



# Climate, Energy & Economic Growth

## **Our work on economic growth & inequality in the climate transition**

The first official global progress report since the 2015 Paris climate agreement, released in 2023, found that the world is not reducing emissions fast enough to keep warming below 2 degrees Celsius compared to pre-industrialization levels — the agreed-upon target to avert the worst catastrophic consequences of climate breakdown.

But a stark headline such as this doesn't reveal a vitally important facet of our climate crisis: its inextricable link with international and national inequality. The countries least responsible for producing greenhouse gasses are those most vulnerable to their effects; and, within countries, wealthier, high-emitting communities can shield themselves from impacts while vulnerable and marginalized populations with very low per capita emissions face the most severe consequences. Because of this unequal representation, climate policy may inadvertently heighten inequalities and put undue burden on particular populations as part of the climate transition.

Perhaps most importantly, climate change will expose gaps between high- and low-capacity governments. Countries with weak governance, unstable or dysfunctional political systems, or closed civic spaces will struggle more with the huge implementation challenges of the climate transition — deepening existing inequalities while failing to address climate change, setting in motion vicious cycles.

To address these linked challenges of climate change, inequality, or governance, all must be addressed together. This requires recognizing that climate change adaptation and mitigation must involve robust efforts to combat inequality and weak governance — a direct connection too infrequently made: fighting climate change needs more equal societies and better functioning states.

Researchers at the Yale Economic Growth Center are researching many sides of the climate crisis as well as potential responses. Some are working on climate, energy, and environmental economics and pathways for economic growth in the climate transition, while others are creating new knowledge on governance and the interacting components that will be required to address the global climate crisis.

#### POLICY ENGAGEMENT

### Curbing emissions in India through market design

Factories burning fossil fuels are a major contributor to climate change, but their air pollution is also one of the world's biggest killers, especially in low- and middle-income countries that are rapidly industrializing. India's air pollution causes an estimated 1.7 million deaths annually.

The Government of Gujarat, in partnership with researchers from Yale EGC, the Energy Policy Institute (EPIC) at the University of Chicago, University of Warwick and Abdul Latif Jameel Poverty Action Lab\* (J-PAL), has launched the world's first emissions trading system (ETS) or cap-and-trade market for particulate matter to tackle this health challenge and promote climate friendly growth.

The ETS allows Gujarat to cap total particulate emissions and let industries buy and sell emission permits amongst themselves. Since its 2019 launch, the ETS has reduced particulate emissions in the city of Surat by 20-30%, without increasing industry operating costs. The program is now expanding to other Gujarati cities and beyond.

### Other examples of EGC's work on environmental policy

#### TRADE, LEAKAGE, AND THE DESIGN OF A CARBON TAX

##### How can we design better climate policies?

Concerns about “leakage” from climate policies — when polluting industries respond to emissions restrictions and other regulations by relocating to places with more lax policies — are central to most proposals to address climate change. Samuel Kortum and coauthors consider the most efficient ways to control leakage, finding that a combination of carbon taxes (on both producers and consumers of fossil fuels) implemented via partial carbon border adjustments is optimal. *Environmental and Energy Policy and the Economy 4* (2023)

#### HOLDING UP GREEN ENERGY: COUNTERPARTY RISK IN THE INDIAN SOLAR POWER MARKET

##### How does the risk of hold-up affect procurement?

Green energy is produced by assets that are often highly vulnerable to counterparty risk. Using data on the universe of solar power auctions in India — where solar plants are procured in auctions that are intermediated either by the federal government or by comparatively risky state governments — Nicholas Ryan studies the effects of counterparty risk on the procurement of new solar power plants. He finds that the counterparty risk of an average state increases solar prices by 10%, and since state demand for green energy is elastic, higher prices due to risk reduce investment in green energy. Contract intermediation by the central government, by contrast, eliminates the counterparty risk premium. (*NBER Working Paper No. 29154*)

#### INTERNATIONAL CLIMATE AGREEMENTS AND THE SCREAM OF GRETA

##### Why is global progress on climate change so slow?

Despite notable and unprecedented progress in recent years, international climate agreements have not gone far enough to prevent the catastrophic effects of a changing climate. Giovanni Maggi and his coauthor create a theoretical model to explore this challenge, emphasizing that policies to address climate change have intergenerational and international externalities: they impact future generations as well as other countries — pointing to important limitations on what such agreements can achieve, even under the best of circumstances. (*NBER Working Paper No. 30681*)

## TOOLS FOR VULNERABLE COMMUNITIES

### Mitigating the effects of floods in India through an innovative early warning system

Climate change increases the frequency of extreme precipitation, which disproportionately affects low- and middle-income countries. In Bihar, India's most flood-prone state where 76 percent of the population lives under the recurring threat of flood devastation, early flood warnings have the potential to significantly reduce fatalities and economic losses. Early warning systems are becoming more accurate with data science advances, but poor and marginalized communities that lack mobile access often fail to receive these.

Researchers from Inclusion Economics at Yale University and Inclusion Economics India Centre are collaborating with Google.org and a Bihar-based NGO to implement an innovative flood early warning system. Launched in 2019, the pilot program combines flood prediction technology with grassroots community information dissemination.

A 2022 midline survey found that participating communities were nearly 50% more likely to receive flood alerts, and those who received alerts took nearly 20% more protective steps – like harvesting crops early or moving crops, food, or animals to a safe place. The program was also



designed with a gender-intentional lens. Since flooding has disproportionate impacts on women and girls, largely due to gender-specific barriers around access to information, the researchers made efforts to recruit women volunteers.

## Other examples of EGC's work on climate resilience

### QUANTIFYING UNCERTAINTY ABOUT GLOBAL AND REGIONAL IMPACTS OF CLIMATE CHANGE

#### Do all countries experience climate change the same?

Future projections of the economic impacts of climate change are uncertain, due to uncertainties around the climate system as well as uncertainty about the damage that climate change will cause. Moreover, the effects of climate change will vary greatly across regions. In a new paper, Tony Smith and coauthors develop a

model to quantify these uncertainties, finding that warmer countries will likely suffer disproportionately while cooler countries may even benefit. *Environmental Research Letters* 17.9 (2022)

### SUPPLY AND DEMAND IN SPACE

#### How can global geography influence economic policy?

Recent advances in economic geography – which examines the location and distribution of economic

resources and the movement of goods, services, and people – offer important lessons about the spatial distribution of economic activity. Despite the inherent complexity of such frameworks, Costas Arkolakis and coauthor show that “spatial linkages” at both the local and global levels can be analyzed through the familiar lens of supply and demand curves, with broad relevance for economic policymaking in our interconnected world. *Journal of Economic Perspectives* 37.2 (2023)

### The Yale Climate, Environment & Economic

**Growth Conference** — hosted by Yale EGC, the Yale Tobin Center for Economic Policy, and the Yale School of Environment, with additional support from Yale Planetary Solutions, the Knobloch Family Foundation, and Smart Prosperity Institute — focuses on the challenges of maintaining economic progress, and improvements in human welfare, while remaining within environmental boundaries that will sustain those improvements.



Learn more:

<https://cutt.ly/YCEEG23>

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### EGC Voices in Development Podcast S2E1

Navigating trade-offs between the environment and economic growth:

Nicholas Ryan on new possibilities for environmental regulation in emerging markets

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