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The Case for Promoting Utilization of West Virginia's Vast Natural Gas Resources: Combined Heat and Power (CHP) Facilities

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Background: An Energy and Sustainability Roadmap for West Virginia

Policymakers in West Virginia are being forced to face a future where the national economy is less dependent on the coal industry. While electricity generation in the U.S. traditionally has relied on coal for about one half of its fuel source, that dependency has declined dramatically in 2012: as older coal generating plants are retired in the face of more stringent regulations of emissions by the U.S. Environmental Protection Agency (EPA), and global demands for coal continue to raise the domestic price to levels that threaten coal's cost-competitiveness compared to other fuel sources for electric generation, such as natural gas. West Virginia coal production is also entering a period of marked decline of almost 30% by the end of the decade, one that will force the State to shore up its economy in unfamiliar but proven ways.

The development of the Marcellus Shale within West Virginia holds significant promise for increased economic activity and reduced dependence on the coal industry for jobs. But the economic benefits flowing from shale gas development within the state are threatened by the low natural gas prices currently prevailing as a result of the shale gas development around the nation. Quite simply, hydraulic fracturing and horizontal drilling have been "game changers" in the energy industry in terms of unleashing vast quantities of natural gas at relatively low prices, resulting in an over-supply of natural gas that is depressing prices and threatening to dampen the economic benefits of shale gas development as the drilling rigs are idled.

Policymakers in West Virginia should be considering measures that could stimulate the demand for natural gas in the hopes of stabilizing natural gas prices at sustainable levels. These measures could include encouraging natural gas distribution companies in West Virginia to promote combined heat and power (CHP) for commercial and industrial customers. CHP facilities typically are fueled by natural gas and, in addition to providing on-site generation for large customers, achieve substantial improvement in energy efficiency by capturing the waste heat that would otherwise be released into the atmosphere and using it to heat and cool buildings, or to meet the thermal needs of industrial processes. This Discussion Paper focuses on the role that CHP can play in creating a sustainable energy future for West Virginia.

The Case for Stimulating Demand for Natural Gas through CHP Facilities

Over one quarter of the natural gas consumed in the United States is in the industrial sector, which includes industries such as chemicals, metals, minerals, oil refining, paper, and food.[1] In total, the U.S. industrial sector used natural gas for 30.4% of its direct energy use (for combustion and non-combustion) in 2010.[2] Of the natural gas consumed in the manufacturing sector, 14% was devoted to CHP and other power systems.[3] CHP systems capture and use the heat that would otherwise be wasted from the production of electricity.[4] In other words, rather than two separate facilities—an electric generating unit (from which the waste heat is discharged into the atmosphere) and a stand-alone boiler at the industrial site to generate heat—a CHP unit at the industrial site would generate electricity and capture the waste heat for heating and/or cooling.[5] As a result, CHP requires less fuel than equivalent separate heat and power systems to produce the same amount of energy.[6] By generating heat and power together, CHP can achieve combined thermal efficiency of up to 80%, versus 45% for generating heat and power separately.[7]

Currently, West Virginia has 382 MW of installed CHP capacity, with almost a third of that capacity (32%) coming from a single installation at a chemical plant.[8] A 2008 Oak Ridge National Laboratory (ORNL) report estimated that West Virginia has the technical potential for an additional 1 to 3 gigawatts (GW).[9] A 2012 report from the American Council for an Energy

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[1] Natural gas usage in the industrial sector was 8.14 quadrillion Btus in 2010, or 27% of natural gas consumed in the U.S. CTR. FOR CLIMATE & ENERGY SOLUTIONS, NATURAL GAS IN THE INDUSTRIAL SECTOR 2 (May 2012), *available at* http://www.c2es.org/docUploads/natural-gas-industrial-sector.pdf [hereinafter CCES].

[2] *Id.*

[3] *Id.* Natural gas dominates the fuel used for CHP; 63% of the fuels consumed for CHP was natural gas, followed by 32% for coal and 5% other fuels. *Id.* at 3. The five industry sectors with the most CHP potential are chemicals, refining, pulp and paper, food processing, and primary metals manufacturing. *See* JAMES BRADBURY ET AL., WORLD RES. INST., MIDWEST MANUFACTURING SNAPSHOT: ENERGY USE AND EFFICIENCY POLICIES 7, 18, 24, 45 (2012), *available at* http://pdf.wri.org/working_papers/midwest_manufacturing_snapshot.pdf.

[4] Combined Heat & Power P'ship, *Environmental Benefits*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/chp/basic/environmental.html (last updated Dec. 6, 2012).

[5] "Instead of purchasing electricity from the local utility and burning fuel in an on-site furnace or boiler to produce needed thermal energy, an industrial or commercial user can use CHP to provide both energy services in one energy-efficient step." *Guide to the Successful Implementation of State Combined Heat and Power Policies*, STATE & LOCAL EFFICIENCY ACTION NETWORK ix (March 2013), *available at* http://www1.eere.energy.gov/seeaction/pdfs/see_action_chp_policies_guide.pdf.

[6] *Id.*

[7] ANNA CHITTUM & NATE KAUFMAN, CHALLENGES FACING COMBINED HEAT AND POWER TODAY: A STATE-BY-STATE ASSESSMENT, ACEEE 3 (2011), *available at* http://www.aceee.org/sites/default/files/publications/researchreports/ie111.pdf.

[8] The chemical plant at Natrium operated by PPG Industries, Inc. has a capacity of 123 MW. *Database of Combined Heat and Power Units Located in West Virginia*, DOE/ICF INT'L, http://www.eea-inc.com/chpdata/States/WV.html (last visited Mar. 21, 2013).

[9] ANNA SHIPLEY ET AL., OAK RIDGE NAT'L LAB., COMBINED HEAT AND POWER: EFFECTIVE ENERGY SOLUTIONS FOR A SUSTAINABLE FUTURE 17 (2008), *available at* http://www1.eere.energy.gov/manufacturing/distributedenergy/pdfs/chp_report_12-08.pdf.

Efficient Economy (ACEEE) estimated 1.7 GW of remaining technical potential within West Virginia, mainly in the chemicals and paper industries.[10] ACEEE further estimated that 588 MW would be economical to develop if utilities were provided incentives to support the development of CHP.[11] In the absence of economic incentives, only 71 MW would be economical to develop.[12] Electric utilities have a significant role to play in helping or hindering the deployment of distributed generation. ACEEE concluded that "West Virginia could meet 32 percent of its high-end range of coal retirements with cost-effective CHP, provided that utilities in the state were incentivized to make CHP investments."[13] Unfortunately, according to ACEEE, "[t]hey currently are not."[14] The ACEEE report observes that "[t]he state has few supportive CHP policies in place and has substantial room for improvement."[15] Among other things missing in West Virginia are financial assistance, financial incentives, or output-based emissions regulations that affect CHP systems.[16]

Stimulating investment in CHP is receiving considerable attention at the federal level. On August 30, 2012, President Barack Obama signed Executive Order No. 13624, which adopts a national goal of "deploying 40 gigawatts (GWs) of new, cost-effective industrial CHP in the [United States] by the end of 2020."[17] In order to achieve this objective, the Executive Order directs federal agencies to, among other things, "provide technical assistance to states and manufacturers to encourage investment in industrial energy efficiency and CHP," and to "identify, develop and encourage the adoption of investment models and state best practice policies for industrial energy efficiency and CHP."[18] As noted in the Order, potential emission reduction benefits of CHP (and other industrial energy efficiency policies) can be reflected when states develop their State Implementation Plans (SIPs) under the Clean Air Act to achieve national ambient air quality standards.[19] In addition, emissions allowance trading programs can include

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[10] ANNA CHITTUM & TERRY SULLIVAN, COAL RETIREMENTS AND THE CHP INVESTMENT OPPORTUNITY, ACEEE 53 (2012), *available at* http://www.aceee.org/sites/default/files/publications/researchreports/ie123.pdf.

[11] *Id.*

[12] *Id.* at 14.

[13] *Id.* at 52.

[14] *Id.*

[15] *Id.* at 54.

[16] *Id.* at 55.

[17] Office of the Press Sec'y, *Executive Order— Accelerating Investment in Industrial Energy Efficiency*, THE WHITE HOUSE (Aug. 30, 2012), http://www.whitehouse.gov/the-press-office/2012/08/30/executive-order-accelerating-investment-industrial-energy-efficiency [hereinafter *Executive Order*].

[18] *Id.*

[19] *Id.* The Executive Order encourages investment in industrial energy and CHP by "providing assistance to States on accounting for the potential emission reduction benefits of CHP and other energy efficiency policies when developing State Implementation Plans (SIPs) to achieve national ambient air quality standards." *Id.* Under the Clean Air Act, the Environmental Protection Agency establishes National Ambient Air Quality Standards (NAAQS)

set-asides for the deployment of CHP and other types of clean energy to provide incentives.[20]

Expanded deployment of CHP in West Virginia could provide numerous benefits. First, as noted above, the vast majority of CHP systems are fired with natural gas, so it serves the purpose of stimulating demand for natural gas to stabilize prices at sustainable levels. According to the *Energy Outlook*, CHP generation is expected to rapidly increase by 235% between 2012 and 2035.[21] Second, CHP facilities substantially improve the cost-competitiveness of industrial operations by using energy much more efficiently and managing costs.[22] By capturing heat that is normally wasted, CHP saves fuel and energy costs and achieves up to two to three times the useful energy products from the fuel.[23] That can help the financial performance of West Virginia industrial facilities, and the economic benefits become even more compelling as electricity prices continue to rise.[24]

Third, CHP provides substantial environmental benefits through emissions reductions. The 2008 ORNL study analyzed the total U.S. energy system and calculated that increasing CHP's share of total U.S. electricity generation capacity from 9% in 2008 to 20% by 2030 would lower U.S. GHG emissions by 800 million metric tons of CO_2 compared to business as usual.[25] Another study, by McKinsey & Company in 2009, estimated that the potential exists in the United States for an additional 50.4 GW of CHP capacity by 2020, which would avoid an estimated 100 million metric tons of CO_2 emissions per year compared to business as usual.[26] McKinsey found that 70%

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for the criteria pollutants. 42 U.S.C. § 7409 (2006). Each state is charged with developing a State Implementation Plan designed to achieve the NAAQS within such state. 42 U.S.C. § 7410.

[20] *Executive Order*, *supra* note 17.

[21] CCES, *supra* note 1, at 4 ("CHP generation is projected to rapidly increase by 235 percent over the period" (citing *Annual Energy Outlook 2012 Early Release*, U.S. ENERGY INFO. ADMIN., http://www.eia.gov/oiaf/aeo/tablebrowser/#release=EARLY2012&subject=0-EARLY2012&table=6- (last visited Mar. 21, 2013)).

[22] Energy Efficiency & Renewable Energy, *Industrial Distributed Energy: Benefits of Combined Heat and Power*, U.S. DEP'T OF ENERGY, http://www1.eere.energy.gov/manufacturing/distributedenergy/chp_benefits.html (last visited Mar. 21, 2013) [hereinafter EERE].

[23] *Economic Benefits*, U.S. CLEAN HEAT & POWER ASS'N, http://www.uschpa.org/i4a/pages/index.cfm?pageid=3378 (last visited Mar. 21, 2013).

[24] A benefit of CHP for the nation is that it "[i]mproves U.S. manufacturing competitiveness through increased efficiencies and reducing energy costs." *Guide to the Successful Implementation of State Combined Heat and Power Policies*, STATE & LOCAL EFFICIENCY ACTION NETWORK 1 (Mar. 2013), *available at* http://www1.eere.energy.gov/seeaction/pdfs/see_action_chp_policies_guide.pdf.

[25] SHIPLEY ET AL., *supra* note 9, at 4. DOE estimates that if 20% of electricity generation capacity, or about 240 GW of power, were provided by CHP, the annual energy consumption would be reduced by 5,300 trillion BTUs, CO_2 would be reduced by 848 million metric tons, 189 million acres of forest would be saved, $234 billion in additional private investment would be leveraged, and one million new jobs would be created. EERE, *supra* note 22.

[26] HANNAH CHOI GRANADE ET AL., MCKINSEY CO., UNLOCKING ENERGY EFFICIENCY IN THE U.S. ECONOMY: FULL REPORT 86 (2009), *available at* http://www.mckinsey.com/client_service/electric_power_and_natural_gas/latest_thinking/unlocking_energy_efficiency_in_the_us_economy.

of the potential cost-effective incremental CHP capacity was through large-scale industrial CHP systems greater than 50 MW.[27] Because less fuel is consumed, criteria air pollutants like NO_X and SO_2 are also reduced.[28]

Fourth, CHP can enhance the reliability of the electricity grid and defer the need for transmission and distribution system investments. Distributed generation sources such as CHP can provide both reactive power and voltage support, which are especially useful on heavily loaded lines.[29] Electricity grids with more distributed resources are more reliable than those that rely on fewer centralized sources.[30] Moreover, by placing generation closer to load, distributed generation systems can take pressure off congested transmission and distribution systems and thereby avoid or defer the need to increase capacity on those lines.[31] This is potentially a significant benefit, inasmuch as 60% (or nearly $50 billion per year) of forecast investments in the utility sector over the next twenty years are expected to be in the transmission and distribution system.[32]

Recommendations

West Virginia has tremendous opportunities to take advantage of the shale gas revolution to lower energy costs in the state, achieve economic and environmental benefits through greater use of natural gas for electricity production and transportation, and revitalize its industrial base. To take full advantage of the benefits that shale gas can offer, however, policymakers should consider a number of measures that can stimulate demand for natural gas and achieve price stability for natural gas at sustainable levels.

One such measure is encouraging natural gas-fired CHP facilities at commercial and industrial sites in the state. In addition to potentially consuming large quantities of natural gas, CHP offers vast benefits in the form of reduced energy costs—which should assist the competitiveness of West Virginia's industry—environmental benefits through reduced emissions, potentially lower utility costs through avoided transmission and distribution

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[27] *Id.*

[28] Combined Heat & Power P'ship, s*upra* note 4.

[29] G. PEPERMANS ET AL., KATHOLIEKE UNIVERSITEIT LEUVEN, DISTRIBUTED GENERATION: DEFINITION, BENEFITS AND ISSUES 6 (2003), *available at* http://www.econ.kuleuven.ac.be/ew/academic/energmil/downloads/ete-wp-2003-08.pdf.

[30] U.S. DEP'T OF ENERGY, THE POTENTIAL BENEFITS OF DISTRIBUTED GENERATION AND RATE-RELATED ISSUES THAT MAY IMPEDE THEIR EXPANSION: A STUDY PURSUANT TO SECTION 1817 OF THE ENERGY POLICY ACT OF 2005 2–12 (2007), *available at* http://www.ferc.gov/legal/fed-sta/exp-study.pdf.

[31] Michael Zimmer, *Distributed Generation Offers T&D Cost Management*, ELECTRIC LIGHT & POWER (Feb. 1, 2000), http://www.elp.com/articles/print/volume-78/issue-2/features/utility-of-the-month/distributed-generation-offers-td-cost-management.html.

[32] CHRIS NEME & RICH SEDANO, U.S. EXPERIENCE WITH EFFICIENCY AS A TRANSMISSION AND DISTRIBUTION RESOURCE i (2012), *available at* http://www.raponline.org/search/site/?q=US%20experience%20with%20efficiency%20as%20a%20transmission%20and%20distribution%20resource.

infrastructure investment, and improved reliability and resiliency of the electric grid. As in the case of encouraging the development of NGV infrastructure, the state's energy utilities can play a significant role in promoting CHP deployment at commercial and industrial facilities in the state. LDCs serving industrial customers, for example, should be aggressively pursuing the installation of CHP facilities at those locations where the necessary electrical and thermal load are present. The West Virginia Public Service Commission (PSC) could institute a proceeding to explore the possible approaches, and invite the LDCs to propose incentive mechanisms designed to stimulate increased penetration of CHP facilities in the state. Among other things, the PSC could offer rate incentives to provide financial rewards to LDCs that are successful in achieving customer installation of CHP facilities.

The state's investor-owned electric utilities should also be enlisted in the effort. These utilities are quite familiar with their large industrial and commercial customers, including familiarity with thermal and electrical loads that would make a CHP facility an attractive economic investment. The PSC could provide financial incentives to the electric utilities that would reward them for facilitating the installation of CHP facilities on their customers' sites. A similar program offered in Connecticut in 2008-2009 was very successful in achieving more widespread deployment of CHP facilities.[33]

Another possibility is amendment of the AEPS to include a specific carve-out for CHP generation, which would impose on electric utilities a procurement obligation to secure a certain portion of their electricity supply from customer-sited CHP facilities. A number of states have RPS measures that include CHP among the qualifying technologies, and a few have a carve-out directed specifically at CHP.[34] A better solution is for West Virginia to adopt an EERS, as recommended above, and expressly include CHP as a measure that can be included to achieve the required levels of energy efficiency. The *ACEEE Scorecard* includes the following as a key recommendation for states to improve energy efficiency: "[t]reat combined heat and power as an energy efficiency resource equivalent to other forms of energy efficiency in an

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[33] "Connecticut has added more than 300 MW [of CHP capacity] in three years, with an incentive program offering $400–$450/kW . . . to companies and institutions that install CHP and a $200/kW incentive to utilities. The state also has paid the standby rates for qualified CHP installations." *Prospects for CHP in North America: States Are Still the Biggest CHP Boosters*, COGENERATION & ON-SITE POWER PROD. (Jan. 7, 2009), http://www.cospp.com/articles/print/volume-10/issue-4/features/prospects-for-chp-in-north-america-states-are-still-the-biggest-chp-boosters.html.

[34] Connecticut's RPS includes CHP as a "Class III resource," a category that is required to provide four percent of each utility's retail load by 2020. DSIRE, *Connecticut Incentives/Policies for Renewables and Efficiency*, U.S. DEP'T OF ENERGY, http://www.dsireusa.org/incentives/incentive.cfm?Incentive_Code=CT04R (last visited Mar. 13, 2013). Of the states with some form of portfolio standards, "26—Arizona, Connecticut, Delaware, Colorado, Hawaii, Illinois, Indiana, Louisiana, Maine, Massachusetts, Michigan, Minnesota, Nevada, New Hampshire, New York, North Carolina, North Dakota, Ohio, Oklahoma, Pennsylvania, Rhode Island, South Dakota, Utah, Vermont, Washington, and West Virginia—specifically call out CHP and/or waste heat-to-power ("WHP") as eligible under their RPS, EERS, or APS program guidelines." Combined Heat & Power P'ship, *Portfolio Standards*, ENVTL. PROT. AGENCY, http://www.epa.gov/chp/policies/standards.html (last updated Mar. 8, 2013).

Energy Efficiency Resource Standard."[35] Senate Bill 315 in Ohio is a good example of a recent state enactment that expressly includes major forms of CHP as a means of meeting the requirements of the state's EERS.[36]

In the absence of a legislative amendment to the AEPS or adoption of an EERS, the PSC could implement a "standard offer" program that would streamline the terms and conditions under which the state's electric utilities would purchase the electrical output from customer-sited CHP facilities.[37] The utilities would recover the costs of any incentives from ratepayers, as part of their cost of service, in rate proceedings. While these incentives would lead to slight upward rate pressures, the broader benefits of CHP deployment more than offset these higher costs.

In the case of electric utilities, promotion of CHP at their industrial and commercial customers' locations can be counter to their economic interests, similar to the effect of successfully promoting energy efficiency. Given that electric rates are set on the basis of a projected level of "throughput" retail sales to commercial and industrial customers, any reduction in the actual level of sales due to customer on-site generation through CHP facilities will cause the utility to fall short of the allowed return, set by the PSC, to which they are entitled under the constitution. Thus, any measure by the PSC to require the participation of electric utilities in the "building" of CHP load must be accompanied by implementation of a decoupling or lost revenue adjustment mechanism to hold them harmless from the financial impact of reduced sales to the participating customers.

Other Elements of the Energy and Sustainability Roadmap

Based on these and similar analyses, these Discussion Papers[38] will result in a number of policy recommendations to be considered as West Virginia embarks on an energy future that will be – and needs to be – far different from its past. It will be a blueprint, or a roadmap, for a sustainable energy future for West Virginia. These Discussion Papers are intended to stimulate

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[35] BEN FOSTER ET AL., AM. COUNCIL FOR AN ENERGY-EFFICIENT ECON., THE 2012 STATE ENERGY EFFICIENCY SCORECARD 20 (OCT. 2012), *AVAILABLE AT* HTTP://WWW.ACEEE.ORG/SITES/DEFAULT/FILES/PUBLICATIONS/RESEARCHREPORTS/E12C.PDF, at xii.

[36] *Id.* at 66.

[37] Delmarva and PEPCO in Maryland, for example, have jointly issued an RFQ for CHP projects, with an upfront incentive of $250/kW and a production incentive of 7 cents/kWh for the first eighteen months of project operation. *Delmarva Power Launches Combined Heat and Power Program*, DELMARVA POWER (June 29, 2012) http://www.delmarva.com/welcome/news/releases/archives/2012/article.aspx?cid=2045.

[38] In December 2012, the Center issued its Discussion Paper on "The Case for Integrated Resource Planning in West Virginia," available at http://energy.law.wvu.edu/r/download/148340. In March 2013, the Center issued its Discussion Paper on "The Case for Energy Efficiency Investments in West Virginia," available at http://energy.law.wvu.edu/r/download/155988. Subsequent Discussion Papers will examine the following topics: "The Case for Revisiting West Virginia's Renewable and Alternative Energy Portfolio Standard"; "The Case for Policies Stimulating Development of West Virginia's Vast Renewable Energy Potential"; and "The Case for Promoting Utilization of West Virginia's Vast Natural Gas Resources: Natural Gas Vehicles."

the thoughtful discussions that are necessary to place the State on a foundation that is sustainable, not only from the perspective of a “cleaner” energy supply but also in the resilience of a more diversified economic base that is better positioned for the future.