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CONSIDERATION OF SOCIAL EQUITY AND JUSTICE IN EXECUTION OF WATER AND ENERGY PROJECTS

An Applied Researcher's Perspective

THUSHARA GUNDA

July 28, 2022

U.S. DEPARTMENT OF ENERGY NNSA

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- Alice Orrell
- Bethel Tarekegne
- Mercy DeMenno
- Various Community Members

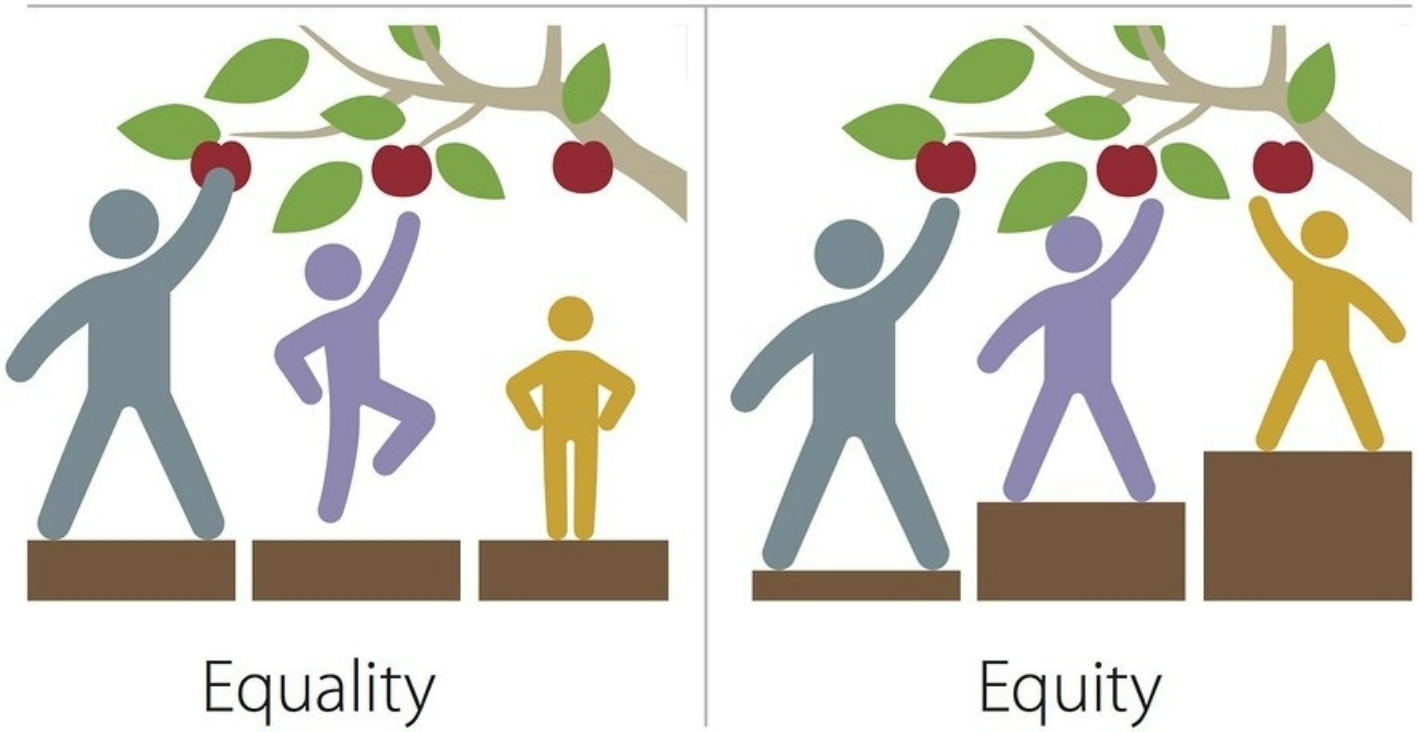
Outline

Background

Research Projects

Lessons Learned

Definitions



Source: Flickr

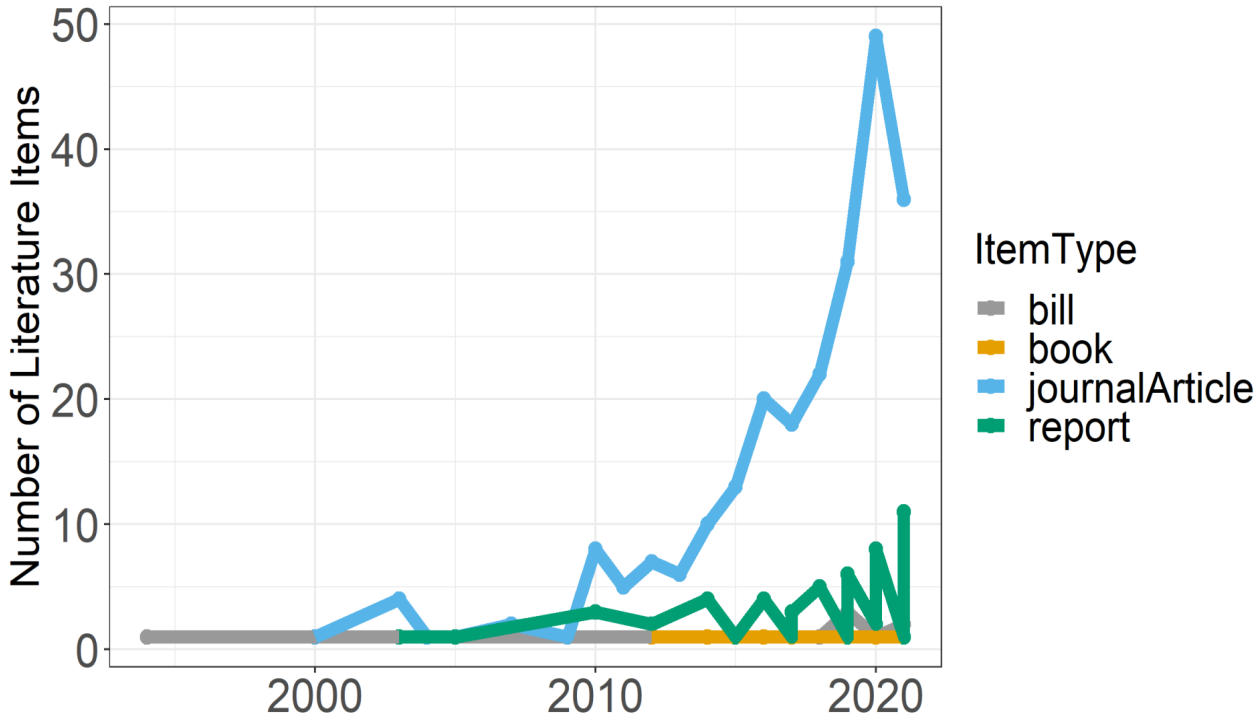
Fair distribution of benefits and costs

Justice

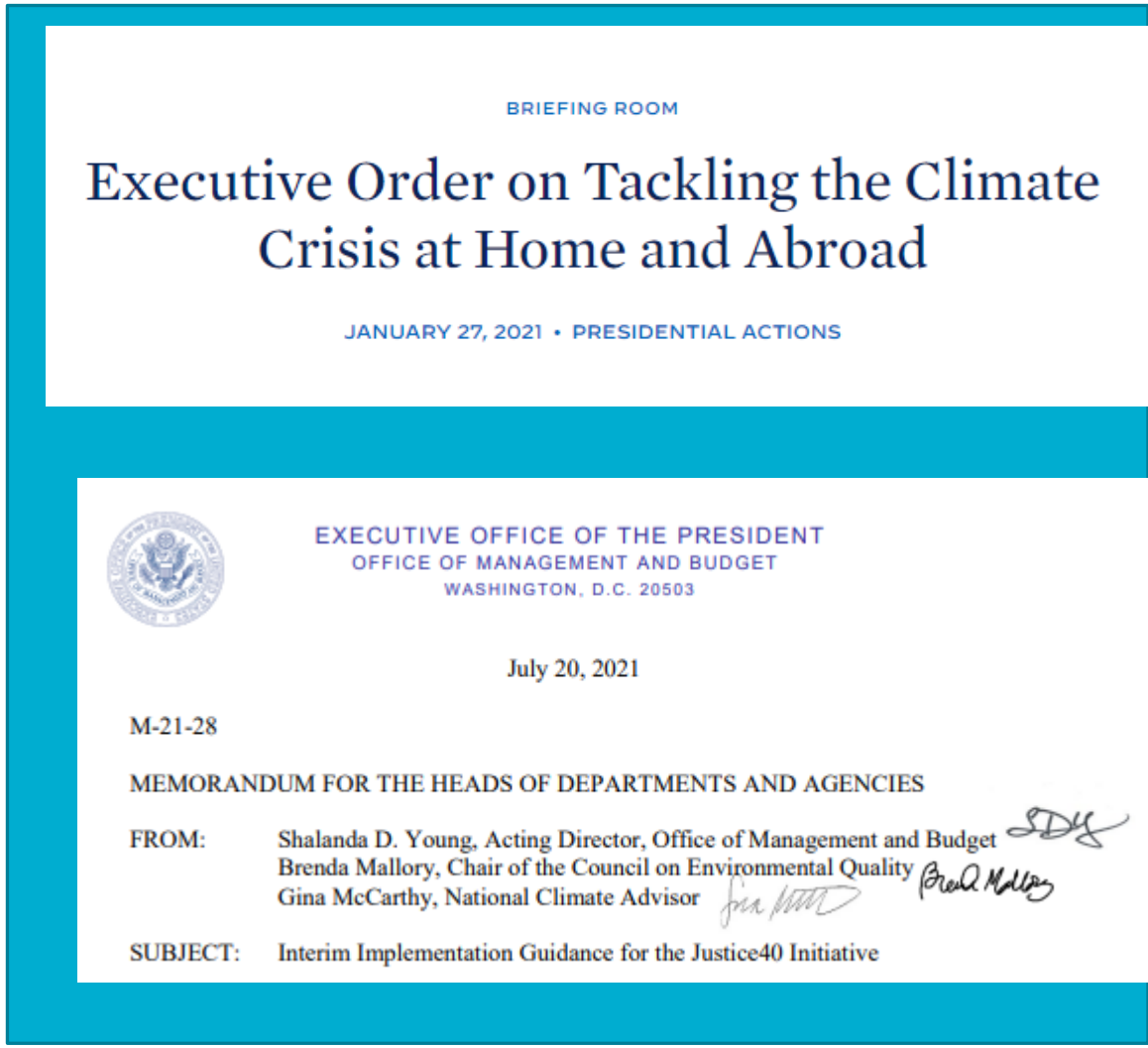
Addressing historical burdens

Fair distribution of benefits and costs

Increasing attention to these priorities



EEEJ-Related Energy Efficiency and Renewable Energy Literature



BRIEFING ROOM

Executive Order on Tackling the Climate Crisis at Home and Abroad

JANUARY 27, 2021 • PRESIDENTIAL ACTIONS

EXECUTIVE OFFICE OF THE PRESIDENT
OFFICE OF MANAGEMENT AND BUDGET
WASHINGTON, D.C. 20503

July 20, 2021

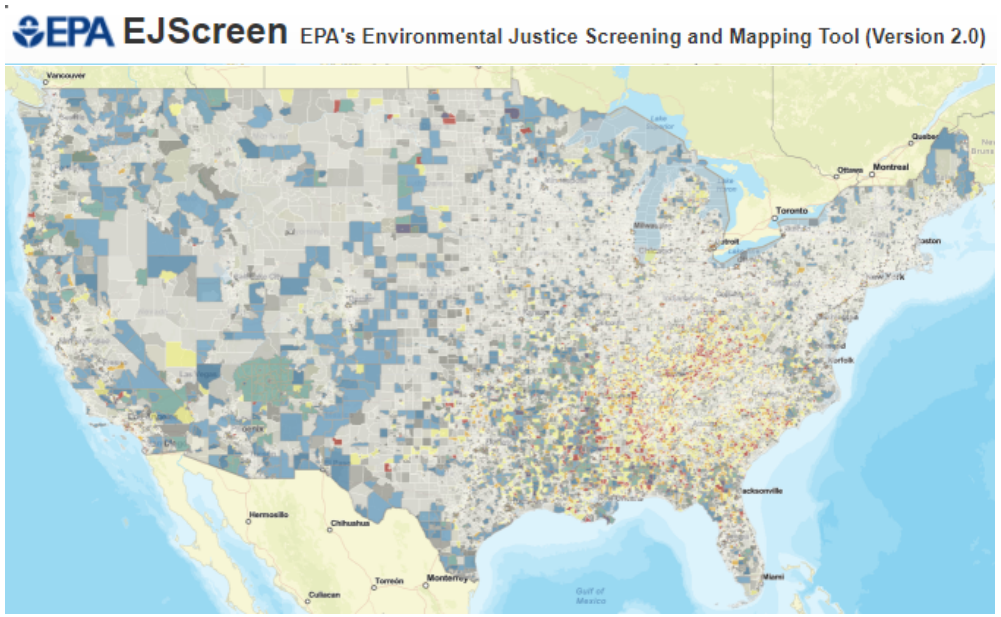
M-21-28

MEMORANDUM FOR THE HEADS OF DEPARTMENTS AND AGENCIES

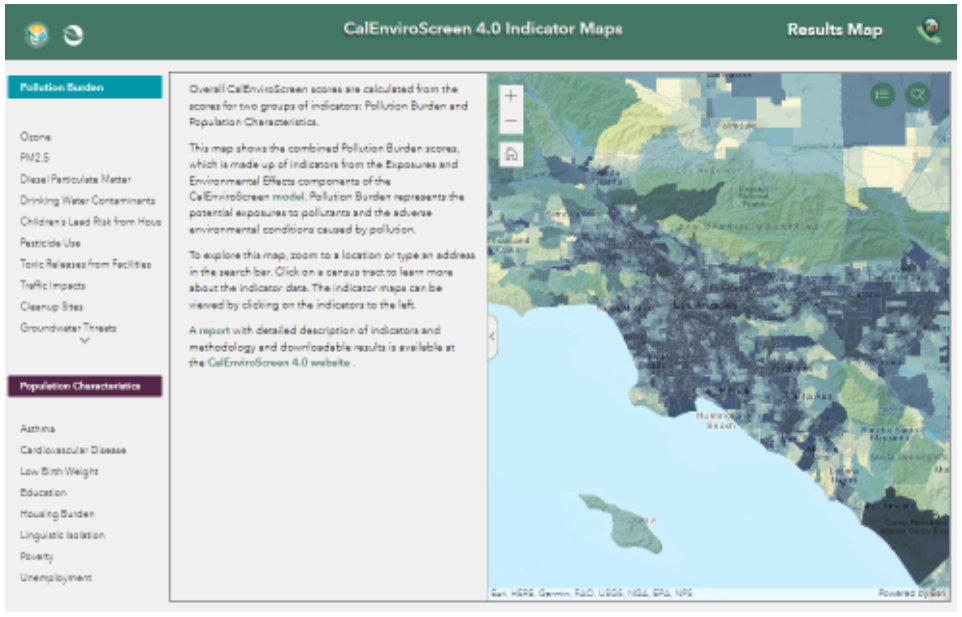
FROM: Shalanda D. Young, Acting Director, Office of Management and Budget
Brenda Mallory, Chair of the Council on Environmental Quality
Gina McCarthy, National Climate Advisor

SUBJECT: Interim Implementation Guidance for the Justice40 Initiative

National Datasets



https://ejscreen.epa.gov/mapper



https://oehha.ca.gov/calenviroscreen/report/calenviroscreen-40

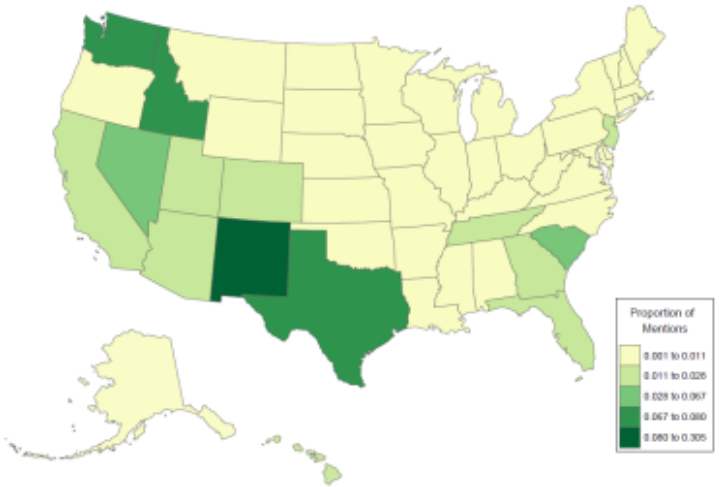
- Focus on pollution burden
- Scoring relative to other spatial regions
- Social demographics are embedded within calculations

EJ Index =

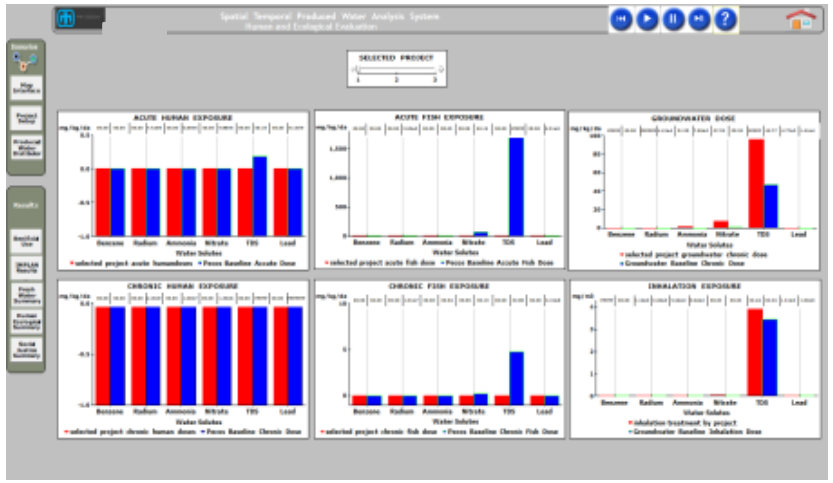
(The Environmental Indicator)
X (Demographic Index for Block Group – Demographic Index for US)
X (Population count for Block Group)

* The Environmental Effects score was weighted half as much as the Exposures score.

Research Portfolio



Characterization



Scenario Evaluations

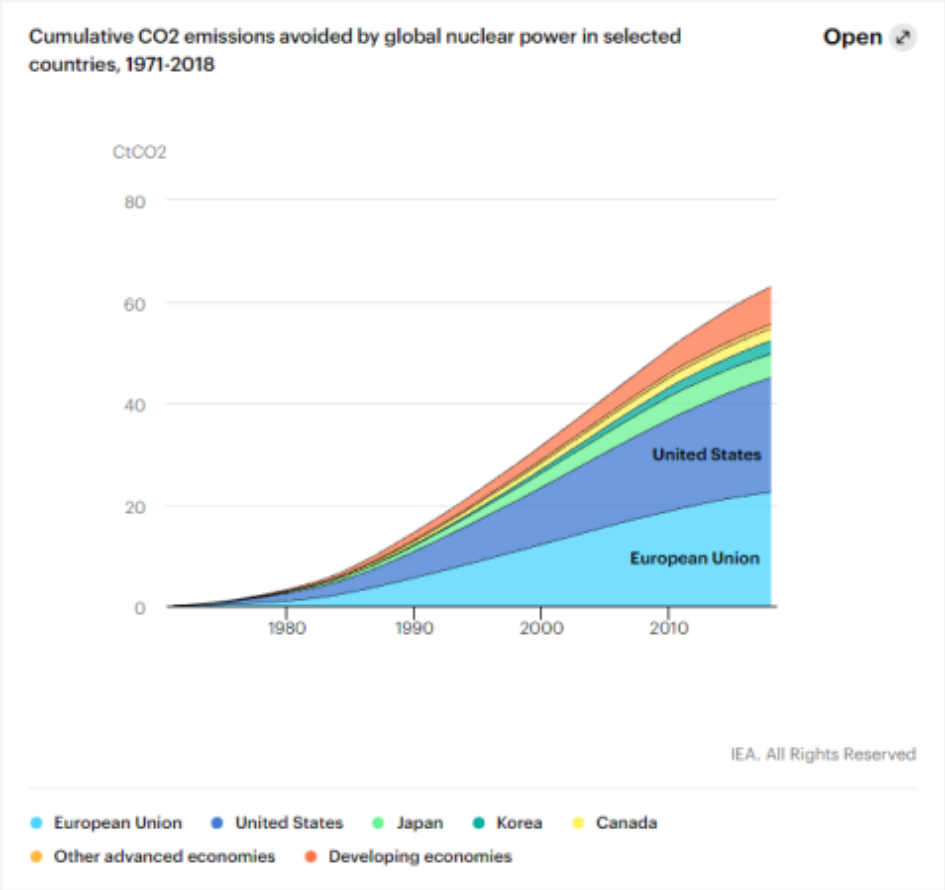
Energy Planning

- Projects span spectrum of activities
- Water and energy are closely interconnected within projects
- Stakeholder engagement is crucial to projects success

Characterization

Nuclear Energy & Waste Management

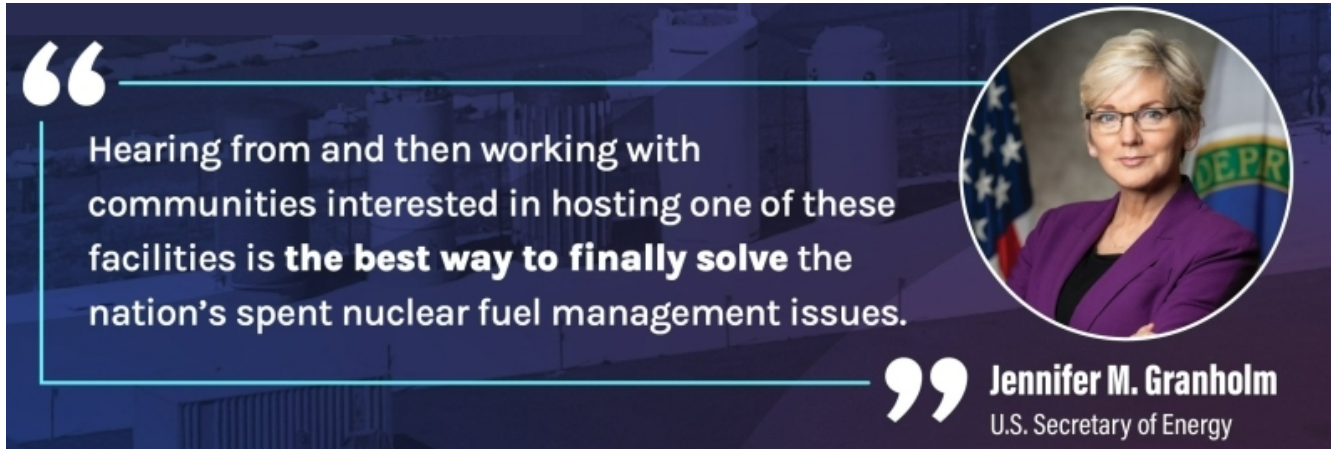
- Nuclear energy generation accounts for 20% of the nation's electricity supply
- Use of nuclear power has reduced CO_2 emissions by 60+ gigatonnes
- Management of spent nuclear fuel
  - Currently, stored in temporary containers on-site of nuclear power plants
  - 85K+ metrics tons of from commercial nuclear power plants in the US
  - Growing at 2K metrics tons/year



Source: IEA

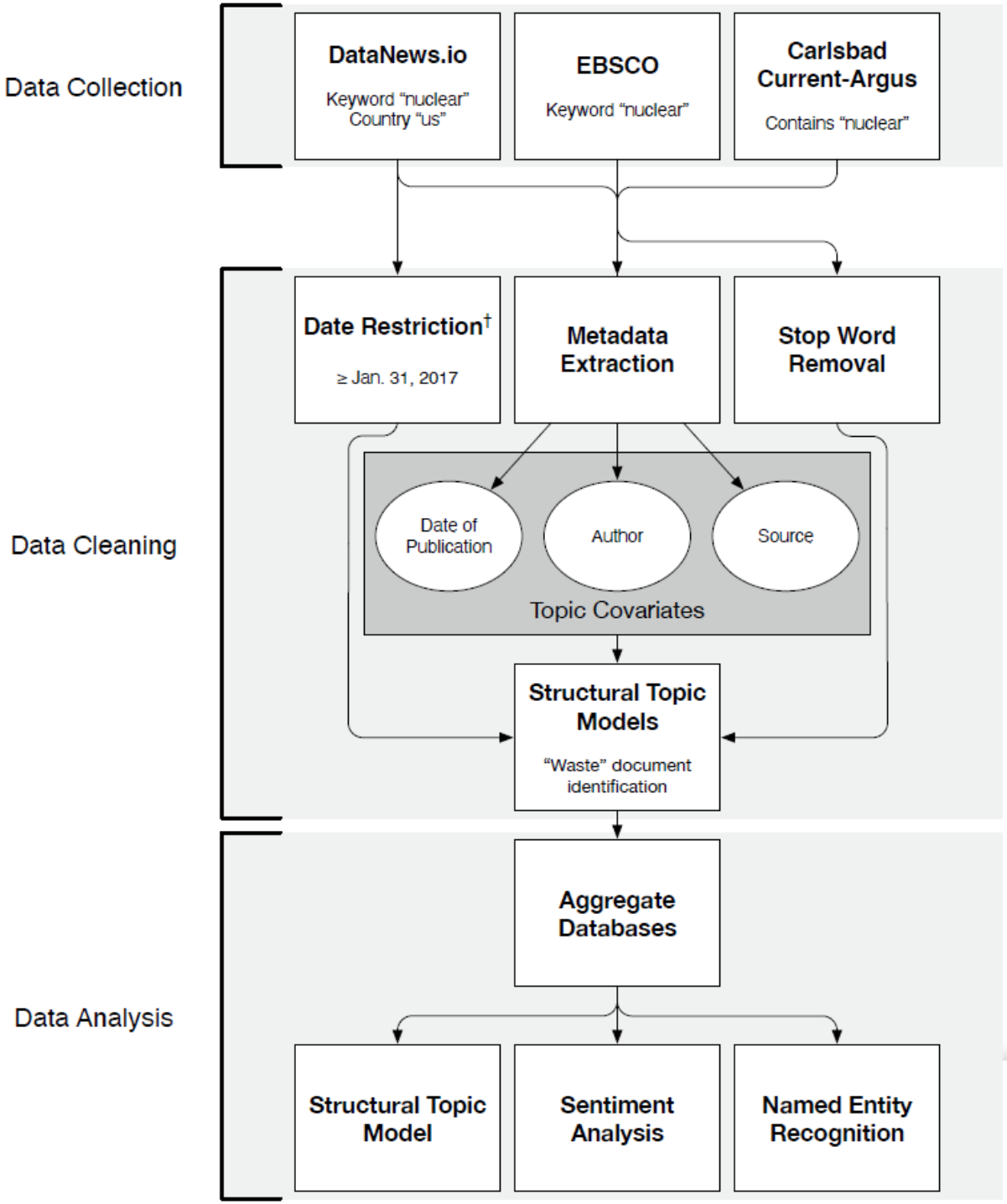
Project Focus

- Support consent-based siting process development
  - Recognizes community-driven perspective is required to ensure equitable and just management of nuclear waste
  - Collaboration between government officials as well as the public and interested groups
- Common “sensors” used to gauge community perspectives include
  - Public opinion surveys
  - Stakeholder interviews
  - Social media
  - Newspapers
- Evaluate potential for natural language processing techniques to understand local narratives within newspapers



Source: DOE

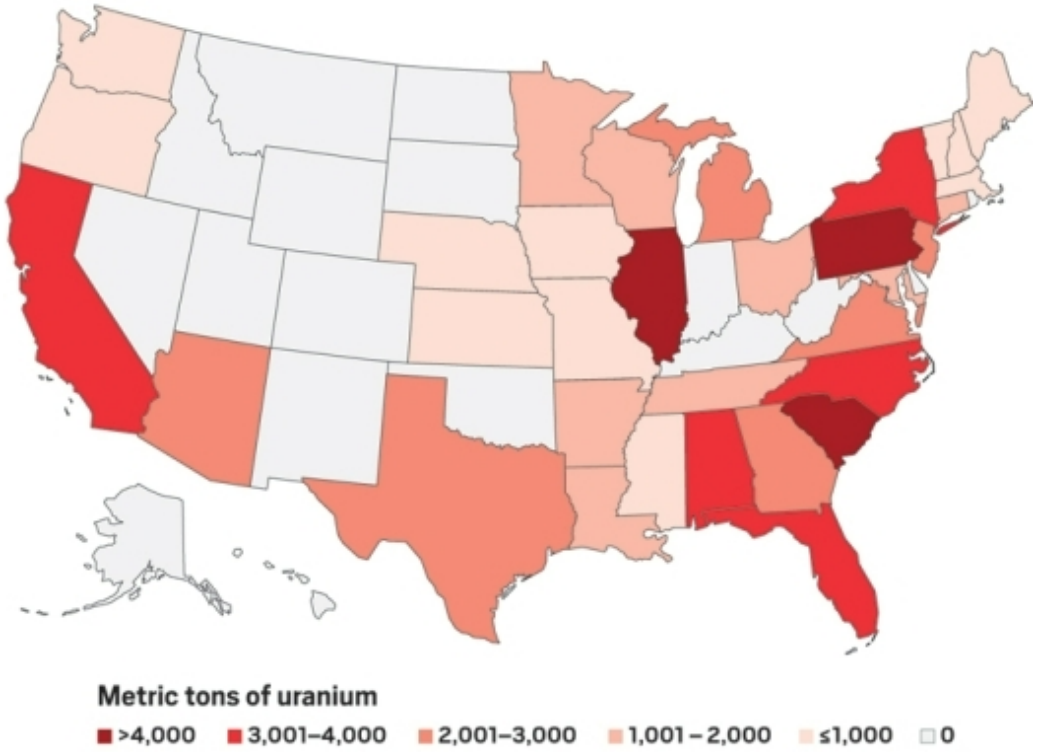
Methodology



- Various datasets downloaded
  - DataNews: 5-year archive, US-wide
  - EBSCOHost: 90-day archive, US-wide
  - Carlsbad Current-Argus: web crawling
- All data collection and analysis conducted in open-source software R
- Human-Machine Teaming: Combines strengths of reliability of computers with interpretability by humans
- Final "Nuclear Waste" Corpus: ~3.5K articles with 450 unique sources

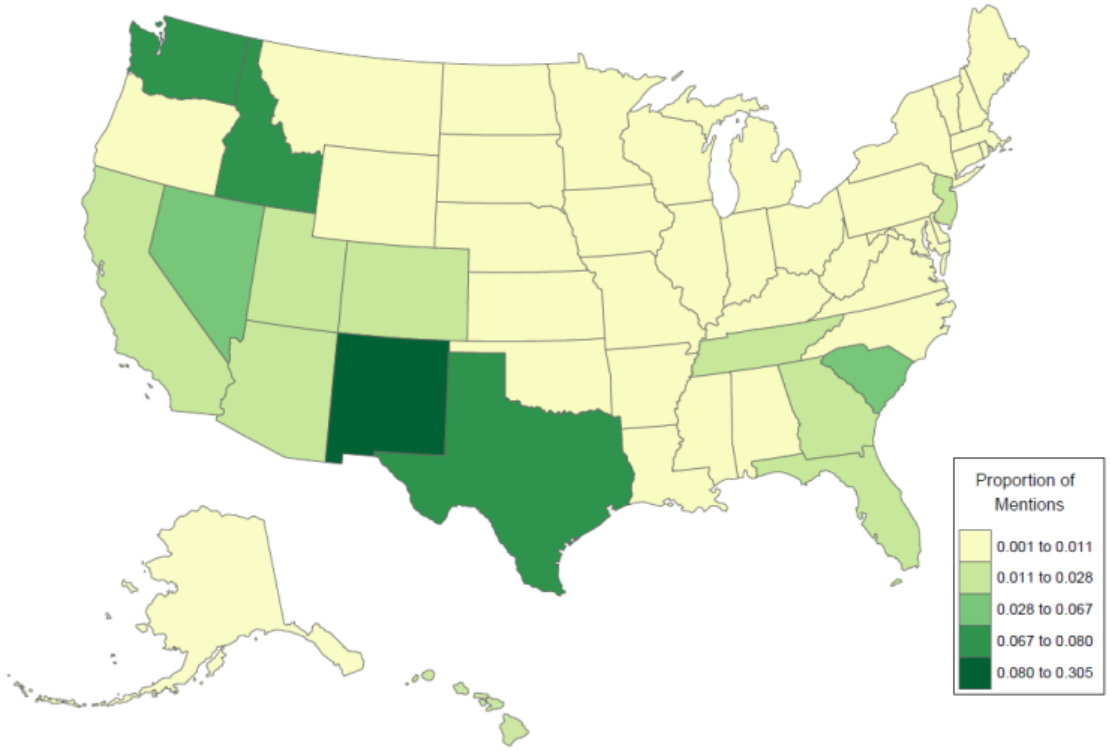
Where is a nuclear waste being discussed?

Current Storage of Spent Nuclear Fuel



Source: c&en

Discussed in “Nuclear Waste” Articles



- States containing waste vs. being actively discussed in newspapers vary
- Significant differences in socio-demographics across regions

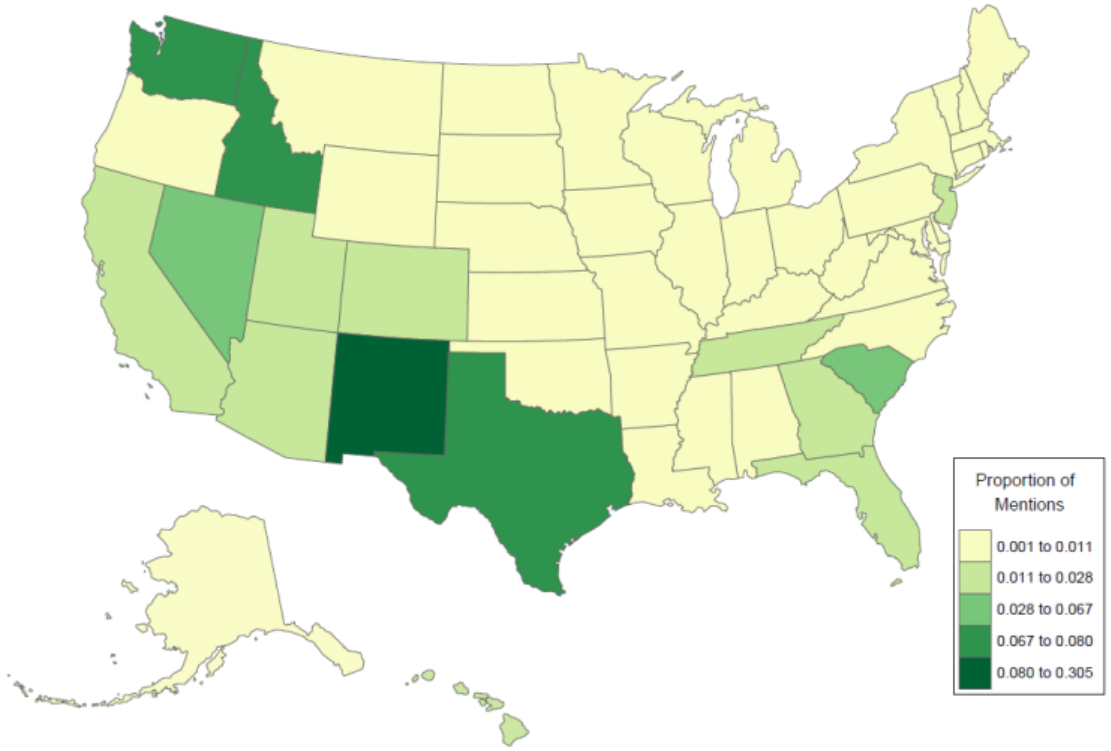
Ongoing Work

- Evaluate intrastate nuances
- Understand related priorities

“water”	“aquifer”
“energy”	“crude”
“oil”	“gas”
“mining”	“Navajo”
“environmental”	“monitoring”
“legacy”	“cleanup”

- Opportunities to inform consent-based process (e.g., community engagement)

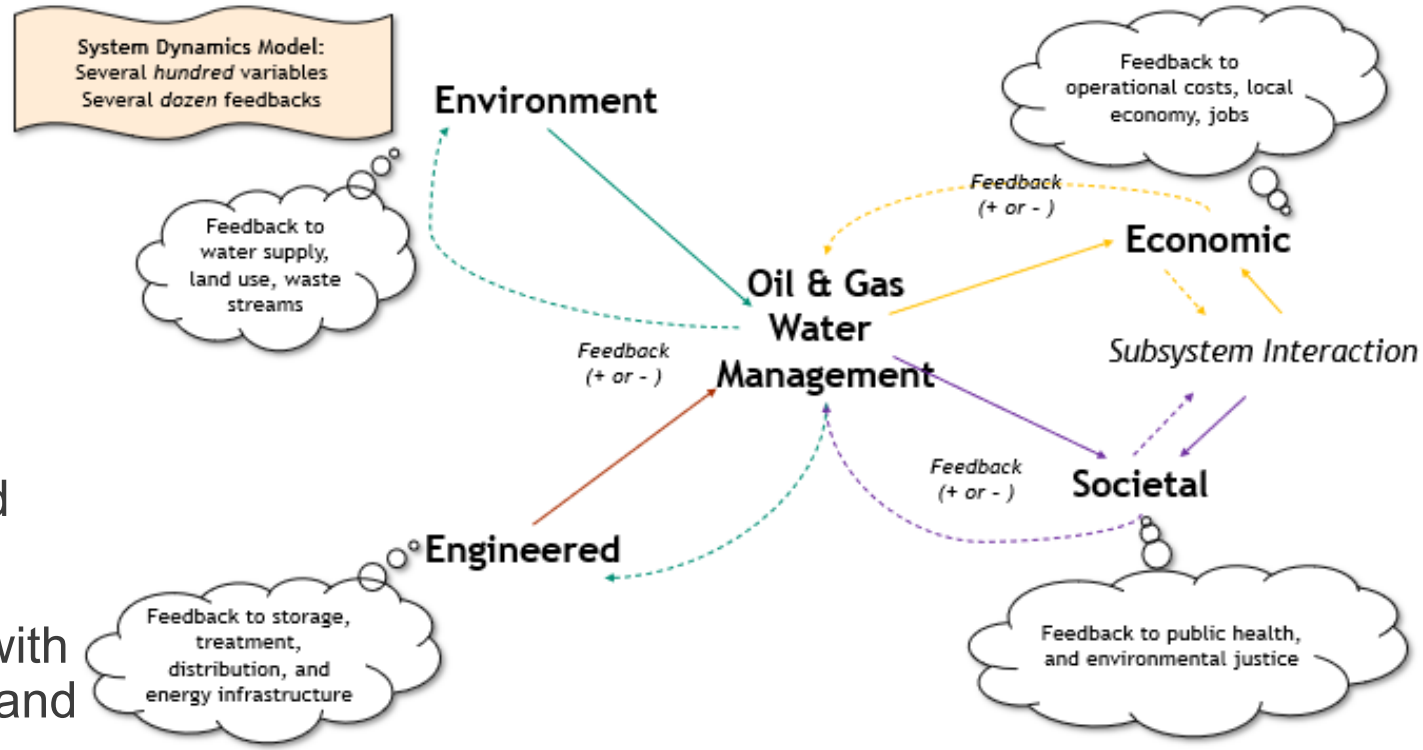
Discussed in “Nuclear Waste” Articles



Scenario Impacts Analysis

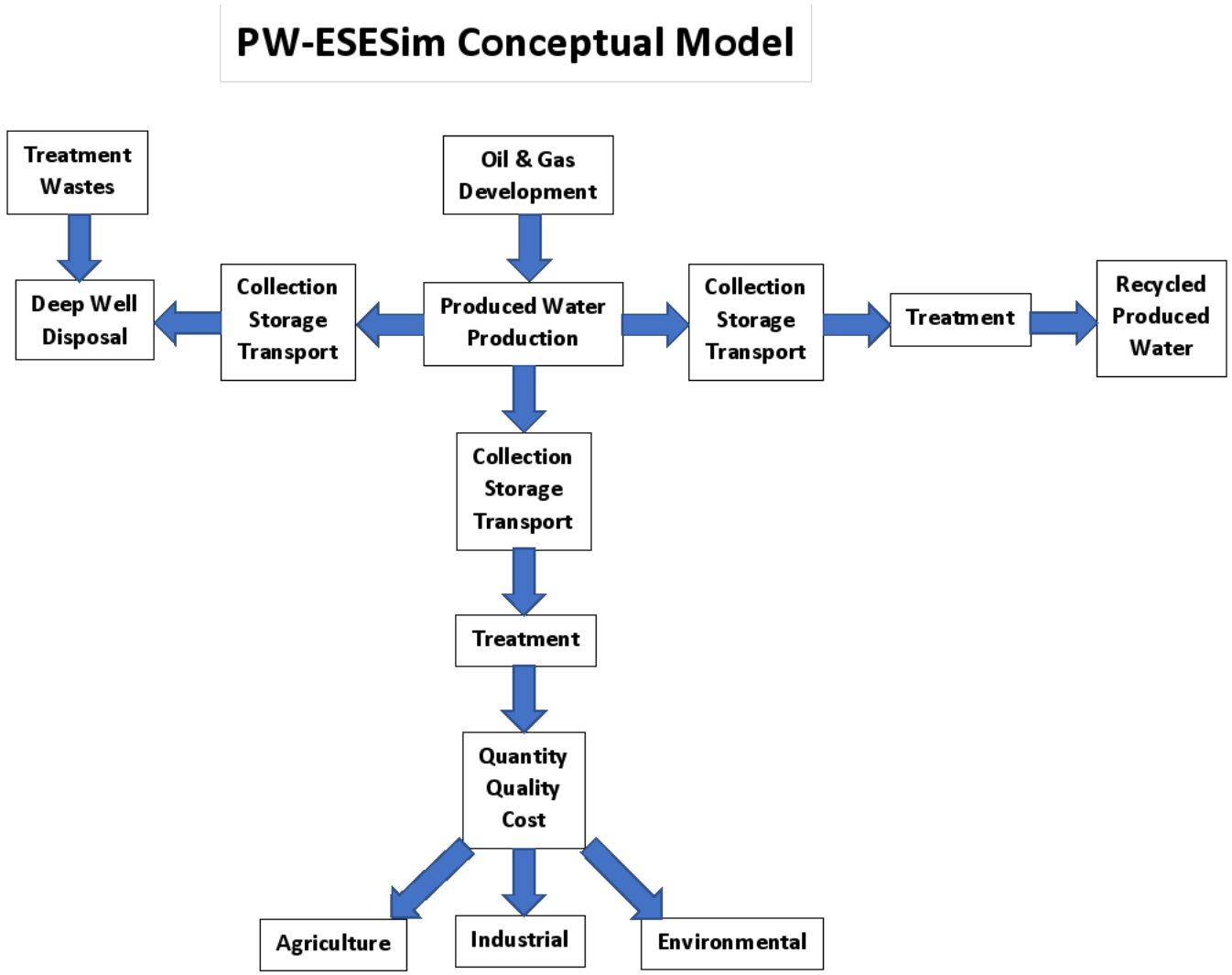
Oil & Gas Produced Water Management

- Oil and gas industry consumes and produces water
  - Rapid growth in the industry
  - Increased demand on freshwater
  - Increased volumes of produced water
- Beneficial reuse of produced water is of interest
- Impacts to economic, societal, and environmental (ESE) is poorly understood
- Goal: Develop an integrated model for assessing the ESE tradeoffs associated with alternative produced water management and fit-for-purpose treatment and reuse



General Scope

- Produced Water-Economic, Socio Environmental Simulation Model (PW-ESESim)
- User-driven scenario design
  - Source water selection
  - Produced water disposition
  - Treatment and other system criteria
- Pilot effort focus: township/range-scale over Lea and Eddy counties
- Model outputs enable analysis and comparison

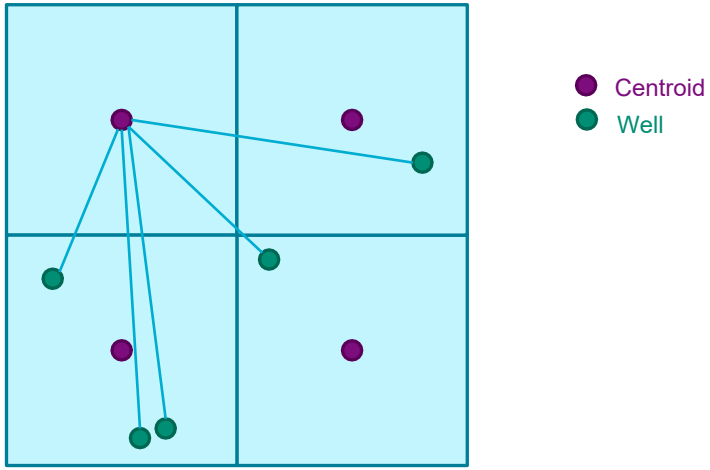


Source: Tidwell et al. 2022

Focus on Environmental Exposure

- PW-ESESim does not explicitly model changes in demographics or O&G infrastructure over time
- Varying impacts over time
  - Static: proximity to O&G well or salt water disposal well
  - Dynamic: impaired water
- Calculations focus on either distance (static measure) or differences between scenarios (dynamic evaluation)

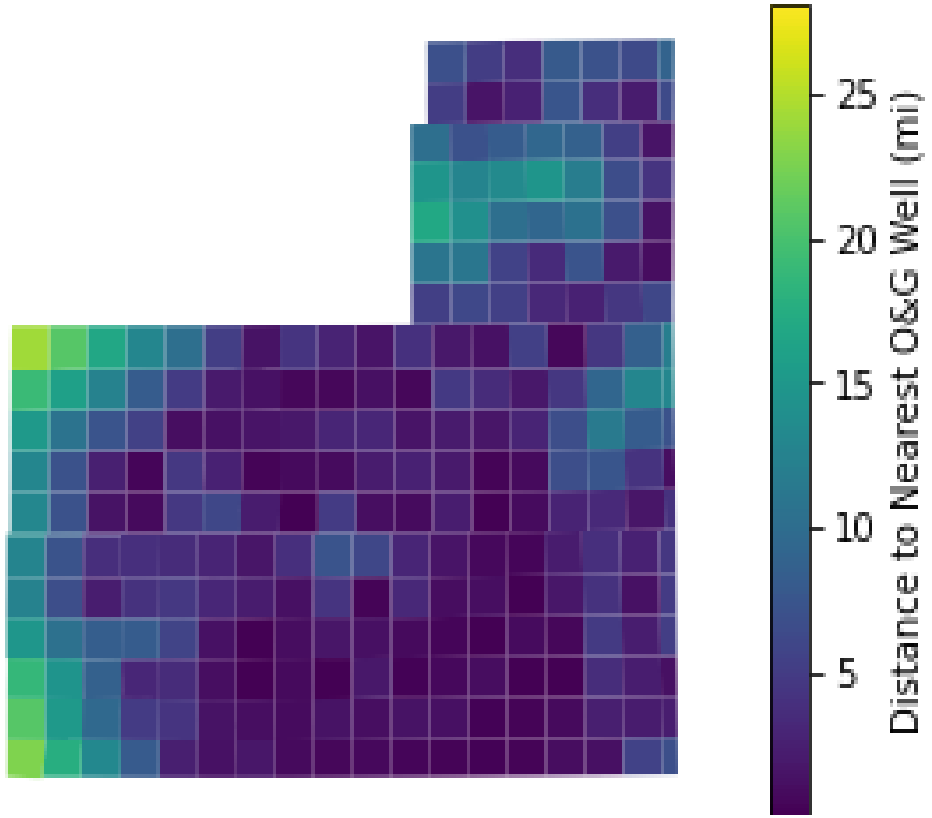
Proximity Calculations



Scenario Comparisons

$$Fraction = \frac{Solute_S}{Solute_B}$$

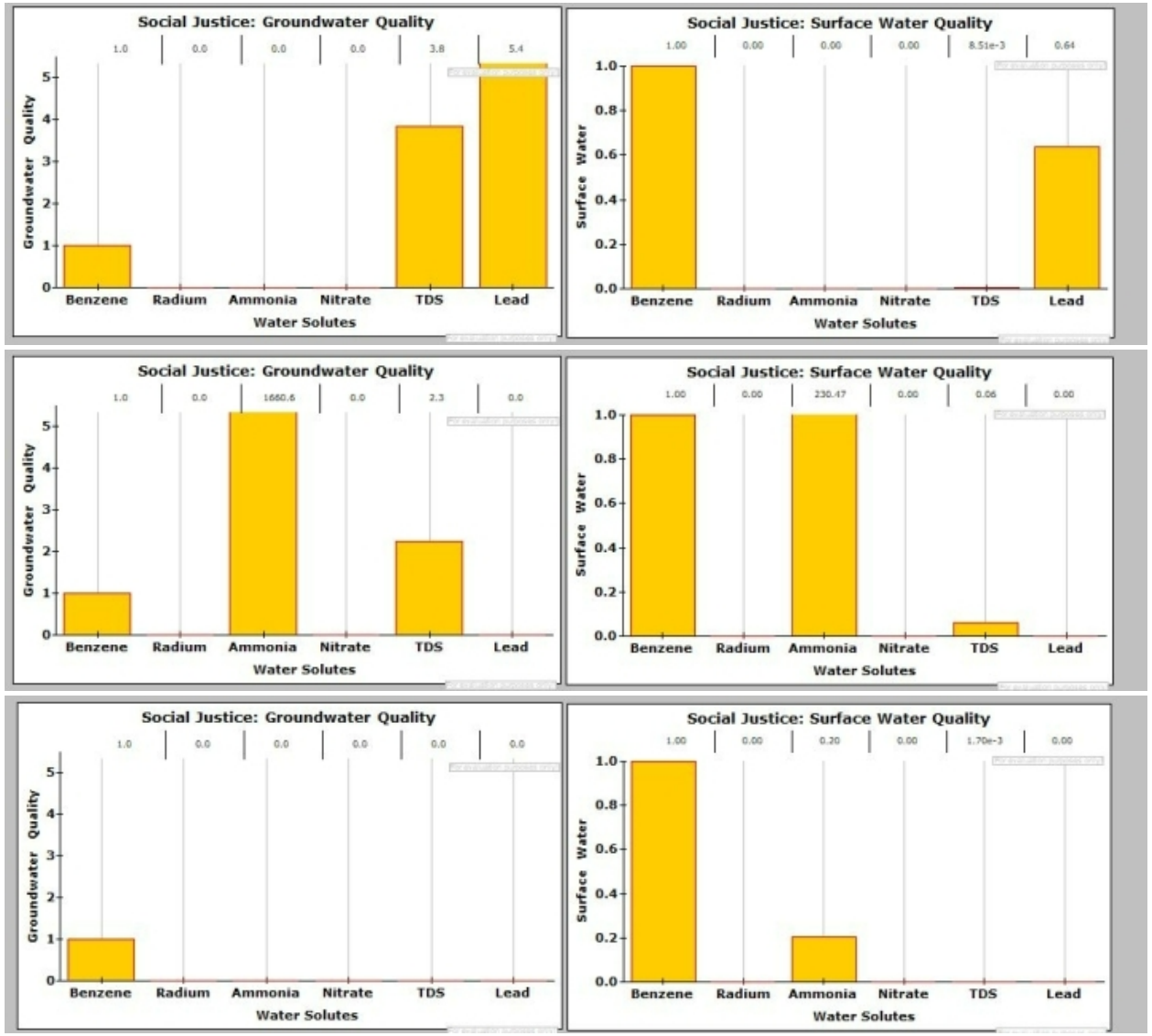
Example Output



Source: Tidwell et al. 2022

- Static evaluations demonstrate clear hotspots in terms of exposure
- Project scenarios highlight variations in solutes across different treatment conditions

	Incoming Water Quality	Water Quantity	Industry	Water Quality
Project 1	>100,000 TDS	20000 bbl per day	All Crops	Irrigation
Project 2	>100,000 TDS	50000 bbl per day	Potash	Clean Brine
Project 3	>100,000 TDS	20000 bbl per day	Petroleum Refining	Drinking



Source: Pillsbury 2022

Lessons Learned

Limited Data Equity and FAIRness

- Limited datasets for equity analysis reflects inequities within data. E.g.,
  - Accessibility of locations
  - Household wastewater treatment
- Significant opportunities exist to increase
  - Findability
  - Accessibility
  - Interoperability
  - Reusability

    ….of datasets used for equity analysis
- Transparency (vs. privacy) of datasets using in decision-making processes

What is your logic model?

Project Objective

To develop a screening tool for produced water mgmt. alternatives (industry, regulators)

EEEJ Objective

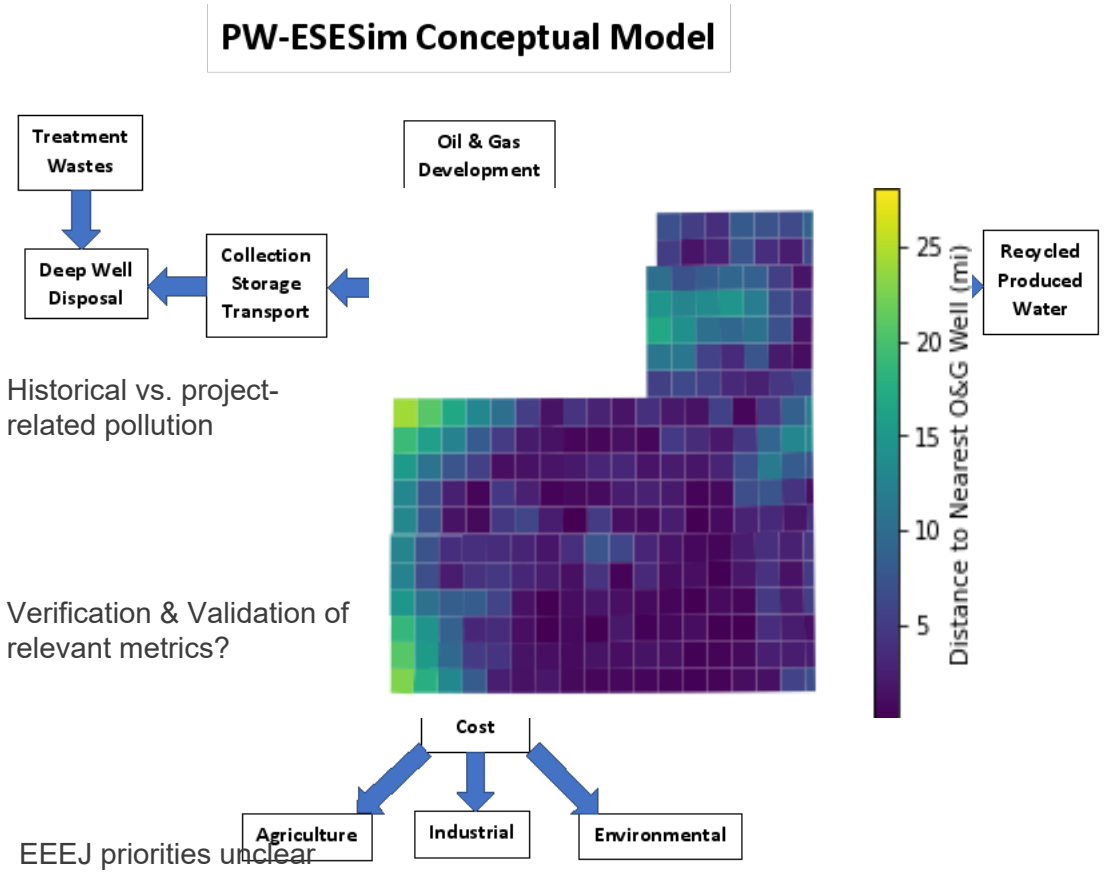
To characterize spatial variations in pollution burdens

Data Needs

Water quality, Traffic patterns, …

Stakeholder Engagement

Screening tool delivery



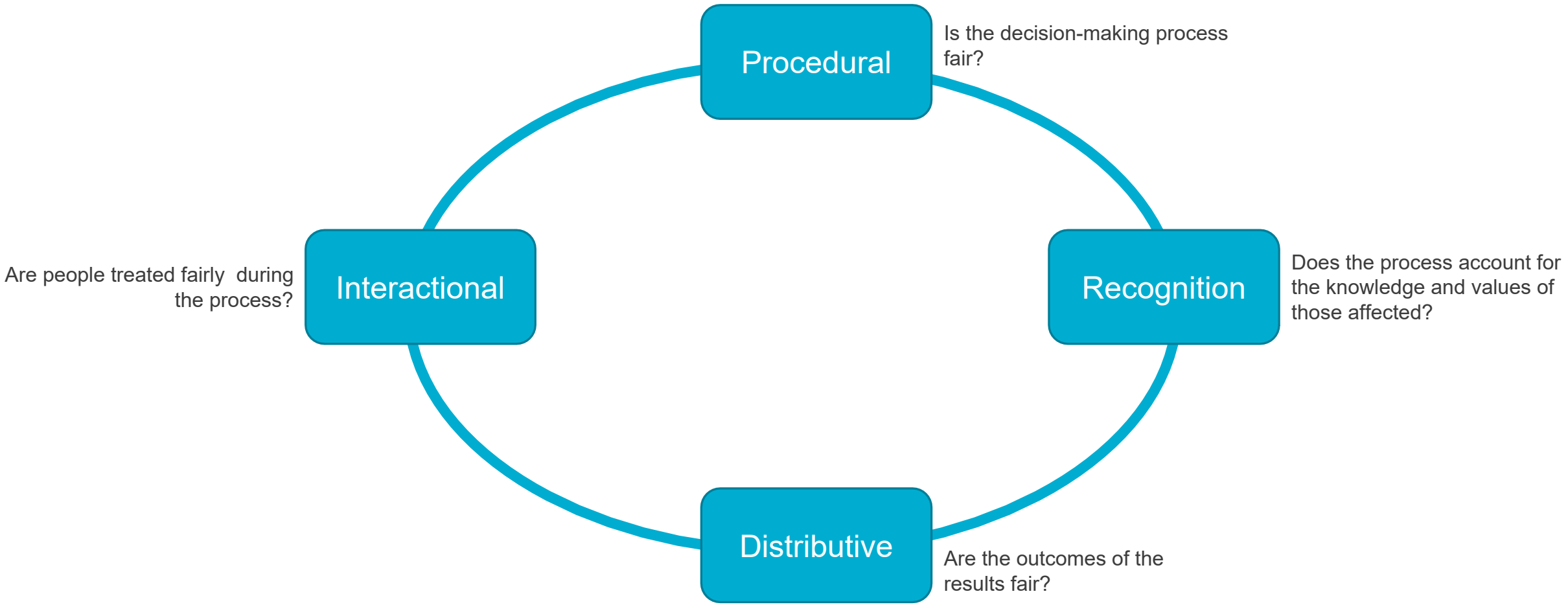
Historical vs. project-related pollution

Verification & Validation of relevant metrics?

EEEJ priorities unclear

Active area of research:
Development of performance-based metrics that are sensitive to complex causal mechanisms (including climate)

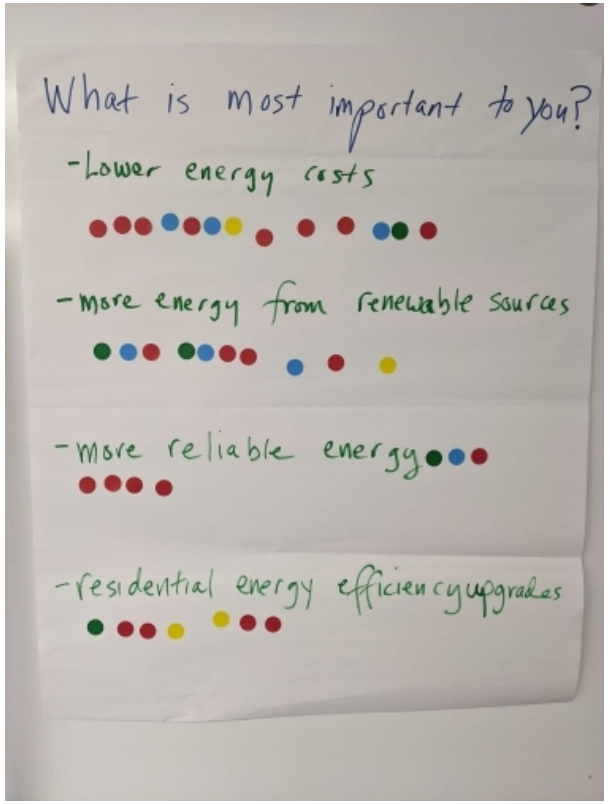
Fairness: Emphasis on Process



Source: WendyHirsch

Community Engagement

- Gain insights into…
  - priorities
  - practical barriers
  - Complex interactions between infrastructures
- Especially important for smaller, more remote communities!



Guiding Questions

What are your project objectives re: equity?

- Improve characterization
- Assess impacts from project activities

What is your logic model?

- What elements of the complex systems does the project target?
- How much do you understand the broader context?
- How will you know you are successful (i.e., measures of success)?

What datasets are needed for analysis?

- Could existing datasets be used as proxies?
- Does new data need to be collected?

How can this be done in FAIR manner?

- Are you being respectful of the stakeholders' time?
- Diversity & inclusivity considerations
  - Who or what are you potentially excluding?
  - Are you reducing burden for engagement – meeting them in their local setting, etc.?
- Can the stakeholder find, access, use the info you've collected or generated (post project completion)?

Concluding Remarks

- There are many approaches for consideration of equity and justice
  - Characterization
  - Scenario impacts
  - Energy planning
- Key dimensions
  - Emphasis on spatial and temporal variations
  - Community engagement is critical
- Ongoing work
  - Data inequities
  - Performance-based metrics

Source: Gunda and Tidwell (2019)

Thank you for your time!

Email: tgunda@sandia.gov