ENERGY 188FS • HISTORY 178FS

History of Energy Use & Power Generation

Global Energy: Past, Present & Future

Fall · 2026 · One Credit · Nicholas Institute of Energy, Environment & Sustainability



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Cover Image: Branobel, commissioner, *Tvo. Br. Nobel: Maslo, mazi, benzin dlia avtomobilei, motornykh lodok, aeroplanov* [*The Nobel Brothers Company: Oil, Wax, and Gasoline for Automobiles, Motorboats, and Airplanes*], 1896, chromolithograph, 69 × 48.5 cm (27.1 × 19.1 in), Russian State Library, Moscow, https://search.rsl.ru/ru/record/01006706442.

ACKNOWLEDGEMENTS

This syllabus brings together pedagogical lessons learned over nearly a decade of college teaching – from countless conversations with more than a dozen colleagues and students across at least four institutions of higher education. In particular, I wish to acknowledge special contributions from Edna Andrews, Edward Balleisen, Kyle Bradbury, Dorian Canelas, Katie Cloud, Mandy Cooper, Michael Domeracki, Jackson Ewing, Matt Fryar, Brooke Guthrie, Evan Hepler-Smith, Carson Holloway, Nico Hotz, Charles Irons, Katharine Jo, DeLayne Jolly, Jennifer Knust, Bryan Koen, Luana Lima, Genevieve Lipp, Yana Lowry, Brian Murray, Colleen Nieto, Will Niver, Tyler Ratcliffe, Eric Rohlfing, Aaron Siegle, Philip Stern, and Carl Thompson. This syllabus, then, is as much a product of their insight and generosity as it is my own.

1. OVERVIEW

1.1. Purpose

Tackling anthropogenic climate change requires intimate, interdisciplinary knowledge of the energy supply sector. To that end, this course provides a comprehensive introduction to the millennia-long evolution of human energy use and power generation focused on foundational concepts, hands-on experimentation, and independent research. Broadly speaking, you will learn 1) to chart the development of human energy use from the Paleolithic to the present in terms of source and technology substitution; 2) to contextualize the emergence of technologies undergirding modern energy systems, and; 3) to apply historical knowledge to contemporary policy debates as part of a small team. Collaborative, case-based, as well as global in scope, this course will ultimately impart to you a deeper understanding of the past along with greater confidence to grapple with the most pressing issues of our own time.

1.2. Cost of Enrollment

To participate in this seminar, you must obtain your own physical copies of two textbooks. (For details, see Section 2.4. Textbooks & Materials below.) As of early August 2026, expect to pay somewhere between about $20 and $40 for physical copies of both books combined, depending on condition (used vs. new) and where you buy them. Anyone whose circumstances may prevent them from acquiring these materials should reach out to the instructor as soon as possible. Do not drop the course because of cost concerns.

1.3. Important Due Dates

This table includes deadlines for only the most heavily weighted assignments. For a complete list, see Section 4.2. Assignments & Grade Weights.

Class	Date	Deliverable
Class 9	*Tuesday, September 22*	*Bluebook Test 1 (completed in class)*
Class 10	*Thursday, September 24*	*Prospectus and Pitch (delivered in class)*
Class 16	*Tuesday, October 20*	*Bluebook Test 2 (completed in class)*
Class 19	*Thursday, October 29*	*Rough Backgrounder and Slide Deck (by 11:59 p.m.)*
Class 25	*Thursday, November 19*	*Bluebook Test 3 (completed in class)*
Class 27	*Tuesday, December 1*	*Presentation*
Class 28	*Thursday, December 3*	*Self-Assessment & Course Evaluation (completed in class)*
Finale	*Thursday, December 10*	*Polished Backgrounder and Slide Deck (by 11:59 p.m.)*

1.4. Detailed Description

In the late nineteenth century, Russia boasted a singular economy. While old King Coal reigned over most industrializing states, a newer source of motive power, petroleum, permeated every corner of the Tsar's Empire.[1] In the Caucuses Region, or the mountainous isthmus between the Black and Caspian Seas, forests of derricks churned out more than half the global crude oil supply. On the Volga River and its tributaries, columns of "cistern steamers" ferried clean-burning distillates to everything from bakeries to blast furnaces.[2] And from St. Petersburg to Yekaterinburg, stretches of railroad hummed under iron horses with extra storage tanks on their tenders as well as "spray injectors" in their fireboxes. At a time when the term "fossil fuel" denoted only solid matter, such fluid innovations captivated many who encountered them.[3] One British expatriate, enthralled by the possibilities "liquid fuel" could bring, even declared Russia an "instructor to the engineers of the world."[4] Other observers echoed the sentiment for years.[5]

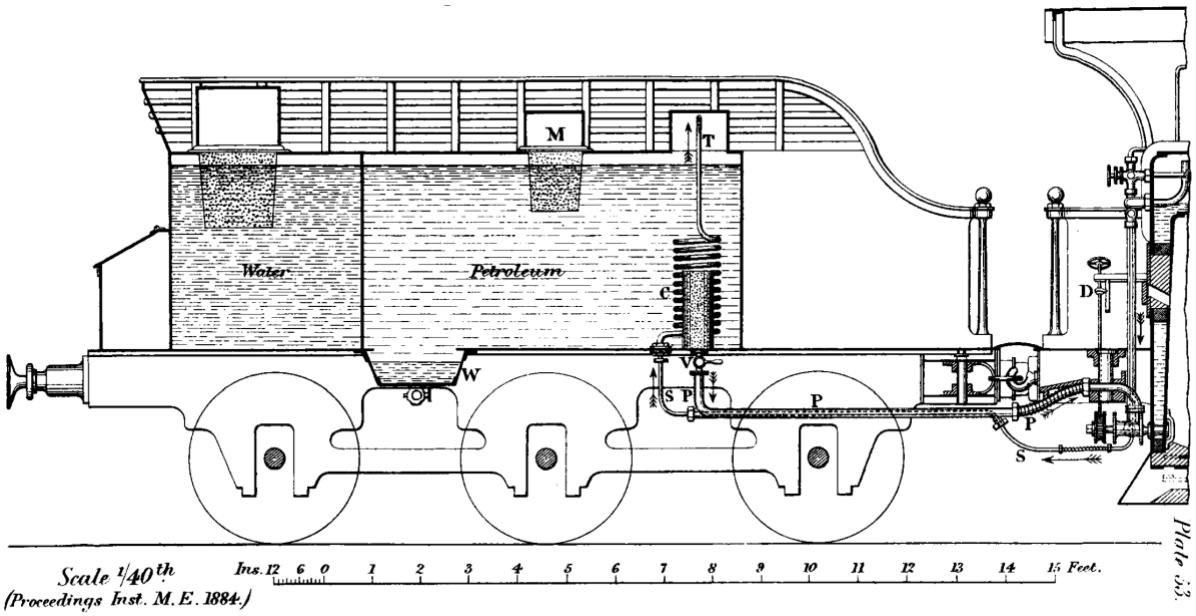


Figure 1: *Goods Locomotive Tender, Longitudinal Section, Grazi-Tsaritsyn Railroad, Russia, 1884*. Source: Thomas Urquhart, "On the Use of Petroleum Refuse as Fuel in Locomotive Engines," *Proc. Inst. Mech. Eng*. 35, no. 1 (August 1884): Fig. 5, https://doi.org/10.1243/PIME_PROC_1884_035_028_02.

[1] A. A. Igolkin, *Otechestvennaia neftianaia promyshlennost v 1917-1920 godakh* (Moscow: Rossiiskii gosudarstvennyi gumanitarnyi universitet, 1999), 17–38.

[2] James Dodds Henry, *Thirty-Five Years of Oil Transport: The Evolution of the Tank Steamer* (London: Bradbury, Agnew, & Co. Ld., 1907), esp. chap. 13.

[3] For the original meaning of the term "fossil fuel," see Charles Edward Groves and William Thorp eds., *Chemical Technology, or Chemistry Applied to Arts and Manufactures, Vol. 1: Fuel* (Philadelphia: P. Blakiston, Son & Co., 1889), 21–23. The Russian equivalent was "mineral fuel" [*mineralnoe toplivo*].

[4] Charles Thomas Marvin, *The Region of Eternal Fire: An Account of a Journey to the Petroleum Region of the Caspian in 1883* (London: W. H. Allen & Co., 1884), 259.

[5] See for example William H. Booth, *Liquid Fuel and Its Combustion* (Westminster: Archibald Constable & Co. Ltd., 1903), chap. 19; A. Beeby Thompson, *The Oil Fields of Russia and the Russian Petroleum Industry* (London: Crosby Lockwood and Son, 1904), chap. 13, and; J. D. Henry, *Oil Fuel and the Empire* (London: Bradbury, Agnew, & Co. Ld., 1908), chap. 1.

Taking Russia's pioneering transition from coal to oil as an analytical point of departure, this FOCUS course offers an intensive foray into the history of human energy use. Thematically, it focuses on energy technologies and pivots around questions of invention. Geographically, it covers the entire inhabited world but concentrates attention on Eurasia and North America. Chronologically, it begins with the domestication of fire some 300,000 years ago; considers the emergence of steam power some 300 years ago; and explores more recent developments, particularly the splitting of the atom.

Although anchored in history, this course engages with a multitude of disciplinary perspectives. The evolutionary anthropology of agriculture, the geology of fossil fuels, and the political economy of electric utility regulation are all covered at introductory levels. In addition, special emphasis is placed on honing the transdisciplinary skills of data visualization, public speaking, and especially teamwork. Thus, the course ultimately serves as a gateway to the study of energy in the very broadest sense.

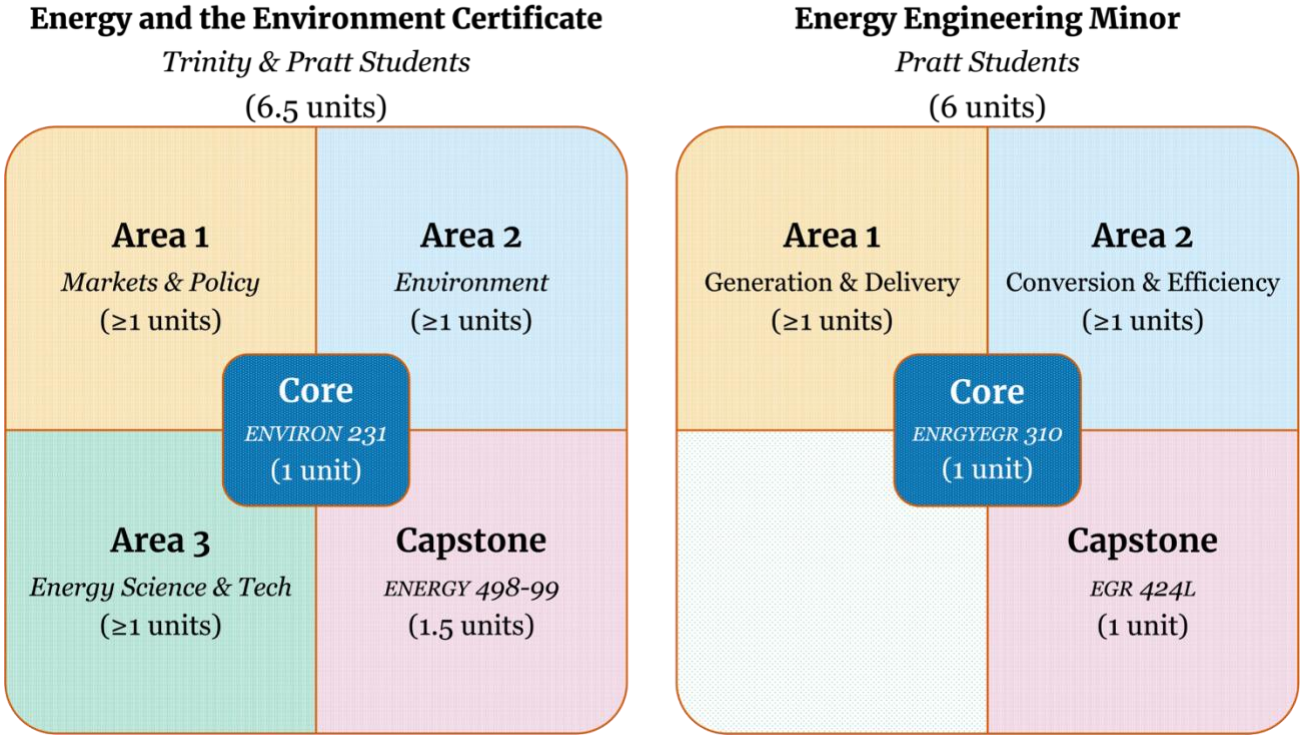


Figure 2: *At Duke, there are two main curricular pathways for the undergraduate study of energy: the Energy and the Environment Certificate (U-ENRENV-C) and the Energy Engineering Minor (U-ENE-MIN). The former is open to students in both Trinity and Pratt, the latter only to students in Pratt.*

1.5. Historical / Institutional Context

In 1905, just as Russia's early oil-fired economy started to falter, James B. Duke expanded an economy of comparable significance right here in the Carolinas. Establishing the Southern Power Company, Duke and his associates dammed portions of the Catawba River to electrify a growing business empire of tobacco warehouses, cotton mills, and furniture factories. The company's goal, as Duke himself declared, was to industrialize the southeastern United States with "white coal," or underutilized hydropower.[6] And from that perspective, the venture initially succeeded in spectacular fashion. By 1912, it boasted a total generating capacity of 84,000 horsepower; and by 1924, a capacity of more than 700,000 horsepower, the largest in the region. Simultaneously, Southern Power even became multinational, leading the construction of Canada's *Ile Maligne* Hydroelectric Station, then the largest in the world.[7]

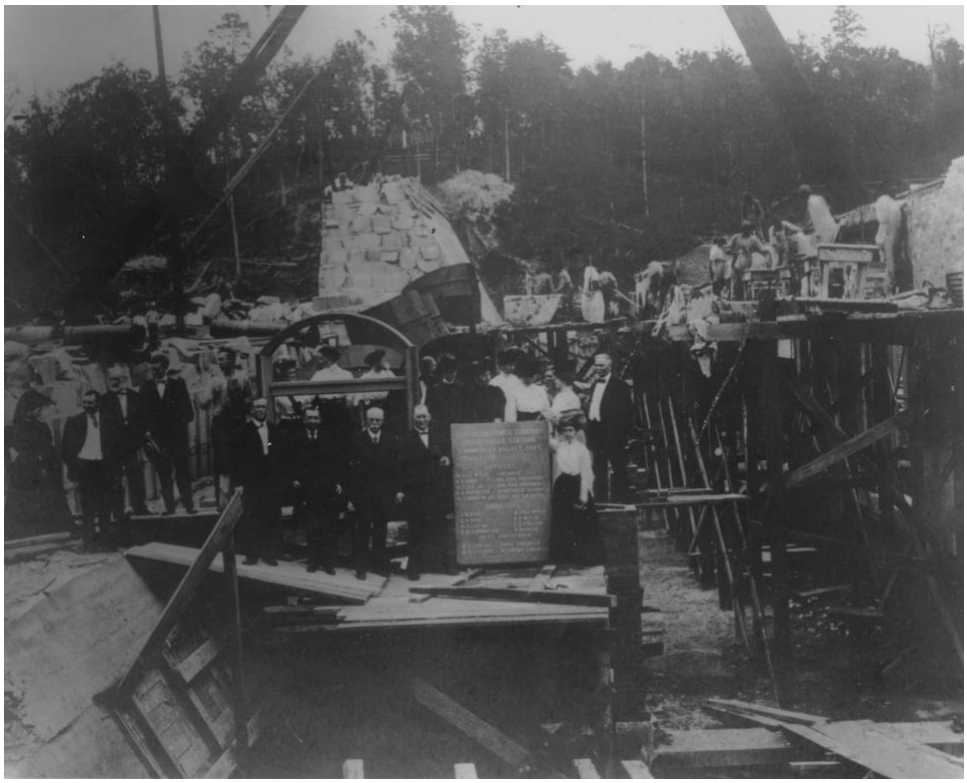


Figure 3: *Directors of the Southern Power Company, Great Falls Station, Catawba River, S.C., 1905*. Source: Rubenstein Library, Doris Duke Photographs, https://idn.duke.edu/ark:/87924/r4028sq54.

The achievements of what one influential sociologist later dubbed "the Piedmont Crescent of Industry" came at a cost, however.[8] Although straightjacketed by dams and artificial reservoirs, North Carolina's rivers receded and overflowed with frustrating irregularity, casting doubts over white coal's potential to fuel the Southeast's modernization. The debate came to a head in 1925 when drought-induced blackouts compelled Southern Power to adopt a new operating

[6] Christopher J. Manganiello, *Southern Water, Southern Power: How the Politics of Cheap Energy and Water Scarcity Shaped a Region* (Chapel Hill, N.C.: University of North Carolina Press, 2015), 47–49.

[7] David Massell, *Amassing Power: J. B. Duke and the Saguenay River, 1897-1927* (Montreal: McGill-Queen's University Press, 2000), 57.

[8] Rupert B. Vance, *Human Geography of the South: A Study in Regional Resources and Human Adequacy* (Chapel Hill, N.C.: University of North Carolina Press, 1932), esp. chap. 12.

strategy. For the next seventy years, the company and its successors, including Duke Energy Corporation, built a fleet of thermal power plants along the very same reservoirs originally engineered for hydroelectric generation.[9] Ironically, the shift led James Duke's brainchild to become synonymous with ordinary black coal. In 1976, director Barbara Kopple released *Harlan County, USA*, a documentary about a grueling coal miners' strike against the company's subsidiaries in Kentucky.[10] The film later won an Academy Award.

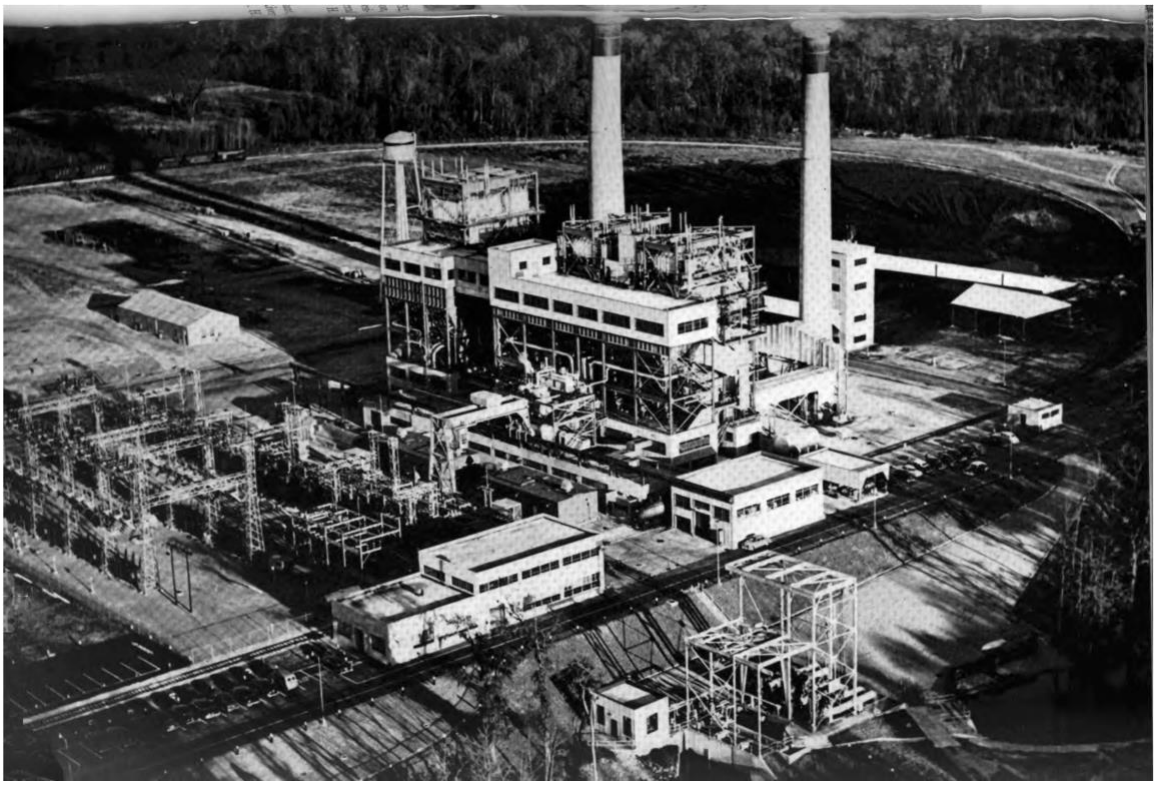


Figure 4: *Aerial View of W.H. Weatherspoon Steam-Electric Generating Plant, Lumber River, N.C., 1958*. Source: J. Riley, *Carolina Power & Light Company*, (Raleigh: Edwards & Broughton Co., 1959), 232–33ff, https://hdl.handle.net/2027/nyp.33433038457267.

As participants in this seminar, we have a special responsibility to learn from Duke's own energy history, one in which James B. Duke played but a part. Yet what does that responsibility entail, exactly, and what should we do about it? Working together, we will devote considerable time throughout the term to exploring these questions and debating our conclusions. Driven by a common desire to secure a sustainable energy future, we will strive to become better citizens of our campus, our communities, and our shared planet.

[9] Christopher J. Manganiello, "Hitching the New South to 'White Coal': Water and Power, 1890–1933," *The Journal of Southern History* 78, no. 2 (2012): 255–92.

[10] Eliot Marshall, "Bloody Harlan Revisited," *New Republic* 170, no. 23 (June 8, 1974): 14–16.

2. LOGISTICS

2.1. Instructor

You are warmly invited to call the instructor by his first name, Tom. An historian of business, energy, and the environment, Tom earned his Ph.D. in 2020 from Duke's own Department of History. He enjoys interacting with students and encourages you to engage him with questions about life at Duke, the FOCUS Program, as well as Energy Studies broadly.



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2.2. Meeting Times & Locations

This course meets in Gross Hall for seventy-five minutes twice per week, the first time on Tuesday, the second time on Thursday. Outside of class time, Tom holds drop-in office hours, also in Gross Hall, on Monday afternoons. In addition, he encourages you to arrange one-on-one consultations with him to address any questions or concerns.

#	Event Type	Day	Time	Location
1	*Office Hours*	*Monday*	*1:00-3:00pm*	*Gross Hall 102R*
2	*Seminar*	*Tuesday*	*1:25-2:40pm*	*Gross Hall 100C*
3	*Seminar*	*Thursday*	*1:25-2:40pm*	*Gross Hall 100C*

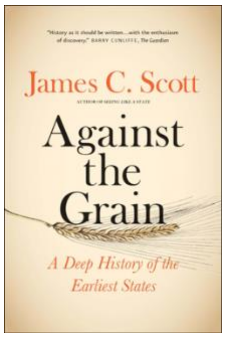
2.3. Learning Management System

CANVAS BY INSTRUCTURE

In this course, you will use the Canvas Learning Management System to submit your written work, review slide decks, and engage multimedia content, among several other tasks. At the start of the term, be sure to familiarize yourself with the course site and its tools. To access it, follow this hyperlink: https://canvas.duke.edu/courses/84563. Should you have any questions about Canvas, be sure to connect with Tom as soon as possible.

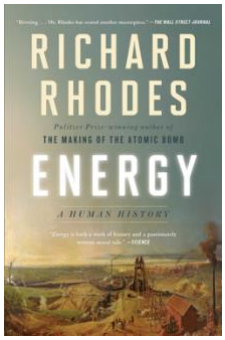
2.4. Textbooks & Materials

To help guide our inquiry, we will use two textbooks. Because electronic devices are generally prohibited in this course, you must acquire paper copies of both (See Section below.) You may find them in several places, including popular online marketplaces and independent retailers like The Regulator on Ninth Street (https://www.regulatorbookshop.com/). Copies are also held on reserve at the Perkins Library's Circulation Desk (https://library.duke.edu/course-support/course-reserves). Should you experience any difficulty acquiring these materials, be sure to contact Tom as soon as possible.



James C. Scott, *Against the Grain: A Deep History of the Earliest States* (Yale University Press, 2017)

A staple of political science and anthropology courses, Scott's *Against the Grain* offers a thought-provoking reinterpretation of the origins of human civilization as we know it. Although not a history of energy per se, the book nevertheless addresses key energy-related questions of the deep past such as why ancient humans adopted fixed-field agriculture. Thus, it will guide our discussions during the first third of the term.



Richard Rhodes, *Energy: A Human History* (Simon & Schuster, 2018)

Rhodes' *Energy* retraces major energy transitions from premodern times to the present through the lens of science and technology. The book's short chapters and broad scope make it ideal for a survey course like this one. We will use it as our main text, parsing Rhodes' narrative individually as well as collectively during the last two-thirds of the term. If you like it, great. If not, even better! Our class discussions will be all the livelier.

2.5. Academic & Wellness Resources

Effortless perfection is a myth. The reality is that learning at the college level pushes us to our intellectual, emotional, and physical limits, even when everything else in life is going well. To navigate these challenges, you are encouraged to explore the many academic and wellness resources Duke provides, including those listed below. After interacting with these places, students often emerge feeling more relaxed, better prepared, and wishing only that they had gone sooner.



Academic Resource Center (ARC): Offers free academic support services like peer tutoring to any Duke undergraduate student, in any year, studying in any discipline. Helpful resources include a real-time map of campus study spaces. For more information, and to schedule a consultation, check out ARC's website: https://arc.duke.edu/.



Writing & Communications Center: Facilitates critical and creative writing through collaborative workshops, writing groups, and events. Free non-evaluative consultations with specialized writing consultants offered in person and online. For more information, and to schedule a consultation, see the Center's website: https://wrp.duke.edu/wcc.



Center for Data & Visualization Sciences: Staffed by consultants who can help with a variety of data projects and related computing problems. Consultations in the Brandaleone Lab, on the first floor of Bostock Library, are available during walk-in hours as well as by appointment. Workshops on programming languages offered regularly. See https://library.duke.edu/data.



DukeReach: Provides comprehensive outreach services to students experiencing difficulties related mental health, physical well-being, social adjustment, post-hospitalization, and coordination of care. Encourages reports of non-emergency concerns from students, faculty, and staff. For information, see https://students.duke.edu/wellness/dukereach/.



Counseling & Psychological Services (CAPS): A short-term care clinic that provides individual and group counseling, including couples counseling, as well as a wide range of skill-building workshops and assistance with referrals for more specialized services. Located on the third floor of the Student Wellness Center next to Penn Pavilion. For information, see https://students.duke.edu/wellness/caps/.

3. PEDAGOGY

3.1. Learning Objectives

This course adopts a pedagogical framework known as Bloom's Taxonomy. Formulated in 1956 and revised in 2001, Bloom's Taxonomy has provided generations of college instructors with an effective roadmap for guiding students' work with knowledge. It comprises six main categories of educational goals lying along a continuum from simple to complex. The act of Remembering represents the simplest type of cognitive process, the act of Creating the most complex.[11] In addition, this course adds a seventh category, the act of Collaborating, an even more demanding core competence essential to success in any job, career, and major undertaking.

#	Category	Description
1	*Remembering*	*Recall some of the major themes, questions, and research agendas of the interdisciplinary field of Energy Studies.*
2	*Understanding*	*Describe anthropogenic (human-made) energy systems in terms of their three basic properties: natural energy sources, their conversions, and specific uses of energy flows.*
3	*Applying*	*Chart the dynamics of local, national, as well as global energy system transitions in terms of the use and substitution of primary energy sources.*
4	*Analyzing*	*Explain global energy system transitions as recursive (non-linear) developments citing examples of technological hybridization, rebound effects, and last-gasp effects.*
5	*Evaluating*	*Assess real-world applications of energy transition research that reveals patterns, dynamics, and drivers of past changeovers in energy systems.*
6	*Creating*	*Compose elements of a multipart historical research project on a salient question of human energy use and power generation.*
7	*Collaborating*	*Work together with a small group of classmates to plan, prepare, and present the same research project above.*

[11] Lorin W. Anderson, ed. et al, *A Taxonomy for Learning Teaching and Assessing: A Revision of Bloom's Taxonomy of Educational Objectives* (New York: Longman, 2001). See also Patricia Armstrong, "Bloom's Taxonomy," Vanderbilt University Center for Teaching, retrieved November 9, 2022, https://cft.vanderbilt.edu/guides-sub-pages/blooms-taxonomy/.

3.2. Teaching Philosophy

To help you achieve the learning objectives above, this course is taught according to three principles derived from academic training, classroom experience, and continuous reading in the field of college teaching. Students interested in learning more about these principles should refer to the sources in the footnotes. Moreover, you are warmly encouraged to consult with Tom, who is always eager to discuss ideas about teaching with students.

Principle 1: *Historians are information processors par excellence.* Although partial to the written word, historians weave together narratives using broad arrays of materials. Statistics, photographs, maps, engineering schematics, art – all have proven indispensable to richly textured studies of the past. This ability to synthesize vast and varied sources in compelling ways, Tom argues, sets historians apart from other scholars.[12] When finely honed, it empowers practitioners to tackle major societal problems better than even the most advanced artificial intelligence – to become, in short, robot-proof.[13] Thus, this course leverages a kaleidoscope of sources to help you cultivate a creative mindset that no smart machine can ever match.

Principle 2: *Studying history requires getting our hands dirty (literally).* The past is not just an abstraction. It persists in the material world around us – on our campus, in our homes, and even throughout the ground beneath our feet. Learning the history of energy, then, means engaging not only a variety of artefacts but also a variety of human senses, especially touch. To that end, several lessons in this course include hands-on components aimed at placing you in physical contact with things like fire, steam, coal, slag, and oil – messy substances one and all. Regardless, these exercises, when properly carried out, are eminently safe and designed to show you an academic discipline that is as much tactile as textual.

Principle 3: *Collective efforts yield impactful scholarship.* Popular histories often emphasize heroic achievements, or the work of exceptional individuals. We know, for example, that Darwin alone wrote *On the Origin of Species* (1859); that Einstein single-handedly revolutionized theoretical physics; that Carson all but launched the environmental movement on her own. Yet careful investigations of the past just as often reveal the prosaic realities behind such stylized narratives. In truth, the great majority of history's movers and shakers benefited from the support of others less known to us. Moreover, the most lasting achievements, including the advancement of entire industries, generally prove impossible to trace to any one person.[14] Much of this course, therefore, is dedicated to leveraging the power of teamwork.

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[12] Anthony Grafton, *The Footnote: A Curious History* (Cambridge, Mass.: Harvard University Press, 1999).

[13] Joseph E. Aoun, *Robot-Proof: Higher Education in the Age of Artificial Intelligence* (Cambridge, Mass.: The MIT Press, 2017).

[14] Robert C. Allen, "Collective Invention," *Journal of Economic Behavior & Organization* 4, no. 1 (March 1, 1983): 1–24, https://doi.org/10.1016/0167-2681(83)90023-9.

3.3. A Typical Class

Even on good days, most of us command only short attention spans. To stay focused on the course's learning objectives, then, we will divide almost every seminar into a series of short activities. The table below provides an example of an agenda for a typical class. But note that the order of activities will vary from class to class; and that several classes will include unstructured time for research.

#	Activity	Description	Time
1	*Warm Up*	*A puzzle designed to redirect your thoughts back to the assigned readings.*	*10 min*
2	*Conversation Piece*	*A student-led discussion about the assigned readings and related topics of interest.*	*25 min*
3	*Practicum*	*A hands-on lesson about a particular energy technology or a small-group research exercise.*	*15 min*
4	*Explainer*	*A brief lecture from Tom about the day's key concept that ties together the above.*	*15 min*
5	*Cool Down*	*An overview of upcoming assignments plus some extra time for clarifying questions*	*10 min*

3.4. Classroom Environment

At all times, we will strive to maintain a classroom that is at once inclusive and intellectual.

3.5. A Note about Grading

If you make a good-faith effort to complete assignments on time, show up in class, and communicate with me proactively, then I will do everything in my power to help you earn your desired grade in the course. I cannot guarantee anyone a top or even a high mark. But I can guarantee everyone that I will meet them halfway. I make that guarantee to you here and now.



Tom J. Cinq-Mars, Ph.D.
August 25, 2026

Letter	Percent
A+	*97-100*
A	*93-96*
A-	*90-92*
B+	*87-89*
B	*83-86*
B-	*80-82*
C+	*77-79*
C	*73-76*
C-	*70-72*
D+	*67-69*
D	*65-66*

4. ACCOUNTABILITY

4.1. Core Policies

This course follows a set of policies designed to support academic integrity, fairness, and a productive learning environment for everyone. Please review the guidelines below regarding coursework deadlines, attendance, accommodations, and classroom conduct, including expectations around electronics, AI tools, and recording. Most policies allow for flexibility in cases of genuine need, but this generally requires reaching out to Tom in advance. If you have any questions about how these policies apply to your situation, don't hesitate to ask.



Academic Integrity: While completing this course, you are expected to uphold the Duke Community Standard. The Registrar's annual bulletin entitled *The Duke Community Standard in Practice* explains what this means in detail. Likewise, many students find the Duke Libraries' resources on avoiding plagiarism to be helpful: https://library.duke.edu/research/plagiarism.



Late Work: With the exception of bluebook tests, all written work must be submitted before class time on the appointed date. Should you need extra time to complete any assignment, contact Tom in advance of the due date or as soon as possible. Without Tom's written approval, late submissions will result in a reduction of five points per day late.



Attendance: You are expected to attend and participate in every class. Excessive tardiness, or arriving to class more than 10 minutes late, will count as an absence. In the event of a short-term medical issue or instance of distress, you should consult with Tom at your earliest convenience and submit an Incapacitation Form: https://class-absences.trinity.duke.edu/if/.



Accommodations: Since all students have the right to have certain accommodations met, you are encouraged to notify Tom about any needs as soon as possible. In addition, you are strongly encouraged to consult Duke's Disability Management System. For helpful information on Duke's accommodations policies, see https:// access.duke.edu/requests.



Electronics: "The pen," a pair of psychologists once declared, "is mightier than the keyboard."[15] In other words, taking notes by hand generally improves how students encode and recall material. Therefore, you will swap your laptops, tablets, etc. for pens and paper notebooks in most (but not all!) classes. Exceptions will be happily granted for any student needing accommodations.

[15] Pam A. Mueller and Daniel M. Oppenheimer, "The Pen Is Mightier Than the Keyboard: Advantages of Longhand Over Laptop Note Taking," *Psychological Science* 25, no. 6 (June 1, 2014): 1159–68, https://doi.org/10.1177/0956797614524581. True, experts have debated Mueller and Oppenheimer's conclusions. See Kayla Morehead et al., "How Much Mightier Is the Pen than the Keyboard for Note-Taking?," *Educational Psychology Review* 31, no. 3 (September 2019): 753–80, https://doi.org/10.1007/s10648-019-09468-2. Yet the consensus in favor of longhand notes remains strong. See Linlin Luo et al., "Laptop Versus



Artificial Intelligence: Students are allowed to use advanced automated tools (artificial intelligence or machine learning tools like ChatGPT) on assignments in this course if instructor permission is given in advance. Unless given permission to use those tools, you are expected to complete each assignment without substantive assistance from automated tools.



Video Recording: No student may video record any classroom activities—including lectures, discussions, presentations, or any other portion of class—without Tom's express written consent obtained in advance. This applies regardless of the device or platform used. Students who record without authorization may be subject to disciplinary action.



Figure 5: Grizzled veterans of this course in December 2023 pose in front of a portrait of Richard Trevithick. They exhort you to take this course seriously and to do your able best.

Longhand Note Taking: Effects on Lecture Notes and Achievement," *Instructional Science* 46, no. 6 (December 1, 2018): 947–71, https://doi.org/10.1007/s11251-018-9458-0.

4.2. Assignments & Grade Weights

To prepare for most classes, you will take brief notes in longhand – that is, with pen and paper – on readings totaling about 40 pages in length, sometimes more, sometimes less. Most readings will be primary sources. After about four such classes, you will compose a short essay on a broader topic in preparation for a wide-ranging discussion with Tom and your classmates. You will also complete an open-ended or "bluebook" test, which will serve as a capstone to a thematic unit or module. Altogether, the course consists of three such modules. Thus, by the end of the term, you will have assembled a portfolio of twelve sets of longhand notes, three essays, and three tests – all on your own. This independent portfolio assignment is designed to help you retain the course's most critical knowledge over the long term.

In addition, you will complete two collaborative assignments. The first is a research project proposal. Working with several classmates, you will lead a class discussion, compose a prospectus, and then "pitch" a project idea to your classmates in a lightening talk. The project pitch will provide the basis of the second collaborative assignment: an historical research project. Working with a larger team, you will prepare a brief report (backgrounder), build a slide deck, and then deliver a more formal oral presentation before a panel of external experts. Both assignments are designed to help you hone your research skills and explore emerging interests under minimal supervision.

The table below breaks down each assignment by work mode, deliverables, their occurrences, and grade weights. The next section shows how they unfold over time.

#	Title	Work Mode	Deliverable	Occs.	Weight
1	*Portfolio*	*Individual*	*Longhand Notes (4x)*	*3*	*5%*
			Mini Essay	*3*	*5%*
			Bluebook Test	*3*	*6%*
2	*Project Proposal*	*Collaborative (Short Term)*	*Conversation Piece*	*1*	*5%*
			Prospectus	*1*	*6%*
			Pitch	*1*	*7%*
3	*Issue Brief*	*Collaborative (Long Term)*	*Rough Backgrounder*	*1*	*6%*
			Rough Slide Deck	*1*	*6%*
			Polished Backgrounder	*1*	*7%*
			Polished Slide Deck	*1*	*7%*
			Presentation	*1*	*8%*

4.3. Extra Credit Opportunities

In addition to the assignments above, you will have several opportunities throughout the term to earn extra credit, all of which require some form of collaboration with your classmates. This extra credit will take the form of points, or fractions thereof, added to your final course grade. Details will be provided in separate assignment guides.

Nicholas Institute-Sponsored Events: *Various times throughout the term.* With a classmate, attend an eligible in-person event sponsored or co-sponsored by Duke's Nicholas Institute for Energy, Environment & Sustainability. Note that FOCUS Interdisciplinary Discussion Courses (IDC) will not be considered eligible events (https://focus.duke.edu/for-faculty/idc). For an up-to-date list of events, see the Nicholas Institute's website: https://nicholasinstitute.duke.edu/events. Limit two events per student per term.

Research Symposium: *Tuesday, December 1.* During the penultimate class, work with your team to deliver the most compelling historical research project presentations as determined by a panel of outside experts. The team selected as the winner will earn not only extra credit, but also eternal glory. Former winners have gone on to become Duke Climate Pathfinders, employees at top management consulting firms, and lowly Duke graduate students.

Course Evaluation: *Thursday, December 3.* This is one is a gimme. If at the end of the term the class as a whole achieves at least a 93 percent response rate on its official Trinity College of Arts & Sciences course evaluation, then everyone will receive no less than an additional quarter point on their final course grades. In practice, this generally all but one of you must submit a completed evaluation. This is all or nothing.

4.4. Course Design

Like any good story, this course has a beginning, a middle, and an end. The beginning spans the term's first week and introduces not only the course content but also Energy Studies as a broader academic discipline, including its key questions, debates, and research methods. The middle includes three parts or modules all its own, each based on a distinct historical period as well as overarching themes. Each module lasts about four weeks and culminates in a bluebook test. The modules themselves culminate in the course's end: a formal research symposium followed by a far less formal debrief, both slated for the last week of classes. Taken together, these three parts structure our long-term learning while varying our short-term practices. In practice, this means you will always be busy, but never bored.

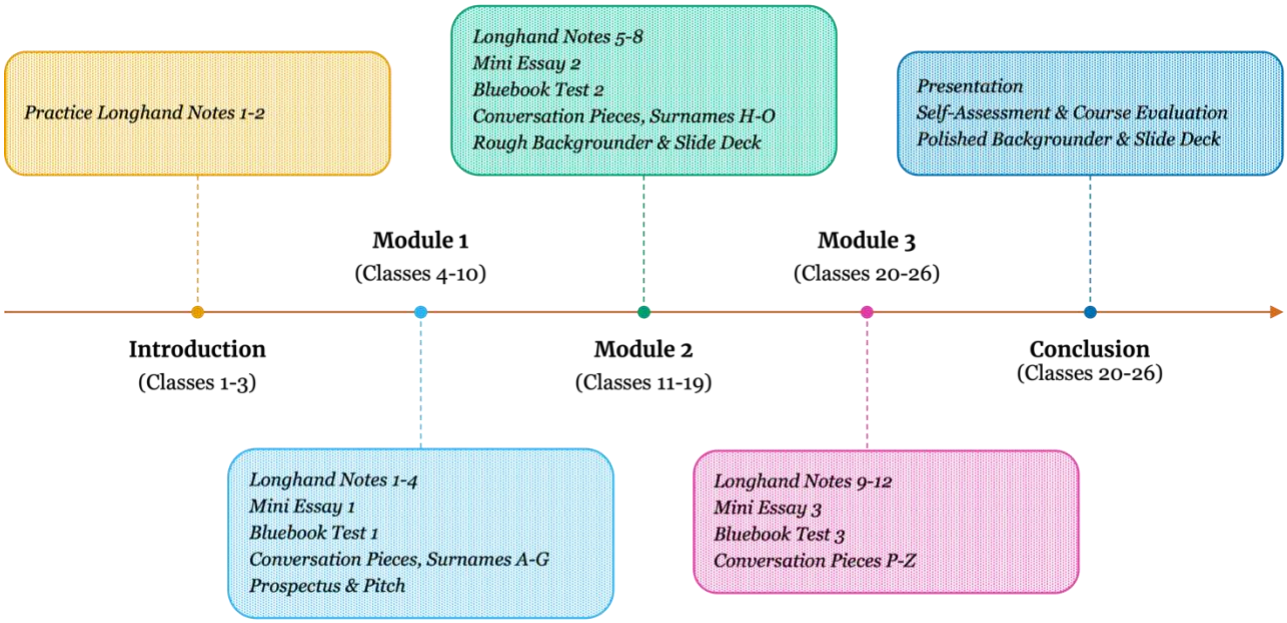


Figure 6: Course timeline showing the progression from Introduction (Classes 1–3) through Modules 1–3 (Classes 4–26) to the Conclusion, with associated assignments and milestones—including Longhand Notes, Mini Essays, Bluebook Tests, Conversation Pieces, and the culminating research symposium deliverables—listed beneath each phase.

4.5. Keywords

In this course, most lessons will boil down to a single core concept or keyword. Drawn from disciplines ranging from evolutionary anthropology to engineering, these keywords have rich histories all their own that map closely onto the overarching narratives we will encounter in our textbooks and primary sources. Thus, the keywords provide a useful means of focusing our reading and class discussions. Practically speaking, they also serve as the subjects of our three bluebook tests.

For detailed discussions of several the keywords below, see Nuno Luis Madureira, *Key Concepts in Energy* (Springer International 2014), https://link.springer.com/book/10.1007/978-3-319-04978-6.

#	Module 1	Module 2	Module 3
1	*Fire*	*Subsistence*	*Marginal Cost Pricing*
2	*Domestication*	*Primary / Useful Energy*	*Last-Gasp Effect*
3	*Sedentism*	*Rebound Effect*	*Oil Reserves / Peak Oil*
4	*Mechanics*	*Candela / Candlepower*	*Energy Intensity*
5	*Slavery*	*Technological Hybridization*	*Levelized Electricity Costs*

5. SCHEDULE

Course Schedule Disclaimer

The course schedule outlined in this syllabus is subject to change at the instructor's discretion. While every effort will be made to keep this document current, the most up-to-date version of the course schedule will always be posted on the Canvas course site. Students are responsible for checking Canvas regularly for any updates, revisions, or announcements regarding readings, assignments, due dates, or exam dates. In the event of a discrepancy between this printed/PDF syllabus and the Canvas schedule, the Canvas version takes precedence.

Introduction: "The Only Universal Currency"[16]

Week 1: A Deceptively Simple Story

Class 1: Energy and the E-Curve of History

Tuesday, August 25

An overview of the course and, by way of teaching demonstration, a short lesson on late Tsarist Russia's pioneering oil industry.

1. Kolomenskii mashinostroitelnyi zavod [Kolomna Locomotive Works] and K. Pentkovskii, draftsman, "Passazhirskii parovoz o 5-ti ociakh sistemy 'Kompaund'" ["Passenger Locomotive on Five Axles, 'Compound' System"], diagram, 1:10, in *Albom chertezhei podvizhnogo sostava zheleznykh dorog eksponirovannago na Vserossiiskoi vystavke v Nizhnom-Novgorode v 1896 g*. [Albums of Drawings of Railroad Vehicles Shown at the Pan-Russian Exhibition in Nizhnii Novgorod in 1896], vol. 1 (St. Petersburg: s.n., 1896), Plate 8, Russian State Library, Moscow (hereafter RSL), https://search.rsl.ru/ru/record/01003946491. [Canvas]
2. R. Meltser, architect, "Pavilon T-va Bratev Nobel" ["Pavilion of the Nobel Brothers Petroleum Production Company"], blueprint, 1:200, in *Proekty kazzennykh zdanii i chastnykh pavilonov: Vserossiiskaia promyshlennaia i khudozhestvennaia vystavka v Nizhnem-Novgorode, 1893-1896* [Blueprints of State Buildings and Private Pavilions: Pan-Russian Industry and Arts Exhibition in Nizhnii Novogorod, 1893-1896] (St. Petersburg: N. Dobroumov and G. de Kelsh, 1897), Plate 68, RSL, https://search.rsl.ru/ru/record/01005116542. [Canvas]

Deliverable due

None

[16] See Vaclav Smil, *Energies: An Illustrated Guide to the Biosphere and Civilization* (The MIT Press, 1999), x.

Class 2: The Source Substitution Model

Thursday, August 27

A lesson on the basic properties of energy systems and some universal patterns in energy system transitions.

1. Luis de Sousa, "Marchetti's Curves," *The Oil Drum: Europe* (blog), July 10, 2007, http://theoildrum.com/node/2746.
2. Cesare Marchetti and Nebojsa Nakicenovic, "The Dynamics of Energy Systems and the Logistic Substitution Model," RR-79-013, (International Institute for Applied Systems Analysis, December 1979), 1–21, IIASA, https://pure.iiasa.ac.at/id/eprint/1024//.

Deliverable Due

Practice Longhand Notes 1

Week 2: Technology as Solution and Problem

Class 3: The Question of Invention

Tuesday, September 1

A team-based discussion of the principal ways in which social scientists have studied and theorized the creation of new things.

Surnames A–G

1. Thomas P. Hughes, "Edison the Hedgehog: Invention and Development," chap. 2 in *Networks of Power: Electrification in Western Society, 1880-1930* (Johns Hopkins University Press, 1993), 18–46, ACLS, https://hdl.handle.net/2027/heb.00001.
2. Thomas A. Edison, "The Phonograph and Its Future," *North American Review* 126, no. 262 (May-June 1878): 527–36, Internet Archive (hereafter IA), https://archive.org/details/sim_north-american-review_may-june-1878_126_262.

Surnames H–O

3. Robert C. Allen, "Collective Invention," *Journal of Economic Behavior & Organization* 4, no. 1 (March 1, 1983): 1–24, https://doi.org/10.1016/0167-2681(83)90023-9.
4. Charles Cochrane, "Description of a Method of Taking Off the Waste Gases from Blast Furnaces," *Proceedings of the Institution of Mechanical Engineers* 6 (1860), 121–26, Plates 24–26, HathiTrust Digital Library, https://hdl.handle.net/2027/uva.x002222901.

Surnames P–Z

5. Wiebe E. Bijker, "The Social Construction of Bakelite: Toward a Theory of Invention," in *The Social Construction of Technological Systems: New Directions in the Sociology and History of Technology*, ed. Thomas P. Hughes et al., Anniversary ed. (The MIT Press, 2012), 156–82, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=3339458.
6. Bakelite Corporation, *Bakelite Molded*, 7th ed. (New York, 1936), 1–17, IA, https://archive.org/details/BakeliteCorpCCA46942.

Deliverable Due

Practice Longhand Notes 2

Module 1: The Descent of *Homo ignis*[17]

Class 4: "The First Great Force"[18]

Thursday, September 3

A lesson about humankind's efforts to tame and understand fire from the Paleolithic through the Premodern Era. Our keyword is **FIRE.**

1. James C. Scott, "The Domestication of Fire, Plants, Animals, and… Us," chap. 1 in *Against the Grain: A Deep History of the Earliest States* (Yale University Press, 2017), 37–67, https://doi.org/10.12987/9780300231687-004.
2. John Evelyn, "The Mystery of Charking," in *Sylva: Or, A Discourse of Forest-Trees, and the Propagation of Timber in His Majesties Dominions* (London: Jo. Martyn and Ja. Allestry, 1664), 100–103, Biodiversity Heritage Library (hereafter BHL), https://www.biodiversitylibrary.org/bibliography/33688.
3. Robert Hooke, "Observation 16: Of Charcoal, or Burnt Vegetables," in *Micrographia: Or, Some Physiological Descriptions of Minute Bodies Made by Magnifying Glasses, With Observations and Inquires Thereupon* (London: Jo. Martyn and Ja. Allestry, 1665), 100–106, National Library of Medicine, Bethesda, MA (hereafter NLM), http://resource.nlm.nih.gov/2366075R.

Deliverable due

Longhand Notes 1

Week 3: Powering the Neolithic Revolution

Class 5: Fire, Culture, and the Civilizing Process

Tuesday, September 8

A deep dive into humanity's transition from hunter-gatherer to settlement lifeways. Our keyword is **DOMESTICATION.**

1. Scott, "Landscaping the World: The Domus Complex," chap. 2 in *Against the Grain* (2017), 68–92, https://doi.org/10.12987/9780300231687-005.
2. John Worlidge, "An Explanation of the Frontispiece," in *Systema Agriculturæ: The Mystery of Husbandry Discovered*, 2nd ed. (London: Tho. Dring, 1675), British Library, London (hereafter BL). http://explore.bl.uk/BLVU1:LSCOP-ALL:BLL01018388648.
3. Worlidge, "The Best Way of Feeding Sheep, &c," *London Magazine* (April 1747), 174–75, IA, https://archive.org/details/s1id11854980.

Deliverable Due

Longhand Notes 2

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[17] The term "*Homo ignis*" denotes the concept that hominids became Human through fire. See Thom van Dooren, *The Wake of Crows: Living and Dying in Shared Worlds* (New York: Columbia University Press, 2019), 133, https://doi.org/10.7312/van-18282-009. See also Nigel Clark and Kathryn Yusoff, "Combustion and Society: A Fire-Centred History of Energy Use," *Theory, Culture & Society* 31, no. 5 (September 1, 2014): 203–26, https://doi.org/10.1177/0263276414536929.

[18] Omer C. Stewart, "Fire as the First Great Force Employed by Man," in *Man's Role in Changing the Face of the Earth*, ed. W. L. Thomas (Chicago: Chicago University Press, 1956), 115 –33. See also Michael Williams, *Deforesting the Earth: From Prehistory to Global Crisis, An Abridgment* (Chicago: University of Chicago Press, 2006), 13.

Class 6: The First Multispecies Encampments

Thursday, September 10

A close look at the history of animal husbandry followed by some unstructured time to work on project proposals. Our keyword is **SEDENTISM**.

1. Scott, "Zoonoses: A Perfect Epidemiological Storm," chap. 3 in *Against the Grain* (2017), 93–115, https://doi.org/10.12987/9780300231687-006.
2. Gervase Markham, "The Minde or Meaning of the Fontispeece," in *Markhams Maister-Peece: Containing All Knowledge Belonging to the Smith, Farrier, or Horse-Leech, Touching the Curing of All Diseases in Horses*, 8th ed. (London: W. Wilson, 1656), BHL, https://www.biodiversitylibrary.org/bibliography/151748.
3. Jacques de Solleysel, "Of the Diseases of Horses, and Their Remedies," chap. 1 in *The Compleat Horseman*, vol. 2, trans. William Hope (London: M. Gillyflower et al, 1696), 1–5, NLM, http://resource.nlm.nih.gov/2416067RX2.

Recommended

4. Wayne C. Booth et al., "From Topics to Questions," chap. 1 in *The Craft of Research*, 5th ed. (University of Chicago Press, 2016), 21–24, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=31597372.
5. Chris Foulds et al., "An Agenda for Future Social Sciences and Humanities Research on Energy Efficiency…" *Humanities and Social Sciences Communications* 9, no. 1 (June 30, 2022): 1–18, https://doi.org/10.1057/s41599-022-01243-z.

Deliverable Due

Longhand Notes 3

Week 4: Weight, Power, and the Ancient Machine

Class 7: The Enduring Link between Grain and Machine

Tuesday, September 15

A team-based discussion about some of the earliest uses of wind and waterpower. Our keyword is **MECHANICS**.

1. Scott, "Agro-ecology of the Early State," chap. 4 in *Against the Grain* (2017), 116–49, https://doi.org/10.12987/9780300231687-007.
2. Thomas Ellicott, preface to *The Practical Mill-Wright*, part 5 in *The Young Mill-Wright & Miller's Guide: In Five Parts – Embellished with Twenty-Five Plates*, by Oliver Evans (Philadelphia: printed by the author, 1795), v–x, Plate X, IA, https://archive.org/details/youngmillwrightm00evan.
3. Oliver Evans, "Oliver Evans' Patents," *Archives of Useful Knowledge* 2, no. 4 (April 1812): 369–79, IA, https://archive.org/details/sim_archives-of-useful-knowledge_1812-04_2_4.

Deliverable Due

Longhand Notes 4

Class 8: State Projects to Fashion Human Tools

Thursday, September 17

A class-wide debate over the role of unfree labor in the development of human civilizations. Our keyword is **SLAVERY**.

1. Scott, "Population Control: Bondage and War," chap. 5 in *Against the Grain* (2017), 150–82, https://doi.org/10.12987/9780300231687-008.
2. Marin Carburi de Ceffalonie and Rémi Henri Joseph Delvaux, *Monument élevé à la gloire de Pierre le Grand* [*Monument Erected to the Glory of Peter the Great*] (Paris: Nyon aîné and Stoupe, 1777), Plates 1–12, Bibliothèque nationale de France, Paris, https://gallica.bnf.fr/ark:/12148/bpt6k10411673.
3. "The Monument of Peter the Great," *The Philadelphia Magazine and Review; Or Monthly Repository of Information and Amusement* 1, no. 2 (February 1799): 64–67, IA, https://archive.org/details/sim_philadelphia-magazine-and-review-or-monthly-repository_1799-02_1_2.

Deliverable Due

Mini Essay 1

Week 5: Grappling with New Civilizational Narratives

Class 9: The Power of Memory as a Learning Tool

Tuesday, September 22

A summative assessment based on the keywords in Module 1 (see Section 4.5. Keywords above).

Recommended

1. Peter C. Brown, "To Learn, Retrieve," chap. 2 in *Make It Stick: The Science of Successful Learning* (Harvard University Press, 2014), 23–45, https://doi.org/10.4159/9780674419377-002.
2. Michael Chen, "The Best Test Prep Structure," filmed August 2020 for the Learning Strategies Center, Cornell University, Ithaca, NY, MP4 video, 4:00, YouTube, https://youtu.be/mKJ9TBObYrw.
3. Duke Academic Resource Center (ARC), "Memory & Review," May 30, 2017, https://arc.duke.edu/memory-review#principles.

Deliverable Due

Bluebook Test 1 (complete in class)

Class 10: An Exercise in Academic Persuasion

Thursday, September 24

A chance to show off your intellectual creativity and public speaking skills before the class.

Recommended

1. Chris Anderson, "How to Give a Killer Presentation," *Harvard Business Review* 91, no. 6 (June 2013): 121–25, https://hbr.org/2013/06/how-to-give-a-killer-presentation.
2. David Epstein, "How to Give a Killer Speech," April 20, 2021, in How To!, produced by Derek John, Rachael Allen, and Rosemary Belson, podcast, MP3 audio, 32:31, https://slate.com/podcasts/how-to/2021/04/how-to-give-a-killer-speech.

Deliverable Due

Prospectus and Pitch (deliver in class)

Module 2: The Escape from Malthusian Traps

Week 6: Key Shifts from Organic to Fossil Energies

Class 11: The Origins and Diffusion of Coal Extraction

Tuesday, September 29

A lesson on the economic origins of the first industrial revolution in eighteenth-century Britain. Our keyword is **SUBSISTENCE**.

Everyone Reads

1. Richard Rhodes, "No Wood, No Kingdom" and "Raising Water by Fire," chaps. 1 and 2 in *Energy: A Human History* (Simon & Schuster, 2018), 3–33.

Choose One

2. Thomas Savery, *The Miner's Friend: Or, An Engine to Raise Water by Fire* (London: S. Crouch, 1702), 1–13, BL, http://explore.bl.uk/BLVU1:LSCOP-ALL:BLL01017535458.
3. Georgius Agricola, *De re metallica*, trans. Herbert Clark Hoover and Lou Henry Hoover (1556; London: The Mining Magazine, 1912), 172–200, IA, https://archive.org/details/georgiusagricola00agri.

Choose One

4. Frederic Morton Eden, *The State of the Poor: Or, An History of the Labouring Classes in England* (London: J. Davis, 1797), 2:433–35, IA, https://archive.org/details/b28773135_0002/page/432.
5. Francisco Pelsaert, *Jahangir's India*, trans. W. H. Moreland and P. Geyl (Cambridge, UK: W. Heffer & Sons Ltd., 1925), Utrecht University Repository, https://dspace.library.uu.nl/handle/1874/274804.

Deliverable Due

Longhand Notes 5

Class 12: The Rise of Heat Engines and the Field of Thermodynamics

Thursday, October 1

A lesson on the formulation of modern concepts of energy accounting plus some unstructured time to work on research projects. Our keyword is **PRIMARY / USEFUL ENERGY**.

Required

1. Rhodes, "A Giant with One Idea" and "To Make for All the World," chaps. 3 and 4 in *Energy* (2018), 34–60.
2. James Watt, New Invented Method of Lessening the Consumption of Steam and Fuel in Fire Engines, GB Patent 913, issued April 29, 1769 (repr. 1855), and extended May 22, 1775 (repr. 1857), German Patent and Trademark Office, Munich, Germany, https://www.dpma.de/docs/dpma/veroeffentlichungen/gb000176900913a_watt1769.pdf.
3. X, "Comparative Proportions of Steam Engines," letter to the editor, *Mechanics' Magazine*, October 14, 1826, 370–72, Google Books, https://books.google.com/books?id=859QAAAAYAAJ.

Deliverable Due

Longhand Notes 6.

Week 7: Industrialization, Urbanization, and the Acceleration of Everyday Life

Class 13: Revisiting Britain's Coal Question

Tuesday, October 6

A lesson on the impactful theories that emerged from Victorian Britain's anxieties over coal depletion, and how subsequent geological, economic, and technological developments both challenged and refined these theories. Our keyword is **REBOUND EFFECT**.

1. Rhodes, "Catch Me Who Can" and "Unconquered Steam!," chaps. 5 and 6 in *Energy* (2018), 61–101.
2. Edward Hull, "Duration of Our Coal Supply," chap. 2, pt. 4, in *The Coal Fields of Great Britain*, 2nd ed. (London: Edward Stanford, 1861), 236–45, BL, http://explore.bl.uk/BLVU1:Available_online:BLL01014813950.
3. William Stanley Jevons, "On the Economy of Fuel," chap. 7 in *The Coal Question*, 2nd ed. (London: Macmillan and Co., 1866), 122–37, BL, http://explore.bl.uk/BLVU1:Available_online:BLL01014814580.

Deliverable Due

Longhand Notes 7

Class 14: Humankind's Struggle to Push Back the Night

Thursday, October 8

The global history of artificial light and its social, economic, and ecological ramifications. Our keyword is **CANDELA / CANDLEPOWER**.

1. Rhodes, "Rush to Gaslight" and "Pursuing Leviathan," chaps. 7 and 8 in *Energy* (2018), 105–37.
2. Herman Melville, "Cetology," chap. 32 in *Moby-Dick: Or, The Whale* (New York: Harper & Brothers, 1851), 144–159, IA, https://archive.org/details/mobydickorwhale01melv.
3. Metropolis Gas Act, 1860, 23 & 24 Vict., c. 125, Bavarian State Library, Munich, Germany, https://mdz-nbn-resolving.de/details:bsb10563674.

Deliverable Due

Longhand Notes 8

Week 8: The Dawn of the Oil Age

No Class – Fall Break

Tuesday, October 14

Class 15: Early Turns to Liquid Fuel

Thursday, October 15

The emergence of the modern petroleum industry and new paths of primary commercial energy consumption. Our keyword is **TECHNOLOGICAL HYBRIDIZATION**.

1. Rhodes, "Burning Fluids" and "Wild Animals," chaps. 9 and 10 in *Energy* (2018), 138–67.
2. "Liquid Fuel as Used in Russia," *Scientific American Supplement* 16, no. 403 (September 22, 1883): 6426–29, IA, https://archive.org/details/sim_scientific-american-supplement_1883-09-22_16_403.
3. Thomas Urquhart, "On the Use of Petroleum Refuse as Fuel in Locomotive Engines," *Proceedings of the Institution of Mechanical Engineers* 35, no. 1 (August 1884): 272–298, Plates 51-60, https://doi.org/10.1243/PIME_PROC_1884_035_028_02.

Deliverable Due

Mini Essay 2

Week 9: Let Us See How Far We Have Come

Class 16: Sharpening New Knowledge of Energy Transitions

Tuesday, October 20

A summative assessment based on the keywords in Module 2 (see Section 4.5. Keywords above).

Recommended

1. Brown, "Mix Up Your Practice," chap. 3 in *Make It Stick* (2014), 46–66, https://doi.org/10.4159/9780674419377-003.
2. Chen, "Finding a New Routine," filmed March 2020 for the Learning Strategies Center, Cornell University, Ithaca, NY, MP4 video, 12:23, YouTube, https://youtu.be/duGAan8awUk.
3. ARC, "The Study Cycle," October 19, 2021, https://arc.duke.edu/study-cycle-0.

Deliverable Due

Bluebook Test 2 (in class)

Class 17: Independent Work on Research Projects, Part 1

Thursday, October 22

The first of two classes dedicated exclusively to your collaborative research projects. Come ready to make the most of this unstructured time with your teammates. The instructor will be available for on-the-spot consultations.

Recommended

1. Booth et al., "Making Good Arguments: An Overview," chap. 5 in *The Craft of Research*, 5th ed. (2024), 101–13, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=31597372.
2. Sword, "The Story Net," chap. 8 in *Stylish Academic Writing* (Harvard University Press 2012), 87–98, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=3301112.

Week 10: Honing Our Research and Writing Skills

Class 18: Independent Work on Research Projects, Part 2

Tuesday, October 27

Another class dedicated exclusively to your collaborative research projects. Build on the momentum you generated at the end of last week.

Recommended

1. Booth et al., "Planning and Drafting," chap. 10 in *The Craft of Research*, 5th ed. (2024), 175–90, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=31597372.
2. Anne Lamott, "Shitty First Drafts," in *Language Awareness: Readings for College Writers*, ed. Paul Eschholz, Alfred Rosa, and Virginia Clark, 9th ed. (Bedford/St. Martin's, 2005), 93–96, https://wrd.as.uky.edu/sites/default/files/1-Shitty%20First%20Drafts.pdf.

Class 19: Speedwriting Rough Drafts

Thursday, October 29

In lieu of a regular class, meet independently with your project team to wrap up the initial drafts of your research-project deliverables.

Deliverables Due

Rough Backgrounder and Slide Deck (by 11:59 p.m.)

Module 3: The Making of High-Energy Societies

Week 11: Uneven & Combined Development

Class 20: "A Giant in Germ?"[19]

Tuesday, November 3

A lesson on the early development of the electric utility industry and electrical rate systems. Our keyword is **MARGINAL COST PRICING**.

1. Rhodes, "Great Forces of Nature" and "A Cadence of Water," chaps. 11 and 12 in *Energy* (2018), 168–206.
2. Arthur Wright, "Cost of Electricity Supply," *Proceedings of the Municipal Electrical Association* (1896), 44–61, Linda Hall Library, Kansas City, MO.
3. William S. Barstow, "The Load Factor System of Charging for Electrical Energy," in *Minutes of the Thirteenth Annual Meeting of the Association of Edison Illuminating Companies* 13 (1897), 83–90, Google Books, https://books.google.com/books?id=ws5BAQAAMAAJ.

Deliverable Due

Longhand Notes 9

Class 21: Engineering with Vital Machines

Thursday, November 5

Energy technologies never fade quietly. Our keyword is **LAST-GASP EFFECT**.

Surnames A–K

1. Rhodes, "An Enormous Yellow Cheese," chap. 13 in *Energy* (2018), 185–206.
2. Ellwood Morris, "On the Tractive Power of the Horse," *Journal of the Franklin Institute* 28, no. 2 (August 1, 1839): 79–82, IA, https://archive.org/details/sim_journal-of-the-franklin-institute_1839-08_24_2.
3. R. H. Thurston, "The Animal as a Prime Mover: Part II. Energy Supplied; Power and Efficiency; Internal Work of the Vital Machine," *Journal of the Franklin Institute* 139, no. 2 (February 1, 1895): 100–121, IA, https://archive.org/details/sim_journal-of-the-franklin-institute_1895-02_139_2.

Surnames L–Z

4. Rhodes, "Pillars of Black Cloud," chap. 14 in *Energy* (2018), 219–26.
5. John Gjers, "A Description of the Ayersome Ironworks, Middlesbrough, with Remarks Upon the Gradual Increase in Size of the Cleveland Blast Furnaces," *Journal of the Iron and Steel Institute* 5, no. 2 (November 1871): 202–15.
6. M. L. Guner, "Successive Enlargements of Blast Furnaces," sec. 2 in *Studies of Blast Furnace Phenomena*, trans. L. D. B. Gordon (Philadelphia: Henry Carey Baird, 1874), 18–24, Google Books, https://books.google.com/books?id=fciP-i7ihRcC.

Deliverable Due

Longhand Notes 10

[19] Edwin James Milliken, "A Giant in Germ; Or, What Will He Come To?," *Punch*, June 25, 1881, 294. See also the engraving by John Tenniel and Joseph Swain on the following page entitled "What Will He Grow To?", available at the Library of Congress, Washington, D.C., https://www.loc.gov/item/2004667789/.

Week 12: Fossil- and Fissile-Fueled Modernity

Class 22: The Slow Climb Up Hubbert's Peak

Tuesday, November 10

A lesson on the long, fraught history of estimating deposits of "black gold." Our keyword is **OIL RESERVES / PEAK OIL**.

1. Rhodes, "A Gift of God" and "One-Armed Men Doing Welding" chaps. 15 and 16 in *Energy* (2018), 229–71.
2. Mark L. Requa, "Methods of Valuing Oil Lands," *Bulletin of the American Institute of Mining Engineers*, no. 134 (February 1918): 409–28, HathiTrust Digital Library, https://hdl.handle.net/2027/umn.31951000874843h.
3. M. King Hubbert, "History of Petroleum Geology and Its Bearing Upon Present and Future Exploration," *AAPG Bulletin* 50, no. 12 (December 1, 1966): 2504–18, https://doi.org/10.1306/5D25B779-16C1-11D7-8645000102C1865D.

Deliverable Due

Longhand Notes 11

Class 23: State-Directed Drives for Heavy Industry

Thursday, November 12

A discussion of top-down efforts to modernize national economies during the twentieth century. Our keyword is **ENERGY INTENSITY**.

1. Rhodes, "Full Power in Fifty-Seven" and "Affection from the Smog," chaps. 17 and 18 in *Energy* (2018), 272–306.
2. A. Aleksandrov and N. Dollezhal, "Development of Uranium-Graphite Channel Reactors in the USSR," Soviet Atomic Energy: A Translation of Atomnaya energyia 43, no. 5 (November 1977), May 1978, Central Intelligence Agency, https://www.cia.gov/readingroom/document/cia-rdp10-02196r000700100001-6.
3. N. Dollezhal' and Yu. Koryakin, "Nuclear Power Operation: Achievements and Problems," *USSR Report: Translations from Kommunist*, no. 14 (September 1979), JPRS 74649, November 27, 1979, 19–31, IA, https://archive.org/details/jprs-report_jprs-74649.

Deliverable Due

Longhand Notes 12

Week 13: The Long Transition to Lower-Carbon Energy Systems

Class 24: Of Gods, Titans, and Mortals

Tuesday, November 17

A lesson on the history of the most successful nuclear-scale up experience in an industrialized country.[20] Our keyword is **LEVELIZED ELECTRICITY COSTS**.

1. Rhodes, "The Dark Age to Come" and "All Aboard," chaps. 19 and 20 in *Energy* (2018), 307–43.
2. Nicholas Wade, "France's All-Out Nuclear Program Takes Shape," *Science* 209, no. 4459 (1980): 884–89, JSTOR, https://www.jstor.org/stable/1685073.
3. Charles Mathias, Jr. "Overview of the French Nuclear Program," sec. 2 in *Nuclear Power Development in France: Report to the Committee on Governmental Affairs*, United States Senate, 78-970 O (Washington, D.C.: Government Printing Office, 1981), 6–10, Google Books, https://books.google.com/books?id=AKgCTgbIx_0C.

Deliverable Due

Mini Essay 3

Class 25: Consolidating Our Intellectual Gains

Thursday, November 19

A summative assessment based on the keywords in Module 3 (see Section 4.5. Keywords above).

Recommended

1. Brown, "Embrace Difficulties," chap. 4 in *Make It Stick* (2014), 67–101, https://doi.org/10.4159/9780674419377-004.
2. Chen, "Managing Multitasking," filmed March 2020 for the Learning Strategies Center, Cornell University, Ithaca, NY, MP4 video, 7:27, YouTube, https://youtu.be/OsW1YKl1gF4.
3. ARC, "Study Strategies That Work," January 22, 2019, https://arc.duke.edu/study-strategies-work.

Deliverable Due

Bluebook Test 3 (in class)

[20] Arnulf Grubler, "The Costs of the French Nuclear Scale-Up: A Case of Negative Learning by Doing," *Energy Policy*, , 38, no. 9 (September 1, 2010): 5174–88, https://doi.org/10.1016/j.enpol.2010.05.003.

Week 14: A Time to Reflect

Class 26: Paths to Senior Theses in Energy Studies

Tuesday, November 24

A wide-ranging discussion about opportunities to continue studying questions of energy and society at Duke led by a guest speaker.

Choose One and Skim

1. Peter Polonsky, Jr., "Politics and Solar Energy: Getting Beyond the Economics of Solar Deployment" (honors thesis, Duke University, 2019), https://hdl.handle.net/10161/19893.
2. Sophia Katz, "Wasted Energy: Re-Directing Investment into Renewables through Environmental Policy," (honors thesis, Duke University, 2020), https://hdl.handle.net/10161/22443.
3. Megan Wang, "Impact of Utility-Scale Solar Farms on Property Values in North Carolina," (honor thesis, Duke University, 2022), https://hdl.handle.net/10161/25560.

Recommended:

4. Booth et al., "Communicating Evidence Visually," chap. 13 in *The Craft of Research*, 5th ed. (2024), 217–34, ProQuest, https://ebookcentral.proquest.com/lib/duke/detail.action?docID=31597372.
5. Scott Berinato, "Visualizations That Really Work," *Harvard Business Review* 94, no. 6 (June 2016): 92–100, https://hbr.org/2016/06/visualizations-that-really-work.

No Class – Thanksgiving Recess

Thursday, November 26

Conclusion: Our Shared Debits & Credits

Week 15: Pages Written & Unwritten

Class 27: Research Symposium

Tuesday, December 1

A grand showcase of our collaborative research projects before a panel of three external judges; at stake is not only extra credit but also eternal glory.

Recommended

1. Will Stephen, "How to Sound Smart in Your TEDx Talk," filmed September 2015 at TEDxNewYork, MP4 video, 5:55, YouTube, https://youtu.be/8SoFDjFBj8o.
2. Rita Gemayel and Seamus J. Martin, "How to Prepare and Deliver a Great Talk," *The FEBS Journal* 286, no. 1 (2019): 39–45, https://doi.org/10.1111/febs.14726.
3. Joel Schwartzberg, "8 Ways to Deliver a Great Presentation (Even If You're Super Anxious About It)," Harvard Business Review (online), July 12, 2020, https://hbr.org/2020/07/8-ways-to-deliver-a-great-presentation-even-if-youre-super-anxious-about-it.

Deliverable Due

Presentation

Class 28: A Comprehensive Review

Thursday, December 3

A debrief on the symposium followed by an informal discussion about the course as a whole.

Recommended

1. Amy Gallo, "How to Write the Dreaded Self-Appraisal," *Harvard Business Review* (online), March 29, 2013, https://hbr.org/2013/03/how-to-write-the-dreaded-self-appraisal.
2. "Giving Useful Feedback to Your Instructors and TAs: A Guide for Students," Center for Innovations in Teaching and Learning, University of California, Santa Cruz, July 2021, https://bpb-us-e1.wpmucdn.com/sites.ucsc.edu/dist/6/1180/files/2021/07/Giving-Useful-Feedback-to-Your-Instructions-and-TAs.pdf.

Deliverable Due

Self- Assessment & Course Evaluation (in class)

Finale: Once & Future Research Projects

Thursday, December 10

Teams submit their *Polished Backgrounders and Slide Decks* via Canvas by 11:59 p.m.

FURTHER READING

Allen, Robert C. *The British Industrial Revolution in Global Perspective*. Cambridge University Press, 2009. https://find.library.duke.edu/catalog/DUKE004151067.

Andrews, Thomas G. *Killing for Coal: America's Deadliest Labor War*. 2nd ed. Harvard University Press, 2010. https://find.library.duke.edu/catalog/DUKE010706659.

Bradford, Travis. *Solar Revolution: The Economic Transformation of the Global Energy Industry*. MIT Press, 2006. https://find.library.duke.edu/catalog/DUKE008593685.

Brown, Kate. *Plutopia: Nuclear Families, Atomic Cities, and the Great Soviet and American Plutonium Disasters*. Oxford University Press, 2013. https://find.library.duke.edu/catalog/DUKE008161565.

Buchholz, Bernd M. *Smart Grids: Fundamentals and Technologies in Electric Power Systems of the Future*. 2nd ed. Springer Berlin Heidelberg, 2020. https://find.library.duke.edu/catalog/DUKE009774485.

Johnston, Jean-Michel. *Networks of Modernity: Germany in the Age of the Telegraph, 1830-1880*. Oxford University Press, 2021. https://find.library.duke.edu/catalog/DUKE010632361.

Jones, Ryan Tucker. *Red Leviathan: The Secret History of Soviet Whaling*. University of Chicago Press, 2022. https://find.library.duke.edu/catalog/DUKE010601565.

McNally, Robert. *Crude Volatility: The History and the Future of Boom-Bust Oil Prices*. Columbia University Press, 2017. https://find.library.duke.edu/catalog/DUKE007980616.

Riggsby, Andrew M. *Mosaics of Knowledge: Representing Information in the Roman World*. Illustrated ed. Oxford University Press, 2019. https://find.library.duke.edu/catalog/DUKE009716422.

Roehrlich, Elisabeth. *Inspectors for Peace: A History of the International Atomic Energy Agency*. Johns Hopkins University Press, 2022. https://find.library.duke.edu/catalog/DUKE010416344.

Smil, Vaclav. *Grand Transitions: How the Modern World Was Made*. Oxford University Press, 2021. https://find.library.duke.edu/catalog/DUKE010013922.

Wellock, Thomas R. *Safe Enough?: A History of Nuclear Power and Accident Risk*. University of California Press, 2021. https://find.library.duke.edu/catalog/DUKE009981060.

Yergin, Daniel. *The Prize: The Epic Quest for Oil, Money & Power*. 4th ed. Free Press, 2008. https://find.library.duke.edu/catalog/DUKE007673876.

Zallen, Jeremy. *American Lucifers: The Dark History of Artificial Light, 1750-1865*. University of North Carolina Press, 2022. https://find.library.duke.edu/catalog/DUKE009747788.