COURSE SYLLABUS - Developing Solar Projects Across the U.S. [Professor Noakes]

Environmental Studies Capstone: DEVELOPING SOLAR PROJECTS ACROSS THE U.S.
ENVST-UA 900.001–ES Capstone Fall 2016

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Meets: Mondays, 5-730pm
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COURSE DESCRIPTION

Project & Capstone Overview:

Companies across the U.S. are employing solar energy projects to help lower their operating expenses. For many companies, electricity costs represent the single largest operating expense. With the current cash/tax incentives in place in conjunction with the continued fall in solar system prices, companies have been able to dramatically reduce energy expenditures. Companies are either purchasing solar systems or purchasing the energy from third party solar systems to compete against local retail electricity rates, saving their business money and operating expenses.

These solar electricity arrangements are structured as locked-in, fixed energy prices. This is referred to as a Power Purchase Agreement (PPAs) and serves as a valuable hedge against rising and volatile electricity rates. Furthermore, companies can offset tax liability by securing tax credits to minimize the upfront cost of the project they're purchasing. Despite the clear benefit of solar energy for commercial businesses, there are still significant barriers that solar developers need to overcome. Many solar companies lament about the sales 'bottleneck' in educating prospective clients on going solar. Some companies with ideal rooftops may simply be against the technology or skeptical of how it will coincide with their facilities (i.e. a realistic concern as to whether their roof can sustain the additional weight burden).

The commercial solar industry comprises solar PV projects for businesses that are larger than residential systems yet smaller than utility scale solar energy plants. These systems are being built rapidly across the U.S. as ground mount projects or rooftop units for businesses that normally have sufficient roof surface area (such as shopping malls and warehouses). The biggest problem with commercial solar is that a large number of businesses lease the facilities they operate from. This makes it difficult for a solar developer, who requires a long-term energy user for the project's solar electricity.

This course will help students understand the various types of 'solar customer pipelines' and why some customers integrate solar into their portfolio of buildings and others don't. In this course you'll be able to understand how to think like a solar developer by developing and financing a project to make the project 'shovel ready'.

Outcomes:

1. Revision of various state based solar incentives and strategies of how to deploy projects in specific sites across the U.S.
2. Identification of the different stages of the solar development process and being able to navigate projects from start to finish.
3. Communicate to stakeholders on how/where to deploy commercial solar across the U.S. and identify the gaps in policies, the issues and/or financial mechanisms that would be needed to effectively serve as a solar developer in the U.S.

Course Objectives & Resources

Students will get a first-hand account on how commercial solar projects in the U.S. are developed from start to finish. Learning how to search for the right client (roof space, credit-worthiness, building ownership, tax structures), through to designing a system for the client (list of design programs, PV analytic software, Google earth tricks). Students will be given tools to understand the basics of solar PV financial analysis - to analyze the financial and technical feasibilities of solar projects for various properties and clients. The key objectives are listed below:

- Identify what various solar companies are looking for - focusing on 2-3 real-life clients in the solar energy industry: Solar Landscape, & General Electric
- Understand how to develop a solar project for specific types of solar companies, by targeting large property-owner companies
- How to deploy as much solar as possible with the tools learned as possible.

From operating projects to winning new business, students will learn how projects are selected, designed, financed, constructed, and maintained. The viability of a project depends on the type of investor and the U.S. state it is based in. Students will learn how to identify key states with policies that allow high solar returns.

Students will understand what the financial community is looking for when they decide to own and operate a solar asset. Students will also be invited to attend a site inspection of current operating project to get a good idea of the materials required (racking, wiring, and inverter placements) and the overall timeframe of project completion.

Some of the Expert/Guest Lectures during the Course:

- CEO of Solar Landscape
- Head of Solar Development for G.E.
- The North East Solar Finance Director of an Independent Power Producer (NRG)

Key Assignment Percentage Breakdowns

1. SCOPING PAPER - 15% Date to be Confirmed
2. FINAL PRESENTATION - 20% Date to be Confirmed
3. CLASS PARTICIPATION - 10% ONGOING
4. HOMEWORK - 5% ONGOING
5. FINAL PAPER - 50% Date to be Confirmed

Key Readings/Networks/Publications for the course

1. The Real Estate Solar Investment Handbook: A Commercial Property Guide to Managing Risks and Maximizing Returns, by Aaron Binkley
2. Re-Imagining U.S. Solar Financing, Bloomberg New Energy Finance, 2012

3. A Framework for Project Development in the Renewable Energy Sector, by Robert Springer, commissioned by the NREL (National Renewable Energy Laboratory).
4. Database of State Incentives for Renewables & Efficiency - www.dsireusa.org
5. Energy.gov http://energy.gov/eere/energybasics/articles/solar-photovoltaic-technology-basics
6. NREL Solar Introduction: https://www.youtube.com/watch?v=JvzUq1ueF-g
7. NREL integrating renewables & solar into existing grid infrastructure http://www.nrel.gov/docs/fy16osti/65800.pdf

Week 1 - General Course Introduction

Introduction: Review Syllabus and highlight expectations over the semester

- Introduce the two clients and highlight what exactly they're looking for (i.e. Local EPC constructing in NJ and large multinational company entering the solar game to own and operate assets)
- Introduce Solar as a technology compared to other renewable energy sources.
- Brief introduction to State Incentives across the U.S.

HOMEWORK:

1. Research specific solar companies to present to the class for the following week (G.E. vs. Solar Landscape vs. specific property companies).
2. Read introduction & Part 1 to 'The Real Estate Solar Investment Handbook: A Commercial Property Guide to …'

Week 2 - Sizing/Efficiency & Development

- Further research into different U.S. solar companies (p.6 of re-imagining solar financing, Bloomberg)
- Discussion on the various types of solar modules. Class is divided into researching different technologies and educates rest of class on the different types of technologies (bifacial, polycrystalline, monocrystaline & perovskite panels)
- So why commercial solar? Research into utilities using a system of debits and credits called "Net Metering" when interacting with your solar power system.
- Activity on sizing a system, introduction to helioscope (a) for more energy than you produce (b) more energy than you consume and (c) when you're consuming exactly the same amount of energy your solar power system is producing

HOMEWORK:

1. Research top 5 incentive states in the U.S. using www.dsireusa.org
2. Select a number of property groups that would be good to track for these incentives

Week 3 - Incentives & Solar Financing

- What are the main solar energy incentives and how do you navigate them?
- What are the different states doing? In-depth look into NY, NJ, CT and MA - then class presents on each to the rest of the class/
- Who pays for the solar system? Discussion of different ownership structures
- PPA vs. Outright purchase Vs. Operating Lease
- Readings:

Power Purchase Agreements (PPAs)
Renewable Energy Policies: http://www.martinot.info/Beck_Martinot_AP.pdf The DSIRE Website: http://www.dsireusa.org/

HOMEWORK

1. Download Helioscope and conduct a PV design for the client based on an appropriate property site.

Week 4 Solar Financing Continued

- Introduction to Cashflows
- Scoping Document discussed
- Tax/Energy/Ownership structures reiterated
- Guest Lecture from one of clients

This lecture briefly reviews the basics of a solar lease & Power Purchase Agreement (or PPA) currently the most popular form of solar financing. This type of financing offers no out-of-pocket cost for the homeowner and typically lower power prices for 20-years. Both up-sides and down-sides are reviewed in this lecture.

HOMEWORK:

1. Work on Scoping Document

Week 5 - Solar Energy Development & Origination Steps

Guest Lecture, Shaun Keegan, CEO of Solar Landscape
- Identify the different steps in the solar development process from NREL (2 phases)
- Introduction to commercial real estate market
- Other sales steps include client screening, securing lead, designing system, Running financial analysis, and Presenting to client - Apply for incentive before Final presentation to client - Receive interconnection approval and NTP on project).
- How to secure a Lead, how to design a site, how to make Client Contact and the internal communication necessary for client contact to occur.
- Readings/ Activity: Break into groups and look at three real estate companies to do solar on their portfolios

HOMEWORK:

1. Do a project Teaser for the intended client (G.E./Solar Landscape)

Week 6 - Solar Finance Modeling Continued

Guest Lecture, Josh Feldman, Head of Finance for NRG Community Solar

- Introduction to NRG - presentation from Josh
  - Students have time to present their progress to date and to work with their groups - What a company like NRG is looking for when purchasing a project.

(c) Total project sq footage.
(d) Calculate allowable sale price and/or calculate if third party financed - sale price, current cost, margin, margin %

HOMEWORK – Read sections of Re: Imagining Solar Financing

Week 7 - RFPs, & Utility Scale Projects,

- RFPs, and competitive bids - example looking at AltaE
- Special utility scale focus targeting NY market
- Emphasis on environmental impact studies
- Focus on Interconnecting large-scale systems
- HOMEWORK: Continue working in groups

Week 8: Analysis of solar developments

- Positive/Negative specific solar developments: Social, Economic, Political, and Ecological Pros/Cons of whether solar is financially viable
- Finalize presentations to client

Students to receive feedback on drafts from the course instructor during this week.
HOMEWORK: Continue working in groups on origination activities

Week 9: In-depth Analysis of pre-construction/post construction

- Outline of project timeline and want chart analysis.
- Summary and overview of origination activities over the past few weeks.
- Outline of what the types of solar investors and the types of models they use to acquire projects
- Identification of the various methods of how these solar investment firms procure projects

HOMEWORK:
Continue working in groups
Reading for final proposal

Week 10: Taxes & Financial Models, LOIs, and Project Contracts

- Examine proper client contract
- Rehearse group presentation
- FAQ for final proposal assignments

Week 11: New Technologies & Batteries

- Guest Lecture from G.E. to discuss batteries and demand/response networks for smart cities
- Peer feedback on final drafts of slides Mock presentations
- Read & Discuss: https://www.greenbiz.com/article/5-smart-cities-players-step-ahead-googles-sidewalk-labs

Week 12 - 14: Final Course Stages & Presentation Rehearsals

- Ensure final proposals are being worked on and final presentation is ready to be presented to NYU community
- Work on previous topics to ensure main objectives are understood
- Submit final proposals to intended client
- Finalize Presentation to the NYU community, Environmental Studies, Client and the public

Final projects due and presentation, which will be published online. A copy of each group's final assignment must be submitted via blackboard dropbox.

Assignments & Grading

Weekly Projects and Responses to Readings – 5%
Students should draft and post on NYU Classes several thoughtful questions about each week's readings and homework activities. All students should read these questions and consider responses for future class conversation. One or more students may be assigned to lead these class discussions, preparing brief mini-presentations on key concepts and questions raised by the readings (PowerPoint or Keynote welcome, but not necessary).

Scoping/background Paper – 15 %
A 5-8 page exploration of the type, extent, and dimensions of the problem your Project. In this report, include the background of the company you're working on, and the justification for your approach to develop solar for them.
Identify what your team seeks to address. It is analogous to a research paper or thesis, and its completion will represent a pivot point in the course, after which Project. Teams shift from widening to narrowing / deepening their focus on the solar development process and what works for the current investors in the solar industry.
The Scoping/background Paper will include substantial relevant content for the Final Project.
The Scoping/background Paper is the document that converts an idea on a particular policy into the details of a potential project.
Scoping/background paper is to guide you in making an informed choice about the direction your project will take the rest of the semester.
It should address the following:

- Discussion of problem and how it came to be (Originating the solar project and selling projects to the real estate portfolio and/or solar investors)
- How have similar problems been responded to (tactics/methods that has worked in the past vs. not worked)

- Spell out possible solutions. Select appropriate sites to develop solar on and how this could be communicated to a purchaser of projects.
- Rationale for choosing the solution/site/development method

Final Policy Report / Cover Memo / Research Review Paper – 50%
Optional topics (for the clients you're working on)

1. Discussion piece on solar being ideal Distributed Generation and the ideal source of renewable energy for the U.S. and your client to reach its renewable energy targets
2. Solar energy projects can provide significant amounts of electricity while emitting virtually no greenhouse gases, but they require large areas of relatively flat land – should this land be used for something else and is there too much focus on solar vs. using arable land for crops
3. Investigate whether a solar investor should own the solar assets, or if the client themselves should own it - discuss their approach to investing in solar and delivering a return for their shareholders.
4. Propose your own solar discussion topic for the course instructor to approve.

Final Presentation – 20%
Teams will deliver PowerPoint presentations to the NYU community and the Project's clients and other experts and decision-makers. These presentations will outline a rigorous solar development process for the client, and convince them that it meets the economic requirements to be sold to an investor in the solar project.
The presentation must define the problems associated with developing a solar project and examine the process of problem solving the issue of selling the right solar package to a client. The scope of work on these presentations should be distributed equally within the group. Students will be graded on quality, appearance and content of presentation; preparation, content and delivery of oral group presentation; strong responses to audience questions, objections, and concerns. One person from each group must submit all final materials through the NYU Classes Final Assignment drop box.

Class Preparation / Attendance / Participation / Effort – 10%
Preparation and attendance are self-explanatory. Participation evaluated according to substance and regularity of contribution to in-class discussion, respect for classmates, and support for project team members' needs. Effort evaluated by receptivity to new skills and ideas, responsiveness to Client needs, collaboration within groups, personal commitment to implementing sustainable change, and a demonstrable journey of developing subject matter expertise over the course of the term.

Team Collaboration & Course Review
Team members will each submit a 1-page write-up of their itemized contribution to the collaborative final project, including reflections on successes and challenges within the collaborative process.

A – Strong understanding of ideas, highly successful development of skills, thorough solutions to problems and projects, constructive classroom participation and timely submission of work. B – Good understanding of ideas, successful development of
skills, good solutions to problems and projects, regular classroom participation, and timely preparation and submission of work.
C – Inconsistent understanding of ideas, some development of skills, coherent solutions to problems and projects, some classroom participation, and sporadic preparation and submission of work. D – Limited understanding of ideas, little development of skills, few solutions to problems and projects, poor attendance or participation, and sporadic preparation and submission of work.

F – No understanding of ideas or development of skills, poor attendance, skipped submission of work.

Attendance Policy:
Attendance will be taken for all classes. More than one unexcused absence will result in penalties to grades. Students are expected to attend all classes on time. Because coursework will be cumulative, material missed due to absences must be made up for the following week.
Plagiarism Policy:Plagiarism results in failure of the class. It includes: copying sentences or fragments from any source without quotes or references; not citing every source used in your papers; citing internet information without proper citation; presenting someone else's work as your own; or inadvertently copying verbatim from any source.

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Disability Disclosure Statement

Academic accommodations are available to any student with a chronic, psychological, visual, mobility, learning disability, or who is deaf or hard of hearing. Students should please register with the Moses Center for Students with Disabilities at 212-998-4980.

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