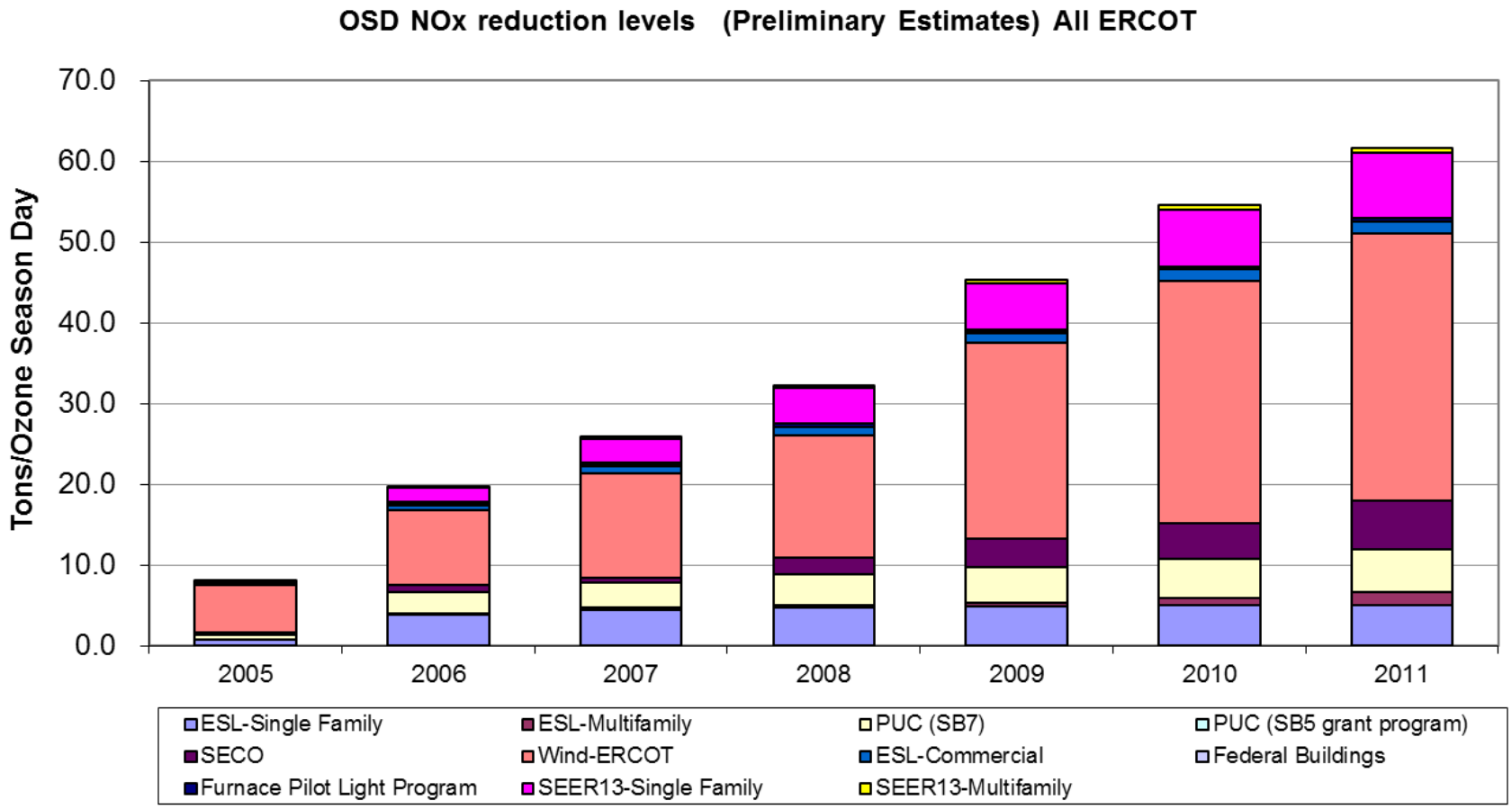
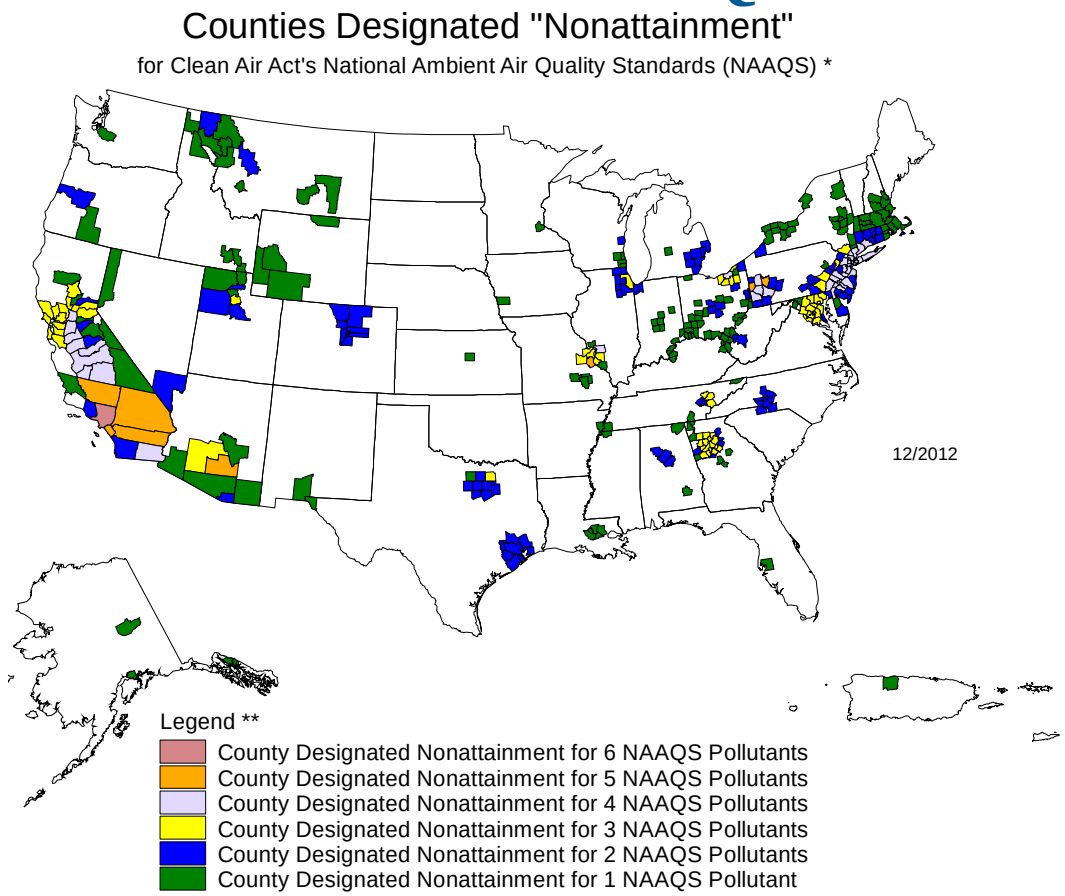
Translating Energy Efficiency Policy Decisions into Air Quality Benefits

Presented by Chris James, John Shenot, and Ken Colburn

Vision: Improve Air Quality With Energy Efficiency Power Plants



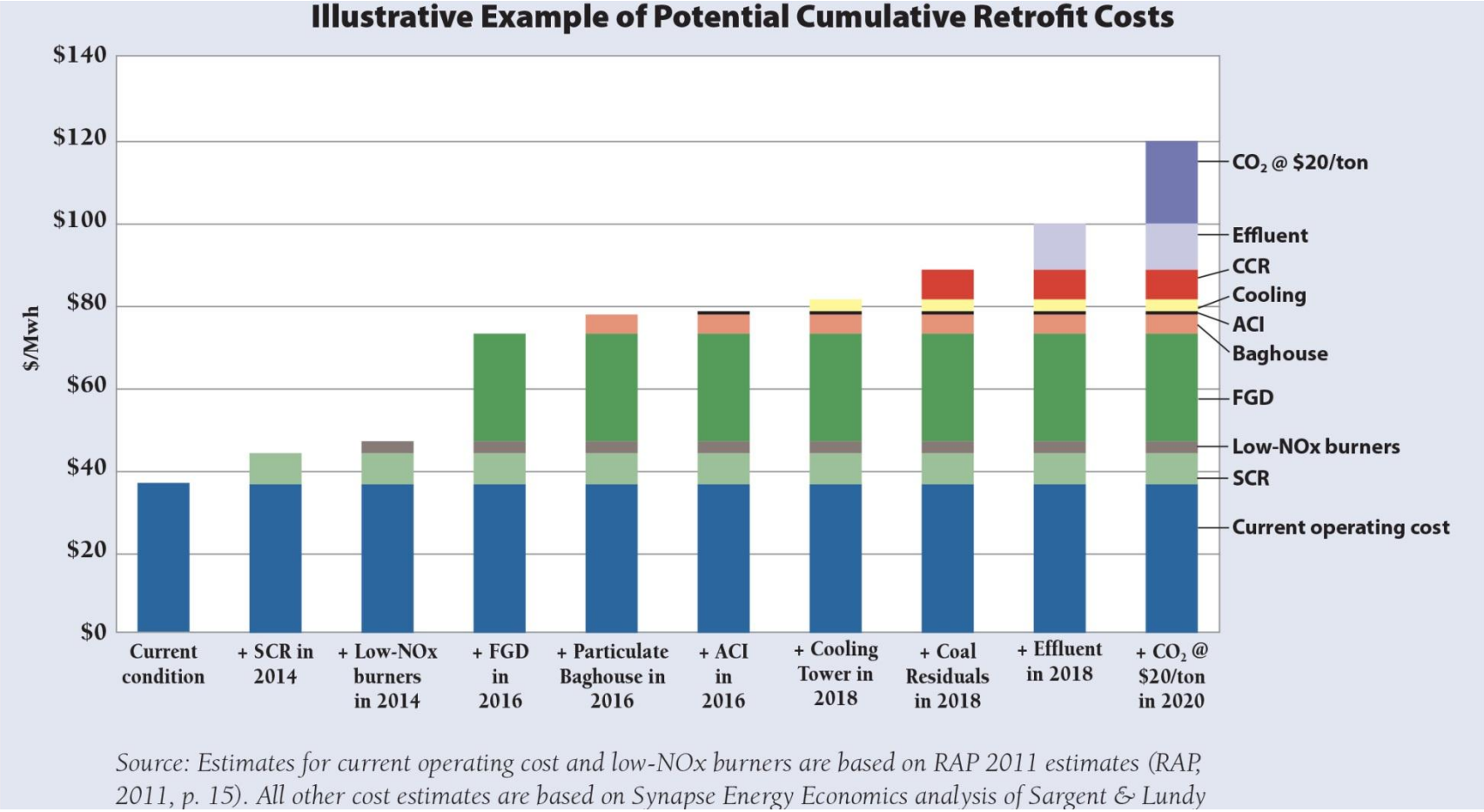
Importance of Topic: Over 150 Million US Citizens Live In Areas That Exceed One or More NAAQS



Interest in Topic

- Future: many new areas exceed ozone or PM2.5 NAAQS
  - Little/no experience with “non-attainment planning”
- Current/Past: anti-backsliding
- EE: highly cost-effective, multiple energy and environmental benefits

BAU Costs Increasing



Source: Estimates for current operating cost and low-NOx burners are based on RAP 2011 estimates (RAP, 2011, p. 15). All other cost estimates are based on Synapse Energy Economics analysis of Sargent & Lundy

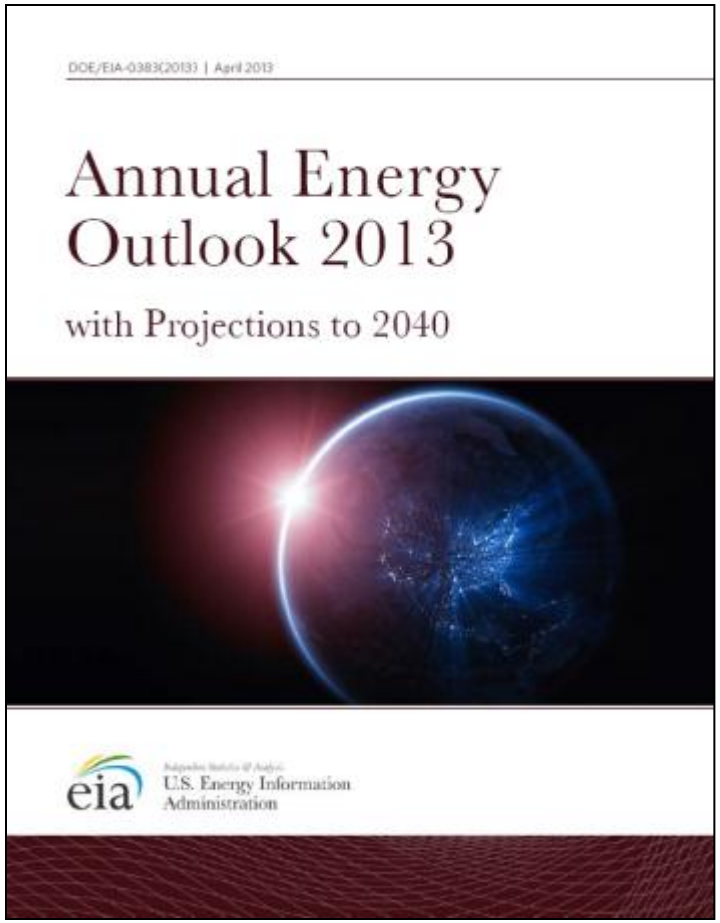
Quantifying Avoided Emissions from EE Policies and Programs

1

Develop a **baseline** forecast of energy consumption and associated emissions

1

Data Source for Baseline Forecast

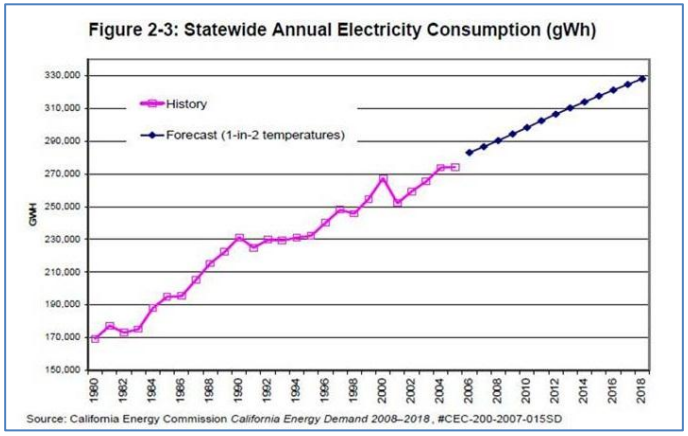


- EPA generally defaults to the AEO for its power sector modeling inputs
- Projections of energy use by *region* (not state)
- Published annually by Energy Information Administration

1

Other Sources for Baseline Forecasts

- Independent System Operator (ISO)
- State Public Utility Commissions and State Energy Offices
  - esp. Utility Integrated Resource Plans (IRPs)
- EE Market Potential Studies



Quantifying Avoided Emissions from EE Policies and Programs

1. Develop a **baseline** forecast of energy consumption and associated emissions

2. Determine which EE policies and programs are already **embedded** in the baseline forecast

2

Which Policies are Embedded in the AEO?

Yes

- Federal energy standards and weatherization $
- Mandatory State RPS policies
- California's cap & trade program

No

- State EERS policies
- State EE/RE *goals*
- Utility EE plans ordered/approved by State PUCs
- Local government actions

Quantifying Avoided Emissions from EE Policies and Programs

1. Develop a **baseline** forecast of energy consumption and associated emissions
2. Determine which EE policies and programs are already **embedded** in the baseline forecast
3. Quantify the expected **energy savings** from incremental EE

3

Data Sources for Energy Savings

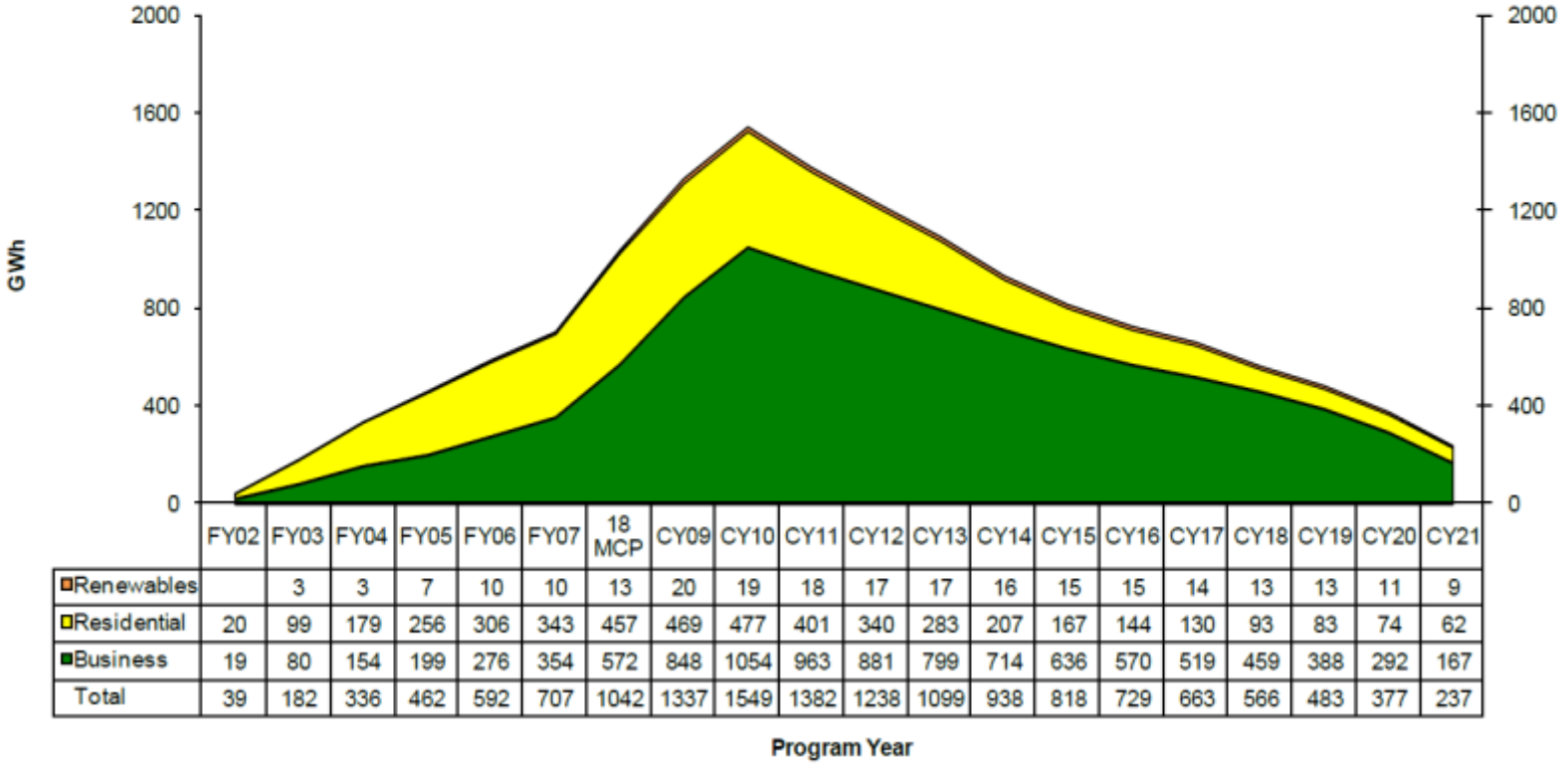
- Annual Energy Savings Evaluations

- Expected
  - Utility Integrated Resource Plans (IRPs)
  - EE Program Plans
  - ISO Forecasts
- Hypothetical
  - EE Market Potential Studies

3

Example: Wisconsin Evaluation Report

Figure 2-12. Persistent Verified Net Electricity Savings (GWh)



	FY02	FY03	FY04	FY05	FY06	FY07	18 MCP	CY09	CY10	CY11	CY12	CY13	CY14	CY15	CY16	CY17	CY18	CY19	CY20	CY21
Renewables		3	3	7	10	10	13	20	19	18	17	17	16	15	15	14	13	13	11	9
Residential	20	99	179	256	306	343	457	469	477	401	340	283	207	167	144	130	93	83	74	62
Business	19	80	154	199	276	354	572	848	1054	963	881	799	714	636	570	519	459	388	292	167
Total	39	182	336	462	592	707	1042	1337	1549	1382	1238	1099	938	818	729	663	566	483	377	237

3

Example: ISO-NE EE Forecast

GWh Savings							
	Sum of States	ME	NH	VT	CT	RI	MA
2015	1619	89	65	110	244	163	948
2016	1518	82	62	102	230	153	889
2017	1423	77	59	95	216	143	833
2018	1333	71	56	88	204	134	780
2019	1247	65	53	82	191	125	731
2020	1167	60	50	77	180	117	684
2021	1092	55	48	71	169	109	640
Total	9399	499	393	625	1434	944	5505
Average	1343	71	56	89	205	135	786
MW Savings							
	Sum of States	ME	NH	VT	CT	RI	MA
2015	249	10	11	20	33	28	147
2016	233	9	10	19	31	26	138
2017	218	8	10	18	29	25	129
2018	205	8	9	16	27	23	121
2019	192	7	9	15	26	22	113
2020	179	7	8	14	24	20	106
2021	168	6	8	13	23	19	99
Total	1444	55	65	115	193	163	853
Average	206	8	9	16	28	23	122

3

Example: TVA Market Potential Study

Table 6-1 Summary of Energy Efficiency Potential

	2012	2015	2020	2025	2030
Baseline Forecast (GWh)	146,505	148,692	156,243	167,462	180,959
Energy Savings (Cumulative GWh)					
Achievable - Low	811	3,256	7,963	13,420	19,093
Achievable - High	2,417	7,494	15,337	25,215	35,781
Economic	4,481	12,418	21,658	33,091	44,821
Technical	5,349	15,347	27,545	42,822	57,244
Energy Savings (% of Baseline)					
Achievable - Low	0.6%	2.2%	5.1%	8.0%	10.6%
Achievable - High	1.7%	5.0%	9.8%	15.1%	19.8%
Economic	3.1%	8.4%	13.9%	19.8%	24.8%
Technical	3.7%	10.3%	17.6%	25.6%	31.6%

Source: Global Energy Partners (2013) for TVA

Quantifying Avoided Emissions from EE Policies and Programs

1. Develop a **baseline** forecast of energy consumption and associated emissions
2. Determine which EE policies and programs are already **embedded** in the baseline forecast
3. Quantify the expected **energy savings** from incremental EE
4. Quantify the expected **avoided emissions** from incremental EE

4

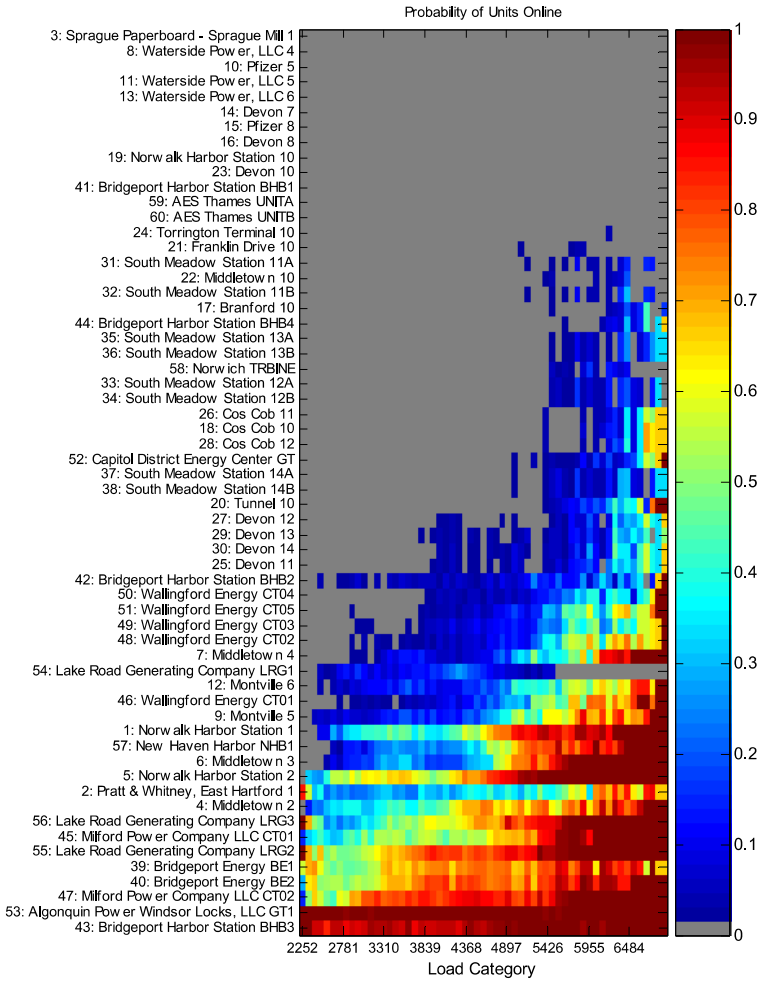
Average Emissions Method

eGRID subregion acronym	eGRID subregion name	Non-baseload output emission rates		
		NO_x (lb/MWh)	Ozone season NO_x (lb/MWh)	SO_2 (lb/MWh)
AKGD	ASCC Alaska Grid	2.4931	2.4833	1.0174
AKMS	ASCC Miscellaneous	19.9536	19.7361	5.7536
AZNM	WECC Southwest	0.8308	0.7754	0.3913
CAMX	WECC California	0.3211	0.2138	0.0315
ERCT	ERCOT All	0.6069	0.6647	0.7011
FRCC	FRCC All	1.0765	1.0703	1.7372
HIMS	HICC Miscellaneous	8.5263	9.0216	5.0550
HIOA	HICC Oahu	2.7853	2.8779	4.0602
MROE	MRO East	2.0351	2.0709	5.7008
MROW	MRO West	3.2356	2.8892	5.7685
NEWE	NPCC New England	0.6539	0.4892	2.1336
NWPP	WECC Northwest	1.5014	1.5262	1.1596
NYCW	NPCC NYC/Westchester	0.6110	0.6275	0.1427
NYLI	NPCC Long Island	1.1701	1.0261	1.1133
NYUP	NPCC Upstate NY	1.0146	1.0079	2.8584
RFCE	RFC East	1.4034	1.3682	8.3013
RFCM	RFC Michigan	1.9392	1.8064	6.6348
RFCW	RFC West	2.0350	1.9049	9.3974
RMPA	WECC Rockies	2.5876	2.7716	1.8331
SPNO	SPP North	2.4208	2.3573	3.7787
SPSO	SPP South	1.8995	1.8433	2.0357
SRMV	SERC Mississippi Valley	1.2885	1.3880	0.9409
SRMW	SERC Midwest	1.4657	1.3518	7.1515
SRSO	SERC South	1.6058	1.5045	7.1426
SRTV	SERC Tennessee Valley	1.5943	1.5495	5.7162
SRVC	SERC Virginia/Carolina	1.3047	1.1950	5.0473
U.S.		**1.4394**	**1.3908**	**4.1847**

4

Marginal Emissions Methods

- EE will usually reduce the output of the least economical EGUs
- Using historical data, identify the EGUs most likely to reduce output due to EE
- Apply EGU-specific emission factors



4

Dispatch Modeling Methods

Load Profiles

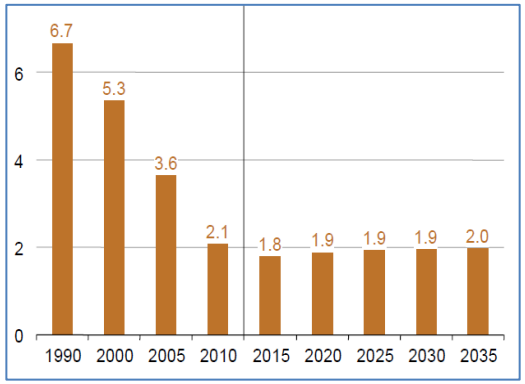
Power Plant Data

Fuel Prices

Grid Constraints

Examples:
IPM, PROMOD, PROSYM, PLEXOS, ENERGY 2020, MARKAL

NOx Emissions



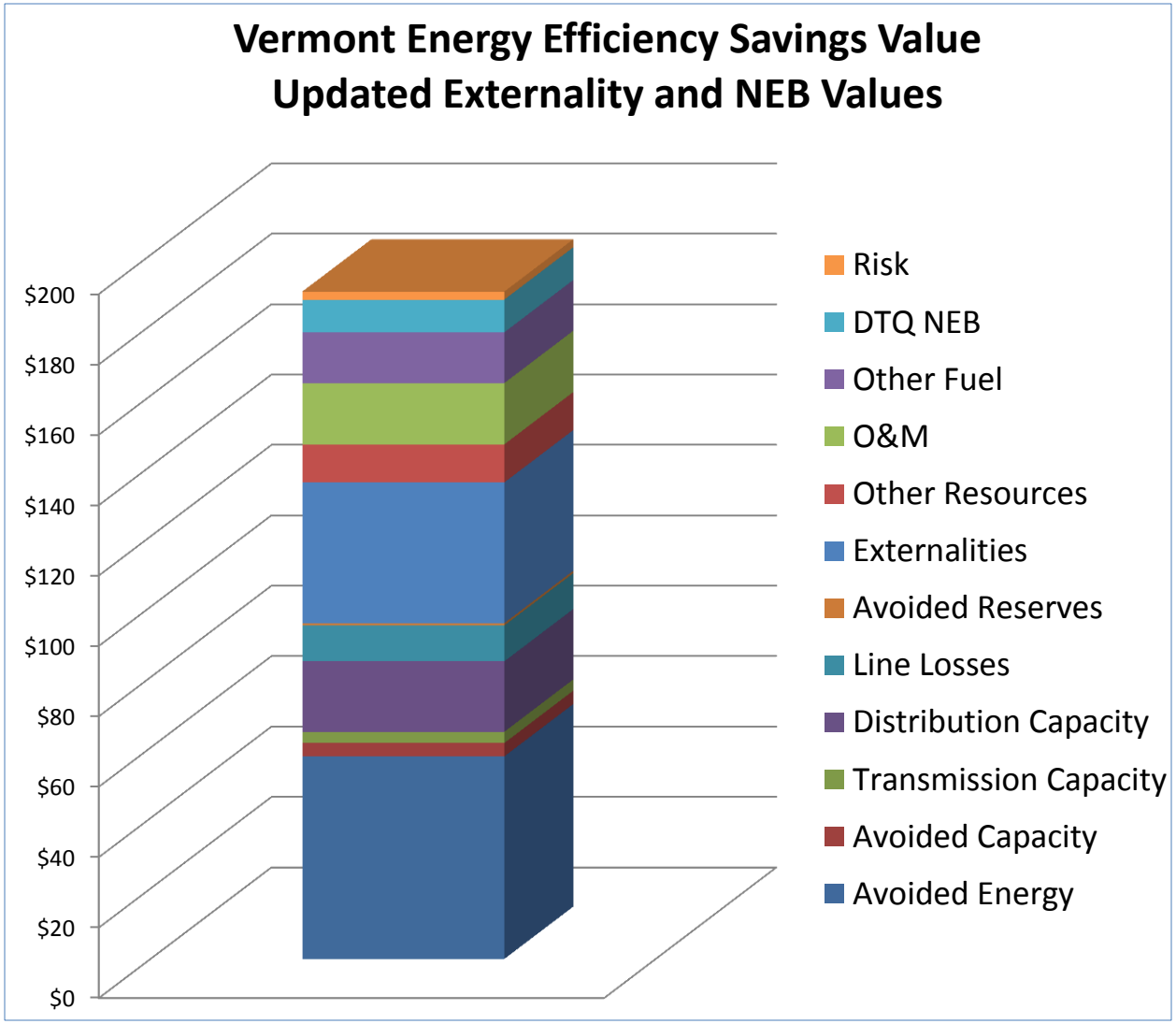
EPA's EE/RE Roadmap "Pathways"

	Baseline Pathway	Control Technology Pathway	Emerging/ Voluntary Measures Pathway	Weight-Of-Evidence Pathway
Types of projects	For "on the book" policies; Best on a state-wide or regional basis	For "on the way" policies	For locally-based activities; Can be bundled	Any
SIP credit limit	None	None	6% of total required emission reductions	No credit taken but do get emissions benefits
Enforcement	State enforceable but not Federally enforceable	Federally enforceable against the responsible party	Not enforceable against the responsible party	None
What happens if SIP reductions do not materialize?	CAA SIP Call; Air agency required to make up for the emissions shortfall	Responsible party required to comply	State responsible for reductions	-
Level of documentation required	Significant analysis to show reductions are in place for planning period, quantify impacts, and ensure no double counting	Significant analysis to show reductions are permanent, enforceable, quantifiable and surplus	Moderate	Can range depending on level of analysis

Key References for Quantifying Impacts

- RAP (soon to be published), *Data Sources and Methods for Quantifying the Air Quality Impacts of Energy Efficiency Policies and Programs*
- U.S. EPA (2012), *Roadmap for Incorporating Energy Efficiency/Renewable Energy Policies and Programs into State and Tribal Implementation Plans*
  - http://epa.gov/airquality/eere/manual.html
  - Note Appendix I, *Methods for Quantifying EE and RE Emission Reductions*
- State and Local Energy Efficiency Action Network (2012), *Energy Efficiency Program Impact Evaluation Guide*
  - http://www1.eere.energy.gov/seeaction/pdfs/emv_ee_program_impact_guide.pdf
  - Note Chapter 6, *Calculating Avoided Air Emissions*
- U.S. EPA (2010), *Assessing the Multiple Benefits of Clean Energy: A Resource for States*
  - http://www.epa.gov/statelocalclimate/documents/pdf/epa_assessing_benefits.pdf
- Synapse Energy Economics (2005), *Methods for Estimating Emissions Avoided by Renewable Energy and Energy Efficiency*
- ACEEE (2013), *Energy Efficiency and Pollution Control Calculator*
  - http://aceee.org/123-solutions

Scale of Avoided Costs from EE



Most analyses of EE are incomplete:

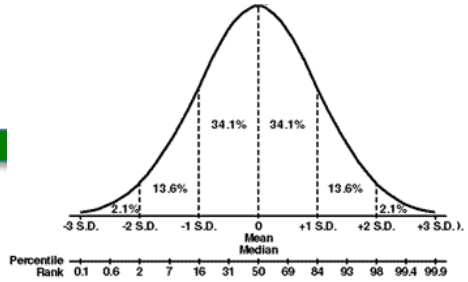
- **Look only at avoided energy costs.**
- **Include production capacity costs, but not transmission capacity, distribution capacity, or line losses.**
- **Few include other resource savings (water, gas, oil).**
- **Few try to quantity non-energy benefits.**

A new RAP paper on EE benefits is forthcoming

Issues Raised for EPA in NESCAUM MA/MD/NY Roadmap Pilot Program

- Expectations about the precise location of emission reductions from EE/RE
- Allow MARKAL modeling to quantify avoided emissions
- Help translate magnitude of EE/RE needed to achieve reductions ("scale it up")
- Clarify purpose and limitations of tools: Power Plant Emissions Calculator Tool and Hourly Marginal Emissions Tool (AVERT)

Measuring Emissions Reductions: RAP's "Mobile Source Analogy"



EPA

Clean Air SIP

EPA

Clean Air SIP

EPA

Clean Air SIP

Clean Air Act § 111(d)

CAA § 111(d) = GHG reductions from existing power plants

EE = Key to 111(d) envir, economic, political effectiveness

EE hinges on "State Equivalency Plans"

State Equivalency Plans hinge on quantifying EE

Quantifying EE hinges on EPA Roadmap

EPA Roadmap hinges on:

- EMV & Data
- Measures ➔Emissions
- EPA Regional Offices
- Success Stories

Progress is Being Made…

- EPA approval of EE/RE into SIPs via the Roadmap still awaits…
- But states are demonstrating "proof of concept"

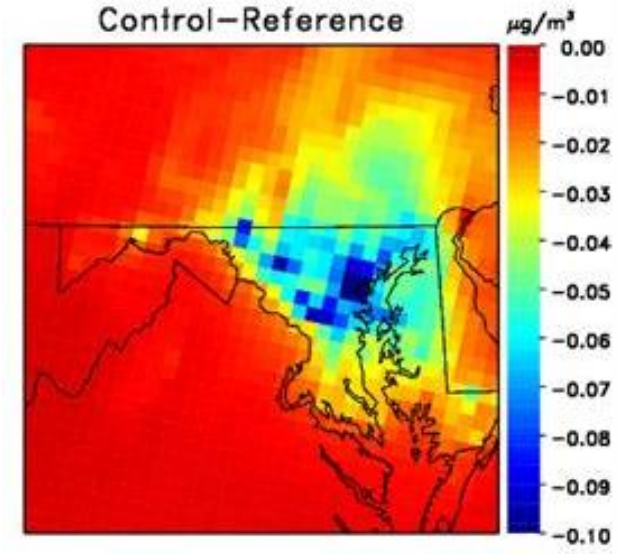
MDE

Power Sector Emission Reductions

MDE

Modeled Fine Particulate Benefits

… from EE/RE Efforts



MARYLAND

Very Preliminary Results – For Demonstration and Discussion Purposes Only

Policy Conclusions

- Many confounding variables, issues:
  - No regulatory path yet clearly established
  - NAAQS changes on the horizon
  - 111(d)
  - Dramatic change affecting the power industry
- Best advice now:
  - Get ahead of it
    - Ozone Advance, PM Advance
    - Investigate/ramp-up EE/RE
    - Set state goals where possible (Maryland, Bay Area, RAP's IMPEAQ, etc.)
    - Develop working relationships with PUC, SEO

About RAP

The Regulatory Assistance Project (RAP) is a global, non-profit team of experts that focuses on the long-term economic and environmental sustainability of the power and natural gas sectors. RAP has deep expertise in regulatory and market policies that:

- Promote economic efficiency
- Protect the environment
- Ensure system reliability
- Allocate system benefits fairly among all consumers

Learn more about RAP at www.raponline.org

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