

Fall 2018

8833 – MB Special Topics – 88634: Utility Regulation and Policy

**T & Th 12:00-1:15
Classroom: Skiles 314
DRAFT**

Instructor: Professor Marilyn A. Brown
School of Public Policy
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Office: DM Smith 312
Office Hours: T & Th: noon – 1:30 pm

Goals, Requirements, and Expectations of PUPB 8833:

Electrification, digitalization, and decentralization are transforming energy systems worldwide. This course will focus on the governance and policies impacting this transformation. It will cover approaches to integrated resource planning, rules around solar integration, rate setting, the 100% renewable energy movement, and the role of utility-scale power plants as well as resources on the customer side of the meter including roof-top solar, energy efficiency, demand response, and electric vehicles.

Students will learn how to use several analytical software tools and data sources to assess the cost-effectiveness of alternative electricity technologies, policies, and investments including:

- The levelized cost of electricity from alternative resources, based on data from Integrated Resource Plans and associated legal filings
- Application of California's standard utility cost tests to energy efficiency programs and investments
- How electric rates and tariffs affect electric vehicle and solar economics, using NREL's solar System Advisor Model (SAM)
- Impact of carbon taxes on electric vehicles, fossil fuels and air quality based on EIA's National Energy Modeling System (NEMS)

The focus will be on U.S. systems, but there will be some case study coverage of several European countries as well as China.

Each student will complete one exercise, lead a discussion of several assigned readings, and write research paper. Students will present their research to their peers at the end of the term.

This is a discussion-based seminar course. Students are expected to have strong written and oral communication skills and experience with data analysis. Prior knowledge of utility regulation and policy is not necessary.

Course Texts:

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None

A selection of relevant articles and data resources will be available on T-Square. Please read the assigned readings on time (prior to class).

Course grading:

Assessment and Grading

Student performance and grades are based on the following:

1) Class Participation: 10%

This includes attendance, participation in discussion, and the degree to which students come to the course prepared to engage the material, their classmates, and the subject at hand.

2) Contributing to Class Discussions: 10%

Each student will be assigned to cover some readings and to lead the discussion of them in class.

3) Exercise 1: 25%

The first exercise will be assigned on September 4 and will be due October 16. It will be flexible to reflect the particular interests of students. Students will report the results of either Exercise 1 or Exercise 2 in class during the first half of the course.

4) Exercise 2: 25%

The second exercise will be assigned on September 4 and will be due October 16. It will be flexible to reflect the particular interests of students. Students will report the results of either Exercise 1 or Exercise 2 in class during the first half of the course.

5) Research Presentation: 10%

Each student will prepare a 20-minute presentation of the independent research they have conducted. The presentation will take place during the last week of classes.

6) Final Research Paper: 20%

Each student will prepare an independent research paper of 20-30 pages investigating a topic of interest related to utility regulation. Each student should discuss their topic selection with the professor before submitting their problem statement.

Assignments and Due Dates

1. Exercise 1 (to be assigned on 9/4/2018)10/11/2018
2. Exercise 2 (to be assigned on 10/4/2018)11/15/2018
3. Research Presentations.....11/20, 27, 29
4. Research Paper.....12/11/2018

All written assignments are to be submitted on T-square.

Communications:

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I have office hours on T & Th at 11 am in my office, Room 312 in the D.M. Smith Building. You may also contact me to arrange to meet at other times. Please use a GA Tech email account for course communications and post all assignments on T-square.

Rights and Responsibilities

Enrollment in this course indicates that you have read, acknowledge and agree to abide by the following:

- Policy on academic performance and incompletes - see Georgia Tech School of Public Policy [Student Handbook](#).
- Georgia Tech [Honor Code](#) - including [Addendum for Graduate Students](#). You are informed that student papers may be reviewed by plagiarism detection software.

Enrollment for the course indicates that you agree to attend all scheduled classes. With instructor's permission, one or a few absences from class will be forgiven for good reason. Absences beyond this may result in a lower final grade.

Course Schedule

Introduction

Week 1 |

August 21 – Review Syllabus – Electricity Sector Overview

- 📖 U.S. Department of Energy. 2016. *Quadrennial Energy Review: Transforming the Nation's Electricity System*, Appendix A: Electricity Sector Overview, pp. A-1 to A-10: covering the Nation's existing electricity system, including its physical structure and elements, the history of its development. <https://energy.gov/epa/quadrennial-energy-review-second-installment>

August 23 – Electricity System History and Governance in the U.S.

- 📖 1 hour Video of Utility Ratemaking Workshop #1-Background (Southface Energy Institute and Vote Solar)
- 📖 U.S. Department of Energy. 2016. *Quadrennial Energy Review: Transforming the Nation's Electricity System*, Appendix A: Electricity Sector Overview, pp. A-10 to A-24: covering the major laws and jurisdictions governing its operation, and the Federal role in the resilience and security of the electric grid, and the complex operations, business models, and market structures comprising the electricity system.
- 📖 Richard F. Hirsh, "Emergence of Electrical Utilities in America," Smithsonian Institution, Powering a Generation of Change, last modified September 2002, <http://americanhistory.si.edu/powering/past/h1main.htm> (7 pages).

Levelized Cost of Electricity

Week 2 |

August 28 – Rate Setting

- 📖 1 hour Video of Utility Ratemaking Workshop #2-Understanding the Utility Business Model and Rate Design (Southface Energy Institute and Vote Solar)

August 30 – Levelized Cost of Electricity

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- 📖 Energy Information Administration (EIA), *Levelized Cost and Levelized Avoided Cost of New Generation Resources in the Annual Energy Outlook 2016* (Washington, DC: EIA, 2016), http://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf
- 📖 Brown, Marilyn A. and Yu Wang. 2015. "Estimating the Levelized Cost of Electricity Generation and Savings" Section 2.5, pp. 37-42, in *Green Savings, How Policies and Markets Drive Energy Efficiency* (Praeger).

Market Failures and Integrated Resource Planning

Week 3 |

September 4 – Introduction to the SNL Energy Data Subscription

- 📖 Georgia Tech Users' Manual (Under Development)

September 6 – Integrated Resource Planning

- 📖 Lazar, Jim. 2016. *Electricity Regulation in the US: A Guide*, Chapter 15: "Integrated Resource Planning" pp. 106-111 <http://www.raonline.org/wp-content/uploads/2016/07/rap-lazar-electricity-regulation-US-june-2016.pdf>

Choose a section of one of these three Integrated Resource Plans (IRPs) to read and review for class discussion. Focus on a section of particular interest to you:

- 📖 2017 Dominion IRP
- 📖 2016 Tennessee Valley Authority IRP
- 📖 Georgia Power IRP

Week 4 |

September 11 – Market Failures and Barriers

- 📖 U.S. Department of Energy. 2016. *Quadrennial Energy Review: Transforming the Nation's Electricity System*, Appendix A: Electricity Sector Overview, pp. A-29 to A-38: covering the major laws and jurisdictions governing its operation, the Federal role in the resilience and security of the electric grid, and the complex operations, business models, and market structures comprising the electricity system.
- 📖 Brown, Marilyn A. 2001. "Market Failures and Barriers as a Basis for Clean Energy Policies," *Energy Policy*, 29 (14): 1197-1207.
- 📖 Yi, H. (2015). Clean-energy policies and electricity sector carbon emissions in the US states. *Utilities Policy*, 34, 19-29.

September 13 – Net metering of Solar Power: Impacts on Rates and Equity Issues

- 📖 Johnson, Erik, Ross Beppler, Christopher Blackburn, Benjamin Staver, Marilyn Brown, and Daniel Matisoff. (2017) "Peak Shifting and Cross-Class Subsidization: The Impacts of Solar PV on Changes in Electricity Costs" *Energy Policy* 106: 436-444, <http://doi.org/10.1016/j.jclepro.2016.12.031>.

The 100 RE Movement

Week 5 |

September 18 – The 100 RE (100% Renewable Energy) Movement

Choose one of these for class discussion:

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- 📖 Clack, C. T., Qvist, S. A., Apt, J., Bazilian, M., Brandt, A. R., Caldeira, K., ... & Jaramillo, P. (2017). Evaluation of a proposal for reliable low-cost grid power with 100% wind, water, and solar. *Proceedings of the National Academy of Sciences*, 201610381.
- 📖 Jacobson, M. Z., Delucchi, M. A., Cameron, M. A., & Frew, B. A. (2015). Low-cost solution to the grid reliability problem with 100% penetration of intermittent wind, water, and solar for all purposes. *Proceedings of the National Academy of Sciences*, 112(49), 15060-15065.
- 📖 Hibbard, P., Tierney, S., & Franklin, K. (2017). *Electricity Markets, Reliability and the Evolving U.S. Power System*. Analysis Group

Policy Diffusion Mechanisms Applied to Solar and Smart Grid Policies

September 20 – Solar Policies: International, U.S., and Georgia Overview

- 📖 Carley, S., Nicholson-Crotty, S., & Miller, C. J. (2016). Adoption, reinvention and amendment of renewable portfolio standards in the American states. *Journal of public policy*, 1-28.
- 📖 Model Solar Ordinances (2 examples)

Week 6 |

September 25 – Solar Policies and Policy Diffusion Mechanisms

- 📖 Matisoff, D. C., & Edwards, J. (2014). Kindred spirits or intergovernmental competition? The innovation and diffusion of energy policies in the American states (1990–2008). *Environmental Politics*, 23 (5) 795-817.
- 📖 Stadelmann, M., & Castro, P. (2014). Climate policy innovation in the South–Domestic and international determinants of renewable energy policies in developing and emerging countries. *Global Environmental Change*, 29, 413-423.

Net Metering

September 27 – Net Metering + **Data Session 1 on electricity sector data** available from EIA

- 📖 Comello, S., & Reichelstein, S. (2016). Cost competitiveness of residential solar PV: The impact of net metering restrictions. *Renewable and Sustainable Energy Reviews*.
- 📖 Balderbos, et al., (2017) “Levelized Cost of Storage” *Energy Economics*.

Demand-Side Programs

Week 7 |

October 2 – Introduction to the GT-National Energy Modeling System (NEMS)

- 📖 Georgia Tech Users’ Manual (Under Development)
- 📖 Brown, M. A., & Li, Y. (2018). Carbon pricing and energy efficiency: pathways to deep decarbonization of the US electric sector. *Energy Efficiency*, 1-19.

October 4 – Demand Response Benefits and Potential

- 📖 Brown, Marilyn A., Benjamin Staver, Alexander M. Smith, and John Sibley. 2015. Alternative Business Models for Energy Efficiency: Emerging Trends in the Southeast, *The Electricity Journal*, 2015, 28 (4): 103-117.
- 📖 Smith, Alexander and Marilyn A. Brown. 2015. “Demand Response: A Carbon Neutral Resource?” *Energy* 85 (2015) 10-22.

Smart Meters and the Smart Grid




Week 8 |

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October 9 – Fall Student Recess – No Class

October 11 – Smart Meters and the Smart Grid


Choose one to read for class discussion:

-  Zhou, S. and Brown, M. 2017. Smart Meter Deployment in Europe: A Comparative Case Study on the Impacts of National Policy Schemes. *Journal of Cleaner Production*. 144:22-32.
<http://www.sciencedirect.com/science/article/pii/S0959652616320868>
-  Oliver, Jeannie and Benjamin Sovacool. 2017. “The Energy Trilemma and the Smart Grid: Implications Beyond the United States,” *Asia # the Pacific Policy Studies* 4(1): 70-84.
-  Brown, M. A., Zhou, S., & Ahmadi, M. Smart grid governance: An international review of evolving policy issues and innovations. *Wiley Interdisciplinary Reviews: Energy and Environment*.



Baseload Plants: Nuclear Power

Week 9 |

October 16 – Concept of Baseload, Integration of VRE, and Nuclear Power

-  DOE. 2017. *Staff Report to the Secretary on Electricity Markets and Reliability, Chapter 3*, https://www.eenews.net/assets/2017/08/24/document_gw_06.pdf



October 18 – Evolving Utility Business Models

-  Various press coverage and materials on the VC Summer and Vogtle Nuclear Plants (see folder on T-square and pick a couple of articles to read)
<http://www.thestate.com/news/politics-government/article164993662.html>
-  Felder, F. A., & Athawale, R. (2016). Optimizing New York's Reforming the Energy Vision. *Utilities Policy*, 41, 160-162.

PV-Battery Systems & Vehicles to Grid (V2G)




Week 10 |

October 23 – PV-Battery Systems

-  Hanser, P., Lueken, R., Gorman, W., Mashal, J., & Group, T. B. (2017). The practicality of distributed PV-battery systems to reduce household grid reliance. *Utilities Policy*, 46, 22-32.
-  Zou, Hongyang, Huibin Du, Marilyn A. Brown, and Guozhu Mao. 2017. “Large-scale PV power generation in China: A grid parity and techno-economic analysis,” *Energy*. 134: 256-268, <https://doi.org/10.1016/j.energy.2017.05.192>

October 25 – Vehicles to Grid (V2G)

Choose one to read for class discussion:

-  Buchmann, M. (2017). Governance of data and information management in smart distribution grids: Increase efficiency by balancing coordination and competition. *Utilities Policy*, 44, 63-72.
-  Kempton, W., & Tomić, J. (2015). Vehicle-to-grid power fundamentals: Calculating capacity and net revenue. *Journal of power sources*, 144(1), 268-279.
-  Shinzaki, S., Sadano, H., Maruyama, Y., & Kempton, W. (2015). Deployment of vehicle-to-grid technology and related issues (No. 2015-01-0306). SAE Technical Paper.

Grid Reliability and Resilience

Week 11 |

October 30 – Reliability, Resilience, and Cyber Security

📖 DOE. 2017. *Staff Report to the Secretary on Electricity Markets and Reliability, Chapter 4: Reliability and Resilience* (pp. 61-101).

https://www.eenews.net/assets/2017/08/24/document_gw_06.pdf

📖 National Academy of Sciences, 2017. *Enhancing the Resilience of the Nation's Electricity System* <https://www.nap.edu/catalog/24836/enhancing-the-resilience-of-the-nations-electricity-system>

📖 National Academy of Sciences report. 2012. *Terrorism and the Electric Power Delivery System*, National Research Council.

📖 Lloyds (2015) *Business Blackout*, 2-page executive summary

November 1– Mega Projects and the Politics of Niche-Regime Conflicts

Choose one to read for class discussion:

📖 Brookes, N. J., & Locatelli, G. (2015). Power plants as megaprojects: Using empirics to shape policy, planning, and construction management. *Utilities Policy*, 36, 57-66.

📖 Hess, D. J. (2016). The politics of niche-regime conflicts: distributed solar energy in the United States. *Environmental Innovation and Societal Transitions*, 19, 42-50.

📖 Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21-40.

📖 Stadelmann, M., & Castro, P. (2014). Climate policy innovation in the South–Domestic and international determinants of renewable energy policies in developing and emerging countries. *Global Environmental Change*, 29, 413-423.

📖 Frank W. Geels, Benjamin K. Sovacool, Tim Schwanen, and Steve Sorrell. 2017. Sociotechnical transitions for deep decarbonization. *Science*. 357 (6357): 1242-1244.

Risk, Precaution, and the Political Control of Regulator

Week 12 |

November 6 –

📖 J. Wiener, M. Rogers, J. Hammitt and P. Sand, 2014. "The Reality of Precaution: Comparing Risk Regulation in the US and Europe." *Synthesis*. pp. 1-10.

📖 Kasperson, Roger. "Four questions for risk communication." *Journal of Risk Research* ahead-of-print (2014): 1-7.

📖 Sunstein, Cass R. "The Paralyzing Principle." *Regulation* 25 (2002): 32-37.

Environmental Regulations

November 8 –

📖 Emanuele Massetti, Marilyn Brown, Melissa Lapsa, Isha Sharma, James Bradbury, Colin Cunliff, and Yufei Li. [Environmental Quality and the U.S. Power Sector: Air Quality, Water Quality, Land Use and Environmental Justice](http://info.ornl.gov/sites/publications/files/Pub60561.pdf), Oak Ridge National Laboratory, ORNL/SPR-2016/772 (2017), <http://info.ornl.gov/sites/publications/files/Pub60561.pdf>
Read Chapter 2 on Air Quality.

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Energy Transitions

Week 13 |

November 13 – Carbon Cap and Trade vs Carbon Taxes

- 📖 Yi, H. (2015). Clean-energy policies and electricity sector carbon emissions in the US states. *Utilities Policy*, 34, 19-29.
- 📖 Tomain, J. P. (2016). A perspective on clean power and the future of US energy politics and policy. *Utilities Policy*, 39, 5-12.
- 📖 Marilyn A. Brown, Gyungwon Kim, Alexander M. Smith, and Katie Southworth. 2017. “Exploring the Impact of Energy Efficiency as a Carbon Mitigation Strategy in the U.S.” *Energy Policy*, 109: 249-259.
- 📖 Narassimhan, Easwaran, Kelly S. Gallagher, Stefan Koester, and Julio Rivera Alejo. 2017. Carbon Pricing in Practice: A Review of the Evidence, The Fletcher School, Tufts University, Report 2017.

November 15 –No Class

Week 14 |

November 20 – Mega Projects and the Politics of Niche-Regime Conflicts

- 📖 Brookes, N. J., & Locatelli, G. (2015). Power plants as megaprojects: Using empirics to shape policy, planning, and construction management. *Utilities Policy*, 36, 57-66.
- 📖 Hess, D. J. (2016). The politics of niche-regime conflicts: distributed solar energy in the United States. *Environmental Innovation and Societal Transitions*, 19, 42-50.
- 📖 Geels, F. W. (2014). Regime resistance against low-carbon transitions: Introducing politics and power into the multi-level perspective. *Theory, Culture & Society*, 31(5), 21-40.
- 📖 Stadelmann, M., & Castro, P. (2014). Climate policy innovation in the South—Domestic and international determinants of renewable energy policies in developing and emerging countries. *Global Environmental Change*, 29, 413-423.
- 📖 Frank W. Geels, Benjamin K. Sovacool, Tim Schwanen, and Steve Sorrell. 2017. Sociotechnical transitions for deep decarbonization. *Science*. 357 (6357): 1242-1244.

November 22 – Thanksgiving Break – No Class

Student Paper Presentations: November 20, 27, and 29

December 6 - 13 – Final Paper Due December 11, 2018

Possible Guest Lectures:

Mark G. Lauby, Senior VP and Chief Reliability Officer, North American Electric Reliability Corporation, mark.lauby@nerc.net
404-446-9723 (o) 404-895-1109 (c)

Bruce Edelston
Vice President, Energy Policy, Southern Company

Additional suggested reading materials:

- 📖 NREL. 2018. Evaluating the Impact of the 2017 Solar Eclipse. <https://www.nrel.gov/docs/fy18osti/71147.pdf>.
- 📖 North Carolina Clean Energy Technology Center. (2017). 50 States of Solar: Q1 2017 Quarterly Report, Executive Summary.
- 📖 Robert L. Rabin, "Federal Regulation in Historical Perspective." *Stanford Law Review*, 38, May, 1986, 1189-1327. This is a rather succinct sweep of most American regulatory history, largely through the lens of the role of the courts. This article ends in the mid-1980s.
- 📖 Yi, H. (2015). Clean-energy policies and electricity sector carbon emissions in the US states. *Utilities Policy*, 34, 19-29.
- 📖 Winston Harrington, Richard Morgenstern, and Peter Nelson, (2000), "On the Accuracy of Regulatory Cost Estimates" *Journal of Policy Analysis and Management* 19: 297-322. (T²)
- 📖 Robert W. Hahn, 2004. "The Economic Analysis of Regulation: A Response to the Critics," *University of Chicago Law Review*, 71 (Summer), 1021-1054. (T²)
- 📖 Furlong, K. (2016). The public shareholder: The commercialization and internationalization of publicly owned utility corporations. *Utilities Policy*, (40), 104-106.
- 📖 McDonald, D. A. (2016). To corporatize or not to corporatize (and if so, how?). *Utilities Policy*, 40, 107-114.
- 📖 Kathryn A. Watts. 2016. "Controlling Presidential Control," *Michigan Law Review*, pp. 683-745 (esp. to p. 726).
- 📖 Lavertu, Stéphane. 2015. "For Fear of Popular Politics? Public Attention and the Delegation of Authority to the United States Executive Branch." *Regulation & Governance* 9, 160-77.

Websites:

Teaching the Duck to Fly <http://www.raponline.org/document/download/id/7956>

DOE Electricity Advisory Committee Websites:

<https://www.energy.gov/oe/services/electricity-advisory-committee-eac/electricity-advisory-committee-reports-and-memos>

<https://www.energy.gov/oe/june-7-8-2017-meeting-electricity-advisory-committee>

Blogs:





Blogs that are useful (but sometimes contentious) and that often point to insightful additional sources include:

- Penn Program on Regulation (Regblog): <http://www.regblog.org> (*highly recommended*)
- Center for Progressive Reform: <http://www.progressivereform.org/CPRBlog.cfm?idSect=27> (liberal)
- American Enterprise Institute: <https://www.aei.org/tag/regulation/> (conservative)
- Environmental Law Prof Blog: http://lawprofessors.typepad.com/environmental_law/

Key Policy Resources, Data Sources and Models

- 📖 IEA/IRENA Global Renewable Energy Policies and Measures Database
- 📖 North Carolina Clean Energy Technology Center. (2017). 50 States of Solar: Q1 2017 Quarterly Report, Executive Summary; DSIRE data base of clean energy policies

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-  ACEEE Database of Energy Efficiency Policies
-  <http://database.aceee.org/state-scorecard-rank>
-  Electricity data from FERC, EIA, EPA's E-Grid, PJM market data, ,...
-  EIA's NEMS, EPA's AVERT, NREL's SAM,...