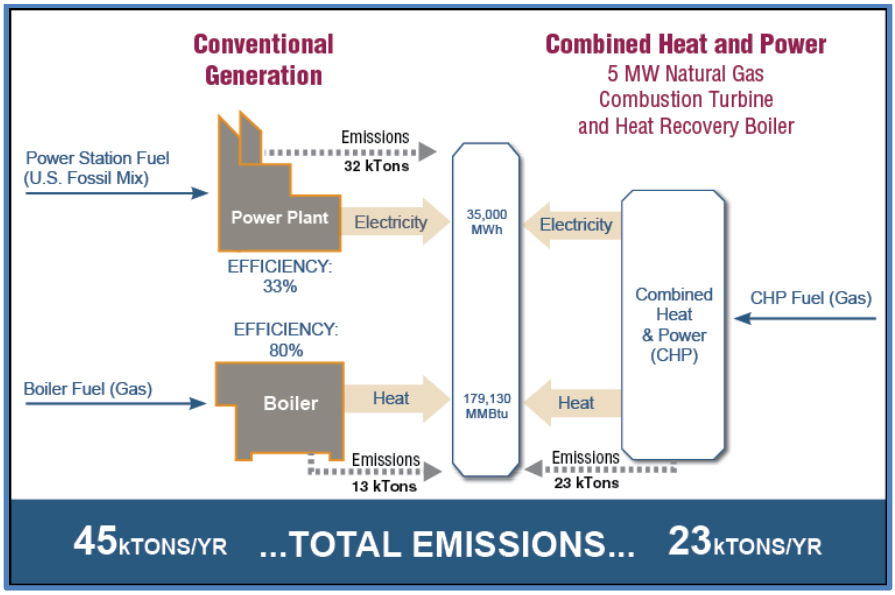
Feb. 5, 2014

RE: Recommendations for Advancing Combined Heat and Power and Waste Heat to Power under 111(d)

As EPA moves forward with its greenhouse gas standards for existing power plants, we note that combined heat and power (CHP) and waste heat to power (WHP) play a central role in reducing emissions from this sector. Indeed, as we explained in a separate memo to EPA (Appendix A), CHP and WHP are proven and cost-effective means for reducing carbon emissions from the electric power system.

By producing both heat and power from a single fuel source and by capturing otherwise wasted heat to generate additional electricity, CHP and WHP dramatically lower energy use and associated emissions. In fact, CHP can produce one-half the carbon emissions of the separate generation of heat and power to deliver the same amount of useful energy (FIGURE 1).[1]

FIGURE 1: CHP Has Significantly Lower Carbon Emissions than Conventional Generation



[1] U.S. EPA, Combined Heat and Power Partnership, *Environmental Benefits* (graphic) (http://www.epa.gov/chp/basic/environmental.html) (visited Sept. 27, 2013).

Moreover, CHP and WHP can reduce emissions at substantially lower cost than other clean energy sources. Indeed, CHP can reduce carbon emissions at less than 15 percent the cost of distributed solar and roughly half the cost of wind (see TABLE 1, below).

EPA has already recognized the value of CHP as a proven cost-effective technology to reduce greenhouse gas emissions by incorporating CHP in its BACT guidance[2] and its 111(b) rule and by issuing awards to various CHP Energy Star projects in recognition of their emissions reductions.[3] Of particular note, the Proposed Standards of Performance for Greenhouse Gas Emissions from New Electric Generating Units explicitly recognizes the greenhouse gas benefits provided by the thermal energy produced from combined heat and power systems.[4] Also of interest, numerous states (fifteen) recognize WHP as a renewable resource in their state renewable portfolio standards because WHP produces electricity with no incremental combustion or emissions.

Below, we briefly highlight several principles for encouraging CHP and WHP in the forthcoming rule. Some large CHP units may be covered under the Rule;[5] however, many smaller, uncovered units can also provide substantial emissions reductions from the overall electric power sector, which should be credited. As noted below, this is why a system-wide approach to emissions reductions is critical. The following principles are intended to guide consideration of CHP at these uncovered units, while ensuring fair treatment of covered units. Many of these considerations also apply to end-use energy efficiency and renewable power generation.

1. To Allow Cost-Effective Emissions Reductions from CHP, EPA Should Adopt a System-Wide Approach When Determining the Best System of Emission Reduction (BSER)

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[2] *See, e.g.,* U.S. EPA, Office of Air and Radiation, EPA–HQ–OAR–2010–0841; FRL–9228–2, Nov. 2010, *PSD and Title V Permitting Guidance for Greenhouse Gases*, March 2011, "PSD and Title V Permitting Guidance for Greenhouse Gases," at 29, 30 & 31 (hereinafter "BACT Guidance") ("Applying the most energy efficient technologies at a source should in most cases translate into fewer overall emissions of all air pollutants per unit of energy produced"; "The second category of energy efficiency improvements includes options that could reduce emissions from a new greenfield facility by improving the utilization of thermal energy and electricity that is generated and used on site." and "For example, an applicant proposing to build a new facility that will generate its own energy with a boiler could also consider ways to optimize the thermal efficiency of a new heat exchanger that uses the steam from the new boiler.").

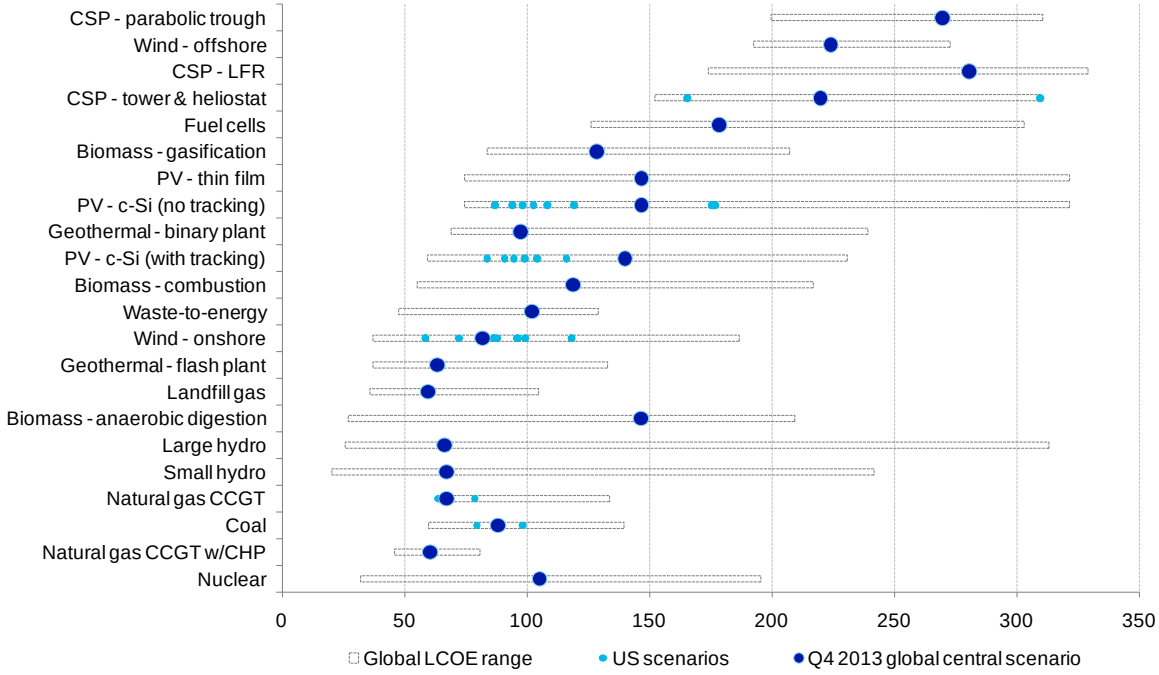
[3] *See, e.g.,* U.S. EPA, Combined Heat and Power Partnership (listing winners of the agency's Energy Star CHP Awards and highlighting carbon reductions) (http://www.epa.gov/chp/partnership/current_winners.html) (visited Jan. 10, 2014).

[4] U.S. EPA, Jan. 8, 2014, "Standards of Performance for Greenhouse Gas Emissions from New Stationary Sources: Electric Utility Generating Units," 79 Fed. Reg. 1430, 1515-16, § 60.5580 (available online at http://www.gpo.gov/fdsys/pkg/FR-2014-01-08/pdf/2013-28668.pdf).

[5] 40 CFR pt. 60, subpart Da applies to electric generating units (EGUs) that produce more than 25 megawatts of electricity (MWe) for sale, or a "fossil fuel-fired unit that cogenerates steam and electricity and supplies more than 1/3 of its potential electric output capacity and more than 25 MWe output to any utility power distribution system for sale."

Under Section 111(d), EPA develops an emission guideline for states to use in drafting a state plan that establishes standards of performance for existing sources, subject to EPA approval. EPA's emissions guideline is to be based on the "best system of emission reduction." EPA should not set the standard based solely on what covered units can achieve on site, but rather should consider a system-wide approach – including what can be achieved through the use of off-site energy-efficiency projects. The inclusion of off-site energy-efficiency measures makes it technically and economically feasible to provide greater reductions in power sector CO_2 emissions, since efficiency measures, including CHP and WHP, are among the lowest cost sources of energy (FIGURE 2). Moreover, CHP and WHP can provide carbon reductions compared to average fossil-fired generation at a fraction of the cost of other sources of distributed power (TABLE 1).

FIGURE 2: Levelized Costs of Energy across Power Generation Technologies, Q4 2013 ($/MWh)[6]



Further, as elaborated in our previous comments (Appendix A), many states have already adopted policies to support CHP and WHP deployment. These policies, in conjunction with

[6] Bloomberg New Energy Finance and Business Council for Sustainable Energy, Feb. 2014, "Sustainable Energy in America 2014 Factbook (Figure 19) (citing Bloomberg New Energy Finance, EIA. Note: LCOE is the per-MWh inflation-adjusted lifecycle cost of producing electricity from a technology assuming a target internal rate of return (IRR) of 10% across all technologies. All figures are derived from Bloomberg New Energy Finance analysis. Analysis is based on numbers derived from actual deals (for inputs pertaining to capital costs per MW) and from interviews with industry participants (for inputs such as debt/equity mix, cost of debt, operating costs, and typical project performance). Capital costs are based on evidence from actual deals, which may or may not have yielded a margin to the sellers of the equipment; the only 'margin' that is assumed for this analysis is 10% after-tax equity IRR for project sponsor. The dark-colored circles correspond to a global central scenario, with the exception of nuclear, gas, and coal – where the dark-colored circles correspond to a US-specific central scenario (ie, accounting for US fuel prices). 'CCGT' stands for combined cycle gas turbine; 'c-Si' stands for crystalline silicon; 'CSP' stands for concentrated solar power; 'LFR' stands for linear Fresnel reflector.)

other cost-effective ratepayer-funded energy-efficiency programs are already reducing power demand and emissions.[7] A system-wide approach to BSER will allow for a more ambitious standard and stimulate investments in renewable energy and energy-efficiency projects, including CHP and WHP.

TABLE 1: CHP Value Proposition[8]

Category	10 MW CHP	10 MW PV	10 MW Wind	Combined Cycle (10 MW Portion)
Annual Capacity Factor	85%	22%	34%	70%
Annual Electricity	74,446 MWh	19272 MWh	29784 MWh	61320 MWh
Annual Useful Heat	103,417 MWh_t	0	0	0
Footprint Required	6,000 ft^2	1,740,000 ft^2	76,000 ft^2	N/A
Capital Cost	$20 million	$60.5 million	$24.4 million	$10 million
Annual Energy Savings	308,100 MMBtu	196,462 MMBtu	303,623 MMBtu	154,649 MMBtu
Annual CO_2 Savings	42,751 Tons	17,887 Tons	27,644 Tons	28,172 Tons
Annual NOx Savings	59.4 Tons	16.2 Tons	24.9 Tons	39.3 Tons
Cost Per Ton of CO_2 Savings	**$468**	**$3,382**	**$883**	**$355**

The values in TABLE 1 are based on:

- 10 MW Gas Turbine CHP with 28% electric efficiency and 68% total efficiency, 15 PPM NOx;
- Capacity factors and capital costs for PV and Wind based on utility systems in DOE's Advanced Energy Outlook 2011;
- Capital cost and efficiency for natural gas combined cycle system based on Advanced Energy Outlook 2011 (540 MW system proportioned to 10 MW of output), NGCC 48% electric efficiency, NOx emissions 9 ppm;
- Electricity displaces National All Fossil Average Generation (eGRID 2012): 9,572 Btu/kWh, 1,743 lbs CO_2/MWh, 1.5708 lbs NOx/MWH; 6.5% transmission and distribution losses; CHP thermal displaces 80% efficient on-site natural gas boiler with 0.1 lb/MMBtu NOx emissions)

[7] For more on ratepayer-funded energy-efficiency programs, *see* ACEEE and ASE, Dec. 5, 2013, "Response to EPA: Considerations in the Design of a Program to Reduce Carbon Pollution from Existing Power Plants" (http://bit.ly/1d7MugL).

[8] U.S. EPA & U.S. DOE, Aug. 2012, "Combined Heat and Power: A Clean Energy Solution," at 8 (cost per ton of CO_2 savings added to original table) (http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_clean_energy_solution.pdf).

2. States, in Turn Should Be Allowed to Adopt a System-Wide Approach in their Air Quality Plans

Once EPA determines the BSER and provides an emissions guideline, states must craft air-quality plans to achieve this limit. EPA should allow states considerable flexibility to determine the best approach for their states. States, in turn, should allow power generators to comply using a systems-based approach, which credits the full set of mitigation options available across the electric grid, including through CHP and WHP that displaces electric generation at covered units. Energy efficiency, including CHP and WHP, allows for larger reductions at substantially lower cost than what generators can achieve on site.

In addition to allowing for lower-cost emission reductions, this is also appropriate from an environmental standpoint, as greenhouse gas emissions do not have localized effects. A CHP or WHP installation at a hospital or industrial facility has the same air quality benefits as fuel switching or generation efficiency measures at the covered source. Where uncovered sources install a CHP unit that is below the threshold for new sources under Section 111(b), that unit should be treated similar to other clean-energy sources that reduce power-sector emissions by displacing electricity generation.

3. CHP Should Receive Credit for All of the CO_2 Reductions Associated with Its Thermal Output

Significantly, CHP produces *both* thermal and electric energy. To encourage this technology, it is important to calculate emissions from both of these outputs. This can be done using two different approaches: (1) equivalence or (2) avoided emissions. The first is simpler; however, the second is arguably more accurate. Both approaches produce an effective emissions rate per kWh generated.

Under the "equivalence approach," the state can simply convert the thermal output (Btu) from a CHP system to its electric equivalent (kWh), and determine an effective emissions rate based on the total energy output from the CHP unit. This is the approach that EPA adopted in the proposed 111(b) rule for new power plants. The equivalence method is relatively straightforward because the state does not need to consider details about the boiler that was displaced by the CHP system.[9]

In previous rules, EPA has applied a range of credits to CHP thermal output, ranging from 75% in EPA's New Source Performance Standard (NSPS) for Electric Utility Steam Generating Units (40 CFR Part 60, Subpart Da) to recognizing 100 percent of thermal output in the NSPS for Stationary Combustion Turbines.[10] A 100% credit has likewise been applied in several states.[11]

[9] This document refers to "boilers," but we also recommend considering emissions from displaced process heaters.

[10] *See* New Source Performance Standard (NSPS) for Stationary Combustion Turbines (40 CFR Part 60, Subpart KKKK) (crediting 100% of thermal output); New Source Performance Standard (NSPS) for

So long as the rule includes monitoring and a minimum thermal efficiency requirement (to protect against "sham" CHP projects), we recommend that 100% of the thermal output be recognized under 111(d) as well. To do otherwise would fail to fully account for the efficiency benefits of a CHP system.

The avoided emissions approach more accurately measures the emissions benefits of CHP, but could be more complex. Under the avoided emissions approach, an effective emissions rate for a CHP system is based on the electricity output and is determined by the measured emissions produced by the system reduced by the emissions that would have been produced onsite to provide the same thermal output without the CHP system (i.e., considering emissions from the CHP unit and subtracting emissions that would have occurred from a "counterfactual boiler" – the boiler that is now not needed). This can be based on the emission rate of the actual boiler that is being replaced by a CHP system, or by making assumptions about a hypothetical displaced boiler. In cases where the CHP unit is not replacing an existing boiler (e.g., new construction), state regulators should generally assume that it will replace a new natural gas-fired boiler sized to meet the thermal load.[12] EPA has recognized that this approach "provides for a more complete accounting of the environmental benefits of CHP by including the emissions avoided by the CHP system's secondary output in the calculation."[13] Notably, this approach has been included in a number of state regulations.[14] These state regulations include efficiency requirements to ensure that the CHP system is more efficient than the separate heat and power generation (central station generator and on-site boiler it is displacing).[15]

The avoided emissions approach is also appropriate for determining the emissions benefits of electricity generation from WHP. In this case the avoided emissions are essentially the emissions at the central station power plant that would have been produced in generating and delivering the electricity now provided by the WHP system.[16]

4. States Should Have the Flexibility to Use Either a Mass-Based or Rate-Based Standard.

Electric Utility Steam Generating Units (40 CFR Part 60, Subpart Da) (crediting 75 percent of thermal output from CHP systems).

[11] *See* U.S. EPA, CHP Partnership, Feb. 2013, "Accounting for CHP in Output-Based Regulations," at 7-9 (citing California's multi-pollutant regulations and Texas permit by rule and standard permitting program) (http://www.epa.gov/chp/documents/accounting.pdf).

[12] This assumes that natural gas is available. Other assumptions may be appropriate if there is not a natural gas supply.

[13] U.S. EPA, CHP Partnership, Feb. 2013, "Accounting for CHP in Output-Based Regulations" (http://www.epa.gov/chp/documents/accounting.pdf).

[14] *Id.* (citing Connecticut and Massachusetts' small distributed generator rules and Delaware and Rhode Island's conventional emissions limits).

[15] *Id.* (typically requiring at least 20 percent of the fuel's recovered energy to be thermal and system efficiency of 55 to 60 percent).

[16] As long as no supplemental fuel is used, electricity generated from WHP has no incremental emissions. If any supplemental fuel is used in generating power through WHP, the emissions from that incremental fuel use would need to be netted out of the avoided central station emissions.

Regardless of how the emissions are calculated, EPA should provide states the flexibility of using rate- or mass-based standards. EPA should also provide guidance on converting limits between mass- and rate-based standards. CHP and WHP can help states achieve their emissions limits under either approach, as CHP produces electricity using only modest, if any, additional fuel and emissions above and beyond a business-as-usual boiler.

CHP Using a Rate-Based Approach

Under a rate-based approach, large-scale CHP units that are covered by the emission rate standard (i.e., those generating and selling more than 25 megawatts and selling more than one-third of their electric generation) should receive the full value of the thermal credit in how their emissions are calculated. The emissions rate from such units will be lower than similarly fueled units that do not also generate useful heat.

For smaller CHP and WHP units that are not covered by the 111(d) standard, we recommend that states credit emissions reductions on the same basis as other clean energy sources. The emissions rate for electricity produced by CHP and WHP systems can be calculated using either the equivalence or avoided-emissions approach, as described above. As described earlier, both of these approaches account for both the thermal and electric output of the CHP or WHP unit. As is the case with other clean energy sources, CHP can be credited based on the difference from a state emission rate target,[17] or based on the difference from a marginal emission rate on the power grid. As long as the CHP or WHP unit's emission rate is lower than the state emission rate target or the marginal emissions rate (depending on the methodology used), the CHP or WHP facility can help with compliance.

CHP Using a Mass-Based Approach

Some existing large-scale CHP projects (i.e., those generating and selling more than 25 MW and selling more than one-third of their electric generation) would be directly subject to the emissions limit. Because CHP and WHP units produce fewer emissions per unit of useful energy derived than conventional power generation, these systems will require fewer allowances than their "conventional" counterparts under a mass-based approach. So long as existing CHP units receive allowances in the same manner as other covered units, encouraging CHP at covered facilities will therefore be fairly straightforward.

As is the case with other clean energy technologies, new smaller CHP systems should fare well under a mass-based approach. This is because while covered gas and coal power plants will need to acquire allowances, small CHP units will not incur this expense. Moreover, an increase in electricity prices would tend to improve the economics for CHP. Note that while it is desirable

[17] *See* Daniel Lashoff, et al, NRDC Report, March 2013, Closing the Power Plant Carbon Pollution Loophole (http://www.nrdc.org/air/pollution-standards/files/pollution-standards-report.pdf) (proposing approach to establish target emission rates for each state).

to see growth in efficient CHP and WHP, to the degree that these technologies displace electricity produced by covered power plants, there may be a small increase in emissions from non-covered sources.

The economic advantage for clean energy sources (including CHP) could be greatly reduced if a state opts to provide free allocations to covered sources. To address this, states should develop a set-aside mechanism to allow clean energy sources to likewise acquire free allowances. CHP should be allowed to participate alongside new renewable energy, energy efficiency, and other zero-emitting resources for these set asides on the basis of avoided emissions from the grid.

If a set aside is used, there are some additional considerations for CHP systems that do not exist for other clean energy technologies. As noted earlier, while most eligible technologies (e.g., wind, solar, end-use energy efficiency) will reduce emissions from covered sources without creating any new emissions, CHP would create emissions that are additional to those from covered sources. To ensure the cap is maintained while still rewarding CHP, it is important to calculate the emissions associated with the electricity production from the CHP unit. These emissions can be calculated using one of the two approaches described above (i.e., avoided emissions or equivalence). The CHP unit would then subtract (and retire) that portion of the earned allowances associated with electricity generation. The remaining portion may be sold to covered units.

5. EPA Should Provide Detailed Guidance to States

EPA should provide both general guidelines to states highlighting the range of activities that can be credited under 111(d), as well as a set of more detailed model rules or templates (a "cookbook") to help states implement them. Some states are not familiar with crediting emission reductions from CHP systems. By providing model provisions and procedures, EPA will simplify the adoption and implementation of state plans and ensure that CHP and WHP are credited in a manner consistent with how other clean energy technologies are credited. The general EPA guidelines should explicitly mention CHP and WHP as methods to reduce greenhouse gas emissions. Supporting templates should provide detailed instructions for how to measure output (both thermal and electric) from these systems.

Once states quantify electricity savings from CHP and WHP projects, they will need to quantify emissions avoidance. States should be allowed to use either dispatch models (like IPM) or emissions calculators to estimate these benefits. Both EPA's Power Plant Emissions Calculator (PPEC) and the emerging AVoided Emissions geneRation Roadmap (AVERT) represent publicly available, easy-to-use tools for estimating avoided emissions. These tools are significantly easier to apply than proprietary dispatch models. States should also be given the flexibility to apply their own quantification, measurement and verification approaches, so long as they demonstrate reasonable credibility.

The guidance may also require states to compare actual monitored emissions with what was projected through modeling to confirm that anticipated reductions are realized, and to adjust compliance programs and models to assure required emission reductions are achieved. This will allow the models to be improved over time.

6. Addressing CHP and WHP Shut Downs

One concern about a system-wide approach to 111(d) is that the affected power plants may not have control over the activities that are being claimed toward compliance. This concern is not unique to CHP and WHP. Energy efficiency resource standards, renewable portfolio standards and other policies may obligate plant owners to achieve certain energy objectives outside their direct control. Wind farms may underperform due to weather conditions. Efficiency programs may be undersubscribed. And a CHP host may shut down.

Because the CHP and WHP facilities generate credits based on their actual performance, in the event of their closure, the affected unit would need to find an alternative source for emission reductions – just as it would if a low or no-carbon generation unit or energy-efficiency measure underperformed relative to projected emissions savings. Since credits are not created prospectively, a change in the facilities' performance would not alter the cap. Moreover, while a CHP or WHP system that shuts down would no longer be generating power, the facility also would no longer be using power. This means that system-wide emissions would actually decrease.

Allowing states to adopt carefully crafted multiyear averaging or banking of emissions allowances provisions and/or alternative compliance payments for underperformance could limit the regulatory consequences of any short-falls that might occur due to the closure of CHP facilities (or the underperformance of other compliance options). Such mechanisms could also insulate regulated entities and states from non-compliance due to weather or other exogenous events (e.g., unusually high number of high electricity demand days, weather-related reduction in hydropower availability, an unscheduled nuclear plant outage) by allowing short-falls to be corrected during the next compliance period.

7. Credit Should Be Given to CHP and WHP Systems that Are Constructed or Augmented after a Predetermined Baseline Year

A greenhouse gas rule for existing sources will require emission reductions from a historical level. That baseline should be derived from average emissions across a multi-year period (e.g., 2010-2013) to account for fluctuating energy demand due to the economy, weather, maintenance, and fuel prices. Regardless of whether a rate- or mass-based system is used,

CHP systems that were installed before the baseline period should not be credited.[18] This is because their emission benefits were already considered when setting the baseline.

Many states have adopted policies that will result in increasing efficiency for years to come. CHP and WHP units installed after a base year – even if due to existing policies such as energy efficiency resource standards – should count as emissions reductions and should not be included in the calculation of a baseline for purposes of 111(d).

Many industrial facilities are currently developing compliance plans for EPA's Industrial Boiler Rule. Notably, EPA has launched an interagency technical assistance program to encourage regulated coal-fired facilities to consider converting to natural gas-fired CHP systems as a compliance option.[19] These facilities will need to comply with the Boiler Rule by December 2015 (or 2016 if awarded a one-year compliance extension). We encourage EPA to consider these projects in concert with the 111(d) rule and establish a baseline that allows credit to be awarded for emission reductions associated with CHP conversions that may occur during that process.

8. Treatment of CHP and WHP under this Rule Has No Bearing on Future Section 111(d) Rulemakings for Other Sectors

EPA should focus exclusively on the current rulemaking for existing power plants. Subsequent 111(d) rules for petroleum refining, pulp and paper production, chemical manufacturing and other sectors are not expected to mandate use of particular technologies, such as CHP or WHP, nor require facilities to reduce their emissions by a given percentage. Thus, if an uncovered unit installs a CHP system under the utility electricity sector 111(d) rules, it will not be subject to more demanding requirements under a future 111(d) standard. An industrial sector's use of CHP may be reflected in how EPA establishes the 111(d) standard for that sector - but it would not require units that already have CHP to go "beyond the floor." Where CHP has been installed at an industrial facility that is subject to a future 111(d) rulemaking, we recommend that EPA recognize the emission reductions that have been achieved in the power system as a result of that project. Doing so will prevent penalizing early actors.

CONCLUSION

CHP and WHP provide a cost-effective means of reducing carbon emissions from the power sector. In recent years, EPA has recognized the economic and environmental benefits of these technologies and incorporated provisions in various Clean Air Act rules to further their

[18] Credit should likewise not be given to other energy efficiency or renewable energy measures that were put in place before the baseline period.

[19] *See, e.g.,* US EPA, Fact Sheet: "EPA Boiler Standards: Department of Energy and Department of Agriculture Technical Assistance for Boiler Operators and Owners (http://www.epa.gov/airquality/combustion/docs/20110221doefs.pdf); U.S. Dep't of Energy, Dec. 2012, Fact Sheet: Boiler MACT Technical Assistance (http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/boilermact_tech_asst_factsheet.pdf).

deployment. We encourage EPA to extend this consideration in the forthcoming greenhouse gas regulation for existing power plants. This paper explores several issues that may emerge throughout the rulemaking process. EPA should clarify in its emission guidelines that CHP and WHP are effective compliance options and encourage states to incorporate CHP and WHP in their compliance plans.

APPENDIX
Helpful Resources Concerning Combined Heat and Power

American Gas Association, May 2013, The Opportunity for CHP in the United States.
Examined CHP economic potential based on projected payback periods and found 41.6 GW of potential projects with "strong" to "moderate" potential (i.e., payback periods of less than 10 years).

Baer, P., M.A. Brown and G. Kim, 2013, The Job Generation Impacts of Expanding Industrial Cogeneration. Georgia Tech, Ivan Allen College School of Public Policy. [no longer available online]
Finds that each GW of installed CHP can support 2,000-3,000 net full-time equivalent jobs.

DOE, CHP Installation Database.
Interactive map providing data on 4,300 CHP installations in the United States (sorted by state). Database is maintained by ICF on behalf of DOE and provides information on facility size, date of installation, location, and prime mover.

DOE, Combined Heat and Power (CHP) Project Profiles Database.
Customizable search engine to locate case studies about CHP projects by region, sector, NAICS code, or prime mover.

DOE, Technical Assistance Partnerships.
Provides background, map and contacts of DOE's six CHP Technical Assistance Partnerships.

ICF International, March 2013, Combined Heat and Power: Enabling Resilient Energy Infrastructure for Critical Facilities.
Provides a comprehensive review of CHP and energy resilience.

ICF-USCHPA-WADE, Oct. 2010, Effect of a 30 Percent Investment Tax Credit on the Economic Market Potential for Combined Heat and Power, at 11-12 (Tables 3 & 4)
Projects roughly 65 gigawatts of technical potential in each the industrial and commercial/ institutional sectors, for a total of 130 gigawatts.

Oak Ridge National Laboratory (hereinafter "ORNL"), Dec. 1, 2008, Combined Heat and Power: Effective Energy Solutions for a Sustainable Future, at 4.
Considers a full-deployment scenario in which CHP provides 20 percent of US electric capacity (240 GW). This would support one-million new jobs and reduce CO_2 emissions by 231 MMT (the equivalent of removing one-half of the vehicles from the road).

EPA & DOE, Aug. 2012, Combined Heat and Power: A Clean Energy Solution.
Released in conjunction with Executive Order 13624. Reaffirms 130 GW of remaining technical potential for additional CHP applications at existing industrial, commercial, and institutional facilities (with roughly equal potential in the industrial and commercial/ institutional sectors).

Includes data illustrating that CHP can reduce carbon emissions at less than 15 percent the cost of distributed solar and roughly half the cost of wind.

EPA, CHP Partnership, Feb. 2013, Accounting for CHP in Output-Based Regulations.
Provides guidance on counting for thermal output using either an equivalence or avoided-emissions approach (with examples of each).

EPA, CHP Partnership, Aug. 2012, Fuel and Carbon Dioxide Emissions Savings Calculation Methodology for Combined Heat and Power Systems.
Provides guidance on counting for thermal output using either an equivalence or avoided-emissions approach (with examples of each).

EPA, 2011, Output-Based Environmental Regulations: An Effective Policy to Support Clean Energy Supply.
Provides background on the benefits of energy efficiency broadly, the role of output-based regulations in promoting energy efficiency, and a survey of existing state output-based environmental regulations.

EPA Combined Heat and Power Partnership, 2013, Portfolio Standards and the Promotion of Combined Heat and Power.
Provides a complete collection of state portfolio standards and notes which ones include CHP.

EPA, 2013, *dCHPP* (CHP Policies and incentives database).
Provides a comprehensive list of financial incentives available for CHP.

DOE, EPA & HUD (Hurricane Sandy Rebuilding Taskforce), Sept. 2013, Guide to Using Combined Heat and Power for Enhancing Reliability and Resiliency in Buildings.
Provides practical information on CHP, including what factors must be considered when configuring a CHP system to operate independently of the electricity grid, what steps are involved in a typical CHP project development process, financing options, and factors for determining whether CHP is an appropriate choice for multifamily housing and critical facilities.

SEE Action Network, 2014 (to be published). Industrial Energy Efficiency: Designing Effective State Programs for the Industrial Sector
Provides a collection of best practices for utility-funded energy efficiency programs in the industrial sector.

SEEAction, March 2013, Guide to Successful Implementation of State Combined Heat and Power Policies.
Showcases best practices in five areas (design of standby rates, interconnection standards, excess power sales, clean energy portfolio standards, and emerging market opportunities).

White House, Office of the Press Secretary, Aug. 30, 2012, Executive Order 13624, "Accelerating Investment in Industrial Energy Efficiency."
CHP executive order, seeking to increase CHP deployment by 40 gigawatts.