



*National Association of
State Energy Officials*

NASEO Webinar: Engaging with Tribal Nations and Local Communities on Clean Hydrogen

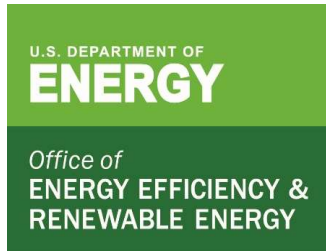
January 26, 2023

Welcome and Zoom 101

Speakers

- Michelle Fox, Department of Energy (DOE), Office of Energy Efficiency and Renewable Energy, Hydrogen Fuel Cell Technologies Office
- Hadia Sheerazi, Research Associate, Center on Global Energy Policy at the Columbia University School of International and Public Affairs (SIPA)
- Daniel Cardenas, Co-founder and Chairman, National Tribal Energy Association

Thank you!



U.S. DEPARTMENT OF
ENERGY

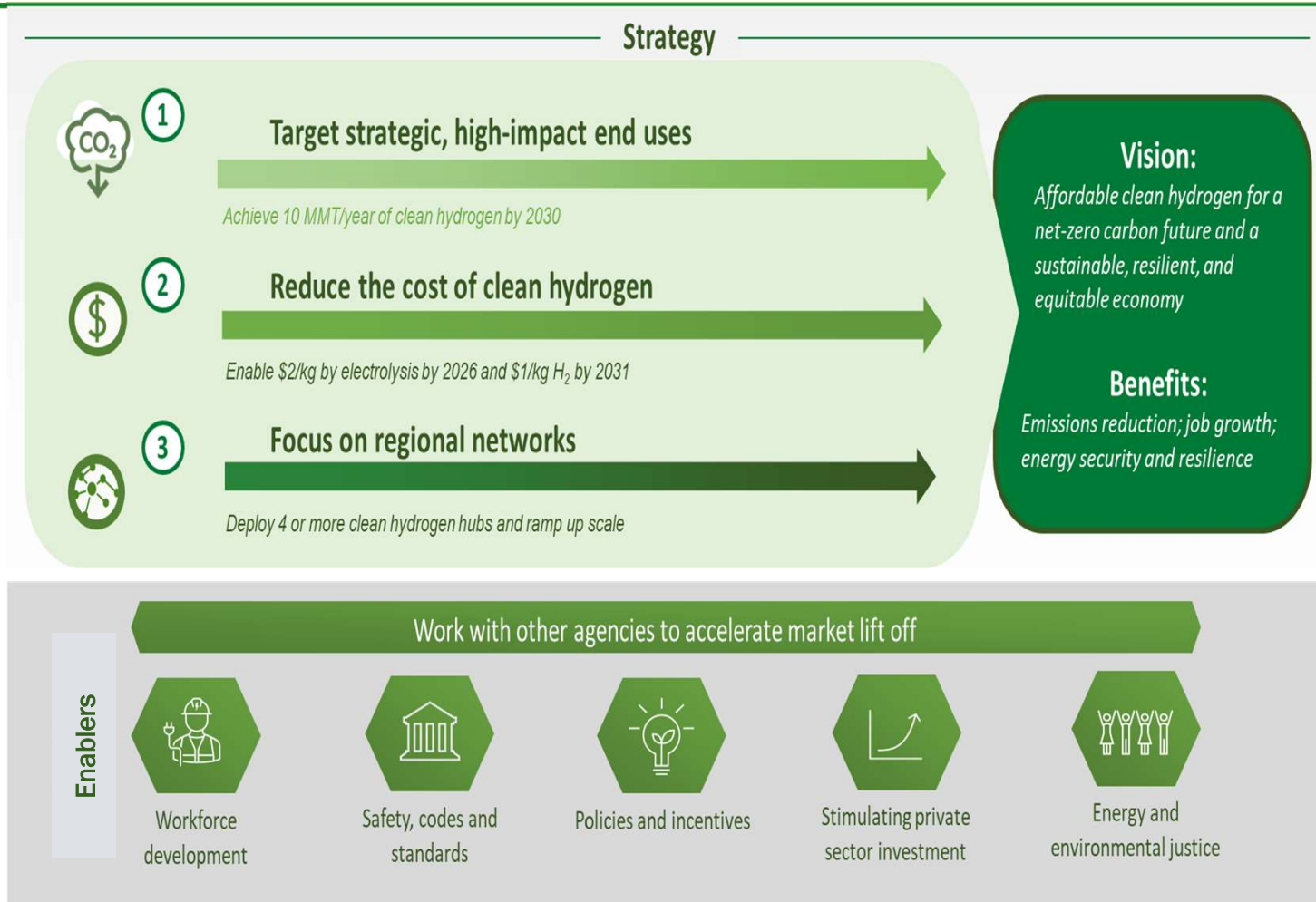
Engaging with Tribal Nations and Local Communities on Clean Hydrogen

Dr. Michelle Fox, Senior Advisor, Hydrogen and Fuel Cell Technologies Office
Energy Efficiency and Renewable Energy
U.S. Department of Energy

January 26, 2023



DOE National Clean Hydrogen Strategy and Roadmap



Existing Tools & Goals for engagement

- **Tools:**
 - English-only
 - RFIs
 - Webinars
 - Technical Workshops & Meetings
 - Prepared Remarks
 - Reports
- **Goals:**
 - Inform experts
 - Advance R&D, set targets
 - Identify challenges with development and deployment

H2 EEEJ Strategy Goals

I. Listening,
Engaging &
Increasing
Transparency

II. Reducing Harm
& Tangible Impacts

III. Lowering
Barriers to
Participation

IV. Creating a
Diverse & Inclusive
Hydrogen
Workforce

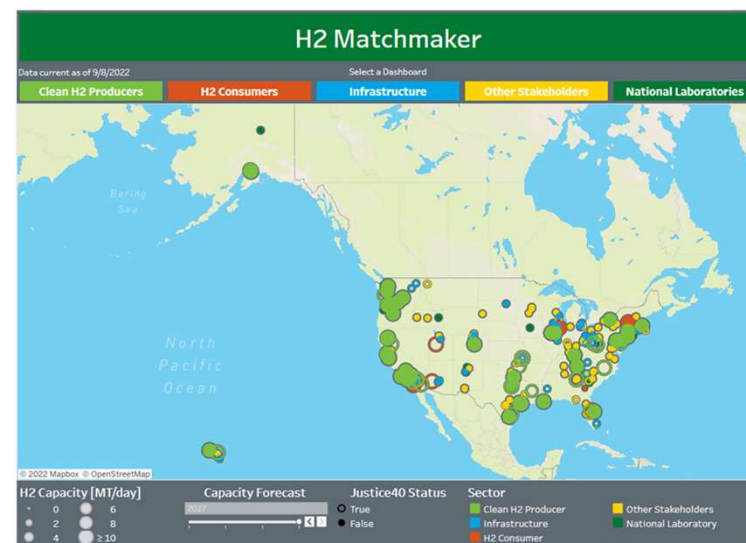
V. Building Internal
Capacity

Evolving Tools & Goals for Engagement

- **Tools**
 - Listening Sessions
 - Place-based meetings
 - Multiple formats for contributions
 - Accommodation based on audience needs
- **Goals:**
 - Learn about community priorities
 - Increase public knowledge about hydrogen technologies
 - Provide accurate information to frontline and fenceline communities
 - Engage early & continue throughout lifecycle of project
 - Provide opportunities for co-creation

Addressing Barriers and Advancing Equity

- **Sample of changes we've made:**
 - Required Community Benefits Plans in Funding Opportunities
 - Different goals for R&D vs D&D
 - Using other funding mechanisms
 - Providing advance notice as a standard practice
 - Offering teaming opportunities
 - Expanding our pool of reviewers
 - Recruiting Special Purpose Reviewers
 - H2 Matchmaker



Challenges remain

- Coordination
- Staff capacity
- Public understanding of hydrogen
- Cost share
- Community capacity building
- Direct remuneration
- Reaching communities, not CBOs

Additional EJ Resources

- [Creating a Community and Stakeholder Engagement Plan 8.2.22.pdf \(energy.gov\)](#)
- [Strengthening Tribal Consultation and Engagement with Tribal Leaders | Department of Energy](#)
- [Summary: Responses to the Request for Information on Inclusive Innovation and Entrepreneurship in Climate Technology | Department of Energy](#)
- Additional Guidance for R,D,D & D Community Benefits Plans: <https://oecd-exchange.energy.gov/FileContent.aspx?FileID=9c024599-7d5c-4e84-9029-d307d7621ab7>
- [Community Benefit Agreement \(CBA\) Toolkit | Department of Energy](#)
- Community Benefits 101 Webinar: <https://youtu.be/Nig-YWjpnkE>
- Sample Quick Start guide: [Community Geothermal Heating and Cooling Design and Deployment Funding Opportunity Quick Guide | Department of Energy](#)

Resources and Opportunities for Engagement

Save the dates:
**2023 DOE Annual Merit Review and Peer
Evaluation Meeting June 5-8, 2023**

**In-person – see www.hydrogen.energy.gov
And October 8th, every year for Hydrogen Day**



**Join Monthly
H2IQ Hour Webinars**
**Download
H2IQ For Free**



**Visit H2tools.Org For
Hydrogen Safety And
Lessons Learned**
<https://h2tools.org/>

**CENTER FOR
Hydrogen
SAFETY**
Connecting a Global Community
www.aiche.org/CHS



Sign up to receive hydrogen and fuel cell updates
www.energy.gov/eere/fuelcells/fuel-cell-technologies-office-newsletter

Learn more at: energy.gov/eere/fuelcells AND www.hydrogen.energy.gov

Thank You

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www.hydrogen.energy.gov



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Columbia University Climate School

 COLUMBIA | SIPA
Center on Global Energy Policy

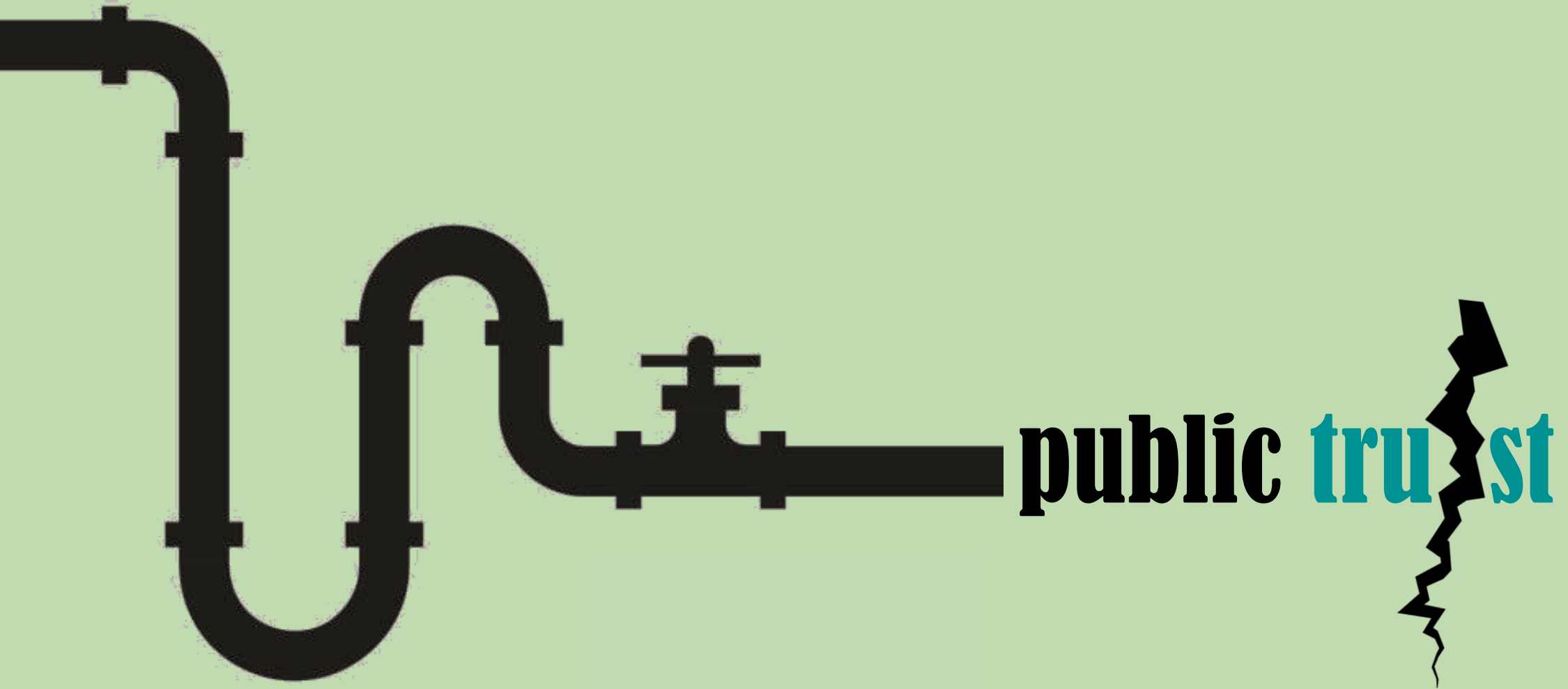
HYDROGEN LEAKAGE: A POTENTIAL RISK FOR THE HYDROGEN ECONOMY

ZHIYUAN FAN, HADIA SHEERAZI, AMAR BHARDWAJ, ANNE-SOPHIE CORBEAU, KATHRYN LONGOBARDI, ADALBERTO CASTAÑEDA, ANN-KATHRIN MERZ, DR. CALEB M WOODALL, MAHAK AGRAWAL, SEBASTIAN OROZCO-SANCHEZ, DR. JULIO FRIEDMANN

Additional resources:

1. Environmental Defense Fund (EDF). "Climate consequences of hydrogen emissions." report. <https://acp.copernicus.org/articles/22/9349/2022/>
2. European Commission's joint research centre (JRC). "Hydrogen emissions from a hydrogen economy and their potential global warming impact," report. <https://publications.jrc.ec.europa.eu/repository/handle/JRC130362>
3. University of Strathclyde and CSIRO. (2022, August 10). "Communicating leakage risk in the hydrogen economy: Lessons already learned from geoeconomy industries." <https://www.frontiersin.org/articles/10.3389/fenrg.2022.869264/full>





Public confidence in:

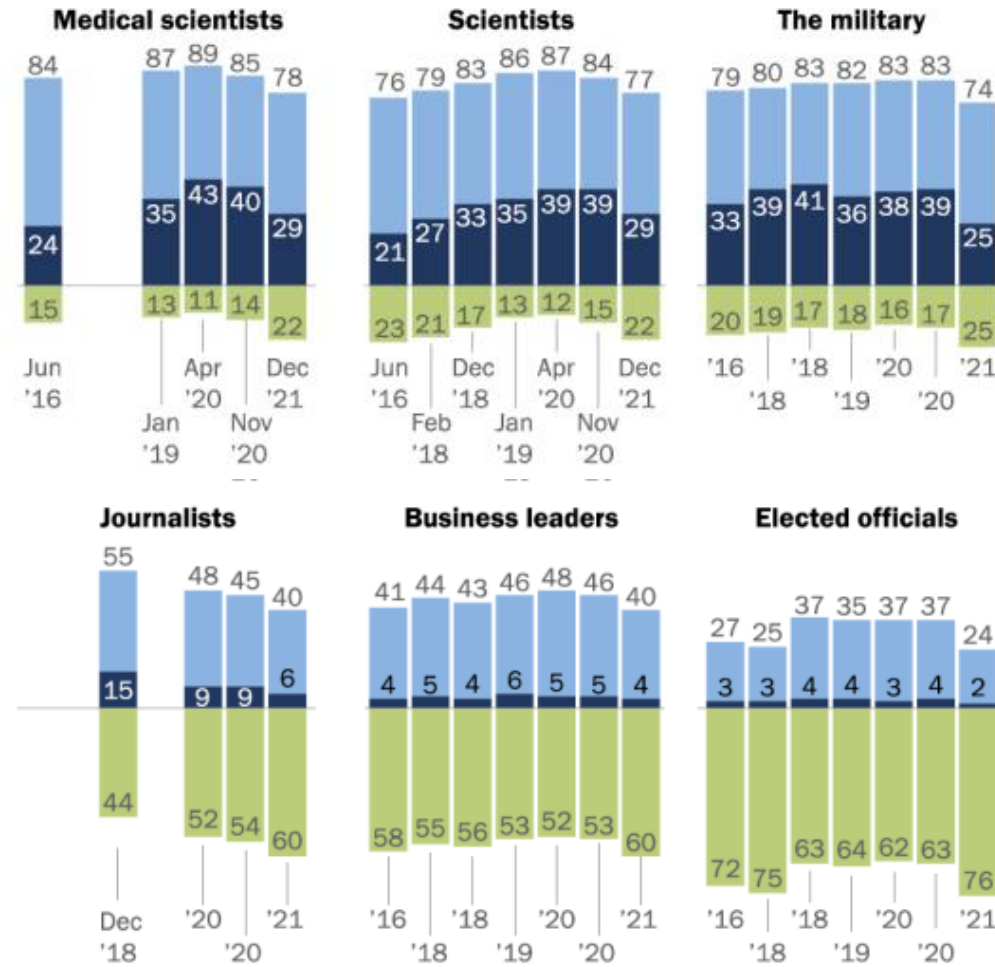
1. *Scientists;*
2. *Medical scientists*
3. *Journalists;*
4. *Business leaders, and;*
5. *Elected officials*

has **declined** over the last year.

The survey was conducted November 30 to December 12, 2021, among **14,497 U.S. adults**, as the omicron variant of the coronavirus was first detected in the United States (nearly two years since the coronavirus outbreak took hold).

% of U.S. adults who have ____ of confidence in the following groups to act in the best interests of the public

● A great deal ● A fair amount ● Not too much/No confidence at all

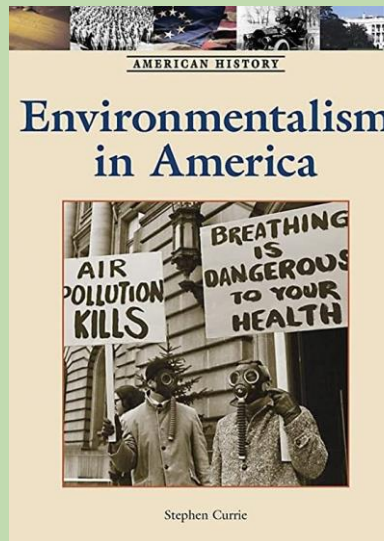
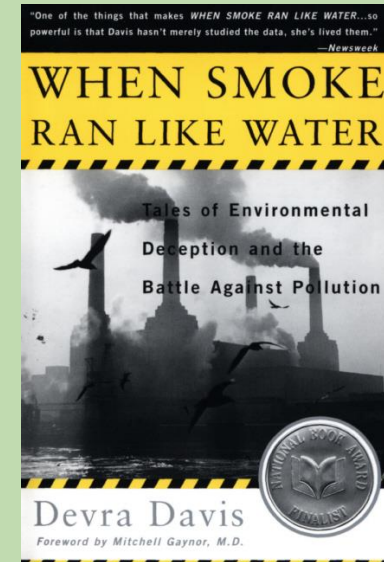
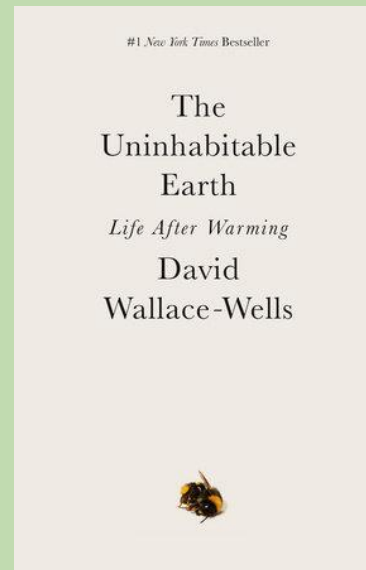
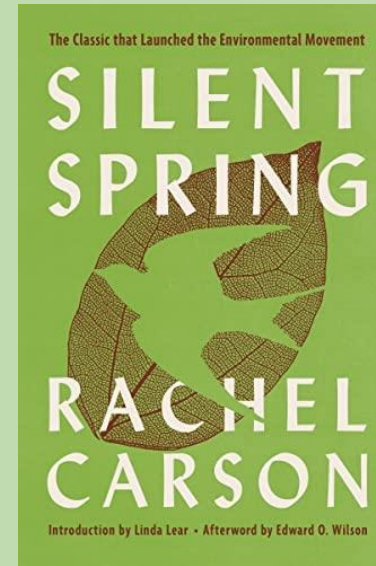
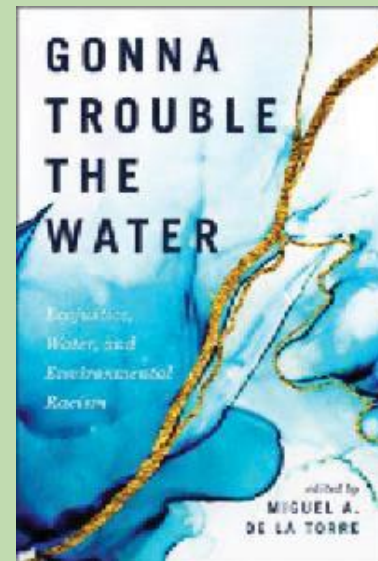
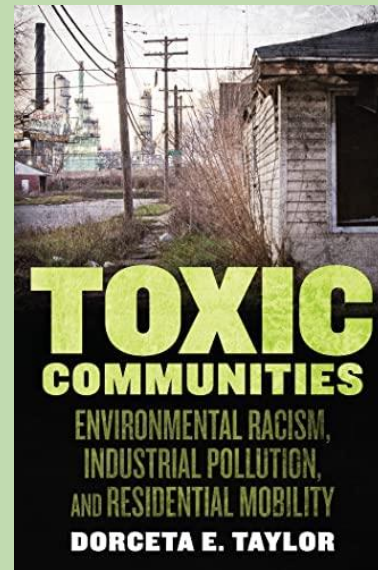
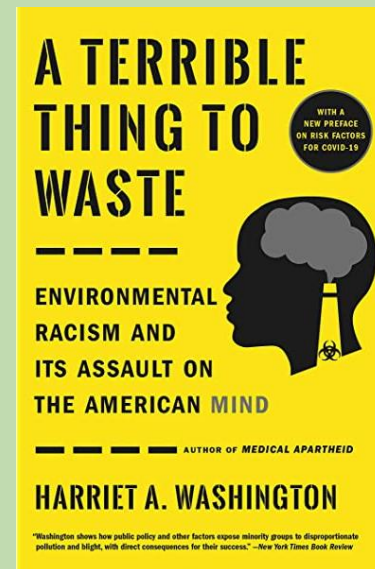
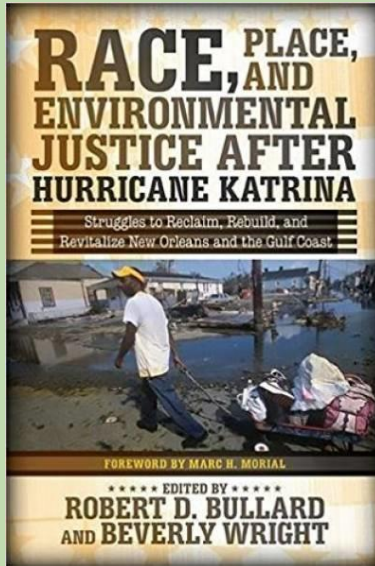
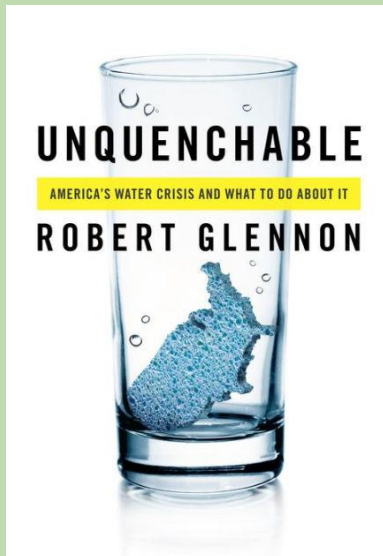
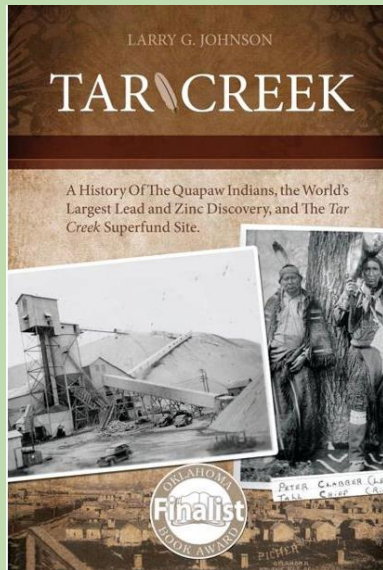
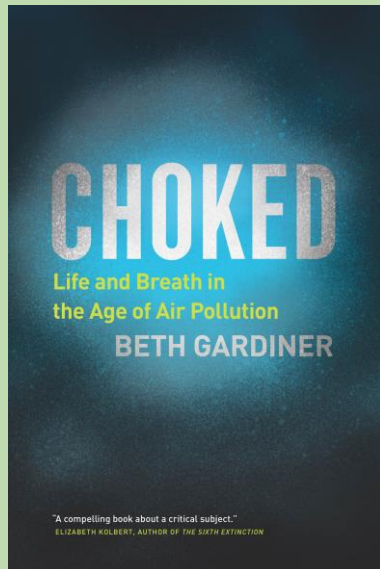
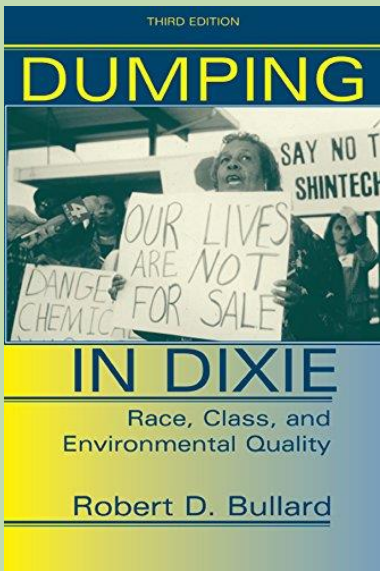


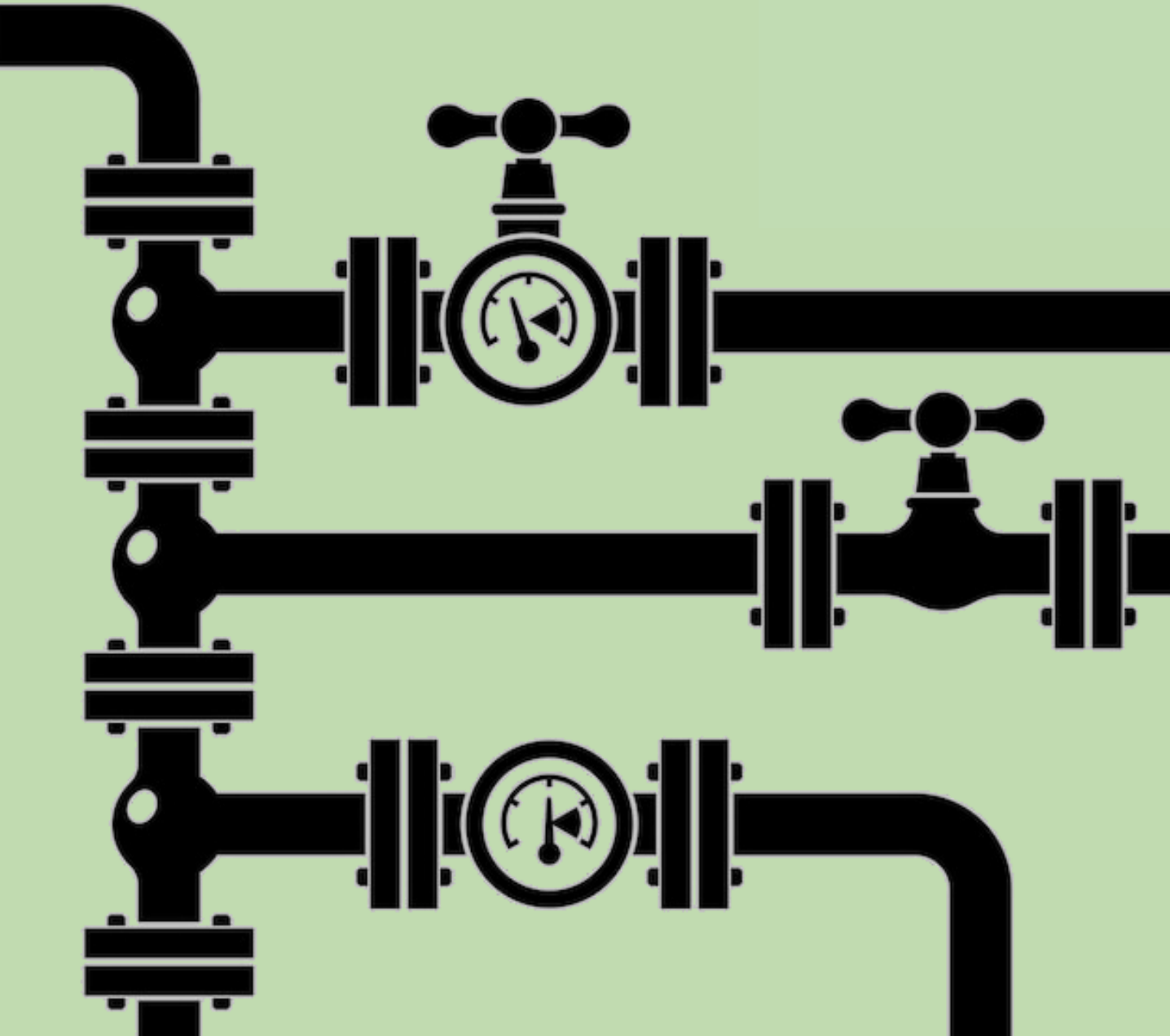
Note: Respondents who did not give an answer are not shown.

Source: Survey conducted Nov. 30–Dec. 12, 2021.

"Americans' Trust in Scientists, Other Groups Declines"







community benefits agreements (CBAs)

trans·par·en·cy

/tran(t)'sperənsē/



in·clu·sion

/in'klʊdʒən,ɪŋ'klʊdʒən/

+

ac·ces·si·bil·i·ty

/ək'sesə'bilədē/



com·mit·ment

/kə'mitm(ə)nt/



feed·back

/ˈfēdˌbak/





community engagement

hy·per lo·cal

/ˈhīpər/ /ˈlōkəl/



Hydrogen Villages experiment in the U.K. ...

23MM homes are currently connected to the gas grid (accounting for about 17% of U.K.'s GHG emissions). The pilot will offer a choice between H₂ or electrification/heat pumps, with all new appliances provided free of charge.

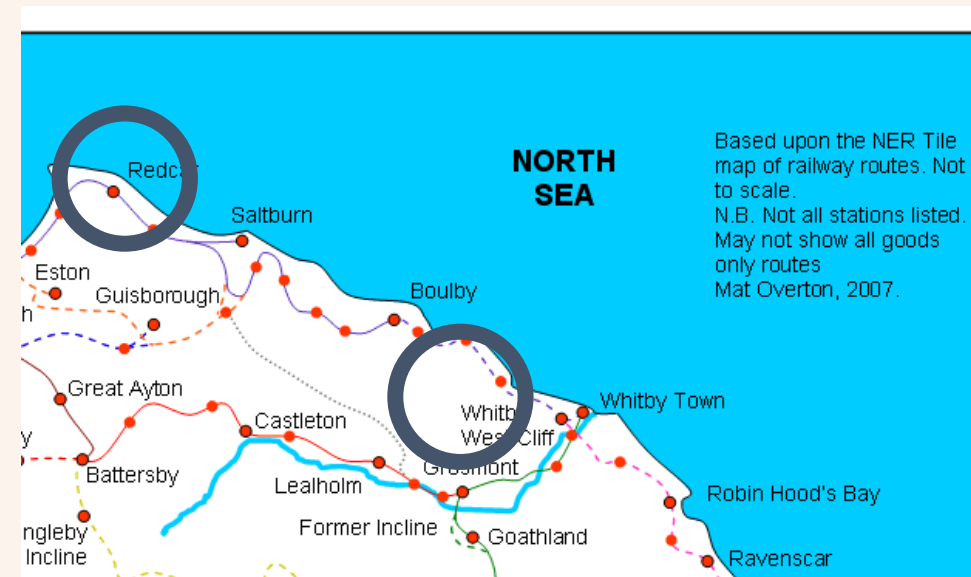
Cadent in Ellesmere Port

Residents were **"surprise[d] to learn"** that Cadent had submitted the Ellesmere Port to be considered for the pilot, and were "deeply concerned" that the firm made the submission **without their support**. [Residents] said questions to the firm had been left unanswered, **leaving constituents in "a lot of doubt."**

Stephen Lyth, who lives just round the corner, said **he and his wife feel like "lab rats."** Both the gas companies and the government say residents are worrying needlessly about safety.

That doesn't wash with Tom Baxter, an expert in Chemical and Process Engineering and Visiting Professor at the University of Strathclyde. **"Would you buy a car from a salesman who said, 'This car will crash more often but because of the safety features, we will be just as safe?'"** he asks.

Kate Grannell, another concerned resident, set up a Facebook page to **help her neighbors get independent advice** about H₂. She's also been taking queries directly to the gas companies. "At the start we had about 140 questions," she says. **"Just over eight weeks later we still haven't had answers to those questions."** The queries include: *What happens after the two-year trial ends? Will they be returned to natural gas? What if hydrogen is more expensive? How might it impact house prices and could they lose out financially from taking part?*



Hydrogen Villages experiment in the U.K. ...

Dr. Jan Rosenow, an energy expert and director of European programmes at the Regulatory Assistance Project, told the BBC that **heating a home with this "green" hydrogen uses 5 or 6 times more electricity (to produce the H₂)** than using the same renewable electricity to drive a heat pump.

*"When you look at it from a sort of scientific perspective and a consumer perspective **the evidence is pretty clear that it's not a good idea,**"* he says.

Mr. Rosenow **sees the H₂ trials as [an] attempt by gas suppliers and distributors to hold onto their market share** as the UK moves away from using natural gas.

Whichever gets the green light, it will be hard for residents to object further.

Legislation currently passing through the British parliament would **give gas distributors powers of entry into homes in order to enforce the transfer away from natural gas.**

A government factsheet says this would only be used as a "last resort" and that those who don't want H₂ should choose electric heating instead.

Northern Gas Networks in Redcar, Teesside

Steve Rudd, **a resident in Redcar, said hydrogen was "inherently unsafe"** – it has also been reported that other residents are worried about hydrogen's more harmful emissions.

The report claims that **people believe hydrogen is more explosive and generates more harmful nitrogen oxide** than natural gas.

Do's of community engagement

engage
early
& often

address
known risks
&
the unknown
risks

provide
the
proof!

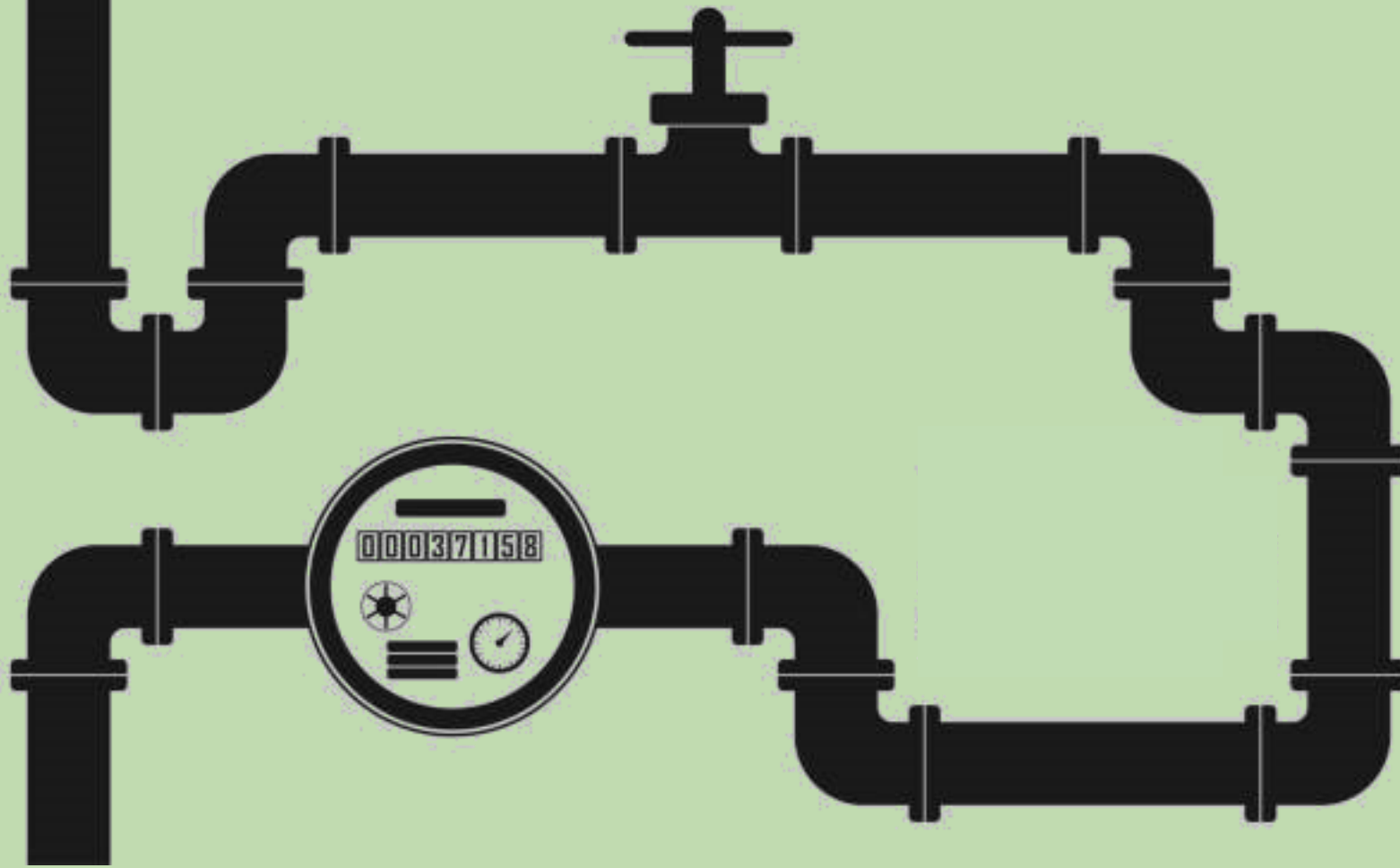
explain
complex concepts
clearly

genuine
respect for
local
traditions &
customs

rehabilitate public
trust
+
build
local trust
in the project & site
teams

monitor
all
impacts &
benefits
+
seek
feedback

honesty
+
transparency
+
ethics
(always)



public perception of **GreenH2** in the U.S.



⚠ leakage risk?

- > **airborne + satellite measurements** of methane (CH₄) emissions **across the natural gas value chain** have shown that there is **often significant leakage**.
- **H₂ is the smallest molecule** in the Universe i.e. **much harder to contain**.
- > Natural gas **blended with H₂** will be **prone to the same leakage problems**.
- > the **farther H₂ travels** between production & end-use, the **greater the potential for leakage**.
- > **H₂ uses** should ideally be concentrated or in close proximity to production sites.

⚠ safety risk?

California Public Utilities Commission's "Hydrogen Blending Impacts Study"

- > H₂ **blends of up to 5%** in the natural gas stream are **generally safe**;
- > H₂ **blends > than 20%** present a **higher likelihood of permeating plastic pipes**, which **can increase the risk of gas ignition outside the pipeline**,"

additional studies + real world demos
on blending H₂ into existing natural gas
systems **are needed to ensure safety**.

⚠️ warming potential?

Environmental Defense Fund (EDF) estimates:

In the **best-case scenario**, EDF assumes a 1% leak rate across the value chain for hydrogen produced from natural gas and CCS (including an additional 1% methane leak rate), which would result in a 70% cut in warming effects compared to traditional fossil fuels. **For renewable hydrogen (with a 1% leak rate), there is a 95% cut in warming effects.** For the same pathways in the **worst-case scenario (assuming a 10% hydrogen leak rate, 3% methane leak rate)**, the benefits compared to fossil fuels are less significant, **ranging from a 20-year warming impact increase of 25% to a 2/3rds reduction.**

“... when we look at the relative warming impact from continuous instead of pulse emissions - which are more representative of the real world - **H2 is 100X more potent than CO2 emissions over a 10-year period.**”

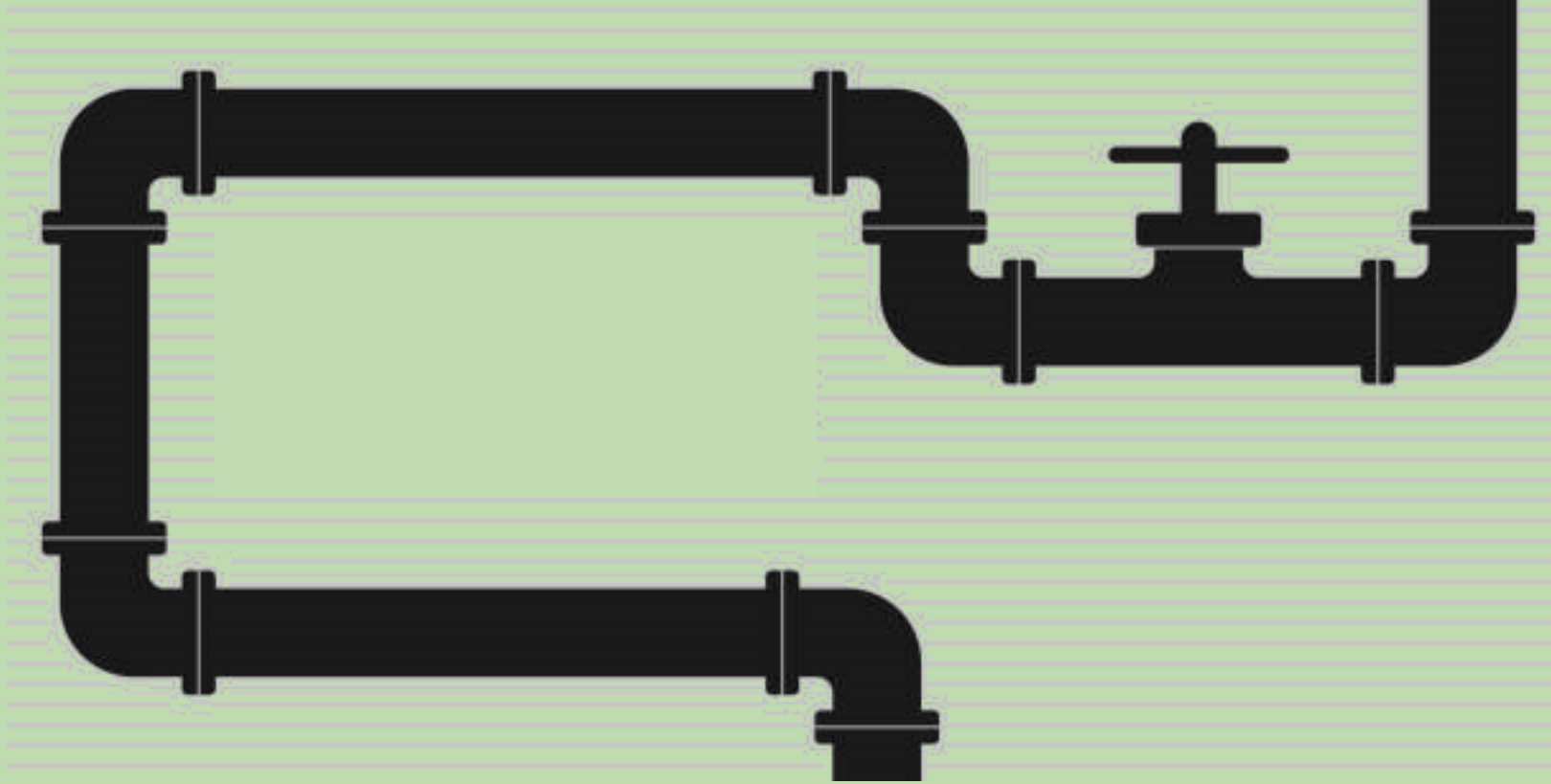
“An average leak rate of 1% would only add about 0.025°C to global warming by 2050, but **5% or 10% leakage could increase average worldwide temperatures by more than 0.1°C or 0.4°C, respectively.**”

⚠️ what about NO_x ?

The DOE FOA references “low NO_x turbines.” People with respiratory illnesses (**esp. children + the elderly**) are at > risk for adverse health effects from short-term high exposure.

No_x pollution **can worsen asthma and heart disease**, & linked to elevated risks of **premature death**.

NO_x also reacts with volatile organic compounds (VOCs) in the atmosphere to produce ozone (**smog**) on hot summer days. It also contributes to the formation of **acid rain** & **nutrient pollution** in coastal waters.



**disadvantaged
communities (DACs)**

Climate change

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [expected agriculture loss rate](#) OR [expected building loss rate](#) OR [expected population loss rate](#) OR [projected flood risk](#) OR [projected wildfire risk](#)

Health

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [asthma](#) OR [diabetes](#) OR [heart disease](#) OR [low life expectancy](#).

Housing

Communities are **identified as disadvantaged** if they are in census tracts that:

Experienced [historic underinvestment](#) OR are at or above the 90th percentile for the [housing cost](#) OR [lack of green space](#) OR [lack of indoor plumbing](#) OR [lead paint](#)

Workforce development

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [linguistic isolation](#) OR [low median income](#) OR [poverty](#) OR [unemployment](#)

AND fewer than 10% of people ages 25 or older have a [high school education](#) (i.e. graduated with a high school diploma)

Energy

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [energy cost](#) OR [PM2.5 in the air](#)

Transportation

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [diesel particulate matter exposure](#) OR [transportation barriers](#) OR [traffic proximity and volume](#)

Legacy pollution

Communities are **identified as disadvantaged** if they are in census tracts that:

Have at least one [abandoned mine land](#) OR [Formerly Used Defense Sites](#) OR are at or above the 90th percentile for [proximity to hazardous waste facilities](#) OR [proximity to Superfund sites \(National Priorities List \(NPL\)\)](#) OR [proximity to Risk Management Plan \(RMP\) facilities](#)

Water and wastewater

Communities are **identified as disadvantaged** if they are in census tracts that:

ARE at or above the 90th percentile for [underground storage tanks and releases](#) OR [wastewater discharge](#)

AND are at or above the 65th percentile for [low income](#)

U.S. Department of Energy's working definition of disadvantaged is based on cumulative burden and includes data for **36 burden indicators** collected at the census tract level.

These burden indicators can be grouped across the following four categories:

- **Fossil Dependence** (2)
- **Energy Burden** (5)
- **Environmental + Climate Hazards** (10)
- **Socio-economic Vulnerabilities** (19)



sample metrics by Benefit Category



Benefit Category	Metric	Measurement
Reducing energy burden	Reduction in energy costs due to technology adoption	Annual energy expenditures (\$s) in DACs before & after program intervention
Reducing environmental burden	Reduction in local pollutant emissions	Measurement of local pollutant (NO _x , SO ₂ , PM _{2.5}) in DACs before and after program intervention
Increase clean energy access	Increase access to clean energy serving DACs	% of local electricity generation mix from clean energy that serves DACs
Increase access to low-cost capital	Increase loans to MBEs/DBEs	Loans \$'s awarded to MBEs/DBEs in DACs / total \$'s of loan awarded
Increase enterprise creation	Increase contracts to MBEs/DBEs	# of contracts to MBEs/DBEs / total # of contracts
Increase clean energy jobs & training	Increase clean energy jobs in DACs	# of jobs created in DACs / total # of jobs created
Increase resilience	Increase community resilience	Energy storage deployed in DACs / total energy shortage deployed
Increase energy democracy	Increase stakeholder engagement	# of events with community groups in DACs / total # of events

“A census tract is identified as “**disadvantaged**” if it exceeds the threshold for an environmental indicator and for socioeconomic indicators.” Federally Recognized Tribes, including Alaska Native Villages, are also considered DACs.

Top 10 Most Disadvantaged Communities
by State

Rank	County / State	% of population in DACs (disadvantage categories exceeded: 5 or above)
1	Puerto Rico	94%
2	Mississippi	52%
3	Arkansas	46%
4	West Virginia	46%
5	New Mexico	44%
6	Louisiana	42%
7	Alabama	39%
8	Oklahoma	38%
9	Kentucky	37%
10	California	36%

Top 10 Most Disadvantaged Communities
by Country

Rank	County / State	% of population in DACs (disadvantage categories exceeded: 5 or above)
1	Bronx County, NY	50%
2	Coahoma Country, MS	43%
3	Allendale County, SC	40%
4	St. Louis City, MO	33%
5	Baltimore City, MD	31%
6	Orleans Parish, LA	29%
7	Washington Parish, LA	23%
8	Los Angeles Country, CA	22%
9	Philadelphia Country, PA	21%
10	Forrest Country, MS	19%

Bulut, Elif. (2022, October 18). “A snapshot of disadvantage in the United States,” ArcGIS Blog. <https://www.esri.com/arcgis-blog/products/bus-analyst/national-government/a-snapshot-of-disadvantage-in-the-united-states/>



A 'Tsunami Of Shutoffs': 20 Million US Homes Are Behind On Energy Bills

August 23, 2022

Bloomberg News | Article Written By Will Wade And Mark Chediak | Photographer: Michael Nagle

Surging Electricity Prices Spur Worst-Ever Crisis In Late Utility Payments

Adrienne Nice woke up early on the morning of July 25 to news she'd been dreading. The power company, Xcel Energy Inc., had shut off the electricity to the small Minneapolis

"Shutoffs are
fall behind on
likely become

\$20B

in unpaid energy debt across the U.S.

during the COVID-19 pandemic + energy crisis + runaway inflation + unemployment

20MM households

(1 in 6 households) couldn't afford their energy bills

>\$2B

of the energy debt is held by

1.2MM households in New York

avg. energy debt in NY ranges from \$1,400 to over \$2,000

~\$1.7B utility + \$1B water

of debt held by

~2MM households in California

~\$2.4MM in utility debt relief was issued by the state

New Jersey	115
California	96
Pennsylvania	90
New York	86
Michigan	65
Texas	56
Florida	52
Washington	46
Illinois	45
Indiana	39
North Carolina	38
Ohio	37
Wisconsin	36
Missouri	33
Massachusetts	32
Virginia	29
South Carolina	27
Minnesota	25

1,336
uncontrolled hazardous waste sites

The Bipartisan Infrastructure Law announced

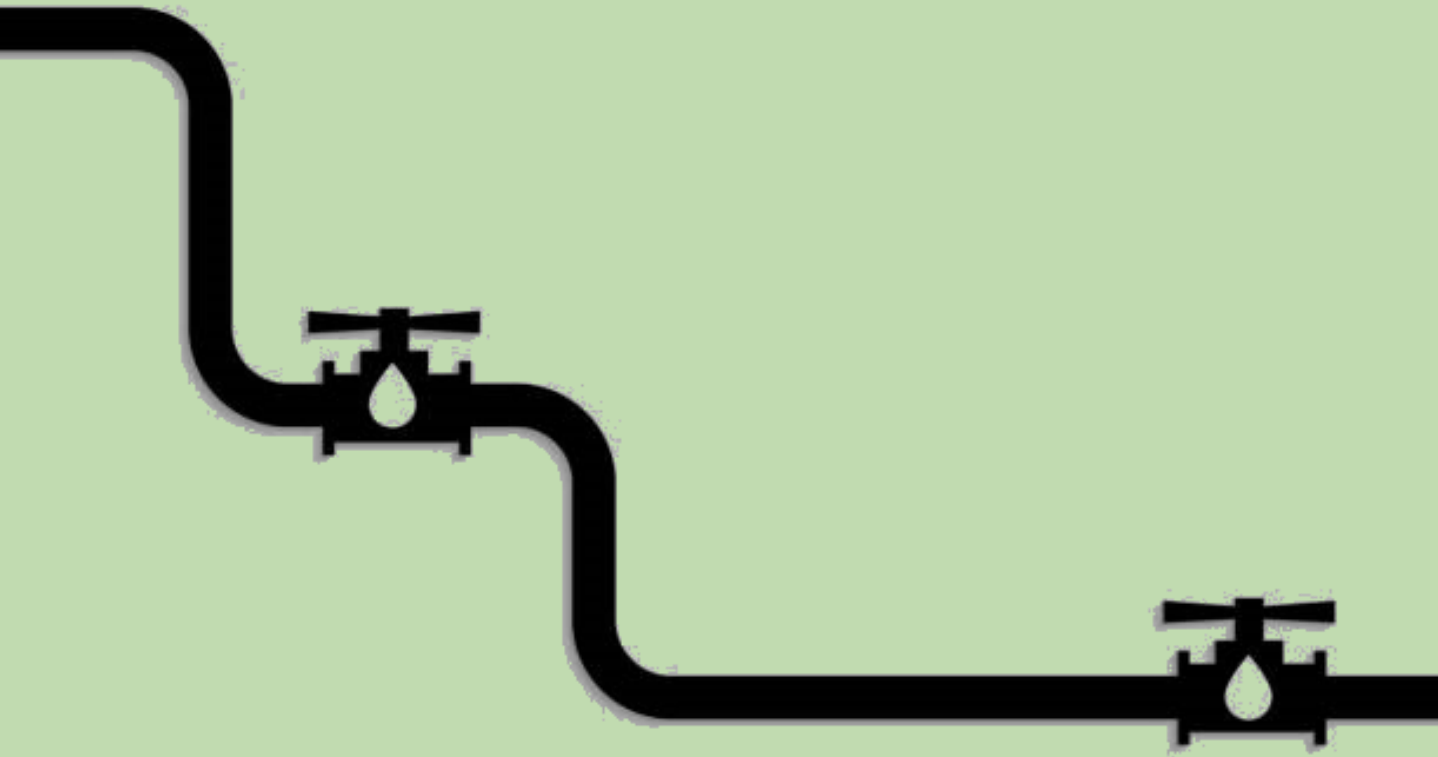
\$3.5 billion
in environmental remediation at
Superfund National Priorities List (NPL) sites

~\$2,619, 760 per site

or

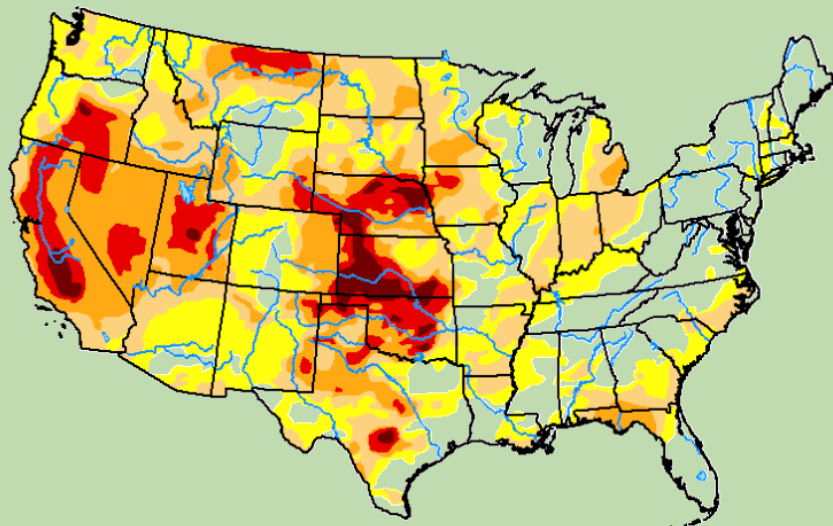
\$51,020,408 per backloged site
(avg. clean up costs per year are in the hundreds of millions)

GreenH2 Hub project developers in each state may be a
“Potentially Responsible Parties” (PRP) in at least one
(if not more) superfund and/or brownfield sites,
and can allocate a % of the minimum 40% benefits to
supplement the funds marked for hazardous site cleanup
under BIL.



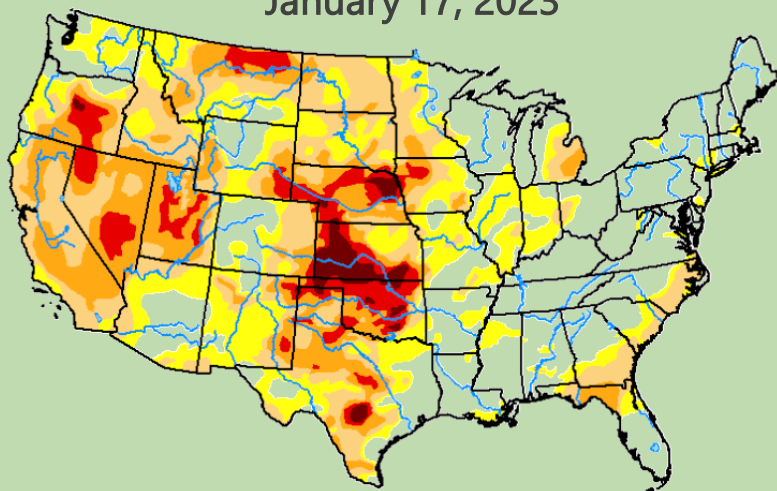
all **water** is not
created equal

December 27, 2022



3 weeks (and ~25 trillion gallons of rain in CA) later ...

January 17, 2023



Megadroughts

are *intense* drought events that **last for at least 20 years.**


(NOAA, 2021).

For the past 20 years, the **southwestern United States** has been desiccated by one of the most severe long-term droughts — or ‘megadroughts’ — **of the last 1,200 years.**

1 kg of H₂ requires ~9 liters of 

The U.S. DOE's expects
that the Regional Clean H₂Hubs will have
the capability of producing impactful
quantities of clean H₂ at a minimum rate of
at least
50-100 metric tons (MT) per day


50,000-100,000 kg of H₂ per day
would require


450,000 L - 900,000 L of 
per day

+ water for cooling and other industrial purposes

• groundwater 

• surface water 

• recycled water 
> “purple water” can be used for Green H₂

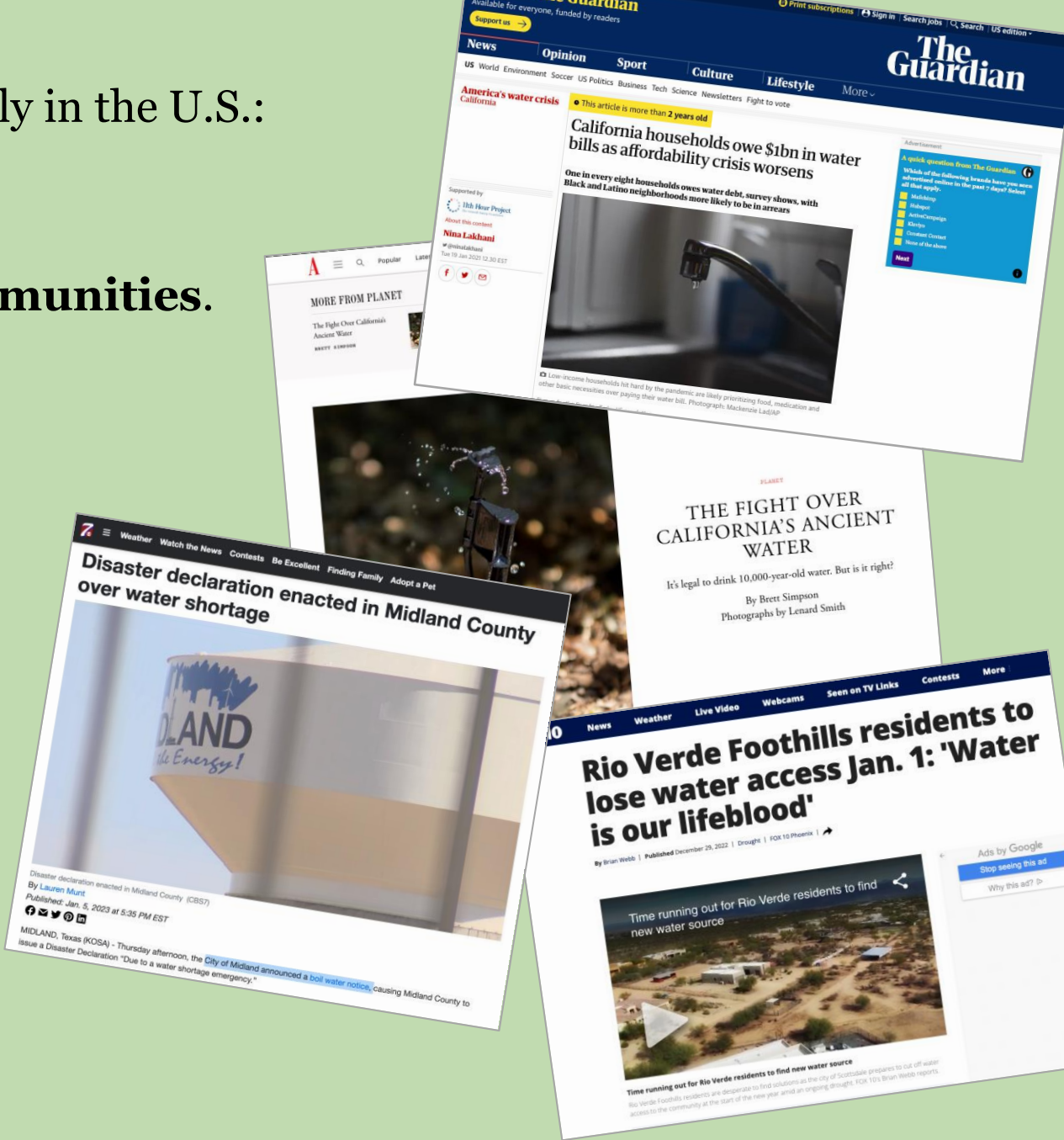
• desalinated water 
> costs ~\$**0.70-3.20 per m³ of purified water**
depending on the size and location of the plant.
> **environmental issues** from disposal of “brine.”

Water insecurity is not experienced equally in the U.S.:

Many of the cities or regions experiencing poor water access or conditions are in predominantly Black or Hispanic communities.

Water is not priced equally in the U.S.:

Highest (\$91-\$49/month)	Lowest (\$18-\$26/month)
West Virginia	Wisconsin
California	Vermont
Oregon	North Carolina
Washington	Louisiana
New Jersey	Nebraska
Connecticut	Mississippi
Alaska	Maine
Arizona	South Dakota
Hawaii	Nevada
Wyoming	Illinois
Kentucky	Arkansas





Thank You!