Carbon Mitigation Status in the U.S.: Secular Trends, Regional Carbon Trading and the Clean Air Act

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Resources for the Future

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Carbon Mitigation Status in the U.S.

Roadmap

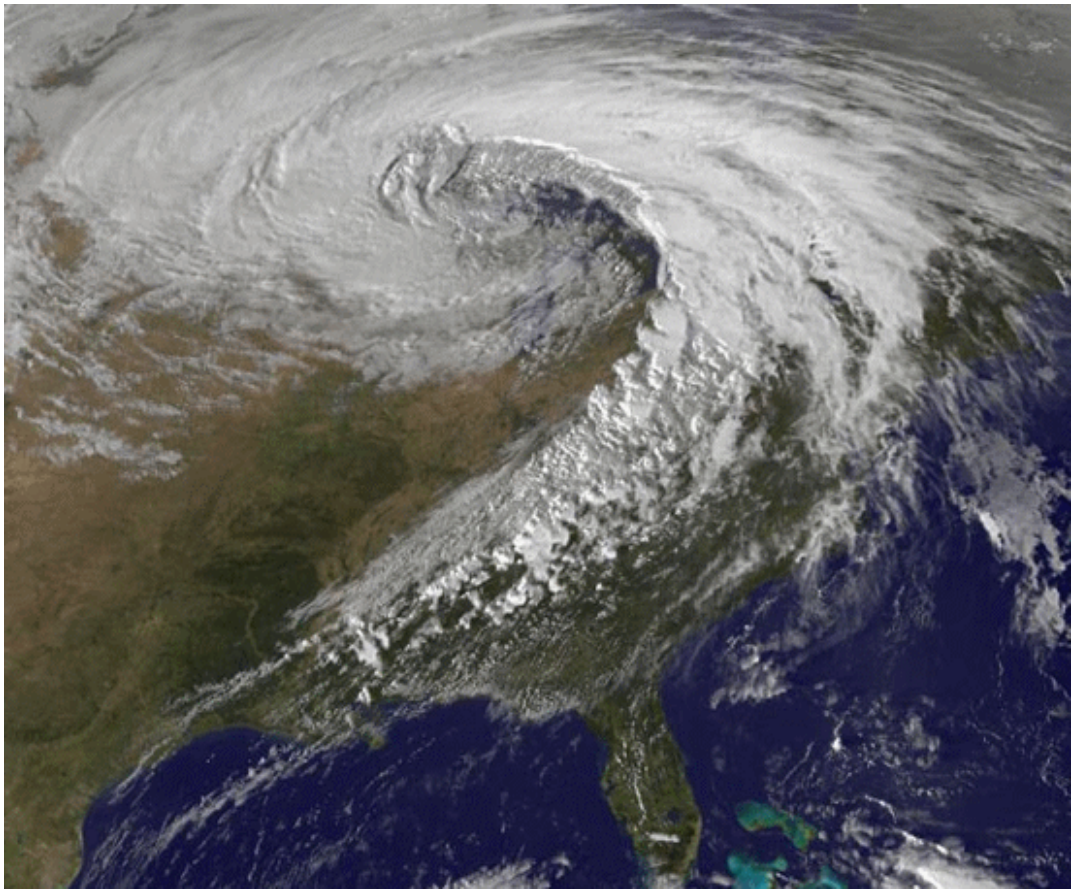
1. Secular Trends
2. California and the Regional Greenhouse Gas Initiative
3. The U.S. Clean Air Act
4. The Question of Additionality
5. How Does It Add Up?

First, why we are having this conversation? A moment on the potential impacts of climate disruption in the U.S.

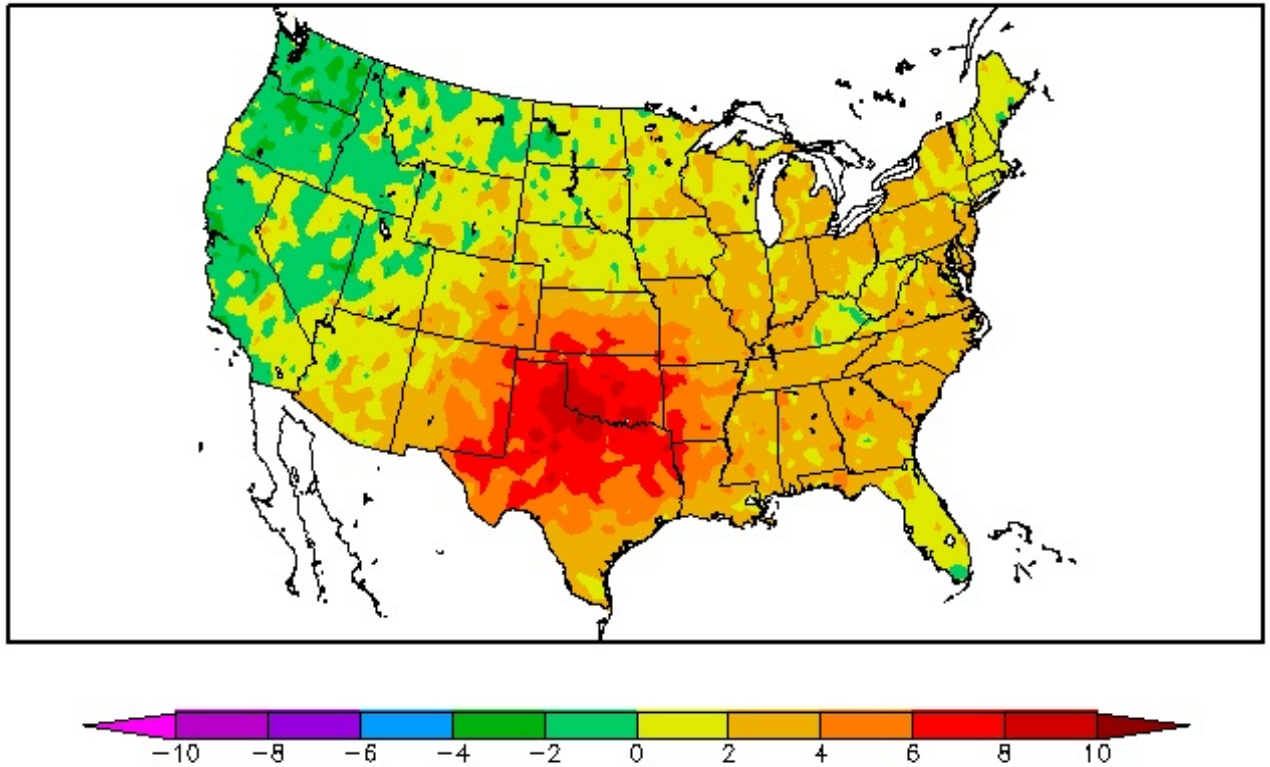
2008 Mississippi River Floods

Eight of the top 10 years for extreme one-day precipitation events have occurred since 1990

The “Chiclone” – 26 October 2010 *Superstorm*



Departure from Normal Temperature (F)
6/1/2011 – 8/31/2011



Source: *Climate Central*

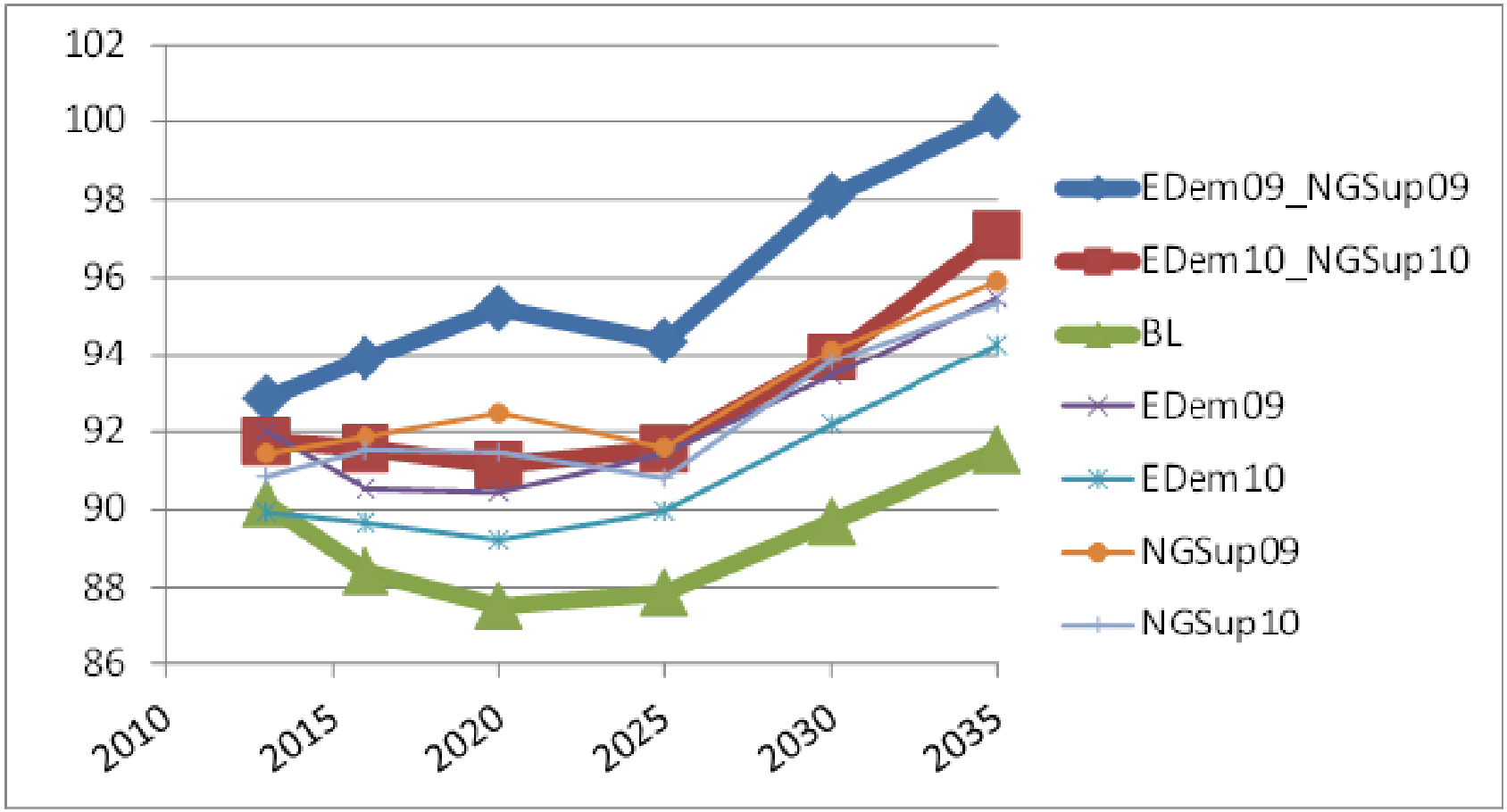
Carbon Mitigation Status in the U.S.

1. Secular Trends

- Increased supply of natural gas from shale gas extraction
  - 2020 price of natural gas has fallen by 35% between EIA's 2009 and 2011 forecasts
  - 2020 consumption of natural gas has increased by 18% between same forecasts
- Decreased demand for electricity due to efficiency measures
  - 2020 electricity consumption has decreased by 151 TWh (4%) between same forecasts

Secular Trends in the Electricity Sector

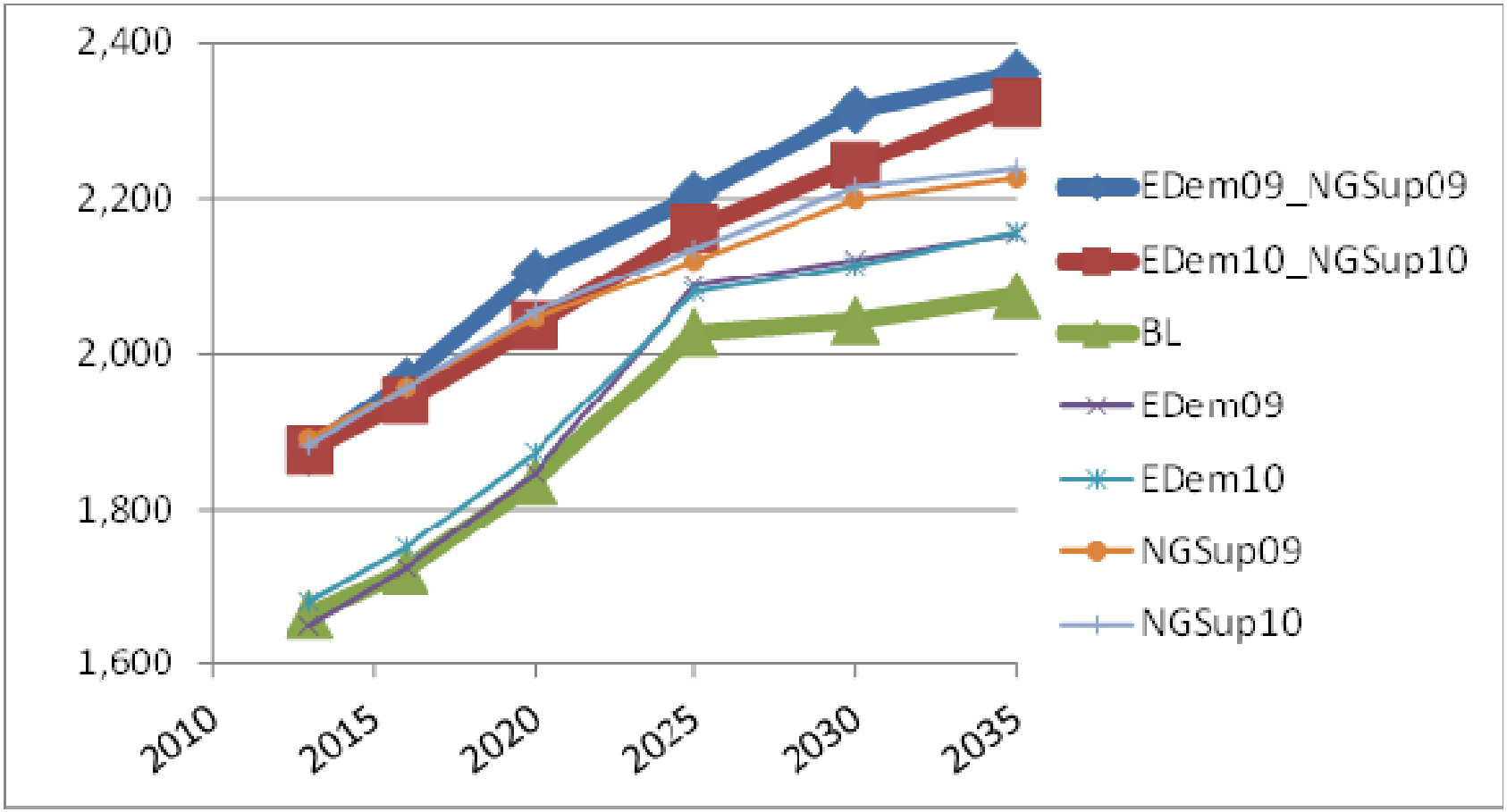
National Average Electricity Price (2009$/MWh)



The Electricity Journal, forthcoming

Effects on Coal (Prior to CSAPR / MATS)

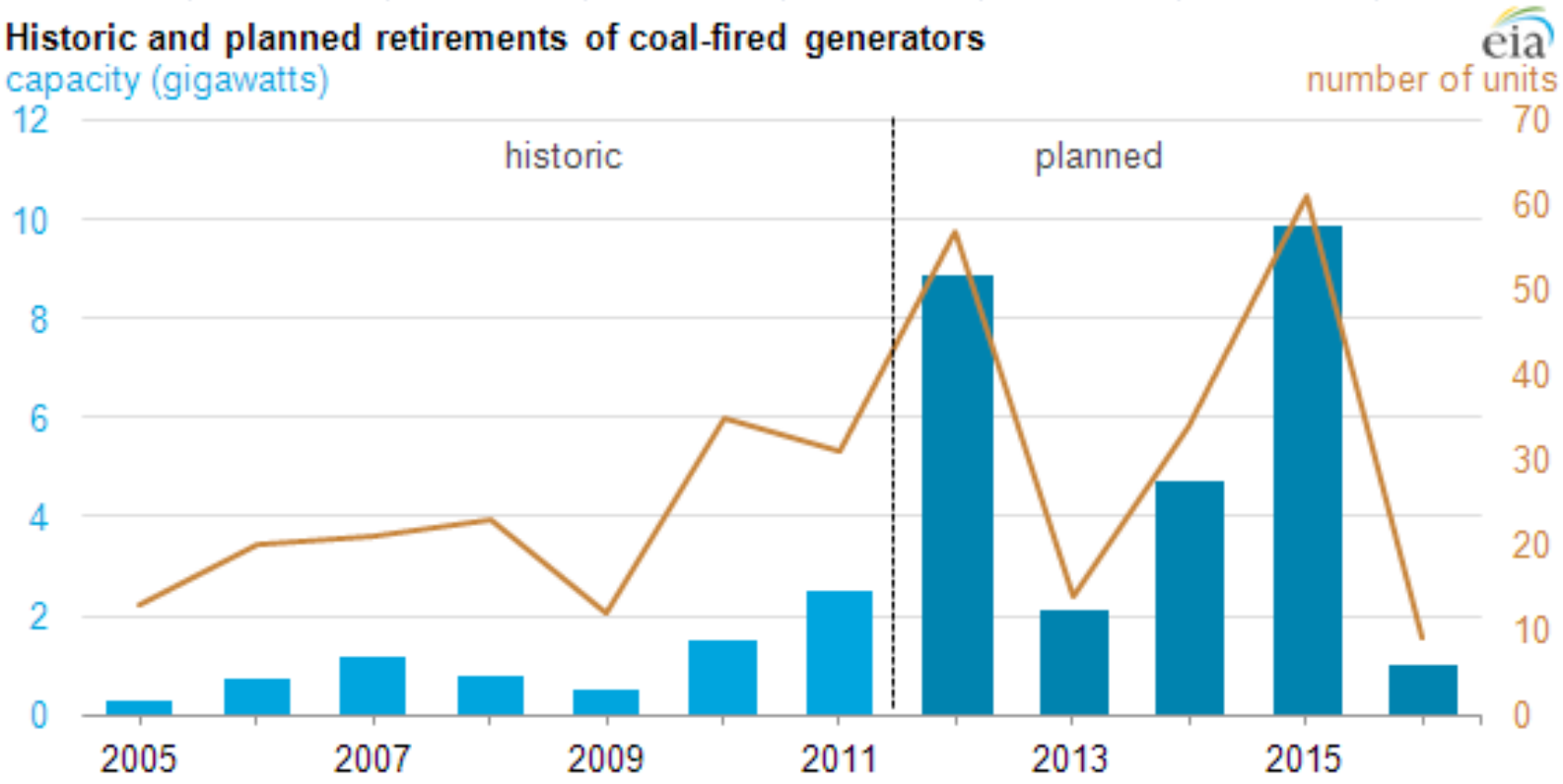
Coal Generation (TWh)



Add to this EPA's Regulatory Agenda

- ✓ Important Change in Natural Gas Supply & Electricity Demand
- ✓ Cross State Air Pollution Rule (CSAPR)
  - Finalized in June 2011, replacing CAIR; stayed by court in December; decision imminent.
  - EGUs in 27 states subject to new constraints on SO_2 and NO_x. Limited trading.
- ✓ Mercury and Air Toxics Standard (MATS)
  - Under court order. Final rule issued in December 2011.
  - Regulates heavy metals including mercury and acid gases.
  - Compliance at most units will also reduce SO_2. No trading.
- ❑ Coal Combustion Residuals Rule - ash
- ❑ Clean Water Act (316(b)) - cooling water
- ❑ Greenhouse Gas Performance Standards

27 GW of Coal-Fired Capacity to Retire over Next Five Years

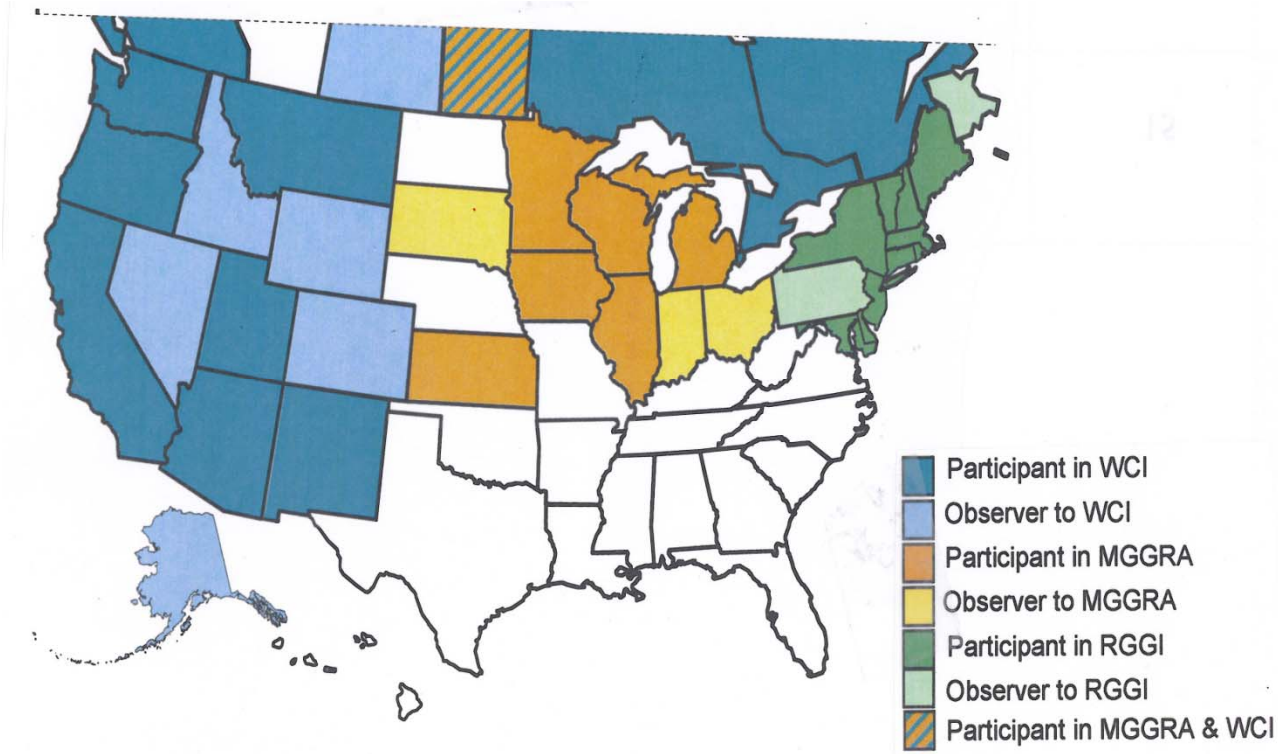


Source: U.S. Energy Information Administration, FormEIA-860, "Annual Electric Generator Report."
Note: Data for 2005 through 2011 represent actual retirements. Data for 2012 through 2016 represent planned retirements, as reported to EIA. Data for 2011 through 2016 are early-release data and not fully vetted. Capacity values represent net summer capacity.

Secular Trends in Summary:

- Trends in fuel prices, electricity demand
- Important changes in regulation of conventional pollutants
- Together provide a punishing blow to coal-fired power

2. California (Western Climate Initiative) and the Regional Greenhouse Gas Initiative (northeast states)

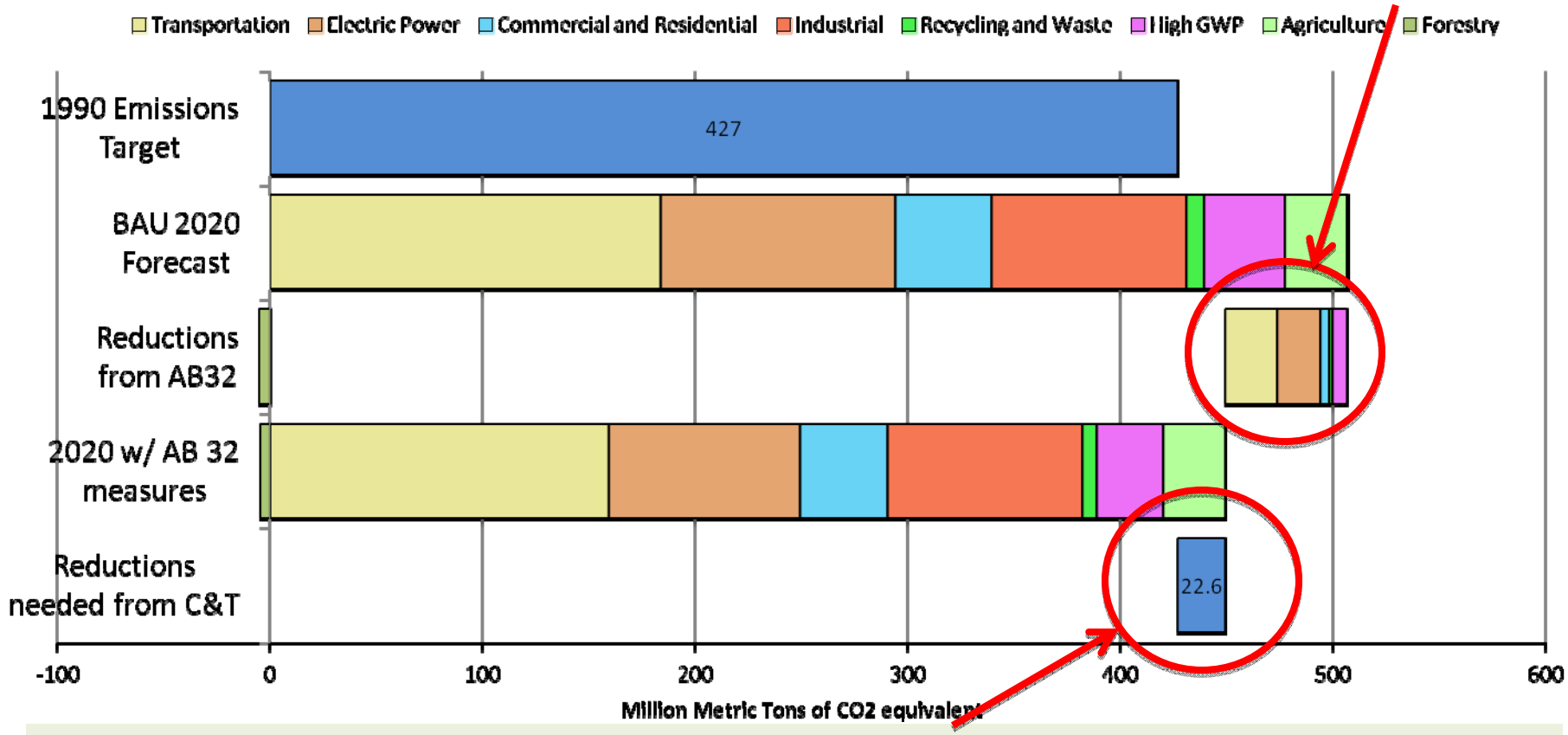


Source: FERC, **http://www.ferc.gov/market-oversight/mkt-electric/overview/elec-ovr-ghg.pdf**

California

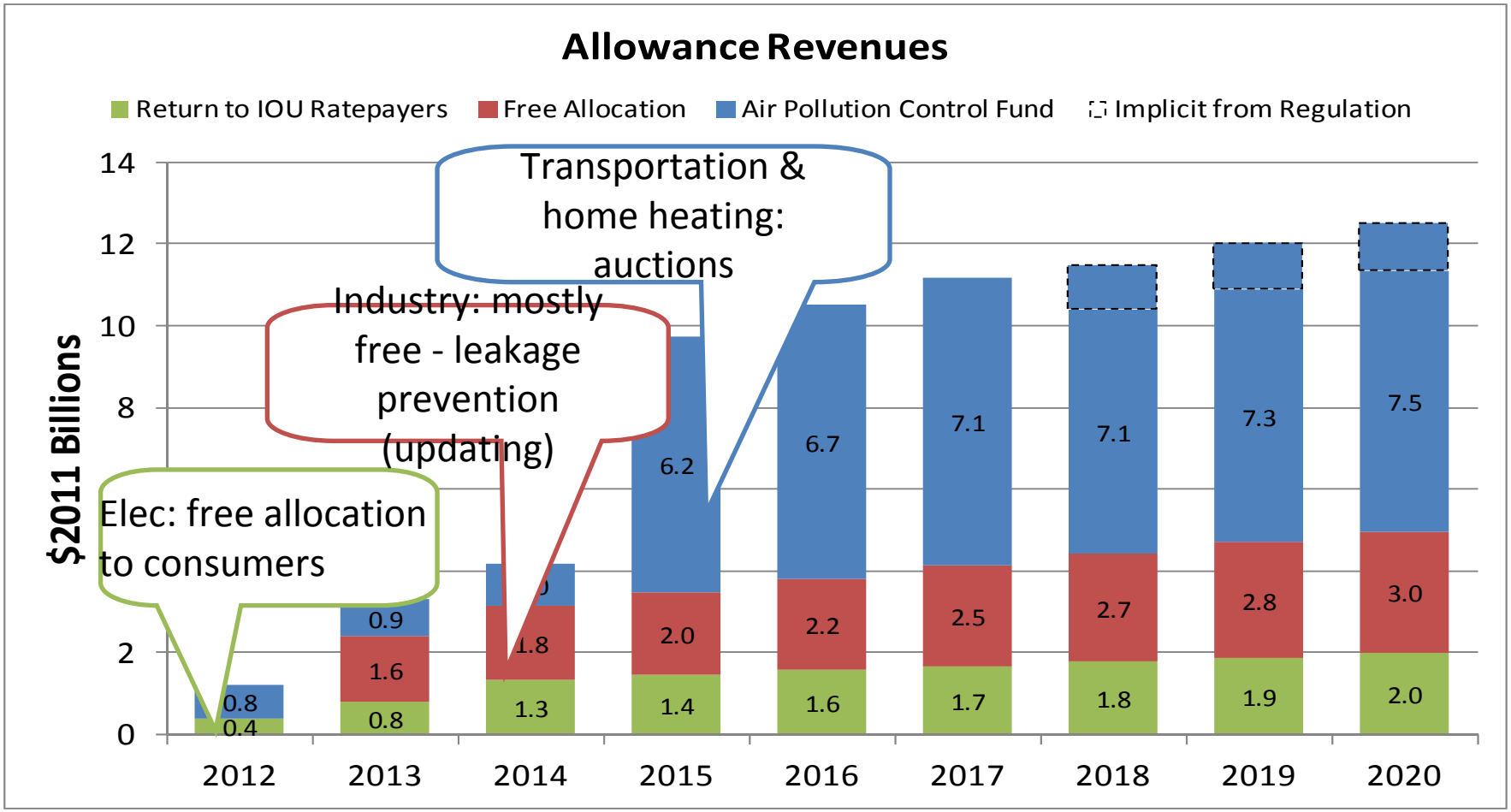
- The 2006 Global Warming Solutions Act (AB32)
  - Reduce statewide emissions to 1990 levels by 2020.
  - Most reductions achieved through regulation.
  - Cap and trade to ensure emissions target, beginning in 2013.
- Cap and trade design:
  - Begins with electricity and large industrial in 2013; economy wide including transportation in 2015.
  - Large role for auctions with price floor. Revenues to reduce electricity prices.
  - Industrial facilities receive "output based allocation" to avoid leakage.
  - Allowance reserve (4% of cumulative allowances 2013-2020) at $40/ton.
  - Offsets up to 8% of cap.
- Linking with Canadian province of Quebec

California: most reductions come from regulatory measures



Cap and Trade contributes a small amount to overall reductions but ensures that *no low-cost reductions get left behind*

California - Representing the policy over time



California Issues of Special Interest to Energy Regulators

1. Imported power
   - About 20 % of power but 50 % of electricity-related CO_2 emissions
   - "First seller" of power in California has compliance responsibility
     - Includes in-state generators and power importers
     - State uses financial information to assign emissions intensity of power
     - Default rate for unassigned power is natural gas (avoids constitutional issues)
2. Prohibition on new long term contracts for coal
   - Emissions standard equivalent to natural gas combined cycle
3. Supplementary policies
   - 33 percent (by 2020) renewable portfolio standard in electricity; possible expansion to 40 percent
     - This investment in the electricity sector reduces allowance cost substantially
     - PG&E has announced 40% of its renewable portfolio in 2020 will be solar PV, 23 % wind, remainder small hydro, geothermal, distributed solar PV
   - Low carbon fuel standard (in transportation) and electrification of transport

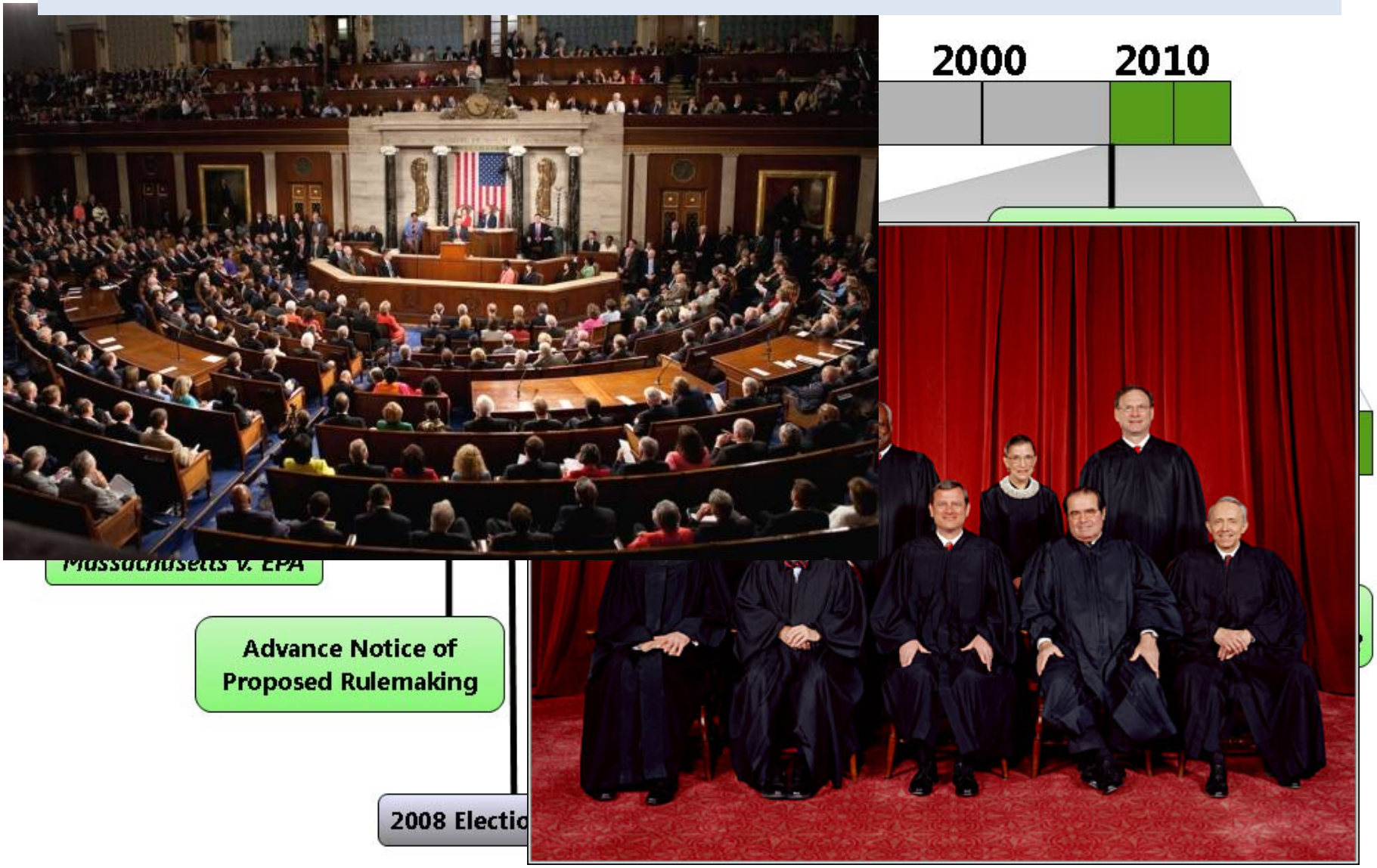
California Issues of Special Interest to Energy Regulators

4. In electricity, allocation "for the benefit of ratepayers"
   - Allocation in electricity to local (retail) distribution companies
   - Publicly owned utilities (1/3 of customers) can use allowances directly for compliance
   - Investor owned utilities (2/3 of customers) must sell allowances in auction and revenue returned to utilities
     - How to use allowance value for benefit of ratepayers to be decided by Public Utility Commission
     - IOU (company) proposal is to reduce bills in proportion to cost increase
     - Other state agency proposal to return value in separate envelope at end of year (~$70/year)

Regional Greenhouse Gas Initiative

- Began in 2009 with ten northeast states (currently nine)
- Caps emissions from 209 power plant facilities
- Emissions reductions are modest:
  - 2009-2014: Cap equals 188 million tons/year
  - 2015-2018: Cap declines by 2.5%/year (10% total)
  - Already changes in generation mix and level (secular trends not due to program).
  - Reserve price in auction is binding at around $2/ton CO_2
- Revenues (nearly $1 billion) directed toward “strategic energy investments,” mostly efficiency
- Program now under review, likely to be strengthened

3. Carbon and the U.S. Clean Air Act



Clean Air Act Tools for GHGs

Mobile Sources

I

- Fuel economy standards (CAFE)

Stationary Sources

Permitting

II

- New Source Review (NSR)
- Title V

Standards

III

- Performance standards (§111)
- ~~Hazardous pollutant standards (HAP)~~
- ~~Air quality standards (NAAQS)~~
- ~~Others (§115, Title IV)~~

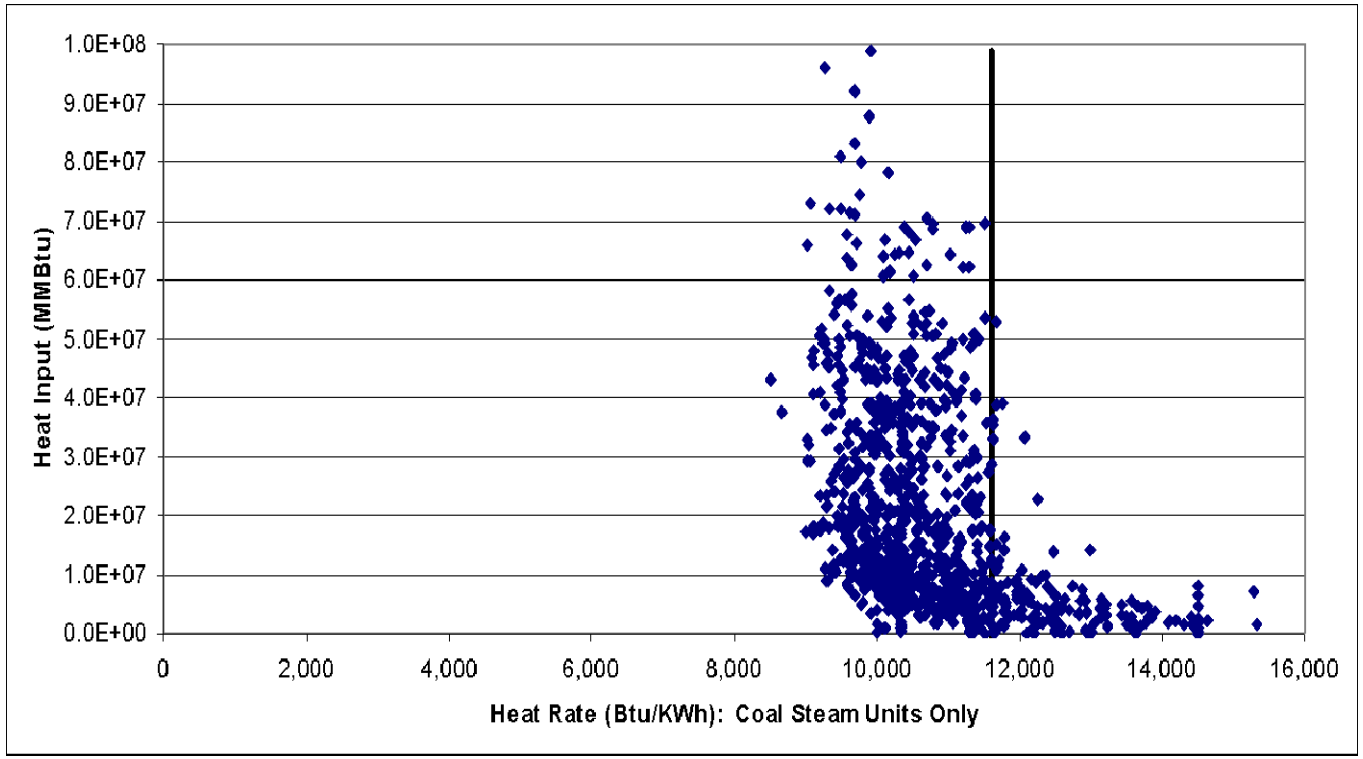
US "federal" policy is taking shape under the Clean Air Act

1. Vehicles: 5%/year improvement to 35.5 mpg fleet avg. in 2016; 54.5 mpg by 2025.
2. Construction permitting (implementation by the states).
3. Performance standards for stationary sources
   - New source rules proposed in April for steam electricity boilers (1000 lbs CO_2/MWh)
   - Existing source performance standard is the big issue

Existing Source Performance Standards

- EPA has to regulate after new source rule is final
- EPA can issue model rule, but states can deviate
  - States submit implementation plans for EPA approval
- Compliance flexibility? Probably yes
  - Consider relevance of California and RGGI
- Electricity sector first; other sectors will follow

Coal steam units: heat-input weighted heat rates



Efficiency at existing coal plants

- Coal accounts for about 1/3 of U.S. CO_2 emissions
- Based on engineering estimates, EPA expects 2-5% efficiency improvements are possible at low cost (without changing utilization)
- Our econometric estimates validate this; we find costs could be lower than engineering estimates (e.g. $10 CO_2 tax would yield 1-3% improvements)
- These reductions could happen very quickly and at large scale
- Corresponds to 1.6% of total U.S. GHG emissions; 10% of the U.S. 2020 target
- Additional 1.5% possible from cofiring with waste biomass

Efficiency performance standards for other sectors (e.g. iron & steel, pulp & paper, etc.) would follow

- EPA has identified opportunities for 7.2% efficiency improvements that are "cost effective" across industrial sector

4. The Question of Additionality

We have understanding of prices as a cost effective policy tool

•But, incidentally 100% leakage of subnational or individual efforts

- An " emissions cap is an emissions floor"

For example, under Waxman-Markey cap and trade:

•Effective preemption of subnational efforts

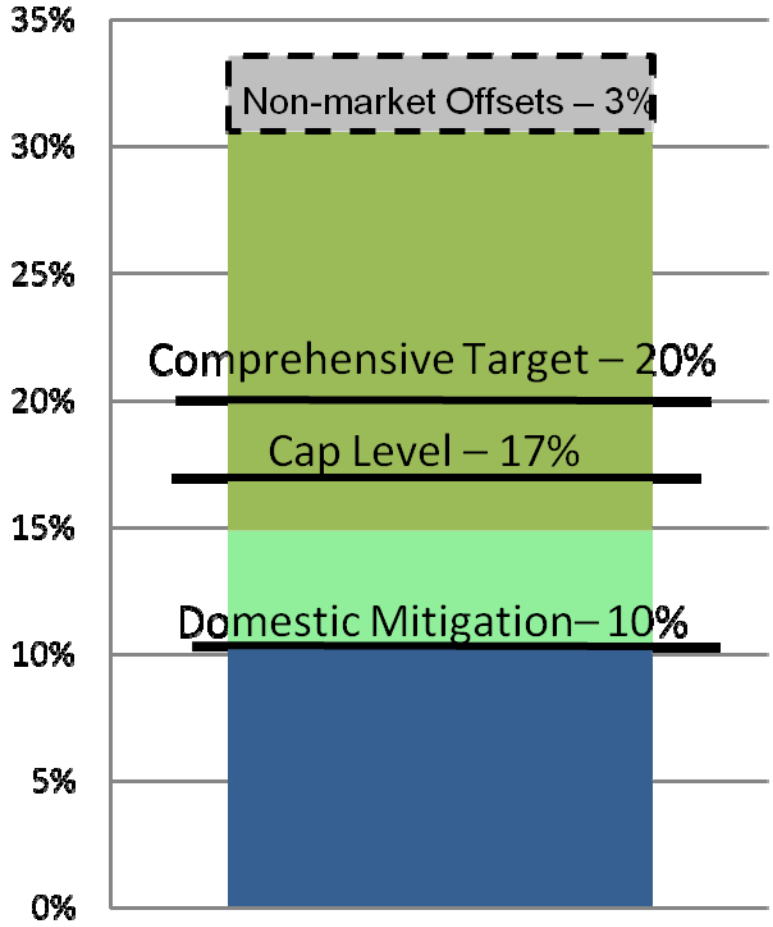
•Crowding out of emissions reductions due to fuel market or technology changes

•Explicit preemption of Clean Air Act for stationary sources

Goulder and Stavins 2011, Burtraw and Shobe 2009

5. How Does It Add Up?

- Secular trends
  - Expanded natural gas supply
  - End use efficiency improvements
  - Economic downturn
- Subnational programs
  - California (We will not count RGGI, or new renewable programs)
- Clean Air Act
  - Mobile sources
  - Existing source performance standards



Emission Reductions in 2020 from 2005 Levels Under Waxman-Markey

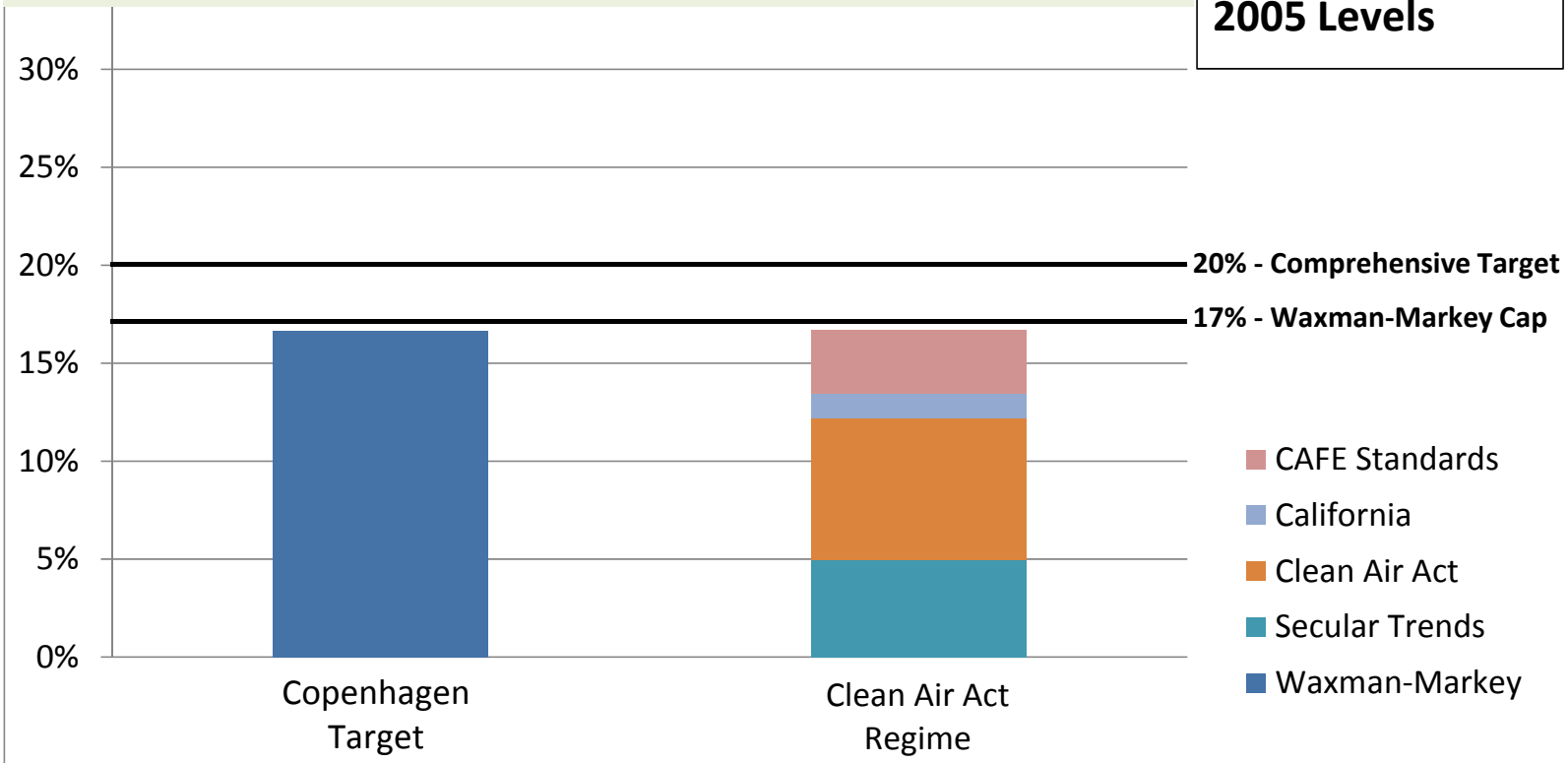
- Non-Market Offsets
- International Offsets
- Domestic Offsets
- Domestic Reductions

Burtraw, Fraas and Richardson, 2011. Note: Waxman-Markey EIA modeling results include banking
EIA 2009. Energy Market and Economic Impacts of H.R. 2454 - Basic Case. <http://www.eia.doe.gov/oiaf/servicerpt/hr2454/excel/hr2454cap.xls>

Clean Air Act Regime:

Domestic emissions reductions are on course to meet the U.S. pledge in Copenhagen

Domestic Emissions Reductions in 2020 from 2005 Levels



No RPS, No RGGI

In Conclusion

- Climate policies are advancing in the U.S.
  - The Clean Air Act is like a freight train: slow but hard to stop
- Domestic mitigation on track
  - U.S. may be "in the range of" its Copenhagen commitment
- International financing is a concern
  - No conceivable role for offsets

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