

## **Three Essentials of the Electric Grid: Business Essentials**

Vermont Law School Summer  
Session 2020, Term  
June 1, 2020- June 4, 2020  
10:30 AM to 12:00 PM  
1:00 PM to 2:30 PM

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### CLASS 1

Monday, June 1, 20  
**Electricity Sector Fundamentals**

#### Videos

- <https://www.studentenergy.org/topics/electrical-grid> (Video – Grid Basics)
- <https://www.youtube.com/watch?v=TlecJcCJ7zg&vI=en> (Video- Distributed Energy Resources)
- [https://www.youtube.com/watch?time\\_continue=149&v=JwRTpWZReJk&feature=emb\\_title](https://www.youtube.com/watch?time_continue=149&v=JwRTpWZReJk&feature=emb_title) (Video – Smart Grid)

#### Readings

- [https://en.wikipedia.org/wiki/Regional\\_transmission\\_organization\\_\(North\\_America\)](https://en.wikipedia.org/wiki/Regional_transmission_organization_(North_America)) (RTO and ISO Defined)
- <https://www.power-grid.com/2010/03/01/why-we-can-t-avoid/-gref> (Avoided Cost Concepts)
- <https://www.profitwell.com/blog/discount-rate-formula> (Discounting and Net Present Value)

#### Reference Materials

- Instructor Provided Spreadsheet (Posted on TWEN)
- <https://www.eia.gov/electricity/generatorcosts/> (Reference Material on Construction Costs of Electricity Generation Resources)
- [https://www.eia.gov/outlooks/aeo/assumptions/pdf/table\\_8.2.pdf](https://www.eia.gov/outlooks/aeo/assumptions/pdf/table_8.2.pdf) (Reference Material on Total Costs of Electricity Generation Resources)
- <https://www.world-nuclear.org/information-library/economic-aspects/economics-of-nuclear-power.aspx> (Reference Material on Cost of Nuclear Generation Resources)
- [https://www.eia.gov/electricity/monthly/epm\\_table\\_grapher.php?t=epmt\\_6\\_07\\_b](https://www.eia.gov/electricity/monthly/epm_table_grapher.php?t=epmt_6_07_b) (Reference Material on Non-Fossil Resource Capacity Factors)
- [https://www.eia.gov/electricity/annual/html/epa\\_04\\_08\\_a.html](https://www.eia.gov/electricity/annual/html/epa_04_08_a.html) (Reference Material on Fossil Resource Capacity Factors)
- [https://www.eia.gov/outlooks/aeo/pdf/electricity\\_generation.pdf](https://www.eia.gov/outlooks/aeo/pdf/electricity_generation.pdf) (pages 1-7) (EIA Presentation on Levelized Cost of Electricity and Levelized Avoided Cost)

**CLASS 2**  
Tuesday, June 2, 2020

**Project Analysis**

Topics:

- Basic Project Financing
  - Debt, Equity and D/E Ratio
  - Weighted Cost of Capital
- Discount Rate Measurement
  - Opportunity Cost (WACC)
  - Private versus Social
- Basic Cost-Benefits Analysis
- Cost-Benefits Metrics
- Comparative Resource Analytics

Videos:

- <https://www.youtube.com/watch?v=7tdKkeNCIPE> (Introduction to Cost-Benefit Analysis)

Readings:

- Instructor Provided Spreadsheet (Posted on TWEN)  
<https://www.nrel.gov/docs/legosti/old/5173.pdf>, pages 9-14 (Cost of Capital and Cash Flow Discounting)
- [https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701\\_cea\\_discounting\\_issue\\_brief.pdf](https://obamawhitehouse.archives.gov/sites/default/files/page/files/201701_cea_discounting_issue_brief.pdf) (Development Private and Social Discount Rate)
- [https://www8.gsb.columbia.edu/faculty/jstiglitz/sites/jstiglitz/files/2006\\_High\\_Cost\\_of\\_the\\_Iraq\\_War.pdf](https://www8.gsb.columbia.edu/faculty/jstiglitz/sites/jstiglitz/files/2006_High_Cost_of_the_Iraq_War.pdf) (Applied Cost-Benefit Analysis)
- <https://www.heritage.org/homeland-security/commentary/iraq-weighing-the-costs-benefits> (Applied Cost-Benefit Analysis)
- <https://insight.kellogg.northwestern.edu/article/economic-cost-coronavirus-recession-covid-deaths> (Applied Cost-Benefit Analysis)
- <https://www.forbes.com/sites/theapothecary/2020/03/27/how-economists-calculate-the-costs-and-benefits-of-covid-19-lockdowns/-a814e4c6f630> (Valuing Human Life)  
<https://www.nrel.gov/docs/fy12osti/52197.pdf> pages 6-11 (Investment Decision Metrics)

Reference Materials:

- [https://www3.epa.gov/ttnecas1/docs/ria/utilities\\_ria\\_final-clean-power-plan-existing-units\\_2015-08.pdf](https://www3.epa.gov/ttnecas1/docs/ria/utilities_ria_final-clean-power-plan-existing-units_2015-08.pdf) (EPA Analysis of Clean Power Plan)

**CLASS 3**

Wednesday, June 3, 2020

**Financial Analysis of Renewable Energy Resources**

Topics:

- Basic Analytics of Renewable Resources
- Key Cash Flows
  - Revenue
  - Avoided Cost
  - Investment Cost
  - Operating Costs
  - Taxes
    - Investment Tax Credit (ITC)
    - Production Tx Credit (PTC)
    - Modified Accelerated Cost-Recovery System (MACRS)
  - Incentives
  - Externalities
- Proforma Cash Flow Analysis

Readings:

- <http://large.stanford.edu/courses/2018/ph240/liang1/docs/gdae-2014.pdf>
- APPA Value of Solar Primer, 2016 American Public Power Association [www.PublicPower.org](http://www.PublicPower.org) (Available on TWEN)
- [https://rmi.org/wp-content/uploads/2017/05/RMI\\_Document\\_Repository\\_Public-Reprrts\\_eLab-DER-Benefit-Cost-Deck\\_2nd\\_Edition131015.pdf](https://rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reprrts_eLab-DER-Benefit-Cost-Deck_2nd_Edition131015.pdf) (pages 7-17)
- <https://www.seia.org/initiatives/depreciation-solar-energy-property-macrs> (MACRS)
- <https://programs.dsireusa.org/system/program/detail/676> (MACRS)
- <https://programs.dsireusa.org/system/program/detail/734> (PTC)
- <https://programs.dsireusa.org/system/program/detail/658> (ITC)
- <https://www.seia.org/initiatives/solar-investment-tax-credit-itc>

Reference Materials:

- Instructor Provided Spreadsheet (Posted on TWEN)
- <https://www.nrel.gov/docs/fy14osti/62447.pdf>

- <http://mdvseia.org/wp-content/uploads/2014/12/SSG-Value-of-Solar-Study-Final-10-31-14.pdf>
- <https://www.nrel.gov/analysis/solar-manufacturing-cost.html>

## CLASS 4

Thursday, June 4, 2020

### **Alternate Perspectives on Resource Economics and C/B outcomes**

#### Topics:

- Developer Cash Flows versus Utility Revenue Requirement
- Cross Customer Subsidization
- Stakeholder perspectives
  - Developer
  - Solar Customer
  - Utility
  - Society
- Stakeholder Perspective and Cost-Benefit Metrics

#### Readings:

- APPA Paper – Solar Photovoltaic Power: Assessing the Cost and Benefits (Posted on TWEN)
- [https://rmi.org/wp-content/uploads/2017/05/RMI\\_Document\\_Repository\\_Public-Reports\\_eLab-DER-Benefit-Cost-Deck\\_2nd\\_Edition131015.pdf](https://rmi.org/wp-content/uploads/2017/05/RMI_Document_Repository_Public-Reports_eLab-DER-Benefit-Cost-Deck_2nd_Edition131015.pdf) (pages 18-19)

#### Reference Materials:

- Instructor Provided Spreadsheet (Posted on TWEN)
- [http://www.irecusa.org/wp-content/uploads/2013/10/IREC\\_Rabago\\_Regulators-Guidebook-to-Assessing-Benefits-and-Costs-of-DSG.pdf](http://www.irecusa.org/wp-content/uploads/2013/10/IREC_Rabago_Regulators-Guidebook-to-Assessing-Benefits-and-Costs-of-DSG.pdf)

