

## **SUMA PS5650 - Solar Project Development**

**Instructor:** Dan Giuffrida

**Office Hours:** 2 hours preceding class time and by appointment

**Response Policy:** Please come to office hours or send me an email with questions or to set up an appointment. I will respond within 24 hours with an answer or to set up a meeting time.

### **Course Overview**

At the end of this course, students will be prepared to fully evaluate the technical and financial aspects of a solar project. They will be equipped with skills allowing them to either develop or rigorously vet solar project proposals.

The course introduces and provides students with a holistic understanding of the end-to-end solar development process. The course has two goals:

1. To provide students a deep understanding of the dozens of critical interrelated steps critical to developing a successful operating solar project.
2. To equip the students with the tools and understanding of the skills necessary to develop a solar project beginning with site selection encompassing the entire process to commissioning and operations.

We begin the course providing the students with an understanding of the different segments of the solar industry; covering the upstream business, the main players both upstream and downstream and then outlining the different downstream markets: utility, commercial, and residential. We will then hone in on the distributed generation segment of the market; commercial, and residential. To begin, we will cover the critical value drivers of solar: sunlight resource, grid energy cost, tax credits, state and utility incentives including renewable energy credit markets. Energy consumption and production, despite what critics will say about renewables, is the main value driver of the move to renewables. In that light, we will cover in detail, net metering, national and local electricity markets, and electric utility tariff structure to understand how value is generated and measured. We will conduct energy consumption analysis for different end-users to see how solar can and will be deployed and valued across different geographic and utility tariff classes.

We will focus on site selection, delving deep into how site characteristics affect system design and ultimately energy production; building azimuth, roof age, RTU locations and parapet walls, roof tilts and materials. We will utilize satellite imagery software to identify viable solar locations as well as utilizing automated solar design software (Helioscope) to design systems. We will cover how to use energy production modeling software, PV Watts and PV Syst, which accurately predicts energy production based on dozens of parameters.

In addition to energy, incentives still play a key role in driving value for solar projects. We will cover state incentive markets, focusing on their design, how they drive value and how and when they de-risk projects for investors and owners. We will also cover federal tax incentives.

We will cover interconnection requirements to be a grid-tied power facility. In addition, we will cover required authorities having jurisdiction and when and how a solar development project must meet their requirements.

Financial valuation and modeling will be a heavy part of this course. The course will cover how to build an income and cash flow statement for a solar project, concepts around valuing solar projects, as well as how investors structure and value solar projects. Students will build capabilities around solar project financial modeling. They will leave the course with the ability to build from scratch a viable solar financial model.

All course concepts will culminate with the creation of a term project in which students create a solar proposal. Students will select from a list of sites around the country. They will utilize resources learned in the course to conduct energy consumption and production analysis, design a system, create a proposed financial structure, outline the financial and environmental benefits for all stakeholders, and provide the financial model backing those benefits. The proposal will include any interconnection and incentive applications required to get their project “shovel ready.”

## Learning Objectives

It is imperative that sustainability managers can rigorously analyze solar and other distributed energy technology projects. A key aspect of careers in sustainability is energy procurement and management. To effectively do this, one must be able to vet and analyze how to procure green energy.

The course will provide skills to those who wish to pursue careers in corporate sustainability with the requisite understanding and toolset to evaluate solar opportunities and shape future green energy corporate strategy. Additionally, it will prepare students with ambitions of entering the solar industry in sales, origination, development, finance or project management. Students will learn and develop the following skills and objectives:

- Demonstrate understanding of solar value drivers and how geographic, financial, regulatory and legislative changes will affect solar project valuations and more broadly accelerate or decelerate solar adoption.
- Explain in clear and concise detail many foundational concepts in solar such as: net metering, variable and demand rates, insolation, power purchase agreement, partnership flip, ITC, kilowatt hour, internal rate of return, discount rate, net present value, solar renewable energy credit among others.
- Explain in clear detail how geographic differences can explain varied financial return due to sunlight, seasonality, energy rates, electric rate structure, and incentive market design.
- Explain why certain solar system financial ownership structures work better with different types of property ownership structures.
- Explain how solar system value is split amongst stakeholders in different financial structures.
- Develop skills to build a viable, bankable financial model after being give only a system's address.
- Develop skills necessary to prepare a solar project for funding including: energy consumption analysis, system design, system energy production analysis, financial model creation, interconnection application preparation, and incentive capture.

### Example midterm/final exam questions:

- In New York City, which direction should solar panels be tilted? Why?
- If a building in Los Angeles consumes 1,000,000 kWh of energy per year, what size solar system is appropriate to offset approximately 90% of this consumption? A) 6 MW B) 600 kW C) 60 kW
- Why would a solar yieldco investment firm prefer to enter into a long-term contract to sell its SRECs?
- What is a demand charge?
- If a building is a night peaking facility with time-of-use pricing, can onsite solar work to reduce their energy usage? Please explain. If no, what technology could be deployed?
- What are the benefits to a solar system owner of string inverters versus central inverters?

### **Readings**

There is no single textbook that covers this course. Readings will be selected from various textbooks, publications, journals, and other sources. All readings are listed below in the course schedule.

### **Resources**

The readings will be provided via courseworks. Students will need to utilize the free online PV Watts energy production tool. In addition, a free trial of the Helioscope software will be provided. Microsoft Excel will be required for all financial modeling exercises and for both exams and term project.

### **Course Requirements (Assignments)**

#### Participation & Homework

Participation in all lectures and project activities is required. Contributions are expected to enhance the quality of the class experience for all students. All students are expected to post on the course discussion board with responses to weekly current events as well as other related topics that they find in their independent reading. Students should be thorough in presenting key issues as well as providing insights and implications of the event at hand. Students are also expected to bring to class comments on and sources for current events that occurred during the prior week and are reasonably related to the course topic. Students should be prepared to discuss current events presented by other students. There will additionally be periodic homework sets that students are expected to complete.

### Midterm exam

The Midterm exam in week 8 will consist of 15 short answer questions covering key terms and computational questions covering energy production utilizing the PV Watts tool. In addition, students will be asked to respond to 3 long form questions covering the calculations regarding the Investment tax credit, depreciation, energy consumption, and electric rate analysis.

### Final Exam

Final exam will cover short answer questions on financial valuation topics. It will consist of 15 short answer questions covering financial valuation metrics, financial valuation calculations, and solar energy specific financial concepts. The majority of the exam will require students to construct a financial model from given parameters and answer questions about the model. The students will be provided with the necessary solar energy and financial assumptions needed to construct a full financial cash flow model that allows students to conduct valuation on an example solar project.

### Term Project

Students will be put into groups of 2-3 and will create a solar proposal for a preselected location. The students will choose a location in the US and create a solar proposal. The proposal will require students to create a solar system design, justification for solar system sizing based on electric consumption and rate analysis. They will be required to create a solar system production projection model to approximate system energy production. They will be required to create a cash flow financial model. Based on their understanding of the occupant of the building and their financial position, they will propose a financial structure that best fits the building occupant and defend their approach. In their proposal, they will provide completed interconnection and incentive application specific to their solar system.

Date	Topics and Activities	Readings (due on this day)	Assignments (due on this date)
Week 1	Introduction to Solar:	1) <u>Historical Summary of Installed price of Photovoltaics</u> <a href="#">[i]</a> (70 pages, from leading renewable energy research laboratory at University of California Berkeley)	
Jan 17	Understanding the industry Verticals	2) <u>SEIA – 2015 Solar Market Insight report</u> <a href="#">[ii]</a> (60 pages; report from US solar trade association)	
Week 2	Solar Project Value Drivers	1) National Renewable Energy Laboratory – Photovoltaic System Pricing Trends <a href="#">[iii]</a> (31 pages; author: U.S. Department of Energy renewable energy research arm)	
Jan 31		2) National Renewable Energy Laboratory – 2014 Renewable Energy Databook <a href="#">[iv]</a> (114 Pages; author: U.S. Department of Energy renewable energy research arm)	
		3) <u>Solar Energy Engineering</u> , Chp. 2 <a href="#">[v]</a> (Pg. 58-122; graduate level solar engineering text)	
		4) <u>Let it Shine</u> , Chp. 24-29. Perlin & Lovins <a href="#">[vi]</a> (98 pages; authored by UCSB physics professor and co-founder of Rocky Mountain Institute)	
Week 3	Energy & Rates	1) <u>Electricity Markets and Power System Economics</u> , Chp. 1 & 2 (pp. 1-51; Graduate text by University of Hong Kong professor) <a href="#">[vii]</a>	
Feb 7		2) <u>Solar Energy Engineering</u> , Chp. 9 <a href="#">[viii]</a> (Pg. 481 – 538; graduate level engineering text)	

3) California ISO – Locational Marginal Pricing [\[ix\]](#) (80 pages; California power market independent system operator)

4) National Renewable Energy Laboratory – “Solar Power and the Electric Grid” [\[x\]](#) (4 pages; U.S. Department of Energy renewable energy research arm)

Week 4 Feb 14	Net Metering & Rates	1) <u>VDER proceeding Order 1</u> 2) <u>VDER proceeding Order 1</u> 3) <u>Photovoltaic Systems Engineering</u> , Chp. 21-46 (pp. 103-161; graduate text on PV system design by professor emeritus at Florida Atlantic University) <a href="#">[xi]</a>	
Week 5 Feb 21	Site Selection, System Design & Production Modeling	4) <u>Solar Energy Engineering</u> , Chp 11 <a href="#">[xii]</a> (Pg. 583 – 695; graduate level engineering text) 5) Rocky Mountain Institute – “Simple BoS – Reducing Solar PV soft costs” <a href="#">[xiii]</a> (61 pages from leading renewable energy research think-tank)	1) Familiarize self with PV Wa 2) Familiarize self with Heliosc
Week 6 Feb 28	Incentive Markets	1) National Renewable Energy Laboratory – “Solar Renewable Energy Certificate Markets: Status & Trends” <a href="#">[xiv]</a> (48 pages; author: U.S. Department of Energy renewable energy research arm) 2) Rocky Mountain Institute - “Net Energy Metering, Zero Net Energy, and The Distributed Energy Resource Future” <a href="#">[xv]</a> (49 pages; author: leading renewable energy research think-tank) 3) Chapter 7, pg. 85-95 <u>Project Development in the Solar Industry</u> <a href="#">[xvi]</a> (Director, Solar Frontier America, Inc.)	<b>DUE by class:</b> utility bill analy provided. Calculate total energy (including all components), and charges). Complete design on s: bills. Complete PV Watts on pr
Week 7	Midterm Exam	Study for Exam	Midterm Exam

Mar 7

NO Class – Spring Break

Mar 14

Week 8

Tax! The ITC  
& MACRs

Mar 28

1) National Renewable Energy Laboratory – “Implications of the Scheduled Federal Investment Tax Credit Reversion for Renewable Portfolio Standard Solar Carve-Out Compliance”[\[xvii\]](#) (47 pages; U.S. Department of Energy renewable energy research arm)

2) Title 26 – Internal Revenue Code 48[\[xviii\]](#) (16 pages; Internal Revenue Service)

3) Corporate Finance, Ivo Welch, chapter 17 (pp 545-593)[\[xix\]](#) (48 pages; MBA corporate Finance text by UCLA finance professor)

Week 9

Project  
Financial  
Modeling

Apr 4

1) Corporate Finance, Ivo Welch, chapters 1, 2 (pp 1-41), 13, 14 (pp. 387-481)[\[xxii\]](#) (135 pages; MBA corporate Finance text by UCLA finance professor)

Optional Submit draft of Term 1 consumption and production and electric rate analysis.

Week 10

Interconnection,  
permitting and  
other AHJs

Apr 11

1) National Renewable Energy Laboratory – SAPC Best Practices in PV System Installation (36 pages; U.S. Department of Energy Renewable Energy research arm)[\[xx\]](#)

2) Photovoltaic Systems Engineering, Chp. 4 (pp. 103-161; graduate text on PV system design by professor emeritus at Florida Atlantic University)[\[xxi\]](#)

3) Chapter 3, pg. 23-36 Project Development in the Solar Industry (Director, Solar Frontier America, Inc.)

Week 11	Project Valuation	1) <u>Damodaran on Valuation</u> , pages 1-66[ <a href="#">xxiii</a> ] (66 pages, <i>MBA finance text by NYU business school distinguished professor</i> )	Complete 30 year revenue mod
Apr 18	Project Valuation	2) <u>Corporate Finance</u> , Ivo Welch, chapters 5 & 6 (pp. 85-157)[ <a href="#">xxiv</a> ] (72 pages; <i>MBA corporate Finance text by UCLA MBA finance professor</i> )	Complete 30 year revenue mod
Week 12	Financial Structures	1) <u>Corporate Finance</u> , Ivo Welch, chapter 16 & 18 (pp. 511-545, 593-639)[ <a href="#">xxv</a> ] (48 pages; <i>MBA corporate Finance text by UCLA Business School finance professor</i> )	Complete 30-year income state
Apr 25	Financial Structures	2) “Tax Equity 101”[ <a href="#">xxvi</a> ] (12 pages; <i>Financial advisory firm Woodlawn Associates</i> )	Complete 30-year income state
		3) “Taking Mystery out of Partnership Flip”[ <a href="#">xxvii</a> ] (2 pages; <i>leading project finance law firm Akin Grump Strauss</i> )	
		4) “SEIA – Solar PPA Fact Sheet”[ <a href="#">xxviii</a> ] (5 pages; <i>Solar Energy trade Association</i> )	
Week 13	Investor Financial Modeling	1) National Renewable Energy Laboratory Solar Power Purchase Agreement (33 pages; <i>U.S. Department of Energy Renewable Energy research arm</i> )	Integrate Equity and tax equity
May 1	Investor Financial Modeling	2) National Renewable Energy Laboratory – 0% down Residential Lease Agreement (21 pages; <i>U.S. Department of Energy Renewable Energy research arm</i> )	Integrate Equity and tax equity
		3) <u>Financial Modeling</u> , Chp. 3 (pp. 103 – 135; <i>graduate finance text by MBA professor at Tel Aviv University</i> )[ <a href="#">xxix</a> ]	
Final Exam Week	Final Exam	STUDY	Final Exam & Term Project

May 9

- [i] Barbose, G.; Darghouth, N.; Weaver, S.; Wiser, R. (2014). *Tracking the Sun VII: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2013*. Berkeley, CA: Lawrence Berkeley National Laboratory.
- [ii] Solar Energy Industries Associate. *US Solar Market Insight Report – 2014 Year-in-Review*. 2014.
- [iii] Feldman, David; Galen Barbose. (2014) *Photovoltaic System Pricing Trends*. Golden, CO. National Renewable Energy Laboratory.
- [iv] Beiter, Philipp; Karin Haas, et al. *2014 Renewable energy Data Book*. U.S. Department of Energy.
- [v] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.
- [vi] Lovins, Amory, John Perlin. Let it Shine. Pg. 341-430. New World Library, California. 2013.
- [vii] Gan, Deqiang, Donghan Feng, Jun Xie. Electricity Markets and Power System Economics. CRC Press, Boca Raton, FL; 2014.
- [viii] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.
- [ix] Treinen, R. *Locational Marginal Pricing (LMP): Basics of Nodal Price Calculation*. California ISO.
- [x] Turchi, Craig. *Solar Power and the Electric Grid*. National Renewable Energy Laboratory.
- [xi] Messenger, Roger A. Jerry Ventre. Photovoltaic Systems Engineering. 3<sup>rd</sup> edition. CRC Press. Boca Raton, FL 2010.
- [xii] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.
- [xiii] Morris, Jesse; Koben Calhoun; Joseph Goodman; Daniel Seif. *Reducing Solar PV Soft Costs – A Focus on Installation Labor*. December 2013. Boulder, CO. Rocky Mountain Institute.
- [xiv] Bird, Lori; Jenny Heeter; Claire Kreycik. *Solar Renewable Energy Certificate (SREC) Markets: Status and Trends*. 2011. Golden, CO. National Renewable Energy Laboratory.

[xv] Rocky Mountain Institute. *Net Energy Metering, Zero Net Energy and the Distributed Energy Resource Future*. 2012. Snowmass, CO. Rocky Mountain Institute.

[xvi] Fong, Albert; Jesse Tippett. Project Development in the Solar Industry. December 2012. CRC Press.

[xvii] Heeter, Jenny; Travis Lowder; Eric O'Shaughnessy; John Miller. *Implications of the Scheduled Federal Investment Tax Credit Reversion for Renewable Portfolio Standard Solar Carve-out Compliance*. 2015. Golden, CO. National Renewable Energy Laboratory.

[xviii] Internal Revenue Service. Internal Revenue Code, Title 26, Code 48.

[xix] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xx] Doyle, C, A. Truitt, D. Inda, R. Lawrence, R. Lockhart, M. Golden. *SAPC Best Practices in PV System Installation, 2015*. Golden, CO. National Renewable Energy Laboratory.

[xxi] Messenger, Roger A. Jerry Ventre. Photovoltaic Systems Engineering. 3<sup>rd</sup> edition. CRC Press. Boca Raton, FL 2010.

[xxii] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xxiii] Damodaran, Aswath. Damodaran on Valuation. 2<sup>nd</sup> Edition. Pp 1-66. 2006. Wiley.

[xxiv] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xxv] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xxvi] Lutton, Josh. "Tax Equity Structures 101." Woodlawn Associates. 2013.

[xxvii] Burton, David, Joe Sebek. "Taking Some Mystery Out of the Alternative Energy Flip Partnership Structures." *Equipment Leasing & Financing Magazine*. May/June 2013.

[xxviii] "Solar Power Purchase Agreements." Solar Energy Industries Association." December 2012.

[xxix] Benninga, Simon. Financial Modeling, 3<sup>rd</sup> edition. MIT Press, Cambridge, MA 2008.

The final course grade will be computed using a weighted index of numeric grades that combine performance under attendance and participation, midterm exam, final exam, and term project. The weighted index will be scaled into a letter grade scale from F to A+ based on an expectation that a class representative of the population of Columbia masters students will receive a median grade of B+ or A-. **Evaluation/Grading**

Class Participation & Homework: 5%

Participation will be evaluated based on the quality of the students' contributions in class discussions each week and their posts to the CourseWorks discussion board regarding course readings and case studies. Periodic graded homework problem sets will also be a component

#### Midterm Exam: 25%

The midterm exam will be evaluated based on the correctness of several short answer questions covering key terminology and key concepts covered to this point. In addition, several long answer questions will require both computational and written responses. The midterm will be graded on a scale of 0-100.

#### Final Exam: 30%

The final exam will be evaluated based on the correctness of several short answer questions covering key terminology and key concepts covered throughout the semester. Students will spend a majority of the exam period constructing a financial model to calculate income, cash flow, and investment returns of a solar project. To construct the model requires students to show aptitude and understanding of several concepts which must be thoroughly understood to translate into a correct and viable excel financial model.

#### Term Project: 40%

The project will be evaluated based on the accuracy of calculations and financial models. They will also be evaluated based on the reasoning and support they provide as justification for their approach to how they arrive at their proposed solar solution. In addition, the professionalism, clarity of information presentation, and clarity of the overall written proposal will be evaluated. Each member of the group will receive the same grade.

### **Course Policies**

#### **Attendance**

Regular attendance in lectures is required. Students are expected to have done the readings for each session prior to the lecture.

#### **Participation**

Participation in all lectures and project activities is required. We expect your contributions to enhance the quality of the class experience for yourself and others. This involves making relevant, useful and non-obvious comments, or posing pertinent questions, in clear and succinct language. During the lectures, come prepared to answer impromptu questions about the readings and course assignments.

#### **Late work**

All assignments must be submitted on the published due dates. In the absence of well-documented extenuating circumstances, I will deduct 10 points from the assignment grade score for each day that you are late in submission.

### **Citation & Submission**

All written assignments must use MLA format, cite sources, and be submitted to the course website (not via email).

### **Course Schedule/Course Calendar**

### **School Policies (Standard boilerplate)**

#### *Copyright Policy*

Please note -- Due to copyright restrictions, online access to this material is limited to instructors and students currently registered for this course. Please be advised that by clicking the link to the electronic materials in this course, you have read and accept the following:

The copyright law of the United States (Title 17, United States Code) governs the making of photocopies or other reproductions of copyrighted materials. Under certain conditions specified in the law, libraries and archives are authorized to furnish a photocopy or other reproduction. One of these specified conditions is that the photocopy or reproduction is not to be "used for any purpose other than private study, scholarship, or research." If a user makes a request for, or later uses, a photocopy or reproduction for purposes in excess of "fair use," that user may be liable for copyright infringement.

#### *Academic Integrity*

Columbia University expects its students to act with honesty and propriety at all times and to respect the rights of others. It is fundamental University policy that academic dishonesty in any guise or personal conduct of any sort that disrupts the life of the University or denigrates or endangers members of the University community is unacceptable and will be dealt with severely. It is essential to the academic integrity and vitality of this community that individuals do their own work and properly acknowledge the circumstances, ideas, sources, and assistance upon

which that work is based. Academic honesty in class assignments and exams is expected of all students at all times.

SCE holds each member of its community responsible for understanding and abiding by the SCE Academic Integrity and Community Standards posted at <http://ce.columbia.edu/student-life-and-alumni-relations/academic-integrity-and-community-standards>. You are required to read these standards within the first few days of class. Ignorance of the School's policy concerning academic dishonesty shall not be a defense in any disciplinary proceedings.

### *Accessibility*

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: <http://health.columbia.edu/services/ods/support>.

[i] Barbose, G.; Darghouth, N.; Weaver, S.; Wiser, R. (2014). *Tracking the Sun VII: An Historical Summary of the Installed Price of Photovoltaics in the United States from 1998 to 2013*. Berkeley, CA: Lawrence Berkeley National Laboratory.

[ii] Solar Energy Industries Associate. *US Solar Market Insight Report – 2014 Year-in-Review*. 2014.

[iii] Feldman, David; Galen Barbose. (2014) *Photovoltaic System Pricing Trends*. Golden, CO. National Renewable Energy Laboratory.

[iv] Beiter, Philipp; Karin Haas, et al. *2014 Renewable energy Data Book*. U.S. Department of Energy.

[v] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.

[vi] Lovins, Amory, John Perlin. Let it Shine. Pg. 341-430. New World Library, California. 2013.

[vii] Gan, Deqiang, Donghan Feng, Jun Xie. Electricity Markets and Power System Economics. CRC Press, Boca Raton, FL; 2014.

- [viii] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.
- [ix] Treinen, R. *Locational Marginal Pricing (LMP): Basics of Nodal Price Calculation*. California ISO.
- [x] Turchi, Craig. *Solar Power and the Electric Grid*. National Renewable Energy Laboratory.
- [xi] Messenger, Roger A. Jerry Ventre. Photovoltaic Systems Engineering. 3<sup>rd</sup> edition. CRC Press. Boca Raton, FL 2010.
- [xii] Kalogirou, Soteris A. Solar Energy Engineering, 2<sup>nd</sup> Edition. Academic Press, Waltham, MA. 2014.
- [xiii] Morris, Jesse; Koben Calhoun; Joseph Goodman; Daniel Seif. *Reducing Solar PV Soft Costs – A Focus on Installation Labor*. December 2013. Boulder, CO. Rocky Mountain Institute.
- [xiv] Bird, Lori; Jenny Heeter; Claire Kreycik. *Solar Renewable Energy Certificate (SREC) Markets: Status and Trends*. 2011. Golden, CO. National Renewable Energy Laboratory.
- [xv] Rocky Mountain Institute. *Net Energy Metering, Zero Net Energy and the Distributed Energy Resource Future*. 2012. Snowmass, CO. Rocky Mountain Institute.
- [xvi] Fong, Albert; Jesse Tippett. Project Development in the Solar Industry. December 2012. CRC Press.
- [xvii] Heeter, Jenny; Travis Lowder; Eric O’Shaughnessy; John Miller. *Implications of the Scheduled Federal Investment Tax Credit Reversion for Renewable Portfolio Standard Solar Carve-out Compliance*. 2015. Golden, CO. National Renewable Energy Laboratory.
- [xviii] Internal Revenue Service. Internal Revenue Code, Title 26, Code 48.
- [xix] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.
- [xx] Doyle, C, A. Truitt, D. Inda, R. Lawrence, R. Lockhart, M. Golden. *SAPC Best Practices in PV System Installation, 2015*. Golden, CO. National Renewable Energy Laboratory.
- [xxi] Messenger, Roger A. Jerry Ventre. Photovoltaic Systems Engineering. 3<sup>rd</sup> edition. CRC Press. Boca Raton, FL 2010.
- [xxii] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.
- [xxiii] Damodaran, Aswath. Damodaran on Valuation. 2<sup>nd</sup> Edition. Pp 1-66. 2006. Wiley.
- [xxiv] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xxv] Welch, Ivo. Corporate Finance: 3<sup>rd</sup> Edition. 2014. Ivo Welch.

[xxvi] Lutton, Josh. "Tax Equity Structures 101." Woodlawn Associates. 2013.

[xxvii] Burton, David, Joe Sebik. "Taking Some Mystery Out of the Alternative Energy Flip Partnership Structures." Equipment Leasing & Financing Magazine. May/June 2013.

[xxviii] "Solar Power Purchase Agreements." Solar Energy Industries Association." December 2012.

[xxix] Benninga, Simon. Financial Modeling, 3<sup>rd</sup> edition. MIT Press, Cambridge, MA 2008.