SUMA PS5035 – Greenhouse Gas Emissions: Measuring and Minimizing the Carbon Footprint

Columbia University: Spring 2017

Logistics

Time: Wednesdays, 6:10-8:00 p.m.

Location: 103 Knox Hall

Office Hours: Office hours will vary by week, but generally will occur Wednesdays 5:00-6:00 p.m. and 8:10-9:00 p.m., by appointment only, or at other times by appointment as needed. Please schedule an appointment in advance.

Instructor

Jonathan Dickinson

Email: jd3033@columbia.edu

Course Description

Global greenhouse gas emissions are now at a record high, and the world's scientific community agrees that continued unabated release of greenhouse gases will have catastrophic consequences. Many efforts to curb greenhouse gas emissions, both public and private, have been underway for decades, yet it is now clear that collectively these efforts are failing, and that far more concerted efforts are necessary. In December 2015, the world's nations agreed in Paris to take actions to limit the future increase in global temperatures to 2°C (3.6°F). Achieving this goal will require mitigation of greenhouse gas emissions from all sectors, both public and private. Critical to any attempt to mitigate greenhouse gas emissions is a clear, accurate understanding of the sources and levels of greenhouse gas emissions. This course will address all facets of greenhouse gas emissions accounting and reporting, and will provide students with tangible skills needed to direct such efforts in the future.

Students in this course will gain hands-on experience designing and executing greenhouse gas emissions inventories, employing all necessary skills including the identification of analysis boundaries, acquisition of data, calculation of emissions levels, and reporting of results. In-class workshops and exercises will complement papers and group assignments. A key component of this exercise will be critical evaluation of both existing and emerging accounting and reporting protocols.

This course will introduce many of the challenges facing carbon accounting practitioners, and will require students to recommend solutions to these challenges derived through critical analysis. Classes will examine current examples of greenhouse gas reporting efforts and will allow students the opportunity to recommend improved calculation and reporting methods.

Assignments will consist of readings and technical analysis projects. Students are expected to have basic experience using Microsoft Excel and basic quantitative skills. However, full Excel proficiency is not required.

Course Objectives

By the end of this course students will be expected to:

- Understand the basic science of climate change
- Understand the sources, sinks, and effects of greenhouse gas emissions
- Understand and be able to evaluate greenhouse gas mitigation opportunities – both policies and specific measures
- Understand different greenhouse gas inventory reporting platforms and certification methods
- Design and complete a comprehensive greenhouse gas emissions inventory for a discrete entity
- Understand all greenhouse gas emissions protocols, for both public and private entities
- Calculate the carbon intensity of the electricity supply for a specific geographic area
- Conduct full life cycle analysis of greenhouse gas emissions from a defined consumer product

Course Schedule

- Week 1 (Jan. 18) – Introduction to Climate Change Science and Greenhouse Gas Inventories
- Week 2 (Jan. 25) – Greenhouse Gas Emissions Mitigation Efforts
- Week 3 (Feb. 1) – Measuring to Manage: The Importance of Regular, Accurate Greenhouse Gas Inventories
- Week 4 (Feb. 8) – Greenhouse Gas Accounting, Reporting, and Certification Methods
- Week 5 (Feb. 15) – Greenhouse Gas Emissions Data Collection
- Week 6 (Feb. 22) – Greenhouse Gas Emissions Calculation
- Week 7 (Mar. 1) – Using Greenhouse Gas Inventories to Identify Mitigation Opportunities
- Week 8 (Mar. 8) – The Importance of the Electricity Supply in Greenhouse Gas Accounting
- Week 9 (Mar. 22) – Greenhouse Gas Emissions Reporting Platforms (Guest Lecturers)
- Week 10 (Mar. 29) – Private Sector Carbon Accounting (Guest Lecturers)
- Week 11 (Apr. 5) – Life cycle/Consumption Based Inventories and Corporate Value Chain Greenhouse Gas Accounting
- Week 12 (Apr. 12) – Public Sector Carbon Accounting
- Week 13 (Apr. 19) – The Next Frontier for Carbon Accounting and Reporting
- Week 14 (Apr. 26) – Final Presentations

THIS CLASS WILL NOT MEET ON MARCH 15 DUE TO COLUMBIA UNIVERSITY'S SPRING BREAK

Course Requirements

No materials are required to be purchased for this course. All required reading will be made available to students in advance or will be accessible through the Internet. Readings will include reports from all levels of government, non-governmental organizations, and private companies, articles from academic journals, and articles from the press. All required readings are expected to be completed prior to each class – students will be expected to discuss assigned readings and should be prepared to brief the class. In addition, supplemental readings, while not required, are recommended to provide additional background and depth on specific areas of focus.

Readings

Key Reports and Reference Documents

The following is a short-list of documents that will be referenced throughout the semester. As different sections of these reports will be assigned in readings week-to-week students should familiarize themselves with them.

- World Resources Institute and World Business Council for Sustainable Development. (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition)*. http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

- World Resources Institute, C40 Cities Climate Leadership Group, ICLEI – Local Governments for Sustainability. (2014). *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*. http://ghgprotocol.org/files/ghgp/GHGP_GPC.pdf

- ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1*. http://icleiusa.org/publications/us-community-protocol/

- City of New York. (2016). *New York City's Roadmap to 80x50*. http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

Week 1: Introduction to Climate Change Science and Greenhouse Gas Inventories (January 18)

Required Readings:

- IPCC. (2013). Summary for Policymakers. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change* https://www.ipcc.ch/pdf/assessment-report/ar5/wg1/WGIAR5_SPM_brochure_en.pdf

- Report of an Ad Hoc Study Group on Carbon Dioxide and Climate, Woods Hole, Massachusetts, July 23–27, 1979, to the Climate Research Board, Assembly of Mathematical and Physical Sciences, National Research Council. (1979). Carbon Dioxide and Climate: A Scientific Assessment. Washington, D.C.: The National Academies Press. ISBN 0-309-11910-3. Summary and Conclusions http://www.cgd.ucar.edu/~brianpm/download/charney_report.pdf

- World Resources Institute and World Business Council for Sustainable Development. (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition)*. Chapter 1 GHG Accounting and Reporting Principles (pages 6-9) http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

- Climate Change Impacts in the United States, U.S. National Climate Assessment, U.S. Global Change Research Program. Overview and Findings http://nca2014.globalchange.gov/system/files_force/downloads/low/NCA3_Full_Report_01_Overview_Report_Findings_LowRes.pdf?download=1

Supplemental Readings:

- World Bank (2012). *Turn down the heat: why a 4°C warmer world must be avoided*. Washington DC: World Bank. Executive Summary
  http://documents.worldbank.org/curated/en/2012/11/17097815/turn-down-heat-4°c-warmer-world-must-avoided

- IPCC. (2013). Climate Phenomena and their Relevance for Future Regional Climate Change. In: *Climate Change 2013: The Physical Science Basis. Contribution of Working Group I to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change.* Executive Summary and Introduction (pages 1219-1223).
  http://www.climatechange2013.org/images/report/WG1AR5_Chapter14_FINAL.pdf

- The Royal Society (2010). *Climate change: a summary of the science*.
  http://royalsociety.org/uploadedFiles/Royal_Society_Content/policy/publications/2010/4294972962.pdf

- National Research Council (2010). *Advancing the Science of Climate Change*. Report in Brief
  http://nas-sites.org/americasclimatechoices/sample-page/panel-reports/87-2/

Week 2: Greenhouse Gas Emissions Mitigation Efforts (January 25)

Required Readings:

- Congressional Research Service, 2009. *An Overview of Greenhouse Gas (GHG) Control Policies in Various Countries*. Summary and Synthesis Observations (pages 1-2)
  http://www.fas.org/sgp/crs/misc/R40936.pdf
  - Select one country or region (e.g. European Union, UK, Australia, Brazil, etc.) to enrich the discussion and be prepared to share impressions on international perspectives.

- Institute for Industrial Productivity, 2013. *China's GHG Emissions Reduction Policies.*
  http://www.iipnetwork.org/IIPFactSheet_China.pdf

- Ellerman, A. Denny, P. Loscow, 2008. *The European Union's Emissions Trading System in Perspective*. Executive Summary and Introduction
  http://www.c2es.org/docUploads/EU-ETS-In-Perspective-Report.pdf

- IPCC, 2014: Summary for Policymakers. In: *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*
  http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_summary-for-policymakers.pdf

- Stern, Nicolas. (2006). *Stern Review on the Economics of Climate Change*. (Cambridge University Press: Cambridge, United Kingdom). Executive Summary
  http://webarchive.nationalarchives.gov.uk/20130129110402/http://www.hm-treasury.gov.uk/d/Executive_Summary.pdf

- Enkvist, P. et al. *A cost curve for greenhouse gas reduction*. McKinsey Quarterly, 2007. http://www.mckinsey.com/insights/sustainability/a_cost_curve_for_greenhouse_gas_reduction

- City of New York. (2011). *PlaNYC 2011 Update*. Introduction and Climate Change (pages 3-14, 150-153) http://s-media.nyc.gov/agencies/planyc2030/pdf/planyc_2011_planyc_full_report.pdf

- City of New York. (2016). *OneNYC Progress Report.* Vision 3 Our Sustainable City (pages 98-118) http://www.nyc.gov/html/onenyc/downloads/pdf/publications/OneNYC.pdf

- City of New York. (2016). *New York City's Roadmap to 80x50*. Executive Summary and Introduction (pages 5-20) http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

- World Bank. (2016). *State and Trends of Carbon Pricing*. Executive Summary and Building an International Carbon Market After Paris (pages 10-16, 79-97) https://openknowledge.worldbank.org/bitstream/handle/10986/25160/9781464810015.pdf?sequence=6&isAllowed=y

Supplemental Readings:

- IPCC. (2014). *Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*. Technical Summary and Chapter 5 Drivers, Trends and Mitigation http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_technical-summary.pdf http://www.ipcc.ch/pdf/assessment-report/ar5/wg3/ipcc_wg3_ar5_chapter5.pdf

- United Nations Environment Program (UNEP). *Introduction to the Clean Development Mechanism (CDM)* http://unfccc.int/files/cooperation_and_support/capacity_building/application/pdf/unepcdmintro.pdf

- MIT Joint Program on the Science and Policy of Global Change (2007). *Assessment of U.S. Cap and Trade Proposals*. Introduction, Issues in System Design and Implementation, and Core Results (pages 2-7, 15-25) http://web.mit.edu/globalchange/www/MITJPSPGC_Rpt146.pdf

- Walmart. (2016). *Global Responsibility Report*. Enhancing Sustainability (pages 54-89) http://cdn.corporate.walmart.com/9c/73/3f9abcef444397f2c771e081e095/2016-global-responsibility-report.pdf

- Unilever. (2015). *Sustainable Living Plan, Mobilizing Collective Action: Summary of Progress.* https://www.unilever.com/Images/uslp-mobilising-collective-action-summary-of-progress-2015_tcm244-424809_en.pdf

Week 3: Measuring to Manage: The Importance of Regular, Accurate Greenhouse Gas Inventories (February 1)

Required Readings:

- Select one of the ten "Best Carbon Disclosure" reports from Corporate Register and be prepared to discuss in class. Note site requires free registration to access reports.
  http://www.corporateregister.com/crra/nom.cgi?c=5&d=2012

- IPCC. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Overview.*
  http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/0_Overview/V0_1_Overview.pdf

- California Air Resources Board, California Climate Action Registry, ICLEI - Local Governments for Sustainability, The Climate Registry. (2010). *Local Government Operations Protocol for the Quantification and Reporting of Greenhouse Gas Emissions Inventories*. Part I Introduction and Part II Chapter 1 Introduction (pages 3-10)
  http://www.arb.ca.gov/cc/protocols/localgov/pubs/lgo_protocol_v1_1_2010-05-03.pdf

- ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1*. Introduction (pages 7-19)
  http://icleiusa.org/publications/us-community-protocol/

Supplemental Readings:

- IPCC. (2006). *2006 IPCC Guidelines for National Greenhouse Gas Inventories, Volume 1, General Guidance and Reporting*.
  http://www.ipcc-nggip.iges.or.jp/public/2006gl/vol1.html

Week 4: Greenhouse Gas Accounting, Reporting, and Certification Methods (February 8)

Required Readings:

- World Resources Institute and World Business Council for Sustainable Development. (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition)*. Chapter 2 Business Goals and Inventory Design, Chapter 3 Setting Organizational Boundaries, and Chapter 4 Setting Operational Boundaries (pages 10-33)
  http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

- World Resources Institute, C40 Cities Climate Leadership Group, ICLEI – Local Governments for Sustainability. (2014). *Global Protocol for Community-Scale Greenhouse Gas Emission Inventories*. Part I Introduction and Reporting Requirements (pages 9-33)
  http://ghgprotocol.org/files/ghgp/GHGP_GPC.pdf

- ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1*. Step One: Conduct the Scoping Process, Step Two: Perform Emissions Calculations, and Step Three: Complete the Community GHG Report (pages 20-50)
  http://icleiusa.org/publications/us-community-protocol/

- The Climate Registry. (2016). *General Reporting Protocol for the Voluntary Reporting Program, Version 2.1*. Chapters 4-6 (pages 13-47)

https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf

Supplemental Readings:

- ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1*. Appendix C-I
  Available on Canvas

Week 5: Greenhouse Gas Emissions Data Collection (February 15)

Required Readings:

- World Resources Institute and World Business Council for Sustainable Development. (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition)*. Chapter 7 Managing Inventory Quality (pages 48-57)
  http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

- World Resources Institute and World Business Council for Sustainable Development. (2011). *Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. Chapter 7 Collecting Data (pages 64-85)
  http://www.ghgprotocol.org/files/ghgp/public/Corporate-Value-Chain-Accounting-Reporing-Standard_041613.pdf

- IPCC. (2006). *2006 IPCC Guideline for National Greenhouse Gas Inventories, Chapter 2, Approaches to Data Collection.*
  http://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf

Week 6: Greenhouse Gas Emissions Calculation (February 22)

Required Readings:

- U.S. EPA. (2015). *Facility Level Information on Greenhouse Gases Tool. 2015 Greenhouse Gas Emissions from Large Facilities*. Review the FLIGHT tool, select a specific facility and be prepared to discuss your impressions of the data in class.
  http://ghgdata.epa.gov/ghgp/main.do

- World Resources Institute and World Business Council for Sustainable Development. (2004). *The Greenhouse Gas Protocol: A Corporate Accounting and Reporting Standard (revised edition)*. Chapter 5 Tracking Emissions Over Time and Chapter 6 Identifying and Calculating GHG Emissions (pages 34-47)
  http://www.ghgprotocol.org/files/ghgp/public/ghg-protocol-revised.pdf

- ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1.* Appendices C-I
  Available on Canvas

- City of New York. (2016). *New York City's Roadmap to 80x50*. Methodology (pages 23-31)

http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

Week 7: Using Greenhouse Gas Inventories to Identify Mitigation Opportunities (March 1)

Required Readings:

- City of New York. (2016). *Inventory of New York City Greenhouse Gas Emissions in 2014, Published April 2016*. Executive Summary, Introduction, and Citywide Inventory (pages 10-28) http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/NYC_GHG_Inventory_2014.pdf

- Googlegreen http://www.google.com/green/bigpicture/#/

- FedEx. (2016). *2016 Global Citizenship Report*. Environment (pages 42-56) http://about.van.fedex.com/wp-content/uploads/2015/01/GCR_Summary.pdf

- Chevron. (2016). *2015 Corporate Responsibility Report Highlights*. Climate Change and energy efficiency (pages 16-17) https://www.chevron.com/-/media/chevron/shared/documents/2015-corporate-responsibility-report.pdf

- City of New York. (2016). *New York City's Roadmap to 80x50*. Next Steps (pages 113-114) http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

- City of New York. (2014). *One City, Built to Last: Transforming New York City's Buildings for a Low-Carbon Future*. Executive Summary (pages 5-17) http://www.nyc.gov/html/builttolast/assets/downloads/pdf/OneCity.pdf

Week 8: The Importance of the Electricity Supply in Greenhouse Gas Accounting (March 8)

Required Readings:

- City of New York. (2012). *Inventory of New York City Greenhouse Gas Emissions, December 2012.* Electricity Supply (pages 11-14) http://www.nyc.gov/html/dem/downloads/pdf/greenhousegas_2012.pdf

- Diem, A., Rothschild, S. (2012). *How to use eGRID for Carbon Footprinting Electricity Purchases in Greenhouse Gas Emission Inventories*. http://www.epa.gov/sites/production/files/2015-01/documents/adiem.pdf

- Siler-Evans, K. et al. (2012). *Marginal Emissions Factors for the U.S. Electricity System*. Available on Canvas

- World Resources Institute. (2015). *GHG Protocol Scope 2 Guidance, Executive Summary, An Amendment to the GHG Protocol Corporate Standard.*

http://ghgprotocol.org/files/ghgp/Scope2_ExecSum_Final.pdf

- Pacific Gas and Electric. (2015). *Greenhouse Gas Emission Factors: Guidance for PG&E Customers*. http://www.pge.com/includes/docs/pdfs/shared/environment/calculator/pge_ghg_emission_factor_info_sheet.pdf

- UK Department of Energy and Climate Change. (2015). *Valuation of energy use and greenhouse gas (GHG) emissions*. Chapter 2 How to undertake energy and GHG emissions appraisals https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/254083/2013_main_appraisal_guidance.pdf

- City of New York. (2016). *New York City's Roadmap to 80x50*. Energy (pages 33-50) http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

Supplemental Readings:

- U.S. EPA. *Sources of Greenhouse Gas Emissions, Electricity.* https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

- EDF Energy. *Measuring Energy's Contribution to Climate Change*. The climate change challenge for each energy source. http://www.edfenergy.com/energyfuture/the-energy-gap-climate-change

- Rothschild, S., Diem, A. (2009). *Total, Non-baseload, eGRID Subregion, State? Guidance on the Use of eGRID Output Emission Rates*. http://www.epa.gov/ttnchie1/conference/ei18/session5/rothschild.pdf

Week 9: Greenhouse Gas Emissions Reporting Platforms (March 22)

Required Readings:

- CDP. (2015). *CDP Global Climate Change Report, At the tipping point?*. Pages 4-17 https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/578/original/CDP-global-climate-change-report-2015.pdf

- Global Reporting Initiative. (2015). *G4 Sustainability Reporting Guidelines Implementation Manual.* Chapters 1-3 and 4.2 Category: Environmental (pages 4-16, 84-141) https://www.globalreporting.org/resourcelibrary/GRIG4-Part2-Implementation-Manual.pdf

- The Climate Registry. (2016). *General Reporting Protocol for the Voluntary Reporting Program, Version 2.1*. Chapters 1-3 (pages 3-12) https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf

- Bonn Center for Local Climate Action and Reporting. (2016). carbonn® Climate Registry Digest 2015-2016.

http://e-lib.iclei.org/wp-content/uploads/2016/11/ccr-report-2015_2016-Digest-web.pdf

Supplemental Readings:

- U.S. EPA. Greenhouse Gas Reporting Program (GHGRP)
  http://www.epa.gov/ghgreporting/

- U.S. Government. The Electronic Code of Federal Regulations, Title 40: Protection of Environment, Part 98 – Mandatory Greenhouse Gas Reporting, Subpart A – General Provision (40 CFR Part 98, Subpart A).
  http://www.ecfr.gov/cgi-bin/text-idx?SID=efb80b07669de0aa366fd72c0a26f83e&node=sp40.21.98.a&rgn=div6

Week 10: Private Sector Carbon Accounting (March 29)

Required Readings:

- Goldberg, S. (2013). *Just 90 companies caused two-thirds of man-made global warming emissions.*
  http://www.theguardian.com/environment/2013/nov/20/90-companies-man-made-global-warming-emissions-climate-change

- Bloomberg L.P. (2016). Impact Report Update 2015.
  https://www.bbhub.io/sustainability/sites/6/2016/04/16_0404_Impact_Report.pdf

- HSBC. (2016). *Annual Report and Accounts 2015.* Carbon dioxide emissions (page 98)
  http://www.hsbc.com/investor-relations/events-and-presentations/quick-read [Downloads]

- Corporate Knights. (2016). *2016 Global 100 results. The results for the 2016 Global 100 Most Sustainable Corporations in the World index*.
  http://www.corporateknights.com/magazines/2016-global-100-issue/2016-global-100-results-14533333/

- Johnson and Johnson. (2016). *Greenhouse Gas Emissions*.
  http://www.jnj.com/caring/citizenship-sustainability/strategic-framework/Greenhouse-Gas-Emissions

- Hess Corporation. (2016). *2015 Corporate Sustainability Report*. Climate Change and Energy (pages 42-51)
  http://www.hess.com/docs/default-source/sustainability/2014-sustainability-report.pdf?sfvrsn=2

Supplemental Readings:

- CDP. (2016). *Out of the starting blocks: Tracking progress on corporate climate action*
  https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/578/original/CDP-global-climate-change-report-2015.pdf

- CDP. (2014). *Why companies need emissions reduction targets: The key to a low-carbon economy*

https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/original/Carbon-action-report-2014.pdf?1472035953

Week 11: Life cycle/Consumption Based Inventories and Corporate Value Chain Greenhouse Gas Accounting (April 5)

Required Readings:

- World Resources Institute and World Business Council for Sustainable Development. (2011). *Greenhouse Gas Protocol: Product Life Cycle Accounting and Reporting Standard*. Chapters 1-8 (pages 2-59) http://www.wri.org/sites/default/files/pdf/ghgp_product_life_cycle_standard.pdf

- World Resources Institute and World Business Council for Sustainable Development. (2011). *Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. Chapters 1-6 (pages 2-63) http://www.ghgprotocol.org/files/ghgp/public/Corporate%20Value%20Chain%20%28Scope%203%29%20Accounting%20and%20Reporting%20Standard.pdf

- PwC. (2011). *Sustainability matters, Carbon accounting in the value chain, New standards represent a leap forward*. http://www.pwc.com/en_US/us/corporate-sustainability-climate-change/assets/sustainability-matters-carbon-accounting-in-the-value-chain.pdf

- British Standards Institution. (2011). *PAS 2050:2011, Specification for the assessment of the life cycle greenhouse gas emissions of goods and services*. http://shop.bsigroup.com/upload/Shop/Download/PAS/PAS2050.pdf

- Ramaswami, A. et al. (2008). *A Demand-Centered, Hybrid Life-Cycle Methodology for City-Scale Greenhouse Gas Inventories*. http://www.ucdenver.edu/academics/colleges/Engineering/research/CenterSustainableUrbanInfrastructure/LowCarbonCities/Documents/Ramaswami/es702992q.pdf

Supplemental Readings:

- Hillman, T. Ramaswami, A. (2009). *Greenhouse Gas Emission Footprints and Energy Use Benchmarks for Eight U.S. Cities.* http://pubs.acs.org/doi/pdf/10.1021/es9024194

- The Economic Input-Output Life Cycle Assessment (EIO-LCA) method is used for supply chain and consumption based GHG emissions measurement. This website developed by researchers at the Green Design Institute of Carnegie Mellon University operationalizes the EIO-LCA method and transforms it into a user-friendly online tool to quickly and easily evaluate a commodity or service, as well as its supply chain. The results from the EIO-LCA model and this website are free for non-commercial use and may not be used in other derivative works or websites without permission. http://www.eiolca.net/. Please review and be prepared to discuss your impressions in class.

Week 12: Public Sector Carbon Accounting (April 12)

Required Readings:

- City of New York. (2016). *Inventory of New York City Greenhouse Gas Emissions in 2014, Published April 2016*. http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/NYC_GHG_Inventory_2014.pdf

- U.S. EPA. (2016). *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2014*. Executive Summary https://www.epa.gov/sites/production/files/2016-04/documents/us-ghg-inventory-2016-main-text.pdf

- Kennedy, C.A. et al. (2011). *Greenhouse Gas Emission Baselines for Global Cities and Metropolitan Regions*. Summary and Introduction (pages 1-4) http://siteresources.worldbank.org/INTURBANDEVELOPMENT/Resources/336387-1256566800920/6505269-1268260567624/KennedyComm.pdf

- Kennedy, C.A. et al. (2010). *Methodology for inventorying greenhouse gas emissions from global cities*. Pages 4828-4837 [Available free on Canvas or using Columbia CLIO] http://www.sciencedirect.com/science/article/pii/S0301421509006387

- CDP. (2016). *Global Cities Report 2016.* https://www.cdp.net/en/research/global-reports/global-cities-report-2016 [Download]

- U.S. EPA. (2016). *2015 GHG Reporting Program Data Sets*. This link contains files with publicly available data from the U.S. GHG Reporting Program for reporting year 2015. Choose one dataset and be prepared to discussion your findings in class. https://www.epa.gov/ghgreporting/ghg-reporting-program-data-sets

- City of New York. (2016). *New York City's Roadmap to 80x50.* Choose either Buildings (pages 55-78), Transportation (pages 79-98), **or** Solid Waste (pages 99-109) and be prepared to discuss in class http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/New%20York%20City's%20Roadmap%20to%2080%20x%2050_Final.pdf

Supplemental Readings:

- CDP. (2013). *Wealthier, Healthier Cities* http://www.c40.org/researches/c40-cdp-2013-wealthier-healthier-cities-report

- Ricardo-AEA. (2016). *UK Emission Mapping Methodology 2014*. https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1607290912_UK_Emission_Mapping_Methodology_2014_Issue_1.pdf

- Commonwealth of Australia. (2016). *Quarterly Update of Australia's National Greenhouse Gas Inventory: June 2016*.

http://www.environment.gov.au/system/files/resources/48275b92-3f4b-44d0-aa4e-50ece408df86/files/nggi-quarterly-update-jun-2016.pdf

Week 13: The Next Frontier for Carbon Accounting and Reporting (April 19)

Required Readings:

- Global Reporting Initiative. (2013). *The sustainability content of integrated reports – a survey of pioneers*. Introduction and Methodology (pages 7-10) https://www.globalreporting.org/resourcelibrary/GRI-IR.pdf

- PUMA. (2016). *Annual Report 2015.* Sustainability (pages 40-61) http://about.puma.com/damfiles/default/investor-relations/financial-reports/en/2015/GB_2015_ENG_Final_links_low-res-c07c3bcddcd6005747ae5fad422e0944.pdf

- Confino, J. (2012). *Puma scales up environmental profit and loss reporting to a product level*. http://www.guardian.co.uk/sustainable-business/blog/puma-scales-up-environmental-profit-loss-product

- Novo Nordisk. (2016). Annual Report 2015. Pages 4, 13, 15, 102-104 http://www.novonordisk.com/content/dam/Denmark/HQ/Commons/documents/Novo-Nordisk-Annual-Report-2015.PDF

- SAP. (2016). *2015 Integrated Report Sustainability Content*. Non-Financial Notes: Environmental Performance (pages 30-35) http://www.sap.com/docs/download/integrated-reports/2015/sap-2015-integrated-report-sustainability-content.pdf

- Coca-Cola Hellenic Bottling Company. (2016). *2015 Integrated Annual Report*. Environmental Data Table (pages 185-187) http://coca-colahellenic.com/media/2390/coca-cola-hbc_2015-integrated-annual-report.pdf

- Entergy. (2016). *2015 Integrated Report.* Pages 15-17, 47, 63 http://integratedreport.entergy.com/Entergy_2015_Integrated_Report.pdf

- Philips. (2016). *Annual Report 2015.* Environmental Performance (pages 39-44) http://www.philips.com/corporate/resources/annualresults/2015/PhilipsFullAnnualReport2015_English.pdf

Supplemental Readings:

- International Integrated Reporting Council (IIRC). *Integrated Reporting Examples Database*. http://examples.integratedreporting.org/home

Week 14: Final Presentations (April 26)

Grading and Assignments

15% - Attendance and Class Participation

10% - Exercise 1 due February 1

10% - Short Paper due February 8 (2-3 pages)

10% - Exercise 2 due February 15

10% - Exercise 3 due March 8 – group project plus presentation

10% - Exercise 4 due April 5

35% - Final Assignment due April 26 (8-10-page report plus presentation)

Participation is very important and will represent **15%** of the student's grade. All students are expected to contribute to the classroom discussion throughout the course.

On-time attendance at each class meeting is expected. Partial attendance, i.e. lateness or early departure, if not excused in advance, will impact the "Participation" component of the course grade. If you need to miss a class for any reason, please email the instructor in advance.

Papers and Reports are due by the beginning of class on the date that they are due, uploaded to Canvas. All assignments must be submitted on time. Any late submission will receive an automatic reduction of one letter grade – **there are no exceptions to this policy**.

- **Exercise 1**

  This assignment, **due at the start of class on February 1**, requires students to complete basic greenhouse gas emissions calculations as a comparative exercise, examining three separate activities. Additional instructions regarding this assignment will be distributed during the course.

- **Short Paper**

  This assignment, **due at the start of class on February 8**, is a 2-3-page paper qualitatively analyzing a publicly available greenhouse gas inventory of the student's choosing. In this analysis, students are expected to present findings on the inventory's approach, depth of content, and prospective utility to both issuing entity and broader audiences (e.g. shareholders for corporate inventories). Students are not expected to complete detailed assessment of quantitative elements of the inventory, including data or calculation methodologies – these assessments will be the subject of later analyses.

  In 2-3 pages, summarize the scope of the inventory and examine how closely the report achieves the issuer's goals. Critical to this assessment is an understanding of the value of greenhouse gas emissions accounting efforts. Students may elect to support or challenge elements of their chosen inventory – in either case specific examples are required. Papers that demonstrate thoughtful choice of what inventory to assess coupled with well-articulated results of analysis will be most successful.

- **Exercise 2**

This assignment, **due at the start of class on February 15**, asks students to calculate the greenhouse gas emissions from a fictional company and the greenhouse gas emissions from the local government operations in the company's hometown. Additional instructions regarding this assignment will be distributed during the course.

- **Exercise 3**

  This assignment, **due at the start of class on March 8**, requires students to complete basic greenhouse gas calculations for an example small town, working in groups. Each group will be responsible for reporting back the results of their analysis to the class. Additional instructions regarding this assignment will be distributed during the course.

- **Exercise 4**

  This assignment, **due at the start of class on April 5,** requires students to calculate the carbon intensity of the electricity supply for a defined geographic region. Students will be provided with needed electricity generation and use data and will use these data to calculate the region's greenhouse gas emissions coefficient. The deliverable is a completed data spreadsheet. Additional instructions regarding this assignment will be distributed during this course.

- **Final Assignment**

  The final assignment, **due at the start of class on April 26**, is a complete greenhouse gas inventory report for a public or private entity to be defined by the student (in consultation with the instructor) during the course. Accompanying this report will be a short presentation from each student, to be delivered during class. The report will consist of an 8-10-page paper that presents the methodology employed and the analysis results. This assignment requires students to acquire all data needed for this assignment, which can take time. As such, students will be encouraged to begin work on this assignment early in the semester. Additional instructions regarding this assignment will be distributed during the course.

Policies

Academic Integrity

The School of Continuing Education does not tolerate cheating and/or plagiarism in any form. Those students who violate the Code of Academic and Professional Conduct will be subject to the Dean's Disciplinary Procedures. The Code of Academic and Professional Conduct can be viewed online: http://ce.columbia.edu/node/217

All work must be your own. The use of any research or external source must be cited and documented appropriately. The School provides some useful resources online; we strongly encourage you to familiarize yourself with these various styles before conducting your research: http://library.columbia.edu/help/howto/endnote.html

Violations of the Code of Academic and Professional Conduct will be reported to the Associate Dean for Student Affairs.

Accessibility Statement

Columbia is committed to providing equal access to qualified students with documented disabilities. A student's disability status and reasonable accommodations are individually determined based upon disability documentation and related information gathered through the intake process. For more information regarding this service, please visit the University's Health Services website: http://health.columbia.edu/services/ods/support