
REMI WEBINAR
Economic Impacts of Comprehensive Climate and Energy Policy
Thursday, February 10 | 2:00 - 3:00 pm (ET)
Thomas D. Peterson
President & CEO, Center for Climate Strategies (CCS)
Guest Speaker
REMI

Agenda

Welcome

Center for Climate Strategies
Thomas Peterson, *Founder & CEO*

Regional Economic Models, Inc.
Peter Evangelakis, Ph.D., *VP of Economics and Consulting*
Nina Mantegna, *Associate*
Haozheyi Guan, *Analyst*

Q&A

THE CENTER FOR CLIMATE STRATEGIES

WORKING TOGETHER TO CREATE A BETTER SAFER AND MORE JUST WORLD

Economic Impacts of Comprehensive Climate and Energy Policy

Tom Peterson, Center for Climate Strategies

February 10, 2022

REMI Webinar

Overview

Old Study

- Conducted in 2010
- One of several REMI and macroeconomic studies of climate actions by CCS
- Part of broader capacity to measure socio economic effects of climate actions

New Meaning

- Urgency, NDCs, and ambition
- COVID and economic recovery
- Equity and justice
- Investment mobilization and legislation

Updates and Improvements

- Target setting
- Social and economic goals
- Policy screening and design
- Benefits and feasibility analysis
- Policy implementation and investment

Impacts of REMI study – approaches and actions

- Causes and effects
- Drivers and indicators
- Benchmarking
- Impact analysis
- Knowledge, Tools, Innovations
- Leadership practices
- Policy agreements
- Implementation

- State climate and energy plans
- American Reinvestment and Recovery Act (ARRA)
- US Kyoto target attainment
- China Subnational Low Carbon Development (LCD)
- USAID Low Emissions Development Strategies (LEDS)
- Paris Agreement
- Biden Climate Change Executive Orders
- Long Term Strategies
- COVID economic recovery

Climate Leadership – Abell Report

The
Abell Report

Published by the Abell Foundation
December 2021
Volume 34, Number 7

Turning Up the Heat on Cooling Down the Planet: Comparing Maryland and Massachusetts Climate Leadership Actions

By Tom Peterson and Rex Hazelton

Executive Summary

Time is running out to tackle the problem of climate change. To avoid unacceptable and unmanageable impacts of climate change, Earth temperatures must flatten by mid-century and annual global greenhouse gas (GHG) emissions levels must be driven down to net zero by mid-century. This requires a series of direct and enabling actions of governments and stakeholders to reduce deposition of GHGs in the atmosphere, with parallel actions to adapt to climate disruptions that occur along the way. US states are critical to this effort as many are leading global emitters and solutions providers.

This report identifies key characteristics of governmental leadership required to implement climate solutions at scale, recognizes the critical importance of stakeholder consensus building, and conducts a detailed review and comparison of Maryland and Massachusetts actions with identification of shortfalls and leadership response needs. Leadership characteristics were determined based on expert review of global best practices and the actions of a cohort of leading states and nations.

The six characteristics for governmental climate change leadership include:

1. Targets and limits
2. Economic and environmental justice systems
3. Whole of government approach
4. Comprehensive policies and measures
5. Matching implementation mechanisms
6. Measurement and verification systems

Review of actions in each state indicate that Massachusetts and Maryland were on similar paths to advancement through 2016 but separated as Massachusetts sped up and Maryland slowed down, although Massachusetts also faces shortfalls. To close gaps, systematic responses are needed through a combination of swift executive and legislative actions. Maryland has the potential to re-establish itself as a national leader on climate change but must take immediate, comprehensive, and sustained new actions.

Targets

Justice & Equity

Whole of Government

Policies & Measures

Implementation Mechanisms

Measurement & Verification

PRESIDENT JOE BIDEN

BUILDING A BETTER AMERICA

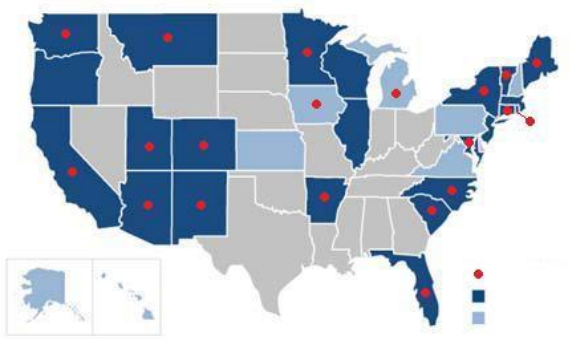
BUILD.GOV

A GUIDEBOOK TO THE BIPARTISAN INFRASTRUCTURE LAW FOR STATE, LOCAL, TRIBAL, AND TERRITORIAL GOVERNMENTS, AND OTHER PARTNERS

THE WHITE HOUSE
WASHINGTON

Infrastructure Act (IIJA)

- Program
  - Identification
  - Prioritization
  - Design
- Funding sources
  - Competitive grants
  - Formula funding
  - Tax credits
- Funding access
  - Gap analysis of cost requirements
  - Documentation of impacts
  - Formation of partnerships
  - Matching sources



Study Context

- Scope
  - State Climate Action Plans
  - Local, state, and national measures
  - National climate legislation
- Structure
  - Costs/Savings, GHGs, Macroeconomics
  - Policies and Measures in all sectors
  - Economy wide measures
- Consolidated Approach

REMI Measurements

- Line-item impacts of policy measures
  - Net changes in GHGs and costs/savings
  - Net changes in employment, growth, income, and distribution
- Aggregate and interactive effects
  - Within and across sectors
  - Boundary adjustments
  - Prices and productivity
- Shifts in spending
  - Direct
  - Indirect
  - Induced
- Regulatory and Budget impacts, Return on Investment

Macroeconomic drivers

Cost Cuts	Localization	Job Intensity
• Cost effective actions increase economic efficiency and expansion • Energy savings cut energy costs, stimulate labor investment	• Shifts to indigenous energy and resources cut financial outflows • Actions supported by local supply chains cut job outflows • Outside investment stimulates local labor investment	• Labor intensive activities create more jobs per dollar

GHG targets, contributions by type of government

Figure 5. GHG Reduction Potential of Stakeholder Policies by Level of Government

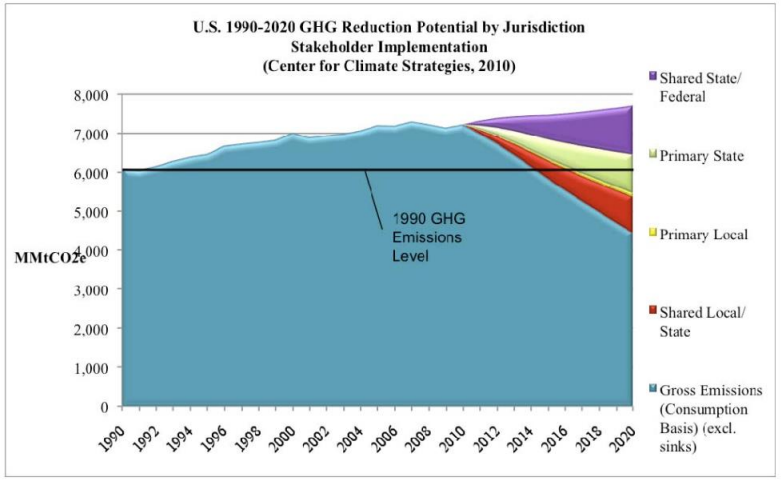
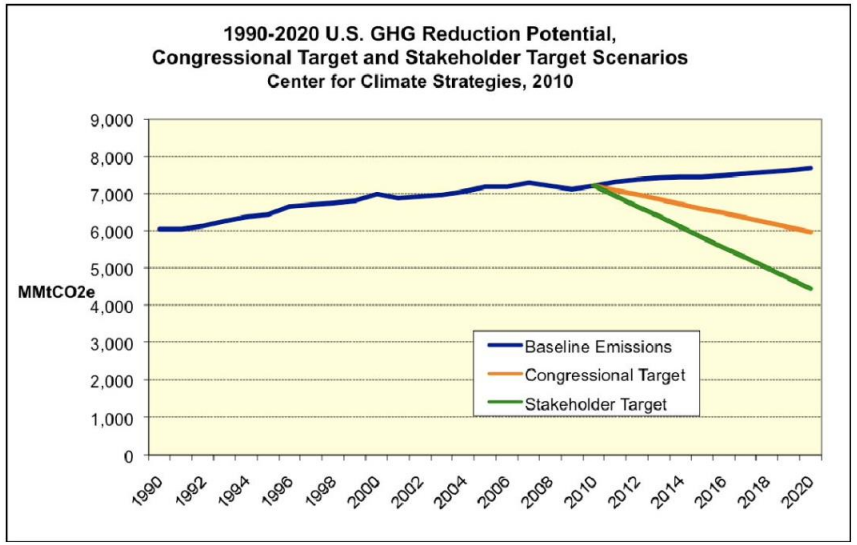


Figure 6. GHG Reductions – Stakeholder and Congressional Target Scenarios



GHG = greenhouse gases; $MMtCO_2e$ = million metric tons carbon dioxide equivalent

Levels of government, line-item costs of policy actions

Figure 1. State Government and Shared Responsibility for GHG Reductions

2020 Stakeholder Implementation Potential GHG Emissions Reductions by Jurisdiction
Center for Climate Strategies, 2010

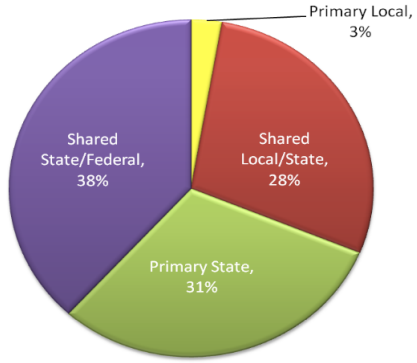
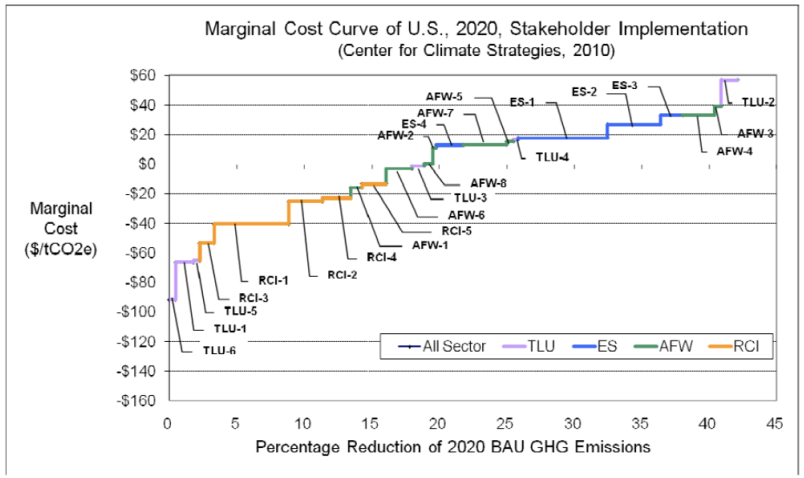


Figure 2. Cost Curve for 23 Stakeholder-Selected Policies and Measures



$MMtCO_2e$ = million metric tons carbon dioxide equivalent; GHG = greenhouse gases; BAU = business as usual (no action to reduce emissions) Table 2, below, lists the sector options: TLU = Transportation & Land Use; ES = Energy Supply; AFW = Agriculture, Forestry and Waste Management; RCI = Residential, Commercial and Industrial [buildings and energy/fuel use]

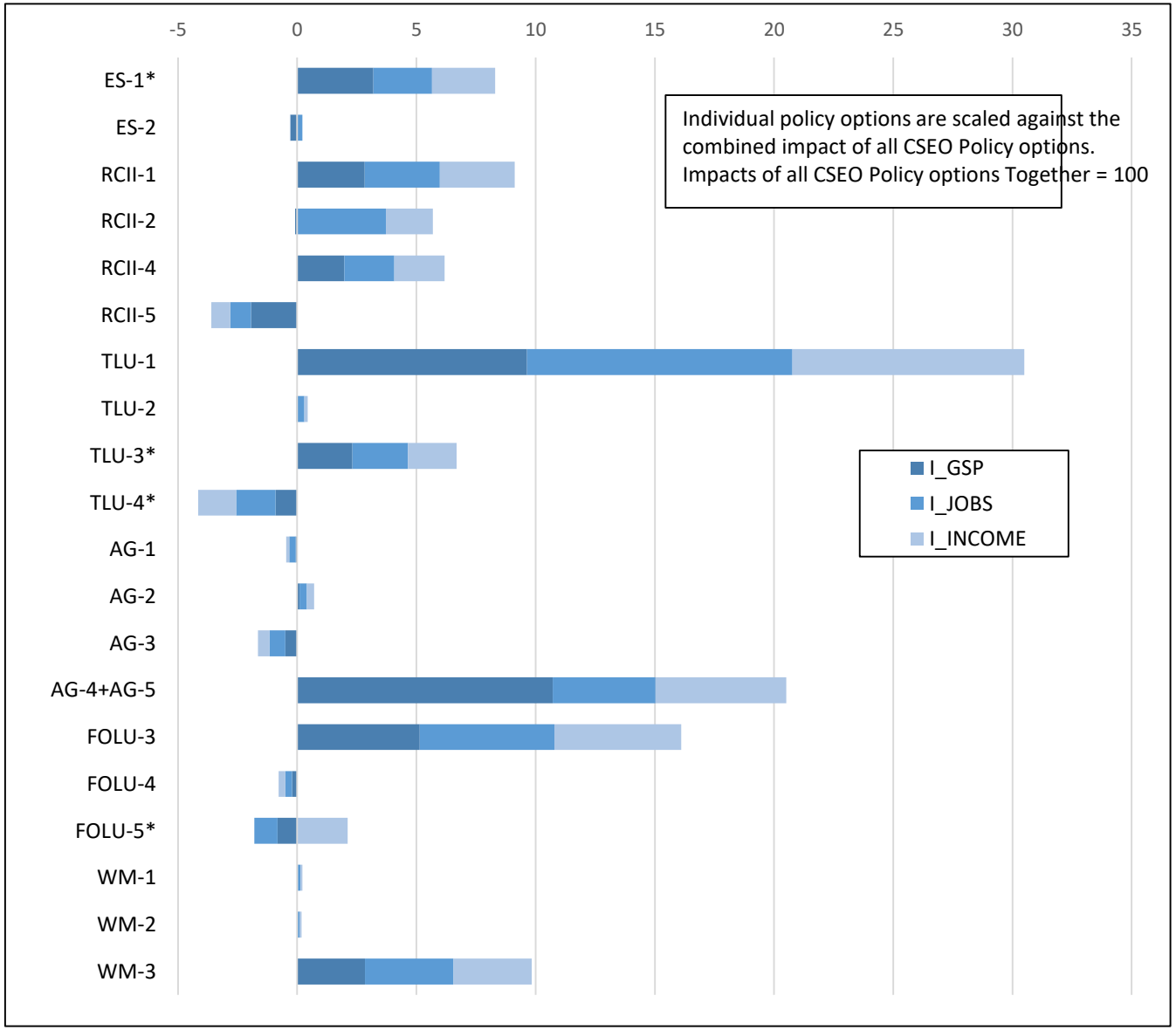
Direct and macro-economic impacts

Table 5. Impacts of 23 Stakeholder Recommended, Sector Based Climate and Energy Policy Options on the U.S. Economy – Stakeholder Target Proposals

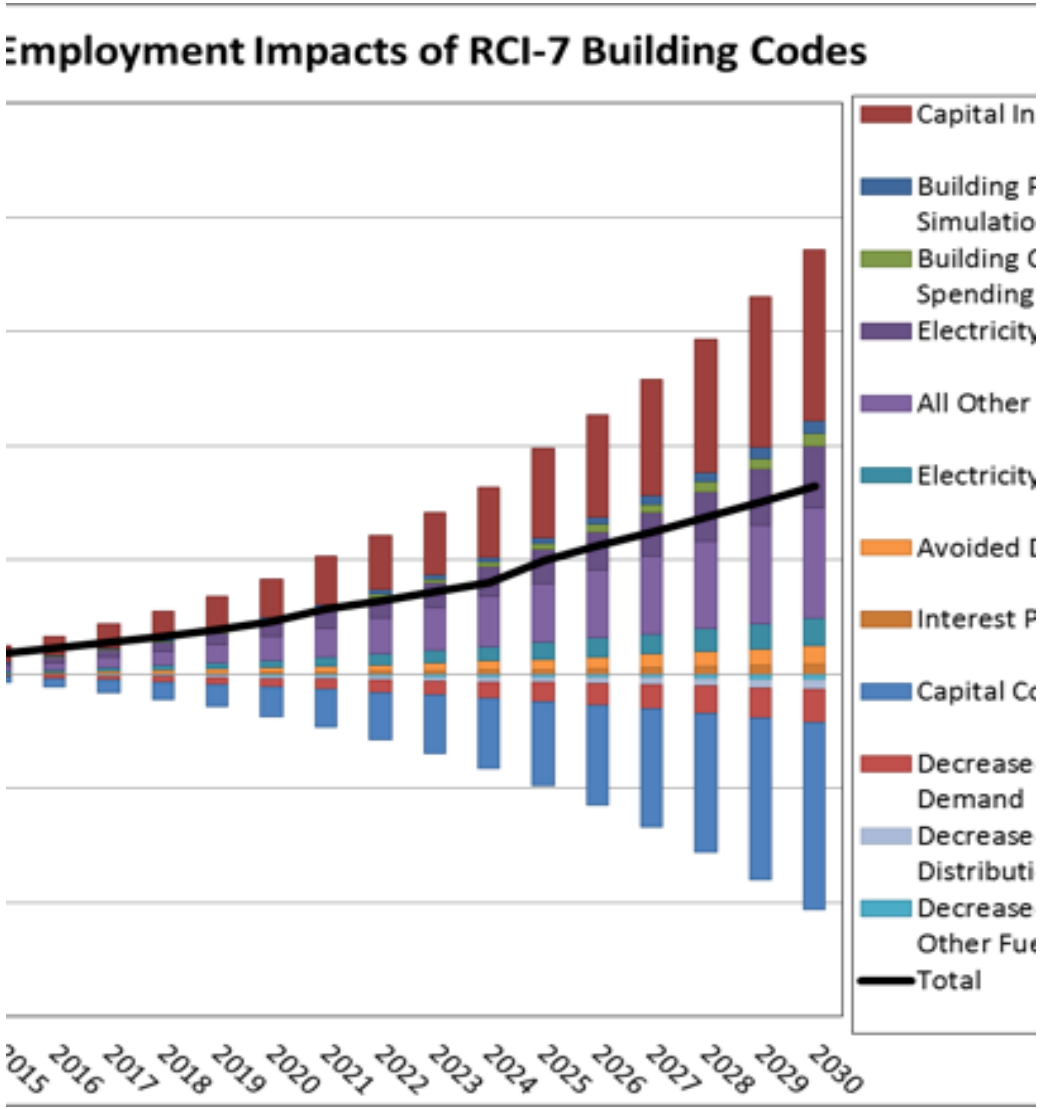
Sector	Climate Mitigation Actions	2020 Annual GHG Reduction ($MMtCO_2e$)	Cost or Cost Savings per ton GHG Removed ($)	2020 Annual Cost or Cost Savings (Million $)	2020 Net Employment Impact (Thousands)	2020 GDP Impact (Billions $)	Impact on GDP 2010–2020 NPV (Billions $)
AFW–1	Crop Production Practices to Achieve GHG Benefits	65.01	–$15.69	–$1,020	87.7	$3.83	$14.73
AFW–2	Livestock Manure – Anaerobic Digestion and Methane Utilization	19.25	$11.27	$217	–0.9	–$0.14	–$0.49
AFW–3	Forest Retention	39.21	$39.38	$1,544	71.2	$0.40	$2.90
AFW–4	Reforestation/Afforestation	178.77	$33.18	$5,932	–117.8	–$9.32	–$61.84
AFW–5	Urban Forestry	39.96	$15.35	$613	505.3	$4.58	$33.77
AFW–6	MSW Source Reduction	147.09	–$3.20	–$471	25.7	$2.13	$8.73
AFW–7	Enhanced Recycling of Municipal Solid Waste	249.27	$13.39	$3,339	114.4	$8.74	$43.44
AFW–8	Landfill Gas Management	48.38	$0.34	$17	94.0	$8.79	$22.28
Agriculture, Forestry, Waste Management (AFW) Totals		786.96	$12.76	$10,170	779.5	$19.01	$63.52
ES–1	Renewable Portfolio Std.	508.39	$17.84	$9,071	–58.6	–$4.50	–$29.90
ES–2	Nuclear	300.77	$26.98	$8,116	–73.3	–$5.77	–$6.85
ES–3	Carbon Capture Sequestration/Reuse	130.23	$32.92	$4,287	–35.4	–$3.76	–$13.95
ES–4	Coal Plant Efficiency Improvements and Repowering	151.05	$12.95	$1,956	1.1	$0.40	$0.72
Energy Supply (ES) Totals		1090.45	$21.49	$23,430	–166.3	–$13.63	–$49.98
RCI–1	Demand Side Management Programs	424.80	–$40.71	–$17,293	886.2	$75.80	$256.78
RCI–2	High Performance Buildings (private and public)	193.88	–$24.99	–$4,845	183.3	$10.20	$33.79
RCI–3	Appliance standards	80.86	–$53.21	–$4,302	25.1	$0.04	–$0.36
RCI–4	Building Codes	161.08	–$22.86	–$3,682	181.1	$11.49	$41.29
RCI–5	Combined heat and power	136.37	–$13.18	–$1,798	–127.9	–$17.82	–$87.86
Residential, Commercial and Industrial (RCI) Totals		996.98	–$32.02	–$31,919	1,147.8	$79.70	$243.64
TLU–1	Vehicle Purchase Incentives, including rebates	103.07	–$66.37	–$6,841	179.5	$13.90	$33.37
TLU–2	Renewable Fuel Standard (biofuels goals)	92.34	$57.14	$5,277	–25.2	–$4.02	–$14.38
TLU–3	Smart Growth/Land Use	71.04	–$1.11	–$79	165.7	$5.18	$16.45
TLU–4	Transit	27.05	$16.72	$452	52.2	$0.99	$2.07
TLU–5	Anti–Idling Technologies and Practices	33.82	–$65.19	–$2,205	16.7	$1.62	$2.49
TLU–6	Mode Shift - Truck to Rail	36.85	–$91.56	–$3,374	40.9	$5.63	$2.46
Transportation and Land Use (TLU) Totals		364.17	–$18.59	–$6,771	429.8	$23.30	$42.47
23 Policy Totals (summation)		**3238.56**	**–$1.57**	**–$5,090**	**2,191**	**$108.38**	**$299.64**
Stakeholder Recommendations Scenario Results (simultaneous)		**3238.56**	**–$1.57**	**–$5,090**	**2,524**	**$134.34**	**$342.37**
Stakeholder Recommendations w/Cap & Trade + trans. fuel fee		**3238.56**	**–$1.57**	**–$5,090**	**2,807**	**$154.70**	**NA**

Notes on next page

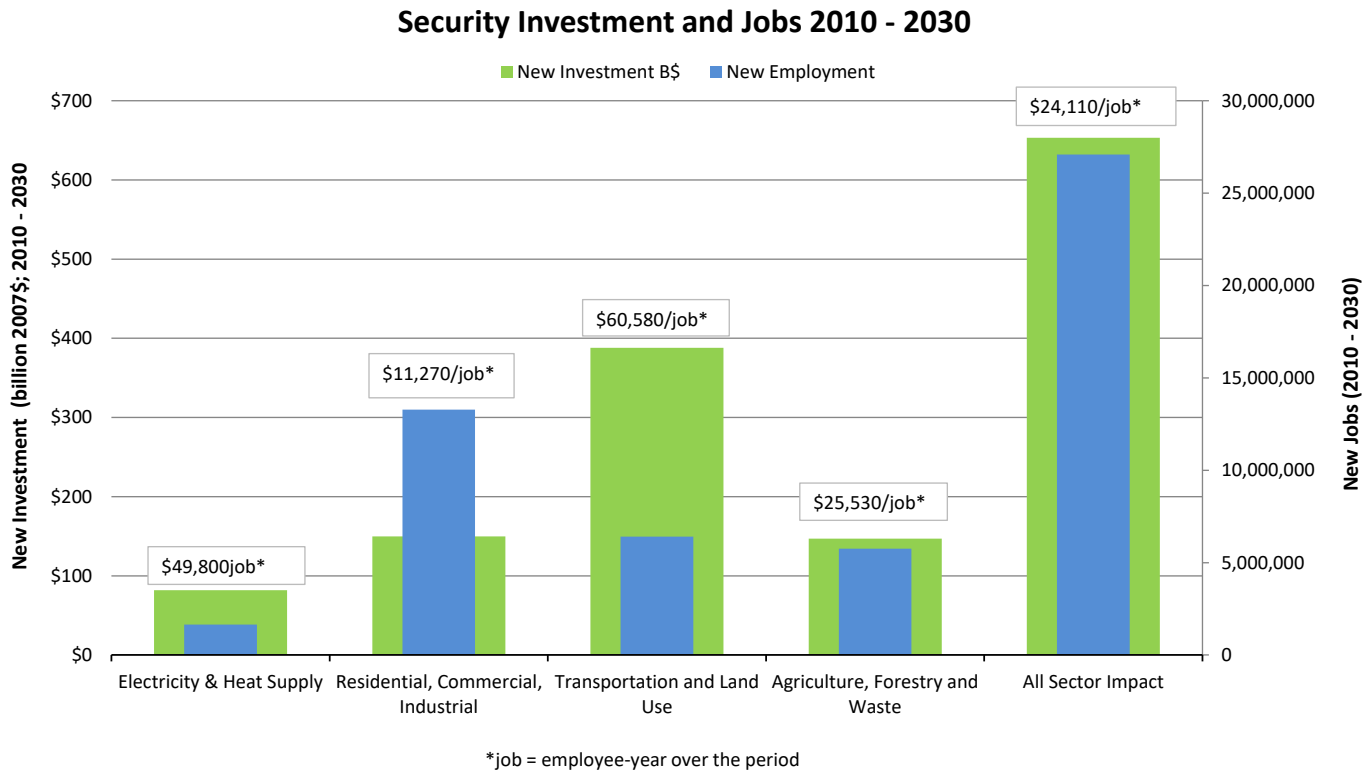
Comprehensive climate action plans



Deep dives into policies and programs



Return on investment for economic development



Benchmarking policies and programs

Sector	Name of State Climate Action/Policy	GHG Mitigation Potential	Cost Effective-ness	Speed to Implement	Leveraging Potential	Job Creation Potential	Funding Class
RCI-1	Non-Utility Incentives and Funds To Promote Renewable Energy and Energy Efficiency Including Demand-Side Management (DSM) Energy Efficiency Programs for Electricity, Natural Gas, Propane, and Fuel Oil	M	M	F	H	H	grant, tax incentive
RCI-2	Energy Efficiency Improvement in Existing Buildings, with Emphasis on Building Operations	M	H	F	H	H	grant
TLU-15	Encourage Low Rolling Resistance Tires and Promote Proper Tire Inflation	L	H	F	H	M	grant, tax incentives
RCI-13	Lead-by-Example Government Buildings, Facilities and Operations	M	H	F	L	M	grant
TLU-17	Heavy-Duty Vehicle Emissions Standards and Retrofit Incentives	L	H	F	M	H	grant, tax incentives
RCI-8	High GWP Reductions from Stationary Sources	M	H	F	M	H	grant
RCI-14	Market Transformation and Technology Development Programs	M	H	F	M	H	financial instrument, grant
RCI-15	Residential, Commercial, and Industrial Energy and Emissions Technical Assistance and Training and Education for Building Design, Construction, and Operation	M	H	F	M	H	grant
TLU-20	Idle Reduction/Elimination Policies	M	H	F	M	H	grant
CC-3	Developing emission inventories	NQ	NQ	F	M	H	grant
CC-4	Local Climate Action Plans	NQ	NQ	F	M	H	grant
AFW-3	Urban Forestry Programs	M	H	F	M	M	grant
AFW-9	Improved Agricultural Management Practices	M	H	F	M	M	grant
TLU-16	Driver and Consumer Education	NQ	NQ	F	M	M	grant

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The Great Recession or progressive energy policies? Explaining the decline in US greenhouse gas emissions forecasts

Hal T. Nelson, David von Hippel, Tom Peterson & Roman Garagulagian

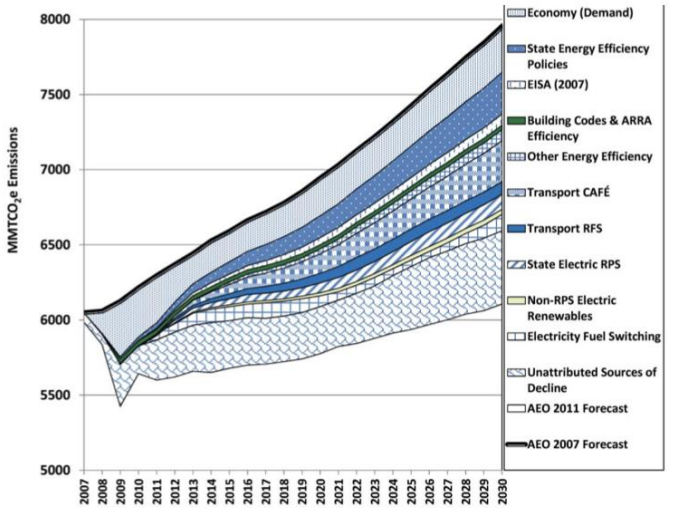
To cite this article: Hal T. Nelson, David von Hippel, Tom Peterson & Roman Garagulagian (2015): The Great Recession or progressive energy policies? Explaining the decline in US greenhouse gas emissions forecasts, Journal of Environmental Planning and Management, DOI: 10.1080/09640568.2015.1017042

To link to this article: http://dx.doi.org/10.1080/09640568.2015.1017042

After the fact policy review

Table 5. Contribution of the sources of GHG emissions declines.

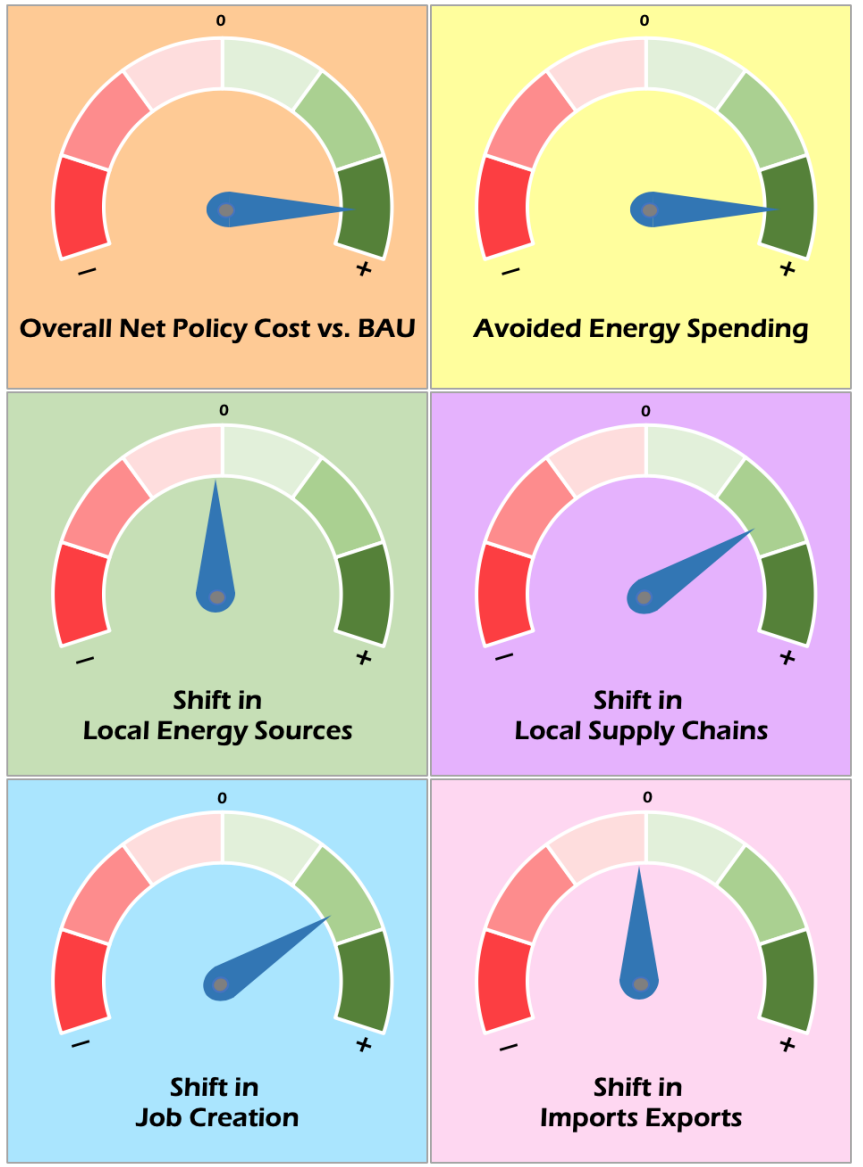
Source	2020	2030	Source
Economy (demand)	22%	18%	Tables 2 and 3 for Base model
Electricity fuel switching	6%	6%	Section 4.2.1 and Online Appendix
State electric RPS	6%	5%	Section 4.2.1 and EIA (2008, 2009a)
Non-RPS electric renewables	2%	2%	Section 4.2.1 and US EIA reports
Transport RFS	6%	5%	Section 4.2.4 and EPA (2010b)
Transport CAFÉ	11%	15%	Section 4.2.4 and EPA (2010a)
Building codes and ARRA efficiency	2%	2%	Section 4.4.2 and EIA (2009b)
EISA (2007)	4%	4%	Section 4.4.2 and ACEEE (2008)
State energy efficiency portfolio standards	12%	15%	Section 4.4.2 and ACEEE (2011), EIA (2011)
Autonomous energy efficiency (Buildings)	3%	4%	Section 4.4.2 and Table 4 (buildings)
Unattributed sources of decline	27%	26%	Unattributed reductions from above analyses



* Abbreviations: RPS = Renewable Portfolio Standards, ARRA = American Recovery and Reinvestment Act, EISA = Energy Independence and Security Act (of 2007), CAFÉ = Corporate Average Fuel Economy

Figure 2. Time series of relative contributions to declines in AEO forecasts of US GHG emissions. (See online colour version for full interpretation.)

Macro-economic indicators



Mato Grosso – Net Zero Pathways

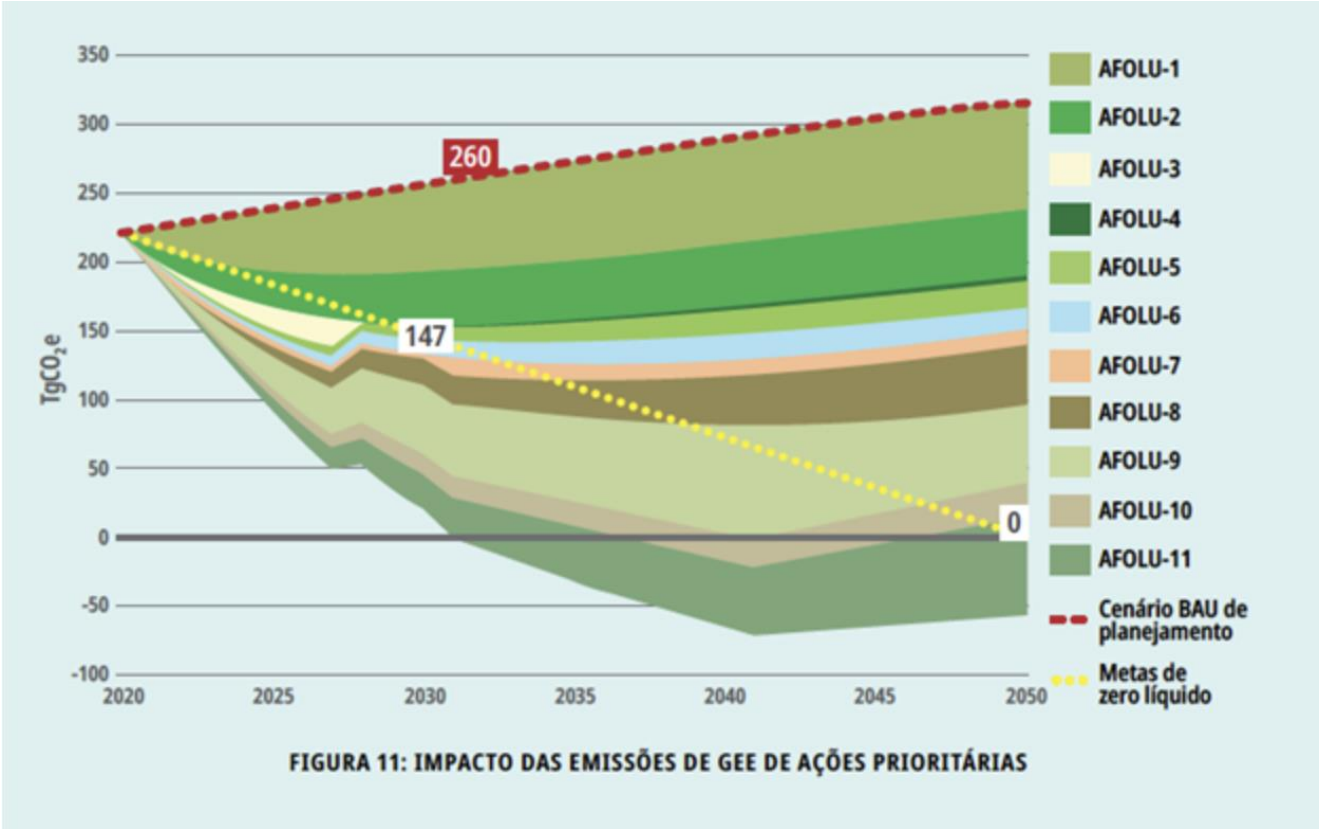


FIGURA 11: IMPACTO DAS EMISSÕES DE GEE DE AÇÕES PRIORITÁRIAS

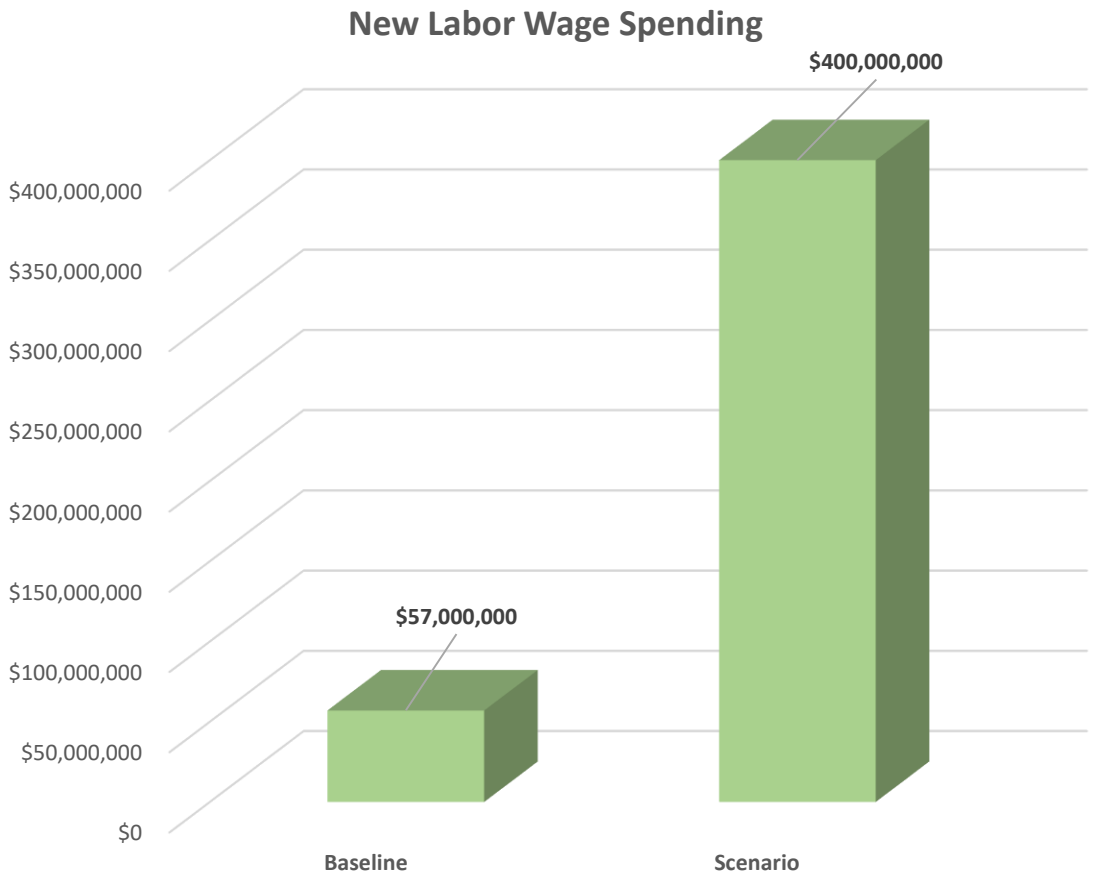
Mato Grosso – Net Zero Pathways

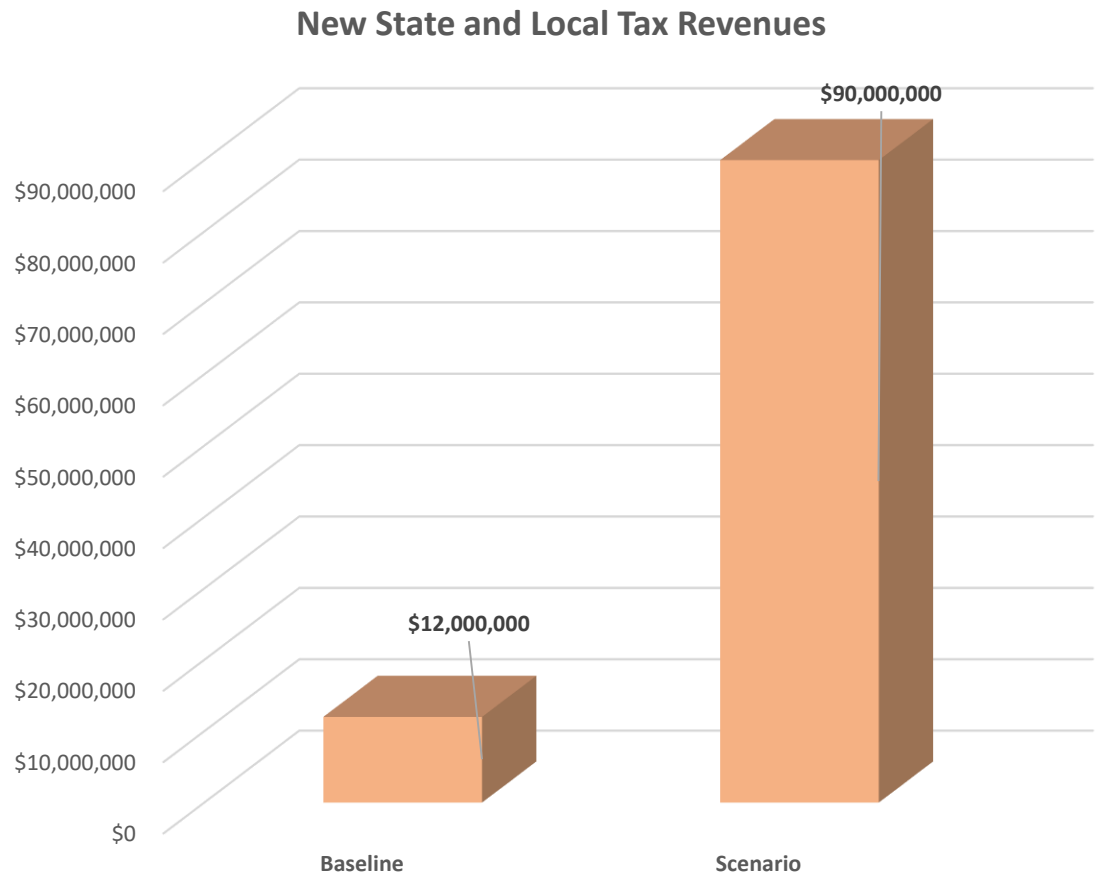
	Custos líquidos mais baixos	Mudança no consumo de energia e recursos	Mudança nas fontes de energia e recursos locais	Mudança nas cadeias de suprimentos locais	Criação de emmprego	Mudanças nas fontes de investimento e renda
1. Manutenção do ativo florestal	–	+	+	+	+	+
. Manejo florestal sustentável	+	–	+	+	+	+
I-3. Regularização fundiária	–	+	+	+	+	+
AFOLU-4. Criação, liação, e melhoria da gestão de Áreas Protegidas	–	+	+	+	+	+
AFOLU-5. Reflorestamentos comerciais	+	–	+	+	+	+
6. Restauração da aisagem florestal	–	–	+	+	+	+
. Redução do risco incêndio florestal	–	+	+	+	+	+
U-8. Boas práticas ejo ag-ropecuário (BPA)	+	+	+	+	+	+
LU-9. Proteção da etação secundária	–	+	+	+	+	+
). Recuperação de agens degradadas	+	+	+	+	+	+
LU-11. Integração Pecuária-Floresta (ILPF)	+	–	+	+	+	+

0 Neutral – Negativo

FIGURA 16: RESUMO DA AVALIAÇÃO MACROECONÔMICA DAS AÇÕES PRIORITÁRIAS.

Local economic and fiscal impacts (Maryland utility scale solar)





Thank you!

Tom Peterson

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Regional Economic Models, Inc.

February 10, 2022

Introduction to REMI E3+

Presented by:
Peter Evangelakis, Ph.D., *VP Economics and Consulting*
Nina Mantegna, *Associate*
Haozheyi Guan, *Analyst*

Agenda

Current Policy Issues

- *Infrastructure Bill and Build Back Better*

Economic Modeling and Environmental Policy Issues

REMI E3+ Model Introduction

E3+ Features

Live Demonstration of E3+ and its capabilities

Current Policies

- $1 trillion Infrastructure Bill put into Law in 2021
- Estimated to add an average of **700,000 jobs per year** for next **10 years**
- Largest federal investment in public transit in US History
- Invests $65 billion in Broadband Infrastructure for high speed internet access
- Investment in resiliency related to climate related disaster events
- Potential Budget Reconciliation Efforts to move along Build Back Better Framework

Current Policies

Increase in use of offshore wind energy

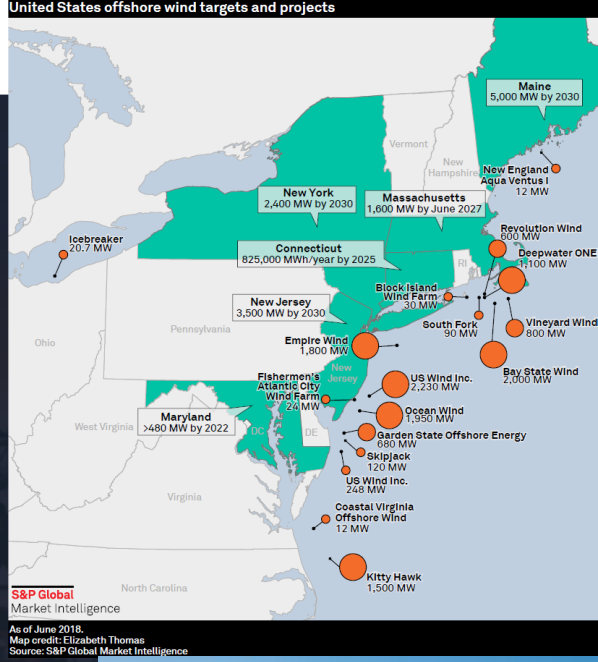
- Biden Administration's goal of doubling use by 2030 to 30 gigawatts

$1.7 trillion Build Back Better Package on pause in the Senate

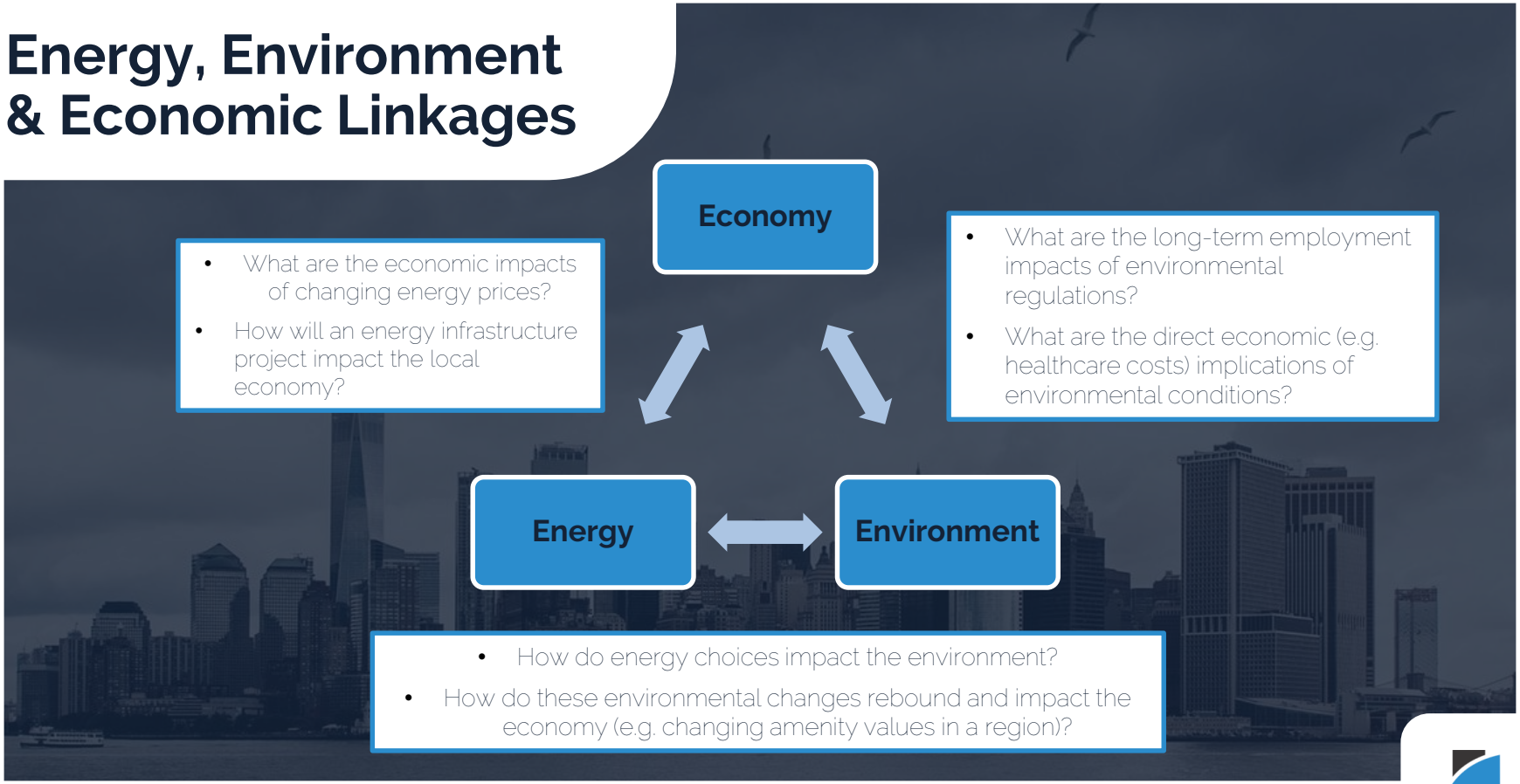
Executive Order Signed on 12/13/21 for

- 100% of vehicles sold to be EVs by 2035
- 100% Carbon-free electricity by 2030
- Achieve Net-Zero Emissions by 2050

Biden Speech at COP26 highlighted Administration's push for reducing greenhouse gas emissions by 50% by 2030



Energy, Environment & Economic Linkages



What is E3+?

E3+ is the premier software solution for analyzing the macroeconomic and demographic impacts of any initiatives related to the energy and environmental sectors.

Decision-makers depend on E3+ to provide comprehensive evaluations of the total economic impact of altering electric rates, introducing new power sources, investing in the production of energy, and other policy changes.

Model Methodology

REMI's 35-year history of rigorous academic research and software development has led to the development of the industry standard in macroeconomic research methodology:

General Equilibrium

Input-Output

Econometrics

Economic Geography

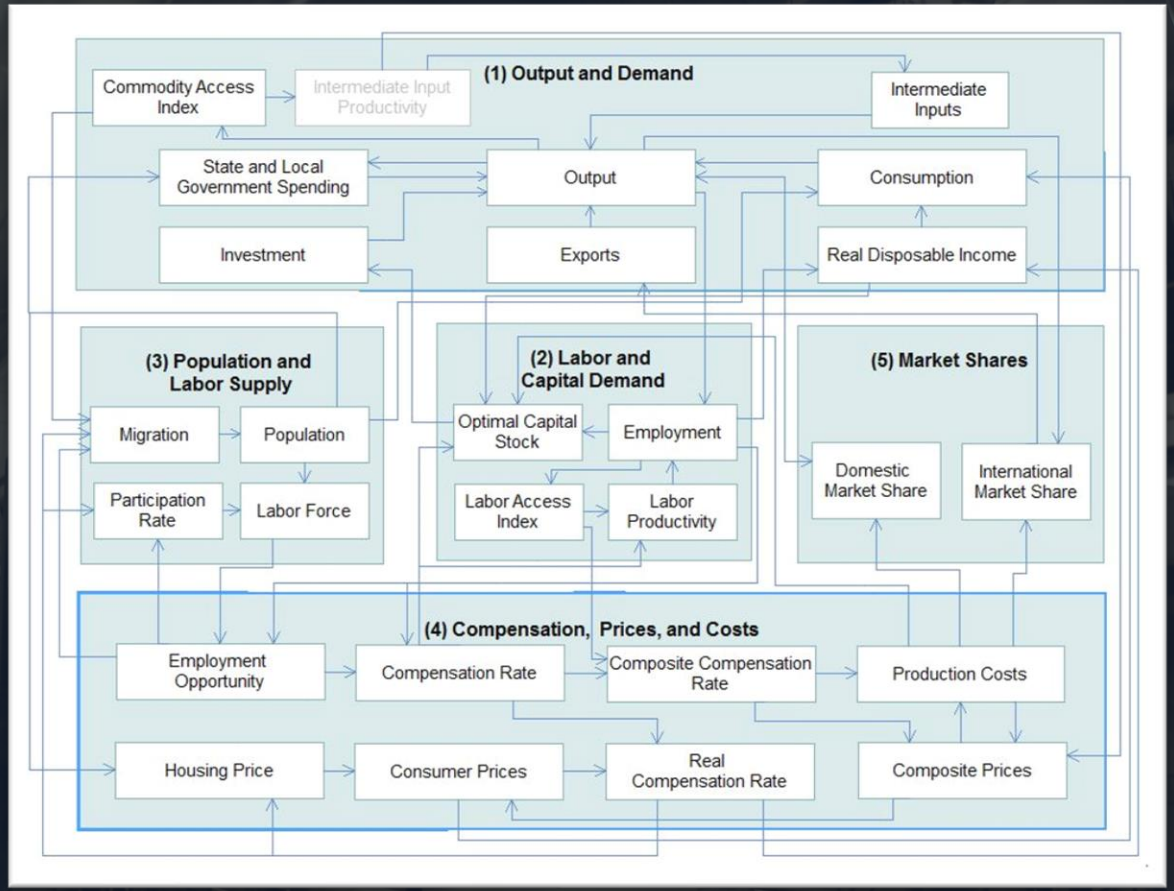
Integrated REMI economic modelling approach

Our clients include:

- National Grid
- AECOM
- FTI Consulting, Inc.
- Sandia National Laboratories
- Arizona State University
- University of Colorado Boulder

E3+

Model Structure



Key Advantages of E3+

Energy Consumption and Emissions Module

Energy Consumption and CO_2 Impacts of a policy, allowing for analyses related to Dynamic Carbon Footprint and Fuel Switching

Carbon Tax Scenarios

Social Cost Policy Variable

Policy variable capturing regional amenity variable associated with 4 types of emissions

Detailed profiles for construction and operations and maintenance of power generation facilities

Includes coal, natural gas, nuclear, solar, onshore, and offshore wind

Key Advantages of REMI SEI

A systematic solution that can measure the core socioeconomic implications of programs and practices to quantify and measure progress for all groups:

Employment
- Employment by Race
- Employment by Gender
- Employment by Education, Doctoral, or Professional Degree
- Employment by Industry Quintile
- Employment by Occupation Quintile

Participation
- Participation Rates by Race
- Participation Rates by Gender
- Unemployment Rate
- Income by Quintile

Compensation
- Compensation Rate by Industry Quintile
- Compensation Inequality Coefficient
- Consumption Price by Income Quintile
- Personal Income per Capita

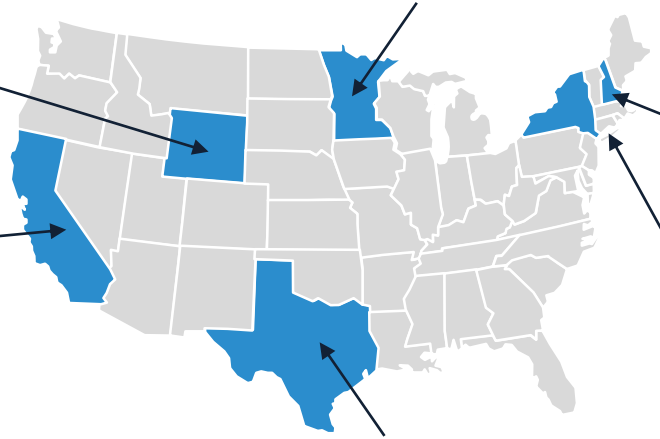
REMI SEI

Model Applications

Wyoming: Impacts of the ZEPHYR power transmission line

Minnesota: Minnesota Utility Economic Impact Study

New Hampshire: Merrimack Valley energy reliability project



California: Impacts of CAFE emissions standards

NYC: Energy Efficiency Programs analysis (NYSERDA)

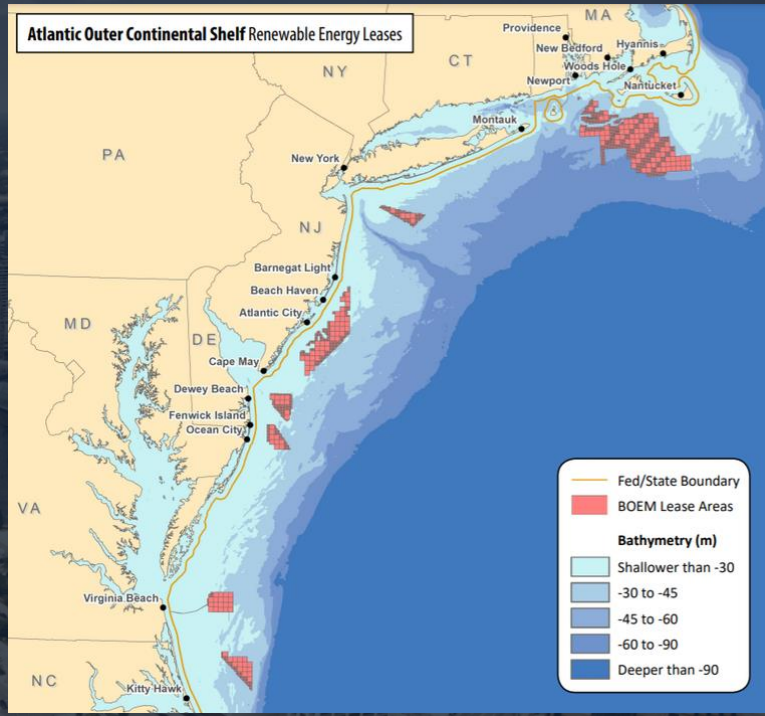
Texas: Coastal Texas Protection and Restoration Feasibility Study

Model Demonstration: Offshore Wind

Simulation: Economic impact of a potential offshore wind farm in the Gulf of Mexico on the Southeast Region

Background Information

- 30 Gigawatts of Offshore Wind by 2030, to constitute 2% of utility-scale energy capacity
  - Goal is supported by federal tax incentives, recent sustainability investment of $13.5 million
  - In 2020, NOWRDC awarded $10.3 million to 12 projects
- BOEM has undertaken pre-leasing evaluations in the Pacific, and solicited interest in potential offshore wind development in the Gulf of Mexico region
- 2021 saw an increase in the leasing of offshore wind off the Northeast Coast



E3+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