US Clean Energy Futures - an analysis of different energy policies towards cleaner air

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Introduction

- **The Biden Administration has called for a 100 percent carbon-free power sector by 2035 with an interim target of 80 percent clean electricity by 2030**
- **To this end, we simulate an array of various Clean Energy Standards (CES) for EGUs to compare the costs and benefits of implementing such policies, with a focus on 2030, 2040 and 2050**

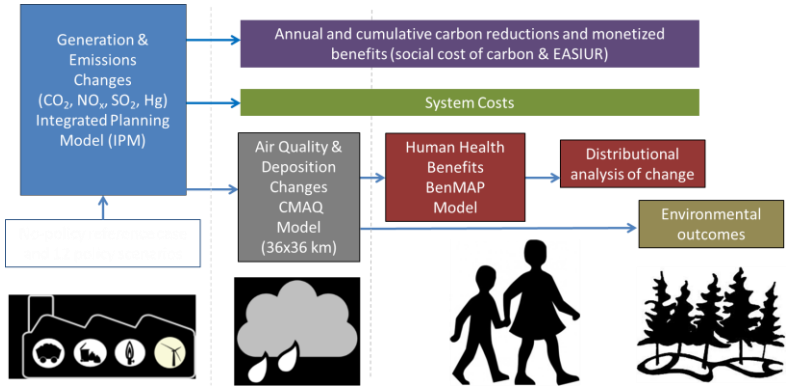
Objective

To compare the:

1. **Carbon dioxide emissions**
2. **Cost**
3. **Co-pollutant emissions**
4. **Air quality and atmospheric deposition**
5. **Health outcomes**
6. **Distributional analysis of benefits**

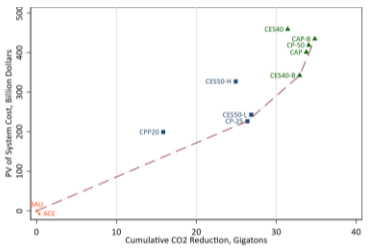
of 12 different energy polices

Approach



CO_2 reductions for all policies vs system costs

Policy Type	Code	Description
Reference case	BAU	Business as usual, no policy
Section 111 rules	ACE	Affordable Clean Energy – assumed 4.5% HRI for affected units
Clean Energy Standard	CPP20	Updated Clean Power Plan - achieves 65% CO2 reduction from 2005 levels by 2035
	CES40	100% clean in 2040, 0.82 metric tons/MWh, partial crediting, total generation, no banking
	CES40-B	100% clean in 2040, 0.82 metric tons/MWh, partial crediting, total generation, banking allowed
	CES50-H	100% clean in 2050, high carbon intensity benchmark (0.82 metric tons/MWh), total generation, banking allowed until 2040
	CES50-L	100% clean in 2050, low carbon intensity benchmark (0.46 metric tons/MWh), total generation, banking allowed until 2040
Cap and Trade	CAP	Net 0 emissions in 2050, offsets allowed but no banking
	CAP-B	Net 0 emissions in 2050, banking allowed
Carbon Price	CP-25	Carbon price $25/ton rising at 5% per year
	CP-25u	Like CP-25 but units below 25 MW "unconstrained" (not held to BAU capacity factors)
	CP-50	Carbon price $50/ton rising at 5% per year
	CP-50u	Like CP-50 but units below 25 MW MW "unconstrained" (not held to BAU capacity factors)



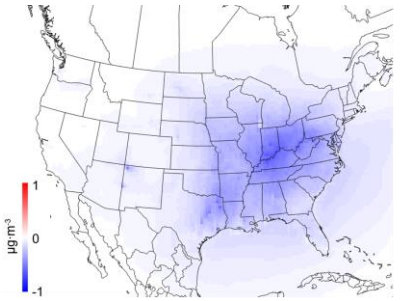
Scenario families

- **Clean Energy Standard (100% clean by 2040 or 2050)**
- **Cap & Trade (0 emissions by 2050)**
- **Carbon price ($50 or $25 per ton emitted)**

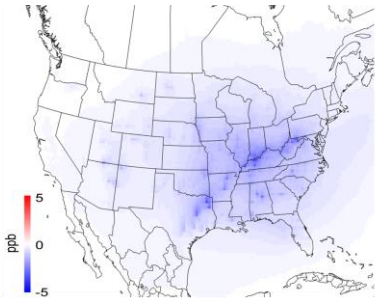
Costs vs Benefits

- **Almost linear dependence of cost to reductions**
- **All policies produce benefits - focus on CES40B**

PM2.5 and Ozone reductions Compared to No Policy (BAU) in 2030



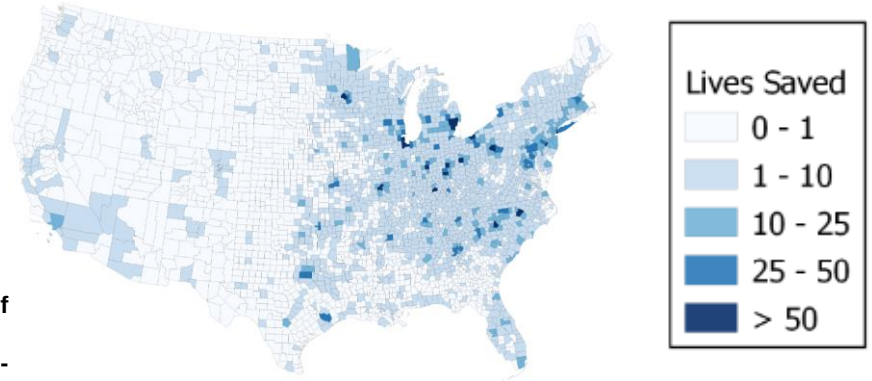
Change in $PM_{2.5}$ (annual average of 24-h averages)



Change in O_3 (O_3 season average of maximum daily 8-h averages)

- ✓ **Considerable air pollution benefits realized**
- ✓ **Most of the reductions are localized in the Eastern US**

County Level Changes in Annual Mortality from $PM_{2.5}$ and O_3 for 2030



- **BENMAP analysis predicts a total of 11,200 lives saved between the BAU and CES40B scenario**
- **Net monetized benefits highest out of all policies (~$600 billion)**

Takeaways

- **All policies produce net benefits, with climate benefits substantially exceeding policy costs**
- **High ambition policies have modest costs and can reach low or zero carbon emissions for ~15% above baseline costs**
- **Slightly less ambitious policies have sharply lower cost and can achieve ~75% of high ambition reductions for ~9% above baseline costs**
- **Policy design is important since it affects costs, timing, co-pollutants, local air quality, distributional impacts**

More info and up to date information:

https://cleanenergyfutures.syr.edu/