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Heather Boushey
Member, Council of Economic Advisers

Thank you, Jim, and NBER for inviting me to speak with you today. I've learned so much about climate policy from Jim—and so many of you—and I'm happy to be able to join you.

The facts are impossible to ignore. In the United States alone, the economic damages from storms, floods, droughts, and wildfires have risen to over 100 billion dollars per year. At the current pace of change, these costs will rise. By the end of this century, we are on track to see a 3-degree Celsius increase in temperature (5.4 degrees Fahrenheit). If we allow that to happen, climate change could depress global GDP by [7 to 10 percent](#).

In truth, we do not know with precision how rapidly costs will rise. And, as [Marty Weitzman showed](#), this uncertainty should motivate a robust public policy response. Economists have a role to play to help policymakers craft solutions that can reduce uncertainty—as well as to provide tools to live with it.

At this conference, you're discussing critical aspects of this challenge. You're focused on the two parts of the economy responsible for the most emissions—power generation, which accounts for a quarter of U.S. emissions, and transportation, which accounts for [a bit more](#). And, Texas's experience this past winter was a case-in-point for focusing on resiliency in the face of extreme weather. These are important issues.

We also need to widen the aperture. Over the 20th century, the change in energy use laid the groundwork for our modern economy and affected all aspects of our lives. Automobiles replaced horse-drawn carriages, electric lights replaced gas lamps, and natural gas and electricity replaced coal and oil in our homes.

Now, we must transform again. We must change the way we make things and how we power our lives. And, we must do so in the face of a threat whose harms will only multiply the longer it remains unaddressed. An economic transformation of this magnitude and with such urgency is unsettling. It also creates new economic opportunities. One of those is to develop new economic tools. And this is what I want to discuss with you.

The field of climate economics developed not that long ago with small changes in mind. In 1991, before most of us were focused on climate change, William Nordhaus wrote a landmark paper called "[To slow or not to slow](#)." He suggested that a careful balancing of costs and benefits pointed to the need for moderate change. In his central case, he concluded total emissions should be reduced by 11 percent.

This framing comes naturally to economists. We're used to thinking about marginal changes. And, for a while, this framing matched the peripheral role that climate played in policy discussions. But not today. The environmental changes are not small. And, neither are the needed policy changes.

The world, [including this administration](#), has rallied around a target of net zero carbon dioxide emissions because net zero is when temperatures [stop](#) increasing, and because the risks of perpetual warming are unacceptable. A pathway to net zero requires a different mindset, and a new set of tools with which to analyze progress. It means we must take bold action to deploy at scale the carbon pollution-free solutions we have today, while at the same time planning for the emissions reductions we need in the next decade and the one after that, as well as the ones that need to happen in the developing world.

That's why the president is proposing unprecedented investments in developing better climate solutions. And, that's why his Council of Economic Advisers' first [report](#) highlighted the benefits of an equitable and cost-effective national energy innovation strategy.

Aiming for net zero rather than incremental changes means building the infrastructure that climate solutions require to thrive. It means investing in charging networks for EVs, transmission lines to harness the potential of solar and wind energy, and pipelines that enable carbon dioxide transport and storage. Viewed in isolation, none of these investments will dramatically reduce emissions. But, together, they are necessary to enable a cost-effective pathway to a carbon-neutral economy. Do we have the right tools to capture the costs of economic transformation, especially when investments today could dramatically reduce the costs of climate solutions tomorrow?

I want pause here for a moment to focus on real world outcomes. One thing is certain: The risks fall more heavily on those who have the fewest resources.

Take coal communities, for example. Just 50 U.S. counties produce [90 percent of U.S. coal](#). These communities are already in trouble. Employment in coal mining is down [half over the last decade](#). In a paper presented at this conference last year, [Adele Morris, Noah Kaufman, and Siddhi Doshi](#) showed that direct losses from the decline in the coal industry could mean that in coal counties, local governments could lose on average about 20 percent of their revenue. They went on to explain why the actual fiscal impacts are much larger, as the disappearance of the counties' dominant employers causes downward spirals to the local economies and further erodes the tax base.

If they are to make it, these communities will need government support. This is why one of President Biden's first actions was to stand up an interagency working group on the economic revitalization of [coal and power plant communities](#).

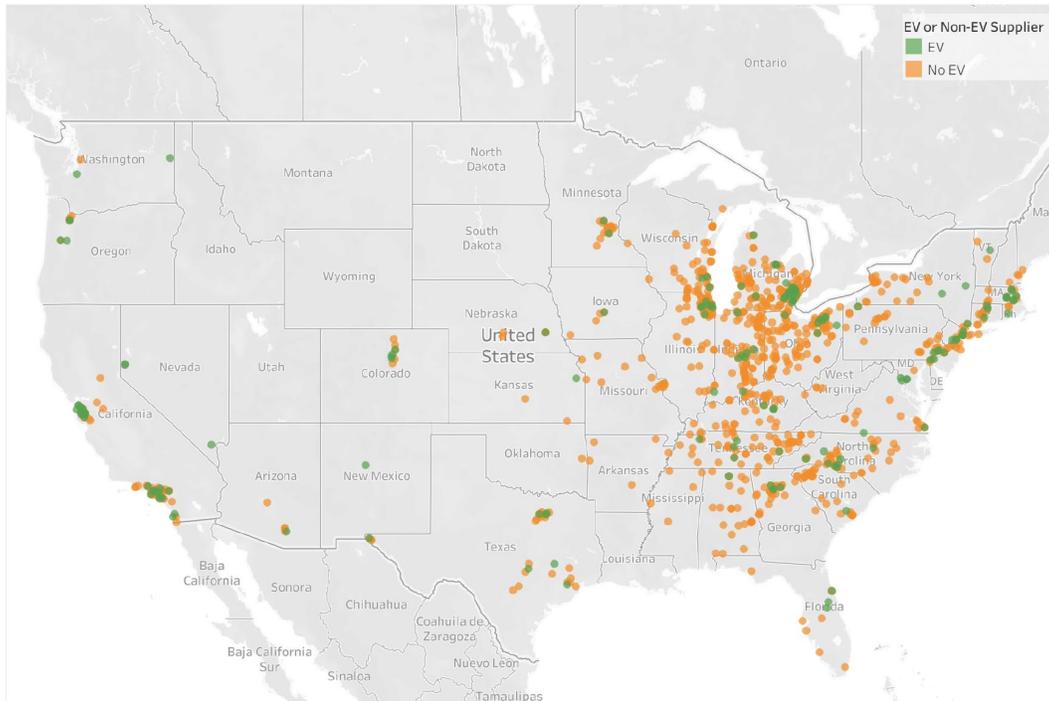
U.S. coal communities are the canary in the coal mine for other community-level transformations that the transition to clean energy will create. A few years ago, [David Autor, David Dorn, and Gordon Hansen showed](#) how local labor markets responded to the rise of China in global trade, calling this the "China Shock." Their research provided insight into the transformation to a more global economy and where policymakers didn't get things right. Today, this kind of analysis can provide a roadmap for how to think about the zero-carbon transition.

One of the issues being discussed in this conference is electric vehicles and it's worth asking ourselves, will the U.S. auto sector experience a "climate shock"? Figure 1 shows the

distribution of EV and non-EV suppliers in the contiguous United States. Look at Indiana, and Ohio in particular, which are home to a high concentration of non-EV suppliers with limited EV component manufacturing present. As demand grows for EVs and the parts used to manufacture them, will production shift from orange to green dots? Or will green dots spring up in new places, while the orange dots disappear? Or will the orange dots disappear and the green dots never appear as U.S. consumers import EVs from abroad?

FIGURE 1

EV/Non-EV Suppliers



Note: Includes Non-EV suppliers of internal combustion engines and drive trains and is therefore not the entire list of nearly 5,000 suppliers in the U.S.
Source: Third Way. "EV and Non-EV Suppliers in the U.S." Data from www.marklines.com and maps constructed by Third Way. April, 2021.

The much-needed rapid shift in demand towards EVs must be accompanied by steps to retool our nation's factories and position our labor markets for success in the global EV industry. What's the policy agenda that will avert the publication of papers on the "climate shock" in top economics journals over the next decade? What's the right set of tools at policymakers' disposal to provide opportunities for workers currently employed in non-EV production to transition to sustainable, high-quality union jobs that will allow them to maintain their quality of life?

This is one of the core ideas behind the [American Jobs Plan](#). The plan lays the groundwork for economic transformation by investing in infrastructure, incentivizing the use of clean energy, and increasing funding for research and development. It directs investments to communities in economic distress and traditionally marginalized groups of Americans. The Biden administration is committed to using this economic transformation as an opportunity to provide Americans the good-paying, union jobs of the future.

And, we could use your good ideas.

These examples show that we can no longer think about climate as an isolated problem. Our textbooks often explain externalities by describing localized situations, like a bakery letting off pleasant smells. The climate externality is fundamentally different. It touches virtually every nook and cranny of the economy.

In addition to measuring microeconomic costs we need to consider the macroeconomic risks of climate change. Climate change is a threat-multiplier, with the potential for cascading damages to interconnected economic systems. It creates uncertainty for businesses, consumers, financial markets, and demand on the public purse. It makes it harder to assess risk. It makes it harder for individuals and organizations, including government, to plan.

The insurance industry, for example, is directly affected as extreme weather events and rising sea levels pose direct risks to insured physical assets and property. In 1992 when South Florida was ravaged by Hurricane Andrew, at least 16 insurance companies failed in the face of [\\$15.5 billion in property damage](#).

As the damages from extreme weather events increase due to climate change, other financial institutions will also be affected. Mortgages, loans, and associated derivatives are all at risk from extreme weather events, particularly agricultural loans and mortgages for coastal commercial and personal properties. This creates systemic risk as our financial institutions are inextricably linked to each other.

As we witnessed in the Great Recession, financial risk can upend the economy—and sharply curtail economic well-being of the average American. And, 2020 showed us what happens when a shock hits our society and threatens our livelihoods: Government steps in.

The economic costs of climate change to the federal government are, and will be, substantial. They include increased spending on [public health, disaster mitigation and response, and potentially decreased tax revenue](#) due to slower growth. Understanding and preparing for the systemic risks that climate change poses to both our financial system and our fiscal health is critical for developing new policies and estimating their long-term economic benefits. This is certainly an opportunity for economists.

And, of course, the United States has the opportunity to play a leadership role in developing these tools. Recognizing this, the Biden administration has already begun to act. Both the [Financial Stability Oversight Council](#) and the [Federal Reserve](#) are undertaking analyses of climate-related risks to financial stability, acknowledging that both climate change and climate policies can have impacts on entire industries that could create risks to financial sector stability.

The need for new tools does not imply that the existing tools of climate economics are any less critical. I'll give you two examples keeping us busy.

A decade ago, the Obama administration relied on the climate economics literature to produce a U.S. government estimate of the social cost of carbon. The literature has evolved, so these

estimates need to be updated. For example, a recent [working paper](#) by Tamma Carleton and Michael Greenstone found that accounting for the low interest rate environment of recent decades by lowering the discount rate from 3 to 2 percent could more than double an estimate of the social cost of carbon.

So, one of [President Biden's day one executive orders](#) reconvened the Interagency Working Group on Greenhouse Gases to reassess and propose updated metrics. Since then, the group has issued interim values for the social cost of carbon as well as methane and nitrous oxide. We are now collecting dedicated public comment through a Federal Register notice, including a specific encouragement from the President to explore how to improve our approach to accounting for risks, environmental justice, and intergenerational equity. For example, what tools are available to estimate the benefits of risk reduction and the benefits of avoiding damages that will disproportionately accrue to vulnerable populations that cannot afford to adapt?

A second example of old-but-still-critical tool in our toolbox are market-based policies for emissions reductions. For example, to achieve his goal of a pollution-free power sector by 2035, the president has proposed a national clean electricity standard. Designed well, this policy can encourage carbon-free power generation wherever and however it can be produced at the lowest cost. We need to make sure our strategy is not only cost-effective but also does not come at the expense of disadvantaged and marginalized groups, who often cannot afford to pay high energy bills and suffer disproportionate harms from local environmental hazards. We also need to make sure that it passes into legislation.

We can use the help of this community on every one of these issues.

Overcoming the threat posed by climate change is a monumental task. Our economy will need to undergo a complete transformation as we reconsider what we make and how we make it across almost every industry. A large-scale, coordinated global governmental effort is necessary to both protect the planet and avoid the substantial economic costs associated with climate change. We will need to rely on the efforts of economists, policymakers, and the American people to see us through.

In particular, we need new analytic tools for modeling the effects of climate change and policies on the economy, and a thorough examination of how we will transition existing productive capabilities into new uses that are consistent with a sustainable, modern economy. We need more analysis to help us understand the composition of what we produce and what this kind of large economic transformation means for industries, jobs, and communities.

Your work is critical for the success of the endeavor. The Council of Economic Advisers looks forward to working with you to make this economic transformation a reality.

Thank you.