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Fact Sheet

POWER SECTOR OPPORTUNITIES FOR REDUCING CARBON DIOXIDE EMISSIONS: OHIO

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WHAT WILL CO_2 STANDARDS MEAN FOR OHIO?

President Obama announced a national climate plan in June 2013, and directed the U.S. Environmental Protection Agency (EPA) to set carbon pollution standards for the power sector. Once EPA establishes those standards, states will implement their own plans for achieving those reductions. In this fact sheet, WRI examines existing tools Ohio can use to reduce power plant emissions.

Disclaimer: *This Fact Sheet contains preliminary research, analysis, findings, and recommendations. It is intended to stimulate timely discussion and critical feedback and to influence ongoing debate on emerging issues. Its contents may eventually be revised and published in another form.*

Box 1 | What's Ahead for the Power Sector?

The power sector is the leading source of carbon dioxide (CO_2) emissions in the United States, but also offers some of the most cost-effective opportunities to reduce those emissions. Despite recent decreases in power sector emissions—due to the recession, increasing competition from renewable energy, and the low price of natural gas—current projections show that, absent policy action, emissions will increase in the coming decades.[1]

New Power Plants: President Obama directed EPA to update draft CO_2 emissions standards for new power plants by September 2013.[2] These standards will likely provide a backstop ensuring that new power plants produce significantly lower CO_2 emissions per megawatt-hour of power generation than the average existing coal plant. However, new coal plants are unlikely to be built even in the absence of the standards because of relatively low natural gas prices, among other factors.[3] If the re-proposed standards are largely similar to the draft proposal issued last April, it is unlikely they will have a significant impact on near-term GHG emissions.

Existing Power Plants: EPA also has been directed to (a) propose CO_2 emissions standards for existing power plants by June 1, 2014; (b) finalize these standards by June 1, 2015; and (c) require states to submit their proposed implementation plans by June 30, 2016. The Clean Air Act provides EPA with considerable flexibility in setting guidelines for states to meet these standards. States could be allowed to pursue a range of programs that encourage activities—such as fuel switching, dispatch of existing low-carbon power plants, increased generation by renewable sources, and energy efficiency, among other options—for meeting emissions targets. EPA also could set guidelines that allow for emissions rate averaging across power sector generation units to help meet the standard.

HOW OHIO CAN REDUCE POWER SECTOR EMISSIONS

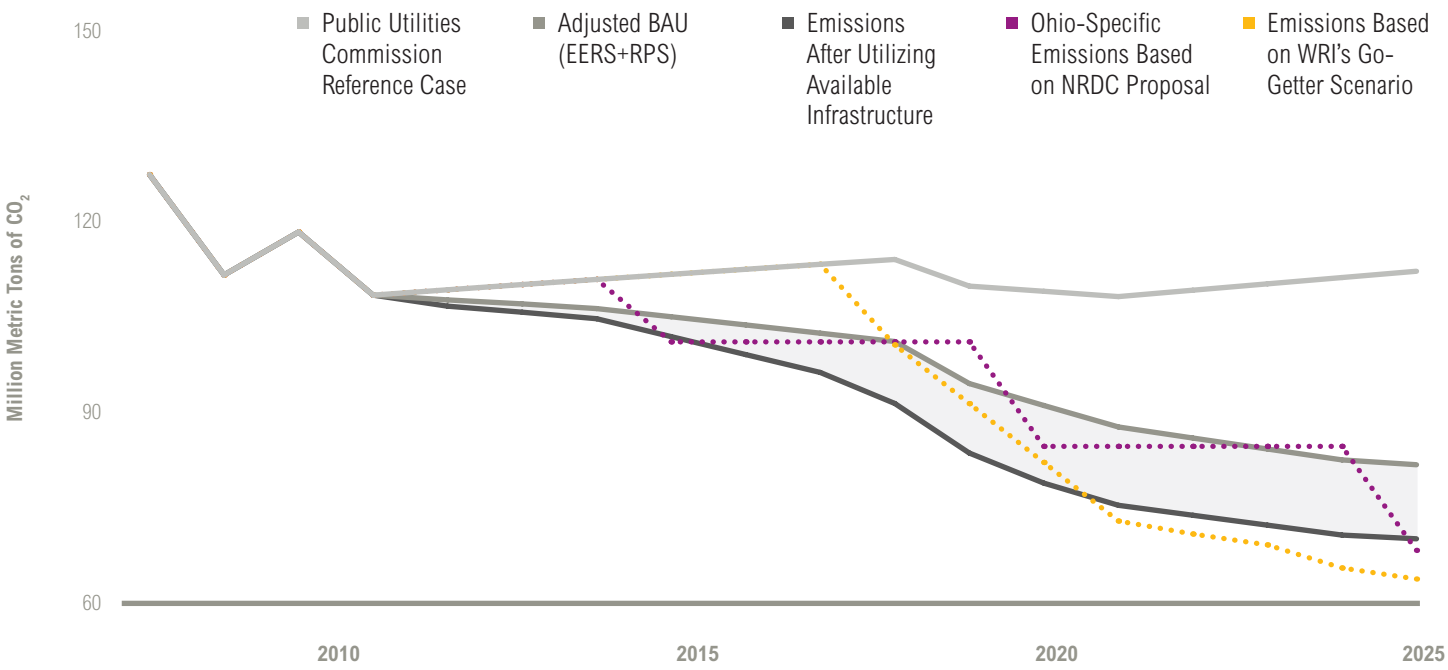
WRI analysis shows that Ohio has many opportunities to reduce carbon pollution from its power sector. Ohio actually is in a strong position to meet, and possibly exceed, forthcoming emissions standards for existing power plants. Carbon dioxide emissions from Ohio's power sector were 18 percent below 2005 levels in 2011 (the most recent year for which we have energy data from Ohio). According to reference case projections from the Ohio Public Utility Commission, they are projected to remain at or above 2011 levels through 2020. However, this reference case does not account for the state's existing renewable portfolio standard (RPS) and energy efficiency resource standard (EERS). Ohio can reduce power sector CO_2 emissions to 27 percent below 2011 levels in 2020 by achieving the targets in these existing state policies and taking advantage of the CO_2 reduction opportunities that use the existing infrastructure listed below.[4] This is equivalent to a 41 percent reduction in emissions from 2005 levels. Reductions of this magnitude would exceed those required by potentially stringent standards for existing power plants.[5]

- **CO_2 REDUCTIONS FROM EXISTING POLICIES**
  - Meeting the EERS (-10 percent in 2020 compared to 2011 levels)
  - Meeting the RPS (-7 percent in 2020 compared to 2011 levels)

- **CO_2 REDUCTION OPPORTUNITIES USING AVAILABLE INFRASTRUCTURE**
  - Increasing combined heat and power (CHP) capacity at commercial and industrial facilities (-3 percent compared to 2011 levels)
  - Fully utilizing existing combined cycle natural gas capacity (-7 percent in 2020 compared to 2011 levels)
  - Increasing the efficiency of the existing coal-fired power plant fleet (-2 percent in 2020 compared to 2011 levels)

Ohio could achieve even greater long-term emissions reductions by expanding existing policies. By taking the actions listed below, which would likely require additional legislation, Ohio can reduce power sector CO_2 emissions by an additional 14 percent in the next six years, to 41 percent below 2011 levels by 2020 and 62 percent below 2011 levels by 2030.[6]

Figure 1 | **Ohio Carbon Dioxide Reduction Opportunities for Power Sector Compliance Under The Clean Air Act**



Note: EPA has not yet proposed a national emissions standard for existing power plants. For purposes of illustration, this analysis shows emissions reductions that would occur if EPA adopted the Natural Resources Defense Council's proposed standards for existing power plants; in Ohio, this would require CO_2 emissions reductions of 22 percent below 2011 levels in 2020. We also show the emissions reductions that would occur if EPA were to adopt a more ambitious "go-getter" reduction schedule that aligns with a national reduction pathway necessary to meet the Administration's goal of reducing emissions 17 percent below 2005 levels by 2020.[7] National power sector emissions in the "go-getter" scenario drop 38 percent from 2005 to 2020; we show the equivalent percent reductions applied to Ohio's power sector (24 percent from 2011 to 2020). See footnote 6 for additional explanation.

- Expanding the RPS (-1 percent in 2030 compared to 2011 levels)[8]
- Accelerating the EERS (-5 percent in 2020 compared to 2011 levels)
- Further increasing CHP capacity at commercial and industrial facilities (-9 percent in 2020 compared to 2011 levels)

OPPORTUNITIES IN DETAIL

Existing and Expanded Energy Efficiency Resource Standards. In 2008, Ohio enacted an energy efficiency resource standard requiring utilities to implement programs that achieve cumulative electricity savings of 22 percent between 2009 and 2025 with specific annual benchmarks. Targeted annual savings started at 0.3 percent per year in 2009, ramping up to 1 percent per year from 2013–18 and 2 percent per year from 2019–25. Utilities are planning to meet the targets through discounts and rebates on energy efficient lighting; weatherization and household appliances; lighting retrofits; and energy management and CHP programs for commercial customers.[9] Analysis by the American Council for an Energy-Efficient Economy has shown that the economic benefits of meeting the standard will outweigh the costs, with the potential to save electricity customers in Ohio over $5 billion through 2020.[10] By achieving its annual electricity savings targets, Ohio can reduce its power sector emissions by 10 percent in 2020 compared to 2011 levels. If the state enacts new legislation to ramp up its annual electricity savings to 2 percent per year beginning in 2015 and continues to achieve this rate of savings through 2030, it can reduce power sector CO_2 emissions by a total of 15 percent in 2020. This would lead to a 26 percent decrease in projected electricity demand in 2030, which is within the range of Ohio's estimated cost-effective energy efficiency potential.[11]

Existing and Expanded Renewable Standards. Ohio's renewable and advanced energy portfolio standard requires 25 percent of the electricity sold by each utility or

electric services company within the state to be generated from alternative energy sources by 2025. At least 12.5 percent of sales by 2024 must be generated from renewable energy resources, including wind, hydropower, biomass, and at least 0.5 percent solar.[12,13] To reach the renewable standard by 2024, Ohio will need to increase its renewable sales by nearly 1 percent per year between 2012 and 2024. Renewable energy in Ohio has been growing rapidly since 2010: wind capacity grew from 9 MW to over 400 MW in 2012 with completion of Iberdrola's Blue Creek Wind Farm, and several utility-scale solar projects are currently in development.[14] By meeting its renewable standard, the state can reduce its power sector emissions by 7 percent in 2020 compared to 2011 levels. If Ohio continues to increase its renewable sales at the same rate after its target has been reached in 2024, it can reduce power sector CO_2 emissions by 11 percent in 2030 compared to 2011 levels.

Increasing CHP at Commercial and Industrial Facilities. Ohio is among the top five states with the greatest technical potential for new CHP capacity, but has utilized only a small fraction of this potential until recently.[15] In the past five years, it has become a leader in creating favorable conditions for CHP deployment.[16] In 2012, Ohio partnered with the U.S. Department of Energy (DOE) to provide guidance, technical assistance, and sharing of best practices among industrial facilities. DOE and the Ohio PUC encourage industrial customers to consider CHP as a long-term cost savings strategy that can help achieve compliance with boiler Maximum Achievable Control Technology compliance. In 2012, Ohio also began offering CHP as an eligible resource to count toward its energy efficiency resource standard.[17] The state has 9.8 GW of technical potential for new CHP, and is currently utilizing about 5 percent of this potential. If the state could achieve 25 percent of this potential by 2030, it would achieve reductions beyond the existing EERS, reducing power sector CO_2 emissions by 3 percent in 2020 compared to 2011 levels. If Ohio could achieve 50 percent of its technical potential by 2030, it would achieve reductions beyond the expanded EERS, reducing power sector emissions by 9 percent in 2020 compared to 2011 levels.

Utilizing Slack Natural Gas Capacity. According to the Energy Information Administration data, the operating capacity of Ohio's existing combined cycle natural gas fleet was only 47 percent in 2011.[18] Increasing the operating capacity of all existing units—including two that have come online since 2011—to 75 percent would cut power sector CO_2 emissions by 7 percent in 2020 compared to 2011 levels.[19, 20] See Box 3 for additional information on Ohio's power sector.

Increasing Efficiency at Existing Coal Plants. According to the National Energy Technology Laboratory and researchers at Lehigh University, it is likely that the existing coal fleet could achieve a 5 percent increase in efficiency on average.[21] For purposes of this analysis, we conservatively assume that Ohio's coal fleet would achieve a 2.5 percent increase in efficiency, half of these potential levels. Existing coal plants can increase efficiency through refurbishment[22] and improved operation and maintenance practices, though the actual efficiency potential depends on plant age and other physical limitations.[23, 24] Another option to reduce the emissions intensity of a coal plant is co-firing with natural gas using the igniters that are already built into many existing pulverized coal boilers.[25] These actions can lead to reductions in power-sector CO_2 emissions of up to 2 percent in 2020 compared to 2011 levels.

OUTLOOK FOR OHIO

Ohio has already put measures in place that will achieve GHG emissions reductions and has the opportunity to

Box 2 | About This Series

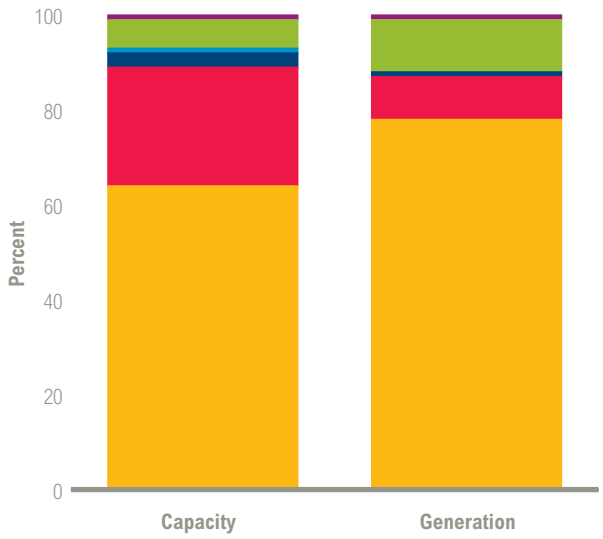
In *Can The U.S. Get There From Here?*, WRI identified four key actions the Obama Administration must take in the absence of congressional action in order to meet the U.S. commitment to reducing greenhouse gas (GHG) emissions by 17 percent below 2005 levels by 2020. These actions include setting performance standards for existing power plants, reducing consumption of hydrofluorocarbons, reducing fugitive methane emissions from natural gas systems, and increasing energy efficiency. Of these four actions, the greatest opportunity for reductions comes from the power sector. In his recently announced Climate Action Plan, President Obama has directed EPA to work expeditiously to finalize carbon dioxide (CO_2) emission standards for new power plants and adopt standards for existing power plants. As states prepare to comply with these standards, it will be necessary to understand available opportunities for reducing CO_2 emissions from the power sector. This series of fact sheets aims to shed light on these opportunities by illustrating the CO_2 emissions reduction potential from measures in a variety of states. We show how these emissions savings stack up against the reductions that could be required under forthcoming standards. This series is based on WRI analysis conducted using publicly available data. See the appendix for additional information on our methodology and modeling assumptions.

Box 3 | Ohio Power Sector Profile

Until the early 1990s, the vast majority of new capacity being built in Ohio was coal-fired. In fact, 44 percent of Ohio's coal-fired capacity was built before 1970. Since then, natural gas has comprised the bulk of new capacity additions, and more than 400 MW of renewable capacity have come online during the past several years. Between 2005 and 2011, coal-fired generation in Ohio decreased by 23 percent, due to a drop in electricity demand and a slight change in the fuel mix, including increased use of natural gas. This trend is likely to continue as Ohio's aging coal plants retire. As of 2012, 43 coal generators (6,800 MW capacity) in the state were slated for retirement. However, coal still represents almost 80 percent of total generation, while nuclear and natural gas sources make up around 11 percent and 9 percent of total generation, respectively. In 2011, Ohio contributed 5 percent of total U.S. CO_2 emissions in the power sector and 3 percent of electricity generation, with a state CO_2 emissions intensity of about 1,750 lbs per MWh. While this is considerably higher than the U.S. average (about 1,100 lbs per MWh), our analysis shows that by using existing policies and infrastructure, Ohio could reduce the carbon intensity of its power sector to around 1,415 lbs per MWh by 2020.

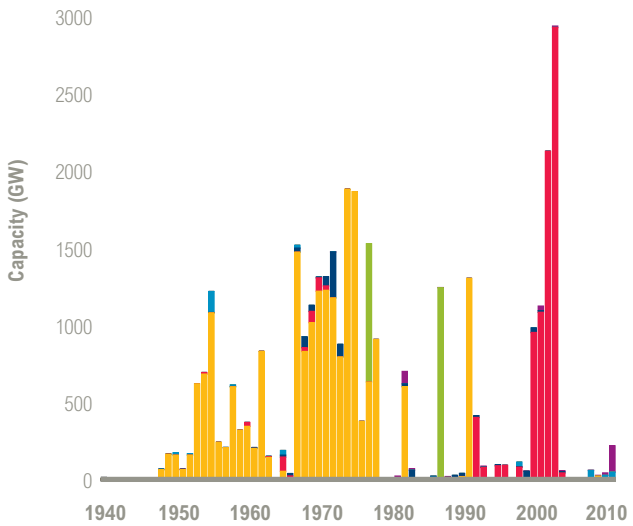
Source: U.S. Energy Information Administration, Annual Energy Review and Form EIA-860; Union for Concerned Scientists, *Ripe for Retirement*

Ohio Generation and Generating Capacity by Fuel, 2011



Source: U.S. Energy Information Administration Form EIA-860 and Annual Energy Review

New Electric Generating Capacity Additions by Fuel Type



Source: U.S. Energy Information Administration Form EIA-860, which includes existing electric generating units at plants with at least 1 MW capacity (electric utilities, independent power producers, and combined heat and power plants) that are connected to a power grid. Data represents installed summer capacity.

BOTH CHARTS USE THE FOLLOWING LEGEND: Coal, Natural Gas, Oil, Other Fossil, Nuclear, Renewables

achieve greater reductions building off of its progress to date. While there have been recent proposals to repeal the state's RPS or EERS, doing so would increase the state's emissions and make meeting forthcoming emissions standards more difficult. However, by meeting the requirements of these existing policies and taking advantage of available infrastructure and underutilized resources, Ohio is in a strong position to comply with upcoming EPA standards for existing power plants. Through federal and state-level actions, the United States can meet its commitment to reduce emissions 17 percent below 2005 levels by 2020.

ENDNOTES

1. According to EIA's AEO2013 Reference Case, CO_2 emissions from the power sector will be 14 percent below 2005 levels by 2020 and only 5 percent below 2005 levels by 2035. See U.S. Department of Energy/Energy Information Administration. 2013. "Energy-Related Carbon Dioxide Emissions by Sector and Source, United States, Reference Case." In U.S. DOE/EIA. *Annual Energy Outlook 2013*. Washington, D.C.: Government Printing Office. Accessible at: <http://www.eia.gov/forecasts/aeo/>.
2. "Fact Sheet: President Obama's Climate Action Plan." White House, Office of the Press Secretary, June 25, 2013. Accessible at: <http://www.whitehouse.gov/the-press-office/2013/06/25/fact-sheet-president-obama-s-climate-action-plan>. "Memorandum for the Administrator of the Environmental Protection Agency." White House, Office of the Press Secretary, June 25, 203. Accessible at: <http://www.ucsusa.org/assets/documents/global_warming/White-House-Memo-to-EPA-Administrator-on-Power-Sector-Carbon-Pollution-Standards-June-25-2013.pdf>.
3. U.S. Department of Energy/Energy Information Administration. 2013. "Electric Generating Capacity, Reference Case." In U.S. DOE/EIA. 2013. Annual Energy Outlook 2013. Washington, D.C.: Government Printing Office. Accessible at: <http://www.eia.gov/forecasts/aeo/>. For more details, see also: <http://www.wri.org/publication/us-electricity-markets-increasingly-favor-alternatives-to-coal>.
4. Note, the sum of reductions from individual measures listed below may not match this total due to rounding. We calculated emissions reductions for existing policies using the annual reference case emissions rates for each fuel type. See the appendix for additional information on the assumptions and methodology used for this analysis.
5. Proposed standards by the Natural Resources Defense Council (available at: <http://www.nrdc.org/air/pollution-standards/files/pollution-standards-report.pdf>) would result in GHG emissions reductions in Ohio of 22 percent below 2011 levels in 2020. In WRI's *Can the U.S. Get There From Here?*, which focuses on reductions from 2005 levels, the most stringent scenario (the "go-getter" scenario) would achieve a 38 percent reduction from the power sector nationally between 2005 and 2020. For Ohio, this is equivalent to a 24 percent reduction from 2011 levels. (It is unlikely that EPA standards would require identical reductions in each state, given the wide variation in emission intensities when the standards will be implemented.)
6. Emissions reductions calculated using the emissions rate resulting from the adjusted BAU projection that includes Ohio's EERS and RPS policies. Reductions listed as a result of an expanded or accelerated policy are additional to reductions from existing policies.
7. Nicholas Bianco, Franz Litz, Kristin Meek, and Rebecca Gasper. 2013. *Can The U.S. Get There From Here? Using Existing Federal Laws and State Action to Reduce Greenhouse Gas Emissions*. Washington, DC: World Resources Institute. Accessible at: <http://pdf.wri.org/can_us_get_there_from_here.pdf>.
8. We assume that Ohio expands its RPS program after current targets have been reached. Since the current target ends in 2024, our assumed expanded RPS does not yield additional savings in 2020.
9. Ohio Incentives for Renewables and Efficiency. DSIRE. Accessible at: <http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=OH16R>.
10. For more details, see: <http://www.aceee.org/sites/default/files/publications/researchreports/E092.pdf> and <http://www.aceee.org/sites/default/files/publications/researchreports/e138.pdf>.
11. Assessments prepared for Ohio utilities found the cost-effective economic potential for energy efficiency savings is equivalent to 17 percent of baseline electricity sales in 2019 and 29 percent of sales in 2028; see: <http://glennschool.osu.edu/research/policy/cost-of-inefficiency/The%20Costs%20of%20Inefficiency%20-%20Dormady3.pdf>. The expanded standard assumed here is conservative by comparison, resulting in electricity reductions equivalent to 11 percent of sales in 2019 and 23 percent of sales in 2028. A study by ACEEE estimated even greater cost-effective economic potential for energy efficiency savings, equivalent to 33 percent of baseline electricity sales in 2025; see <http://www.aceee.org/sites/default/files/publications/researchreports/E092.pdf>.
12. *Ohio's Renewable and Advanced Energy Portfolio Standard*. Public Utilities Commission of Ohio. Accessible at: <http://www.puco.ohio.gov/puco/index.cfm/industry-information/industry-topics/ohioe28099s-renewable-and-advanced-energy-portfolio-standard/>.
13. The remaining 12.5 percent of the standard can be generated from advanced energy resources. The Ohio PUC's definition of advanced energy sources includes fossil fuel burning units ("new, retrofitted, refueled, or repowered generating facility located in Ohio, including a simple or combined-cycle natural gas generating facility or a generating facility that uses biomass, coal, modular nuclear, or any other fuel as its input"). We conservatively assume that this portion of the standard will be met using fossil fuel resources and therefore will not drive additional CO_2 emissions reductions.
14. *Renewable Energy for America, Ohio*. Natural Resources Defense Council. Accessible at: <http://www.nrdc.org/energy/renewables/ohio.asp>.
15. State-level estimates of CHP technical potential are from ICF International, prepared for the Ohio Coalition for Combined Heat and Power in 2012. For more information, see: <http://www.midwestcleanenergycenter.org/ohiochp/index.html>.
16. In 2012, Ohio ranked second on ACEEE's State Energy Efficiency Scorecard rating based on its adoption of measures to encourage deployment of CHP systems. These measures include standard interconnection rules, inclusion of CHP in efficiency standards, financial incentives, favorable net metering regulations, emissions regulations, and other supportive policies.
17. *State Energy Efficiency Scorecard 2012*. ACEEE. Accessible at: <http://aceee.org/sector/state-policy/scorecard>.
18. WRI estimates based on data from U.S. Energy Information Administration, EIA-923 Generation and Fuel Data (http://www.eia.gov/electricity/data/eia923/); and EIA-860 Annual Electric Generator Data (http://www.eia.gov/electricity/data/eia860/).
19. NGCC units are designed to be operated up to 85 percent capacity (see http://mitei.mit.edu/system/files/NaturalGas_Chapter4_Electricity.pdf), but actual maximum capacity factors may differ among units. We conservatively assume a maximum capacity factor of 75 percent. All three of Ohio's existing NGCC plants reached a monthly capacity factor of 75 percent or greater during 2011, demonstrating that natural gas utilization at this rate is possible in these plants.
20. We did not account for the associated increases in methane associated with the increased production of natural gas due to a higher demand for the fuel. Going forward, industry should work with EPA to reduce methane leakage rates from natural gas systems. For more information, see: <http://www.wri.org/publication/clearing-the-air>.

21. Phil DiPetro and Katrina Krulla. 2010. *Improving the Efficiency of Coal-Fired Power Plants for Near Term Greenhouse Gas Emissions Reductions*. National Energy TechnologyLaboratory, Office of Systems, Analyses and Planning. DOE/NETL-2010/1411. Accessible at: <http://www.netl.doe.gov/energy-analyses/pubs/ImpCFPPGHGRdctns_0410.pdf>. Chris Nichols, Gregson Vaux, Connie Zaremsky, James Murphy, and Massood Ramezan. 2008. Reducing CO_2 Emissions by Improving the Efficiency of the Existing Coal-fired Power Plant Fleet. National Energy Technology Laboratory, Office of Systems, Analyses, and Planning, and Research and Development Solutions, LLC. DOE/NETL-2008/1329. Accessible at: <http://www.netl.doe.gov/energy-analyses/pubs/CFPP%20Efficiency-FINAL.pdf>. "Analyses Show Benefits of Improving Unit Heat Rate as Part of a Carbon Mitigation Strategy." Lehigh Energy Update 28 (1), February 2010. Accessible at: <http://www.lehigh.edu/~inenr/leu/leu_65.pdf>.
22. While there are high upfront costs associated with refurbishing existing coal units, the resulting increase in unit efficiency will lead to annual fuel savings. For example, the National Energy Technology Laboratory found a payback period of less than 4 years for a refurbishment technology that achieves a 2 percent heat rate improvement. For more information, see *Benefits of the Big Bend Power Station Project*, National Energy Technology Laboratory. Accessible at: <http://www.netl.doe.gov/technologies/coalpower/cctc/ccpi/pubs/tampa.pdf>; and "Analyses Show Benefits of Improving Unit Heat Rate as Part of a Carbon Mitigation Strategy." Lehigh Energy Update 28 (1), February 2010. Accessible at: <http://www.lehigh.edu/~inenr/leu/leu_65.pdf>.
23. Phil DiPetro and Katrina Krulla. 2010. *Improving the Efficiency of Coal-Fired Power Plants for Near Term Greenhouse Gas Emissions Reductions*. National Energy TechnologyLaboratory, Office of Systems, Analyses and Planning. DOE/NETL-2010/1411. Accessible at: <http://www.netl.doe.gov/energy-analyses/pubs/ImpCFPPGHGRdctns_0410.pdf>.
24. "Regulating Greenhouse Gas Emissions Under the Clean Air Act." 73 Register §147(2008). Accessible at: <http://www.gpo.gov/fdsys/pkg/FR-2008-07-30/pdf/E8-16432.pdf>.
25. Personal communication with Tomas Carbonell, Environmental Defense Fund, July 12, 2013.

POLICY FRAMEWORK AND INTERACTION

This analysis assumes the existing policies and other reduction opportunities listed above are fully implemented. Depending on the combination of measures actually implemented by Ohio, each will have different impacts on the generation mix and resulting emissions. For example, increasing the efficiency of existing coal-fired power plants results in fewer emissions reductions in this analysis than would be the case if it were considered in isolation, because implementation of the EERS and RPS and an increase in natural gas generation all decrease the state's coal-fired generation. The emissions reductions presented in the text are a result of each policy in combination with all other policies. We first applied existing EERS and RPS policies to calculate an adjusted reference case. Next, we increased CHP capacity and increased utilization of existing natural gas capacity compared to this adjusted reference case. Last, we increased the efficiency of any remaining coal plants. When considering the expanded policies, we applied the expanded EERS followed by increased CHP capacity, and then applied the expanded RPS to the resulting adjusted demand.

Equally important is the policy framework, which will define how each of these measures counts toward compliance under EPA's standards. We assumed that the emissions reductions from each measure would count directly toward the standard. State measures may be counted differently in the actual standards, thus actual compliance levels could potentially be greater or less than what was modeled. See the appendix for additional information on our methodology and modeling assumptions.

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