# UNDERSTANDING ENVIRONMENTAL IMPACTS WITH E3+

Presented By: Leon Zhang, Economist

*what does REMI say?* sm

# Agenda

- ☐ Introduction

- ☐ Overview of E3+

- ☐ Model Demonstration

- ☐ Q & A

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# About REMI

## Regional Economic Models, Inc. (REMI) is a World Leader in Economic Policy Modeling

### Software

- REMI PI+ is the **state of the art** for policy analysis.
- Other Customized Models
  - **TranSight**
  - **Tax-PI**
  - **E3+**

### Support

- REMI licenses include **unlimited** telephone and email technical support.
- REMI users have access to vast resources to enhance their understanding and skill in the model.

### Services

- Macroeconomic impact consulting
- Analysis of prominent state and federal legislation
- Led by REMI's team of highly experienced and qualified research economists

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# About REMI

**Answers to "what-if…?" questions about the economic and demographic effects of events and policies**

- **Economic Results:**
  - Employment by Industry and/or by Occupation
  - Output by Industry
  - Gross Regional or State Product
  - Personal Income
  - Total wages, compensation, earnings
- **Demographic Results:**
  - Population, by 808 age-ethnicity-gender cohorts
  - Migration, by 808 age-ethnicity-gender cohorts

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# 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**

Regionalized inter-industry relationships

**General Equilibrium**

Understanding how supply and demand affects markets over time

**Econometrics**

Behavioral responses to a changing economy

**Economic Geography**

Effects of geographic concentration of labor and industry

**Integrated REMI economic modeling approach**
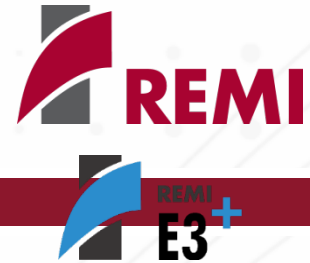
# Dynamic Analysis
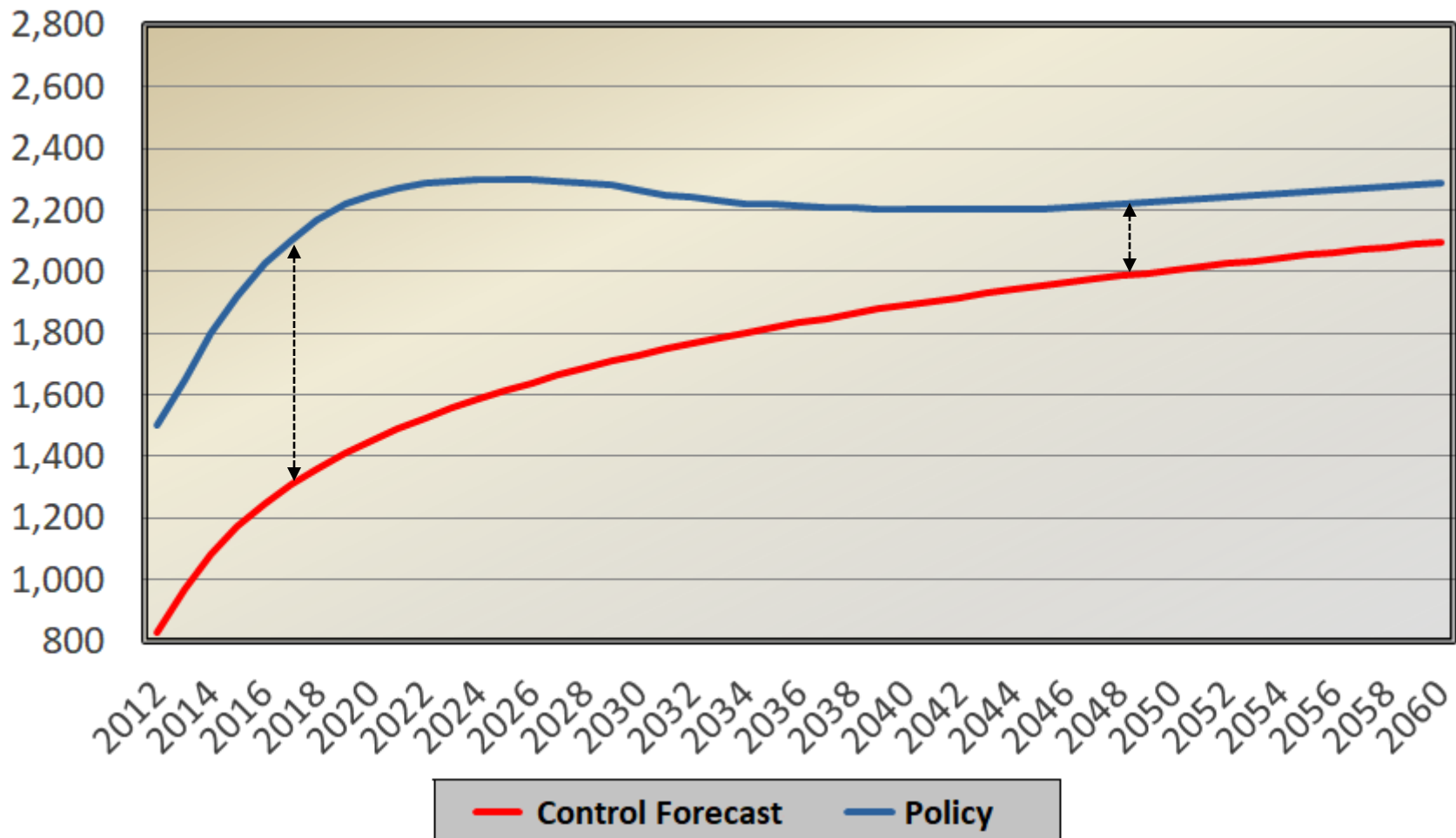
# Introduction to E3+

*REMI E3+ was designed to capture a more complete set of the linkages between the energy sector, the environment, and the broader economy*

- ☐ <u>Who</u> it's meant for:
    - ◻ Utilities
    - ◻ State energy research departments
    - ◻ Consultants
    - ◻ Environmental regulators

- ☐ <u>What</u> it's meant for:
    - ◻ Integrated resource planning/energy policy
    - ◻ Energy efficiency/technology regulation
    - ◻ Air quality planning
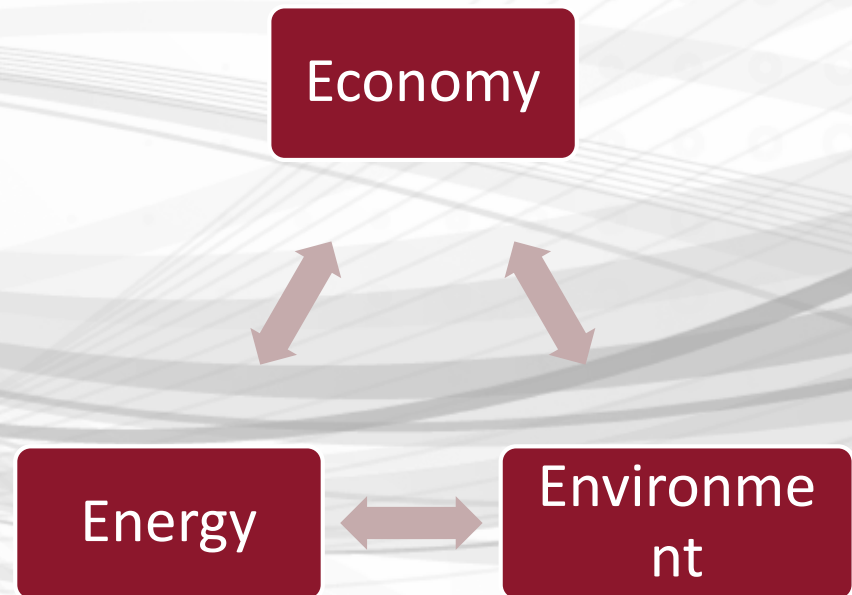
**Energy, Environment, and the Economy: E3+**



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# What is E3+?

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

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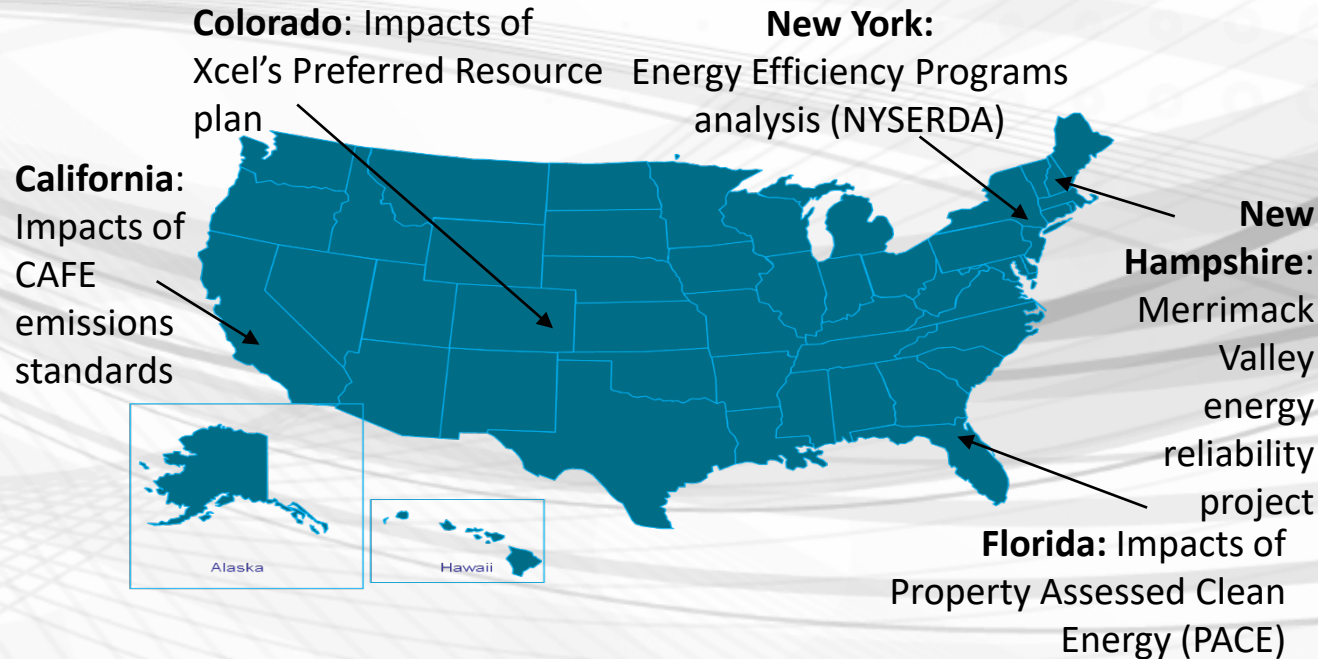
# Foundations for Energy and Environmental Analysis

**REMI**

## E3+ builds on extensive experience analyzing the macroeconomic impacts of energy and environmental policies

**REMI PI+ features for energy/environment**

- Fuel costs, spending
- Consumption reallocation
- Estimating local sourcing of inputs through trade flows

*Now, in E3+…*

**Colorado**: Impacts of Xcel's Preferred Resource plan

**New York:** Energy Efficiency Programs analysis (NYSERDA)

**California**: Impacts of CAFE emissions standards

**New Hampshire**: Merrimack Valley energy reliability project

Alaska

Hawaii

**Florida:** Impacts of Property Assessed Clean Energy (PACE)

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# Aspects Unique with E3+

*REMI E3+ includes functionality to make energy and environmental analyses more comprehensive and more accessible to non-energy or environmental users*

1. Construction and O&M Profiles for natural gas, solar, on/off-shore wind, coal and nuclear power plants
2. Energy Consumption and Carbon Dioxide Emissions Module
3. Emissions cost policy variable associated with five types of emissions
4. Resilience Module
5. Carbon Tax scenario
6. Allows for integration with third-party energy models

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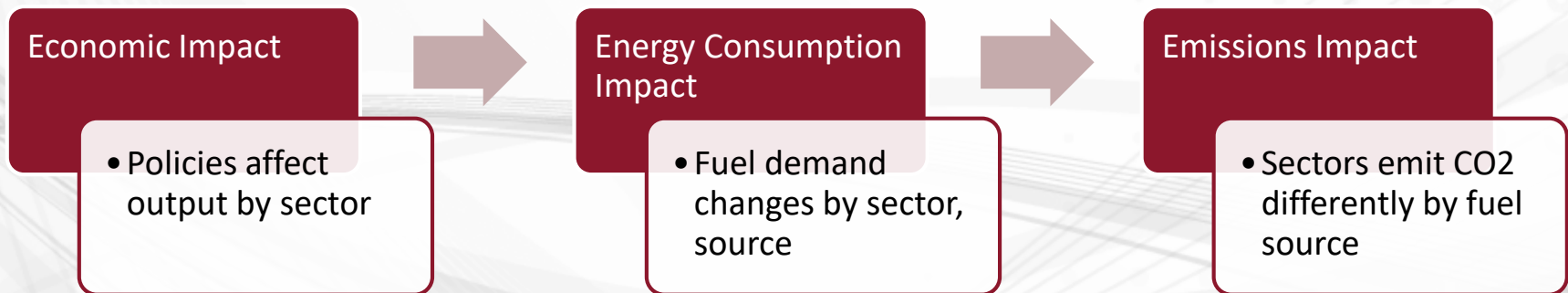
# Custom Variables in the E3+ Model



- ☐ The model provides custom **construction and operations and maintenance** profiles of electrical power plants
  - ☐ Previously, clients needed this from operators or third party sources, hard to get

- ☐ Based on studies and data from several sources, including:
  - ☐ National Renewable Energy Laboratory
  - ☐ Energy Information Administration

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

# REMI E3+ Energy/Emissions Module

| Economic Impact | | Energy Consumption Impact | | Emissions Impact |
|---|---|---|---|---|
| • Policies affect output by sector | → | • Fuel demand changes by sector, source | → | • Sectors emit CO2 differently by fuel source |

Uses EIA data to generate parameters that are applied to economic impact results

1. BTUs consumed by sector and source
2. $CO_2$ emissions by sector and source
3. Residential, Industrial, Commercial, and Transportation sectors

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# REMI E3+ Emissions Costs

**Emissions affect the environmental and human health of a region, making it a more or less attractive place to live**

*E3+ translates changes in emissions into 'amenity value' impacts in a region, driving inward or outward migration*

Emissions costs for five different types of pollutants

1. CO2
2. SO2
3. Nitrogen Oxides
4. PM2.5
5. PM10

Based on data from US Government IWGSCC,

National Academies of Sciences



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# Resilience Loss Reduction Potential

□ E3+ can now produce an automatic calculation discussing resiliency through a forecast's "Resiliency Report"

    ◘ This compares a no-action baseline disaster scenario to a resilience investment scenario

□ The model produces a **Resilience Loss Reduction Potential** figure:

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

Source: *Modeling Economic Resilience to Disasters, Adam Rose and Dan Wei, Sol Price School of Public Policy and Center for Risk and Economic Analysis of Terrorism Events University of Southern California, June 2019*

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# Commonly Utilized Results

(Can be reported by year out to year 2060)

- □ Employment
  - ◘ By industry or grouping of industries
- □ Occupations
  - ◘ By Industry or grouping of industries
- □ Personal Income by type
- □ Industry specific output and value-added
- □ GRP
- □ Population changes

# Model Demonstration