



Integrated E³ Modeling Framework – US9r & NE12

International Resources Group





Related Domestic Multi-Region Models

- ↑ Two previously (IRG) built multi-region domestic MARKAL models
 - ↑ US9r Nine Census Region Model (completed by EPA-ORD)
 - ↑ NE12 State Level Northeast Regional Model (turned over to NESCAUM)
- ↑ Make use of tools and approaches proposed for this project (that will also benefit from SAGE, NEEDS)
- ↑ Offers a starting point for design review and tool development



US9r Nine Census Region Model

- ↑ EPA-ORD model designed to support technology scenario analysis
- ↑ IRG designed and built supply side
 - ↑ Domestic and imported coal, crude oil, gas, ethanol, biodiesel availability and cost
 - ↑ Simplified refinery representation
 - ↑ Trade links for coal, crude oil, gas, and petroleum products
 - ↑ Trade links (grids) for electricity
 - ↑ Renewable resource and technology characterization
- ↑ Data mined from NEMS and processed into MARKAL-compatible framework
- ↑ Possible model for supply-side representation: level of detail to be reviewed as needed
- ↑ Submitted to 3 MARKAL experts for peer review

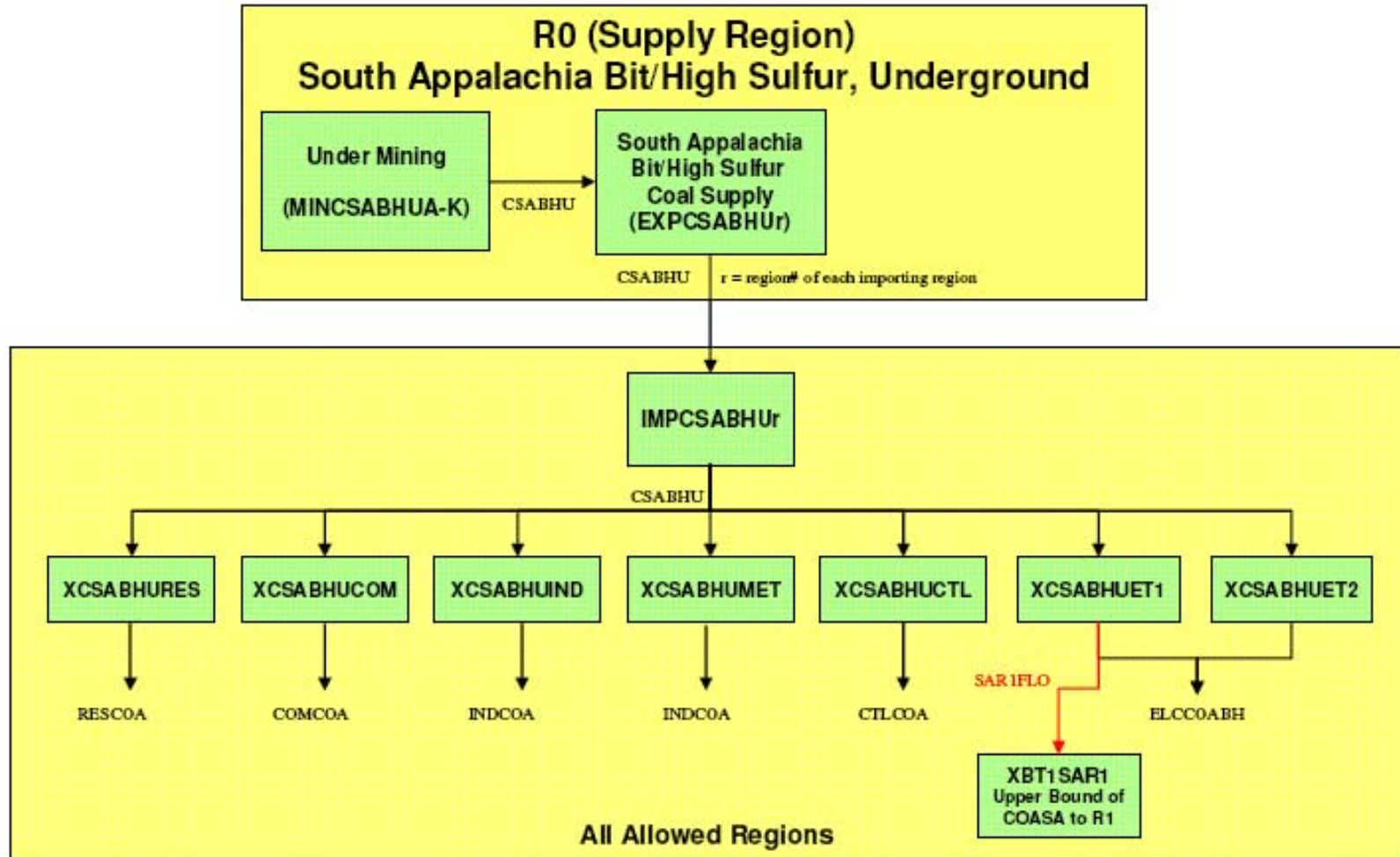


US9r Supply Side Example – Coal

- ↑ **Supply data: 11-step supply curves from 14 supply regions derived from AEO2006 input data**
 - ↑ **40 coal types based on region, sulfur content, and mine type**
- ↑ **Coal types are traded to six sectors in nine census regions using matrix of trade links and differential costs, also from AEO2006 inputs**
- ↑ **Coal carbon, mercury, and sulfur content tracked by type**



US9r – Sample Coal RES Links



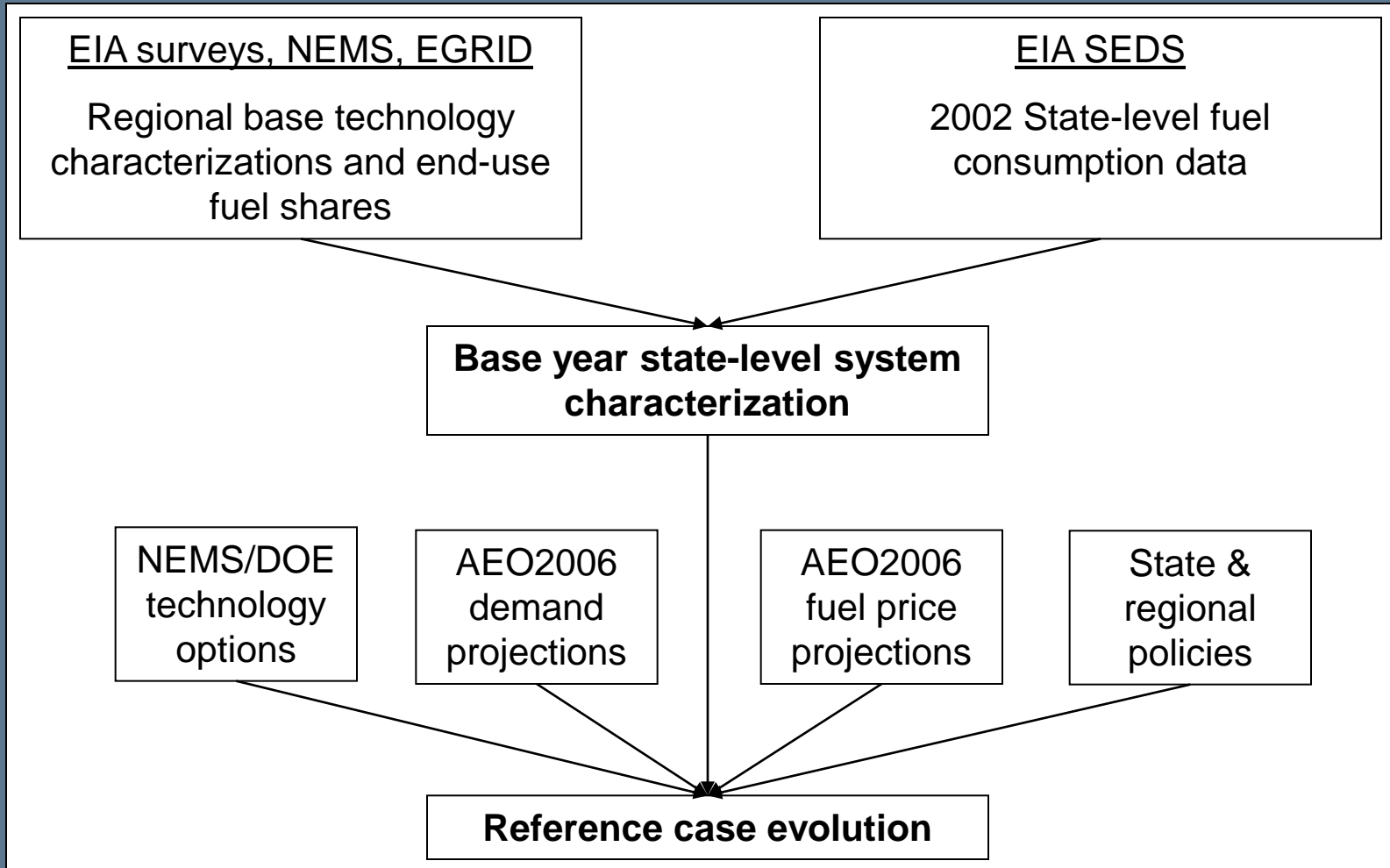


NE12 State Level Regional Model

- ↑ Northeast regional model with eleven states and the District of Columbia
- ↑ Designed and built for Northeast States for Coordinated Air Use Management (NESCAUM) for analysis of regional and state-level greenhouse gas, energy, and emissions policies
- ↑ States are independently represented and linked to trade electricity, emissions permits
- ↑ Supply, power sector, and demand side data mined from NEMS and apportioned to state level using State Energy Data System (SEDS) data
- ↑ Individual power plants down to 25MW represented from EIA data
- ↑ Possible model for power sector and demand side

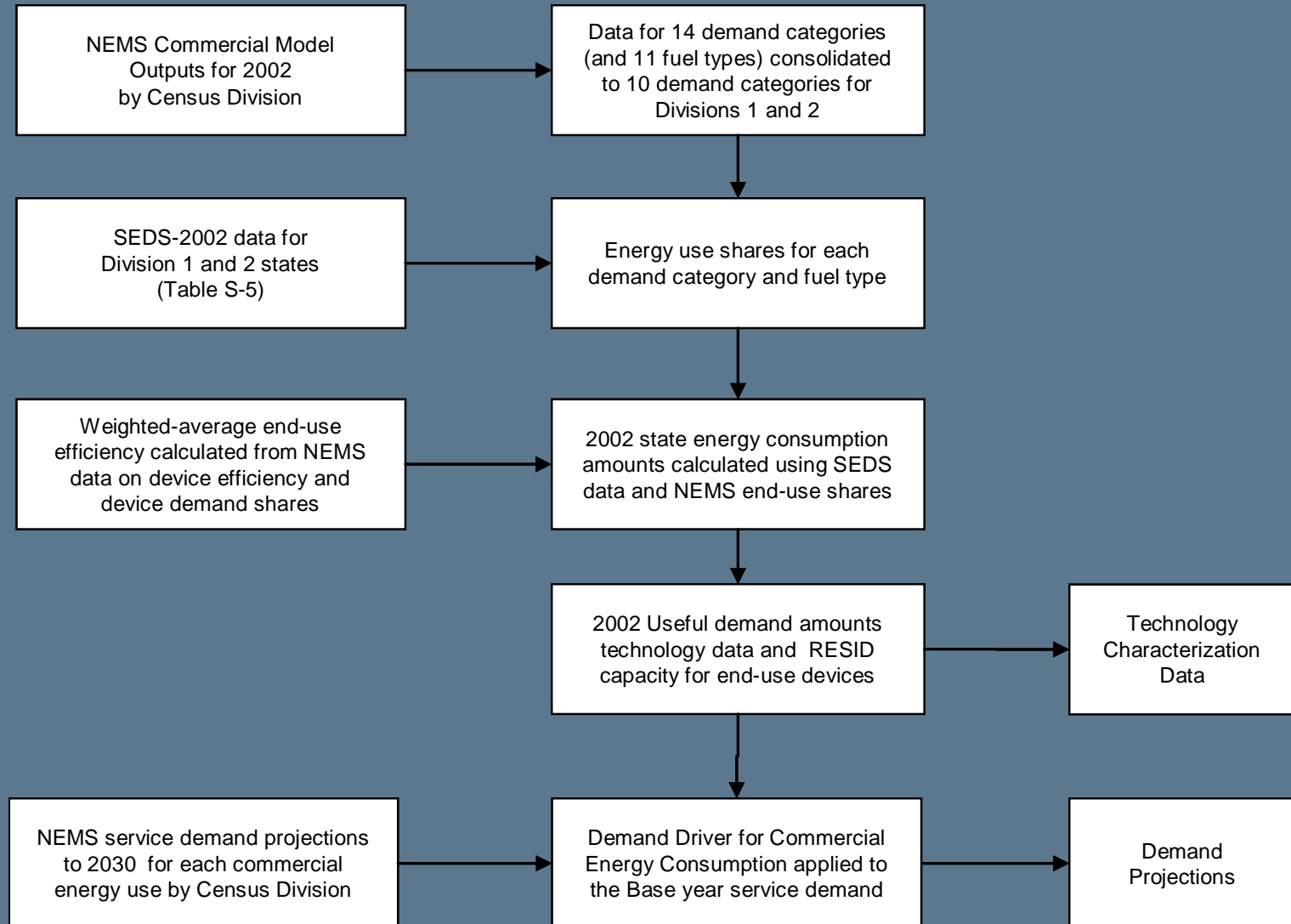


NE12 Data Development Process





NE12 Demand Side Example



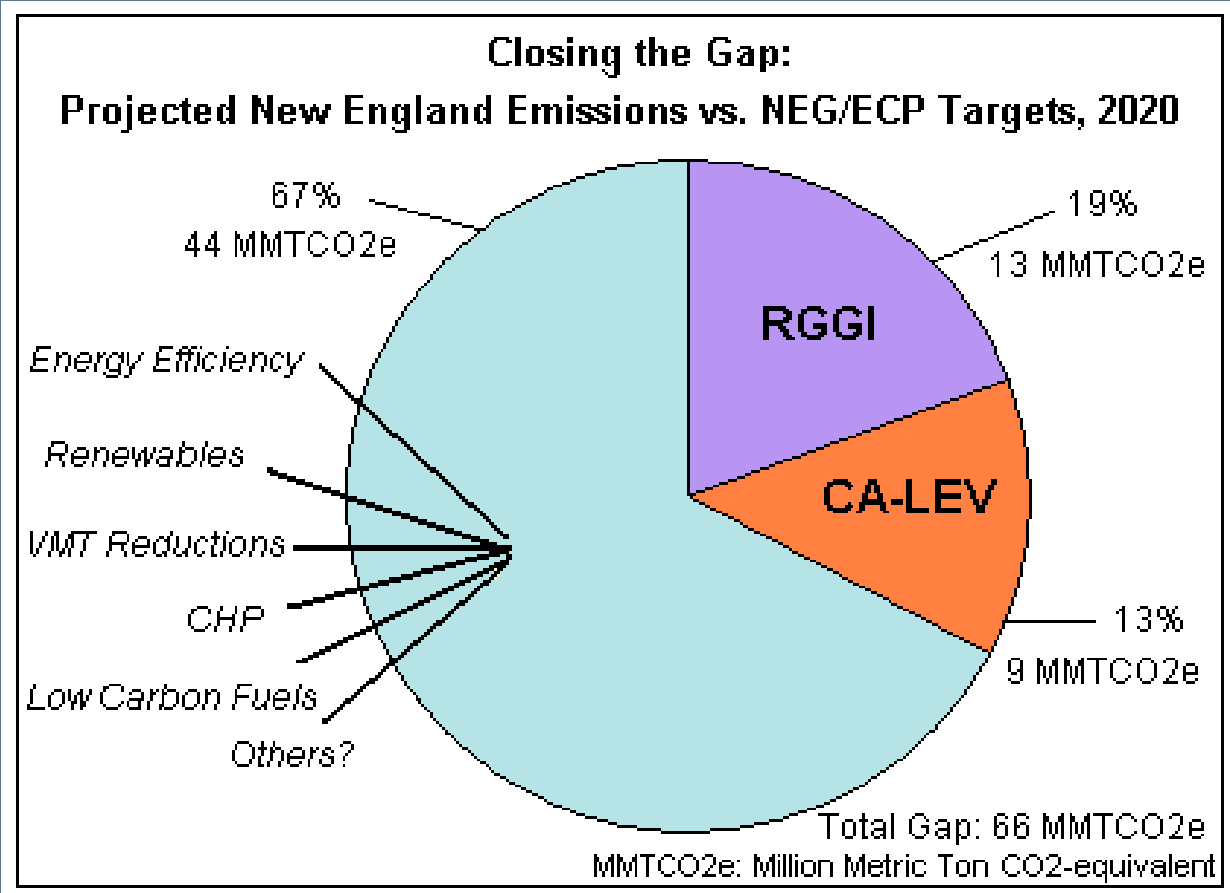


NE12 Analysis – Regional Climate and Energy Modeling

- ↑ NESCAUM’s vision is to use NE12 for a Northeast “wedges analysis” that charts the least-cost pathway for meeting our 2020 and 2050 GHG reduction goals while maintaining AQ standards
- ↑ States are intrigued by NE12 because of its rare capability to handle multiple sectors AND multiple pollutants
- ↑ Links to regional air quality (CMAQ) and economic models (REMI) have already been established
- ↑ Our strategy is to build up our region-specific database through analyses on individual states, policies, and technologies (e.g., MA CHP)
- ↑ This will enable us to eventually do robust, economy-wide modeling for the entire region



Closing the Gap: Using NE12 to Chart a Path to 2020 and 2050





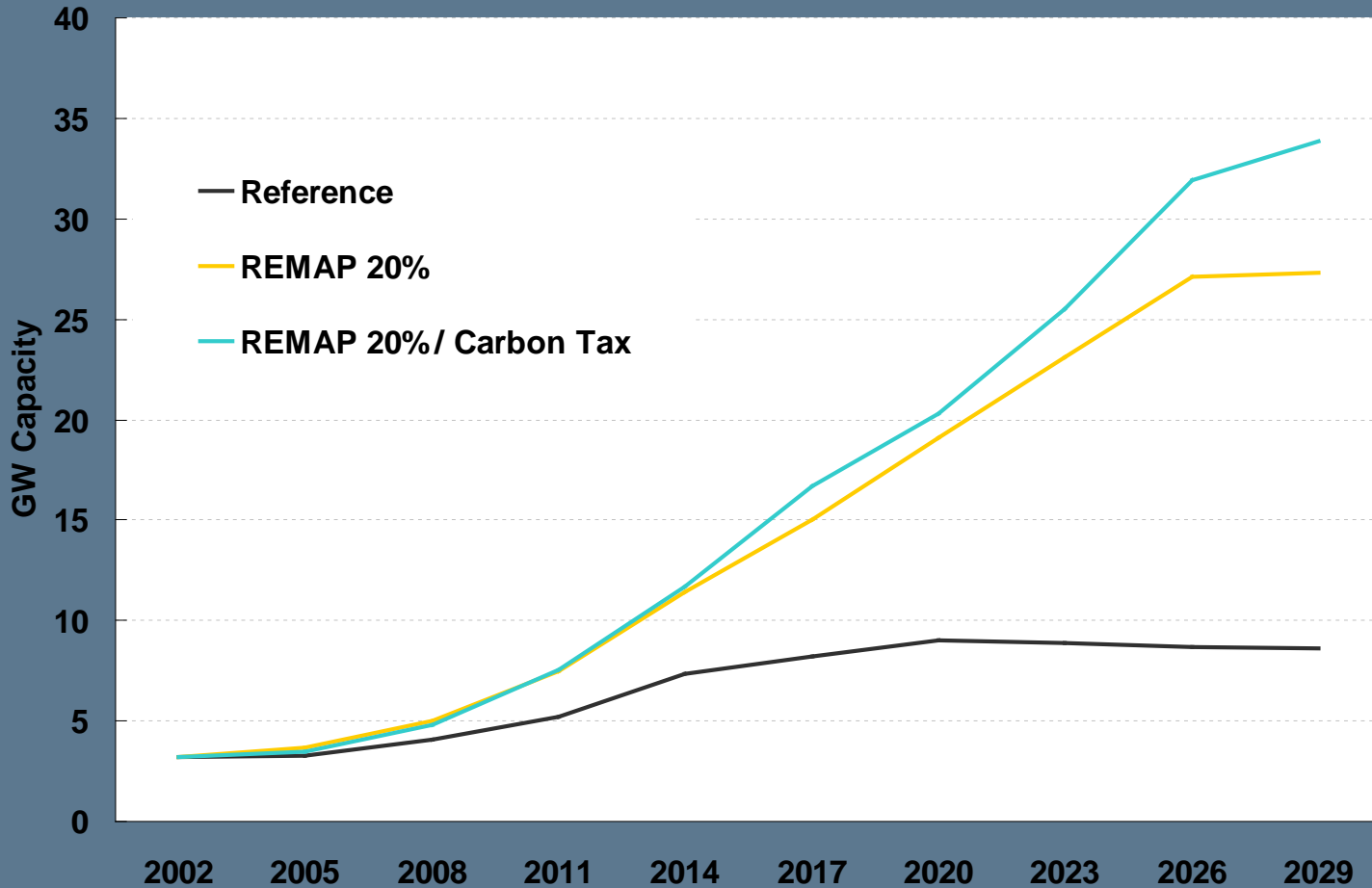
NE12 Analysis Examples

- ↑ **Renewable Energy and Efficiency Analysis Partnership model comparison project (EPA, NREL, DOE)**
 - ↑ **Multi-model comparison of renewable portfolio standard analysis**
- ↑ **Massachusetts Combined Heat and Power**
 - ↑ **Evaluation of the economic potential for greater CHP deployment in MA commercial sector**
 - ↑ **Showed significant GHG reductions and more efficient use of natural gas for power and thermal needs**
- ↑ **Upcoming analyses**
 - ↑ **MA Climate Roadmap: analysis of GHG reference case using MA-specific projections**
 - ↑ **NY economy-wide GHG mitigation analysis (*pending funding*)**
 - ↑ **RI CHP analysis: similar to MA CHP assessment**



NE12 REMAP Preliminary Results

Total Renewable Capacity NE9 Region



Carbon tax was taken from a Synapse report *Climate Change and Power: Carbon Dioxide Emissions Costs and Electricity Resource Planning*. The tax starts at 10\$ / ton then increases to 35\$ / ton by 2029