

# Assignment: Decarbonization for One Country

EES 3310/5310 Global Climate Change

Presentations on Monday, December 4

Report due on Wednesday, December 6

## Introduction

This assignment will be more free-form than the lab assignments we have done earlier in the semester. For this assignment, you will build on the work you did for the bottom-up and top-down decarbonization analysis and investigate how decarbonization might play out in one specific country. You can work on your own or in a team of two or three for this assignment. You will choose one country, decide what that country's greenhouse gas emissions target should be for the year 2050, and then sketch out a plan for how that country could achieve its goal.

You and your team will give a **short (five minutes per person) presentation** in the final lab on Monday, December 4 and turn in a **written report** (one report from the whole team is acceptable) before midnight on . The report is not meant to be an exhaustive research report. I expect a length of **around 5 pages of double-spaced text (or equivalently, around 3 pages single-spaced) per team member**, plus appropriate figures, tables, and references. Unlike previous assignments, you may use RMarkdown, Word, or any other word-processing mode that you wish, but I would like to you produce PDF output (e.g., if you're writing in Word, save a copy in PDF format).

## Establishing a Goal

Briefly, compare your country to the rest of the world, and discuss what would be a fair contribution for your country to make to reducing global greenhouse gas emissions (for simplicity, I recommend that you focus on carbon dioxide emissions from burning fossil fuels rather than on all different kinds of greenhouse gases). There is no right answer, and it would be possible to write a 50-page paper just on this part, but that is *not* what I want you to do. Rather, just present a simple overview of the issues and how you would choose a goal, under the assumption that the whole world must reduce its total emissions 36% below 2005 levels by 2050. For instance, you could discuss the cumulative emissions since the beginning of the industrial revolution, the different ways of measuring CO<sub>2</sub> emissions (total, per-capita, per dollar of GDP, etc.), the relative economic wealth of your country's citizens compared to other countries, etc.

You may want to refer to the table below, which lists emissions reductions from 2005-2050 for different parts of the world that would meet a global 36% emissions target in 2050. This table comes from the IPCC's representative concentration pathway database and is based on the pathway called "RCP 2.6," which gives about a two-thirds probability of keeping global warming below 2 °C. However, this table was produced from an economic model and does not take account of political and ethical considerations, such as fairness, so you are not obliged to choose the same goal that this table lists for your country or its region.

Country	Year	Emissions Reduction from 2005
Africa	2050	28%
Australia_NZ	2050	82%
Canada	2050	72%
China	2050	78%
India	2050	73%
Japan	2050	66%
South Korea	2050	67%
Latin America	2050	40%
Middle East	2050	32%
Southeast Asia	2050	-17%
USA	2050	73%
Western Europe	2050	74%
World Total	2050	36%

## Realizing the Goal

Once you have chosen a goal, you should apply the same kinds of methods that we used in the bottom-up and top-down decarbonization analyses to estimate what your country's population and per-capita GDP may be in 2050, and what the implications are for energy efficiency and the mixture of fuels that should supply its energy needs. This is a place to research the country's natural resources, current energy supply, and opportunities to decarbonize. For instance, if your country is mountainous with many rivers, you may want to expand hydroelectricity. On the other hand, if it is relatively flat, has few rivers, or if all the major rivers already have dams and generators, then you may want to look at other sources of energy. If your country receives a lot of sunshine, you may want to emphasize solar energy. Don't forget to think about nuclear energy as well as renewables like hydroelectricity, wind, and solar.

I am not asking you to give a thorough engineering and economic assessment of the energy transition, but to give a brief overview of the major opportunities and obstacles to clean energy in your country and what you think would be the best strategy for reducing emissions.

## Format

This is a lab report, not a formal research paper, so you do not need to structure it as a formal paper. What I will be looking for when I grade it will be:

- Thoughtful and sensible analysis of goals [30%]
- Thoughtful and sensible analysis of how to realize the goal [30%]
- Good use of the data for your country [20%]
- Organization of the report (do the parts fit together well and tell a clear story) [10%]
- Quality of writing [5%]
- Appropriate use of citations and references [5%]

You may choose to turn this in as an RMarkdown document (knitted to PDF, of course) or a Word document (saved as PDF), or any other format that you can render to PDF. The key is that you explain clearly how you do your analysis. It is also acceptable to turn in a report written in Word and refer the reader to R scripts or an RMarkdown document with "supplemental information" that contains the details of your calculations and quantitative analysis.

You will turn this assignment in by accepting the assignment, cloning the repository to your own computer, saving your final products in the repository and committing and pushing them to github.

## Data Sources

The kayadata package and the data files I provided for the previous decarbonization assignments (also included in this assignment) have data on the Kaya identity variables for 67 countries and top-down projections for 42 countries. If you are working on a country that's not one of these, you may want to look at additional data, such as the International Energy Agency's energy and emissions analyses (these reports are extremely expensive to buy, but the Vanderbilt Library provides free online access to the World Energy Outlook reports from 1999-2016 through the ACORN library catalog and this link [http://www.oecd-ilibrary.org/energy/world-energy-outlook\\_20725302](http://www.oecd-ilibrary.org/energy/world-energy-outlook_20725302) if you are on campus. You can also get detailed data for energy in the OECD nations at [http://www.oecd-ilibrary.org/energy/energy/indicator-group/english\\_379b6cdc-en](http://www.oecd-ilibrary.org/energy/energy/indicator-group/english_379b6cdc-en)). The U.S. Energy Information Administration publishes detailed country profiles for a number of countries at <https://www.eia.gov/outlooks/ieo/>, with data on many individual countries at <https://www.eia.gov/beta/international/> and brief country-analysis reports at <https://www.eia.gov/beta/international/analysis.cfm>

This list of data sources is not exhaustive and you should feel free to explore other sources of information, but don't feel that you have to spend hours in the library or the internet chasing down data. It is fine for this assignment to use "good-enough" data or to substitute estimates if you can't find exact numbers for what you're looking for. Just be clear about how you're doing your analysis.