Promoting Deep Energy Retrofits of Large Commercial Buildings
To Reduce Nitrogen Oxide Emissions
In the Ozone Transport Region

Ozone Transport Commission Energy Efficiency Workgroup
Status Report 08-15-12

Overview: In June 2011, the Ozone Transport Commission (OTC) members charged the OTC with evaluating the potential for energy efficiency strategies to reduce ozone levels in the Ozone Transport Region (OTR), and recommending an appropriate strategy or strategies. In September 2011, the OTC's Stationary and Area Sources Committee launched the Energy Efficiency Workgroup to fulfill the OTC's charge. The workgroup decided to initially focus on the ozone reduction potential from profitable "deep energy retrofits" of commercial buildings.

Purpose of this report: This report: 1) estimates the magnitude of NOx emission reductions possible in the OTR through profitable deep energy retrofits of large commercial buildings; and 2) lists several low-cost policy strategies that jurisdictions in the OTR could pursue to promote these profitable NOx reductions (including strategies that some jurisdictions are already pursuing).

Partly because OTC works with state air quality agencies, and energy efficiency strategies are typically pursued by state and local energy agencies, the strategies listed here are not subjected to an in depth analysis. Rather, they are presented as options which air divisions may discuss with their respective states' energy divisions, for further evaluation and possible implementation.

NOx Reduction Potential from Profitable Deep Energy Retrofits

Potential for profitable NOx and ozone reductions from commercial building energy efficiency: Commercial building deep energy retrofit projects have recently achieved profitable energy reductions of 38 percent to 70 percent, with profitability demonstrated by simple payback periods as low as three years.[1] High profitability often begins with planning a retrofit at a time when the heating/ventilation/air-conditioning, or HVAC, system will be replaced. Then, replacing windows with highly insulating windows and implementing other energy efficiency measures allows the purchase of a smaller HVAC system, at lower capital and operating costs.

These profitable deep energy retrofit projects achieve year-round energy reductions, including reductions in air conditioning demand during the ozone-season. Reducing air conditioning

[1] http://retrofitdepot.org/TrueStories (a website of the Rocky Mountain Institute).

demand reduces electricity demand, thus reducing electric generating unit emissions of nitrogen oxides (NOx) - an ozone precursor.

Potential magnitude of NOx reductions from deep energy retrofits of large commercial buildings in the OTR: The spreadsheet analysis presented at the end of this paper in Attachment 1 shows a potential annual reduction of 36,000 tons of NOx emissions from deep energy retrofits of large commercial buildings in the OTR. The spreadsheet analysis is designed to be self-explanatory, with data and assumptions presented in the top portion of the analysis (along with data sources), and estimated NOx reductions in the bottom portion. The Excel version of the spreadsheet, which shows the formulas used in the bottom portion of this analysis, is available from the OTC upon request.

Policy Options to Promote NOx Reductions from Profitable Deep Energy Retrofits

To date the OTC Energy Efficiency Workgroup has become aware of the following low-cost strategies to promote NOx reductions from profitable deep energy retrofits:

Collecting data on energy use by large commercial buildings and making it publicly available:

New York City has taken this approach, requiring owners of large commercial buildings to measure and report their energy use.

New York City requires owners of large non-residential and residential buildings to "upload data into an Internet-based database tool developed by the U.S. Environmental Protection Agency [called Energy Star Portfolio Manager] that is used to track and assess energy and water use relative to similar buildings". New York City will make the data publicly available after a time lag—for example, on September 1, 2012 for non-residential private buildings.[2] David Bragdon, head of New York City's Office of Long-Term Planning and Sustainability, expects that energy service companies will use the data to market their services and offer energy-saving retrofits.[3] New York City also requires owners of large buildings to conduct energy audits and "submit energy efficiency reports to the Department of Buildings that include both an energy audit report and a retro-commissioning report."[4]

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[2] http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=NY16R&re=1&ee=1

[3] "Energy Efficiency: Plenty of data, many confused landlords," CNNMoney online, November 21, 2011

[4] DSIREUSA web page for New York City, cited above

Although cities are probably better suited than states for verifying that building owners submit energy use data (because each city maintains databases of properties in the city, for property tax and other purposes), state energy offices could assist cities in their states to develop the capability to collect and make available building-level energy data.

Credit assistance: Offering credit assistance could be a low-cost option for a city or state, depending on how the credit assistance is structured—including, for example, whether the city or state can borrow at a lower interest rate than it can lend for such projects. The New York City Energy Efficiency Corporation offers credit assistance for retrofit projects.[5] On June 15, 2012, Daniel P. Malloy, the Governor of Connecticut, signed into law a revised property-assessed clean energy statute (C-PACE) allowing the State's newly formed "Green Bank", the Clean Energy Finance and Investment Authority (CEFIA) to offer properly assessed clean energy financing and program services to municipal and commercial property owners throughout the State of Connecticut. Connecticut's approach (C-PACE) is exciting because CEFIA will play a central role in developing statewide program guidelines that municipalities will agree to follow when joining. CEFIA is also empowered by the legislation to provide financing for projects. Program measures to ensure that energy efficiency and renewable energy projects help property owners and local governments achieve their goals of saving costs, safeguarding the environment, and creating jobs.[6] Currently, 28 states, plus DC authorize PACE. PACE-enabling legislation has been adopted by 27 states (Hawaii had existing authority). A map of States with PACE programs can be downloaded from: http://www.dsireusa.org/solar/solarpolicyguide/?id=26

Property-assessed clean energy (PACE) financing is one option whereby the city **or state** lends the property owner funds for the retrofit project, and the property owner pays back the loan through an incremental charge on the property tax bill. If the building is sold, the incremental charges must be paid by the building's new owner, until the loan is paid off. Typically the city requires due diligence, including an energy audit, before approving the PACE loan. There has been a controversy over which debt obligation takes seniority in the event of foreclosure —the original mortgage on the property, or the PACE debt. For buildings that have no mortgage, however - as is the case for many commercial buildings - this would not be an issue.

[5] "Energy Efficiency: Plenty of data, many confused landlords," cited above

[6] http://www.ctcleanenergy.com/Home/tabid/36/Default.aspx

Building ratings: State and local governments across the country are adopting policies to reduce energy use in commercial buildings through both required policy measures and voluntary campaigns. For example, the Massachusetts Department of Energy Resources is launching a building energy labeling program, which will be akin to the miles-per-gallon ratings for cars. The program is designed to "provide clear and actionable energy information about a building's potential energy performance, increase the value of good energy performance in the marketplace, and lead ultimately to greater uptake of efficiency investments."[7] More information on State and Local policy development in the U.S. can be found at: http://www.imt.org/performance-policy/us-policies, and a detailed list of policies and incentive programs leveraging Portfolio Manager, EPA's ENERGY STAR measurement tracking tool can be found at: http://www.energy star.gov/ia/business/government/State_Local_Govts_Leveraging_ES.pdf

Efforts to adopt policies to reduce energy use in commercial buildings are taking place in other countries as well. For example, the Australian Government has graded buildings on their energy efficiency, with grades of A, B, or C. The Government will only rent space in buildings graded "A." One observer has noted that this grading scheme influenced both commercial tenants, many of whom sought office space with a high grade, and property owners, many of whom sought to improve their grade by improving their building's energy efficiency.[8]

Recommendations

1.OTC's energy efficiency workgroup recommends a commitment to monitor the implementation of New York City's Green Buildings and Energy Efficiency program and other similar leading programs.

2. Specifically, commitment is needed to review the data that is scheduled for this Fall regarding the energy footprint of buildings that report. Since this will be the first report, a comparison can only be made with the next report of 2013.

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[7] http://www.mass.gov/eea/energy-utilities-clean-tech/energy-efficiency/ee-for/business-institutions/energy-labeling-for-commercial-buildings.html

[8] David Cote, Chairman and CEO of Honeywell, speaking at the Center for American Progess's Rountable Discussion on Energy Efficiency Leadership, "Unlocking Investment in Smart and Higg-Performance Buildings," November 17, 2011

Recommendations (Continued)

3. This year's report will help develop the method to calculate NOx emissions reduced based on electricity consumption using the tool within EPA's forthcoming Energy Efficiency and Renewable Energy in SIPs Manual. This is expected to be a significant number based on the estimates of the workgroup.

4. Examples of NOx reductions and electricity consumption need to be created to help make a more solid connection between energy efficiency programs and ozone SIP.

5. The energy generation and utilization should be more closely and directly linked in the ozone transport and high energy demand day efforts in view of the compelling economics of reducing NOx emissions through energy efficiency programs.

6. Energy efficiency could be used more widely based on the example of boiler MACT program with the additional benefit of potential SIP credits.

7. OTC provides a large forum for energy efficiency initiatives and therefore significant NOx reductions. The pace of developments is such that the workgroup firmly believes that best outcomes can come about in cooperation with other regional organizations such as NESCAUM, MARAMA, member states, EPA and technology developers and independent efforts as well.

Attachment 1

- Spreadsheet analysis estimating potential magnitude of NOx reductions from deep energy retrofits of large commercial buildings in the OTR

Attachment 2

- Number of Office Buildings in the OTR (Source: CoStar Group, Ms. Kristen Joy)

Attachment 3

- Number of Energy Efficient Buildings in the OTR

Attachment 4

- Overview of Energy Star Portfolio Manager Tool, presentation by Andrew Kreider, US EPA Region 3 Philadelphia, PA, February 9, 2012

Attachment 1 - Estimating Magnitude of NOx Reductions from Deep Energy Retrofits in the Ozone Transport Region

Table 1 - Data and Assumptions

Data Element	Value	Units	Source
Commercial, governmental and institutional building space in Mid-Atlantic and New England states in 2003	12,900,000,000	square feet	http://www.eia.gov/emeu/cbecs/cbecs2003/officereport/office1.html
Percentage of U.S. commercial, governmental and institutional building space in large buildings (over 50,000 square feet) in 2003	48%		http://www.eia.gov/emeu/cbecs/cbecs2003/officereport/office1.html
Percentage of Mid-Atlantic and New England commercial, governmental and institutional building space in large buildings (over 50,000 square feet) in 2003	48%		Assumed to be the same percentage as for the U.S. as a whole
Median U.S. electricity usage in commercial, governmental and institutional building space in 2003	11.5	kilowatt-hours per square foot	http://www.eia.gov/emeu/cbecs/cbecs2003/officereport/office2.html
Average Mid-Atlantic and New England electricity usage in office buildings in 2003	11.5	kilowatt-hours per square foot	Assumed to be the same as the *median* for the U.S. as a whole

Attachment 1 - Estimating Magnitude of NOx Reductions from Deep Energy Retrofits in the Ozone Transport Region

Table 1 - Data and Assumptions (Continued)

Data Element	Value	Units	Source
Average percentage reduction in energy use in profitable "deep energy retrofits"	42%		http://retrofitdepot.org (a website of the Rocky Mountain Institute)--average of the 2 profitable projects: Empire State Building and a retail franchise chain
Average percentage reduction in electricity consumption from profitable "deep energy retrofits" in the Ozone Transport Region	42%		Assumed to be the same as the average reduction in annual *energy* use for the deep energy retrofit projects cited above
Average NOx emissions in the Ozone Transport Region from electricity generation/consumption	2.43E-03	pounds per kilowatt-hour	Average emissions per kWh across the OTC states, using state-level data from "Source Energy and Emission Factors for Energy Use in Buildings," National Renewable Energy Laboratory, 2007, pp. 27-28 (http://www.nrel.gov/docs/fy07osti/38617.pdf)

Attachment 1 - Estimating Magnitude of NOx Reductions from Deep Energy Retrofits in the Ozone Transport Region

Table 2 - Estimates of Potential Energy Reductions & NOx Reductions in OTR (based on data and assumptions above)

Data Element	Value	Units
Commercial, governmental and institutional space in large buildings (over 50,000 square feet) in the Ozone Transport Region (Mid-Atlantic and New England states)	6,211,111,111	square feet
Electricity usage in large OTR in commercial, governmental and institutional space large buildings	71,427,777,778	kilowatt-hours per year
Potential reduction in electricity usage from deep energy retrofits of office space in large commercial, governmental and institutional space buildings in the Ozone Transport Region	29,642,527,778	kilowatt-hours per year
Potential reduction in NOx emissions from deep energy retrofits of commercial, governmental and institutional space in large buildings in the OTR	35,980	tons per year

Attachment 2 - Number of Office Buildings in OTR

Source: CoStar Group, Ms. Kristen Joy

State	Number of Buildings	Number of Office Buildings
DC	10,767	2,368
DE	7,803	1,697
MA	61,595	11,913
MD	51,497	10,684
ME	15,720	2,761
NH	14,178	2,666
NJ	93,617	18,630
PA	105,809	23,571
RI	14,063	2,437
VA	70,580	14,055
VT	2,397	506

Attachment 3 - Number of Energy Efficient Buildings in OTR

State	# of Energy Star Certified Buildings
CT	65
DC	154
DE	31
MA	200
MD	114
ME	15
NH	66
NJ	120
NY	327
PA	248
RI	36
VA	274
VT	10

Attachment 4 - Overview of Energy Star Portfolio Manager Tool, presentation by Andrew Kreider, US EPA Region 3 Philadelphia, PA, February 9, 2012