Geospatial Dimensions of Energy Inefficiency and Equity

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Georgia Tech: "a public research university established by the state of Georgia in Atlanta in 1885 and committed to *developing leaders who advance technology and improve the human condition.*"

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Presentation

Climate/Energy Efficiency Nexus And Ethics

1.Local Scale

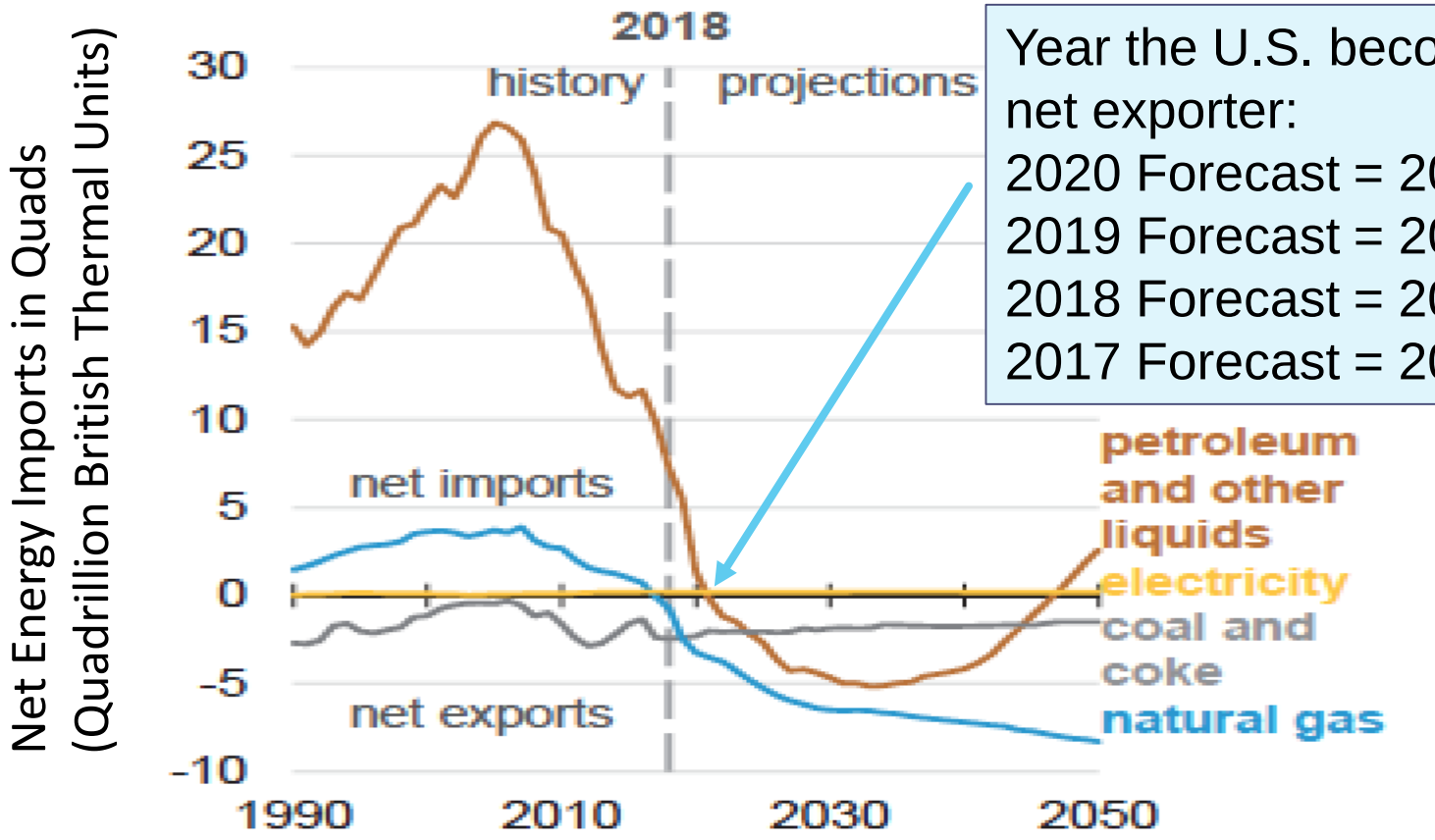
2.Persistently high energy burdens among low-income households

National Scale

Carbon taxes and regional wealth transfers

Summary

The U.S. Will Soon be a Net Energy Exporter (First Time Since 1953)



Year the U.S. becomes a net exporter:
2020 Forecast = 2021
2019 Forecast = 2020
2018 Forecast = 2022
2017 Forecast = 2026

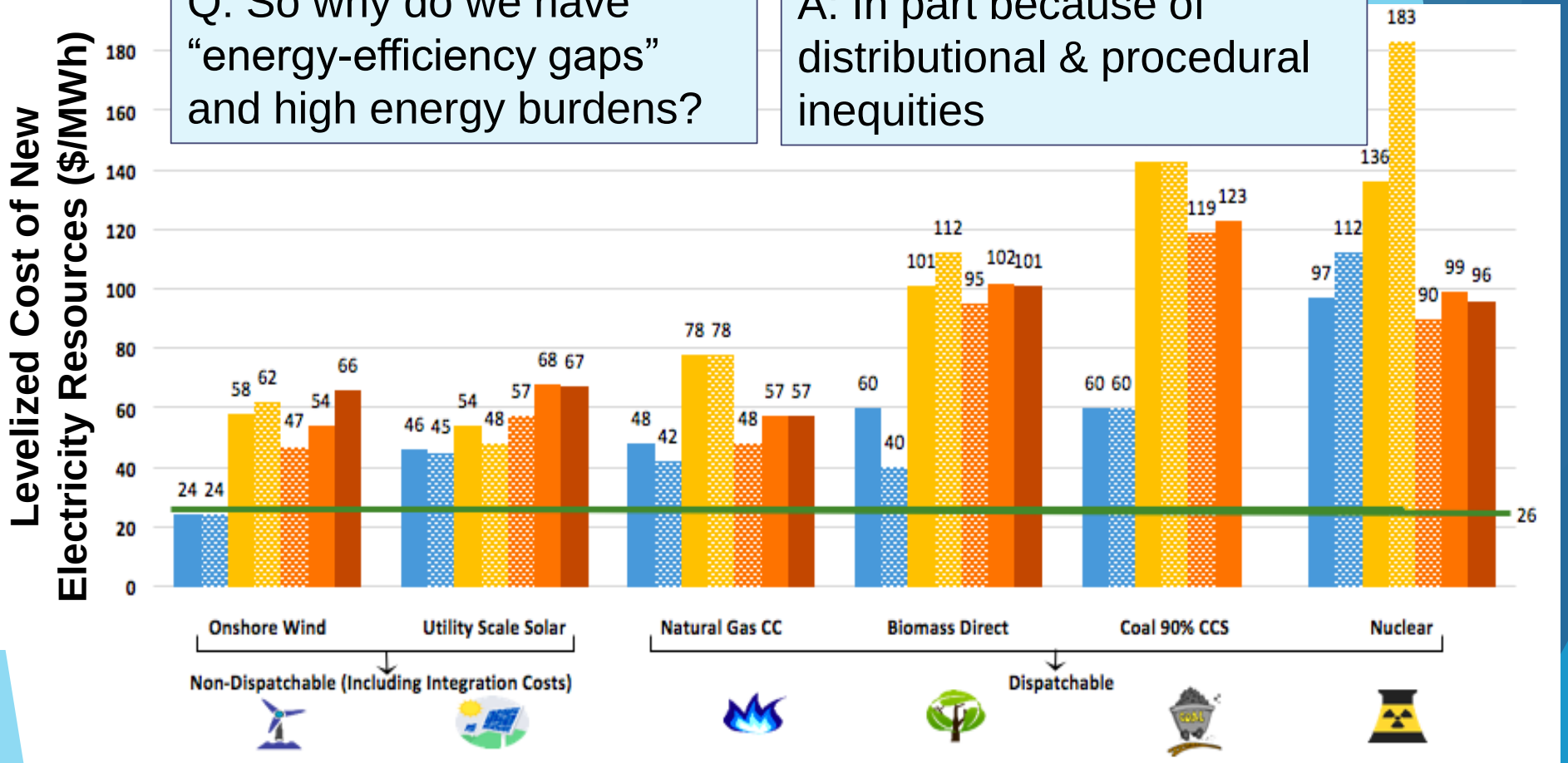
Resetting the U.S. energy system is challenging when fossil fuels are so abundant and cheap.

Sources: EIA, *Annual Energy Outlook 2019, 2018* and *2017*

Even with Low Fossil Fuel Prices, Energy Efficiency is Competitive

Q: So why do we have "energy-efficiency gaps" and high energy burdens?

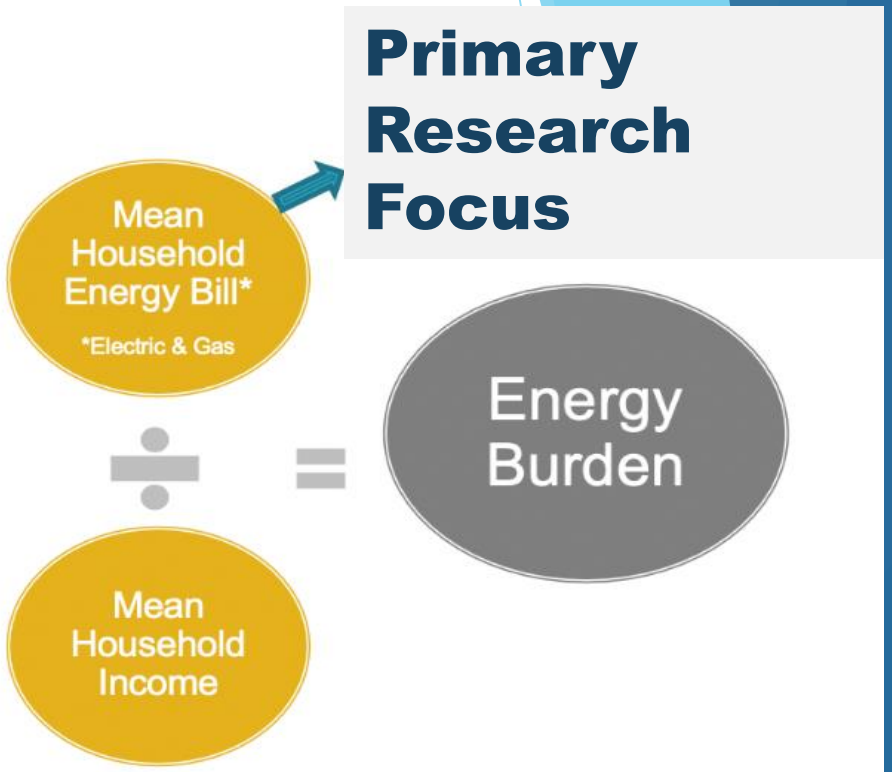
A: In part because of distributional & procedural inequities



Source: Brown, et al. (2019) "The Economic and Environmental Performance…," *Utilities Policy,* 58: 52-62. https://authors.elsevier.com/a/1YzH53Peo9V

There are Geospatial Dimensions to the EE Gap—Consider Energy Burdens

- Low-income (LI) households spend a higher share of their income on energy bills than any other income cohort.
- LI energy burdens are particularly high in geographies such as the South, rural America, and minority communities.
- And LI energy burdens are not declining despite decades of targeted public programs.



Source: Brown, et al. (2020) *Low-Income Energy Affordability…* ORNL/TM-2019/1150.DOI: 10.2172/1607178

Utilities Spend <Per Customer Share on LI Energy Efficiency

- Energy efficiency spending for LI programs accounts for ~18% of residential electric efficiency spending.
- The LI target segment of the population accounts for ~33% of total households

LI households are not excluded from program offerings. They are just less likely than other customers to participate in them, for lots of reasons….

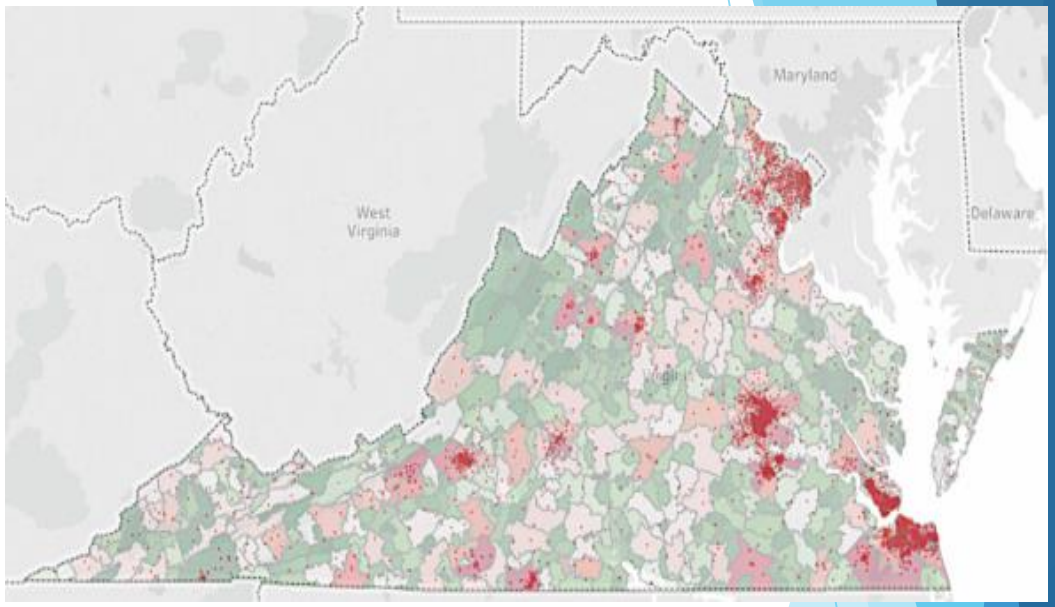
Some Promising Opportunities to Tackle the Energy-Poverty Nexus

- Community-based strategies are showing great promise.
- Monetizing the benefits of health and safety upgrades to show the broader value of WX.
- Broader technology scope (e.g., energy efficiency+rooftop solar+smart meters+smart thermostats,..).
- Information feedback offers more dimensions of influence today than ever before.

Data Analytics
Key to Improving Effectiveness

- The first step in making better data analytics possible will be collecting, analyzing, and visualizing more spatially and temporally high-resolution data to better inform low-income energy programs.

- With high-resolution data, investments in demand-side management can be designed to displace more expensive generation and grid investments.



Energy Burden and Evictions in Virginia

The distribution of energy burden high=red, low=green) and evictions (red dots) in Virginia:

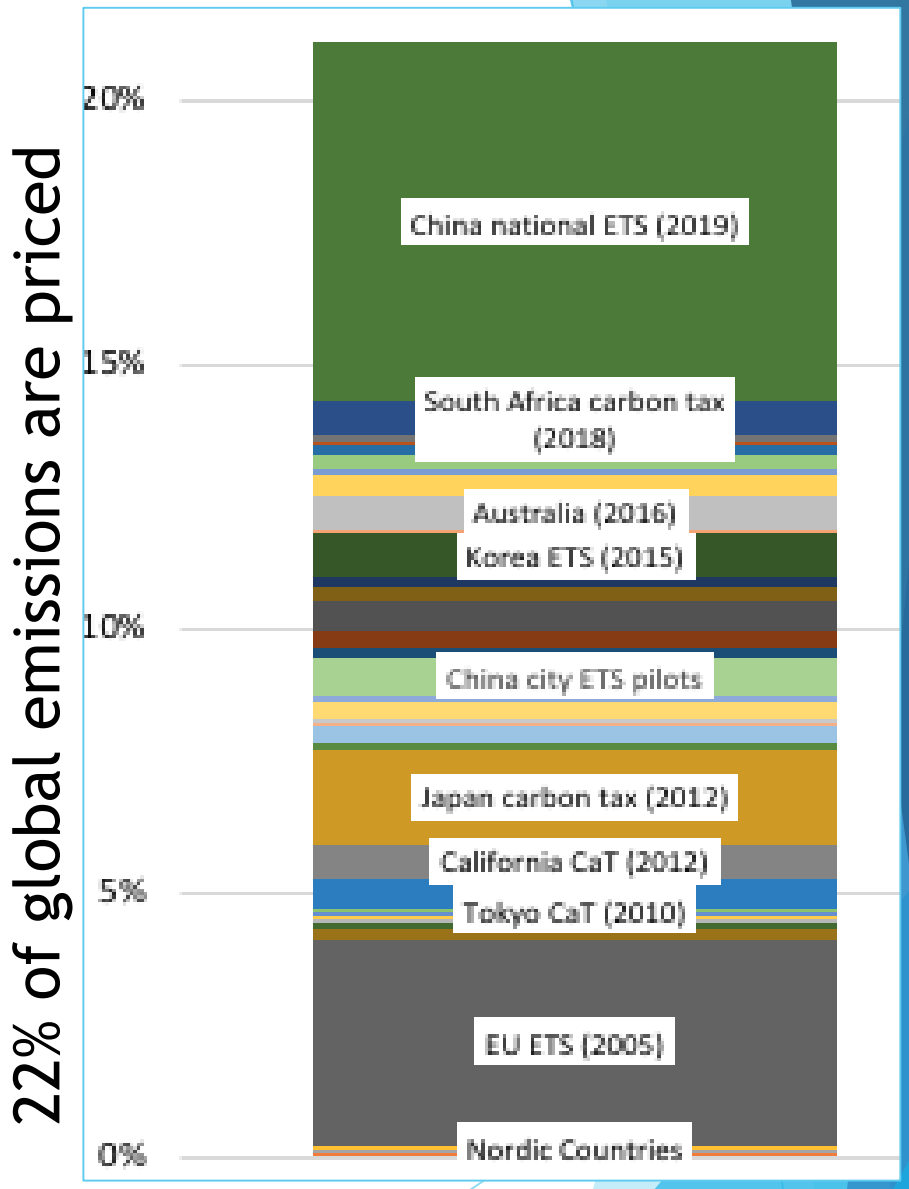
https://drive.google.com/file/d/1a[illegible]qN glifhE1avOcI0bg0glFVC/view

Across the Globe: Energy is on the Verge of a Complete Makeover

- The makeover will create new global corporate powerhouses that will lead the 21st century global economy.
- Revamping electricity grids, restructuring energy networks, reengineering energy systems—all represent economic and social opportunities.
- There are first-mover advantages to firms and communities with early market shares of wind, solar, storage, smart meters, smart charging, energy efficiency,...
- But will the energy transition be “just?”

Pricing Carbon is an "Efficient" Way to Motivate the Transition

But is it equitable?



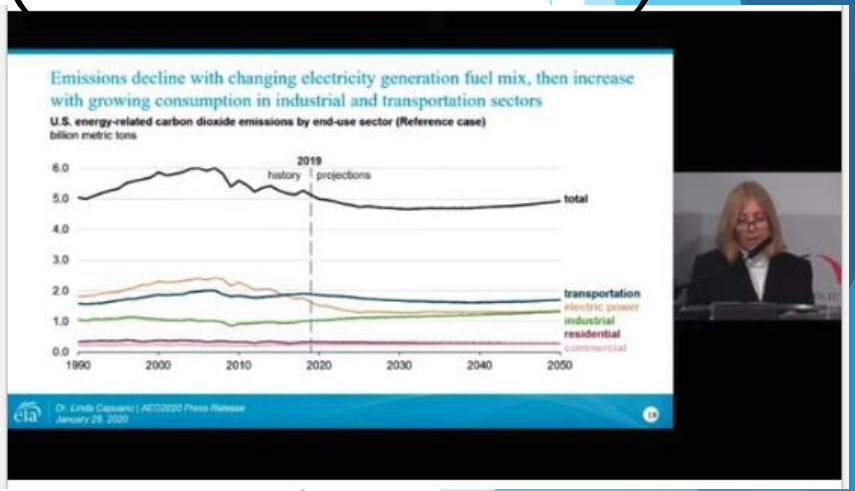
Nordic countries taxed carbon in 1990-92

Source: Valentine, Brown, and Sovacool. 2019. *Empowering the Great Energy Transition*

How is the U.S. Responding?

- At the 2020 World Economic Forum in Davos, U.S. Treasury Secretary Steven Mnuchin said that a carbon tax is unnecessary because technology will almost certainly bring down clean-energy costs.
  - multi-silicon solar module prices dropped by 90% from over $2 per watt in 2010 to just over $0.20 per watt in Q3 2019.
  - the overnight capital cost required to build new onshore wind in the U.S. decreased by 38% between 2010 and 2018.

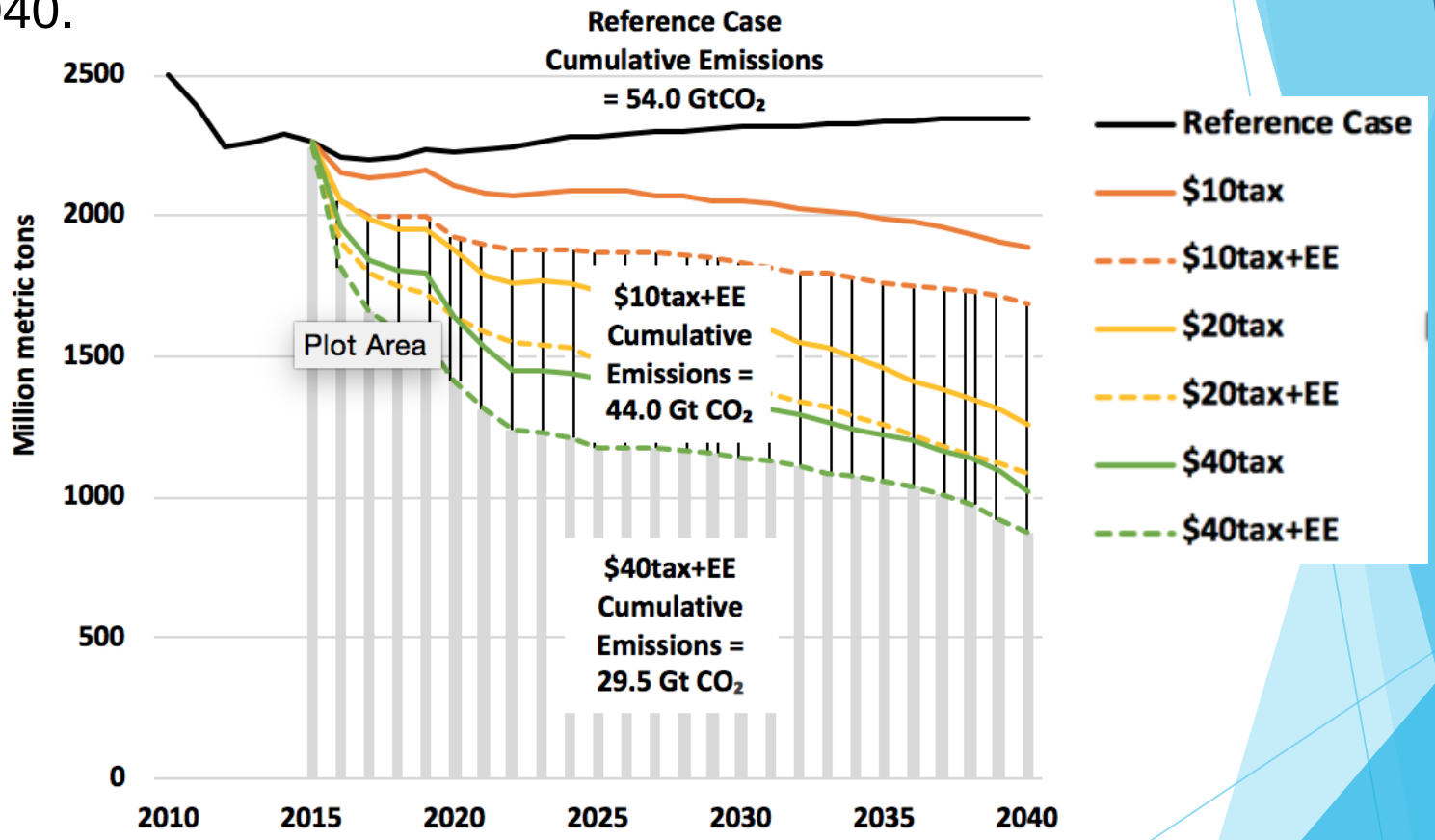
- A few days later, EIA Administrator Linda Capuano shared the latest CO_2 emissions projections~5 GT in 2050 (as in 2010 & 2020).



- This suggests that a carbon tax might be needed.

Carbon Taxes + Energy Efficiency = Deeper & Cheaper Decarbonization

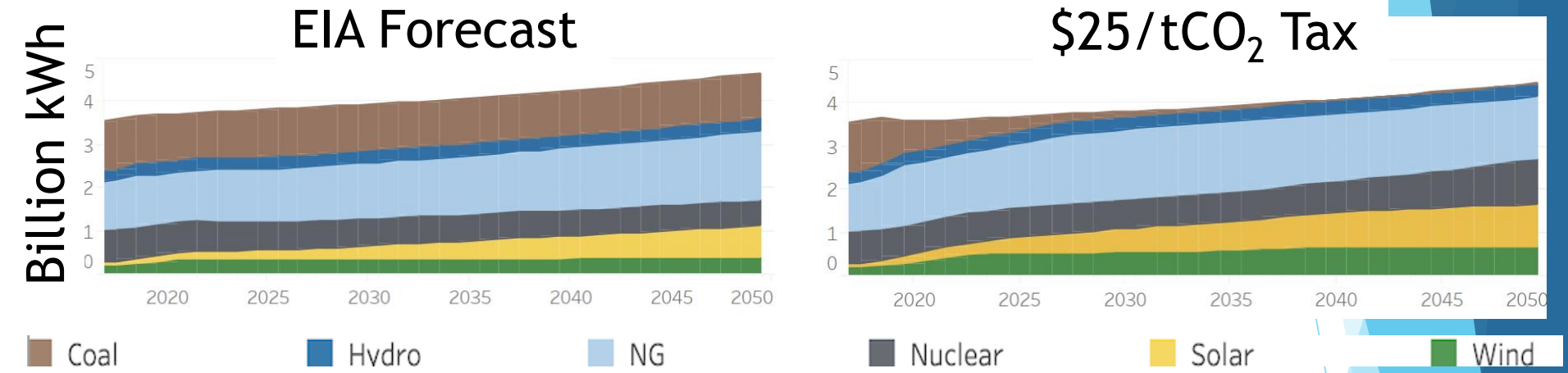
Current policies would lead to 54 GT CO_2 in the U.S. electric sector from 2016-2040.

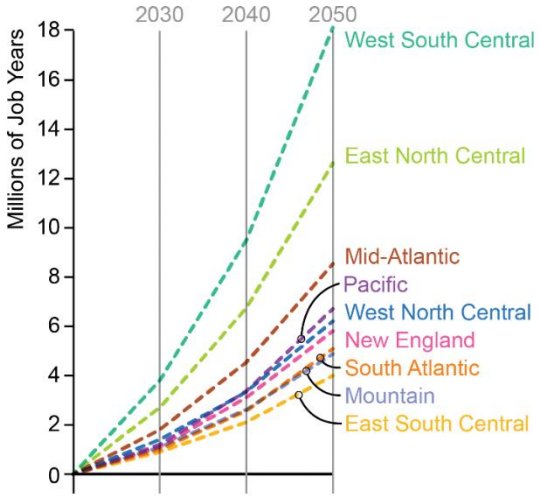


With strong energy-efficiency programs, this transition would be affordable.

Source: Brown, M. A., & Li, Y. (2018). Carbon pricing and energy efficiency…. *Energy Efficiency*, 12(2), 463-481, https://doi.org/10.1007/s12053-018-9686-9.

A $25/tCO$_2$ Carbon Tax Could Transform the U.S. Power Sector



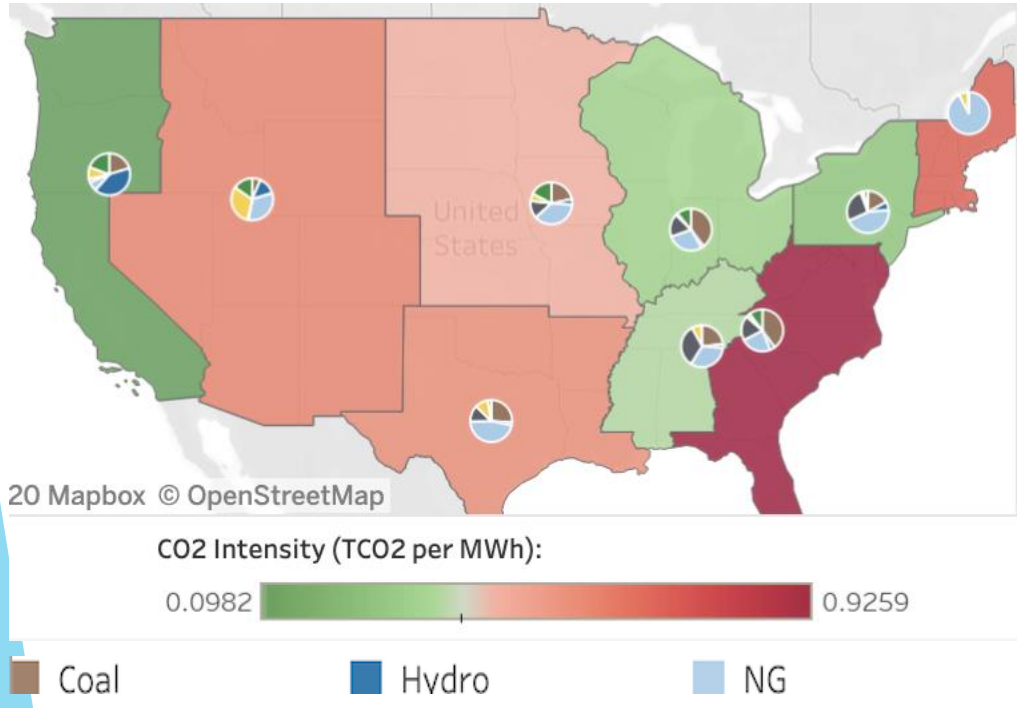


Every region would experience job growth, and more of the jobs would be local.

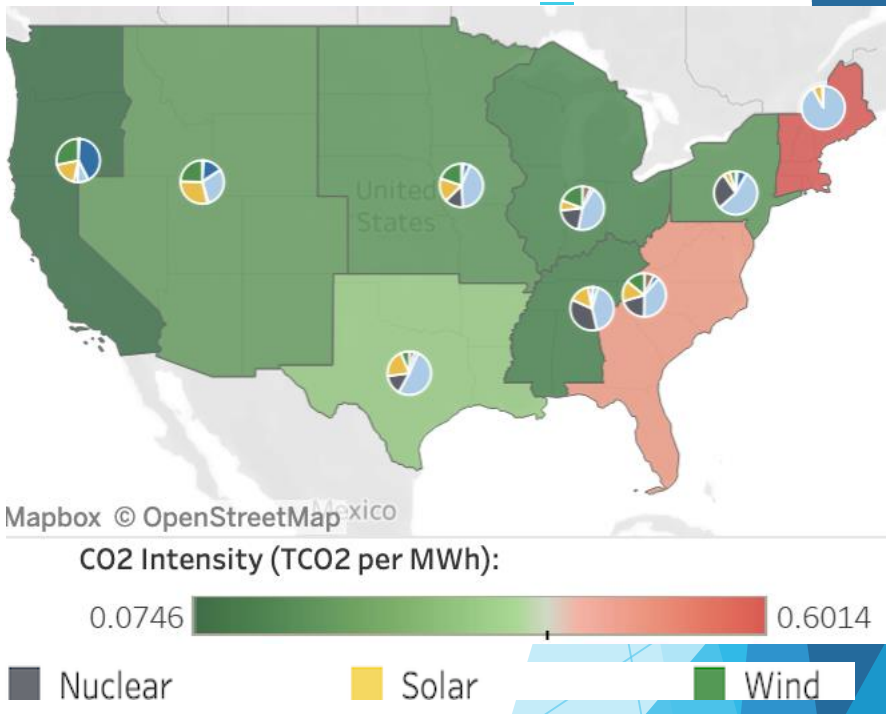
Brown, M.A. and M. Ahmadi (2019) https://www.scientificamerican.com/article/would-a-green-new-deal-add-or-kill-jobs1/

But Carbon Pricing Creates Regional Heterogeneities

EIA Forecast 2030



$25/tCO$_2$ Tax

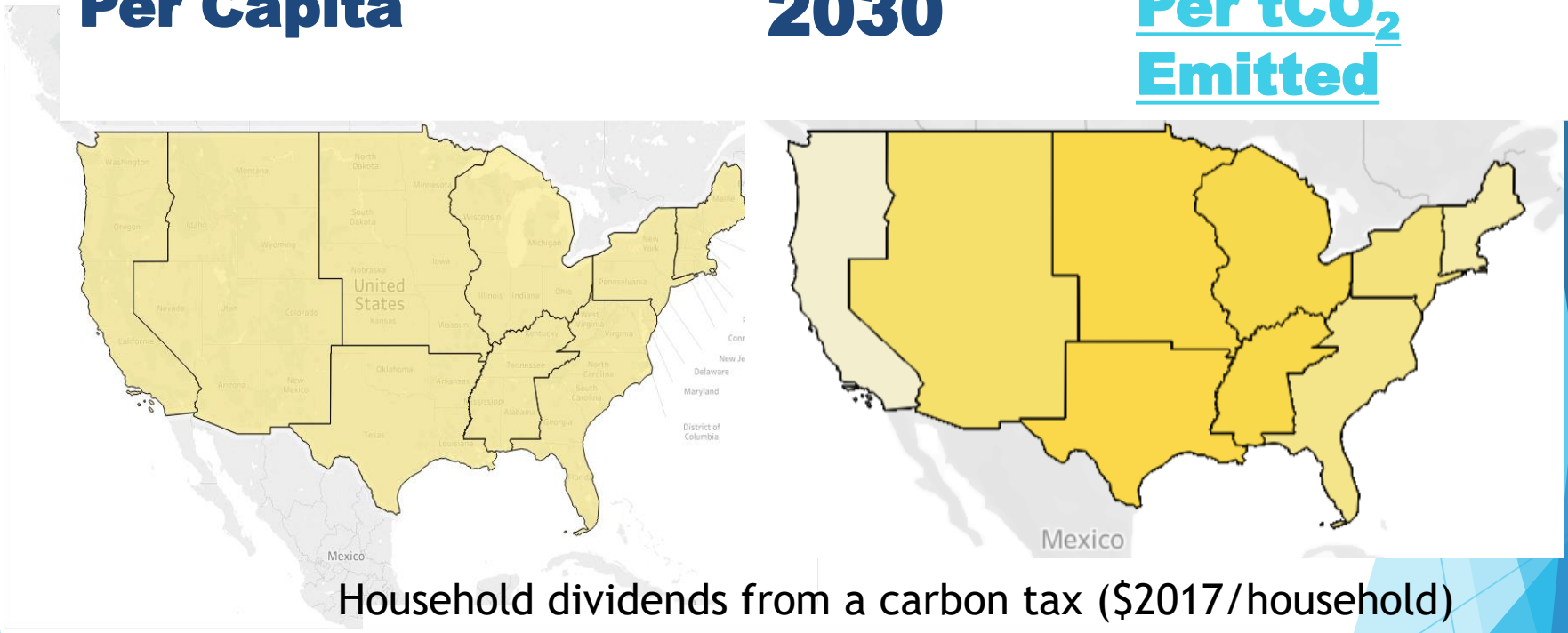


The regional complexities of a uniform environmental tax have largely been overlooked.

Brown, M.A. et al. (2020) Are All Jobs Created Equal? … *Applied Energy*, https://authors.elsevier.com/a/1aShY15eiewCbQ

Per Capita Recycling of Tax Revenues = Geospatial Wealth Transfers

Per Capita **2030** **Per tCO_2 Emitted**



Per capita recycling of tax revenues would transfer wealth to the Pacific region, electricity rates would rise more in other regions, and LI energy burdens would increase.

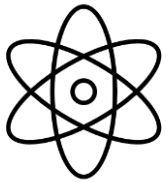
States and Localities: Where Most of the Action is

The Georgia Drawdown project aims to identify the most promising solutions to significantly reduce Georgia's net carbon emissions by 2030.

Drawdown Georgia

"…advance technology and improve the human condition."

Conclusions



- Lots of challenges: Covid-19, racial oppression, the climate crisis,…
- Now is the time to ensure that our future is powered by clean energy that benefits all.
- Distributional and procedural equity need to be considered every step of the way.
- Remember this is a marathon and not a spring.

This work has benefited from many collaborators and funding sources.

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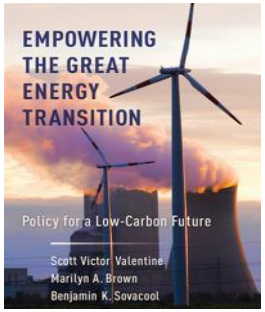
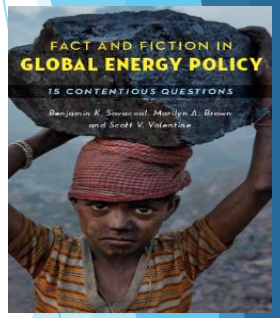
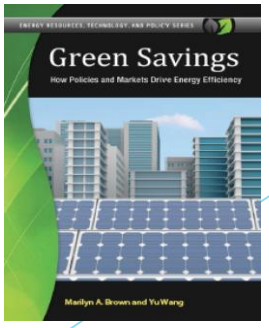


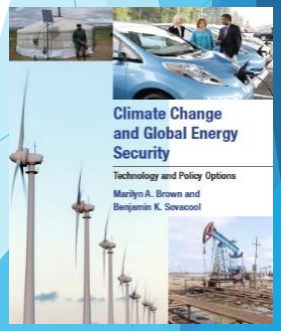
2019



2016



2015



2013