Instructor: Dr. Daniel Zachary is Associate Director of the Energy Policy and Climate Program. For many years as a physicist, he has been teaching, among many courses, a series of conceptual physics courses related to the environment. He is particularly excited about this new course to be offered in the EPC program. He can be contacted by phone at (202) 663-5976 or by e-mail at d.s.zachary@jhu.edu. E-mails received in the morning or early afternoon usually will be answered the same day; ones received later in the day usually will be answered not later than the following morning.

Course Description:

Topics include the assessment of wind resources, basic principles of wind turbines and power transmission, electricity markets and wind power, technological and economic aspects of storage of intermittent wind power, legal issues at state and federal levels, international water issues, and environmental impact assessment processes for wind developments.

Modern wind turbines have begun to play an important role in the production of electricity. This course provides an overview of wind turbine technology and energy concepts. It is designed for non-engineering majors. A brief history of windmills and their design will be given. The question of whether wind technology (or any other renewable source) can impact the energy crisis will be debated. The course gives an overview of fluid dynamic, thermodynamic, and rotor dynamic concepts as they apply to wind technologies. The fundamentals of energy measurement, energy availability, energy transmission, and energy consumption will be covered and used to strengthen the debate.
The importance of function and form and the entangling of politics, human nature, and technology will be explored. Students will perform experiments, measure personal energy use, and visit wind turbine installations.

**Course Goals & Learning Objectives:**

The subject of this course is the past, current and future applications of wind technologies. We will cover the science of wind technologies – how wind energy is converted to electric power as we cover the nexus of mechanics and electric issues from the wind turbine to the electric grid. We will also discuss the important policies at all levels, including state, national and international.

The course covers two areas of material. One describes the principal (technical) tools needed to harvest wind energy. We will cover different types of wind machines, electric grid/smart grid issues, and storage devices. The second examines the policies and practices of states, the federal government, and other nations.

We expect the student to understand how different policies and practices do influence just how much wind power is harvested and included into the mix of energies of the electric grid.

At the end of the course, students should understand:

- Summarize wind and other renewable technology development and their place in the US utility generation mix
- Classify wind turbine and drive-train architectures
- Distinguish the flow and control of power and torque through a wind turbine drive train
- Apply descriptors of wind characteristics and energy conversion to include calculation of annual energy output
- Explain basic electric circuits and identify the circuit configuration of power electronic systems
- Derive wind turbine power and efficiency relationships using blade element momentum theory
- Estimate the performance and loads of an aerodynamic rotor
- Describe wind farm architecture to include siting, layout, and electric interconnection
- Explain wind turbine and wind farm economic descriptors
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- Describe wind farm architecture to include siting, layout, and electric interconnection
- Explain wind turbine and wind farm economic descriptors

The rest of this syllabus consists of three parts. Part I discusses course procedural issues: assigned readings, grades, instructor contact information, and Blackboard. Part II describes the organization of the course: the topics to be covered and the estimated number of classes devoted to each. The corresponding assignments will be posted separately; initial assignments will be posted at least two weeks before the first class meeting. Part III sets out some University rules and guidelines applicable to the course.

**Teaching Style:** The course will be delivered primarily through lectures, reading, videos and group 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.

This course will be comprised of 14 Modules (lessons). Each Module is equivalent to one week and includes individual and whole group activities in a weekly cycle of instruction. Each module begins on a Monday and ends on the following Monday. Please review the course syllabus thoroughly to learn about specific course outcomes and requirements.

**II. Course material**

**Textbooks**

We will have a couple of texts for the course. We will supplement these texts with articles, reports, white paper documents and other material/videos. This material will be available on the internet, electronically via JHU (see Syllabus and Readings for the preliminary list).

There is, however one required text that supports parts of the science and technology aspects of the course, as well as some parts of the economic and environmental impact.

Required text:
Wind Energy Explained, Manwell, 2nd edition, James F., 2009, ISBN 13: 978-0-470-01500-1, ISBN 10: 0-470-01500-4, MBS Direct SKU #: 933306, Publisher: John Wiley & Sons, Inc – (This book is designed for engineers, but has excellent explanations of turbine design and use. We will not use the entire book, but the material we do cover it excellent and it also makes for a good reference).


And an excellent (supplementary) reference books:


Wind Energy Handbook (John Wiley and Sons) Tony Burton, David Sharpe, Nick Jenkins, Ervin Bossanyi


Online resources

Other readings will be available online via the EReserves (ARES) area of the course or within the weekly content under ‘Lesson’. (See Reading List below). Please note that the syllabus will be updated from time to time to incorporate additional readings.

Specific Technology Requirements & Skills for this Course

Although the course is not online, learning a few online skills is none-the-less useful. 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
- Find basic resources on the Internet
- Create and organize files & folders on your computer
- Send, receive, and manage email
Sample Syllabus
III. About the course

Course Topics

Week 1: The history of wind
Week 2: Wind characteristics and resources (climate & geography of the wind)
Week 3: The aerodynamics of wind turbines (Energy and power of the wind)
Week 4: Mechanics and dynamics
Week 5: Electrical aspects of wind turbines
Week 6: Wind turbine material, components and control
Week 7: Wind turbine siting, design, integration and application
Week 8: Wind energy system economics
Week 9: Environmental aspects and impacts
Week 10: USA wind policies
Week 11: Global wind policies
Week 12: Project presentations
Week 13: Special topics in wind energy
Week 14: Field trip

Directions for Students

Next Steps: Carefully review the remaining sections of the syllabus before beginning to go over material in Module 1 activities, which are located in the Modules folder in your online course.

Once you feel that you are ready to dive into the first week’s activities, click on the Modules link in the left-side navigation menu. Then, click on Module 1 to begin with the Introduction and Objectives. Please note, that since this on-ground, some of the material will only be made available in-class or otherwise made available upon request to the instructor.

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 Thursday and ends on the following Thursday. Please review the course syllabus thoroughly to learn about specific course outcomes and requirements.

Apart from the normal weekly in-class lectures, 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 key information to assist your learning.

In this course, you will also experience online learning activities, which include discussion boards, synchronous sessions, group work, the use of Web 2.0 tools, and online multimedia presentations.

**Note:** Please include a brief explanation of what Web 2.0 tools will be included (if applicable).

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

**Course Structure**

We chose the set of topics in the course to reflect the most important aspects of energy technologies and polices in the USA and the world. We structure the course to follow in a set of logical steps from basic energy topics to applications, both renewables and fossil fuels. Students should keep in mind or 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 share current event items when they find them via the email/discussion platform on Blackboard.

**Field Trip (Optional)**

A virtual field trip is being planned. The virtual trip will of course be accessible via the internet, but provision will be made (if possible appropriate) for students to attend. Details of the trip will be announced later in the course.

### IV. Assessments and grading policy

**Assignments**

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Final Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>Class Participation. ~3 points per class - or online BB discussion</td>
<td>50 points</td>
</tr>
<tr>
<td>Quantitative Homework 20 points per assignment (Modules 1–9)</td>
<td>180 points</td>
</tr>
<tr>
<td>Draft Essay 20 points per assignment (Modules 10)</td>
<td>10 points</td>
</tr>
<tr>
<td>Essay – covered in Module 11 -14</td>
<td>100 points</td>
</tr>
<tr>
<td>Presentation – covered in Module 13</td>
<td>40 points</td>
</tr>
<tr>
<td><strong>Total points</strong></td>
<td><strong>380 points</strong></td>
</tr>
</tbody>
</table>
Details on assignment rubric grading (discussion, blogs, memos and essay)

Blogs and discussion are both worth 10 points per module. Details and example of grading these points are given. The student is required to submit one of their blogs from the semester to the Environment, Energy, and Climate news blog found here: http://eecn.johnshopkins.edu/. More details can be found in the individual rubrics.

Discussion grading: 3 points per module (online only):

Three Criteria:
- Responding to assigned questions. Weight 50%
- Responding to other students. Weight 25%
- Risk taking. Weight 25%

Four grade levels:
- Unsatisfactory. Worth 0%
- Adequate. Worth 33.3%
- Proficient. Worth 66.6%
- Exemplary. Worth 100%

Example, suppose a blog assignment receives exemplary marks (100%) for the first criteria – weight of 50%, and had adequate marks (33.3%) for the second criteria - weight of 25%, and unsatisfactory marks (0.0%) for the third criteria – weight 25%. The total points for this blog would be: (.5×1 + .25×.33 + .25×0) × 10points = 5.82 points.

*Similar logic applies to the rubrics for the memos and essay.

Turning in the essay

Both the memos and essay will be turned in via the ‘Turnitin’ tool. This tool allows you to view the percentage of your work that is duplicated elsewhere and allows you to self-check the originality of your work. The instructor will also be viewing your memos and essay using this tool.

Grading

Grades will be based upon class participation. A total of 380 point == 100%. Students are expected to follow appropriate ethics and honor codes. Class assignments that are submitted after deadline will automatically be downgraded by 10% of the points for each day of lateness. JHU-AAP uses the full range of the
Assignment Guidelines

The weekly directions will indicate where assignments will be posted (e.g. in assignment tool within the Lessons folder). If submitting documents for an assignment or discussion forum, please specify the assignment name in the document title and/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. For example: dzachary_assignment1.doc

When will assignments be due?

Assignment and activity due dates are listed in this syllabus and the weekly checklists. Assignment due dates can also be found within the Assignment Guidelines area of your online classroom. The instructor via an announcement in your online classroom will announce changes. 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?

The instructor 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 on the left hand menu of your course.
What is the policy for late assignments?

All assignments are due at 11:59 PM of day 7 of the module week. There is also a 24-hour “grace period” during which you may submit your assignment without penalty (i.e., until 11:59 PM of day 1 of the following module). Late assignments (i.e., assignments submitted after the end of the grace period) will be reduced by one letter grade (10 percentage points). Assignments more than one week late will not be accepted. If you know in advance that you will not be able to submit an assignment on time (e.g., due to illness or travel), contact the instructor of that module.

The final paper (week 14) will be due 11:59 PM of day 14 of the module week.

Time Management Expectations

What is the time demand and schedule of the course? Because this is a graduate-level course that is offered in a condensed format, the rigor and time commitment is higher than a traditional 14-week 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. Be sure to consider how group activities impact your schedule as well.

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 participate in class. In the exception that you cannot attend class then you will be expected to log into the Blackboard at and participate in the BB discussion. 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.

Please refer to the Course Engagement assignment directions and scoring document, located in the Course Overview page in the Lessons section in your Blackboard classroom, for more specific information about individual and group participation in this course.
**Network Etiquette (i.e. “Netiquette”)**

Please note, in all textual online (or email) communications it’s important to follow proper rules of netiquette.

What is netiquette? Simply stated, it's network etiquette -- that is, the etiquette of cyberspace. And "etiquette" means the social and cultural norms of communicating with others in a proper and respectful way. In other words, netiquette is a set of rules for behaving and interacting properly online.

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**

You can contact me with comments, questions, and concerns via email: d.s.zachary@jhu.edu. I check my email often so under normal circumstances, this should be sufficient since 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.

Feel free to contact me with comments, questions, and concerns. You will receive a response within 24-48 hours.

**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 often with your classmates and with your instructor. 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 contact your instructor, or post your question in the course’s “Syllabus & Assignment Question” forum.

Are there any requirements for sending e-mail messages?

When you send an e-mail message to the instructor or to another participant in the course, please observe the following guidelines:

Include the title of the course in the subject field (e.g., JHU Insert Name of Course).

- 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).

VII. Course Topics, Activities & schedule

General Comment

The classes will follow the syllabus below quite closely, with the following caveats. Depending on the amount of material covered, class interest and level of discussion some topics may be discussed in more length than others. Also, we will confirm the readings one week before the scheduled class in order to update material. Most of the readings are as is in the syllabus (there may be some minor corrections later in the semester).

As a result some of the material might be covered in the ‘Special Topics’ slot – week 13. The potential availability of outside speakers may also modify the content covered and timing slightly.

Note: The class reading is still in process of being updated. A few additional papers may be added, and other papers list below may be dropped or made optional.

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. Please consult the help listed in the "Blackboard Help" link in the online classroom 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 atop this syllabus.