The Climate Challenge and Solutions for Communities

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Georgia Institute of Technology

Rachel Carson Distinguished Lecture, Michigan State University

October 1, 2024

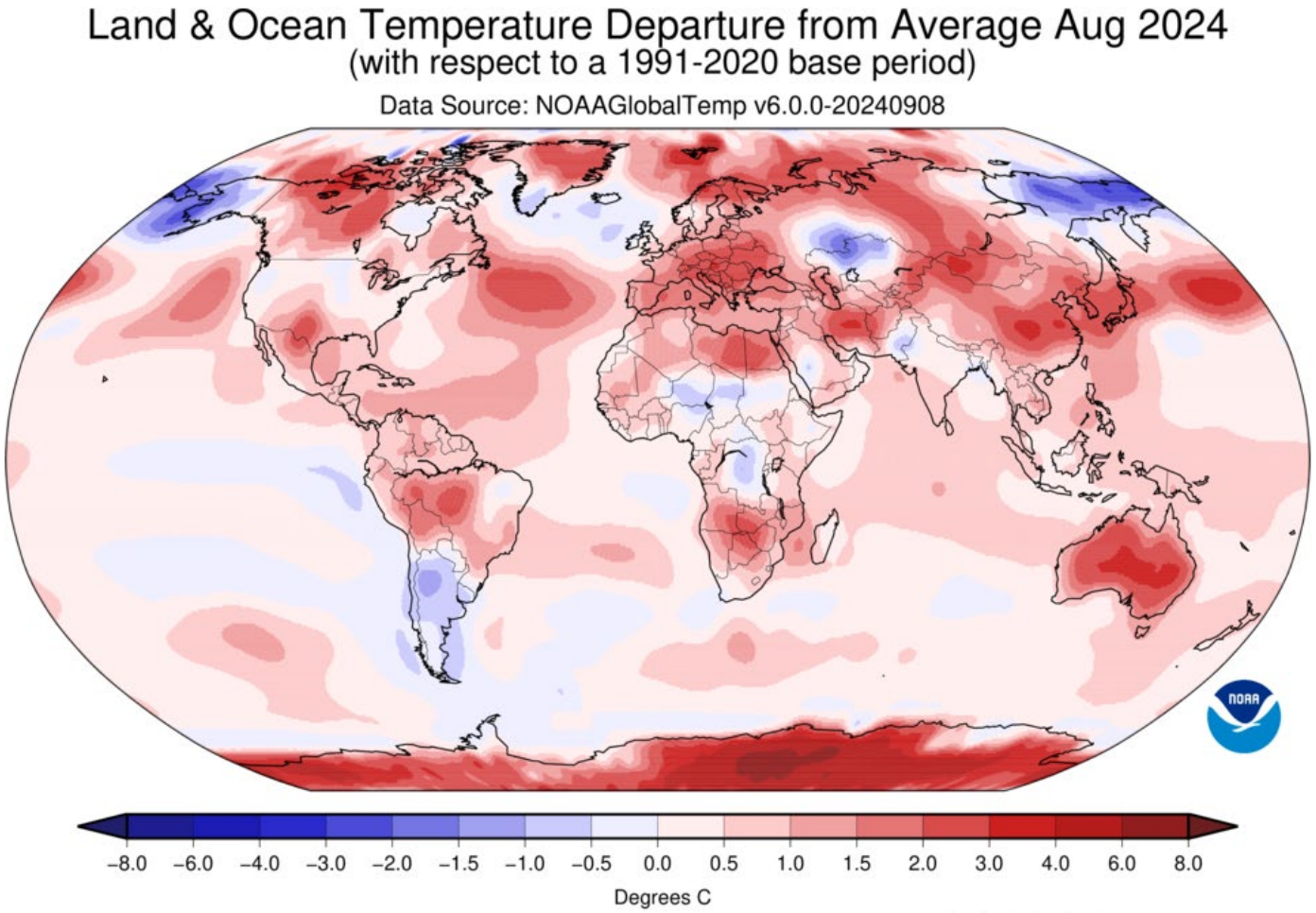
- Georgia Tech
- University of Georgia
- Emory University
- Georgia State

- Southface Institute
- Greenlink Analytics
- Partnership for Southern Equity

- Atlanta Metropolitan
- Georgia State College
- Kennesaw State
- Morehouse College
- Spelman College

Our motivation: Global climate change and the harm it is causing

August 2024 was the 15 th consecutive record -warm month since 1850.

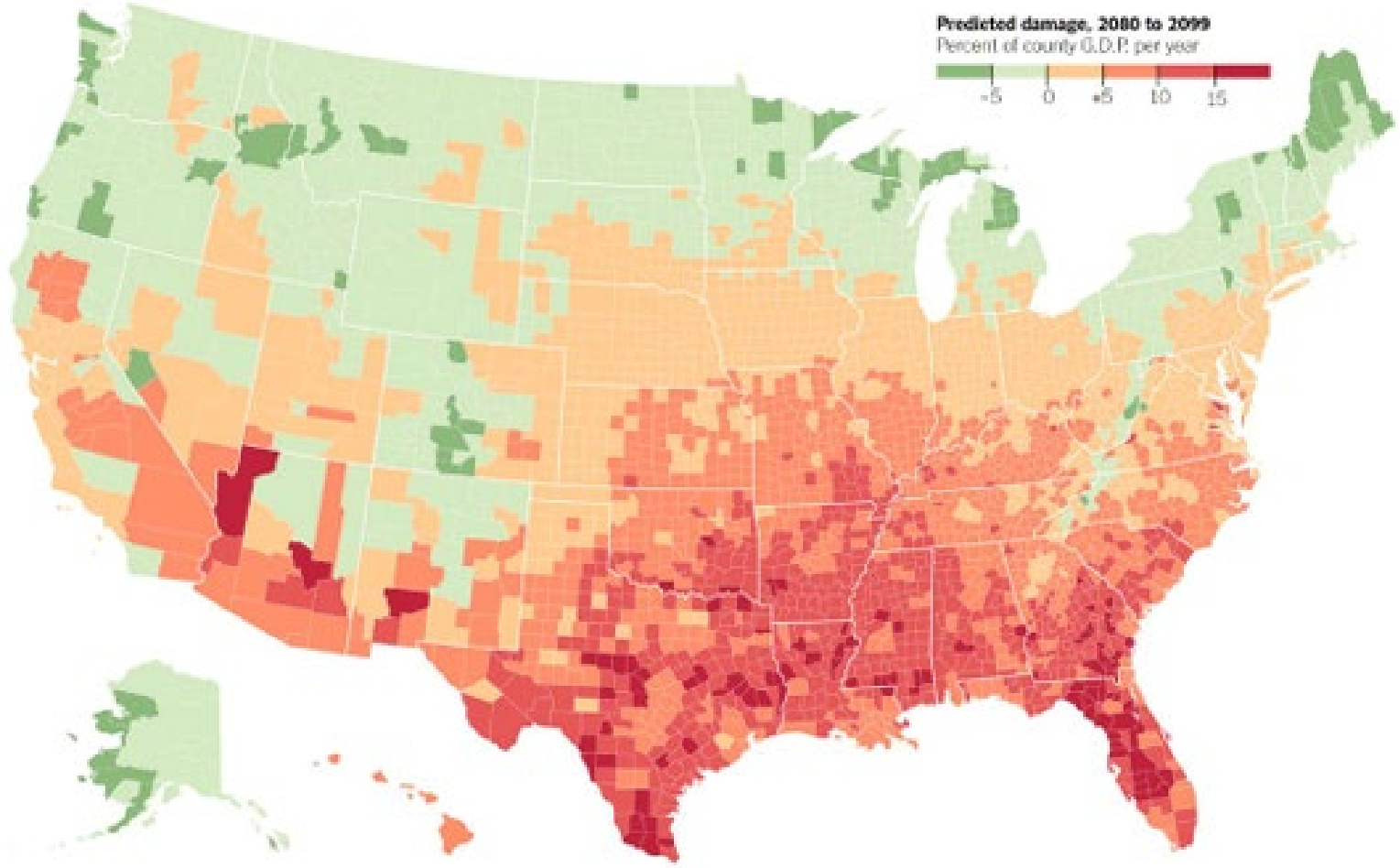


Think global,
Act local

National Centers for Environmental Information https://www.ncei.noaa.gov/access/monitoring/climate-at-a-glance/global/mapping

Most of the U.S. will experience damages from climate change, especially the Southeast

Predicted county-level economic damage from climate change, 2080-2099, under a high-emissions scenario. Could lead to 10-20% loss of GDP in much of the Southeast.



(Source: Adapted from Solomon Hsiang et al., as published by the New York Times June 29, 2017)

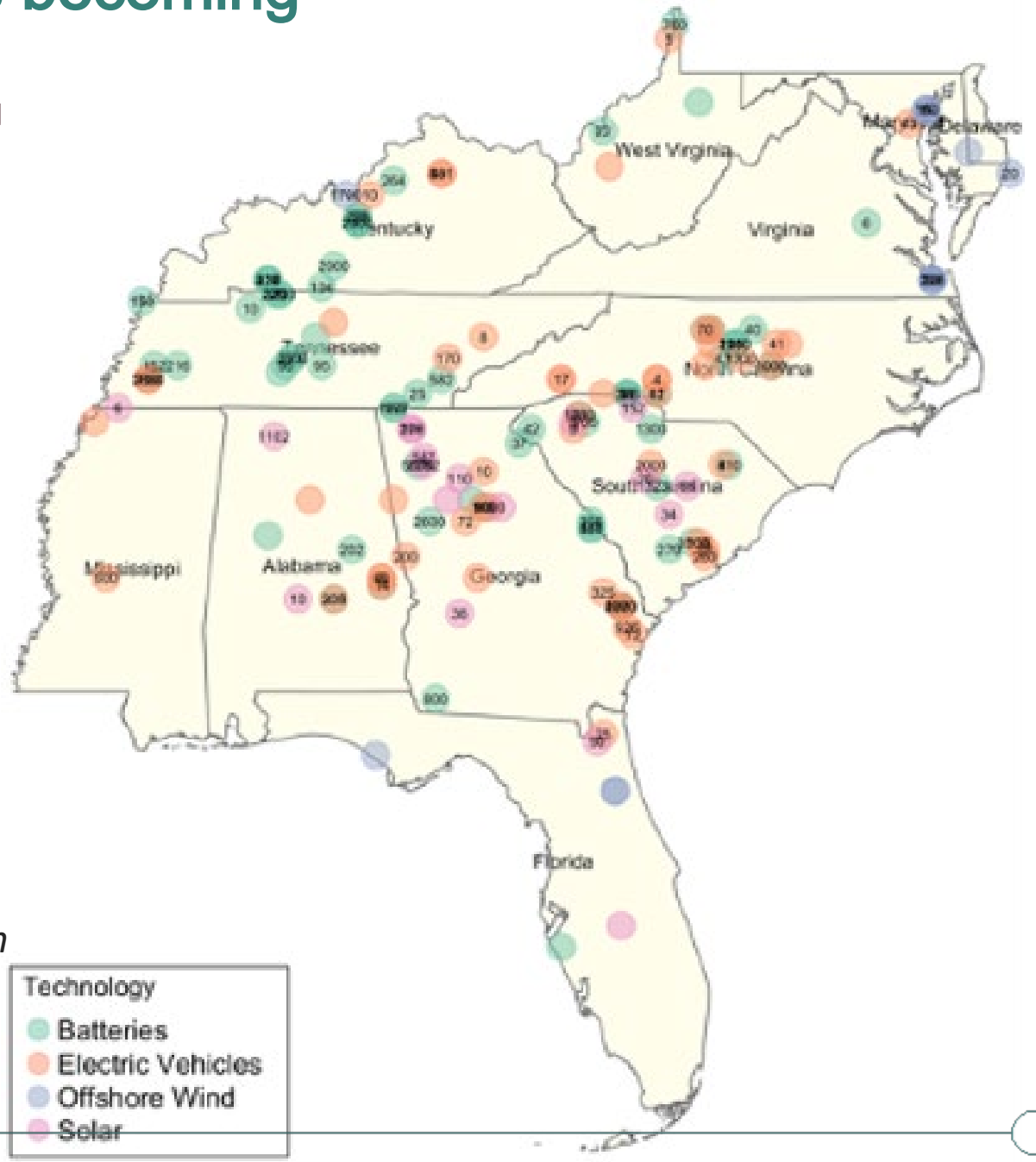
At the same time, the Southeast is becoming a clean energy manufacturing hub

The US government will spend more than $500 billion on climate technology over the next decade.

This is the biggest downpayment on climate change solutions every made:

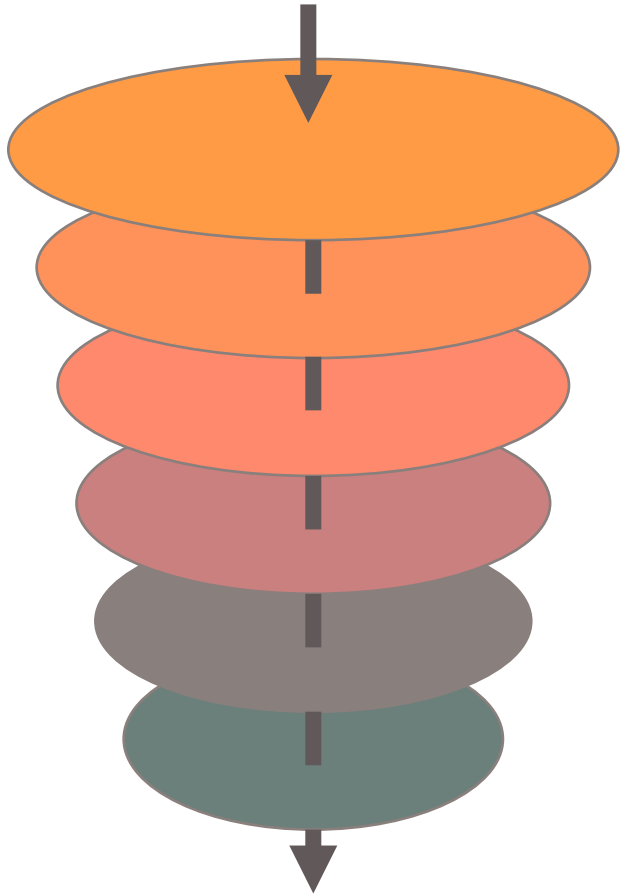
- Infrastructure Investment and Jobs Act
- Inflation Reduction Act (IRA)
- CHIPS and Science Act

The SE received 47% of the first $179 billion of this funding.



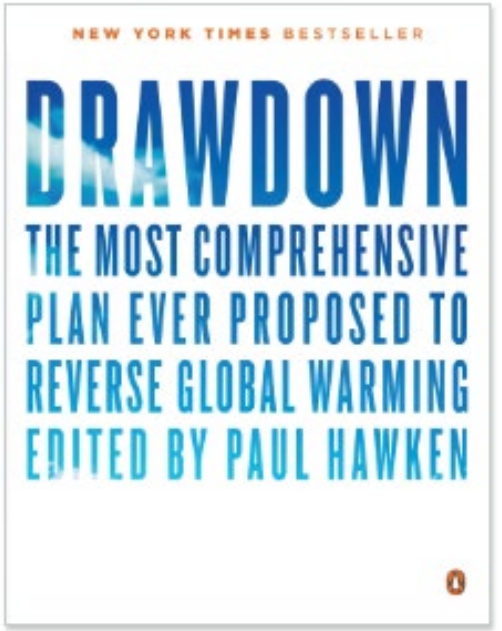
Source: Brown, M. A. et al. 2024. *Southeast Decarbonization Workshop - Activating science, business, and community partnerships.* Oak Ridge National Laboratory. https://www.osti.gov/biblio/2404612/

In the absence state targets and plans, we launched a grass roots project in 2018 called “Drawdown Georgia”



The research team put 100 global solutions through a series of filters to “localize” them

- Is it market ready?
- Is there local experience?
- Can it have a meaningful impact by 2030?
- Is it affordable?
- What about equity, jobs, public health and other social values “beyond carbon”?



Brown, Marilyn A., et al. (2021a)

Standardized methods were used to evaluate solutions

Technical Potential: Maximum realistic application without regard to cost or other impacts, up to hard limits on resources such as available land and materials.

e.g., Recycling 95% of disposed recyclable materials.

Achievable Potential: A realistic scenario that considers costs, impacts, and stakeholder acceptance, but consistent with a greater commitment to success.

e.g., Growing large-scale solar from 2 to 11% of its electricity mix.

Baseline Forecast: "No new policies," slow rate of performance improvement, and economic growth resulting in a flat trajectory of climate pollution.

For info on each of this methodology, go to: Brown, MA, et al. (2021b).

The result: A roadmap of 20 high -impact climate solutions for Georgia

Drawdown Georgia climate solutions come from all sectors of the economy

Electricity
- Utility-Scale Solar*
- Demand Response*
- Rooftop Solar + Storage*
- Cogeneration
- Landfill Methane

Transportation
- Electric Vehicles*
- Energy-Efficient Cars
- Energy-Efficient Trucks
- Mass Transit
- Alternative Mobility

Food & Agriculture
- Composting
- Climate-Smart Agriculture
- Plant Rich Diet
- Reduced Food Waste

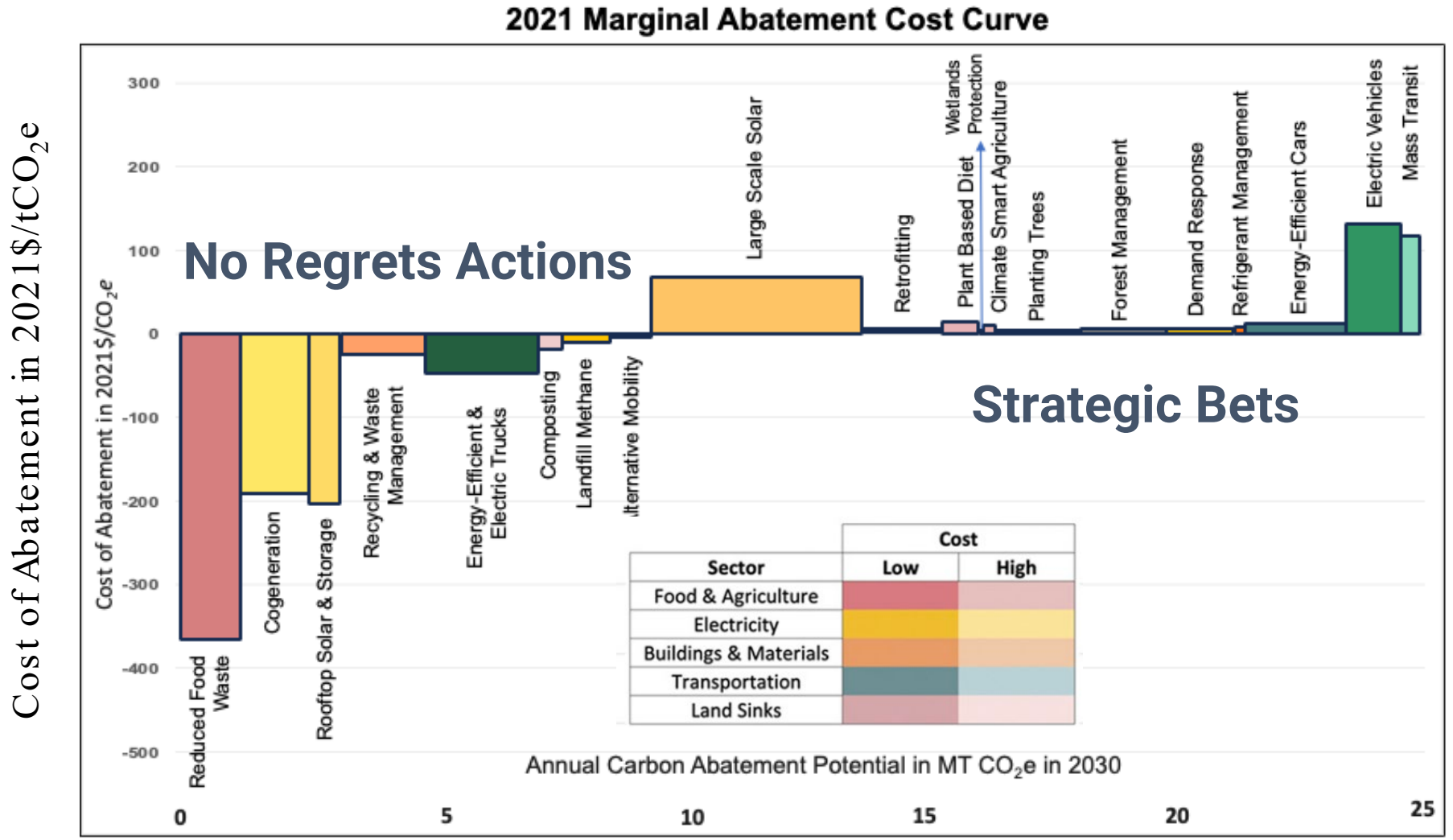
Buildings & Materials
- Recycling
- Refrigerant Management
- Retrofitting Buildings*

Land Sinks
- Planting Trees
- Wetlands
- Forest Management

Beyond Carbon
- Equity
- Economic Development & Jobs
- Public Health
- Environmental Quality

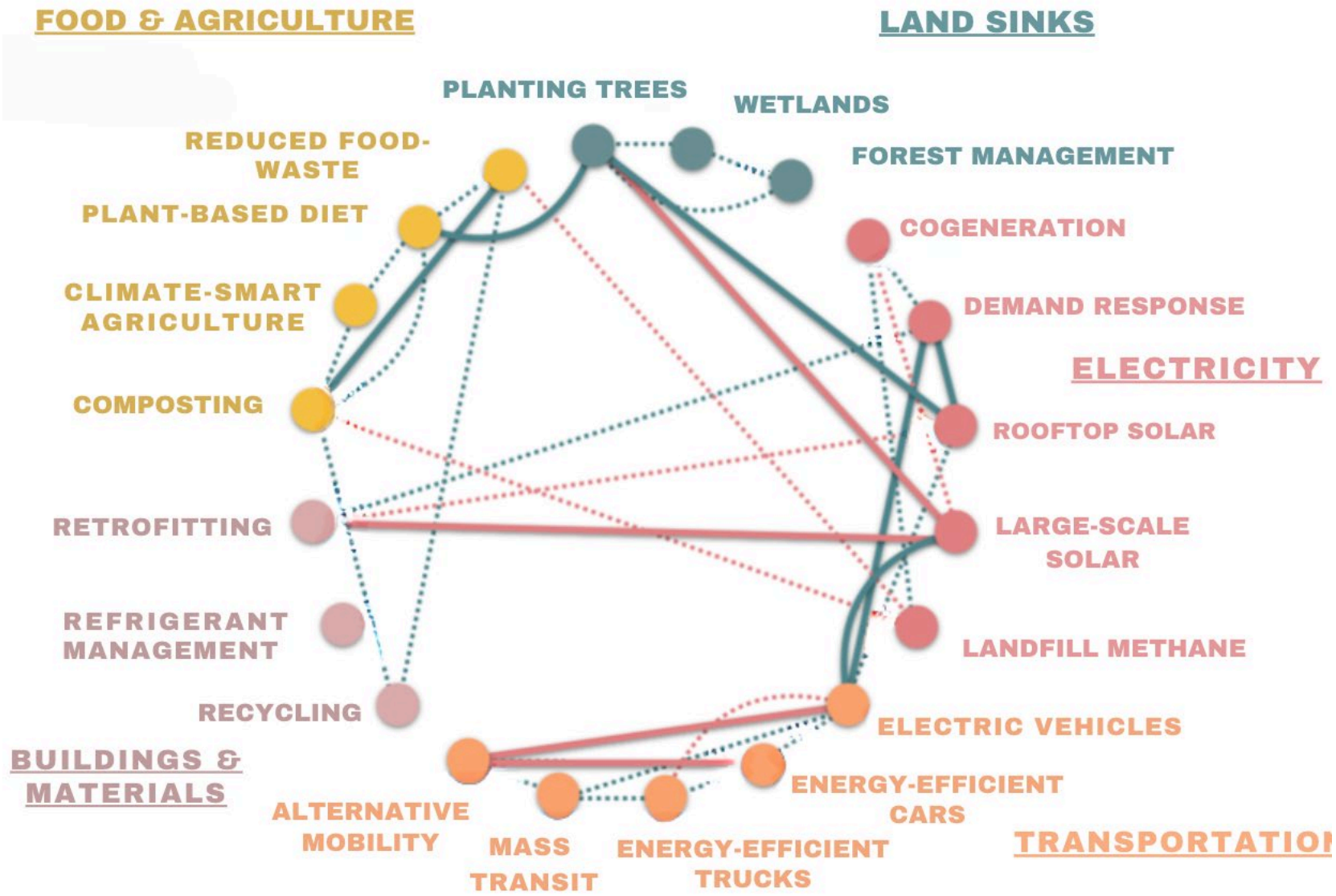
*Many of these involve electrification of the economy.

There were both “no regrets actions” and “strategic bets”

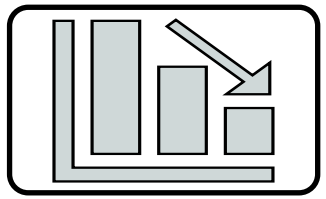


Note: Lighter-colored shapes document the higher estimate of cost estimates

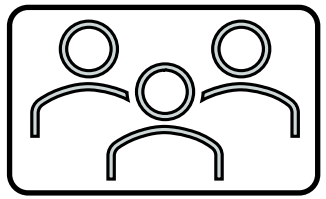
Interactions between solutions were modelled.



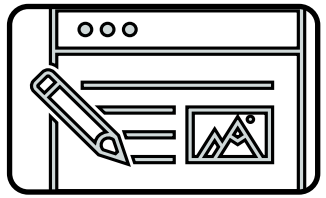
In 2021, we created the first state Business Compact focused on climate solutions with 4 expectations:



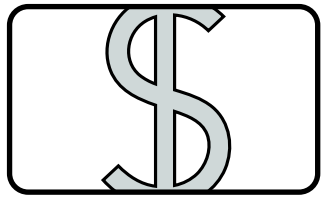
Support the target to achieve net -zero greenhouse gas emissions in Georgia by 2050



Participate in collaborative initiatives



Report annually on activities to support the state -wide target



Contribute resources to sustain the compact

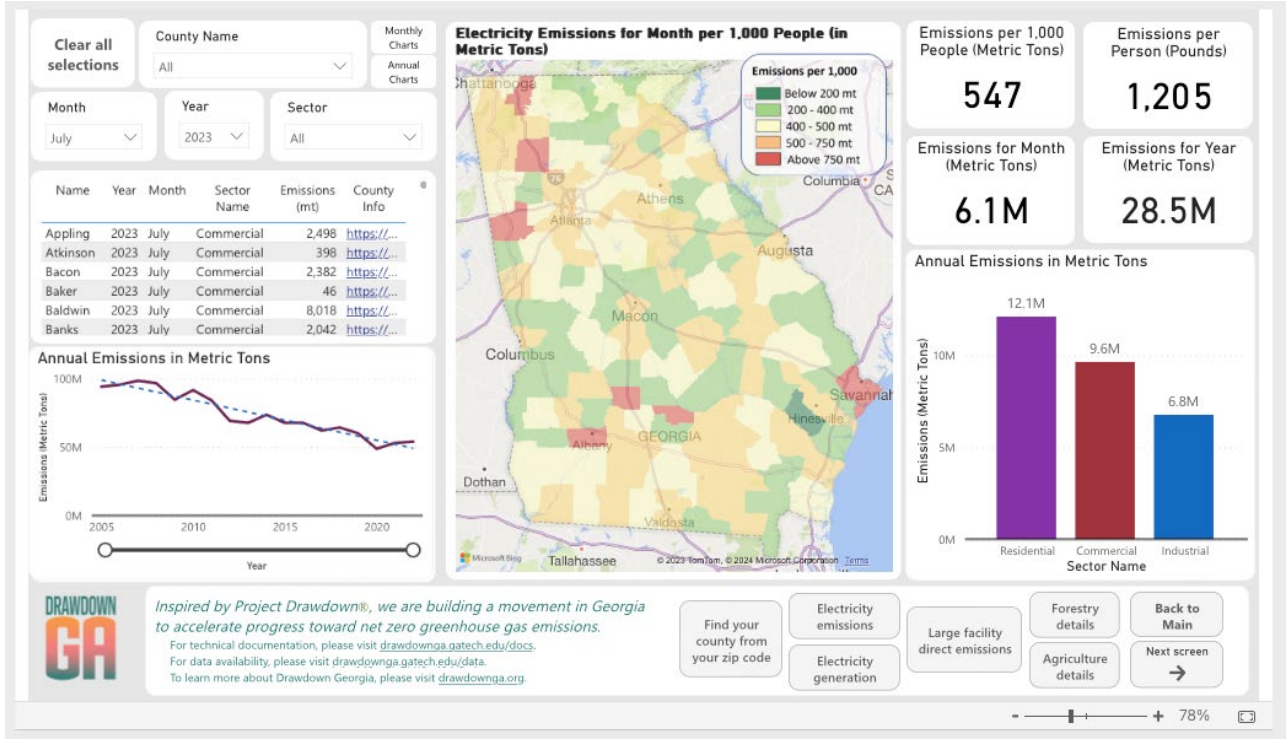
Brown, Marilyn A. et al. 2023. "Drawdown Georgia Business Compact: A Partnership Advancing Collective Action for Climate Mitigation" in *Sustainable Development Goal 17: Partnerships for the Goals,* A. Cabrera and D. Cutright (eds.), Emerald Publishing. pp. 133-161. https://doi.org/10.1108/978-1-80455-704-420231008.

We now have ~60 Business Compact Members

Emissions are being tracked monthly across 159 counties

Tracker goals:

- Help understand Georgia's GHG emissions by making them local, timely, and as accessible as possible
- Monitor progress toward net zero—requiring that we track both emissions and removals

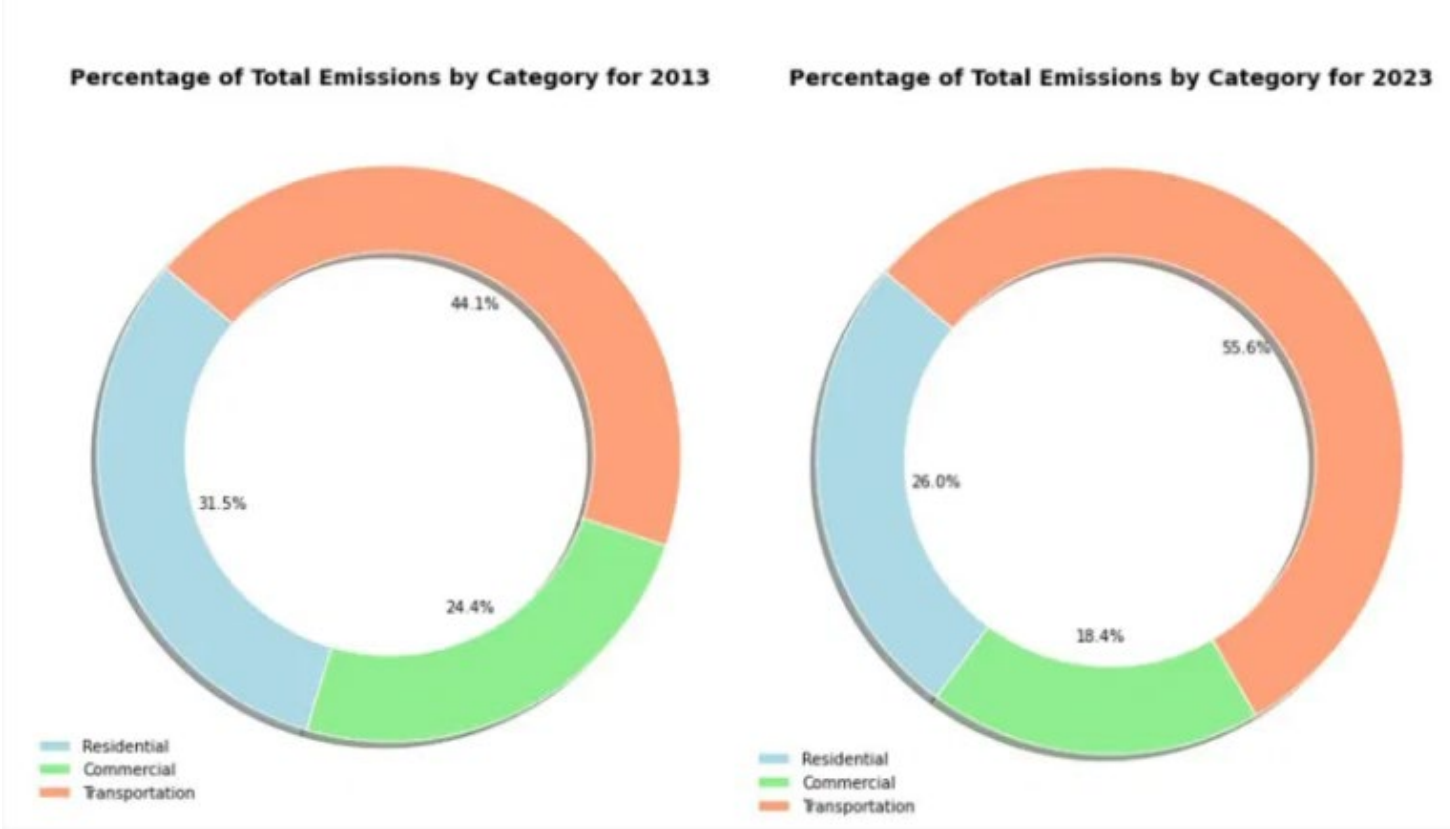


A city tracker will be launched in December 2024

The tracker is available at: https://climatesolutions.gatech.edu/

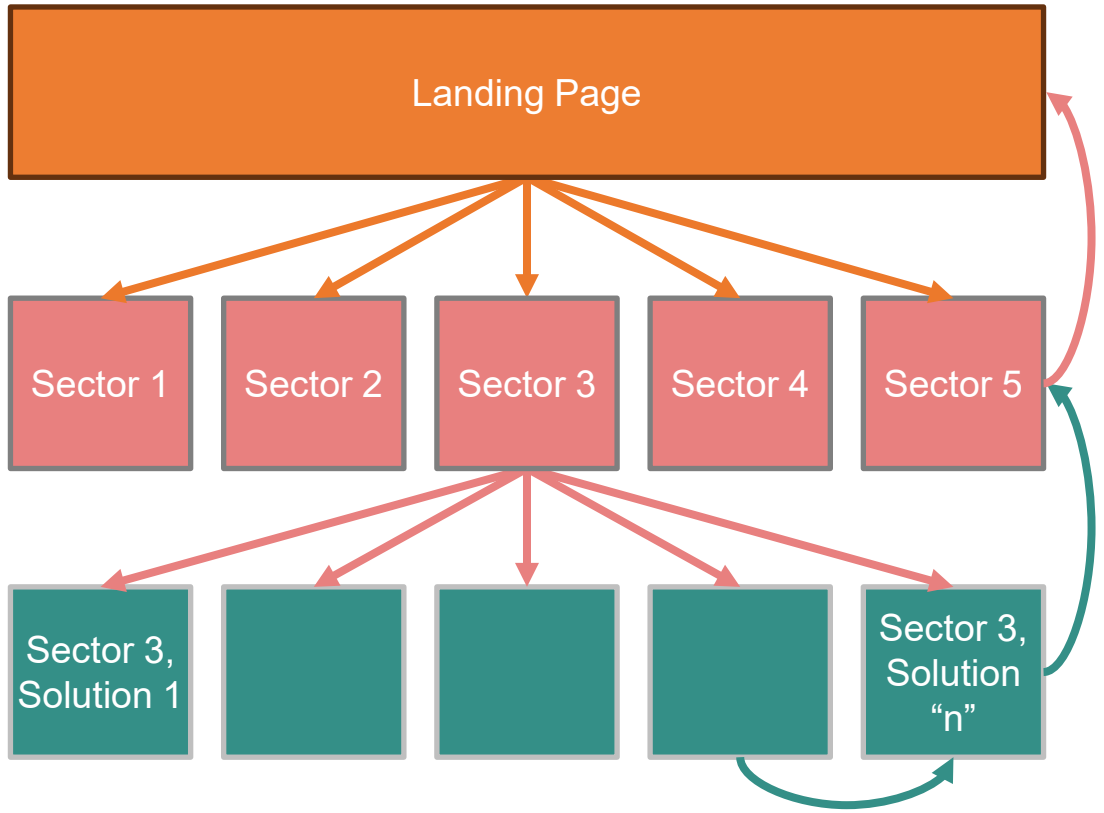
Transportation in Georgia has become the dominant source of the state's GHG emissions

From 2013 to 2023, transportation has grown from 44% to 56% of the emissions included in Emissions Tracker.



Source: Maisunath Amin, Atlanta Regional Commission September 10, 2024

We have also developed a Climate Solutions Tracker for Georgia



The solutions tracker is available at: https://climatesolutions.gatech.edu/

Solutions Tracker Tour: Landing Page

Goal: Enable accessible, intuitive, and powerful interaction with the Solutions Tracker

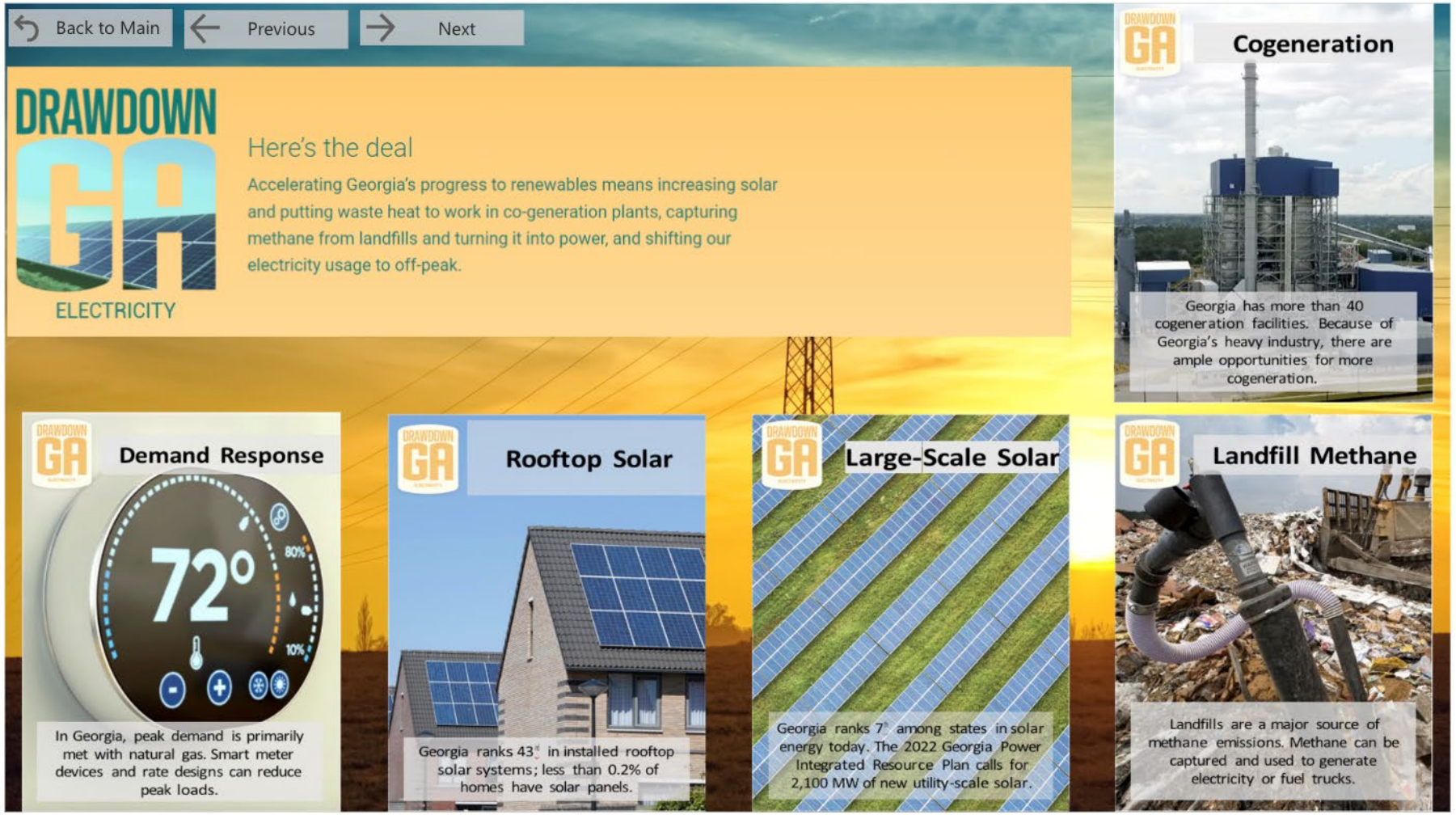
The Science of What's Possible

We love geeking out over our potential to dramatically reduce greenhouse gas emissions in Georgia, and we have a feeling you will too. Click "Explore" on the State of Georgia graphic to see what's possible. Our Carbon Reduction Visualizer allows you to see where emissions in the state are headed under the status quo -- and how that trajectory will change as our solutions begin to scale.

Every color-coded wedge represents how each solution can contribute ambitious, but achievable, emission reductions. It helps us visualize what's possible, and we believe if you can see it, you can achieve it. These calculations are a work in progress based on estimates and forecasts gathered from numerous sources. Stay tuned as this graph changes over time and as our emissions projections change.

Solutions Tracker Tour: Electricity Sector Page

Goal: Enable accessible, intuitive, and powerful interaction with the Solutions Tracker



Heat pumps are constrained by natural gas heating

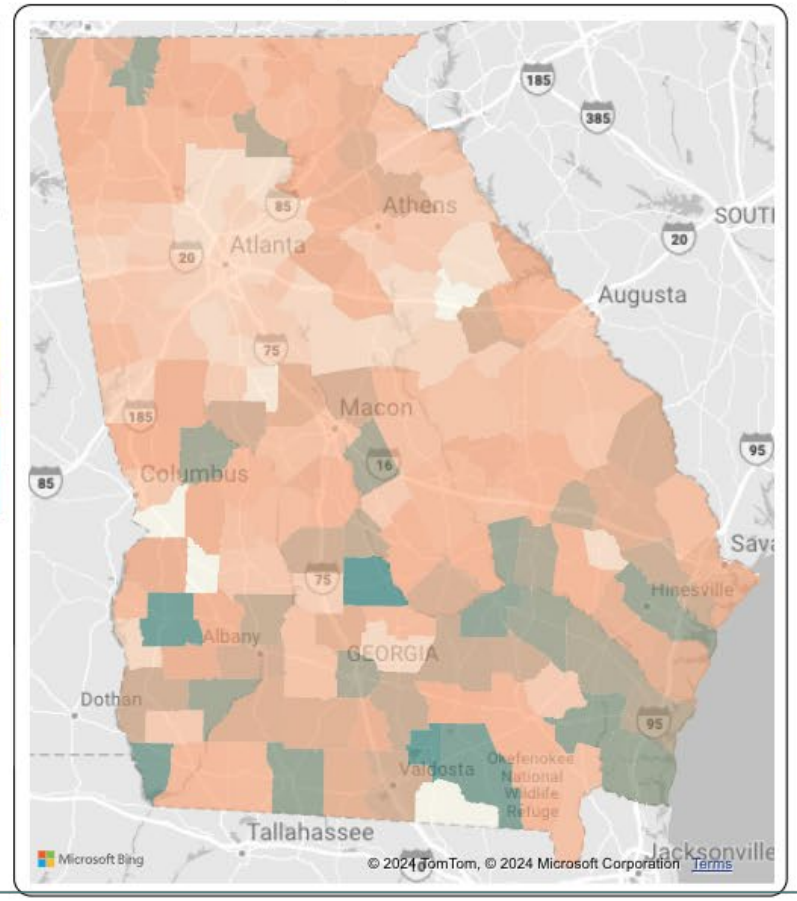
Retrofitting
BUILDINGS & MATERIALS

Next Solution →

Jump to Sector... ELECTRICITY | BUILDINGS & MATERIALS | FOOD & AGRICULTURE | LAND SINKS | TRANSPORTATION

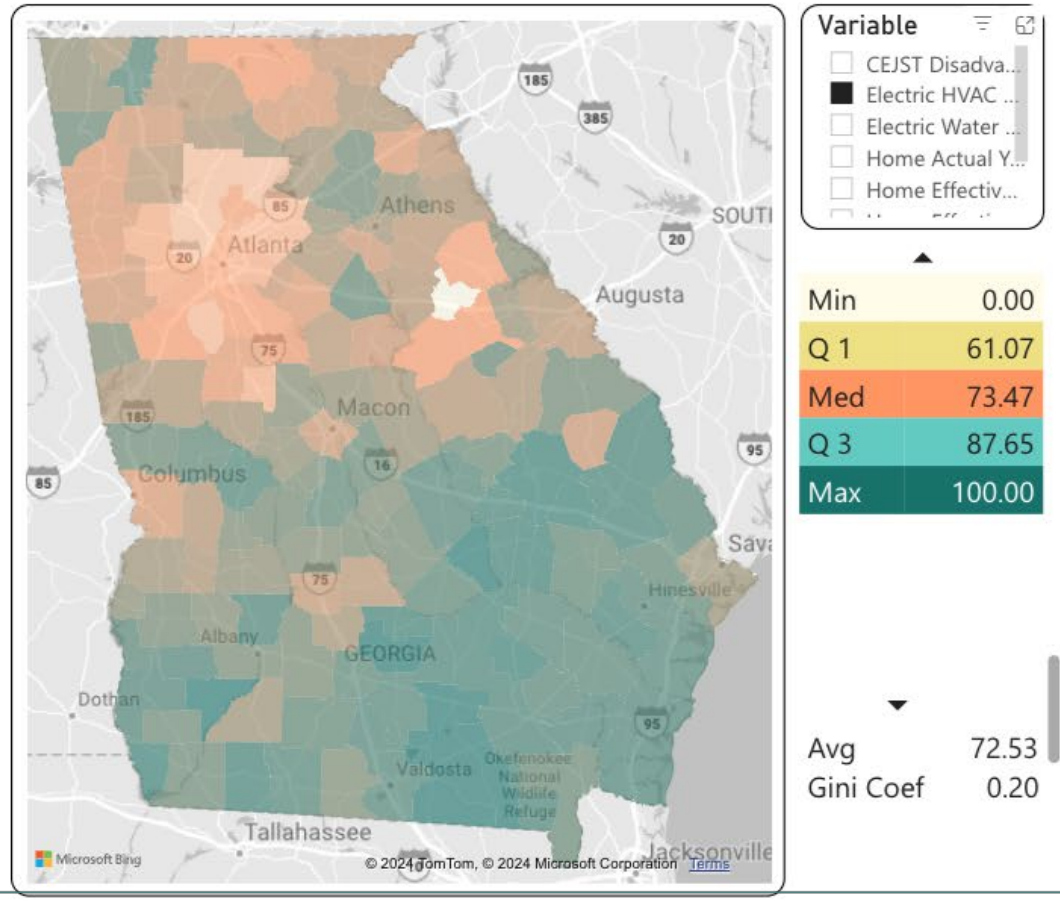
Retrofitting Solution

Heat Pumps (% Total Homes)

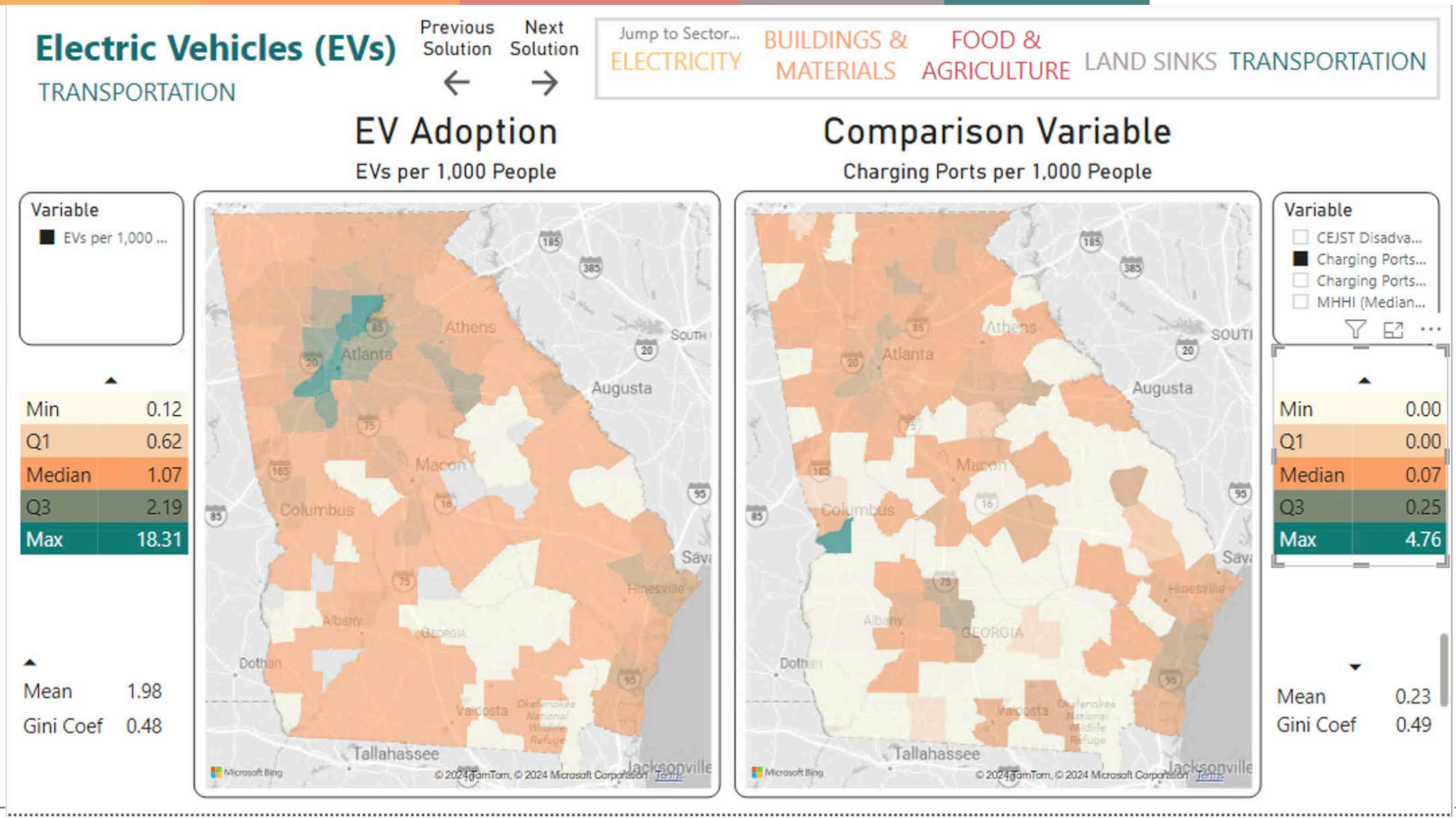


Comparison Variable

Electric HVAC Fuel (% Total Homes)



EVs are urban and infrastructure constrained



Demand response tracks the service territories of electric coops

Demand Response
ELECTRICITY

Previous Solution ← Next Solution →

Jump to Sector... ELECTRICITY | BUILDINGS & MATERIALS | FOOD & AGRICULTURE | LAND SINKS | TRANSPORTATION

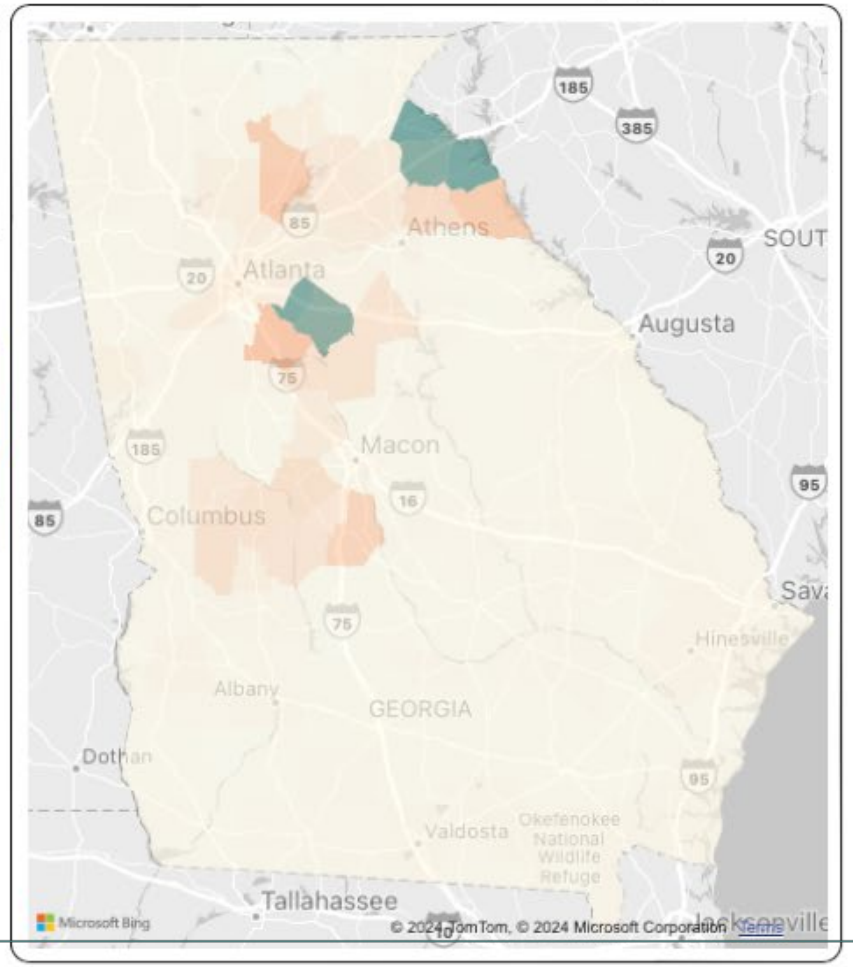
Demand Response

% of households enrolled in DR programs

Variable
- # of househol...
- % of househol...

Min	0.00
Q 1	0.91
Median	1.45
Q 3	2.68
Max	86.53
Mean	6.07

Inequality Index
0.70



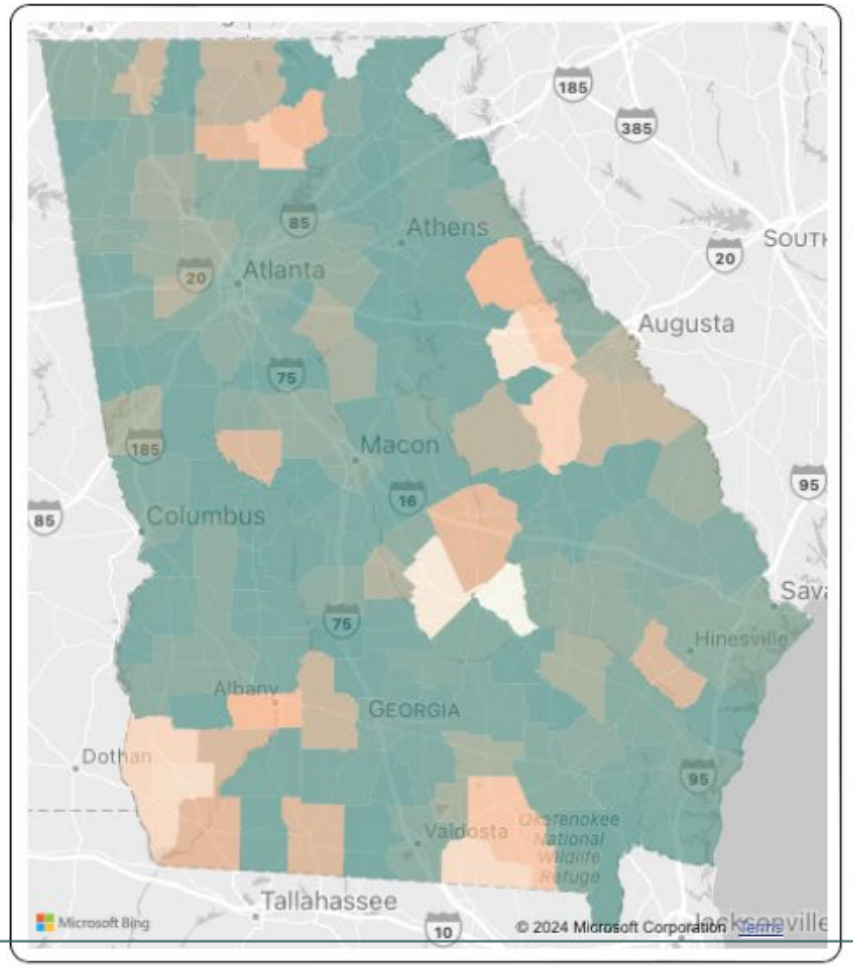
Comparison Variable

% AMI Households

Variable
- % AMI Househ...
- % AMR House...
- % Direct Load ...
- % Households...
- Total AMI Hou...

Min	7.72
Q 1	83.10
Median	90.07
Q 3	96.17
Max	100.00
Mean	84.44

Inequality Index
0.06



Rooftop solar is wealth & urban constrained

Rooftop Solar
ELECTRICITY

Previous Solution ← Next Solution →

Jump to Sector... ELECTRICITY | BUILDINGS & MATERIALS | FOOD & AGRICULTURE | LAND SINKS | TRANSPORTATION

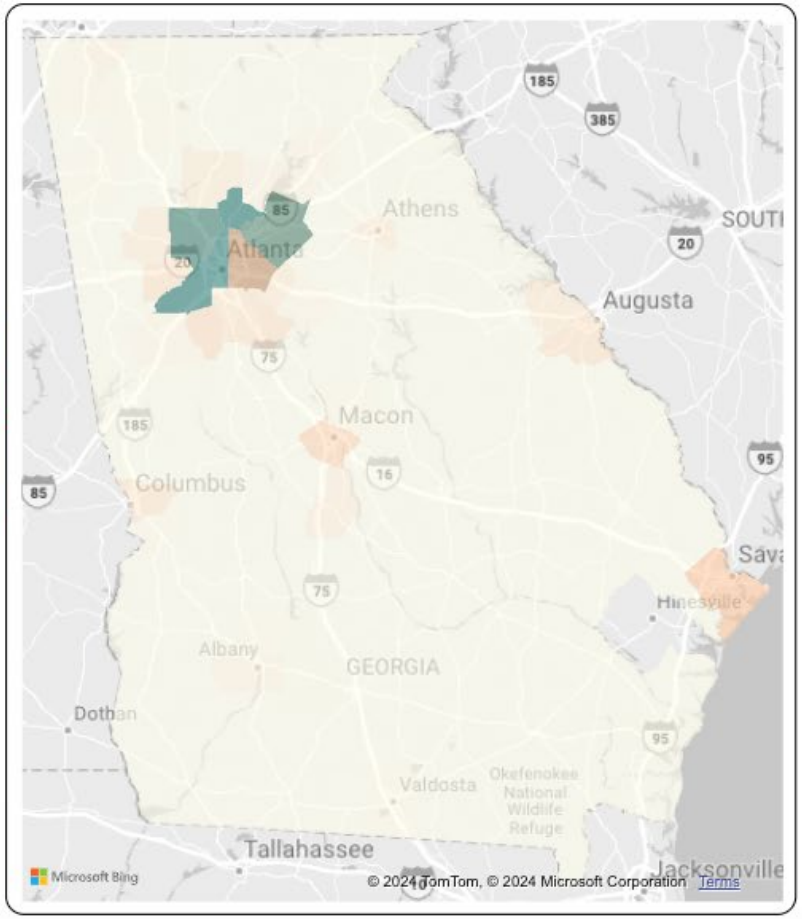
Rooftop Solar Solution

Residential Total Generation (KW)

Variable
Residential Tot...

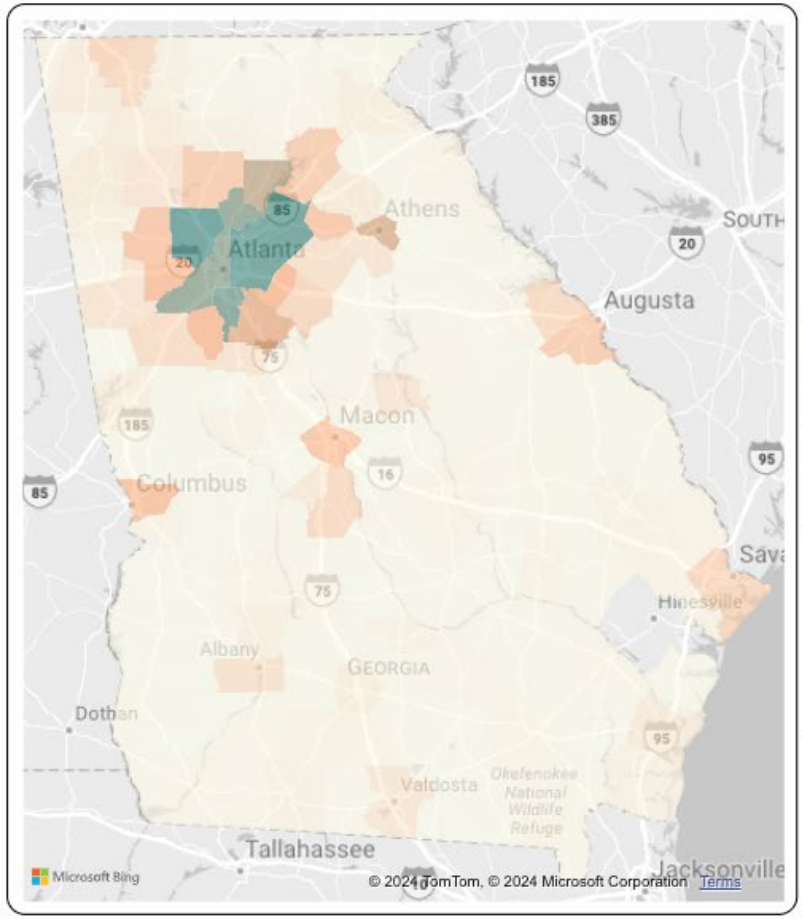
Min	0.00
Q 1	1.48
Median	12.42
Q 3	69.14
Max	859.05
Mean	87.71

Inequality Index
0.9



Comparison Variable

Urban Area (% Land Area)



Variable
- CEJST Disadva...
- MHHI (Median...
- Residential Pot...
- Urban Area (%...

Min	0.00
Q 1	0.59
Median	1.47
Q 3	6.88
Max	98.11
Mean	9.60

Inequality Index
0.76

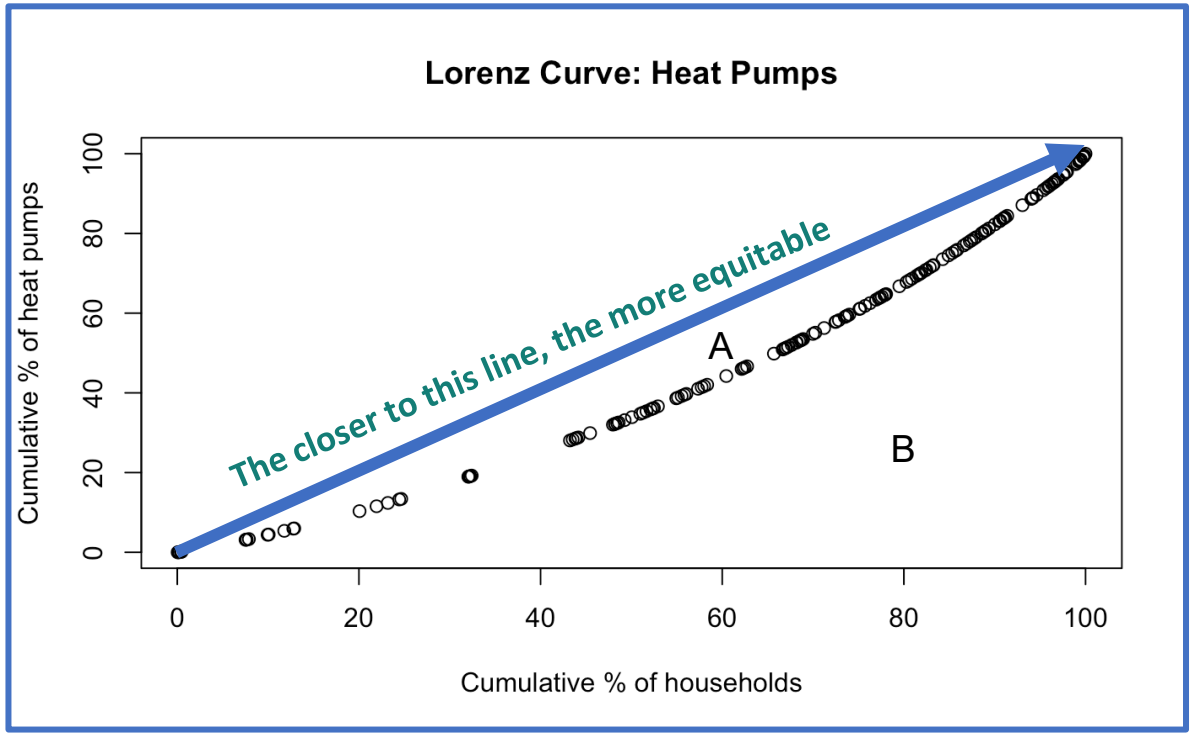
Gini coefficients can measure some equity aspects of climate solutions

Measuring equity with a Gini Coefficients:

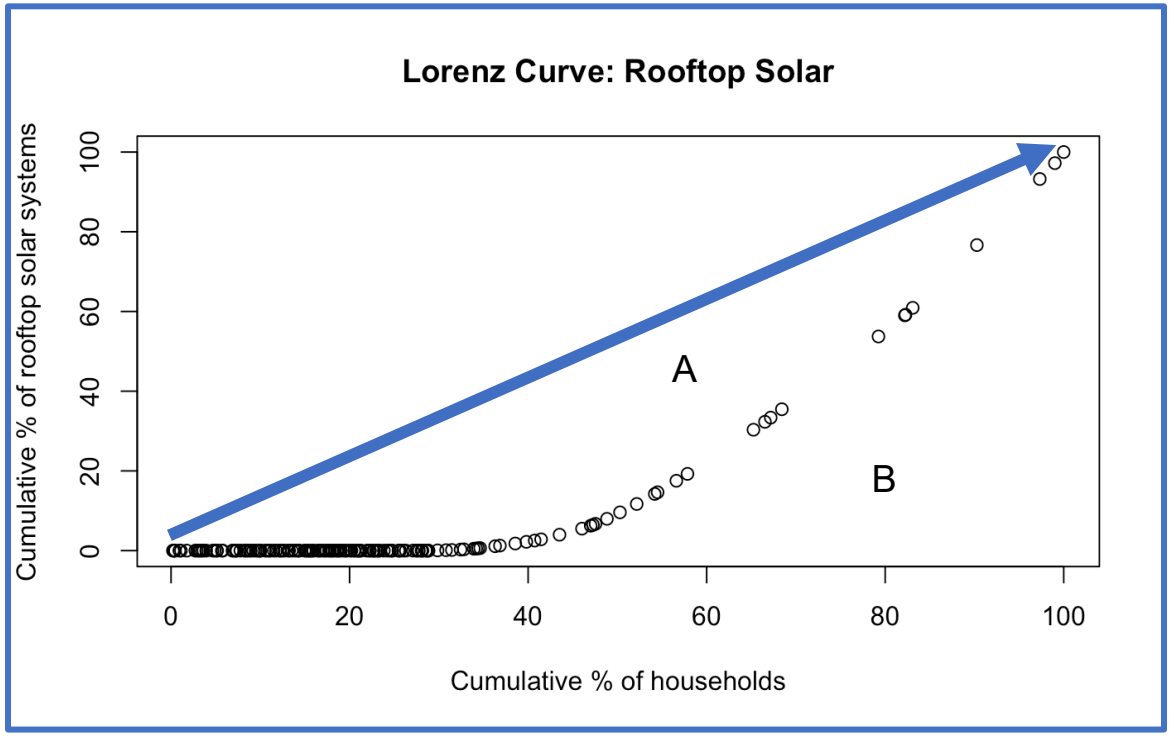
$$\text{Gini Coefficient} = \frac{A}{A+B}$$

Distributed less equitably across Georgia

Solution	Gini
Heat pumps per household	0.22
EVs per capita	0.48
Demand response per household	0.70
Rooftop solar KW per household	0.90

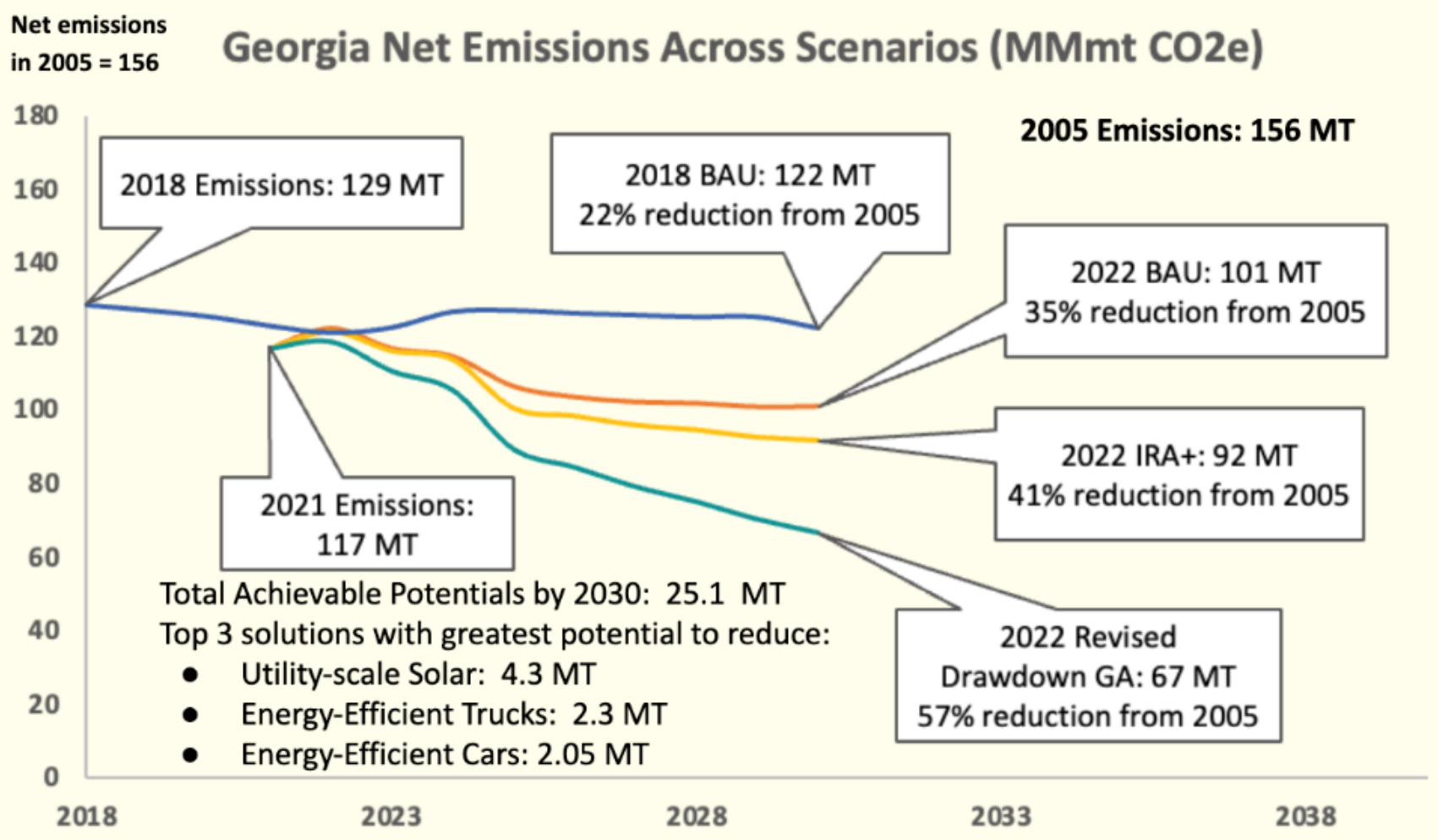


Heat pumps: 0.22



Rooftop Solar: 0.90

Our estimates of impacts are periodically update, especially following the 2022 “paradigm shirt”

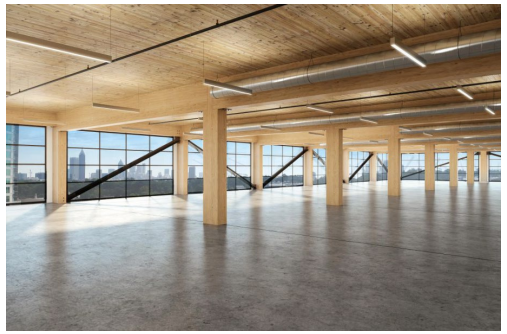


Marilyn A. Brown, Niraj Palsule and Jeffrey Hubbs, 2024.

We are extending our planning horizon to 2035 and adding some new solutions

The "Peach State Voluntary Emission Reduction Plan", expert consultations at the SE Decarbonization Workshop, and our own research have led the team to consider six emerging technologies:

- Sustainable Aviation Fuel
- Alternative Cement
- Mass Timber
- Green Hydrogen
- Carbon Capture and Use
- Small Modular Reactors



Brown, et al, 2024.

The road ahead

Launch the Solutions Tracker in December 2024

Expand our reach to more communities with the new City Emissions Tracker

Extend our timeline and portfolio of solutions

Demonstrate how communities can work together to dial down carbon emissions

Thank You!

For more about Drawdown Georgia: www.drawdownga.org

Climate and Energy Policy Lab: cepl.gatech.edu/

Go to Climatesolutions.gatech.edu for more about Drawdown Georgia's research program, trackers, and the business compact.

Learn more about the roadmap of 20 solutions, go here: https://doi.org/10.1073/pnas.2100008118

You can reach me at mbrown9@gatech.edu or on LinkedIn.

References

All of these are “open access” papers.

Marilyn A. Brown, Niraj Palsule and Jeffrey Hubbs, 2024. “Anticipating the response of climate solutions to a policy paradigm shift: Case study of the U.S. and the State of Georgia,” *Energy Strategy Reviews,* Vol. 53. https://doi.org/10.1016/j.esr.2024.101411.

Brown, M. A. et al. 2024. *Southeast Decarbonization Workshop - Activating science, business, and community partnerships.* Oak Ridge National Laboratory. https://www.osti.gov/biblio/2404612/

Brown, Marilyn A., et al. (2021a) “Translating a Global Emission-Reduction Framework for Subnational Climate Action: A Case Study from the State of Georgia,” *Environmental Management.* 67: 205-227. https://doi.org/10.1007/s00267-020-01406-1.

Brown, MA, et al. (2021b). “A Framework for Localizing Global Climate Solutions and their Carbon Reduction Potential,” *Proceedings of the National Academy of Sciences,* 118 (31); https://doi.org/10.1073/pnas.2100008118