THE INEFFICIENCIES AND DEFICIENCIES OF WASTE COAL

Jonathan Skinner & Michael Brown***

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INTRODUCTION

On July 3, 2007, the General Assembly of Pennsylvania introduced, through a noncontroversial resolution, House Resolution No. 363 to designate August 29, 2007, "Environmentally Beneficial Use of Waste Coal

* Jonathan Skinner received his J.D./LL.M. from Duke University School of Law and graduated from the University of California, Berkeley.

** Michael Brown received his J.D. from Boston College Law School and graduated from Williams College. The authors submitted written comment on behalf of the Clean Air Council to the Environmental Protection Agency's proposed Mercury and Air Toxics Standards for power plants at EPA-HQ-OAR-2009-0234-15884. The views expressed in this article do not necessarily represent the views or position of the Council.

as an Alternative Energy Source Day."[1] The bill passed with significant bipartisan support[2] and celebrated the efforts of the Anthracite Region Independent Power Producers Association (ARIPPA) in promoting waste coal as an alternative energy source for Pennsylvania.[3] Three years earlier, however, waste coal power generated vigorous debate and outrage between industry supporters and environmental coalitions as the Commonwealth of Pennsylvania considered an energy portfolio standard for electric utilities operating within the state.[4]

The debate and outrage centered on Senate Bill 1030, introduced on March 15, 2004,[5] and signed into law as Act 213 on November 30, 2004, for the inclusion of waste coal as an alternative fuel.[6] Proponents argued that the Pennsylvania waste coal industry generates nearly 1,000 megawatts of electricity, or enough to power one-million homes, and reclaimed more

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1. H.R. 363, 191st Leg., Reg. Sess. (Pa. 2007–2008), *available at* http://www.legis.state.pa.us/CFDOCS/Legis/PN/Public/btCheck.cfm?txtType=PDF&sessYr=2007&sessInd=0&billBody=H&billTyp=R&billNbr=0363&pn=2192.

2. Roll Call Vote for HR 363, 191st Leg., Reg. Sess. (Pa. 2007–2008), *available at* http://www.legis.state.pa.us/CFDOCS/Legis/RC/Public/rc_view_action2.cfm?sess_yr=2007&sess_ind=0&rc_body=H&rc_nbr=722 (190 yeas, 7 nays).

3. Letter from Sens. Mary Jo White and Raphael J. Musto, Senate Envtl. Res. and Energy Comm., to Jeff A. McNelly, Exec. Dir., ARIPPA (Aug. 15, 2007) (*available at* http://arippa.org/documents/2007%20TESTIMONIAL%20LETTER%20SEN%20WHITE.pdf).

4. *Pennsylvania's "Alternative" Energy Law*, ACTIONPA.ORG, http://www.actionpa.org/cleanenergy/#enviros (last visited June 1, 2012).

5. When first introduced, Senate Bill 1030 was titled the "Renewable and Environmentally Beneficial Portfolio Standards Act." "Renewable and Environmentally Beneficial" was deemed by environmental groups in Pennsylvania to be code for "waste coal." The term was later replaced with "alternative energy." *Compare* S.B. 1030, 188th Sess., Printer's No. 1419 (Pa. 2004), *available at* http://www.legis.state.pa.us/cfdocs/legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2003&sessInd=0&billBody=S&billTyp=B&billNbr=1030&pn=1419, *with* S.B. 1030, 188th Sess., Printer's No. 1912 (Pa. 2004), *available at* http://www.legis.state.pa.us/cfdocs/legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2003&sessInd=0&billBody=S&billTyp=B&billNbr=1030&pn=1912.

6. S.B. 1030, 188th Sess., Printer's No. 1912 (Pa. 2004), *available at* http://www.legis.state.pa.us/cfdocs/legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2003&sessInd=0&billBody=S&billTyp=B&billNbr=1030&pn=1912. Since the passage of Act 213, at least four other states (Indiana, Ohio, Virginia, and West Virginia) have considered including waste coal in renewable portfolio standards. *Pennsylvania's "Alternative" Energy Law,* ACTIONPA.ORG, http://www.actionpa.org/cleanenergy/#dirtyenergy (last visited June 1, 2012). It appears, however, that only two states currently promote waste coal as an alternative fuel: Pennsylvania and West Virginia. See *Pennsylvania Alternative Energy Portfolio Standard*, DATABASE OF STATE INCENTIVES FOR RENEWABLES AND EFFICIENCY (Aug. 23, 2011), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=PA06R&re=1&ee=1 (Indicating that Pennsylvania does include waste coal as part of its alternative energy standard); *West Virginia Alternative and Renewable Energy Portfolio Standard*, DATABASE OF STATE INCENTIVES FOR RENEWABLES AND EFFICIENCY (Jan. 5, 2011), http://dsireusa.org/incentives/incentive.cfm?Incentive_Code=WV05R&re=1&ee=1. (Indicating that West Virginia also includes waste coal as part of its alternative energy standard).

than 3,400 acres of abandoned mine land since 1990.[7] Opponents argued that waste coal power generation caused significant air pollution and merely converted abandoned waste coal piles into concentrated toxic ash.[8]

Since the Senate Bill was signed into law by then Governor Edward G. Rendell, many economic and environmental studies questioned the assumptions underlying the Bill's legislative justification. This article reconsiders the debate in light of these studies, in consideration of the U.S. Environmental Protection Agency's proposed rules regulating mercury and air toxics emissions as well as greenhouse gas emissions under the Clean Air Act, and in view of the proposed rule for coal ash categorization under the Resource Conservation and Recovery Act.

This article is divided, generally, into two parts: first, the economic inefficiencies of waste coal as a viable alternative energy source and, second, the environmental deficiencies of combusting waste coal. The first section challenges the economic sustainability of waste coal and fluidized bed combustion power plants, the only industrial boilers currently capable of utilizing waste coal fuel, and analyzes the state and federal programs aimed at promoting waste coal technology. The second section discusses the environmental liabilities created by federal environmental laws and critiques the beneficial justifications for burning waste coal. But before addressing the technical arguments of this article: a primer on the waste coal dilemma.

Waste coal, also known as "gob," "boney," or "culm,"[9] is the low-grade, residual coal remaining at the sites of past or abandoned coal mining operations. Most of these legacy piles accumulated between 1900 and the late 1970s and look like dark and barren mountains.[10] Estimates suggest that, in the central Appalachian region alone, tens of thousands of legacy piles blemish the landscape and contain hundreds of millions of tons of

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7. COMMONWEALTH OF PA., HOUSE LEGIS. JOURNAL, 188th Sess., No. 73 at 2258 (2004), *available at* http://www.legis.state.pa.us/WU01/LI/HJ/2004/0/20041120.pdf#page=25.

8. These groups included: ActionPA, Citizen Power, Pennsylvania Environmental Network, Student Environmental Action Coalition, Green Party of Pennsylvania (and various county Green Party groups), Sierra Club-Pennsylvania Chapter, PennEnvironment, State PIRGs, and the Clean Air Council. *Pennsylvania's "Alternative" Energy Law*, *supra* note 4.

9. *See,* U.S. ENVTL. PROT. AGENCY, EPA-HQ-RCRA-2008-0329-1816, MATERIALS CHARACTERIZATION PAPER IN SUPPORT OF THE FINAL RULEMAKING: IDENTIFICATION OF NONHAZARDOUS SECONDARY MATERIALS THAT ARE SOLID WASTE COAL REFUSE 1 (2011) ("Gob" or "boney" is mined from the bituminous coal regions of western Pennsylvania, West Virginia, and elsewhere. Waste coal mined from the anthracite coal region of eastern Pennsylvania is called "culm.").

10. *AML Polluted & Unsafe Land*, ANTHRACITE REGION INDEP. POWER PRODUCERS ASS'N, http://arippa.org/index.php?id=95 (last visited June 1, 2012).

waste coal.[11] Across the United States, waste coal mounds leach aluminum, arsenic, iron, lead, manganese, and mercury pollution and cause substantial acid drainage.[12] Additional pollution is created by dust storms of uncontained particulates and by the spontaneous combustion of volatile fuels.

Beginning in 1977, laws were enacted that required the stabilization and reclamation of mining sites, including new waste coal disposal piles and fills[13]—this curtailed the practice of abandoning coal mining sites but did not stop the growth of new waste coal mounds. In fact, U.S. coal mines continue to generate 109 million metric tons of waste coal from 600 coal preparation plants in twenty-one coal-producing states each year.[14] And, according to the U.S. Environmental Protection Agency, the Council of Industrial Boiler Owners reported that 1.1 billion tons of waste coal is located throughout the United States.[15] Legacy piles, however, remain an abandoned liability to the states.

In Pennsylvania, there are more than 5,000 abandoned, un-reclaimed waste mounds encompassing more than 189,000 acres.[16] The Pennsylvania Department of Environmental Protection (PaDEP) Bureau of Abandoned Mine Reclamation (BAMR) estimated that the state suffers from acid mine drainage in nearly 3,100 miles of streams as a result of abandoned mines.[17] BAMR estimated that $14.6 billion would be needed to eliminate Pennsylvania's abandoned mine land (AML) problems.[18]

Since 1967, Pennsylvania authorized the expenditure of more than $200 million for AML reclamation projects under the Operation Scarlift Program.[19] Today, the state operates "Growing Greener," a program that funds environmental clean-up efforts through state and federal grants to

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11. ERNIE NIEMI ET AL., ECONOMIC ANALYSIS OF MANAGING WASTE COAL 1, 1 (2009), *available at* http://alleghenysc.org/wp-content/uploads/2009/03/waste-coal-economic-analysis-0109.pdf.

12. *See Burning Waste Coal is Much More Polluting than Burning Coal*, ENERGY JUSTICE NETWORK, http://www.energyjustice.net/coal/wastecoal (last visited June 1, 2012) (waste coal piles impact nearby waterways, and may even catch fire, becoming a source of air pollution).

13. *See* Surface Mining Control and Reclamation Act of 1977, 30 U.S.C. §§ 1201–1328 (2006). (This legislation decreased the number of abandoned waste coal piles in the United States).

14. U.S. ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9, at 2.

15. *Id.*

16. Alfred D. Dalberto et al., *Overview: Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation, in* COAL ASH BENEFICIAL USE IN MINE RECLAMATION AND MINE DRAINAGE REMEDIATION IN PENNSYLVANIA 1, 1 (2004), *available at* http://www.dep.state.pa.us/dep/deputate/minres/bmr/beneficial_use/Index.htm.

17. *Id.*

18. *Id.*

19. *Id.*

nonprofit groups and municipal governments.[20] At the federal level, the U.S Office of Surface Mining (OSM)—created by the Surface Mining Control and Reclamation Act (SMCRA) of 1977—has allocated to BAMR nearly $587 million for AML projects and currently averages about $30 million annually obtained from a per-ton fee paid to OSM from active mine operators that is then distributed to states with AML problems.[21] Together, state and federal expenditures have, nevertheless, only dented the $14.6 billion needed to reclaim Pennsylvania's scarred landscape—because of this private management of the waste coal problem appeared attractive.

I. ECONOMIC INEFFICIENCIES OF WASTE COAL AS A VIABLE ALTERNATIVE ENERGY SOURCE

For many years, waste coal was abandoned across the United States because it contains low levels of energy per unit of volume[22] and requires significant processing to make it an economical fuel for most conventional pulverized coal-fired power plants.[23] Unlike conventional power plants, fluidized bed combustor (FBC) power plants can utilize lower-quality fuels like waste coal—the technology, however, is not independently viable.

The vast majority of FBC power plants came online during the late 1980s and early 1990s, and only one FBC technology power plant has been built this century.[24] Although waste coal accumulated since the early development of coal, the late development of FBC technology was a result of significant government assistance. In 1978, Congress passed the Public

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20. *Id.*

21. *Id.* at 2.

22. In general, waste coal means any by-product of coal mining or coal cleaning operations with an ash content greater than 50% (by weight) and a heating value less than 13,900 kilojoules per kilogram (kJ/kg) or 6,000 British thermal units per pound (Btu/lb). Nationally, waste coal has an average of 60% of the Btu value of conventionally used coal. U.S. ENVTL. PROT. AGENCY, OFFICE OF AIR AND RADIATION, AVAILABLE AND EMERGING TECHNOLOGIES FOR REDUCING GREENHOUSE GAS EMISSIONS FROM COAL-FIRED ELECTRIC GENERATING UNITS 8 (2010), http://www.epa.gov/nsr/ghgdocs/electricgeneration.pdf.

23. Niemi, et. al., *supra* note 11, at 5. Conventional coal fired power plants first appeared in the 1920s and rely on pulverized high quality coal powder that is fed into an industrial boiler where it is burned to create heat and steam that is used to spin turbines to generate electricity. Pulverized coal power plants currently serve over fifty percent of the U.S. electricity industry but only operate at 37–45 percent efficiency depending on the pressure and temperature levels of the boilers, where higher pressures and temperatures increase efficiency. *Pulverized Coal Power*, WORLD RESOURCES INST., http://www.wri.org/publication/content/10338 (last visited June 1, 2012).

24. Steve Blankinship, *CFB: Technology of the Future?*, POWER ENGINEERING (Feb. 1, 2008), http://www.power-eng.com/articles/print/volume-112/issue-2/features/cfb-technology-of-the-future.html.

Utility Regulatory Policies Act (PURPA), which aimed to promote greater use of alternative energy, including waste coal, but also compelled electric utilities to purchase power from efficient producers.[25] Congress believed that renewable and alternative fuel sources would reduce the demand for traditional fossil fuels and recognized that "electric utilities had traditionally been 'reluctant to purchase power from, and to sell power to, the nontraditional facilities.'"[26] Through PURPA, the Federal Energy Regulatory Commission (FERC) is authorized to set rates for nontraditional sources of energy and require utilities to purchase electricity from qualifying facilities at a rate equal to the utility's full avoided cost—the electric utility's cost of energy generation.[27] Under PURPA, electric utilities entered into guaranteed, long-term contracts with qualifying facilities, stimulating research and development of alternative energy technologies. One such technology was the circulating fluidized-bed boiler, also known as the fluidized bed combustor boiler.

A. Fluidized Bed Combustion Technology

Overall, most waste coal FBC boilers can only be economically built where huge volumes of waste coal exist and many require substantial government aid to stay in business.[28] In the United States, there are currently nineteen waste coal burning power plants in operation, fifteen of which are located in Pennsylvania (*see* Table 1).[29] Pennsylvania alone has 820 abandoned mounds amounting to approximately 328 million tons of waste coal in the state.[30] According to one industry association, waste coal plants in Pennsylvania consumed 88.5 million tons of waste coal, mostly from legacy piles, and burned an average of 7.5 million tons of waste coal per year from 1987 to 2003.[31]

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25. Public Utility Regulatory Policies Act, 16 U.S.C. §§ 2601–45 (2006).

26. Am. Paper Inst. v. Am. Elec. Power Serv. Corp., 461 U.S. 402, 405 (1983) (citing FERC v. Mississippi, 456 U.S. 742, 750 (1982)).

27. *See Am. Paper Inst.*, 461 U.S. at 406 (regarding FERC's role under PURPA).

28. Historically, the cost of electricity generated by fluidized bed combustor power plants has been higher per megawatt than conventional coal plants, conventional hydropower, and power generated from landfill gas and wood wastes. *See* CALVIN KENT & CHRISTINE RISCH, INNOVATIVE ENERGY OPPORTUNITIES IN WEST VIRGINIA 4 (2006), http://www.marshall.edu/cber/research/Final%20Report%20-%20Innovative%20Energy%20Opportunities%20in%20WV.pdf.

29. *Waste Coal Facilities in the U.S.*, ENERGY JUSTICE NETWORK, http://www.energyjustice.net/coal/wastecoal/facilities (last visited June 1, 2012).

30. Dalberto et al, *supra* note 16.

31. *Id.* at 5.

Thirteen additional plants burn waste coal as a secondary fuel with bituminous coal serving as the primary fuel, but only two currently operate in Pennsylvania.[32] As of August 2011, twenty new waste coal facilities have been proposed across the country; some companies, however, have withdrawn plans because of unsecured financing or escalating costs (*see* Table 1).[33]

Table 1: Existing and Proposed Primary Waste Coal Facilities in Central Appalachia.[34]

Location	Capacity (MW)	Primary Fuel	Secondary Fuel	Year Online
Chester, PA	67.0	Culm	Pet Coke	1986
Tremont, PA	30.0	Culm	Diesel/Fuel Oil	1987
Frackville, PA	80.0	Culm	Diesel/Fuel Oil	1988
Frackville, PA	43.0	Culm	Diesel/Fuel Oil	1988
McAdoo, PA	50.0	Culm	Diesel/Fuel Oil	1989
Ebensburg, PA	49.5	Gob		1990
Marion Heights, PA	43.0	Culm		1990
Shenandoah, PA	88.6	Culm		1990
Ebensburg, PA	88.0	Gob		1991
Morgantown, WV	50.0	Gob	Bituminous Coal	1991
Bayard, WV	74.0	Gob	Bituminous Coal	1992
Clairon, PA	32.5	Gob	Diesel/Fuel Oil	1992
Marion, WV	80.0	Gob	Tires	1992
Nesquehonig, PA	83.0	Culm	Diesel/Fuel Oil	1992
Kennerdell,	85.0	Gob	Bituminous	1993

32. *Waste Coal Facilities in the U.S.*, *supra* note 29; *see also* ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9 at 3.
33. *Id.*
34. *Id.*

PA			Coal	
Colver, PA	110.0	Gob	Propane	1995
Northampton, PA	108.0	Culm	Petroleum Coke	1995
Seward, PA	521.0	Gob		2004
Calvert City, KY	500-525.0	Coal/Waste Coal		Proposed
Irvine, KY	110.0	Waste Coal		Proposed
Knott, KY	525.0	Coal/Waste Coal		Proposed
Gilberton, PA	41.0	Coke/Waste Coal		Proposed[35]
Cumberland, PA	525.0	Waste Coal		Proposed
Robinson, PA	300.0	Waste Coal		Withdrawn[36]
Karthaus, PA	290.0	Waste Coal		Withdrawn[37]
Curwensville, PA	15.0	Waste Coal		Proposed
Aliquippa, PA	?	Waste Coal		Proposed
Shade, PA	300.0	Waste Coal		Withdrawn[38]
Wise Co., VA	585.0	Coal/Waste Coal		Proposed
Logan Co., WV		Coal/Waste Coal		Proposed
Greenbrier Co., WV	85.0	Waste Coal		Withdrawn[39]
Upshur Co., WV	450.0	Coal/Waste Coal		Proposed

Indeed, a West Virginia energy resources study shows that FBC power plants are ultimately not competitive with conventional coal power, conventional gas, or even wind energy. Operating costs for FBCs are in the range of $8 to $12 per ton of fuel, which, for high Btu waste coal, results in

35. *Stopping the Coal Rush*, SIERRA CLUB, http://www.sierraclub.org/environmentallaw/coal/plantlist.aspx (follow "Name" to see location name)(last visited June 1, 2012).
36. *Id.*
37. *Id.*
38. *Id.*
39. *Id.*

a favorable overall cost relative to current coal prices—however, as noted above, most waste coal has low Btu values relative to traditional coal fuel.[40] The study shows that the cost of electricity (COE) is the cost per megawatt-hour (MWh) to produce electricity and includes the cost of capital, construction, and variable and fixed operation and maintenance costs. According to the study, most resources cannot produce electricity at the prevailing wholesale price of $36 to $42/MWh, and that, accounting for the lower Btu levels of waste coal, FBCs are no more competitive than wind energy (*see* Table 2).

Table 2: Electricity Generating Costs.[41]

Fuel Type	MW	MWh	Capital Costs	COE $/MWh
Waste Coal (FBC)	100.0	700-800,000	$260-275 mil.	$52-63[42]
Conv. Coal	600.0	3.7-4.5 mil.	$750 mil.	$26-29
Conv. Gas	160.0	70,000-240,000	$64 mil.	$38-121
Conv. Hydro.	25.0	110,000	$36 mil.	$40
Wind[43]	100.0	240-265,000	$120-160 mil.	$53-81

In Pennsylvania, with many PURPA-era power purchasing contracts nearing expiration, some waste coal power plants reported to the state legislature that open market competition would cause $4 million in loses per year. And so, in 2004, the Pennsylvania legislature passed Act No. 213, the state's Alternative Energy Portfolio Standard (AEPS),[44] which schedules two tiers of alternative energy sources to displace a percentage of traditional coal by 2020. Under Tier II, Act 213 promotes waste coal as a viable "alternative fuel" to traditional coal.

40. KENT & RISCH, *supra* note 28, at 17.
41. *Id.* at 5.
42. *Id.* This figure assumes a capacity factor of 80–90%.
43. *Id.* This calculation does not account for the federal production tax credit, which allows wind facilities to be competitive with nearly all fossil fuels except conventional coal and landfill gas *Id.*
44. *See* S.B. 1030, 188th Sess., Printer's No. 1912 (Pa. 2004), *available at* http://www.legis.state.pa.us/cfdocs/legis/PN/Public/btCheck.cfm?txtType=HTM&sessYr=2003&sessInd=0&billBody=S&billTyp=B&billNbr=1030&pn=1912 (When first introduced, Senate Bill 1030 was titled the "Renewable and Environmentally Beneficial Portfolio Standards Act." "Renewable and Environmentally Beneficial" was deemed by environmental groups in Pennsylvania to be code for "waste coal." The term was later replaced with "alternative energy.").

B. Pennsylvania's Alternative Energy Portfolio Standard

Alternative energy credits provide a source of additional revenue that can help provide long term financing for qualifying facilities and help reduce the payback period. Credit owners can choose to sell their energy credits to a broker, aggregator, or load serving entity who must buy alternative energy credits to meet a state's alternative energy portfolio standard obligation. Some project developers will offer to buy the credits as part of the project financing, thereby reducing the amount of capital needed up front to finance a new installation.

The Pennsylvania AEPS, or Act 213, designates two tiers of alternative energy sources and requires that an annually increasing percentage of qualifying alternative energy be used by retail electricity customers in Pennsylvania.[45] The sources listed under Tier 1 include: solar photovoltaic energy; solar thermal; wind power; low-impact hydropower; geothermal energy; biologically derived methane gas (including landfill gas); fuel cells; biomass energy; coal mine methane; black liquor; and large-scale hydropower (certain restrictions apply). These sources are generally accepted to be renewable energy sources.[46] Waste coal, however, is listed as a Tier 2 energy source, along with distributed generation systems; demand-side management; large-scale hydropower; municipal solid waste; generation of electricity utilizing byproducts of the pulping process and wood; and integrated combined coal gasification technologies.[47] Through this second tier, the Pennsylvania legislature encourages the development of non-renewable alternative fuels.

Electric Distribution Companies (EDCs) and Electric Generation Suppliers (EGSs) can comply with Act 213 by purchasing Alternative Energy Credits (AECs) from qualified alternative energy resource facilities.[48] Companies purchase individual AECs for each megawatt hour (equal to 1000 kilowatt-hours) of generation from a qualified Tier 1 or Tier 2 alternative energy system. AECs can be sold or traded by EDCs or EGSs, but only within the specific tier from which they qualify.[49] By 2020, Pennsylvania retail electricity sellers must acquire eight percent of energy

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45. *Pennsylvania AEPS Alternative Energy Credit Program*, PENNSYLVANIA PUBLIC UTILITIES COMMISSION, http://paaeps.com/credit/overview.do (last visited June 1, 2012).

46. *Id.*

47. *Id.*

48. *Id.*

49. *Pennsylvania AEPS Alternative Energy Credit Program FAQs*, PENNSYLVANIA PUBLIC UTILITIES COMMISSION, http://paaeps.com/credit/faqs.do#2 (last visited June 1, 2012).

through Tier 1 sources, and ten percent through Tier 2 sources, which includes waste coal burning.[50]

Many facilities that qualify for AECs register with credit aggregators and brokers that arrange trades with EDCs and EGSs; others enter into direct partnerships to secure longer term financing for new alternative energy projects. By qualifying under Tier II, waste coal burning FBCs secure energy credits, which can be sold and traded in a registered energy market, such as the PJM-GATS.[51] This market is connected to the largest regional transmission organization in the United States, the PJM Interconnection.[52]

C. Federal and State Grant Programs

Federal and State grant programs are another avenue for the implementation of waste coal as a viable energy source within Pennsylvania. The Pennsylvania Energy Development Authority (PEDA) is an independent public financing authority that was created in 1982 by the Pennsylvania Energy Development Authority and Emergency Powers Act and that was revitalized by Governor Rendell through an April 8, 2004 Executive Order.[53] The Authority's mission is to finance clean, advanced energy projects in Pennsylvania, and any facilities which qualify under the AEPS may apply for funding from the state. The Authority presently can award grants, loans, and loan guarantees and can develop a variety of other types of funding programs.[54] Tax-exempt and taxable bond financing for energy projects are also available through PEDA's partnership with the Pennsylvania Economic Development Financing Authority (PEDFA).

For example, PEDA awarded PFBC Environmental Energy Technology, Inc. a $1,000,000 grant for a waste coal project in Allegheny County, Pennsylvania. The project uses a carbon dioxide separation technology for

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50. *Pennsylvania AEPS Alternative Energy Credit Program*, *supra* note 45.

51. PJM-GATS is administered by the PJM transmission system, the largest regional transmission organization in the United States. It serves all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia, and the District of Columbia. *How does GATS work?*, PJM, http://www.pjm.com/faqs/renewables/general/how-does-gats.aspx (last visited June 1, 2012).

52. *Company Overview*, PJM, http://pjm.com/about-pjm/who-we-are/company-overview.aspx (last visited June 1, 2012).

53. THE PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY, ANNUAL REPORT (JULY 1, 2009 – JUNE 30, 2010) 11 (2011), *available at* http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-82977/7000-MN-DEP4302%20%20%20PEDA%20Annual%20Report%20July%201,%202009%20-%20June%2030,%202010.pdf.

54. *Id.* at 2.

the pressurized FBC generation technology.[55] PEDA has also awarded close to $300,000 to Breen Energy Solutions for a waste coal project in Allegheny County, and over $70,000 to the University of Pittsburgh for waste coal research.[56] The average PEDA grant is $500,000.[57]

According to the U.S. Department of Energy, continued investment and development in FBC technology will likely increase the efficiency of FBC generators and reduce the cost of power generation.[58] Indeed, the Department of Energy has occasionally committed significant funds for the development of new FBC technology facilities. But while cleaner than conventional coal-fired power plants, FBC power plants generate significant amounts of coal combustion ash and emissions[59], and even with federal and state aid, these projects do not always come to fruition.[60]

D. A Case Study—The Western Greenbrier Co-Generation Facility

An example of the economic inefficiencies surrounding waste coal and FBC technology is the failed Western Greenbrier Co-Generation Facility

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55. *Id.*

56. *See* THE PENNSYLVANIA ENERGY DEVELOPMENT AUTHORITY, ANNUAL REPORT (JULY 1, 2005–JUNE 30) (2006), *available at* http://www.elibrary.dep.state.pa.us/dsweb/Get/Document-46224/7000-RE-DEP4088.pdf.

57. *PEDA (PA Energy Development Authority) Grants*, DEP GRANT PROGRAM SUMMARY, http://www.depreportingsvcs.state.pa.us/ReportServer/Pages/ReportViewer.aspx?%2fGrants%2fGrantLoans (last visited June 1, 2012).

58. *See generally,* U.S. DEPT. OF ENERGY, NATIONAL ENERGY TECHNOLOGY LABORATORY, "FLUIDIZED BED COMBUSTION PROGRAM" (2000), *available at* http://fossil.energy.gov/programs/powersystems/combustion/Fluidbed_prog031.pdf (explaining the Department of Energy's efforts to develop new Fluidized Bed Combustion technology including an analysis of the benefits that a generation of technology would be able to provide).

59 GEORGE KAZONICH & ANN G. KIM, RELEASE OF TRACE METALS FROM FBC ASH DURING LEACHING WITH ACIDIC SOLUTIONS, NATIONAL ENERGY TECHNOLOGY LABORATORY, *available at* http://www.flyash.org/2003/ashpdf/86kaz.pdf.

60. *See* GEORGE KAZONICH & ANN G. KIM, RELEASE OF TRACE METALS FROM FBC ASH DURING LEACHING WITH ACIDIC SOLUTIONS, NATIONAL ENERGY TECHNOLOGY LABORATORY, *available at* http://www.flyash.org/2003/ashpdf/86kaz.pdf (Outlining the methods used by researchers in collecting data to support the idea that FBC plants generate less harmful by-products than conventional technologies). In fact, waste coal power plants are not as clean as newer integrated gasification combined cycle, or IGCC, power plants. WORLD RESOURCES INSTITUTE, IGCC WITH CARBON CAPTURE SEQUESTRATION, http://www.wri.org/publication/content/8125 (last visited June 1, 2012). IGCC, power plants produce electricity combine gas and steam turbines for increased efficiency and are significantly cleaner than conventional pulverized coal power plants, especially when outfitted with carbon capture and storage (CCS) technologies. *Id.* With CCS, IGCC power plants could capture 85–95% of their emissions. *Id.* IGCC technology in the United States, however, is not yet considered commercially practical. Taylor Moore, *Coal-Based Generation at the Crossroads*, EPRI JOURNAL (2005), *available at* http://mydocs.epri.com/docs/CorporateDocuments/EPRI_Journal/2005-Summer/1012149_CoalBasedGeneration.pdf.

project. The facility, which was to be located in Rainelle, West Virginia, was a proposed joint-venture, co-generation plant that would have produced 100 megawatts of energy (electricity and thermal), up to 30,000 pounds of steam per hour, and about 340 million Btu per hour, while processing 3,000-4,000 tons/day of waste coal.[61] In its Department of Energy (DOE) fund application, the project developer claimed the new design would reduce construction costs by 40%.[62] The proposed power plant would have been the first commercial application, within the United States, of a circulating fluidized-bed (CFB) combustor featuring a compact inverted cyclone design.[63]

The DOE planned on providing financial assistance for development through President Bush's Clean Coal Power Initiative, a component of the Energy Policy Act of 2002, covering 50% of the total cost (DOE estimated the plant would cost $215 million and its share would be $107 million).[64] The new design would also, allegedly, reduce the boiler construction time by up to 10 percent and the boiler footprint by up to 40 percent.[65]

On June 14, 2008, however, the proposed project was discontinued after project administrators received word that the DOE was pulling all funding from the project. Costs for the proposed project had skyrocketed in the time since the DOE funding agreement, and financial problems ran rampant, including a Western Greenbrier Co-Generation project loan default.[66]

The economic inefficiency of the project was obvious by its ultimate failure, but there was also evidence of environmental deficiencies associated with the project. On November 6, 2007, the DOE released its Environmental Impact Statement (EIS) for the proposed project. The DOE EIS identified the maximum potential to emit for various pollutants

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61. WESTERN GREENBRIER CO. DEMONSTRATION PROJECT: EIS PURPOSE AND NEED, 1–5 (2007), *available at* http://www.netl.doe.gov/technologies/coalpower/cctc/EIS/wgreenbrier_pdf/WGC_FEIS_Chapter%201%20-%20Purpose%20and%20Need%20for%20Agency%20Action.pdf.

62. *Id.*

63. Record of Decision and Floodplain Statement of Findings: Western Greenbrier Co-Production Demonstration Project, Rainelle, Greenbrier County, WV, 73 Fed. Reg. 23214 (April 29, 2008).

64. The National Energy Technology Laboratory, *DOE Releases Final Western Greenbrier Co-Generation Environmental Impact Statement* (Nov. 6, 2007), http://www.netl.doe.gov/publications/press/2007/07076-Western_Greenbrier_EIS_Released.html.

65. WESTERN GREENBRIER CO. DEMONSTRATION PROJECT: EIS PURPOSE AND NEED, *supra* note 61.

66. *State May Be On $3 Million Hook for Plant,* CHARLESTON DAILY MAIL, Nov. 27, 2007.

including SO_2, NO_x, CO, VOC, Pb, H_2SO_4, and Hg compounds.[67] While the DOE EIS concluded that the proposed project would not exceed allowable emissions levels, result in objectionable odors, or cause an exceedance of air quality standards as outline by the criteria used in the impact analysis,[68] numerous groups challenged the findings of both the DOE EIS and the West Virginia Department of Environmental Protection's ruling that the project would not harm air quality.

The Sierra Club, the West Virginia Highlands Conservancy, and the Greenbrier River Watershed Association sued after the project was issued permits. Notably, the petitioners claimed that the permits failed to require best available control technology (BACT) for SO_2 and NO_x emissions. While the suit was ultimately rejected by the West Virginia Air Quality Board, it may have been a major reason behind the pulling of funding from the DOE, and the eventual failure of the project.[69] The suit also recognized the serious uncertainties surrounding the environmental legitimacy of waste coal combustion.

II. ENVIRONMENTAL DEFICIENCIES OF COMBUSTING WASTE COAL

As with traditional coal, the chemical properties of waste coal vary with its geographic origins. The EPA identified in a materials characterization report released on February 3, 2011, that West Virginia and Virginia waste coal contained less than 10 parts per million (ppm) of arsenic , 0.3 ppm of mercury, and 15.8–20 ppm of lead.[70] Waste coal from Pennsylvania, on the other hand, contains an average 50.5 ppm of arsenic, 0.668 ppm of mercury, and 33.8 ppm of lead.[71] Compared to traditional coal, waste coal tends to

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67. Record of Decision and Floodplain Statement of Findings, *supra* note 63, at 2316 (The EIS did not address emissions of N_2O, a potent greenhouse gas. Greenhouse gases were not, at the time, regulated under the Clean Air Act); WESTERN GREENBRIER CO. DEMONSTRATION PROJECT: EIS ENVIRONMENTAL CONSEQUENCES, 4.3-3 (2007), *available at* http://www.netl.doe.gov/technologies/coalpower/cctc/EIS/wgreenbrier_pdf/WGC_FEIS_Chapter%204%20-%20Environmental%20Consequences.pdf.

68. *Id.*

69. *See* Pam Kasey, *Feds Pull Plug on Greenbrier Co-Gen Plant*, WTRF 7 (Sept. 11, 2008), http://www.highbeam.com/doc/1P3-1564607961.html.

70. ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9, at 8 (citing R.S. Lee & W. Lee Daniels, *Reclamation of Coal Refuse with a Papermill Sludge Amendment*, 281 (1997)).

71. ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9, at 9 (citing RRI Energy, Inc., public comment in response to EPA's Proposed Rulemaking for the Identification of Non-hazardous Materials That Are Solid Waste, EPA docket EPA-HQ-RCRA-2008-0329-1081.1, submitted on August 3, 2010).

have a higher concentration of mercury. In West Virginia, gob has four times more mercury than bituminous coal; in Pennsylvania, gob has 3.5 times more mercury. Culm has nineteen percent more mercury than anthracite coal. Bituminous rejects have higher levels of sulfur. Pennsylvania culm and gob also have about four times more chromium and three times more lead.

To burn waste coal in FBC boilers, waste coal is crushed (3/8in to 3in in size) and injected into a boiler above a grate-like air distributor. FBC boilers use strong jets of hot air to suspend pulverized waste coal, biomass, and other poor quality fuels including tires and municipal waste. During the combustion process, the suspension gives the bed a liquid-like characteristic—hence, the fluidized state of FBC boilers.[72] At the top of the combustion chamber, gasses and particles of burned fuel enter a solids separation device called a cyclone.[73] By using centrifugal force, the larger particles are separated and returned, or circulated, to the bottom of the combustion chamber where they are reheated with any remaining carbon; this cycle may repeat many times over several hours and contributes to the complete combustion of any carbon in the combustion chamber.[74]

FBC technology burns fuel at temperatures of 1,400 to 1,700 degrees Fahrenheit, well below the 2,100 to 2,800 degrees Fahrenheit of pulverized coal combustion boilers, and below the oxidation temperature for NO_x and NO_2.[75] Utilizing a fluidized bed also allows limestone particles to be injected with the waste coal to react with SO_2, forming calcium sulfite and carbon dioxide. Calcium sulfite is an inert substance and the calcium sulfite particles either settle and are removed with bottom ash, or are captured downstream by a fabric filter. Calcium sulfite is an inert substance that can be converted into gypsum.

But due to the lower firing temperatures of waste coal, FBC plants generate nitrous oxide (N_2O),[76] a greenhouse gas approximately 300 times more powerful in terms of global warming potential than carbon dioxide—

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72. Dalberto et. al., *supra* note 16, at 3.
73. *Id.* at 4.
74. *Id.*
75. Niemi et. al., *supra* note 11, at xx.
76. In optimal FBC operation, there is a conflict between the lower temperature favoring sulfur capture and the higher temperature required to reduce N_2O emissions. Typical N_2O emissions in the range of 40–70 ppm (at 3% O_2) result from FBC operation at 1472–1562°F, also the optimal temperature range for sulfur capture. At higher temperatures outside the range of typical FBC power plants, $CaSO_4$, the product of sulfur capture, gradually decomposes and SO_2 is released. NAT'L COAL COUNCIL, COAL-RELATED GREENHOUSE MANAGEMENT ISSUES 7 (2003), *available at* http://www.nationalcoalcouncil.org/Documents/fpb.pdf

effectively emitting fifteen percent more greenhouse gas pollution than conventional boilers.[77] Burning at lower temperatures also causes increased carbon monoxide and polycyclic aromatic hydrocarbon (PAC) emissions.[78]

According to an analysis by the U.S. Department of Energy's National Energy Technology Laboratory, FBC plants typically generate more sulfur dioxide,[79] carbon dioxide, hydrochloric acid, hydrofluoric acid, and ash byproducts than IGCC power plants.[80] Pennsylvania continues to suffer from one of the nation's worst acid rain problems,[81] and exempting waste coal power plants from adequate regulations will adversely affect human health and contribute to acidification.

A. Clean Air Act New Source Performance Standards Exemptions (Air Toxics and Mercury Rulemaking)

A principal concern with the construction of new coal derived power is the emission of mercury pollution, and the use of waste coal as an energy source will produce a significant amount of mercury emissions. As noted above, Pennsylvania gob has 3.5 times more mercury than traditional coal, while West Virginia gob has 4 times the amount of mercury.

Mercury in the air has numerous negative environmental and public health effects.[82] After mercury falls from the air, it can end up in streams, lakes, or estuaries, where it can be transformed into methylmercury through microbial activity.[83] Methylmercury can harm fish and other animals

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77. *Id.* at 44.

78. A.M. Mastral, M.S. Callen, T. Garcia, *Toxic Organic Emissions From Coal Combustion*, 67 FUEL PROCESSING TECHNOLOGY 1, 1 (2000), *available at* http://www.energyjustice.net/files/coal/wastecoal/pah/2000FPT.pdf.

79. EPA acknowledges it is because waste coal has higher sulfur content than higher quality coals that EPA intends to exempt waste coal power plants from meeting the proposed sulfur dioxide standard. *See* U.S. ENVTL. PROT. AGENCY, NOTICE OF PROPOSED RULE, NATIONAL EMISSION STANDARDS FOR HAZARDOUS AIR POLLUTANTS FROM COAL- AND OIL-FIRED ELECTRIC UTILITY STEAM GENERATING UNITS 505 (2011), *available at* http://www.epa.gov/airquality/powerplanttoxics/pdfs/proposal.pdf.

80. JAY A. RATAFIA-BROWN ET AL., AN ENVIRONMENTAL ASSESSMENT OF IGCC POWER SYSTEMS (2002), *available at* http://www.netl.doe.gov/technologies/coalpower/gasification/pubs/pdf/18.pdf.

81. JAMES A. LYNCH ET AL., REDUCTIONS IN ACIDIC WET DEPOSITION IN PENNSYLVANIA FOLLOWING THE IMPLEMENTATION OF THE CLEAN AIR ACT AMENDMENTS OF 1990: 1995-2006, at 1 (2006), *available at* http://www.dep.state.pa.us/dep/deputate/airwaste/aq/acidrain/report_caaa/2006report_caaa.pdf.

82. Jonathan Skinner, *Myths of Coal's Clean Future: The Story of Methylmercury*, 29 VA. ENVTL. L.J. 171 (2011).

83. *Environmental Effects: Transport and Ecological Effects of Mercury*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/hg/eco.htm (last visited June 1, 2012).

exposed to it, with effects including mortality, reduced fertility, and diminished survival skills.[84] Methylmercury also has negative effects on humans—most notably, impaired neurological development. Regulation of mercury emissions is critical to mitigating environmental and public health impacts.

The U.S. Clean Air Act Section 111 establishes mechanisms for controlling emissions of pollutants from stationary sources and provides authority for EPA to promulgate New Source Performance Standards that apply to new and modified sources. Specifically, Section 111(b) requires EPA to establish emission standards for any category of new and modified sources that "causes, or contributes significantly to, air pollution which may reasonably be anticipated to endanger public health or welfare."[85] Currently, EPA has developed NSPS for more than 70 source categories and subcategories. EPA has significant discretion, however, to identify the facilities within a source category and determine the appropriate level for the standards.[86] Under Section 111(a)(1), EPA should take into account the cost of achieving emission reductions and any non-air quality health and environmental impact and energy requirements—this level of control is known as best demonstrated technology, or BDT.[87] In determining BDT, EPA conducts a technology review and evaluates each emissions limit in conjunction with costs, secondary air benefits, and non-air quality impacts such as solid waste generation.

EPA's proposed air toxics rule for mercury and other hazardous air pollutants would, however, exempt waste coal plants from meeting more stringent sulfur dioxide standards because "these units warrant special consideration so as to prevent the amended [new source performance standards] NSPS from discouraging the construction of future waste coal-fired [electric utility steam generating units] EGUs in the U.S."[88] The Environmental Protection Agency is also considering subcategorizing waste coal-fired EGUs and maintaining the existing NO_x standard.[89]

By encouraging the development of waste coal burning facilities, EPA encourages the construction of new mercury emitting facilities. But even discounting the additional emissions, EPA fails to consider the negative

84. *Id.*

85. 42 U.S.C. § 7411(b)(1)(a) (2010).

86. U.S. ENVTL. PROT. AGENCY, BACKGROUND ON ESTABLISHING NEW SOURCE PERFORMANCE STANDARDS (NSPS) UNDER THE CLEAN AIR ACT (2011), *available at* http://www.epa.gov/airquality/pdfs/111background.pdf.

87. 42 U.S.C. § 7411(a)(1).

88. U.S. ENVTL. PROT. AGENCY, NOTICE OF PROPOSED RULE, *supra* note 71, at 505.

89. *Id.* at 537.

effects of burning waste coal because it does not account for coal ash. For instance, an EPA support paper regarding final rulemaking on waste coal largely ignores the negative impacts of coal ash and instead focuses solely on the avoided impacts of using waste coal.[90] The support paper concludes by stating that there is no available data to determine environmental impacts associated with extracting waste coal from waste coal piles and processing such materials.[91]

B. Coal Ash

Coal Combustion Products (CCPs), or coal combustion residuals (CCRs), are created by the combustion of coal for energy and predominately consist of fly ash, bottom ash, boiler slag, and flue gas desulfurization residue. The precise environmental hazards associated with CCRs are determined by the particular composition of toxic metals and metalloids, generally reflect the chemical composition of the parent coal, and can vary based on geography and the type of coal. Approximately five million tons of coal ash is generated in Pennsylvania plants which use waste coal as a key ingredient in their fuels.[92]

Coal ash is, however, currently considered an exempt waste under an amendment to the Resource Conservation and Recovery Act (RCRA), despite EPA twice evaluating CCRs in 1993 and 2000.[93] Coal ash's exemption stems from the "Bevill Amendments," which were a part of the Solid Waste Disposal Act Amendments of 1980.[94] The Bevill Amendments exempted "special wastes" from regulation under subtitle C of RCRA until further study and assessment of risk could be performed. A May 2000 regulatory determination ruled that the Bevill Amendments applied to "beneficial" uses of coal ash, therefore exempting those uses from federal regulation.[95] A beneficial use is considered the use of a material that provides a functional benefit, meaning that it replaces the use of an

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90. *See generally*, ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9 (Explaining what coal waste is, and how it is currently being used in energy generation).

91. *Id.*

92. *Id.* at 7.

93. *Coal Combustion Residuals – Proposed Rule*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/osw/nonhaz/industrial/special/fossil/ccr-rule/index.htm (last updated Oct. 20, 2011).

94. LINDA LUTHER, MANAGING COAL COMBUSTION WASTE (CCW): ISSUES WITH DISPOSAL AND USE. U.S. CONGRESSIONAL RESEARCH SERVICE (2010), *available at* http://www.fas.org/sgp/crs/misc/R40544.pdf.

95. *Frequent Questions: Coal Combustion Residues (CCR)–Proposed Rule*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/osw/nonhaz/industrial/special/fossil/ccr-rule/ccrfaq.htm (last updated Oct. 24, 2011).

alternative material or conserves natural resources that would have been extracted and used for such process.[96]

Annually, the United States generates 109 million metric tons of coal ash.[97] Of all the mining production within the United States, up to fifty percent of the product may end up as refuse depending on the particular impurities of the coal.[98] Currently, coal ash is used for both combustion and non-combustion purposes. In terms of combustion, coal ash is third behind coal and biomass in terms of the primary sources used by CFBs.[99] Non-combustion uses of coal ash include its being used as a granular base, in mine reclamation projects, and for stockpile remediation. Stockpile remediation often utilizes beach grass, which can grow in the coal piles and rebuild organic matter; this allows for plant cover and native species to eventually resurface.[100]

Unfortunately, the absence of regulatory oversight received considerable attention following the 2008 coal ash spill at the Tennessee Valley Authority's Kingston Plant in eastern Tennessee. The tragic spill flooded more than 3,000 acres of land with coal ash and flowed into the Emory and Clinch rivers.[101] The Kingston disaster may have been the critical moment in pushing EPA to reconsider coal ash classification under RCRA.

1. EPA's proposed RCRA rule

For the first time, EPA is proposing to regulate coal ash in order to address the risks from the disposal of the wastes generated by electric utilities. EPA is considering two possible options for the management of coal ash for public comment; both options fall under RCRA.[102] Under the

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96. *Id.* For a detailed description of the particular uses of waste coal that are considered "beneficial" in Pennsylvania, *See also IEP – Coal Utilization By-Products – Pennsylvania*, NATIONAL ENERGY TECHNOLOGY LABORATORY, http://www.netl.doe.gov/technologies/coalpower/ewr/coal_utilization_byproducts/states/pennsylvania.html (last visited June 1, 2012).

97. ENVTL. PROT. AGENCY, MATERIALS CHARACTERIZATION PAPER, *supra* note 9, at 2.

98. *Id.*

99. *Id. at* 4.

100. *Id.*

101. Shaila Dewan, *Tennessee Ash Flood Larger Than Initial Estimate*, N.Y. TIMES, Dec. 26, 2008, http://www.nytimes.com/2008/12/27/us/27sludge.html.; David A. Fahrenthold, *Still unresolved, Tennessee coal-ash spill only one EPA hurdle*, WASH. POST, Dec. 22, 2009, http://www.washingtonpost.com/wpdyn/content/article/2009/12/21/AR2009122103312.html.

102. *Coal Combustion Residuals, Key Differences Between Subtitle C and Subtitle D Options*, U.S. ENVTL. PROT. AGENCY, http://www.epa.gov/epawaste/nonhaz/industrial/special/fossil/ccr-rule/ccr-table.htm (last updated July 27, 2011) [hereinafter *Coal Combustion Residuals*].

first proposal, EPA would list these residual products as special wastes subject to regulation under Subtitle C of RCRA, when destined for disposal in landfills or surface impoundments.[103] Under the second proposal, EPA would regulate coal ash under Subtitle D of RCRA, the section for non-hazardous wastes.[104] The Agency considers each proposal to have its advantages and disadvantages.

EPA's two-pronged consideration for regulation was designed to ensure that the ultimate decision was based on the best available data with the maximum amount of public input taken into the consideration.[105] While both proposals will require that liners and ground water monitoring be established at landfills handling coal ash, there are differences surrounding implementation and regulation.[106] For instance, regulation under Subtitle C will require the development of federal or state permit programs, as well as allowing for direct federal enforcement.[107] However, enforcement under Subtitle D will be through citizen suits.[108]

Subtitle C regulation is the favored approach by many environmental groups because it ensures federal enforcement and standards, while providing EPA with enforcement and inspection authority.[109] Many states and industry groups favor regulation under Subtitle D however, believing that states should be the sole regulator of coal ash, with current regulations being sufficient.[110]

2. RCRA Exemption: Beneficial Use Under State Law

Under Pennsylvania law, coal ash is regulated as a solid waste under the state's Solid Waste Management Act and residual waste management regulations. Coal ash is defined under Pennsylvania law as fly ash, bottom ash, or boiler slag resulting from the combustion of coal, and it may be beneficially used.[111] There are numerous uses of coal ash under

103. *Id.*
104. *Id.*
105. *Frequent Questions*, *supra* note 95.
106. *Id.*
107. *Id.*
108. *Coal Combustion Residuals, supra* note 102. It is important to note that states can act as citizens for the purpose of citizen suit enforcement under Subtitle D.
109. *Id.*
110. *Id.*
111. *Current Regulations Governing Coal Combustion By-Products*, NATL. ENERGY TECH. LAB., http://www.netl.doe.gov/technologies/coalpower/ewr/coal_utilization_byproducts/states/pennsylvania.html (last visited June 1, 2012).

Pennsylvania law currently considered "beneficial," including, but not limited to: coal mine reclamation projects; as a structural fill; in the manufacture of concrete; and as a raw material for a product with commercial value, including the use of bottom ash in construction aggregate.[112]

In New Jersey, regulators judge beneficial use applications on a case-by-case basis, with no uses explicitly ruled out.[113] However, New Jersey does not allow the beneficial use exemption to be used for any materials which constitute hazardous waste as defined under RCRA.[114] Therefore, a federal determination of waste coal constituents, including coal ash being labeled as hazardous wastes, will significantly close the beneficial use loophole.

While numerous uses are currently established for the use of coal ash and other coal residuals, there is debate about the environmental efficiency of specific "beneficial uses." For instance, while it is true that burning waste coal and injecting limestone produces limestone ash, which can cover mounds, this process does not necessarily stop leaching of materials underneath the limestone ash layer.[115] Also, when waste coal is burned, it leaves behind heavy metals (Pb, Hg, etc.) that will collect and become concentrated and mixed with ash that are not neutralized with the addition of limestone.[116]

In 2004, PaDEP released a book on the beneficial uses of coal ash in mine reclamation and mine drainage remediation in Pennsylvania. This book, clearly favoring the use of coal ash, found that almost all coal ash beneficial uses were clear success stories.[117] In the cases where acid mine drainage was worsened after the use of coal ash, the study concluded that coal ash was not to blame and faulted the lack of causality in the determination.[118] It should be noted that this study, whether skewed or not, was heavily relied upon in the EPA's Final Rulemaking paper regarding waste coal refuse.

112. *Id.*

113. Dennis J. Krumholz, *The Beneficial Use Exemption to the Solid Waste Rules - A Little Known but Flexible Exemption*, RIKER.COM (April 1999), http://riker.com/articles/index.php?id=3268.

114. *Id.*

115. Energy Justice Network, *Burning Waste Coal is Much More Polluting than Burning Coal*, http://www.energyjustice.net/coal/wastecoal (last visited June 1, 2012).

116. *Id.*

117. Barry E. Scheetz et al., *Coal Ash Beneficial Use in Mine Reclamation and Mine Drainage Remediation in Pennsylvania*, PA. DEP'T OF ENVTL. PROT., 344 (2004), *available at* http://www.dep.state.pa.us/dep/deputate/minres/bmr/beneficial_use/19%20CHAPT%2011/Chapter%2011.pdf.

118. *Id.* at 345.

A subsequent National Resource Council study illustrated the extent of uncertainty regarding the environmental ramifications of numerous waste coal beneficial uses. The report states:

> Based on its review of CCR post-placement monitoring, the committee concludes that the number of monitoring wells, the spatial coverage of wells, and the duration of monitoring at CCR minefills are generally insufficient to accurately assess the migration of contaminates. Additionally, the committee found quality assurance and control and information management procedures for water quality data at CCR mine placement sites to be inadequate.[119]

The report went on to conclude that the Committee had a "poor understanding" of the field conditions influencing the behavior of CCRs; that "comparatively little is known" about the potential for mine filling to degrade the quality of groundwater and/or surface waters; and that there is "insufficient data" to make accurate human risk assessments.[120]

In another criticism, the Public Employees for Environmental Responsibility (PEER) argued that Pennsylvania turned a blind eye to the environmental and health risks associated with using waste coal in coal mine reclamation projects.[121] PEER took exception to a Pennsylvania state report used to gain approval of the beneficial use of coal wastes by minimizing environmental concerns. PEER compared filling abandoned coal mines with coal ash to "letting nuclear reactors throw their spent fuel rods down abandoned uranium mines and calling it a beneficial use."[122] PEER also discredited a preliminary finding regarding the use of coal ash at Bark Camp Run, a tributary to the Bennett Branch of the Sinnemahoning Creek in west-central Pennsylvania. The report claimed that adding and mixing dredged material with coal ash had no negative impacts on surface or groundwater quality.[123] Moreover, a hydro-geologic expert, Robert Gadinski, filed a formal complaint with the Pennsylvania Department of

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119. NATIONAL RESOURCE COUNCIL, MANAGING COAL COMBUSTION RESIDUES IN MINES 77 (2006) (emphasis in original).

120. *Id.* at 79, 105.

121. *Eco-Risk of Coal Ash as Mine Fill Understated,* PUBLIC EMPLOYEES FOR ENVIRONMENTAL RESPONSIBILITY (Dec. 15, 2010), http://www.peer.org/news/news_id.php?row_id=1433.

122. *Id.*

123. ANDREW S. VOROS, ET AL., MINE RECLAMATION USING DREDGED MATERIALS AND COAL ASH 8 (2002), *available at* https://fs.ogm.utah.gov/pub/MINES/AMR_Related/NAAMLP/PMImpl/Voros.pdf.

State in April 2008 about the lack of qualifications of the author of the Bark Camp report, under laws requiring state licensure for geologic consulting work in Pennsylvania. Two years later, however, the Commonwealth has not responded.[124]

PEER also explained that, during the Bush administration, EPA entered into a formal partnership with the American Coal Ash Association to promote coal combustion wastes for industrial, agricultural, and consumer product uses. Since engaging the rulemaking process, however, EPA has suspended participation in the Coal Combustion Products Partnership, or C^2P^2.[125]

C. Greenhouse Gases—Tailoring Rule

The use of waste coal could also trigger the requirements of the newly implemented greenhouse gas tailoring rule. As of January 1, 2011, facilities that were already required to obtain New Source Review permits for other pollutants are required to include greenhouse gases in their permits if the increase of such emissions was at least 75,000 tons of carbon dioxide equivalent per year.[126] Since July 2011, the tailoring extends to new construction projects that emit at least 100,000 tons of greenhouse gases and to existing facilities that emit over 75,000 tons of greenhouse gases, even if these facilities don't trip federal thresholds for other pollutants.[127]

In the United States, the generation of electricity is the single largest source of CO_2 emissions, representing 39 percent of total CO_2 emissions from all CO_2 emissions sources across the country. Methane and N_2O account for a smaller portion of emissions and in 2009, represented less than 0.1 percent and 0.4 percent, respectively.[128] However, FBC plants

124. Letter from Jeff Ruch and Megan Corrado, Requesting Action on Gadinski Complaint Re: Audit of Voros Report (Dec. 15, 2010), *available at* http://peer.org/docs/pa/12_15_10_PA_Auditor_General_Complaint.pdf.

125. *See generally*, Memorandum from Truett Degeare to OSWER Regional IMR Team (May 5, 2010), *available at* http://peer.org/docs/epa/6_21_10_C2P2_Suspension_notice.pdf (notifying interested parties that the EPA had suspended active participation in the Coal Combustion Products Partnership while undertaking rulemaking).

126. Robin Bravender, *EPA Issues Final 'Tailoring' Rule for Greenhouse Gas Emissions*, N.Y. TIMES, May 13, 2010, http://www.nytimes.com/gwire/2010/05/13/13greenwire-epa-issues-final-tailoring-rule-for-greenhouse-32021.html (explaining the EPA's standards for new greenhouse gas emissions).

127. *Id.*

128. U.S. ENVTL. PROT. AGENCY, INVENTORY OF U.S. GREENHOUSE GAS EMISSIONS AND SINKS: 1990-2009, at 3-10 (2011), *available at* http://www.epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Complete_Report.pdf.

operate at lower temperatures than conventional coal power plants and create far greater emissions of nitrous oxide (N_2O), which is a potent global warming gas.[129] Some have estimated that FBCs emit fifteen percent more greenhouse gas pollution than conventional boilers.[130] With the rise in use of waste coal FBCs, the greenhouse gas tailoring rule's applicability will become all the more relevant and important.

D. Site Reclamation and Green Jobs

As an alternative to costly conventional remediation projects, researchers at the Natural Resources Conservation Service discovered an environmentally viable and cheaper alternative to traditional practices through beach grass remediation. They found that beach grass thrives in waste coal piles and can establish enough plant cover to enable native plants to take root in only a few years. In fact, this method has been shown to bring life back to desolate waste coal piles for only 6–10% of the cost of conventional methods. Costs for traditional grading, top-soiling, and seeding waste coal piles averaged $30,000 per acre, whereas a two-acre site in southern West Virginia was stabilized with Cape American Beachgrass for $3,750 per acre.[131] The success of Beachgrass remediation depends, however, on the underlying characteristics of the waste coal pile, such as its slope aspect, compaction, water-holding capacity, pH, and temperature. These factors may also determine how much site preparation work must be done to establish viable plant communities and the failure rate of initial re-vegetation, which may change the cost profile for the remediation project.

According to statistics provided to Congress from the National Association of Contractors, each million dollars of AML money spent on reclamation projects creates 59 jobs.[132] OSM estimates that it would take over $625 million to clean up all the highest priority sites in

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129. *See* COAL-RELATED GREENHOUSE MANAGEMENT ISSUES, *supra* note76, at 7 (regarding N_2O emissions associated with FBC generation technology).

130. *See Id.* (regarding emissions from FBC plants compared to conventional burners).

131. Robert Glennon & Sam De Pue, *Beachgrass: Succession on a Coal Mine Gob Pile Stabilized With 'Cape' American Beachgrass*, ENERGY JUSTICE NETWORK, http://www.energyjustice.net/coal/wastecoal/beachgrass (last visited June 1, 2012); TESTIMONY OF CLEAN AIR COUNCIL ON U.S. EPA'S PROPOSAL, CLEAN AIR COUNCIL 4 (May 24, 2011), *available at* http://www.cleanair.org/sites/default/files/Minott%20EPA%20Testimony%205.24.11.pdf; *see also* VIRGINIA COOPERATIVE EXTENSION, RECLAMATION OF WASTE COAL DISPOSAL AREAS (2010), *available at* http://pubs.ext.vt.edu/460/460-131/460-131_pdf.pdf.

132. Robert Hughes, *Watershed Weekly*, FUNDING FOR ABANDONED MINE RECLAMATION, http://www.greenworks.tv/watershed_weekly/more_information/featuredtopic_abandonedmine.htm (last visited June 1, 2012).

Pennsylvania—that would also mean over 36,000 new jobs in the Pennsylvania coalfields.[133]

CONCLUSION

Waste coal mounds scar the landscapes of coal mining country and contribute to air and water pollution in adjacent communities. Managing waste coal is a priority for these communities and has been addressed by state and federal regulators. Their solutions, however, may simply transform waste coal mounds into concentrated toxic ash mounds that are currently not regulated as hazardous wastes, leading to considerably more environmental degradation.[134]

In Pennsylvania, waste coal is a Tier II alternative energy source and qualifies for energy credits that may be sold and traded on the market. Many waste coal facilities also qualify for direct state and federal financial assistance to offset construction costs. The Environmental Protection Agency even proposes to exempt new waste coal facilities from meeting new emissions standards. And through other federal environmental law exemptions, combusted waste coal ash is applied as mine filler and may cause acid mine drainage—the principal environmental concern associated with waste coal mounds.

Despite the significant incentives available to waste coal burning power plants, these facilities are economically inefficient and environmentally deficient. State and federal regulators should instead encourage sustainable and efficient solutions for managing waste coal mounds rather than promote superficial and potentially destructive solutions to handling waste coal.

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133. *Id.*

134. *See*, Hazardous and Solid Waste Management System; Identification and Listing of Special Wastes; Disposal of Coal Combustion Residuals From Electric Utilities, 75 Fed. Reg. 35128, 35145 (June 21, 2010) (In fact, the EPA's proposed coal combustion residuals ("CCR") rule places CCR managed with waste coal in the 90th percentile risk level for arsenic, lead, cobalt, and selenium.).