Modeling Power Sector GHG Reduction Policy in New York State

Jia Li, Policy Analyst
Center for Clean Air Policy

****

Economic and Environmental Modeling Workshop
Beijing, November 7-8, 2002

Center for Clean Air Policy

- Non-profit research-advocacy group founded in 1985 by state governors to find market-based solution to acid rain.
- Applying similar approaches to ozone, greenhouse gases, and air toxics at state, regional, national, international levels.
- Using dialogs that bring together diverse stakeholders to test policy designs and seek common-ground for environmental problems.

Center for Clean Air Policy

CCAP Activities

- US Domestic
  - GHG Emissions Trading Braintrust
  - State Roundtable for Global Climate Change
  - Multi-Pollutant Strategy for Electricity Sector
  - Policy Incentives for Energy Efficiency and Renewables
  - Transport Repositioning
- International
  - CDM Dialogue
  - Dialogue on Future Commitment to GHG Reduction
  - GHG Emissions Trading Design for the EC
  - Capacity Building on Air Quality and Climate Issues in Latin America, East Europe and China

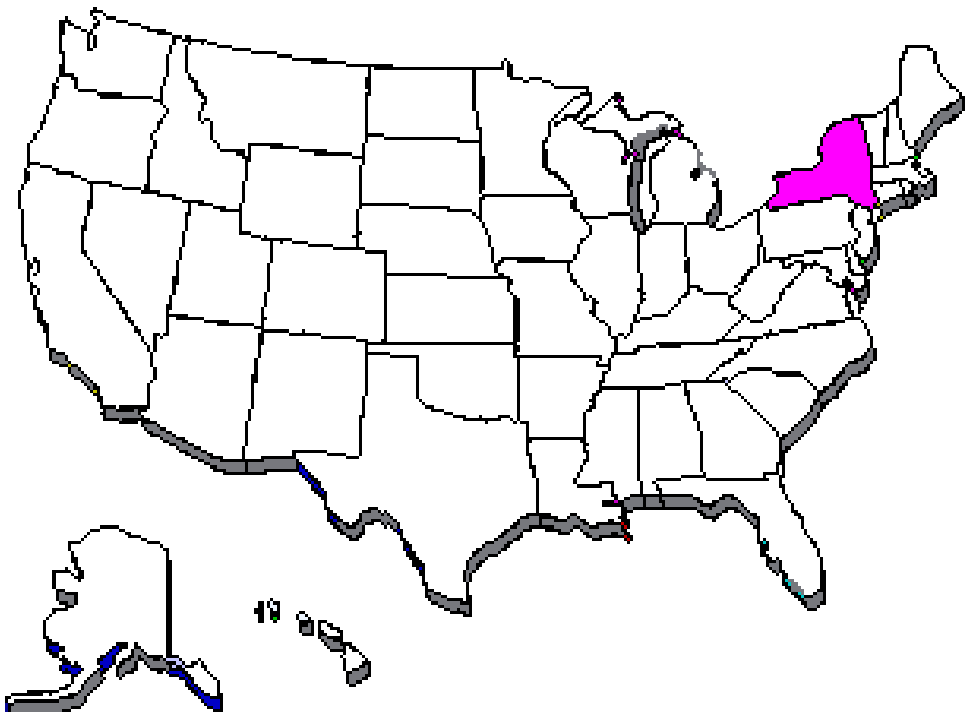
Center for Clean Air Policy

New York Greenhouse Gas Task Force

- In June 2001, NY Governor George Pataki formed the GHG Task Force to develop policy actions to reduce GHG emissions in NY
- CCAP was asked by the Governor to:
  - » Facilitate the Task Force;
  - » Chair policy analysis and development;
  - » Recommendations GHG policy options in collaboration with the Task Force;
  - » Deliver recommendations on strategies to reduce New York GHGs to the New York State Energy Planning Board to assist in the development of the State Energy Plan.

Center for Clean Air Policy

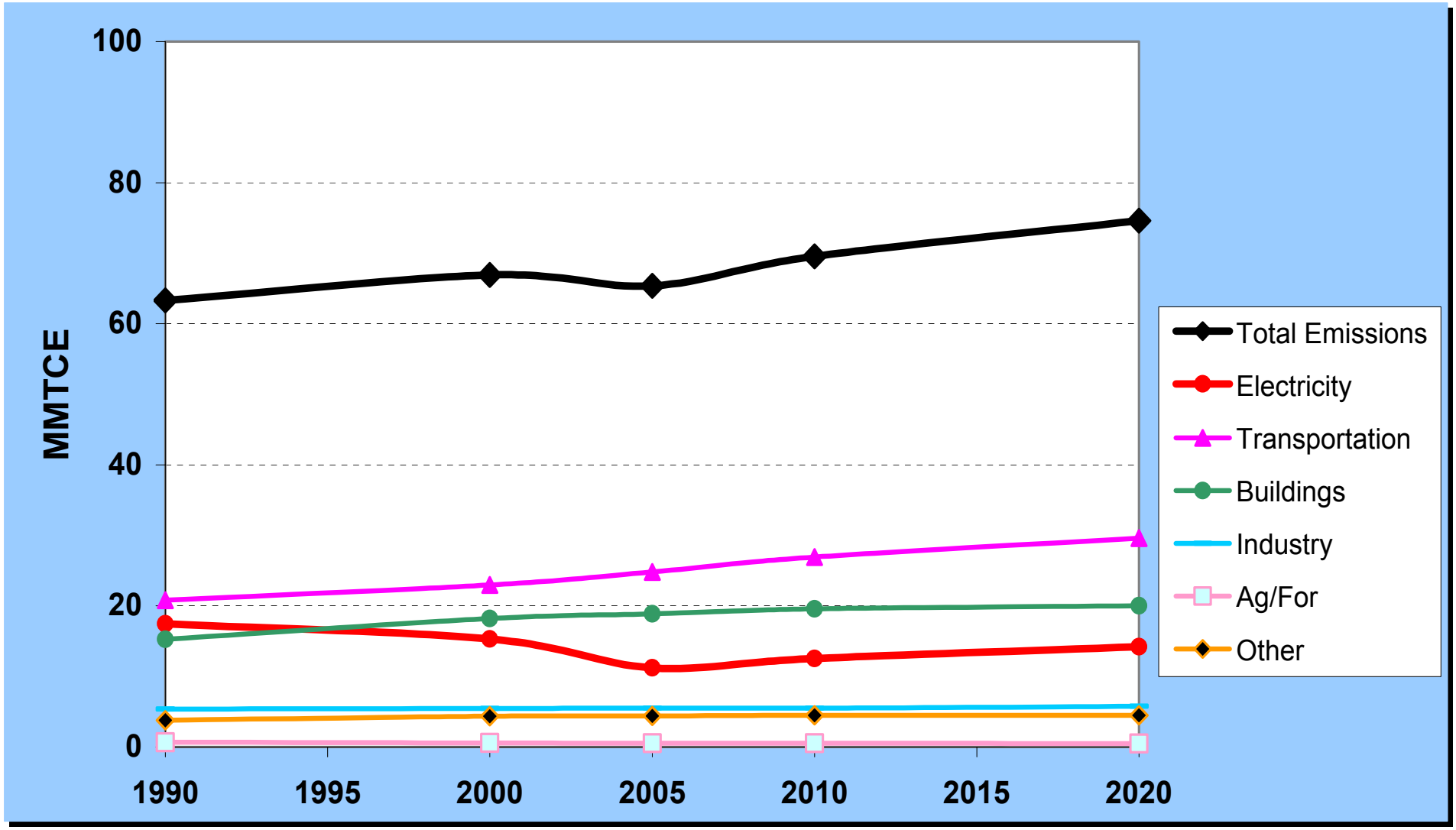
State of New York



- Top 5 largest economy in the U.S.
- 19 million residents
- Most energy efficient state (per capita)
- 0.9% of world and 4.2% of US C emissions
- A progressive state on environmental and energy policy

Center for Clean Air Policy

NY State GHG Emissions

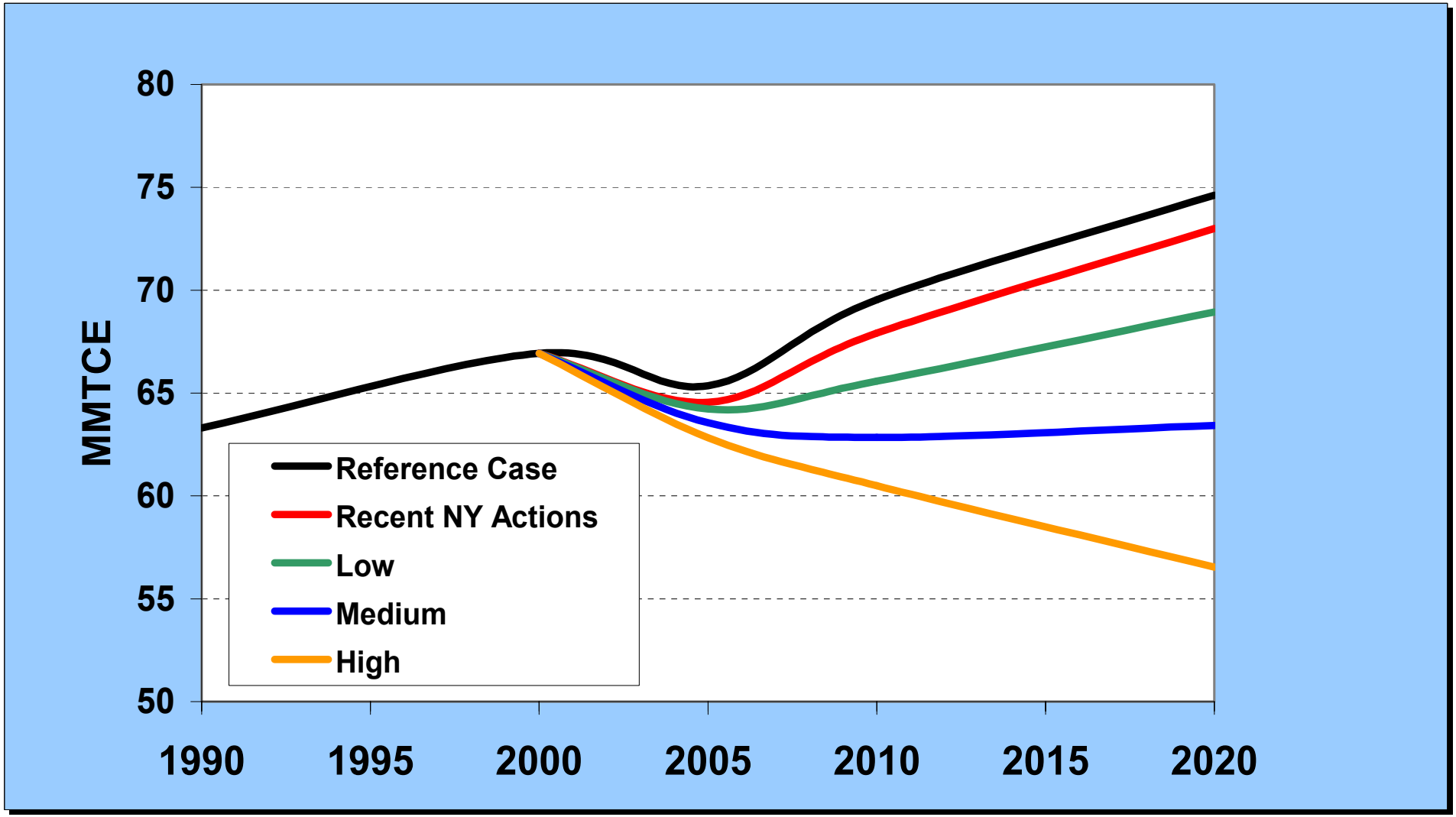


GHG Task Force Process

- Five Working Groups consisting of broad stakeholder participation:
  - » Registry
  - » Electricity
  - » Transportation
  - » Buildings/Industry
  - » Agriculture/Forestry
- CCAP has worked closely with the Task Force over the last year to develop detailed policy analysis and recommendations

Center for Clean Air Policy

NY GHG Emissions Under Various Scenarios



Task Force Recommendations

- Statewide target to reduce GHG emissions to 5% below 1990 levels by 2010 and 10% below 1990 levels by 2020
  - » State Energy Plan of 2002 adopted the target
- Sector Policy Measures and Goals, such as:
  - Electricity Sector CO2 cap and trade
  - Renewable portfolio standards
  - Utility incentive programs (i.e., CHP, repowering)
  - End-use energy efficiency measures
  - Transportation, and others

Center for Clean Air Policy

Electricity Sector Policy Options

A suite of policy options for reducing GHG from electricity generation identified:

- » Carbon Cap and Trade
- » Renewable Policy
  - – Renewable Portfolio Standard (RPS)
  - – Utility regulatory changes (i.e., interconnection, stand-by rate)
- » Combined Heat and Power
- » Fossil Plants Re-powering
- » Carbon Capture and Sequestration

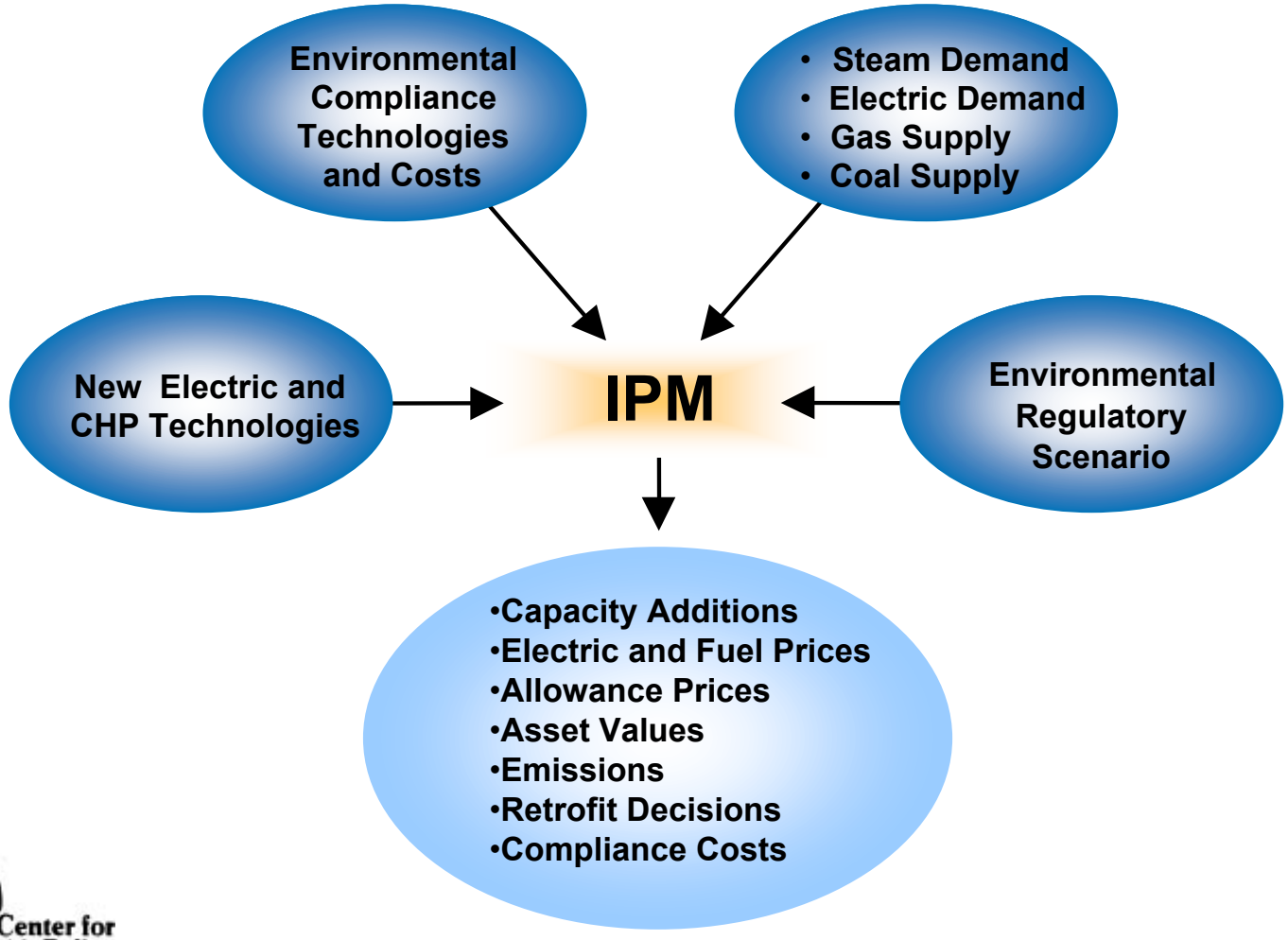
Center for Clean Air Policy

Modeling Analysis of Electricity Sector Policy

- Working Group members recognized the dynamic features of electricity generation system, that modeling was recommended to illuminate the effect and interactions of various policy options
- CCAP and NY State agency (NYSERDA) recruited ICF Consulting to conduct a modeling study using IPM

Center for Clean Air Policy

Analytical Framework - IPM



Center for Clean Air Policy

IPM Model

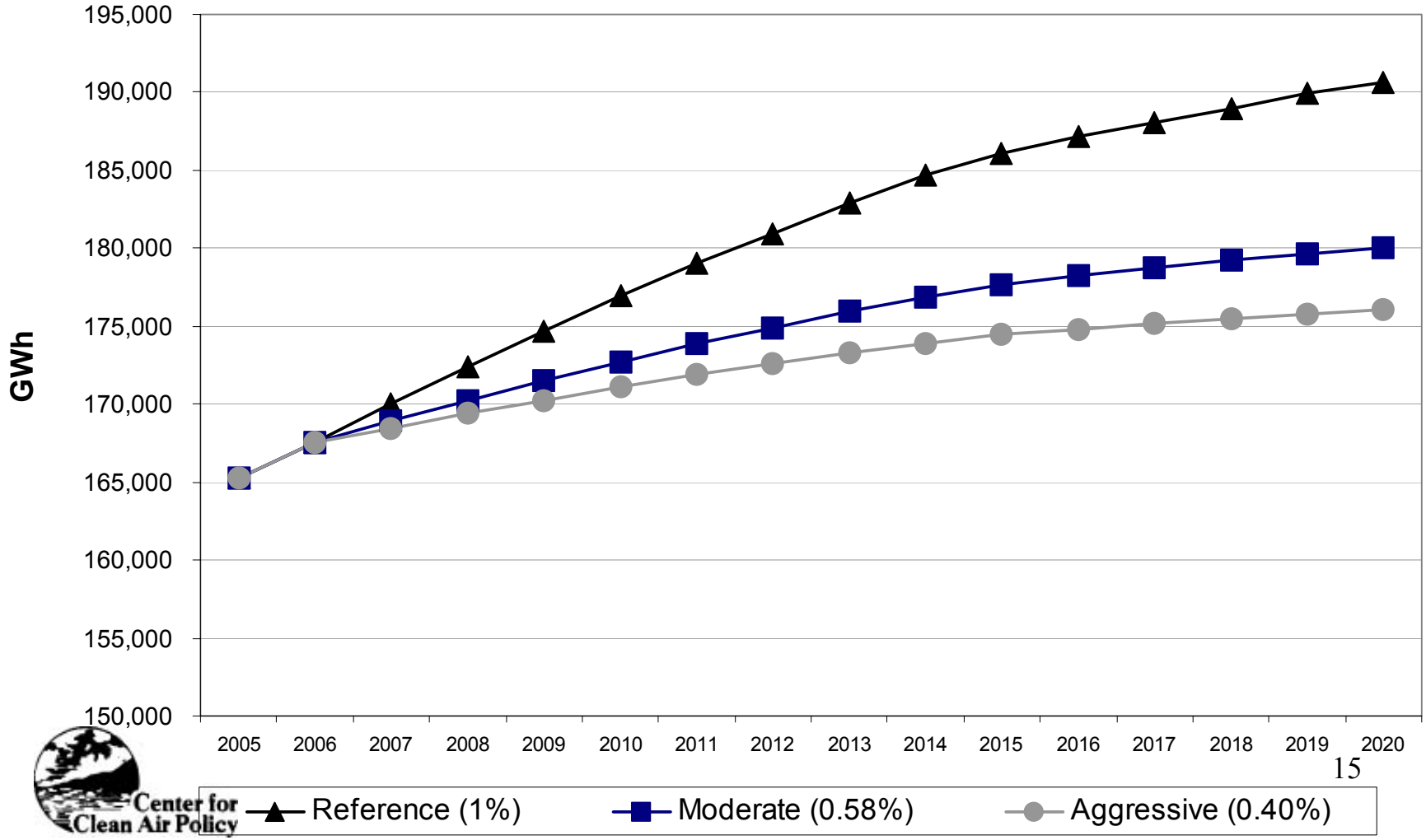
- A detailed engineering-economic production costing model
- Estimates marginal cost of emission reductions for the electric generating sector
- Determines the least-cost means of meeting the carbon policy requirement, forecasting:
  - » allowance prices
  - » compliance costs
  - » unit dispatch
  - » retrofit decisions for each boiler and generator.

Center for Clean Air Policy

Policy Scenarios

- **Carbon Caps**
  - » 30% below 1990 levels by 2010
  - » 40% below 1990 levels by 2010
- **Energy Efficiency Program**
  - » Moderate EE (SBC, appliance stds)
  - » Aggressive EE
- **Renewable Portfolio Standard (RPS)**
  - » 6% in 2010 and 8% in 2020
- **NY-only vs. Regional (w/NE) Carbon Caps**
  - » 20% below 1990 levels
  - » 30% below 1990 levels
- **National three-pollutant (NOx, SO2, Hg) policy**

NY Demand Growth Alternative Forecasts



Center for Clean Air Policy

Impacts of 30% below 1990 New York-Only CO2 cap

- Cost of CO_2 allowance is minimal, ranging from $0.1 cents/ton in 2010 to $0.2 cents/ton in 2020, due to small redux requirements
- Average wholesale marginal electricity price in NY increases by 1% (+0.3 mills/kWh) in 2010 and decreases by 1% (-0.4 mills/kWh) in 2020
- The carbon cap reduces emissions of NOx and SO2 by an additional 2,000 tons and 1,400 tons in 2010, respectively.

Center for Clean Air Policy

Impacts of a 40% below 1990 New York-Only CO2 cap

- Cost of CO2 allowances: $4/ton in 2010, $8/ton in 2020
- Wholesale energy prices increase by 3% (+1.1mils/kWh) in 2010 and 5% (+2.0 mils/kWh) in 2020 from base case
- Power imports increase by 20% in 2010, double in 2020
- NY coal plant generation drops 11% in 2010, wind generation increases > 10%, less NGCC, repowering and cogen capacity built

Center for Clean Air Policy

Impact of including RPS with -30% Cap

- Including RPS reduces carbon emissions further by 0.3MMTCE in 2010, 0.4 in 2020
- RPS reduces power imports by 20% in 2010, 25% in 2020 from 30% cap only case
- RPS lowers wholesale energy prices, though system costs rise (retail RPS adders: 2 mils/kWh in 2010; 4 mils/kWh in 2020)
- NY generation rises by 4%, wind gen triples, repowering is replaced by wind

Center for Clean Air Policy

Impacts on NY of regional vs. NY only -30% cap

- NY carbon emissions drop significantly (47% below 1990), as NY supplies C redux to NE
- CO2 prices rise to $8/ton in 2010 compared to $0.1/ton under NY-only 30% cap
- NY and NEPOOL energy prices rise, generation drops in both NY & NE
- Regional cap increases power imports in NY by 67%, more than double in 2020
- Asset values of NY plants increase under regional cap due to higher carbon allowance value and more sale of generation to NE

Center for Clean Air Policy

EE Spending Induces Net Benefits in Meeting Cap

	NY 30% Cap w/ Aggressive EE	NY 40% Cap w/ Aggressive EE	NY 30% Cap w/ RPS + Agg. EE	NY+NE 30% Cap
Electricity System Costs	-178	-283	116	-348
EE Expenditures	726	726	726	726
Energy Savings	-1383	-1383	-1383	-1383
Net Costs	-835	-940	-541	-1005
Net Costs to Consumers	-658	-658	-658	-658

Center for Clean Air Policy

Key Findings

- NY CO_2 emissions are effectively reduced to 25-30% below 1990 levels or more under all scenarios
- Energy efficiency is a key driver for cost-effective CO_2 emission reductions
- A 30% cap combined with aggressive energy efficiency result in negligible carbon allowance price

Center for Clean Air Policy

Key Findings (II)

- RPS reduces wholesale energy price (by 1.5% in 2010), natural gas price, lower power imports, energy diversity but results in slightly higher system costs
- Carbon caps lead to lower generation in NY and increased power imports from neighboring regions, except for RPS cases
- Regional caps lead to more reductions in NY and NY generation assets benefit due to reduction credits flow to New England Region

Center for Clean Air Policy

More Information

Jia Li (李 嘉)
Center for Clean Air Policy
750 First St., NE, Suite 940
Washington DC 20002
(Tel): 1-202-408-9260
(Fax): 1-202-408-8896
http://www.ccap.org

Center for Clean Air Policy

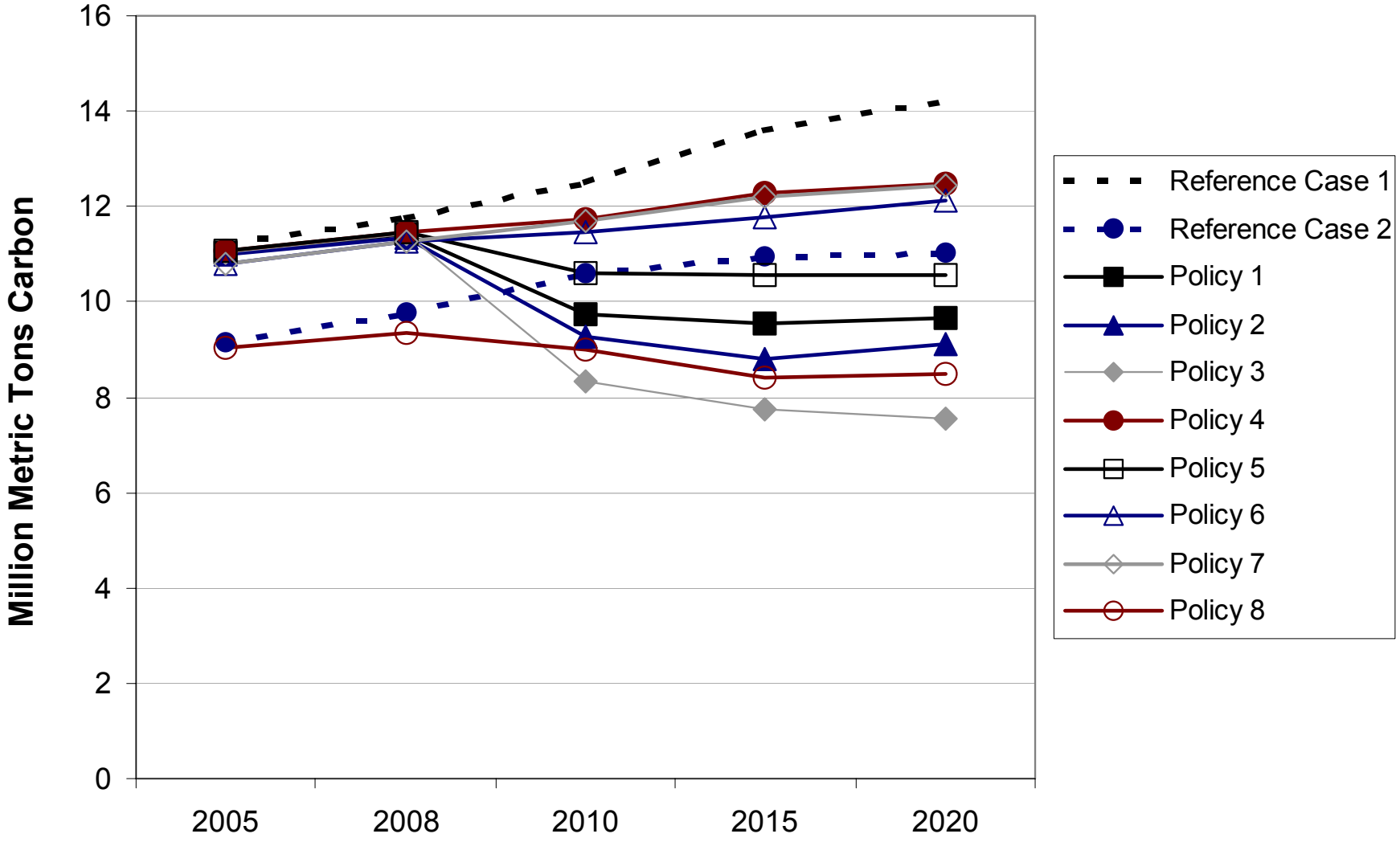
Scenarios Analyzed

Scenario	National Action[1]	Northeast State Policies[2]	Energy Efficiency Penetration in NY and New England	Regional CO_2 Cap (NY and New England)	Regional RPS
Reference Case 1	No	Yes	Existing Actions NY: 1.0% NE: 1.5%	None	None
Policy Scenario 1	No	Yes	Moderate NY: 0.58% NE: 1.0%	20% Below 1990 Levels in 2010	None
Policy Scenario 2	No	Yes	Aggressive NY: 0.4% NE: 0.7%	30% Below 1990 Levels in 2010 with 5% Flexibility	None
Policy Scenario 3	No	Yes	Moderate NY: 0.58% NE: 1.0%	30% Below 1990 Levels in 2010 with 5% Flexibility	None
Policy Scenario 4	No	Yes	Aggressive NY Only NY: 0.4% NE: 1.5%	NY-Only: 30% Below 1990 Levels in 2010 with 5% Flexibility NE: None	None
Policy Scenario 5	No	Yes	Aggressive NY Only NY: 0.4% NE: 1.5%	NY-Only: 40% Below 1990 Levels in 2010 with 5% Flexibility NE: None	None
Policy Scenario 6	No	Yes	Aggressive NY Only NY: 0.4% NE: 1.5%	NY-Only: 30% Below 1990 Levels in 2010 with 5% Flexibility NE: None	NY Only RPS 2005 – 4% 2010 – 6% 2012 and after – 8%
Policy Scenario 7	No	Yes	Moderate NY: 0.58% NE: 1.0%	None	NY+NE RPS 2005 – 4% 2010 – 6% 2012 and after – 8%
Reference Case 2	Yes	Yes	Existing Actions NY: 1.0% NE: 1.5%	None	None
Policy Scenario 8	Yes	Yes	Aggressive NY: 0.4% NE: 0.7%	30% Below 1990 Levels in 2010 with 5% Flexibility	None

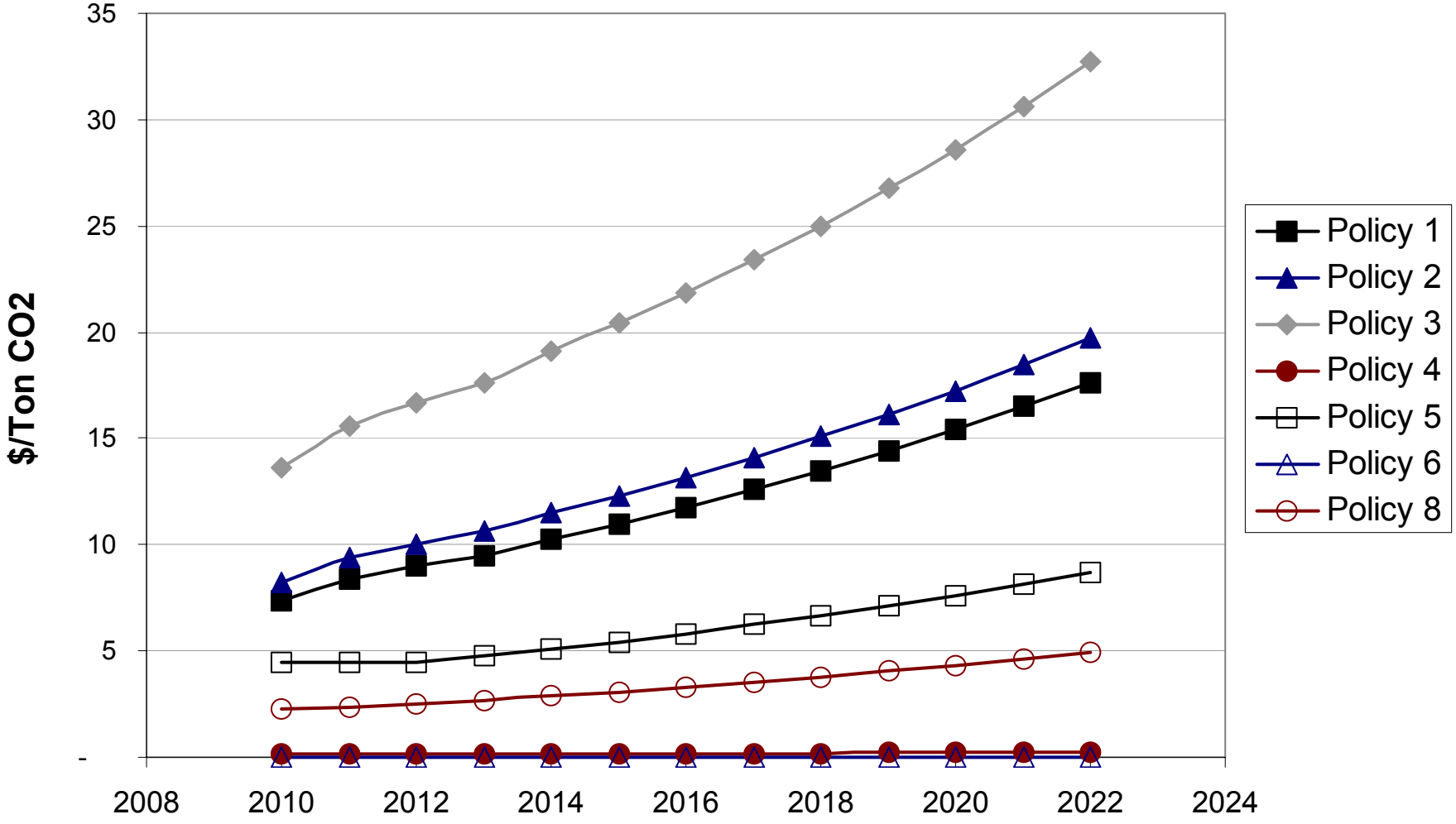
[1] National Action includes reductions in mercury, SO2, and NOx at the national level.

[2] Northeast state regulations include NY, CT, MA, NH, and NJ as outlined in the assumptions document titled "Policy Analysis Assumptions for NYSERDA" dated April 9, 2002.

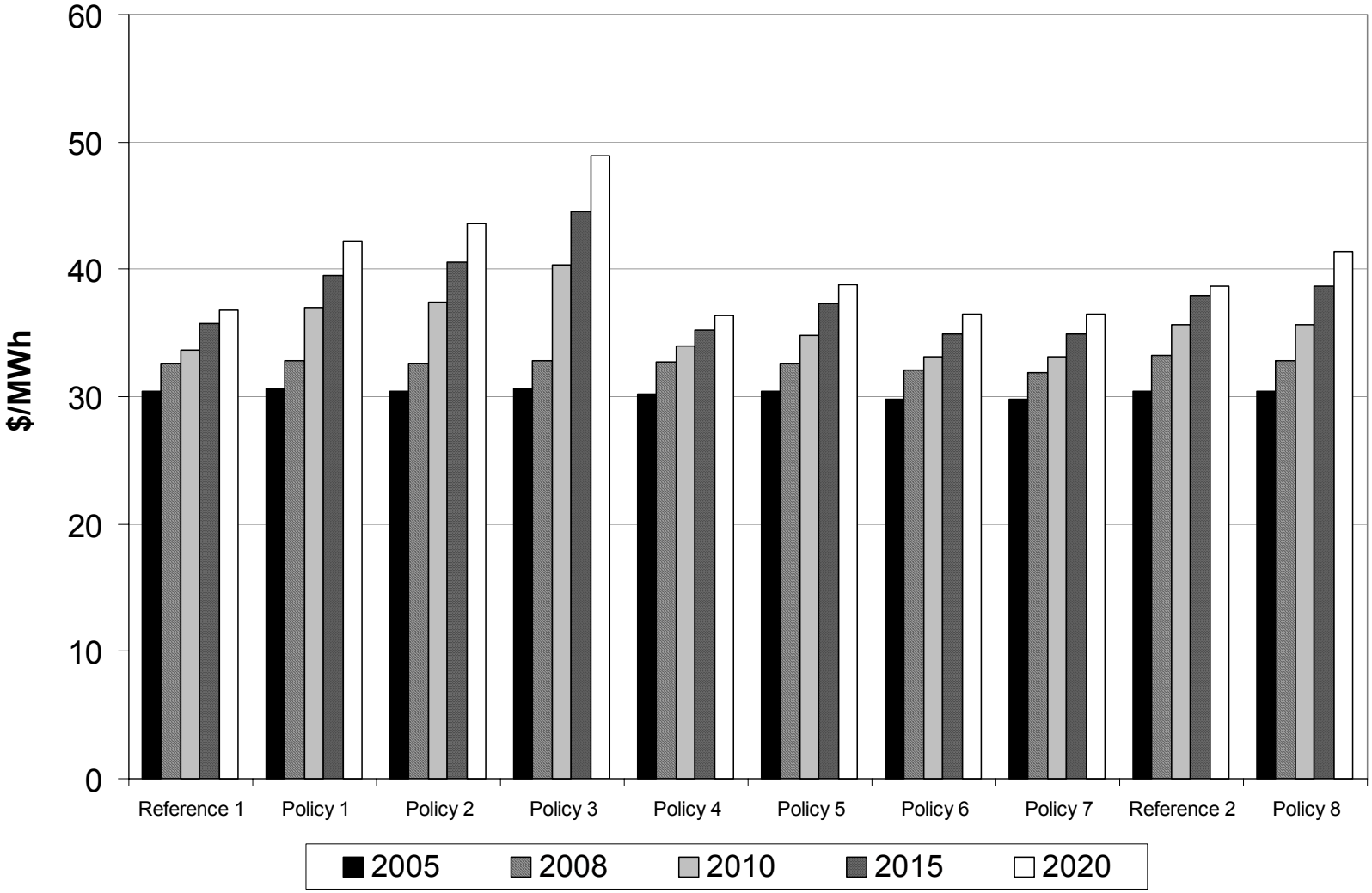
New York Carbon Emissions Forecasts Across Scenarios



CO_2 Allowance Prices Across Policy Scenarios

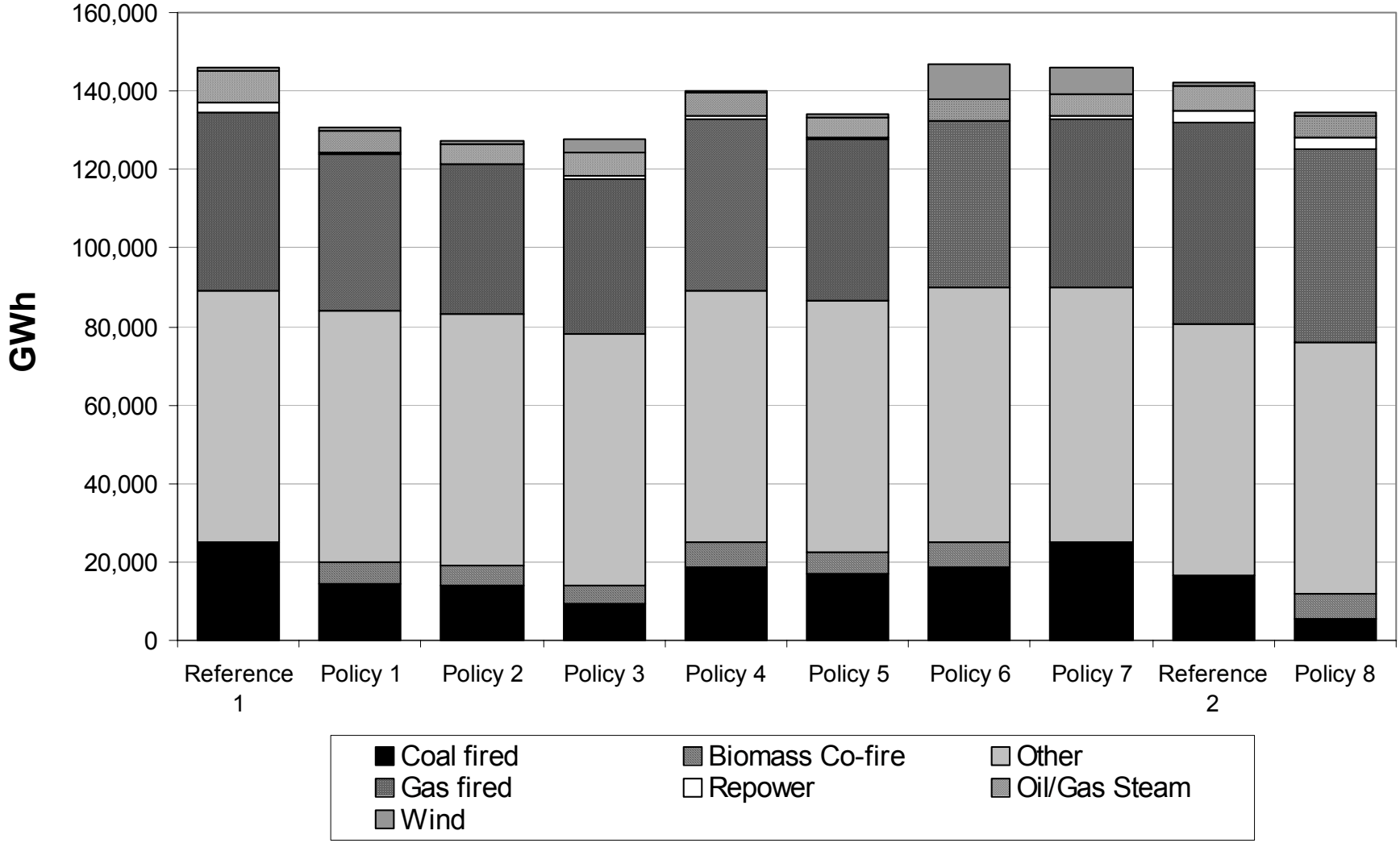


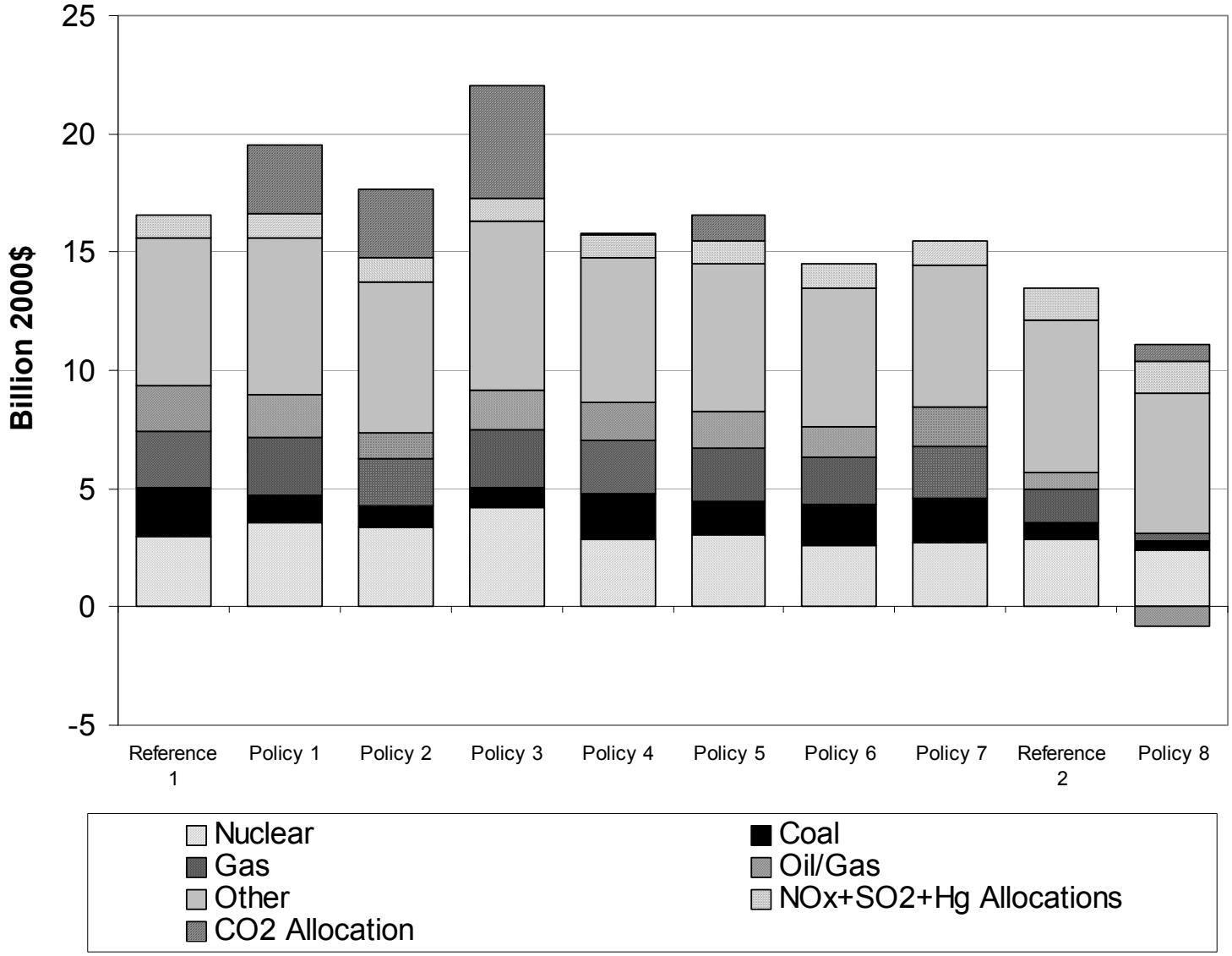
New York Wholesale Energy Prices



Note: Does not include the renewable energy credit adder for Policy Case 6 or 7.

New York Generation Mix Across Scenarios - 2010



Note: Other includes nuclear and hydropower.

NPV Asset Value Impacts on Existing New York Units Across Scenarios (2005 – 2030)