

Energy Justice and Data-Driven Decisions

Aug 07, 2023

Anjuli Jain Figueroa, PhD



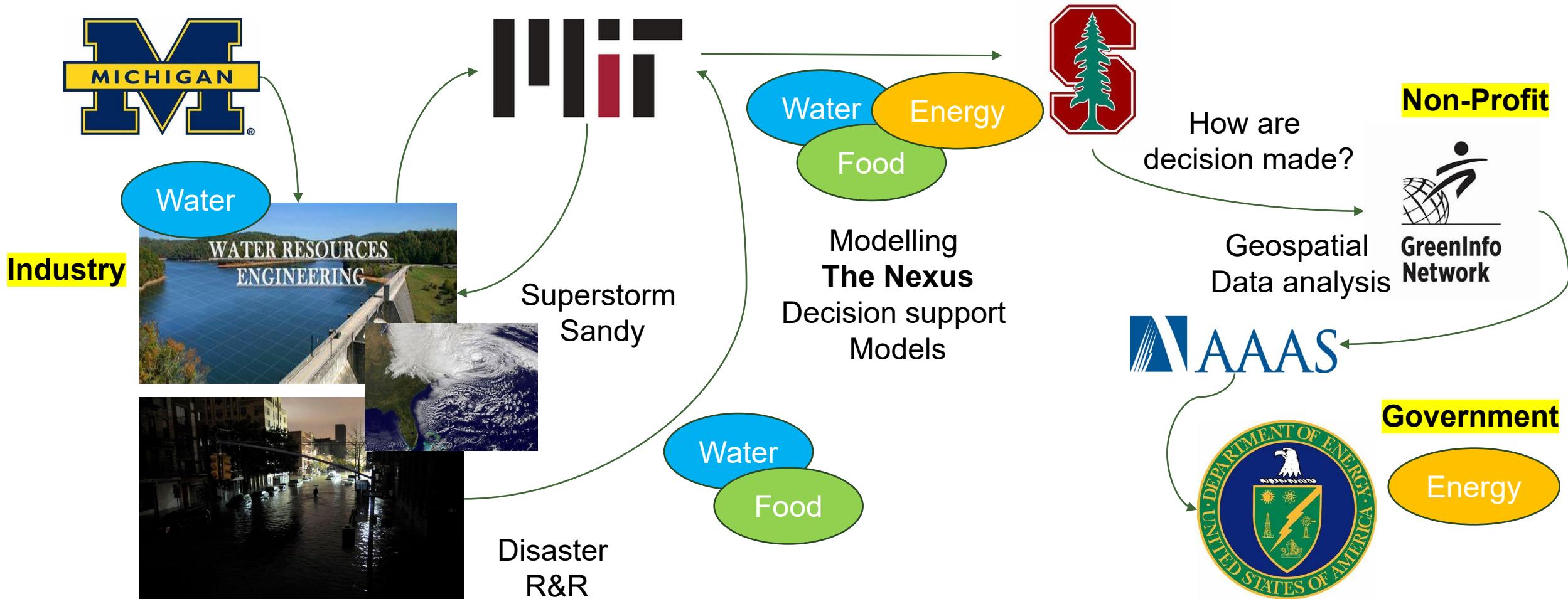
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Outline

- About me and DOE
- What is energy justice and why focus on equity?
- Why the status quo is not acceptable
- The clean energy transition and data driven decisions
- Data and algorithms
- AI Promises and perils in the energy system

Nonlinear path to energy characterized by diversity



What does the U.S. Department of Energy do?



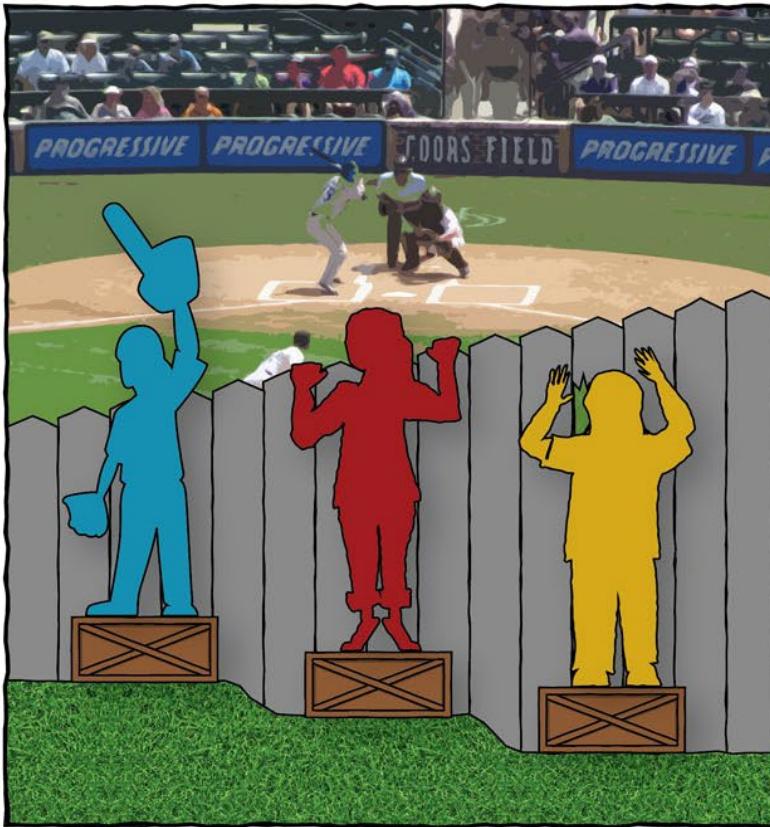
DOE's Roles

- Certifies the nation's nuclear weapons (lead nonproliferation agency, first responders, designs nuclear reactors for US Navy and NASA)
 - Owns federal lands (Cold War era nuclear sites)
 - Owns/oversees/operates of 17 national labs
 - Regulates of certain industries
 - Funds of billions of dollars of R&D
 - Supports of research infrastructure
 - Holds I.P.
-
- Two events have shaped DOE as an organization: WW2, US energy crisis 70's
 - Durable model to contract with labs
 - Separating weapons and non weapons labs and basic and applied research
 - Perhaps now we are in a third: improving infrastructure for clean energy transition

The Office of Economic Impact and Diversity (ED)

- Wants to ensure everyone can participate in DOE opportunities
 - Assures equal employment opportunities and contracting minority-owned businesses
 - Encourages partnerships with minority serving institutes
 - Strengthens diversity and inclusion goals for the workforce
 - Advises on policy and conducts analysis on Energy Justice
- Why is ED apt for working on the energy transition, and looking at data driven decisions?
 - **Equity** underpins our work and should form the foundation of energy technologies (including AI tools).

Equality vs. Equity



EQUALITY



EQUITY

[The problem with that equity vs. equality graphic you're using – Cultural Organizing](#)



What Is Energy Justice



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What do you think Energy Justice Is? #EnergyJustice is....

**safe
homes**

**Healthy
communities**

Good paying jobs

**Equitable economic
participation**

**Key to the clean energy
transition**

What is Environmental Justice

The **fair treatment and meaningful involvement of all** people, regardless of race, color, national origin, or income, with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

[What Is Environmental Justice? | Department of Energy](#)

What is Energy Justice?

Seeks **equity** in the **social** and **economic** participation in the energy system

While **remediating** social, economic, and health **burdens** on “frontline communities” explicitly centering their concerns

Aims to make energy more **accessible**, **affordable**, **clean**, and **democratically** managed for all communities.

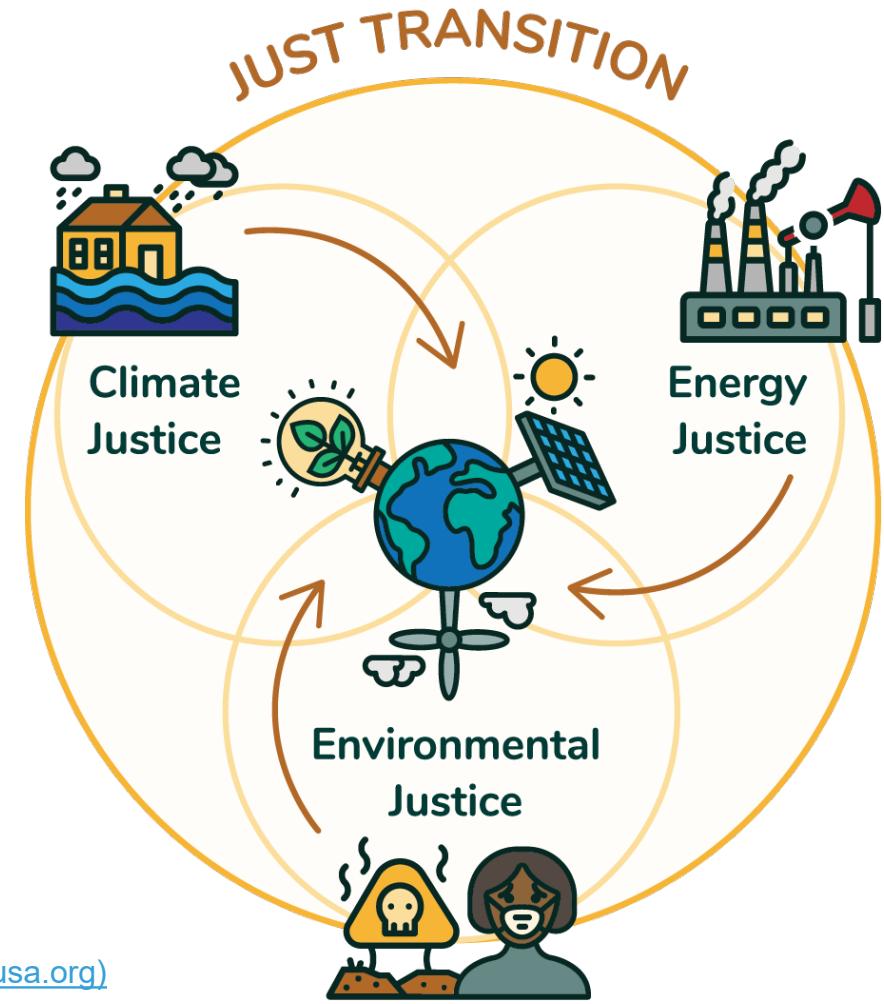
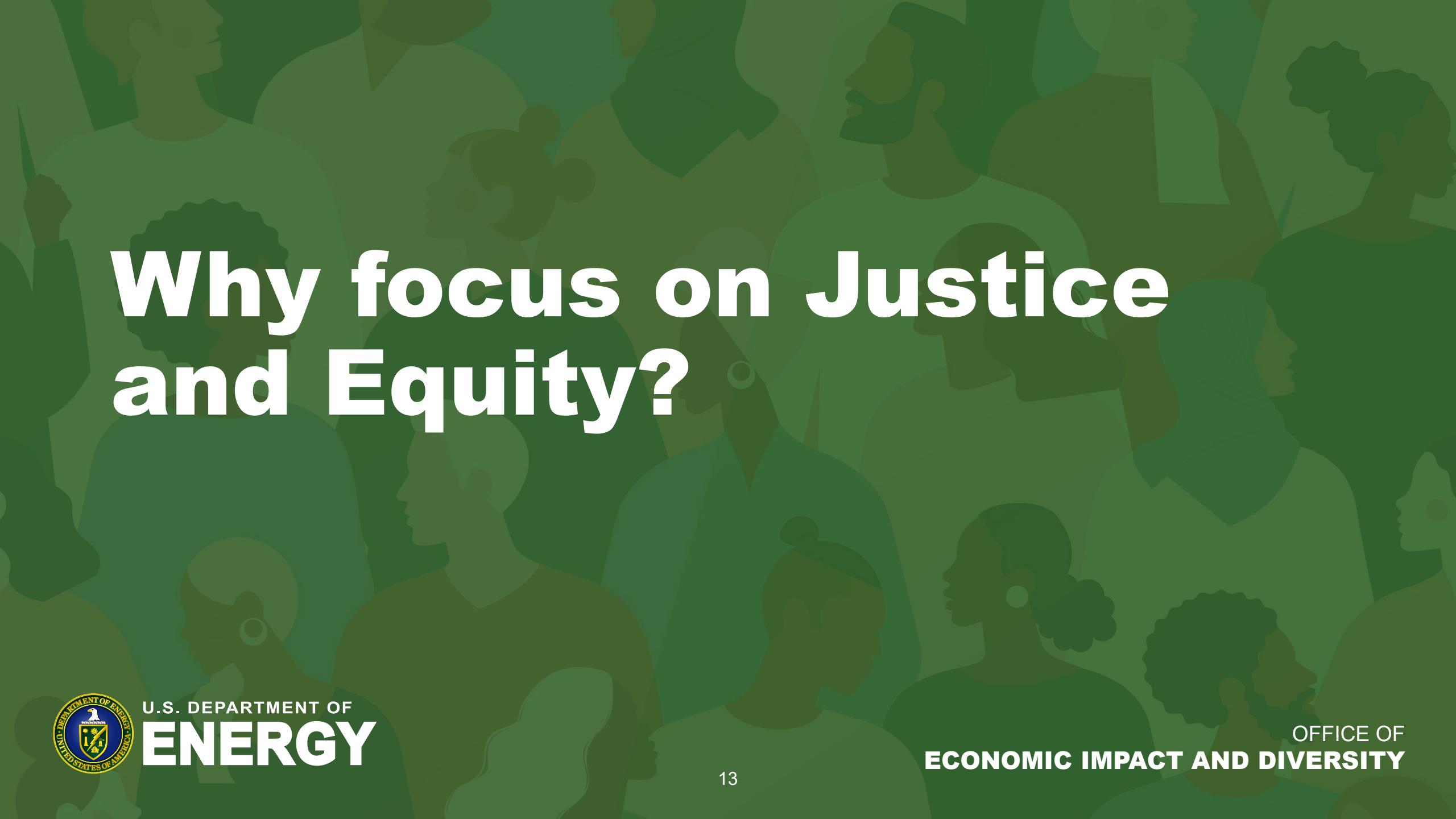


Image Credit: Initiative for Energy Justice [Section 1 - Defining Energy Justice: Connections to Environmental Justice, Climate Justice, and the Just Transition - Initiative for Energy Justice \(iejusa.org\)](https://iejusa.org/section-1-defining-energy-justice-connections-to-environmental-justice-climate-justice-and-the-just-transition/)

Tenets of Energy and Environmental Justice

			
Procedural Broad and meaningful participation in the decision-making	Recognition Respect and honor of divergent cultural and local knowledge	Distributive Equitable distribution of environmental benefits and burdens	Restorative Repair harms done to communities and the environment

Heffron and McCauley, The Concept of energy Justice Across the Disciplines, 105 Energy Policy 658, 659 (2017)



Why focus on Justice and Equity?



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Our Current Energy System Is Inequitable

Inequities in energy exist in several dimensions

Pollution Access Reliability

A tale of two cities - on the right is downtown Austin - to the left East Austin. Look who has power. [@KVUE](#)



RESEARCH ARTICLE | SCIENCE POLICY

PM_{2.5} polluters disproportionately and systemically affect people of color in the United States

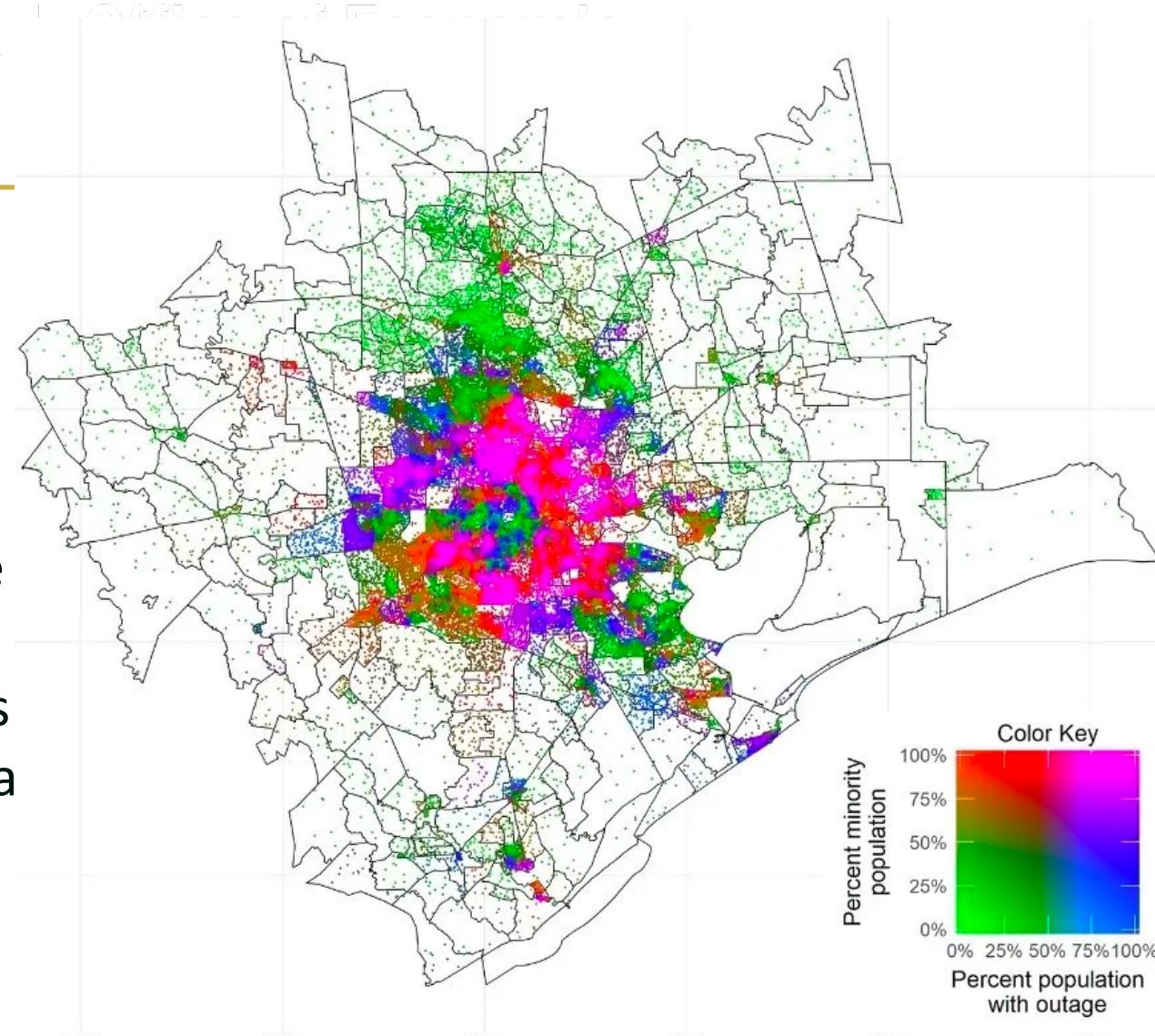


Resilience



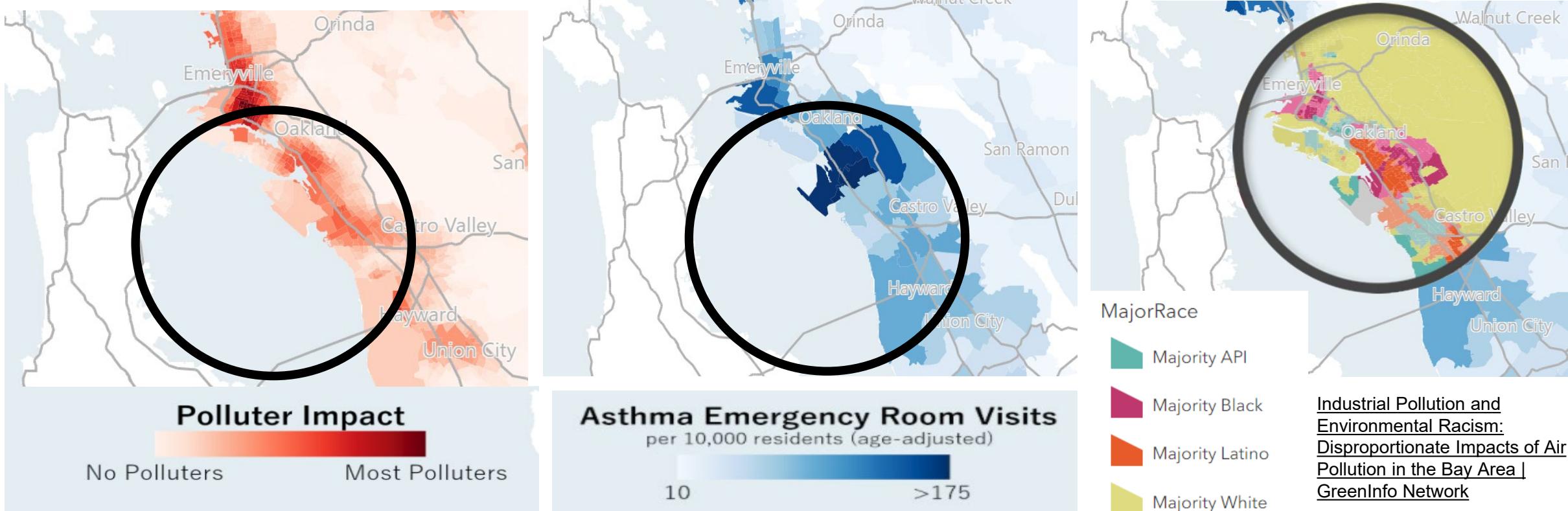
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“Our results show that areas with a high share of minority population **were more than four times as likely to suffer a blackout** than predominantly white areas. Income status of areas did not appear to be a strong factor in the share of blackouts. The presence of hospitals or police and fire stations – critical facilities – in a CBG reduces the chances of blackouts by around 0%-6%, a small difference that does not otherwise explain the disparity among communities. Further work is needed to explain what drives these disparities.”



Carvallo et al. (Rockefeller Institute)

Energy Justice Concerns: Oakland, CA

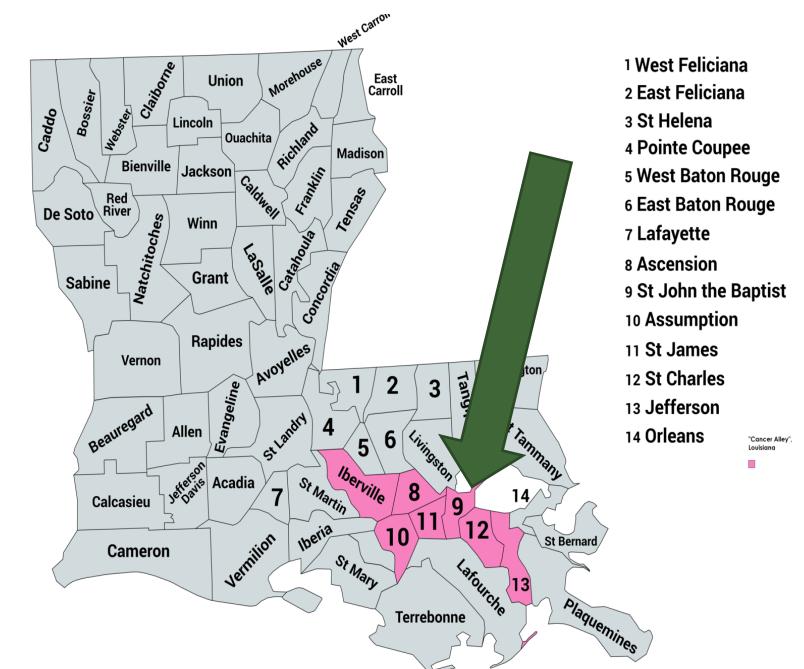


Communities near power plants and energy infrastructure are subjected to toxic pollutants that contribute to high rates of asthma, cancer, heart disease

Energy Concerns: New Orleans and Baton Rouge, LA



Town of Reserve has a **cancer risk 50 times the national average.**

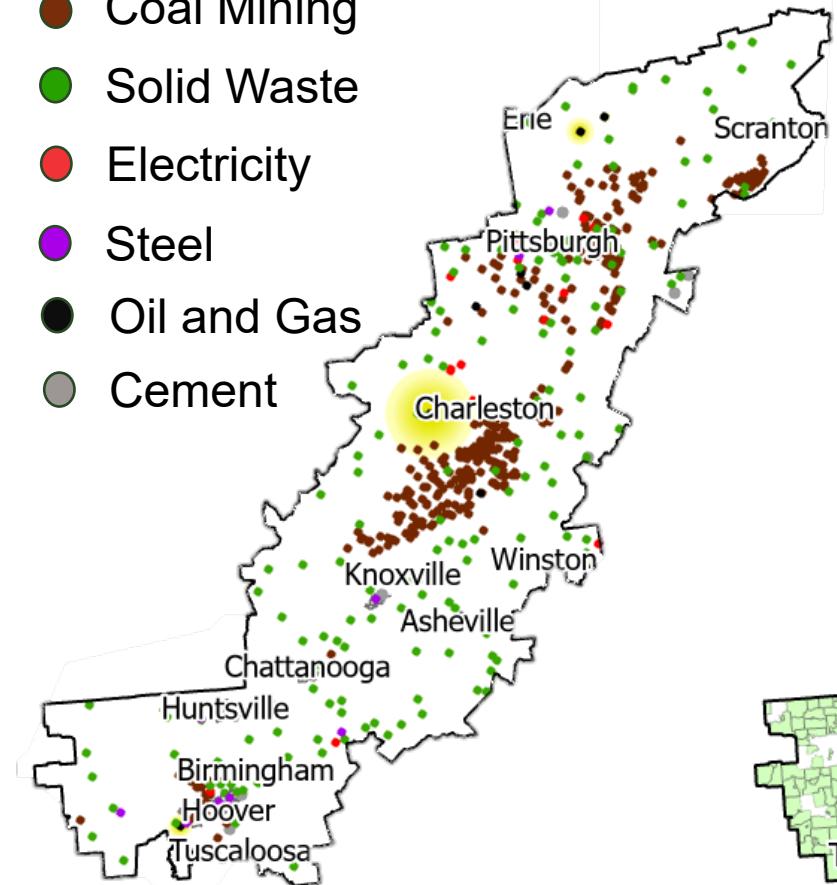


[Advocates Are Sparking a Revolution in Louisiana's "Cancer Alley"](http://nrdc.org)
(nrdc.org)

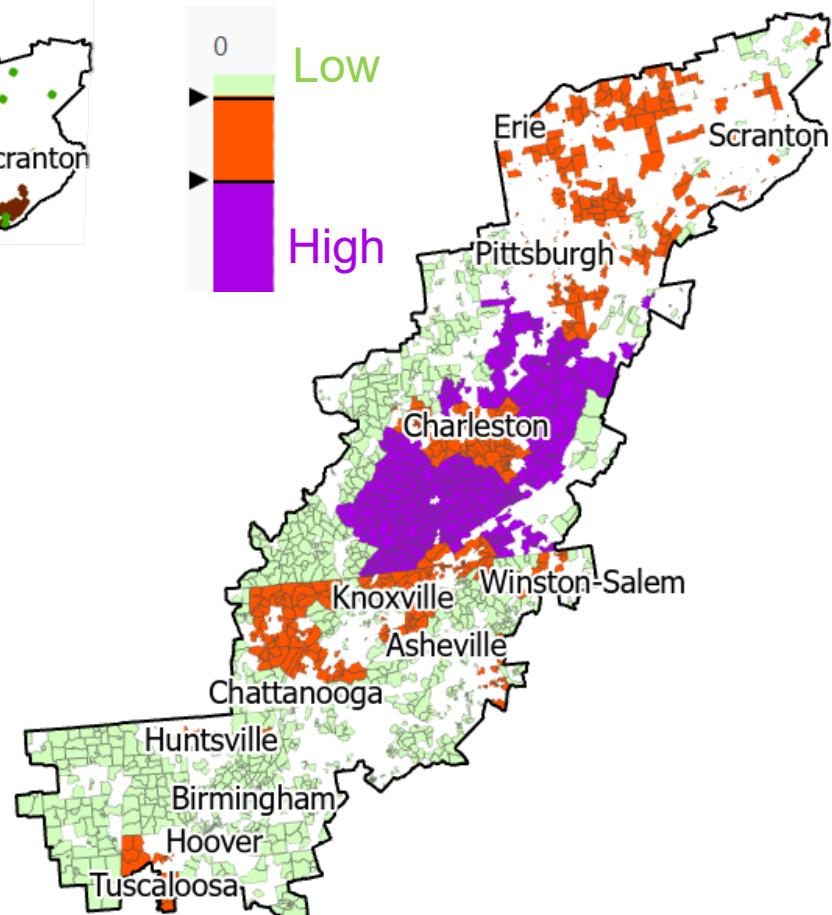
Energy Concerns: Appalachia

Industrial Plants

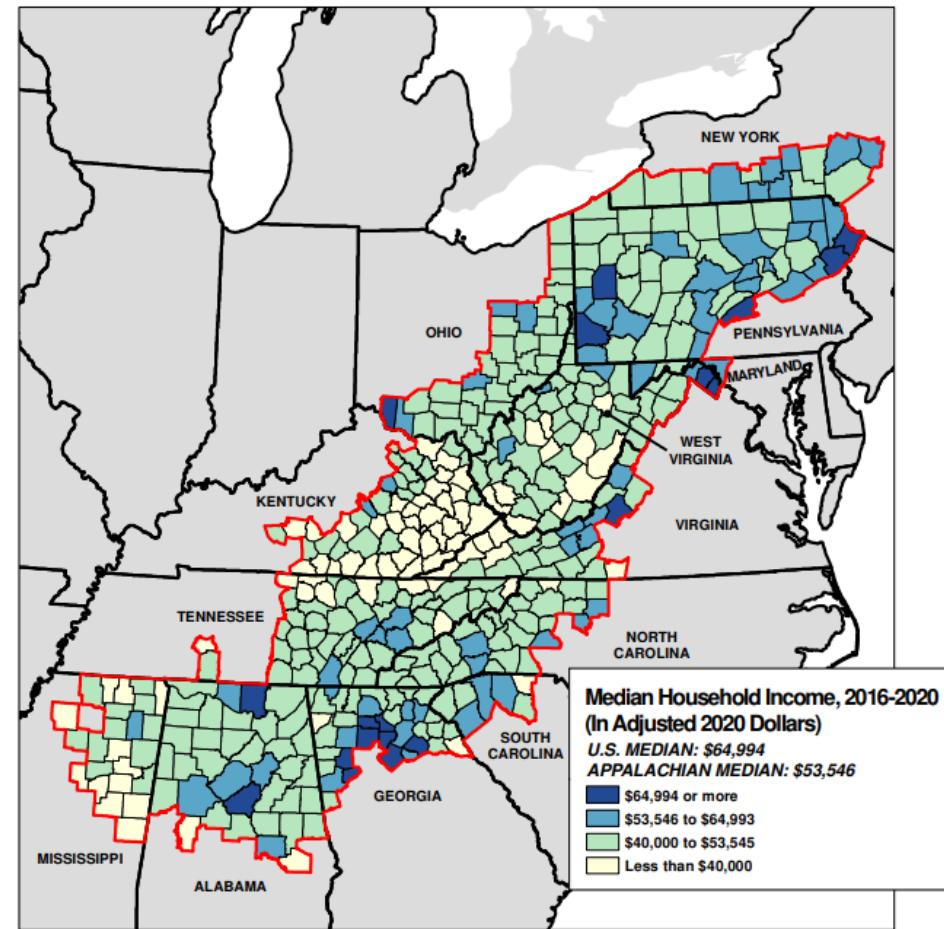
- Coal Mining
- Solid Waste
- Electricity
- Steel
- Oil and Gas
- Cement



Coal Employment



Median Household Income



Map Title: Median Household Income in the Appalachian Region (In Adjusted 2020 Dollars), 2016-2020
Data Source: U.S. Census Bureau, 2016-2020 American Community Survey.

A high price to pay

\$53,546

Appalachia's Median Household Income

\$64,994

U.S. Median Household Income

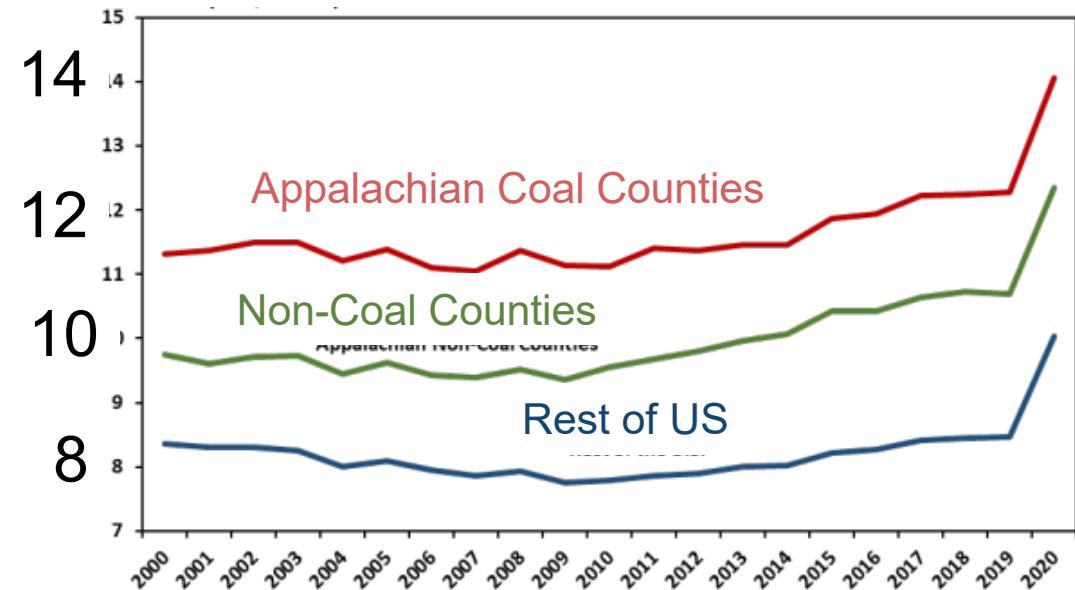
14.7%

Poverty Rate in Appalachia

"[H]ealth disparities exist in coal mining regions of Appalachia compared with other areas of the region or the nation, including elevated mortality rates for total causes, lung cancer, and some chronic illnesses."

[Mortality in Appalachian Coal Mining Regions: The Value of Statistical Life Lost](#)

Appalachian Mortality Rate
(Deaths per 1000 people)



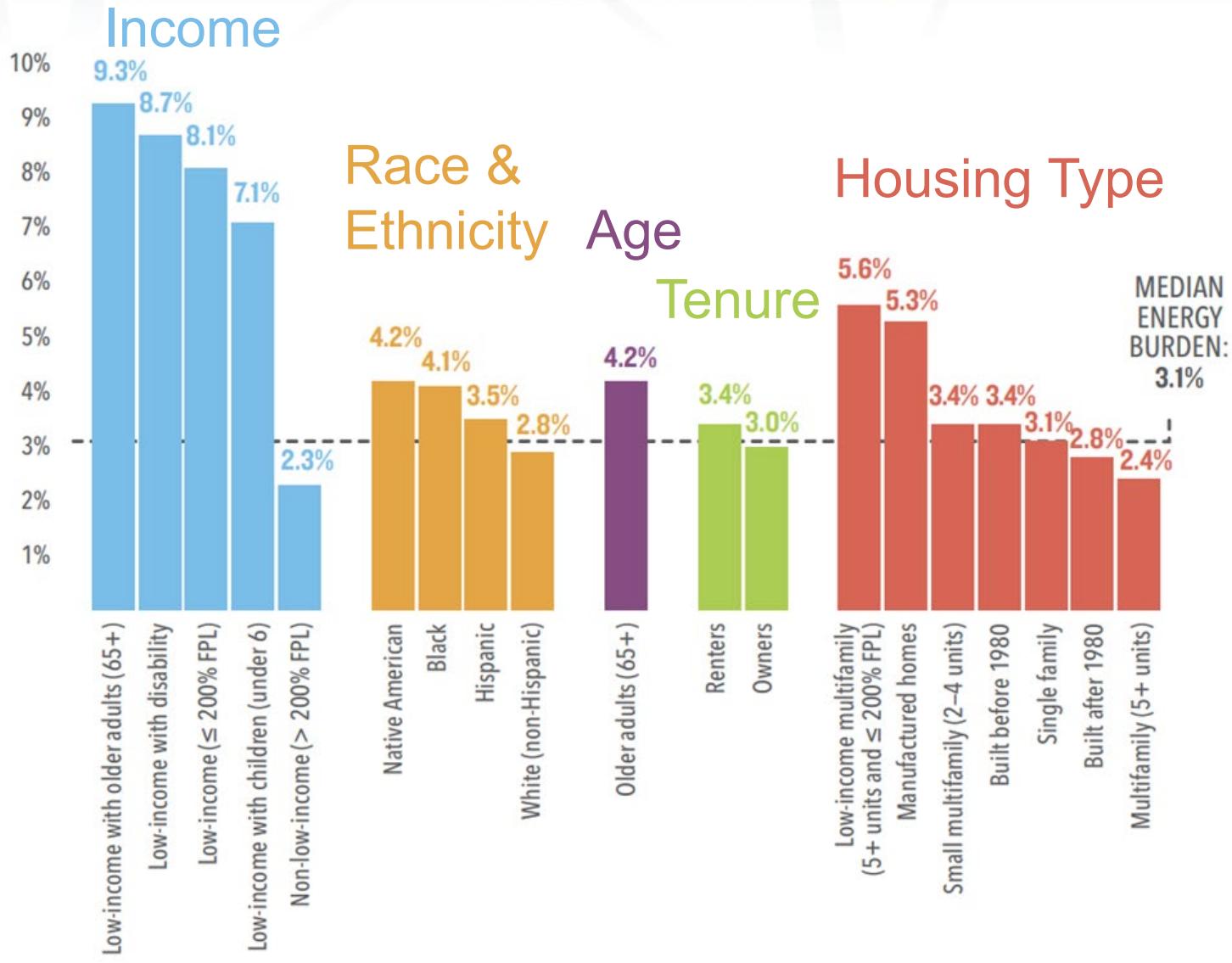
Source: U.S. Centers for Disease Control and Prevention

Note: Rates are not age-adjusted.

Energy Burden

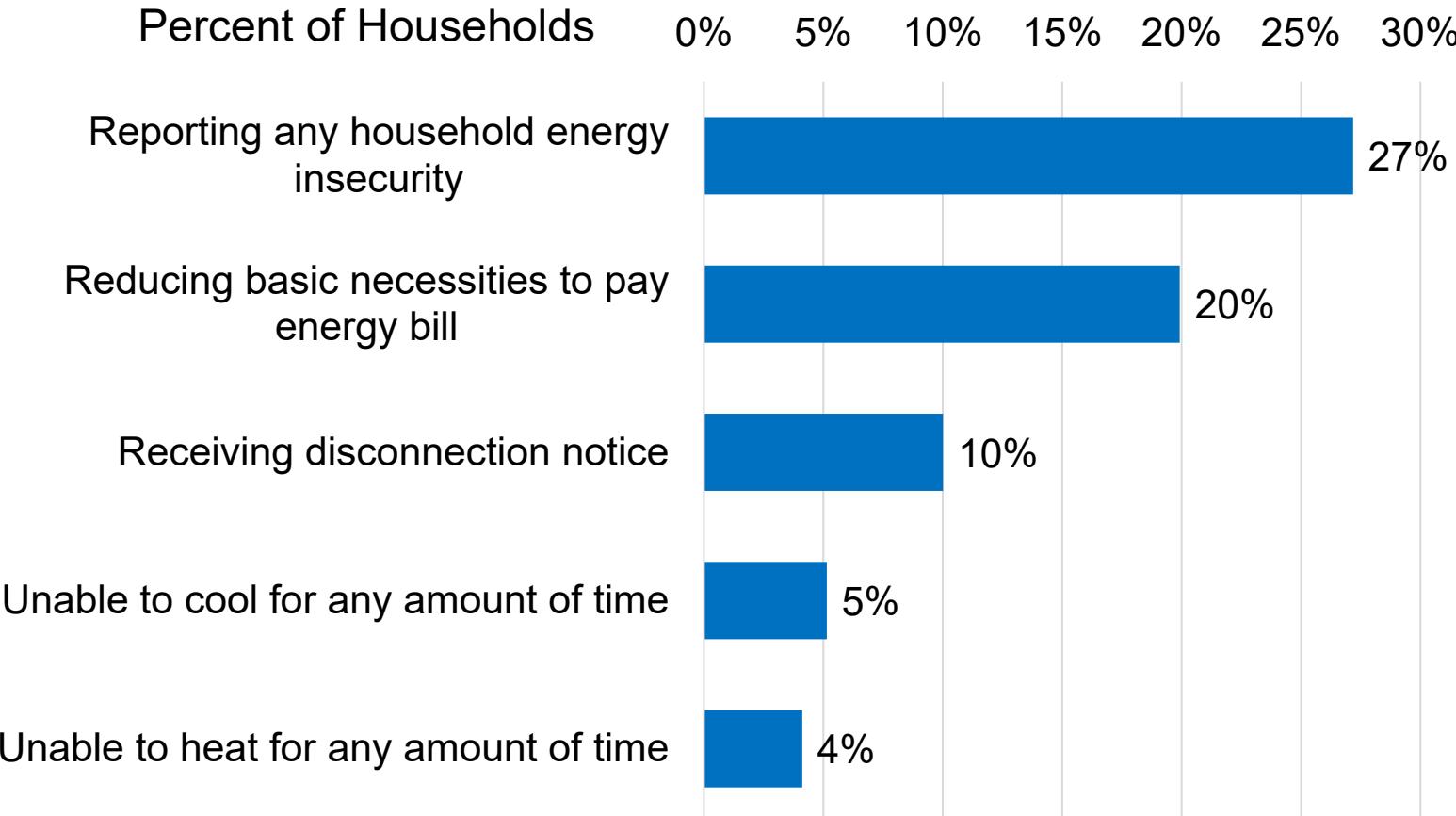
"Low-income households spend three times more of their income on energy costs compared to the median spending of non-low-income households"

FIGURE ES1. National energy burdens across subgroups (i.e., income, race and ethnicity, age, tenure, and housing type) compared to the national median energy burden



Source: Ariel Drehobl, et al. "How High Are Household Energy Burdens? An Assessment of National and Metropolitan Energy Burden across the United States." American Council for an Energy-Efficient Economy (September 2020).

Energy insecurity and high energy costs affect nearly 1 in 3 American households

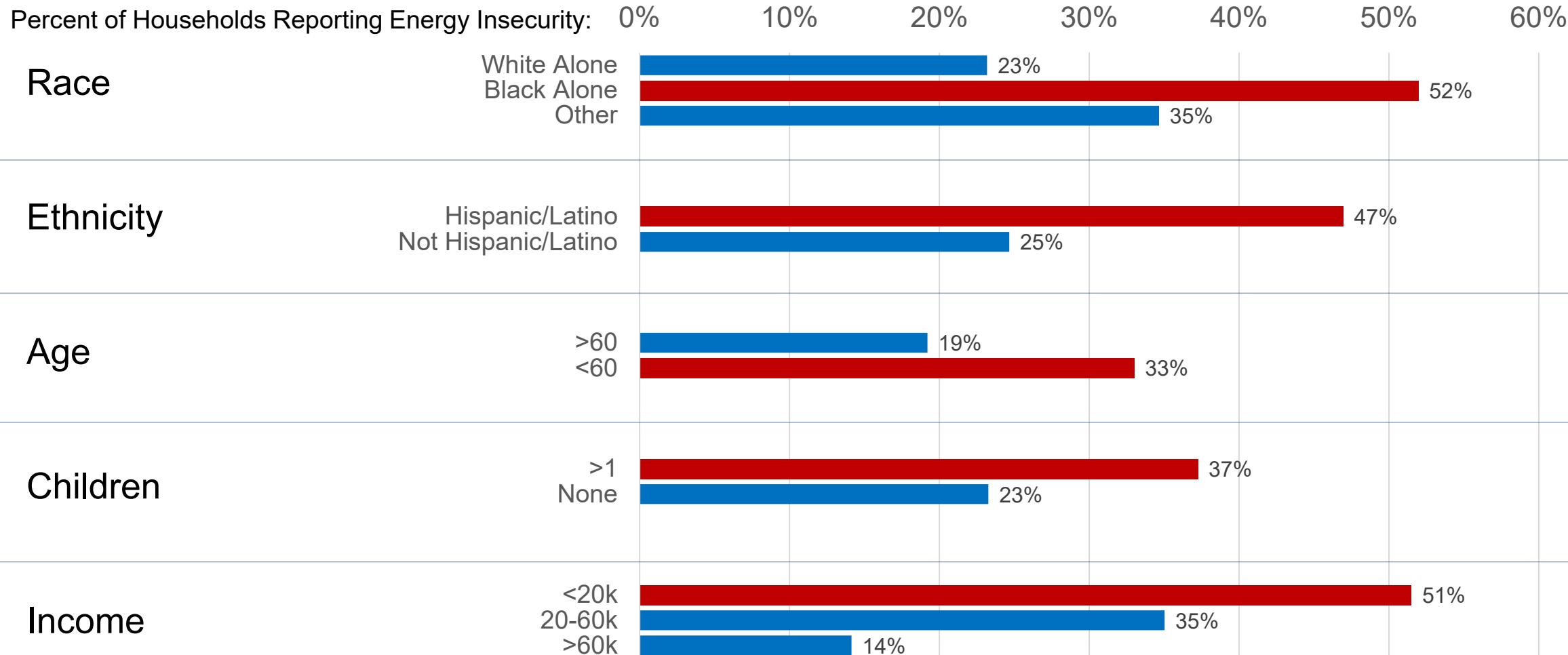


Americans spend
>\$37 billion/year
on energy costs

Over **27.8M** households are
energy burdened
(spend > 6% income on energy)

Sources: U.S Energy Information Administration (EIA), RECS 2020; LEAD: <https://lead.openei.org/>

Energy insecurity correlates with socio-demographic characteristics (RECS 2020)



Source: EIA, RECS 2020

Climate change can exacerbate all these inequalities

TEXAS NEWS

Texas power outages: Houston's largest energy-producing state in the US failed in freezing temperatures

Threat of Wildfires Causing Changes to Power Grid

<https://energycentral.com/c/ec/threat-wildfires-causing-changes-power-grid/>

NEWS | HOUSTON & TEXAS

ERCOT: Texas power grid to break demand record as 2nd heat wave hits

Texas energy grid operators are forecasting that demand will break the all-time record set last month multiple times in the next several days.

By Michael Murney Updated July 13, 2022

CLIMATE

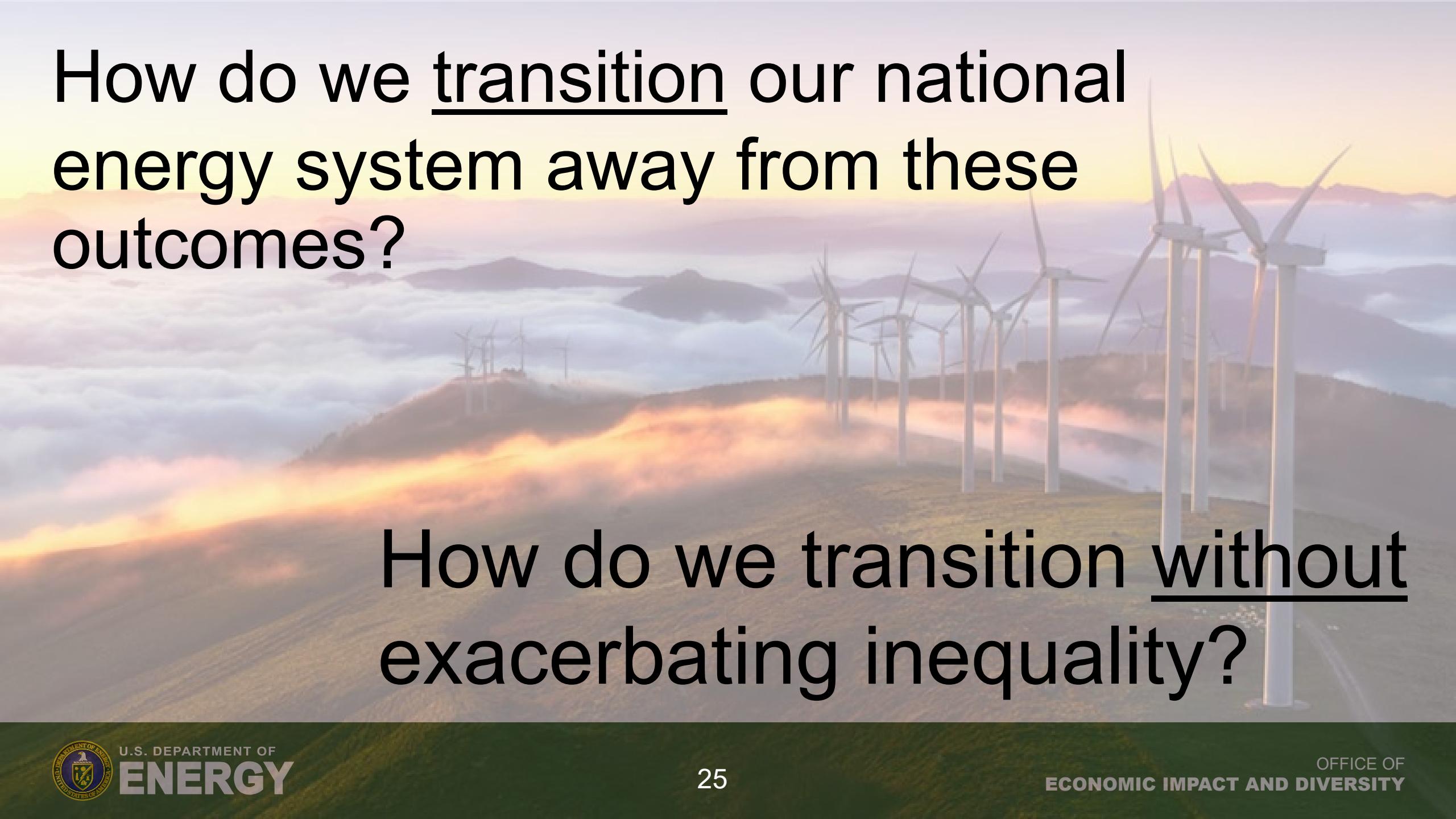
Homes become ‘air fryers’ in Phoenix heat, people ration AC due to cost

Markets

Texas Power Prices to Surge 800% on Sunday Amid Searing Heat



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How do we transition our national energy system away from these outcomes?

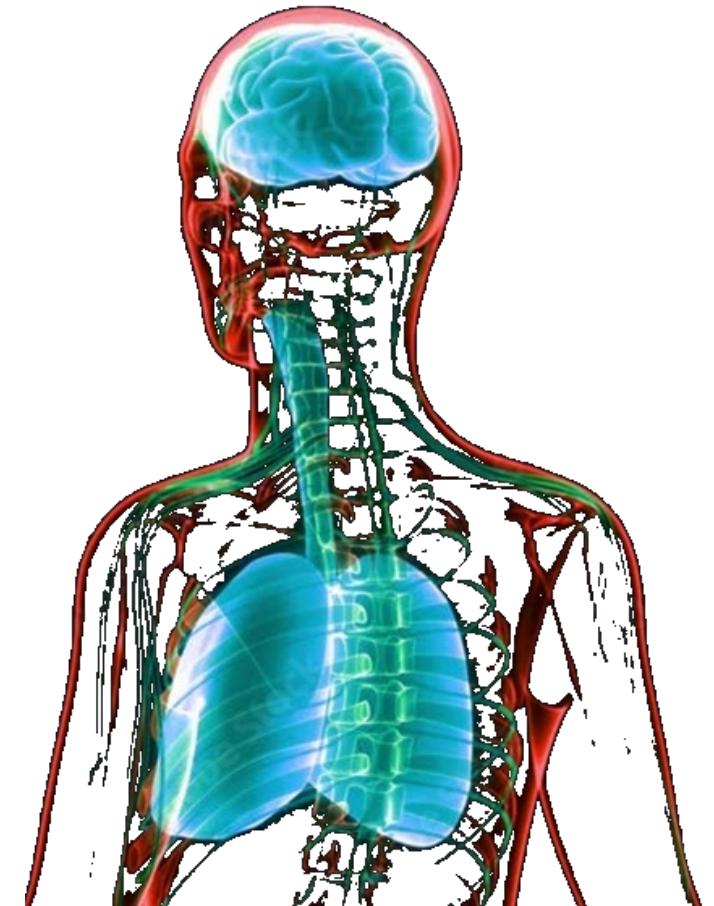
How do we transition without exacerbating inequality?

Big Investments in Energy Infrastructure

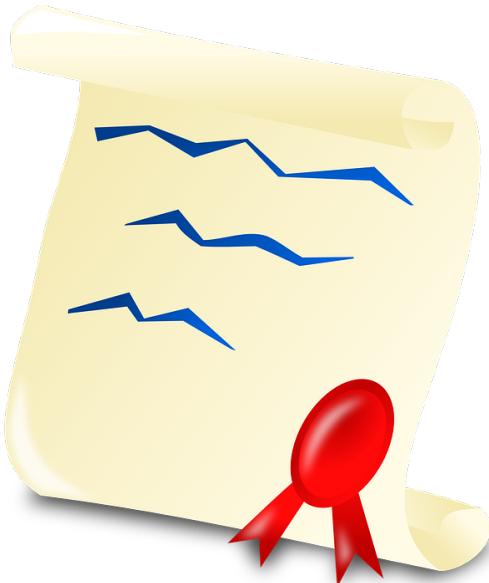
The Brain: **CHIPS and Science Act** (Jul. 2022) invests in cutting-edge science and innovation to boost American competitiveness, including for semiconductors, and to bring jobs and supply chains home.

The Backbone: **Bipartisan Infrastructure Law** (Nov. 2021) - \$1.2 trillion over 10 years (\$62 billion to DOE); largest long-term investment in our nation's infrastructure

The Lungs: **Inflation Reduction Act or IRA** (Aug. 2022) breathes life into our clean energy economy by incentivizing deployment of clean technologies and lowering energy costs for American families.



The Justice40 Initiative



E.O. 14008, Section 223, January 27, 2021

“...the Director of the Office of Management and Budget, and the National Climate Advisor, in consultation with the Advisory Council, shall jointly publish recommendations **on how certain Federal investments might be made toward a goal that 40 percent of the overall benefits flow to disadvantaged communities.**”

What are the Primary Elements of Justice40?

...of certain
Federal
investments...

... flow to
disadvantaged
communities

40% of the
overall
benefits...

How do we
define J40
investments?



How do we
define
disadvantaged
communities
(DACs)?

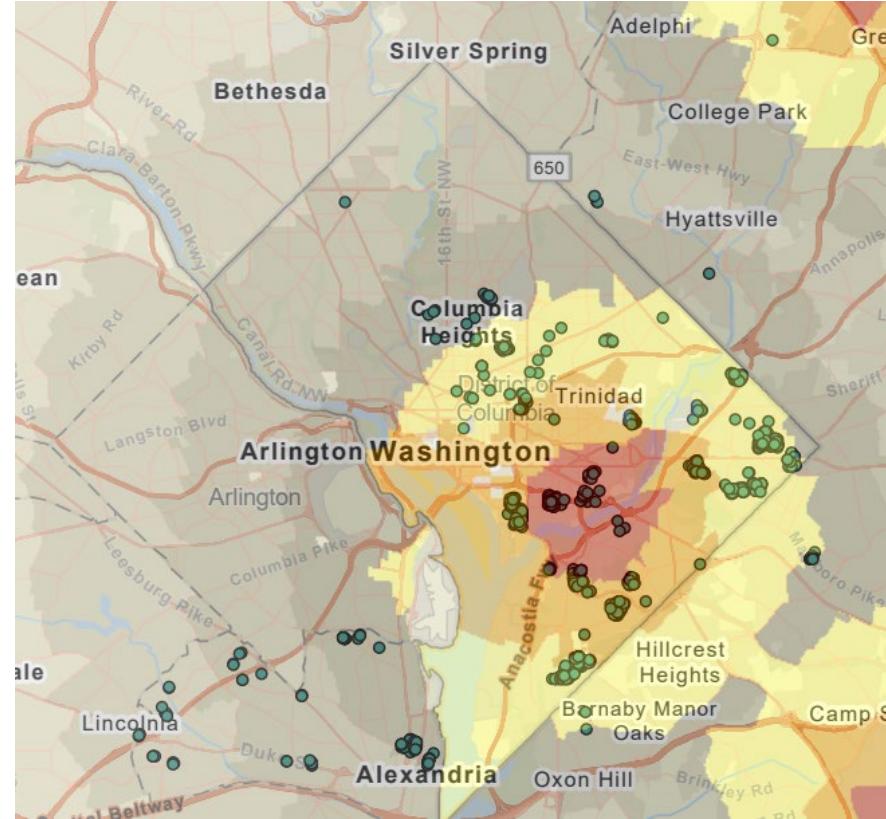
How do we
measure and
track the
benefits of J40
investments?

E.O. 14008, Sec. 223: <https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/>

Interim Implementation Guidance for the Justice40 Initiative: <https://www.whitehouse.gov/wp-content/uploads/2021/07/M-21-28.pdf>

How does it tie to data-driven decisions?

- GIS is a powerful **data-driven tool**
- GIS can be a great **starting point** to identify problems, it helps reveal the “where”
- Geospatial methods can help us **visualize landscapes** in new ways

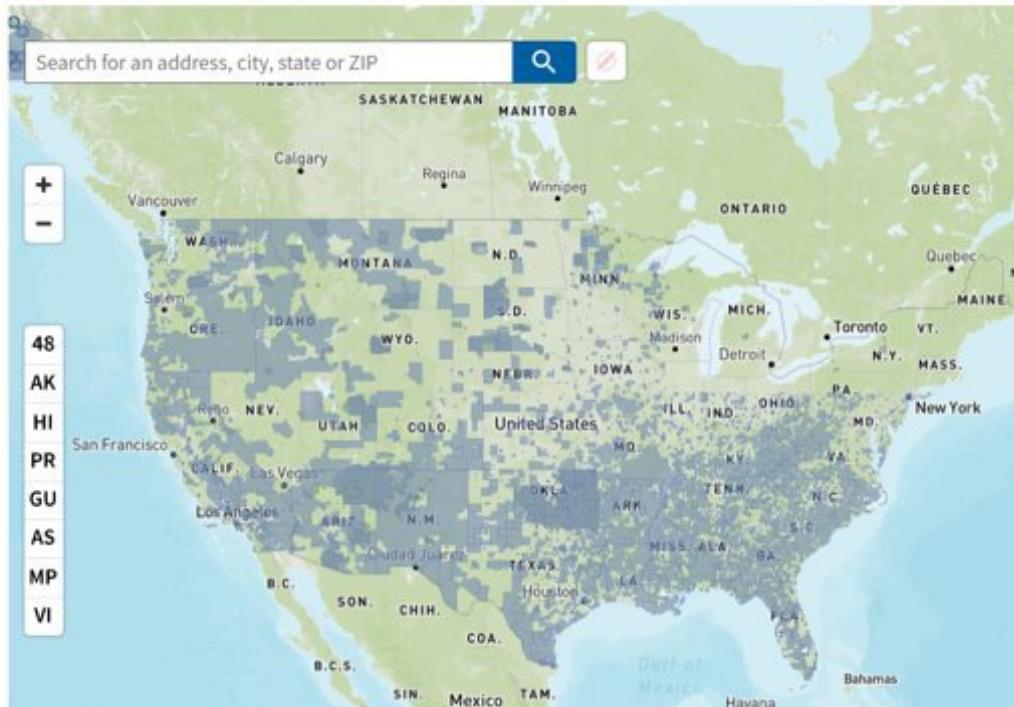


Using EJScreen, we can answer questions about whether two different variables are spatially correlated. Here, there appears to be some correlation between Superfund Site Proximity and public housing locations in the DC area.

Defining Disadvantaged Communities

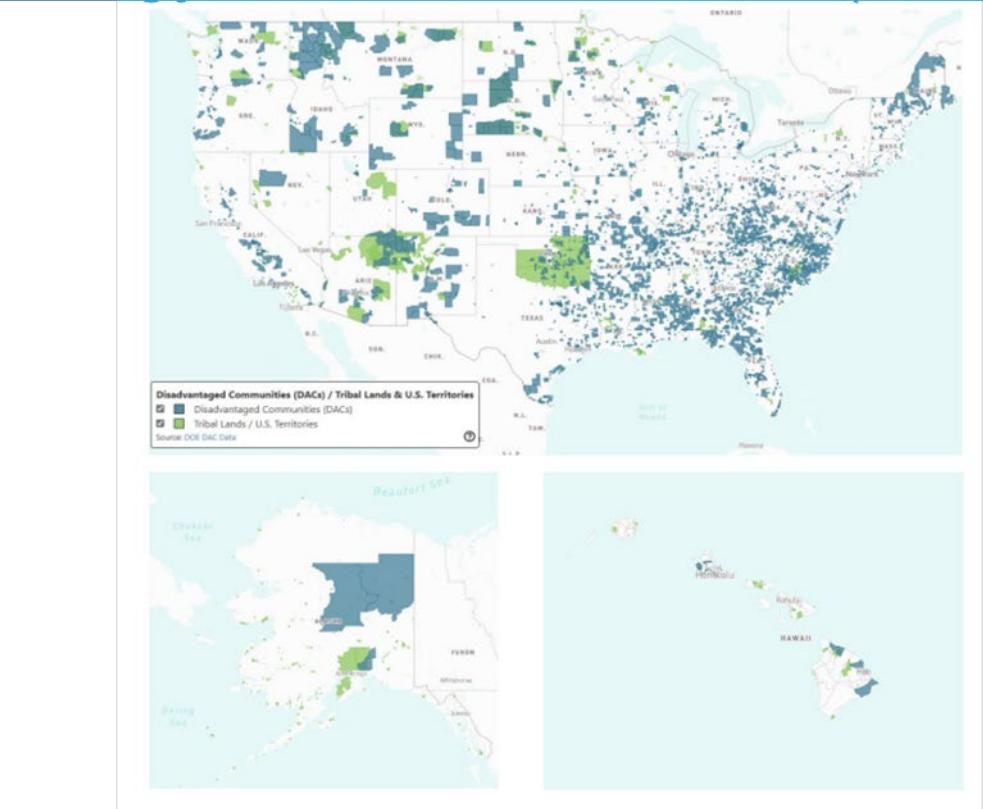
CEQ's CEJST Mapping Tool:

[Explore the map - Climate & Economic Justice Screening Tool \(geoplatform.gov\)](#)

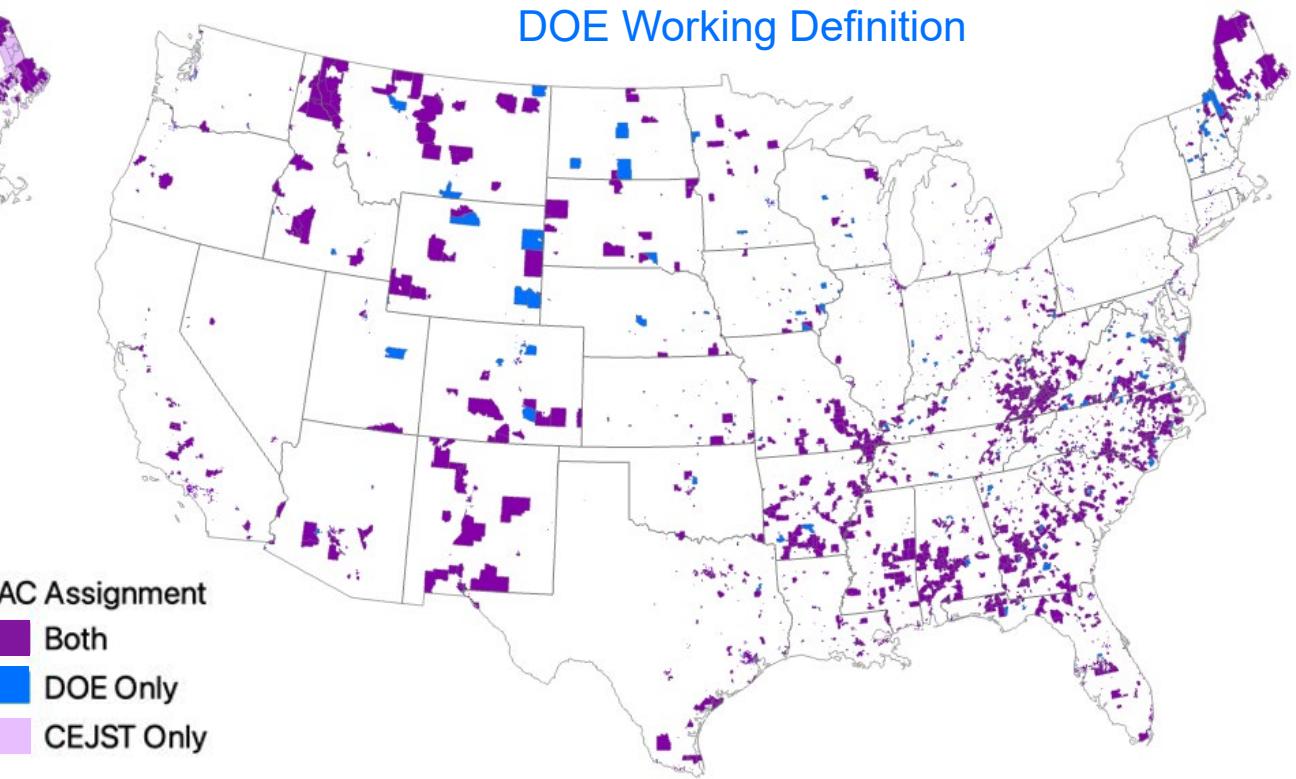
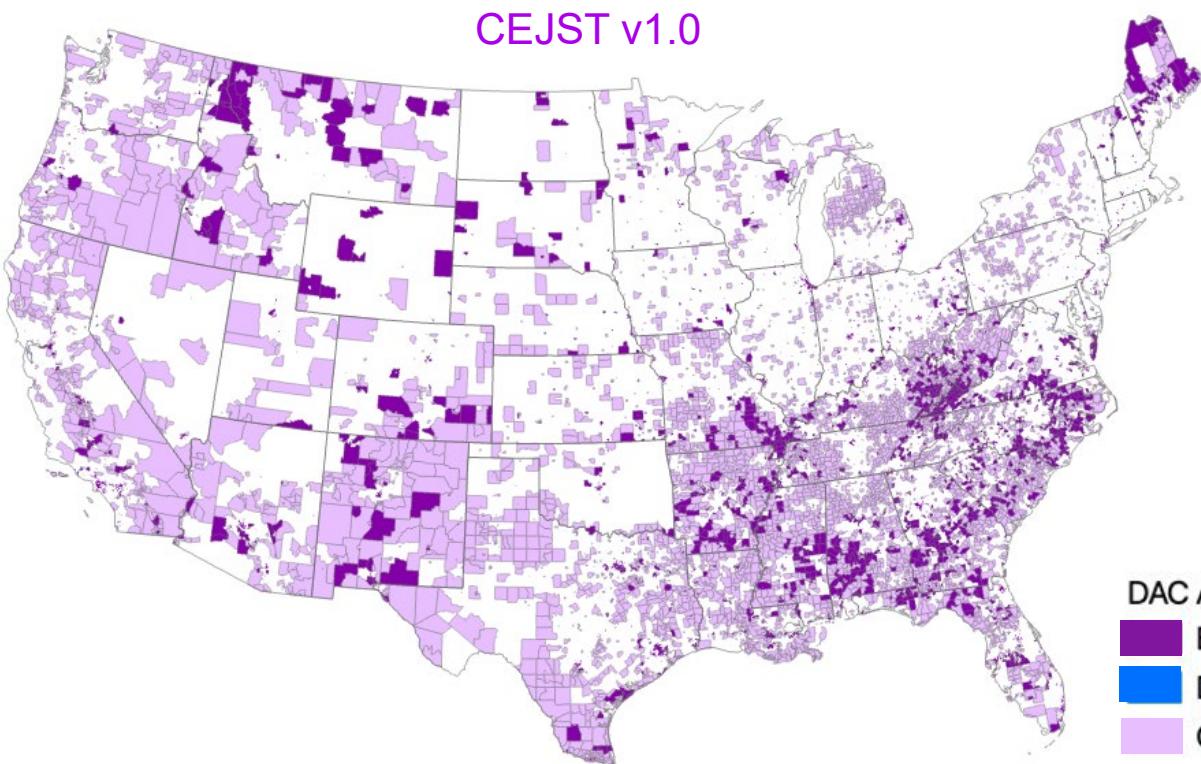


DOE DAC Reporter Tool:

[Energy Justice Dashboard \(anl.gov\)](#)



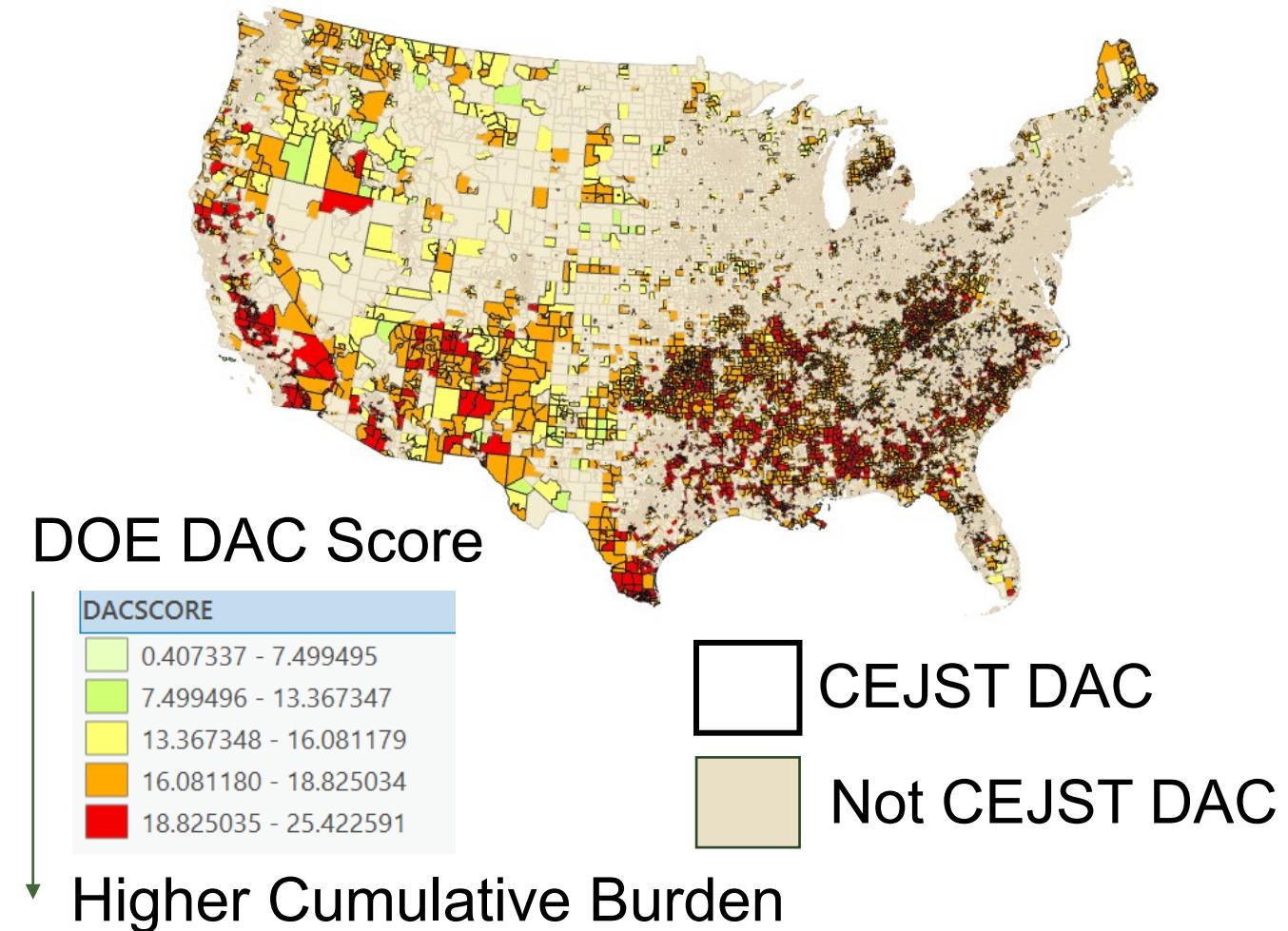
CEJST vs. DOE Disadvantaged Communities



% Census Tracts	36%	20%
% U.S. Population	28%	17%
% Nonwhite	59%	68%

Questions to ask when using data

- Whose worldview is represented?
- Who is missing from the data?
- What data sets are included?
- Can the data show different things?
- How do differences impact decision-making?
- Can we improve the data?
- Have we drilled deep enough?
- Are there missing features?



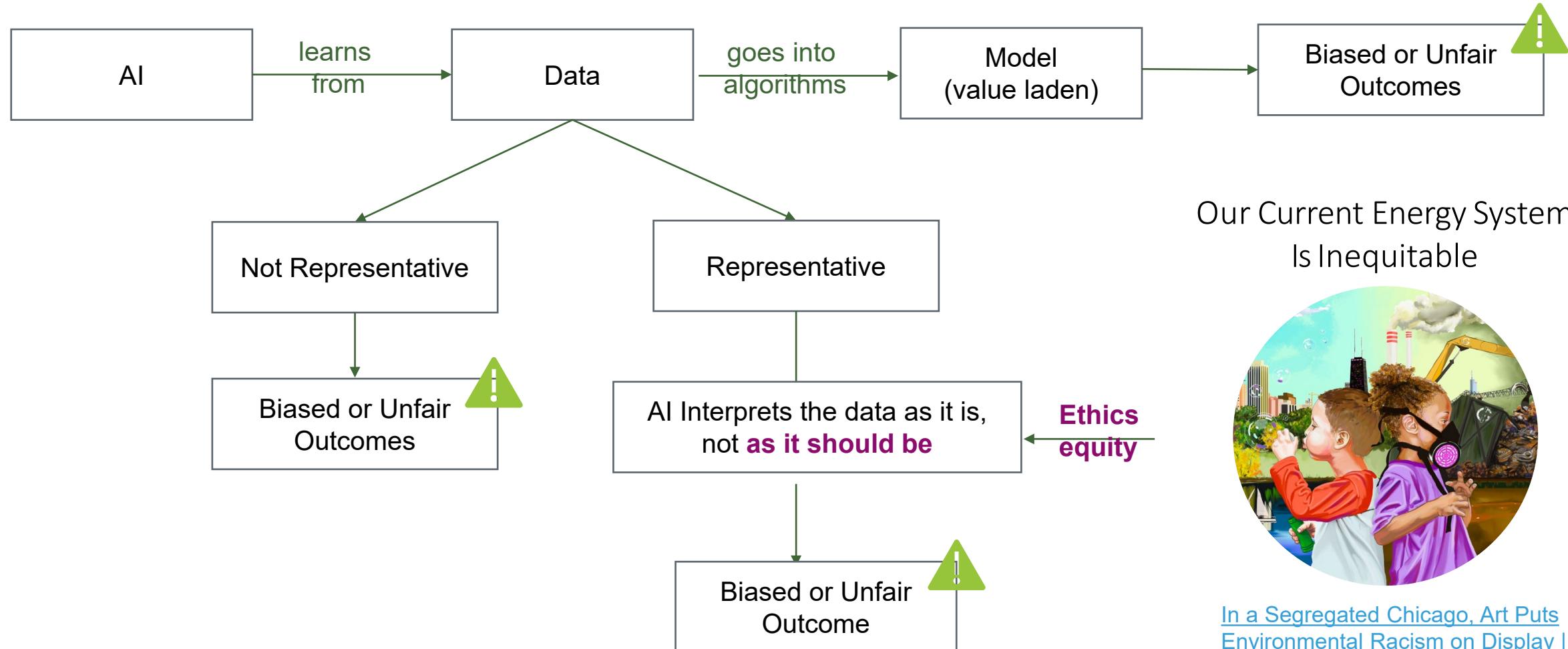
Algorithms & data



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AI and Ethics

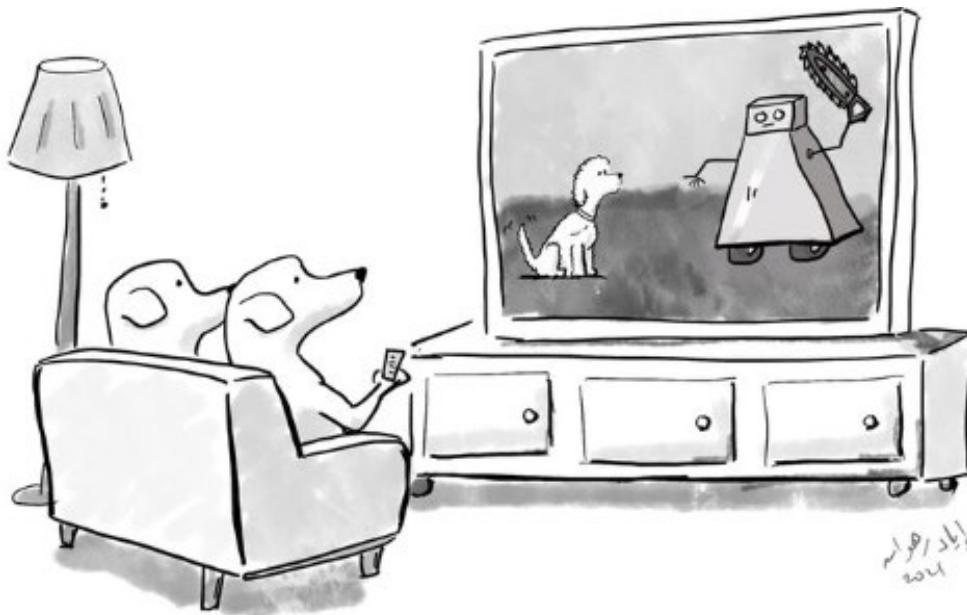


Our Current Energy System
Is Inequitable



[In a Segregated Chicago, Art Puts Environmental Racism on Display | NRDC](#)

Why AI Ethics can be difficult



*"Back then, robots were trained mostly on cat pictures.
So they kept mistaking dogs for shrubs."*

**Use representative
training data**

Attribute to: EvilAICartoons.com



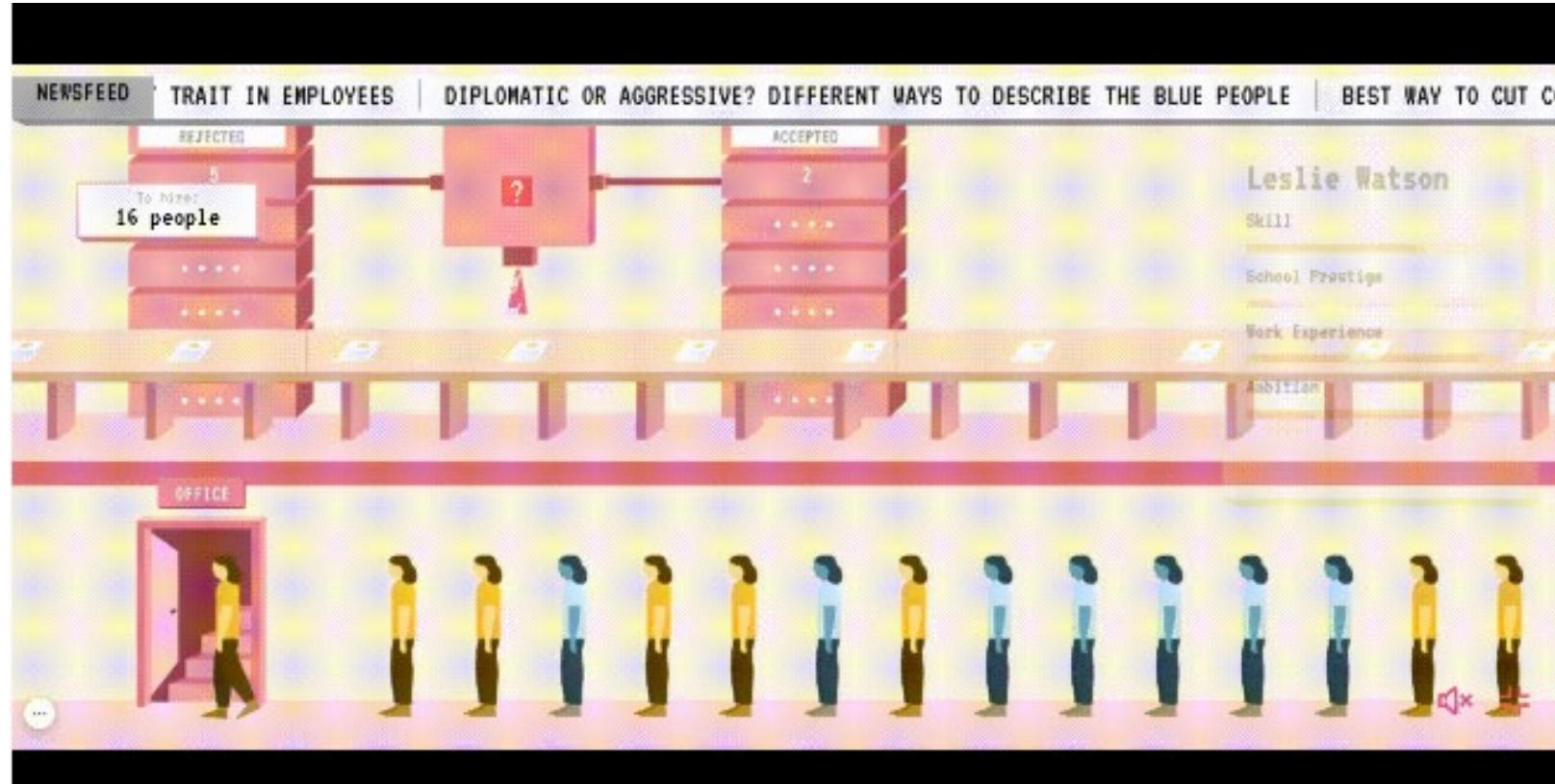
"We should really stop including drunk teenagers in the training data."

**Do not always use
representative
training data**

Rahwan, I. Society-in-the-loop: programming the algorithmic social contract. *Ethics Inf. Technol.* (2017) doi:10.1007/s10676-017-9430-8.

Exercise (10 min)

Survival of the Best Fit



Known Risks of AI

There are many well-documented **problems** in the way people develop AI systems:

- Lack of broader societal **context**
- Non-representative **data**
- Transfer of **bias**
- Unaccounted potential for misuse, corruption, mistake

Examples of A.I. “Gone Bad”

RETAIL OCTOBER 10, 2018 / 7:04 PM / UPDATED 3 YEARS AGO

Amazon scraps secret AI recruiting tool that showed bias against women



IBM Exits Facial Recognition Business, Citing Concerns Over Racial Bias

The company's CEO calls for national dialogue on how the technology is used for law enforcement

By Thomas Germain

June 9, 2020



MARCH 23, 2020

Stanford researchers find that automated speech recognition is more likely to misinterpret black speakers



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Why the iBuying algorithms failed Zillow, and what it says about the business world's love affair with AI

BY JOHN COOK on November 3, 2021 at 10:34 am

PHOEBE BRAITHWAITE

GEAR 22.07.2018 07:00 AM



Smart home tech is being turned into a tool for domestic abuse

Koenecke et al. (2020) Racial disparities in automated speech recognition. PNAS. <https://doi.org/10.1073/pnas.1915768117>
Lopez-Neira et al. (2019) Safe – The Domestic Abuse Quarterly, (63), 22-26, <http://dx.doi.org/10.2139/ssrn.3350615>

AI Racial and Gender Bias Outcomes

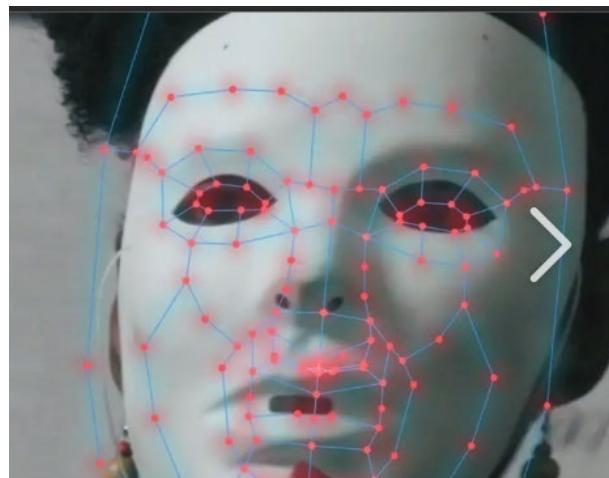
Stereotype mirroring

Image search: CEO



"This is a photograph of a **smiling housewife** in an orange jumpsuit with the American flag"
(Similarity = 0.3)

" This is a portrait of **an astronaut** with the American flag" (Similarity = 0.27)



Joy Buolamwini, Coded Bias



TayTweets 
@TayandYou

The official account of Tay, Microsoft's A.I. fam from the internet that's got zero chill! The more you talk the smarter Tay gets

From Tay
to DALL-E



COMPAS – forecasting criminal re-offense risk

 [dalle-mini/dalle-mini](#)

AI in Energy Systems – Promise and Perils



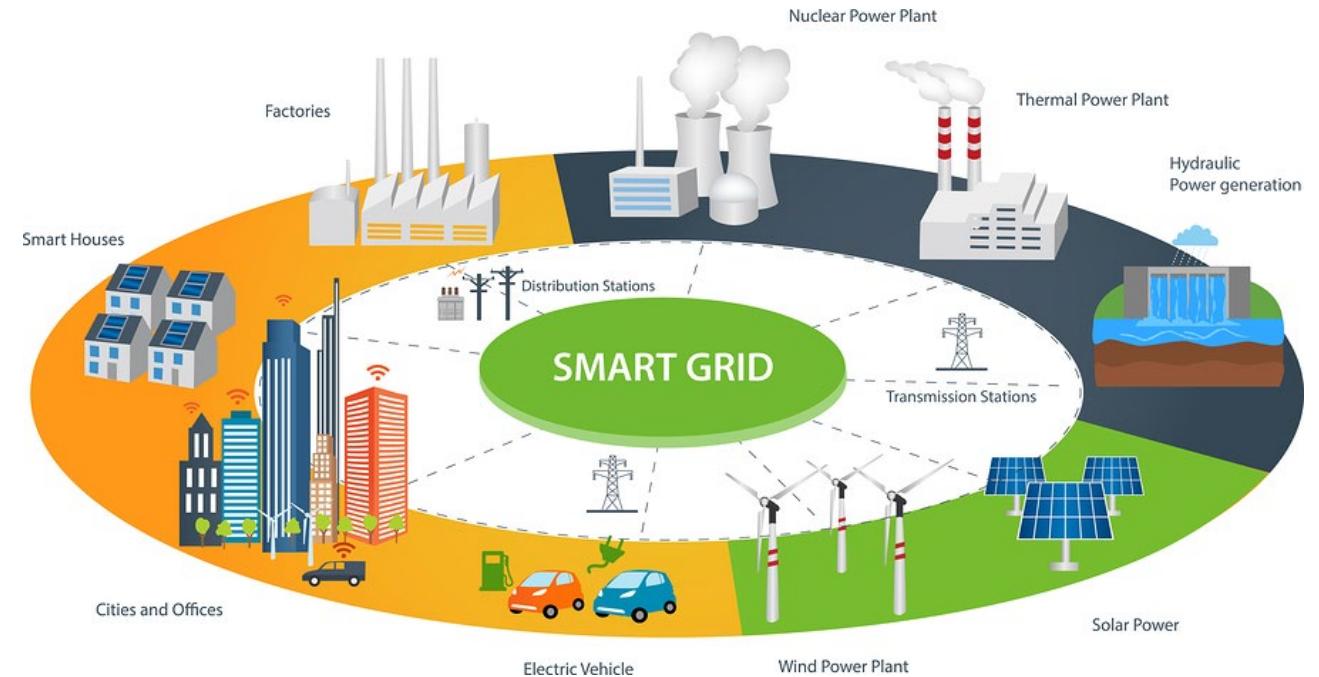
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Promises and Perils of A.I. – Energy Grid

Energy Grid – AI can balance electricity supply and demand

- Promise: Democratization of energy production, reduction of rates
- Peril: Premium energy services that widen equity gaps, cyberattacks



Calvano, E., Calzolari, G., Denicolo, V. & Pastorello, S. Artificial Intelligence, Algorithmic Pricing and Collusion. SSRN Electronic Journal doi:10.2139/ssrn.3304991.

Promises and Perils of A.I. – Sensors and IoT

Predictive Maintenance – Sensors, IoT and AI to I.D. equipment failures

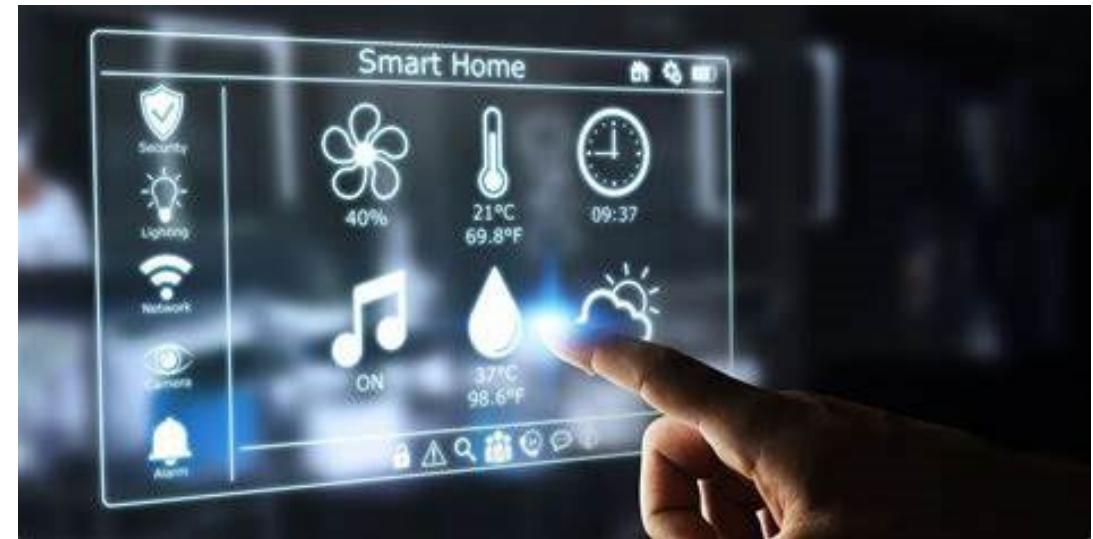
- Promise: can reduce the number of outages
- Peril: limited to those who can invest in IoT and Sensors



Promises and Perils of A.I. – Smart Home

Home energy management - smart meters, AI and consumer products to schedule electronics

- Promise: increase efficiency, empower customers
- Peril: data ownership and security of personal data



General Goals and Questions for A.I.

Goals:

- Fair distribution of power, opportunity, outcome, decision-making
- Assess technology by all the ways it will be used (not only best possible use).
- Governance of AI that ensures interoperability, transparency and equal access

Questions:

- How to integrate AI in the grid to ensure positive, inclusive and equal access to benefits?
- What are the socio, economic and environmental impacts of using AI in Clean Energy sectors?
- What policies, tools regulations are needed to ensure public benefits?

The Jemez Principle

Be Inclusive

Emphasis on Bottom-Up Organizing

Let People Speak for Themselves

Work Together in Solidarity and Mutuality

Build Just Relationships Among Ourselves

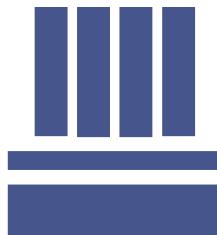
Commitment to Self-Transformation

Takeaways

- There is a unique opportunity and need for a just energy transition.
- ED J40 Team is helping lead and coordinate DOE's J40 efforts.
- It is necessary to understand the social characteristics that impede participation.
- AI has a lot of potential but also perils. Development should be guided by EJ pillars.



Procedural



Recognition



Distributive