**CARBON FINANCE (B8363)**

**SPRING 2014**

Professor Bruce Usher

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Office Hours: By appointment only (contact Julie Adams, ja2403@columbia.edu)

Note: classes are on Wednesdays from 2:15-5:30 pm, beginning Wednesday, February 5th, with one class on Friday February 21st from 10:45 am – 2:00 pm.

**REQUIRED COURSE MATERIAL**

The Carbon Finance course utilizes the following cases, articles and background notes:

Introduction to Carbon Finance

* + The Political Economy of Carbon Trading (HBS 710-056)
  + IPCC Summary Report
  + Note on Energy (Stanford E-302)
  + Better Place: The Opportunity

Emissions Trading

* + Acid Rain: The Southern Company (A) (HBS 792-060)
* International Carbon Finance and EcoSecurities (HBS 208-15)
* Plantar SA (TB 0011)

Financing Cleantech Companies

* Pathways to a Low-Carbon Economy (McKinsey & Company)
* Khosla Ventures: Biofuels Strategy (HBS 809-004)
* First Solar, Inc in 2010 (SM-190)

Financing Renewable Energy Projects

* + Wind Power in the United States: Technology, Economic and Policy Issues 2008
  + The Jersey-Atlantic Wind Farm (Columbia 120307)
  + Keystone Solar (Columbia 130305)
  + The Renewables Portfolio Standard: How it Works (AWEA)

Financing Energy Efficiency & CCS

* Buildings and Energy (708-024)
* Design Creates Fortune: 2000 Tower Oaks Boulevard (HBS 210-070)
* Clean Coal in the US and China: An Industry Note (SM-183)
* Adapting to Climate Change: The Case of Suncor Energy (Ivey 9B08M073)

**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:

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| **Core Course** | **Connection with Core** |
| Corporate Finance | 1. Time value of money 2. Efficient markets 3. Risk 4. Capital Asset Pricing Model |
| Decision Models | 1. Use of analysis in decision making 2. Decision making under uncertainty and risk 3. Sensitivity analysis |
| Global Economic Environment I | 1. Role of financial markets in the economy |
| Managerial Economics | 1. Analyzing complex decision making under uncertainty |

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

*Students who have previously taken Finance & Sustainability (B8349) will find significant overlap with this course, and are recommended against taking it.*

**COURSE DESCRIPTION**

Climate change may be today’s most serious challenge to the future well being of our planet. The extent of the environmental and economic impact from climate change is uncertain; however, the recent scientific evidence is increasingly worrisome, suggesting that the world’s businesses and governments may have to take aggressive and coordinated steps in order to avert a catastrophe. Carbon finance - which refers to investments in GHG emission reduction companies and projects, and the creation of financial instruments that effectively put a price on carbon emissions – is required to transform our global economy.

This half-term 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, venture capital to develop low emissions technologies, project finance to build clean energy projects, and corporate finance to manage businesses impacted by climate change and ultimately, related regulatory changes.

This is a finance course, designed around a combination of cases and financial tools to reach our course objectives. The course is composed of 5 modules:

*I. Background* (1 class). Understanding the science of climate change and related impact on the environment, and introducing the application of financial tools to this problem.

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

*II. Capital Markets Tools* (1 class). Critical analysis of carbon markets, including allowance markets and carbon credit offset programs.

The EU Emissions Trading System, the Kyoto Protocol and the Clean Development Mechanism: International treaties and market based mechanisms, credit trading systems, and forestry offsets.

*III: Investment Tools* (2 classes). Investing in companies and projects that have the potential to reduce emissions of greenhouse gases, including renewable energy sectors such as biofuels, wind and solar.

Class 1: Financing Cleantech Companies: What are key considerations when investing in cleantech companies?

Class 2: Financing Renewable Energy Projects: How can we increase the availability of renewable energy through project finance?

*IV: Financing Energy Efficiency and Sequestration* (1 class). Evaluating the challenges and opportunities of investing in energy efficiency and in sequestration through carbon capture.

*V: Financing Innovation* (1 class). Analysis of the most recent and innovative financial tools for driving adoption of renewable energy and reducing emissions of greenhouse gases.

**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 cleantech or 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 who may help 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.

**ASSIGNMENTS**

Students are required to individually prepare 2 case write-ups during the course, each of which is a maximum of one page. The final exam is a take-home case analysis.

**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 companies that invest in projects and businesses that reduce emissions of greenhouse gases, in order to understand why certain business decisions and 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. Guest speakers will be invited to some classes and will provide an opportunity for students to meet industry specialists. Students are expected to challenge each other and to challenge the professor and our guests.

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| Class participation | 40% |
| Case write-ups  (Type B – group/individual) | 20% |
| Final take-home exam  (Type C - individual) | 40% |

**CLASSROOM NORMS AND EXPECTATIONS**

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. Students are expected to add thoughtful analysis to each class discussion.