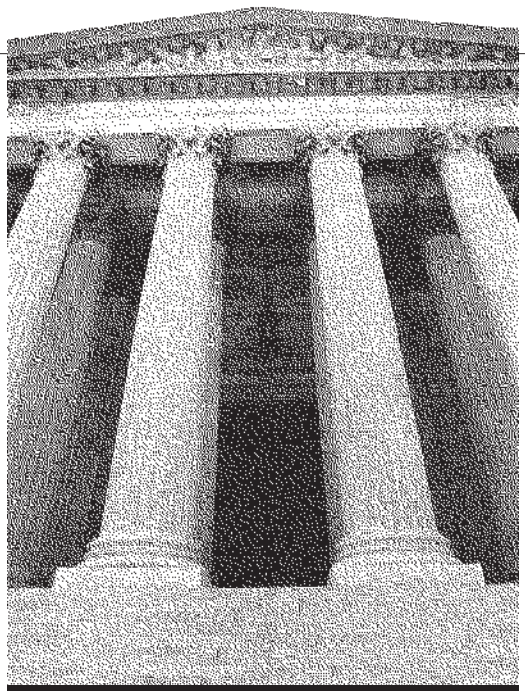

THE DEBATE

Private Actors: Part of the Problem, Part of the Solution

The Paris Agreement establishes a framework for international cooperation in limiting the impact of climate change to an average global temperature increase of less than 2 degrees Celsius. The accord also facilitates equitable climate adaptation and seeks to align financing incentives with sustainability.

To achieve these goals, the 195 adopting nations will develop individual plans for meeting their Nationally Determined Contributions. Most of these emissions-reduction plans will involve regulation at various levels of government and bilateral or regional agreements among nations.

But these actions will still fall short of the goals of the agreement. In fact, temperatures could increase almost twice as much if governments alone address the risks to society and the biosphere — a truly dangerous situation.

To meet the 2 degree target involves making a positive out of what is seemingly a triple negative: nongovernmental actors will need to take steps not required or not incentivized by regulation.

These initiatives will come from a variety of agents, take many forms, and aim at a myriad of objectives. Corporations will reduce emissions and track reductions. Citizens groups will facilitate transitions to clean energy and sustainable resource use. Financing mechanisms will recognize the value of sustainable enterprises, including green municipal bonds and development projects, and selective investment and divestment.

Institutions — cultural, religious, and academic — will reduce emissions while adjusting their platforms and reallocating resources to respond to the effects of climate change. And households across the globe will make adjustments involving the day-to-day lives of almost all people around the planet, as energy generation and use is transformed.

The 2016 ELI-Miriam Hamilton Keare Policy Forum took on this difficult problem at the intersection of public and private policy. ELI's multidisciplinary panel debated the complementary mechanisms that will facilitate the transition to a climate-sensitive future, with special emphasis on what the Paris Agreement will mean for private actors and related civil society mechanisms. We present a transcript of the forum that has been edited for space reasons and to improve clarity.

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Ken Berlin
President & CEO
The Climate Reality Project

Astri Kimball
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Vicki Arroyo, *moderator*: The Paris Agreement brought together developed and developing countries, nearly 200 in total, to keep global warming below 2 degrees Celsius. Targets will be revisited every five years. The agreement also hopes to mobilize $100 billion a year in support. It signals for the first time the end of the fossil fuel era. It also importantly puts adaptation on more equal footing with mitigation, since we are already seeing the consequences of climate change. Adopted by numerous nations already, the agreement entered into force on November 4.

While the Paris Agreement represents a tremendous achievement in global diplomacy, its targets will not be easy to meet. It will take more than the world's national governments can achieve on their own. Actions by provincial and local governments will be needed and, crucially, actions as well by the private sector — individuals and companies.

I want to start the conversation with Mike Vandenbergh, the David Daniels Allen distinguished chair of law at Vanderbilt. Mike is also the director of the Climate Change Research Network and co-director of the Vanderbilt Energy Environment and Land Use Program. Mike long ago identified the gap between governmental action and what is actually needed.

Mike, can you tell us how to get to the Paris targets, and the role of the private sector in reducing that gap?

Mike Vandenbergh: I have a really modest goal in answering your question, which is to change the way everybody in the room thinks about what we can do about climate change and to go from saying what can government do to saying what can any actor do.

We can draw a chart showing the global increase in carbon emissions over time, projecting emissions forward to identify what we need to achieve for a 2 degree future. And we can draw another line representing the probable emissions trajectory if every country meets all of its obligations, both contingent and non-contingent, in the Paris Agreement.

There is a substantial gap between these two lines — what I call the Paris Gap. Just in the next 10 years alone, the Paris Gap amounts to 30 to 90 billion tons of carbon dioxide. In a new book, physicist Jonathan Gilligan and I show how private governance can help close that gap. By that I mean actions by corporations, investors, and lenders. I also mean actions by other private organizations, including advocacy groups and certification-standards groups. And I mean even households and religious organizations.

These private actors can achieve reductions of a billion tons a year. We tend to view government as the only force when in fact the private sector is doing a remarkable amount that is easy to overlook. And it can do a lot more with the appropriate policy structure and incentives.

For roughly half of the U.S. population, the solution to climate change — government regulation — seems worse than the problem. But if the private sector can make a major contribution, we might be able to help beat this solution-aversion problem and bring moderates and conservatives into the fight against climate change.

Vicki Arroyo: I want to turn to Bob Perciasepe, who has had experience at both the federal and state level as a policymaker and now heads C2ES and its business-environmental leadership council of companies that are pushing through institutional barriers and making real commitments. C2ES works with cities, states, and national policymakers, as well as business leaders and other stakeholders, to find consensus solutions to climate change, focusing largely on market mechanisms. Prior to taking the helm at C2ES, Bob served as EPA deputy administrator.

Bob, how do you see the interplay of private- and public-sector commitments? Are the private-sector actors that Mike is talking about really willing to push forward?

Bob Perciasepe: Mike is correct that the non-state actors are an important component to drive that force, and governments need to create frameworks to enable that to accelerate. There is a potentially symbiotic relationship between government and private actors. Of all the annual Conferences of the Parties to the climate convention that I've attended, the Paris COP in 2015 that produced this remarkable agreement had the most activity from non-state actors. The French really pushed hard to make that happen. There was even a Non-State Actor Zone, giving tremendous input from cities, states, and businesses.

If you were in Paris you could almost taste the impact that non-state actors were having by pushing the negotiators to an agreement. There were so many mayors, and business leaders, and state and regional government leaders.

The agreement has now entered into force. In the last year, the world also came together on aviation emissions and agreed to phase down hydrofluorocarbons. The energy of those seeking solutions at the governmental level is stunning.

On the other side of the coin, the non-state actors are pushing forward with their own programs. It would be easy to underestimate the work that is being undertaken by the business sector, by local governments, and by state governments. In fact, when the United States puts out its biannual report required under the climate convention, it doesn't even mention cities and states.

So how do we get non-state actors to be linked to the policy frameworks? C2ES just released a report that outlines numerous opportunities for increased linkages.

Vicki Arroyo: Astri Kimball is a senior policy counsel with Google. Google has been carbon neutral since 2007, and consistently works to improve its operational efficiency and to promote sustainability, including with its suppliers. Before joining Google,

she served as deputy general counsel to Vice-President Joe Biden and senior advisor for the Overseas Private Investment Corporation.

I'm going to ask Astri to tell us about Google's philosophy and why we are seeing other private entities promoting a lower-carbon future.

Astri Kimball: Most of you probably think of Google as a search engine, so I just want to start with a search stat from today. Who can guess which country had climate change as its most popular search term compared to other search terms today? The answer is Fiji. Number 2 is Malawi. Number 3 is Ethiopia. The United States is number 24.

So why is Google here to talk about energy? We come at this from three major angles. One, as a major energy consumer, it is absolutely critical to our business. Our data centers make us the largest corporate purchaser of renewable energy in the world.

Second, Google has been a big energy investor. We've invested over $2 billion in clean and renewable energy projects, mostly in the U.S. but we also own the largest wind farm in Africa and the largest solar farm in Africa — and we have made money out of those investments.

Third, our basic products — Gmail, Google Maps, the Cloud — have an important and positive impact on the environment. A business that uses Gmail reduces its carbon impact for email by 98 percent. Maps saves $5 billion in fuel annually and 1 billion hours of travel time. So we think our basic products have a big contribution to the environment.

Google has committed to purchasing 100 percent of our energy for data centers from renewable energy resources. We are not there yet, but we're very close. We do this mostly through power purchase agreements. We have purchased over 2 gigawatts of renewable energy, which is the equivalent of taking a million cars off the road. State policies on renewable energy are a big driver of where we choose to put our data centers.

This is a real commitment by the company, and it is driven in large part by business needs. Google uses so much energy that it needs to find diverse, sustainable, affordable supplies. That is why we use renewables. In addition, there are our values and our commitment to sustainability. Finally, it is a hedge against price volatility. These power purchase agreements provide long-term financial planning that is helpful to our business needs.

Vicki Arroyo: Sameer Kwatra is the climate change and energy policy analyst for the India Initiative at the Natural Resources Defense Council. Sameer's focus is on policy research, clean energy, energy access, and sound climate policy in that very important part of the world.

Sameer Kwatra: The Paris Agreement commits every nation on Earth to do something about climate change. We should also realize that it does not require any private actors or subnational actors to do anything, and yet we see increasingly the financial community and a lot of other private players making voluntary pledges, determining that it is in their best interest to work on solutions and prepare for climate change effects.

I have worked in banking and insurance. The financial community is very familiar with risk. Traditionally, energy has been a safe long-term investment because humans are always going to need energy. But now we see a massive transition, a shift toward clean energy sources. Savvy investors can foresee that. We at NRDC have come to see that finance is recognized as a prime mover around the world in enabling us to meet our climate aspirations.

So there is clearly recognition. There is also demand. Insurers and investors have been forcing governments to get the Paris Agreement into force. What investors typically need is some kind of assurance of the greenness of the underlying projects. At NRDC, we have been working with partners like the Climate Bonds Initiative on setting up standards and certification for green bonds. That's a market that has been scaling up enormously over the past five years. Green bonds are like any other debt instrument except that they finance clean energy projects, better transportation, and climate adaptation.

This demand does encounter some structural barriers. First of all, there is a relative lack of knowledge, and therefore, higher uncertainty, which adds to the cost of these investments. In addition, the technology is new and often untried. Since clean energy is a new market with a lot of emerging players, many actors do not have a track record of financial and project performance.

Into this situation we are seeing the emergence of green banks all across the world. Green banks are specialized institutions that work on scaling up clean-energy investments, and they do that by several means. First of all, aggregation, providing means of securitization or warehousing of a large number of projects so that they become more attractive for investors. This in turn provides credit enhancement and other products needed for clean-energy investments.

Most importantly, the objective of green banks is to leverage limited public funding. Almost all the green banks currently in operation have received some kind of public funds, and then they leverage this several times to attract private finance, making the limited kitty of public funding go much further. Typically, because their motive is not to generate more profits, they recoup these investments and recycle the funds.

Vicki Arroyo: Our next panelist is James Whetstone, who is the special assistant to the director for greenhouse gas and climate measurements for the National Institute of Standards and Technology. He is responsible for the institute-wide greenhouse gas and climate science measurements research program, which seeks to advance science standards and methodologies supporting greenhouse gas monitoring.

James, what are NIST and other scientific agencies doing to help us monitor our progress toward these goals?

James Whetstone: NIST is the U.S. national metrology institution. We're responsible for the standards that underlie the measurement system of the country. These start with standards for weights and distances and extend to cutting-edge areas like biomedical research and cybersecurity. In the case before our panel, the issue is measuring greenhouse gases.

The Paris Agreement presents a quantitative problem because each Nationally Determined Contribution pledge essentially says that a country will reduce its emissions of greenhouse gases by some amount.

This raises some obvious questions. How do you measure progress toward these goals? That is going to be measured by inventories. The U.S. has the most robust and extensive inventory of any nation in the world. However, we will be seeing more scrutiny placed on inventory data, and how the data are generated and what backs them up — the scientific basis.

NIST is developing independent methods for making those kinds of emission measurements. Local, regional, and global levels are important. Several federal agencies have monitoring activities in this space. Most of what we are doing is focused on cities. 70 percent of the population of the world lives in cities. That is forecast to increase to 90 percent by the end of the century. Cities concentrate energy usage as well as emissions. Being able to characterize what is going on in cities is crucial.

In addition, we need to know who is responsible for an emission. Or if you're going to a market-driven arrangement, then maybe the question is who can take credit for an emission. The fungibility of the carbon asset will become an issue whether through regulation, a market mechanism, or a combination.

In the U.S., we established a testbed system that involves three metro areas, Indianapolis, Los Angeles, or the South Coast Air Basin of California. The third testbed location is the U.S. Northeast Corridor extending from the Baltimore-Washington, D.C., area to the Boston area. Linking these local measurements to regional, nationwide, and global measurements is going to be an important task. NIST along with EPA and several other federal agencies are working toward bolstering the accuracy and science base supporting the U.S. inventory.

Vicki Arroyo: Ken Berlin, after many years as a partner at leading law firms, is the president and CEO of The Climate Reality Project. The organization's mission is to catalyze a global solution to the climate crisis by building momentum for and supporting the switch to a low-carbon economy.

Ken, the project played a big role in the run-up to the Paris Agreement. It is active now in implementation. Can you tell us what civil society should be doing, and how traditional NGOs interact with some of the other private entities?

Ken Berlin: There are two aspects of the Paris Agreement that are guiding the work we are doing at The Climate Reality Project, and that guide the work of a lot of the environmental groups involved in implementation. Almost every country in the world has now made a commitment to reduce its greenhouse gas emissions. But those commitments are not enforceable at the international level. Our organization has established branch offices in 10 key countries. Our goal is to get these nations to do what they say they are supposed to do, then get them to strengthen the commitments five years from now.

The second aspect concerns the institutional structure you need to address climate change. When a country comes up with its commitment, it is also supposed to have a roadmap of how it is going to meet that commitment. Some countries have good roadmaps, but very few have complete ones. And some countries have very rudimentary roadmaps. It is up to civil society to assess what each country is lacking in its roadmap, and if a country has a good roadmap, ask whether it has the laws and regulations it needs to actually implement its commitment.

In most places, including the United States, the answer to these questions is no. Once we know that, then civil society's goal needs to be to get those laws in place and help implement them.

Another way civil society can play an active role is by helping countries build the capacity to do what they say they are going to do, particularly developing countries. Indeed, many countries do not even have the capacity to measure and report their emissions.

Once a country's roadmap is established and it has the necessary resources, we get down to implementation. There are all kinds of reasons not to take action, particularly for vested interests. So again, the role of civil society here is to build the public support that is needed to make sure that the implementation that the countries are talking about really happens.

The final stage is to strengthen each country's commitment in 2020. Al Gore, who is our founder and chairman, is very confident that we can make great progress here. One reason is that the economics of renewable energy are changing very quickly and very fundamentally. But, just as there has been science denial around climate change, there is going to be economic denial around renewable energy. The fossil fuel industry is going to fight against the economics of renewables, but the situation is improving every single year.

There is also a role for civil society on the international level, in the climate negotiations. Civil society can play a role in pushing issues, bringing expertise, and getting countries to take ambitious actions.

We helped form, first in Peru and then in Paris, something called Friends of the Future, which is a group of about 30 countries that meet to talk

about the level of ambition in the agreement. NGOs played a very useful role in establishing that.

Vicki Arroyo: Let's get to the numerous examples of collaborations between private-sector entities and the public sector, in this country and worldwide. I'd like to turn first to Bob.

Bob Perciasepe: Recently, we were in France with a number of countries and a number of businesses talking about Article 6 of the Paris Agreement and looking at implementation. Article 6 is the foot in the door for international tradable credits to create markets.

The fact that we had multinational corporations urging us on gives confidence to the international negotiators. One of the ways that the non-state actors, particularly the private sector, are going to help make that happen is to be able to engage with the international community at the provincial and city level, to provide the confidence for them to be more ambitious. So we keep bending the curve that Michael described earlier.

Mike Vandenbergh: The challenge with the Paris Agreement is that it sets both a ceiling and a floor. It tells us what countries will achieve if they satisfy all their commitments. On the other hand, it reduces the pressure to do more between now and 2025. Scientists are concerned that we will be too far away from a 2 degree pathway if we wait a decade to get to where Paris is aiming. Both Ken and Bob are right to push governments to meet their commitments. The gap will be even bigger if we don't.

Vicki Arroyo: As someone who works a lot with states and cities more than the private sector, I don't really see the point you are making that there is a ceiling. As an example, the Regional Greenhouse Gas Initiative has brought real economic benefits to the northeastern states. I agree that we have to catalyze more of that. But I don't really see a ceiling.

Mike Vandenbergh: The ceiling is at the national level not the subnational level. The ceiling definitely exists. It arises from what the countries feel pressure to commit to do between now and 2025. And what we're talking about here are private actions and subnational actions to fill the gap.

Astri Kimball: I do want to touch on federal policy. We couldn't feel more strongly about the Clean Power Plan. We have filed briefs to say, from our perspective as an energy purchaser, how important it is. We also work regularly with states about locating our data centers while getting clean energy into the mix. In regulated markets — an example is North Carolina, where there was a green tariff that we worked with the state on — that has been a great model.

In Alabama, there was a coal plant that had shut down completely and we repurposed it to make it renewable-energy driven. The governor there couldn't be more supportive of that occurrence, because it's an economic good thing for his state.

There need to be incentives put in place that encourage every customer to get clean energy. We need to go further than that. One of the things we focus on is which clean energy we are buying. We make sure it is additional, that it is adding more to the grid that wouldn't just happen.

Mike Vandenbergh: In terms of carbon emissions, the southeastern United States is roughly equivalent to the eighth-largest country in the world. Companies like Google, Facebook, and others are helping to catalyze support for smaller businesses in the region to demand cleaner power. There is no additionality problem, at least in the near term. The Southeast is a place where most states oppose carbon regulations, but companies are using their market power to have a real effect.

Vicki Arroyo: For the first time, the Paris Agreement is putting adaptation on equal footing with mitigation. I'd like to ask the panel about their experiences with adaptation.

Astri Kimball: Google works with governments not only on mitigation but also on resilience. Some countries are not open to U.S. tech companies preaching on policy. So in Indonesia, we are assisting fishers through our Maps application. There are a lot of ways we are using tools to support governments.

Sameer Kwatra: Many countries, especially India, realize that climate change is already happening. They feel the impact. Therefore, adaptation and resilience are critical and definitely a priority. So we work specifically on a thin margin between mitigation and adaptation, especially related to heat impacts of climate change.

As an example, NRDC has worked in Hemtabad, a city of 7 million that has had high heat mortality. More than 2,500 people died in a 2010 heat wave that saw temperatures reaching as high as 124 degrees. It is just inhuman to exist in those circumstances. In those parts of India, weather forecasts were only for three days. That doesn't give people enough time to prepare for extreme weather. So we worked with the Indian Meteorological Department as well as organizations in the U.S. to refine those predictions. Today, they have five-day forecasts.

Then the issue becomes how you communicate this information. Everybody in India has a smartphone. So we used social media to push out the forecasts. We also worked to ensure coordination among agencies to help people foresee, anticipate, and then prepare for a heat wave.

The results have been amazing Heat mortality has gone down substantially in the region. In the last year alone, we have seen 10 cities adopt similar heat action plans.

Vicki Arroyo: James, what is your take on the predictive powers of our science agencies, and how they in turn can work with the private sector to help get apps out to provide this kind of information in the United States?

James Whetstone: What Sameer was talking about was something like combining our National Center for Atmospheric Research and the Weather Service to improve meteorological predictability.

Predictability is not only important to weather forecasting, it's important to greenhouse gas measurements and monitoring. Predictability of both weather and the transport of greenhouse gases in the atmosphere are very similar and an area where places like NCAR can contribute significantly to greenhouse gas measurements and ultimately, the accuracy of inventory data and reports.

Translating these advances into operational monitoring capability, whether it be surface-based or from satellites, remains a challenge, but a tractable one. For example, as we develop calibration capabilities for on-orbit measurements, our capabilities to monitor greenhouse gases and support inventory data will increase in utility.

There is, however, the issue of capacity. How do you translate the lessons we have learned in the U.S. to other countries, particularly in the developing world?

Ken Berlin: I want to say a couple of things about finance. One, there are a lot of estimates of how much money has to be spent to transition to a clean-energy economy in the amount of time we have. Most of those estimates come to about $1 trillion a year. The actual clean energy investments in 2015 totaled $329 billion. That's not enough. It is increasingly clear that we are not going to get to $1 trillion a year from national governments alone. But governments can play a role in encouraging innovation and investment by reducing risks for businesses and other private actors.

I had a meeting a year ago with India's energy minister. He said he can install 100 gigawatts of solar at 12 percent interest, which is their current rate. He could also do 200 gigawatts of solar at 6 percent interest. So finance can make a phenomenal difference in helping and not hurting the country.

Vicki Arroyo: At this time I'd like to open the floor to audience questions.

Doug Keare: We need to think more in terms of sticks than carrots. The carrots seem to be there. There is some low-hanging fruit that Google, for one, is harvesting. And I concede we do need incentives for people who haven't caught on yet. But what we seem to need more is ways of embarrassing — financially, legally, or just in the public sphere — the vested interests that are standing in the way. I don't think Exxon got anything like the amount of bad press it should have for its behavior over the years. There ought to be something that can be done about that.

The second thing is that there are a bunch of actors that ought to be brought into this discussion. Warren Buffet and Bill Gates have made pledges to donate 50 percent of their wealth. There is a lot of money out there, probably more than can be encouraged to come in, and a lot of brain power behind that money that could be applied to deal with some of the obstacles. For instance, in the U.S. there are 60,000 workers in the coal industry. It shouldn't be hard to figure out how to get them into a different livelihood.

Mike Vandenbergh: On the carrots and sticks, government obviously is thought of as having the coercive power to provide the stick. But private institutions do as well. Much of Google's current market value is reputation, and so part of what is going on at companies like Google is protecting reputation. Savvy NGOs understand that. There are numerous examples we found where after an initial NGO campaign occurs, often against the largest firm in a given sector, the large firm makes changes, then you see a cascade of the smaller firms in that same sector hopping on.

Bob Perciasepe: In answer to your question, that brings us around to what the private sector can do and how things can change outside the boundaries of the national government. I am often struck by the data. The Department of Energy projected in 2005 that U.S. greenhouse gas emissions would increase 12 percent in the next 10 years. What actually happened is our emissions went down 10 percent.

The Clean Power Plan wasn't in force during that time. There were no restrictions on methane. The transformation in emissions from cars started later in that time period and hasn't penetrated the fleet yet. So something happened there. There are a lot of other forces like the recession and the price of natural gas. But not to get into the details, something happened that nobody was seeing — something that was generated in the marketplace and by the private sector.

Vicki Arroyo: The role of public policy is also important in fostering private action. When we work with the carmakers, we find there are barriers — range anxiety for electric cars, as an example. There are legal and policy questions that come up about the siting of charging infrastructure and whether or not that makes a provider a regulated utility. Then, if we have self-driving cars constantly looking for passengers rather than parking, we may not see a carbon benefit.

Astri Kimball: Certainly the driverless car team is thinking a lot about this, how to make the vehicles as efficient as possible and have the lowest carbon imprint. Our cars that do Street View, which is our mapping progam, are all tracking emissions. We work closely with the government on that.

Bob Perciasepe: The next few presidential administrations are going to have to start thinking about deep decarbonization by the middle of the century, and what kind of change is needed for that to happen. It can't be the incremental ambition change every five years under the Paris Agreement.

Robert McKinstry: What are your thoughts about how we deal with decarbonization? Right now electricity works on least-cost dispatch, which really depends on fossil energy. We will need to sequester carbon dioxide, and foster renewables, nuclear power, and energy storage. How do we structure the market in a way to realize these

long-term goals without over investing in natural gas?

Sameer Kwatra: India has one of the most ambitious renewable energy goals in the world, 100 gigawatts of solar, 75 gigawatts of wind, and other renewables as well. So those are not questions that we've been pondering. We've been thinking of what market transformation is required for renewable energy to be viable. The cost of renewables is coming down as technologies scale up.

When India launched the National Solar Mission in 2010, we were seeking solar plants in the range of 5 megawatts. Now there are many 500 megawatt projects that are already in place. That is bridging the scale discrepancy between a huge coal power plant versus solar. And renewables are disaggregated, especially important in developing countries that lack a grid.

Worldwide, governments spend $440 billion annually on subsidizing fossil fuel, and that's an enormous amount. When you factor in the externalities of fossil fuel power generation, then all the long-term investment is pretty much a stranded asset. So hopefully in all those things we'll converge and we'll see the transformation that you're talking about.

Unidentified questioner: In the United States, it takes seven to nine years to permit a new mine, but that also applies to siting a windmill or a solar plant. Canada and Australia can do this in one to three years. Not that we are any less or more environmentally conscious than they are, but we've seen President Obama try and fast-track some of the environmental impact rules to lessen this disparity. Are we really going to get a change? At risk is not only renewable energy but our infrastructure replacement.

Bob Perciasepe: I went to too many meetings when I was deputy administrator of EPA in which I had to find ways to expedite permitting decisions. When we look at accelerating these things, market structures and market signals are going to be very important — whether through consumer demand or putting the externalities into the price of carbon. But none of that is going to be effective if we can't build transmission lines or new renewable energy facilities, even at a microgrid scale. These are the challenges for what government needs to do.

Mike Vandenbergh: Maybe there is a role for a private standard and certification system in examining the kind of facilities you are talking about. In other words, if your project hits benchmarks in terms of additionality and the like, it can go on a different track.

Vicki Arroyo: I know California has used its state ombudsman to try to overcome some of the barriers to transmission lines needed there to move renewable energy to market.

Bob Perciasepe: It's not just wind and solar that face problems. Look at advanced nuclear facilities. We have great bench-level work done on nuclear reactors that are passively cooled and have all kinds of other advantages. Trying to get a license for some of those technologies through the Nuclear Regulatory Commission can take a decade.

John Pendergrass: We are not even close to getting a price on carbon, which would be a very good signal to improve energy efficiency. And that in turn would help to close the emissions gap. What is the private sector doing to improve efficiency?

Ken Berlin: If you are in business, you can spend your money on reducing your cost, as through energy efficiency, or you can spend your money on increasing your sales. That is not an easy choice. For the homeowner, the question can be whether you spend your money on energy efficiency or redoing your kitchen. We need the right policy incentives to push costs as low as we can to encourage people to invest in energy efficiency. The financial community could play a critical role here.

Dan Esty and I have done work together on green banks. The idea is to get the efficiency project paid for upfront through a loan, and the payments are offset by the energy savings. However, energy efficiency is not as easy as it should be because people don't necessarily act the way economists think they should. We have to narrow the choices enough so that energy efficiency comes out and wins that battle in the minds of businesses and in the minds of homeowners.

Bob Perciasepe: I used to be a city planner, and I would worry about water efficiency. My boss told me not to worry — in a hundred years, he said, every faucet in the city will be changed. If new faucets for sale become more efficient over time, the installed base will end up being more efficient. The same applies to energy efficiency — we can accelerate how people change the products they buy.

Mike Vandenbergh: There are also private groups that are going after both market failures and behavioral failures to find efficiency. For example, if you are a landlord, there is a split incentive between you and your tenant. The tenant may pay the electric power bill for the furnace that you installed. In the shipping industry, there is also a split incentive. The person shipping the good pays 70 percent of the energy cost, the ship owner pays the rest. Green finance provides a great opportunity for NGOs and other private actors to help bridge the financial barriers to fixing these problems.

Vicki Arroyo: Many states have prioritized using some of their proceeds from cap-and-invest programs on energy efficiency. States that do this, like Massachusetts and California, end up ranked at the very top in terms of efficiency gains.

While much of the discussion has been on promoting private-sector action, I am sure we would all agree there is a role for government policy. We are already seeing improved policies driving real change in our country and beyond as these actors step forward in the fight against climate change. **TEF**