

# Massachusetts Institute of Technology

Latest update — September 16, 2012

## MIT 11.165/11.477J/1.286J ENERGY AND INFRASTRUCTURE TECHNOLOGIES

Department of Urban Studies and Planning  
Massachusetts Institute of Technology  
Mondays and Wednesdays, 11:00-12:30 P.M.  
Room: 10-401  
Credit Units: 3-0-9  
Fall 2012

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## Seminar Description

What is the relationship between infrastructure and economic growth and development? How does energy security affect geopolitical relations among nations as well as socioeconomic relations within nations? This seminar will cover some of these timely and complex questions linking infrastructure, energy, and their technologies. We will examine efforts in economically developing and developed nations to build, finance, and regulate infrastructure systems, technologies, and services, particularly those affecting energy security. We will explore how infrastructure is defined, financed, and delivered; how infrastructure, technologies, and innovations are intertwined; how infrastructure supports the energy system and its technologies; and how different countries face the challenges of energy security. Students will think about how the current worldwide economic and energy crises can be an opportunity for making fundamental changes to improve collapsing infrastructure networks and technologies and to attain energy sustainability.

Students taking the graduate version will complete additional assignments.

## Assignments and Grading

Students must complete

1. four two-page (double-spaced) reaction essays
2. one 25-page (double-spaced) final research paper, due at the end of the seminar, December 14.

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## Grading

50% Reaction papers will collectively represent 50% of the grade,

40% The final paper will represent 40% of the grade. The final research paper, not exceeding 25 pages (double spaced) should be on a topic related to energy infrastructure. Students will present a summary of their final paper during the last week of the term.

10% Regular and active class participation throughout the semester.

All assignments are due at 5:00pm on the designated date. Submit your paper in .doc format (not .docx) through the Homework section of the Stellar class site. Points will be deducted for late papers. Emphasis is on the quality of the writing. Papers will be returned within one week after submittal.

## Disabilities

If you have a documented disability, or any other problem you think may affect your ability to perform in class, please see us early in the semester so that arrangements may be made to accommodate you.

## Academic Misconduct

Plagiarism and cheating are both academic crimes. Never (1) turn in an assignment that you did not write yourself, (2) turn in an assignment for this class that you previously turned in for another class, or (3) cheat in any way. If you do so, it may result in a failing grade for the class, and possibly even suspension from MIT. Please see the teaching staff if you have any questions about what constitutes plagiarism. Anyone caught cheating will be reported to the provost in line with recognized university procedures.

## Seminar Schedule

1. The Economics of Public Goods and Infrastructure (9/05, 9/10, 9/12)

2. Infrastructure and Development (9/17, 9/19, 9/24)

*Reaction paper 1 due on 9/20 (Thursday) by 5PM*

3. Energy, Development, and Technology (9/26, 10/01, 10/03)

4. Infrastructure Financing, Funding and Delivery (10/10, 10/15, 10/17, 10/22, 10/24, no class on 10/08)

*Reaction paper 2 due on 10/12 (Friday) by 5PM*

5. The Energy System (10/29, 10/31, 11/05)

*Reaction paper 3 due on 11/02 (Friday) by 5PM*

6. Energy Infrastructure (11/07, 11/14, no class on 11/12)

7. Energy Security Issues (11/19, 11/21)

*Reaction paper 4 due on 11/26 (Monday) by 5PM*

8. Energy Security and Food Security Intertwined (11/26, 11/28)

9. The Political Economy of Energy (12/03)

10. Student Presentations (12/05, 12/10)

*Final paper due on 12/12 (Wednesday) 9:00AM*

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## 1. THE ECONOMICS OF PUBLIC GOODS AND INFRASTRUCTURE

### September 5: Introduction

#### **Required readings** (Skim materials. They will be summarized in class):

Torrise, G. 2009. "Public Infrastructure: Definition, Classification and Measurement Issues." *Economics, Management and Financial Markets*, 4 (3). Pp.100-124  
(pre-publication version: [http://mpra.ub.uni-muenchen.de/25850/1/MPRA\\_paper\\_25850.pdf](http://mpra.ub.uni-muenchen.de/25850/1/MPRA_paper_25850.pdf))

Moteff, J., et al. 2003. Critical Infrastructures: What Makes an Infrastructure Critical? Report for Congress RL31556. Washington, D.C.: The Library of Congress. 29 January 2003.  
<http://www.dtic.mil/cgi-bin/GetTRDoc?AD=ADA467306&Location=U2&doc=GetTRDoc.pdf>

#### **Suggested readings:**

Heintz, J. et al. 2009. *How Infrastructure Investments Support the U.S. Economy: Employment, Productivity, and Growth*. Political Economy Research Institute. University of Massachusetts, Amherst. [http://www.peri.umass.edu/fileadmin/pdf/other\\_publication\\_types/green\\_economics/PERI\\_Infrastructure\\_Investments](http://www.peri.umass.edu/fileadmin/pdf/other_publication_types/green_economics/PERI_Infrastructure_Investments)

Canning D. 1998. A Database of World Infrastructure Stocks, 1950-95, Policy Research Working Paper 1929, World Bank, Washington DC.

American Society of Civil Engineers. 2009. 2009 Report Cards for America's Infrastructure. <http://www.infrastructurereportcard.org/>

### September 10: Infrastructure, public goods, and market failure

#### **Required readings:**

Holcombe, R. 1997. A Theory of the Theory of Public Goods. *Review of Austrian Economics*. 10(1), 1-22.

Krueger, A. 1990. Government Failures in Development. *Journal of Economic Perspectives*. 4 (3): 9-23.

Frischmann, B.M. 2005. An Economic Theory of Infrastructure and Commons Management, *Minnesota Law Review*, 89, 917-1030. (Skim pages 917-979 only)

#### **Suggested readings:**

Mas-Colell, A. et al. 1995. *Microeconomic Theory*, Oxford University Press. (Chapter 11 only)

Samuelson, P.A. 1954. The Pure Theory of Public Expenditure. *Review of Economics and Statistics*. 36(4), 387-389.

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Sugden, R. 1992. Suckers, Free-Riders, and Public Goods. *Human Studies Review*. 7(1), Winter 1991/1992.

### September 12: Infrastructure and regulations

#### Required readings:

Hardin, G. 1968. The Tragedy of the Commons. *Science*. 162(3859), 1243-1248. (<http://www.sciencemag.org/content/162/3859/1243.full.pdf>)

Posner, R.A. 1974. Theories of Economic Regulation. *The Bell Journal of Economics and Management Science*. 5 (2), 335-358.

United Nations. 2001. The Economic Regulation of Facilities and Services. Bangkok: United Nations - Economic and Social Commission for Asia and the Pacific. (Read chapters 1 and 3)

#### Suggested readings:

Cubbin, J., and J. Stern. 2005. Regulatory Effectiveness: The Impact of Regulation and Regulatory Governance Arrangements on Electricity Industry Outcomes. *Policy Research Working Paper 3536*, World Bank, Washington D.C.

Svensson, J. 1998. Investment, Property Rights, and Political Instability: Theory and Evidence. *European Economic Review*, 42 (7), 1317-1341.

## 2. INFRASTRUCTURE, DEVELOPMENT, AND TECHNOLOGY

### September 17: Infrastructure investment and economic growth

#### Required readings:

Esfahani H.S., and M.T. Ramírez. 2003. Institutions, Infrastructure, and Economic Growth. *Journal of Development Economics*, 70, 443-477.

Gramlich E.M. 1994. Infrastructure Investment: A Review Essay, *Journal of Economic Literature*, 32, 1176-1196.

Department of the Treasury and the Council of Economic Advisers. 2010. An Economic Analysis of Infrastructure Investment. Washington, D.C.: Department of the Treasury and the Council of Economic Advisers. October 11, 2010. ([http://www.treasury.gov/resource-center/economic-policy/Documents/infrastructure\\_investment\\_report.pdf](http://www.treasury.gov/resource-center/economic-policy/Documents/infrastructure_investment_report.pdf))

Banerjee A., and E. Duflo. 2005, Growth Theory through the Lens of Development Economics, in *Handbook of Economic Growth*, P. Aghion and S. Durlauf, eds., Elsevier. pp. 474-515.

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## **Suggested readings:**

Rohatyn, F. 2009. Bold endeavors: How Our Government Built America, and Why It Must Rebuild Now. New York: Simon & Schuster. (Chapters on the Erie Canal, the Rural Electrification Administration, and the Interstate Highway System)

Bramati, M.C., and D. Veredas. 2006. *The Impact of Infrastructure on Growth in East Asia: Technical Report*. mimeo, World Bank.

Cadot O., L.H. Röller, and A. Stephan. 2006. Contribution to Productivity or Pork Barrel? The Two Faces of Infrastructure Investment, *Journal of Public Economics*. 90(6-7), 1133-1153.

Hulten C.R. 1996. Infrastructure Capital and Economic Growth: How Well You Use It May Be More Important Than How Much You Have", NBER working paper 5847.

## **September 19: Infrastructure and development**

### **Required readings:**

Prud'homme, R. 2005. Infrastructure and Development, in: F. Bourguignon and B. Pleskovic, (eds). *Lessons of Experience (Proceedings of the 2004 Annual Bank conference on Development Economics)*. Washington: The World Bank and Oxford University Press, pp. 153-181.

Estache, A. 2007. "Infrastructure and Development: A Survey of Recent and Upcoming Issues," in Bourguignon, F., and B. Pleskovic, *Rethinking Infrastructure for Development – Annual World Bank Conference on Development Economics*, Washington, D.C.: World Bank, pp. 47-82. ([http://siteresources.worldbank.org/INTDECABCTOK2006/Resources/Antonio\\_Estache\\_Infrastructure\\_for\\_Growth.pdf](http://siteresources.worldbank.org/INTDECABCTOK2006/Resources/Antonio_Estache_Infrastructure_for_Growth.pdf))

Ali, I. and E. M. Pernia. 2003. Infrastructure and Poverty Reduction– What is the Connection? ERD Policy Brief No. 13. Manila: Asian Development Bank. ([http://www.adb.org/Documents/EDRC/Policy\\_Briefs/PB013.pdf](http://www.adb.org/Documents/EDRC/Policy_Briefs/PB013.pdf))

### **Suggested readings:**

McKenzie D., and D. Mookherjee (2003), "The Distributive Impact of Privatization in Latin America: Evidence from Four Countries", *Economía*, 3: 161-233.

Briceño-Garmendia C., A. Estache, and N. Shafik. 2004. Infrastructure Services in Developing Countries: Access, Quality, Costs, and Policy Reform, *Policy Research Working Paper 3468*, World Bank, Washington DC.

Robinson J.A. and R. Torvik. 2005. White Elephants. *Journal of Public Economics*. 89, 197-210.

**[Reaction paper 1 due on 09/20 (Thursday) by 5PM]**

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## September 24: Infrastructure and regional development

### Required readings:

Munnell, A.H. 1990. How Does Public Infrastructure Affect Regional Economic Performance? *New England Economic Review*, Sept-Oct., 2-22.

Eberts, R.W. 1990. Public infrastructure and regional economic development. *Economic Review*. Q1. 15-27.

Fan, S., and X. Zhang. 2004. Infrastructure and regional economic development in rural China. *China Economic Review*. 15 (2), 203-214.

Ghoshal, B., and P. De. 2005. Investigating the linkage between infrastructure and regional development in India: era of planning to globalization. *Journal of Asian Economics*. 15 (6), 1023-1050.

### Suggested readings:

Eberts, R.W. 1986. Estimating the Contribution of Urban Public Infrastructure to Regional Growth. *Working Paper of the Federal Reserve Bank of Cleveland no. 8610*. Cleveland, OH, December.

Polenske, K.R., et al. 1983. *An Assessment of Public Infrastructure in Massachusetts*. Joint Center for Urban Studies of the Massachusetts Institute of Technology and Harvard University, September.

## 3. ENERGY, DEVELOPMENT, AND TECHNOLOGY

### September 26: Energy and economic development

#### Required readings:

Jorgenson, D.W. 1984. The Role of Energy in Productivity Growth. *The American Economic Review*. 74(2): 26-30.

Kauffmann, C. 2005. Energy and Poverty in Africa. OECD Working Papers No. 8,05/2005. OECD Development Center.

Toman, M. and B. Jemelkova. 2002. Energy and Economic Development: An Assessment of the State of Knowledge. Working Paper 9. Stanford University Program on Energy and Sustainable Development.

#### Suggested readings:

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Asafu-Adjaye, J. 2000. The Relationship between Energy Consumption, Energy Prices, and Economic Growth: Time Series Evidence from Asian Developing Countries. *Energy Economics*. 22(6): 615-625.

Cheng, B.S. and T.W. Lai. 1997. An Investigation of Co-integration and Causality between Energy Consumption and Economic Activity in Taiwan. *Energy Economics*. 19(4): 435-444.

Judson, R.A. et al. 1998. Economic Development and the Structure of Demand for Commercial Energy. MIT Center for Energy and Environmental Policy Research.

Templet, P.H. 1999. Energy, Diversity, and Development in Economic Systems: An Empirical Analysis. *Ecological Economics*. 30(2): 223-233.

### October 1: Social development and sustainability aspects

#### Required readings:

Hoffert, M.I. et al. 1998. Energy Implications of Future Stabilization of Atmosphere CO<sub>2</sub> Content. *Nature*. 395: 881-884.

Pachauri, S. and D. Spreng. 2003. Energy Use and Energy Access in Relation to Poverty. CEPE Working Paper 25. Eidgenössische Technische Hochschule Zürich and École Polytechnique Fédérale de Lausanne. Available at [http://www.cepe.ethz.ch/publications/workingPapers/CEPE\\_WP25.pdf](http://www.cepe.ethz.ch/publications/workingPapers/CEPE_WP25.pdf).

Sagar, A.D. 2005. Alleviating Energy Poverty for the World's Poor. *Energy Policy*. 33(11): 1367-1372.

#### Suggested readings:

Liao, H. et al. 2007. What Induced China's Energy Intensity to Fluctuate: 1997-2006? *Energy Policy*. 35(9): 4640-4649.

Jaber, J.O., and S.D. Probert. 2001. Energy Demand, Poverty, and the Urban Environment in Jordan. *Applied Energy*. 68(2): 119-134.

Murthy, N.S. et al. 1997. Economic Development, Poverty Reduction, and Carbon Emissions in India. *Energy Economics*. 19(3): 327-354.

Suri, V., and D. Chapman. 1998. Economic Growth, Trade, and Energy: Implications for the Environmental Kuznets Curve. *Ecological Economics*. 25(2): 195-208.

Xiaohua, W., and F. Zhenmin. 2001. Rural Household Energy Consumption with the Economic Development in China. Stages and Characteristic Indices. *Energy Policy*. 29(15): 1391-1397.

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## October 3: Infrastructure, technologies, and innovations

### Required readings:

Juma, C., and Yee-Cheong, L. (2005). Innovation: applying knowledge in development. UN Millennium Project Task Force on Science Technology and Innovation. London: Earthscan. Chapter 5. "Adequate Infrastructure Services as a Foundation for Technological Development"

Tassey, G. 2008. "Modeling and Measuring the Economic Roles of Technology Infrastructure" Economics of Innovation and New Technology, 17, 615–629.

Rouach, D. and Saperstein, D. 2004. Alstom Technology Transfer Experience: The Case of the Korean Train Express (KTX). International Journal of Technology Transfer and Commercialisation, 3 (3), 308-323.

Ockwell, D. et al., 2006. UK–India collaboration to identify the barriers to the transfer of low carbon energy technology. London: Department of Environment, Food, and Rural Affairs. Read Executive Summary (required), Chapter 2: Literature review (suggested)

[http://www.decc.gov.uk/assets/decc/what%20we%20do/global%20climate%20change%20and%20energy/tackling%20climate%20change/intl\\_strategy/dev\\_countries/india/techtransfer-fullreport.pdf](http://www.decc.gov.uk/assets/decc/what%20we%20do/global%20climate%20change%20and%20energy/tackling%20climate%20change/intl_strategy/dev_countries/india/techtransfer-fullreport.pdf)

### Suggested readings:

Alic, J. et al. 2010. A new strategy for energy innovation. Nature. 466. 15 July 2010. (<http://www.cspo.org/projects/eisbu/reading-Nature-opinion-energy.pdf>)

Gallagher, K.S. et al. 2012. The Energy Technology Innovation System. Annual Review of Environment and Resources. 37:6.1-.26. (<http://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-060311-133915>)

Smith, A. et al. 2010. "Innovation studies and sustainability transitions: The allure of the multi-level perspective and its challenges." Research Policy 39, 435–448

Tassey, G. 2008. "Modeling and Measuring the Economic Roles of Technology Infrastructure" Economics of Innovation and New Technology, 17, 615–629.

**(No class on October 8: Columbus Day)**

## 4. INFRASTRUCTURE FINANCING, FUNDING AND DELIVERY

### October 10: Infrastructure Financing

#### Required readings:

Estache, A. 2010 "Infrastructure finance in developing countries: An overview" European Investment Bank Papers, 15 (2), 60-89



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Canada West Foundation. 2006. *New Tools for New Times: A Sourcebook for the Financing, Funding, and Delivery of Urban Infrastructure*. Calgary: Canada West Foundation. pp. 37-71; skim 3-36 if interested. <http://www.cwf.ca/V2/cnt/fa09ea2a51965a83872571f40049081f.php>

Chan, C. et al. 2009. *Public Infrastructure Financing: An International Perspective*. *Staff Working Paper*. Productivity Commission. Australian Government. Chapter 2 only. ([http://www.pc.gov.au/\\_\\_data/assets/pdf\\_file/0008/86930/public-infrastructure-financing.pdf](http://www.pc.gov.au/__data/assets/pdf_file/0008/86930/public-infrastructure-financing.pdf))

### **Suggested readings:**

Eichengreen, B. 1996. "Financing Infrastructure in Developing Countries: Lessons from the Railway Days", in Ashoka Mody (ed.), *Infrastructure Delivery: Private Initiative and the Public Good*. Washington, DC: The World Bank.

Wu, W. 2010. Urban Infrastructure Financing and Economic Performance in China. *Urban Geography* 31 (5) (July 1): 648-667.

Ehrlich, E., and R. G. Rohatyn. 2008. A New Bank to Save Our Infrastructure. *The New York Review of Books*. October 9, 2008. Available online at URL: <http://www.nybooks.com/articles/21873>

**[Reaction paper 2 due on 10/12 (Friday) by 5PM]**

### **October 15: Infrastructure funding**

#### **Required readings:**

Canada West Foundation. 2006. *New Tools for New Times: A Sourcebook for the Financing, Funding, and Delivery of Urban Infrastructure*. Calgary: Canada West Foundation. pp. 72-136.

Hanak, E. and K. Rueben. 2006. *Funding Innovations for California's Infrastructure: Promises and Pitfalls*. Research Paper 06-01. The Keston Institute for Infrastructure Research Paper Series. [http://www.urban.org/uploadedPDF/1000943\\_california\\_infrastructure.pdf](http://www.urban.org/uploadedPDF/1000943_california_infrastructure.pdf)

#### **Suggested readings:**

Foldvary, F.E. 2005. Infrastructure: Optimal Private and Governmental Funding and Provision. *Economic Affairs*. 25(1), 25-30.

Nunn, S. 1990. Budgeting for Public Capital. *Journal of Urban Affairs*. 12(4), 327-344.

Washington State Legislature. 2007. *Final Report on Public Infrastructure Programs and Funding Structures*. Study Committee on Public Infrastructure Programs and Funding Structures. Olympia, WA.

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## October 17: Infrastructure delivery

### Required readings:

Canada West Foundation. 2006. *New Tools for New Times: A Sourcebook for the Financing, Funding, and Delivery of Urban Infrastructure*. Calgary: Canada West Foundation. pp. 137-160.

Grimsey, D. and Lewis, M.K. 2004. *Public private partnerships: the worldwide revolution in infrastructure*. Cheltenham, UK: Edward Elgar. Chapters 1 and 6.

### Suggested readings:

Bardhan, P. and D. Mookherjee. 2006. Decentralization and Accountability in Infrastructure Delivery in Developing Countries. *Economic Journal*. 116(508): 101-127.

Miller, J.B. 2007. *Case Studies in Infrastructure Delivery*. Springer.

Mody, A. 1996. *Infrastructure Delivery: New Ideas, Big Gains, No Panaceas*, in Mody, A. (ed.) *Infrastructure Delivery. Private Initiative and the Public Good*, Washington, DC: World Bank.

Werner, J. and D. Nguyen-Thanh. 2007. *Municipal Infrastructure Delivery in Ethiopia: A Bottomless Pit or an Option to Reach the Millennium Development Goals?* Working Paper 01-2007. Institute of Local Public Finance.

## October 22: Project Financing

### Required readings:

Gershi, H., and J. Sabal. 2006. *An Introduction to Project Finance in Emerging Markets*. IESA Working paper No. 29. Caracas, Venezuela.  
(<http://servicios.iesa.edu.ve/Portal/EstudiosIESA/An%20introduction%20to%20project%20finance%20in%20emerging%20markets.pdf>)

Miller, R., and D. Lessard. 2008. "Evolving Strategy: Risk Management and the Shaping of Mega-Projects." In *Decision-making on Mega-projects: Cost-benefit Analysis, Planning, and Innovation*, edited by Hugo Priemus, Bent Flyvbjerg, and Bert Van Wee. Edward Elgar Publishing Ltd.: pp. 145-172.

Matsukawa, T., and O. Habeck. 2007. *Review of Risk Mitigation Instruments for Infrastructure Financing and Recent Trends and Developments*. Trends and Policy Options No. 4. (Read pages 1-16)

### Suggested readings:

Ahmed, P. A. et al. 1999. *Project Finance in Developing Countries*. Washington: International Finance Corporation. Chapter 1.

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Beidleman et al. 1990. On Allocating Risk: The Essence of Project Finance. *Sloan Management Review*. 31(3): 47-55.

Brealey, R.A. et al. 2005. Using Project Finance to Fund Infrastructure Investment. *Journal of Applied Corporate Finance*. 9(3): 25-39.

### October 24: Financing energy infrastructure

#### **Required readings:**

UNEP. 2004. Financial Risk Management Instruments for Renewable Energy Projects. Summary document. Paris: United Nations Environment Programme.  
[http://www.unep.fr/energy/activities/sefi/pdf/RE\\_Risk\\_Manag.pdf](http://www.unep.fr/energy/activities/sefi/pdf/RE_Risk_Manag.pdf) (Read pages 12-44)

Bloomberg New Energy Finance 2010. Crossing the Valley of Death. Solutions to the next generation clean energy project financing gap. 21 June 2010.  
[bnef.com/WhitePapers/download/29](http://bnef.com/WhitePapers/download/29)

Jamison, E. 2010. From Innovation to Infrastructure: Financing First Commercial Clean Energy Projects. San Francisco, CA: CalCEF

#### **Suggested readings:**

Milken Institute. 2010. Financial Innovations for Energy Infrastructure: The Grid, Renewables and Beyond. Santa Monica, CA: Milken Institute.  
<http://www.milkeninstitute.org/pdf/ElectricGridLab.pdf>

Tang, A, Chiara, N., Taylor, J.E. 2012. [Financing renewable energy infrastructure: Formulation, pricing and impact of a carbon revenue bond](#). *Energy Policy*, 45: 691-703.

## 5. THE ENERGY SYSTEM

### October 29: The energy chain and market, Part I

#### **Required readings:**

Asif, M., and T. Muneer. 2007. Energy Supply, Its Demand, and Security Issues for Developed and Emerging Economies. *Renewable and Sustainable Energy Reviews*. 11(7): 1388-1413.

National Petroleum Council. 2007. "Facing the Hard Truths About Energy: A Comprehensive View to 2030 of Global Oil and Natural Gas." July 18. Available at <http://www.npchar truthsreport.org/download.php>. Executive Summary, Chapters 1 and 2 only.

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## **Suggested readings:**

Blanchard, O.J., and J. Galí. 2007. The Macroeconomic Effects of Oil Price Shocks: Why Are the 2000s So Different from the 1970s? Paper 07-011, MIT Center for Energy and Environmental Policy Research.

Department of Trade and Industry. 2007. Meeting the Energy Challenge: A White Paper on Energy. London: HMSO. Chapter 1 only.

Pindyck, R.S. 1999. The Long-Run Evolution of Energy Prices. *The Energy Journal*. 20(2): 1-27.

## **October 31: The energy chain and market, Part II**

### **Required readings:**

Energy Information Administration. 2012. *Annual Energy Outlook 2012 with Projections to 2035*. Official Energy Statistics from the U.S. Government. Available at <http://www.eia.gov/forecasts/aeo/>. Chapter 3 (Market Trends) only.

UNDP, UNDESA, and World Energy Council. 2004. *World Energy Assessment: Overview 2004 Update*. UNDP: New York, NY. Parts I and II only.

### **Suggested readings:**

Brennan, T. et al. 2002. *Alternating Currents: Electricity Markets and Public Policy*, RFF Press. Part I only.

Odell, P.R. 2000. The Global Energy Market in the Long Term: The Continuing Dominance of Affordable Non-Renewable Resources. *Energy Exploration and Exploitation*, 18(5): 599-615.

Salant, S.W. 1995. The Economics of Natural Resource Extraction: A Primer for Development Economists. *The World Bank Research Observer*. 10(1): 93-111.

Smith, J.L. 2008. World Oil: Market or Mayhem? Working Paper 08-015. MIT Center for Energy and Environmental Policy Research.

UNDP, UNDESA, and World Energy Council. 2004. *World Energy Assessment: Overview 2004 Update*. UNDP: New York, NY. Chapter 8 only.

**[Reaction paper #3 due on 11/2 (Friday) by 5PM]**

## **November 5: Issues and challenges**

### **Required readings:**

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Congressional Budget Office. 2003. *The Economics of Climate Change. A Primer*. Washington, D.C.: The Congress of the United States. Chapters 3 and 4 only.

Holdren, J.P. 2001. Meeting the Energy Challenge. *Science*. 291(5506), 945. Available at [http://belfercenter.ksg.harvard.edu/publication/1120/meeting\\_the\\_energy\\_challenge.html](http://belfercenter.ksg.harvard.edu/publication/1120/meeting_the_energy_challenge.html).

United Nations. 2005. *The Energy Challenge for Achieving the Millennium Development Goals*. UN-Energy: New York, NY.

### **Suggested readings:**

Babiker, M., J.M. Reilly, and H.D. Jacoby. 2000. The Kyoto Protocol and Developing Countries. *Energy Policy*. 8(1): 525-536.

Intergovernmental Panel on Climate Change. 2001. *Climate Change 2001: Impacts, Adaptation, and Vulnerability*. Cambridge University Press.

Stavins, R.N. 2008. Addressing Climate Change with a Comprehensive U.S. Cap and Trade System. Harvard University. JFK School of Government Working Paper RWP 07-053. Available at [http://belfercenter.ksg.harvard.edu/files/Stavins\\_Climate\\_Change.pdf](http://belfercenter.ksg.harvard.edu/files/Stavins_Climate_Change.pdf)

Zweig, D., and B. Jianhai. 2005. China's Global Hunt for Energy. *Foreign Affairs*. September/October.

## **6. ENERGY INFRASTRUCTURE**

### **November 7: Energy infrastructure: needs and urgencies in the United States**

#### **Required readings:**

National Commission on Energy Policy. 2006. *Siting Critical Energy Infrastructure. An Overview of Needs and Challenges*. White paper prepared by the staff of the NCEP.

National Energy Technology Laboratory. 2001. America's Energy Infrastructure: A Comprehensive Delivery System. Pittsburgh, PA: NETL. Available at <http://www.netl.doe.gov/publications/press/2001/nep/chapter7.pdf>

Lester, R. 2009. America's Energy Innovation Problem (and How to Fix It). MIT-IPC-Energy Innovation Working Paper 09-007. ([www.annualreviews.org/doi/pdf/10.1146/annurev-environ-060311-133915](http://www.annualreviews.org/doi/pdf/10.1146/annurev-environ-060311-133915))

#### **Suggested readings:**

Hibbard, P.J. 2006. *U.S. Energy Infrastructure Vulnerability. Lessons from the Gulf Coast Hurricanes*. Analysis Group: Boston, MA.

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U.S. Congress. 2009. *American Recovery and Reinvestment Act of 2009*. Public Law 111-5-February 17. 111<sup>th</sup> Congress. Title IV only. Available at [http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111\\_cong\\_public\\_laws&docid=f:publ005.pdf](http://frwebgate.access.gpo.gov/cgi-bin/getdoc.cgi?dbname=111_cong_public_laws&docid=f:publ005.pdf).

### November 14: Energy infrastructure in emerging and other advanced economies

#### Required readings (choose **two** of the following):

Calderón, C. et al. 2003. Latin America's Infrastructure in the Era of Macroeconomic Crises, in Easterly, W. and L. Servén, *The Limits of Stabilization. Infrastructure, Public Deficits, and Growth in Latin America*. The World Bank: Washington, DC. Chapter 2 only; focus on energy infrastructure. Available at [http://books.google.com/books?hl=en&lr=&id=gcxM8kSSKMAC&oi=fnd&pg=PA95&dq=Energy+Infrastructure+latin+america&ots=WJheIPhMq9&sig=qriZju\\_05UE\\_-X2CtULjU\\_z70Xw#PPP1,M1](http://books.google.com/books?hl=en&lr=&id=gcxM8kSSKMAC&oi=fnd&pg=PA95&dq=Energy+Infrastructure+latin+america&ots=WJheIPhMq9&sig=qriZju_05UE_-X2CtULjU_z70Xw#PPP1,M1)

European Commission. 2001. *Transport and Energy Infrastructure in South East Europe*. Directorate General for Energy and Transport: Brussels.

Oshikoya, W.T., and M. Nureldin Hussain. 2002. Infrastructure for Economic Development in Africa, in Braga de Macedo, J. and O. Kabbaj. *Regional Integration in Africa*. OECD Development Centre Seminars. Available at <http://books.google.com/books?hl=en&lr=&id=XRwMUMoxz-oC&oi=fnd&pg=PA77&dq=+Infrastructure+africa+energy&ots=F9x3T8K33H&sig=G2fF1lweNRV-KIWeHlas2H90MtM#PPP1,M1>. Focus on energy issues only.

United Nations Economic and Social Commission for Asia and the Pacific. 2006. *Enhancing Regional Cooperation In Infrastructure Development Including That Related To Disaster Management*. Bangkok: United Nations. Chapter 5. Energy Infrastructure. Available at [http://www.unescap.org/pdd/publications/themestudy2006/11\\_ch5.pdf](http://www.unescap.org/pdd/publications/themestudy2006/11_ch5.pdf)

#### Suggested readings:

Asian Development Bank. 2008. *Energy Infrastructure: Priorities, Constraints, and Strategies for India*. Oxford University Press.

Caspari, G. 2007. *The Energy Sector in Latin America. Key Prospects, Risks, and Opportunities*. Deutsche Bank Research: Frankfurt. Section 2 only.

## 7. ENERGY SECURITY ISSUES

### November 19: Disruptions to energy supply

#### Required readings:

## Massachusetts Institute of Technology

Deffeyes, K. 2001. *Hubbert's Peak: The Impending World of Oil Shortage*. Princeton, NJ: Princeton University Press, Chapter 1.

Deutch, J. et al. 2007. Energy Security and Climate Change. The Triangle Papers no. 61. The Trilateral Commission. pp. 1-20.

Toman, M.A. 1993. The Economics of Energy Security: Theory, Evidence, Policy. *Handbook of Natural Resource and Energy Economics*, vol. III, Chapter 25, 1167-1218.

### **Suggested readings:**

Antholis, WJ. 2008. Memo to the President: Build a Secure Energy Future. Washington, DC: Brookings Institution. Available at [http://www.brookings.edu/papers/2008/1111\\_energy\\_security\\_memo.aspx](http://www.brookings.edu/papers/2008/1111_energy_security_memo.aspx)

Nuttall, WJ. and D.L. Manz. 2008. A New Energy Security Paradigm for the Twenty-First Century, *Technological Forecasting and Social Change*, 75(8): 1247-1259.

Sagar, A. D., et al. 2005. Climate Change, Energy, and Developing Countries. *Vermont Journal of Environmental Law*, 7(1). Available at <http://www.vjel.org/journal/VJEL10041.html>.

Watkins, G. 2006. Oil Scarcity: What Have the Past Three Decades Revealed? *Energy Policy* 34:508-514.

Williams, P.A. 2006. Projections for the Geopolitical Economy of Oil after War in Iraq. *Futures*. 38 (9): 1074-1088.

### **November 21: Infrastructure protection, natural disasters, and terrorist threats**

#### **Required readings:**

Cornell, P.E. 2009. Energy Security as National Security: Defining Problems ahead of Solutions. *Journal of Energy Security*. February issue.

Perl, R.F. 2008. *Protecting Critical Energy Infrastructures against Terrorist Attacks: Threats, Challenges, and Opportunities for International Co-operation*. Reinforced NATO Economic Committee Meeting, Brussels. Available at [http://www.osce.org/documents/atu/2008/09/33084\\_en.pdf](http://www.osce.org/documents/atu/2008/09/33084_en.pdf).

Yergin, D. 2006. Ensuring Energy Security. *Foreign Affairs*. 85(2): 69-82.

Lieberthal, K., and H. Herberg, H. 2006. China's Search for Energy Security: Implications for U.S. Policy. *NBR Analysis*, 17(1): 1-54.

#### **Suggested readings:**

## Massachusetts Institute of Technology

Deutch, J. et al. 2007. Energy Security and Climate Change. The Triangle Papers no. 61. The Trilateral Commission. pp. 21-50.

Huntington, H.G., and S.P.A. Brown. 2004. Energy Security and Global Climate Change Mitigation. *Energy Policy*. 32(6): 715-718.

Kalicki, J.H., and D.L. Goldwyn. 2005. *Energy and Security: Toward a New Foreign Policy Strategy*, Washington, DC: Woodrow Wilson Center Press.

**[Reaction paper #4 due on 11/26 (Monday) by 5PM]**

### 8. ENERGY SECURITY AND FOOD SECURITY INTERTWINED

**November 26: Food vs. Fuel?**

#### **Required readings:**

Mitchell, D. 2008. A Note on Rising Food Prices. Policy Research Working Paper 4682. The World Bank Development Prospects Group. Washington, DC. South Center. 2008.

*Food and Energy Crisis. Time to Rethink Development Policy. Reflections from the High Level North-South Dialogue on Food and Energy Security.* South Center: Geneva. Pages 1-25.

United Nations Economic and Social Commission for Asia and the Pacific. 2008. Energy Security, Biofuels and Food Supply. Bangkok: United Nations. Available at <http://www.unescap.org/ESD/energy/theme/documents/FS7-EnergSecurity&FoodSupply.pdf>

#### **Suggested readings:**

Anderson, K., and C.Y. Peng. 1998. Feeding and Fueling China in the 21st Century. *World Development*, 26(8):1413-1429.

Farm Foundation. 2008. *The 30-Year Challenge: Agriculture's Strategic Role in Feeding and Fueling a Growing World.* Oak Brook, IL.

Khan, A.R. 2008. Interfacing Food and Energy Security: Bangladesh Perspective. Presented at NTS-Asia 2<sup>nd</sup> Annual Convention. Beijing.

Pingali P., et al. 2008. Biofuels and Food Security: Missing the Point. *Review of Agricultural Economics*, 30(3): 506-516.

**November 28: Biofuels and development**

#### **Required readings:**



## Massachusetts Institute of Technology

Sachs, I. 2007. *The Biofuels Controversy*. Presented at the United Nations Conference on Trade and Development. UNCTAD/DITC/TED/2007/12.

United Nations. 2008. *Achieving Sustainable Development and Promoting Development Cooperation*. Department of Economic and Social Affairs. Office for ECOSOC Support and Coordination. New York, NY. Chapter 6 only.

South Center. 2008. *Food and Energy Crisis. Time to Rethink Development Policy. Reflections from the High Level North-South Dialogue on Food and Energy Security*. South Center: Geneva. Pages 25-43.

### **Suggested readings:**

Banse, M., et al. 2007. Impact of Biofuel Policies on World Agricultural and Food Markets. Presented at the 10th Annual Conference on Global Economic Analysis, Purdue University.

Peters J., and S. Thielmann. 2008. Promoting Biofuels: Implications for Developing Countries, *Energy Policy*, 36(4): 1538-1544.

United Nations Food and Agriculture Organization. 2008. *Declaration of the High-Level Conference on World Food Security: the Challenges of Climate Change and Bioenergy*. Rome, June.

## 9. THE POLITICAL ECONOMY OF ENERGY

### **December 3: Regulations, constraints, and political processes of energy infrastructure**

#### **Required readings:**

Gabriele, A. 2004. Policy Alternatives in Reforming Energy Utilities in Developing Countries. *Energy Policy*. 32(11), 1319-1337.

Estache A., and M. Rossi. 2005. Do Regulation and Ownership Drive the Efficiency of Electricity Distribution? Evidence from Latin America. *Economic Letters*. 86(2): 253-257.

Walz, R. 2007. The Role of Regulation for Sustainable Infrastructure Innovations: The Case of Wind Energy. *International Journal of Public Policy*. 2 (1-2): 57-88.

#### **Suggested readings:**

Banks, Ferdinand E. 2007. *The Political Economy of World Energy: An Introductory Textbook*. New Jersey: World Scientific. (Chapter 1 only; omit Appendix.)

Joskow, P.L. 2006. Incentive Regulation in Theory and Practice: Electricity Distribution and Transmission Networks. Prepared for the National Bureau of Economic Research Conference on Economic Regulation, <http://www.electricitypolicy.org.uk/pubs/wp/eprg0511.pdf>.

## Massachusetts Institute of Technology

Guerrero Compeán, R. 2009. Fueling an Omnivorous Car: The Rise, Fall, and Rise of Brazil's Renewable Energy Industry, *Industrial Performance Center Energy Innovation Working Paper Series*, Massachusetts Institute of Technology.

Hira, A. 2003. *Political Economy of Energy in the Southern Cone*. Westport, CT: Praeger. Chapter 5 only.

Krueger, A. 1990. Government Failures in Development. *Journal of Economic Perspectives*. 4 (3): 9-23.

Molchanov, M.A., and Y. Yevdokimov. 2004. The Political Economy of the Energy Sector in the Central Asia-Caspian Sea Region: A Conceptual Framework. Roundtable on Transnationality and the Conference Transnational Risks – A New Challenge for a Global Society, Berlin. [http://users.ox.ac.uk/~scat1663/Berlin/Berlin-Draft\\_17.pdf](http://users.ox.ac.uk/~scat1663/Berlin/Berlin-Draft_17.pdf)

Nivola, P.S. 2004. The Political Economy of Nuclear Energy in the United States, CFE Policy Paper Series. The French Center on the United States, May. [http://www.ifri.org/files/CFE/Nivola\\_NuclearEnergy\\_US.pdf](http://www.ifri.org/files/CFE/Nivola_NuclearEnergy_US.pdf)

Dal Bo, E., and M. Rossi. 2003. Corruption and Inefficiency: Theory and Evidence from Electric Utilities, mimeo, Oxford.

Henisz, W. J. and B. A. Zelner. 2004. Interest Groups, Veto Points and Electricity Infrastructure Deployment, mimeo.

Woodhouse, E. 2005. Political Economy of International Infrastructure Contracting. Lessons from the IPP Experience. Program of Energy and Sustainable Development Working Paper 52, Stanford University.

### **December 5 and 10: Student Presentations**

**[Final Paper due on Wednesday, December 12, by 9:00am]**