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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.

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/maassachusetts
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](http://en.wikipedia.org/wiki/Massachusetts_Bay_Transportation_Authority)

Multiregional Planning Team, MIT
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 Torrisi.

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