NEW ECONOMIC SCHOOL
Masters of Energy Economics

Natural Resource Evaluation and Development Strategy
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Course description

This course covering topics of resource economics will provide the foundations needed to understand and analyze development and production dynamics of various natural resources, including oil, natural gas, coal, lithium, uranium, solar, wind, and water.

The presented resource evaluation framework will incorporate the principles of microeconomics, industrial organization, supply chain management, project financing, and corporate financing. The economic and financial evaluation principles would be coupled with thourough understanding of the geologic and engineering characteristics of the resource. So, the course would be equally useful for engineers, economists, financial analysts, and policy-makers. The course emphasizes the importance of interdisciplinary knowledge. The utility and applicability of the presented approaches will be demonstrated through case studies.

The students will:
- learn how to evaluate resources, from economic, financial and policy-maker perspectives;
- learn to apply their theoretical knowledge, combining approaches from various disciplines, to real world decision-making problems;
- learn to work as a team utilizing individual capabilities and background knowledge;
- practice their presentation and communication skills.

Course requirements, grading, and attendance policies

Prerequisites: Microeconomics
Teaching and Work Forms: lectures + workshop presentations. Case studies will be assigned to groups, and each group will deliver an analytical essay and a presentation.

Grading policy: Grades will be assigned based on the following criteria:
· Attendance 20% (students may get extra points for active participation)
· Homework assignments 30% (get extra points for questions and discussion)
· Group presentation and analytical essay (10-12 pages, should include literature review, data analysis, theoretical model, applied analysis with sensitivity tests, and discussion) 50%

Course contents

1. Introduction (1 lecture)
- Course overview: goals, grading, sources of information
- Motivation for the course: macroeconomic, socio-economic, and financial role of resources, parties involved, questions
- Demonstration of what students will learn to do: Interdisciplinary study of shale resources (maybe delayed, depending on attendance)

2. Resources: definitions and characteristics (1 lecture)
- Resource characteristics:
  - Resource estimations: Definitions of Resource-In-Place (RIP), Technically Recoverable Resource (TRR) and Economically Recoverable Resource (ERR),
  - Energy potential and its dimensionality, Environmental value/impact
- Background research: Bid data and data analysis (use of www.eia.doe.gov; www.worldbank.org; ec.europa.eu)
- Uncertainties and errors in data, importance of spatial-temporal variations

3. Resource exploration and production: From planning to development (2 lectures)
- Production: Capabilities and Characteristics:
  - Defining the scope of a production/investment project
  - Production decline profiles,
  - Production possibilities frontier,
  - Inventory of production projects by quality and capacity
- Production data and data analysis
- Technology: Changes in productivity, production capabilities, inventory:
  - Technologic vs. allocation efficiency
  - Uncertainty related to factor productivity

4. Project evaluation vs. resource evaluation (4 lectures)
- Project Economics:
  - Cash flow analysis
  - Value of Options
  - Value of Investment delay
- Project Evaluation:
  - Relative vs. absolute profitability, payoff period, project value vs. firm value
  - Productivity vs. Profitability
  - Differences in optimization problems of various stakeholders
- Sensitivity analysis:
  - Variables vs. parameters: Costs, prices, production profiles, discounting, depreciation, taxation
  - Intertemporal optimization: Change in goals and financial constraints
  - Risk vs. sensitivity: Tornado charts, probability vs. range of uncertainty
  - Monte-Carlo analysis

5. Resource development strategy (3-4 lectures)

- Supply function: From a project to supply capabilities and capacities:
  - Budgetary and physical constraints
  - Profit maximization vs. loss minimization
  - Risk attitude and risk dimensions (prices, funding, etc.)
- Company strategy and industry dynamics: Labor, Capital, Technology and New Resources
- Intertemporal view
- Elasticity of supply: Definition depends on your question
- Market and policy environments
- Production outlook and outlook scenarios

7. Workshop presentations (2-3 lectures, depending on the class size)

- Case studies of various resources from different perspectives

Case study topics (will be advised):

1. Choose a role: investor/lender (equity holder or bank), producing company, policy-maker/regulator
2. Choose a resource: Oil, natural gas, coal, mineral (mining) resource, renewable resource (solar, wind), water
3. Formulate a question related to the development strategy or outlook projections (effects on supply/investments owing to change in market or regulatory environment, infrastructure planning, or company's strategy).

Course Materials (*selected printouts will be provided*):

1. M.A. Mian, Project Economics and Decision Analysis, Volume 1: Deterministic Models, 2d edition, copyright© 2011 by PennWell
2. J. Church & R. Ware, Industrial Organization: A strategic Approach, Irwin McGraw-Hill.
3. R. Pindyck & D. Rubinfeld, Microeconomics, 3d edition, Prentice-Hall International.
4. Handbook of natural resource and energy economics, Volumes 1, 2 &3.

Selected journal articles:

1. Aragón, F. and P. Rud. 2013. Natural Resources and Local Communities: Evidence from a Peruvian Gold Mine, American Economic Journal: Economic Policy, Vol. 5 (2), pp. 1-25.
2. Berman, N., Couttenier, M., Rohner, D., Thoenig, M. This Mine is Mine! How Minerals Fuel Conflicts in Africa, American Economic Review, forthcoming
3. Braguinsky, Serguey, Atsushi Ohyama, Tetsuji Okazaki, and Chad Syverson. 2015. "Acquisitions, Productivity, and Profitability: Evidence from the Japanese Cotton Spinning Industry." *American Economic Review*, 105(7): 2086-2119.
4. Collard-Wexler, A. and J. De Loecker. 2015. American Economic Review 2015, Vol. 105(1), pp. 131–171, http://dx.doi.org/10.1257/aer.2013009
5. Covert, T., Greenstone, M., Knittel, C., R.Will. 2016. We Ever Stop Using Fossil Fuels? The Journal of Economic Perspectives, Vol. 30 (1), Winter 2016, pp. 117-137(21)

6. Dixit, A. and R. Pindyck. 1995. The new option view of investment, Working paper http://dspace.mit.edu/bitstream/handle/1721.1/2564/SWP-3794-32616490.pdf?sequence=1
7. Gowrisankaran, G., Nevo, A., and R. Town. 2015. "Mergers When Prices Are Negotiated: Evidence from the Hospital Industry." American Economic Review, Vol. 105(1), pp. 172-203.
8. Novan, K. 2015. Valuing the Wind: Renewable Energy Policies and Air Pollution Avoided, American Economic Journal: Economic Policy, Vol. 7(3), pp. 291-326(36)
9. Oblak, D. J., & Helm, R. J. 1980. Survey and Analysis of Capital Budgeting Methods Used by Multinationals. Financial Management, 9(4), pp. 37–41.
10. Osborne, M. 2010. A resolution to the NPV–IRR debate? The Quarterly Review of Economics and Finance, Vol. 50, Issue 2, May 2010, pp. 234–239
11. Pindyck, R. 1999. The Long-Run Evolution of Energy Prices. The Energy Journal, April 1999.
12. Pindyck, R. 1982. Jointly produced exhaustible resources, Journal of Environmental Economics and Management, Vol. 9, Issue 4, December 1982, pp. 291-303
13. Weber, J. 2014. A decade of natural gas development: The makings of a resource curse? Resource and Energy Economics, Vol. 37, August 2014, pp. 168–183
14. Govinda, R., Timilsinaa, G., van Kootenb, C., Narbel, P. 2013. Global wind power development: Economics and policies, Energy Policy, Vol. 61, October 2013, pp. 642–652

Other useful resources:

1. Energy statistics on USA: https://www.eia.gov/
2. Solar maps: http://solargis.info/doc/free-solar-radiation-maps-GHI
3. World bank data: http://data.worldbank.org/indicator
4. Global atlas for renewable energy: http://irena.masdar.ac.ae/
5. Just check: http://earth.nullschool.net/