Columbia Business School

CLIMATE FINANCE (B8363)

Fall B-term 2020

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Office Hours: By appointment only

All course readings and cases are posted on Canvas, and all course announcements are made through Canvas. Students should regularly check Canvas for announcements and course materials.

COURSE DESCRIPTION

Climate change may be today's most serious challenge to the future of humanity. The extent of the environmental and economic impact from climate change is uncertain; however, the scientific evidence is increasingly worrisome, suggesting that the world's businesses and governments may have to take aggressive steps to avert a catastrophe. Climate finance - which refers to investments in technologies, companies and projects that reduce greenhouse gas emissions, and the creation of financial instruments designed to reduce emissions – is required to transform our global economy.

This block week course will explore the science of climate change and its related economic and environmental impacts, and carefully examine the financial tools and techniques that can be applied to combat climate change in the context of evolving global policy. Specific areas to be covered include the use of capital markets to create market-based emissions trading systems, project finance to build renewable energy projects, venture and growth capital to fund innovative low emissions technologies, and investment management to direct capital towards public companies engaged in climate change solutions and away from companies emitting significant greenhouse gas emissions.

This is a finance course, designed around a combination of cases and financial tools to reach our course objectives. The course is composed of 6 modules:

I. Background. Understanding the science of climate change and related impact on the environment, introducing the application of investment to this problem.

- Climate Change Science and Introduction to Climate Finance: What is the problem, and how can climate finance address it?

II. Capital Markets Tools. Critical analysis of carbon markets, with a focus on carbon credit offset programs.

- International treaties and the theory of market-based mechanisms and credit trading systems.

- Carbon credit markets as a financial tool to reduce industrial greenhouse gas emissions and to protect forests and reduce deforestation.

III: Investment Tools. Investing in companies and projects that have the potential to reduce emissions of greenhouse gases, including renewable energy wind and solar, low-emissions agriculture, and electric vehicles.

- Financing Renewable Energy Projects: What are the economics of wind and solar projects? How can we increase the availability of renewable energy through project finance and financial innovation?
- Financing Renewable Energy Companies: Using the case study of the electric vehicle industry, what is the opportunity, what are the challenges, and how to create a new product in a traditional industry?
- Energy Storage: Understanding the need for storing energy, and the economics of incorporating energy storage into the modern electrical grid.
- Financing Innovation: What are the challenges and opportunities for venture capital funding of innovative low-emission products and technologies?

IV: Carbon Capture and Storage. Evaluating the challenges and opportunities of funding the capture and sequestration of greenhouse gases from fossil fuel production, followed by a brief discussion on geoengineering.

V: Climate Policy. Brief review of U.S. and international climate policy, followed by a discussion and exercise based on the "Green New Deal".

VI. Socially Responsible Investing. Analysis of the movement to divest investment portfolios of shares in fossil fuel companies, and the growth of the green bond sector.

VII: Wrap-Up. Understanding the future trajectory of greenhouse gas emissions in the context of the mitigation opportunities discussed in the course, and the implications for climate change.

Students who have previously taken Finance & Sustainability (B8349) will find significant overlap with this course; approximately 30% of the material is the same. Students who have completed Finance & Sustainability should only take Climate Finance if they have a serious interest in financing solutions to climate change.

COURSE OBJECTIVES

This course is designed for both MBA students planning a career in financial services who want to understand the financial implications of climate change, and for students planning a career in a climate change-related field (such as renewable energy companies, non-profit or government organizations) who want to understand the application of the relevant financial tools. The course will also be useful for future consultants or general managers helping their clients or employer develop and implement "green business" strategies.

Specifically, the course objectives are to:

1. Understand the scientific issues underlying climate change.
2. Analyze which financial tools have been used to date, and their relative effectiveness in combating climate change.
3. Evaluate financial tools and strategies that might be used in the future, in the context of a carbon-constrained global economy and national and international policy developments.

REQUIRED COURSE MATERIAL

Students prepare for the course by reading the book *Renewable Energy, A Primer for the Twenty-First Century*, providing background on the topic. To prepare for each class, students will be required to read the following cases, articles and background notes:

Emissions Trading
- International Carbon Finance and EcoSecurities
- American Electric Power: Investing in Forest Conservation

Financing Renewable Energy Projects - Wind
- The Jersey-Atlantic Wind Farm

Financing Renewable Energy Projects – Solar
- Case under development

Financial Innovation in Renewable Energy
- SunEdison

Electric Vehicles
- Speeding Ahead to a Better Place
- Tesla Motors

Financing Low-Carbon Technologies
- Beyond Meat: Taking on the Beef Industry

Socially Responsible Investing
- Stanford Dumps Coal

REQUIRED PREREQUISITES AND CONNECTION TO THE CORE

Students must have completed or be concurrently enrolled in B8306 - Capital markets and investments. The learning in this course will utilize, build on and extend concepts covered in the following core courses:

Core Course	**Connection with Core**
Corporate Finance	1. Time value of money 2. WACC + leverage
Strategy Formulation	1. Cost leadership 2. Differentiation
Marketing	1. Segmentation and targeting 2. Influencing customer behavior
Managerial Economics	1. Consumer demand 2. Cost analysis 3. Agency and incentives

Students will be expected to have mastered these concepts and be able to apply them in the course.

ASSIGNMENTS

This course requires substantial preparation, including reading a short book prior to the start of the course. As this is predominantly a case-based course, it is essential that every student carefully reads the assigned cases and comes to class prepared to actively participate and contribute to the class discussion. To make the most effective use of your time, the assigned readings will inform you of what cases and sections to focus on. Students will be required to complete short quiz questions on the case readings, due online in Canvas, the evening prior to the start of each class. Completion of the quiz questions will contribute towards your class participation grade.

The final take-home exam will be available at the end of the last class and is due one week later.

METHOD OF EVALUATION

This course relies predominately on the case method. The focus of most of the classes is on understanding concepts, and the challenges and opportunities of applying those concepts in real-world settings. The chosen cases analyze investments in projects and companies that reduce emissions of greenhouse gases, to understand why certain business decisions and investment models have succeeded while others have failed. This course requires active class participation, and students' grades will be heavily dependent on the quality of class discussion. Students are expected to challenge each other and to challenge the professor.

Class participation (Zoom and in-person)	40%
Project financial model (Type C - individual)	10%
Climate finance project TBD (Type A – group/group)	10%
Final take-home exam (Type C - individual)	40%

CLASSROOM NORMS AND EXPECTATIONS

Students are expected to adhere to CBS Core Culture in this course by being Present, Prepared, and Participating. Students are required to prepare for each class by reading and analyzing the assigned cases, utilizing the study guidance questions which are provided in the Canvas system, and completing the on-line question set. In class, students are expected to add thoughtful points to each class discussion.

ATTENDANCE POLICY

Students are required to attend each class, including classes held on Zoom. Students should contact the TA regarding excused absences (for religious observances; personal, medical, and family emergencies; military service; court appearances such as jury duty). Unexcused absences will affect your class participation grade and your overall course grade.

- Students that miss more than 33% of their classes (unexcused absences) will at most receive a P for the course grade.
- Students that miss more than 50% of their classes (unexcused absences) will receive an F for the course grade.

INCLUSION, ACCOMODATIONS, AND SUPPORT FOR STUDENTS

Columbia Business School will make reasonable accommodations for persons with documented disabilities. Students are encouraged to contact the Columbia University's Office of Disability Services for information about registration. Students seeking accommodation in the classroom may obtain information on the services offered by Columbia University's Office of Disability Services online at www.health.columbia.edu/docs/services/ods/index.html or by contacting (212) 854-2388.

Columbia Business School is committed to maintaining a safe environment for students, staff and faculty. Because of this commitment and because of federal and state regulations, we must advise you that if you tell any of your instructors about sexual harassment or gender-based misconduct involving a member of the campus community, your instructor is required to report this information to a Title IX Coordinator. They will treat this information as private, but will need to follow up with you and possibly look into the matter. Counseling and Psychological Services, the Office of the University Chaplain, and the Ombuds Office for Gender-Based Misconduct are confidential resources available for students, staff and faculty. "Gender-based misconduct" includes sexual assault, stalking, sexual harassment, dating violence, domestic violence, sexual exploitation, and gender-based harassment. For more information, see http://sexualrespect.columbia.edu/gender-based-misconduct-policy-students.