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

Columbia University: Spring 2021

**Instructor**

Cynthia Cummis

**Course Description**

Global greenhouse gas (GHG) 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 well below to 2°C, while pursuing efforts to limit the temperature increase even further to 1.5°C. 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 for companies, financial institutions and governments employing all necessary skills including the identification of analysis boundaries, data collection, calculation of emissions levels, and reporting of results. In-class workshops and exercises will complement papers and group assignments. A key component of this course will be critical evaluation of both existing accounting and reporting standards as well as GHG emissions reduction target setting practices.

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 the major greenhouse gas emissions accounting and reporting standards, for both public and private entities,
    - Understand best-practice approaches to set GHG emissions reduction targets.

# Course Schedule

* + - Week 1 (Jan 11) – Introduction to Climate Change Science and Greenhouse Gas Inventories (Guest Lecturer)
    - **January 18 (NO CLASS) Martin Luther King Jr. Holiday**
    - Week 2 (Jan 25) – Greenhouse Gas Emissions Mitigation Efforts
    - Week 3 (Feb 1) – Measuring to Manage: The Importance of Regular, Accurate Greenhouse Gas Inventories: **Assignment due: Exercise 1**
    - Week 4 (Feb 8) – Greenhouse Gas Accounting, Reporting, and Certification Methods & Using Greenhouse Gas Inventories to Identify Mitigation Opportunities: **Assignment due: Short Paper**
    - Week 5 (Feb 15) – Greenhouse Gas Emissions Data Collection: **Assignment due: Exercise 2**
    - Week 6 (Feb 22) – Greenhouse Gas Emissions Calculation
    - Week 7 (March 1) – Private Sector Carbon Accounting (Scopes 1 and 2) (Guest Lecturer)
    - Week 8 (March 8) – Product Life-Cycle Inventories and Corporate Value Chain (Scope 3) Greenhouse Gas Accounting (Guest Lecturer)
    - Week 9 (March 15) – Science-Based Targets and Net Zero target setting
    - Week 10 (March 22) – Public Sector Carbon Accounting (Guest Lecturer)
    - Week 11 (March 29) – Financed Emissions Accounting and Portfolio-Level Target Setting (Guest Lecturer): **Assignment due: Exercise 3**
    - Week 12 (April 5) – Greenhouse Gas Emissions Reporting Platforms (Guest Lecturer)
    - Week 13 (April 12) – Final Presentations: **Assignment due: Final Assignment**

# 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**

Each week, one or more of the required readings will be the subject of a student-l ed di s cus s i on i n that week’ s class. Recent news articles may also be posted in the week prior to a class and used for the basis of a group discussion.

**Week 1: Introduction to Climate Change Science and Greenhouse Gas Inventories**

**(January 11)**

Required Readings

* IPCC, 2014: Summary for Policymakers. WG II. (available at: https://www.ipcc.ch/site/assets/uploads/2018/03/ar5\_wgII\_spm\_en-1.pdf)
* Chapter 2 of the Fourth National Climate Assessment (available at: [science2017.globalchange.gov](http://science2017.globalchange.gov/))
* Ge, Mengpin and Johannes Friedrich. 2020. “4 Charts Explain GHG Emissions by Countries and Sectors.” (available at: <https://www.wri.org/blog/2020/02/greenhouse-gas-emissions-by-country-sector>)
* [*https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change*](https://www.carbonbrief.org/explainer-nine-tipping-points-that-could-be-triggered-by-climate-change)
* Lenton, Timothy M., Johan Rockström, Owen Gaffney, Stefan Rahmstorf, Katherine Richardson, Will Steffen, and Hans Joachim Schellnhuber. 2019. “Climate Tipping Points — Too Risky to Bet Against.” *Nature* 575 (7784): 592–95. (available at: <https://doi.org/10.1038/d41586-019-03595-0>)

Supplemental Readings

* *Skim:* <https://interactive.carbonbrief.org/impacts-climate-change-one-point-five-degrees-two-degrees/?utm_source=web&utm_campaign=Redirect>
* Lenton, T. M., H. Held, E. Kriegler, J. W. Hall, W. Lucht, S. Rahmstorf, and H. J. Schellnhuber. 2008. “Tipping Elements in the Earth’s Climate System.” *Proceedings of the National Academy of Sciences* 105 (6): 1786–93. (available at: <https://doi.org/10.1073/pnas.0705414105>)
* Roberts, David. 2020. “What’s Causing Climate Change in 10 Charts.” (available at: <https://www.vox.com/energy-and-environment/21428525/climate-change-west-coast-fires-cause-charts>)
* Tong et al. 2019. “Committed Emissions from Existing Infrastructure Jeopardize 1.5˚C Climate Target.” *Nature.* Vol 572. (available at: <https://www.nature.com/articles/s41586-019-1364-3.epdf?referrer_access_token=r5iR2Eohp3lekAepJnbQ59RgN0jAjWel9jnR3ZoTv0PdO5WVipRqBUMeBcZf-002NRS2vI09Momxci5bmedA_H-iEdV2alvUSMRvyKJNoUkxZV3z1dAPqG64bk4_5__SI7qquQ1PVEMigxgiuMYon-22YWAll4o3uI149earn6evJ8Ms9C1s4PxxnOwR2kxMFcM_OyvZKqSdmVCJ2MpFAw%3D%3D&tracking_referrer=www.nationalgeographic.com>)

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

Required Readings:

* **Climate Action Tracker. Countries. Select one country or region to enrich the discussion and be prepared to share impressions on international efforts.** [**http://climateactiontracker.org/countries.html**](http://climateactiontracker.org/countries.html)
* Natural Resources Defense Council. (2017). *The Road from Paris: China’s Progress Towards its*

*Climate Pledge.*

<https://www.nrdc.org/sites/default/files/paris-climate-conference-China-IB.pdf>

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European Union. (2016). *The EU Emissions Trading System (EU ETS).*

<https://ec.europa.eu/clima/sites/clima/files/factsheet_ets_en.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 https://webarchive.nationalarchives.gov.uk/20130123161956/http://www.hm- treasury.gov.uk/d/Executive\_Summary.pdf

* Nordhaus, William. (2013). *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World, Climate-Change Policies at the National Level*

https://www-jstor-[org.ezproxy.cul.columbia.edu/stable/pdf/j.ctt5vkrpp.24.pdf?refreqid=excelsior%3Ac656468ca24a](https://www-jstor-org.ezproxy.cul.columbia.edu/stable/pdf/j.ctt5vkrpp.24.pdf?refreqid=excelsior%3Ac656468ca24a3df58498261a728523f2) [3df58498261a728523f2](https://www-jstor-org.ezproxy.cul.columbia.edu/stable/pdf/j.ctt5vkrpp.24.pdf?refreqid=excelsior%3Ac656468ca24a3df58498261a728523f2)

* Enkvist, P. et al. *A CostCcurve forGreenhouse Gas Reduction.* McKinsey Quarterly, 2007. [https://www.mckinsey.com/business-functions/sustainability/our-insights/a-cost-curve-for- greenhouse-gas-reduction#](https://www.mckinsey.com/business-functions/sustainability/our-insights/a-cost-curve-for-greenhouse-gas-reduction)
* City of New York. (2018). *One NYC Progress Report*. Vision 3 Our Sustainable City (pages 58-86) <https://onenyc.cityofnewyork.us/wp-content/uploads/2018/05/OneNYC_Progress_2018.pdf>
* City of New York. (2017). *OneNYC Progress Report*. Livable Climate (pages 2-31) [http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5- AligningNYCwithParisAgrmtFORWEB.pdf](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf)
* City of New York. (2017). 1.5°C: *Aligning New York City with the Paris Agreement*. (pages 2-31) [http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf) [AligningNYCwithParisAgrmtFORWEB.pdf](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.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?seque nce=7](https://openknowledge.worldbank.org/bitstream/handle/10986/25160/9781464810015.pdf?sequence=7)
* Center for Climate and Energy Solutions (C2ES). (2017). *The Business of Pricing Carbon*. Introduction and Corporate Carbon Pricing Approaches (pages 1-8) <https://www.c2es.org/site/assets/uploads/2017/09/business-pricing-carbon.pdf>

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 <https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_technical-summary.pdf> <https://www.ipcc.ch/site/assets/uploads/2018/02/ipcc_wg3_ar5_chapter5.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. (2018). 2018 *Global Responsibility Report*. (pages 26-41) [https://corporate.walmart.com/media-library/document/2018-grr-](https://corporate.walmart.com/media-library/document/2018-grr-summary/_proxyDocument?id=00000162-e4a5-db25-a97f-f7fd785a0001) [summary/\_proxyDocument?id=00000162-e4a5-db25-a97f-f7fd785a0001](https://corporate.walmart.com/media-library/document/2018-grr-summary/_proxyDocument?id=00000162-e4a5-db25-a97f-f7fd785a0001)

(If the link does not work, please search for “Walmart 2018 Global Responsibility Report” on theInternet. The first Walmart link is the one to be used)

* Nordhaus, William. (2013). *The Climate Casino: Risk, Uncertainty, and Economics for a Warming World*, New Technologies for a Low-Carbon Econom
* <https://www-jstor-> [org.ezproxy.cul.columbia.edu/stable/pdf/j.ctt5vkrpp.27.pdf?refreqid=excelsior%3Ac656468ca24a3d f58498261a728523f2](https://www-jstor-org.ezproxy.cul.columbia.edu/stable/pdf/j.ctt5vkrpp.27.pdf?refreqid=excelsior%3Ac656468ca24a3df58498261a728523f2)

# 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. <https://www.corporateregister.com/accounts/>

* 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>
* ICLEI – Local Governments for Sustainability USA. (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/>
* 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>

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 & Using Greenhouse Gas Inventories to Identify Mitigation Opportunities (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) [**https://ghgprotocol.org/sites/default/files/standards/ghg -protocol-revised.pdf**](https://ghgprotocol.org/sites/default/files/standards/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) <https://ghgprotocol.org/sites/default/files/standards/GHGP_GPC_0.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](https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf)

* City of New York. (2017). *Inventory of New York City Greenhouse Gas Emissions in 2015, Published April 2017.* Executive Summary, Introduction, and Citywide Inventory (pages 7-26). <https://climatesmart.ny.gov/fileadmin/csc/documents/GHG_Inventories/nycghg.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>
* ICLEI-Local Governments for Sustainability USA. (2017). Localizing the Paris Agreement (pages 13-30)

[http://icleiusa.org/wp-content/uploads/2017/09/Localizing-the-Paris-Agreement-ICLEI-USA- 2017.pdf](http://icleiusa.org/wp-content/uploads/2017/09/Localizing-the-Paris-Agreement-ICLEI-USA-2017.pdf)

* Google. (2019). *Environmental Report, 2019*

<https://services.google.com/fh/files/misc/google_2019-environmental-report.pdf>

* FedEx. (2019). 2019 *Global Citizenship Report.* Environment (pages 39-52) <http://csr.fedex.com/pdf/FedEx_GCR_FINAL_4.17.19_144dpi.pdf>
* Chevron. (2017). *2016 Corporate Responsibility Report Highlights*. Addressing climate change risks (pages 10-13).

[https://www.chevron.com/-/media/shared-media/documents/2016-corporate-responsibility- report.pdf](https://www.chevron.com/-/media/shared-media/documents/2016-corporate-responsibility-report.pdf)

* Microsoft. (2017). *The Microsoft Carbon Fee: Theory and Practice* (pages 3-26). [http://download.microsoft.com/documents/en-](http://download.microsoft.com/documents/en-us/csr/environment/microsoft_carbon_fee_guide.pdf) [us/csr/environment/microsoft\_carbon\_fee\_guide.pdf](http://download.microsoft.com/documents/en-us/csr/environment/microsoft_carbon_fee_guide.pdf)

Supplemental Readings:

* ICLEI. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions,*

*Version 1.1.* Appendix C-I <http://icleiusa.org/publications/us-community-protocol/>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) <https://ghgprotocol.org/sites/default/files/standards/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://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing- Standard-EReader\_041613\_0.pdf](http://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard-EReader_041613_0.pdf)
* IPCC. (2006). *2006 IPCC Guideline for National Greenhouse Gas Inventories, Chapter 2, Approaches to Data Collection.*

<https://www.ipcc-nggip.iges.or.jp/public/2006gl/pdf/1_Volume1/V1_2_Ch2_DataCollection.pdf>

* New York City Open Data. Inventory of New York City Greenhouse Gas Emissions – Citywide GHG Emissions Summary (2016).

[https://data.cityofnewyork.us/Environment/Inventory-of-New-York-City-Greenhouse-Gas- Emission/k3e2-emsq](https://data.cityofnewyork.us/Environment/Inventory-of-New-York-City-Greenhouse-Gas-Emission/k3e2-emsq)

# 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)

<https://ghgprotocol.org/sites/default/files/standards/ghg-protocol-revised.pdf>

* ICLEI. Local Governments for Sustainability USA. (2013). *U.S. Community Protocol for Accounting and Reporting of Greenhouse Gas Emissions, Version 1.1.* Appendices C-I <http://icleiusa.org/publications/us-community-protocol/>

Available on Canvas

* City of New York. (2017). 1.5°C: *Aligning New York City with the Paris Agreement.* Methodology (pages 58-62). [http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf) [AligningNYCwithParisAgrmtFORWEB.pdf](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf)

# Week 7: Private Sector Carbon Accounting (March 1)

Required Readings:

## Bloomberg L.P. (2020). 2019 Impact Report.

<https://data.bloomberglp.com/company/sites/56/2020/05/Impact-Report-2019d.pdf>

* Shen, L. (2017). *These 100 Companies Are Responsible for Most of the World’s Carbon*

*Emissions.*

<http://fortune.com/2017/07/10/climate-change-green-house-gases/>

* HSBC. (2017). *Annual Report and Accounts 2016.* Carbon dioxide emissions (page 66) <http://www.hsbc.com/investor-relations/group-results-and-reporting/annual-report>[Downloads]
* Corporate Knights. (2019). *2019 Global 100 Results. The Results for the 2019 Global 100 Most Sustainable Corporations in the World index.*

<https://www.corporateknights.com/reports/2019-global-100/2019-global-100-results-15481153/>

* Johnson and Johnson. (2019). *2018 Health for Humanity Report.* Our Performance (pages 123-124). <http://healthforhumanityreport.jnj.com/downloads>
* Hess Corporation. (2018). 2018 Sustainability Report. Climate Change and Energy (pages 39-52) [https://www.hess.com/docs/default-source/sustainability/hess-2018-sustainability-](https://www.hess.com/docs/default-source/sustainability/hess-2018-sustainability-report.pdf?sfvrsn=11cd7b6b_2) [report.pdf?sfvrsn=11cd7b6b\_2](https://www.hess.com/docs/default-source/sustainability/hess-2018-sustainability-report.pdf?sfvrsn=11cd7b6b_2)
* H&M. (2018). 2018 Sustainability Report Becoming Climate Positive (pages 53-59) [https://hmgroup.com/content/dam/hmgroup/groupsite/documents/masterlanguage/CSR/reports/ 2018\_Sustainability\_report/HM\_Group\_SustainabilityReport\_2018\_%20FullReport.pdf](https://hmgroup.com/content/dam/hmgroup/groupsite/documents/masterlanguage/CSR/reports/2018_Sustainability_report/HM_Group_SustainabilityReport_2018_%20FullReport.pdf)

Supplemental Readings:

* CDP. (2016). *Out of the Starting Blocks: Tracking Progress onCorporate Climate Action Report.* (Pages 4-9)

<https://www.cdp.net/en/research/global-reports/tracking-climate-progress-2016>

* CDP. (2014). *Why Companies Need Emissions Reduction Targets: The Key to a Low-Carbon Economy* [https://b8f65cb373b1b7b15feb-](https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/original/Carbon-action-report-2014.pdf?1472035953) [c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/ original/Carbon-action-report-2014.pdf?1472035953](https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/original/Carbon-action-report-2014.pdf?1472035953)

# Week 8: Product Life-Cycle Inventories and Corporate Value Chain Greenhouse Gas Accounting (March 8)

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)

## [https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Product-Life-Cycle-Accounting-](https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.pdf) [Reporting-Standard\_041613.pdf](https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Product-Life-Cycle-Accounting-Reporting-Standard_041613.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)

[https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing- Standard\_041613\_2.pdf](https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf)

* World Resources Institute Evaluator Tool. To help facilitate the adoption of the Scope 3 Standard, the GHG Protocol teamed up with [Quantis](http://www.quantis-intl.com/) to develop this free scope 3 screening tool. This tool provides users with a simple interface to make a first, rough approximation of their full scope 3 footprint, regardless of their organization type and size.

<https://quantis-suite.com/Scope-3-Evaluator/>[Register and create an account]

* 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](http://www.pwc.com/en_US/us/corporate-sustainability-climate-change/assets/sustainability-matters-carbon-accounting-in-the-value-chain.pdf)

* Ramaswami, A., Chavez, A. and Chertow, M. (2012). “Carbon Footprinting of Cities and Implications for Analysis of Urban Material and Energy Flows.” *Journal of Industrial Ecology*, 16: 783–785. <http://onlinelibrary.wiley.com/doi/10.1111/j.1530-9290.2012.00569.x/full>
* Ramaswami, A. et al. (2008). *A Demand-Centered, Hybrid Life-Cycle Methodology for City-Scale Greenhouse Gas Inventories.*

<https://pubs.acs.org/doi/pdf/10.1021/es702992q>

Supplemental Readings:

* The Gold Standard (2020) Value Chain (Scope 3) *GHG Accounting Interventions Guidance* <https://www.goldstandard.org/impact-quantification/value-chain-interventions>
* 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 noncommercial use and may not be used in other derivative works or websites without permission. [http://www.eiolca.net/.](http://www.eiolca.net/)

**Week 9: Science-Based Targets and Net Zero target setting (March 15)**

Required Reading

## Science Based Targets. (2016). Case Studies. Select one case study from the link below of a company that has set science-based targets (e.g., Coca-Cola, Dell, Kellogg’s, etc.) and be prepared to discuss in class how they went about developing targets to help achieve their goals. <http://sciencebasedtargets.org/case-studies/>

* Science Based Targets initiative (2020) *Foundations for Net Zero Target Setting in the Corporate Sector*

<https://sciencebasedtargets.org/resources/legacy/2020/09/foundations-for-net-zero-full-paper.pd>

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* Science Based Targets initiative (2019) *Foundations of Science Based Targets Setting*

<https://sciencebasedtargets.org/resources/files/foundations-of-SBT-setting.pdf>

* Science Based Targets initiative (2020) *Science-Based Target Setting Manual*

<https://sciencebasedtargets.org/resources/files/SBTi-manual.pdf>

* Brad Smith (2020) *Microsoft will be Carbon Negative by 2030*

<https://blogs.microsoft.com/blog/2020/01/16/microsoft-will-be-carbon-negative-by-2030/>

* Unilever (2020) *Unilever Sets Out New Actions to Flight Climate Change and Protect and Regenerate Nature to Preserve Resources for Future Generations*

<https://www.unilever.com/news/press-releases/2020/unilever-sets-out-new-actions-to-fight-climate-change-and-protect-and-regenerate-nature-to-preserve-resources-for-future-generations.html>

Edie (2019) *Amazon Commits to Net-Zero by 2040 Following Staff Protests*

<https://www.edie.net/news/6/Amazon-commits-to-net-zero-by-2040-following-staff-protests/>

Supplemental Reading

* University of Oxford (2020) *Oxford Principles for Net Zero Aligned Carbon Offsetting*

<https://www.smithschool.ox.ac.uk/publications/reports/Oxford-Offsetting-Principles-2020.pdf>

* PWC (2020) *Building Block for Net Zero Transformation*

<https://www.pwc.co.uk/sustainability-climate-change/assets/pdf/building-blocks-net-zero-companies-transformation.pdf>

IPCC (2018) *Special Report: Global Warming of 1.5 degrees Celsius, Summary for Policy Makers*

<https://www.ipcc.ch/site/assets/uploads/sites/2/2019/05/SR15_SPM_version_report_LR.pdf>

**Week 10: Public Sector Carbon Accounting**

**(March 22)**

Required Readings:

* GHG Protocol, ICLEI, C40 (2014) *Global Protocol for Community-Scale GHG Inventories*

<https://ghgprotocol.org/greenhouse-gas-protocol-accounting-reporting-standard-cities>

* City of New York. (2017). *1.5°C: Aligning New York City with the Paris Agreement.* Inventory of NYC GHG Emissions in 2016 (pages 42-57) [http://www1.nyc.gov/assets/sustainability/downloads/pdf/publica tions/1point5-](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf) [AligningNYCwithParisAgrmtFORWEB.pdf](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.pdf)
* U.S. EPA. (2017). *Inventory of Greenhouse Gas Emissions and Sinks: 1990-2015.* Executive Summary. <https://www.epa.gov/sites/production/files/2017-02/documents/2017_complete_report.pdf>
* Kennedy, C.A. et al. (2011). *Greenhouse Gas Emission Baselines for Global Cities and Metropolitan Regions.* Summary and Introduction (pages 1-4) [Available on Canvas]
* 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. (2018). 2018 *GHG Reporting Program Data Sets.* This link contains files with publicly available data from the U.S. GHG Reporting Program for reporting year 2018. 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. (2017). *1.5°C: Aligning New York City with the Paris Climate Agreement.* NYC’s 2020 Climate Actions. You will be assigned a specific recommendation to support during the class discussion.

[http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5- AligningNYCwithParisAgrmtFORWEB.pdf](http://www1.nyc.gov/assets/sustainability/downloads/pdf/publications/1point5-AligningNYCwithParisAgrmtFORWEB.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\_Methodolo gy\_2014\_Issue\_1.pdf](https://uk-air.defra.gov.uk/assets/documents/reports/cat07/1607290912_UK_Emission_Mapping_Methodology_2014_Issue_1.pdf)

* Commonwealth of Australia. (2019). *Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2019*.

[https://www.environment.gov.au/system/files/resources/6686d48f-3f9c-448d-a1b7- 7e410fe4f376/files/nggi-quarterly-update-mar-2019.pdf](https://www.environment.gov.au/system/files/resources/6686d48f-3f9c-448d-a1b7-7e410fe4f376/files/nggi-quarterly-update-mar-2019.pdf)

# Week 11: Financed Emissions Accounting and Portfolio-Level Target Setting

# (March 29)

# Required Reading

# Partnership for Carbon Accounting Financials (2020). *The Global GHG Accounting and Reporting System for the Financial Industry*, First Edition

# <https://carbonaccountingfinancials.com/standard>

* World Resources Institute and World Business Council for Sustainable Development. (2011). *Greenhouse Gas Protocol: Corporate Value Chain (Scope 3) Accounting and Reporting Standard*. (pages 51-54)

[https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-](https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf)  [Standard\_041613\_2.pdf](https://ghgprotocol.org/sites/default/files/standards/Corporate-Value-Chain-Accounting-Reporing-Standard_041613_2.pdf)

# Science Based Targets initiative (2020) *Financial Sector Science Based Targets Guidance*, Pilot Version, Chapters 1-8

# <https://sciencebasedtargets.org/resources/legacy/2020/10/Financial-Sector-Science-Based-Targets-Guidance-Pilot-Version.pdf>

# Supplemental Reading

# Cynthia Cummis, (2020) Responsible Investor, *How can Financial Institutions Deliver on the Paris Agreement?*

# <https://www.responsible-investor.com/articles/how-can-financial-institutions-deliver-on-the-paris-agreement>

# 2 Degrees Investing Initiative (2020) *On the Road to Paris: A Review of Financial Institutions Climate Commitments*

# <https://2degrees-investing.org/wp-content/uploads/2020/12/On-the-Road-to-Paris.pdf>

# 2 Degrees Investing Initiative, UNEP FI, WRI (2015) *Climate Strategies and Metrics: Exploring Options for Investors*

# <https://www.ghgprotocol.org/sites/default/files/ghgp/standards/Climate%20targets_FINAL_med.pdf>

# Business Forward Foundation (2020) *Tracking Financed Emissions: We Can’t Manage if Banks Don’t Measure*

# <https://www.businessfwd.org/wp-content/uploads/sites/2/BFF_Sustainable_Banking_Issue_Brief.pdf>

# Week 12: Greenhouse Gas Emissions Reporting Platforms (April 5)

Required Readings:

* **CDP. (2016). *Out of the starting blocks: Tracking progress on corporate climate action report.***

**(Pages 4-9)**

[**https://www.cdp.net/en/research/global-reports/tracking-climate-progress-2016**](https://www.cdp.net/en/research/global-reports/tracking-climate-progress-2016)

* 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/UNGC-G4-linkage-publication.pdf>

* Global Reporting Initiative. (2019) GRI *Sustainability Reporting Guidelines.* Chapters: Energy, Emissions and Environmental Compliance [Download] <https://www.globalreporting.org/standards/gri-standards-download-center/>
* 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](https://www.theclimateregistry.org/wp-content/uploads/2014/11/General-Reporting-Protocol-Version-2.1.pdf)

* Bonn Center for Local Climate Action and Reporting. (2017). carbonn® Climate Registry Digest 2016- 2017.

<http://carbonn.org/20171101_cCR%20report_final-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).

[https://www.ecfr.gov/cgi-bin/text-](https://www.ecfr.gov/cgi-bin/text-idx?SID=efb80b07669de0aa366fd72c0a26f83e&amp;node=sp40.21.98.a&amp;rgn=div6) [idx?SID=efb80b07669de0aa366fd72c0a26f83e&node=sp40.21.98.a&rgn=div6](https://www.ecfr.gov/cgi-bin/text-idx?SID=efb80b07669de0aa366fd72c0a26f83e&amp;node=sp40.21.98.a&amp;rgn=div6)

* H&M. (2018). 2018 Sustainability Report Becoming Climate Positive (pages 53-59) [https://hmgroup.com/content/dam/hmgroup/groupsite/documents/masterlanguage/CSR/reports/ 2018\_Sustainability\_report/HM\_Group\_SustainabilityReport\_2018\_%20FullReport.pdf](https://hmgroup.com/content/dam/hmgroup/groupsite/documents/masterlanguage/CSR/reports/2018_Sustainability_report/HM_Group_SustainabilityReport_2018_%20FullReport.pdf)

Supplemental Readings:

* CDP. (2016). *Out of the Starting Blocks: Tracking Progress on Corporate Climate Action Report.* (Pages 4-9)

<https://www.cdp.net/en/research/global-reports/tracking-climate-progress-2016>

* CDP. (2014). *Why Companies Need Emissions Reduction Targets: The Key to a Low-Carbon Economy* [https://b8f65cb373b1b7b15feb-](https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/original/Carbon-action-report-2014.pdf?1472035953) [c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/ original/Carbon-action-report-2014.pdf?1472035953](https://b8f65cb373b1b7b15feb-c70d8ead6ced550b4d987d7c03fcdd1d.ssl.cf3.rackcdn.com/cms/reports/documents/000/000/848/original/Carbon-action-report-2014.pdf?1472035953)

# Week 13: Final Presentations (April 12)

# Grading and Assignments

15% - Attendance and Class Participation

12.5% - Exercise 1: due February 1

12.5% - Short Paper: due February 8 (2-3 pages)

12.5% - Exercise 2: due February 15

12.5% - Exercise 3: due March29 (group project plus presentation)

35% - Final Assignment: due April12 (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 at least one day 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 (public or private sector). 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 29**, 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.

* **Final Assignment**

The final assignment**, due at the start of class on April 12,** 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.

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