Course Syllabus – DRAFT
ver. 2
ISEN 440 Energy Infrastructure Development and Finance
Spring 2020
Northwestern University

Instructors:

Tom O’Flynn
CFO, The AES Corporation
tom.oflynn@aesinfra.com

About Tom: Tom O’Flynn served as Executive Vice President and Chief Financial Officer of AES Corporation from Sept. 2012 – Dec. 2018. In a new leadership role beginning Jan. 1, 2019, Tom will focus on raising third-party capital to systematically and cost effectively help finance AES’ attractive growth opportunities. Prior to AES, Tom’s previous roles include Senior Advisor to the Private Equity Group of Blackstone, an investment and advisory group, as Chief Financial Officer of PSEG, a New Jersey-based merchant power and utility company, as President of PSFG Energy Holdings, and various positions within leadership of the Global Power and Utility Group of Morgan Stanley. Tom is based in New Jersey.

Paul Astolfi
Partner, Mayer Brown
pastolfi@mayerbrown.com

About Paul: Paul Astolfi is co-lead of Mayer Brown’s Project Finance and Infrastructure Investment groups and a member of its Oil & Gas group. He leads engagements in a wide variety of complex settings, including cross-border project finance, infrastructure development and finance, and acquisition and disposition of energy assets. Paul regularly represents major financial institutions, international strategic firms, and private equity funds. Before joining Mayer Brown, Paul sharpened his business skills as general counsel for Acciona Energy North America. He is also an adjunct professor at the University of Michigan Law School, where he teaches energy finance. Paul is based in Chicago.

Additional NU Faculty Advisor is to be announced (likely from Kellogg)

Office Hours: By appointment

Class Room: Tech LG66
Class Timing: Tuesday, 3-6pm

Course Synopsis: This course takes students through the design, permitting, financing, and implementation process of large-scale energy infrastructure developments, including natural gas plants, solar and wind farms, hydro, and electric storage.
Course Goals: The objective of this course is to help students gain an understanding of the legal, financial, and engineering tools and factors affecting the projected lifetime value of various energy systems. Through lectures, guest speakers, and case studies, students will learn how to quantify business opportunity tied to new energy infrastructure, understand the motivations and interaction of various stakeholders, and optimize the selection of a site, entity structure, finance partners, and proposed offtake customers. At the end of this course, a student should:

- Detail the factors which must be considered when assessing the suitability of a new energy infrastructure project;
- Understand the distribution of risk, interest and capacity among project stakeholders, including developers, project finance lender, and infrastructure equity investment firms;
- Stipulate a detailed financial project IRR given various project entity structure, financing and power offtake agreements

Prerequisites: none

Grading/Assessment:
Grading will be based 10% on class participation and 90% on exams and written assignments. Written assignments will include one case study assignment – roughly 3-5 pages in nature (20% of total grade), a mid-term exam (30%) and one final paper (40%). Class participation (10%) will include ownership and mastery of discussion topics.

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<thead>
<tr>
<th>Component</th>
<th>Weight</th>
<th>Details</th>
<th>Due</th>
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<tbody>
<tr>
<td>Case Study / Short</td>
<td>20%</td>
<td>Will cover one of the topics from lecture in the first</td>
<td>Week #3</td>
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<tr>
<td>Paper</td>
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<td>3 weeks of class / readings</td>
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<td>Mid-term</td>
<td>30%</td>
<td>Written exam – will cover all lecture and reading material</td>
<td>Week #6</td>
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<td>in first half of course (through Week #5)</td>
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<tr>
<td>Final Paper</td>
<td>40%</td>
<td>Final paper (~15-20 pages) will cover an infrastructure</td>
<td>Week #10</td>
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<td></td>
<td></td>
<td>project</td>
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<tr>
<td>Participation</td>
<td>10%</td>
<td>Based on attendance and instructor assessment of</td>
<td>All quarter</td>
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<td>preparation and participation in class on a weekly basis</td>
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All questions and problems regarding grades must be presented in writing within one week after the test, homework, or project has been returned. Grades will be assigned based on all the work you have completed during the semester following the traditional practice of A=90-100, B=80-89, C=70-79, D=60-69, F<60.
**Course Readings:**

Weekly discussions will draw on materials for the below texts, reports, and primers:

- Scott L. Hoffman, "The Law and Business of International Project Finance" (Boston: Kluwer Law International)

Instructor may also assign a number of industry news services to discuss timely/current updates in Project Finance that are illustrative of core course topics.

### CLASS OUTLINE

<table>
<thead>
<tr>
<th>Week 1 (Date): Market evaluation &amp; opportunity assessment</th>
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<tr>
<td><strong>Description/Topics:</strong></td>
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<tr>
<td>- Distribution of project finance by energy source (thermal, O&amp;G, renewables), and lender profile (commercial, capital markets, etc)</td>
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<td>- Project need and viability, including policy dis/incentives (RPS, ITC/PTC, etc)</td>
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<td>- Understanding value split among infrastructure stakeholders, including developer, sponsor, EPC, lender, tax equity investor, operator, and offtake customer(s)</td>
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<th>Week 2 (Date): Financial modelling and returns</th>
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<td><strong>Description/Topics:</strong></td>
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<tr>
<td>- Valuation of assets, cost/revenue assumptions</td>
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<td>- Capital/operating costs</td>
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<td>- IRR and debt coverage ratios - gearing (debt-to-equity), annual debt service coverage, project life coverage, etc.</td>
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<th>Week 3 (Date): Project finance</th>
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<td><strong>Description/Topics:</strong></td>
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<tr>
<td>- Typical project finance lenders: Debt (senior vs. junior/mezzanine), Equity</td>
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<td>- Why create a Special Purpose Vehicle/Project Company? Benefits/disadvantages</td>
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<td>- Entity structure – LLC, JVs, strategic alliances, MLP/YieldCo, etc.</td>
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<td>- Sale of Project Company: partnership flip, Sale-leaseback and inverted lease</td>
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<td>- Rating agencies and project credit risk</td>
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<td>- New debt issuance / refinancing</td>
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**Week 4 (Date): Offtake agreements**

**Description/Topics:**
- PPA
- Capacity markets & ancillary services
- Environmental and renewables attributes

**Week 5 (Date): Legal / regulatory**

**Description/Topics:**
- Real estate, siting, and land use due diligence, environmental assessment and permitting
- Transmission and Interconnection
- Federal and state regulatory bodies/statutes, including PURPA, FPA, and Energy Policy Act of 2005

*Mid-term will cover all content through Week #5 lecture*

**Week 6 (Date): Project risk management**

**Description/Topics:**
- Risk source
  - Technology maturity
  - Fuel/resource availability/intermittency
  - Long-term market pricing risk
  - Construction delay/completion risk and operational/O&M
  - Regulatory risk – both permitting and financial
  - Competitor performance – risk of obsolescence by time project is complete
  - Other – management performance, risk majeure, budget estimate accuracy, etc.
- Stakeholder risk-management capabilities, risk-bearing capacities, and ownership (e.g. contractors, operators, financiers, etc)
- Solutions and tools
  - Adequate risk ratios
  - Debt service reserve account
  - Syndication / risk pooling
  - Financial hedging instruments (credit derivatives)

**Week 7 (Date): Public-private partnerships**

**Description/Topics:**
- Pooling risk and resources for mutual benefit:
  - *Private sector:* guarantees against policy and the financing risks entailed by the time gap between a project’s planning phase and its actual implementation
  - *Public sector:* needs capital investment and management expertise
**Week 8 (Date): International project considerations**

**Description/Topics:**
- Risk: Tariffs, Currency risk, Political/sovereign
- IP
- Workforce skill base
- Multilateral Development Banks

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**Week 9 (Date): Specific resource considerations**

**Description/Topics:**
- Oil & Natural Gas
- Solar
- Wind
- Hydro
- Storage

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**Week 10 (Date): Sample project**

**Description/Topics:**
- Build a sample project IRR and pitch to theoretical investors

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**Northwestern University Policies & Resources:**

**Academic Integrity**

*Academic integrity is taken very seriously at Northwestern. Students are responsible for reading and understanding Northwestern’s Academic Integrity policies. All suspected violations will be reported to the McCormick College of Engineering’s Dean’s Office. These include: cheating, plagiarism, fabrication, unfair advantage, unauthorized collaboration, and aiding and abetting of academic dishonesty. Students found in violation of academic integrity may receive a zero on the assignment or a failing grade for the course, and may be suspended or permanently expelled from the University. See Academic Integrity: A Basic Guide for more information.*

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**AccessibleNU and Disability Accommodations**

*Any student requesting accommodations related to a disability or any other condition is required to register with AccessibleNU (847-467-5530) and provide professors with an accommodation notification from AccessibleNU, preferably within the first two weeks of class. All information will remain confidential. See the AccessibleNU website for more information.*
Illness and Medical Leave of Absence

Review the University’s policy on missing academic work due to illness. Your instructor cannot waive an assignment missed due to illness unless she can verify your illness with Health Services.

Discrimination and Sexual Harassment

Northwestern’s Policies on Discrimination, Harassment, and Sexual Harassment apply to all members of the University community, including students, staff, faculty, and third parties. Any student, staff, faculty member, or third party who believes that they have been discriminated against or harassed on the basis of their race, color, religion, national origin, sex, sexual orientation, gender identity, gender expression, pregnancy, parental status, marital status, age, disability, citizenship, veteran status, genetic information or any other classification protected by law, should contact the Office of Equity at (847) 467-6571. Additional information about the University’s discrimination and harassment policies, including the campus resources available to assist individuals with discrimination or harassment concerns, is available online on the Office of Equity Website. Students, staff, and faculty who report harassment, discrimination, or sexual misconduct are also protected under the University’s Policy on Non-Retaliation.

Sexual Misconduct and Reporting

Northwestern University is committed to fostering an environment where students are safe and free from sexual misconduct. Confidential resources are available to those who have experienced sexual misconduct. Faculty and instructors are not confidential resources and are required to report incidents of sexual misconduct, whether discussed in your assignments or in person, to the Office of Equity, which can provide information about resources and options. We encourage students who have experienced sexual misconduct to talk with someone to get support. For more information, including how to request interim protective measures and academic accommodations or file a complaint, see the Get Help page.

Other Resources

Students can find useful resources for safety and security, academic support, and mental and physical health and well-being at the NUhelp website.