DISCIPLINE-SPECIFIC MODULE

# Engineering Climate Justice

CJIT

CLIMATE JUSTICE INSTRUCTIONAL TOOLKIT

# What’s in this module?

**Contents**

This module combines engineering with concepts of climate justice, discusses how engineering decisions impact people’s lives, and encourages students to discuss how justice is at the heart of engineering.

**Activities**

3 parts
1 video
5 readings
5 activities
3 optional projects

**Key Resources**

- Engineering climate justice: how can we contribute to equitable global decarbonisation?
- Engineering for the People: Putting Peace, Social Justice, and Environmental Protection at the Heart of All Engineering
- The climate is changing. Engineering education needs to change as well.

# Learning Objectives

01

**Understand** engineering as a proactive approach to climate justice

02

**Identify** the intersection between environmental justice and engineering

03

**Discuss** personal responsibilities as engineers

04

**Explore** case studies from MIT

# Introduction

## PART 1

# Introduction

**What is climate justice?**

"As engineering continues to move society forward in innovative, exciting ways, it also interacts with the ongoing climate crisis. Climate justice recognizes the disproportionate impacts of climate change on low-income and BIPOC communities around the world, the people and places least responsible for the climate crisis." (Center for Climate Justice)

**Connection between engineering and CJ**

Climate justice is a movement that emerged in recent decades, and is something that has begun turning into a priority for engineering and design. This module explores some of the ways in which engineering and climate justice interact, looking at the ways in which engineering and design can help mitigate climate injustices.

# Review: *Engineering Climate Justice*

**Key point**

High income countries need to focus on decarbonizing faster, and engineers have a role to play in pushing for infrastructure changes that work towards these goals.

**People in lower-income countries face a triple injustice**

1. A disproportionately large impact from climate change
2. Structural disadvantage
3. A block on development

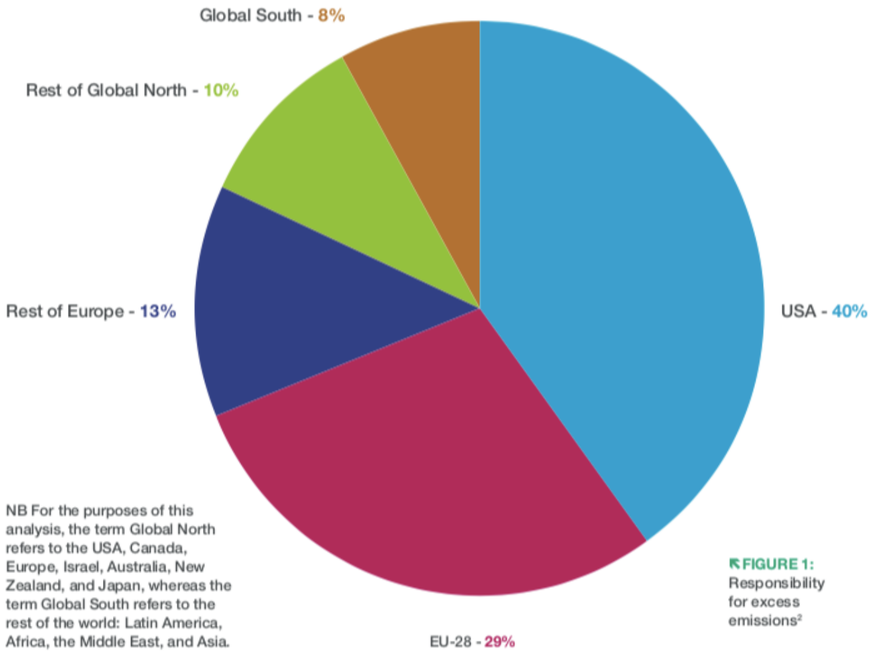



Figure 1: Global Responsibility for Excess Emissions – adapted from (Newby, 2022)

ACTIVITY #1

# AN INTRODUCTION TO ENGINEERING CLIMATE JUSTICE

5. Influence the brief

Engineering climate justice: how can we contribute to equitable global decarbonisation?

**In this personal perspective, Tom Newby argues that high-income countries have a moral responsibility to decarbonise faster, and urges structural engineers to advocate for changes in the way infrastructure is designed and built in order to work towards this goal.**

It is generally well understood that the climate emergency is a global problem, which needs global solutions. Hence the need for the Conference of Parties (COP) process to reach global agreements to mitigate and adapt to climate change.

The COP process includes ongoing discussion of who is responsible for the cost of adaptation and compensating for loss and damage in lower-income countries, based both on ability to pay and responsibility for creating the crisis we face. However, the construction industry has barely confronted issues of equity and climate justice and how these should – and will – affect our ability to decarbonise the built environment globally.

This viewpoint seeks to help those working in the built environment to understand the reality and context of how we, as a profession, respond to the climate emergency in a matter that is equitable and just for all of humanity.

**What is climate justice?**

The world is a deeply unequal place, and the climate crisis greatly exacerbates this inequality. People in lower-income countries, who make up the majority of the world's population, face a triple injustice of:

1) a disproportionately large impact from climate change;

**Disproportionate impact**

With less resilient infrastructure, less money and less capability to respond to and mitigate the climate crisis, and generally with a geography and climate more prone to high temperatures and natural hazards, the effects of climate change are assuming first, and assuming most, in the countries least able to respond to 'them'. This while people in these countries have – both historically and currently – made effectively no contribution to the climate emergency.

**Structural disadvantage**

Lower-income countries are structurally disadvantaged as a result of a history of colonisation and exploitation upon which much of the wealth of the richer countries of the world is built.

**Block on development**

In fighting the climate crisis, it is critical that high-income countries stop emitting greenhouse gases, and that lower-income countries do not substantially increase their greenhouse gas emissions. But stopping greenhouse gas emissions now will potentially severely limit the development and resilience of lower-income countries, trapping them in a permanent state of inequality and poverty.

**What does this mean?**

This triple injustice is what is meant by climate



## Read

*Engineering Climate Justice: how can we contribute to equitable global decarbonisation?*

## Post-reading discussion questions

- Discuss the triple injustice; can you think of examples of each kind?
- How are engineers' moral obligations also pragmatic ones?
- What are the implications of climate justice for engineers?
- What critiques do you have of this article?

ACTIVITY #2

# DIVING DEEPER INTO ENGINEERING CLIMATE JUSTICE

## Read

*Engineering and Environmental Justice*

"Construction and engineering students visit the Folsom spillway job site" by USACE HQ is marked with Public Domain Mark 1.0.

## Post-reading discussion questions

- How is community and community engagement centered in this article? How does community participation and impact bring together engineering and environmental justice?
- What notions of justice are covered in this article? What notions of justice are important when considering how engineering processes impact communities?

# Climate Justice in Engineering Education

## PART 2

# Brainstorm

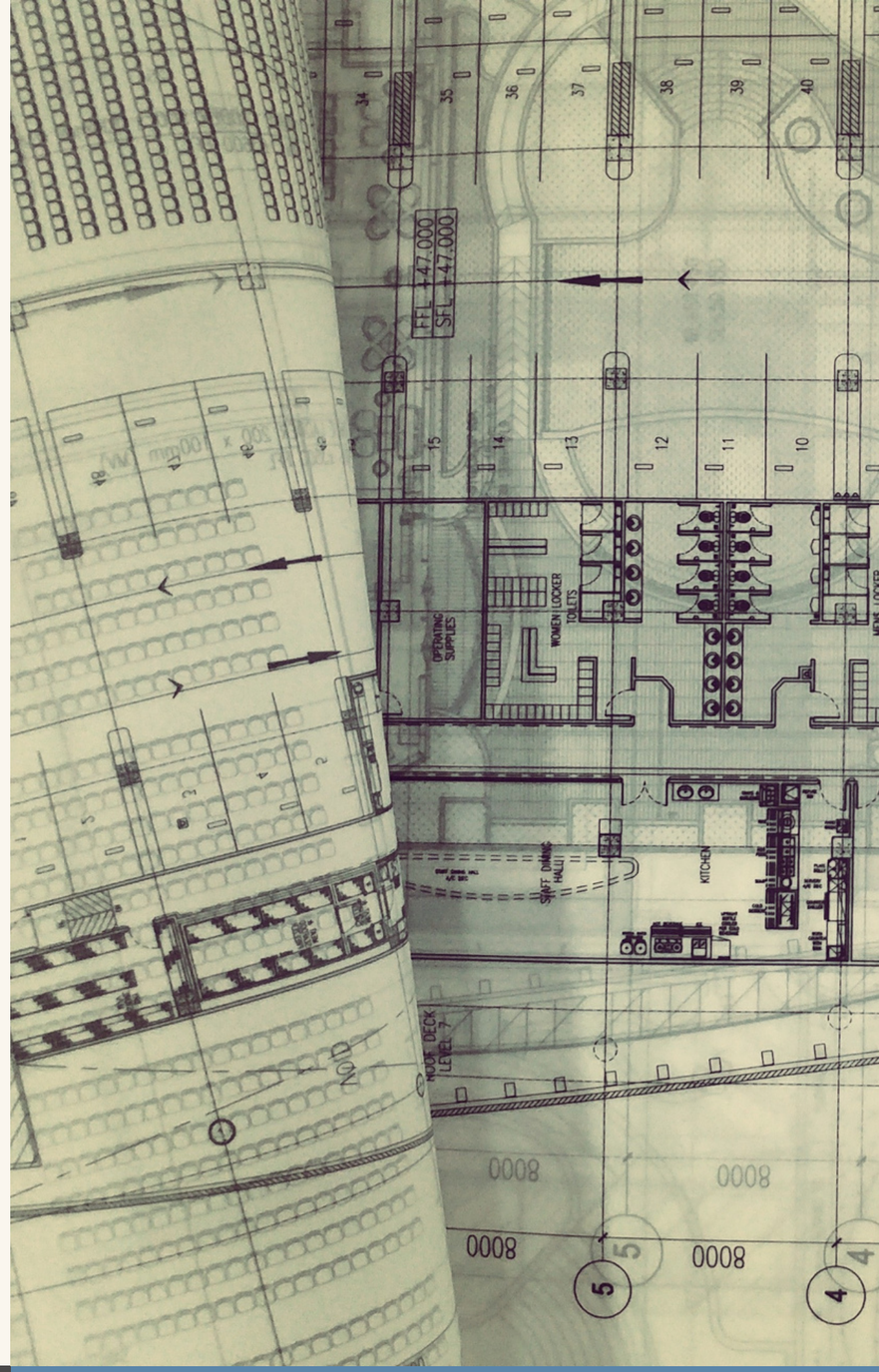
**How should engineering education change to better address issues of environmental & climate justice?**

“Empowering engineers with the skills to address the challenges created by climate change requires adapting both the technological and philosophical frameworks used in engineering education”
– The Research Journal for Engineering Education

# Review: *The climate is changing. Engineering education needs to change as well.*

**Discuss your thoughts**

- According to the article, how should engineering education change in the face of climate change and climate justice?
- What are the engineering skill sets in relation to climate justice , and why is are they necessary? Which skill set stands out most to you and why?
- In your opinion and experience, have the engineering classes you have taken sufficiently included issues of climate and climate justice? Why or why not?



# Climate Justice: The Design Challenge

PART 3

Photo from MIT D-Lab's work with the adaptive design center in Mexico

# Brainstorm

**How should climate justice be incorporated as a critical component of design?**

ACTIVITY #3

# FURTHER EXAMINATION OF JUSTICE

**Climate justice is the design challenge of our lives**

Climate change and toxic emissions disproportionately affect poor and minority communities. Here's how designers can help.

leoadaly.com

## Read

*Climate Justice is the design challenge of our lives*

## Post-reading discussion questions

- In what ways is the climate crisis an issue of social justice?
- According to the article, how do engineers interact with underserved communities?
- As engineers, how do we benefit from solving problems of injustice?
- What would it mean to adopt climate justice as a foundational principle of design? What would a climate justice design protocol look like?

ACTIVITY #4

# CASE STUDIES AND JIGSAW ACTIVITY

## Group and pick a case study

In 3 groups, pick one of these case studies to research:

- Anthro-Engineering in Mongolia
- Environmental Engineering and Climate Justice: An Interview with Juliana Mitkiewicz
- Xylem Water Filters

## Read and discuss

In your groups, spend about 5-10 minutes reading about your case study and taking note of how it relates to climate justice and design. Then, take another 5 minutes to briefly discuss within your groups what you took note of.

## Jigsaw discussion

Get into groups of 3, where each person read a different case study, give a brief outline of the case study that you read about and then discuss these questions:

- What helped with the success in the project? What roles did the engineers of the project play? How were community members or organizations included in the design process?
- What are some ideas can you take with you to implement in future projects (either climate justice related or not)?
- What were some elements of climate justice or social justice that you noticed?

ACTIVITY #5

# BUILDING A CONCEPT MAP

## Read

*Engineering for the People: Putting Peace, Social Justice, and Environmental Protection at the Heart of All Engineering*

## Discussion questions

In groups of 3-5 people, discuss these questions and think about real life examples:

1. How can we bring CJ closer to the heart of engineering's goals?
2. Which subfields of engineering need to grow to meet the new demands of a changing climate and ensure greater social parity? Which fields within engineering need to diminish, or be transformed?

## Create a concept map

Make a concept map for how engineering can consider and address issues of climate injustice. Think about how different sectors of engineering might have different opportunities and capabilities, and brainstorm any possible incentives for engineers and engineering firms to consider and address climate justice.

# Beyond the Module

PART 3

PROJECT OPTION #1

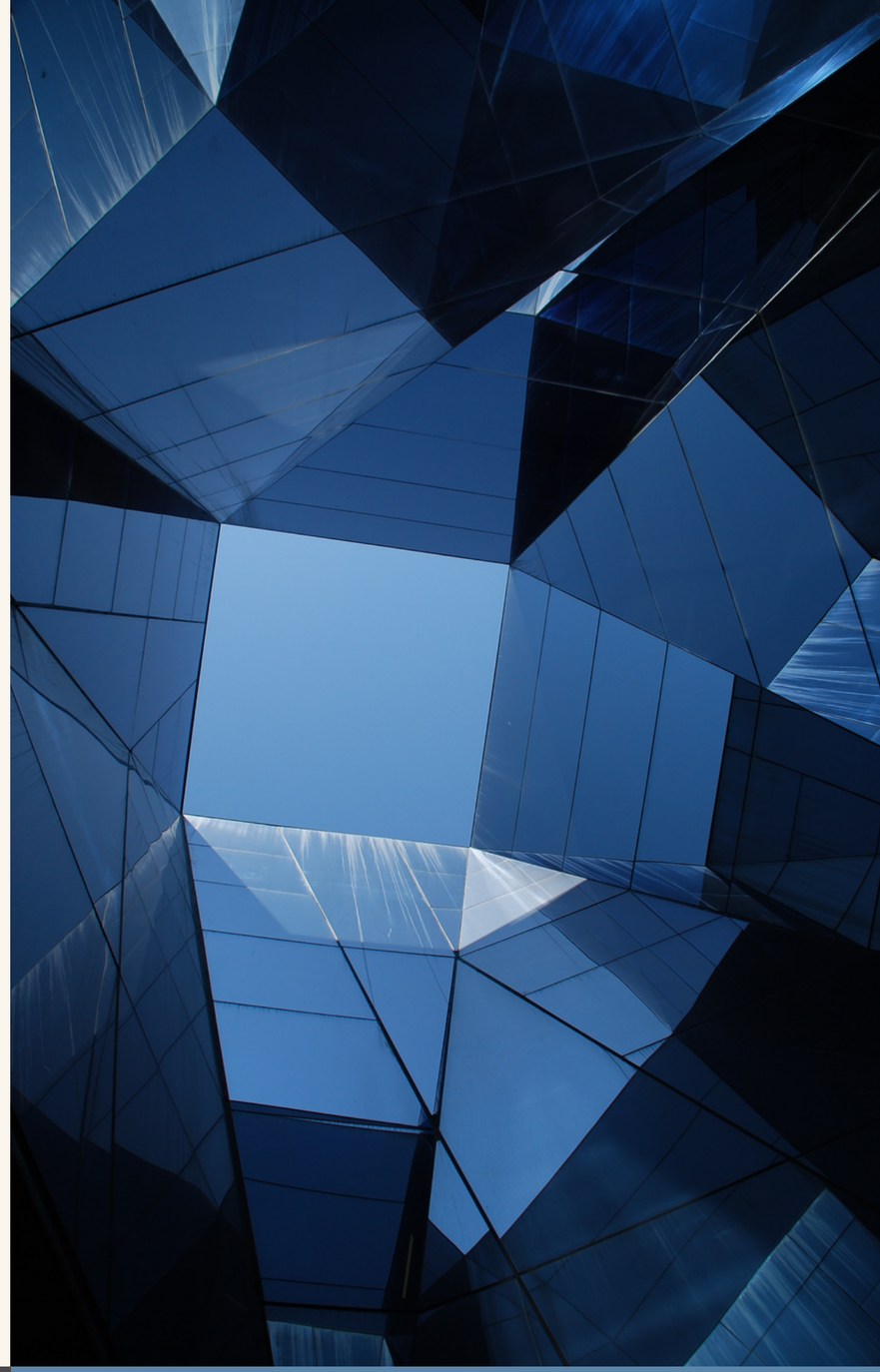
# Develop a Climate Justice Design Protocol

**Prompt suggestion**

Work with a group to develop a Climate Justice Design Protocol.

**Guiding Questions**

- How would it inform engineers or designers that are not familiar with climate justice?
- What key climate or environmental justice concepts from this module could be included as critical parts of this protocol?
- How would the protocol include voices and experiences from community members or organizations that face climate related problems and threats?



PROJECT OPTION #2

# Presentation Connecting What You've Learned to a Previous Project

**Prompt suggestion**

Create a presentation on a current or past project you are working on and explain how Tom Newby's discussion of climate justice could be included in the design process.

What principles from his article (facts, theories, arguments) are critical to include in civil and environmental engineering?

PROJECT OPTION #3

# Essay on Implementing CJ Concepts into an Important Project

**Prompt suggestion**

Imagine you were designing a needed engineering or design project of your choice in Massachusetts or in a community you know well.

How could you implement climate justice concepts into a design—considering how engineering has a relationship with both the earth and social injustices?

# Additional Resources

- Video lecture from Khalid Kadir: Me. We. – Moving from Ethics to Justice in Engineering

For more resources on climate and environmental justice: **Please explore other modules in the Climate Justice Instructional Toolkit.**

# Module References


- University of California Center for Climate Justice. (2023, July, 7). What is Climate Justice? Centerclimatejustice.universityofcalifornia.edu.
- Daly, L. A. (2023, January 11). Climate justice is the design challenge of our lives. Leoadaly.com.
- Jye , J. (2023, June 12). Powering the future in Mongolia. MIT News | Massachusetts Institute of Technology.
- KARWAT, D. M. A. (2018, January 28). Engineering for the People: Putting Peace, Social Justice, and Environmental Protection at the Heart of All Engineering. National Library of Medicine.
- Xylem water filter. MIT D-Lab. (n.d.).
- Adeshokan, O. (2020, February 26). How Makoko, Nigeria's floating slum went digital with new Mapping Project. CNN.
- Martin, M.J., Diem, S.J., Karwat, D.M.A., Krieger, E.M., Rittschof, C.C., Bayon, B., Aghazadeh, M., Asensio, O., Zeilkova, T.J., Garcia-Cazarin, M., Alvelo Maurosa, J.G. and Mahmoud, H. (2022). The climate is changing. Engineering education needs to change as well. J Eng Educ, 111: 740-746.