

# INVESTING IN ENERGY AND THE ENVIRONMENT POST- COVID

# Agenda



- Impacts of COVID
- Federal & State Level Policy Responses
  - Federal & State Programs
  - Market-based Solutions
- REMI E3+ and Modeling Methodology
- Model Demonstration in REMI E3+

# Impacts of COVID



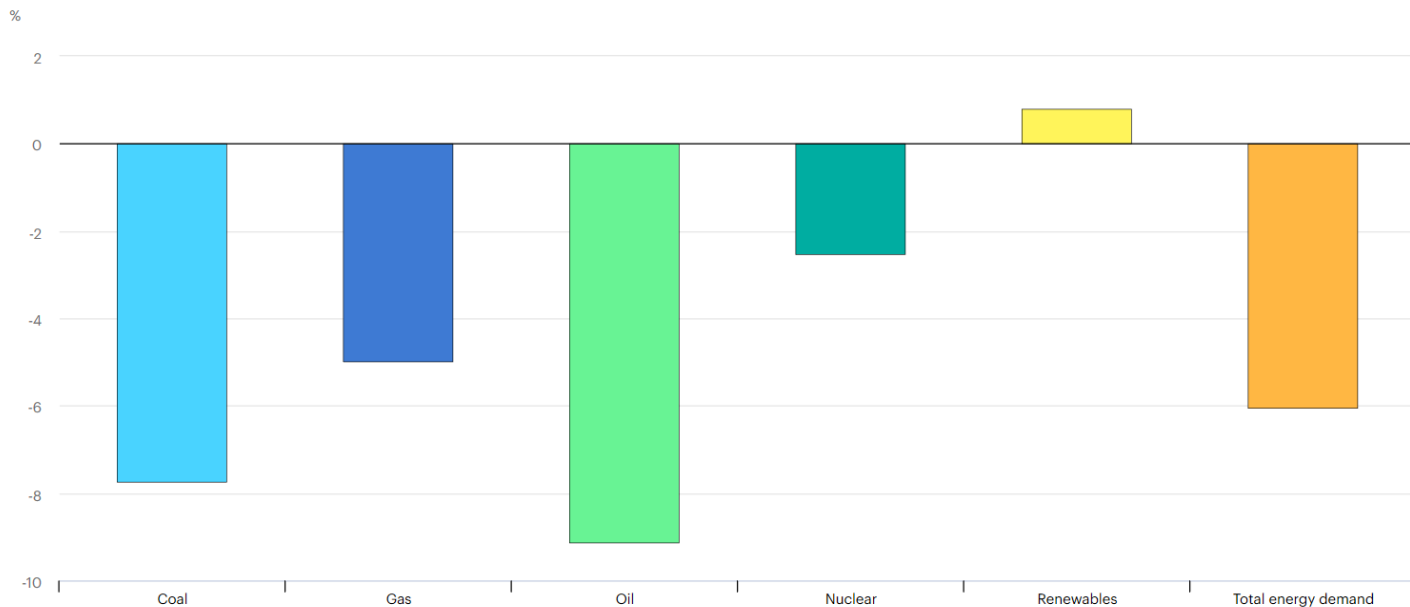
- Climate change and COVID
- Positives
  - Lower green house gas emissions
  - More biking and walking in dense areas
  - Production tax credit for renewable energy projects extended for one year
- Drawbacks
  - Delayed international and domestic political processes
  - Less state and federal funding for resiliency and renewable energy projects
  - *More* single-use plastic

# Reductions in GHG Emissions



- Reductions in GHG emissions
  - ▣ U.S. overall energy demand down 6%; coal down by 8% this year
  - ▣ Effects on the trajectory of climate change?

Projected change in primary energy demand by fuel in 2020 relative to 2019



what does **REMI** say? *sm*

# Walking & Biking



- Sales of children's and adult leisure bicycles have increased by 56% and 121% from March 2019, respectively
- Bike shops, globally, are experiencing shortages
  - Compounded by an increase in demand and slowdown of global trade due to supply chain challenges
- University of New Orleans study shows increase in walking trail usage on campus

# Fiscal Shortfalls



- State and local governments face revenue shortfalls and expenditure increases
  - Increased UI claims as employees are furloughed and businesses close permanently
  - Decrease in gas tax revenue – fewer people traveling and commuting

*Exhibit 4: Estimated Combined Fiscal Shock as a Percentage of Pre-COVID-19 Revenue Estimates by Region (USD millions)*

REGION	PRE-COVID-19 REVENUE FORECAST (FYE2020 AND 2021)	ESTIMATED REVENUE DECLINE BY FYE2021	ESTIMATED MEDICAID SPENDING INCREASE BY FYE2021	COMBINED FISCAL SHOCK PERCENTAGE OF PRIOR REVENUE FORECAST
East	\$493,013	-\$43,615	\$6,820	-10.2%
Midwest	\$380,767	-\$34,852	\$6,790	-10.9%
South	\$512,423	-\$36,044	\$8,078	-8.6%
West	\$492,617	-\$67,461	\$7,586	-15.2%
<b>U.S.</b>	<b>\$1,878,819</b>	<b>-\$181,972</b>	<b>\$29,273</b>	<b>-11.2%</b>

# Federal & State Policy Responses

- Federal & State Policies
  - ▣ Green New Deal
- Market-based Solutions
  - ▣ Carbon Taxes
  - ▣ Electric Vehicles

# What is the “Green New Deal”



- U.S. Rep. Alexandria Ocasio-Cortez and Sen. Ed Markey proposed a Congressional Resolution defining the “Green New Deal”
  - Describes environmental and economic goals to be achieved in **10 years** which include:
    - Meeting **100 percent** of power demand in the U.S. through renewable, zero-emission sources
    - Promoting energy efficiency, clean manufacturing, high-speed rail, zero-emission vehicles, and other innovations
    - Resiliency initiatives to mitigate the impact of natural disasters
    - Upgrading infrastructure
    - Encouraging economic development and guaranteeing jobs with living wages
- The Democratic Party’s Presidential nominee, Joe Biden, has incorporated several aspects of the plan into his platform



# Political Context



- Increased public concern about climate change
  - Especially 18-34 year-olds (70% worried compared to 62% among ages 35-44 and 56% 55 or older – Gallup, May 11,2018)
  - Dissatisfaction with perceived Republican “denial” of a problem, link to man-made activities, or ability to solve (e.g. requires a global response)
- Perception that status-quo politics of elected officials (including Democrats) fails to resolve the problem
  - During President Obama’s first term, U.S. House passed cap-and-trade bill, but it never came to a vote in the Senate
- Linkage with a range of economic and social challenges such as income inequality, marginalized communities

# State-level Significance



- Climate change matters to all states and regions, whether they are “blue” or “red”
  - Resiliency is a growing problem (hurricanes, wildfires, coastal and inland flooding)
    - \$150 billion in FEMA disaster relief in 2018
  - State and local governments are responsible for finding solutions to these problems
- Avoidance of market solutions or regulations may result in political backlash
- Natural-resource dependent states may wish to further diversify their economy in any case, since oil and gas prices are volatile and will be depleted over time
- For coastal states, investments in infrastructure reduce the transportation cost when exporting energy

# How Does Analysis Fit In?



- The Green New Deal represents aspirational goals; implementation of even a small aspect requires detailed understanding of engineering, economic, environmental and financial issues
  - REMI, in particular, has been involved in national, state and local evaluation of the economic effects of environmental and social policies

# Market-based Solutions



- A carbon tax is an efficient means for reflecting the cost of carbon in economic decision making
  - Applies to everything from investments made by companies to the product choices made by consumers
  - Legislation requires energy companies to pay \$15 per ton of carbon emitted from producing products, with the fee rising by \$10 each subsequent year
  - All revenue – minus administrative costs – would be returned to taxpayers
  - Some progressives see carbon taxes as insufficient
    - *“A carbon price could be part of a ‘Green New Deal,’ but it must not prioritize corporate profit over community burdens and benefits.”* – Stephen O’Hanlon, spokesman for the Sunrise Movement

# Carbon Tax Dynamic Economic Results



ES Figure 2: Economic Impact of Revenue-Neutral Carbon Tax (Carbon Tax Case vs. Base Case)



# Carbon Tax Emissions Reductions



*ES Figure 3: Reduction of Emissions from Carbon Tax (millions of metric tons)*

RESULT	REDUCTION	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2019-2028
Total	Absolute	257	414	511	620	701	769	912	999	1,052	1,136	7,371
Total	Percentage	5%	8%	10%	12%	14%	15%	18%	20%	21%	23%	13%
Non-Power	Absolute	38	72	111	153	198	248	302	359	421	487	2,389
Non-Power	Percentage	1%	2%	3%	4%	6%	7%	9%	11%	12%	14%	6%
Power	Absolute	219	342	400	467	503	521	610	640	631	649	4,982
Power	Percentage	13%	21%	25%	29%	32%	33%	39%	41%	41%	43%	28%

# Disruptive Technologies



## Impacts of Hybrids and Electric Vehicles in Connecticut

- Retrospective and Prospective Connecticut Center for Economic Analysis, 2015

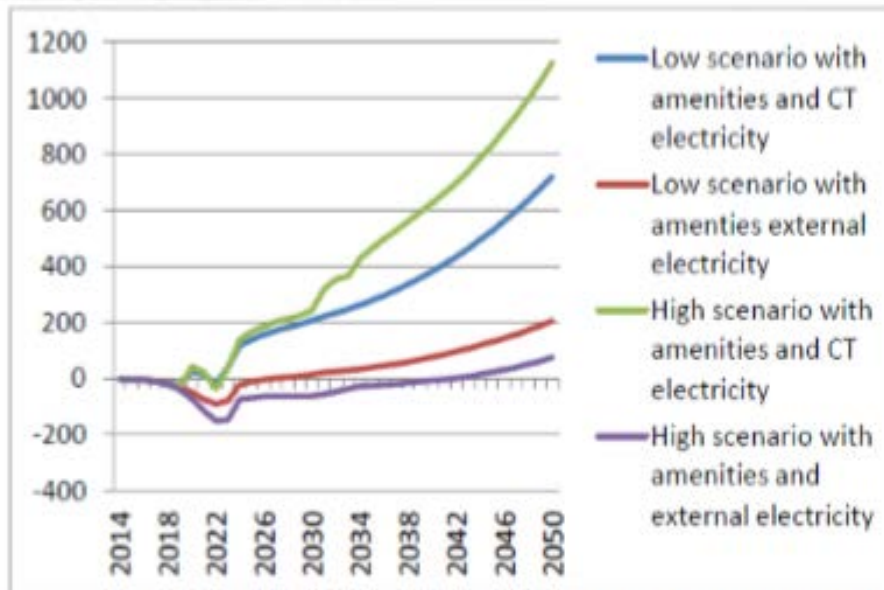


Figure 6. Personal Disposable Income Impacts Utilizing External or Connecticut Generated Electricity (\$M)

“In contrast to the impact on jobs, at least in the low growth scenario, changes in personal disposable income (PDI) turn positive over time when amenity impacts are included as noted in chart 4. The good performance of PDI relative to job creation arises from improved productivity.”

# About REMI



REMI's 40-year history of rigorous academic research and software development has led to the development of the the industry standard in macroeconomic research methodology:

## Input-Output

Close analysis of inter-industry relationships

## General Equilibrium

Estimate of long-run stability of the economy allows for analysis of policy decisions

## Econometrics

Advanced statistical analyses underpinning the model

## Economic Geography

Effects of geographic concentration of labor and industry

Integrated REMI economic modelling approach



what does **REMI** say? <sup>sm</sup>



# What is E3?



CADMUS

*E3+ is the leading off-the-shelf solution for analyzing the macroeconomic and demographic impacts of any environmental or energy initiative*



what does REMI say? <sup>sm</sup>

# Previous Analyses



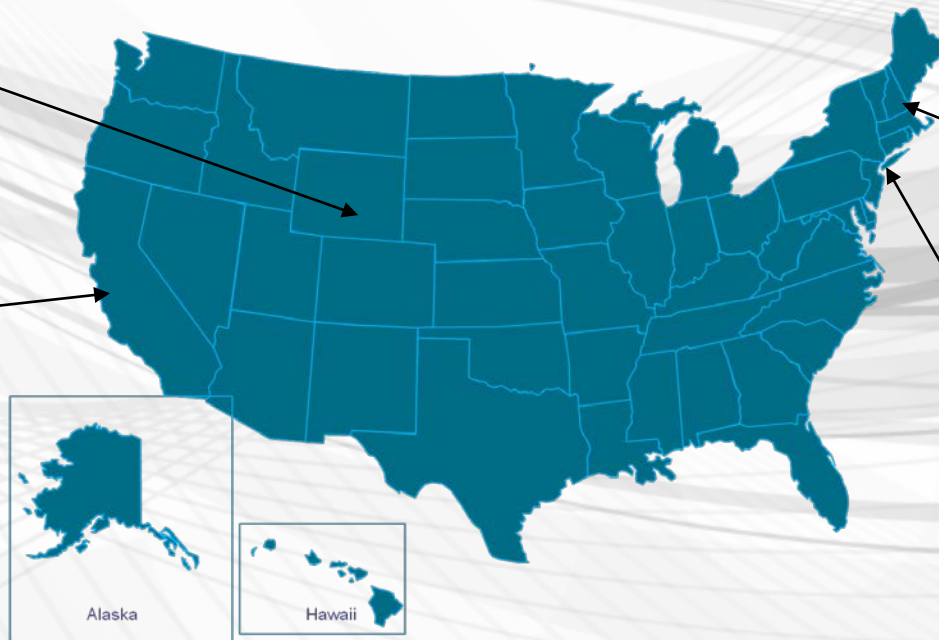
**REMI is the industry leader for regional macroeconomic and demographic analyses of energy and environmental issues.**

## **Wyoming:**

Impacts of the ZEPHYR power transmission line

## **California:**

Impacts of CAFE emissions standards



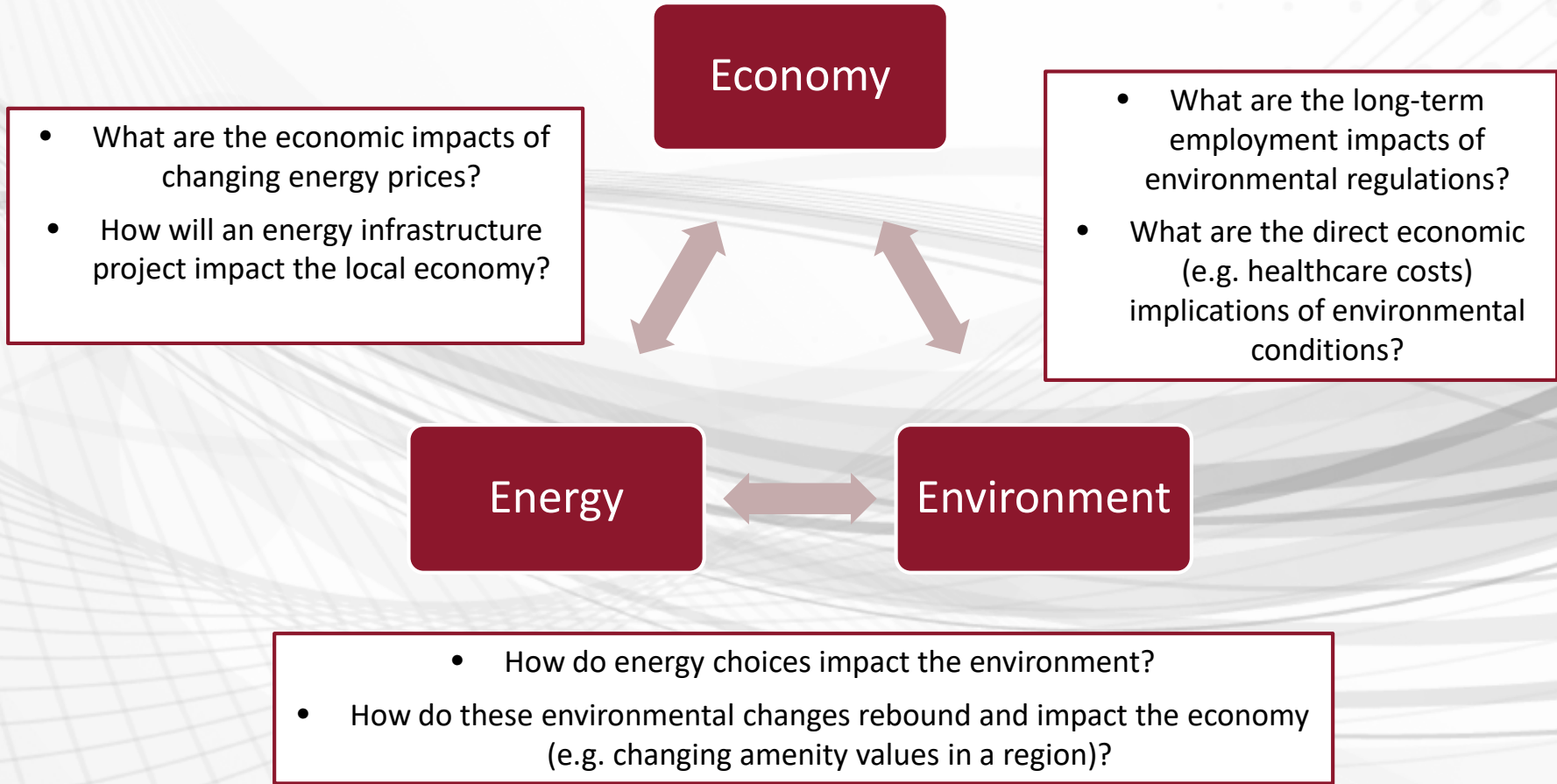
## **New Hampshire:**

Merrimack Valley energy reliability project

## **NYC:**

Energy Efficiency Programs analysis (NYSERDA)

# Energy, Environment, & Economic Linkages



# Aspects Unique to E3+



Specific analysis of Energy and Environment related policies including:

1. Translator variables for electrical, solar, wind, and nuclear power plant construction and operations and maintenance
2. Energy Consumption and Carbon Dioxide Emissions Module
3. Resilience Module
4. Carbon Tax scenario
5. Social cost policy variable associated with five types of emissions
6. Allows for integration with third-party energy models

# Translators in the E3+ Model



- The model can distribute spending on **construction and operations and maintenance** of a electrical power plant across 160 industries
- Based on studies and data from several sources, including:
  - ▣ National Renewable Energy Laboratory
  - ▣ Energy Information Administration



Accounts for:  
Nuclear, Solar, Natural Gas, Coal, and  
Wind Energy

# REMI E3+ Emissions Module



- Dynamic Carbon Footprint
  - Forecast results include Energy Consumption and Carbon Dioxide Emissions
- Uses EIA data to generate parameters that are applied to economic impact results
  1. Btus consumed by sector and source
  2. CO2 emissions by sector and source
  3. Residential, Industrial, Commercial, and Transportation sectors



# Resiliency Module in the E3+ Model



- ❑ E3+ can now produce an automatic calculation discussing resiliency through a forecast's "Resiliency Report"
  - ❑ This compares a no-action baseline disaster scenario to an a resilience investment scenario
- ❑ The model produces a **Resilience Loss Reduction Potential** figure:

$$RLRP = \frac{\textit{Avoided Losses}}{\textit{Maximum Potential Losses}}$$

# Dynamic Carbon Footprint- A Hypothetical E3+ Application



## Inputs:

New Renewable Energy Developments with Retirement of Coal Plant & Direct Energy Cost Changes

## Model Responses

## Relative Output

Change in output of supply chain and other industries

Business & consumer responses to change in energy prices

## Relative Employment

Change in employment, different industry impacts

Change in employment from consumer spending responses

## Dynamic Carbon Footprint

Increase in carbon emissions for travel in service industries

Decrease carbon emissions in manufacturing industries

what does **REMI** say? <sup>sm</sup>



# Model Demonstration