excludability
- Efficiency of Public Goods

Paying for Infrastructure: Who pays and How?

- User Fees, e.g., tolls, meter
- Taxes
 - Income
 - Sales
 - Excise

Special Challenges of Infrastructure

- **Large capital requirements** ("lumpy")
- **Long-lived** (beneficiaries may not pay adequately some times, pay too much at other times)
- **Ongoing maintenance burden** (or not, depending on funding arrangement, e.g., federal highways pays 90% for new and/or heavy reconstruction and 0% for ongoing regular maintenance)

Special Challenges of Infrastructure (2)

- Sized to meet future needs; Can lead to **overprovision** (surplus capacity) in early years, underprovision at end-of-life.
- "**Free ridership**" problems in eliciting public-finance support for additional tax burden to provide public infrastructure.
- **Weak public administration** skills in U.S. cities and towns and in other countries

Infrastructure and Economic Growth

Reasons for contradictory findings in literature:

- **Networked** infrastructure; critical nodes.
Discontinuity of investment at local levels in advanced economies?
- **Poor data** and stock estimation?
- **Cause and effect**; Does growth cause infrastructure investment or vice-versa?

INFRASTRUCTURE IN USA AND MASSACHUSETTS

1981 Pat Choate and Susan Walters write *America in Ruins*, estimating that infrastructure investments will require billions of dollars.

1982 U.S. Joint Economic Committee establishes state studies of infrastructure needs.

1982-1984 Tabors and Polenske lead Massachusetts study.

Source for the following slides:: Polenske et al. reading for today;
http://en.wikipedia.org/wiki/Massachusetts_Bay_Transportation_Authority

INFRASTRUCTURE IN MASSACHUSETTS

- 1830 private Boston and Lowell Railroad was chartered
- 1856 streetcar lines appeared in Boston under chartered companies—operated as a horsecar line between Cambridge and Boston.
- 1897 Boston is first city with a subway system
The subway system has three rapid transit lines—the Red, Orange and Blue Lines, and two light rail lines—the Green Line and the Ashmont-Mattapan High Speed Line (designated as part of the Red Line).
- 1904 first underwater tunnel (under Boston Harbor)

Energy Technologies

- What are some old (new) energy technologies?
- How are they connected with infrastructure issues?

Definition and Types of Infrastructure

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To view the table, go to page 13 of
“Public Infrastructure: Definition, Classification,
and Measurement Issues”
by Gianpiero Torrasi.

mpra.ub.uni-muenchen.de/12990/1/Survey_infra_def.pdf

Discussion Questions

- What are the differences between developed and developing countries concerning energy and infrastructure?
- What kind of infrastructure and energy issues have you noticed in developed and developing countries?
- What would you define as the most critical infrastructure?
- Who are some of the main actors in solving infrastructure and energy problems?

Next Session

- When was the U.S. interstate highway system constructed?
- Why was it constructed?
- What about waterways, airports, pipelines?
- Do the readings based on the questions
- Bring your thoughts and examples to class

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