RENEWABLE RESOURCES JOURNAL

VOLUME 36 NUMBER 4

CONTENTS

RNRF Staff Report:

Pursuing the Climate Crisis Agenda – 2022

After having been delayed a year due to the COVID-19 pandemic, the 2020 United Nations Climate Change Conference, or COP26, is scheduled to be conducted from October 31st to November 12th, 2021 in Glasgow, Scotland. At the meeting, world leaders will convene in hopes of making progress on the implementation of the Paris Climate Agreement. Key priorities include the strengthening of countries' Nationally Determined Contributions (NDCs) for the mitigation of climate change, as well as increased commitments for international climate finance, and improved adaptation actions. While some progress will likely be made at this meeting, many key challenges to effectively addressing the climate crisis will remain unresolved.

This special report identifies four key areas related to international climate action that have been persistently challenging in the past and will continue to be barriers to the Paris Agreement's success. These are: insufficient international climate finance; barriers to large-scale carbon capture and storage; increasing emissions from coal in China and other Asian nations; and the fragile durability of American global leadership in achieving the necessary ambitious carbon-reduction goals.

International Climate Finance

Countries of the world have been debating and negotiating for decades on how to reduce and mitigate climate change. Since the UN Framework Convention on Climate Change was established at the 1992 Earth Summit, COP meetings have been conducted annually (with the exception of 2020). In that time, multiple agreements have failed. The Paris Agreement, with its universal buy-in from the countries of the world, shows promise to be the framework under which real climate solutions will be achieved. However, the agreement still has yet to resolve one of the most serious impasses that has persisted through almost 30 years of climate negotiations: the divide between the interests of the developed and developing world.

Highly developed nations like the U.S. and many nations within the EU have had the opportunity to pursue decades of carbon-intensive development free of scrutiny and constraint. Prior to the recognition of climate change as a serious planetary threat, industrialized countries grew their wealth for decades, their economies largely driven by the burning of fossil fuels. Now, the threat of climate change is widely acknowledged and the necessity of reducing, and eventually eliminating, carbon emissions is accepted. Many developing countries feel disadvantaged by the lost opportunity of using inexpensive but highly polluting fossil fuels.

The developing world is both more vulnerable to the impacts of climate change and has played less of a historic role in creating the problem. Additionally, these countries' ability to develop economically may be stunted by the transition away from a fossil fuel-dependent economy. At climate negotiations, developing countries frequently argue that, since they bear relatively little responsibility for the carbon crisis, the countries that have profited most from the burning of fossil fuels should finance their current climate adaptation initiatives and energy transitions. This tension contributed to the failure of both the Kyoto Protocol and Copenhagen Accord climate agreements.

Developed countries have begun to contribute more money for global climate finance. The Paris Agreement established the Green Climate Fund (GCF), a climate finance mechanism for affluent countries to contribute funding to the developing world. However, the amounts so far pledged are insufficient to truly adapt to climate impacts and transition away from fossil fuels. Contributions have been further stifled by pandemic impacts on developed nations. Significant increases in international climate finance will be necessary to accomplish those goals.

The Biden administration **has said** that it intends for the U.S. to double its commitments by 2024 compared to levels promised under the Obama administration, in part to make up for a reductions in global climate

finance during the Trump administration. This will include renewed commitments to the Green Climate Fund, as well as using multilateral development banks, USAID, and other mechanisms to fund climate projects.

In 2009, developed countries committed to mobilize $100 billion per year in global climate finance by 2020. In 2018, the most recent year for which we have data, the Organization for Economic Co-operation and Development (OECD) estimated that total global climate finance was $78.9 billion. This was an 11% increase from the $71.2 billion contributed the year prior, representing a positive upward trajectory at that time. However, a **UN report** noted that it is unrealistic to expect that the 2020 total met the $100 billion goal. The economic impacts of the COVID-19 pandemic on developing nations have made climate finance even more necessary for them to mitigate carbon emissions and adapt to climate change. This issue will continue to be a point of focus in international climate negotiations and is unlikely to be resolved soon. However, it is an impasse that the countries of the world will have to resolve if they wish to effectively address the climate crisis.

Renewable Resources Journal

Renewable Resources Journal (ISSN 2578-3998) is published quarterly by the Renewable Natural Resources Foundation, 6010 Executive Boulevard, Suite 700, North Bethesda, MD 20852-3809, USA. Tel: +1 301 770 9101 Email: info@rnrf.org Website: https://www.rnrf.org

Editorial Staff: Robert D. Day, editor; Stephen Yaeger, assistant editor.

Carbon Capture and Storage

Even if countries make bold, ambitious carbon reduction goals (NDCs), they must be realistically achievable and have an implementation plan that is sufficient to achieve the goals. There is growing concern about over-reliance on carbon capture and storage (CCS) for meeting "net-zero" climate goals. Net-zero climate goals take a dual-track approach of reducing carbon emissions while also removing carbon from the atmosphere, with the goal of removing as much carbon as is emitted. While this seems like a viable concept in theory, some experts have expressed their doubts about it, saying that this approach relies too much on unproven technological advances and gives undue license to continue use of fossil fuel.

CCS is often portrayed optimistically in the media, and is commonly assumed to be an important component of climate action in the coming decades. However, its viability, especially in the critical next decade for climate action, should be questioned. A **report published by the Tydall Center for Climate Change Research and Friends of the Earth Scotland** explains the reasoning for being skeptical about CCS.

The report notes that the technology to remove carbon from the atmosphere and store it underground has

existed for decades. While it was first demonstrated for strictly environmental purposes in 1996, it was first introduced in the 1970s to aid in a process called enhanced oil recovery, which allows more oil to be forced out of the ground. Still today, the vast majority of CCS applications are part of this process. That stored carbon is allowing more oil to be extracted from the ground, oil that will be burned; the majority of CCS being conducted today is not actually carbon-negative.

While truly carbon-negative CCS technology was conceived of decades ago, it has consistently failed to meet expectations for its deployment at scale. The primary barrier to its widespread adoption is cost. For example, there is a very large cost to retrofit carbon scrubbers onto an existing coal plant, pipe the captured carbon underground, and monitor its storage site indefinitely. Direct air capture is also associated with high costs and energy demand, especially at the scale that would be required to have a significant positive impact on climate change. There is also significant doubt about the long-term stability of storing captured carbon in geological formations without it escaping back into the atmosphere.

According to the IPCC, massive drawdown of carbon emissions will have to occur by 2030 in order to keep warming below 1.5° C, one of the core goals of the Paris Agreement. Currently, even in optimistic estimates CCS is not expected to contribute to climate change mitigation in a meaningful way by 2030. CCS will not be available to help achieve these short-term goals, and given the technology's track record, it is reasonable to question whether it will be deployed at scale after that date. The theoretical implementation of CCS technology at some point in the future does not replace the urgent need to reduce carbon emissions right now.

New skepticism about over-reliance on CCS from prominent scientists has recently been offered. In **an April 2021 article**, Robert Watson, former chair of the Intergovernmental Panel on Climate Change (IPCC), along with climate scientists Wolfgang Knorr and James Dyke, expressed their reservations about the concept of net-zero and the over-reliance on CCS in climate plans. They noted that the mere idea that viable CCS technology would exist at some point in the future has given policymakers a way out of making the immediate cuts to emissions necessary to achieve Paris Agreement goals. They summarize their argument with the following:

> "In principle there is nothing wrong or dangerous about carbon dioxide removal proposals. In fact developing ways of reducing concentrations of carbon dioxide can feel tremendously exciting. You are using science and engineering to save humanity from disaster. What you are doing is important. There is also the realization that carbon removal will be needed to mop up some of the emissions from sectors such as aviation and cement production. So there will be some small role for a number of different carbon dioxide removal approaches.
>
> The problems come when it is assumed that these can be deployed at vast scale. This effectively serves as a blank cheque for the continued burning of fossil fuels and the acceleration of habitat destruction."

The efficacy of international climate agreements has been hampered by the assumption that CCS technologies would be implemented at scale. While the popularity of this assumption may be eroding, it will likely continue to be an impediment to meaningful, immediate climate action in the aftermath of COP26 in Glasgow.

Increasing Coal Emissions

Accomplishing the goals of the Paris Agreement will require reducing and eventually eliminating the burning of coal, which is the most carbon emissions-intensive fossil fuel. Antonio Guterres, the secretary general of the UN, **has called for all construction of new coal plants to be cancelled**. In the 2000s, coal use grew more than any other previous decade in history, according to the **International Energy Agency**. China led the world in new coal consumption, accounting for 85% of global growth. However, global coal consumption trended downwards in the 2010s largely due to more competitive prices for shale gas and renewables and increased motivation to act on the climate crisis. Ensuring that this trend continues and coal is not revived will be an important factor in the success of the Paris Agreement. This is why Guterres has called on the countries of the world to cancel new coal projects, end financing of coal plants, and end "the deadly addiction to coal."

Despite this, many new plants are in the works, 80% of which are planned in five Asian countries: China, India,

Indonesia, Japan, and Vietnam. A new report published by the think tank Carbon Tracker in June of 2021 entitled "**Do Not Revive Coal: Planned Asia coal plants a danger to Paris**" describes how plans to build new coal plants endanger climate goals and are going forward despite the availability of more affordable renewable energy.

These five countries have planned more than 600 new units which would provide over 300 GW of generation capacity. China accounts for more than half of this planned capacity. Even if climate was not a consideration, these plants are still not a good idea: according to the Carbon Tracker report, 92% of the new installations will be uneconomic, even under a business-as-usual emissions scenario. This likely means that they will be propped up by subsidies and other policy measures if they are constructed.

The same countries already account for nearly 75% of global coal generation capacity, with 55% in China and 12% in India. According to the report, about 27% of global coal capacity is already not profitable and another 30% is close to revenue neutral, meaning it is at risk of falling into unprofitability in the near future. Currently, about 80% of global coal capacity could be immediately replaced by new renewables for a lower cost; by 2026, this number is expected to be almost 100%. Simply put, the construction of new coal-fired power plants does not make economic or environmental sense.

While some countries, **including China**, have announced improvements in the ambitions of their NDCs, they are moving forward with the construction of new coal-fired power plants. This year's conference in Glasgow may push some countries to make progress in this area, but the use of coal power is likely to persist as a serious challenge to meeting the goals of the Paris Agreement.

Can America Provide Durable Global Leadership in Achieving Paris Climate Agreement Goals?

America's leadership helped forge support for the complicated architecture of the Paris Climate Agreement in 2015, which was quickly ratified early in 2016. The promise of American political, scientific and funding leadership made this difficult task of turning aspirations into commitments—and raising aspirations to meet necessities of the task—seem possible. The world would walk the climate tightrope together and endeavor to make it work.

America's national elections in 2016 ushered in a new administration that had no interest in implementing the Paris Agreement, withdrew funding support, and set about to rollback U.S. pollution and carbon-limiting measures. American government leadership was profoundly diminished. The scientific and NGO communities, the private sector, and some state and municipal governments worked to fill the void but were not able to replace the federal government.

Further complicating the mission of addressing the climate crisis over the past 18 months has been the coronavirus pandemic. Research has been delayed, meetings of scientists have been disrupted, and COP26 has been delayed by a year (but stay tuned). Also, many nations have suffered significant financial losses and this may dampen their philanthropic tendencies toward developing nations.

The 2020 elections brought Joe Biden to The White House, a possible one-vote Democratic Party majority to the Senate, and a slender Democratic Party majority was sustained in the House.

Political constraints have been a major historical roadblock to international climate action that will continue to persist after COP26. This issue manifests in two important ways: it can be a barrier to the implementation of countries' NDCs, and it can negatively impact the leadership, credibility, and participation of the U.S. in climate agreements. Polarization between U.S. political parties and structural issues contribute to these constraints.

One of the most important expectations for COP26 is that many countries will update their NDCs to have more ambitious climate goals. The U.S.-hosted **climate summit** in April of 2021 was aimed at inspiring countries to increase their ambition, and some did, including the U.S. However, while NDCs are important as benchmarks for countries to meet in addressing climate change, they typically do not describe the set of policies that will be used to achieve them. The implementation of NDCs will be an ongoing challenge in the U.S. and across the world after COP26.

In the United States, the executive branch has the unilateral power to set the country's NDC, which Biden has done. However, the durability and implementation of the commitments will be subject to political obstacles which will be very difficult to bypass. According to the various analyses from institutions like the **University of Maryland Center for Global Sustainability** and the **Environmental Defense Fund**, the U.S.'s new commitments are technically feasible. The main barrier to their implementation will be political constraints.

Implementation of the NDC will occur via a variety of policies, some more effective and realistic than others. Some measures, like **improving fuel economy standards** for cars and trucks, can be conducted unilaterally by the executive branch and are expected to face little pushback. There are also two measures that have already passed through Congress which will contribute to the reduction of non-CO_2 carbon emissions – a **reinstation of Obama-era methane rules** which had been invalidated by the Trump administration, and new legislation to **phase down use of hydrofluorocarbons**.

However, most of the necessary measures to achieve the commitments of the new NDC will have to be included in legislation passed through Congress. Political polarization and structural barriers make this a difficult task. The initial legislative proposal that came from the Biden Administration to address climate change in meaningful ways was the American Jobs Plan. This proposal has since morphed into a set of two bills. Legislators are aiming to pass one on a bipartisan basis, needing at least 60 votes to override the filibuster in the Senate. The other would be passed through reconciliation, which allows spending bills to pass the Senate with a simple majority. However, even the reconciliation bill would require either complete cooperation among Democratic senators or cooperation from some Republicans, making it more difficult to pass more ambitious climate provisions. It is likely that sufficiently robust legislation to fulfill the U.S.'s NDC will depend on increased support in Congress as a result of a future election. Of course, the loss of a majority in either house of congress could compromise U.S. domestic ambitions and leadership on the international stage.

Building Flood Resilience in a Changing Climate

Maryam Golnaraghi, Swenja Surminski, and Carolyn Kousky

For The Geneva Association

As the world responds to the COVID-19 crisis and governments prepare their economic stimulus plans, the potential compounding effects of weather-related extremes such as floods, tropical cyclones and wildfires could significantly challenge a country's emergency management capacities and slow down socio-economic recovery. This study is focused on building resilience to floods in a changing climate. It points to the need for a paradigm shift from reacting to crises towards a risk-based, anticipatory, holistic and all-of-society approach to managing the potential impacts of catastrophes.

Flooding is one of the most important physical climate risks in many countries, affecting households, communities, businesses and governments on a regular basis.

There are several kinds of floods:

- Fluvial floods (river floods)
- Pluvial floods (flash floods and surface water)
- Coastal floods (storm surge and coastal tidal flooding)

Each kind differs in terms of occurrence, potential damage and management measures.

"Building Flood Resilience in a Changing Climate: Insights from the United States, England, and Germany" was originally published by the Geneva Association. It was written by ***Maryam Golnaraghi*** *of The Geneva Association;* ***Swenja Surminski*** *of London School of Economics; and* ***Carolyn Kousky*** *of Wharton Risk Center, University of Pennsylvania. The Geneva Association is an international think tank of the insurance industry.*

Building resilience has become a priority for many countries around the world in recent years, due to the major socio-economic effects of flooding, including threats to human lives and livelihoods as well as direct and indirect economic impacts.

The costs associated with floods are growing in many places due to the combined impacts of

- Increasing concentrations of people and assets in areas of high flood risk linked to land use, urbanisation and development practices; and
- The increasing frequency and severity of weather-related events linked to climate change (e.g. changing storm and precipitation patterns and rising sea levels) (Intergovernmental Panel on Climate Change (IPCC) 2018).

Over the last decade, underpinned by three international framework agreements,[1] some governments have started to adopt a more proactive approach to disaster risk management (including for floods), engaging a variety of stakeholders (The Geneva Association 2016, 2017). Despite some progress, a number of hurdles remain related to policy and regulatory constraints, institutional and sectoral silos and capacities, conflicting and/or competing priorities and insufficient coordination within and across layers of government and with other key stakeholders, such as the private sector and non-governmental organisations (NGOs).

As part of its commitment to strengthening socio-economic resilience to extreme events and climate change, The Geneva Association has undertaken this study to take a deeper look at the evolution of flood risk management (FRM), particularly in light of the changing risk landscape. Specifically:

- This study offers a comprehensive review of FRM

[1] The United Nations Hyogo Framework for Action (2005–2015), Sendai Framework for Disaster Reduction (2015–2030) and The Paris Agreement, which have been adopted by over 190 member states.

in three high-income countries with mature insurance markets: the U.S., England (a constituent country of the U.K., as defined by the Commonwealth) and Germany;

- Special attention is given to mapping the evolution of governance, institutional frameworks and the interplay of different components of FRM, including risk assessment, risk communication and awareness, risk reduction, risk prevention, risk financing, risk transfer (e.g. insurance and alternative risk transfer) and reconstruction measures;
- Trends and patterns are explored and key findings and recommendations for stakeholders aiming to improve FRM systems in any country are provided;
- The study did not set out to draw comparisons among the three countries, or to identify and promote best practices. In fact, a best practice in one country may not be so in another, as it cannot be isolated from the governance, institutional and cultural environments in which it was originally developed.

The methodology, framework for FRM analysis, overall findings from the three case studies and overall recommendations are provided in this overview report. Case studies for the U.S., England and Germany are available in The Geneva Association (2020a), (2020b) and (2020c), respectively.

Key trends and findings

- **Flood risk:** The rising socio-economic impacts of floods have become a national concern in all three countries particularly in the immediate aftermath of flood events. The three countries are impacted by fluvial floods (river floods), pluvial floods (flash floods and surface water) and coastal floods (storm surge). Recurrent, high-impact flooding has led to growing political, public and insurance industry concern, particularly around the need for action to reform FRM systems and strengthen flood resilience. The generation and management of flood risks are impacted by actions taken by different stakeholders.

- **Institutional roles and responsibilities:** There is growing evidence that approaches to FRM are slowly evolving from efforts to control water to building resilience to floods. Countries are increasingly taking into consideration a risk-based and more collaborative approach to FRM. Protection of the most vulnerable citizens, particularly those residing in very high-risk areas, remains a critical issue for governments.

FRM entails a range of policies, interventions and activities, delivered by a variety of stakeholders, with different incentives and priorities. This creates complementarities, duplication and sometimes gaps in efforts related to FRM.

Importantly, the evolution of FRM in the three countries differs significantly, driven by a variety of country-specific factors. For example, types and impacts of flood risks; each country's governance structure; overall strategy, policies, regulatory frameworks, institutional arrangements, coordination and dynamics within and across layers of government to address FRM; institutional and cultural legacies associated with FRM; the extent and nature of engagement between the public and private sectors (namely, insurance, banking, development and real estate); availability and accessibility of decision-relevant risk information for all members of society; overall risk awareness, risk perception and ownership across society; societal perceptions of and the governmental approach to post-disaster aid versus protection through insurance; and considerations for climate change, which are deeply connected to the politics in the country.

- **Risk information and communication:** In the last decade, the need for flood-risk assessment and communicating about risks has gained significant momentum although with different levels of success and impact on government, business, community and homeowner decisions. The level of risk awareness and utilisation of risk information in decision-making varies greatly among stakeholders and in many cases, risk information is not decision-relevant, for example, for local governments and homeowners.
- **Alerts and early warnings:** The three case studies confirm significant progress toward the implementation of

early warning systems to enhance emergency preparedness and response operations to save lives and expedite post-disaster assessments and claims payouts.

- **Risk reduction and risk prevention:** The need for ex-ante investments in risk reduction and risk prevention measures by governments, businesses, communities and homeowners is slowly coming into focus. However, when it comes to implementation, there are different priorities, approaches and levels of coordination among agencies and levels of the government. Implementing these measures is critical to driving affordability and to the sustainability of insurance programmes.

  There appear to be perverse incentives in all the countries, particularly with the government agencies responsible for land-use planning and building-code decisions that may limit actions to reduce and prevent risks.

- **Risk financing:** Risk financing and contingency planning for protection of government budgets is gaining some attention, particularly at the national level. However, none of the three countries have established a pre-disaster budget or contingency planning process, with funds appropriated by the government after the event.

- **Risk transfer (insurance and alternative-risk transfer):** The value proposition of the insurance industry is evident. Beyond facilitating financial protection for recovery, the insurance sector in some countries provides flood-risk analytics and modelling, assists in flood-risk communication and awareness campaigns, and incentivising risk-reduction and risk- prevention measures. However, the sustainability and affordability of insurance products remains deeply reliant on the ex-ante efforts of governments to invest in risk-reduction and risk-prevention measures. Furthermore, limited take-up of insurance is linked to low levels of flood-risk awareness and understanding of the benefits of insurance, underestimating the potential impacts of severe floods and reliance on other support mechanisms such as post-disaster government handouts.

  Collaboration between the government and insurance industry can help boost accessibility, affordability and the sustainability of insurance as a key contributor to enhancing flood resilience. At the heart of this issue is the need for the government and insurance industry to be more deeply committed to working together towards promoting and incentivising risk reduction and risk prevention and to achieving mutually agreed definitions of their respective roles.

- **Reconstruction:** There is growing recognition of the need to build back smarter after an event in order to strengthen resilience to future events in medium- and high-risk regions, with clear guidelines on how to build. However, meaningful action from those involved in the recovery and reconstruction process has been limited. Climate change considerations are not systematically factored in and politically motivated decisions, such as to not build back at all or relocate from high-risk regions, are sometimes taken.

- **Multi-stakeholder engagement:** Cross-sectoral and multi-stakeholder collaboration and initiatives prove to be highly beneficial, although efforts are needed to develop and sustain such mechanisms beyond awareness raising and towards real action.

- **Overall FRM Approach:** Despite all the developments, FRM systems remain, in general, reactive to floods, pointing to the need for a more anticipatory, cohesive and systems-based approach to addressing this growing risk. Furthermore, the development of FRM systems need to be an integral part of economic development and climate adaptation strategies at all levels of the government. Finally, a major shortcoming in all countries is that they do not rigorously and systematically monitor the impacts and benefits of investments in risk awareness and communication, risk reduction and risk-prevention measures in order to make ongoing improvements to the system.

Recommendations

FRM is a multi-faceted challenge that requires coordinated action from a wide range of stakeholders, with clearly defined roles and responsibilities, effective collaborations and incentives. A shift towards a more

anticipatory FRM approach requires a change in behaviour not only from those tasked with managing risks, but also those at risk or involved in creating risks. The shift towards a more anticipatory focus is important, particularly in the face of climate change and other emerging risks. As the world grapples with managing the health and socio-economic impacts of the COVID-19 crisis, the need for a paradigm shift towards a risk-based, anticipatory, holistic and all-of- society approach to managing risks of disasters cannot be stressed enough.

Recommendation 1 **Governments** should develop a *clear national strategy for FRM,* with an anticipatory, cohesive and systems-based approach to building flood resilience. This should be an integral part of economic-development and climate change-adaptation plans. They should establish effective mechanisms to leverage the strengths, expertise and innovative solutions of key stakeholders, particularly the private sector.

Governments should (i) move from reactive to proactive approaches that consider the changing risk landscape caused by climate change and other socio-economic drivers; (ii) consider that FRM entails highly interdependent measures, including risk assessment and risk communication, risk reduction and prevention, risk financing, risk transfer and building back better after an event; (iii) re-evaluate and reform their post disaster aid programmes to incentivise flood-risk reduction and prevention measures, while considering measures for the most vulnerable populations; (iv) make it mandatory to disclose previous flood events to potential property buyers (e.g. through flood disclosure laws) in the early stages of their decision-making; and (v) establish mechanisms for monitoring and improving the FRM system and its components over time.

Recommendation 2 The **insurance industry** should further *step up their proactive engagement with governments and their customers,* as risk advisers, risk management experts, risk underwriters and investors, to support the implementation of FRM systems to strengthen resilience to floods. Specifically, national insurance associations should work with their members to find effective mechanisms for industry-level engagement and collaboration with government authorities to identify and develop practical and sustainable solutions to enhancing socio-economic resilience to floods.

This could include sharing risk information, providing risk management advice, engaging in risk awareness campaigns, sharing practical guidelines on risk reduction and preventive measures for homeowners, businesses and governments and offering innovative insurance products that incentivise risk reduction.

Furthermore, insurance companies, in light of developments related to the Task Force on Climate-related Financial Disclosures (TCFD), should evaluate the impacts of changing flood risks on both sides of their balance sheet (liabilities and investments) and also offer risk modelling and risk management advice to their commercial clients for implementing TCFD recommendations.

Recommendation 3 **Businesses and households** should proactively seek flood-risk information; *understand and take responsibility for managing their flood risk;* and make risk-informed decisions.

Recommendation 4 **International organisations, academic institutions, professional and executive education programmes** could utilise this study in their awareness-raising campaigns and educational programmes targeted at government officials, policy makers, businesses and the general public, *promoting the need for a risk-based, anticipatory, cohesive and systems-based approach,* which takes climate change into consideration for building flood resilience.

Recommendation 5 **Government officials, the insurance industry and other stakeholders** responsible for FRM in the U.S., England and Germany should come together in their respective countries, *review and discuss the gaps, challenges and weaknesses* identified in our review and find effective ways to work together to enhance their FRM system towards a more cohesive, systems-based and forward-looking approach. The national insurance associations in each country could play a key role in convening these stakeholders.

*This article was adapted from The Geneva Association report "Building Flood Resilience in a Changing Climate: Insights from the United States, England, and Germany." The full report, as well as individual country reports, can be found **here**.*

References

Intergovernmental Panel on Climate Change. 2018. *IPCC Special Report on the Impacts of Global Warming of 1.5° C.* https://www.ipcc.ch/sr15/

The Geneva Association. 2016. *An Integrated Approach to Managing Extreme Events and Climate Risks.* Authors: Maryam Golnaraghi, Swenja Surminski and Kai-Uwe Schanz. https://www.genevaassociation.org/ media/952146/20160908_ecoben20_final.pdf

The Geneva Association. 2017. *The Stakeholder Landscape in Extreme Events and Climate Risk.* Authors: Maryam Golnaraghi and Patrick Khalil. https://www. genevaassociation.org/sites/default/files/research-topics- document-type/pdf_public//stakeholder-landscape-in- eecr.pdf

The Geneva Association. 2020a. Flood Risk Management in the United States. Authors: Carolyn Kousky and Maryam Golnaraghi. https://www.genevaassociation.org/research- topics/flood-risk-management-united-states

The Geneva Association. 2020b. Flood Risk Management in England. Authors: Swenja Surminski, Sara Mehryar and Maryam Golnaraghi. https://www.genevaassociation.org/ research-topics/flood-risk-management-england

The Geneva Association. 2020c. Flood Risk Management in Germany. Authors: Swenja Surminski, Viktor Roezer and Maryam Golnaraghi. https://www.genevaassociation.org/ research-topics/flood-risk-management-germany

A Social Contract for Decarbonization

Committee on Accelerating Decarbonization in the United States: Technology, Policy, and Societal Dimensions

National Academies of Sciences, Engineering, and Medicine

Because the transition to a low-carbon economy is likely to be disruptive and create uneven distributions of benefits, costs, and risks, U.S. energy policy in the 2020s will need to establish and maintain a strong social contract for decarbonization (see Box 1; O'Brien et al., 2009). In the absence of broad support from U.S. families, workers, businesses, and communities, progress is unlikely to proceed at the pace and scale required to achieve a carbon-neutral economy by 2050.

Polls show that, across the political spectrum, a significant majority of Americans support urgent efforts to combat climate change and decarbonize the economy (Leiserowitz et al., 2018; Roberts, 2020; Tyson and Kennedy, 2020). That support is likely to be tested, however, as the United States navigates the complexities of the changes required and the disruptions they bring to people's lives and livelihoods.

Research has demonstrated a "social gap" between widespread general support for renewable energy technologies yet relatively slow uptake (Dwyer and Bidwell, 2019; Rai and Beck, 2015; Boudet, 2019). Public perception and opposition can be road-blocks to a carbon-neutral transition (Firestone et al., 2017, 2020), especially where public engagement is perfunctory, carried out too late in the process, and where key decisions have already been made. These cases often exacerbate conflict among groups and catalyze opposition to new technologies and infrastructures. The deliberate undermining of public support for climate action through misinformation and the ways that publics are encouraged or discouraged from participating in governance processes can also significantly shape social responses to new technologies (Giordono et al., 2018; Hall et al., 2013). This is particularly relevant in the energy system, where there is often a lack of fairness and unequal distributions of power and resources in decision-making processes (Pezzullo and Cox, 2017; National Research Council, 2008).

There is no silver bullet for sustaining widespread public support for the transition to a carbon-neutral economy. That support will come only from persistent and sustained efforts on the part of civic, policy, labor, and business institutions in the energy system and beyond. A more coordinated, national effort is needed to proactively engage diverse publics and stakeholders (Dwyer and Bidwell 2019; Ashworth et al., 2011); to meaningfully integrate the social and economic dimensions of transitions into energy analysis and policy (Miller et al., 2015); and to work collaboratively with communities (Wyborn et al., 2019) to create a strong clean energy economy that supports a robust U.S. workforce and distributes the costs, benefits, risks, opportunities, and burdens of decarbonization as fairly and equitably as possible.

Generating sustained public support requires a multipronged approach, including public engagement to discover and embed community preferences in decision-making and a concerted effort to communicate the necessities, costs, benefits, and remedies of policy actions (Steg et al., 2015). It also needs to facilitate inquiry and dialogue about what those policies might mean for specific communities and how to apply policies equitably and effectively in different contexts (Kimura and Kinchy 2019), while systematically dismantling misinformation to minimize confusion and polarization (Farrell et al., 2019). Technology and infrastructure needs toward deep decarbonization goals necessarily involve heterogeneous costs and benefits across communities and regions in the United States.

Inevitably, public support for necessary policy actions (see Chapter 4) will vary across U.S. regions based on

perceptions of costs and benefits (Howe et al., 2015). Importantly, such perceptions are mediated through cognitive ideologies (e.g., individualistic versus egalitarian; Leiserowitz et al., 2013) and values (e.g., egoistic versus altruistic, Steg et al., 2015), which are relatively stable. Generating long-term public support will entail understanding those values and incorporating them into implementation to design strategies that are sensitive and responsive to local and contextual factors (Haggerty et al., 2018, Steg et al., 2015). Relatedly, to be effective, implementation strategies should take an integrated approach, anticipating barriers and challenges that

Box 1: A Social Contract for Deep Decarbonization

The committee defines a social contract for deep decarbonization as a broadly shared understanding among the energy industry; local, state, and federal governments; and U.S. families, businesses, workers, and communities to support efforts to advance a transition to a carbon-neutral U.S. economy so long as that transition meets societally determined criteria.

Such a contract cannot be assumed to exist at present, nor will it result from naïve programs that seek only to "educate" the public. It must be created and nurtured via active public engagement that raises awareness and strengthens knowledge and learning as it listens and responds to individuals' and communities' concerns and incorporates diverse values into energy decisions. The committee believes that a principal way to get action on addressing climate change is to make sure that doing so also addresses the countless ways in which the U.S. energy economy has left people out, left some communities bearing excessive burdens of pollution and related public health problems, and led to communities dependent on fossil-energy resource extraction with limited lifetimes. The committee finds that making progress on mitigating the effects of climate change depends on navigating the energy transition in socially responsible ways.

Key considerations for such a contract include:

- Accepting a joint responsibility on the part of business, government, and civil society for transforming the U.S. economy and energy systems to carbon neutrality with sufficient rapidity to reduce the likelihood of extreme weather and climate risks and protect the environment for future generations.
- Honoring the contributions of energy workers to the nation's economy, including those displaced by the adoption of new energy technologies.
- Acknowledging interdependence among diverse stakeholders, sectors, and regions.
- Identifying, anticipating, assessing, and making transparent the societal and economic implications of future energy system design and use under diverse pathways to decarbonization.
- Engaging diverse communities and stakeholders in inclusive decision-making processes that allow participants to give full voice to their hopes and concerns about the current state of energy systems and the economy, decarbonization, and the energy and economic futures it will help bring into being.
- Providing financial support and capacity building to disadvantaged communities to ensure that they are able to effectively participate in transition decision making and contribute to the transition.
- Distributing the costs, benefits, risks, opportunities, and burdens of decarbonization fairly and equitably and redressing harms caused by the transition and by injustices and inequities that stem from existing energy systems.
- Leveraging energy innovation to create an economy that works better for all Americans, and especially for BIPOC (Black, Indigenous, people of color), women, rural, and low-income families, workers, and communities that have traditionally received a smaller proportion of the benefits of new energy technologies and systems or disproportionately borne their risks and burdens.

communities and individuals might face with particular technologies or behaviors and crafting solutions that not only address immediate costs and benefits but also pay attention to ongoing informational and maintenance needs.

Achieving these goals will be arduous, but critical, and can only be accomplished through a deep commitment to working with relevant networks of trusted organizations and institutions and genuinely engaging communities in decision making (Berkes, 2009). The importance of public engagement is even higher in the early phases of the transition in order to establish a foundation of longer-term trust, cooperation, and transparency, without which broader and deeper scale-up actions necessary beyond 2030 could be crippled.

At the same time, it will be extremely important to prevent misinformation from continuing to exacerbate confusion, mistrust, and already polarized worldviews of the future of the energy system, thereby weakening public support for necessary policy actions (Farrell, 2019). Two things in particular could go a long way in taming the dangers of misinformation. First, financial disclosure and transparency requirements should be expanded and tightened to preclude proliferation of misinformation under the veil of secrecy and intractable affiliations (Farrell et al., 2019). Second, creating new forms of social interaction that bridge disconnected information-sharing systems has the potential to enable the cross-flow of information and building of linkages across diverse communities and value systems (Lewandowsky et al., 2017), thus helping rebuild a more foundational basis of trust.

Evidence strongly shows that, especially during times of significant technological change, robust public engagement using these kinds of strategies can deliver significant benefits with respect to both designing technological futures that effectively meet the needs of the public and strengthening public support for processes of change (Narrasimhan et al., 2018), especially where such engagement facilitates a bidirectional dialogue that connects national policy making with local communities (Devine-Wright, 2011; Petrova, 2013). This is particularly true where technological changes have substantial impacts on matters that are meaningful to members of the public (e.g., siting of new energy facilities near neighborhoods, the kinds of cars or light bulbs that are available to buy, energy costs, or the availability of alternative transportation modes) and where public engagement is carried out upstream, significantly in advance of proposed technological changes, and in a manner that allows for public input to make meaningful contributions to technology design or adoption (Wilsdon and Willis, 2004; Wiersma and Devine-Wright, 2014). Well-designed public engagement, including younger populations, also has the potential to significantly improve public literacy and learning on matters of concern, as well as more inclusive and constructive public decisions (Tierney and Hibbard, 2002; Bice and Fischer, 2020; McLaren Loring, 2007).

In light of these findings, it will be important for the United States to invest in innovative approaches to strengthen public engagement and participation in the design and deliberation of decarbonization pathways. These should include high-profile regional public dialogues and listening sessions organized by clusters of federal agencies in collaboration with state/regional governments and industry participation to discuss decarbonization pathways and goals and open conversations about questions of justice and inequality confronting communities in the context of decarbonization. It will also be important to set standards and resources for public participation in decarbonization planning processes by requiring a role for representatives of disadvantaged populations—low-income and communities of color—in advisory boards and other influential bodies to enable them to participate in meaningful ways. Standards should also mandate best practices in social impact assessment (Vanclay, 2003; Esteves et al., 2012), many of which have been neglected as federal project review has tilted heavily to focus solely on environmental criteria (Burdge, 2002).

Over the past decade, an increasingly broad coalition of groups has advocated that a low-carbon transition must be a “just transition”: redressing the harms caused by the transition to a carbon-neutral economy in ways that ensure viable and thriving futures for the individuals, families, and communities whose lives and livelihoods have been disrupted (see Box 2; Carley and Konisky, 2020; Henry et al., 2020; Newell and Mulvaney, 2013; Sovacool et al., 2020). Similar to other movements, such as Black Lives Matter, that have highlighted persistent forms of

injustice and economic insecurity in the U.S. economy and society, calls for a just energy transition highlight the importance of building a social contract for decarbonization that recognizes the ways that pathways differentially affect communities and using the resulting insights to design policies that create better, fairer, and more equitable outcomes. To address these concerns, a number of cities and states have already taken the lead in developing new approaches for evaluating and assessing the social and economic dimensions of pathways to decarbonization (e.g., City of Providence, 2019; California Energy Commission, 2018), which supplement more traditional methods for assessing the cost, reliability, and carbon footprint of new energy technologies and systems.

Over the next three decades, as U.S. cities, states, and companies move toward a carbon-neutral economy, they will make myriad decisions about how to reshape U.S. energy systems. Deep decarbonization offers a rare opportunity to deploy large-scale innovation in the energy system to advance an array of key U.S. national goals and objectives. In the 20th century, the electrification of cities, industry, and rural communities and the creation of world-leading automobile, oil, and gas industries played key roles in transforming America into a global economic and military power. Today, as described below, if the United States can leverage and sustain existing widespread public support for climate action and mobilize it in favor of a coordinated set of policy actions for deep decarbonization, the country has a similar opportunity not only to help minimize impacts of climate change but also to leverage deep decarbonization to strengthen U.S. economic leadership, reduce inequalities, and create a fairer and more just society.

On the other hand, failure to appropriately envision, evaluate, and integrate the social and economic implications of decarbonization into decision-making about pathways—and the attendant failure to secure a robust social contract with all segments of the American public that can overcome persistent and diverse efforts to undermine public will—poses stark risks to both the timing and achievement of deep decarbonization goals. These risks include erosion of popular and political support for both decarbonization as a goal and for specific policies and pathways to achieving it, higher costs, increased entrenchment of social division and inequality, persistent legacy threats to public and environmental health, and lost opportunities for systemic innovation to enhance near-term and long-term U.S. competitiveness.

Box 2: The Just Transition Movement and the U.S. Experience of Economic Transformation

The crucial importance of attending to the wider societal and economic dimensions of decarbonization is rooted in the American experience of past economic transitions and failures. While the United States has never deliberately undertaken a transformation of critical infrastructures and industries as deep and rapid as that envisioned by decarbonization, workers and communities in many parts of the United States have experienced past periods of economic transition.

Prominent examples in living memory include the decline of industry and manufacturing in Rust Belt cities of the Midwest; the hollowing out of U.S. farming communities and the small towns that served them associated with agricultural transformation in the 1970s and 1980s; boom-bust cycles in the oil industry in places like Pennsylvania, Texas, and North Dakota; and the current collapse of the coal industry in West Virginia, Kentucky, and Wyoming. At the same time, there is a growing recognition that the U.S. economy has resulted in greater poverty and lower educational opportunities and upward mobility for some communities, including BIPOC (Black, Indigenous, people of color) (Table 1; Drehobl et al., 2020). These communities continue to suffer high rates of economic disenfranchisement and, as a result, high rates of illness and death in the COVID-19 pandemic (Oppel et al., 2020; Van Slyke, 2020).

Table 1: Vulnerable Groups in the Context of an Energy Transition

Stakeholder	Concerns in a Just Energy Transition
Coal, oil, and gas workers; power-plant workers; and other participants in fossil fuel-dependent economic activities, including manufacturing, operations and maintenance, and service industry jobs, e.g., in automobile parts or repairs or gas stations.	• Job loss • Local businesses dependent on business from energy industry employees • Accessible, alternative job training • Other economic concerns, including risks of insolvent benefit funds • Psychosocial impacts of lost occupational identity (Carley et al., 2018a; Carley and Konisky, 2020; Rolston, 2014)
Residents in places impacted by fossil fuel and renewable energy supply chains, the siting of energy facilities, and/or the decommissioning of legacy fossil-dependent facilities, including fenceline communities	• Economic opportunity versus local cost • Racial injustice • Environmental justice • Health and well-being • Psychosocial impacts (Jacquet and Stedman, 2013) • Consultation fatigue • Unreclaimed infrastructure and associated health risks
Native American nations and rural communities whose economies, tax revenues, or lands are currently dependent on or impacted by coal and oil and gas development or potentially impacted by future renewable energy development	• Economic opportunity versus local cost • Racial injustice • Environmental justice • Health and well-being • Less tax revenue for schools and other publicly supported services
Clean energy industry workers and workers in the energy efficiency industry	• Looking for (better, long-term) jobs • Professional development/advanced training
Communities facing high energy costs and burdens that contribute to perpetuating or exacerbating poverty	• Affordable electricity • Accessibility and connectivity to immediate and distant areas/regions • Access to opportunities and financing to improve infrastructure to reduce costs and take advantage of renewable energy opportunities

This article was adapted from a report published by the National Academies of Sciences, Engineering, and Medicine:

National Academies of Sciences, Engineering, and Medicine. 2021. *Accelerating Decarbonization of the U.S. Energy System*. https://doi.org/10.17226/25932. Reproduced with permission from the National Academy of Sciences, Courtesy of the National Academies Press, Washington, D.C.

References

Ashworth, P., A. Littleboy, P. Graham, and S. Niemeyer. 2011. "Turning the Heat On: Public Engagement in Australia's Energy Future." Pp. 131-148 in *Renewable Energy and the Public* (P. Devine-Wright, ed.). New York, NY: Taylor & Francis.

Berkes, F. 2009. Evolution of co-management: Role of knowledge generation, bridging organizations and social learning. *Journal of Environmental Management* 90(5): 1692–1702.

Bice, S., and T.B. Fischer. 2020. Impact assessment for the 21st century—What future? *Impact Assessment and Project Appraisal* 38(2): 89–93.

Boudet, H.S. 2019. Public perceptions of and responses to new energy technologies. *Nature Energy* 4(6): 446–455.

Burdge, R.J. 2002. Why is social impact assessment the orphan of the assessment process? *Impact Assessment and Project Appraisal* 20 (1): 3–9.

California Energy Commission. 2018. *Energy Equity Indicators Tracking Progress.* Sacramento, CA.

Carley, S., and D.M. Konisky. 2020. The justice and equity implications of the clean energy transition. *Nature Energy* 5(8): 569–577.

Carley, S., T.P. Evans., and D.M. Konisky. 2018a. Adaptation, culture, and the energy transition in American coal country. *Energy Research & Social Science* 37: 133–139.

City of Providence. 2019. *The City of Providence's Climate Justice Plan*. Providence, RI.

Devine-Wright, P. 2011. Public engagement with large-scale renewable energy technologies: Breaking the cycle of NIMBYism. *Wiley Interdisciplinary Reviews: Climate Change* 2(1): 19–26.

Drehobl, A., L. Ross, and R. Ayala. 2020. *How High Are Household Energy Burdens?* Washington DC: American Council for an Energy-Efficient Economy.

Dwyer, J., and D. Bidwell. 2019. Chains of trust: Energy justice, public engagement, and the first offshore wind farm in the United States. *Energy Research and Social Science* 47: 166–176.

Esteves, A.M., D. Franks, and F. Vanclay. 2012. Social impact assessment: The state of the art. *Impact Assessment and Project Appraisal* 30 (1): 34–42.

Farrell, J. 2019. The growth of climate change misinformation in US philanthropy: Evidence from natural language processing. *Environmental Research Letters* 14(3).

Farrell, J., K. McConnell, R. and Brulle. 2019. Evidence-based strategies to combat scientific misinformation. *Nature Climate Change* 9: 191–195.

Firestone, J., B. Hoen, J. Rand, D. Elliott, G. Hübner, and J. Pohl. 2017. Reconsidering barriers to wind power projects: Community engagement, developer transparency and place. *Journal of Environmental Policy and Planning* 20(3): 370-386.

Firestone, J., C. Hirt, D. Bidwell, M. Gardner, and J. Dwyer. 2020. Faring well in offshore wind power siting? Trust, engagement and process fairness in the United States. *Energy Research and Social Science* 62.

Giordono, L.S., H.S. Boudet, A. Karmazina, C.L. Taylor, and B.S. Steel. 2018. Opposition "overblown"? Community response to wind energy siting in the Western United States. *Energy Research and Social Science* 43: 119–131.

Haggerty, J.H., M.N. Haggerty, K. Roemer, and J. Rose. 2018. Planning for the local impacts of coal facility closure: Emerging strategies in the U.S. West. *Resources Policy* 57: 69-80.

Hall, N., P. Ashworth, and P. Devine-Wright. 2013. Societal acceptance of wind farms: Analysis of four common themes across Australian case studies. *Energy Policy* 58: 200–208.

Henry, M.S., M.D. Bazilian, and C. Markuson. 2020. Just transitions: Histories and futures in a post-COVID world. *Energy Research and Social Science* 68.

Howe, P.D., M. Mildenberger, J.R. Marlon, and A. Leiserowitz. 2015. Geographic variation in opinions on climate change at state and local scales in the USA. *Nature Climate Change* 5(6): 596–603.

Jacquet, J.B., and R.C. Stedman. 2013. The risk of social-psychological disruption as an impact of energy development and environmental change. *Journal of Environmental Planning and Management* 57(9): 1285–1304.

Kimura, A.H., and A. Kinchy. 2019. *Science by the People: Participation, Power, and the Politics of Environmental Knowledge*. New Brunswick, NJ: Rutgers University Press.

Leiserowitz, A.A., E.W. Maibach, C. Roser-Renouf, N. Smith, and E. Dawson. 2013. Climategate, public opinion, and the loss of trust. *American Behavioral Scientist* 57(6): 818–837.

Leiserowitz, A., E. Maibach, S. Rosenthal, J. Kotcher, A. Gustafson, P. Bergquist, M. Goldberg, et al. 2018. *Energy in the American Mind, December 2018*. New Haven, CT: Yale Program on Climate Change Communication.

Lewandowsky, S., U.K. Ecker, and J. Cook. 2017. Beyond misinformation: Understanding and coping with the "post-truth" era. *Journal of Applied Research in Memory and Cognition* 6(4): 353–369.

McLaren Loring, J. 2007. Wind energy planning in England, Wales and Denmark: Factors influencing project success. *Energy Policy* 35(4): 2648–2660.

Miller, C.A., J. Richter, and J. O'Leary. 2015. Socio-energy systems design: A policy framework for energy transitions. *Energy Research and Social Science* 6: 29–40.

Narassimhan, E., K.S. Gallagher, S. Koester, and J.R. Alejo. 2018. Carbon pricing in practice: A review of existing emissions trading systems. *Climate Policy* 18(8): 967–991.

National Research Council. 2008. *Public Participation in Environmental Assessment and Decision Making*. Washington, DC: The National Academies Press.

Newell, P., and D. Mulvaney. 2013. The political economy of the "just transition." *The Geographical Journal* 179(2): 132–140.

O'Brien, K., B. Hayward, and F. Berkes. 2009. Rethinking social contracts: Building resilience in a changing climate. *Ecology and Society* 14 (2).

Oppel Jr., R.A., R. Gebeloff, K.K.R. Lai, W. Wright, and M. Smith. 2020. "The Fullest Look Yet at the Racial Inequity of Coronavirus." *The New York Times.* July 4.

Petrova, M.A. 2013. Public acceptance of wind energy in the United States: NIMBYism Revisited. *Wiley Interdisciplinary Reviews: Climate Change* 4(6): 575–601.

Pezzullo, P.C., and R. Cox. 2017. *Environmental Communication and the Public Sphere*. Thousand Oaks, CA: SAGE Publications.

Rai, V., and A.L. Beck. 2015. Public perceptions and information gaps in solar energy in Texas. *Environmental Research Letters* 10(7).

Roberts, D. 2020. "US Public Opinion Supports Action on Climate Change—and Has for Years." *Vox.* June 23. https://www.vox.com/energy-and-environment/2020/6/23/21298065/climate-clean-energy-public-opinion-poll-trends-pew.

Rolston, J. 2014. *Mining Coal and Undermining Gender: Rhythms of Work and Family in the American West*. New Brunswick, NJ, London: Rutgers University Press.

Sovacool, B.K., D. Furszyfer Del Rio, and S. Griffiths. 2020. Contextualizing the COVID-19 pandemic for a carbon-constrained world: Insights for sustainability transitions, energy justice, and research methodology. *Energy Research and Social Science* 68.

Steg, L., G. Perlaviciute, and E. van der Werff. 2015. Understanding the human dimensions of a sustainable energy transition. *Frontiers in Psychology* 6.

Tierney, S.F., and P.J. Hibbard. 2002. Siting power plants in the new electric industry structure: Lessons from California and best practices for other states. *The Electricity Journal* 15(5): 35–50.

Tyson, A., and B. Kennedy. 2020. "Two-Thirds of Americans Think Government Should Do More on Climate." https://www.pewresearch.org/science/2020/06/23/two-thirds-of-americans-think-government-should-do-more-on-climate/.

Van Slyke, A. 2020. "The Collapse of Health Care: The Effects of COVID-19 on US Community Health Centers." https://lernercenter.syr.edu/2020/08/10/ib-38/.

Vanclay, F. 2003. International principles for social impact assessment. *Impact Assessment and Project Appraisal* 21(1): 5–12.

Wiersma, B., and P. Devine-Wright. 2014. Public engagement with offshore renewable energy: A critical review. *Wiley Interdisciplinary Reviews: Climate Change* 5(4): 493–507.

Wilsdon, J., and R. Willis. 2004. See-through science: Why public engagement needs to move upstream. *Demos* 1.

Wyborn, C., A. Datta, J. Montana, M. Ryan, P. Leith, B. Chaffin, C. Miller, and L. van Kerkhoff. 2019. Co-producing sustainability: Reordering the governance of science, policy, and practice. *Annual Review of Environment and Resources* 44: 319–346.

News and Announcements

American Geophysical Union

Telling the Stories Behind the Science

AGU journals and books have captured research in Earth and space science for over a century, providing a documented record of scientific discovery. There is another history, however, which has not been as well documented, and these are the stories of how that scientific research was accomplished. These are the stories that might be told in a department coffee room or recounted after-hours at a scientific meeting, often passed down informally from one generation of scientists to the next.

AGU launched a new journal, *Perspectives of Earth and Space Scientists,* to capture these stories. Perspectives is a collection of memoirs, essays, and insights by AGU Fellows and other invited authors reflecting on important scientific discoveries, advances, and events in Earth and space science, focusing on the process of scientific discovery. All articles are open access and are intended to be read and understood by the wider geosciences community and the science-interested public, both as a documentation of the past history of our fields and as inspiration for future scientists.

To read more, click **here**.

American Meteorological Society

International Report Confirms Record-High Greenhouse Gases, Sea Levels

Greenhouse gases and global sea levels both reached record highs in 2020—as the planet sweltered in a near-record warm year—according to the 31st annual State of the Climate report.

This international annual review of the world's climate, led by scientists from NOAA's National Centers for Environmental Information and published by the Bulletin of the American Meteorological Society, is based on contributions from more than 530 scientists in over 60 countries. It provides the most comprehensive update on 2020's global climate indicators, notable weather events and other data collected by environmental monitoring stations and instruments located on land, water, ice and in space.

To read more, click **here**.

American Society of Civil Engineers

2021 International Conference on Sustainable Infrastructure

December 6-10, 2021

The 2021 International Conference on Sustainable Infrastructure will showcase the latest thinking in sustainable civil engineering. Held every two years, the next ICSI will take place virtually Dec. 6-10. Leaders will hold discussions around the convention theme "leveraging sustainable infrastructure for resilient communities" and the latest developments and advancements in design, construction, technology, policy, and education related to sustainable and resilient infrastructure. The keynote speaker will be the Crown Prince of Monaco, Albert II.

For more information, click **here**.

American Society of Landscape Architects Fund

ASLA Conference on Landscape Architecture Focuses on Inclusive Design with the Theme "Designing Shared Spaces"

November 19-22, 2021

"In an era of mounting climate change crises, racial and social inequities, and emerging variants of COVID-19, landscape architects are increasingly being called upon to help solve society's critical challenges. This year's Conference will highlight the profession's inclusive planning and design solutions for all communities."

—Torey Carter-Conneen, ASLA CEO

Landscape architecture professionals will feature new approaches to inclusive design at the ASLA Conference on Landscape Architecture at the Music City Center in Nashville, TN, Nov. 19-22, 2021—a year in which the profession has seen its role become even more important in helping communities, particularly historically marginalized and underserved communities, use nature-based solutions to become healthier and more resilient.

To read more, click **here**.

American Water Resources Association

AWRA 2022 Spring Conference: Water Risk Under a Rapidly Changing World - Evaluation & Adaptation

April 24-27, 2022

Tuscaloosa, AL

AWRA's 2022 Spring Specialty Conference is being co-hosted by the AWRA Future Risk Committee and the Alabama Water Institute. With a theme of "Water Risk Under a Rapidly Changing World: Evaluation and Adaptation," this conference seeks to bring together a diverse multi-disciplinary group of water professionals - both thought leaders and on-the-ground implementers to disseminate, share and learn about cutting-edge solutions aimed at evaluating future water risks and improving human adaptation to those risks.

For more information, click **here**.

Geological Society of America

GSA Connects 2021

October 10-13, 2021

Portland, Oregon

At GSA Connects 2021 you will discover a dynamic meeting that surrounds you with the inspiration and opportunities for engagement you need to advance your geoscience career.

Join us 10–13 October for cutting-edge technical sessions, outstanding professional education, and inclusive networking opportunities that will broaden your geologic knowledge and connect you to our diverse geoscience community.

GSA Connects will offer online-only and in-person options.

For more information, click **here**.

Society of Environmental Toxicology and Chemistry

SETAC North America 42nd Annual Meeting Is Going Fully Virtual

November 14-18, 2021

Amid the latest surge in the pandemic and having to confront many uncertainties and restrictions, organizers have decided to once again go virtual for the SETAC North America 42nd Annual Meeting, which will be held from 14–18 November.

SETAC events are intentionally planned with multi-sector engagement from all stakeholders to advance multi-disciplinary approaches to solving environmental problems, yet current circumstances have made it hard to plan this meeting with that approach. Given the situation and after thoughtful discussion, the SETAC North America board of directors and 2021 program committee prudently decided to change from a hybrid to a fully virtual meeting. “We believe an online format is the best option when considering the health and safety of participants and the scientific success of our annual meeting,” said Eric Van Genderen, SETAC North America President.

To read more, click **here**.

Renewable Natural Resources Foundation
6010 Executive Boulevard, Suite 700
North Bethesda, Maryland 20852 USA