



# Addressing Inequities in Public Infrastructure

Davis Chacón-Hurtado  
Opening Remarks

Issues at the Intersection of  
Engineering and Human Rights

November 18, 2024

# Panelists

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**Davis Chacón-Hurtado**, Assistant Professor, School of Civil and Environmental Engineering & Human Rights Institute. Co-Director Engineering for Human Rights Initiative, University of Connecticut.



**Kimberly L. Jones**, Associate Provost, Office of the Provost and Chief Academic Officer, and Professor, Department of Civil and Environmental Engineering. Howard University.



**Bethany Gordon**, Assistant Professor, Civil and Environmental Engineering. Place-based Liberatory Advances for Climate Equity in Civil Engineering (PLACE(E) Lab). University of Washington.



**Eric Buckley**, Director of Oxygen Engineering, Senior Structural Engineers, Build Health International (BHI).



# Progressive Realization of Human Rights and Immediate Obligations

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Community of Tastayoq, Cusco, Peru. (Pictures, Davis Chacon-Hurtado)



FOOD



EDUCATION



HEALTH



HOUSING



WATER



WORK

# Aspirational Role of Engineers in Society

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## Canon #1

Hold paramount the safety, health, and welfare of the public.

(NSPE, 2019)

## Student Outcomes

Impact of engineering solutions in **global, economic, environmental, and societal contexts** to produce solutions that “**meet specified needs with consideration of public health, safety, and welfare, as well as global, cultural, social, environmental, and economic factors**”  
(ABET, 2018)

Engineers will translate the **dreams of humanity**, traditional knowledge, and the concepts of science into action through the creative application of technology to **achieve sustainable development**. The ethics, education, and practices of the engineering profession will shape a **sustainable future for all generations**

(WEPSD, 1997)

## Desired Attributes of a Global Engineer

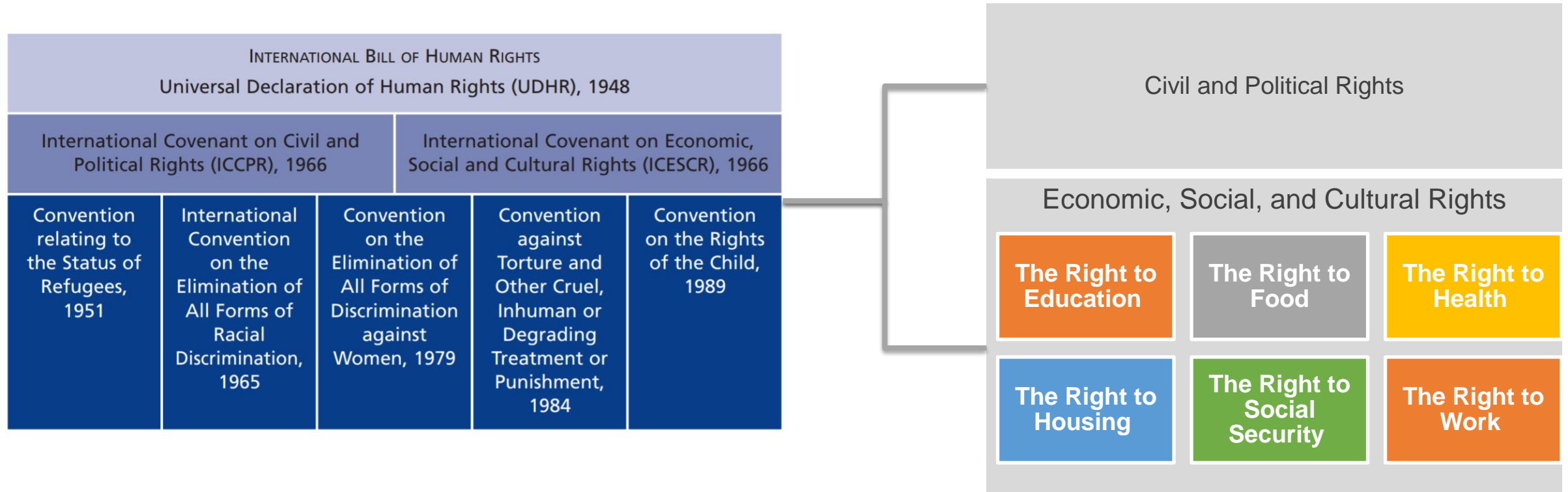
- Economics/Finances of projects
- Basic supplier management principles
- Customer and societal emotions and needs
- Cultures, Languages, and business norms
- Societal, Economic, and environmental impacts of engineering decisions**
- An international/global perspective

Hundley and Brown (2013)

National Society of Professional Engineers, Accreditation Board for Engineering and Technology, World Engineering Partnership for Sustainable Development

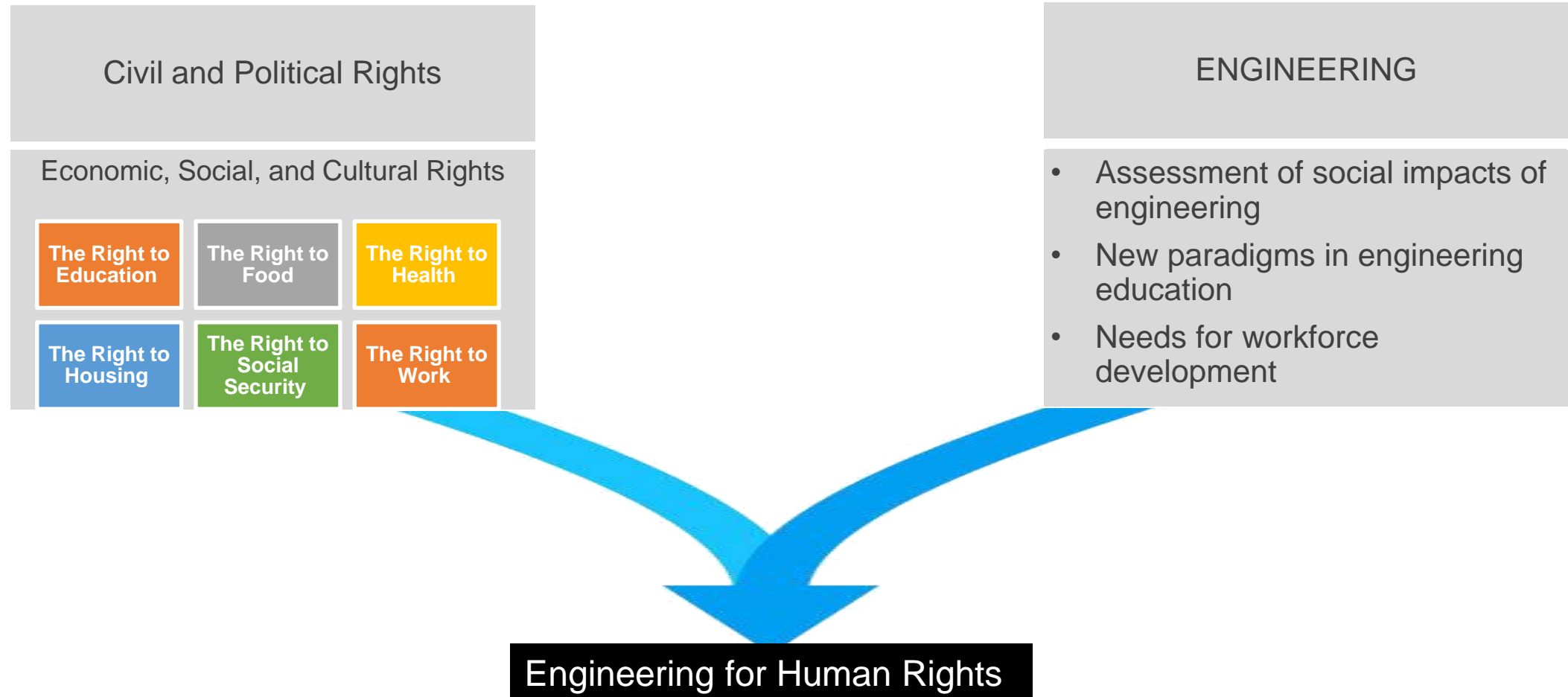


# Normative foundations



# Human Rights-based Approach to Engineering

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# Principles of ENGR-HR

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# ENGR-HR Benefits

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- ❑ “New” paradigm for engineering design
- ❑ Better understanding of the role of engineering in society
- ❑ Improve public awareness and understanding of engineering
- ❑ Improve recruitment and retention in engineering education



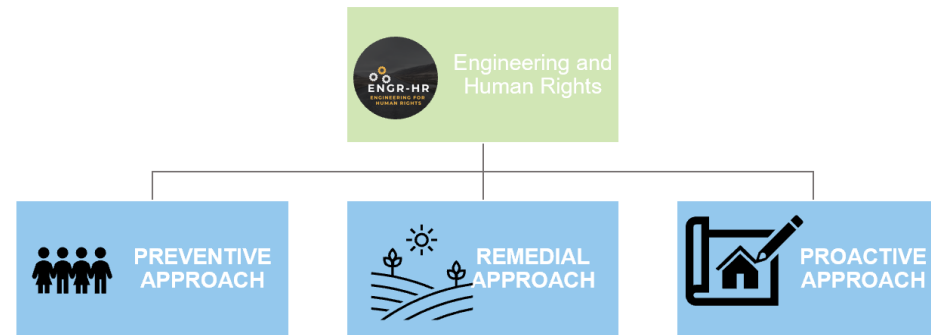
# HR Engineering Education and Service

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## □ Teaching Human Rights in Engineering

*“Whoever takes this class will feel rewarded and be exposed to very relevant and issues that need to be addressed.”*

*“Taking this class helped me understand the world better and my place in it”*



<https://engineeringforhumanrights.initiative.uconn.edu/education/>

-Lee, M., & Chacon-Hurtado, D., & Hertel, S., & Fenn, S. (2024, June), *Engineering Education in Human Rights and Sustainability: Exploring Students' Motivations and the Learning Outcomes from an Undergraduate Class at the University of Connecticut* Paper presented at 2024 ASEE Annual Conference & Exposition, Portland, Oregon. <https://peer.asee.org/47279>  
Chacón-Hurtado, D., S. Sirota, S. Hertel, (2022). "Teaching Engineering for Human Rights: Lessons Learned from a case study-based undergraduate class" Proceedings of the American Society for Engineering Education. <https://peer.asee.org/teaching-engineering-for-human-rights-lessons-learned-from-a-case-study-based-undergraduate-class.pdf>

# Progressive Realization of Human Rights and Immediate Obligations

## **Right to standard of living**

*including food, clothing, housing and medical care, and necessary social services (Article 25)*

## **Right to education**

*Elementary education shall be compulsory, technical and professional education, and higher education on the basis of merit. (Article 26)*

## **Right to work**

*Choice of employment and favorable conditions of work protection against unemployment. (Article 23)*

## **Freedom of Discrimination**

*Everyone is entitled to all the rights and freedoms [...], without distinction of any kind, such as race, color, sex, language, religion, political opinion, national or social origin, property, birth, or other status. (Article 2)*



FOOD



EDUCATION



HEALTH



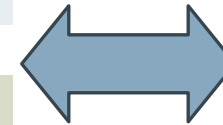
HOUSING



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# Progressive Realization of Human Rights and Immediate Obligations

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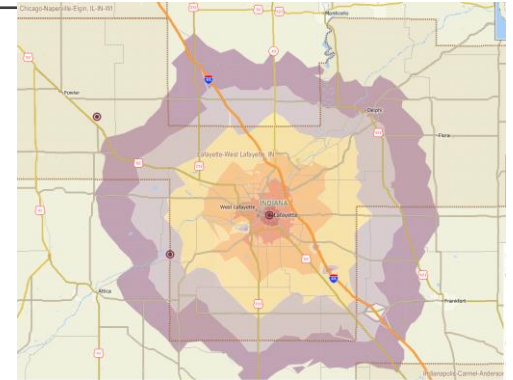
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Accessible area within 30 –minute drive, Lafayette, IN. Developed using Maptitude.



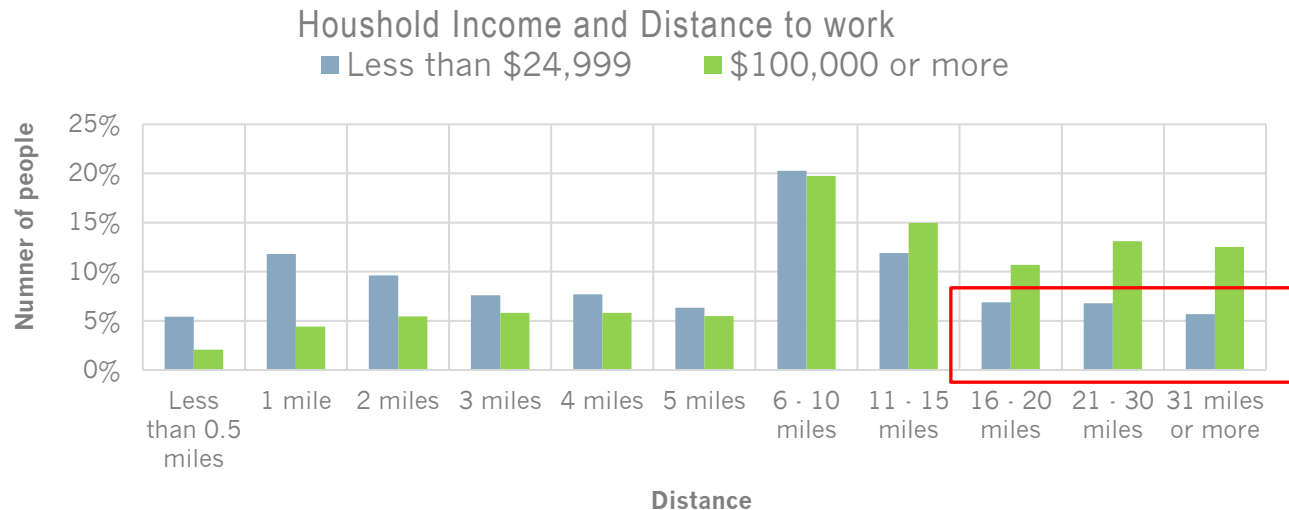
Smithsonian Exhibition "381 Days: The Montgomery Bus Boycott Story" (1955). "For the first time, black passengers board through the front of the bus and, like Rosa Parks, sit where they please."

Photo by Don Cravens. Courtesy Time Life Pictures/Getty Images.

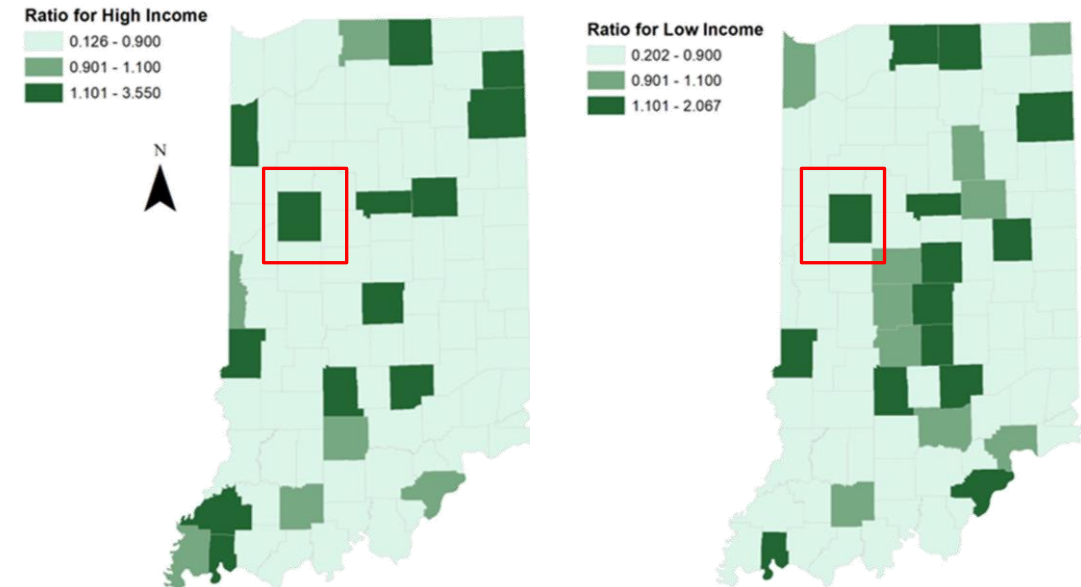
<https://www.sites.si.edu/s/archived-exhibit?topicId=OTO36000000TzVtGAK>



# Unequal Access to Opportunities



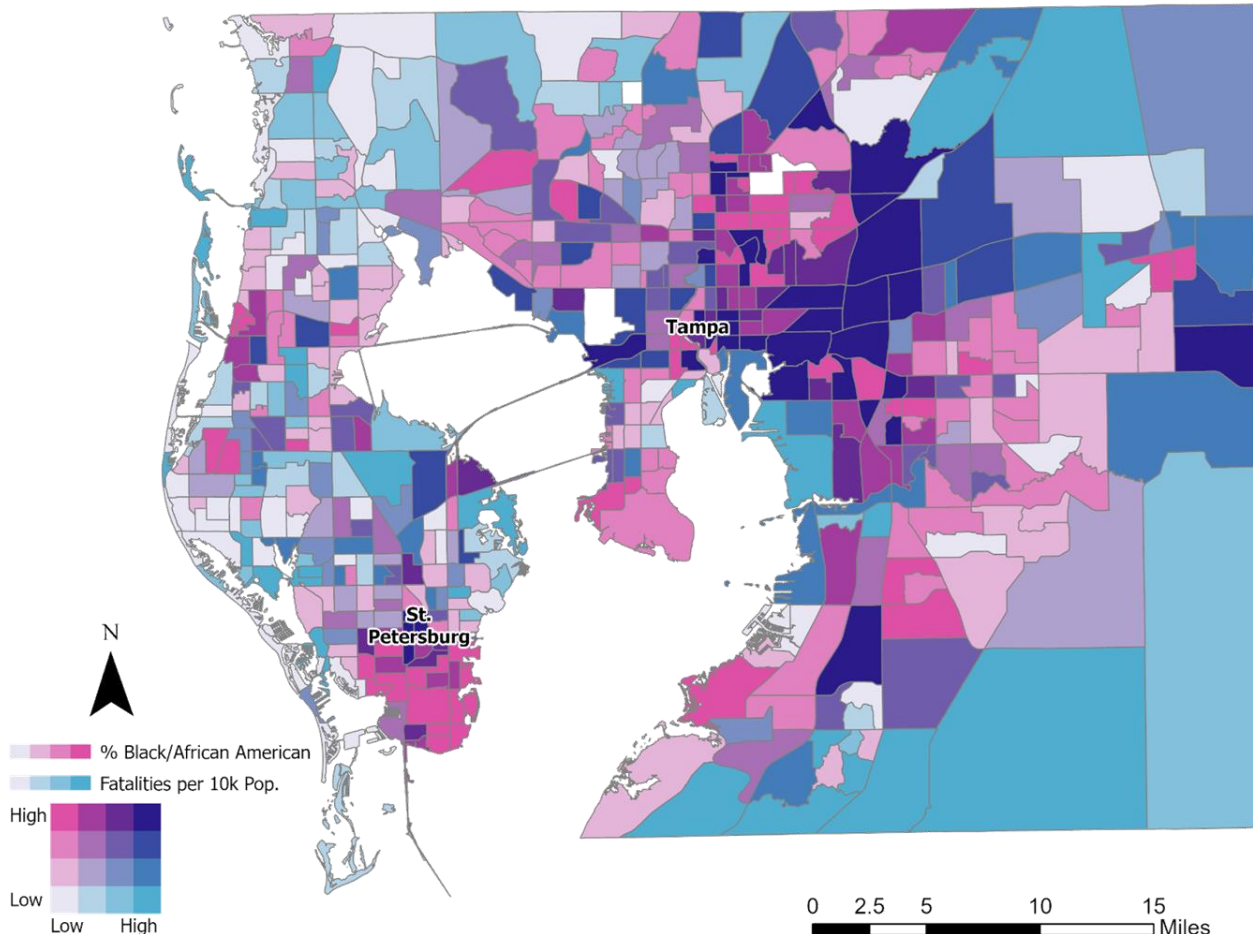
Source: Federal Highway Administration, 2017 National Household Travel Survey (NHTS)  
 Tabulation created on the NHTS website at <http://nhts.ornl.gov>



Accessibility index for high-income and low-income groups, and number of counties for each income group as a function of the accessibility ratio.

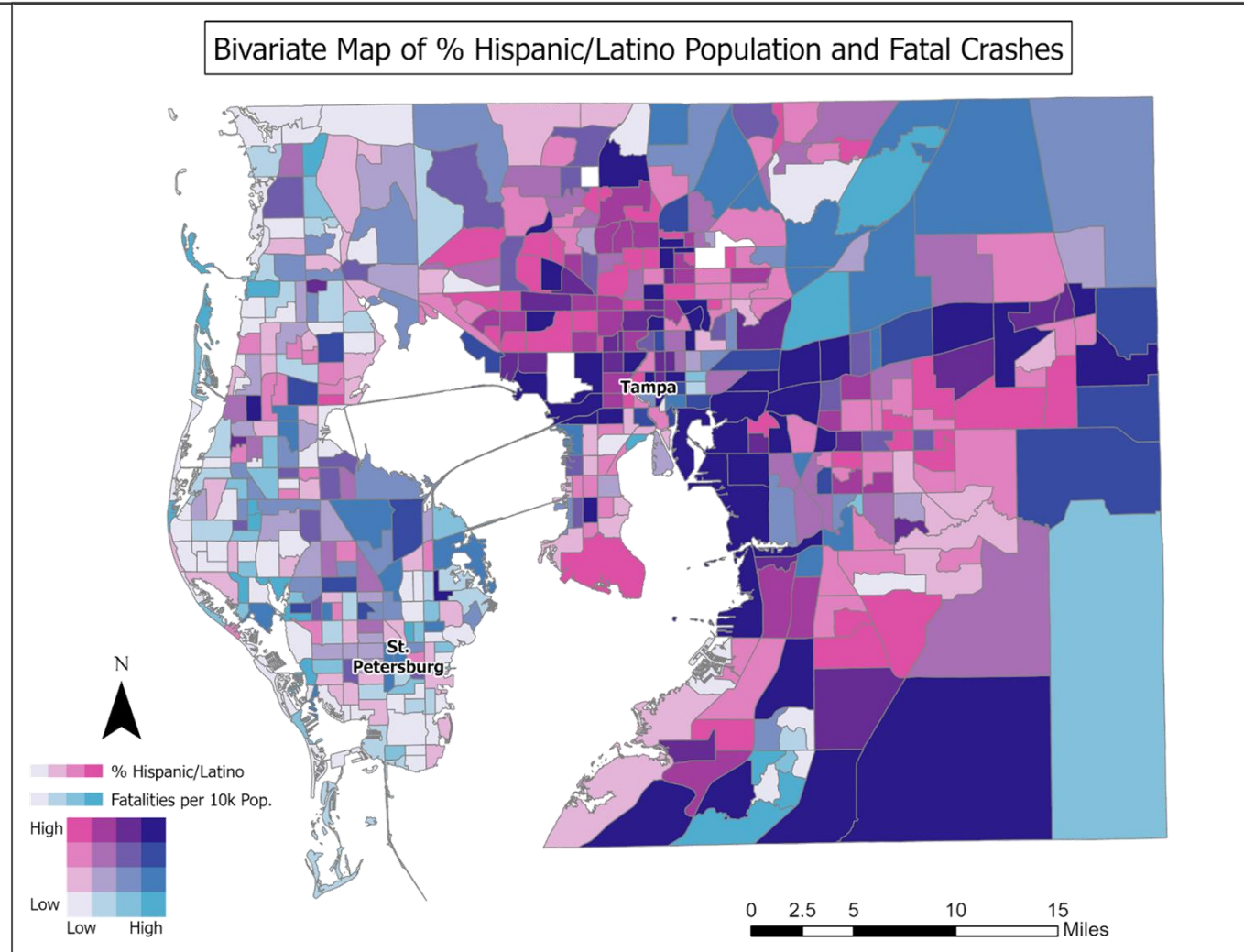
# Transportation and Safety Inequity

Bivariate Map of % Black/African American Population and Fatal Crashes



Green, O., Frazier, A. P., Chacon Hurtado, D. Ivan J. N., Paxton, A., and Marsh, K. "Unveiling Safety Inequity: A Location-Based Crash Prediction Approach." University of Connecticut. Working Paper.

# Transportation and Safety Inequity



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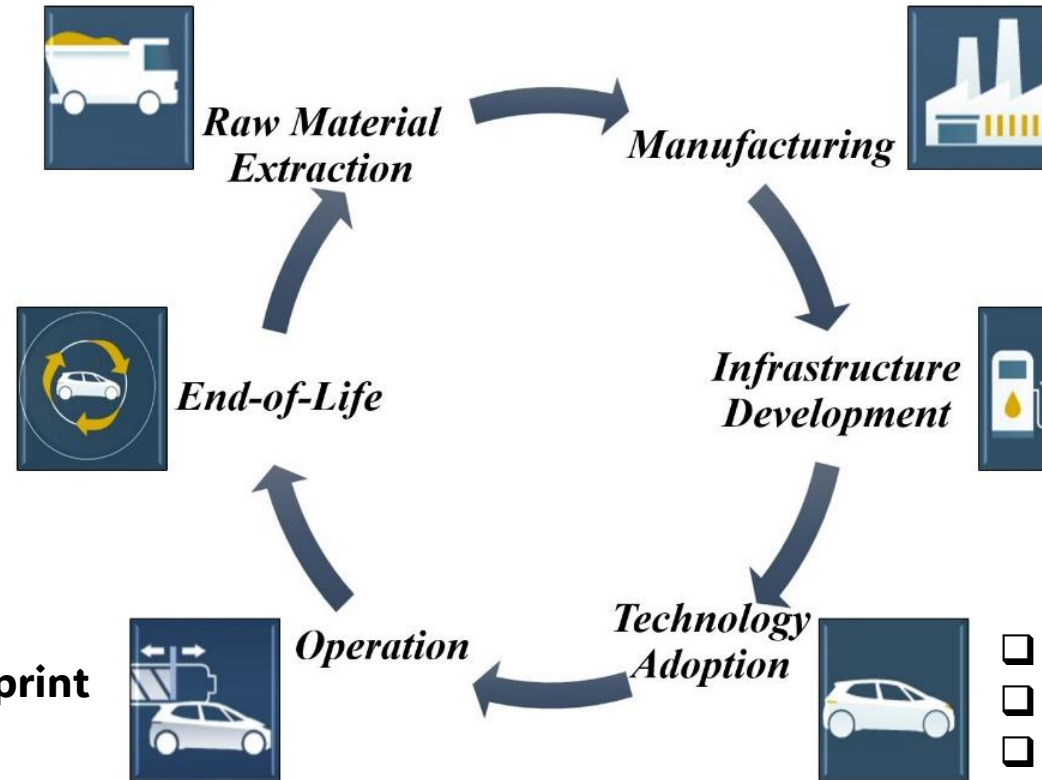


# EV Life-cycle Stages and Human Rights Concerns

- ❑ Child Labor Abuse
- ❑ Hazardous Working Conditions
- ❑ Invading Lands & Resources
- ❑ Racial & Gender Inequality
- ❑ Sustainability & Environmental Risks

- ❑ Ecosystem Contamination
- ❑ Supply Chain Insecurity
- ❑ Unequal Risk Exposure
- ❑ Improper Recycling
- ❑ Human Toxicity

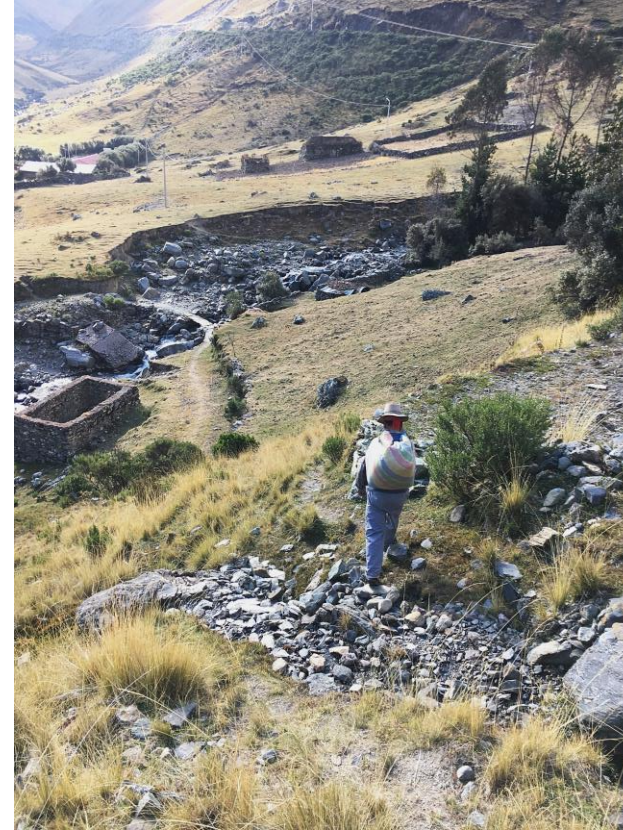
- ❑ Energy Source & GHG Footprint
- ❑ Social Exclusion
- ❑ Accessibility & Mobility
- ❑ Privacy & Security



Rouhana, F., Zhu, J., Chacon-Hurtado, D., Hertel, S., & Bagtzoglou, A. C. (2024). Ensuring a just transition: The electric vehicle revolution from a human rights perspective. *Journal of Cleaner Production*, 462. <https://doi.org/10.1016/j.jclepro.2024.142667>

# Progressive Realization of Human Rights and Immediate Obligations

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Community of Tastayoq, Cusco, Peru. (Pictures, Davis Chacon-Hurtado)



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# Engineering for Human Rights @ UConn: Research Areas



**Water, Health, and Food Security**



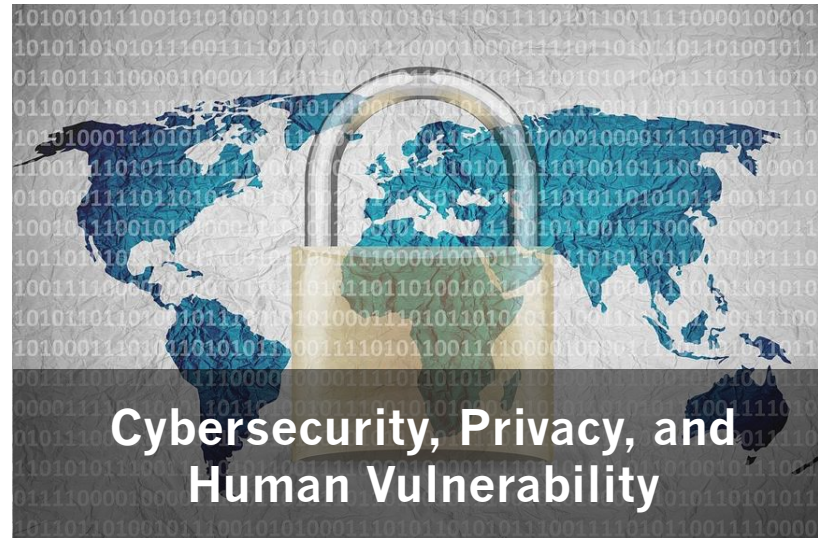
**Community Planning, Resilience,  
and Justice for a Changing  
Environment**



**Product Design, Manufacturing,  
and Supply Chain Management**



**Engineering Education and  
Accessibility Rights**



**Cybersecurity, Privacy, and  
Human Vulnerability**



**Engineering Substances and  
Process Sustainability**



# Addressing Water Inequities Inequities in Public Infrastructure

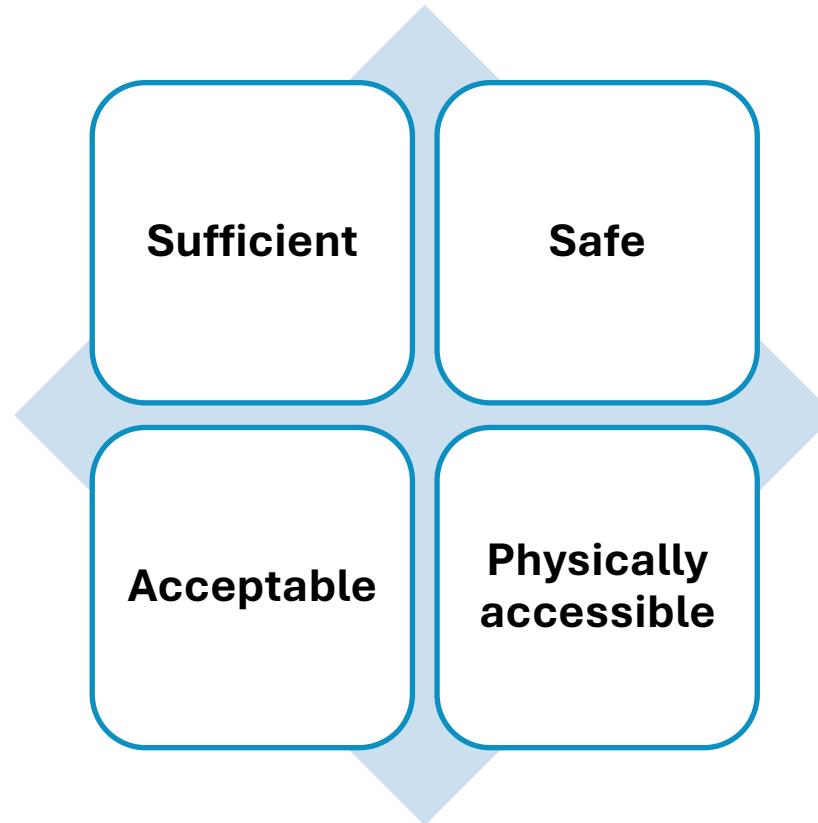


**Issues at the Intersection of Engineering and Human Rights**  
**November 18 – 19, 2024**

**Kimberly L. Jones, Ph.D., BCEEM, F. AEESP**

Professor, Civil and Environmental Engineering  
Associate Provost, Office of the Provost and Chief Academic Officer  
Chair, EPA Science Advisory Board

In 2010, the United Nations General Assembly adopted a resolution recognizing “the **right to safe and clean drinking water and sanitation** as a **human right** that is essential for the **full enjoyment of life and all human rights**”



# We have a global water crisis

A background photograph showing a group of people, including children and adults, standing in a shallow river or stream. They are using various methods to collect water, such as carrying jerrycans on their heads and using a small wooden boat. The surrounding area is lush with green vegetation, and a motorcycle is parked on the bank to the right.

**821**

Number of children that  
die from water-related  
diseases every day

**1.8**  
**Billion**

People who have no  
on-premise drinking  
water

**115**  
**Million**

Collect drinking water  
directly from surface  
waters such as lakes  
and rivers

**2.2**  
**Billion**

People lacking access  
to safely managed  
drinking water services

**\$18.5**  
**Billion**

Revenue lost from  
avoidable deaths from  
lack of access to basic  
water and sanitation



# We have a water crisis in the US

Number of Americans  
who received water from a  
source that violated  
SDWA between 1982 -  
2015

**9–45**  
**Million**

**63**  
**Million**


Americans were exposed  
to potentially unsafe  
water more than once  
during the past decade.

**3–10%**

US Water systems  
in violation of  
SDWA each year

**\$384**  
**Billion**

Investment needed  
by US water utilities  
to meet water  
regulations



We have a water crisis in the US

**The burdens of this crisis affect  
communities  
in a very disproportionate way**

9–45  
Million

Americans were exposed  
to potentially unsafe  
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“Concepts...of water justice demand that all communities be able to access and manage water for beneficial uses, including drinking, waste removal, cultural and spiritual practices, reliance on the wildlife it sustains, and enjoyment for recreational purposes.” A Twenty-First Century U.S. Water Policy (2012)

### *State of Emergency Declared Over Man-Made Water Disaster in Michigan City*

Give this article



May 21, 2021 HUMAN RIGHTS

### Environmental Injustice in Uniontown, Alabama, Decades after the Civil Rights Act of 1964: It's Time For Action

by Marianne Engelman-Lado, Camila Bustos, Haley Leslie-Bole, and Perry Leung

Share: f in e



NEWS

### Industrial poison oozed through small South Carolina town for years, unknown to many

Sammy Fretwell The State

Published 9:46 a.m. ET Oct. 1, 2018

f t e



Pollution from the former Burlington Plant in Cheraw contaminated land over a three-mile area seen here on Sept. 20, 2018. This may have gone on for decades. There is now an EPA Superfund project to eliminate PCB's and other contaminants from the soil downstream from the plant. Tim Dominick/The State

# How can we address inequities in the water sector?

- **Infrastructure investment:** target underserved communities for upgrades
- **Community-led initiatives:** empower local groups to manage water resources effectively
- **Policy reforms:** implement regulations to ensure affordable access to safe water
- **Capacity building:** provide training and resources for sustainable water management

## How do we consider human rights?

### Recognize Disparities

Acknowledge historical and systemic inequities in water access.

### Involve Communities

Ensure affected groups participate in water management decisions.

### Invest Strategically

Direct resources to areas with the greatest greatest need.

### Monitor Progress

Regularly assess and adapt water equity strategies.



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# Engineering in Context

## Inclusive Decision Making Requires Acknowledgement of our Humanity

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BETHANY M. GORDON, PH.D.

NASEM SYMPOSIUM: ISSUES AT THE INTERSECTION OF ENGINEERING  
AND HUMAN RIGHTS



UNIVERSITY *of* WASHINGTON

CIVIL & ENVIRONMENTAL ENGINEERING

# WHEN IS INFRASTRUCTURE A **RIGHT** VS. A **SERVICE**?

## *Case Study*

- Water and sanitation utilities for climate refugees in Germany
- Survey respondents were willing to provide water and wastewater services for ~2.9 years
- A “deeply contextual” question

(Kaminsky and Faust, 2017)





# EXAMPLES OF CONTEXT



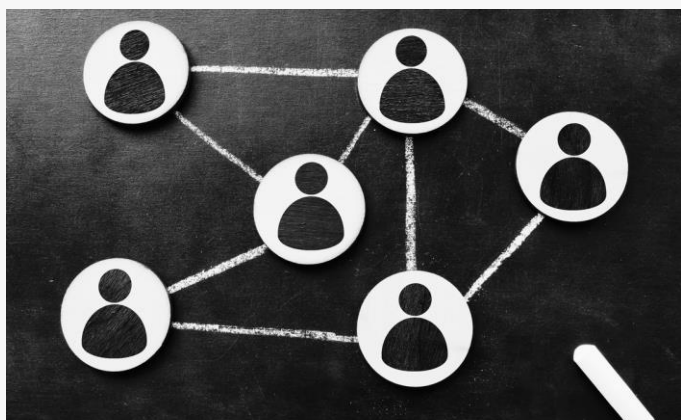
Existing policy &  
system capacity to  
meet demands



**Awareness of  
Historical Context**



**Positionality of  
decision-makers**



**Sense of Community**

Community Engagement



# UNDERSTANDING HISTORY MATTERS FOR EQUITABLE DECISION-MAKING

## *Example*

- Knowledge of racial history affects perceptions of systemic racism  
(Nelson et al., 2012; Bonam et al. 2019)
- Participants given racial history context distributed climate adaptation resources differently than participants without  
(Gordon et al. 2022)



# POSITIONALITY

*Social and political context that shapes a person's identity*

(Secules et al., 2021)



# ACCOUNTABILITY & RECIPROCITY

*Acknowledge and compensate the expertise of lived experience*

(Kovach, 2021)



# REFLEXIVITY

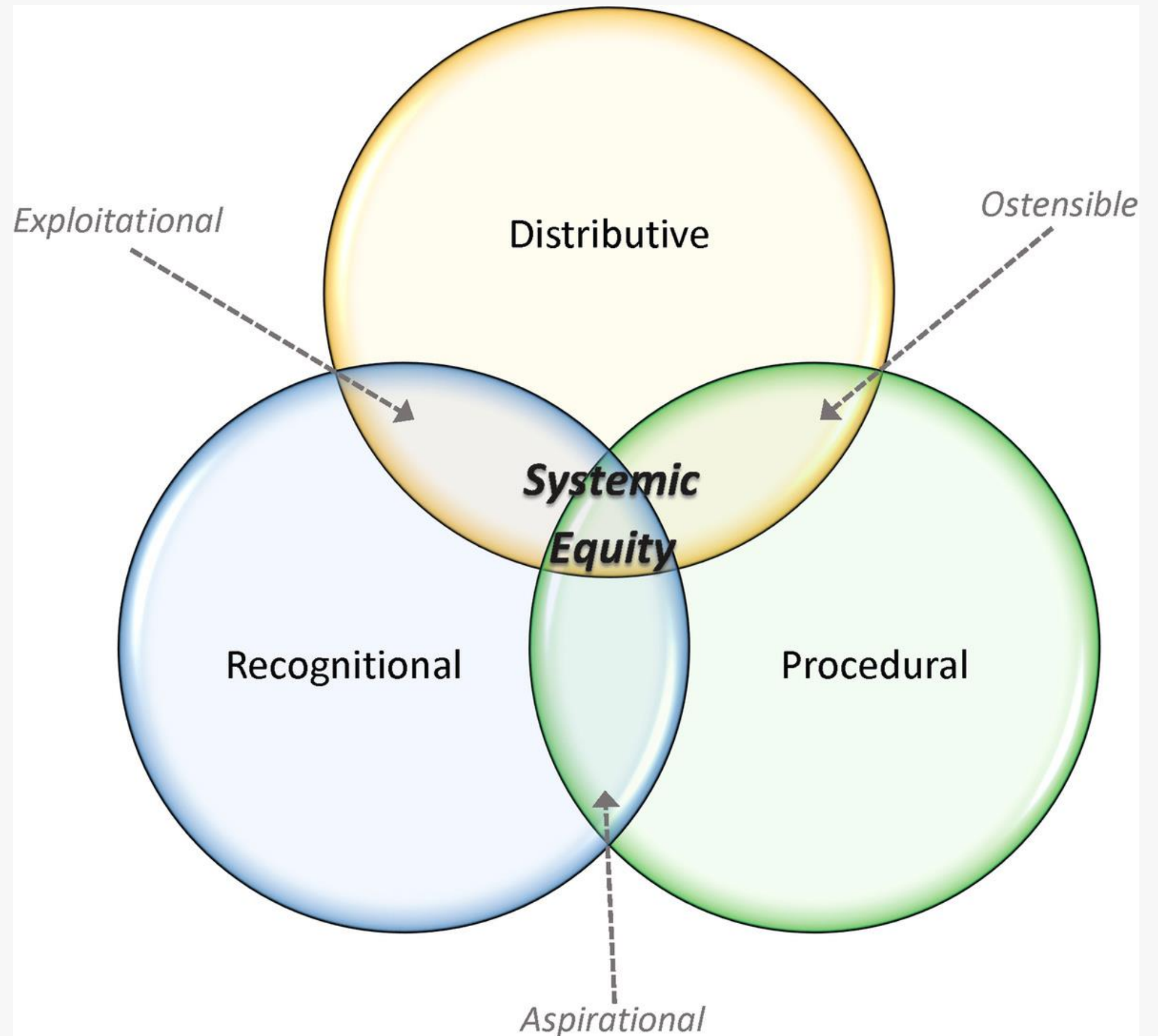
*Process of self-reflection: who are we as engineers? How does our positionality influence our work?*

(Jamieson et al., 2023)





**JUST AS WE  
PREPARE  
OURSELVES, WE  
MUST PREPARE  
OUR  
ORGANIZATIONS.**







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## Acknowledgements:



# REFERENCES

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# Building the Foundation of Global Health Equity





A man in a tan shirt and blue jeans is walking away from the camera on a narrow concrete path that runs between rows of solar panels on a roof. The background features a vast landscape of green, hilly terrain under a sky with soft, colorful clouds, suggesting a sunrise or sunset. The solar panels are dark blue and arranged in neat rows on the left and right sides of the path.

Enabling **dignified, affordable,** and  
**high-quality** healthcare for all.



Build Health  
International

1

# Infrastructure & Healthcare Access





2

## Engineering for Health Equity





# 3

## Building Sustainable Systems



# 4

## Local Capacity Building







# Maternal Center of Excellence Koidu, Sierra Leone