Instructor:
Dr. Peter Saundry is a Senior Fellow of the National Council for Science and the Environment. He can be contacted by e-mail at psaundr1@jhu.edu. E-mails will usually be answered with 24 hours. If urgent send a text to 202-365-0187.

Course Description
The course examines the most critical energy technologies and how they work within the broader energy system (demand and supply, economics, policies, and environmental impacts). In particular, the course will explore the how technologies can be view in the context of concerns about global climate change.

Students will gain a solid understanding of the science, economics, environmental impact associated with various electricity generation technologies, including renewable energy, conventional generation (existing and future), carbon storage and sequestration, and electricity storage. Transportation topics will address a variety of technologies and energy sources.

Prerequisites: 420.301 - Quantitative Methods
420.302 - Chemistry of Natural Processes

Risk and uncertainty will be highlighted throughout the course. In general, there is tremendous uncertainty about how the future will unfold, including if and when a policy will be implemented, what the impact of a policy will be, whether or not some new technologies will become feasible at all, and if so when and at what cost (both in terms of required investment and environmental impact).

It should be evident from the significant breadth of this course that there will be a need to be selective in the depth of coverage, and this will be the case. Almost every topic covered in
this course could be an entire course by itself.

Lectures and discussion will focus on conveying the fundamental science and technology, economic, environmental impact and policy ideas in a clear and straightforward, but not simplistic, manner. There is a significant benefit to providing the broader energy picture in this way because many of these topics and approaches are inherently interlinked. We will also be sensitive the interests of the student and will focus, as is practicable, on topics that pertain to the student's field.

In summary, the course will provide the core underlying principles and ideas, as well as provide numerous citations and sources that will enable the student during the course, or later, to pursue areas of interest in greater depth.

Course Goals & Learning Objectives
In addition to gaining an understanding of the foundational science and technologies of the U.S. and global energy systems, students should, as a result of taking this course, be able to:

- Understand the respective roles of key energy technologies in the broader energy system that seeks to elevate people out of poverty, support advanced lifestyles, and not incur damage to human health and the environment;
- Discuss the strengths and weakness of different technologies quantitatively when judged under different criteria;
- Explain how diverse types of energy technologies and uses related to global climate change;
- Understand how traditional and emerging energy technologies support specific energy and environmental goals in different locations and times;
- Understand how different energy technologies both compete with and complement each other;
- Analyze the merits of arguments advanced by advocates and opponents of different energy technologies.

Teaching Style:
The course will be delivered primarily through the online modules, reading, discussions, quizzes, quantitative problem solving, and writing.

This course will be comprised of 14 modules/lessons. Each Module will include 4-6 recordings (Panopto videos) of lectures by the instructor. The slides presented in these lectures will be available on Blackboard. A transcript of the lectures will be available in most instances.

The technology and science parts of the course are generally taught in a "ground up" manner based on key physical principles to allow students from a wide range of
backgrounds to find the material covered accessible and understandable. All students can expect to find themselves challenged on occasion by some of the concepts and ideas covered – though hopefully in a rewarding way).

Students will complete a quiz each week, engage in online discussions during most (13) weeks; answer quantitative questions most (8) weeks; and write four short memos, one final paper.

II. Course material

Required Textbooks

Reading assignments will include “core” texts plus “additional” texts. Everyone will read core texts. Students are encouraged to read “additional” texts to deepen their understanding of topics.

Two required texts support the science and technology aspects of the course, as well as some parts of the economic and environmental impact.


This textbook will provide most of the quantitative assignments for the course. At times, it goes into significantly greater scientific detail and mathematical complexity than the course. As such, it will also be a useful future resource.


While this text is U.K. focused, it gives an excellent review of the technologies which can be applied anywhere.

*You can purchase these new or used, but make sure they are the correct edition.

Some topics will be addressed just in lectures and discussion or through assigned papers and reports that will be available on the Blackboard site, either:

- Under a “Readings” section in each Module.
- Under the JHU reserves (EReserves or (ARES)) in the left-hand menu

*Note*, energy technologies are changing very rapidly at this time. As such, some data and graphs in the textbooks may be out of date, even though the textbooks are relatively new. The Instructor has striven to provide the most up-to-date data in lectures. **Be aware of this.**

Recommended Supplies
APA Manual. Extensive reading and writing are essential practices to expand your energy technology and applications knowledge and hone your ability to formulate a sound argument. Use of APA style for all papers and discussion posts. While there are a few good internet resources, nothing is as up-to-date and as accurate as the APA Publication Manual, a resource you will undoubtedly refer to throughout your graduate education.


Citation Software. Because you will be reading and citing books and scholarly work throughout graduate school, you may want to use a citation manager such as EndNote, RefWorks, or Mendeley. Several of these programs have a free option and a feature to cite-as-you-write, instantly formatting sources in your word-processing software.

Specific Technology Requirements & Skills for this Course

Learning online requires some basic knowledge of computer technology. At a minimum, you need to be able to:

- Navigate in and use Blackboard; the Blackboard Student Orientation course on your “My Institution” page
- Create and save MS Word documents; see *MS Word training and tutorials* for PC users (all versions); *Word Help* for Mac users
- Create, save, and utilize Excel spreadsheet functions for basic statistical analysis (or another spreadsheet such as Google Sheets or Apple Numbers); see *Excel training and tutorials* for PC users (all versions); *Excel Help* for Mac users
- Find primary resources on the Internet
- Create and organize files & folders on your computer
- Send, receive, and manage email

III. Modules, Topics, and Activities

Course Structure

Course topics were chosen to give you significant exposure to the most critical aspects of energy technologies and policies in the USA and the world.

The course follows a set of logical steps from basic energy topics to applications for both renewables and fossil fuels.

Students should keep in mind (and watch out for as the course progresses) news items on a particular topic, experiences at their job that relate to the course, and so on.

Students are strongly encouraged to share current event items when they find them via the discussion platform on Blackboard.

Course Topics
This course runs from 09/4/2019 to 12/17/2019. Our “weeks” will run from Wednesday to Tuesday. Content will be delivered primarily through lectures, reading, videos and discussion. One of the primary goals of this course is for all students to gain a good grasp of underlying scientific, technical, and policy principles. The mathematics used will be kept at a straightforward level.

Week 1. Intro and Energy Supply & Demand
Week 2. Climate Change
Week 3. Introduction to the Electricity Sector in the United States
Week 4. Introduction to Wind Power and Fluid Mechanics
Week 5. Wind Power
Week 6. Hydro, Waves, and Tide Power
Week 7. Solar Power
Week 9. Conventional Generation – Fossil Fuels
Week 10. Electricity Storage & Integration issues
Week 11. Nuclear Power
Week 12. Biomass Power
Week 13. Energy for Transportation and Fuel Cells

Directions for Students

Next Steps: Carefully review the remaining sections of the syllabus. Once you feel that you are ready to dive into the first week’s activities, click on the Lessons button on the left-side navigation menu. Then, click on Week 1, to begin.

What To Expect in this Course

This course is 14 weeks in length and includes individual, group, and whole group activities in a weekly cycle of instruction.

Each week begins on a Wednesday and ends on the following Tuesday. Please review the course syllabus thoroughly to learn about specific course outcomes and requirements.

Each week, you will complete readings that may include videos, multimedia presentations, web-based resources, and articles from professional journals.

A reading may be integrated within an activity during the week or provide some essential information to assist your learning.

In this course, you will also experience online learning activities, which include discussion boards, group work, and online multimedia presentations.

Be sure to refer to the Checklist each week (at the end of each lesson), which provides a week-at-a-glance and shows targeted dates for the completion of activities.
IV. Assessment

Assignments
Specific due dates are given in lesson folders and the course schedule.

<table>
<thead>
<tr>
<th>Week</th>
<th>Quiz</th>
<th>Discussion</th>
<th>Quantitative Homework</th>
<th>Memo</th>
<th>Paper</th>
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<td>280</td>
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<td>240</td>
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Grading

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<th>Points</th>
<th>Total Points</th>
<th>%</th>
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<td>14</td>
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<td>280</td>
<td>28%</td>
</tr>
<tr>
<td>Discussions</td>
<td>13</td>
<td>10</td>
<td>130</td>
<td>13%</td>
</tr>
<tr>
<td>Quantitative HWK</td>
<td>8</td>
<td>30</td>
<td>240</td>
<td>24%</td>
</tr>
<tr>
<td>Short Memos</td>
<td>4</td>
<td>50</td>
<td>200</td>
<td>20%</td>
</tr>
<tr>
<td>Final Paper</td>
<td>1</td>
<td>150</td>
<td>150</td>
<td>14%</td>
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</tbody>
</table>
Letter Grade & Percentage

The grading scale for students enrolled for credit is:

- A+ 98% to 100%
- A 94% to less than 98%
- A- 90% to less than 94%
- B+ 88% to less than 90%
- B 84% to less than 88%
- B- 80% to less than 84%
- C 70% to less than 80%
- F 0% to less than 70%

Assignment Guidelines

How should assignments be submitted?

The weekly directions will indicate where assignments will be posted (e.g., to an assignment submission link within the Lessons area). If submitting documents for an assignment or discussion forum, please specify the assignment name in the document title or the discussion thread.

When creating files, include your name and the name of the assignment in the file title. Also, please be sure to only include one period in file names. The period should be between the file name and the extension. Use underscores instead of spaces in file names (Blackboard does not like spaces).

For example psaundr1_assignment1.docx. Acceptable file submission formats are DOCX and PDF unless otherwise stated.

APA Formatting and Style.

All papers, discussion posts, and assignments must use APA citation style to credit sources. Papers must also be formatted according to APA guidelines.

Turnitin.

The four memos and the final paper will be submitted using Turnitin, an educational tool that helps identify and prevent plagiarism from Internet resources.

You will be required to submit your memos and paper electronically using the Turnitin link during certain weeks of class. You do not need a Turnitin account.

Your assignment will be assigned an originality score and report which you and Professor Saundry will be able to see. You are allowed to submit your paper multiple times up to the due date, and Professor Saundry will grade the last submission by default. To learn more about Turnitin, go to [http://turnitin.com/](http://turnitin.com/).
When will assignments be due?

Assignment and activity due dates are listed in this syllabus and the weekly checklists. Professor Saundry will announce changes in the online classroom via the announcements tool. Some larger assignments will be completed over several weeks. In these cases, you will be prompted to complete portions of the assignment each week.

When will completed assignments be returned?

Professor Saundry will aim to return assignments to you within 5-7 days following the due date, depending on the length of the assignment. You will receive feedback under the My Grades link in the left-hand menu of your course.

What is the policy for late assignments?

You are expected to contact Professor Saundry in advance if you think you cannot meet an assignment deadline. However, if an assignment is late and prior arrangements have not been made with Professor Saundry, the assignment score will be marked zero. No exceptions.

What happens if I cannot participate in a synchronous session?

Synchronous sessions might occasionally be scheduled by Professor Saundry to discuss course projects. Attendance in these sessions is encouraged but not required. Sessions will be recorded and posted for students to watch at a later time if they could not attend.

Time Management Expectations

What is the time demand and schedule of the course?

Because this is a graduate-level course, the rigor and time commitment is higher than a traditional semester course. It is expected that you look ahead to schedule your time. Plan to complete coursework across several days of the week rather than all in one day.

Some assignments require that you work on them for multiple weeks. Be sure to review the assignment directions at the beginning of the course so that you can plan your time accordingly. Please seek help before becoming frustrated and spending a significant amount of time to resolve an issue.
V. Course Participation & Communication Policy

Participation

What are the participation requirements?

You are expected to log into Blackboard at least three times a week, though a daily check-in is recommended.

It is your responsibility to read all announcements and discussion postings within your assigned forums.

You should revisit the discussion multiple times over the week to contribute to the dialogue and review feedback from your peers.

Each week there will be a discussion prompt. Each discussion forum prompt requires an initial (primary) post and one or more substantive response (secondary) posts. Your first post should be a direct response to the prompt and be submitted by Saturday evening each week. Subsequent posts should be in response to posts by your classmates. Engaging in a lively but constructive discussion (see "Netiquette below) will be very beneficial, so I encourage you to contribute to discussion well beyond the minimum.

Posting details and requirements are further specified in each discussion prompt’s directions.

For the most part, the discussion area is intended for you and your peers to discuss and debate the lesson topic, readings, activities, and themes. I recognize that frequent posts from me tend to distract and stifle rich student conversation. I will be reading your posts daily, but I generally refrain from directly commenting on most posts (unless you specifically address a question to me). I will occasionally interject to guide the conversation back on track, to connect student ideas, and to share examples that deepen your understanding.

Network Etiquette (i.e. “Netiquette”)

In this course, online discussion will primarily take place in our online discussion board. In all online textual communication, it is essential to follow proper rules of netiquette.

What is netiquette? Simply stated, it is the social and cultural norms of communicating with others constructively and respectfully in cyberspace.

The Netiquette “Core Rules” linked below are a set of general guidelines for cyberspace behavior. They probably won't cover all situations, but they should give you some basic principles to use in communicating online.

For Netiquette Core Rules visit The Core Rules of Netiquette web page.
Contacting the Instructor
The instructor for this course is Professor Saundry (jpsaundr1@jhu.edu). Feel free to contact me with comments, questions, and concerns. You will receive a response within 24-48 hours.

All email messages will be sent to you via your JHU email account, so you should be in the habit of checking that account every day or you should ensure that your JHU email account forwards messages to another account of your choice.

Professionalism and respect are expected throughout this course, whether online, in person, emailing, or calling.

VI Course Protocols

Course Protocols

How will I know about changes to the course?
Frequently, you will find new announcements posted in the Announcements, which contain information about current course activities that you are working on and any changes to the course. Please check announcements every time that you log into your online course.

How should I communicate with others in this course?
You should communicate regularly with your classmates and with Professor Saundry. The majority of communication will take place within the Discussion forums. When you have a question about an assignment or a question about the course, please email Professor Saundry, or post your question in the course’s discussion forum.

Are there any requirements for sending e-mail messages?
When you send an e-mail message to the instructor or another participant in the course, please observe the following guidelines:

- Include the title of the course in the subject field (e.g., JHU Energy Tech).
- Keep messages concise, and check spelling and grammar.
- Send longer messages as attachments.
- Sign your full name (the sender’s email is not always obvious).
## Tentative Course Schedule

Our “weeks” run from Wednesday to Tuesday. Below is the agenda for the semester. The schedule is subject to change with fair notice. If changes are needed, students will be notified via Blackboard announcements at least five days in advance.

<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Lesson Topics</th>
<th>Readings</th>
<th>Assessments Due</th>
</tr>
</thead>
</table>
| 1    | 9/4-9/10 | Energy Basics | Andrews & Jelley (2018) – Chapter 1  
EIA (2017)  
Gruenspecht (2017)  
Pacala & Socolow (2004) | Quiz  
Discussion Forum  
Avoiding Plagiarism at JHU |
| 2    | 9/11-9/17 | Climate Change | Andrews & Jelley (2017) – Ch 12.1, 12.5-12.9  
Peake (2018) – Ch 1.3  
IPCC (2014)  
Nordhaus (2008)  
Stern (2007) | Quiz  
Quantitative Homework  
Discussion Forum |
Peake (2018) – Appendix B  
DOE (2017)  
FERC (2017) | Quiz  
Quantitative Homework  
Discussion Forum |
| 4    | 9/25-10/1 | Introduction to Wind Power and Fluid mechanics | Andrews & Jelley (2017) – Ch 2.8 – 2.14 and 7.1-7.5  
Peake (2018) -Ch 8.1-8.4 | Quiz  
Quantitative Homework  
Discussion Forum |
<p>| 5    | 10/2-10/8 | Wind Power | Andrews &amp; Jelley (2017) – Chapter 7.6-7.17 | Quiz |</p>
<table>
<thead>
<tr>
<th>Week</th>
<th>Dates</th>
<th>Topic</th>
<th>Text References</th>
<th>Additional Materials</th>
</tr>
</thead>
</table>
| 6    | 10/9-10/15  | Hydro, Wave, and Tide Power | • Andrews & Jelley (2017) – Chapter 6  
• Peake (2018) – Ch 6, 7, 9 | Quiz  
Discussion Forum  
Wind Energy Memo |
| 7    | 10/16-10/22 | Solar Power              | • Andrews & Jelley (2017) – Ch 5.1-5.10 and Chapter 8  
• Peake (2018) – Ch 1.4, Ch 3 and Ch 4  
• Reddy (2012) | Quiz  
Quantitative Homework  
Discussion Forum |
• Peake (2018) – Ch 2 and Ch 10  
• Fowler (2008) | Quiz  
Quantitative Homework  
Discussion Forum |
| 9    | 10/30-11/5  | Conventional Generation - Fossil Fuels | • Andrews & Jelley (2017) – Chapter 3  
• Deutch & Moniz (2007) – Ch 2, 3  
• IPCC (2005) | Quiz  
Discussion Forum  
Clean Coal Memo |
| 10   | 11/6-11/12  | Electricity Storage & Integration Issues | • Andrews & Jelley (2017) – Ch 10.6-10.16  
• Peake (2018) – Ch 11.7  
• Sioshansi et al. (2009) | Quiz  
Quantitative Homework  
Discussion Forum |
• GNI (2015) | Quiz  
Nuclear Memo |
| 12   | 11/20-11/26 | Biomass                  | • Andrews & Jelley (2017) – Ch 4  
• Peake (2018) – Ch 5 | Quiz  
Quantitative Homework  
Discussion Forum |
| 11/27-12/3 | Thanksgiving Break, no participation required | | | |

Sample Syllabus
<table>
<thead>
<tr>
<th>Week</th>
<th>Date Range</th>
<th>Topic</th>
<th>Readings</th>
<th>Activities</th>
</tr>
</thead>
</table>
| 13   | 12/4-12/10 | Energy for Transportation and Fuel Cells | • Andrews & Jelley (2017) – Ch 10.18-10.20 and 11.3  
• Peake (2018) – Ch 11.8 only pages 579 – 586  
• DOE (2017) | • Quiz  
• Discussion Forum |
• IEA (2016) | • Quiz  
• Final Paper |
VIII University Policies

General

This course adheres to all University policies described in the academic catalog. Please pay close attention to the following policies:

Students with Disabilities

Johns Hopkins University is committed to providing reasonable and appropriate accommodations to students with disabilities. Students with documented disabilities should contact the coordinator listed on the Disability Accommodations page. Further information and a link to the Student Request for Accommodation form can also be found on the Disability Accommodations page.

Ethics & Plagiarism

JHU Ethics Statement: The strength of the university depends on academic and personal integrity. In this course, you must be honest and truthful. Ethical violations include cheating on exams, plagiarism, reuse of assignments, improper use of the Internet and electronic devices, unauthorized collaboration, alteration of graded assignments, forgery and falsification, lying, facilitating academic dishonesty, and unfair competition. Report any violations you witness to the instructor.

Read and adhere to JHU’s Notice on Plagiarism.

Dropping the Course

You are responsible for understanding the university’s policies and procedures regarding withdrawing from courses found in the current catalog. You should be aware of the current deadlines according to the Academic Calendar.

Getting Help

You have a variety of methods to get help on Blackboard. Please consult the resource listed in the "Blackboard Help" link for important information. If you encounter technical difficulty in completing or submitting any online assessment, please immediately contact the designated help desk listed on the AAP online support page. Also, contact your instructor at the email address listed in the syllabus.

Copyright Policy

All course material are the property of JHU and are to be used for the student's individual academic purpose only. Any dissemination, copying, reproducing, modification, displaying, or transmitting of any course material content for any other purpose is prohibited, will be considered misconduct under the JHU Copyright Compliance Policy, and may be cause for disciplinary action. In addition,
encouraging academic dishonesty or cheating by distributing information about course materials or assignments which would give an unfair advantage to others may violate AAP's Code of Conduct and the University's Student Conduct Code. Specifically, recordings, course materials, and lecture notes may not be exchanged or distributed for commercial purposes, for compensation, or for any purpose other than use by students enrolled in the class. Other distributions of such materials by students may be deemed to violate the above University policies and be subject to disciplinary action.

**Code of Conduct**

To better support all students, the Johns Hopkins University non-academic Student Conduct Code has been integrated and updated to include all divisions of the University. In addition, it is important to note that all AAP students are still accountable for the Code of Conduct for Advanced Academic Programs.

**Title IX**

**Confidentiality and Mandatory Reporting**

As an instructor, one of my responsibilities is to help create a safe and inclusive learning environment on our campus. I also have mandatory reporting responsibilities related to my role as a Responsible Employee under the Sexual Misconduct Policy & Procedures (which prohibits sexual harassment, sexual assault, relationship violence and stalking), as well as the General Anti-Harassment Policy (which prohibits all types of protected status based discrimination and harassment). It is my goal that you feel able to share information related to your life experiences in classroom discussions, in your written work, and in our one-on-one meetings. I will seek to keep information you share private to the greatest extent possible. However, I am required to share information that I learn of regarding sexual misconduct, as well as protected status based harassment and discrimination, with the Office of Institutional Equity (OIE). For a list of individuals/offices who can speak with you confidentially, please see Appendix B of the JHU Sexual Misconduct Policies and Laws.

For more information on both policies mentioned above, please see: JHU Relevant Policies, Codes, Statements and Principles. Please also note that certain faculty and other University community members also have a duty as a designated Campus Safety Authority under the Clery Act to notify campus security of certain crimes, as well as a duty under State law and University policy to report suspected child abuse and/or neglect.