Updated January 6, 2024

Climate Change and Business Strategy

Assignments, readings and questions

Class meeting 1

Graded assignment:

- None

Reading assignment:

- None

Heaven points:

- None

Class meeting 2

Graded assignment:

- Equivalency Problem #1: Hamburger or miles?

  The purpose of this equivalency problem is to assess the climate footprint of producing a unit of beef relative to a unit of use of a gasoline-powered car. Please refer to the template provided in b-courses to complete this assignment.

  Calculate *d*, where *d* is the distance you will drive your 2021 Kia Sportage from your home to a Safeway to purchase 1 kilogram of beef, such that the GHG contribution from driving your Kia distance *d* is equal to the GHG contribution associated with the production of 1 kg of beef.

  - Include an approximation for the embodied carbon associated with the manufacturing of the vehicle.
  - Use EPA published city fuel economy for the Kia.
  - If you find different numbers for the climate footprint of 1 kg of beef, either provide an average or a range
  - In your reflection, you may compare the climate footprint of beef with another protein source (other animal- or plant-based alternatives)

Reading assignment:

- 8 minutes - video - A Brief History of CO2 Emissions - September 13, 2017
- 20 minutes - website - Berkeley Earth - Independent, non-governmental Climate Change data and analysis
- 20 minutes - website - Wikipedia: Introduction to Climate Change
- 30 minutes - NYT review article - The Science of Climate Change Explained: Facts, Evidence and Proof - November 6, 2021

Heaven points:

- 5 minutes - video - NOAA: Ralph Keeling on the origin and meaning of the Keeling Curve
- 5 minutes - article - realclimate.org - How do we know that recent CO2 increases are due to human activities? - December 22, 2004

Double Heaven points:

- 20 minutes - American Chemical Society dedicates the Keeling Curve a "national Chemical Landmark" - 2015
- 1 hour - technical paper- Deep dive into the physics of how Greenhouse Gases work at the molecular level

Class meeting 3

Graded assignment:

- Equivalency Problem #2: A Winery goes Green

The purpose of this equivalency problem is to assess the carbon capture potential of trees compared to transitioning to renewable solar energy. Please refer to the template provided in b-courses to complete this assignment.

A winery in Napa Valley installed a large PV system as a way to reduce its carbon footprint. In order to make space for the PV system, the winery cut down a forest of 35 mature oak trees. Calculate how long it will take for the PV system to reduce the winery's carbon footprint each year as much as the trees would have achieved on their own each year. (That is, each year how long will it take for the atmospheric carbon savings to catch up with what the atmospheric carbon capture would have been by the oaks?)

Include in the calculation the GHG contribution associated with the manufacture of the PV system.

- Use the NREL solar resource model for Sacramento, CA to calculate the likely power produced annually by the PV system: https://pvwatts.nrel.gov/
- The PV system consists of 1,750 panels (Model: Sharp ND216U1F)
- PV array orientation: Azimuth = 195 degrees, tilt = 20 degrees from horizontal
- Use PG&E's value of 200 kg of CO_2 per MWh for the carbon contribution of the electricity provided by PG&E in Napa.

In your reflection, you may discuss the environmental impact of cutting down trees, topics related to biodiversity, or other aspects.

Reading assignment:

- 30 minutes - website - EPA overview of sources of greenhouse gas emissions
- 30 minutes - book chapter - Climate Forcings and Climate Models - National Academy of Science - 2006
- 30 minutes - United Nations Environmental Program Gap Report - 2020

Heaven points:

- 15 minutes - video - PBS: Milankovitch Cycles and ice ages explained - May 25, 2016
- 10 minutes - article - NASA: Milankovitch Cycles and Their Role in Earth's Climate - February 27, 2020
- 10 minutes - article - NASA: Why Milankovitch Cycles Can't Explain Earth's Current Warming - February 27, 2020

Class meeting 4

Graded assignments:

- Equivalency Problem #3: Air travel

  The purpose of this equivalency problem is to assess the feasibility of the "plant a tree to offset your trip" concept provided by some airlines when purchasing a plane ticket. Please refer to the template provided in b-courses to complete this assignment.

  This year you are planning to travel by air four times, each trip being a non-stop round trip between New York and San Francisco in economy seating. As a result of your air travel, you will generate a significant amount of CO_2. To offset the climate impact of that air travel, you plan to purchase a small farm in the American Midwest that in the past had been forested land, and reforest that land with 20 trees. Wisely, you have also decided to put that land into a trust such that it will remain forested in perpetuity. The forest you plant will eventually reach maturity, that is, old trees will die and new trees will germinate at the same rate, such that the amount of CO_2 that is captured will remain stored indefinitely by the trees in your forest. You can assume that the trees you plant will capture CO_2 each year as if they were mature trees starting in Year 1.

  How long will it take for your forest to capture the same amount of CO_2 that you generated with your year of air travel?

  - In your calculations, include only the flights (not travel to the airport, food consumed, luggage checked, etc.)

- Equivalency Problem #4: Honda or Tesla?

  The purpose of this equivalency problem is to examine the choice between an electric vehicle and a gasoline-powered vehicle based on their embodied carbon and CO_2 emissions per mile. Please refer to the template provided in b-courses to complete this assignment.

  You have been asked to select which vehicle you will drive for the next 10 years, driving 30,000 kilometers per year, based solely on the climate footprint of that activity. Your choice is between (a) a Honda Civic with a gasoline engine (1.5 L 4-cylinder) getting average real-world fuel performance (see this or similar sites), and (b) a standard range rear-wheel drive Tesla Model 3. Which vehicle do you choose, if climate footprint is your only criterion?

  - Use the most recent model year for each vehicle for which data are available.
  - Include in your calculation the embodied carbon of the two vehicles, amortized over the 10 years that you will be using the vehicles.

    - For charging the Tesla, we'll use electricity entirely from PG&E (see PG&E's doc on carbon content per kWh) and 6.6 kM/kWh for the efficiency of the Tesla (or another value if you can find a better number!).
    - Ignore all purchase decision factors other than climate footprint (purchase cost, maintenance costs, energy cost, registration and operating costs, etc.)

Reading assignment:

- 10 minutes - Nature article - IPCC climate report: Earth is warmer than it's been in 125,000 years - August 9, 2021
- 30 minutes - IPCC Special Report on 1.5C Global Warming - 2018
- 15 minutes - website - Wikipedia: Representative Concentration Pathway
- 15 minutes - website - Wikipedia - Paris Agreement

Heaven points:

- 30 minutes - Paris Agreement - 2015
- 30 minutes - IPCC 6th Assessment Report - Climate Change 2021

Class meeting 5

Graded assignments:

- HBR text Introduction and Chapter 1 (Read these two brief chapters before reading the Henderson, Reinert and Oseguera paper)
- Henderson, Reinert and Oseguera. Climate Change in 2020: Implications for Business. Harvard Business School Press, 2020

  Assignment questions:

  1. How would you balance the share of effort and responsibility for mitigating climate change between government, industry, and consumers? Assign a percentage to each and justify your answer.
  2. How do industry-wide consortia and standards for climate change mitigation play a role in driving down the carbon intensity of business? Provide some examples, or as an alternative, an assessment of the pros and cons as you see them.
  3. Discuss to what extent driving down the carbon intensity of a business can be used as a marketing differentiator.
  4. Realistically, can driving down the carbon intensity of a business cut operating costs? Provide some examples.

Reading assignment:

- 5 minutes - article - WSJ: Carbon Prices Jump Despite Record Drop in Emissions - December 24, 2020
- 5 minutes - article - WSJ: Japan to Phase Out Gasoline-Powered Cars, Bucking Toyota Chief - December 25, 2020
- 10 minutes - article - NYT: To Cut Emissions to Zero, U.S. Needs to Make Big Changes in Next 10 Years - December 15, 2020
- 10 minutes - read Executive Summary of this white paper - Plastic and Climate, the Hidden Costs of a Plastic Planet - May, 2019
- 30 minutes - website - KPMG Reports on Climate Change - November, 2020
- 20 minutes - article - Deloitte: Companies are under pressure on climate change and need to do more - December 12, 2019

Heaven points:

- 20 minutes - Report - IPCC 6th Assessment Report - April, 2022

Class meeting 6

Graded assignments:

- 10 minutes - article - WSJ: Unilever to Give Investors Advisory Vote on Climate-Change Plan - December 14, 2020
- 20 minutes - Apple Environmental Progress Report - October, 2023
- 20 minutes - Tesla Impact Report - 2022
- 10 minutes - press release - Apple commits to be 100 percent carbon neutral for its supply chain and products by 2030 - July 21, 2020
- 10 minutes - website - CDP company scores - 2021
- 10 minutes - website - Climate Action 100 - 2023
- 5 minutes - article - WSJ - Companies Resist Activist Investor's Climate Campaign - March 20, 2021

  Assignment questions:

  1. Based on the Unilever case, what do you think about the idea of asking corporate shareholders to advise on climate policy? Provide pros and cons.
  2. From their reports and other sources, what do you find promising in Apple's and Tesla's stated plans for climate action, and what do you find lacking?
  3. What patterns do you see in the lists of companies that have made progress, or commitments, regarding climate action? Provide some examples based on the Climate Action 100 report and other sources of your choice.

- Case Study: Isaacs and Costa i Coromina. Net Zero, 2022

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

Reading assignment:

- 10 minutes – article – Why Wal-Mart is a retail sustainability leader (but doesn't really want to talk about it) – August 9, 2016
- 10 minutes – article – WSJ: Big Companies Urge Biden, Congress to Address Climate Change – December 2, 2020
- 10 minutes – article – WSJ: 100 Most Sustainably Managed Companies in the World Ranking – October 13, 2020
- 10 minutes – article – WSJ – Companies Grapple with Climate Change Math – August 10, 2021
- 10 minutes – article – WSJ – Companies Are Tallying Their Carbon Emissions, but the Data Can Be Tricky – September 3, 2021

Heaven points (Sea Level Rise and Ocean Acidification):

- 20 minutes - article - NOAA: Climate Change and Global Sea Level - August 14, 2020
- 20 minutes - webpage - Wikipedia: Ocean acidification

Heaven points (A world without ice):

- 3 minutes – video – NASA: Disappearing Arctic sea ice – March 15, 2018
- 1 minute – video – WMO: Arctic Sea Ice Animation – September, 2019
- 3 minutes – video – NASA: Arctic Sea Ice Reaches 2019 Minimum Extent – September 23, 2019
- 10 minutes – article – NYT: Shift to a Not-So-Frozen North Is Well Underway, Scientists Warn – December 8, 2020

Double Heaven points:

- 10 minutes - NOAA Report: Arctic Report Card - December 6, 2021
- 5 minutes - video - Why scientists are so worried about this glacier - July 13, 2020

Class meeting 7

Graded assignments:

- HBR text Chapter 2

  Assignment questions:

  1. Can a business fully account for its global GHG footprint, and if so, how? Discuss feasibility and limitations. You may also refer to the GHG Protocol, regulation on mandatory disclosure, and tools a company can use to carry out these measurements.
  2. By what means can – or should – a company apply stricter emissions requirements on its operations than are required by local regulations? Provide some examples.

- HBR text Chapter 6

  Assignment questions:

  1. A company is attempting to be zero-carbon or "Net Zero" in terms of its climate footprint. What needs to be included "in the accounting" for this company's carbon budget, and what can be excluded? State your assumptions based on the context and the industry you are assessing.

- Case Study: Isaacs and Costa i Coromina. Carbon Offsets, 2022

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

Reading assignment:

- 30 minutes - white paper - McKinsey: Responding to climate risk: Actions for US state and local leaders - December 15, 2020
- 10 minutes - article - NYT: E.U. Agrees to Slash Carbon Emissions 55% from 1990 levels by 2030 - December 11, 2020
- 20 minutes - report - Goldman Sachs: Sustainability Report - 2020

Heaven points (Extreme Weather Events):

- 15 minutes - website - Attributing Extreme Weather to Climate Change
- 15 minutes - website - Extreme Weather and Climate Change
- 10 minutes - article - Washington Post - Iowa derecho in August was most costly thunderstorm disaster in U.S. history - October 17, 2020

- 1 minute - video - CNN: wildfire smoke turn San Francisco's sky orange - September 10, 2020
- 1 minute - article - CNN: Temperatures in Arctic hit 100 F - June 22, 2020
- 30 minutes - WMO: The State of the Global Climate Report - 2020

Double Heaven points:

- 30 minutes - IPCC Special Report on Climate Change and Land Use - 2019
- 10 minutes - article - WRI summary of IPCC Special Report on Climate Change and Land Use - August 8, 2019
- 1 hour - white paper - Princeton University: Net Zero America Report - December 15, 2020

Class meeting 8

Graded assignments:

- Case Study: Isaacs and Costa i Coromina. Greenwashing, 2022

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

- Case Study: Isaacs and Costa i Coromina. Generation Z: Is Climate Concern matched by Climate Knowledge, 2022

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

Reading assignment:

- 30 minutes - McKinsey Report on Climate Change: Pathways to a Low Carbon Economy - 2010
- 10 minutes - letter - BlackRock: Larry Fink Letter to CEOs - 2020
- 10 minutes - letter - BlackRock: Sustainability Letter to Investors - 2020
- 10 minutes - white paper - BlackRock: FAQs on Sustainability and Risk - 2020

Heaven points (Permafrost and clathrates):

- 2 minutes - video - University of Alaska: Methane release from permafrost - January 15, 2010
- 14 minutes - video - HBO: Methane release from permafrost (and some strange but entertaining theories) - January 18, 2018
- 5 minutes - article - The Economist: Risks of melting permafrost (similar content as HBO video) - December 19, 2020
- 30 minutes - technical paper - AGU: The interaction of climate change and methane hydrates - March 31, 2017

Heaven points:

- 20 minutes - website - Project Drawdown - Detailed outline of industry-by-industry carbon reduction solutions
- 20 minutes - website - Embodied Carbon Footprint Database

Class meeting 9

Graded assignment:

- Case Study: Isaacs and Costa i Coromina. Hydrogen and Clean Energy, 2023

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

Reading assignment: None

Heaven points:

Heaven points (Eemian):

- 10 minutes - webpage - Wikipedia - The Eemian period
- 5 minutes - video - Paleoclimate - the Eemian period - July, 2009

Heaven points (PETM):

- 10 minutes - video - PBS: The Last Time the Globe Warmed (the PETM) - December 4, 2017
- 5 minutes - article - Nature - Paleocene–Eocene Thermal Maximum - August 31, 2017

Class meeting 10

Graded assignment:

- Case Study: Isaacs and Costa i Coromina. CCUS, Separating Fact from Fiction, 2022

  Assignment questions:

  Please answer the Case Discussion Questions found at the end of the case.

Reading assignment: None

Heaven points:

- 10 minutes - FT - 'Put up or shut up': can Big Oil prove the case for carbon capture? - October 19, 2022
- 21-minute video - FT - Is CCUS a help or a hindrance? - 2022
- 20 minutes - Report - LLNL Getting to Neutral - 2021

Class meeting 11

Graded assignment: None

Reading assignment: None

Heaven points: None

Class meeting 12

Graded assignment: None

Reading assignment: None

Heaven points: None

Class meeting 13

Graded assignment: None

Reading Assignment: None

Heaven points: None

Class meeting 14

Graded assignment:

- None

Reading assignment:

- 18 minutes - video - Netflix: The world's water crisis explained - April 17, 2020

Heaven points:

- None