Communication Working Group White Paper

Proven Principles of Effective Climate Change Communication

COMMISSION ON ACCELERATING CLIMATE ACTION

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Veronica Johnson, chief meteorologist at WJLA, gives the weather forecast
on air at the station in Arlington, VA, on Tuesday, January 10, 2023.
Photo by Matt McClain/*The Washington Post* via Getty Images.

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This publication identifies examples that illustrate 12 climate change communication principles.

1. **Prioritize a climate frame in news.** News media can increase the salience of climate change by relating its effects (for example, an increase in extreme weather events such as wildfires, drought, and hurricanes) to human causes.

2. **Communicate consensus.** People are more likely to believe climate change is happening and caused by human beings if they understand that the scientific evidence justifies these conclusions and that there is a scientific consensus about both.

3. **Change social norms.** People are susceptible to peer pressure. When individuals feel that their neighbors expect them to act in a more climate-friendly way, those individuals are more likely to take science-consistent climate action.

4. **Overcome the spiral of silence (if you believe it, say it).** Those who view the belief in the realities of climate change as an unpopular position are less likely to share their science-consistent beliefs about it with others, which makes others who may agree less likely to voice their views as well. To overcome the "spiral of silence," people should share their science-consistent climate views.

5. **Emphasize nonscientific identities.** Scientists and other experts can minimize the polarizing effects of tribal identity by emphasizing aspects of identity that they share with their audience. While many Americans oppose elitism and, correspondingly, messages from elite scientists, people identify with those they see as like them.

6. **Frame climate change as an in-group issue.** People listen to and believe people they think of as like them and as liking them. Such in-group validation increases the acceptance of climate realities among those who identify with groups historically associated with a rejection of climate action.

7. **Make messages locally relevant.** Many people in the United States align their identity with groups that have historically doubted climate change. When communicators convey information about a changing climate without attacking these identities, they can convince people more readily. Those who see an issue as local are more likely to be concerned about it and are more likely to support policy solutions to it. Strategies to accomplish this include adapting messages to local audiences and communicating through local messengers.

8. **After priming an accuracy motivation, encourage audiences to draw their own conclusions.** Asking audiences to focus on accuracy before presenting data can minimize motivated reasoning. Inviting audiences to examine the scientific data and draw their own conclusions serves that purpose.

9. **Combine hope with actions.** When provided with engaging stories that convey hope, people are more likely to take action. Narratives have unique persuasive power. People who are confident their actions will have an effect are more likely to feel motivated to act.

10. **Help people take actions themselves.** When problems are seen as large, individuals can become fearful and hopeless. People engage with climate science and support taking action when they believe that the actions they, as individuals, take will matter.

11. **Demand accountability.** Organizations are not only collections of individuals; they also respond to the collective demands of those on whom they depend for survival. One of the individual actions that a person can take is to insist that the groups of which they are a part (for example, local, state, and federal governments; businesses; social groups; educational and financial institutions) engage in the kinds of science-consistent action required to create a sustainable future.

12. **Encourage commitments in the form of accountable climate action plans.** When people, organizations, and governments make concrete commitments through climate action plans, they are more likely to take the promised action. Concrete commitments also help others hold them more accountable and reduce the likelihood of greenwashing.

Principle 1
Prioritize a Climate Frame in News

News media can increase the salience of climate change by relating its effects (for example, an increase in extreme weather events such as wildfires, drought, and hurricanes) to human causes.

Put succinctly by political scientist Bernard Cohen in 1963, the press "may not be successful much of the time in telling people what to think, but it is stunningly successful in telling its readers what to think about" (Cohen 1963). Consistent with Cohen's postulate, after surveying potential voters in Chapel Hill, North Carolina, journalism scholars Maxwell McCombs and Donald Shaw (1972) found that the media's agenda setting, or how frequently and to what degree an outlet features an issue, was powerfully correlated (+0.967) to what voters considered to be a campaign's most salient issues. Two decades later, John Kingdon (1995) argued that highly salient issues are more likely to be discussed and prioritized by governmental institutions. Significantly, issues that are prominently featured in the news factor more highly in voter decisions about political candidates (Iyengar and Kinder 2010). Subsequent research that included media coverage of climate change found that mainstream media also can influence agenda setting when filtered through social media, an effect that was strongest among those with low levels of political interest (Feezell 2017).

To put this communication theory simply, agenda setting focuses the public's attention on certain issues in consequential ways.

The challenge to be addressed:
Although 65 percent of American adults are worried about global warming, the Yale Program on Climate Change Communication found that only 33 percent of American adults hear about climate change in the news about once a week or more; the other 67 percent hear about climate change once a month or less often (Marlon et al. 2022).

In June 2022, Gallup data indicated that Americans are not prioritizing climate change as an issue. When asked, "What do you think is the most important problem facing the country today?" 2 percent answered, "Environment/Pollution/Climate change" (Gallup 2022).

The climate science:
In a report analyzing extreme weather events of 2016, scientists noted,

> some extreme events [such as record global heat, heat across Asia, and a marine heat wave off the coast of Alaska] were not possible in

a preindustrial climate. . . . Climate attribution scientists have been predicting that eventually the influence of human-caused climate change would become sufficiently strong as to push events beyond the bounds of natural variability alone. . . . There were a number of marine heat waves examined in this year's report, and all but one found a role for climate change in increasing the severity of the events. . . . In this report, twenty-one of the twenty-seven papers in this edition identified climate change as a significant driver of an event, while six did not. Of the 131 papers now examined in this report over the last six years, approximately 65% have identified a role for climate change, while about 35% have not found an appreciable effect. (Herring et al. 2018)

Example 1
Using a climate frame to communicate about a heatwave

Amid the historic July 2022 heat wave across Western Europe, *Nightly News with Lester Holt* journalist Meagan Fitzgerald remarked that, as "train tracks and runways [buckled]" and fires broke out across London, the United Kingdom was "logging [its] highest temperatures ever: 104 degrees, the usual high for July, 75," her words accompanied by images of buildings in flames and people sweltering under the heat. Immediately following her remark that "climate experts say this is just the start," the segment quoted climate expert Craig Snell as saying, "it's certainly something the UK has never seen before, but unfortunately, I think, going forward we may well see this type of heat across the UK more and more common" (NBC News 2022). A headline from the July 21, 2022, edition of *The Economist* ("A rising share of people are exposed to dangerously high temperatures: Climate change and population distribution are the cause") similarly asserted that the "dangerously high temperatures" were the result of climate change.

However, broadcast news does not routinely make the connection between extreme weather events and climate change. Media Matters researchers, upon completing a search in SnapStream video and Nexis databases of transcripts from July 16 to July 18, 2022, for programming on CBS, ABC, NBC, CNN, Fox News, and MSNBC for terms related to the heat wave, as well as the words *climate* or *global warming*, found that only 32 percent (20 of 62) of the segments and weather reports that mentioned the heat waves framed the extreme weather as a symptom of climate change (Macdonald 2022).

Example 2
Commitment by *New England Journal of Medicine* Group

Scholarly publications have a role to play as well. On June 16, 2022, the *New England Journal of Medicine* announced that "Although the NEJM Group publications have already been covering the health consequences of climate change and air pollution . . . we are redoubling our commitment in response to the increasing urgency. We are launching a broader effort starting with articles in each of our journals—the *New England Journal of Medicine*, *NEJM Evidence*, and *NEJM Catalyst Innovations in Care Delivery*—addressing different aspects of this unprecedented challenge. . . . Throughout 2022, we will publish at least one article in an NEJM Group journal each month related to fossil-fuel–driven health harms and will subsequently plan ongoing coverage of related content" (Solomon et al. 2022).

Effectiveness:
Scholars have found that media coverage is particularly powerful when it predominantly features one side of an issue. As Feldman and colleagues (2012) noted, "[M]edia cues are especially clear and one sided, this is enough to overwhelm partisan biases in processing," a conclusion that is more pronounced at the local level (Dalton, Beck, and Huckfeldt 1998) and among less politically sophisticated individuals (de Vreese and Boomgaarden 2006).

The need:
Clear communication from media outlets connecting extreme weather in local areas to global climate change.

Principle 2
Communicate Consensus

People are more likely to believe climate change is happening and caused by human beings if they understand that the scientific evidence justifies these conclusions and that there is a scientific consensus about both.

Individuals' beliefs about climate change are influenced by what they think scientists believe (Lewandowsky, Gignac, and Vaughan 2013). Communicating that there is a scientific consensus about the existence, harmful nature, and need to address climate change can increase acceptance of the existence of human-caused global warming (Bolsen, Leeper, and Shapiro 2014; van der Linden, Leiserowitz, and Maibach 2018). Accepting the scientific consensus about climate change can act as a "gateway belief" to understanding and engaging with other dimensions of the issue (van der Linden et al. 2015). Consensus messaging of this sort works by using perception of widespread acceptance as a means of aligning individual perception with the descriptive norm (for an explanation of the process, see Tankard and Paluck 2017). A meta-analytic examination of the demographic and psychological correlates of belief in climate change found that belief in climate change was stronger among those who accept a source heuristic ("scientists are trustworthy so the scientific orthodoxy must be true") and a consensus heuristic ("there is scientific consensus around climate change, and consensus implies correctness") (Hornsey et al. 2016).

The challenge to be addressed:

For decades, the media tendency to imply the existence of two opposed but equally justified scientific positions on the nature, extent, and causes of climate change distorted the public's perception of the extent of agreement among published climate scientists (Boykoff and Boykoff 2004; Koehler 2016). At the same time, those with a vested interest in sustaining fossil fuel use (Farrell 2016; Supran and Oreskes 2017) were seeding doubts about the extent of scientific agreement (Oreskes and Conway 2011). Worrisomely, a recent meta-analysis concluded that "belief in climate change is more easily weakened than strengthened" (Rode et al. 2021). Consensus uncertainty—a disagreement among experts or about the existence or strength of evidence—is the only kind that erodes a message's credibility, according to a 2020 review of the literature on the effects of uncertainty in science (Gustafson and Rice 2020).

The climate science:

Since the *Fifth Assessment Report* (AR5) of the Intergovernmental Panel on Climate Change, "human influence on the Earth's climate has become unequivocal, increasingly apparent, and widespread, reflected in both the growing scientific literature and in the perception and experiences of people worldwide (high confidence)" (Working Group II 2022).

An analysis of 11,944 climate abstracts from 1991–2011 matching the topics "global climate change" or "global warming" found that, "among abstracts expressing a position on AGW [anthropogenic global warming], 97.1% endorsed the consensus position that humans are causing global warming" (Cook et al. 2013; see also Anderegg et al. 2010).

Example 1
Graphically communicating climate consensus
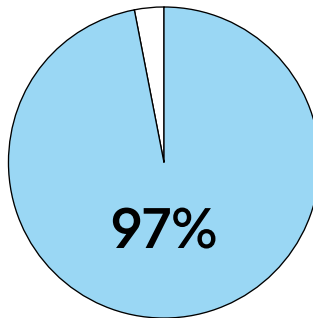
97% of climate scientists have concluded that human-caused climate change is happening.

Source: van der Linden et al. 2014.

Effectiveness:

Descriptive text and a pie chart capsulizing the scientific consensus on human-caused climate change ("97% of climate scientists have concluded that human-caused climate change is happening," with the logo of the American Association for the Advancement of Science [AAAS]) were able to increase belief certainty about estimates of the scientific consensus (van der Linden et al. 2014; see also Goldberg, van der Linden, Ballew, Rosenthal, and Leiserowitz 2019).

Example 2
Communicating consensus through a pictograph

97 out of 100 climate scientists agree humans are causing global warming

Source: Cook et al. 2013.

Effectiveness:

By using as a stimulus a graphic that visually represents the percentage of climate scientists who agree that climate change is caused by human activity, Cook and Lewandowsky (2016) found that, although providing consensus information did raise perceptions of consensus, the consensus messaging was potentially polarizing with American subjects who endorse free markets (i.e., hierarchical individualists attributing less expertise to climate scientists). But the consensus information did have a small world-view neutralizing effect on Australians.

Example 3
Dramatizing climate consensus
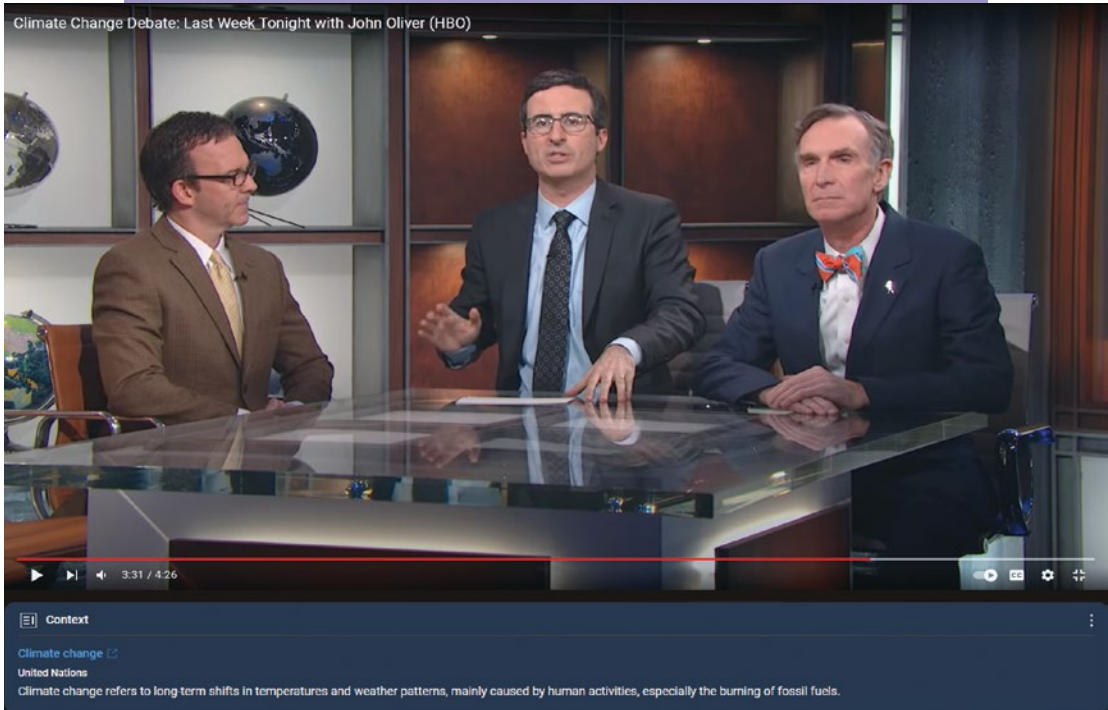
Source: *Last Week Tonight with John Oliver* 2014.

Effectiveness:

While climate scientists have generally represented the scientific consensus on climate change using graphs, a segment of HBO's *Last Week Tonight with John Oliver* from 2014 has, as of October 2022, drawn more than 8.8 million YouTube views for a dramatization of what the show cast as "a mathematically representative climate change debate." "It's a little unwieldy," host John Oliver said, "but this is the only way we can actually have a representative discussion." The "overwhelming view of the scientific community" involved a lot of yelling and waving of files, leading Oliver to tell the denier: "I can't hear you over the weight of scientific evidence" (Last Week Tonight with John Oliver 2014). "If you look at the science," noted an article in *The Atlantic*, "rather than just asking people on the street if they believe in global warming, it's not a 50/50 debate between two sides" (Beck 2014).

On the science podcast *Inquiring Minds*, science journalist Chris Mooney praised both Oliver's concision and effectiveness: "I feel like they said in 4 minutes something I've been saying for 10 years with like tens or hundreds of thousands of words; what they said was that there's no debate

over global warming, so to have these 'balanced' 1-on-1 TV debates is just preposterous" (Nuccitelli 2014).

Effectiveness:
Findings from a randomized experiment showed that viewing the Oliver segment increased viewers' belief in global warming and perceptions that most scientists believe in its existence (Brewer and McKnight 2017).

Example 4

Communicating consensus through analogy
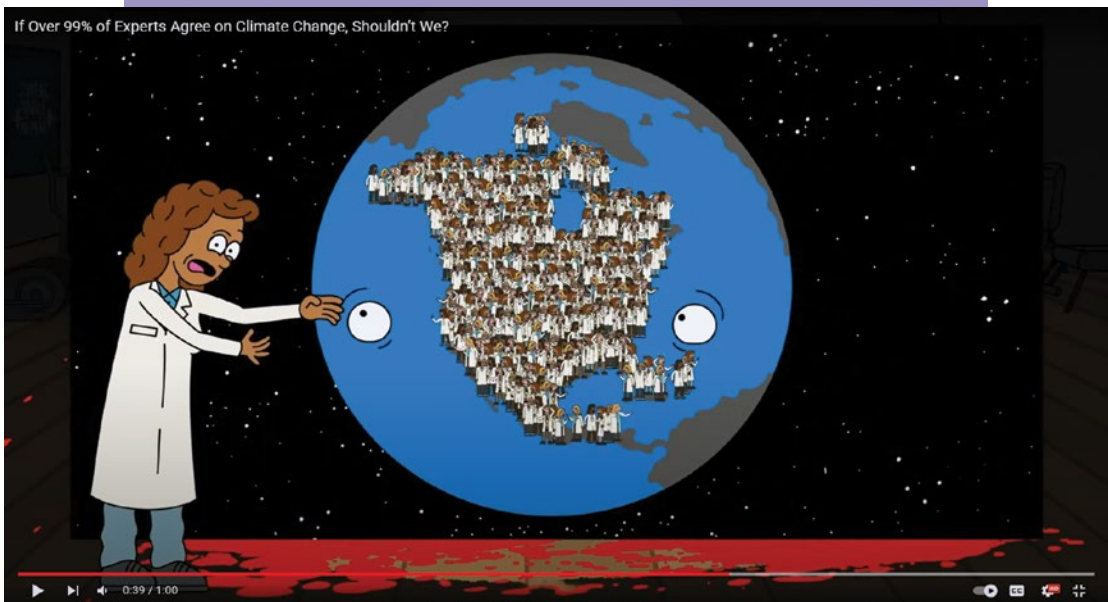
Source: Science Moms 2021a.

Effectiveness:
Using analogy to convey the scientific consensus, a team of scholars found that belief in human-caused global warming increased as an issue of concern, as did its priority after subjects in a controlled experiment were exposed to either a speaker in the video or print text reading, "If 97% of all dentists told you a tooth couldn't be saved, you'd pull that tooth. If 97% of all engineers told you your house was unstable, you'd move. And if 97% of all airline workers told you not to get on a plane, you wouldn't. So, when 97% of the world's climate science experts tell you our planet is warming and we're responsible, why would you ignore them? When you're 97% certain, you're certain. Protect America from climate change" (Goldberg, van der Linden, Ballew, Rosenthal, Gustafson, Leiserowitz 2019).

The need:

Clear communication that uses trusted messengers to reiterate the scientific consensus that climate change is happening and increasing the likelihood or severity of heat waves, fires, flooding, droughts, and hurricanes.

Principle 3
Change Social Norms

People are susceptible to peer pressure. When individuals feel that their neighbors expect them to act in a more climate-friendly way, those individuals are more likely to take science-consistent climate action.

The challenge to be addressed:

Individuals do not necessarily think that climate change will affect them or their immediate communities. Its effects can seem distant (Leiserowitz et al. 2013). At the same time, knowledge does not itself motivate action. Individuals see as desirable many behaviors they nonetheless avoid.

The climate science:

Norming works because our decision-making and behavior are affected by the actions and beliefs of others (Cialdini and Goldstein 2004). Social norms are the "predominant behaviors, attitudes, beliefs, and codes of conduct of a group. As perceived, they influence the expectations, opinions, and actions of group members and facilitate social coordination and solidarity within the group" (Cialdini and Jacobson 2021). Unsurprisingly then, social norms affect climate policy preferences (Alló and Loureiro 2014) and have been shown to promote household energy conservation (Allcott 2011), reduce the use of towels in hotels (Cialdini 2005), and lower water consumption in homes (Ferraro and Price 2013; Bernedo, Ferraro, and Price 2014).

By identifying them as common or uncommon or as approved or disapproved, social norms can both describe and enjoin behaviors. Messaging that shows that descriptive and injunctive norms are aligned is generally more effective than communication relying on one type alone. The direction of change in prevalence of a behavior (that is, the trend in the social norm) can affect individuals' behavior even when the level of that behavior in the group itself is relatively low (Cialdini and Jacobson 2021).

Example 1
Opower's use of social norms to incentivize reductions in energy use

In 2020, Opower reported that since 2007, it had sent nearly one billion home energy consumption comparisons on behalf of its utility clients (Oracle 2020).

Utility companies contract with Opower, a large software company, to send personalized household energy reports that both explain how to save energy and compare the recipient's use to their neighbors'.

The home energy reports initially awarded households a rating of "Good" with one smiling emoticon if they used less energy than the mean of the neighborhood comparison group and a "Great" with two smiling emoticons if they used less energy than the 20th percentile of the comparison group. In 2016, Opower updated its report to telegraph additional data about households' energy use relative to neighbors', assigning an overall score of Fair, Good, or Great and providing suggestions for how to further reduce use.

Effectiveness:
A large-scale study found that receipt of Opower's mailed comparisons of energy use was correlated with a 2.0 percent reduction in energy consumption (Allcott 2011). The positive effects persisted even after the households stopped receiving the reports (Allcott and Rogers 2014).

The need:
Find ways to apply social norming to all sectors of our lives and the economy.

Principle 4
Overcome the Spiral of Silence (If You Believe It, Say It)

Those who view the belief in the realities of climate change as an unpopular position are less likely to share their science-consistent beliefs about it with others, which makes others who may agree less likely to voice their views as well. To overcome the "spiral of silence," people should share their science-consistent climate views.

Developed by Elizabeth Noelle-Neumann (1974; 1993), the "spiral of silence" concept hypothesizes that an individual is less likely to express their opinion to friends, family, and peers when they perceive that the majority hold an opposed view. That is, for "fear of isolating oneself (not only fear of separation but also doubt about one's own capacity for judgment)" (Noelle-Neumann 1974), an individual is more likely to keep silent in an environment where they perceive that their own views are controversial.

A meta-analysis of 66 studies assessing the strength of the relationship found a significant positive relationship between opinion climate and opinion expression. The largest silencing effect was found when "participants talk to their family, friends, or neighbors about obtrusive issues" (Matthes, Knoll, and von Sikorski 2018). The tendency to hold in unpopular opinions remains true online, where "encountering agreeable political content predicts speaking out, while encountering disagreeable postings stifles opinion expression" (Gearhart and Zhang 2015).

The challenge being addressed:

A recent study of a sample of over six thousand U.S. adults drawn from the Ipsos eNation Omnibus found that 80–90 percent of Americans underestimate the prevalence of support for major climate change mitigation policies and climate concern (Sparkman, Geiger, and Weber 2022). According to a study conducted by researchers at Yale's Program on Climate Change Communication, only 35 percent of American adults discuss global warming "occasionally"; the remaining 64 percent discuss the phenomenon "rarely or never" (Marlon et al. 2022). Climate advocates need to increase the likelihood that everyone in their sphere of influence is aware of their positions on climate-related matters.

The climate science:

Climate change is real and human caused.

Example 1
Actively engaging reporters and the media

Since this is an interpersonal phenomenon, effective examples are difficult to locate. But as we were writing this report, we observed an instance in which a climate scientist took issue with the sorts of visual images being used by mainstream media reports to illustrate stories about the existence of extreme climate change–driven heat.

In July 2022, J. Marshall Shepherd, Distinguished Professor of Geography and Atmospheric Sciences at the University of Georgia and the former president of the American Meteorological Society, tweeted to his more than 65,000 followers, "Heatwaves should not be covered with kids eating ice cream or romping around in fountains. Cover extreme heat as a threat not a vacation. We don't cover the approach of a hurricane as great potential kite flying weather" (Shepherd 2022b).

Shepherd's tweet received more than 21,000 retweets and 113,000 likes. More important, local and national leaders responded with a renewed commitment to cover extreme heat from a "climate lens." This interaction illustrates the capacity of individuals to affect media agendas and is consistent with the finding of "visible links between social media and changing public perceptions, with the possibility of public opinion influencing political decision-making" (Mavrodieva et al. 2019).

Effectiveness:

Research from Geiger, Swim, and Fraser (2017) shows a positive correlation between discussing climate change on an interpersonal level and feelings of empowerment to address the problem at hand. Additional research indicates that "people who often or occasionally discuss global warming with family and friends consistently have a greater understanding of global warming, higher risk perceptions, and stronger support for mitigation policies than people who rarely or never discuss it" (Ballew et al. 2019).

The need:

Change the balance of discourse on climate by increasing the likelihood that those who hold science-consistent beliefs about climate change express them.

Principle 5
Emphasize Nonscientific Identities

Scientists and other experts can minimize the polarizing effects of tribal identity by emphasizing aspects of identity that they share with their audience. While many Americans oppose elitism and, correspondingly, messages from elite scientists, people identify with those they see as like them.

Opposition to elites is for some a form of social identity (Schulz, Wirth, and Müller 2020). But because people also identify with those they perceive to be like them ("like tend to associate with like"—a tendency sociologists call the "homophily principle"; Lazarsfeld and Merton 1954), a scientist can have other identities with greater credibility.

Women overall are more likely to support climate action than are men (Leiserowitz et al. 2020). A 2019 survey by the Potential Energy Coalition found that global warming is of special concern to mothers (Phillips 2021). Motherhood is an identity that transcends partisan divides to signal shared experiences and concerns.

The challenge to be addressed:
Although trust in science and scientists remains high, it is lower among some segments of the population (Kennedy, Tyson, and Funk 2022).

The climate science:
"Climate change is already impacting our world, putting wildlife, nature and people's lives and homes at risk. We can already see that the current global temperature rise of around 1°C on pre-industrial levels is impacting the UK climate. We've had one of the hottest summers on record as part of a heatwave which hit the entire northern hemisphere. But even this extreme weather is nothing compared to what warming of 1.5°C or 2°C could look like, and what damage it could have on a global scale. The difference between 1.5°C and 2°C is huge. It means three times as many people exposed to extreme heatwaves at the higher temperature, than at 1.5°C, and a massive 170% increase in flood risk compared to today, if a 2°C warming is reached" (WWF 2018).

"Advanced technologies that provide great promise include greater use of electric-drive technologies" (Kahn Ribeiroet al. 2007).

What Do Wildfires Have to Do With Climate Change? Dr. Emily Fischer Explains

IF YOU COULD ASK A CLIMATE SCIENTIST ANYTHING WHAT WOULD IT BE?
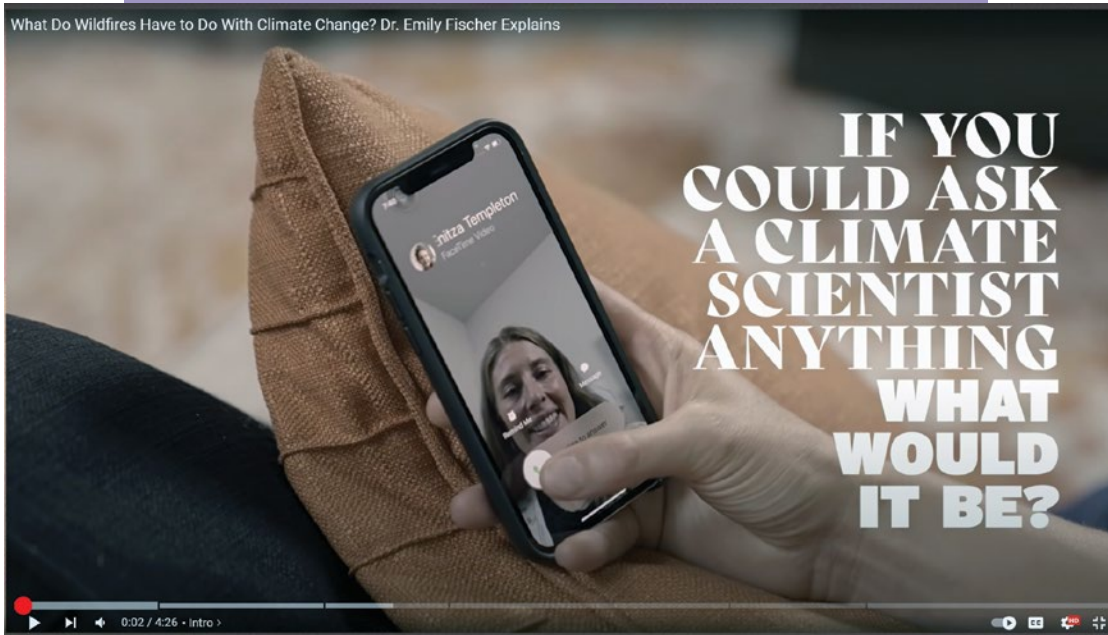
Source: Science Moms 2021b.

Science Moms is a group of women climate scientists whose videos, public service announcements (PSAs), and podcasts focus on persuading other moms to urge local, state, and federal officials to pass and implement solutions to the climate crisis. Their message:

"We're a group of nonpartisan climate scientists and mothers, working to give our children the planet they deserve.

We founded Science Moms to help mothers who are concerned about their childrens' [sic] planet, but aren't confident in their knowledge about climate change or how they can help. Together, we aim to demystify climate science and motivate everyday moms to demand solutions that preserve the planet for their kids.

As scientists, we have collectively spent decades studying our earth and what human activity is doing to it. We are steeped in this reality every day and know that to solve this problem, it will take all of us moms joining forces.

Together, we aim to demystify climate science and motivate everyday moms to demand climate change plans and solutions that preserve the planet for our kids."

Source: Science Moms 2022.

In 2021, Science Moms' messaging was featured in a $10 million ad campaign. As this report was being written, its PSAs were still airing on cable stations in the United States.

Source: Science Moms 2022.

Emily V. Fischer, a founding member of Science Moms, is an atmospheric chemist, an associate professor in the Department of Atmospheric Science at Colorado State University, a 2019 recipient of the American Geophysical Union's James B. Macelwane Medal, and formerly a National Oceanic and Atmospheric Administration (NOAA) Environmental Fellow at the Harvard University Center for the Environment, where she "explored the processes controlling the distribution of the most important atmospheric oxidants, the hydroxyl radical and ozone" (Wikipedia 2021).

In an online video titled "What Do Wildfires Have to Do with Climate Change?" Fischer foregrounds her identity as a mom as she talks with Enitza, a mom of four in Colorado, about how climate change is causing bigger, deadlier wildfires and how this makes her feel as a climate scientist. "The way forward is toward energy production that does not use fossil fuels," she notes. "At the local level, ask your utility company, ask your leaders: how are you shifting to clean energy. . . . Put that pressure on" (Science Moms 2021b).

Effectiveness:

John Marshall is CEO of the nonprofit marketing firm Potential Energy Coalition, which launched the Science Moms campaign. "We've tested a whole bunch of different angles, and it's really human stories about you, your community, and the people you love and care about being impacted that anchors us in relevance," Marshall said. "And we found that messaging through your children is one of the leading effective ways, if not the most effective" (Beer 2021).

An earlier campaign mobilizing moms, Mothers Against Drunk Driving (MADD), has been credited with helping pass more than one thousand tougher DUI laws (Editorial Staff 2020) and with "changing American attitudes toward drinking and driving" (Fell and Voas 2006).

The need:

Identify, deploy, and test the feasibility of employing other identities that climate advocates have in common with their intended audiences.

Principle 6
Frame Climate Change as an In-Group Issue

People listen to and believe people they think of as like them and as liking them. Such in-group validation increases the acceptance of climate realities among those who identify with groups historically associated with a rejection of climate action.

Social and psychological schemas as well as an audience's prior experiences, cultural contexts, and personal circumstances shape their responses to messages (Brossard and Lewenstein 2009). Human values affect individuals' engagement with environmental issues in part by filtering the climate information to which one is exposed (Corner, Markowitz, and Pidgeon 2014). Communication can prime (that is, make more salient) specific values (Maio et al. 2009).

Focusing on some facets of an issue rather than others can affect the way an audience sees the issue and can influence audience response (Nisbet and Scheufele 2009). Climate change can, for example, be framed as an environmental problem, a health problem, a national security problem, or an economic problem. The impact of an issue frame is determined in part by the identities, values, and preexisting understandings of the audience (Scheufele 1999). Framing an issue in a way that is consistent with the values of an audience and does not threaten its ideological dispositions and identity should minimize identity-protective cognition. For example, affixing an environmental message to energy-efficient lightbulbs reduced the rate at which conservatives purchased them (Gromet, Kunreuther, and Larrick 2013). Conservatives were more receptive to environmental messaging focused on conservative values such as protecting the purity or sanctity of the environment from pollution and less receptive to ones focused on one's moral responsibility to avoid environmental degradation (Feinberg and Willer 2013).

Scholars have argued that an important aspect of creating attitude change is to align with rather than compete with "vested interests, personal identity expression, social identity needs, and fears and phobias" (Hornsey and Fielding 2017) and that "the impact of cultural cognition would be relatively small if citizens observed persons of diverse values on *both* sides of the . . . debate" (Kahan et al. 2010).

Human beings need the protection of the tribe to thrive in a dangerous world. Researchers have measured intense brain activity in people sensing betrayal (Aimone, Houser, and Weber 2014). Perhaps because each of us

knows the intensity of the betrayal response, we are cautious about straying from our respective tribes' orthodoxies.

The orthodoxies of liberals and conservatives differ. In the United States, rejection of climate science is associated with identification as a conservative or libertarian (Lewandowsky, Gignac, and Oberauer 2015). Some have argued that conservatives are more likely to reject anthropogenic climate change because, while they might approve of science conducted in service of economic production (termed "production science"), they are less receptive to science in the service of understanding the impact human beings have on the environment and human health ("impact science") because it is often used to justify governmental regulation of private-sector activity (Schnaiberg 1977; McCright and Dunlap 2011; McCright et al. 2013).

Messaging from Democratic elites favoring climate science and policies increased from 1990 to 2015, while it decreased among Republican elites (Merkley and Stecula 2018). As McCright and Dunlap (2011) argue, "Environmental protection typically entails governmental intervention into markets and restrictions on property rights, challenging conservative values, but is consistent with liberals' view that protecting collective welfare is a proper role of government." Messages emphasizing free-market solutions to climate change have been shown to increase conservatives' climate change acceptance (Dixon, Hmielowski, and Ma 2017). Conservatives' rejection of evidence of climate change may not reflect aversion to the science but rather "a conflict between specific ideological values and the most popularly discussed environmental solutions" (Campbell and Kay 2014).

The challenge to be addressed:
The identity-protective cognition of conservatives reinforces their reluctance to support action to address climate change.

The climate science:
The National Academy of Sciences' (National Research Council 2011) reports and studies conducted by the U.S. Department of Defense (2014) and the National Security Council (Flavelle et al. 2021) have demonstrated the geopolitical impact of climate change, including sea-level rise, on U.S. national security. In a 2014 report, eleven retired U.S. generals and admirals identified climate change as a "catalyst for instability and conflict" and argued that it is a threat multiplier (IISD 2014).

Example 1

Emphasizing a shared cultural/political identity—
New Climate Voices

General Ron Keys: Air Force General (ret'd), Climate Advocate

Dr. Katharine Hayhoe: Climate Scientist, Evangelical Christian

Bob Inglis: Former South Carolina GOP Congressman, Climate Campaigner

Jerry Taylor: Republican, Climate Convert
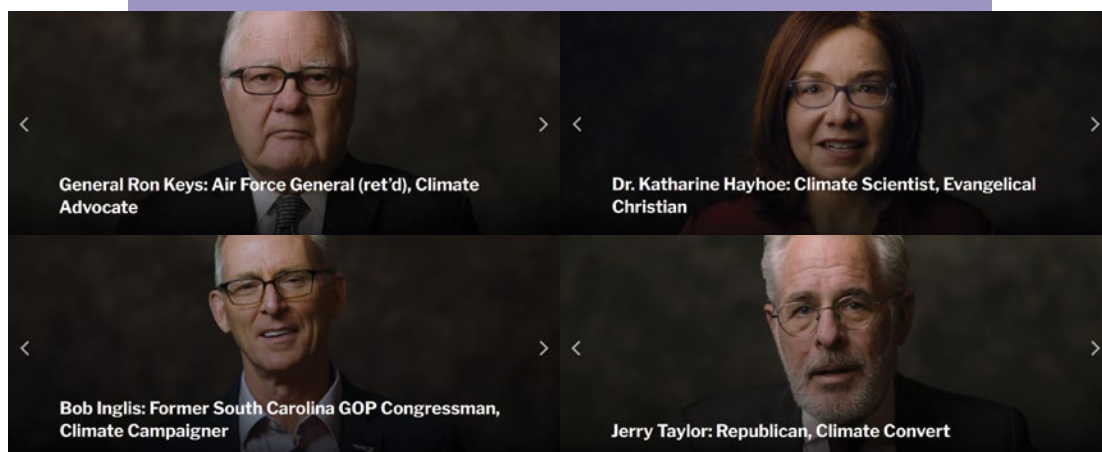
Source: New Climate Voices 2022.

The group New Climate Voices produced videos featuring conservatives arguing that "Climate change threatens our freedom. It threatens our property, homes, communities and country. It threatens our health and our economy. That's why conservatives should lead on climate change. We can lead on climate change." Among the featured conservatives are "Dr. Katherine Hayhoe: Climate Scientist, Evangelical Christian; Bob Inglis: Former South Carolina GOP Congressman, Climate Campaigner; General Ron Keys: Air Force General (ret'd), Climate Advocate; Jerry Taylor: Republican, Climate Convert" (New Climate Voices 2022).

Effectiveness:
A study of the effects of a one-month field experiment that aired ads about the reality and risks of climate change in a way designed to appeal to Republicans, including an ad featuring General Keys, in two competitive congressional districts found that "the campaign increased Republicans' understanding of the existence, causes and harms of climate change by several percentage points" (Goldberg et al. 2021).

The need:
Expand the reach of communicators from historically climate change–denying groups who frame taking action on climate change as an in-group position.

Limitations:

When perceived as manipulative, the framing of climate change through a national security lens can backfire. Myers et al. (2012) found that climate change skeptics responded angrily to a national security–framed climate message (see also Zhou 2016).

Principle 7
Make Messages Locally Relevant

Many people in the United States align their identity with groups that have historically doubted climate change. When communicators convey information about a changing climate without attacking these identities, they can convince people more readily. Those who see an issue as local are more likely to be concerned about it and are more likely to support policy solutions to it. Strategies for this include adapting messages to local audiences and communicating through local messengers.

Recent developments in attribution science have allowed climate scientists to show connections between both extreme weather events and local changes and climate change. This is important because the effects of extreme weather experiences on climate attitudes and support for "climate change mitigation responses" have been found to occur among those who attribute the events to climate change (Ogunbode et al. 2019). Trusted local meteorologists are well positioned to communicate such causal connections.

As a person's perception that climate change is remote and abstract increases, their concern about it decreases. While such perceived psychological distance can undermine climate action, psychological closeness to climate change predicts a heightened level of engagement in pro-environmental behaviors (Wang et al. 2019). By reducing psychological distance, locally framed climate change messages can increase climate change engagement (Scannell and Gifford 2013) and increase perceptions of problem severity and support for local policy action (Wiest, Raymond, and Clawson 2015). By contrast, distantly framed messages that featured victims of climate change backfired among conservatives (Hart and Nisbet 2012). Messages that are personally relevant also are more interesting, more effortlessly processed (Maio and Haddock 2007), and more effective (Kruglanski and Sleeth-Keppler 2007). There is a temporal dimension to psychological distancing as well. Environmental benefits that arrive thirty to forty years
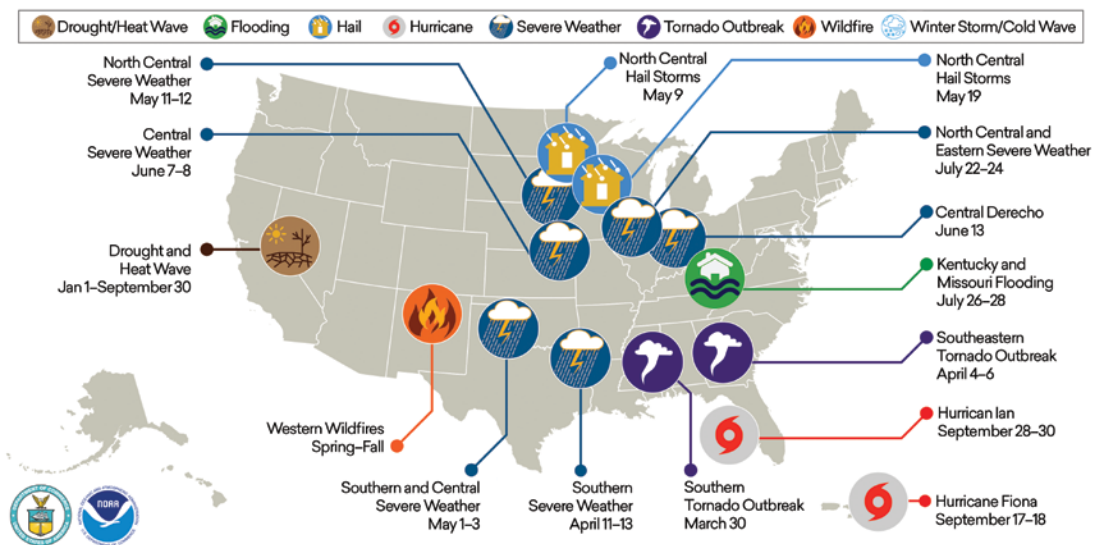
into the future are more likely to be discounted than are those in the here and now (Sparkman, Lee, and Macdonald 2021).

The desire to get it right (accuracy motivation) is more likely to come to the fore when a topic is personally relevant and tied to consequences for the individual (Eagly and Chaiken 1993). Direct experience of climate change–related phenomena such as extreme weather events can generate community discussion (Boudet et al. 2020), increase concern about climate change (Bergquist, Nilsson, and Schultz 2019), and elicit "support for mitigation policies, and personal climate adaptation in matters unrelated to the direct experience" (Demski et al. 2017). Weathercasters can increase the salience of those connections.

The challenge to be addressed:

Climate change itself is not directly observable and is seen by some as a psychologically distant issue (far away, not immediate, not affecting the perceiver, and hypothetical) (Liberman and Trope 2008).

U.S. 2022 Billion-Dollar Weather and Climate Disasters

This map denotes the approximate location for each of the **15 separate billion-dollar weather and climate disasters that impacted the United States January – September of 2022.**

Source: NOAA National Centers for Environmental Information 2022.

The climate science:

The Intergovernmental Panel on Climate Change's (IPCC) Working Group II 2022 assessment reported that the "increase in global surface temperature [was] 1.09 [0.95 to 1.20] °C in 2011–2020 above 1850–1900. The estimated increase in global surface temperature since AR5 is principally due to further warming since 2003–2012 (+0.19 [0.16 to 0.22] °C). Considering all five

illustrative scenarios assessed by WGI, there is at least a greater than 50% likelihood that global warming will reach or exceed 1.5°C in the near-term, even for the very low greenhouse gas emissions scenario" (Working Group II 2022).

> Because of its ability to induce contact dermatitis, the establishment and spread of poison ivy is recognized as a significant public health concern. In the current study, we quantified potential changes in the biomass and urushiol content of poison ivy as a function of incremental changes in global atmospheric carbon dioxide concentration (CO_2). . . . Overall, these data confirm earlier, field-based reports on the CO_2 sensitivity of poison ivy but emphasize its ability to respond to even small (~ 100 µmol mol^{-1}) changes in CO_2 above the mid-20th century carbon dioxide baseline and suggest that its rate of spread, its ability to recover from herbivory, and its production of urushiol, may be enhanced in a future, higher CO_2 environment (Ziska et al. 2007).

Example 1
Using a credible source to highlight local impact

Known as "South Carolina's weatherman" (WLTX 2019), Jim Gandy served as News19's chief meteorologist from 1999 to 2019. In segments titled "Climate Matters," he harnessed his credibility and identification with the interests and needs of his local community. In an exemplary segment aired in 2016, he showcased research from Duke University, a neighboring institution, confirming that, as carbon dioxide in the atmosphere increases, so, too, does the prevalence and toxicity of poison ivy.

Effectiveness:

A year-long study of viewers of Gandy's "Climate Matters" video found that, "after controlling for baseline measures, demographics, and political orientation—viewers of Climate Matters were more likely to hold a range of science-based beliefs about climate change. . . . Climate Matters improved the understanding of climate change among local TV viewers in a manner consistent with the educational content" (Zhao et al. 2014). The effect was not an isolated one. An internet-based randomized controlled experiment involving local TV news viewers (n = 1,200) in Chicago and Miami found that, "Compared to participants who watched weather reports, participants who watched climate reports became significantly more likely to 1) understand that climate change is happening, is human-caused, and is causing harm in their community; 2) feel that climate change is personally relevant and express greater concern about it; and 3) feel that they understand how climate change works and express greater interest in learning more about it" (Feygina et al. 2020).

> ## Example 2
> ### Providing tools to help meteorologists localize

The program Climate Matters, which helped create the video in Example 1, has developed a tool for broadcast meteorologists to forecast the wind and solar power generated in a given day and region based on real-time weather data. These forecasts make clean energy solutions both local and concrete.
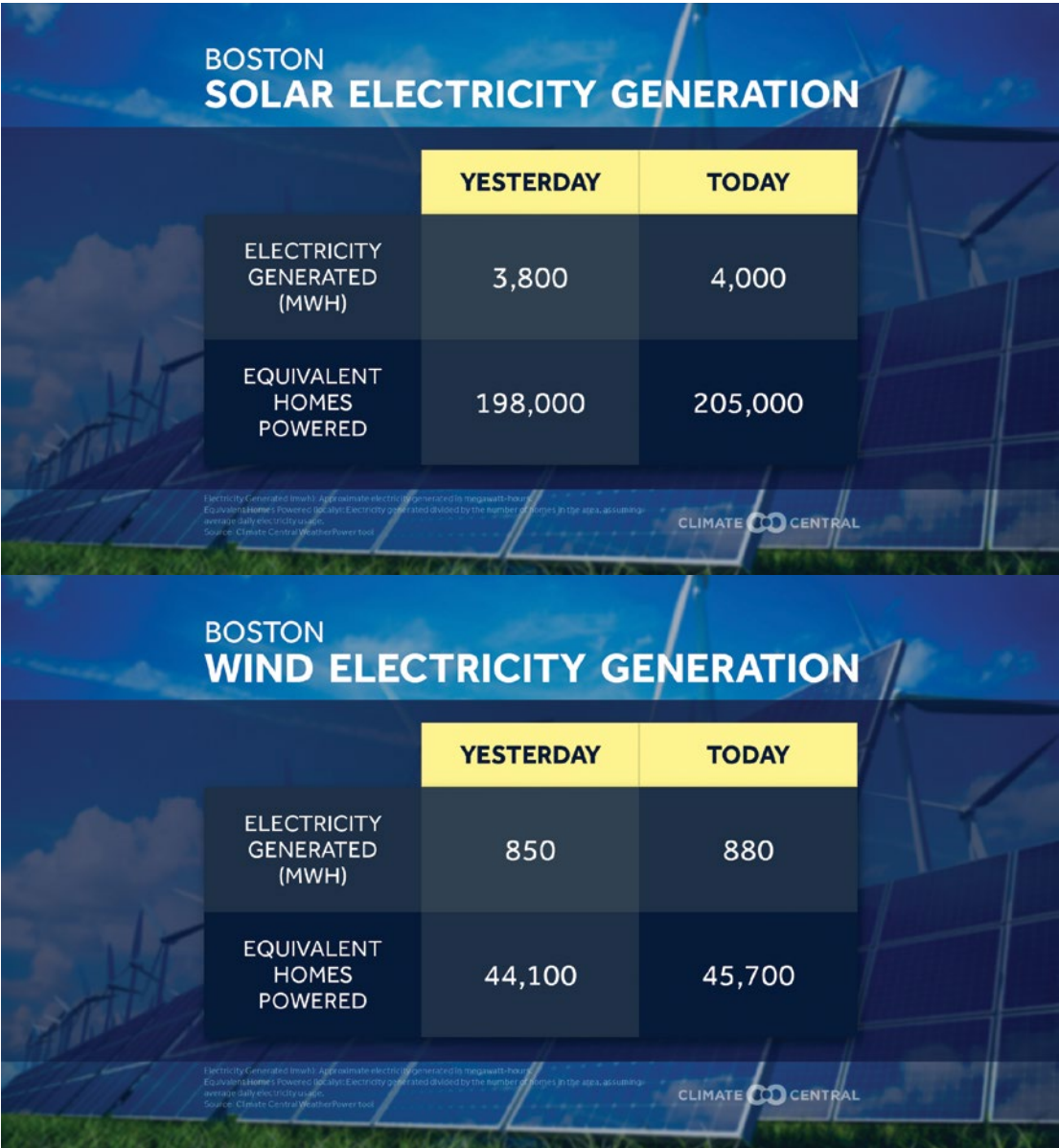
BOSTON
SOLAR ELECTRICITY GENERATION

	YESTERDAY	TODAY
ELECTRICITY GENERATED (MWH)	3,800	4,000
EQUIVALENT HOMES POWERED	198,000	205,000

CLIMATE CENTRAL

BOSTON
WIND ELECTRICITY GENERATION

	YESTERDAY	TODAY
ELECTRICITY GENERATED (MWH)	850	880
EQUIVALENT HOMES POWERED	44,100	45,700

CLIMATE CENTRAL

Source: Climate Central 2022b.
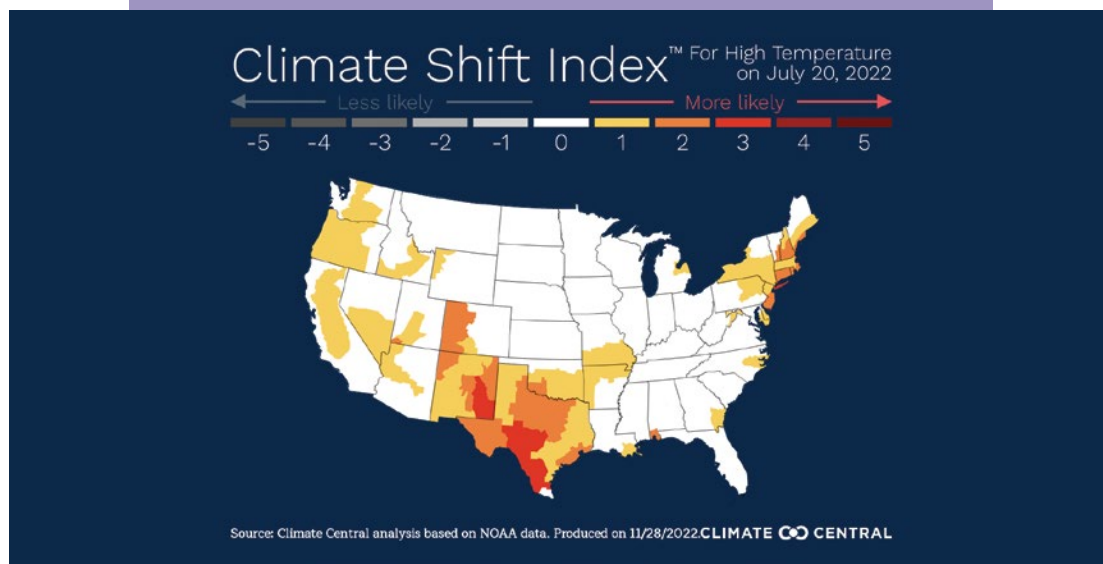
Source: Climate Central 2022a.

Climate Central (2022a) developed a new visualization tool called the Climate Shift Index. According to *The Washington Post*, the site uses NOAA data to "[show] how everyday weather that may not make news headlines is altered as well . . . [by calculating] how much more likely daytime high and overnight low temperatures are to occur because of climate change. An index score, or CSI, of 2, for example, means climate change made the day's temperature twice as probable" (Muyskens, Patel, and Ahmed 2022).

Expanding the impact:

Not only is local news personally relevant and locally framed, but it is widely viewed (Pew Research Center 2021) and more highly trusted than its national counterpart (Pew Research Center 2019). Local weathercasters are trusted messengers who regularly provide residents with such usable information as whether to carry an umbrella or bundle up before heading outdoors. In the process, local on-air meteorologists also can educate the public about climate and climate change. A partnership among Climate Matters, Climate Central, the American Meteorological Society, NASA, NOAA, and Yale University provides broadcast meteorologists with training and content designed to increase their impact as climate educators. A 2017 survey of broadcast meteorologists found that about one in four "report longer format science stories on air outside the weather segment" and

nearly two-thirds "think the local climate in their area has changed in the past 50 years as a result of climate change" (Maibach et al. 2017). By 2020, "more than 770 weathercasters across 184 media markets [were] participating in *Climate Matters*, and on-air reporting about climate change ha[d] increased dramatically—approximately 3,200% between 2012 and 2018" (Feygina et al. 2020). According to Edward Maibach (personal communication, April 4, 2022), 2,200 weathercasters are employed in the United States.

"Every meteorologist who is in the business of communicating weather information has an obligation to explain why the weather does what it does, and climate change is playing an ever-increasing role in this story," argued Jason Samenow (2016), *The Washington Post*'s weather editor and Capital Weather Gang's chief meteorologist. "Ignoring climate change in weather reporting is anti-scientific by omission, and it's irresponsible."

The need:

Increase the number of meteorologists and other communicators connecting local events to climate change at the local and national levels.

Principle 8
After Priming an Accuracy Motivation, Encourage Audiences to Draw Their Own Conclusions

Asking an audience to focus on accuracy before presenting data can minimize motivated reasoning. Inviting the audience to examine the scientific data and draw its own conclusions serves that purpose.

As Bolsen and Druckman (2015) argue, "Instead of defending a prior belief, identity, or worldview, an accuracy motivation leads individuals to assess all available information objectively, even if it runs counter to one's existing beliefs or identities." When motivated to attend to a message, individuals will engage more deeply and evaluate it with a goal toward accuracy (Druckman and McGrath 2019). Priming accuracy goals can help thwart reasoning influenced by biases by inducing participants to correctly interpret data shown to them (Bolsen, Druckman, and Cook 2014; Jamieson and Hardy 2014; Bolsen and Druckman 2015; Hardy and Jamieson 2016; Flynn, Nyhan, and Reifler 2017).

Example 1
Engaging audiences through role-playing and simulation

Source: Sterman et al., n.d.

Developed by Climate Interactive, the System Dynamics Group at MIT Sloan School of Management, and the UMass Lowell Climate Change Initiative, the World Climate Simulation is an in-person group role-playing simulation in which over a three-or-so-hour period between six and forty participants play negotiators in a fictitious international climate summit representing countries and regional blocs that work to create an agreement that limits climate change by reducing greenhouse gas emissions. Their goal is achieving a global agreement that keeps climate change well below 2°C, with under 1.5°C the desired objective, the boundaries established by the Paris Agreement. Proposals are tested using a climate policy simulation model that provides participants with science-based feedback on the implications of their proposals for atmospheric carbon dioxide concentrations, global mean surface temperature, sea-level rise, and other impacts. World Climate enables participants to explore the dynamics of the climate and impacts of proposed policies in a way that is consistent with the best available peer-reviewed science but does not prescribe what should be done (Sterman et al., n.d.).

Effectiveness:

Juliette Rooney-Varga and her colleagues' cross-national study found statistically significant gains among players in three areas: "(i) knowledge of climate change causes, dynamics and impacts; (ii) affective engagement including greater feelings of urgency and hope; and (iii) a desire to learn and

do more about climate change." Significantly, "Gains were just as strong among American participants who oppose government regulation of free markets—a political ideology that has been linked to climate change denial in the US—suggesting the simulation's potential to reach across political divides" (Rooney-Varga et al. 2018).

The need:

Tie engaged participation to the creation, implementation, and monitoring of climate action plans in ways that demonstrate their possible effects on human well-being and a sustainable economy and ecosphere.

Principle 9
Combine Hope with Actions

When provided with engaging stories that convey hope, people are more likely to take action. Narratives have unique persuasive power. People who are confident their actions will have an effect are more likely to feel motivated to act.

As psychologist Jerome Bruner (1991) argued, "Our experience of human affairs comes to take the form of the narratives we use in telling about them." Indeed, some argue that the human capacity for the creation of meaning depends on narrative (Jensen 2016). Narratives can reduce counterarguing and psychological reactance (Moyer-Gusé and Nabi 2010). A meta-analysis of fourteen studies found that "a single narrative message has a stronger persuasive impact than a non-narrative message on attitudes and intentions at immediate as well as on attitudes, intentions, and behaviors at delayed measurement" (Oschatz and Marker 2020).

Engagement is unlikely unless individuals feel that "they can do something about the problem, and that it is worth doing something" (Howell 2011). Exposure to efficacy information indirectly increases hope and thus a willingness to participate—even, in some cases, among conservatives (Feldman and Hart 2016). An online experiment showed that "after a single exposure to a news story, stories including positive internal efficacy content increased perceived internal efficacy." At the same time, "Perceived internal, external, and response efficacy all offered unique, positive associations with intentions to engage in climate change–related political participation" (Feldman and Hart 2016). Confidence that one is able to do what is necessary to take action is a key motivator of science-consistent environmental behaviors (Lam and Chen 2006).

The climate science:

"Climate change is intensifying the water cycle. This brings more intense rainfall and associated flooding, as well as more intense drought in many regions" (IPCC 2021).

> ## Example 1
> Deploying a problem-solution narrative structure—
> *Good Morning America*

In a May 20, 2021, segment of *Good Morning America*, ABC Chief Meteorologist Ginger Zee told the story of the nineteenth-century Church of the Virgin of Dolores in central Mexico that had been underwater for thirty years. By design, the area was flooded to create a reservoir and a dam, but now in the dry season the church breaches the surface. Zee's story vivifies a change across time with the emerging church as a symbol of the emerging drought in Mexico and the ongoing drought in the Western United States. "Last year the water level was so low that people could walk through the church on the ground for the first time in four decades," Zee says. "Many reservoirs are at their lowest historic points" (*Good Morning America* 2021).

Using a problem-solution narrative structure, the segment also points to responsive action. "Human caused factors have made what would have been bad, 'megadrought bad,'" says an expert who then demonstrates how those who work in "water-precarious environments" are installing harvesting systems that capture and treat rainwater. "Such a system can provide between 40 and 80% of a house's water needs," adds the expert. "The problem is shared; I hope the solution will be shared" (*Good Morning America* 2021). Zee notes that this, coupled with using less water, is something everyone can do now.

The segment also notes, integrating facts that show relationships to other phenomena, "The size of fires in any given year has increased by over 100 percent" (*Good Morning America* 2021).

"Lake Tahoe [is] now a foot below last year," says Zee (*Good Morning America* 2021). Establishing that the emerging church in Mexico and the drop in the water level of Lake Tahoe are not atypical instances, data about climate change appear on screen.

The need:

Increase the scale and scope of engaging journalism that demonstrates solutions in a fashion that engenders hope and, with it, action at the local, national, and international levels.

Principle 10
Help People Take Action Themselves

When problems are seen as large, individuals can become fearful and hopeless. People engage with climate science and support taking action when they believe that the actions they, as individuals, take will matter.

Virtue signaling on climate change is a powerful motivation for some people. But unless it is tethered to science-consistent action, it is little more than symbolic expression.

Self-efficacy (Bandura 1977) and perceived behavioral control (perception that an individual has the capacity and means to carry out a plan of action) predict behavior intentions (Sheeran and Taylor 1999), including climate-related ones (Lam and Chen 2006). The IPCC tied self-efficacy to behavioral control when it noted,

> An increasing body of evidence demonstrates that climatic risks to people can be lowered by strengthening nature, meaning that we invest in protecting nature and rebuilding ecosystems to benefit both people and biodiversity. Flood risk along rivers, for instance, can be reduced by restoring wetlands and other natural habitats in flood plains, by restoring natural courses of rivers, and by using trees to create shade. Cities can be cooled by parks and ponds and by greening streets and buildings' rooftops and walls. Farmers may increase their businesses' climate resilience by diversifying their crops and livestock, by planting trees and bushes on the fields for shade and organic manure (agroecological farming), by increasing soil health (more soil organic matter), and by combining crops, livestock and natural elements such as trees and bushes.

Actions and solutions that safeguard nature are relatively inexpensive in many parts of the world because they do not rely on complex machinery or on the development of extensive infrastructure. (IPCC 2022)

The challenge to be addressed:
People are less likely to try to address "bigger-than-self problems" (Corner and Randall 2011), and information, visualizations, and narratives that convey the dire consequences of climate change can activate fear and hopelessness instead of action (Nicholson-Cole 2005; Moser 2009; O'Neill and Nicholson-Cole 2009; Feinberg and Willer 2011). Fear-based messages that fail to offer a means of reducing the fear are not only ineffective

(Tannenbaum et al. 2015) but run the risk of eliciting climate change skepticism as a coping strategy (Haltinner and Sarathchandra 2018).

Pew researchers found in 2021 that, although seven out of ten millennials regard climate change as a top priority, just over one in five (23 percent) reported that they personally have acted to help address the issue (Tyson, Kennedy, and Funk 2021). Gen Zers and millennials are more likely than adults to be "*talking* more about the need for action on climate change; among social media users, they are *seeing* more climate change content online; and they are *doing* more to get involved with the issue through activities such as volunteering and attending rallies and protests." The same poll also found that "majorities see an array of actors, from government to business, as doing too little to reduce the effects of climate change" (Tyson, Kennedy, and Funk 2021).

The climate science:

"[T]here is still time to limit climate change, IPCC experts say. Strong and sustained reductions in emissions of carbon dioxide (CO_2) and other greenhouse gases, could quickly make air quality better, and in 20 to 30 years global temperatures could stabilize" (UN News 2021).

Example 1
Identifying individual action

The Washington Post launched Climate Solutions, a line of coverage focused on the people and organizations tackling global warming (WashPostPR 2019). One of their articles, titled "10 steps you can take to lower your carbon footprint: Small changes alone won't stop climate change, but your actions are certainly worthwhile," lists actions that individuals can take (Washington Post Staff 2022).

Example 2
Identifying adaptive action—The risk-response frame

A graphic from the EPA reproduced in the National Climate Assessment report uses color to show risks and responsive actions. "White text indicates the risks faced by those communities, while dark text indicates actions that can be taken to reduce those risks" (U.S. Global Change Research Program 2018).
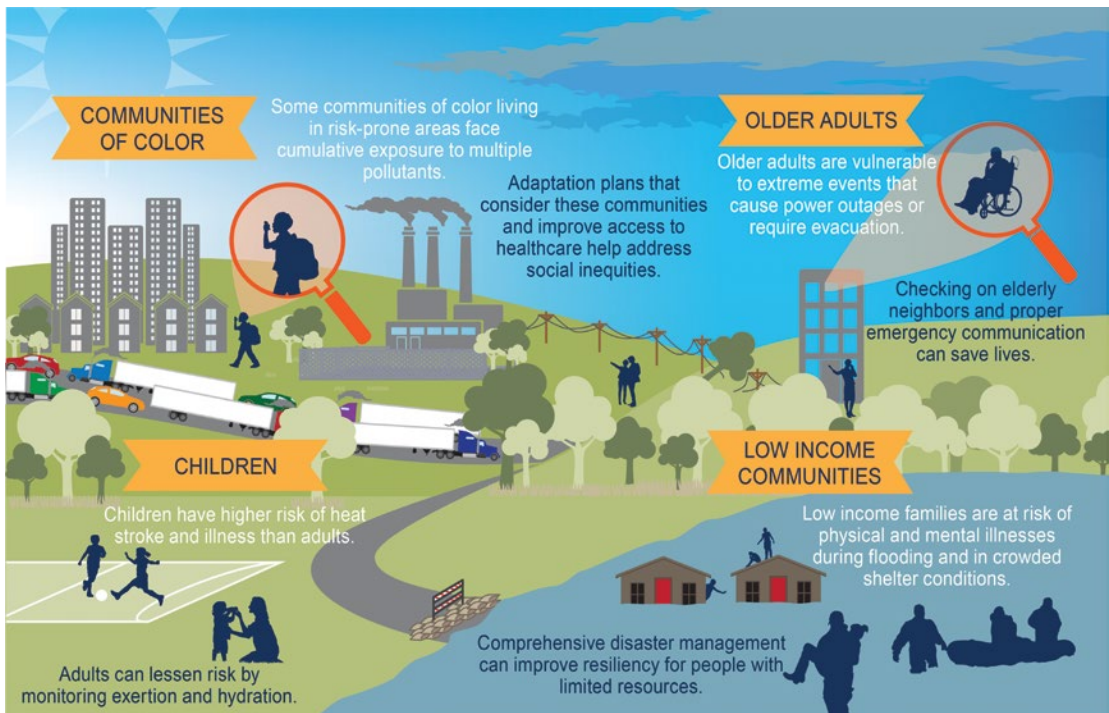
Source: U.S. Global Change Research Program 2018.

Effectiveness:

Engagement is unlikely unless individuals feel that "they can do something about the problem" and that doing something will be worth the effort (Howell 2011). Confidence that one can actually do what is needed is a key motivator of science-consistent environmental behaviors (Lam and Chen 2006). An online experiment showed that single exposures to news articles can affect an individual's perceptions that they can act in meaningful ways. One story associated with this effect was headlined, "With Severe Impacts of Climate Change on the Horizon, Many Americans are Finding it Easy to Take Political Action on the Issue." The perception that one can act in ways

that will elicit desired responses is associated with intentions to engage in "climate-related political participation" (Hart and Feldman 2016).

The need:
Increase uptake of individual climate-friendly actions.

Principle 11
Demand Accountability

Organizations are not only collections of individuals; they also respond to the collective demands of those on whom they depend for survival. One of the individual actions that a person can take is to insist that the groups of which they are a part (for example, local, state, and federal governments; businesses; social groups; educational and financial institutions) engage in the kinds of science-consistent action required to create a sustainable future.

The oil giant BP created a calculator to allow individuals to determine their carbon footprint. "Find out your #carbonfootprint with our new calculator & share your pledge today!" read the 2004 appeal (Yoder 2020). "Worrying about Your Carbon Footprint Is Exactly What Big Oil Wants You to Do," read a 2021 headline in an essay in *The New York Times* about corporate efforts to redirect responsibility for climate change from them to individuals (Schendler 2021).

Example 1
Reaching audiences in an unanticipated venue

Dr. J. Marshall Shepherd is an international expert in weather and climate, a past president of the American Meteorological Society, director of the University of Georgia's Atmospheric Sciences Program, and host of the Weather Channel's *Weather Geeks* podcast. For twelve years he worked as a research meteorologist at NASA-Goddard Space Flight Center and was deputy project scientist for the Global Precipitation Measurement mission.

But none of those distinctions are foregrounded either in his podcast or in his regular columns in *Forbes*, a conservative business outlet. "I am unapologetically a supporter of electric vehicles (EVs) and have thoroughly enjoyed mine," he wrote in the March 10, 2022, issue. "It has eradicated my gasoline bill, and my home power bill has not significantly changed thanks

to my power company's EV rate. I ride in the toll lanes in Georgia without fees and will claim my tax rebate this season."

The title of his piece ("Electric Vehicles Don't Have to Be Elitist—They Can Erode Social Inequities") telegraphs that its argument is not one that a reader would ordinarily expect to read in a conservative outlet (Shepherd 2022a). Shepherd argues that "tax breaks and other incentives will be required to address the inequity issues associated with income gaps based on race, class, geographic region and so forth." He notes with approval that the 2021 "Build Back Better" bill "included tax incentives for the purchase of new or used EVs," praises the emergence of EV sharing programs and resource groups such as EVHybridNoire, and applauds the city of Pittsburgh's 2070 Mobility Vision Plan for including the principle that mobility justice should "redress the infrastructure racism of the past." Pittsburgh's plan "'provides an equity-driven lens for infrastructure investment and maintenance to bring all neighborhoods to a good state of repair.' To achieve its goal of a 50 percent reduction of transportation emissions by 2030 (80 percent overall by 2050), the plan calls for public charging stations (row and off-street parking), induction charging on public streets, and other strategies to remove barriers to charging" (Shepherd 2022a). As for cost, Shepherd quotes an expert who recounts that preowned EVs are relatively inexpensive, in some cases selling for as little as $6,000.

The need:
Increase public pressure on all types of organizations to take steps needed to create a sustainable future.

Principle 12
Encourage Commitments in the Form of Accountable Climate Action Plans

When people, organizations, and governments make concrete commitments through climate action plans, they are more likely to take the promised action. Concrete commitments also help others hold them more accountable and reduce the likelihood of greenwashing.

The challenge being addressed:
Moving past virtue signaling and greenwashing to create, monitor, and hold corporations and governmental entities accountable for effective climate action plans.

The climate science:

The future habitability of Earth for human societies depends on the collective actions humanity takes now. There is rising evidence that this is a decisive decade (2020–2030). Loss of nature must be stopped and deep inequality counteracted. Global emissions of greenhouse gases need to be cut by half in the decade of 2021–2030. This alone requires collective governance of the global commons—all the living and non-living systems on Earth that societies use but that also regulate the state of the planet—for the sake of all people in the future (National Academies of Sciences, Engineering, and Medicine 2021).

When an individual or entity commits themselves to a plan, the likelihood of taking the planned action increases (Green and Gerber 2019). Peer pressure within a sector increases the adoption of similar commitments among peers. Public accessibility of plans increases accountability.

> ### Example 1 (corporate)
> Greenhouse Gas Protocol

Nonstate actors have an important role to play in reducing greenhouse gas emissions. Determining whether a company is meeting its commitment to becoming carbon neutral or negative requires an accurate disclosure of its carbon footprint. "[T]he standard for corporate reporting of greenhouse gases, adopted by governments for regulations, NGOs for accountability and corporations for compliance" (Patchell 2018)—the Greenhouse Gas Protocol (GHGP)—is conceptualized as "an international accounting tool to assist with understanding, quantifying, and managing greenhouse gas emissions" (Andrew and Cortese 2011). Created by the World Resources Institute in conjunction with the World Business Council for Sustainable Development, the GHGP "provides accounting and reporting standards, sector guidance, calculation tools and trainings for businesses and local and national governments" (World Resources Institute, n.d.). Its "comprehensive, global" frameworks provide sector-adapted accounting and reporting tools to reduce greenhouse gas emissions from corporations and public-sector entities. These tools detail best practices and knowledge that entities can use to inventory their emissions (Greenhouse Gas Protocol, n.d.-b). "The GHG Protocol," notes social scientist Jerry Patchell (2018), "asks companies to assess their responsibility for GHG emissions from their internal operations, energy bought from external sources and used internally (principally electricity), and the emissions their products incur upstream and downstream in the value chain. These responsibilities are termed scopes 1, 2 and 3 respectively." "Scope 1 refers to

direct emissions from a company's own activities, scope 2 refers to emissions from the production of purchased energy, and scope 3 refers to emissions from up- and downstream activities along the value chain" (Klaaßen and Stoll 2021). Scope 3 emissions are substantial (Hertwich and Wood 2018).

Overview of GHG Protocol scopes and emissions across the value chain
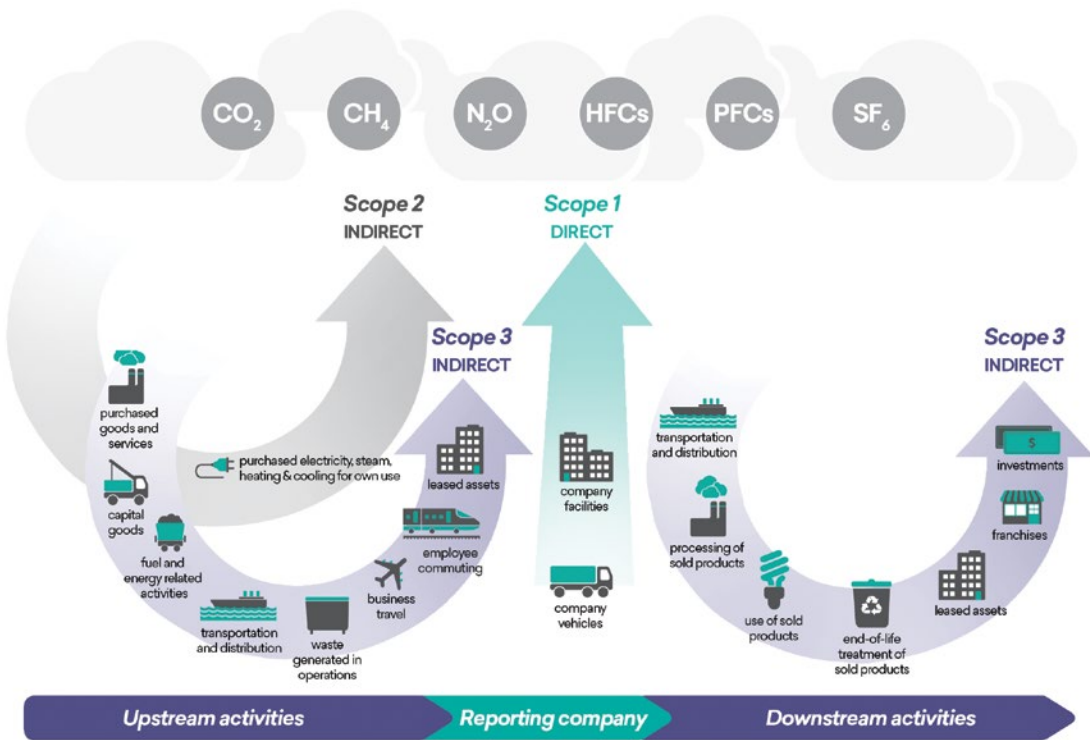
Source: World Resources Institute, n.d.

Effectiveness:

According to the GHGP, more than nine out of ten Fortune 500 companies reporting to the CDP (formerly the Carbon Disclosure Project), "a not-for-profit charity that runs the global disclosure system for investors, companies, cities, states and regions" (CDP, n.d.), use the GHG Protocol (Greenhouse Gas Protocol, n.d.-a). "The CDP," according to business professors Jane Andrew and Corinne L. Cortese, "has increased the amount of carbon related corporate information in the public domain. In fact, its size and scope is impressive[,] holding out the promise of widespread climate change related allocation decisions, disciplining the market towards sustainable futures and carbon sensitivities" (Andrew and Cortese 2011).

Political scientist Jessica F. Green argues that these "two NGOs were successful rule-makers because they were able meet a demand for three

benefits to potential users of the standard: reduced transaction costs, first-mover advantage, and an opportunity to burnish their reputation as environmental leaders" (Green 2010). However, others caution that "Only if private companies receive a clear political signal that stringent mandatory GHG emission controls and a global market-based instrument are at least likely to be adopted will they put substantial efforts into the accurate measurement and management of their GHGs" (Hickmann 2017). Furthermore, "Current carbon accounting and reporting practices remain unsystematic and not comparable, particularly for emissions along the value chain (so-called scope 3)" (Klaaßen and Stoll 2021).

Example 2 (municipal)
Global Covenant of Mayors for Climate and Energy

The European Commission launched the Global Covenant of Mayors for Climate and Energy (GCoM) in 2008 to support European Union locales in mitigating climate change. GCoM is "the largest international initiative dedicated to promoting climate action at a city level, covering globally over 10 000 cities and almost half the population of the European Union (EU) by end of March 2020" (Kona et al. 2021).

Effectiveness:
A study of the emissions reports from the cities in the Covenant of Mayors indicates that "monitoring signatories are on track to reach their commitment" (Kona et al. 2021).

Example 3 (non-profit)
American College and University Presidents' Climate Commitment

Organized by the United Nations to create in-sector social pressure and accountability, the American College and University Presidents' Climate Commitment (ACUPCC) is designed "to promote the research, education, and community engagement efforts needed to create a sustainable society, and to eliminate net greenhouse gas emissions from specified sources in their own campus operations" (UN Department of Economic and Social Affairs, n.d.).

Examples:
University of Buffalo Climate Action Plan (https://www.buffalo.edu/climate-action.html); and University of Pennsylvania Sustainability (https://www.sustainability.upenn.edu/our-commitment/about-penn-sustainability).

Effectiveness:

To date, nearly seven hundred educational institutions have signed the pledge, making their climate action plans and progress reports publicly accessible, pending website updates, via the ACUPCC Reporting System.

> ## Example 4 (health care)
> ### Health Care Sector Climate Pledge

On Earth Day 2022, the U.S. Department of Health and Human Services in partnership with the White House urged health care stakeholders to take the Health Care Sector Climate Pledge, which promises,

> We voluntarily pledge to: 1. At minimum, reduce organizational emissions by 50% by 2030 (from a baseline no earlier than 2008) and achieve net-zero by 2050, publicly accounting for progress on this goal every year. a) Share publicly our strategies for reducing on-site emissions (where relevant addressing sources related to on-site energy usage, waste anesthetic gases, vehicle fleets and re-frigerants). 2. Designate an executive-level lead for our work on reducing emissions by 2023 and conduct an inventory of Scope 3 (supply chain) emissions by the end of 2024. 3. Develop and re-lease a climate resilience plan for continuous operations by the end of 2023, anticipating the needs of groups in our community that experience disproportionate risk of climate-related harm (U.S. Health and Human Services, n.d.).

> More than six hundred hospitals have signed onto the pledge (White House 2022). Organizations that have signed the pledge were publicly recognized. (The list of signatories is available at: https://www.whitehouse .gov/briefing-room/statements-releases/2022/06/30/fact-sheet-health -sector-leaders-join-biden-administrations-pledge-to-reduce-greenhouse -gas-emissions-50-by-2030/.)

Example 5 (accountability)
Global Fossil Fuel Divestment Commitments Database

The database of fossil fuel divestment commitments made by institutions worldwide

⊘ VIEW DATABASE

Source: DivestmentDatabase.org/Stand.earth.

As *The New York Times* noted, "Two environmental nonprofit groups, Stand.earth and 350.org, started a website to keep track of divestment pledges from universities, banks, companies and even Queen Elizabeth II. So far, the list includes more than 1,500 institutions and businesses worth some $40 trillion" (Andreoni 2022).

The need:
Increase the number of organizations and individuals committed to plans that address and reduce climate change, timelines that meet the need, and forms of disclosure that ease monitoring and maximize accountability of the plans and their promulgators.

Example 6

Tying personal to institutional accountability

A resolution of the Executive Committee of the Faculty Senate at the University of Pennsylvania asked faculty members to sign a pledge agreeing not only to take these individual actions:

1. to support and encourage relevant teaching and research initiatives in our respective schools and departments, and centers and initiatives;

2. to reduce our personal carbon footprints with respect to our air travel (including the purchase of reliable offsets when such travel is necessary) and our energy use at work, at home, and in transportation between work and home;

3. to examine our personal retirement investment portfolios in order to align them as closely as possible with our values favoring a radical reduction in greenhouse gas emissions and new business solutions to the climate challenge;

but at the same time to make these efforts to create institutional change:

4. to encourage our Schools, departments, Centers, and other administrative units to become active in the Green Office Program, including certification for reducing energy use, greening supply purchases, and adopting green catering options;

5. to work within our academic and professional societies to find pathways to a less carbon-intensive future—in particular to create alternatives to conference travel.

A copy of the climate pledge is available at https://almanac.upenn.edu/volume-66-number-35#from-the-senate-office-resolution-on-the-individual-and-institutional-responses-of-faculty-in-the-university-of-pennsylvania-to-the-global-climate-emergency.

A video produced by the Faculty Senate to encourage members of the Penn community to sign the pledge is available at https://vimeo.com/698668481.

About the Commission on Accelerating Climate Action

The Commission on Accelerating Climate Action was formed in 2021 by the American Academy of Arts and Sciences, reflecting a significant long-term commitment by its Board of Directors to address the challenges of climate change. The Commission's work answers two core questions: 1) What policies would most effectively and equitably remove barriers to climate action? 2) How can the United States accelerate climate mitigation and adaptation strategies for all Americans? While the science of climate change is well-established, the Commission aims to leverage its diverse composition to identify strategies for building a durable and inclusive political coalition for climate action. In the first phase of the project, the Commission assessed the national landscape on climate action by interviewing seventy experts across three domains: communication, the private sector, and human and national security. Summaries of the findings from all areas are accessible at https://www.amacad.org/project/accelerating-climate-action. These documents form the basis for innovative recommendations for climate action across sectors and ideologies.

Antonique Smith (Hip Hop Caucus), Emma Stewart (Netflix), Alexandria Villaseñor (Earth Uprising), Cora Went (Sunrise Movement), Bernadette Woods Placky (Climate Central), and Ginger Zee (ABC News) for their contributions and insight.

Chairs

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Revitalization Strategies

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