COLUMBIA UNIVERSITY
School of Professional Studies

Master of Science in Sustainability Management

SUMA PS5710 Electrification and Decarbonization – Regulatory approaches and strategies

Class Day and Time:	**Mondays 4:10-6:00pm (Spring 2025)**
Number of credits:	**3**
Modality:	**Elective**
Instructor:	Rory Christian, RoryMchristian@protonmail.com
Office Hours:	TBD
Response Policy:	[Include a brief statement about your preferred means of communication and when students should expect a response from you. Will you be available 24/7 or during the workweek only? Will you generally respond within 12 or 24 hours?]
Teaching Assistant:	TBD
Office Hours:	TBD
Response Policy:	[Include a brief statement about your preferred means of communication and when students should expect a response from you. Will you be available 24/7 or during the workweek only? Will you generally respond within 12 or 24 hours?]

Course Overview

Electricity is the lifeblood of human society. Decarbonization of global economies through electrification is seen as the most viable path for reducing GHG emissions and addressing the worst effects of climate change. Though generally accepted as the best path forward, an understanding of the operational parameters of the electric system is essential to understanding both the benefits and limitations of current and future actions. This includes the highly visible investments in renewable energy generation, less visible but equally important investments in transmission and distribution infrastructure, and the largely personal, private choices of individual households and businesses.

The Course will be conducted in-person and students will be graded based on a combination of class participation, problem sets, an individual mid-term paper and a group final paper and presentation. There are no cross-registration requirements for this course. Recommended additional materials may be required when needed and provided by the instructor.

Learning Objectives

The course will examine pathways for the transition from fossil fuel-based electricity generation to one dominated by electricity generated by renewable energy. Students will examine the drivers of past energy transitions and various factors influencing current energy systems. At the conclusion of the course, students will be able understand the drivers of past energy transitions, the impact of those drivers on the overall energy supply chain, and how new technologies (e.g. distributed energy resources, smart meters, internet of things (IOT), etc.), consumer adoption of mass market products (e.g. Electric Vehicles, battery backup, etc.) and evolving consumer expectations (e.g. fast charging) are altering long held assumptions about energy production and use. Through this work, students will be able to infer practical steps to

support current efforts to decarbonize and the potential impacts of those actions on the modern energy supply chain.

Using the load duration curve of a typical electric utility in the N.E. United States, students will develop a foundational understanding of the electric system and the impact of electrification on its operation. Students will also learn the roles of various stakeholders (e.g. regulators, utilities, advocates, elected officials, heavy industry, RTOs/ISOs, communities, etc.) in the day-to-day operation of electric systems, both as end users' of electricity and as groups influencing policy related to the electric system. Students will be able to understand the role of different electric generators (nuclear, renewable, natural gas, etc.), various considerations when designing and setting rates, the impact of wholesale markets, and multiple competing factors influencing actions taken by Commissions, utilities and other stakeholders.

LO1 – Students will be able to evaluate the impact of customer load profiles on electric generation, transmission and distribution, and emissions, through a review of the load duration curve. Students will be able to demonstrate how the load duration curve is developed, distinguishing the various factors influencing its shape. Students will be able to discuss its significance in analyzing factors driving costs for consumers, and how this tool can influence decision-making aimed at reducing costs and emissions.

LO2 – Evaluate the impact of different generator types and associated economic dispatch profiles in the context of the typical load duration curve. Students will be able to measure and interpret the impacts of energy use on different generator types, while also assessing the capital and operating costs of various generator types, along with environmental and equity considerations.

LO3 – Identify various policy actions (e.g. energy efficiency, baseload generation, peaking units and renewable energy, etc.) influencing the load duration curve, and predict the impacts on emissions and costs.

LO4 – Compute calculations and produce analyses necessary to determine the cost of electricity use for different customer classes and explain the underlying economic theory behind the differentiation of classes.

LO5 - Describe the impact of transmission bottlenecks on the availability of different generation assets and distribution system limitations on distributed energy resources.

LO6 - Evaluate various levers available to policy makers for advancing electrification through the lens of the regulatory compact and the underlying economic theory behind regulating natural monopolies.

Readings

Note: Please refer to the course schedule below for the specific page numbers for the relevant assigned readings per class.

1. Badtke-Berkow, M., Mohlin, K., Spiller, B., & Centore, M. (2015). *A primer on time-variant electricity pricing*. Environmental Defense Fund. https://www.edf.org/sites/default/files/a_primer_on_time-variant_pricing.pdf
   Most residential customers pay the same price for a unit of electricity regardless of the time of day that energy is consumed. This price is based on the average cost of generation, transmitting, and distributing electricity, and effectively disconnects consumer behaviour from the drivers of costs. This paper explores the impacts of this disconnect and offers a variety of options to reflect the time-variant nature of costs for providing electricity.
2. Blonz, J., Palmer, K., Wichman, C., & Wietelman, D. (2021). *Smart thermostats, automation, and time-varying prices*. Resources for the Future. https://www.rff.org/publications/working-papers/smart-thermostats-automation-and-time-varying-prices/
   The paper explores how automation can complement economic incentives by encouraging households to use smart thermostats in tandem with time-of-use electricity pricing. The feature reduces air-conditioning use during the highest-priced afternoon period, raising indoor temperatures above a household's preferred temperature, primarily for customers who are typically home during the day.

3. Chang, J., Aydin, M., Pfeifenberger, J., Spees, K., & Pedtke, J. (2017). *Advancing past "baseload" to a flexible grid how grid planners and power markets are better defining system needs to achieve a cost-effective and reliable supply mix*. https://www.brattle.com/wp-content/uploads/2022/09/Advancing-Past-Baseload-to-a-Flexible-Grid.pdf
   The term "baseload" generation is an artifact from a time when most electricity was generated through coal-fired and nuclear generating stations. During most of that period, coal and nuclear plants offered significantly lower fuel costs than other technologies, which meant they operated around the clock to meet electricity customers' "baseload" needs. The pervasiveness of these resources resulting in the development of operational and planning dynamics that are not aligned with the development and operation of renewable energy resources, which tend to generate electricity intermittently. This paper explores various considerations for adapting existing practices to better align with a flexible grid, where intermittent generation and flexible supply can be synchronized.

4. Coase, R. H. (1960). The problem of social cost. *Journal of Law and Economics, the University of Chicago Law School*, *III*.
   https://www.law.uchicago.edu/lawecon/coaseinmemoriam/problemofsocialcost
   Nobel Prize winning Economists R. H. Coase's paper has had a profound impact on how economists and policymakers think about externalities, property rights, and transaction costs, as well as the role of government in economic activities. This is the groundwork for many subsequent developments in law and economics and establishes a framework for determining when market-based or government-based solutions are most effective.

Adapted from: **The Course Syllabus: A Learning-Centered Approach, 2nd Edition,** Judith Grunert O'Brien, Barbara J. Millis, Margaret W. Cohen. ISBN: 978-0-470-60549-3. Available as an E-Book from Wiley at:
https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493

5. Denholm, P., Sun, Y., & Mai, T. (2019). *An introduction to grid services: Concepts, technical requirements, and provision from wind*. https://www.nrel.gov/docs/fy19osti/72578.pdf
This report provides an overview of "ancillary services", also referred to as ""essential reliability" services (ERS). These services are essential to the efficient and reliable operation of the electric system. The report will describe technical requirements, quantities currently procured, and some estimates of costs. The paper focuses on the potential role of wind energy in providing these services and summarizes the technical and regulatory issues around wind providing these services.

6. Gundlach, J., & Stein, E. (2020). *Harmonizing States' energy utility regulation frameworks and climate laws: a case study of New York*.
https://policyintegrity.org/files/publications/Harmonizing_States_Energy_Utility_Regulation_Frameworks_Gundlach_and_Stein.pdf
Multiple states have adopted net-zero emissions goals with a target date some time prior to 2050. While the laws establishing these mandates authorize agencies to adopt new regulations, they are often silent about existing laws that require, authorize, or subsidize the development and use of infrastructure designed to enable the consumption of fossil fuels. This article concentrates on New York's situation to illustrate how these tensions can manifest and explores views on what can be done to address them.

7. Hendrickson, J. (2009). *Electric utility cost of service and rate design*.
https://pubs.naruc.org/pub.cfm?id=53788304-2354-D714-5194-BCE9529A6212
An exploration of terminology, processes and considerations involved in electric rate design.

8. Kabeyi, MJB., & Olanrewaju, OA. (2023). *The load curve and load duration curves in generation planning*. https://ieomsociety.org/proceedings/2023australia/245.pdf
A primer exploring the nature of the load duration curve and the fundamentals behind it's structure and development. It highlights the distinction between baseload, load-following (intermediate) and peaking generation, as well as key considerations for electric system planning.

9. Lawton, T. (2023). *History of electric metering*.
https://www.tescometering.com/wp-content/uploads/2023/05/Mid-South-History-of-Electric-Metering_Tom-Lawton_5-1-2023-final20.pdf
An industry presentation documenting the history of electric metering and the development of metering technology from the 19th century to the present.

10. MacKay, D. J. (2009). *Sustainable Energy - without the hot air*.
http://www.inference.org.uk/sustainable/book/tex/sewtha.pdf
A resource – focused on UK energy needs - long used by many regulators, policymakers and practitioners to understand the potential for renewable energy.

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https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493

11. Potter, B. (2023a, May 25). *The birth of the grid*. Construction Physics. https://www.construction-physics.com/p/the-birth-of-the-grid
12. Potter, B. (2023b, June 3). *The grid, part II: The golden age of the power industry*. Construction Physics. https://www.construction-physics.com/p/the-grid-part-ii-the-golden-age-of
13. Potter, B. (2023c, June 17). *The grid, part III: The dream of deregulation*. Construction Physics. https://www.construction-physics.com/p/the-dream-of-deregulation-the-grid
14. Potter, B. (2023d, June 28). *The grid, part IV: The hard and soft paths of energy strategy*. Construction Physics. https://www.construction-physics.com/p/the-grid-part-iv-the-hard-and-soft

    This series documents the development of the electric grid from the 19th century to the present. Technological advancements, evolution of regulation, as well as economic and regulatory impacts on the development of the electric sector are explored, providing a basis for understanding the current landscape.

15. Solar Electric Power Association. (n.d.). *Ratemaking, solar value and solar net energy metering—a primer*. https://www.energy.gov/sites/prod/files/2015/03/f20/sepa-nem-report-0713-print.pdf
    A product of the Solar Electric Power Association (SEPA), this paper was developed in partnership with multiple US utilities and explores the role of Net Energy Metering (NEM) in supporting the adoption of distributed solar generation. It explores the history of NEM, the rate-making process, and explores how best to value the benefits of distributed solar

16. Order adopting interconnection management plan and cost allocation mechanism, and making other findings, (State of New York, Public Service Commission January 25, 2017). https://documents.dps.ny.gov/public/Common/ViewDoc.aspx?DocRefId={22BEAB22-7F9F-45B8-89FD-0E8AD84692B4}
    This order addresses the then backlog of Distributed Generation (DG) (a.k.a. Distributed Energy Resources - DERs) in utility interconnection queues. It explains the rationale behind the original Standardized Interconnection Requirement (SIR) established in 1999, the reasons for the backlog in 2017, and details various proposals to accelerate the installation of DG throughout the state.

17. Order on net energy metering transition, phase one of the value of distributed energy resources, and related matters, (State of New York, Public Service Commission March 9, 2017). https://www.nyserda.ny.gov/-/media/Project/Nyserda/Files/Programs/NY-Sun/Original-Value-Stack-Order.pdf
    This order details the rationale used by the NYS Public Service Commission to transition away from Net Energy Metering (NEM) and adopt the Value of Distributed Energy Resources (VDER) approach to valuing energy produced by distributed energy resources.

18. Stein, E. (2018). 8. Judging and mediating for the "long emergency": Superstorm Sandy, New York State's regulatory response to the climate change crisis, and reforming the energy vision. In *Effective*

Legal Advocacy in Emergency Situations. Crisis Lawyering. https://chooser.crossref.org/?doi=10.18574%2Fnyu%2F9781479801701.003.0009
This is a case study of post-Sandy decision-making by state regulators and government, and events leading up to New York State's Reforming the Energy Vision (REV). It is written from the point of view of the administrative law judge (ALJ) charged with bringing diverse parties together, ensuring equitable participation for affected communities, and mobilizing climate scientists and thought leaders to advise and generate meaningful recommendations to decision-makers—all with an eye to the high stakes of these projects.

19. Stein, E., & Ucar, F. (2018). *Driving environmental outcomes through utility reform lessons from New York REV*. https://www.ourenergypolicy.org/wp-content/uploads/2018/02/driving-environmental-outcomes.pdf
For a century, utilities' ability to make profit has depended on their investment in infrastructure, and their revenue has been tied to charging customers based on how much energy they use. Yesteryear's approach conflicts with today's public interests—energy efficiency, less local air pollution, and decarbonizing our economy. It also conflicts with the technological advancements of the last several decades, which now allow energy to flow more freely through copper wires, much as data flows through the airwaves. With customers now able to generate, store and sell their own electricity, while also being able to "see" their usage and make real-time and make informed decisions, what elements are key considerations on the path to full electrification and maximizing environmental benefits are key considerations.

20. The New York State Independent System Operator (NYSIO). (2018). *2018 power trends report*. https://www.nyiso.com/documents/20142/2223020/2018-Power-Trends.pdf/4cd3a2a6-838a-bb54-f631-8982a7bdfa7a

21. The New York State Independent System Operator (NYSIO). (2024). *2024 power trends report*. https://www.nyiso.com/documents/20142/2223020/2024-Power-Trends.pdf/31ec9a11-21f2-0b47-677d-f4a498a32978
The New York Independent System Operator's (NYISO) annual Power Trends report discusses the challenges and issues that will shape the future of the electric grid. The reports identify key issues and challenges shaping the grid, and details efforts to maintain reliability.

22. Troesken, W. (1994). The institutional antecedents of state utility regulation: The Chicago gas industry, 1860 to 1913. In C. Goldin & G. D. Libecap (Eds.), *The Regulated Economy: A Historical Approach to Political Economy*. University of Chicago Press. https://www.nber.org/system/files/chapters/c6572/c6572.pdf
A primer often provided to new regulators detailing the historical context that spurred the need for and creation of utility regulation. The benefits of State Commissions as an independent body separate

from the legislature are explored, along with concerns related to politically motivated actions related to utility investments.

Optional Readings

1. Leber, R. (2023, March 29). *Refrigerators have gotten really freaking good. Thanks, Jimmy Carter.* Vox. https://www.vox.com/climate/2023/3/29/23588463/carter-efficiency-appliances-climate
2. Matthews, D. (2023, August 7). *Why a "room-temperature superconductor" would be a huge deal*. Vox. https://www.vox.com/future-perfect/23816753/superconductor-room-temperature-lk99-quantum-fusion
3. Potter, B. (2023e, November 17). *How the gas turbine conquered the electric power industry*. Substack. https://substack.com/@brianpotter/p-138944264
4. Roberts, D. (2018, May 18). *Solar and wind are coming. And the power sector isn't ready.* Vox. https://www.vox.com/energy-and-environment/2018/5/18/17359730/wind-solar-power-grid-electricity-managers
5. SCE DRET Findings. (2017). *DR12.21: Evaluation of residential room air conditioner control with smart plugs for peak load reduction*. https://www.dret-ca.com/wp-content/uploads/2020/07/DR12.21-Summary.pdf

Assignments and Assessments

Students will have seven assignments designed to reinforce the learning objectives, building upon course materials and knowledge obtained through the course. Assignments will be a combination of multiple choice and short answer questions.

At the end of week 8, students will be given 48 hours to complete a written take-home midterm exam. This exam will require students to evaluate potential impacts of specific actions related to the achieving a policy objective related to reducing emissions. Students will work independently, and grades will be based on the ability to articulate the individual impact of various policies, quantify their financial impacts on different stakeholders and calculate associated emissions reductions.

The final project will be a group exercise and will take the form of a group paper and presentation during the final two days of class. Students will work in teams to explore a specific topic based on real-world examples, identifying potential options for increasing the adoption of emissions-free generation, electrification, and reducing GHG emissions. Students will present their recommendations in class, where they will be graded based on their understanding of the various considerations (e.g. economic, practical, political, etc.) that may influence policy implementation and consumer adoption.

Grading

The final grade will be calculated as described below:

Grade	Percentage

A+	98–100 %
A	93–97.9 %
A-	90–92.9 %
B+	87–89.9 %
B	83–86.9 %
B-	80–82.9 %
C+	77–79.9 %
C	73–76.9 %
C-	70–72.9 %
D	60–69.9 %
F	59.9% and below

Assignment/Assessment	**% Weight**	**Individual or Group/Team Grade**
Class Participation – Regular participation in class discussions and project activities is required. Students are expected to have completed required readings prior to the lecture. Your contributions are expected to enhance the quality of the class experience for yourself and others. Participation includes the pre-reading required for the class, participation in class discussions and through online discussion boards. Both written and online participation is expected.	15%	Individual
Problem Sets – Completion of problem sets designed to reinforce information learned in lectures and will be based on real world scenarios to ensure understanding of materials.	25%	Individual
Mid Term Exam – At the end of week 8, students will be given 48 hours to complete a written take-home midterm exam. This exam will require students to evaluate potential impacts of specific actions related to the achieving a policy objective related to reducing emissions. Students will work independently. The Mid Term Exam will address LOs 1,2,4 & 5.	30%	Individual
Final Paper and Presentation – The final project will require students to work in teams to write a paper recommending various policy actions taking into consideration economic, political and environmental considerations and make a case for a particular course of action. Students will also provide an oral presentation of their paper in class. The paper and accompanying presentation will be graded separately, with each	30%	Group

contributing 50% towards the final grade. The Final Paper and Presentation will address LO6.		

Course Schedule/Course Calendar

Module/Week and Topic with specific dates	Topic Covered	Readings	Activities and Assignments for this module
MODULE 1: Fundamentals	**Kw and Kwh** - Students will understand the difference between Kw and Kwh, and the impact of each on consumer bills and the electric system. **Electric metering** – Students will understand historical developments related to electric meters, the accuracy of, and logistics behind measuring electric consumption and how those factors influenced much of the history of the development of electric generation. **Customer Classes and Load Profiles –** Students will understand the differences between different customer classes and how consumption patterns vary between them. **Utilization rate** – Students will learn at a high level what factors are considered in the design and operation of the electric system and the utilization rates of different aspects of the system, from generation, to transmission and distribution to individual appliances and usage. **Overview of stakeholders** – Overview of Federal, State, and Local stakeholders, Non profits, Industrial and Commercial groups and the various roles played in electric policy.	MacKay (2009) – pg. 24-26 Lawton (2023) - 66 slides Potter (2023a) - 17 pages Stein & Ucar, (2018) - pg. 1 – 18 NYISO (2018) - Executive Summary pg. 8-11 Troesken (1994) - 27 pages	**Introductions** **Understand the Concept of the Load Duration Curve** **Problem Set:** Calculate the monthly cost of electricity using kw and kwh for different customer classes **(LO1)**
MODULE 2: Utility Regulation 1	**Background -** The history, theory and rationale behind utility regulation. Students will understand the basic economic theory	Coase (1960) – 44 pages	**(LO6)**

	behind natural monopolies and the regulatory compact. **Equity Considerations** **Economic Regulation**		
MODULE 3: Load Duration Curve	**Load Duration Curves –** Explore how load profiles of different customer classes impact electric load and total system costs. Explore potential impacts of renewable energy, energy efficiency, demand response, time variant pricing and other actions on load profiles and the ultimate impact of the load duration curve.	Kabeyi & Olanrewaju (2023) – 20 pages Blonz et al. (2021) – pg. 1-29	**Problem Set:** Students will calculate financial impact of different actions based on changes to the load duration curve. **(LO1, L04)**
MODULE 4: Electric Generation and Fuel Sources -	**Electric Generation –** Students will explore the concepts of alternating and direct current, the logistics and operating characteristics of various fuel sources (natural gas, nuclear, coal, renewables, etc.) and the operating and performance characteristics of different types of generation and their roles in the day-to-day operation of the electric grid. Environmental, equity and cost considerations intersect will be explored at length using historical examples. **Reliability requirements –** Students will explore historical precedents for current reliability standards of North America Electric Reliability Council (NERC) **Economic Dispatch Model for Electric Generation** **Ancillary Services**	Potter (2023b) - 16 pages Potter (2023c) - 6 pages Chang et al. (2017) – 33 pages Denholm et al. (2019) - pg. 1-6 NYISO (2018) - pg. 20-21 & 31-32 NYISO (2024) - pg. 24-26 (Optional) Roberts (2018, May 18) (Optional) Potter (2023e, Nov 17) (Optional) MacKay (2009) –	**Problem Set:** Students will model changes in generator dispatch based on a set of evolving conditions **(LO1, LO2, LO4, LO5)**

		pg. Chapter 18, 9 pages)	
MODULE 5: Transmission and Distribution - .	**Transmission** – Students will learn the importance of transmission and its historical role in the development of the U.S. electric grid. Regulatory, economic and political considerations will be explored as will the role of RTO/ISOs and FERC in the development of transmission. Federal programs (e.g. GRIP, LBNL Technical assistance, etc.), and recent FERC decisions (e.g. Order 2023) will be explored. The Accelerated Renewable Energy Growth and Community Benefit Act (AREGCBA) will be reviewed as an example of legislative directives directing regulatory action and its impact. **Distribution –** Students will be able to distinguish the difference between transmission and distribution level considerations and the impacts of investments of each on final costs. **Siting, permitting, FERC, etc**.	NYISO (2018) -pg. 18 NYISO (2024) - pg. 13-15 & 26-30 (Optional) Matthews (2023, Aug 7)	**Problem Set:** Students will model how changes in transmission influence the dispatch of electric generation. **(LO1, LO4, LO5)**
MODULE 6: Wholesale Electric Markets -	**Review differences between Kw and Kwh and considerations for meter reading** **Vertically integrated utilities vs. Deregulated utilities** – Discuss economic and pollical landscape that contributed to deregulation. **RTOs and ISOs** – Creation of and role of ISO's and RTOs in the coordination of wholesale energy markets **Load forecasting** – Considerations for load forecasting (multi-year, monthly, day ahead and hourly) **Day ahead, Hourly and Real-Time markets**	NYISO (2018) – pg. 18-20 NYISO (2024) - pg. 33-41 Denholm et al. (2019) - pg.7-23	**Problem Set:** Students will calculate financial impact of different actions based on changes to the load duration curve. **(LO1, LO2, LO3, LO4, LO5)**

	Demand Response		
MODULE 7: Retail electric pricing -	**Review Kw and Kwh, Meter reading and differences between customer classes.** **Regulatory history** – Rationale behind the creation of State Commissions **Cost of Service and Rate Design** – How customers classes are defined and costs are allocated between them. **Supply vs. T&D Charges** **Energy Service Companies (ESCOs)** **Fixed, Variable, Block and Index Pricing**	Hendrickson (2009) – 20 slides	**Problem Set:** Students will determine the $/kwh price customers will pay based on available transmission, generation and customer demand **(LO1, LO2, LO3, LO4, LO5, LO6)**
MODULE 8: Energy Efficiency and Demand Response	**Review Kw and Kwh and Meter reading** **Objectives of energy efficiency and demand response.** **Approaches to measurement and verification** **Technologies and strategies** **Human behavior and energy efficiency rebound effect** **Challenges – CoolNYC case study**	(Optional) Leber (2023, March 29)	
MODULE 9: Distributed Energy Resources	**Review Kw and Kwh, Meter reading and differences between customer classes** **Review differences in electric pricing along load duration curve** **Operational limitations to Distributed Energy Resources** **The interconnection process** **Electrification - Electric Vehicles, Heat Pumps, etc.**	Solar Electric Power Association (n.d.) – pg.1-4 Order on net energy metering transition, phase one of distributed energy resources, and related matters – pg. 19-42 Order adopting interconnection	

	The coming transition from electric consumer to "pro-sumer" **Pros and Cons of DERs – A discussion on risk and reward**	management plan and cost allocation mechanism, and making other findings (pg. 1-10) NYISO (2024) - pg. 13	
MODULE 10: Net Energy Metering	**Principles of Net Energy Metering (NEM)** **Economic and regulatory implications** **Value of Distributed Energy Resources (VDER)**	Solar Energy Power Association, "Ratemaking, Solar Value and Solar Net Energy Metering – A Primer" – 40 pages	
MODULE 11: Time Variant Pricing -	**Principles of Time Variant Pricing Models** **Review human behavior and energy efficiency rebound effect** **Economic and regulatory implications** **Value of Distributed Energy Resources (VDER)** **Impact of NEM and VDER on load duration curve**	Badtke-Berkow et al. (2015) - 20 pages	**Problem Set:** Students will determine the cumulative impact of time variant pricing, demand response, energy efficiency and other actions on the load duration curve. **(LO1, LO2, LO3, LO4, LO5, LO6)**
MODULE 12: Utility Regulation 2	**Explore tools available to regulators and policy makers** **Safe and reliable utility service** **Just and reasonable rates** **Social and political considerations** **Geopolitical impacts** **Workforce development**	Potter (2023d) – 8 pages Gundlach & Stein (2020) - pg. 223-236 & 245-249 Stein & Ucar (2018) - pg.18-45	

	Cost containment **Continued exploration of tools available to regulators and policy makers** **Continued exploration of tools available to regulators and policy makers**		
MODULE 13: Utility Regulation 3	**Continuation of Module 12 - Continued exploration of tools available to regulators and policy makers**		
MODULE 14: Final Presentations	**Group Presentations and Papers due**		

Course Policies

Participation and Attendance
You are expected to complete all assigned readings, attend all class sessions, and engage with others in online discussions. Your participation will require that you answer questions, defend your point of view, and challenge the point of view of others. If you need to miss a class for any reason, please discuss the absence with me in advance. More than one absence will affect your grade.

Late work
There will be no credit granted to any written assignment that is not submitted on the due date noted in the course syllabus without advance notice and permission from the instructor.

Citation & Submission
All written assignments must use standard citation format (e.g., MLA, APA, Chicago), cite sources, and be submitted to the course website (not via email).

School and University Policies and Resources

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https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493

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Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SPS holds each member of its community responsible for understanding and abiding by the SPS Academic Integrity and Community Standards posted at https://sps.columbia.edu/students/student-support/academic-integrity-community-standards. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

Use of Artificial Intelligence (AI) Policy

Statement permitting AI Usage with Considerations: AI generative or machine learning tools can be used to assist with course deliverables, provided that all utilized information is cited in accordance with program guidelines. In addition, note that information produced by AI generative tools may be inaccurate or outdated. Please speak with your instructor if you have questions about course-specific policies relating to the usage of AI generative tools.

*If there is a violation of the above statements related to the use of AI, please see below the University Policy related to Academic Violations within the Standards and Discipline for all Columbia Students.

Use of Artificial Intelligence Tools, Unauthorized Absent a clear statement from a course instructor granting permission, the use of generative Artificial Intelligence (AI) tools to complete an assignment or exam is prohibited. The unauthorized use of AI shall be treated similarly to unauthorized assistance and/or plagiarism. Language available via: https://cssi.columbia.edu/content/academic-violations

To report a violation of the University Standards and Discipline including Academic Integrity violations, please visit: https://cm.maxient.com/reportingform.php?ColumbiaUniv=&layout_id=4

Exception: There are no exceptions to this policy.

Inclusion

In any M.S. or M.P.S. program at SPS, faculty and staff are committed to the creation and maintenance of "inclusive learning" spaces – classrooms and other places of learning where you will be treated with

Adapted from: **The Course Syllabus: A Learning-Centered Approach, 2nd Edition,** Judith Grunert O'Brien, Barbara J. Millis, Margaret W. Cohen. ISBN: 978-0-470-60549-3. Available as an E-Book from Wiley at:
https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493

respect and dignity, and where all individuals are provided an equitable opportunity to participate, contribute, and succeed. The School of Professional Studies welcomes students of all races/ethnicities, gender identities and expressions, sexual orientation, socio-economic status, age, disabilities, religion or spirituality, regional background, veteran status, citizenship status, nationality and other diverse identities.

Names/Pronouns
You deserve to be addressed in a manner that reflects your identity. You are welcome to tell me your name and pronoun(s) you would like used in class, at any time, either in person or via email.

Discrimination
The School of Professional Studies embraces the diversity of gender, gender identity and expression, sex, sexual orientation, race, ethnicity, national origin, age, religion and spirituality, disability status, family status, socioeconomic background, and other visible and non-visible identities. Columbia University does not tolerate unlawful discrimination, discriminatory harassment, sexual assault, domestic or dating violence, stalking, or sexual exploitation, and all such conduct is forbidden by Columbia University Policy.

Accessibility
The School of Professional Studies wants you to succeed in this course. Contact your SPS student advisor, who will connect you with Disability Services for learning accommodations. Columbia University is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website:

http://health.columbia.edu/services/ods/support

Diversity Statement
It is our intent that students from all diverse backgrounds and perspectives be well-served by this course, that students' learning needs be addressed both in and out of class, and that the diversity that the students bring to this class be viewed as a resource, strength and benefit. It is our intent to present materials and activities that are respectful of diversity: gender identity, sexuality, disability, age, socioeconomic status, ethnicity, race, nationality, religion, and culture.

Class Recordings
All or portions of the class may be recorded at the discretion of the Instructor to support your learning. At any point, the Instructor has the right to discontinue the recording if it is deemed to be obstructive to the learning process. If the recording is posted, it is confidential and it is prohibited to share the recording outside of the class.

SPS Academic Resources

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The Division of Student Affairs provides students with academic counseling and support services such as online tutoring and career coaching: https://sps.columbia.edu/students/student-support/student-support-resources.

Columbia University Information Technology
Columbia University Information Technology (CUIT) provides Columbia University students, faculty and staff with central computing and communications services. Students, faculty and staff may access University-provided and discounted software downloads.

Columbia University Library
Columbia's extensive library system ranks in the top five academic libraries in the nation, with many of its services and resources available online.

The Writing Center
The Writing Center provides writing support to undergraduate and graduate students through one-on-one consultations and workshops. They provide support at every stage of your writing, from brainstorming to final drafts. If you would like writing support, please visit the following site to learn about services offered and steps for scheduling an appointment. This resource is open to Columbia graduate students at no additional charge. Visit http://www.college.columbia.edu/core/uwp/writing-center.

Career Design Lab
The Career Design Lab supports current students and alumni with individualized career coaching including career assessment, resume & cover letter writing, agile internship job search strategy, personal branding, interview skills, career transitions, salary negotiations, and much more. Wherever you are in your career journey, the Career Design Lab team is here to support you. Link to https://careerdesignlab.sps.columbia.edu/

Netiquette
Online sessions in this course will be offered through Zoom, accessible through Canvas. A reliable Internet connection and functioning webcam and microphone are required. It is your responsibility to resolve any known technical issues prior to class. Your webcam should remain turned on for the duration of each class, and you should expect to be present the entire time. Avoid distractions and maintain professional etiquette.

Please note: Instructors may use Canvas or Zoom analytics in evaluating your online participation.

More guidance can be found at: https://jolt.merlot.org/vol6no1/mintu-wimsatt_0310.htm

Netiquette is a way of defining professionalism for collaborations and communication that take place in online environments. Here are some Student Guidelines for this class:

- Avoid using offensive language or language that is not appropriate for a professional setting.
- Do not criticize or mock someone's abilities or skills.

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https://www.wiley.com/en-us/The+Course+Syllabus%3A+A+Learning+Centered+Approach%2C+2nd+Edition-p-9780470605493

- Communicate in a way that is clear, accurate and easy for others to understand.
- Balance collegiality with academic honesty.
- Keep an open-mind and be willing to express your opinion.
- Reflect on your statements and how they might impact others.
- Do not hesitate to ask for feedback.
- When in doubt, always check with your instructor for clarification.

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