DIALOGUE

BUILDING SCIENCE INTO MANAGEMENT OF TECHNOLOGY

SUMMARY

Technology has raised standards of living for people around the world, but technological developments also have unintended and negative impacts on people, places, and the environment. Science is an essential driver of both technology's advances and management of its impacts. Yet some long-standing threats, such as climate change, continue to persist and grow despite well-established evidence of harm; emerging advances in fields such as genetic engineering offer grave risks along with great benefits. Meanwhile, public trust in and funding of science are down, and dis- and misinformation are dramatically up, making it harder to agree on the science needed to manage technology's impacts. On October 23, 2025, ELI convened an expert panel to discuss these issues. Below, we present a transcript of the discussion, which has been edited for style, clarity, and space considerations.

Madison Calhoun is Senior Manager of Educational Programs at the Environmental Law Institute (ELI).
David Downes (moderator) is a Visiting Scholar at ELI.
Charles Weiss is a Distinguished Professor Emeritus at Georgetown University.
Angela Bednarek is Director for Scientific Advancement at The Pew Charitable Trusts.
Juha I. Uitto is a Visiting Scholar at ELI.

Madison Calhoun: I'd like to introduce our moderator, David Downes, a visiting scholar at the Environmental Law Institute. He is an experienced leader, advisor, analyst, teacher, and mentor in the fields of environment and natural resources, with a focus on international law and policy. From 2010 to 2025, David served in the Office of International Affairs of the U.S. Department of the Interior (DOI); from 2000 to 2010, he was DOI's trade adviser, representing the Department in interagency policy deliberations and on U.S. delegations for numerous bilateral, regional, and global trade and investment negotiations. Before entering federal service, David practiced in the nonprofit sector with the Center for International Environmental Law.

David Downes: Increasingly powerful technologies have raised standards of living, quality of life, and well-being for people around the world. But they can also have significant negative impacts and pose serious threats to health and the environment. Science drives technological advances and also informs the responses to the impacts of technology.

When I refer to science, I want to note that science is not simply a body of knowledge, but a process, a method, an enterprise to develop knowledge and understanding. Science has produced important successes in terms of addressing threats from technology, like reducing pollution both nationally and internationally.

But the response to some well-demonstrated threats, such as climate change, has been inadequate, and emerging advances in fields like genetic engineering offer great risks as well as great benefits. Meanwhile, public trust in science and public funding of science are in decline while misinformation is increasing dramatically.

Our focus today is on how to strengthen the role of science in addressing technology's impacts, and our panel will explore the following questions: How can we best develop and apply the science needed to manage technology's impacts? How can science be developed to engage constructively and build trust with policymakers and the public? And how can we do a better job of bridging the gap between scientific knowledge of technology's impacts and the actions needed to manage those impacts?

With that background, I am honored to introduce today's speakers, starting with Charles Weiss, a distinguished professor emeritus and former director of the Science, Technology, and International Affairs Program at the Walsh School of Foreign Service at Georgetown University. He was the first science and technology advisor to the World Bank, and is a fellow of the American Association for the Advancement of Science and a member of the Council on Foreign Relations.

Charles has written several books relevant to our conversation today. His most recent book, *The Survival Nexus*,[1] provides a remarkable and comprehensive overview of the issues we'll be talking about today—the interweaving

1. Charles Weiss, The Survival Nexus: Science, Technology, and World Affairs (Oxford Univ. Press 2021).

of science and technology with international affairs, politics, economics, law, business, and culture—and their impact on global issues such as nuclear weapons, pandemics, climate change, internet governance, cybersecurity, and artificial intelligence (AI).

Next, I'd like to introduce Angela Bednarek, who leads The Pew Charitable Trusts' scientific advancement portfolio, which includes efforts to support groundbreaking science and ensure that research informs public policy and improves outcomes. In this role, she co-founded and leads the Impact Funders Forum, a global collaborative aimed at closing the gap between research and outcomes.[2] She has published and presented widely on improving the connections between research, policy, and practice.

Angela previously served as an American Association for the Advancement of Science (AAAS) diplomacy fellow in the Office of Environmental Policy at the U.S. Department of State. She served as a fellow at Columbia University's Earth Institute and as a scientist at Oak Ridge National Laboratory.

Also joining us is Juha Uitto, a visiting scholar at the Environmental Law Institute. As a strategic advisor, Juha supports evaluation functions with a focus on the nexus of development in environment and climate change. Previously, he served as the director of the Independent Evaluation Office at the Global Environment Facility (GEF). Prior to that, he served in the Independent Evaluation Office of the United Nations Development Program (UNDP), and has held other roles at UNDP, GEF, and the United Nations University. He's a board member of the International Evaluation Academy and co-coordinator of the Monitoring and Evaluation Interest Group of the Environmental Peacebuilding Association. A native of Finland, Juha was educated at the universities of Helsinki and Lund.

I'm really honored to be with such distinguished speakers today. We'll hear first from Charles, then from Angela, and then Juha will provide comments on those presentations. Then, we'll move to question-and-answer.

Charles Weiss: I want to talk today about global, technology-driven challenges that endanger human survival. Nuclear war, climate disruption, pandemics, AI, geoengineering, gene drives, and many others. The world will have to face these issues together—whatever the geopolitical system that emerges from the present turmoil and whoever wins out in the current technological competitions.

These global threats are environmental issues in the broadest sense. Nuclear war, for example, is not good for the environment. Each of these threats evokes concern that science and technology are out of control and are taking us in unwanted directions. Each requires that we make policy decisions based on the best science and that we mobilize science, technology, and innovation to deal with them. This is a tall order, but it's been done before.

The defense of the stratospheric ozone layer is a classic success story. Scientists alerted the world to chemicals destroying the ozone layer and causing an epidemic of skin cancer. An epistemic community of scientists and journalists and later a formal scientific advisory committee educated diplomats and policymakers. The outcome was the Montreal Protocol on Substances that Deplete the Ozone Layer[3] and subsequent amendments that have brought the problem under control.

This is a difficult time for global solutions to global problems. As we all know, there is in many countries a widespread distrust of scientific expertise and truth. The United States is harassing or dismantling many of the nongovernmental organizations (NGOs), think-tanks, government agencies, and research laboratories that are needed to integrate science, technology, and innovation with foreign policy, present company, I must say, included.

Internationally, multilateral structures for dealing with global issues have been allowed to deteriorate. Nuclear arms control regimes are being allowed to lapse. The United States, Russia, and China are expanding or updating their nuclear arsenals, threatening a three-way arms race that can easily get out of control.

Binding agreements have failed to meet agreed targets for ending global warming. Absent sustained political determination to fight climate change, private businesses are reluctant to invest in needed research, technology, and innovation. Governments are discouraging the collaborative discussions and research that are needed to develop common understanding of global threats to which we are all subject—in whatever country we reside.

Against this background, we arrive at the questions David posed for us to explore: How do we ensure that we understand the impact of these technologies and the options for managing them? This understanding must be shared by governments and by people with different political systems and values. Can we engage the public in developing this understanding? Will this restore public trust in scientific expertise? Most importantly, can we bridge this gap with increased knowledge and more effective action? In sum, can we mobilize science and technology to meet these global challenges?

The COVID pandemic provided lessons, both positive and negative. On the positive side, scientists developed new vaccines in one year instead of the usual 10, thanks to 20 years of basic scientific research. "Operation Warp Speed," a policy innovation, saved time by paying manufacturers to scale up production of promising vaccines while testing for safety and effectiveness was still underway.

On the negative side, scientists failed to anticipate how public health measures would affect education and public morale. Governments downplayed the pandemic and hawked discredited "cures" or used public health measures to suppress civil liberties. On the ethical side,

2. For more, visit https://www.pew.org/en/projects/evidence-project.

3. 1522 U.N.T.S. 3, 26 I.L.M. 1541, 1550 (1987).

wealthier countries delayed sharing scarce vaccines with low-income countries.

In all of these examples, science, technology, and innovation are intimately interwoven with each other and with politics, economics, law, business, culture, and ethical values. Renewable energy, for example, involves not only research and development, but also manufacturing, trade, competitiveness, subsidies, carbon pricing, and our ethical obligations to future generations. AI, for that matter, raises any number of issues of national security, privacy, and civil liberties.

The current crisis in our legacy systems is an opportunity to rethink how to deal with the science, technology, and innovation dimensions of today's potentially catastrophic global issues. We have to think long-range. We can't afford nostalgia for what we have lost.

For now, we need to do our best to defend federal support for science policy, research, development, and innovation—specifically including manufacturing in key technologies. This will require an "all hands on deck" effort to restore the public trust and expertise that has traditionally underpinned public support to science, technology, and innovation.

We'll need more scientists, innovators, and policymakers who understand each other's fields. We'll need university curricula to train them, venues where they can work together, and ways to involve the public in the resulting discussions. All this will require substantial changes in culture, career paths, and educational systems.

Internationally, we need venues where experts from different countries can develop the mutual trust needed to work out a common international understanding of global threats, to develop a framework within which they can be managed, and formulate regimes and norms to guide the behavior of governments, businesses, international organizations, and individuals—especially the super-rich, who today command resources comparable to those of governments. Yes, norms are collapsing all around us. But they have kept us out of nuclear war and, besides, they're all we've got.

We also need networks of civil society thinkers spanning different parts of the world. If all goes well, ideas from these networks will gradually coalesce, influence local judges and policymakers, and work their way into judicial decisions in different countries and formal international agreements. Such networks are already proposing norms on AI, geoengineering, and other subjects.

Here are a few suggestions for international norms related to the management of potentially catastrophic global threats:

- Don't make nuclear power plants military targets. The International Atomic Energy Agency has developed such a norm, but it needs higher visibility and more teeth.[4]

- Don't spread mis- or disinformation on global existential threats and don't suppress relevant research and innovation.

- Accept the obligation to do your share of research within your capabilities on the nature and consequences of global threats. I stress the word *obligation*.

- Collaborate within and across boundaries on both curiosity-motivated and non-proprietary applied research and technological development.

- Share knowledge and technology with low-income countries and help them build their capacity to contribute to the management of global threats. In sum, accept the fact that potentially catastrophic global challenges are problems that we all face regardless of politics. They all have important elements of science, technology, and innovation, and we should all do our share in addressing them.

- When the United States rebuilds our system for science and technology and innovation, we should encourage innovative international collaboration and research and strengthen the research and policy arms of key institutions like the U.S. Environmental Protection Agency, National Oceanic and Atmospheric Administration, and many others. Give them an explicit mandate to identify key innovations that are unlikely to attract private support, to develop programs to support them, and to identify and eliminate obstacles to their development and commercialization. This last is the difference between an invention and innovation—somebody uses it at a large scale.

- I would further suggest an advanced research project agency (ARPA) for potentially catastrophic global challenges, on the model of the ARPAs that already link cutting-edge technology to fill needs in defense, intelligence, and health.[5]

All this will take time. It's taken the world a long time to get where we are—it's not an event of just the last few months—and it will take us a good while to recover. We shouldn't lose heart, but we better get started, both in thinking and in acting.

Angela Bednarek: I'd like to explore some of the ways in which the group of funders I work with have been thinking about some of the interventions discussed and making them real. I'll start by sharing a little bit more about the Impact Funders Forum and the shared priorities and principles that drive our work together, and then I'll get into

4. Visit https://www.iaea.org/ for more.

5. For more information on existing ARPAs, see Emerging Tech Policy Careers, *Advanced Research Project Agencies,* https://emergingtechpolicy.org/institutions/executive-branch/arpas/.

some of the promising strategies and ways we're thinking about moving forward.

This group and the work that I've been doing is not explicitly focused on technology in decisionmaking and management, but is looking more broadly at how we think about science, evidence, and research and how that feeds into decisionmaking about lots of societal issues. One of the many wonderful things about this group is that, by taking that larger sample size of "how does it work to close the gap between the research we're funding and the outcomes we seek on issue areas," we can get a better idea of what are the promising strategies, what are the best practices, and what are the real cross-cutting gaps of needs.

The Impact Funders Forum is a collaborative of philanthropic and public research funders around the world interested in closing the gap between the research science we fund and the outcomes we hope create a better world. We take a really large view and are cross-cutting in the kinds of issues we care about. As individual research funders, they do include those focused on the environment. But it spans the gamut with public health, criminal justice, education, you name it. We've been very agnostic about the kinds of social issues you cover if you are interested in that intersection in closing that gap and what do you do to close that gap.

Even though we're quite cross-cutting, we agree on a few things within this group. One is that we recognize that most social issues are "wicked problems" that are incredibly complex and aren't easily addressed by siloed work, by short-term work, or by short-term thinking. We really have to lean into the complexity of these problems, and when we start there, we can get better at understanding how to address them with our individual efforts but also as a collective.

It helps that my background is in ecology. I always think about this work as an ecologist does; it's an ecosystem and you can't really push on one part without affecting the rest. So, we start with the understanding that most social problems are wicked problems, and we better get our heads around how to account for the reality of that.

The second shared priority or value is that we want to be evidence-based in how we go about closing the gap. This gets a little meta, but if we want to encourage the use of research, evidence, and science that can make a difference, we should be science-based and evidence-based about that process. Let's not just guess what works, let's be evidence-based. It seems simple, but it's shocking how little work is guided by the evidence base and is really guesswork—it "feels like" we should communicate more about *x*. Well, does the evidence bear that out? Do studies bear that out? Sometimes, yes. A lot of times, no. So, we think a lot about what that evidence base is and how do we use that evidence base to guide our work.

What do we know about what it takes to close the gap? First, research needs to be relevant to ensure saliency for problems on the ground. It seems simple, but it is a very strong predictor of success.

Second, research needs to be relational to build trust and to allow those involved in the process to make sense of it. It doesn't mean that everything has to be community-engaged research, but there needs to be some element of relationship-building in that process.

Third, you need routines and infrastructure for the evidence use. There must be a structure that involves routines, processes, and people who understand what that process looks like. In summary, the three Rs of evidence-based evidence use are relevance, relational, and routines.

So, how do we attain the three Rs? How are we including those who might be impacted or use the research in the development of the research questions themselves? How do we ensure that research is rigorous and relevant? And while there's a great deal of translation and research mobilization, relationship-building, and multidisciplinary cross-disciplinary partnerships, what does that look like in practice?

"Co-defined research agendas" is one approach for building the relational. For example, one of my projects at Pew involved funding policy-relevant research about the oceans. We thought a lot about how we could support research teams to co-define research agendas with those who might use it or be impacted. We included research scientists who study fisheries, government fishery managers, the fishery industry themselves, and the NGOs. All of those folks then come together to shape the research question. While it sounds really messy, there are rubrics and ways to help do this.

And I have colleagues in the education space who use a similar process where they include school districts, researchers, and communities to identify and shape which research questions are the most pressing for a school superintendent about "X, Y, or Z" and how to make sure those issues are reflected in the research agendas.

As for building relevance, I'll share an example from Arizona State University's Consortium of Science, Policy & Outcomes (CSPO),[6] located in Washington, D.C. They applied a "participatory technology assessment" and took large groups of the public and brought them together to understand what they think are the problems with technology at hand right now. The issue they were focused on was driverless cars. This approach asks what are the technological issues that the public sees, and how can a deliberative process be structured so those views are incorporated into the development or evolution of those technologies?

Last, are routines. I'm sure some of you are familiar with the Evidence Act,[7] which provides a structured way for bringing routines and infrastructure for evidence use into agency learning agendas to ensure that there is a system and framework for bringing that research and evidence into agency decisionmaking.

Next, I'd like to provide a few examples to give you a better understanding of how this funder collaborative works. And this goes back to the shared way of thinking

6. To learn more, visit https://cspo.org/.
7. Foundations for Evidence-Based Policymaking Act of 2018, Pub. L. No. 115-435, 132 Stat. 5529.

about problems. When we think about the kind of work we want to do together, we think about three things. First, we want to know what works to close the gap. Second, we want to invest in what works to close the gap. And third, because we are a cross-cutting group that can't succeed in isolation, we want to work together to build or shape a foundation and infrastructure at a system level to enable all of that work toward closing the gap to go forward.

Figure 1 explains some of our initiatives at Pew. We organize our funders and our participants into a couple of key priority areas. One of our earliest initiatives, which continues today, examines how research funders are funding—how do we construct our processes, priorities, and practices so that we're reflecting that best practice and supporting the interventions that work.

Figure 1: Initiatives to Close the Gap

Research Impact: Align funding streams and experts to build an actionable knowledge base about how to close the gap, in theory and practice.

Funding Practices: Build and maintain effective funding practices so funders can invest in what works to close the gap.

Systems Incentives & Infrastructure: Align funding streams and research leaders to expand academic incentives and strengthen infrastructure to scale efforts to close the gap.

Innovation Series: Host global conference series to spark innovation and collaborations among experts around the world about what works to close the gap.

Another big initiative concerns university leadership.[8] We are bringing together university leaders to think about what are the elements of a responsive resilient research system that supports relational, routine, and relevant work and incentivizes university research to engage in that work. These elements are often counter to promotion, tenure, and other kinds of incentives within universities. So, we've been working with this group of university leaders to understand where is the promising progress that we can lean into together.

Recently, we created a state science and technology policy fellowship initiative to strengthen the exchange of information between scientists and policymakers. It is similar to the federal AAAS science technology fellowship program but is focused solely on state legislatures. We just started this last summer, building on some promising practices, some promising pilots, and some work around the country. We're going to be expanding this to more states. So again, in thinking about the demand side and routines within state legislatures, the initiative looks at how can we build that capacity and how can we strengthen those interventions.

The last example I wanted to share in thinking about how do we make research more relevant, more relational, and more routinized involves "living evidence synthesis,"[9] which takes bodies of evidence from around the world and then uses machine learning to update it and get it to policymakers in real time. This is a great use of AI and machine learning to make that happen. But notably, they engage in regular facilitation and consultation with those using the evidence and research to make sure there is a relational component. They're not just maximizing relevance; they're also thinking about the relational aspect to all of this.

David Downes: Now, I'd like to turn to Juha Uitto to provide some comments and reflections in response to these very stimulating remarks from our speakers.

Juha Uitto: I'll provide a few observations, hopefully not entirely random observations, to what we have heard today.

As these global challenges—whether they are from climate change or pandemics or AI or whatever—grow more complex, we depend on scientific knowledge and technological innovation to navigate and manage them. But science, as we have been already discussing, science itself has become kind of under suspicion. Many now perceive it as part of an elite project responsible for the very problems we are trying to solve here now. This erosion of trust is deeply concerning. It is the widespread inability of many of our brethren, if you wish, to distinguish between scientific evidence and opinion.

I think that this problem is not limited to the uneducated, but exists even among my field, the environmental field. We have a lot of advocates in that field who are skeptical about technological solutions, whether it's carbon capture or any others. I believe that we need to have some technological solutions to the climate crisis, for example, because the energy transition and behavior change that we're all talking about won't be enough to keep us within the Paris Agreement targets.

So, we have to be open to different solutions, but at the same time we have to be very clear on both the upsides and the risks that are involved. And that's a scientific task. Of course, we are experiencing a systematic defunding of science and dismantling of the scientific infrastructure that threatens to undermine national competitiveness. And while I'm referring to the United States in this particular context, similar phenomena, maybe to a lesser degree, are evident in Europe and even in Japan.

I just listened to a podcast episode of *The Weekly Show With Jon Stewart*. His guest was Geoffrey Hinton, who is often referred to as the "godfather of AI" because of his

8. *See* Benjamin Olneck-Brown, *University Leaders Come Together to Spur Positive Change Through Research* (The Pew Charitable Trusts June 12, 2024), https://www.pew.org/en/research-and-analysis/articles/2024/06/12/university-leaders-come-together-to-spur-positive-change-through-research.

9. *See* Julian Elliott et al., *Decision Makers Need Constantly Updated Evidence Synthesis*, Nature (Dec. 15, 2021), at https://www.nature.com/articles/d41586-021-03690-1.

decades-long foundational work in this area. He just said something that I thought was so well said that I will quote it in its entirety:

> Suppose you want to do one thing that would really kneecap a country, that would really mean that in 20 years' time that country is going to be behind instead of ahead. The one thing you should do is mess with the funding of basic science, attack the research universities, remove grants for basic science. In the long run that's a complete disaster.[10]

I think he is really right here. Like Charles said, once we dismantle the scientific infrastructure and expertise, it will be very difficult to rebuild as even the people and researchers might migrate elsewhere or decide to abandon the field and find something else to do.

But equally critical, and obviously closely linked, is restoring public confidence in science. As I said earlier, science today is often portrayed as the domain of coastal elites and global technocrats. That is the perception that fuels this kind of populist backlash.

To rebuild trust, I think the scientific community must embrace greater transparency and humility. I believe that dismissive responses and the lack of openness, as we saw in the community's reluctance to discuss the COVID-19 origins, have damaged credibility. So, openness to legitimate debates and clearer communication of uncertainty are essential to reestablish legitimacy. The fact that you say "trust me, this is good, and we need this" simply will not cut it in the future.

Also, science itself is becoming increasingly politicized. The Intergovernmental Panel on Climate Change (IPCC), which was originally created to synthesize and communicate peer-reviewed evidence, has increasingly taken an advocacy role. I'm not sure that's very good. It's understandable, but this shift risks polarizing public discourse. If people see the IPCC as taking sides, they will conclude that it is not purely impartial.

For example, their persistent use of the extreme RCP 8.5 emission scenario,[11] even though there's a clear understanding that this scenario is highly unlikely to unfold, may undermine confidence in climate projections. The scientific community should resist both denialism and alarmism, and instead focus on providing transparent and balanced communications of risks and evidence. Charles referred to the tendency or temptation to suppress findings that are not in line with the political consensus. That happens on both sides of the aisle, so we should resist that temptation.

Just very briefly, from my long experience with the GEF, I've seen the importance and challenges of integrating scientific evidence into decisionmaking. The GEF was founded as a science-based funding mechanism supported by two key advisory bodies. One was the Independent Evaluation Office, which I headed for a decade until last year, and the other was the Scientific and Technical Advisory Panel or STAP, which is tasked with ensuring that the latest science informs project design and programming.

It does this, on the one hand, by reviewing project proposals, which guarantees instant feedback into programming. But the second role, which is also very important, is identifying emerging trends and scientific discoveries that have a bearing on the global environment. This is more challenging. The STAP conducts workshops, writes reports, conducts research of its own, and so forth, and presents these to the partners, to the governing council, and so on. The question is: How does this kind of horizon-scanning translate into robust advice and concrete programming? That's more challenging.

I think Angela's proposals for co-produced transdisciplinary research are very useful and can take us quite far in the right direction. Relevance and rigor, those were two of the Rs she referenced.

So, engaging scientists, communities, and civil society in jointly defining research priorities can strengthen trust. It will enhance policy relevance. It will bridge the gap between knowledge and action. But still, we must remember that not all research should be immediately instrumental. As Hinton reminded us, sustained investment in basic science remains the bedrock of future innovation and societal resilience. So ultimately, evidence-based policymaking depends not only on sound data and technology, but also on the institutional norms and trust that allow science to serve the public good.

Rebuilding this foundation requires renewed investment in research, stronger science policy interfaces, and a culture of openness and engagement. If and when we succeed at this, science can once again become a trusted foundation for solving problems and no longer be another arena for ideological conflict.

David Downes: Between these three presentations, we have a lot of food for thought here. I can imagine there are plenty of questions in the audience. I have a few myself. First, I'd like to ask our speakers if they would like to respond or if you have any additional thoughts or responses triggered by hearing the other speakers.

Charles Weiss: I'd like to ask Angela a couple of questions. One is: As you pull together different stakeholders to design questions that meet the needs of the people who presumably would use the results, did it matter, for example, whether the scientists had an understanding of the economics and politics of the subject at issue; the economics and politics of fisheries, for example? Is it okay for them just to simply say "here's my research" and throw it into the meeting?

My second question: Much of the research you described is social science research. Did you end up with any social sci-

10. *See The Godfather of AI*, The Weekly Show With Jon Stewart, *available at* https://www.youtube.com/watch?v=dZmsnn6eSe0.
11. Representative concentrated pathways (RCPs) are climate change scenarios used to project future greenhouse gas scenarios. RCP 8.5 takes a "business as usual" approach. On the other end of the spectrum is RCP 1.9, in which global warming would be limited to below 1.5 degrees Celsius and is the aspirational goal of the Paris Agreement.

ence-based innovations? Some very important social science-based innovations—focus groups or ranked choice voting, for example—can be as profitable as technological innovations. Did anything like that come out of your system?

Angela Bednarek: Great questions. On the first one, it really depended on how the research team was put together and the stakeholder team. We would often have basic researchers involved in those teams. Using fisheries as an example, scientists who study fish population and genetics would need to be partnered with someone who understood the other aspects of the problem and could bring the various lines of evidence and research and science together—we sometimes called this person the "boundary spanner."

Does it help when researchers of various kinds, whether they're natural physical scientists or social scientists, understand that there's a broader context out there? Yes, as it's more likely to result in an efficient process.

But the way our funding works for those kinds of projects is that we also funded the boundary spanner facilitator. It sounds like they're just making sure everybody has the chance to talk, but it is much more than that. It was really an integration and a key part of the work.

We would often assure our basic research grantees this is not about forcing them to go outside of their comfort zone. This is about bringing them to the table to make sure we understand how their knowledge can feed into this process. So, we want to make sure there's someone who can facilitate that.

On the second question, I think that participatory technology assessment is an interesting intervention (although Pew did not make that happen, that was our CSPO colleagues.) And we try to keep track of the systems, strategies, and tactics, like that one, that are really promising.

Charles Weiss: As an old science advisor myself, I'd like to hear more from Juha about how the two GEF science advisory committees (the Independent Evaluation Office and STAP) worked and how they got the nine scientists that were the recipients of their advice? How do they sell these ideas? How did that work?

Juha Uitto: It's a long story. The panel is supposedly independent, but it is not entirely independent because it is organized under the United Nations Environment Programme (UNEP). GEF puts together the panel based on the topic or area that the scientists work on. There is biodiversity, climate mitigation and adaptation, chemicals and waste, and so on. So, you have a collection of scientists who have this technical knowledge.

There is a fairly strong secretariat here in Washington, D.C., which also has scientific expertise. They can lead the process and sort of harness these scientists together. The secretariat knows, perhaps even more so, what the immediate needs of the GEF are.

But there is a tension between the nitty-gritty of reviewing project proposals. The project proposals come from the recipient countries through the agencies that propose projects for funding. Seldom are these projects particularly innovative. There are innovations, obviously. I shouldn't say that there aren't. There are social science and natural science innovations in these projects. But they are looking at projects from the point of view of what is there already.

Then, there is the horizon-scanning where STAP looks into things like novel entities and AI and so on. This research is communicated to the GEF Council through presentations and reports.

But there is a much more tenuous link to what actually gets done, because when you talk about novel entities to UNEP, which is basically helping a bunch of countries deal with known global environmental issues, it is harder to translate this type of research into practice.

Angela Bednarek: I might just draw on a few points. I think there's a clear signal that trust in scientists as individuals is still pretty strong. It's the institutions where trust is eroding. So, I try to think about how that plays out, how we think about supporting different kinds of interventions, and how we lean into that. Now, that may change and I haven't seen the latest, but I think there's some new Pew Research Center data on trust in higher education institutions.[12]

Anyway, going back to the evidence base for how we approach this, we have to ask where is the trust eroding and what does that mean for what we do about this? As we've been working with state legislatures over the last few months on the new State Science and Technology Policy Fellowship, we see there is still quite a bit of demand for research and science and evidence, particularly around AI. There is still a demand for understanding option sets and the implications of different decisions sitting on their desks.

By leaning into where there are still needs and demands and clear signals that are not politicized—these are across the board—will help us understand what we can do at this moment when at the federal level or national level there's just a lot afoot.

Juha Uitto: Can I just make one observation? I was thinking of the fisheries here. When we get into the domain of evaluation, we can't assume that all stakeholder groups have the same interests. Specifically, I'm thinking of an evaluation that I've read about but wasn't involved in. I think it happened in the New England area where there was a question about protecting a river.

There are commercial fishermen, leisure fishermen, conservationists, energy folks, and navigation people who are involved. And it involved a fairly concrete, participatory, and inclusive process. Although everybody had a stake in that river and wanted to protect their stakes, their goals were not identical. So, this is another thing you have to navigate.

12. Claudia Deane, *Americans' Deepening Mistrust of Institutions*, Trend Mag. (The Pew Charitable Trusts Oct. 17, 2024), at https://www.pew.org/en/trend/archive/fall-2024/americans-deepening-mistrust-of-institutions.

David Downes: This very interesting discussion has triggered additional questions for me, but I I'd first like to turn to the audience.

Sandra Nichols Thiam[13]**:** The National Environmental Policy Act (NEPA) is at the heart of this big question of energy transition and permitting, which is something that is on many people's minds, especially at the state level. And there are so many threads to tie together, so please bear with me.

Here at ELI, our work is to address urgent environmental problems, for example, helping communities or local governments or states understand their legal and policy options and how to use law and policy to manage nonpoint source pollution, or indoor air quality, or data systems, or whatever it may be. Our work is also about helping decisionmakers understand the critical information they need to make those decisions, such as climate science for judges or the scientific aspects of fisheries for local fishery officials. But our work is also about building an evidence base and doing the research to show that whatever policies we end up working to advance are shown to have impacts.

So, a couple of questions occurred to me. First, and this doesn't just apply to ELI, how do we maintain the integrity of the enterprise of science while also ensuring that policy or other governance decisions are appropriately based on scientific evidence?

ELI has been thinking a lot about this issue, and it's been part of our approach since our founding. But we've been focusing, especially in these times, on how to make sure that decisions are informed by science. But how do we have a science-policy interface and protect the integrity of the scientific enterprise?

Relatedly, how do we make trade offs? For example, in building the necessary infrastructure for renewable energy, do we need to damage wetlands or whatever it may be? So, how do we figure out those sorts of trade offs?

Angela Bednarek: I have a follow-up question on the last part of Sandy's question, which I found really interesting. Understanding the trade offs between different decisions is always necessary, correct? There's always that reality of "if you do this, this is going to happen; if you do that, that's going to happen." So, what I would love to hear is whether there is a difference now.

Carl Bruch[14]**:** I think that we are no longer talking about trade offs. It's denying the science, so that this is not an issue. And trade offs can sometimes become very much value-laden.

Juha Uitto: Yes, as to what Carl is saying, in some situations, the whole trade off question becomes moot. It relates to participatory decisionmaking, planning, and all of that, of course. But we have different power relations.

I think we in the GEF, for example, did a fairly large evaluation looking at synergies and trade offs between different or both environmental domains. Sometimes you have conflicts between biodiversity conservation and climate, for example. You plant trees that can act as carbon sinks but can be detrimental to biodiversity.

But more often it is the socioeconomic side of things and the environmental side of things. So, it is important to have these processes where you are very clear. Whether you are a scientist or an evaluator, you must be very clear on both the positive and the negative synergies and trade offs at play.

I tend to be an advocate for scientists and evaluators. I mean, we all have stakes in the issues and believe we know what is wrong, what makes sense, and what is right. But to maintain credibility, we have to be able to see both sides of things in many ways.

Charles Weiss: In an ideal world, you would have scientists present the data and then have a committee of some kind that says, "yes, this is the right data," and then a policy organization that makes the ultimate decision based on the science and all the other stuff that feeds into the decision.

This gets blurred in the middle of these real human institutions. Somebody appoints the committee. Somebody decides which scientist to ask for advice. Somebody abolishes the research institution that provides the data. So, there's really no way to keep these things separate in the real world. Basically, you do the best you can, or you do the best that they let you. With the proper support at all levels, this can work. And you can have all of these institutions that are separate. Even so, there are people involved.

John Doherty[15]**:** I have two questions. My first is for Juha and relates to the statement about the IPCC being perceived as advocacy. The example given was their use of the RCP 8.5 emissions scenario—the high-end "business as usual" emissions scenario. But the IPCC also looks at low-likelihood, low-emissions scenarios. They look at a range of different kinds of scenarios. So, do you think it's fair to characterize that kind of work as advocacy? I think there are legitimate scientific reasons to use and understand the upper bounds of the climate system and what the response of the climate system might be to those unrealistically high emissions scenarios.

My second question is for Angela. I was really excited to learn more about the State Science and Technology Policy Fellowships you're setting up. I wondered if there's scope to think about extending those fellowships into the other two branches of government at the state level, both the governor's office and the state judiciary, which would benefit from scientists being placed there.

13. Sandra Nichols Thiam is Vice President, Research & Policy, at ELI.
14. Carl Bruch is a Senior Attorney and Director of International Programs at ELI.
15. John Doherty is a Science and Policy Analyst at ELI.

Juha Uitto: I think the IPCC has moved into more advocacy than it used to. It's not only the use of the RCP 8.5. Maybe it's not the IPCC's fault, but when they present that kind of a scenario, that's the one that all journalists and media pick up on. They forget about or ignore the lower scenarios. I think it contributes to the desperation that we see.

Incidentally, the desperation has gone down. It's curious. Just yesterday, I read that five years ago, roughly 40% of Swedish kids thought we were all going to die because of climate change. That dropped to 15% this year. So, there has been a major drop in that part of the existential crisis. We don't know why it is. Perhaps, it is because of the war and other crises that come up.

But with the RCP 8.5, when basically everybody, including IPCC itself, agrees that this is a highly unlikely scenario, this means that this would materialize only if nobody did anything and if there was no energy transition and if renewable energy wasn't getting cheaper and competitive.

Last year was the first time, largely thanks to China and India, that renewable energy—excluding nuclear—was the single largest source of energy in the world. It doesn't mean that it's more than half. It means that it's bigger than coal. It's bigger than gas. It's bigger than oil. It's bigger than nuclear.

These are the trends. Whatever some politicians might think, these are irreversible trends because of economics and all of that stuff. Perhaps it is time to retire the RCP 8.5 scenario that then gets everybody to think. That's my point. But you are correct that, in itself, that is not IPCC advocacy.

Angela Bednarek: I'll quickly touch on the state fellowship question. It is going to be the legislatures for the foreseeable future for a variety of reasons. The legislature is where it started, and there's some partnership with pilots that were in place already, but certainly there are folks who think about this, for example, at the governor's office level.

For example, North Carolina's Office of Strategy and Partnerships was set up to provide a bridge between the state's research universities and colleges and all the capacity they have for providing research into the governor's office. It was set up to provide that bridge. So, there are some isolated examples.

But for this particular initiative that we've just set up, it will focus on state legislation. But certainly, as we move into a scaled-up version, I'm sure that idea will come back. It's not just the legislatures who have these questions. So, it is good to keep that in mind.

Carl Bruch: I was wondering if you could comment on how we determine how much science we need for decisionmaking. Over the last 55 years in the United States, I think we have realized that there are all these different sectors and that these sectors are interlinked; they link to economy, to public health, to equity. But while we have a better understanding of the system, it is getting really difficult to understand how does this particular policy choice affect everything and is affected by everything. How do you put boundaries on this so that you can actually make a decision?

Charles Weiss: The short answer is you do the best you can. The beginning of the longer answer is that you identify areas of uncertainty and try to reduce them. In fact, I argue that there should be. There should be an obligation that everybody pulls their oar in trying to reduce them. Then, for when you don't know what you don't know, the argument there is that you better keep searching for new knowledge. There's no limit to how much you can do along these lines, so you have to be reasonable.

Scientists usually have a decent notion of how far they are in understanding a given issue and where the big areas of uncertainty are. They aren't always right, but they probably can tell you that, "okay, in climate the big problem is clouds." Now, maybe somebody else will come in from left field, find an important solution, or identify something else that needs better understanding. But I don't have a better answer than that.

Angela Bednarek: This is clearly a big question and one without a definitive answer. And so, of course, it depends. These problems are complex, and science is not going to answer the values question. It just doesn't. It's going to tell you what could happen if you make one decision or another.

What I've been looking to are the strategies that build systems for acknowledging that uncertainty and are able to evolve and adapt over time. For example, Water Trust Australia,[16] which was a collaboration of Australian philanthropies, set up a 10-year project to get all the different stakeholders who are dealing with water issues in Australia and the scientists who are providing information about what that looks like. They funded a 10-year project cycle. Over those 10 years, all the stakeholders are facilitated to get together, so there is that relational aspect to it. The scientists continue to feed information into that process, but it's over a 10-year period.

So, there's long-term thinking as well as the acknowledgement that the science is going to change. That's a reality. The needs are going to change, and that's a reality. Even the stakeholders might change, and that's also a reality. But over a 10-year period, how can we look at what setting that up rather than funding more science at the time? Does that work? Does that intervention work and how does it work?

Of course, it's an isolated intervention. I think it's really interesting and promising, and I'd love to see more initiatives like that that are acknowledging the realities of that complexity. Acknowledging that they might not always need more science, but you might need science at different times or in different ways. Everything is going to be changing, especially with water issues.

16. For more, visit https://watertrustaustralia.org.au/.

So, that's what I look to when I'm thinking about what to fund. Do I think about funding more science or do I think about funding more science and funding processes in which we try to account for all of that?

Juha Uitto: AI is perhaps an interesting case here because science and technology are advancing very fast. But there are a lot of these "unknown unknowns," to quote one past thinker,[17] in the process. So, there clearly is a need to regulate. There is clearly a need to have some sort of policy, which we don't have currently on AI, and see where it is going.

But there are also conflicting feelings. Some are very enthusiastic about it and think that AI is going to save humanity, whereas others think that it's going to destroy humanity. So, you need policymakers who have a certain level of understanding of science in the AI sphere but who can then regulate the science also.

Audience Member: What I have seen over the years that is very, very positive is the cooperation and integration of the various fields of sciences. In the past, everybody was specializing in something in silos. So, this is a very, very good direction that the different sciences have taken.

I'm a civil engineer by training. The first thing I start looking at is how do the lawyers and the law address these engineering questions? That was how I first found out about ELI and really started to follow the different activities at ELI. In any case, that cooperation is very interesting to me.

An important question right now is how scientists communicate the science to the public so that it resonates with the public and causes the public to respond appropriately. For example, the scientific papers will often say, "if the temperature is one degree or two degrees beyond such and such, we're doomed." That happens every day out there. But what is the public to do?

We must set up the criteria by which we convey the science so that it means something to the public or the policymakers. That issue has been worrying me for a few years now. We have to convey that in all the fields of science. That is how I think we can make a difference or at least put a dent in the current situation.

David Downes: That's a really powerful point to end on, as the theme that has come across throughout this conversation is how to build trust between scientists and the public and decisionmakers. Part of that is going to be stronger communication. I take your point that interdisciplinary communication within the scientific community could be a really valuable step in that direction.

Any closing remarks?

Charles Weiss: Two things: First, we need not only science, but also technology and innovation, including manufacturing, commercialization, and making the thing happen. Second, we should be thinking long term—whether long term means 5 years, 10 years, or 30 years from now.

17. "Unknown unknowns" can be attributed to former U.S. Secretary of Defense Donald Rumsfeld during a February 12, 2002, news briefing concerning the lack of evidence linking the government of Iraq with the supply of weapons of mass destruction to terrorist groups. An archived transcript of the news briefing is available at https://web.archive.org/web/20160406235718/http://archive.defense.gov/Transcripts/Transcript.aspx?TranscriptID=2636.