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Assessing the Potential Economic and Distributional Impacts of a Tighter Ozone NAAQS

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Anne E. Smith, Ph.D.
NERA Economic Consulting

Insight in Economics™

Outline of Presentation

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- The Role and Need for "Economic Impact Models"
- Difference between Compliance Cost Estimates and Economic Impact Estimates
- Methods to Assess Economic Impacts of Major Regulations
- Results of an Analysis of Potential Impacts of a 65 ppb Ozone NAAQS
  - National and Texas-specific
  - Macroeconomic impacts
  - Distributional impacts
- Limitations and Conclusions

Historical Evidence of Economic Impacts vs. Potential Impacts in Future

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- Projections of impacts of future regulations cannot be based on simple extrapolations from findings of historical impact studies
- Empirical/historical analyses provide evidence that environmental costs can have a net negative effect on economic productivity and on individual workers and firms. But these studies reflect:
  - Markets and technologies in 1970s through 1990s
  - Less stringency and narrower types of emitting sources
- Economic impact models simulate the types of economic interactions that empirical studies have identified, but with:
  - Present and projected market conditions
  - Current production relationships & new technologies
  - Specific estimates of new regulation's incremental cost

Terminology

- Compliance Cost: ⟵ In EPA's RIA
  - Expenditures by emitters to reduce their emissions ($)
  - Government spending to prepare SIPs, fund rebate programs, etc. ($)
  - Household spending, e.g., enhance O&M costs ($)
  - Constraints or hindrances to economic activities, e.g., permitting, transportation controls (not a direct expense)
- Economic impacts from compliance costs: ⟵ Not in EPA's RIA
  - Changes in household spending power due to economic productivity changes
  - Changes in economic activity (e.g., GDP)
  - Changes in market shares of products and/or fuels
  - Changes in output and employment of sectors/businesses
  - Changes in geographic location of economic activity

(Impacts can be long-term or temporary)

How Compliance Cost Estimates and Economic Impact Estimates are Related

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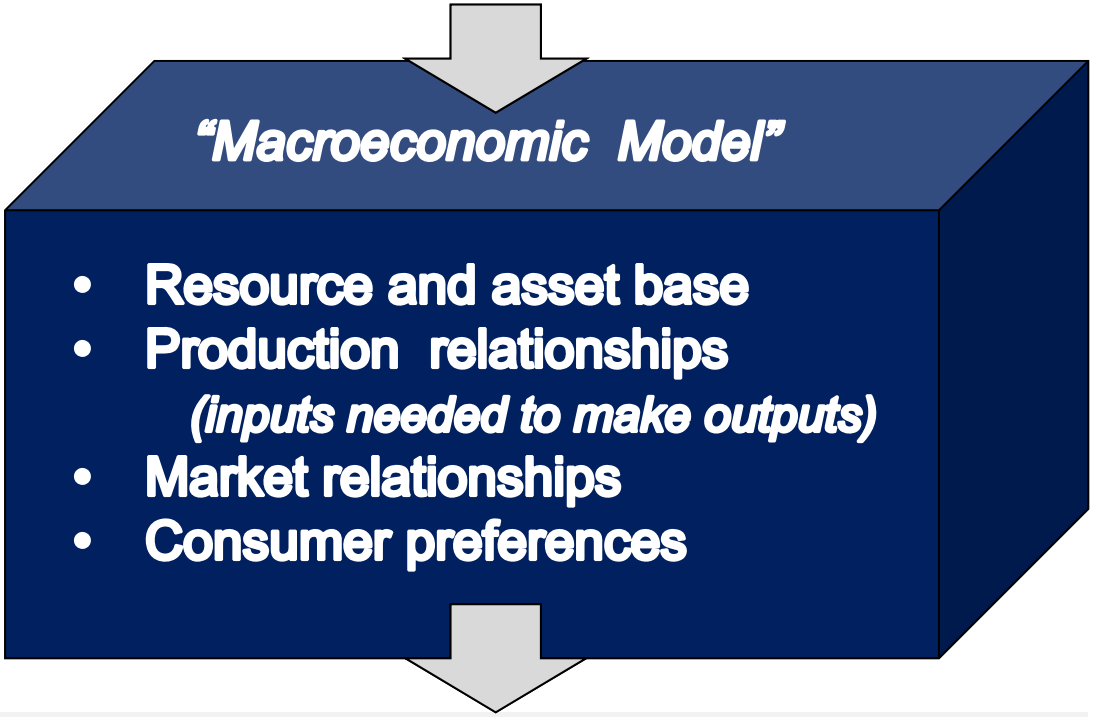
Compliance costs and constraints



Economic impacts and their distribution

Compliance Costs Can Have Economic Impacts Far Beyond the Sectors and Regions That Face Those Costs

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Some examples:

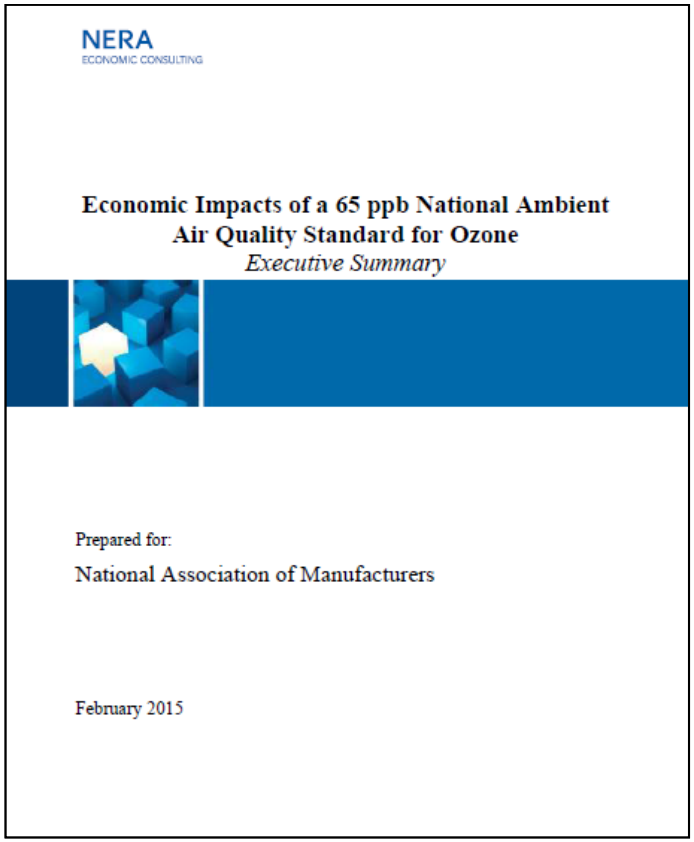
- Businesses facing higher costs may pass costs through to customers
  - ➔ costs are shifted to customers in other sectors that cannot pass the costs through….or further onwards to households
- Capital spending to control emissions diverts capital budgets away from productive investments
  - ➔ reduces labor productivity
    - ➔ reduces worker income
- Rebate programs to incentivize owners of relatively old vehicles or other mobile equipment to scrap them
  - ➔ reduces other government services &/or increases taxes
    - ➔ reduces households' consumption

Computable General Equilibrium (CGE) Models Assess the Net Effect of a Policy

- Costs and gains are *both* accounted for in a CGE analysis
  - Every expense to reduce emissions is also seen as an economic gain for the providers of the technology/fuel/services that are newly demanded
  - Increased spending on equipment or construction to reduce emissions is seen as an increase in labor and capital as well as a reduction in the economy's productivity
- Economic impact estimates are the net effect, but CGE analysis also identifies *where* the gains and losses occur (by sector, location, type of household, etc.)
- CGE models represent long-run equilibrium outcomes, and may therefore understate policy impacts
  - Transitional disruption cost is not addressed (employment literature suggests this can be substantial in the case of job transitions)
  - "Surprises," volatility, and impact of uncertainty on business decision making can add to costs and are not captured by most CGE models

Only 1 Economic Impact Analysis of the Proposed Ozone NAAQS Appears to Exist

- July 2014: released economic impact analysis of possible 60 ppb NAAQS using best available (but older) data
- February 2015: economic impact analysis of 65 ppb NAAQS using EPA's newly released data
- April 2015: economic impacts to Texas, based on a more detailed assessment of Texas' emissions reduction needs
  - Preliminary results are being presented today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Economic Impacts of a 65 ppb National Ambient Air Quality Standard for Ozone

Executive Summary

Prepared for:

National Association of Manufacturers

February 2015

www.nera.com/publications/archive/2015/economic-impacts-of-a-65-ppb-national-ambient-air-quality-standa.html

Analysis Used a CGE Model of the U.S. Economy ("NewERA Model")

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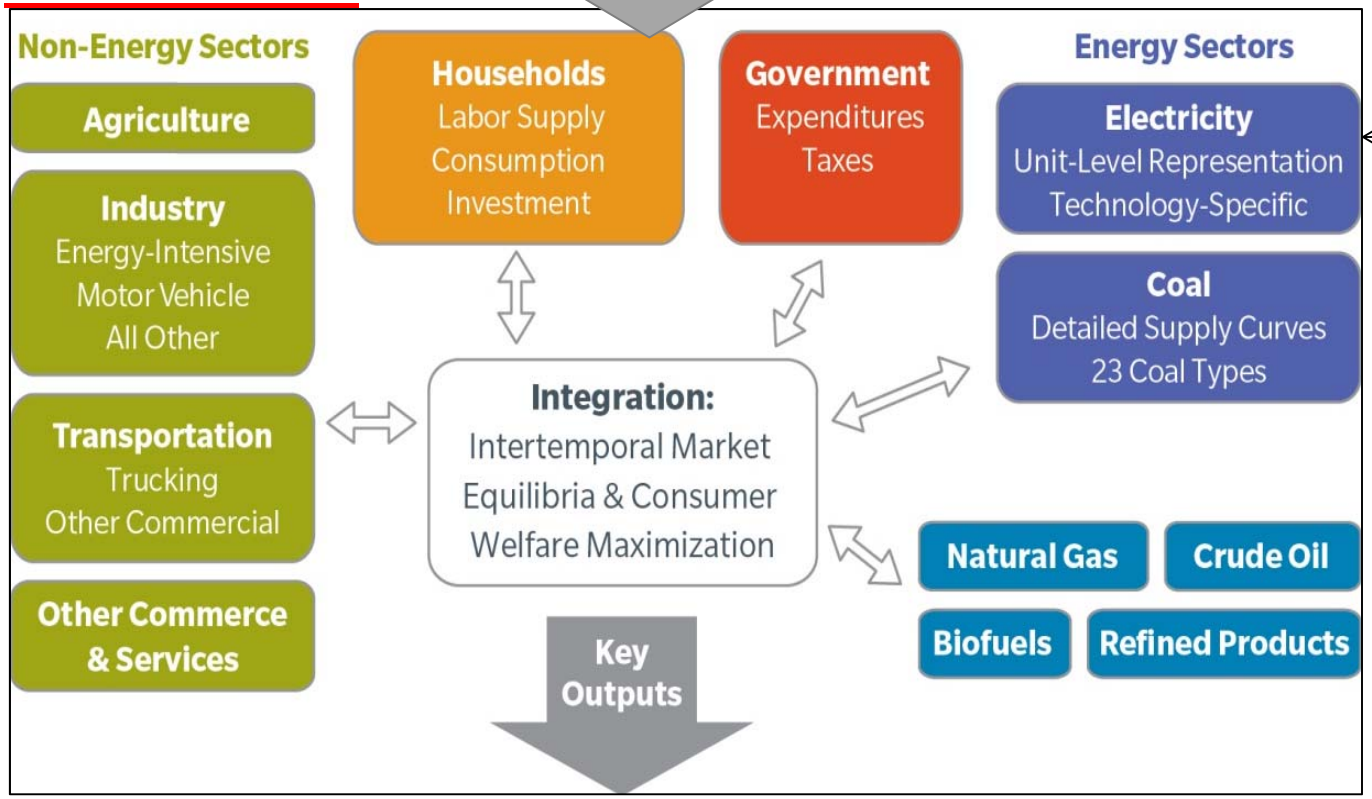
Total estimated compliance spending, by state, by sector, by year
+ coal-fired electricity unit closures (by unit)

"NewERA Model"



Note:
The model finds the lowest-cost replacement power to meet electricity demands

Macroeconomic
- Consumption
- GDP
- Output by sector

Primary Fuels
- Demand
- Prices

Electricity
- Prices
- Capacity
- Load and dispatch

Recap of Costs Estimated by NERA for Attainment of 65 ppb NAAQS

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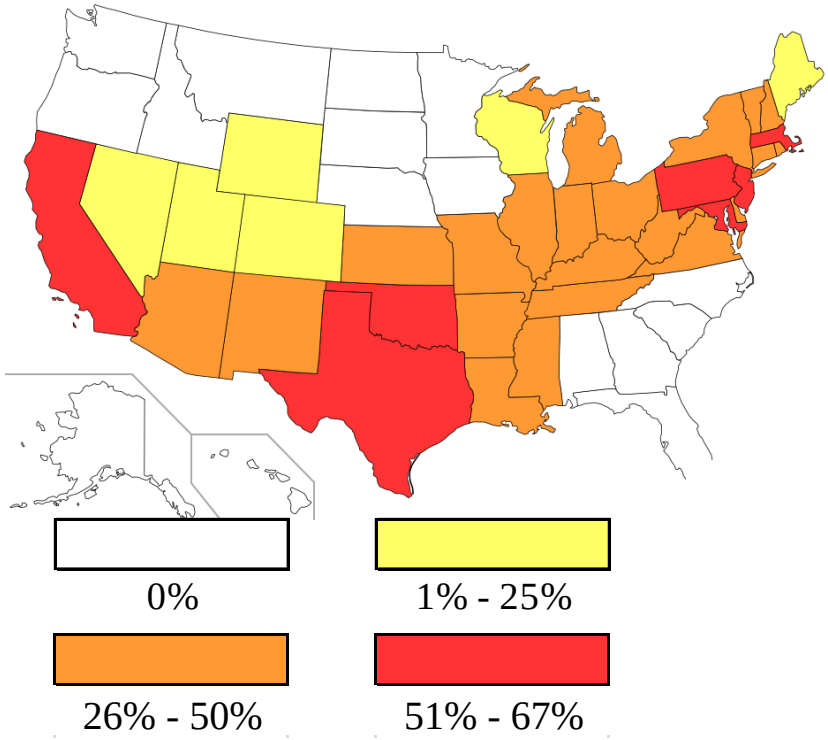
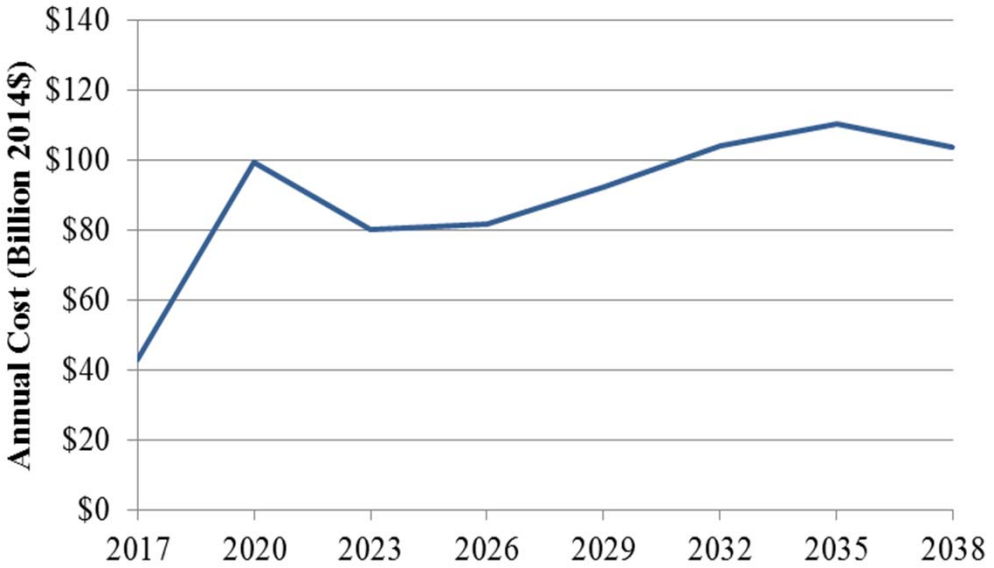
% NO_x Reduction Needed Relative to Base Case Emissions



Potential Emission Reduction Costs (Excluding Costs of Electricity Sector)



This economic impact analysis includes only emissions reduction spending. It does not include any SIP-related state expenses, barriers to economic activity, or lifestyle alterations.

Projected Macroeconomic Impacts Are Large, Particularly in Texas

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Potential Impacts of 65 ppb Ozone Standard on Gross Domestic Product and Household Consumption (2017-2040, 2014$)

	NATIONAL	TEXAS (Preliminary)
GDP Loss Relative to Baseline (Annualized)	**$140 billion/year**	**$30 billion/year**
GDP Loss Relative to Baseline (Present value)	**$1,720 billion**	**$360 billion**
Consumption Loss per Household	**$830/year**	**$1,850/year**

Notes: Present value is from 2017 through 2040, discounted at a 5% real discount rate. Consumption per Household is annualized value calculated using a 5% real discount rate.

Potential Reduction in Worker Income Is 1% Nationally, and Over 3% in Texas

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Potential Impacts of 65 ppb Ozone Standard on Employment (Average, 2017-2040)

	NATIONAL	TEXAS (Preliminary)
Real Wage Rate (% Change from Baseline)	**-0.6%**	**-1.4%**
Change in Labor Income (% Change from Baseline)	**-0.9%**	**-3.2%**
Labor Income Change in Job-Equivalents (Change from Baseline)	**-1.4 million**	**-0.4 million**

Notes: Baseline annual job-equivalents is 156 million nationally, and 12 million in Texas.

Energy Price Impacts (2014$)
Averages 2017-2040

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	NATIONAL				TEXAS (Preliminary)			
	Avg. Baseline	Avg. 65 ppb	Change	**% Change**	Avg. Baseline	Avg. 65 ppb	Change	**% Change**
Henry Hub Natural Gas Price ($/MMBtu)	$6.22	$6.47	$0.25	**3.7%**	(same as national)			
Residential Delivered Natural Gas ($/MMBtu)	$14.23	$14.76	$0.53	**3.7%**	$14.10	$14.61	$0.51	**3.6%**
Industrial Delivered Natural Gas ($/MMBtu)	$8.71	$9.27	$0.55	**6.3%**	$6.47	$7.03	$0.56	**8.7%**
Retail Gasoline ($/gal)	$3.68	$3.82	$0.14	**3.7%**	$3.68	$4.18	$0.50	**14%**
Residential Electricity Rates (¢/KWh)	14.9¢	15.2¢	0.2¢	**1.7%**	15.2¢	15.9¢	0.7¢	**4.4%**
Industrial Electricity Rates (¢/KWh)	9.7¢	10.0¢	0.3¢	**2.8%**	9.5¢	10.2¢	0.7¢	**7.6%**

Even States That Have No Compliance Spending Face Macroeconomic Impacts

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Potential Impacts of a 65 ppb Ozone Standard on Annual Consumption per Household by State (Average, 2017-2040, 2014$)

State		State		State	
AL	-$400	ME	-$1,100	OH	-440
AZ	-$660	MD	-$1,340	OK	-$900
AR	-$680	MA	-$2,190	OR	-$280
CA	-$790	MI	-$430	PA	-$1,240
CO	-$390	MN	-$430	RI	-$1,050
CT	-$1,520	MS	-$770	SC	-$300
DE	-$2,260	MO	-$700	SD	-$310
FL	-$250	MT	-$690	TN	-$960
GA	-$280	NE	-$470	TX (*)	-$1,850
ID	-$290	NV	-$920	UT	-$410
IL	-$640	NH	-$1,180	VT	-$1,200
IN	-$540	NJ	-$1,470	VA	-$1,440
IA	-$350	NM	-$630	WA	-$330
KS	-$1,990	NY	-$1,390	WV	-$980
KY	-$470	NC	-$250	WI	-$580
LA	-$710	ND	-$830	WY	-$4,380

(*): Texas results shown are the preliminary, refined estimates from April 2015 TCEQ analysis.

Estimated Average Consumer Impact in Each State Depends on Many Factors

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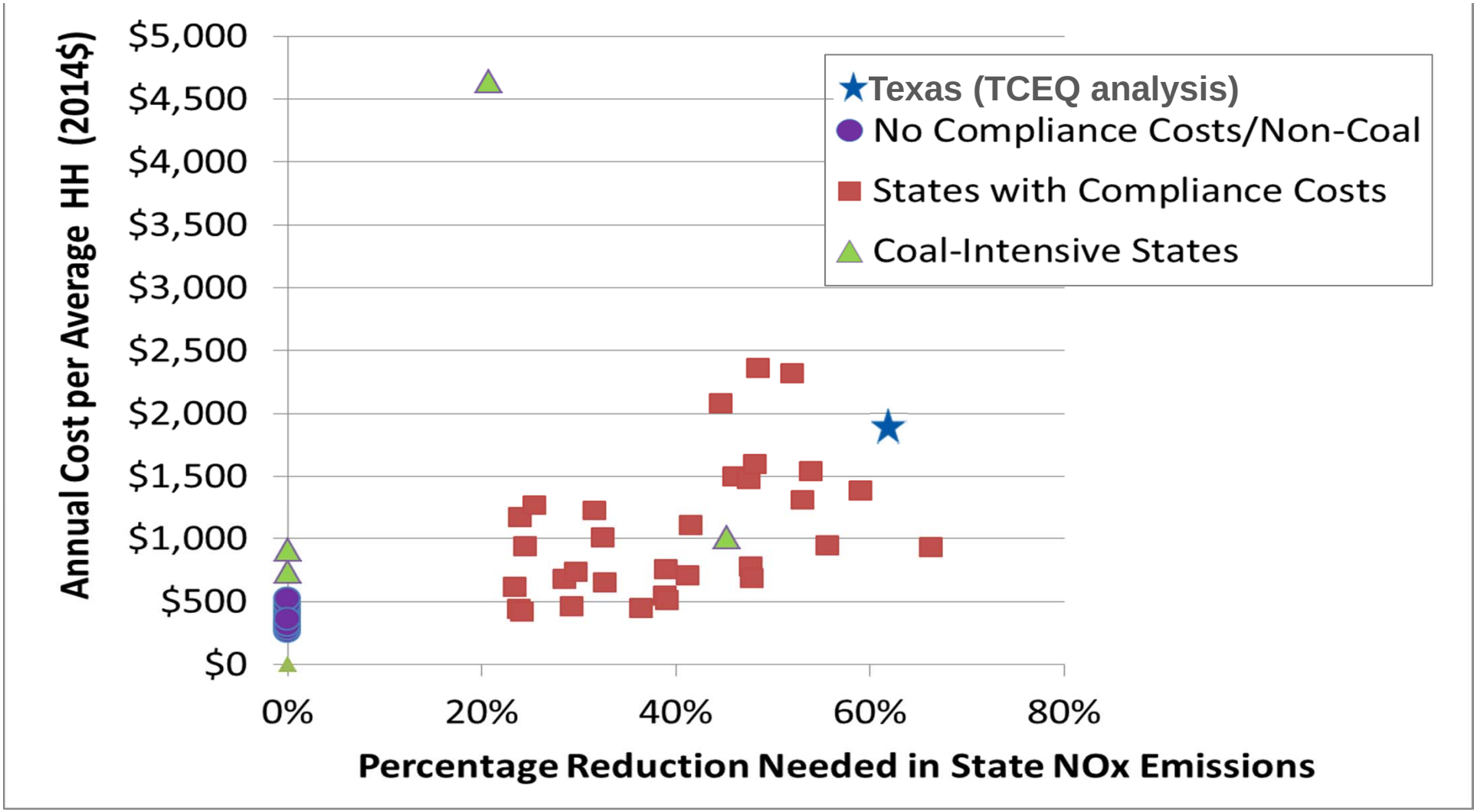
State-by-State Loss in Annual Consumption/Household vs. % NOx Reduction (65 ppb NAAQS)



Output Impacts Vary by Sector

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Potential Percentage Impacts of 65 ppb Ozone Standard on Sectoral Output (2017-2040)

	NATIONAL	TEXAS (Preliminary)
Non-Energy Sectors		
Agriculture	-0.9%	-9.6%
Commercial/Services	-0.4%	-1.7%
Manufacturing	-0.3%	-2.2%
Commercial Transportation	-0.9%	-2.3%
Commercial Trucking	-0.5%	-2.0%
Energy Sectors		
Coal	-28%	-41%
Natural Gas	3.9%	4.6%
Crude Oil/Refining	-0.8%	-0.7%
Electricity	-1.5%	-4.5%

Business profitability is not necessarily tied to output value, and would require a different type of analysis.

Note: Values in table are the simple average of percentage change over 2017-2040.

Economic Impacts May Be Distributed Regressively

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- A common finding is that costs per household are larger as a percent of income for lower income households than for higher income households (*i.e.*, impacts are "regressive")
- The N_{ew}ERA analysis did not assess distributional impacts by type of household
- Some reasons regressive impacts might be expected for the ozone NAAQS:
  - Price increases are projected for electricity, natural gas, and gasoline -- energy costs that tend to be a larger fraction of lower income household budgets
  - More rapid scrappage of older vehicles reduces supply of low cost vehicle alternatives that are purchased by lower income people
- More analysis is needed to provide better insight on distributional impacts to types of households

Limitations and Uncertainties for the Quantitative Economic Impact Estimates

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- Are driven by compliance cost inputs that are highly uncertain
- Assumes that compliance spending will occur on schedule
- Possibility that regulatory pressure will spur innovations in production processes that increase output productivity not analyzed
  - However, empirical evidence does not support this as a general phenomenon, although it may occur in some pockets of the economy
- Assumes costs are all passed into product prices
  - Absorption of costs, if not passed through, would still reduce productivity but with incidence/distribution of impacts being different
- No transitional costs are included, nor is an estimate of number of workers displaced (and subject to such transition) possible
- Effects of constraints on development projects and local government spending costs not included

Non-Attainment Costs/Constraints Not Included in NERA's Analysis

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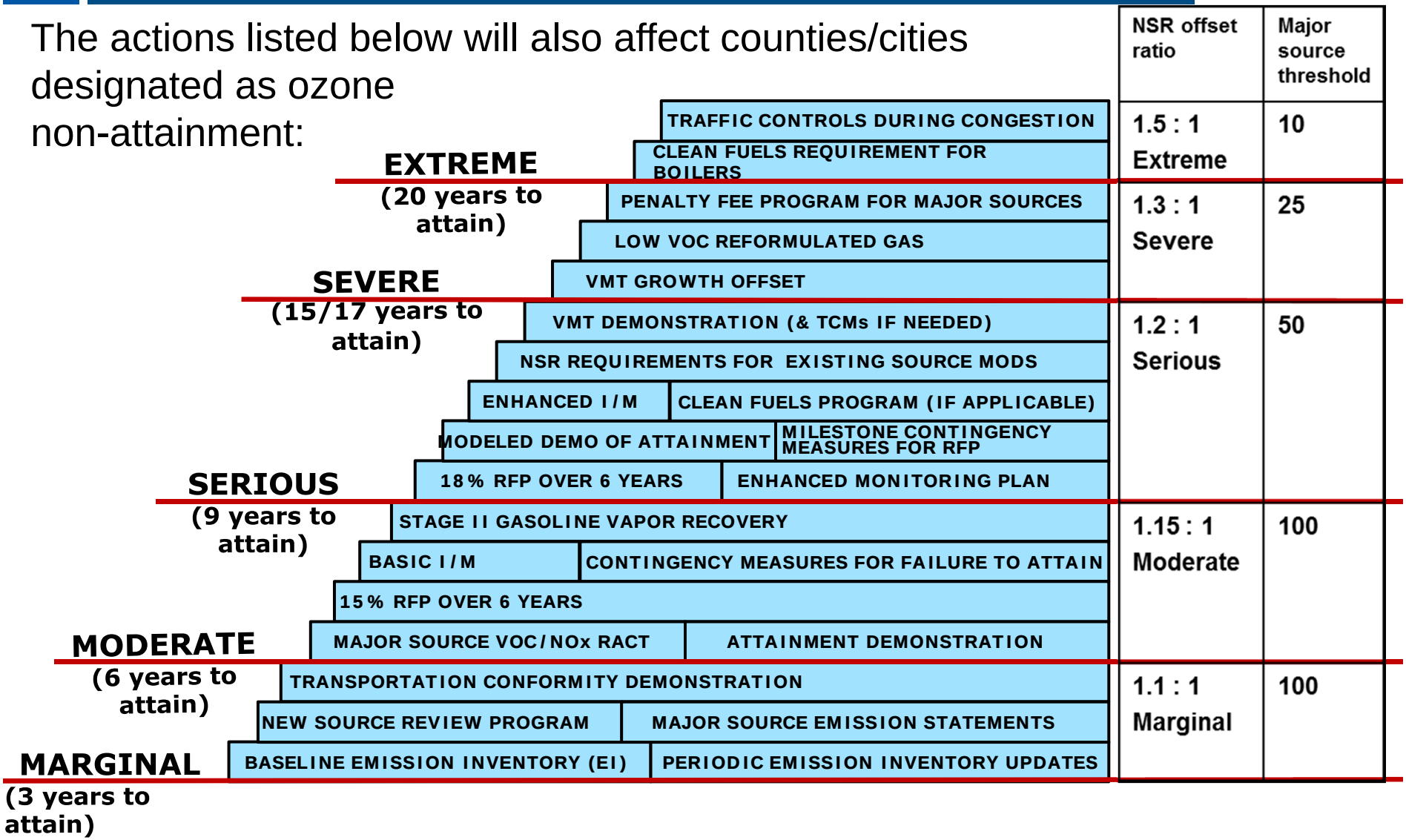
The actions listed below will also affect counties/cities designated as ozone non-attainment:



	NSR offset ratio	Major source threshold
EXTREME	1.5 : 1 Extreme	10
SEVERE	1.3 : 1 Severe	25
SERIOUS	1.2 : 1 Serious	50
MODERATE	1.15 : 1 Moderate	100
MARGINAL	1.1 : 1 Marginal	100

Source: Presentation by Doug Aburano, EPA Region 5, "Lessons for Why to Avoid Nonattainment and How Minnesota Might Do It"

Insights from NERA's Economic Impact Analyses

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- Larger than historically experienced costs to meet 65 ppb NAAQS imply potentially sizeable macroeconomic impacts
- Economic impacts projected for all U.S. states, although with large variation due to many state-specific factors:
  - States with no compliance costs face net negative macroeconomic impacts due to economy-wide impacts
  - Some of the largest state impacts are due to attainment actions in other states (*e.g.*, coal-supplying states)
- Impacts filter across whole economy primarily via energy price effects
- Natural gas is the only sector projected to gain (although unanalyzed potential permitting constraints on new wells could alter this)
- Regressivity of impacts by type of household not yet explored

No other economic impact analysis of ozone proposal exists.
(EPA provided one in its 2008 ozone RIA, but included only the "known" compliance cost estimates. Current RIA does not even do that.)

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Anne Smith, Ph.D.

Senior Vice President
NERA Economic Consulting
Washington, D.C.
+1 202 466 9229
Anne.Smith@nera.com

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