ENV 790.02:  
Introduction to Environmental Finance  

Fall 2018  

SYLLABUS  
(Version: August 24, 2018)

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TA:  
Jay Vitha, jay.vitha@duke.edu

Class Meeting Times:  
Mondays 4:40 to 7:10pm  
Environment Hall, Field Auditorium, Room 1112

Office Hours - Professor:  
Mondays 2:00 to 3:30 pm  
Environment Hall, Room 4112

Office Hours - TA  
Tuesdays 9:00 to 10:00 am
Course Description

This course will provide students with a primer on finance, especially in the context of achieving environmental objectives such as clean air, clean water, habitat preservation, and public health.

As an example of the important role of finance in environmental management, consider that today 800+ investors representing $100+ trillion in financial assets now pay attention to and support the CDP’s (fka, Carbon Disclosure Project) annual survey of the climate change, water, forestry, and supply chain activities of over 5,000 companies around the world.

Topics in this class include key financial principles, useful financial documents, common investment instruments, the role of various financial institutions and professionals, important financial return metrics, the three core financial statements, impact investment, venture capital, angel investing, private equity, project finance, and public finance.

The teaching format includes discussion of Harvard Business Publishing case studies, lectures on important finance principles, exercises with essential financial documents (e.g., income statement), group projects, interviews with guest speakers, analysis of the latest environmental finance headlines, up-to-date industry reports, and practice-oriented assignments.

This course serves as a prerequisite for ENV 790.03 Clean Energy Finance (Fall, Dr. Chris Wedding), ENV 741 Water Finance (Spring, Dr. Martin Doyle), and ENERGY 602 Energy Finance (Spring, Professor Emma Rasiel).

This course is especially relevant for students with Business & Environment and Energy & Environment concentrations at the Nicholas School, but students from other programs and schools are also welcomed.

Course Objectives

General goals for students:

- Recognize the pivotal role that finance plays in environmental management
- Understand 10 of the most important principles of finance (e.g., time value of money, risk vs. reward, liquidity risk)
• Be equipped to consider a wider range of financial instruments and investment perspectives when crafting solutions to environmental challenges in consulting, corporate, nonprofit, and government careers
• Recognize the difference between various types of private finance (e.g., angel finance, venture capital, private equity) vs. public company finance (e.g., Fortune 500 company)
• Learn to speak more like investors and your future finance peers by comprehending 50+ of the most widely used financial vocabulary
• Be better prepared for finance courses at Fuqua School of Business or the Economics Department that go into greater depth on these topics

Skills students should learn:

• Calculate various financial metrics of success for environmental finance opportunities (e.g., IRR, ROI, MOIC, NPV, payback period)
• Understand and opine on key financial documents (e.g., strengths and weaknesses in income statements, balance sheets, cash flow statements)
• Understand and be able to calculate 10 key financial ratios to determine a company’s financial health
• Understand and be able to co-create a Letter of Intent (LOI) and Term Sheet for an investment proposal (convertible note)

Course documents to stay organized:

To easily keep track and stay on top of things in this course, it will help if you bookmark these websites:

• Syllabus
• Key takeaways
• Q&A
• Framing questions for your readings

Course Outline and Readings

The Harvard Business Publishing case studies course pack can be purchased at this link.

When you have questions:
I do not want any student to fall behind or remain confused. (Some confusion though is good. That might be a temporary step to greater learning.) Please do not wait too long to get answers.

There are seven ways to get your questions answered, in order of preference:
1. Ask your question to me during or after class.
2. Ask your question to your peers after class.
3. Email the TA with questions: Jay Vitha, jay.vitha@duke.edu
4. Set up a time to meet with the TA during office hours.
5. Post any questions you have after class in this shared document -- Q&A.
6. Email me with your question: chris.wedding@duke.edu.
7. Schedule a time to visit me in my office hours (Mondays 2:00 to 3:30 most weeks).

To facilitate helpful class discussions

I expect students to come to class prepared to share their ideas and questions from the readings. To help students prepare and focus on certain parts of the readings below, I will share some specific questions for class ahead of each class in this shared document -- Question for your readings.

To facilitate retention of key lessons

In any university course, including this one, we will cover many pages of reading and many topics of discussion. It can be difficult to decipher the most important points for each class.

In order to help students remember the critical takeaways for each class, I will share about five of these takeaways with about three days after each class. I will also invite students to post their own takeaways after class, too. If you choose to do so, please put your name in parenthesis behind each bulleted addition. This contributes towards your Class Participation portion of your grade. We will use this shared document -- Key Takeaways.

<table>
<thead>
<tr>
<th>Date</th>
<th>Topics &amp; Guest Speakers</th>
<th>Readings (required) &amp; Resources (optional)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Week 1: Mon. 8/27</td>
<td>Class Introductions:</td>
<td>Readings:</td>
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<tr>
<td></td>
<td>● What experience, if any, do you have in finance?</td>
<td>● <strong>Mind Map of the Financial Industry (Chris Wedding)</strong></td>
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<tr>
<td></td>
<td>● How will you apply this course in your career?</td>
<td>● <strong>Top 10 Principles of Finance (Chris Wedding)</strong></td>
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<tr>
<td>Syllabus</td>
<td>Resources</td>
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<td>------------------------------------------------------------------------</td>
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<tr>
<td>● Learning outcomes</td>
<td>• The Types of Investor Funding (Fundable)</td>
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<tr>
<td>● Course requirements: Assignments and readings to support course objectives</td>
<td>• Net Present Value and Internal Rate of Return: Accounting for Time - Harvard coursepack</td>
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<tr>
<td>● Student evaluation methods</td>
<td>Resources:</td>
<td></td>
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<tr>
<td></td>
<td>• Investopedia - sign up</td>
<td></td>
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<tr>
<td></td>
<td>&quot;Newsletter: Term of the Day“ (middle of page, check the box, etc.</td>
<td></td>
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<tr>
<td></td>
<td>• HBR Guide to Finance Basics for Managers - Harvard coursepack; it provides more useful content</td>
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<td></td>
<td>than we can cover in class; various chapters can serve as a resource for your assignments</td>
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<tr>
<td></td>
<td>• The Most Important Financial Terms Everyone Should Know (LifeHacker)</td>
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<tr>
<td>Top 10 Principles of Finance</td>
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<tr>
<td>● Ex: Risk-reward, time value of money, liquidity risk</td>
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<tr>
<td>Key Roles and Institutions in Finance</td>
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<tr>
<td>● Ex: Private equity investors, retail investors, GPs, LPs, broker dealers, crowdfunding</td>
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<tr>
<td>Types of Financial Instruments</td>
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<tr>
<td>● Ex: Equity (e.g., venture capital, common shares of public companies), debt (e.g., construction, permanent, mezzanine), tax equity, bonds</td>
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<tr>
<td>My Path</td>
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<tr>
<td>● Environmental Science and Rainforest Research to Private Equity and Investment Banking</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Week 2: Mon. 9/3</th>
<th>Readings:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Private Company Finance</td>
<td>• What Is Private Equity? (Investopedia)</td>
</tr>
<tr>
<td>● Angel investing, venture capital, private equity; Key documents - teaser, pitch deck, NDA, LOI, term sheet, PPM, subscription agreement</td>
<td>• Honest Tea case study - Harvard coursepack</td>
</tr>
<tr>
<td></td>
<td>• Sample - Non Disclosure Agreement (NDA) (NOLO)</td>
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<tr>
<td></td>
<td>• Sample - Letter of Intent (LOI) - click on top orange button to create the LOI (Rocket Lawyer)</td>
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<td></td>
<td>• Sample - Private Placement Memorandum (PPM) - scan but do not</td>
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<tr>
<td>Guest Speaker:</td>
<td></td>
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<tr>
<td>● Joe Bachman, Executive in Residence, Nicholas School, Duke University</td>
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<tr>
<td>● Topic: Forestry Finance</td>
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</tbody>
</table>
| Week 3: Mon. 9/10 | Project Finance  
- Ex: Solar and wind power projects  
**Guest Speaker:**  
- Edward May: Managing Director, Energy Intelligence Partners (MEM alumnus)  
- Topic: Renewable energy project finance | Readings:  
- **Project Finance Primer for Renewable Energy and Clean Tech Projects (WSGR)**  
**Resources:**  
- The Book of Jargon - Project Finance (Latham Watkins) |
|------------------|--------------------------------------------------|
| Week 4: Mon. 9/17 | Public Company Finance  
- Fortune 500 companies; Key financial documents - cash flow statement, income statement, balance sheet  
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- **ESG Institutional Investor Survey (State Street)**  
- **Cash Flow Statement (Accounting Coach)** - complete all parts of the tutorial  
- **Income Statement** |
### Week 5: Mon. 9/24

**Impact Investment**
- Mission-driven investing to achieve financial plus social or environmental goals in parallel; Off grid solar; sustainable agriculture; Trends, investors, drivers

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**Guest Speaker:**
- Dr. Martin Doyle: Professor, Nicholas School, Duke University
- Topic: Water Finance

**Readings:**
- From the Margins to the Mainstream Assessment of the Impact Investment Sector and Opportunities to Engage Mainstream Investors (WEF)
- Annual Impact Investor Survey 2018 (GIIN)
- The Growing Case for Conservation Finance (Environmental Finance)

**Resources:**
- Impact Investing Glossary (Impact Investing Australia)

### Week 6: Mon. 10/1

**Public-Private Finance**
- Green bonds, Property Assessed Clean Energy Bonds (PACE), Environmental Impact Bonds

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**Readings:**
- PACE Market Data (PACE Nation)
- What is PACE? (PACE Nation)
- How To Issue a Green Bond: Green Muni Bonds Playbook (CBI)
Guest Speaker: TBD
- Ben Abrams, Mark Laabs: Co-Founders, Modern Energy (Ben is Duke alum)
- Topic: Financing early stage innovation in niche markets with high impact
- DC Water Environmental Impact Bond (Harvard Kennedy School)
- Environmental Impact Bonds May Not Bear Fruit for Green Investors (RAND)

Course Format, Assignments, Grading, and Expectations

The course will consist of lectures, class discussion of Harvard Business Publishing case studies and other readings, summaries of key takeaways, and interviews with guest speakers.

A note on guest speakers:

Many weeks we will have invited speakers to join our class. This offers several benefits:
1. To provide perspective on their career path in order to inspire you and provide tactical advice for considering in your career.
2. To provide insight into different aspects of environmental finance, including discussion of specific deals, businesses, challenges, and financial tools.
3. To promote the development of your professional networking and your potential to find internships.

Each speaker may present material and/or be interviewed by me in a “fireside chat” format. Furthermore, I will ask that students research these professionals’ backgrounds before class and think of questions you would like me to ask them before class. Question can be emailed to the TA, who will summarize them in a list for me to add to my list of questions for guest speakers. Students will also have time to ask them questions during class.

Assignment and Trend Summary Due Dates:

<table>
<thead>
<tr>
<th>Date</th>
<th>Assignment/Due Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aug. 27</td>
<td>Trend Summary #1 (&lt;2 pages of bullets)</td>
</tr>
<tr>
<td>Mon. 4:40pm</td>
<td>Assignment #1: Comparing Financial Returns in Venture Capital, Private Equity, and Project Finance</td>
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<tr>
<td>Sept. 6</td>
<td>Assignment #1: Comparing Financial Returns in Venture Capital, Private Equity, and Project Finance</td>
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<tr>
<td>Thu. 5:00pm</td>
<td>Assignment #1: Comparing Financial Returns in Venture Capital, Private Equity, and Project Finance</td>
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<tr>
<td>Date</td>
<td>Time</td>
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</tr>
<tr>
<td>Sept. 10</td>
<td>Mon. 4:40pm</td>
</tr>
<tr>
<td>Sept. 17</td>
<td>Mon. 4:40pm</td>
</tr>
<tr>
<td>Sept. 26</td>
<td>Thu. 2:00pm</td>
</tr>
<tr>
<td>Oct. 1</td>
<td>Mon. 2:00pm</td>
</tr>
</tbody>
</table>

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30% of Class Grade:
Assignment #1: Comparing Financial Returns in Venture Capital, Private Equity, and Project Finance

Due: Sept. 6 - Thursday 5:00 pm

Individual Assignment

Using the assumptions I have provided in this shared document, build a simple five-year financial model that includes the following:

- Revenue
- Capital Costs (e.g., Year 0)
- Operating Costs
- EBITDA (Earnings Before Interest Taxes Depreciation and Amortization)
- Financial metrics
  - IRR (%) (Internal Rate of Return)
  - MOIC (Multiple on Invested Capital) (aka, Realization Multiple, Distributed to Paid in Capital, Cash on Cash, or Equity Multiple)
  - NPV (Net Present Value)
  - ROI (%) (Return on Investment)
  - Payback Period
  - Annual Yield (%) (Average across 5-year investment hold period)
- Include the Terminal Value in all your Financial Metrics calculations, except for Payback Period and Annual Yield
- Use formulas in the cells for the 2nd and 3rd tabs in the Excel sheet (i.e., don’t “hard code” or use direct manual inputs of numbers)
Two data tables showing variation in IRR based on changes in these two sets of variables. Please put these data tables on the 1st tab, Assumptions. See blue cells.

- Data table 1
  - Annual growth rate for Revenue: 3%, 4%, 5%, 6%, 7%
  - Annual growth rate for Costs: 1%, 2%, 3%, 4%, 5%
- Data table 2
  - Year 1 - Initial Investment: $6M, $8M, $10M, $12M, $14M
  - Discount Rate for Terminal Value: 5%, 6%, 7%, 8%, 9%
- Create these in Excel

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**30% of Class Grade:**
Assignment #2: Financial Ratio Analysis

**Due:** Sept. 26 - Thursday 5:00 pm

**Group Assignment:** Three students

You will assess the financial health of three public companies that focus on environmental services and products:

- Tesla
- Energy and Environment
- First Solar

The first part of your homework is as follows:

1. Find the companies three financial statements (cash flow, balance sheet, income statement) online. Learn more.
2. Calculate the following 10 financial ratios for each company. Learn more.
   a. Quick Ratio
   b. Gross Profit Margin
   c. Operating Profit Margin
   d. Pretax Profit Margin
   e. Net Profit Profit Margin
   f. Return On Assets
   g. Return On Equity
   h. Debt Ratio
i. Interest Coverage Ratio
j. Sales/Revenue Per Employee
3. Decide which company scores the best on each financial metric.
4. You can read the following resource from the Harvard coursepack for additional information.

The second part of your homework is as follows:

1. Find the companies’ 10-K’s. Learn more.
2. Find the discussion of financials, risks, and opportunities. Learn more.
3. Describe what you see as the companies’ 3 biggest risks and opportunities.

Use this template to submit your homework in Sakai.

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25% of Class Grade:
Assignment #3: Deeper Understanding of Financial Statement

Due: Oct. 1 - Monday 2:00 pm

Group Assignment: Two students

Go to the following websites:

- Cash Flow Statement
- Income Statement
- Balance Sheet

After completing all parts of the tutorial as part of your required reading, take the quiz at the end in groups of two students while physically in the same room, report your correct vs. incorrect answers (e.g., 23/25) and your percentage correct via text entry into Sakai as follows:

- Cash Flow Statement - x/x, %
- Income Statement - x/x, %
- Balance Sheet - x/x, %
**15% of Class Grade:**

**Class Participation**

**Class Engagement:**

Students are expected to be active learners and come to class with comments and questions. Questioning what you read, making it relevant to your professional goals, and explaining it to others contribute greatly to the learning process. A positive attitude also goes a long way. Always assume good intentions.

All students will receive a 2 (on a scale of 1 to 3, see “Grading” below) by default. If you stand out or underperform, then this will be changed to 1 or 3, respectively. Regardless, this is a very small consideration in your overall grade. I nor the TAs will debate this part of your grade. (But no worries because I know you will also do your best!)

**Trends Summary:**

**Due Aug. 27, Sept. 10, Sept. 18 - Mon. 4:40pm**

These short briefings provide a mechanism for students to watch for and understand current events regarding environmental finance.

For each Trend Summary, pick a topic based on the themes covered in class on that particular day.

A written “Trends Summary” (1-2 pages, bulleted format) contains five sections:

1. Your hypothetical company and title in finance (e.g., analyst at a regional bank, Managing Director at a private equity firm, VP at venture capital firm, CFO at Fortune 1000 company, Finance Director at an international development bank).
2. Summary of the environmental finance news headline -- What is the environmental and financial opportunity that it represents? Why is it better than status quo? How does it help solve an environmental challenge with few solutions today?
3. Pros (benefits) for your organization.
4. Cons (risks) for your organization.
5. Your recommendation as to what your hypothetical organization should do regarding the environmental finance news or trend about which you are
writing (e.g., ignore it, act on it, implement a variation on the theme). What is the general timeline for next steps and implementation of the plan?

Sample topics for news students could write about might include the following:

- New investment fund launched for energy efficiency
- New bill proposed to allow bond financing for green building
- Financial performance of a renewable energy company
- New company launched to finance land conservation
- New report published about trends in impact investment
- New university research about a water efficiency technology that could be funded as a spin-out startup company

Students will share their Trend Summaries in small groups of 2-3 students in class and respond to peers’ questions in order to stimulate analysis and discussion of recent developments in the field of environmental finance.

Google searches are not the method to find relevant articles for this assignment. Instead, students should at first rely on the pre-vetted sources listed below.

- [Environmental Finance](https://www.environmentalfinance.com) (sign up for 1-month subscription)
- [Greentech Media](https://www.greentechmedia.com) (see Finance & VC channel)
- [Climate Bonds Initiative](https://www.climatescenario.org) (see Resources or News)
- [Greenbiz](https://www.greenbiz.com)
- [Impact Alpha](https://www.impactalpha.com)
- [Global Impact Investing Network, aka, GIIN](https://www.globalimpactinvesting.org) (see News)
- [Environmental Leader](https://www.environmentalleader.com)
- [IronOak Energy Capital](https://www.ironoak.com) (see Blog or Newsletter)
- [CB Insights](https://www.cbi.org) (see Blog or search the site for keywords)
- [Private Equity News](https://www.pvnews.com)
- [AngelList](https://angel.co)
- [Institutional Investor](https://www.institutionalinvestor.com) (search site for keywords such as ESG, SRI, solar, impact, responsible investing)

Use this [Trends Summaries template](#) to make this exercise easier.
Grading will be based on the rubric below. All assignments will be submitted via Sakai, unless otherwise specified.

<table>
<thead>
<tr>
<th>Assignment</th>
<th>Where Submitted</th>
<th>How Graded</th>
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</thead>
<tbody>
<tr>
<td>Class Engagement</td>
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<tr>
<td>Trends Summaries #1, #2, #3</td>
<td>Online via Sakai</td>
<td>Scale: 1-3</td>
</tr>
<tr>
<td>Assignment #1</td>
<td></td>
<td>3 = highest, great job</td>
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<tr>
<td>Assignment #2</td>
<td></td>
<td>2 = average</td>
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<tr>
<td>Assignment #3</td>
<td></td>
<td>1 = lowest, try harder</td>
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</tbody>
</table>

Grading is based on the following:

- **Insight** - e.g., original commentary, breadth of perspectives, “beyond the headlines and buzz words”
- **Rigor** - e.g., number of footnotes, validity of citations, depth of arguments, awareness of challenges / cons, excelled compared to peers
- **Polish** - e.g., formatting, typos, writing quality
- **Structure** - e.g., followed directions
- **Presentation / Q&A** (for Trend Summaries) - e.g., loud voice, eye contact, thoughtful response to questions

Late assignments will be penalized with one lower letter grade, unless students notify the professor or TA before the assignment’s due date, and the excuse is reasonable, unusual, and not recurring.

I want you to strive for excellence in my class, where the goal is to learn as much as you can. In contrast, I am not especially focused on your grades, and I do not expect you to worry about grades. If you must, you can discuss grades with the TAs, but please only plan to discuss non-grading topics with me (e.g., course content, professional interests, internships, or job searches).
Other Topics

Come see me

I hope that every student comes to see me in my office, or plans a short meeting with me after class. I want to learn more about your path to Duke, your plans after Duke, and how I might help you. When you come visit me, my goal is to provide each of you with 1-2 professional introductions that might support your internship, job, or job hunt. (It helps if you also get your resume and one-paragraph professional bio updated with help from Nicholas School Career Center staff.)

Timely Feedback

My goal is to be one of the best professors you have ever had. (I joke, but I am also serious.) If you have concerns, questions, or suggestions on how to improve student learning, please tell me immediately. I may be able to adjust class structure along the way. In contrast, if you wait to provide feedback when the class is over, then I am unable to help you or fellow students who may share similar thoughts on ways I can help you learn better.

My speaking

I am very passionate about environmental finance, so I sometimes speak quickly. For some students, especially those from countries outside of the U.S., this may add difficulty in understand new finance concepts.

If you find this to be true for you, please email or ask me in person to speak more slowly, or to explain idioms or expressions from the business or finance world that are not intuitive to you. I am happy to slow down, step back, and explain more clearly.

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Disclaimer:

Content, schedules, and assignments in the syllabus may change slightly during the semester. If this happens, students will be notified accordingly.

Honor Code:
The honor code observed in the Nicholas School of the Environment (the “Nicholas School”) follows the principles set out in the Duke Community Standard. Its procedures draw on those developed by the Duke undergraduate judicial system. By enrolling in this class, you agree to abide by the Duke Community Standard and its application in the Nicholas School before you may enroll. Please find the full code here.

**Professor Biography:**

Dr. Chris Wedding’s professional focus is renewable energy project finance, green building strategy, early stage cleantech ventures, the electric vehicle market, opportunities in energy storage, entrepreneurship, and market research. He has 20 years of experience in private equity, project finance, startup finance, executive education, and academia. He is an Executive in Residence with the Nicholas School of the Environment at Duke University; the Founder and Managing Partner of IronOak Energy Capital, an investment banking and advisory firm focused on exclusively on clean energy; a Registered Representative with Series 22, 63, 79, and 82 financial licenses via the Carolina Financial Group; a Professor of the Practice with the University of North Carolina at Chapel Hill (UNC) Kenan-Flagler Business School; Founder of The Invest for Impact Academy, an education platform for impact-driven business and finance; and one of the earliest LEED Accredited Professionals with the US Green Building Council. He was also a Director and Senior Advisor at Cherokee Investment Partners, a private equity firm that has raised over $2 billion in private equity funds and, separately, founded or invested in 150 startups and venture funds. He brings a global perspective, with experience in 21 countries and language abilities in Spanish, Japanese, and Creole. As one of the top 10% most viewed LinkedIn profiles, he is a connector, catalyst, and frequent speaker at national and global energy and finance conferences. Dr. Wedding received a BS summa cum laude in Environmental Science from Western Kentucky University, where he was a national Goldwater Scholar in Math and Science. At UNC, he earned an MS and PhD focused on business and strategy in real estate and energy.