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UNLOCKING THE FIRE: A PROPOSAL FOR JUDICIAL OR LEGISLATIVE DETERMINATION OF THE OWNERSHIP OF COALBED METHANE[1]

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This Article may cite certain publications that the reader may have difficulty locating. If an obscure source is cited and the reader would like to obtain a copy of the referenced material, please contact the author for assistance.

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I. INTRODUCTION

In an article published in this journal fifty years ago, Professor C.C. Williams noted: "The abundant presence of gas in various coal strata is a matter of common knowledge, but the intrinsic worth of these deposits seldom gets attention."[2] Variously known as "firedamp," "coalbed gas," and "coalbed methane," this combustible gas has killed thousands of miners in underground mine explosions.[3] The need for ventilation of this gas has been known for nearly a century[4] and has been required by federal law for several decades.[5] It is now understood that coalbed gas primarily consists of methane;[6] hence, in the remainder of this Article it will be referred to as coalbed methane, or "CBM."

The potential for making productive use of CBM has long been recognized. Indeed, it was the successful production of marketable gas from coal seams in northern West Virginia that prompted Pro-

2. C.C. Williams, Jr., *On Leasing Gas from Coal Seams*, 47 W. VA. L.Q. 211, 212 (1941).

3. H.B. HUMPHREY, U.S. DEP'T OF INTERIOR, HISTORICAL SUMMARY OF COAL-MINE EXPLOSIONS IN THE UNITED STATES (Bureau of Mines Information Circular 7900, 1959). Concern about mine explosions provided the impetus for the establishment of the Bureau of Mines in 1910.

4. *See id.* at 162.

5. The Federal Coal Mine Health and Safety Act of 1969 contains detailed standards for controlling methane in underground coal mines. *See* 30 U.S.C. §§ 801-962 (1988). Enactment of this legislation was prompted in part by outrage at the deaths of 78 miners from a mine explosion near Farmington, West Virginia on November 20, 1968. *See* 1969 U.S.C.C.A.N 2503.

6. *See infra* note 29 and accompanying text.

fessor Williams' 1941 article.[7] European use of CBM as an energy source began in the 1940s and was well-established by the 1950s.[8] In this country, rich in reserves of natural gas, coal, and petroleum, productive development of CBM has lagged behind, and for many years the only persons actively studying the extraction of CBM were employees of the U.S. Bureau of Mines (BOM).[9]

Following the energy crisis of the 1970s, interest in the productive potential of CBM increased dramatically.[10] An extensive technical literature now exists on the extraction and utilization of CBM.[11]

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7. Williams, *supra* note 2, at 213; P.H. Price & A.J.W. Headlee, *Physical and Chemical Properties of Natural Gas in West Virginia*, 9 W. VA. GEOLOG. SURV. 52-54 (1937). The Big Run field in Wetzel County produced over two billion cubic feet of gas between 1932 and 1975. A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Appalachian Basin*, Q. REV. OF METHANE FROM COAL SEAMS TECH., July 1991, at 10, 13.

8. J. VENTER & P. STASSEN, U.S. DEP'T OF INTERIOR, DRAINAGE AND UTILIZATION OF FIREDAMP (Bureau of Mines Information Circular 7670, 1953).

9. The conclusions from BOM's impressive research program are compiled in U.S. DEP'T OF INTERIOR, METHANE CONTROL RESEARCH: SUMMARY OF RESULTS 1964-80 (Bureau of Mines Bulletin 687, Maurice Deul & Ann G. Kim eds., 1988) [hereinafter METHANE CONTROL RESEARCH].

10. *See, e.g.*, Maurice Deul & Ann G. Kim, *Methane in Coal: From Liability to Asset*, MINING CONGRESS J., Nov. 1975, at 28; George Getschow, *Untapped Resource Gas Found in Nation's Coalbeds Attract Interest as New Source of Heating Fuel*, WALL ST. J., Aug. 31, 1977, at 28. There appears to have been a resurgence of interest in CBM in the late 1980s. *See, e.g.*, Jacki L. Kelly, *Coalbed Methane: From Nuisance to New Source*, GRID, Summer 1989, at 2; Vello A. Kuuskraa & Charles F. Brandenburg, *Coalbed Methane Sparks a New Energy Industry*, OIL & GAS J., Oct. 9, 1989, at 3; Thomas W. Lippman, *Long Feared Methane Now Valued*, WASH. POST, Apr. 12, 1990, at A20. The *Oil & Gas Journal* published a series of articles on coalbed methane in 1989 and 1990, and it reprinted them together in a special issue.

11. BOM summarized the results of its research in METHANE CONTROL RESEARCH, *supra* note 9, and it also compiled a bibliography. Gerald L. Finfinger, U.S. DEP'T OF INTERIOR, GROUND AND METHANE CONTROL PUBLICATIONS LIST (1989). While BOM continued to engage in research on coalbed methane, in the 1980s work on recovery and utilization of coalbed methane was transferred to the Department of Energy (DOE). A significant coalbed methane research project was undertaken by DOE at the Morgantown Energy Technology Center (METC). In addition to numerous technical papers and presentations, major reports include METC/DOE COALBED METHANE: TECHNOLOGY STATUS REPORT (DOE/METC-87/0251 1987); METC/DOE COALBED METHANE: TECHNOLOGY STATUS REPORT (DOE/METC-86/0233 1986); METC/DOE COALBED METHANE: TOPICAL REPORT (DOE/METC/SP-208 1984); METC/DOE COALBED METHANE RECOVERY AND UTILIZATION IN THE UNITED STATES: TOPICAL REPORT (DOE/METC/SP-202 1983); METC/DOE METHANE RECOVERY FROM COALBEDS: A POTENTIAL ENERGY SOURCE (T.H. Mroz, et al., eds., 1983).

As DOE funding began to decline, the Gas Research Institute (GRI) started its own methane research program. In 1983, GRI began publishing its *Quarterly Review of Methane from Coal Seams Technology*. GRI has established regional coalbed methane information centers at the Colorado School of Mines, the University of Alabama School of Mines and Energy Development, and most recently at Marietta College in Ohio.

A Coalbed Methane Symposium has been held in Tuscaloosa, Alabama in the Spring of 1987,

Development of CBM has proceeded rapidly in other areas of the country, most notably in the Western states and in the Black Warrior Basin of Alabama.[12]

The state of West Virginia contains vast quantities of CBM in its coal reserves, and the state has the potential to become one of the nation's largest commercial producers of CBM.[13] Instead, virtually all of the CBM in West Virginia's coal is vented into the atmosphere, so that this state has the distinction of being the nation's greatest squanderer of this precious and irreplaceable resource.[14]

Why? One significant obstacle to CBM development in West Virginia, unanimously identified by all commentators, is uncertainty over the ownership of the gas.[15] Although the technology exists to extract pipeline-quality methane from coal seams, especially in connection with longwall mining, mine operators in West Virginia routinely vent this gas into the atmosphere, in part because they are

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1989, and 1991, sponsored by GRI, the University of Alabama, the U.S. Department of Labor and the Geological Survey of Alabama; the symposium proceedings have been published and are cited throughout this Article as 19XX PROCEEDINGS. The Eastern Mineral Law Foundation sponsored special institutes devoted to coalbed methane in the Fall of 1988, 1989, and 1990, and it cosponsored another institute in 1992 with the Rocky Mountain Mineral Law Foundation; the institute proceedings have been published and are cited throughout this Article as 19XX SPECIAL INSTITUTE. (We have cited several papers from the 1992 Special Institute in the footnotes, but they were not received in time for their contents to be assimilated into the text.) The Pittsburgh Coalbed Methane Forum has met regularly in Pennsylvania and West Virginia since 1985, but it does not publish its proceedings.

12. *See infra* notes 49-53 and accompanying text.

13. *See infra* notes 37-43 and accompanying text.

14. *See* C.M. Boyer, II et al., U.S. ENVTL. PROTECTION AGENCY, METHANE EMISSIONS FROM COAL MINING: ISSUES AND OPPORTUNITIES FOR REDUCTION (1990) (a report produced by employees of ICF Resources Incorporated under contract with the EPA) [hereinafter METHANE EMISSIONS FROM COAL MINING] (West Virginia produces 34% of U.S. methane emissions from mining and 38% of emissions from underground mining); *see* Michael A. Trevits et al., *Evaluation of U.S. Coal Mine Emissions*, *in* PROC. OF THE 5TH U.S. MINE VENTILATION SYMP. 177 (1991). "West Virginia has produced the highest methane emissions each year with the exception of 1985 when the Alabama mines produced more." *Id.* at 178.

15. *See, e.g.*, A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Northern and Central Appalachian Basins—Past, Present and Future*, *in* 1991 PROCEEDINGS, *supra* note 11, at 127, 130; Hilmar von Schonfeldt, *Joint Development in the Appalachian Basin*, *in* 1988 SPECIAL INSTITUTE, *supra* note 11, at ch. 2B, 4-5. Walter B. Ayers Jr. & Bruce S. Kelso, *Knowledge of Methane Potential for Coalbed Resources Grows, But Needs More Study*, OIL & GAS J., Oct. 23, 1989, at 64, 68; Herbert T. Black, *Update on U.S. Coalbed Methane Production*, ENERGY INFO. ADMIN./NAT. GAS MONTHLY, Oct. 1990, at 1, 14; AM. GAS ASS'N, COALBED METHANE RESOURCE, RESERVOIR, AND PRODUCTION CHARACTERISTICS 11 (Issue Brief 1990-15, 1990).

unwilling to invest the resources necessary to capture CBM when they may not own it.[16]

In his 1941 article, Professor Williams noted that title to CBM was uncertain whenever the coal rights were severed from ownership of the fee,[17] and he concluded that there was no clear answer to the ownership question:

> While each position may fairly be criticized — the coal operator's for an overstressing of property concepts and the surface owner's for its failure to appreciate thoroughly the problems of the mining industry — the ultimate legal solution probably lies somewhere between such extremes. One should hardly stand in small awe of principle, precedent and doctrine, but the trouble is they are here in equipoise; and the lack of direct authority on the point leaves the problem wide-open.[18]

Following the intensification of interest in CBM in the 1970s, the question of its ownership has been the subject of debate in law reviews,[19] at mineral law institutes,[20] in practitioner-oriented legal

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16. In addition to its direct disincentive effects, uncertainty of ownership is inseparably linked with two of the other reasons that have been advanced for the virtual absence of CBM development in West Virginia: that extraction of CBM may limit the autonomy of mining operations and interfere with the extraction of coal. *See* discussion *infra* notes 132-47, 200-41, 383-98 and accompanying text.

17. Williams, *supra* note 2, at 215: "But suppose someone else has the fee in the gas-producing seam: as between the farmer and that coal owner, who has title to the gas contained with the strata? Or — a different question — which of the two may legally lease such coal-gas?"

18. *Id.* at 224.

19. *E.g.*, Harry Cohen, *Developing and Producing Coalbed Gas: Ownership, Regulation, and Environmental Concerns*, 2 PACE ENVTL. L. REV. 1 (1984); Sarah K. Farnell, *Methane Gas Ownership: A Proposed Solution for Alabama*, 33 ALA. L. REV. 521 (1982); Patrick C. McGinley, *Legal Problems Relating to Ownership of Gas Found in Coal Deposits*, 80 W. VA. L. REV. 369 (1978); Ronald K. Olson, *Coalbed Methane: Legal Considerations Affecting Its Development as an Energy Resource*, 13 TULSA L.J. 377 (1978); Richard H. Lorenson, Comment, *Ownership of Coalbed Gas*: United States Steel Corp. v. Hoge, 82 W. VA. L. REV. 1451 (1980); Steven P. McGowan, Comment, United States Steel Corp. v. Hoge: *A Judicial Decision Which Fails to Solve the Coalbed Gas Ownership Problem*, 85 W. VA. L. REV. 803 (1983); Nancy P. Regelin, Comment, *Coalbed Gas Ownership in Pennsylvania A Tenuous First Step with* U.S. Steel v. Hoge, 23 DUQ. L. REV. 735 (1985); Laura E. Little, Case Digest, 57 TEMP. L.Q. 427 (1984).

20. *E.g.*, Paul N. Bowles, *Coalbed Gas: Present Status of Ownership Issue and Other Legal Considerations*, 1 E. MIN. L. INST. ch. 7 (1980); Edward A. Craig, III & Marlee S. Myers, *Ownership of Methane Gas in Coalbeds*, 24 ROCKY MTN. MIN. L. INST. 767 (1978); Charles L. Kaiser & Mark D. Bingham, *Coalbed Gas Exploration and Development on Federal and Other Lands in the West*, *in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 2; John H. Morrow, *Coalbed Methane—The Title Game: Who Owns It? A Trial Lawyer's Perspective*, *in* 1988 SPECIAL INSTITUTE, *supra* note 11, at ch. 6; Phillip E. Norvell, *Competing Uses of Coal, Oil & Gas Estates in Coalbed Methane Development*, *in* 1990 SPECIAL INSTITUTE, *supra* note 11, ch. 3; John Schumacher, *An Introduction to*

journals,[21] in other publications,[22] and occasionally in legal proceedings.[23] Nevertheless, Professor Williams' conclusion of fifty years ago remains true today in West Virginia: "principle, precedent and doctrine . . . are in equipoise; and the lack of direct authority on the point leaves the problem wide open."

So long as the question of ownership remains unresolved, the waste of CBM is likely to continue. In addition to dissipating a valuable resource, the venting of CBM has been identified as a substantial contributor to the problem of global warming, often referred to as the "greenhouse effect."[24] It is time to resolve the ownership question and "unlock the fire."[25]

Coalbed Methane Development on Indian Lands, in 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 3; Mark A. Swartz, *Ownership Issues and Their Impact Upon Coalbed Methane Development, in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 1; Thomas R. Wright, *Ownership of Coalbed Gas—Legal Analysis:* United States Steel Corporation v. Hoge *and* Rayburn v. USX Corp., *in* 1988 SPECIAL INSTITUTE, *supra* note 11, ch. 4.

21. *E.g.*, Harry Cohen, *Legal Issues Involved in Producing Coal Bed Methane Gas*, 42 ALA. LAW. 660 (1981); David E. Brody, *Coalbed Methane Development Ownership and Related Issues*, THE LANDMAN, May/June, 1991, at 51; Jeanine Feriancek, *Coalbed Gas Development in the San Juan Basin: The Ownership Question*, 4 NAT. RESOURCES & ENV'T, Winter 1990, at 59; M. Jill Morgan & Elizabeth A. McClanahan, *Competing Ownership Claims to Coalbed Methane in the Appalachian Basin*, THE LANDMAN, July-Aug. 1990, at 19; Kurt M. Petersen, *Coal-Bed Gas Ownership in the San Juan Basin*, 18 COLO. LAW. 1329 (1989).

22. *E.g.*, Harry Cohen, Sarah K. Farnell, & Dan A. Thompson, *Legal and Regulatory Aspects of Coalbed Methane Development, in* U.S. DEP'T OF ENERGY, THE DEVELOPMENT POTENTIAL OF COALBED METHANE IN THE WARRIOR COAL BASIN OF ALABAMA 171 (1984); Richard A. Counts, *Legal Aspects of Coalbed Methane, in* 1989 PROCEEDINGS, *supra* note 11, at 29; Richard A. Counts, *Ownership Questions Can Stymie Development of Coalbed Methane*, OIL & GAS J., Jan. 1, 1990, at 66 [hereinafter *Ownership Questions*]; S.K. Farnell, *Who Owns the Gas in Coal? — A Legal Update, in* 1987 PROCEEDINGS, *supra* note 11, at 11; J. Hovey Kemp & Kurt M. Petersen, *Coal-Bed Gas Development in the San Juan Basin; A Primer for the Lawyer and Landman, in* ROCKY MTN. ASSOC. OF GEOLOGISTS, COAL-BED METHANE, SAN JUAN BASIN 257 (1988); Norman E. Mutchler & Harry R. Sachse, *Legal Aspects of Coalbed Gas*, 33 J. PETROLEUM TECH. 1861 (1980).

23. The three judicial decisions are Rayburn v. USX Corp., No. 85-G-2661-W, 1987 U.S. Dist. LEXIS 6920 (N.D. Ala. July 29, 1987), *aff'd mem.*, 844 F.2d 796 (11th Cir. 1988); United States Steel Corp. v. Hoge, 468 A.2d 1380 (Pa. 1983); Pinnacle Petroleum Co. v. Jim Walter Resources, Inc., No. CV-87-3012 (Cir. Ct., Mobile Cty., Ala., July 28, 1989) (granting partial summary judgment). Ownership is also at issue in certain pending litigation. *See infra* notes 172 & 270. Formal legal opinions have been issued by the Attorney General of Pennsylvania, 53 Op. Att'y Gen. 211 (1974), and the Solicitor General of the United States, M-36935, 88 Interior Dec. 538 (1981); M-36970, 98 Interior Dec. 59 (1990). The relatively small body of existing precedent has not substantially clarified the ownership question, because these authorities have taken different approaches and have reached different conclusions. *See* discussion *infra* Part V.

24. See *infra* Part II-D for a more detailed discussion of the role of CBM in the greenhouse effect and in the anticipated regulatory responses.

25. UNLOCKING THE FIRE (Univ. of Maryland 1987) (videotape about CBM funded by DOE through a grant to the Am. Pub. Gas Ass'n (available from Charles W. Byrer, DOE-METC).

Part II of this Article provides technical background concerning CBM which is crucial to understanding the complexity of the ownership question. Topics include the origins and chemical composition of CBM, the extent of CBM reserves in the nation and in the state of West Virginia, the technology of CBM extraction and utilization, and the relationship of CBM to energy policy and the problem of global warming.

Part III considers the extraction-related conflicts between coal owners and potential CBM developers. These conflicts, along with the ownership question, constitute a major obstacle to development of CBM resources in the Appalachian region. In Part IV we analyze the legislative solutions to these conflicts that have been adopted or proposed at the state and federal level. We conclude that resolution of the ownership question is an essential component of any regulatory solution to the extraction-related conflicts which have impeded CBM development in West Virginia.

Part V considers six alternative "rules" that a court might employ in resolving the question of CBM ownership at common law based on existing principle and precedent from the field of mineral law. Whereas most commentators have assumed that title to CBM must be awarded to either the coal owners or gas owners on an all-or-nothing basis, we conclude that principle and precedent most strongly support two rules that would confer qualified or limited ownership rights in one party and secondary rights in the other.[26] Concluding that none of the six common-law rules is necessarily "correct" as a matter of theory or precedent, in Part VI we consider the competing policy arguments that might assist the courts in selecting an optimal common-law solution to the ownership question.

As an alternative to judicial determination of title to CBM, in Part VII we consider the possibility of a legislative solution to the ownership question. In a dramatic departure from the common-law approaches, we conceived of a seventh rule that would establish

26. "Rule #5" would establish "successive ownership," with coal owners having title to CBM within the coal but gas owners having title to CBM released into the gob zone. "Rule #6" would establish "mutual simulataneous rights," with gas owners having title to CBM but coal owners having the right to extract CBM as an incidental mining right.

shared ownership of CBM. By adopting "Rule #7," the legislature[27] would make the competing entities partners in CBM development, with the coal owners and gas owners each having a 50% ownership interest in the CBM as tenants in common. Although we do not definitively endorse this statutory solution to the ownership question, our evaluation of Rule #7 in comparison with the six common-law rules suggests that a legislatively-mandated partnership between coal owners and gas owners could establish the best incentives for efficient extraction of this valuable resource.

Part VIII addresses the potential constitutional objection to Rule #7 as a "taking" of property rights in CBM without due process. While most previous commentators have presumed that any legislative solution to the ownership question was certain to be declared unconstitutional, we believe that Rule #7 could withstand a constitutional challenge. Even if it were invalidated, however, such a statute would have the salutary effect of obtaining a definitive judicial resolution of the ownership question.

II. BACKGROUND

A. What is CBM?

CBM is a by-product of the "coalification" process. Plant life incorporates carbon dioxide and water to form various hydrocarbon-based compounds which in turn decay to form peat. When peat is buried under other sediments, the pressure and temperature eventually convert it to coal, methane, and other gaseous byproducts.[28]

CBM is not pure methane, but it generally contains in excess of 80% methane, which is also the primary component of "natural gas."[29] CBM has a heating value of roughly 1,000 BTU per cubic foot, again comparable to pipeline-quality natural gas.[30] Despite these

27. We conceived of Rule #7 as suitable for adoption in West Virginia and other states where uncertainty as to ownership is impeding CBM development. However, it could also be incorporated in federal legislation addressing the ownership issue. *See infra* notes 173-199 and accompanying text.

28. Ann G. Kim and F.N. Kissell, *Methane Formation and Migration in Coalbeds*, *in* METHANE CONTROL RESEARCH, *supra* note 9, at 18.

29. *Id.* at 20; Ann G. Kim & M. Deul, *Conservation of Methane Drained From Coal*, *in* METHANE CONTROL RESEARCH, *supra* note 9, at 150; ANN G. KIM, U.S. DEPT. OF INTERIOR, THE COMPOSITION OF COALBED GAS (REPORT OF INVESTIGATIONS No. 7762, 1973).

30. *Id.*

important similarities, CBM usually can be distinguished from natural gas through an analysis of its other component gases.[31]

The methane in coal can exist as a free gas in the cracks or fractures (macropores) within the coal seam, but most of the gas is "adsorbed" within the coal, adhering to the internal surface of micropores in the structure of the coal.[32] The methane pressure within the coal ordinarily exceeds atmospheric pressure, so that mining of the coal releases the gas in a two-step process.[33] In the first step, gas de-adsorbs from micropores and flows into the macropores. In the second step, gas in the macropores flows via an interconnected system of fractures to the mine face.

The methane content of a coalbed reflects the quantity of methane generated during coalification less whatever quantity has escaped. The current methane content thus depends on a variety of factors, including the coal rank, the pressure and temperature, the permeability and porosity of the coal, the degree of fracturing, the distance to the outcrop, and the permeability of adjacent strata.[34] In general, deeper coals are subject to greater pressure and tend to be gassier.[35]

Substantial quantities of CBM may escape from the coalbed and become trapped in less permeable adjacent non-coal strata.[36] There

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31. The profile of trace gases ordinarily found with methane in CBM differ from those which tend to occur in natural gas. Unlike most natural gas, CBM usually contains only small quantities of ethane, little or none of the heavier hydrocarbons (propane, butane, pentane), and no carbon monoxide or sulfur compounds. *Compare* Kim & Kissell, *supra* note 28, at 20; Kim & Deul, *supra* note 29, at 150-51, *with* A.I. LEVORSEN, GEOLOGY OF PETROLEUM 216-23 (2d ed. 1967); Exxon Corp. v. Lujan, 730 F. Supp. 1535, 1538-40 (D. Wyo. 1990) (discussing hydrocarbon and nonhydrocarbon gases found in natural gas in support of its holding that carbon dioxide is natural gas for purpose of federal regulatory statute). Samples of both CBM and natural gas exhibit substantial variability in these trace gases, however, so it may not always be possible to determine whether the gas in a particular sample had its origins in a coalbed.

32. Kim & Kissell, *supra* note 28, at 22; *see* Kim, *supra* note 29, at 2.

33. *See, e.g.*, Kim & Kissell, *supra* note 28, at 23-24.

34. *Id.* at 22.

35. *See id.*

36. Within the coal and gas industries this phenomenon is generally accepted, but its occurrence is not well-documented. In one BOM report, the authors determined that the source of methane emissions into a mine was a sandstone formation directly above the coalbed, and they concluded that while some of this methane was produced by coalification of organic matter within the sandstone, a portion had migrated from subjacent coalbeds. J.P. ULERY & G.M. MOLINDA, U.S. DEP'T OF

is some controversy over whether methane trapped in these associated strata is subject to the same ownership rules as the methane within the coal. Where this distinction is relevant, we will refer to coalbed gas trapped in non-coal strata as "strata gas" and limit the term CBM to gas adsorbed within coal seams.

B. CBM Resources

The Department of Energy and the Gas Research Institute estimate that sixteen major basins contain approximately 300-400 trillion cubic feet (Tcf) of CBM in place, of which 90 Tcf is recoverable.[37] This 90 Tcf of recoverable CBM represents five years of total natural gas production in the United States.[38]

CBM production in three major basins totaled 91.5 billion cubic feet (Bcf) in 1989, representing 0.5% of total U.S. gas production.[39] The American Gas Association estimated that production would exceed 100 Bcf by the end of 1990.[40]

Most of the State of West Virginia lies within the Northern and

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INTERIOR, INFLUENCE OF OVERLYING STRATA ON METHANE EMISSIONS IN A NORTHERN WEST VIRGINIA COAL MINE 1, 11-12 (Bureau of Mines Report of Investigations 8879, 1984). The authors did not explain the basis for their conclusions that a portion of the gas did not originate within the sandstone and that its source was coalbeds rather than a natural gas reservoir.

37. The first comprehensive study by DOE-METC estimated that gas-in-place was between 67.7 and 405.8 Tcf. Charles W. Byrer et al., *Coalbed Methane Production Potential in U.S. Basins*, J. PETROLEUM TECH., July 1987, at 821, 822. GRI has sponsored a series of follow-up studies that yielded a total for estimated gas-in-place of 296-394 Tcf. ICF Resources, Inc., *The United States Coalbed Methane Resource*, Q. REV. OF METHANE FROM COAL SEAMS TECH., Mar. 1990, at 10, 11. GRI estimates that 90 Tcf of this gas is "considered to be recoverable by present technology or by technology that is expected to be developed in the near term." *Id.* at 10. *See also* Walter B. Ayers, Jr. & Bruce S. Kelso, *Knowledge of Methane Potential for Coalbed Resources Grows, But Needs More Study*, OIL & GAS J., Oct. 23, 1989, at 64, 65 (estimate of 401 Tcf in-place, 90 Tcf recoverable); AM. GAS ASS'N, COALBED METHANE RESOURCE, RESERVOIR, AND PRODUCTION CHARACTERISTICS (Issue Brief 1990-15 1990) (Potential Gas Committee estimates 133-448 Tcf in-place, 90.1 Tcf recoverable). The current estimates are far below those of the 1970s. *Compare, e.g.*, Getschow, *supra* note 10 (1977 estimate of 794 Tcf in-place, 250 Tcf recoverable).

38. Herbert T. Black, *Update on U.S. Coalbed Methane Production*, NAT. GAS MONTHLY, Oct. 1990, at 1. The 90 Tcf of gas would increase current U.S. reserves by nearly 50%. *See* Philip C. Crouse, *Coal Seam Methane is One of the Hotter Current Plays*, WORLD OIL, Nov. 1989, at 47 (current U.S. gas reserves are 193 Tcf).

39. Black, *supra* note 38, at 1. The breakdown for these three basins are as follows: Black Warrior (Alabama), 23.4 Bcf; San Juan (Colorado and New Mexico), 67.3 Bcf; Piceance (Colorado), .8 Bcf.

40. AM. GAS ASS'N, 1990-15, *supra* note 37, at 8.

Central Appalachian Basins, which together contain roughly 66 Tcf of CBM in place.[41] The areas with the greatest potential for CBM extraction in these basins include an elliptically shaped area in the southwest corner of Pennsylvania and northwestern West Virginia,[42] an area centered in Buchanan County, Virginia, and an area centered on the border between McDowell and Wyoming counties in West Virginia.[43]

Despite this potential, CBM production in these two basins has lagged behind other areas of the country. Part of the explanation lies in technical constraints, including the failure of Appalachian coal and gas operators to employ state-of-the-art extraction techniques,[44] but "socio/economic" factors are also important.[45] Two factors identified as impeding development are uncertainty over ownership[46] and a low level of interest on the part of the coal companies in this area.[47] As a result, current mining operations are producing commercial quantities of CBM from horizontal and vertical ventilation boreholes, but this gas is being vented into the atmosphere.[48]

Production has proceeded most rapidly in the Western states,[49] where ownership is less uncertain[50] and much of the coal is so deep

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41. The DOE-METC study estimated that the Northern Appalachian Basin contained 61 Tcf and the Central Appalachian Basin contained 10-48 Tcf. Byrer et al., *supra* note 37, at 822. GRI accepts the 61 Tcf estimate for the Northern Appalachian Basin, but it estimates only 5 Tcf in the Central Appalachian Basin, because it omits a significant amount of shallow coal with low gas values. ICF Resources, Inc., *supra* note 37, at 11; J.R. Kelafant et al., *A Geologic Assessment of Natural Gas From Coal Seams in the Northern Appalachian Coal Basin*, GRI TOPICAL REPORT 88/0039 (March 1988); J.R. Kelafant & C.M. Boyer, *A Geologic Assessment of Natural Gas From Coal Seams in the Central Appalachian Coal Basin*, GRI TOPICAL REPORT 88/0302 (December 1988); *see also* William P. Diamond et al., *Geologic and Economic Appraisal of Gas From Coalbeds in the Northern Appalachian Coal Basin*, SME-AIME E. REGIONAL MEETING (1987) (61 Tcf estimate).

42. Diamond et al., *supra* note 41, at 7 & Fig. 10; Kelafant et al., *supra* note 41, at iii.

43. Kelafant & Boyer, *supra* note 41, at iii.

44. A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Appalachian Basin*, Q. REV. OF METHANE FROM COAL SEAMS TECH., July 1991, at 11; A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Northern and Central Appalachian Basins Past, Present and Future*, *in* 1991 PROCEEDINGS, *supra* note 11, at 127, 129-30; J.R. Kelafant et al., *Production Potential and Strategies for Coalbed Methane in the Central Appalachian Basin*, SPE 18550 (1988).

45. Hunt & Steele, 1991 PROCEEDINGS, *supra* note 44, at 130.

46. *See supra* at note 15.

47. Hunt & Steele, 1991 PROCEEDINGS, *supra* note 44, at 130; Kim & Deul, *supra* note 29, at 153; von Schonfeldt, *supra* note 15, at 5-6.

48. Kim & Deul, *supra* note 29, at 152-53; M.J. Zebrowitz et al., *Reservoir Characterization and Production Potential of the Coal Seams in Northern and Central Appalachian Basins*, *in* 1991 PROCEEDINGS, *supra* note 11, at 391, 395.

49. Black, *supra* note 15, at 1, 6-9, 13-14.

50. Much of the activity in the Western states has been undertaken by lessees of the oil and

as to be unminable.[51] Substantial development has also occurred in the Black Warrior Basin of Alabama,[52] where coal and gas rights frequently have not been divided among multiple owners and where unified ownership of large tracts has facilitated negotiation to resolve disputes over title to CBM.[53] Subsequent to Virginia's 1990 enactment of legislation to facilitate CBM development, several major projects have been undertaken in that state.[54]

C. *The Technology of CBM Extraction*

A variety of techniques exist for the extraction[55] of CBM from coal seams and associated strata.[56] Some of these techniques involve adaptations of traditional gas industry technology and are employed in virgin coal seams independent of any mining of the coal. Other methods that extract CBM in conjunction with coal mining have been developed by the mining industry and BOM.[57]

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50. Much of the activity in the Western states has been undertaken by lessees of the oil and gas rights on federal and Indian lands. Opinions of the United States Solicitor General in 1981 and 1990 declared that gas lessees had the exclusive right to extract CBM from these properties and that CBM rights were *not* encompassed within a lease or reservation of coal rights. M-36539, 88 Interior Dec. 538 (1981); M-36970, 98 Interior Dec. 59 (1990). The Western development has proceeded in reliance on these two opinions. *Hearings on H.R. 1078 Before the Subcomm. on Mining & Natural Resources of the House Comm. on Interior and Insular Affairs* 102d Cong., 2d Sess. 1, 4 (1991) (unpublished and on file with author) (testimony of Patricia Dunmire Bragg on behalf of OXY USA Inc.). [hereinafter *Hearings*]; Richard A. Counts, *Ownership Questions Can Stymie Development of Coalbed Methane*, OIL & GAS J., Jan. 1, 1990, at 66, 70. These opinions of the Solicitor General are now being tested in litigation filed by an Indian tribe that owns the coal and has leased the gas rights. *See infra* note 270.

51. Lippman, *supra* note 10; Bragg, *Hearings*, *supra* note 50, at 1.

52. Black, *supra* note 15, at 1, 9-12; J.R. Holland et al., *Projected Economic Impact of Accelerated Coalbed Methane Development, Black Warrior Basin, Alabama, in* 1989 PROCEEDINGS, *supra* note 11, at 33.

53. *Hearings*, *supra* note 50, at 1; Counts, *Ownership Questions*, *supra* note 22, at 70.

54. *See* Lippman, *supra* note 10. The Virginia legislation is discussed *infra* at Part III. Recent activity in Virginia includes projects by Island Creek Coal Company (a subsidiary of OXY, USA), Equitable Resources Exploration, Inc. (EREX), Consolidation Coal Company, and Penn Virginia Resources Corporation. *See* A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Appalachian Basin*, Q. REV. OF METHANE FROM COAL SEAMS TECH., Nov. 1991, at 26.

55. Extraction of CBM from coal seams is also referred to as "drainage" or "degasification" (sometimes shortened to "degas"); these terms essentially are interchangeable.

56. *See* METHANE CONTROL RESEARCH, *supra* note 9, at 94-133; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 25-31.

57. Commencing in 1964 BOM's methane control program initially was directed at enhancing mine safety and productivity through drainage and venting of CBM. It was only in 1975 that BOM began to consider CBM as a potential fuel source. METHANE CONTROL RESEARCH, *supra* note 9, at 5. Although BOM has continued its involvement in research on methane drainage, the commercialization of CBM is now the responsibility of DOE. Kim & Deul, *supra* note 29, at 150 n.2.

The earliest commercial development of CBM was undertaken by the gas industry using its traditional technology. The production from the Big Run Field in Wetzel County, West Virginia, employed a vertical well drilled into the coalbed, a traditional technique of the gas industry. Indeed, it was in removing casing from a gas well drilled into deeper strata that the operator discovered gas emissions at the level of the Pittsburgh coal seam.[58]

Vertical degasification wells are similar to conventional oil and gas wells.[59] They may be used to extract CBM from a coal seam independent of any mining activity, or they may be drilled into the seam several years ahead of active mining in order to degasify the coal.[60]

In an "open hole" completion, a vertical borehole is drilled with casing into the strata immediately above the coalbed, and the borehole is extended into the coal seam without any casing.[61] The borehole releases the pressure on the coal, and CBM begins to flow into the well from any fractures within the coal that intercept the borehole.[62]

In many coal seams, however, simple open hole completion does not yield a sufficient output of CBM, and "stimulation" is required to enhance the rate of production.[63] Stimulation or hydrofracturing involves the injection of a fluid under pressure to expand the natural fracture system of the coal, which facilitates the release of CBM.[64]

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58. A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Appalachian Basin*, Q. REV. OF METHANE FROM COAL SEAMS TECH., July 1991, at 10, 12-13.

59. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 30.

60. *Id.* at 30-31.

61. M.A. Trevits *et al.*, *Methane Drainage Through Small-Diameter Boreholes*, *in* METHANE CONTROL RESEARCH, *supra* note 9, at 106, 107.

62. If the seam is "below drainage," water must be pumped out of the hole to release the pressure on the CBM. *See* METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 30.

63. Trevits et al., *supra* note 61, at 106; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 30.

64. The fluid contains "proppants," which are suspended solids that prop open the fractures created by the injection of the liquid. By expanding the fracture system, stimulation increases the permeability of the coal, thereby increasing the rate at which CBM flows into the wellbore. A great deal of theoretical and empirical research has focused on the special problems associated with stimulation of coal seams, which differ in certain significant respects from other gas-bearing strata. In addition to the published proceedings of the CBM symposia, *supra* note 11, many technical papers are available from GRI and from the Society of Petroleum Engineers (SPE).

Stimulation usually involves a "cased hole" vertical wellbore, with casing run to the bottom of the lowest coal-bearing strata and cemented into place. The well is "completed" by perforating the casing and injecting the fracturing fluid into the coal seam.[65] In a "multiple seam completion," the casing is perforated within several coal seams, and each is stimulated, either simultaneously or sequentially.[66]

The foregoing methods employ ordinary gas industry techniques and treat the coal seam as just another gas-bearing stratum from which methane can be extracted, without regard to the fact that it will later be mined. As described in Part III, these techniques may interfere with subsequent mining operations. Other techniques have been developed by the mining industry to drain CBM in conjunction with mine operations.

One method of degasification uses a "multipurpose borehole" that is drilled into the virgin coal several years in advance of mining; this borehole later serves as an airshaft during active mining operations.[67] The multipurpose borehole is enlarged within the coal seam itself to create a working space. From this working space, horizontal degasification holes of varying lengths are drilled into the coal seam.[68] The holes are connected to a gas-water separator, and

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65. *See* Steven W. Lambert et al., *Warrior Basin Drilling, Stimulation Covered*, OIL & GAS J., Coalbed Methane Special Issue, 1990, at 19, 20; Trevits et al, *supra* note 61, at 107. The holes may be "perforations" produced by explosive charges or "vertical slots" cut by jetting equipment.

For a variety of technical reasons, the effectiveness of hydraulic stimulation of coal seams is often less than anticipated. *See, e.g.*, S.A. Holditch et al., *Enhanced Recovery of Coalbed Methane Through Hydraulic Fracturing*, SPE 18250 (1988); A.H. Jones et al., *Examination of Potential Mechanisms Responsible for the High Treatment Pressures Observed During Stimulation of Coalbed Reservoirs*, SPE/DOE 16421 (1987); M. Khodaverdian et al., *Influence of Near Wellbore Effects on Treatment Pressure in Coal, in* 1991 PROCEEDINGS, *supra* note 11, at 257; R. Puri et al., *Damage to Coal Permeability During Hydraulic Fracturing, in* 1991 PROCEEDINGS, *supra* note 11, at 247. Because stimulation of coal seams is not always effective, open hole completion may yield superior results. *See* J.M. Duckworth & C.A. Rector, *Devon Blends Drilling Methods in Fruitland Coal*, W. OIL WORLD, July 1991, at 26.

66. *See, e.g.*, M.R. Militzer and F.C. Schwerer, *Preliminary Economic Assessment Potential for Producing Coalbed Methane for the Multiple Coal Seams Completion Project at Rock Creek* GRI TOPIC REPORT (1986); Trevits et al, *supra* note 61, at 108.

67. *See* T.W. Goodman et al., *Methane Drainage Through Shafts, in* METHANE CONTROL RESEARCH, *supra* note 9, at 94.

68. Goodman, described three projects in which the horizontal boreholes ranged from 500 feet to over 2100 feet. *Id.* at 94, 96, 99.

the gas can be flared or connected to a compressor for introduction into a commercial pipeline.[69]

A related method accomplishes "in-mine drainage" by drilling horizontal boreholes from the outside entryways into an undeveloped area of the mine or at an angle ahead and slightly to the side of an area of projected development.[70] The CBM is piped from these horizontal holes to the surface, where the gas can be flared or captured.[71]

Horizontal drilling from either multipurpose boreholes or in-mine drainage requires underground access and may delay mining activity while degasification proceeds. These problems eventually might be avoided by employing "directional drilling" to intersect a coal seam horizontally by progressively deviating a single vertical or near-vertical well drilled from a site on the surface.[72] Before this technique can be used routinely, however, various technical problems must be solved, and the cost must be reduced.[73]

Finally, with longwall mining, CBM can be obtained from vertical boreholes drilled into the "gob zone," the area of rubble left behind as the longwall face retreats.[74] Ventilation of the mine face

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69. The costs of CBM capture from a multipurpose borehole include the capital cost of the drainage system itself plus the interest on capital used for construction of the shafts several years before they would otherwise be needed. The sale of gas drained from these shafts can recover these costs and possibly produce a profit. *Id.* at 101. Even if the sale of CBM from a multipurpose borehole does not fully recover the costs, it may be cost-justified, because it reduces methane-emission levels during mining, thereby lowering ventilation costs and reducing the incidence of costly shutdowns triggered by excessive methane levels.

70. *See* G.N. Aul et al., *In-Mine Drainage, in* METHANE CONTROL RESEARCH, *supra* note 9, at 102; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 27-28. Another in-mine drainage technique removes methane from the overlying or underlying coal and rock strata by drilling "cross-measure boreholes" at an angle through the roof or floor of the mine. *Id.*

71. Capture of CBM from in-mine drainage through horizontal boreholes appears to be profitable in its own right even without consideration of savings from decreased ventilation costs. *See* R.H. Grau, III and E. Baker, *Economic Evaluation of Horizontal Borehole Drilling for Methane Drainage from Coalbeds, in* 1987 PROCEEDINGS, *supra* note 11, at 285.

72. W.P. Diamond and D.C. Oyler, *Directional Drilling for Degasification of Coalbeds in Advance of Mining, in* METHANE CONTROL RESEARCH, *supra* note 9, at 128. *See, e.g.*, Duckworth & Rector, *supra* note 65, at 26 (describing successful application of directional drilling to reach CBM underlying state parks where drilling was restricted).

73. *Id.*

74. A.W. Layne, H.J. Siriwardane & C.W. Byrer, *Assessment of Gas Production Potential From Coalbeds and Adjacent Strata*, SPE 17765 (1988); METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 29-30; *see, e.g.*, Trevits et el., *supra* note 61, at 122-26.

is an inherent problem with longwall mining due to both the large area of the mine face and the great quantities of methane released from other strata by the "super-fracture" of the material that collapses into the mined-out areas.[75] Depending on the thickness of the mined-out seam, the gob can affect an area up to 300 feet above and 100 feet below the primary seam,[76] causing the release of methane from these strata. The overburden frequently includes thin unminable coal seams and other gas-bearing strata which are fractured by the collapse of the gob.[77] The gob zone may also contain methane released from the mine floor,[78] as well as gas migrating horizontally from old mine workings.[79] Hence, the quantity of methane in the gob zone far exceeds the amount that would be predicted from estimates of the methane content of unmined coal in the primary seam.[80]

The methane and other gases in the gob zone are generally referred to as "gob gas." Gob gas may include methane released from any of three distinct sources, which may have separate owners: (1) CBM released from residual coal in the primary seam, from thin coal seams in the roof and floor, or from nearby mine workings;

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75. M.C. Irani & F.N. Kissell, *Methane Emission in Underground Bituminous Coal Mines*, *in* METHANE CONTROL RESEARCH, *supra* note 9, at 7, 12; Layne, Sirwardane & Byrer, *supra* note 74, at 494; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 23-25; Morrow, *supra* note 20, at ch. 6.04-.05.

76. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 24; *see also* W.P. Diamond et al., *Evaluation of the Source and Migration of Longwall Gob Gas—Lower Kittanning Coalbed, Cambria County, Pennsylvania*, *in* 1991 PROCEEDINGS, *supra* note 11, at 171; Layne, Siriwardane, Byrer, *supra* note 74, at 496.

77. Irani & Kissell, *supra* note 75, at 12; Layne, Sirwardane & Byrer, *supra* note 74, at 494, 498 ("The effective thickness of the reservoir is much larger than the thickness of secondary coal seams in the gob area, suggesting that other strata produce gob gas."); Diamond et al., *supra* note 76, at 171, 174, 177 (91% of gob gas originated in overlying coalbeds but some came from non-coal strata); R. Bishop & S. Battino, *Extraction and Utilization of Coalseam Methane—The Australian Experience*, *in* 1989 PROCEEDINGS, *supra* note 11, at 107, 109 (source of gob gas included a 500 foot thick bed of sandstone 360 feet above the worked seam). None of these works address the question of whether the gas found in non-coal strata was "strata gas" that had been trapped after escaping from nearby coalbeds or was natural gas produced in these or other non-coal strata.

78. Diamond et al., *supra* note 76, at 171, 175. The release of gas from underlying strata may be enhanced by fracturing of the floor caused by stress changes associated with the removal of the coal and the collapse of the overburden.

79. *Id.*

80. Diamond et al., *supra* note 76, at 171, 177; Irani & Kissell, *supra* note 75, at 12 ("The amount of methane emitted directly from the coalbed is small"); Layne, Sirwardane & Byrer, *supra* note 74, at 494.

(2) strata gas that escaped from coal seams and was trapped in non-coal strata; and (3) natural gas that originated in non-coal strata.[81]

To ventilate the gob area, a vertical borehole is drilled in advance of mining.[82] Production of gob gas begins shortly after the longwall face passes the location of the borehole. The borehole for a gob gas well need not penetrate the primary coal seam so long as the "short hole" extends into strata that will collapse into the rubble zone in the mined-out area, creating a channel for gob gas to reach the surface. On the other hand, if the borehole for the gob gas well is drilled into the primary coal seam, it can serve a dual purpose, providing pre-mining degasification until it is converted into a gob well.[83]

Significant quantities of pipeline-quality gas have been obtained from gob wells.[84] Methane concentration in gob wells tends to be lower than that obtained by other methods, however, because the gob gas may be diluted by fresh air from the mine's ventilation system.[85] As a result, gob gas is often below pipeline quality.

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81. The multiplicity of origins of gob gas leads to questions about its ownership, and it is possible that all or a portion of the gob gas may be owned by persons who do not hold the ownership rights to CBM in the primary coal seam. Accordingly, the question of ownership of gob gas receives separate consideration within the analysis in Part V of common-law rules governing ownership of CBM.

82. F.N. Kissell, *Ventilation to Control Methane*, *in* METHANE CONTROL RESEARCH, *supra* note 9, at 134, 137; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 29-30; Trevits et al., *supra* note 61, at 123.

83. *Id.* The optimal dimensions of a gob well differ from those of a vertical wellbore for pre-mining degasification, which may warrant certain technical modifications prior to conversion. *See* John A. Wallace, *Practical Considerations of Demethanization in Advance of Longwall Mining and Post Mining Recovery of Gob Gas*, *in* 1990 SPECIAL INSTITUTE, *supra* note 11, Ch. 2 at 2.06-07.

84. *See, e.g.*, Layne, Siriwardane & Byrer, *supra* note 74, at 493; METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 30. In the Black Warrior Basin of Alabama, most of the CBM production has been from gob wells. Black, *supra* note 15, at 4; R.A. Mills & J.W. Stevenson, *History of Methane Drainage at Jim Walter Resources, Inc.*, *in* 1991 PROCEEDINGS, *supra* note 11, at 143, 147 (83% of production is from gob wells); *see also* J.W. Stevenson, *Methane Control It's a Gas!*, LANDMARC, Nov./Dec. 1988, at 16, 18. Gob wells have reduced ventilation costs for Jim Walter Resources, Inc. by approximately one dollar per ton of coal. Russell A. Carter, *Underground Developments in Methane Recovery*, COAL, Dec. 1990, at 55, 57.

85. Kim & Deul, *Conservation of Methane Drained From Coal*, *in* METHANE CONTROL RESEARCH *supra* note 9, at 151. The methane concentration of gob gas can be enhanced by sealing the gob area from the mine face.

The technology for commercial utilization of sub-pipeline-quality gob gas is still being developed. To the extent that dilution with ventilation air cannot be avoided, gob gas can be refined to pipeline quality by using specialized on-site processors to remove the oxygen and nitrogen.[86] Alternatively, sub-pipeline-quality gob gas may be burned on-site in generators designed to run on lower methane concentrations, supplying electricity for mine operations.[87] Co-firing in a coal-fired power plant is another possibility, but only if the coal mine is sufficiently close to the plant.[88]

In sum, a variety of techniques exist for the extraction of CBM. Each has certain advantages and disadvantages. In non-minable coal seams, the optimal method may be the traditional vertical cased hole with stimulation of several coal seams in a multiple-seam completion.[89] For minable coal seams, however, it appears to be more cost-effective to coordinate CBM extraction with mining activity. The usual mining-related techniques include horizontal boreholes and gob wells,[90] but coal operators are beginning to employ pre-mining de-

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86. *E.g.*, Joseph S. D'Amico, Coalbed Methane Enrichment Via Pressure Swing Adsorption (PSA) Utilizing Carbon Molecular Sieves (CMS) April 1991 (unpublished manuscript presented at Pittsburgh Coalbed Methane Forum).

87. Kim & Deul, *Conservation of Methane Drained From Coal*, *in* METHANE CONTROL RESEARCH *supra* note 9, at 151; *see, e.g.*, Carter, *supra* note 84, at 55, 59; James D. Cooper, *Case Study: Conflicting Property Interests—Implications and Opportunities for Joint Prospect Development*, 1989 SPECIAL INSTITUTE, *supra* note 11, at 6.08 and .12; Raymond M. Malinchak, Coalbed Methane Power Generation (April 1987) (unpublished manuscript presented at the Pittsburgh Coalbed Methane Forum); Frank E. Scott, *Degasification for Safety and Profit*, COAL MINING & PROCESSING, Mar. 1981, at 62; P.M. Soot et al., *Coalbed Methane Power Generation at Coal Mines*, *in* 1991 PROCEEDINGS, *supra* note 11, at 203; Carl L. Sturgill, *Recovery and Use of Coalbed Methane*, SOC'Y PETROLEUM ENG'RS No. 8739 1979). Additional information is available from Charles Byrer at DOE-METC.

88. P.M. Soot et al., *Coalbed Methane Power Generation at Coal Mines*, *in* 1991 PROCEEDINGS, *supra* note 11, at 206. Co-firing is an emerging technology in the effort to reduce sulfur dioxide and nitrogen oxide emissions at electric utility generating plants. *See* Timothy Kelley, *When Two Fuels Are Better Than One*, AM. GAS, July 1989, at 17; Jason Makansi, *Cofiring Gas: Cure for Ailing Powerplants?*, POWER, Sept. 1989, at 19.

89. *But see* Duckworth & Rector, *supra* note 65.

90. *See, e.g.*, R.J. Kline et al., *Island Creek Corporation's Experience with Methane Degasification*, *in* 1987 PROCEEDINGS, *supra* note 11, at 279; M.J. Mavor & J.J. Schwoebel, *Stimulation Based Selection of Underground Coal Mine Degasification Methods*, *in* 1991 PROCEEDINGS, *supra* note 11, at 153; R.A. Mills & J.W. Stevenson, *History of Methane Drainage at Jim Walter Resources, Inc.*, *in* 1991 PROCEEDINGS, *supra* note 11, at 143; Stevenson, *supra* note 84, at 16.

gasification through vertical boreholes, enhanced by hydraulic stimulation.[91]

D. The Role of CBM in Energy and Environmental Policy

1. The Extent of Methane Emissions From Mining

CBM is currently being vented into the atmosphere in distressingly large quantities. Since 1971, BOM has compiled data on methane emissions through the ventilation systems of active coal mines.[92] These studies reveal a rapid rise in methane emissions between 1975 and 1985 which is attributable to several related factors: mining of deeper and gassier coals, increased use of longwall mining techniques, and increased size of longwall panels.[93]

For mines with methane liberations in excess of 100,000 cubic feet per day,[94] BOM reported that methane emissions through ventilation systems totaled 110.9 billion cubic feet (Bcf) in 1985[95] and 106.6 Bcf in 1988.[96] Moreover, BOM's compilations do *not* include emissions from sources other than mine ventilation systems, such as gob wells or other degasification systems, so the total volume of methane emissions must be far greater. Employing a formula based on total tonnage of coal and average emissions per ton, EPA has estimated that the total volume of methane liberations from underground coal mines in the United States through both ventilation and degasification systems was roughly 305 Bcf in 1987.[97]

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91. Jim Walters Resources in Alabama has been the pioneer, producing 7% of its gas from hydraulically stimulated vertical wells, 10% from in-mine horizontal boreholes, and 83% from gob wells. Mills & Stevenson, *supra* note 84, at 147; Stevenson, *supra* note 84. According to industry sources, these techniques are now being employed in Virginia by Island Creek Coal Co./OXY USA, EREX, and Consolidation Coal Co.

92. Roy H. Grau, III, *An Overview of Methane Liberations From U.S. Coal Mines in the Last 15 Years*, *in* 1987 PROC. OF THE THIRD U.S. MINE VENTILATION SYMP. 251 (University Park, PA, Oct. 1987); Michael A. Trevits et al., *Evaluation of U.S. Coal Mine Emissions*, *in* 1991 PROC. OF THE FIFTH U.S. MINE VENTILATION SYMP. 177 (1991).

93. Grau, *supra* note 92, at 252.

94. The 100 Mcf/day limit was selected because a previous study indicated that mines liberating less than that amount represented only 2% of all liberations. *Id.* at 251.

95. *Id.* (303.9 million cubic feet per day).

96. Trevits et al., *supra* note 92, at 179 (292.1 million cubic feet per day).

97. METHANE EMISSIONS FROM COAL MINING, *supra* note 14. (the authors of the report were employees of ICF Resources Incorporated, a gas industry firm specializing in CBM, which performed

2. Methane Emissions From Mining and Global Warming

In addition to wasting a valuable source of energy, the venting of CBM contributes to the problem of global warming. The "greenhouse effect" is a phenomenon in which molecules of carbon dioxide, methane, and other trace gases trap heat emanating from the Earth's surface and prevent it from radiating into space.[98] According to the global warming theory, the increasing build-up of these trace gases produced by modern industrial activity will dramatically accelerate the warming of the Earth that has taken place since the last ice age.[99] There is a strong consensus that global warming will be accompanied by substantial regional anomalies in temperature, rainfall, cloudiness, and other climatic conditions, which could have a substantial impact on sea level, water supplies, agriculture, forests, fisheries, human and animal health, and biological diversity.[100]

Alarm about the greenhouse effect has spread in recent years from the scientific community to the popular press,[101] and it has

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this study under contract with EPA). To estimate methane emissions in the United States, the report employs an empirically-derived formula that relates methane emissions to in-place methane content. The authors state that their estimates have a margin of error of 23%, but it may be far greater. According to their formula, the quantity of methane emissions is 2.04 times the in-place methane content, plus 8.16; the authors mention other studies, however, which indicate that methane emissions may exceed in-place methane content by factors ranging from 2 to 5, or even 6 to 9. *Id.* at 42-43.

98. *See, e.g.*, COMM. ON SCIENCE, ENGINEERING, & PUBLIC POLICY, POLICY IMPLICATIONS OF GREENHOUSE WARMING—SYNTHESIS PANEL 1-3 (1991) [hereinafter SYNTHESIS PANEL]; DOE MULTILABORATORY CLIMATE CHANGE COMMITTEE, ENERGY AND CLIMATE CHANGE 1-5 (1990) [hereinafter DOE ENERGY AND CLIMATE CHANGE]; William D. Nordhaus, *Global Warming: Slowing the Greenhouse Express*, *in* SETTING NATIONAL PRIORITIES: POLICIES FOR THE NINETIES 185-87 (Henry J. Aaron ed., 1990); Stephen H. Schneider & Norman J. Rosenberg, *The Greenhouse Effect: Its Causes, Possible Impacts, and Associated Uncertainties*, *in* GREENHOUSE WARMING: ABATEMENT AND ADAPTATION 7 (Norman J. Rosenberg et al. eds., 1990) [hereinafter "*Greenhouse Warming*]; U.S. CONGRESS, OFFICE OF TECHNOLOGY ASSESSMENT, CHANGING BY DEGREES: STEPS TO REDUCE GREENHOUSE GASES 45-53 (OTA-0-482, 1991) [hereinafter OTA CHANGING BY DEGREES]; U.S. ENVTL. PROTECTION AGENCY, POLICY OPTIONS FOR STABILIZING GLOBAL CLIMATE 2 (Daniel A. Lashof & Dennis A. Tirpak eds., 1990) [hereinafter EPA POLICY OPTIONS].

99. While the pace of global warming is debated, it is generally agreed that global average temperatures will increase by one to five degrees centigrade by the middle of the next century. *See* Schneider & Rosenberg, *supra* note 98, at 31; Nordhaus, *supra* note 98, at 187-92; DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 5-7; EPA POLICY OPTIONS, *supra* note 98, at 102-03; OTA CHANGING BY DEGREES, *supra* note 98, at 45-46; SYNTHESIS PANEL, *supra* note 98, at 24-26.

100. DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 8-9; *see also* Nordhaus, *supra* note 98, at 192-96; Schneider & Rosenberg, *supra* note 98, at 31; SYNTHESIS PANEL, *supra* note 98, at 34-46.

101. Ved Nanda, *Global Warming and International Environmental Law—A Preliminary In-*

even made its way into the law reviews.[102] Global warming has been the subject of intense study by numerous private and public agencies over the past decade,[103] including over a dozen congressional hearings.[104] Both private and public bodies have generated detailed policy options and recommendations which include measures aimed at prevention or mitigation of global warming and strategies for adapting or coping with its effects, as well as additional research and education.[105]

While carbon dioxide has been the principal focus of attention, methane is also a significant "greenhouse gas." Although it is far less abundant than carbon dioxide, methane has 25-30 times more "radiative effect," and scientists believe that increased methane concentrations are responsible for roughly 15-20% of the global warming that has taken place in recent decades.[106]

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quiry, 30 HARV. INT'L L.J. 375, 385 n.62 (1989). For a recent bibliography, see JOHN O. CHRISTENSEN, GREENHOUSE EFFECT AND PUBLIC POLICY: A SELECTIVE BIBLIOGRAPHY OF RECENT REFERENCES (1991).

102. *See, e.g.*, Alan S. Miller, *Policy Responses to Global Warming*, 14 S. ILL. U. L.J. 187 (1990); William R. Moomaw, *Assessing the Greenhouse Challenge*, 14 S. ILL. U. L.J. 169 (1990); Nanda, *supra* note 101; Lewis D. Solomon & Bradley S. Freedberg, *The Greenhouse Effect: A Legal and Policy Analysis*, 20 ENVTL. L. 83 (1989).

103. In addition to the works cited elsewhere in this Article, several reports have been issued by the Intergovernmental Panel on Climate Change (IPCC). The IPCC was formed in 1988 by the United Nations and the World Meteorological Organization to study the scientific information and to assess strategies of response to global warming. *See* Jack Fitzgerald, *The Intergovernmental Panel on Climate Change: Taking the First Steps Towards a Global Response*, 14 S. ILL. U. L.J. 231 (1990); Moomaw, *supra* note 102, at 183. Other significant monographs are listed in CHRISTENSEN, *supra* note 101, at 14-15.

104. *See* CHRISTENSEN, *supra* note 101, at 15-17 (listing 19 congressional hearings between 1986 and 1990).

105. *See, e.g.*, EPA POLICY OPTIONS, *supra* note 98; GREENHOUSE WARMING, *supra* note 98; Nordhaus, *supra* note 98; OTA CHANGING BY DEGREES, *supra* note 98; SYNTHESIS PANEL, *supra* note 98; POLICY RECOMMENDATIONS, GLOBAL CLIMATE CHANGE CONFERENCE, NATIONAL GOVERNORS' ASSOCIATION (1989), [hereinafter POLICY RECOMMENDATIONS]; U.S. DEP'T OF ENERGY, A COMPENDIUM OF OPTIONS FOR GOVERNMENT POLICY TO ENCOURAGE PRIVATE SECTOR RESPONSES TO POTENTIAL CLIMATE CHANGE (1989) [hereinafter COMPENDIUM].

The Clean Air Act Amendments of 1990 mandated that EPA submit five reports to Congress by September 1992 on methane emissions from human sources and cost-effective options for reduction, with a detailed plan for stabilizing methane emissions due two years later. D.W. Kruger, *Coalbed Methane: Environmental Protection at a Profit*, *in* 1991 PROCEEDINGS, *supra* note 11, at 196. The recent EPA Report on Methane Emissions From Coal Mining, *supra* note 14, represents a portion of the first part of this study.

106. DOE ENERGY & CLIMATE CHANGE, *supra* note 98, at 50-52; EPA POLICY OPTIONS, *supra* note 98, at 34, 53-61; Kruger, *supra* note 105, at 194; OTA CHANGING BY DEGREES, *supra* note 98, at 4-5, 54. *But see* Nordhaus, *supra* note 98, at 186-87 (instantaneous contribution is 9.6%; total contribution over the indefinite future is only 0.8%).

Underground coal mining is one of several major contributors to global methane emissions.[107] Methane is a by-product of organic decay and other natural processes[108] as well as many human activities.[109] Worldwide, underground coal mining is responsible for nearly 10% of total methane emissions from all human and natural sources.[110] The amount and percentage of methane emissions from mining is expected to increase in the future as shallower coals are depleted and mining proceeds in deeper, gassier coal seams.[111]

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107. METHANE EMISSIONS FROM COAL MINING, *supra* note 14. This EPA report discusses emissions from both underground and surface mining. Surface mining accounts for only 12% of methane emissions in the United States and less than 8% of global emissions. It does not appear to be feasible to capture these emissions so we have focused on the estimates pertaining to underground mining.

108. Roughly 30%-50% of current methane emissions occur naturally in oceans, lakes, and wetlands and from the digestive tracts of wild animals, termites and other insects. The recent EPA study estimates that global methane emissions total between 445 and 635 teragrams (Tg) per year and that natural sources account for 30-35%. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 1. (One Tg is 10^{12} grams or one million metric tons and is equal to 52.6 billion cubic feet (Bcf) of methane). The recent DOE study estimates that global methane emissions total between 400 and 640 Tg per year and that natural sources account for approximately 50%. DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 19. The Office of Technology Assessment estimates that CBM emissions range between 290 and 965 Tg, with natural sources accounting for 116 to 445 Tg or slightly under 50%. OTA CHANGING BY DEGREES, *supra* note 98, at 59-60.

109. For the 50-70% of methane emissions attributable to "anthropogenic" or human sources, the primary culprits are agriculture (rice paddies, cattle, and slash-and-burn land clearing) and energy (deep coal mining, natural gas production and transmission, incomplete combustion, and landfills). *See* DOE ENERGY AND CLIMATE CHANGE, *supra*, note 98, at 17-19; EPA POLICY OPTIONS, *supra* note 98, at 59-61; MICHAEL J. GIBBS ET AL., ENVIRONMENTAL PROTECTION AGENCY, REDUCING METHANE EMISSIONS FROM LIVESTOCK: OPPORTUNITIES AND ISSUES 1-2 (EPA 400/1-89/002 1989) (hereinafter REDUCING METHANE EMISSIONS FROM LIVESTOCK); OTA CHANGING BY DEGREES, *supra* note 98, at 60.

110. Kruger, *supra* note 105, at 194. An international workshop sponsored by the EPA found that coal mining activities emit 30-50 Tg of methane, representing roughly 7% of global methane emissions and approximately 10% of anthropogenic methane emissions. *International Workshop on Methane Emissions From Natural Gas Systems, Coal Mining and Waste Management Systems* (1990), *in* METHANE EMISSIONS FROM COAL MINING, *supra* note 14, app. A, A-1. The EPA Report subsequently concluded that 7-12% of all methane emissions were attributable to coal mining, and that nearly 90% of these were attributable to underground mining, which generated 30.3 to 59.1 Tg of methane. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 1, 52. These amounts and percentages are somewhat higher than those estimated in earlier studies. *Compare* DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 19 (5-45 Tg, roughly 5% of total); EPA POLICY OPTIONS, *supra* note 98, at 56-60 (15-45 Tg, roughly 6% of total); OTA CHANGING BY DEGREES, *supra* note 98, at 60 (19-50 Tg, roughly 6% of total).

111. *See* EPA POLICY OPTIONS, *supra* note 98, at 258. In the absence of stabilizing policies, the percentage of methane emissions from fuel production, predominantly coal mining, is predicted to grow from 10% in 1985, to 20% in 2025, and 30% in 2100.

In 1987, the top ten coal producing nations generated 90% of the methane emissions from underground mining.[112] The United States was responsible for 15% of all underground mining emissions, and more than one-third of these came from mines in West Virginia.[113]

3. Scenarios for Energy and Environmental Policy

While methane is an important greenhouse gas, the primary target of greenhouse policy will be carbon dioxide emissions. Carbon dioxide produces 50% of the current greenhouse effect, and scientists predict that it will be responsible for 80% of the problem in the next century.

The principal source of carbon dioxide emissions is the burning of fossil fuels. Most greenhouse policy analysts recommend a long-term reduction in dependence on fossil fuels through conservation, improved energy efficiency, and development of alternative fuels.[114] As a short-run mitigation strategy, they advocate "fuel switching" from coal or oil to natural gas, because gas generates far less carbon dioxide per unit of heat.[115] Any regulatory program that promoted

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112. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 49-54. The top four — China, the Soviet Union, the United States, and Poland — accounted for 75%.

113. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 48, 52. Of the 6.1 Tg of methane generated by underground mines in the United States, 2.3 Tg were emitted in West Virginia. Mines in West Virginia are thus responsible for over 5% of all global methane emissions from underground mining each year and for roughly 1% of all methane emissions from human sources.

114. *E.g.*, *Greenhouse Effect and Global Climate Change: Hearing Before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess., pt.2 151, 187 (1988) (statement of Dr. William Moomaw, Director of Climate, Energy, and Pollution Program, World Resources Institute); *Energy Policy Implications of Global Warming: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 100th Cong., 2d Sess. 14 (1988) (statement of Dr. John Firor, National Center for Atmospheric Research); *id.* at 122 (statement of Dr. Irving Mintzer, World Resources Institute); *id.* at 187 (statement of Linda J. Fisher, Assistant Administrator for Policy, Planning, and Evaluation, EPA); *Global Climate Change: Hearings Before the Sen. Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess. 212-13 (1987) (statement of James G. Speth, President, World Resources Institute); DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 122-26; EPA POLICY OPTIONS, *supra* note 98, at 144, 389, 497-501; OTA CHANGING BY DEGREES, *supra* note 98, at 77-79, 92-94; Solomon & Freedberg, *supra* note 102, at 103; SYNTHESIS PANEL, *supra* note 98, at 47-63.

115. *E.g.*, *Global Warming: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 101st Cong., 1st Sess. 14 (1989) (recommendations to President-Elect Bush from presidents of the National Academy of Sciences, National Academy of Engineering, and Institute of Medicine); *Greenhouse Effect and Global Climate Change: Hearing Before the Senate*

fuel switching would increase the relative value of the CBM in coal, creating greater incentives for CBM development. Other strategies for control of carbon dioxide include regulations to restrict fuel supplies, regulations mandating increased energy efficiency, and economic incentives to reduce energy demand or increase efficiency, such as tax credits, subsidies, or a system of tradable carbon permits.[116]

A repeated refrain of greenhouse policy analysts is that the price of fossil fuels should reflect their impact on global warming through a carbon tax imposed on all fuels in proportion to their contribution to carbon dioxide emissions.[117] A carbon-based fuel tax would in-

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Comm. on Energy and Natural Resources, 100th Cong., 1st Sess., pt. 2, 151, 187 (1988) (statement of Dr. William Moomaw, Director of Climate, Energy, and Pollution Program, World Resources Institute); *Energy Policy Implications of Global Warming: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 100th Cong., 2d Sess. 14 (1988) (statement of Dr. John Firor, National Center for Atmospheric Research); *id.* at 105-06 (statement Donna R. Fitzpatrick, Under Secretary of Energy); *id.* at 122, 133, 151 (statement of Dr. Irving Mintzer, World Resources Institute); *id.* at 187-88 (statement of Linda J. Fisher, Assistant Administrator for Policy, Planning, and Evaluation, EPA); *id.* at 200 (statement of Dr. John H. Gibbons, Director, OTA); *Global Climate Change: Hearings Before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess. 213 (1987) (statement of James G. Speth, President, World Resources Institute); DOE ENERGY AND CLIMATE CHANGE, *supra* note 98, at 121, 125-26; EPA POLICY OPTIONS, *supra* note 98, at 389, 497-99, 504-09; OTA CHANGING BY DEGREES, *supra* note 98, at 92-94; POLICY RECOMMENDATIONS, *supra* note 105, at 1, 7; Solomon & Freedberg, *supra* note 102, at 103; SYNTHESIS PANEL, *supra* note 98, at 54-59, 74-75.

Combustion of natural gas releases less than 60% as much carbon dioxide per unit of energy as the burning of coal and 70% as much as burning of petroleum products. *See* DOE ENERGY AND CLIMATE CHANGE, *supra* at 125 (57%, 69%); Nordhaus, *supra* note 98, at 187 (58%, 71%).

116. COMPENDIUM, *supra* note 105; U.S. CONGRESSIONAL BUDGET OFFICE, CARBON CHARGES AS A RESPONSE TO GLOBAL WARMING: THE EFFECTS OF TAXING FOSSIL FUELS 15-17 (1990) [hereinafter CARBON CHARGES]; OTA CHANGING BY DEGREES, *supra* note 98, at 103-04; Miller, *supra* note 102, at 204-08.

117. *Greenhouse Effect and Global Climate Change: Hearing Before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess., pt.2 151, 187 (1988) (statement of Dr. William Moomaw, Director of Climate, Energy, and Pollution Program, World Resources Institute); *Energy Policy Implications of Global Warming: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 100th Cong., 2d Sess. 137-39 (1988) (statement of Dr. Irving Mintzer, World Resources Institute); *Global Climate Change: Hearings Before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess. 213 (1987) (statement of James G. Speth, President, World Resources Institute); OTA CHANGING BY DEGREES, *supra* note 98, at 103-04; COMPENDIUM, *supra* note 105, at E-9, E-21, E-90, 2-1, 4-20 to 4-21, 7-28 to 7-32, 8-25 to 8-26; POLICY RECOMMENDATIONS, *supra* note 105, at 1; SYNTHESIS PANEL, *supra* note 98, at 30-31, 67-68, 73; Miller, *supra* note 102, at 204-05; Nordhaus, *supra* note 98, at 203-05. The advantages and limitations of a carbon tax are discussed in JOSHUA M. EPSTEIN & RAJ GUPTA, CONTROLLING THE GREENHOUSE

crease the price of coal relative to natural gas, which should result in fuel switching and increased incentives for CBM development.

On the other hand, the current National Energy Strategy continues to emphasize coal as a primary energy resource.[118] It does not advocate fuel switching from coal to gas, and there is little likelihood of any substantial environmentally oriented restrictions on coal usage under the current administration.[119]

4. CBM as a Target of Greenhouse Policy

While the percentage impact of American underground mining on the greenhouse effect might seem insignificant (1.5% of global emissions of a gas which is responsible for only 15-20% of the greenhouse effect), these emissions are important to greenhouse policy for three related reasons. First, because of the diversity of significant sources of greenhouse gases, the anticipated policy response to global warming should involve a broad spectrum of measures aimed at reducing emissions of greenhouse gases from many sources.[120] Second, the capture of CBM increases the supply of natural gas, which is consistent with the greenhouse policy of fuel switching. Thus, the

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EFFECT: FIVE GLOBAL REGIMES COMPARED (1990).

The Congressional Budget Office studied the impact of a tax of $100 per ton of carbon, which would translate to $1.63 per thousand cubic feet of natural gas, $12.99 per barrel of oil, and $60.50 per ton of coal. CARBON CHARGES, *supra* note 116, at 20. As of the year 2000, such a tax would raise projected fuel prices by 53% for natural gas, 49% for oil, and 256% for coal. *Id.* A carbon tax of this magnitude would have a devastating impact on the coal industry. The actual proposals for a carbon tax have been far more modest, ranging from $5 to $10 per ton. Gordon McDonald suggested a tax of one cent per kilogram of carbon (roughly $9.09 per ton), which would add 14 cents to a thousand cubic feet of gas, $1.20 to a barrel of oil, and $5.20 per ton of coal. *Greenhouse Effect and Global Climate Change: Hearings Before the Senate Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess. 178, 197 (1987) (statement of Gordon J. MacDonald, vice president of the MITRE Corporation). William Nordhaus concluded that an efficient policy would involve a tax of $5 per ton of carbon dioxide (not carbon), equivalent to $3.50 on a ton of coal, 58 cents on a barrel of oil, or 1.4 cents on a gallon of gasoline. Nordhaus, *supra* note 98, at 204 (Nordhaus gave no figure for natural gas).

118. U.S. DEP'T OF ENERGY, NATIONAL ENERGY STRATEGY 98 (1st ed. 1991/1992) [hereinafter NATIONAL ENERGY STRATEGY].

119. While the National Energy Strategy does not favor switching to natural gas from coal, it does favor switching to natural gas from petroleum in order to achieve reductions in energy costs, oil imports, and carbon dioxide emissions. NATIONAL ENERGY STRATEGY, *supra* note 118 at 87-88. To facilitate natural gas production, it proposes to deregulate the gas industry. *Id.* at 86-96.

120. EPA POLICY OPTIONS, *supra* note 98, at 386; Miller, *supra* note 102, at 203-04; REDUCING METHANE EMISSIONS FROM LIVESTOCK, *supra* note 109, at 2, 14.

capture and use of CBM makes a two-fold contribution to reducing the greenhouse effect, directly reducing the level of atmospheric methane and indirectly contributing to a reduction in carbon dioxide emissions.[121] Finally, most studies have emphasized that greenhouse policy should focus on measures that are likely to be cost-effective and would be justified even in the absence of the greenhouse effect, such as improved energy efficiency and a reduction in waste.[122] Under this "no regrets" policy, a reduction in methane emissions from underground coal mining is a prime target for any initiatives aimed at ameliorating the greenhouse effect. Accordingly, reduction of methane emissions from mining through extraction of CBM regularly receives mention as a useful step in mitigating or preventing global warming.[123]

Although it is not entirely clear what percentage of methane emissions from coal mining could be captured using currently available technology, the potential for substantial reductions in emissions is apparent.[124] An aggressive CBM program at fewer than 200 of

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121. EPA POLICY OPTIONS, *supra* note 98, at 511-12.

122. *Global Climate Change: Hearings Before the Sen. Comm. on Energy and Natural Resources*, 100th Cong., 1st Sess. 212 (statement of James G. Speth, President, World Resources Institute); COMPENDIUM, *supra* note 105, at E-91; SYNTHESIS PANEL, *supra* note 98, at 52-53; Miller, *supra* note 102, at 198-202; Nordhaus, *supra* note 98, at 208; Robert M. White, *The Great Climate Debate*, SCIENTIFIC AMERICAN, July 1990, at 36, 42.

123. In addition to the EPA Report, METHANE EMISSIONS FROM COAL MINING, *supra* note 14, *see, e.g.*, EPA POLICY OPTIONS, *supra* note 98, at 511-12; OTA CHANGING BY DEGREES, *supra* note 98, at 84; Kruger, *supra* note 105.

124. On a global basis, the Intergovernmental Panel on Climate Change estimates that it is technically feasible to reduce emissions from gassy underground mines by 60% and that reductions of about 10% are likely to be economically attractive. Kruger, *supra* note 105, at 193, 194, 201. Using a combination of pre-mining degasification, in-mine drainage, and gob wells, in 1987 Jim Walters Resources, Inc. produced 12 Bcf of CBM and was venting between 27 and 36 Bcf. Black, *supra* note 15, at 4. This suggests the economically feasible percentage of capture may be 25-35%.

In the United States, roughly 20% of methane emissions from underground mining are released from gob wells associated with longwall mining, 75% is released from ventilation or degasification systems during mining operations, and the remaining 5% is from postmining processing of coal. METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 45-49. Most of the 20% released via gob wells could be captured if the incentives were sufficient. Of the 75% released via ventilation and drainage systems, a substantial percentage could be captured through more intensive programs of CBM extraction. For example, a ten-year program of pre-mining degasification through vertical boreholes can capture 73-79% of the CBM in a coal seam. W.P. Diamond et al., *Measuring the Extent of Coalbed Gas Drainage After 10 Years of Production at the Oak Grove Pattern, Alabama*, *in* 1989 PROCEEDINGS, *supra* note 11, at 185.

the gassiest mines in the United States could have a significant impact on total emissions.[125]

The government could encourage CBM extraction in a variety of ways. One possibility is direct regulation of methane emissions from mining.[126] Another is a tax on methane emissions.[127] A third is positive economic incentives, such as the tax credit for nonconventional fuels which has been crucial to the economics of CBM

125. According to BOM studies, fewer than 200 mines with emissions in excess of 100,000 cubic feet per day account for over 98% of all methane emissions from underground mining. The number of mines emitting more than 100,000 cubic feet per day was 180 in 1985. Grau, *supra* note 92, at 251 (180 such mines in 1985); Trevits et al., *supra* note 92, at 178 (193 such mines in 1988). On a yearly basis, the ventilation systems of these gassy mines released 110.9 Bcf or 2.1 Tg of methane in 1985 and 106.6 Bcf or 2.0 Tg in 1988. Grau, *supra* note 92, at 251; Trevits et al., *supra* note 92, at 178.

Moreover, fewer than 70 mines with liberations in excess of one million cubic feet (MMcf) per day accounted for roughly 87% of all emissions. Grau, *supra* note 92, at 253 (69 such mines produced 85% of all emissions in 1985); Trevits et al., *supra* note 92, at 181 (65 such mines produced 88% of all emissions in 1988).

Finally, in 1985 the ten gassiest mines alone produced 116.9 MMcf per day, or 38% of the total. Despite the extensive degasification programs in Alabama's Black Warrior Basin, in 1985 that area contained the five mines with the highest methane emissions. Three of the next five mines and nine of the top twenty-five were in West Virginia. Grau, *supra* note 92, at 253.

126. The government could establish a regulatory program that specified degasification performance standards (such as a ceiling on the amount of methane that could be vented per ton of coal mined) or that mandated the use of particular degasification techniques. The cost of any such regulations, both to the government and to the coal industry, could be minimized by applying them only to the gassiest mines. For example, the regulations could be limited to the approximately 200 mines that vent more than one million cubic feet of methane per day or they could be specially tailored to mines employing longwall systems.

The concept of monitoring was incorporated in the current version of the energy bill but on a voluntary basis; the incentive for voluntary reporting would be the possibility of retroactive credits "under any future law which provides credits for reductions in coalbed methane gas emissions . . . after calendar year 1987." H.R. 776, 102d Cong., 1st Sess., § 813 (1991); Coal Policy Act of 1991, H.R. 776 102d Cong., 1st Sess., Title 8, § 14 (1991) (as adopted by the Subcomm. on Energy and Power on July 31, 1991). The "credits" would be offsets for methane reduction within any future greenhouse gas reduction program. These credits would not be available for CBM extraction independent of mining activity, and they would not be valid until mining commenced.

127. A universal methane emissions tax would be costly to administer due to the large number of mines and the numerous ventilation outlets at each mine. *See Energy Policy Implications of Global Warming: Hearings Before the Subcomm. on Energy and Power of the House Comm. on Energy and Commerce*, 100th Cong., 2d Sess. 132 (1988) (statement of Dr. Irving Mintzer, World Resources Institute) (economic penalties on methane leakage from coal mines "would promote the use of technically feasible control measures but would be difficult to monitor and enforce"). Even if the tax were limited to the gassiest mines, monitoring the methane emissions from each in-mine degasification borehole and each gob well as well as the regular ventilation system would involve considerable administrative expense.

extraction since 1980.[128] Given the potential inefficiency of regulations and the administrative costs of taxing methane emissions, the optimal policy may be an enhanced tax credit for CBM production.[129] To the extent that coal owners would share in the benefits of a special tax credit for CBM production, it would cushion the impact on the coal industry of other greenhouse policies that may eventually be adopted.[130]

III. EXTRACTION-RELATED CONFLICTS ASSOCIATED WITH CBM

Extraction of minerals from different strata underlying a single tract has long been a source of conflict between the oil and gas

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128. *See* P. M. Soot, *The Non-Conventional Fuel Tax Credit, in* 1987 PROCEEDINGS *supra* note 11, at 175. For an explanation of the tax credit, see Bruce N. Lemons and David J. Crapo, *The Applicability of the Section 29 Credit to Gas Produced from Coal Seams and Devonian Shale*, 41 INST. ON OIL & GAS L. & TAX'N ch. 13 (1990); Bruce N. Lemons & Larry Nemirow, *Maximizing the Section 29 Credit in Coal Seams Methane Transactions*, J. OF TAX'N, Apr. 1989, at 238.

The tax credit has been revised several times; it was extended for one year in 1989 and for two years in 1990. Peter M. Soot, *Tax Incentives Spur Development of Coalbed Methane*, OIL & GAS J., June 10, 1991, at 40. The National Energy Strategy mentions encouragement of CBM extraction through continuation of the tax credits for unconventional gas under Section 29. National Energy Strategy, *supra* note 118, at 90, 101. Nevertheless, industry members fear that the Section 29 credit will not be extended for wells drilled after January 1, 1993. Reba Raffaeli, *Section 29—Its Uncertain Future, in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 9.

129. The CBM tax credit could either be a supplement to or a substitute for the Section 29 credit now given to producers of gas from unconventional sources. A CBM tax credit has several advantages over any form of regulation. If the ultimate goal is to promote pre- and post-mining degasification whenever it is cost effective, the CBM development companies are in a far better position to evaluate the data than even the best-informed administrative agency. This is especially true for CBM, as the technology is still developing and the technical and economic feasibility of extraction must be determined on a case-by-case basis. Moreover, the producers of CBM already would be keeping records of their production, so the tax credit should not create any new administrative burden. The only potential difficulty would be in ascertaining whether the gas in question was derived from a coalbed, which should be relatively easy to verify.

To the extent that the tax credit were given for extraction of CBM from unminable coal, the credits would not always translate into a corresponding reduction in methane emissions from mining. The tax credit would nevertheless contribute to global warming policy and to national energy policy by increasing the supply of methane.

130. For example, a special CBM tax credit could be made revenue neutral if it were offset against a tax on coal or on all carbon-based fuels.

In lieu of a tax credit, the "CO2 Offsets Policy Efficiency Act of 1991" proposed to count CBM production as a "CO2 offset credit" within a permit program that would require new major sources of CO2 to possess credits equal to their total expected emissions each year. H.R. 2663, 102d Cong., 1st Sess., §§ 702(a) & 703(b)(6) (1991). In contemplation of the eventual enactment of such an offset program, the House version of the current energy bill contains a provision encouraging voluntary reporting of methane emissions from coal mines, with the promise of retroactive credits "under any future law which provides credits for reductions in coalbed methane gas emissions . . . after calendar year 1987." H.R. 776, 102d Cong., 1st Sess., § 813 (1991); Coal Policy Act of 1991, H.R. 776, 102d Cong., 1st Sess., Title 8, § 14 (1991) (as adopted by the Subcomm. on Energy and Power on July 31, 1991).

industry and the coal industry.[131] Ongoing mining activity may, at least temporarily, interfere with the drilling of wells. Gas wells drilled through a coal seam can interfere with mining activity, forcing operators to leave unmined pillars of coal or precluding development of longwall panels. Gas wells also can create safety hazards if the gas leaks from the well bore into the coal seam.

CBM extraction gives rise to unique conflicts because both target minerals, coal and CBM, co-exist in commingled form in a single stratum.[132] Extraction of one mineral cannot take place without some impact on the other mineral. If the coal owner has title to the CBM, the potential conflicts are internalized, leaving the single owner to resolve them in a manner that maximizes the total return from these two resources. If someone other than the coal owner has title to the CBM, however, the following extraction-related conflicts may require legal resolution:

(1) CBM extraction in advance of mining can interfere with mining activity if it employs cased-hole production techniques, with casings penetrating into the coal seams. These casings can damage mining equipment and may prevent mining of substantial portions of the coal.[133] If wells are planned in conjunction with mining, conflicts

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131. *See, e.g.*, Paul N. Bowles, *Surface and Subsurface Conflicts: Coal vs. Oil and Gas*, 3 E. MIN. L. INST. § 24-1 (1982); Frank Broyles, *Oil and Gas Producers vs. Coal Producers: Planning Impacts of a Developing Judicial Policy*, 15 FORUM 481 (1980); Bruce Kramer, *Conflicts Between the Exploitation of Lignite and Oil and Gas: The Case for Reciprocal Accommodation*, 21 HOUS. L. REV. 49 (1984); H.L. Snyder & C. Lynch Christian, III, *Oil and Gas Operations Through Coal Seams in West Virginia*, 1 E. MIN. L. INST. § 5-1 (1980).

A recent example of litigation arising from such a dispute is Consolidation Coal Co. v. Cabot Oil & Gas Corp., Nos. 178-88 & 196-88 (Circuit Court of Buchanan County, Virginia) (appeal of drilling permit and action for declaratory and injunctive relief alleging that gas wells would interfere with future mining of coal). *See* Timothy E. Scott, *Statutory Accomodation of Concurrent Mineral Development in Virginia*, *in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 4C.

132. Conrad P. Armbrecht, *Multimineral Development Conflicts—Coalbed Methane in the Balance*, *in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 4B; Phillip W. Lear, *Multiple Mineral Development Conflicts in Coalbed Methane Operations*, *in* 1992 SPECIAL INSTITUTE, *supra* note 11, ch. 4A; Phillip E. Norvell, *Competing Uses of Coal & Oil & Gas Estates in Coalbed Methane Development*, *in* 1990 SPECIAL INSTITUTE, *supra* note 11, ch. 3; John A. Wallace, *Practical Considerations of Demethanization in Advance of Longwall Mining and Post Mining Recovery of Gob Gas*, 1990 SPECIAL INSTITUTE, *supra* note 11, ch. 2.

133. Norvell, *supra* note 132, at 2-3; Wallace, *supra* note 132, at 2.04. *See also* Snyder & Christian, *supra* note 131, at 5-18, 5-20. As expressed by representatives of the coal industry:

The location of a well can adversely affect a coal owner/operator by interfering with the

often can be avoided by locating them in coal pillars that would have been left unmined in any event. Such coordination is not possible if CBM extraction proceeds in virgin coal as to which no production plans exist. Accordingly, coal owners and operators strenuously object to any degasification in areas where mining plans have not yet been developed because of its potential for "interfering with the orderly development of the coal reserve."[134]

(2) CBM extraction in advance of mining is enhanced by stimulation, *i.e.*, hydraulic fracturing, but coal owners and operators fear that stimulation will damage the roof of the coal seam, rendering entire tracts of coal unminable.[135] The available evidence from mine-throughs after stimulation have shown little or no damage to the roof.[136] This evidence is not conclusive, however, and has not allayed the concerns of the coal industry.[137]

> orderly development of the coal reserve or limiting an operator's flexibility . . . . If a well is located in such a manner to require a longwall to be stopped short or to sterilize an area from longwall development, this would result in higher costs and an impairment of the operator's ability to recover his investment and efficiently recover the reserves.

"Position of the Coal Industry Members of [West Virginia's] CBM Technical Committee on the Requirement of Coal Owner and Operator Approval of CBM Wells," Sept. 1990, at 1 (hereinafter "Position of the Coal Industry") (copy on file with the author). In short, the coal industry fears that CBM development could treat coal as a "horizontal pegboard for the petroleum industry." Brief for Appellant at 33, United States Steel Corp. v. Hoge, 468 A.2d 1380 (Pa. 1983) (quoting the opinion of the trial court).

Special milling tools can be used to cut away casing before mining a coal seam, but this procedure now costs about $20,000 per hundred feet of casing. Wallace, *supra* note 132, at 2.07. Another possible solution in certain situations is the use of minable fiberglass casing. AMERICAN GAS ASS'N, COALBED METHANE RESOURCE, RESERVOIR, AND PRODUCTION CHARACTERISTICS, Issue Brief 1990-15, Nov. 16, 1990, at 9-10 (citing Steve Spafford, Multiple Seam Completion Techniques, Pittsburgh Coalbed Methane Forum (Morgantown, WV, Oct. 10, 1990)).

134. POSITION OF THE COAL INDUSTRY, *supra* note 133, at 1. "There was some discussion to (sic) differentiating between reserves to be mined in a 5 to 10 year time frame from those of longer time frame with respect to a right to object to development. The major flaw in that argument is . . . any damage to the coal seam and the roof will not be healed by the passage of time. *Id.* at 2.

In addition to concern about the integrity of the roof, some mining engineers have suggested that stimulation could increase the risk of mine explosions if the subsequent degasification were incomplete and pockets of gas accumulated within the artificially widened fracture system.

135. *See, e.g.*, Bowles, *supra* note 20, at § 7.03[1], p. 7-7; Norvell, *supra* note 132, at 3; United States Steel v. Hoge, No. 682 slip. op. at 2 (C.P. Greene Cty., Pa., 1980), *aff'd*, 450 A.2d 162 (Pa. Super. 1982), *rev'd*, 468 A.2d 1380 (Pa. 1983).

136. WILLIAM P. DIAMOND & DAVID C. OYLER, EFFECTS OF STIMULATION TREATMENTS ON COALBEDS AND SURROUNDING STRATA, (Bur. of Mines Report of Investigations, 9083 1987); P.F. Steidl, *Inspection of Induced Fractures Intercepted by Mining in the Warrior Basin, Alabama, in* 1991 PROCEEDINGS, *supra* note 11, at 181; W.P. Diamond, *Characterization of Fracture Geometry and Roof*

Even if stimulation is potentially safe in theory, the impact of stimulation in practice is entirely dependent on the skill and care of the operator. Also, the effects of stimulation may depend on a number of factors, including the composition and condition of the stratum that constitutes the roof, which may not be understood by CBM developers. The coal industry fears that if CBM developers employ improper stimulation techniques in virgin coal seams, the coal owners will have no recourse if it later turns out that roof damage has rendered large tracts of coal unminable.[138] Thus, while coal owners are beginning to employ stimulation techniques in their own mines,[139] the coal industry vehemently objects to any stimulation of minable coal seams by other parties without the prior consent of the coal owners.[140]

(3) CBM is liberated and dissipated in the course of ordinary mining activity. Active ventilation of mines in the interest of mine safety is required by federal and state regulations[141] and today results

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Penetrations Associated with Stimulation Treatments in Coalbeds, *in* 1987 PROCEEDINGS, *supra* note 11, at 243; C.A. Dixon, *Coalbed Methane—A Miner's Viewpoint*, *in* 1987 PROCEEDINGS, *supra* note 11, at 7; Cooper, *supra*, note 87, at 6.08-.11; A.M. Hunt & Derek J. Steele, *Coalbed Methane Development in the Appalachian Basin*, 8 Q. REV. OF METHANE FROM COAL SEAMS TECH., July 1991, at 10, 14; Richard A. Schraufnagel & Stephen D. Spafford, *Multiple Coal Seams Project*, 8 Q. REV. OF METHANE FROM COAL SEAMS TECH., Feb. 1991, at 15; Russell A. Carter, *Underground Developments in Methane Recovery*, COAL, Dec. 1990, at 55, 58.

137. Representatives of the coal industry have written:

> Another issue, probably the one that causes the most concern, is coal seam stimulation. The coal owners and operators feel the stimulation of coal seams is still in the early stages of technological development. Although there have been some published reports of mine throughs of CBM stimulations they are relatively few in number and many are inconclusive. There is still not sufficient empirical evidence the stimulation of coal seams will not damage the seam and roof, thus increasing mining costs, or perhaps rendering coal unmineable [sic].

POSITION OF THE COAL INDUSTRY, *supra* note 133, at 2.

138. Although this concern does not appear in the literature, in our conversations the coal industry representatives have conceded that stimulation will not necessarily damage the roof and have shifted their focus to the risk of improper stimulation techniques by CBM developers. They point out that the CBM developers are not likely to be available when damage is discovered upon mining of the coal, which may not occur until years or possibly decades later. Further, even if the operators can be found, they are not likely to have sufficient resources to compensate the coal owners for their losses. The coal owners therefore insist on having control over *who* will stimulate their coal seams and *how* the stimulation will be performed.

139. *See supra* note 91.

140. POSITION OF THE COAL INDUSTRY, *supra* note 133, at 1-2.

141. 30 U.S.C. §§ 863 & 877(h) (1988); 30 C.F.R. § 75.301-330 (1991); W. VA. CODE § 22-2-2 *et seq.* (1985).

in the atmospheric venting of billions of cubic feet of methane from coal mines each year. Coal owners and operators insist that regardless of who owns the CBM, the CBM owner cannot limit the right of coal operators to vent CBM in order to assure the safety and efficiency of mine operations.[142] This degasification necessarily will exhaust or diminish the subsequent CBM production capability, in effect destroying the CBM to ensure the safe mining of the coal.[143] Representatives of the gas industry generally concede the right of coal operators to vent CBM in the interests of safety.[144] Nevertheless, CBM developers presumably would prefer to have some limitations on the right of mine operators to vent CBM whenever it might profitably be captured.

(4) Coal owners and CBM developers have conflicting interests in the spacing of gob wells.[145] Coal operators in the primary seam are concerned with maximizing the rate of ventilation of the gob gas in order to reduce methane concentrations at the mine face, and they would tend to prefer closer spacing of gob wells. CBM developers are concerned with minimizing costs and maximizing the long-term production of CBM, and they would tend to prefer a somewhat wider spacing of gob wells that would drain more slowly.[146] The owners of any coal seams above the gob zone presumably would prefer an even wider spacing of gob wells in order to minimize interference with mining of their seams in the future.

(5) In order to reduce methane concentrations at the mine face, coal operators occasionally may need to accelerate the ventilation rate from gob wells even though this may reduce the methane concentration of the gas issuing from the wells.[147] Accelerated extraction

142. *E.g.*, letter from Larry King, U.S. Steel Mining Co., Inc., to Ted Streit, Director, West Virginia Division of Oil and Gas, at 1 (May 16, 1990) (copy on file with the author).

143. Norvell, *supra* note 132, at 3.

144. *E.g.*, letter from R. Neal Pierce, Columbia Natural Resources, to Ted Streit, Director, West Virginia Division of Oil and Gas at 2 (Dec. 12, 1989) (copy on file with the author); WEST VIRGINIA CBM WORKING GROUP, SUMMARY OF ISSUES (Dec. 15, 1989) (copy on file with the author) ("All parties agree that venting of methane for coal safety is not Waste").

145. Wallace, *supra* note 132, at 2.03.

146. Coal owners would prefer spacings of 25 to 40 acres per well, whereas CBM developers would prefer spacings of 80 to 160 acres per well. Wallace, *supra* note 132, at 2.03.

147. This point was made by industry sources with whom we spoke, but we have found no published commentary.

of gob gas, which reduces its concentration below pipeline quality, may necessitate costly additional processing or render the gas entirely unusable.

In resolving these and other extraction-related conflicts, the courts would refer to existing legal principles relating to conflicting mineral interests. Unfortunately, this area of law is in flux, and it is not clear what legal rule would be applied.[148] Regardless of the legal rule, the rights of the parties are likely to be indeterminate because the rules tend to establish standards which mandate a fact-specific balancing of interests.[149]

Beyond these extraction-related conflicts, CBM developers confront practical and economic obstacles. The CBM developer is often a specialized firm that can provide a turn-key degasification project for coal owners, gas owners, or for its own account.[150] CBM development requires an extensive infrastructure of processors and pipelines if the gas is to be introduced into the interstate gas pipeline system. The economics of CBM extraction thus necessitate assembly of large tracts which can be treated as a single field.[151] To assemble a CBM field, the CBM developer must negotiate with the owners of the CBM in all of the tracts. The number of parties is further multiplied whenever mineral ownership has become highly fraction-

148. *See* Norvell, *supra* note 132, for a complete discussion of the various common-law rules that might be applied to resolve these conflicts. Regardless of the applicable common-law standard, several of these disputes would be governed by existing statutes pertaining to conflicts between the oil, gas, and coal industries.

149. The following summary is based on Norvell, *supra* note 132. The traditional approach to extraction-related conflicts would apply the law of easements, identifying a dominant and servient estate based primarily on the order of severance. The rights of the dominant estate would be qualified, however, by a "rule of reason" mandating a "due regard" for the rights of the servient estate, which could require the use of any "reasonable alternatives" that would avoid or minimize the impact on the servient estate.

An alternative to the easement-based approach would be to treat both parties as having equal or correlative rights. Conflicts would be adjusted under a "doctrine of accommodation" through a "balancing of the interests," with consideration of such factors as priority of severance, priority of operations, the parties' relative utility and harm, and the public interest.

150. Russell A. Carter, *Underground Developments in Methane Recovery*, COAL, Dec. 1990, at 55, 58 (describing Resource Enterprises, Inc.); *Hearing, supra* note 50 (statement of John A. Wallace at 1-2, describing Taurus Exploration, Inc.) (on file with author).

151. One developer has testified that projects typically contain in excess of 100 wells which with 80 acre spacing would require a tract of 80,000 acres. *Hearing, supra* note 50 (statement of John A. Wallace of Taurus Exploration, Inc., at 7) (on file with author).

alized as the result of several generations of inheritance following an initial severance.

The uncertainty as to CBM ownership increases the cost of these negotiations. In addition to increasing the number of parties, the uncertainty as to ownership complicates the negotiations because the participants are unsure of their rights. Developers must negotiate with both gas owners and coal owners who have potential claims as owners of the CBM, and all claimants can be expected to begin by demanding a full royalty interest or proportional participation. Because of the uncertainty as to ownership, both the gas owners and coal owners usually get some portion of the royalties or a share as participants in the project, but the precise division is always open to negotiation.[152]

In addition to negotiations with claimants to ownership of the CBM, the CBM developers usually must negotiate with surface owners over the placement of wells, pipelines, and access roads. Finally, CBM developers ordinarily attempt to obtain agreements from the coal owners with respect to the various extraction-related conflicts described above.

The cost of all these negotiations is a substantial barrier to CBM development. Moreover, CBM developers are vulnerable to strategic bargaining by the various parties who can threaten to block a project by holding out for better terms. Most of the existing and proposed

152. When surface owners retain the gas rights, a 50-50 split of the standard 1/8 gas royalty is not uncommon, with the surface owners and coal owners each receiving a 1/16 royalty. Instead of taking a royalty, the gas owner or coal owner may participate in the development, sharing in a percentage of the costs and profits. Depending on the circumstances and the bargaining ability of the parties, the total royalty for the surface owner, gas lessee, and coal owner could exceed the standard 1/8. While several attorneys confirmed that 50-50 splits were the norm, attorneys who favored the gas owners indicated that coal owners received a smaller percentage of the royalties or profits in their transactions.

When the surface owner has leased out the gas rights, negotiations are more complicated. The gas lessee may demand a bonus for transfer to rights under the lease as well as a royalty in addition to the royalty retained by the surface owner as lessor. The economics of some ventures may leave room for royalties of 3/16, and we are informed that even larger royalties have been negotiated for CBM.

Instead of negotiating a final settlement of the competing claims, the parties sometimes agree to have the CBM developer pay a specified royalty into an escrow fund for allocation pursuant to subsequent litigation or settlement.

CBM statutes described in the next section attempt to facilitate CBM development by minimizing these transaction cost barriers through forced pooling as well as by directly addressing some of the extraction-related conflicts.

IV. THE PROSPECTS FOR LEGISLATION

The coal industry and the oil and gas industry are heavily regulated, and many states have adopted legislation addressed at extraction-related conflicts between these industries. Until quite recently, however, none of this legislation directly addressed the issues uniquely associated with extraction of CBM.[153]

A. CBM Legislation in Virginia

In 1978, the State of Virginia attempted to legislate ownership of "migratory gases," declaring that:

> A. Except as otherwise provided by law, on or after January one, nineteen hundred seventy-eight, all migratory gases, including but not limited to propane and methane, shall be conclusively presumed to be the property of the owner of the surface real property beneath which such migratory gases are or may be located.[154]

Neither the purpose nor the effect of the Migratory Gas Act was entirely clear. On its face, the Act did not appear to address ownership of CBM or apply where there had been a severance of mineral interests.[155] Under one interpretation, the Act simply established that surface owners who had not previously severed their mineral interests held title to gas in place as a "property right" as opposed to holding a mere right to drill for the gas.[156] On the other hand, if the Act

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153. In 1984 the Alabama State Oil and Gas Board adopted rules and regulations for CBM, but these related primarily to technical matters such as spacing, casing, and plugging and did not address either the ownership question or the major extraction-related conflicts. Rules and Regulations Governing the Permitting, Drilling and Production of Coalbed Methane Gas, Rule 400-4-1-.01 *et seq.*, Documents Nos. 12-2-8360 and 8361, January 3, 1984, reprinted in Cohen, Farnell & Thompson, *supra* note 22, at 274. The Alabama regulations do, however, authorize forced pooling for the development of the interests of multiple owners as a single drilling unit. *See* General Rules and Regulations of the State Oil and Gas Board of the State of Alabama, Rule 400-1-13.

154. The Virginia Migratory Gas Act, VA. CODE ANN. § 55-154.1 (Michie 1986) (repealed 1990). Oklahoma has a similar statute, OKLA. STAT. ANN. tit. 52, § 231 (West 1991).

155. For mineral severances entered into prior to its effective date, the Act provided that their interpretation "shall be governed by the applicable law in effect at the time the agreement or agree-

did apply where there had been a prior severance of mineral interests, it would vest title to CBM in the surface owners, defeating the claims of both coal owners and gas lessees.[157]

The interpretation of the Migratory Gas Act was placed at issue in *Equitable Resources Exploration, Inc. v. Richardson*.[158] The plaintiff oil and gas lessee sought to enjoin the defendant surface owners from interfering with construction of gas pipelines over defendants' lands. The plaintiff's chain of title traced back to an 1890 deed that had granted title to "all the coal and other minerals" under the land currently owned by defendants. The defendants asserted that this grant had not conveyed the oil and gas,[159] and to bolster their argument they cited the Migratory Gas Act as recognizing or establishing the retained gas rights of the surface owner.[160] The plaintiff replied that the purpose of the Act was only to establish the ownership-in-place theory of gas ownership and that it was not meant to nullify a prior severance of gas rights by the surface owner.[161] The trial court agreed with the plaintiff and held that the Act "is

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ments were entered into." VA. CODE ANN. § 55-154.1 (Michie 1986) (repealed 1990). Those interpreting the Act as leaving unresolved the question of CBM ownership where there had been a prior severance of coal and/or gas rights include Farnell, *supra* note 19, at 533-34; McGinley, *supra* note 19, at 392 n.84. *Cf.* Craig & Myers, *supra* note 20, at 808-09 (interpreting statute as vesting ownership of CBM in surface owner or gas lessee, without discussing retroactivity).

156. The distinction among the "ownership," "qualified ownership" and "non-ownership" theories of natural gas ownership is discussed *infra* notes 254-60 and accompanying text.

157. While the Act on its face applied to all migratory gasses, attorneys who are familiar with the history of this legislation insist that it was directed at ownership of CBM and was intended to apply retroactively, to nullify past conveyances of rights to CBM. Several commentators apparently have accepted this interpretation of the Act and have concluded that it was therefore unconstitutional. Cohen, Coalbed Gas, *supra* note 19, at 20; Graham, *Energy Resources in the Commonwealth: The Virginia Gas and Oil Act of 1990*, VIRGINIA LAWYER, January, 1991, at 22.26.

158. Chancery No. C88-123 (Cir. Ct., Wise Cty., Va., Oct. 11, 1988). We thank attorney M. Jill Morgan for sending us copies of the briefs and opinion in this case.

159. The defendants' argument was based on Pennsylvania's "Dunham" rule, from Dunham v. Kirkpatrick, 101 Pa. 36 (1882), which holds that the word "minerals" does not include oil and gas. The Virginia court already had rejected the Dunham rule, however, in Warren v. Clinchfield Coal Corp., 186 S.E. 20 (Va. 1936), which held that a conveyance of "all of the coal and minerals of every description" included title to petroleum, oil, and gas.

160. Defendants' Reply Memorandum, at 11-12.

161. Complainant's Response to Defendants' Reply Memorandum, at 20. *See also* Brief of Fleming-Kinship Land Corporation as Amicus Curiae, at 10-11. *But see* Brief for Cabot Oil & Gas Corporation as *Amicus Curiae*, at 8-9 (suggesting that the Act applied only to CBM and not to reservoirs of natural gas, but arguing that the Act could not apply retroactively to nullify prior conveyances of gas rights or it would be unconstitutional).

not applicable where there has been a prior severance of oil and gas."[162]

In the Virginia Gas and Oil Act of 1990,[163] Virginia adopted the nation's first legislation specifically addressed to CBM in the context of a substantial revision of the state's regulatory program.[164] With respect to CBM, the key features of the Gas and Oil Act include forced pooling provisions,[165] the requirement of an escrow account in the event of "conflicting claims to the ownership of coalbed methane gas,"[166] and permit procedures for CBM wells.[167] The Act gives coal owners the power to block stimulation of coal seams.[168] Although the Act purports to authorize a tighter spacing of CBM wells than is allowed for ordinary shallow gas wells,[169] an objecting coal owner in a CBM field apparently has the right to insist upon the broader spacing applicable to ordinary shallow gas wells,[170] thereby

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162. Final Decree, at 3. In dictum, the court added: "Such an application [to prior severances] would result in an unconstitutional taking of property without compensation and in violation of U.S. CONST. amends. V & XIV, § 1 and VA. CONST. art. I, § 11."

163. VA. CODE ANN. § 45.1-361.1 to 45.1-361.40 (Michie Supp. 1990).

164. For a description of the Act, see Graham, *supra* note 157.

165. VA. CODE ANN. §§ 45.1-361.21 (Supp. 1990). The forced pooling provisions allow the regulatory board to issue orders combining tracts into a single drilling unit, with a sharing of production in proportion to acreage. Under forced pooling, CBM owners have three options: (1) lease their interests for a royalty; (2) participate as operators by contributing a proportionate share of the costs in return for a share of the profits; or (3) receive a share in the profits as nonparticipants without contributing to expenses, but only after deduction of twice the amount of the party's proportionate share of the costs. For parties holding under a lease that is already subject to a royalty, the leasing option is not available, and these parties must decide whether to actively participate and share in the cost or be carried as nonparticipants subject to a deduction of twice their share of the cost before receiving a proportionate share of the profits.

166. VA. CODE ANN. § 45.1-361.22 (Michie Supp. 1990). The escrow account receives the operator's payment of royalties or profits attributable to disputed claims and any claimants' payments of their share of costs as participating operators.

167. Application for a CBM permit must be accompanied by notice to coal owners. VA. CODE ANN. § 45.1-361.30 (Michie Supp. 1990). The Act specifies the criteria that the regulatory board must apply in ruling on objections to a well, a drilling unit, or stimulation of a coal seam. VA. CODE ANN. § 45.1-361.20 (Michie Supp. 1990).

168. Any application for a stimulation permit must include the signed consent from all coal operators of each coal seam within 750 horizontal feet of the proposed well and within 100 vertical feet of the target coal bearing strata. VA. CODE ANN. § 45.1-361.29.F. (Michie Supp. 1990).

169. CBM wells may be spaced 1,000 feet from other wells and 500 feet from the boundary of the tract, and gob wells may be spaced 500 feet apart and 250 from the boundary. VA. CODE ANN. § 45.1-361.17 (Michie Supp. 1990). The spacing for an ordinary shallow gas well is 2,500 feet from existing wells unless it can be drilled through an existing or planned pillar. VA. CODE ANN. § 45.1-361.12 (Michie Supp. 1990).

170. *See* Norvell, *supra* note 20, at 14; Graham, *supra* note 157, at 26. Section 361.12 allows

giving the coal owner a veto over well spacing in addition to the veto over stimulation. The Migratory Gas Act was repealed later in 1990.[171]

The Virginia legislation makes no effort to resolve the ownership issue, nor does it create any new procedural mechanisms to facilitate prompt resolution of disputes over ownership. Instead, it seeks to circumvent the ownership issue through escrow provisions that allow CBM development to take place while such disputes are pending.

The Virginia Oil and Gas Act has been in effect for only two years, so it is too early to assess its impact. Much of the CBM development under the statute has proceeded where mineral interests are held by a single owner or where agreements have been reached among all gas owners and coal owners, without testing the forced pooling provisions or the criteria governing objections to drilling units, wells, or stimulation of coal seams. The gas industry is unhappy with the coal owners' vetoes over stimulation and well spacing, but these provisions have not yet been challenged. Forced pooling orders have been issued in several projects, however, and an appeal in one proceeding may test the constitutionality of the Act.[172]

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a veto to the coal owner whenever a well will not be drilled through a pillar, but it arguably applies only to wells drilled *through* the coal seam and not to an open hole vertical degas well or to a gob well that did not even penetrate the seam. On the other hand, to the extent that any of these wells penetrated minable coal seams *above* the target seam, the owner of these seams (who may also be the owner of the target seam) clearly would have the right to object to a closer spacing unless the well were to be drilled through an existing or planned pillar in these upper seams. Regardless of whether the coal owner can object to closer spacing of CBM wells, the statute would appear to empower the coal owner to object to drilling of a conventional gas well through the coal seam in a CBM field. *See* Graham, *supra* note 157, at 26.

171. 1990 Virginia Acts ch. 601.

172. Ashland Exploration Inc. v. OXY USA Inc., Ch. Nos. 4-91, 5-91, 6-91, 7-91, 60-91, 61-91, 62-91, 84-91 & 103-91 (Cir. Ct., Buchanan Cty., Va.) involves a series of related appeals by Ashland of decisions by the Virginia Gas and Oil Board that had allowed OXY to undertake CBM development with a forced pooling of interests. Ashland is the gas lessee. OXY is the designee and attorney in fact of the coal lessee, Island Creek Coal Company (an OXY subsidiary), and OXY also holds a CBM lease from the residuary mineral owners. As gas lessee, Ashland has asserted that it is the sole owner of the CBM and that OXY is therefore not entitled to act as a CBM developer. The Board upheld OXY's position that the designee of a "claimant" may obtain a forced pooling order and that it is irrelevant whether the claimant is later determined to have no ownership interest in the CBM. If the court agrees with the Board's seemingly correct interpretation of the statute, it will have no need to address the ownership issue. Ashland is also challenging the forced pooling provisions on constitutional grounds, alleging that it takes their property without due process and

B. *Federal Efforts at CBM Legislation*

Early in 1991, Representative Nick J. Rahall introduced H.R. 1078, the National Coal and Extractive Energy Strategy Act of 1991.[173] Title III of the bill[174] sought to resolve the CBM ownership question, declaring that recovery of CBM "has been impeded or made impossible by uncertainty and litigation over the ownership of the rights to the gas."[175]

The bill proposed "to establish an equitable legal rule to apply in the case of severed estates in instances where State law and the applicable instruments of title do not establish clear title to the coalbed methane."[176] This "equitable legal rule" would have divided ownership of CBM among the owners of the surface, the coal rights, and the oil and gas rights in three equal shares, one-third to each.[177]

Title III of the bill was the subject of hearings on April 18, 1991.[178] The participants universally condemned the bill as unfair, impractical, and unconstitutional.[179] A repeated refrain was that is-

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without compensation.

In an unrelated action, Street v. Harrison, Ch. No. 162-90 (Cir. Ct., Buchanan Cty., Va.), the surface owners who hold no mineral rights are seeking to assert ownership of CBM against OXY USA, Inc., the CBM developer which holds leases from the owners of the gas rights and the coal rights. All residuary mineral interests are owned by third parties. Although the plaintiffs' claims appear to be entirely unfounded, this suit could result in a determination of the ownership issue if the gas lessors or coal lessors were to cross claim to quiet title.

173. H.R. 1078, 102d Cong., 1st Sess. (1991), referred to the Interior Comm. on Interior and Insular Affairs.

174. *Id.*, Title III, Sec. 301. This title would amend Section 32 of the Mineral Leasing Act, 30 U.S.C. § 189, by adding a new subsection (b), entitled "Ownership of Coalbed Methane." The references in the following footnotes are to the numbered paragraphs of this proposed subsection.

175. *Id.*, subsection (b)(1)(B).

176. *Id.*, subsection (b)(1)(C). The bill contains three exceptions in subsection (b)(3): (A) where state law "specifically addresses and resolves the ownership" of CBM; (B) where the instruments transferring or leasing or leasing the minerals specifically provide for ownership of CBM; or (C) where the United States owns the surface estate or the mineral estate. On its face, the bill would seem to except all transactions in which the current instruments specifically referred to CBM, even those in which the gas and coal rights had been severed in the distant past and someone was disputing the right of the current grantor to convey the CBM.

177. *Id.*, subsection (b)(2). It is not clear why the gas owners' one-third share was given to the owners of "oil and gas" rather than "gas," for the bill would create unintended ambiguity whenever the oil and gas rights were owned by different persons.

178. Hearings on H.R. 1078, National Coal and Extractive Strategy Act of 1991, Titles II, III, IV, V, VI, VII, before the Subcomm. on Mining and Natural Resources of the House Comm. on Interior and Insular Affairs 102d Cong., 1st Sess. (Apr. 18, 1991) (unpublished).

179. *See Coalbed methane bill stirs controversy*, COAL & SYNFUELS TECH., Apr. 29, 1991, at 2.

sues relating to property rights are uniquely appropriate for state and not federal determination.[180] Several witnesses said that surface owners should retain no rights in CBM following a severance of minerals,[181] and the granting of a one-third interest to surface owners was attacked as a taking of the mineral owners' property.[182] It was pointed out that an award of a one-third interest to the surface owner could jeopardize the profitability of projects in which negotiations with the mineral owners already had been consummated[183] and that adding the surface owners to prospective transactions would vastly increase the number of parties with whom developers would have to negotiate.[184] Several witnesses warned that the legislation would open up the question of CBM ownership on federal and Indian lands, which could cause a shutdown of major development that has been taking place in reliance on opinions of the United States Solicitor General that the CBM is owned by the gas lessee.[185]

In his testimony, Representative Phil Sharp submitted a discussion draft of a proposed amendment to H.R. 1078 that incorporated the forced pooling provisions of the Virginia Act. Several of the witnesses testified that CBM development could be facilitated by such a forced pooling statute.[186] In July of 1991, Rep. Sharp in-

180. Hearings, *supra* note 178, testimony of Patricia D. Bragg on behalf of OXY USA Inc., at 3-4; testimony of attorney Richard A. Counts, at 22; testimony of David E. Brody of Amoco Production Company, at 4; testimony of Walter L. Oldham of Oryx Energy Company, at 9-10; testimony of Harry Ptasynski for four petroleum and oil and gas trade associations, at 6.

181. Hearings, *supra* note 178, testimony of John A. Wallace of Taurus Exploration, Inc., at 5; testimony of Walter L. Oldham at 7.

182. Hearings, *supra* note 178, testimony of Rep. Phil Sharp, at 4; testimony of attorney Richard A. Counts, at 22, 28; testimony of John A. Wallace of Taurus Exploration, Inc., at 9; testimony of David E. Brody of Amoco Production Company, at 5-6; testimony of Walter L. Oldham of Oryx Energy Company, at 8; testimony of Harry Ptasynski for four petroleum and oil and gas trade associations, at 5-6.

183. Hearings, *supra* note 178, testimony of John A. Wallace of Taurus Exploration, Inc., at 5; testimony of Walter L. Oldham of Oryx Energy Company, at 9.

184. Hearings, *supra* note 178, testimony of John A. Wallace of Taurus Exploration, Inc., at 5-7; testimony of David E. Brody of Amoco Production Company, at 7; testimony of Harry Ptasynski for four petroleum and oil and gas trade associations, at 5.

185. Hearings, *supra* note 178, testimony of Patricia D. Bragg on behalf of OXY USA Inc., at 4; testimony of David E. Brody of Amoco Production Company, at 6-7; testimony of Walter L. Oldham of Oryx Energy Company, at 8; testimony of Harry Ptasynski for four petroleum and oil and gas trade associations, at 5-6. These opinions of the U.S. Solicitor General are discussed *infra* at notes 265-70 and accompanying text.

186. Hearings, *supra* note 178, testimony of Patricia D. Bragg on behalf of OXY USA Inc.,

troduced a revised version of this draft as H.R. 2998.[187] The Sharp bill was incorporated virtually verbatim in the "coal title" of the House energy bill, H.R. 776.[188] The major features of the CBM ownership section of the House energy bill, referred to here as the Sharp bill,[189] include limited application only to states where uncertainty over ownership is impeding CBM development;[190] administration by the state agencies under a regime of cooperative federalism;[191] forced pooling;[192] escrow accounts for disputed ownership claims;[193] a permit system for CBM wells;[194] determination of

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at 2, 5; testimony of Isaias Ortiz of the Appalachian Coalbed Methane Association, at 2-4; testimony of David E. Brody of Amoco Production Company, at 8; testimony of Harry Ptasynski for four petroleum and oil and gas trade associations, at 5.

187. H.R. 2998, 102d Cong., 1st Sess. (1991).

188. H.R. 776, 102d Cong., 1st Sess. § 814 (1991). This section of the bill was not revised in the subcommittee mark-up. *See* Coal Policy Act of 1991, H.R. 776, 102d Cong., 1st Sess., Title 8, § 13 (1991) (as adopted by the Subcomm. on Energy and Power on July 31, 1991). The CBM ownership provision appears as section 1314 in the May 19, 1992 committee print of the Comprehensive National Energy Policy Act.

189. The Sharp bill proposed to amend Section 7 of the Natural Gas Act by adding a new subsection (i) entitled "Ownership of Coalbed Methane." With only minor changes, the Sharp bill became § 814 of H.R. 776 (which emerged from the subcommittee as Title 8, § 15). The references in the following footnotes are to the numbered paragraphs of this proposed subsection (i), which appear in H.R. 2998, in H.R. 776, § 814 (as introduced); and in the Coal Policy Act of 1991, H.R. 776, Tit. 8, § 15 (as reported by subcomm. on July 31, 1991).

190. *Id.* para. (2), "Affected States." The Sharp bill would apply only in states where the Secretary of Energy found that disputes, uncertainty or litigation were impeding CBM development and no statutory or regulatory procedure existed to facilitate CBM development pending final resolution thereof. Until the Secretary published a different list, the initial affected states would be West Virginia, Pennsylvania, Kentucky, Ohio, Tennessee, Indiana, and Illinois.

191. *Id.* para. (3), "State Agencies for Affected States." Each listed state would establish or designate a state agency to function as the "Board" specified in bill, or the Secretary of Energy would assume that function.

192. Like the Virginia Act, the Sharp bill contains forced pooling provisions which would allow the regulatory board to issue pooling orders combining tracts into a single drilling unit and providing for sharing of production in proportion to acreage. *Id.* Para. (5), "Drilling Units." CBM owners would have three options: (1) lease their interests for a royalty, (2) participate as operators by contributing a proportionate share of the costs in return for a share of the profits, or (3) receive a share in the profits as nonparticipants without contributing to expenses, but only after deduction of a multiple of the party's proportionate share of the costs. *Id.* para. (6), "Development Under Pooling Arrangement."

193. *Id.* para. (7), "Escrow Account." As in the Virginia Act, the escrow account receives the operator's payment of royalties or profits attributable to disputed claims and any claimants' payments of their share of costs as participating operators.

194. *Id.* para. (10), "Notice and Objection." The Sharp bill mandates notice to coal owners in conjunction with an application for a CBM permit, and it specifies the criteria that the regulatory board must apply in ruling on objections to a well, a drilling unit, or stimulation of a coal seam. These criteria resemble those in the Virginia Act, though slightly re-organized and expanded.

well spacing under state law;[195] and a requirement of coal owner consent to stimulation of coal seams.[196] The House energy bill could be ready for adoption in 1992,[197] but because other provisions of the bill are likely to be controversial, no prediction can be made on the likelihood of enactment.

In February of 1992, Representatives Rahall and Sharp introduced H.R. 4186, the Coalbed Methane Development Act of 1992.[198] Although it initially was almost identical to the Sharp bill, it has been amended in committee, and the amended version of H.R. 4186 may replace the Sharp bill within the House Energy Bill.[199]

C. *Attempts at Enacting CBM Legislation in West Virginia*

Recent efforts at drafting CBM legislation for West Virginia were initiated in the Fall of 1989 by Ted Streit, the Director of the Oil and Gas Division of the West Virginia Department of Energy.[200] These efforts were premised on the belief that legislative resolution of the ownership question "would do nothing to bring the parties together."[201] Instead, Streit proposed the creation of a permit system under the auspices of the Shallow Gas Well Review Board

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195. *Id.* para. (4), "Spacing." Minimum spacing of CBM wells would be determined by each state board unless already specified by state law.

196. *Id.* para. (9), "Consent of Affected Coal Operator." The Sharp bill requires that the CBM operator obtain a signed consent from the coal operator of each coal seam within 1500 horizontal feet of the proposed well and within 200 vertical feet of the target coal bearing strata, both distances being twice those in the Virginia Act.

197. Telephone conversations with Congressional staff members Judy Greenwald (Subcomm. on Energy and Power of the House Comm. on Energy and Commerce) and Ruth Fleischer (counsel to Subcomm. on Environment, Energy and Natural Resources of the House Comm. on Government Operations).

198. H.R. 4186, 102d Cong., 2d Sess. (1992). In early March of 1992, H.R. 4186 was approved by the Subcommittee on Mining and Natural Resources and forwarded to the Committee on Interior and Insular Affairs for full committee action. 138 Cong. Rec. D 241 (March 10, 1992).

199. Telephone Interview, Brette Bates, Staff Member, House Subcomm. on Mining & Natural Resources. A committee print was not available in time for inclusion here.

200. Memorandum from Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. Department of Energy (DOE), to Commissioner George E. Dials, Commissioner of the W. Va. DOE (Sept. 6, 1989). Streit's proposal began with the declaration that CBM "is a hazard and impediment to the safe and efficient mining of coal, and that under proper supervision that gas can be removed to the benefit of its owner and the citizens of this state." (All of the documentation of the efforts at drafting CBM legislation for West Virginia which are cited in this section of the article were provided to the authors by Ted Streit.).

201. *Id.*

("SGWRB") through which applicants who had no claim of ownership to the CBM could obtain authorization to extract the CBM without incurring liability for trespass. The SGWRB would "set such operational conditions to insure that such operations will not interfere with the safe recovery of coal" and have "the authority to reasonably allocate the proceeds of the sale of the gas" on "just and equitable" terms and conditions.

In October of 1989, Streit convened a coalbed methane working group composed of interested members of the gas[202] and coal industries. Representatives of the coal industry insisted that any venting of CBM from coal mines in the interest of health and safety of miners should not give rise to liability for "waste" of the gas.[203] In December of 1989, representatives of the gas industry submitted a proposal dealing with various technical issues.[204] They agreed with the coal industry's position "that venting of CBM in conjunction with or in advance of mining is not waste and that a mine operator has no *obligation* to capture CBM and market it."[205] They proposed, however, that coal operators would have the *right* to capture and produce CBM "in conjunction with mining operations or as part of a mining plan" upon payment of a 1/8 royalty to the owner of the methane, with an escrow of the royalty whenever ownership was unclear.[206] They further recommended "that the SGWRB be given authority to force pool CBM wells."[207]

A member of the Attorney General's office assisted the working group in drafting a bill based on the Virginia legislation.[208] In dis-

202. The gas industry representatives frequently referred to themselves as members of the "oil and gas industry," but the shorter designation is used in the interest of brevity.

203. Letter from H. Preston Henshaw of Western Pocahontas Properties to George E. Dials, Commissioner of the W. Va. DOE (Oct, 18, 1989) letter from Stephen G. Young Vice President for Government Affairs, Consolidation Coal Company to Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. DOE (Dec. 5, 1989).

204. Letter from R. Neal Pierce, General Counsel & Secretary Columbia Natural Resources, Inc. and Donald Fickenscher, CNG Development Company to Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. DOE (Dec. 12, 1989). Most of the technical proposals related to casing and plugging requirements (Attachment A) and spacing of wells (Attachment B).

205. *Id.* at 2 (emphasis added). *See also* Attachment C (excluding from the definition of waste the venting of CBM for safety or testing purposes and the plugging of CMB wells for recovery of coal).

206. *Id.* at 3.

207. *Id.* at 3.

208. Ted Streit, Director of the Division of Oil and Gas of the W. Va. DOE, informed us that the primary author was Lowell Greenwood.

cussions of this draft legislation, no consensus was reached among the interested parties, so it was not introduced in the 1990 legislative session.[209]

The CBM working group continued to meet and confer in the spring of 1990. Several potential stumbling blocks emerged at a meeting on May 9, 1990.[210] One issue was whether consent by coal operators would be a prerequisite to stimulation of a coal seam.[211] Another was the insistence of the coal industry that the coal owner or operator have the exclusive right to produce CBM from an active mine area.[212]

In June of 1990, the group created three committees: organizational, technical, and legal.[213] In early September, the technical committee submitted its final report and recommendations.[214] The gas and coal industry representatives agreed on numerous technical provisions, but they were unable to reach agreement on the issue of control of CBM development,[215] including the location and stimulation of wells.[216] In the absence of agreement, the gas and coal industry representatives submitted separate position papers for consideration by the legal committee.[217]

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209. Letters from George E. Dials, Commissioner of the W. Va. DOE, to members of the CBM working group (Mar. 19, 1990). The members of the CBM working group as of March 19, 1990 included James Brink, CNG Development Co.; Donald A. Fickenscher, CNG Development Co.; Tom Gallagher, Peabody Coal Co.; Larry King, U.S. Steel Mining Co.; J. Thomas Lane, Bowles, Rice, & McDavid; Delbert G. Oliver, OXY U.S.A. Inc.; Neal Pierce, Columbia Natural Resources, Inc.; Kevin Wall, Western Pocahontas Properties; and Stephen G. Young, Consolidation Coal Co.

210. A letter from Larry King of U.S. Steel Mining Co., Inc. to Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. DOE, listed 23 issues that had to be addressed to satisfy the coal owners and operators (May 16, 1989).

211. Letter from Delbert G. Oliver of OXY USA Inc. to Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. DOE (May 14, 1990); letter from Larry King, *supra* note 210, at 2.

212. Letter from Larry King to Ted M. Streit, *supra* note 210, at 1.

213. *See* letters from Ted M. Streit, Director of the Division of Oil and Gas of the W. Va. DOE, to representatives of four trade associations requesting nominations to these committees (June 6, 1990). An organizational meeting was held on June 28, 1990. *See* letter from Ted M. Streit to CBM group members (June 29, 1990). The first meeting of the technical committee occurred on July 11, 1990. *See* Summary of July 11, 1990 CBM Meeting.

214. Memorandum from Sharon Flanery & Kevin Wall, co-chairpersons of the CBM technical committee to the CBM oversight committee, with 8-page attachment setting forth their recommendations (Sept. 4, 1990).

215. Memorandum from Kevin Wall of Western Pocahontas Properties to the CBM oversight committee (Sept. 5, 1990).

216. Memorandum from Sharon Flanery & Kevin Wall to the CBM oversight committee, *supra* note 214.

217. Memorandum from Sharon Flanery and Kevin Wall to Members of the CBM technical

Based on concerns about well location and stimulation, the coal industry members took the position that any CBM permit application must be conditioned on the written consent of the owners of any minable seams to be penetrated.[218] The rationale for this consent requirement was to force the CBM developer to negotiate an agreement with the coal owner on these two issues. The coal industry members emphasized the greater capital investment and risk of the coal owners and operators, contrasting the $15 to $20 million cost of a longwall operation with the $100,000 to $150,000 investment in a CBM well. They also emphasized that the value of CBM was only 1% to 3% of the value of the coal.[219]

The gas industry members conceded that, in the interests of mine safety, the coal operator should exercise control over both location and stimulation of CBM wells in "active mining areas,"[220] but they disagreed with the coal industry's insistence on control even in non-active areas.[221] In non-active mining areas, the gas industry believed that CBM development should be allowed to take place under the auspices of the SGWRB. They would define a non-active mining area as one where no mining plans existed for the next eight to ten years.[222]

With respect to stimulation, the gas industry "[did] not agree with the coal industry's position that the stimulation process will sterilize coal reserves."[223] They asserted that "the impact on the coal

committee (Sept. 7, 1989). The two industry position papers are "Position of the Coal Industry Members of CBM Technical Committee on the Requirement of Coal Owner and Operator Approval of CBM Wells" (September, 1990) [hereinafter "Position of the Coal Industry"], and "Location and Stimulation of Coal Bed Methane Gas Wells: Oil and Gas Position Paper" (September, 1990) [hereinafter "Gas Position Paper"].

218. Position of the Coal Industry, *supra* note 217, at 1-2.

219. *Id.* at 1. "The value extracted in CBM wells may be 40 to 70 cents per ton [of coal], while a ton of mined coal may bring $25 to $40 per ton, FOB mine." *Id.*

220. In active mining areas, the gas industry saw no problem with allowing the coal operator to control the stimulation of coal seams because the coal operator would "have in depth knowledge" as to the characteristics of the coal and the roof and could "technically contribute to the stimulation design." *Id.* at 2-3. With respect to extraction of gob gas, if the coal operator were not satisfied with the location of gob wells, "then the coal operator still has the choice of using ventilation holes to remove the methane." *Id.* at 2.

221. Gas Position Paper, *supra* note 217. They pointed out that some coal reserves may not be mined for decades, or perhaps never, and "the arbitrary assertion of control over coal reserves for which there are no reasonably foreseeable development plans" may cause the gas industry to "lose valuable income" and suffer deprivation of their "correlative rights." *Id.* at 1.

222. *Id.* at 1.

223. *Id.* at 2.

seams from stimulation is substantially less than the impact from subsidence that occurs when one lower seam is mined and the superincumbent seams are allowed to collapse."[224] They pointed out that no procedural or substantive protection exists with respect to mining of lower seams, whereas coal owners would receive notice of proposed stimulation, and if the parties failed to negotiate a satisfactory resolution of the stimulation design, then the SGWRB would have final authority.[225]

Despite these areas of disagreement within the technical committee, the legal committee was asked to draft proposed legislation based on its report.[226] A "first rough draft" prepared by Tom Lane was sent to legal committee members in late September for discussion at a meeting on October 2, 1990.

Following the October 2 meeting of the legal committee, the coal industry members issued a position statement reiterating the demand for coal owner consent "to any stimulation, horizontal drilling, or other operations which could affect mine ventilation or the current or future mineability (sic) of the coal."[227] This position statement declared that "the issue of consent remains the hard issue which must be addressed before the technical aspect of drafting a proposed agreed bill should proceed."

The members from the gas industry were "unwilling to assent to the coal industry's position on the matter of consent of coal owners to coalbed methane development."[228] A meeting of the legal committee scheduled for mid-November was canceled, and the coal industry co-chair suggested: "Perhaps a moratorium on proposed legislation would be in order at this time."[229]

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224. *Id.*

225. *Id.*

226. Letter from Thomas Gallagher, coal industry co-chair, to members of the CMB legal committee (Sept. 7, 1990). The legal committee started with the draft that had been prepared the previous year by Ted M. Streit, and it incorporated changes recommended by the technical committee and the coal group.

227. Coal Industry Position: Coalbed Methane Legislation, one-page document attached to memorandum from Tom Gallagher, the coal industry co-chairman of the legal committee, to the CBM working group (Oct. 12, 1990).

228. Letter from Donald Fickenscher, the gas industry's co-chair of the legal committee, to Thomas Gallagher, the coal industry's co-chair (Nov. 8, 1990): "It is principally objectionable because it is cast in terms of an absolute pre-condition and allows for no appeal, mediation, arbitration or any other basis for the testing of the reasonableness of withheld consent."

229. Letter from Thomas Gallagher to Donald Fickenscher (Nov. 9, 1990).

Despite the suggested moratorium, on January 16, 1991, Senator Minard introduced into the West Virginia State Senate Senate Bill 63 (S.B. 63), a revised version of one of the earliest drafts produced by the CBM Working Group.[230] Although it differed in several respects, the key features of S.B. 63 were patterned after the Virginia legislation, including forced pooling provisions,[231] an escrow fund for disputed ownership claims,[232] a permit system for CBM wells,[233] and a coal owner veto over stimulation of coal seams.[234]

On February 19, 1991, the West Virginia Oil and Natural Gas Association issued a short statement of its position on CBM regulation in which it expressed dissatisfaction with S.B. 63 and endorsed the moratorium on legislation proposed by the coal industry.[235] Lack-

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230. W. Va. Legis., Senate J., 70th Legis., Regular Sess., Jan. 16, 1991, at 9. S.B. 63 is virtually identical to the first draft that was prepared by Lowell Greenwood and circulated by Ted M. Streit to members of the legal and technical committees in June of 1990. The bill proposes to create a new article 7A in chapter 22 of the West Virginia Code, and the references in the following footnotes are to the section numbers in this proposed new article [hereinafter *Minard bill*].

231. *Id.* § 9(a). The bill provided for forced pooling of interests in the event of conflicting claims to ownership of CBM, as well as for forced pooling of separately owned tracts or interests. (This section is somewhat ambiguous in that it contains a cross reference to itself: "A pooling order under this section may also pool the interests in the separately owned tracts or interests as set forth in section nine of this article.") As in Virginia, under forced pooling CBM owners would have three options: (1) lease their interests for a royalty established by the board; (2) participate as operators by contributing a proportionate share of the costs in return for a share of the profits, or (3) receive a share in the profits as nonparticipants without contributing to expenses, but only after deduction of a multiple of the party's proportionate share of the costs. *Id.* § 9(b)-(h).

232. *Id.* § 9(f)-(h).

233. The criteria that the board would apply in ruling on objections to a well, a drilling unit, or stimulation of a coal seam differed substantially from those in Virginia. *Id.*, §§ 6(a), 6(f), & 10(c). Instead of limiting objections to a detailed list of factors, S. 63 mandated that: "[a]ll applications shall be evaluated on a site-specific basis, with all due regard to the responsible protection of workable coal seams, groundwater, and all other aspects of the environment." *Id.* § 6(a)(1). In determining the merits of an application, S. 63 created different standards for unworkable and workable coal seams. In unworkable coal seams, the coal owner or operator had the burden of supporting any objections with "good cause . . . on the basis of substantial evidence on the record." S. 63, § 6(f)(1). In workable coal seams, however, the coal owner or operator would have a virtual veto over all aspects of the project: any objection "shall be sustained unless the board is persuaded by clear and convincing evidence on the record that the objection is without merit." *Id.*, § 6(f)(2). Unlike the Virginia Act, the bill did not specify spacing of wells but left this for determination by the board. *Id.*, § 8.

234. *Id.*, § 6(a)(1). As in Virginia, the bill would require that the operator obtain signed consent from the owners of each coal seam within 750 feet horizontally from the well or 100 feet vertically from the target coal seam.

235. Letter from Rex Burford, Executive Director of the West Virginia Oil and Natural Gas Association, with attachment entitled "West Virginia Oil and Natural Gas Association Position on

ing support from either the gas or coal industries, the bill was never brought to the floor during the 1991 legislative session.[236]

Bills to establish forced pooling of CBM were introduced in both the House of Delegates and the Senate during the recently completed 1992 legislative session.[237] These bills died in committee, primarily because of the coal industry's opposition, which, as earlier, centered on the problem of control.[238]

Selected Issues: A. *Coal Bed Methane (CBM).*" The cover letter stated:

> S. 63 does not, as written measure up to our position on this issue. Apparently, from the enclosed documentation it does not measure up to the position of the coal industry either. . . . As far as I am aware, the oil and gas industry is in favor of the moratorium, suggested by the coal companies.
>
> I would encourage you to review this material and take the suggestion of the coal industry to heart that a moratorium might be the wisest course to follow for the time being.

236. S.B. 63 was referred to the Senate Committee on Energy, Industry and Mining. The Committee introduced a resolution that would have directed the Joint Committee on Government and Finance to study the CBM industry and "determine the most efficient and effective statutory manner by which conflicting ownership claims to coalbed methane gas can be resolved." W. Va. Legis., Senate J., 70th Legislature, Reg. Sess., Feb. 27, 1991, at 36. This resolution was referred to the Committee on Rules, *id.*, and no further action was taken. Topical Index of Senate Bills Introduced and History of All Bills and Resolutions Considered by Senate, W. Va. Legis., Senate J., 70th Legis., Regular Sess., Mar. 7, 1991, at 59.

237. House Speaker Chuck Chambers and Delegate William Carper introduced H.B. 4238 on January 27, 1992. Senator Minard introduced S.B. 406 on February 6, 1992. Both bills were based on Senator Minard's S.B. 63 from the 1991 session, but they included new provisions to resolve ownership of CBM in accordance with the proposal described in Part VII of this Article. (Sections 14-16 of these bills were drafted by Professor Lewin at the request of Delegate Carper. The text of two of these sections is discussed *infra* at notes 408 and 412.).

238. On February 5, 1992, the House Committee on Government Organization held a public hearing on H.B. 4238. The coal industry's representative, Tom Lane, stated: "More important than ownership is the issue of control." Summary of Remarks on H.B. 4238 by J. Thomas Lane for the Coal Industry, Feb. 5, 1992, at 5. Mr. Lane's conclusions and recommendations included the following:

> 2. The effects of fracturing coal seams have not been adequately studied and until such effects are better known, control over methane development in virgin coal seams must remain in the coal owner. Any serious consideration of this legislation should include changes which place control of coal reserves exclusively in the coal owner.
>
> 3. Proper ventilation of active coal mines is essential to the safety of miners, and accordingly any production of methane from active mines must likewise be controlled by the coal operator . . . .
>
> 6. The bill as drafted needs substantial changes to provide that the coal owner retain control over development of coalbed gas and any other activity in coal seams or active mines.

Id. at 6-7. The coal industry's fears with respect to stimulation of virgin coal seams were so great that its representatives apparently either overlooked or distrusted the absolute protection afforded by the bill's requirement that *all* applications for permits to stimulate a well be accompanied by the "*signed consent* . . . from the coal owner or coal operator of each workable coal seam" located within 750 horizontal feet of the well or within 100 vertical feet of the target coal seam. H.B. 4238 at § 22-7A-6(a)(1).

While the primary impediment to adoption of CBM legislation in West Virginia has been the issue of control, this issue appears to be a proxy for the underlying dispute over CBM ownership. In demanding absolute control over CBM development, the coal industry essentially wants to treat the CBM as the property of the coal owners. Conversely, in seeking the right to develop CBM in the absence of mining activity, the gas industry is invoking the "correlative rights" of a CBM owner who is someone distinct from the coal owner.

The crucial role of the ownership question is highlighted in several statements by participants in the West Virginia CBM working group. In the memorandum conveying the recommendations of the technical committee, the co-chairpersons concluded that the document "demonstrates the difficulty of addressing technical issues when the major legal issue of ownership remains unresolved."[239] The position paper of the coal industry also emphasized "the difficulty of separating the technical considerations from the ownership issue."[240] Indeed, concern over ownership was central to the coal industry's reluctance to submit these disputes to regulation.[241]

Resolution of the ownership issue could break the deadlock over the issue of control. If it were determined that CBM was the property of the coal owners, then they would have the sole right to engage in production, and the issue of control would disappear. On the other hand, if it were determined that CBM was the property of the gas owners, they would have a far stronger basis for their assertion of a right to engage in development without consent of the coal owners.

V. The Indeterminacy of CBM Ownership at Common Law

The question of CBM ownership only arises if there has been a severance of some or all of the mineral interests. In the absence of

239. Memorandum from Sharon Flanery & Kevin Wall to the CBM oversight committee, *supra* note 214.

240. Position of the Coal Industry, *supra* note 217, at 2.

241. Position of the Coal Industry, *supra* note 217, at 1, "[A]s the ownership has not been settled in West Virginia, it is important to take a conservative approach to this issue and allow the people affected to negotiate in their own best interests and not have a governmental appointed arbiter decide these very important issues for them." *Id.*

severance, no one could challenge the ownership claims of the fee simple absolute owner of property underlain with gas-bearing coal strata. Severance of mineral interests can occur by grant, with the fee simple owner conveying all or a portion of the mineral rights while retaining ownership of the surface.[242] Severance might also occur by reservation or exception, with the fee simple owner conveying the surface while retaining all or a portion of the mineral rights.[243]

Throughout much of West Virginia the surface ownership has long been severed from the coal rights. In some cases there have been separate out-conveyances of distinct coal seams.[244] It thus would be possible for one person to own the Pittsburgh seam, another the Kittanning seam, and a third the strippable coal, while the surface owner retained the coal in other seams including those that are currently unminable. Severance of gas rights from the surface is also quite common, and on occasion, there have been separate conveyances of gas in distinct strata. When both coal rights and gas rights have been severed from the surface ownership, these minerals sometimes have a single owner, but they frequently are owned by different persons.

Whenever coal or gas rights have been severed separately, the ownership of CBM at common law is uncertain. In analyzing the ownership question, a court might take any one of a variety of approaches. The conflicting legal principles and the existing precedent from West Virginia and other jurisdictions do not point toward any one of these solutions as necessarily or even probably correct, so a court could adopt any one of the approaches described below and not be "wrong" in any objective sense.

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242. *E.g.*, Buffalo Mining Co. v. Martin, 267 S.E.2d 721, 722 (W. Va. 1980) (grant of coal, oil, gas, and other minerals); Fisher v. West Virginia Coal & Transp. Co., 73 S.E.2d 633, 636 (W. Va. 1952) (grant of coal); Paxton v. Benedum-Trees Oil Co., 94 S.E. 472, 473 (W. Va. 1917) (grant of 1/16th of oil and 1/2 of the gas).

243. *E.g.*, West Virginia Dept. of Highways v. Farmer, 226 S.E.2d 717 (W. Va. 1976) (reservation of "oil, gas and other minerals"); Tate v. United Fuel Gas Co., 71 S.E.2d 65 (W. Va. 1952) (exception of oil, gas, and other minerals).

244. *See* Bowles, *supra* note 20, at 7-11. *E.g.*, Stamp v. Windsor Power House Coal Co., 177 S.E.2d 146 (W. Va. 1970) (appellant owned Pittsburgh No. 8 seam of coal); Erwin v. Bethlehem Steel Corp., 62 S.E.2d 337 (W. Va. 1950) (exception or reservation of "third vein"); *cf.* Robinson v. Wheeling Steel & Iron Co., 129 S.E. 311, 312 (W. Va. 1925) (defendant owned coal below a rock stratum 30 feet above the Wheeling vein of coal).

To simplify the discussion of these alternative legal rules, the persons with possible ownership claims to CBM will be referred to as the "coal owners," "gas owners," and "surface owners",[245] and distinctions sometimes will be made among "CBM," "strata gas," "natural gas," and "gob gas."[246] The various approaches and arguments that commentators have advanced for assignment of CBM ownership to the coal or gas owners will be referred to as the claims of the coal or gas owners themselves, as though their respective trade associations had submitted *amicus* briefs.

A. Possible Common-Law Approaches to the Ownership Question

Although a variety of approaches are theoretically possible, most commentators have focused their attention on four possible legal rules as leading candidates for judicial adoption. From our analysis of principle and precedent, we have identified two additional rules that merit further consideration. For simplicity of exposition, we have assigned numbers and short-hand labels to each of these six possible common-law solutions to the ownership question:

#1 "CBM is Gas." Ownership of CBM is encompassed within any grant or reservation of gas rights as a matter of law, so CBM is always owned by the gas owner.

#2 "CBM is Coal." Ownership of CBM is encompassed within any grant or reservation of coal rights as a matter of law, so CBM is always owned by the coal owner.

#3 "Priority of Severance." Ownership of CBM passes with either a grant or reservation of gas rights or a grant or reservation of coal rights, so CBM ownership will depend on priority of severance, again as a matter of law. If gas rights are severed first, CBM is owned

245. The "coal owner" has the right to extract coal by grant or reservation in a written instrument (a will, deed, lease, profit à prendre, easement, or license); the "gas owner" has the right to extract natural gas by virtue of a grant or reservation in a written instrument; the "surface owner" (who may also be the coal owner or gas owner) has ownership rights with respect to the surface either by grant or by reservation in a written instrument. Although the terms "reservation" and "exception" have specific technical meanings, we use the term "reservation" more broadly to encompass any such retained interest.

246. "CBM" refers to coalbed gas in place; "strata gas" refers to coalbed gas that has escaped from the coal and become trapped in other non-coal strata; "natural gas" refers to gas that originates in non-coal strata; and "gob gas" refers to gas that migrates into the gob zone created by high-extraction mining and which may include CBM, strata gas, and natural gas.

by the gas owner. If coal is severed first, CBM is owned by the coal owner.

#4 "Case-by-Case." Ownership of CBM may be vested in either the gas owner or the coal owner, but this can only be determined from a case-by-case analysis of the language of particular deeds in light of the intentions of the parties and general principles of interpretation applicable to mineral deeds without any *a priori* presumptions favoring either coal owners or gas owners.

#5 "Successive Ownership."[247] For coal in place, CBM is part of the coal and is owned by the coal owner, so the coal owner has the right to any CBM extracted by pre-mining degasification. Once coal mining is complete, the coal owner no longer owns the container space or any liberated gas in the gob zone, so the gob gas is the property of the gas owner, who has the right to any CBM extracted via gob wells.

#6 "Mutual Simultaneous Rights."[248] Both the gas owner and the coal owner have non-exclusive rights to extract CBM or gob gas. Insofar as CBM is a "gas," the gas owner owns the CBM and has the right to extract it, along with strata gas and gob gas, provided this does not unreasonably interfere with mining activity. Insofar as CBM or gob gas must necessarily be ventilated in order to mine the coal, the coal owner has the right to extract CBM or gob gas as an implied incidental mining right.

B. Implausible Common-Law Approaches to the Ownership Problem

Before discussing the legal arguments for and against these six possible common-law rules, a few words should be said about certain conceivable rules that we have rejected because they are extremely unlikely to accurately describe the current state of CBM ownership in West Virginia or in any other jurisdiction.

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247. This "rule" was suggested by WVU Adjunct Professor of Law Thomas Lane, who teaches a course on the law of coal, oil, and gas.

248. This "rule" was suggested by the decisions of the lower courts in United States Steel Corp. v. Hoge, 450 A.2d 162 (Pa. Super. 1982), *rev'd*, 468 A.2d 1380 (Pa. 1983), and by several older Pennsylvania and West Virginia authorities discussed *infra* at notes 356-66 and accompanying text.

First, we have rejected the possibility that CBM might be retained by a surface owner who had conveyed away all of the mineral interests. CBM is quite obviously a "mineral," a term which is comprehensively defined.[249] Most commentators conclude that a general conveyance of "minerals" would include CBM.[250]

Second, we have rejected the theoretical possibility, mentioned by several writers, that CBM could be viewed as a unique mineral, distinct from either gas or coal. If CBM were a distinct mineral, it would only pass by an express conveyance of CBM or by a general conveyance of all mineral rights but not with a conveyance of gas or coal.[251] The commentators have given little serious consideration to this position because it is obvious that CBM is a gas, similar in most respects to ordinary "natural gas," and that the only reason why CBM might not pass with a conveyance of gas rights would be if it were viewed as part of the coal and passed with a conveyance of coal rights.[252] There is little precedent that would even indirectly support the claim to CBM ownership by surface owners who owned neither the gas nor the coal.[253] Thus, we assume that the ownership

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249. *See, e.g.*, Bruen v. Thaxton, 28 S.E.2d 59, 62 (W. Va. 1943); Sult v. Hochstetter Oil Co., 61 S.E. 307, 310 (W. Va. 1908). West Virginia does not follow Pennsylvania's unique *Dunham* rule which holds that the term "mineral" does not include natural gas. Dunham v. Kirkpatrick, 101 Pa. 36 (1882).

250. *E.g.*, Mutchler & Sachse, *supra* note 22, at 1862; Olson, *supra* note 19, at 393; *cf.* Eugene O. Kuntz, *The Law Relating to Oil and Gas in Wyoming*, 3 WYO. L.J. 107, 112-13 (1949) (discussing whether oil and gas are encompassed within the term "minerals"):

> [T]he courts are seeking to give effect to an *intention* to include or exclude a *specific substance*, when, as a matter of fact, the parties had nothing specific in mind on the matter at all . . . . The intention sought should be the *general intent* rather than any supposed but unexpressed *specific intent* . . . .
>
> Where a general grant or reservation is made of all minerals without qualifying language, it should be reasonably assumed that the parties intended to sever the entire mineral estate from the surface estate, leaving the owner of each with definite incidents of ownership enjoyable in distinctly different manners . . . .
>
> Applying this intention, the severance should be construed to sever from the surface all substances presently valuable in themselves, apart from the soil, whether their presence is known or not, and all substances which become valuable through development of the arts and sciences, and that nothing presently or prospectively valuable as extracted substances would be intended to be excluded from the mineral estate.

251. *See* Craig & Myers, *supra* note 20, at 797; Farnell, *supra* note 19 at 525; McGinley, *supra* note 19, at 387; Mutchler & Sachse, *supra* note 22, at 1863.

252. *See* Bowles, *supra* note 20, at 7-12.

253. The sole precedent for treating CBM as distinct from either gas or coal is Hammett v.

of CBM must pass with a conveyance of gas rights or a conveyance of coal mining rights, or perhaps with either, unless the instrument of conveyance expressly excluded CBM.

Third, the courts are not likely to hold that CBM is an unowned mineral subject to a right of capture by anyone having a right to

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Gypsy Oil Co., 218 P. 501 (Okla. 1921), one of the "casinghead gas" cases. Casinghead gas is a gaseous substance, often produced in conjunction with oil, from which gasoline can be extracted. *See* Craig & Myers, *supra* note 20, at 795; Robert E. Hardwicke, *Evolution of Casinghead Gas Law*, 8 TEX. L. REV. 1 (1929); McGinley, *supra* note 19, at 382; Ralph A. Midkiff, Note, *Phase Severance of Gas Rights from Oil Rights*, 63 TEX. L. REV. 133, 134 n.5 (1984). In *Hammett*, the court held that casinghead gas was neither oil nor gas, and that ownership of casinghead gas was retained by the lessor of oil and gas rights; the court ordered an accounting based on the royalty applicable to oil. Courts in the other casinghead gas cases have taken a variety of approaches to computing the royalty owed by the oil and gas lessee but none adopted *Hammett*'s holding that the lessor retained ownership. *E.g.*, Duke v. Sun Oil Co., 320 F.2d 853 (5th Cir. 1963) (casinghead gas is like oil); Vernon v. Union Oil Co., 270 F.2d 441 (5th Cir. 1959) (casinghead gas is like oil); Livingston Oil Corp. v. Waggoner, 273 S.W. 903 (Tex. 1925) (treated as oil and subject to higher oil royalty); Wemple v. Producers Oil Co., 83 So. 232 (La. 1919) (contract adjusted equitably based on oil royalty); Locke v. Russell, 84 S.E. 948 (W. Va. 1915) (contract adjusted equitably based on oil royalty); Lone Star Gas Co. v. Harris, 45 S.W.2d 664 (Tex. Civ. App. 1931) (subject to lower gas royalty); Reynolds v. McMan Oil & Gas Co., 11 S.W.2d 778 (Tex. Civ. App. 1928) (same). *See* McGinley, *supra* note 19, at 382-84; Craig & Myers, *supra* note 20, at 797. Because the casinghead gas cases focused on the remuneration of the lessor, they offer little assistance in resolving the question of CBM ownership. McGinley, *supra* note 19, at 384; Craig & Myers, *supra* note 20, at 798.

Mutchler and Sachse mention the possibility that the landowner might retain ownership of CBM despite a grant of gas and coal rights. Mutchler & Sachse, *supra* note 22 at 1863. They cite Murphy v. Van Voorhis, 119 S.E. 297 (W. Va. 1923), but this case does not seem to support the treatment of CBM as being distinct from gas or coal. *Murphy* interprets a reservation of "oil privileges" in an 1865 deed as retaining only oil rights and not gas rights, resting primarily on the fact that oil and gas were regarded as separate minerals. CBM is *not* generally regarded as a separate mineral, however, and *Murphy* provides no support for treating it as separate from both gas and coal. Farnell also mentions the possibility that the landowner might retain CBM rights despite a conveyance of gas and coal rights, but she simply cites Mutchler & Sachse and does not attempt to explain the basis of such a rule in principle or precedent. Farnell, *supra* note 19, at 525.

McGinley suggests that an argument for retention of CBM rights following conveyance of oil and gas rights could be made on the basis of dicta in United States v. Union Oil Co. of Cal., 549 F.2d 1271 (9th Cir. 1977). *Union Oil* held that geothermal steam was retained by the government under a general mineral reservation in patents issued under the Stock-Raising Homestead Act of 1916. The court rejected the appellees' argument that they obtained the right to underground water and geothermal steam based on statements in the legislative history that patentees would have the right to drill wells and develop springs. *Id.* at 1279. McGinley suggests that a surface owner could cite this case by analogy for the proposition that the substance in question (geothermal steam) found in conjunction with a second substance (water) did not pass with a conveyance of the second substance and would be included with a general mineral reservation because the substance in question was not within the contemplation of the parties. McGinley, *supra* note 19, at 386-87. The analogy is not entirely apposite, however, for the court did not rule that geothermal steam was a mineral that was distinct from underground water which was conveyed; rather, it held that the underground water itself was not conveyed but only a right to drill springs for domestic use in conjunction with the surface.

drill into or through the coal.[254] The concept of non-ownership of CBM is suggested by the "non-ownership" theory which a minority of states have adopted with respect to ownership of oil and natural gas.[255] While the distinction between "ownership" and "non-ownership" of oil and gas may have significant implications in other contexts, it does not affect the extent of extraction rights,[256] and the non-ownership classification does *not* create a rule of capture involving competition among holders of different mineral interests within a single tract.[257] Accordingly, even in non-ownership or qualified ownership jurisdictions, there is no principled basis or precedent for a rule that would treat a particular mineral underlying a single tract as unowned but subject to capture by parties holding separate interests in two other minerals.[258]

In any event, West Virginia treats both coal and natural gas as subject to ownership in place.[259] For a court to treat CBM as unowned and subject to a rule of capture would require a doctrinal innovation in which CBM was treated as separate and distinct from either natural gas or coal and subject to different rules of ownership than

254. Under a rule of capture, anyone who had the right to drill into or through the coal—gas owners and coal owners, and possibly surface owners or their assignees holding mineral rights in subjacent strata—would have a nonexclusive right to capture and extract CBM. The CBM would be owned by whichever party first extracted it and possessed it.

255. 1 H. WILLIAMS & C. MEYERS, OIL AND GAS LAW § 203 (1977). In the handful of states that have been classified as "nonownership" or "qualified ownership" jurisdictions, the oil and gas under one's property is not owned insofar as it can be drained by oil and gas wells drilled vertically within the boundaries of nearby properties within the field. This lack of protection against drainage applies even in "ownership" jurisdictions, however. Brown v. Spilman, 155 U.S. 665, 670 (1895); Trent v. Energy Dev. Corp., 902 F.2d 1143, 1147 (4th Cir. 1990); Gain v. South Penn Oil Co., 86 S.E. 883, 885 (W. Va. 1915).

256. Williams & Meyers, *supra* note 255, at § 204. Regardless of the nominal ownership theory, at common law the holders of oil and gas rights in all jurisdictions have an exclusive right to drill vertically within their boundaries; neighboring property owners are *not*, however, permitted to engage in directional drilling across their boundaries; absent negligence, waste, or fraud, the owners of oil and gas rights have no protection against drainage resulting from vertical drilling on adjacent tracts, but under the rule of "go and do likewise" they are not liable if their activities drain oil or gas from adjacent tracts.

257. The rule of capture under a nonownership rule relates to competitive vertical drilling on other tracts within the field. It does not mean that more than one party would have the right to drill within the boundaries of a tract for oil and gas thereunder.

258. *See* Olson, *supra* note 19, at 390-92.

259. Boggess v. Milam, 34 S.E.2d 267 (W. Va. 1945); Williamson v. Jones, 19 S.E. 436 (W. Va. 1894); ROBERT T. DONLEY, THE LAW OF COAL, OIL AND GAS IN WEST VIRGINIA AND VIRGINIA §§ 1-3 (1951).

either of these minerals. In sum, the idea of treating CBM as unowned and subject to the possibility of capture by various persons having mineral rights in a single tract is inconsistent with existing doctrine and precedent, and it would require the creation of an entirely new and unprecedented legal rule.[260]

C. Indeterminacy of the Legal Arguments for the Six Leading Common-Law Rules

1. Rule #1: CBM is Gas

Rule #1 takes a definitional or conceptual approach to ownership of CBM, declaring that CBM is a gas and, as a matter of law, is encompassed within the ordinary meaning of the terms "gas" or "natural gas" in standard conveyancing language. The argument for this position is straightforward. The gas within coal strata is a "natural" gas, a product that arises from natural processes without any human intervention. The composition of the gas in coal strata is essentially the same as ordinary natural gas, primarily methane and other hydrocarbons, with smaller quantities of other gases.[261] CBM is far more similar to ordinary natural gas than are the naturally occurring nonhydrocarbon gases helium, hydrogen sulfide, and carbon dioxide, all of which have been denominated "natural gases" in disputes over the interpretation of leases[262] or the scope of federal regulations.[263]

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260. While the courts are unlikely to find that CBM is *unowned* and subject to a rule of capture, they might well adopt a rule under which more than one person had the right to extract CBM. Under our Rule #6, "mutual simultaneous rights," both gas and coal owners have the right to extract CBM, but it is not a rule of capture because the gas owners would have title to the CBM, whereas the coal owners could extract CBM in the exercise of an incidental mining right. *See* discussion, *infra*, at notes 345-72 and accompanying text.

261. *See supra* notes 29-31 and accompanying text.

262. *E.g.*, Scott Paper Co. v. Taslog, Inc., 638 F.2d 790 (5th Cir. 1981) (hydrogen sulfide included in lease of "gas including casinghead gas and other gaseous substance"); Northern Nat. Gas Co. v. Grounds, 441 F.2d 704 (10th Cir. 1971) (helium included in lease of "all the oil and gas deposits"); Navajo Tribe of Indians v. United States, 364 F.2d 320 (Ct. Cl. 1966) ("oil and gas deposits" in Indian lease includes helium). *See also*, Robert W. Holland, *Is Helium Covered By Oil and Gas Leases?*, 41 TEX. L. REV. 408 (1963). Professor McGinley recognizes that these cases tend to support the claims of the gas owners, but he does not view them as persuasive authority: "[T]hese cases are not really apposite, since they do not weigh the conflicting interests of the surface owner and the owners of two distinctly different minerals as in the coalbed gas situation." McGinley, *supra*

Both the Attorney General of Pennsylvania and the Solicitor General of the United States have opined that ownership of CBM is governed by the definitional "CBM is gas" rule. Responding to an inquiry from another state agency about whether the holders of gas rights or coal rights had legal title to CBM, the Pennsylvania Attorney General concluded in 1974 that because methane was a "natural" gas, the gas owners therefore had title to CBM and had the exclusive right to extract it.[264]

In a 1981 opinion, the Solicitor General of the United States answered questions about the ownership of CBM with respect to certain conveyances of federal lands and about whether CBM was subject to disposition under the Mineral Leasing Act.[265] The Solicitor General opined that CBM was not included within reservations of coal to the United States but was included within reservations of oil and gas and was leasable as a gas.[266] While these conclusions depended on an examination of various statutes, the analysis emphasized a direct definitional approach.[267]

The Solicitor General again addressed the question of CBM ownership in a recent response to an inquiry from the Bureau of Indian Affairs as to whether CBM was encompassed within a lease of oil and gas by the Jicarilla Apache Tribal Council.[268] On the basis of a definitional analysis, the Solicitor General declared that the tribe's lease of "oil and gas deposits" unambiguously conveyed the right

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note 19, at 384-85.

Curiously, these cases are sometimes cited as support for the claims of the coal owners. Rather than viewing these decisions as interpreting the term "natural gas" to include the nonhydrocarbon gases, several commentators read these cases as holding for the gas owners because the nonhydrocarbon gases were produced as "part of" the natural gas, which would be consistent with the claim that CBM is "part of" the coal. *See* Cohen, *supra* note 19, at 9; Cohen et al., *supra* note 22, at 190; Craig & Meyers, *supra* note 20, at 798-801.

263. *E.g.*, Exxon Corp. v. Lujan, 730 F. Supp. 1535 (D. Wyo. 1990) (term "natural gas" in Mineral Leasing Act includes carbon dioxide).

264. 53 Op. Att'y Gen. 211 (Pa. 1974).

265. M-36935, 88 Interior Dec. 538 (1981).

266. *Id.* at 540, 549.

267. "Coalbed methane is both scientifically defined and legally regarded as a gas." *Id.* at 540 (citations omitted). "Like oil, gas is a term of art, and the courts have interpreted gas broadly to include both fuel and non-fuel gases." *Id.* at 545.

268. M-36970, 98 Interior Dec. 59 (1990).

to extract CBM.[269] Responding to the possible argument that the tribe did not specifically intend to grant rights to CBM, the opinion concluded that where the general intent to lease all gas was clear, the absence of specific intent to include CBM as a gas was irrelevant.[270]

All of the commentators acknowledge the definitional basis for the gas owners' ownership claims, and none voices a principled objection to the merits of this argument on its own terms.[271] Several note further that a definitional approach tends to preclude any claim by the coal owner, because a grant of coal refers only to a solid carboniferous substance and not to any gaseous substance.[272] None of these authorities believe that the definitional claims of the gas owners are conclusive, however.

One argument against this definitional approach is that CBM is not a gas because it is part of the coal.[273] The response to this argument is that despite its adsorption within the pore structure of the coal, CBM remains a "gas" and is not part of the solid molecular structure of the coal. CBM can be extracted from a coal seam just as from any other gas-bearing stratum.[274] In this regard,

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269. *Id.* at 61 ("We have found no definition of 'natural gas' which would exclude coalbed methane.").

270. *Id.* at 61, 63, 69. In construing the lease, the Solicitor General was obligated to resolve any "reasonable ambiguity" in favor of the tribe, but the opinion concluded that no ambiguity was created by the absence of specific intent to convey CBM.

The Solicitor General's position is currently being challenged in Southern Ute Indian Tribe v. Amoco Prod. Co., No. 91-B-2273 (D. Col. filed Dec. 31, 1991). The defendants include twenty oil and gas companies, the Department of the Interior, and a class of over 20,000 individual claimants of interests in CBM. The tribe, as beneficial owner of the coal, is seeking to establish its ownership of the CBM through an award of broad declaratory and injunctive relief as well as an award of damages against the private defendants.

271. Bowles, *supra* note 20, at 7-12; Cohen, *supra* note 19, at 14; Craig & Myers, *supra* note 20, at 785-91; Farnell, *supra* note 19, at 534-25; McGinley, *supra* note 19, at 377; Mutchler & Sachse, *supra* note 22, at 1863; Olson, *supra* note 19, at 383-83, 385, 392-93; *cf.* Ralph A. Midkiff, Note, *Phase Severance of Gas Rights from Oil Rights*, 63 TEX. L. REV. 133, 166 n.148 (1984) (advocating "phase allocation" to define fluid hydrocarbons as oil or gas based on whether they exist as liquid or gas in the reservoir, and noting that phase allocation would resolve ownership of CBM by treating it as a gas).

272. Williams, *supra* note 2, at 216; Cohen, *supra* note 18, at 13-14.

273. Volatile matter ("V.M."), which includes adsorbed gases such as CBM, is a recognized constituent of coal and is one of the standard items in the description and comparison of coals, along with fixed carbon, moisture, ash, and sulfur. *See* 1991 KEYSTONE COAL INDUSTRY MANUAL (1991); McGinley, *supra* note 19, at 388 n.75.

274. Not all of the CBM can be extracted in advance of mining. Regardless of the extent of

the CBM in coal may be analogous to oil that can be produced from oil shale. The case law on ownership of oil shale is inconclusive, however, and neither of the two leading cases provides definitive authority for resolving ownership of CBM.[275]

A second argument against awarding CBM ownership to the gas owner is that the coal owner must vent the gas in order to mine the coal and is required to do so by various mine safety statutes.[276] The response to this argument has been that the coal owner's right to destroy the resource in the process of mining may qualify the rights of the gas owner, but it does not necessarily require that ownership rights be shifted to the coal owner.[277] The rule concededly creates bizarre incentives in that the coal owner may waste the CBM but is not allowed to capture it; this does not, however, invalidate the rule as a matter of legal principle.[278]

A third argument against awarding CBM ownership to the gas owner is that the ownership of competing interests in the same strata by coal owners and gas/CBM owners will inevitably lead to conflicts, for extraction of one resource necessarily interferes with extraction of the other.[279] The response to this argument is that such conflicts

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pre-mining degasification, some CBM will be released during mining, some during processing, and some CBM will continue to de-adsorb from the coal for up to six months. *See* C. McCULLOCH, MEASURING THE METHANE CONTENT OF BITUMINOUS COALBEDS, BUR. OF MINES REPORT OF INVESTIGATION No. 8043 (1975); METHANE EMISSIONS FROM COAL MINING, *supra* note 14, at 19-33. Nevertheless, the fact that the gas owners cannot extract all of their property would not provide a principled reason for concluding that they did not have the right to do so if it could be accomplished without unduly interfering with the mining of coal.

275. The gas owners could cite Brennan v. Udall, 379 F.2d 803 (10th Cir.), *cert. denied*, 389 U.S. 975 (1967), which held that the government's reservation of oil and gas included oil shale from which oil could be extracted. The court rejected the patent holder's argument that oil shale was a solid substance which had to be processed to produce oil. Coal owners could counter by citing Bell Petroleum Co. v. Cross V Cattle Co., 492 P.2d 80 (Colo. Ct. App. 1971), which held that a reservation of oil and gas did not include oil shale. The former decision was based on the interpretation of a federal statute which mandated a construction in favor of the government, while the latter turned on a rule of construction that construed the ambiguity in a reservation of rights against the grantor. *See* McGinley, *supra* note 19, at 385.

276. *See, e.g.*, Cohen, *supra* note 19, at 11, 15; Cohen et al., *supra* note 22, at 199; McGinley, *supra* note 19, at 390-91; Mutchler & Sachse, *supra* note 22, at 1865.

277. *See, e.g.*, 53 Op. Att'y Gen. 211, 212 (Pa. 1974).

278. On the other hand, the right of coal operators to vent CBM in conjunction with mining activity provides the foundation for the argument in favor of Rule #6, mutual simultaneous rights, discussed *infra* at notes 345-72 and accompanying text.

279. *See, e.g.*, Cohen et al., *supra* note 22, at 187; McGinley, *supra* note 19, at 377-78; Olson, *supra* note 19, at 388.

already exist between gas owners and coal owners.[280] Many common-law principles exist to regulate land use conflicts of this nature, including the law of easements and the rule of reasonable accommodation,[281] as well as the law of nuisance.[282] To the extent that common-law principles are inadequate, they may be supplemented by regulation.[283] In any event, this practical objection should not preclude a common-law court from ruling in favor of the gas owner if principle and precedent so require.

Fourth, it has been asserted that even if CBM is a natural gas, the gas owners did not purchase it because they had no intent to do so.[284] The lessee would not have expected to extract or utilize CBM because until recently it had a *de minimis* value and was primarily viewed as a potential hazard.[285] Moreover, the gas lessee would not have wanted to be held responsible for degasification or for damages arising from an explosion. Each of the foregoing propositions is debatable, however. The commercial potential of CBM has been known since at least the 1930s, so there frequently would be a factual question whether the parties to a particular conveyance expressly contemplated inclusion of CBM within a conveyance of gas rights. More fundamentally, if CBM is a natural gas, and the parties generally intended a conveyance of all natural gas, then the specific intent of the parties with respect to CBM may be irrelevant.[286] Finally, ownership of CBM would not necessarily render the gas owner responsible for degasification or for damages from explosions. Thus, the argument based on the intent of the parties would

280. *See supra* note 131.

281. *See* Norvell, *supra* note 132.

282. *See, e.g.*, Armstrong v. Maryland Coal Co., 69 S.E. 195, 203 (W. Va. 1910) ("The maxim *sic utere tuo ut alienum non laedas* would apply with full force"). West Virginia's law of nuisance is analyzed in Jeff L. Lewin, *The Silent Revolution in West Virginia's Law of Nuisance*, 92 W. VA. L. REV. 235 (1990).

283. *See* Opinion of the U.S. Solicitor General, M-36970, 98 Interior Dec. 59, 68-69 (1990); Olson, *supra* note 19, at 388.

284. McGinley, *supra* note 19, at 390-91.

285. *Cf.* Murphy v. Van Voorhis, 119 S.E. 297, 299 (W. Va. 1923) (reservation of petroleum did not encompass natural gas, in part because "natural gas was considered of little value, if any, at that time").

286. *See* Opinion of the U.S. Solicitor General, M-36970, 98 Interior Dec. 59, 68 (1990); Craig & Myers, *supra* note 20, at 790; *Cf.* Kuntz, *supra* note 250, at 112.

not preclude a court from holding that CBM is gas as a matter of law.

Finally, it might be argued that any CBM rights of the gas owners have been abandoned by the failure to assert them. It is certainly possible that the silence of particular gas owners who have not protested the venting of CBM during mining operations would estop them from any claim for past damages at those mines. Their past silence should not, however, affect the claims of other gas owners with respect to CBM in properties that have not yet been mined. Ownership of gas in place is an interest in land that is not lost by non-use but only by express disclaimer or by adverse possession.[287] Except where mining activity has already occurred, the failure of gas owners to develop their CBM resources would not constitute an abandonment of their ownership rights.

In sum, the definitional claims of the gas owners are plausible and are not precluded by principle or precedent. The principal objections to the claims of gas owners are practical, not legal, and do not in themselves negate the gas owners' definitional claims.[288] Were it not for the coal owners' equally compelling claims to CBM ownership, the gas owners' definitional argument would be persuasive.

2. Rule #2: CBM is Coal

Rule #2, which declares that title to CBM should pass with any grant or reservation of coal rights, is also based on a definitional or conceptual approach. While the arguments for this rule have been variously expressed, the coal owners' claims to ownership of CBM are always premised on the fact that CBM is physically intermixed with the coal.[289]

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287. *See* ROBERT T. DONLEY, THE LAW OF COAL, OIL AND GAS IN WEST VIRGINIA AND VIRGINIA § 35 (1951).

288. The existence of these practical objections may, however, help explain why this rule has not been applied in the East where minable coal was involved but only with respect to federal and Indian lands in the West where the coal currently is unminable.

289. *See, e.g.*, Bowles, *supra* note 20, at 7-12; Cohen et al., *supra* note 22, at 181; Morgan & McClanahan, *supra* note 21, at 19.

Several commentators have described a "container space" theory of CBM ownership[290] which is based on the concept that a conveyance of coal encompasses all substances located within the boundaries of the space in which the coal seam is located. The container space theory derives from *Lillibridge v. Lackawanna Coal Co.*,[291] which held that a coal owner also had the right to use passageways within the seam to haul coal from an adjacent tract.[292] The applicability of *Lillibridge* is questionable, however, for it dealt only with the right of passage through the container space and not with the ownership of other items of property located therein.[293]

A related approach employs what may be termed the "stratum" theory of CBM ownership.[294] In his early article, Professor Williams asserted that "title to the seam normally includes everything contained in it, such as sulphur, iron ore, rock, and even diamonds and precious metals."[295] Although this proposition sounds plausible, it is not necessarily correct; the lone case cited by Williams was not at all on point.[296]

A third approach considers ownership of intermixed minerals. None of this precedent is especially helpful in resolving the question

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290. McGinley, *supra* note 19, at 380-82; Olson, *supra* note 19, at 778-80; Williams, *supra* note 2, at 220-21.

291. 22 A. 1035 (Pa. 1891).

292. The court stated:

> The coal in place was absolutely owned in fee-simple by the defendant. In a state of nature, the coal necessarily occupied space. How could the defendant own the coal absolutely and in fee-simple, and not own the space it occupied? Or, how is it possible to conceive of such a thing as ownership of the space independently of the coal?

22 A. at 1037. A subsequent decision held that the right to use the container space terminated upon the removal of the coal. Webber v. Vogel, 42 A. 4 (Pa. 1899). West Virginia has adopted this qualified version of the container-space rule. Fisher v. West Virginia Coal & Transp. Co., 73 S.E.2d 633, 638-40 (W. Va. 1952).

293. *See* Bowles, *supra* note 20, at 7-18; Cohen, *supra* note 19, at 11; Craig & Myers, *supra* note 20, at 779; McGinley, *supra* note 19, at 381-82.

294. Williams, *supra* note 2, at 219.

295. *Id.* (citations omitted).

296. Kentucky Diamond Mining & Developing Co. v. Kentucky Transvaal Diamond Co., 132 S.W. 397 (Ky. 1910), held that a general mineral reservation encompassed the right to mine for diamonds, so the grantee could not interfere with the grantor's mining efforts. This case does not support the quoted proposition, for it has nothing to do with the rights of the owner of a coal seam. If anything, this case would tend to support the claim by the owner of a reserved mineral interest against the owner of a coal seam who found other minerals therein.

of CBM ownership, however, and it provides virtually no support for the claims of the coal owners. For example, Williams assumed that the coal owner would have title to refuse from mining operations,[297] but recent commentators have emphasized two old Pennsylvania cases which hold that the lessee does *not* obtain title to refuse that consists primarily of materials other than those granted in the lease.[298] The "casinghead gas" cases[299] also involved commingled minerals, but they are not especially helpful because the disputes were over remuneration of the lessor, not ownership of the resource,[300] and the conflicting holdings "blur any possible legal analogy that might be made . . . ."[301] Also of little use are federal statutes granting lessees of one mineral the right to extract other minerals found in conjunction therewith.[302]

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297. Williams, *supra* note 2, at 220: "Just as the operator gets the worthless slate and mine refuse which are cast on the gob pile, so he might at least enjoy the right to reduce coal-gas to possession when it is liberated in mining development."

298. Appeal of Erwin, 12 A. 149 (Pa. 1887), held that ochre accumulated on the landowner's property from the washings of iron ore belonged to the landowner and not to the iron ore lessee. Doster v. Friedensville Zinc Co., 21 A. 251 (Pa. 1891), followed *Erwin*, holding that the right to the refuse from the lessee's zinc mining operations, which could be used to make roads and artificial stone, belonged to the landowner and not to the lessee of zinc and iron ores. *See* Craig & Myers, *supra* note 20, at 792-95; Cohen, Farnell & Thompson, *supra* note 22, at 185-87.

In this century, *Erwin* and *Doster* were followed in Wolfe v. Licking Gravel Co., 48 N.E.2d 254 (Ohio Ct. App. 1943), which held that the lessee of sand and gravel did not have the right to remove topsoil or overburden from the property. For recent cases on ownership of mine tailings *see* Eunice A. Eichelberger, Annotation, Mine Tailings As Real or Personal Property, 75 A.L.R. 4th 965 (1990).

299. *See supra* note 253.

300. *See* Cohen, Farnell & Thompson, *supra* note 22, at 188-89; Craig & Myers, *supra* note 20, at 795-98; McGinley, *supra* note 19, at 382-84. See discussion *supra* notes 253.

Ownership *was* at issue in a recent Texas case involving competing claims by holders of gas rights and oil rights over title to certain fluid hydrocarbons, but the opinion turned on a question of statutory interpretation and sheds no light on the issue of title to CBM. *See* Amarillo Oil Co. v. Energy-Agri Products, 794 S.W.2d 20 (Tex. 1990) ("casinghead gas" is statutorily defined as vapor produced from an "oil stratum"; although the Railroad Commission classified the well as an oil well, the proportion of oil was so low that the stratum was not an oil stratum but a gas stratum; the substance in question was therefore a "gas" and was owned by the holder of gas rights). *Compare* Ralph A. Midkiff, Note, *Phase Severance of Gas Rights from Oil Rights*, 63 TEX. L. REV. 133 (1984) (title in phase severance disputes should not be resolved with reference to statutory definitions but according to a rule of phase allocation based on whether the substance was primarily a liquid or a gas within the reservoir).

301. McGinley, *supra* note 19, at 384.

302. See Farnell, *supra* note 19, at 528-29, describing congressional action taken to clarify mining rights on federal lands involving uranium commingled with lignite and potash commingled with sodium. In the former instance, the legislation authorized removal of any lignite necessary to recover

A fourth approach asserts that the coal owners have a right to capture CBM as an "incidental mining right" that is implied by law in conjunction with their right to extract coal.[303] While a strong case can be made for the right of coal owners to *extract* and *capture* CBM as an incidental mining right, this theory does not support the ownership claims of coal owners because it implicitly presumes that some *other* party (presumably the gas owner) has *title* to the CBM. The incidental mining rights theory thus serves as the foundation for Rule #6, mutual simultaneous rights, and it will be discussed below in that context.

Only three courts have spoken on the question of CBM ownership, and all three have ruled in favor of the coal owners; none, however, provides strong authority in support of the absolute claims of the coal owners under Rule #2. The leading case, and the only published opinion, is a decision of the Pennsylvania Supreme Court in *United States Steel Corp. v. Hoge*.[304] The court treated CBM as a gas and applied the law applicable to ownership of gas, but it concluded that the coal owners had title to the CBM. The court explained:

> Thus, as a general rule, subterranean gas is owned by whoever has title to the property in which the gas is resting. [citations omitted] When a landowner conveys a portion of his property, in this instance coal, to another, it cannot thereafter be said that the property conveyed remains as part of the former's land, since title to the severed property rests solely in the grantee. In accordance with the foregoing principles governing gas ownership, therefore, *such gas as is present in coal must necessarily belong to the owner of the coal*, so long as it remains within his property and subject to his exclusive dominion and control.[305]

The court in *Hoge* treated ownership of CBM as a question of law, but it analyzed the particular deeds in order to determine whether

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the uranium. In the latter instance, the legislation provided that the United States reserved ownership of all commingled leasable mineral deposits, thereby empowering the government to lease both sodium and potash even though it had reserved only the potash. Neither of these examples is especially helpful because they involve legislation dealing with conveyances by the federal government. In terms of their content, these statutes embody a recognition of the practicality of allowing a party having the right to extract one mineral to extract a second mineral inextricably commingled therewith. On the other hand, the enactment of these statutes reflects an implicit concession that ownership of one mineral does not necessarily encompass ownership of a second mineral commingled therewith.

303. Mutchler & Sachse, *supra* note 22, at 1863.

304. 468 A.2d 1380 (Pa. 1983).

305. *Id.* at 1383.

the coal owner had allowed the surface owner to retain any right to extract CBM.[306]

The decision in *Hoge* is most accurately characterized as an application of the ownership-in-place theory of gas ownership,[307] which is consistent with the stratum theory of CBM ownership.[308] *Hoge* has been described as an application of the container space theory of CBM ownership,[309] but this description would appear to be inaccurate: the court expressly noted that the coal owner's property right to CBM was based on its presence within the coal and not on any rights in the space as such.[310]

Despite its support for the ownership claims of coal owners, *Hoge* cannot be read as establishing the absolute title of coal owners under Rule #2. As explained more fully below, the case dealt only with the right to extract CBM from virgin coal, and both the logic and language of the opinion indicate that coal owners would *not* have title to CBM that escaped into the gob zone.[311]

The trial court decision in *Rayburn v. USX Corp.*[312] provides some support for the ownership claims of the coal owners, but not as a matter of law under Rule #2. The court construed a 1960 deed to USX as including CBM within the grant of all mineral rights and not within the reservation of oil and gas rights, but it based the decision on the language of the deed in question and expressly de-

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306. *Id.* at 1384.

307. *See* Cohen, *supra* note 19, at 12.

308. *See* Kemp & Peterson, *supra* note 22, at 270.

309. Norvell, *supra* note 132, at 2; Feriancek, *supra* note 21, at 59.

310. 468 A.2d at 1384:

> We do not regard as inconsistent with this analysis the fact that the coal owner's interest in the situs occupied by the coal may be less than perpetual . . . . The potential for reversion of the situs, however, does not diminish the character of the coal as property of its grantee, or of the gas contained therein as a mineral *ferae naturae* resting inside the coal owner's property and falling within the dominion and control of the coal estate. The coal owner may, as any property owner, exercise dominion over his property so as to maximize his right of enjoyment thereover . . . . Hence, the coal owner may mine his coal, extract the gas from it, or both. (citations omitted).

311. *Hoge* is more correctly interpreted as establishing a rule of successive ownership, Rule #5. *See infra* notes 338-44.

312. No. 85-G-2661-W, 1987 U.S. Dist. LEXIS 6920 (N.D. Ala. July 29, 1987), *aff'd*, 844 F.2d 796 (11th Cir. 1988).

clined the parties' invitation to determine ownership of CBM as a matter of law.[313]

The unreported decision in *Pinnacle Petroleum Co. v. Jim Walter Resources, Inc.*[314] is the sole judicial authority consistent with Rule #2. *Pinnacle* holds that the coal owner has absolute title to the CBM as a matter of law,[315] including title to gob gas generated by longwall mining. The plaintiffs claimed title to CBM under their 1978 lease from the fee simple owners of oil, gas, and all other minerals except coal; the defendant claimed under a 1984 lease of the coal that also expressly granted the CBM within the coal seams and the gas in strata immediately above and below it.[316] On cross motions for summary judgment, the court granted partial summary judgment in favor of the defendant coal lessee.[317] Apart from a citation to *Hoge* as authority, the court's letter opinion provides virtually no explanation for its ruling.[318]

One possible objection to the absolute ownership claims of the coal owners under Rule #2 is that much of the CBM released in high extraction mining does not have its origins in the primary seam that is being mined but migrates from other strata that are fractured

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313. *Id.* at *5.

314. No. CV-87-3012 (Cir. Ct. Mobile County, Ala. July 28, 1989) (unpublished order granting partial summary judgment). We thank Conrad Armbrecht for providing us with copies of the pleadings, briefs, opinion and order.

315. The trial court ruled: "The law seems to me to be that a coal lease grants to the lessee the right to produce the coal bed gas regardless of whether or not coal mining is in progress." *Id.* (letter opinion of Douglas Johnstone, J.) (June 15, 1989) (on file with the author). The Order dated July 28, 1989, recites the holding:

> That, without a genuine dispute as to any material fact and as a matter of law, the Defendants (the coal owner and its coal lessee), as the owners of the coal, own and have the exclusive right to produce coalbed gas and that, therefore, the Defendants have the exclusive right to produce coalbed gas from the property made the subject of this lawsuit.

Id.

316. *Id.* (Deed of December 6, 1984, at 6-7) (Exhibit B to Brief of Defendant Jim Walter Resources, Inc.).

317. *Id.* at 1 (Order dated July 28, 1989). The grant of summary judgment was only partial because of a factual dispute as to whether all of the gas produced by defendant was CBM, as opposed to strata gas or natural gas, and whether it had the right to produce any gas other than CBM. *Id.* *See infra* notes 342-44 and accompanying text.

318. *Id.* (letter opinion dated June 15, 1989, at 2). While the court appears to have decided the issue as a matter of law, it may well have taken into account the language of the applicable leases, which were referred to in the parties' briefs.

as the gob zone collapses. Most of this methane apparently originates in thin seams of coal above the primary seam. Some of the gob gas may be strata gas that originated in coal seams but escaped and became trapped in other non-coal strata. More significantly, some portion of the gob gas may be ordinary natural gas produced by the disturbance or fracture of gas-bearing strata. Two distinct questions can be raised about the ownership of gob gas.

First, assuming that under Rule #2 the coal owner retains the right to capture CBM after it is released into the gob zone, does this include a right to strata gas released from associated non-coal strata or natural gas released from ordinary reservoirs? Several of the existing and proposed statutes would define CBM broadly to include gas produced from rock strata associated with coalbeds,[319] which would seem to encompass strata gas and possibly even natural gas in the gob zone. The legal basis for such a broad definition is questionable, however, for the ownership claims of coal owners are based on the presence of CBM within the coal and would not seem to include either natural gas or strata gas released into the gob zone from non-coal strata. In *Pinnacle Petroleum*, for example, the court held that the coal lessee had the exclusive right to produce CBM, but it granted only partial summary judgment because of remaining factual disputes about whether some of the gas was not CBM and whether the coal lessee would have the right to produce gas other than CBM.[320]

Under the stratum theory of CBM ownership, the coal owners would have title to any gas within the coal, and they arguably would

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319. VA. CODE ANN. § 45.1-361.1 (Michie Supp. 1990) ("occluded natural gas produced from coalbeds and rock strata associated therewith"); Minard Bill S.B. 63, § 2(d), *supra* note 230 (methane produced from coalbeds and/or rock strata associated therewith); Sharp Bill, H.R. 2998, 102d Cong., 1st Sess. para. 15(B) (1991) ("occluded natural gas produced (or which may be produced) from coalbeds and rock strata associated therewith"); House Energy Bill, H.R. 776, 102d Cong., 1st Sess. § 814, para. 15(B) (1991) (same).

320. The Court's Order of July 28, 1989, recited:

> [T]here appear to be factual disputes relating to whether all of the gas produced by Defendants was coalbed gas and whether Defendants had a right to produce any gas other than coalbed gas and that, therefore, this matter should proceed to additional discovery or trial on these limited issues.

Pinnacle Petroleum Co. v. Jim Walter Resources, Inc., No. CV-87-3012 (Cir. Ct. Mobile County, Ala. July 28, 1989) (order granting partial summary judgment); *see also* Morgan & McClanahan, *supra* note 20, at 23.

retain ownership of CBM released into the gob zone, but they would have no right to strata gas or natural gas in the gob zone. If the rights of the coal owners under Rule #2 were limited to capture of CBM released from coal seams, then ownership of gob gas would have to be apportioned between coal owners and gas owners.[321] While competing claims to the gob gas could be recognized and apportioned,[322] the administrative expense of the apportionment process could be considerable.

A second and more fundamental question is whether coal owners have title to *any* of the gas in the gob zone. Insofar as the ownership claims of coal owners are based on the presence of CBM within the coal seam, their ownership rights would be lost as soon as the CBM escaped into the gob zone. Claims by coal owners based on the container space theory are especially vulnerable, for the ownership rights of the coal owners would cease as soon as all of the merchantable coal had been extracted.[323] Even under the ownership-in-place theory employed by the court in *Hoge*, the coal owners' title to CBM would not extend to the gob gas.[324] While coal owners have a strong *equitable* claim to the gob gas by virtue of their having incurred the expense to produce it in conjunction with longwall mining, it is difficult to articulate a sound *legal* basis for their claim of ownership.

In sum, there is ample authority for the proposition that CBM is encompassed in a conveyance of coal rights. Most commentators

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321. It also would have to be apportioned among coal owners whenever the upper seams and primary seams had different owners.

322. The relative contribution of various strata to the production of gob gas raises factual questions that can be resolved with the assistance of experts. When the coal operator owns only the primary seam and the owners of other coal strata assert claims to the gob gas, the shares of the parties can be apportioned on the basis of such factors as the relative thickness and gas content of the various coals within the gob zone. Likewise, when gas owners claim that some portion of the gob gas is generated in non-coal strata, their claims can be the subject of expert testimony and proof as to the thickness and gas content of the reservoir. The court in *Pinnacle Petroleum* was prepared to allow discovery and trial of this issue, and there is no reason to believe that it is beyond the competence of a court to resolve.

323. Fisher v. West Virginia Coal & Transp. Co., 73 S.E.2d 633 (W. Va. 1952); Webber v. Vogel, 42 A. 4 (Pa. 1899).

324. Indeed, there is dictum in *Hoge* strongly suggesting that the landowner or gas lessee would have title to the gob gas. *See infra* text accompanying note 341.

believe that coal owners should have title to CBM,[325] and all of the decided cases have ruled in favor of the coal owners. On the other hand, there is scant authority supporting the absolute claims of coal owners under Rule #2. The commentators primarily base their support for the coal owners' claims on grounds of fairness or public policy rather than on any compelling principle or precedent.[326]

Of the three decisions, only the *Hoge* case articulates a theoretical basis for its ruling, and this theory would not extend to ownership of gob gas. *Rayburn* explicitly declines to decide the issue as a question of law. *Pinnacle Petroleum* purports to adopt Rule #2, but the court does not explain its ruling, so this unpublished opinion granting partial summary judgment is not persuasive authority. Thus, despite the judicial decisions favorable to the coal owners and the endorsement of their claims by many of the commentators, neither the existing precedent nor the available legal theories provide strong support for Rule #2.

3. Rule #3: Priority of Severance

Because both gas owners and coal owners can make convincing arguments that conveyances of gas or of coal include the right to extract CBM as a matter of law, several commentators have suggested that the resolution of competing claims by gas and coal owners may depend on the order in which their interests were created.[327] Under one possible variant of this rule, the right to extract CBM

325. *See* Bowles, *supra* note 20, at 7-22; Cohen, *supra* note 19, at 11, 15; McGinley, *supra* note 19, at 395; Mutchler & Sachse, *supra* note 22, at 1863, 1865 (as to minable coal); Williams, *supra* note 2, at 227. *But see* Craig & Myers, *supra* note 20, at 805-07 (advocating recognition of ownership in landowner or gas lessee); Farnell, *supra* note 19, at 538-41 (advocating statutory vesting of ownership in surface owner to resolve uncertainty and promote development).

326. *See* Bowles, *supra* note 20, at 7-22 (ownership by coal owners would eliminate extraction-related conflicts); Cohen, *supra* note 19, at 11 ("the use and marketing of mining by-products should go with the responsibilities"); Cohen, Farnell & Thompson, *supra* note 22, at 199 ("It is equitable that these obligations of long standing should be turned into benefits when coalbed gas becomes commercially valuable."); McGinley, *supra* note 19, at 377-78, 395 (emphasizes practical problems if gas owner prevails, and intent of the parties that CBM be the responsibility of the coal owner); Mutchler & Sachse, *supra* note 22, at 1867 (to encourage extraction, proposed legislation would give CBM rights in minable coal to coal owners and in non-minable coal to gas owners); Williams, *supra* note 2, at 227 ("sound policy should favor the owner of the coal.").

327. *See, e.g.*, Mutchler & Sachse, *supra* note 22, at 1863; Farnell, *supra* note 19, at 525.

would, as a matter of law, be conveyed with whichever mineral was first severed: if the earlier severing transaction involved a grant or reservation of coal rights, the CBM would be owned by the coal owner, but if the severance of gas rights came first, then CBM would be owned by the gas owner.[328] Under another possible variant, a court could apply a rule of construction that resolved the ambiguity against the grantor and favored the grantee: the right to extract CBM would pass to the grantee under a grant of either gas rights or coal rights; the right to extract CBM would not be retained by the grantor who excepted or reserved the gas rights or coal rights.

The priority of severance approach seems less likely to be adopted than either of the first two rules. In order to adopt Rule #3, the court essentially would have to adopt both Rule #1 and Rule #2 as a matter of law and then develop a priority of severance rule to resolve the competing claims of gas owners and coal owners. A court is unlikely to find that Rule #1 and Rule #2 are equally persuasive, however. In comparison with a rule that systematically favored either gas owners or coal owners, any priority of severance rule would seem arbitrary, turning on the fortuity of which mineral was severed first or whether the severing transaction was a grant or reservation of gas or coal.

Instead of inventing a priority of severance rule, a court that found Rule #1 and Rule #2 equally persuasive would be more likely to seek a resolution through an examination of the intentions of the parties as manifested in the instruments and possibly in other extrinsic evidence. This leads to consideration of Rule #4 — the case-by-case approach to determining CBM ownership.

4. Rule #4: Case-by-Case

If CBM ownership can be conveyed in conjunction with either gas or coal rights, priority of severance may not be the only factor

328. A subsidiary rule would be needed to resolve disputes whenever the severing conveyance mentioned both gas and coal, with a grant of one mineral and a reservation of the other. One solution would be to apply a rule of construction favoring the grantee. On the other hand, application of the "regrant" theory to a mineral reservation could result in treating CBM as having been conveyed with the grant of one mineral and re-conveyed to the grantor by the reservation of the other mineral, leaving title to CBM in the grantor.

relevant to the determination of which mineral owner obtained the rights to extract CBM. Other pertinent factors would include the language of particular instruments, the current state of knowledge concerning CBM at the time they were executed, and the actual intentions of the parties.

In *Hoge*, the court did not rest its decision entirely on the ownership-in-place or stratum theory. The court adopted a rebuttable presumption that the CBM was owned by the coal owner,[329] and it interpreted the coal severance deed in light of contemporaneous understandings about the nature and value of CBM in order to determine whether the coal owners had allowed the grantor to retain the right to extract CBM.

In particular, the court had to decide whether, in a 1920 deed of coal rights, the grantor's reservation of a right to drill *through* the coal seam for natural gas also reserved the right to extract CBM. Two dissenting justices interpreted the reservation in the deed as encompassing the right to drill for gas in any stratum, including the coal.[330] The majority instead accepted the appellant's interpretation, consistent with the language of the deed, "that the reservation intended only a right to drill through the seam to reach the unconveyed oil and natural gas generally found in strata deeper than the coal."[331] The majority found it "inconceivable" that the parties would have intended to reserve rights to a waste product that was dangerous and had no commercial value.[332] The case might have been decided

329. 468 A.2d at 1380, 1384 (Pa. 1983) ("Although coalbed gas contained in coal is, *ab initio*, property of the coal owner, that owner may allow others certain rights respecting the gas.").

330. 468 A.2d at 1385, 1388-90 (Flaherty, J., dissenting).

331. 468 A.2d at 1385.

332. The majority explained:

> Although the unrestricted term "gas" was used in the reservation clause, in light of the conditions existing at the time of its execution we find it inconceivable that the parties intended a reservation of all types of gas. In so finding, we are unable to overlook a basic question: Why would a party retain the right to something which is only a waste product with well-known dangerous propensities? . . . We find implicit in the reservation of the right to drill through the severed coal seam for "oil and gas" a recognition of the parties that the gas was that which was generally known to be commercially exploitable. It strains credulity to think that the grantor intended to reserve the right to extract a valueless waste product with the attendant potential responsibility for damages resulting from its dangerous nature.

468 A.2d at 1384-85 (citing McGinley, *supra* note 19, at 391).

differently if the severance had occurred twenty years later when the potential for CBM production was more widely understood, if the coal owner were claiming under a reservation instead of under a grant so that any ambiguity would have been construed against the coal owner, or if there were additional evidence about the actual understandings and intentions of the parties.

Although *Hoge* took into account the language of the deed, it would be incorrect to interpret the opinion as employing a case-by-case approach to CBM ownership. The court began its analysis with the legal presumption that the coal owner had title to the CBM, and the deed was examined with a view to determining whether the coal owner had relinquished these rights. Even the dissenting justices accepted the legal presumption in favor of the rights of the coal owner. Under their interpretation of the reservation clause in the coal lease, the lessor had retained a nonexclusive right to drill for gas, which did not negate the rights of the coal owner, so both the coal owner and gas owner would have had the right to extract CBM.[333]

In *Rayburn*, however, the decision turned entirely on the court's interpretation of the language of a 1960 coal severance deed. The parties had sought a more general ruling, but the court expressly declined to decide as a matter of law whether CBM was encompassed in the conveyance of coal or in the reservation of gas.[334] The grantors had reserved the oil and gas rights, and, as in *Hoge*, the court interpreted the deed as reserving only the right to drill *through* the coal seam to reach oil and gas in deeper strata. The court emphasized that the deed included a "requirement that all coal seams located in said lands penetrated in such exploration or drilling operations shall be encased or grouted off, except those which may be specifically exempted by United States Steel Corporation in writing."[335] The court said that this requirement essentially precluded any access of the grantors to gas within the coal seam.[336] Although it held that

333. 468 A.2d at 1389-90 (Flaherty, J., dissenting).

334. No. 85-G-2661-W, 1987 U.S. Dist. LEXIS 6920, at *5 (N.D. Ala. July 29, 1987), *aff'd*, 844 F.2d 796 (11th Cir. 1988).

335. *Id.* at *2.

336. The court concluded that the language of the deed was unambiguous, holding: "The clearly

the language of the deed was unambiguous, the court sought to bolster its conclusion by considering the status of the oil and gas industry in 1960 as further evidence bearing on the intentions of the parties.[337]

In contrast to *Rayburn*, the court in *Pinnacle* determined the ownership of CBM entirely as a matter of law, without any discussion of the language of the applicable deeds or the intentions and understandings of the parties. The absence of consideration of these factors may simply reflect the unique facts of that case, in that both deeds postdated the recent interest in CBM and contained no language that would give rise to any ambiguity. The decision in *Pinnacle* certainly does not hold that CBM will in all cases be decided as a matter of law, nor would it preclude parties in subsequent cases from basing their arguments on the language of the deeds or extrinsic evidence bearing on the intentions of the parties.

It is necessary to add a few words of qualification to the distinction that has been made between the case-by-case approach of Rule #4 and the other five rules that would treat ownership of CBM as a question of law. Even under a pure case-by-case approach, a court might often be able to grant summary judgment as a matter of law based on the specific instruments interpreted according to

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expressed intention is that the methane in the coalbed not be available to any well drilled by the grantors who reserved the 'oil and gas' or to their assigns. Otherwise, the words 'encased or grouted off' would be meaningless." *Id.* at *8. The court ignored a possible alternative explanation of this provision, under which the requirement of casing and grouting would have applied only to drilling "through" the coal seam to lower strata, a requirement that would have been imposed by statute even in the absence of this provision in the deed. Under this alternative interpretation, the quoted provision would *not* require casing or grouting when drilling "into" the coal seam (as opposed to "through" it) to extract CBM therefrom, and the deed therefore would not preclude access to the CBM.

337. The court asserted confidently:

> Regardless of what the grantor in this case conceivably might subjectively have meant, in 1960, in Tuscaloosa County, Alabama, occluded coalbed methane gas was not considered a gas to be included within the oil and gas exception to deeds. It was not at the time considered commercially recoverable and the language of the reservation clearly shows an intention that it not be available to the reserving grantors, and therefore an intention that they not be the owners of it.

Id. at *8-9. The court's conclusion here is somewhat stronger than the evidence appeared to warrant, for the record included a driller's log that in at least one instance reflected the production of commercial quantities of gas from a coal seam. *Id.* at *4 & n.8.

existing precedent. Each decision would establish the meaning of one or more provisions, at least within a given time period. Eventually, the case law may be sufficiently well developed that a pattern of sub-rules would emerge to provide interpretations for most of the relevant terms in mineral deeds and leases. If so, the net effect could be equivalent to a rule of law that one of the parties would always prevail unless the other party could establish the existence of one of the recognized exceptions.

Conversely, as the *Hoge* opinion demonstrates, none of the rules that treat ownership of CBM as a question of law would preclude consideration of the language of the particular instruments. At most, these legal rules would create presumptions that would apply in the absence of expression of a contrary intent. In this sense, any of the six rules will result in a case-by-case approach to CBM ownership insofar as it would be virtually impossible to ascertain ownership of CBM solely on the basis of a title search without a careful reading of the instruments and a knowledge of the local understanding as to the existence and value of CBM as of the date of the conveyance. Most lawyers who have handled transactions involving CBM are convinced that ownership of CBM is virtually certain to be determined on a case-by-case basis in this sense, regardless of whether the decided cases purport to determine ownership as a matter of law. If so, then judicial decisions in particular cases cannot definitively answer the question of who has title to CBM.

Finally, as the cases bear out, a case-by-case approach may tend to favor the claims of coal owners. *Hoge* and *Rayburn* both emphasized the understanding that until quite recently CBM was viewed as a dangerous waste product with little or no potential commercial value. While both of these cases involved reservations of gas rights, which tend to be construed against the grantor, neither court relied on this rule of construction. To be employing a case-by-case approach, a court must have rejected the gas owners' definition-based claims to ownership of CBM as a matter of law under Rule #1; once having done so, the court is unlikely to find that any particular grant or reservation of gas rights was intended to convey title to CBM unless the instrument explicitly referred to ownership of CBM.

5. Rule #5: Successive Ownership

Rule #5, successive ownership, posits that coal owners own CBM adsorbed within virgin coal and have the exclusive right to degasify coal seams in advance of mining, but they have no right to gas in other strata or in the rubble zone created by longwall mining. Although none of the commentators have recognized the possible existence of Rule #5, this rule has the strongest support on the basis of principle and precedent.

Under the container space theory of CBM ownership, the coal owner owns the container space only so long as it contains minable coal.[338] Prior to any mining activity, CBM in coal is viewed as gas in place and is owned by the coal owner who owns the container space. After removal of the coal, however, the container space would revert to the grantor, and the gas owner then would have the right to extract any CBM in the gob zone. Under this rule, the coal owner would have the exclusive right to engage in pre-mining degasification, and the gas owner would have the exclusive right to capture the gob gas.

Under the ownership-in-place theory applicable to natural gas, the owner of the tract has the exclusive right to drill for gas within the tract, but ownership in this fugacious mineral is lost if the gas migrates or is drained away by drilling on adjacent tracts. The Pennsylvania Supreme Court applied the ownership-in-place theory to CBM in *Hoge*, holding that, by virtue of the rules applicable to ownership of gas, the owner of the coal was the owner of CBM that was present within the coal. Under this theory, the coal owner's right would be lost as soon as the gas was liberated from the coal and escaped from the mine into non-coal strata. The coal owner could assert that it retained dominion and control over the CBM so long as it was present within the mine, but it could not claim any such right to gas in the gob zone above the level of the mined out seam.

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338. *See supra* note 323.

The coal owners may counter with the argument that the CBM in the gob zone has not really escaped and remains within the dominion and control of the mine operator, subject to extraction via gob wells. Nevertheless, the mine operator would not retain *exclusive* control over the gob gas, for the gas owners could drill competing gob wells to siphon off the gob gas, and they could do so without penetrating the coal or interfering with mining operations.[339] Because the coal owners do not have exclusive dominion and control over gob gas, fundamental principles of gas ownership would appear to confer title to gob gas on the gas owners and not on the owners of the coal from which it was released.[340]

The *Hoge* decision involved the question of ownership of CBM within virgin coal, and the court was not called upon to address the ownership of gas in the gob zone. Nevertheless, in explaining why the coal owner has title to CBM within the coal, the court strongly implied that the coal owner would *not* own the gob gas:

> In accordance with the foregoing principles governing gas ownership, therefore, such gas as is present in coal must necessarily belong to the owner of the coal, so long as it remains within his property and subject to his exclusive dominion and control. The landowner, of course, has title to the property surrounding the coal, and owns such of the coalbed gas as migrates into the surrounding property."[341]

The last sentence was dictum, and the court may have been referring to strata gas rather than gob gas. The court's logic is not so limited, however, and it would apply with equal force to gob gas. The coal owner owns the CBM only "so long as it remains within his property [*i.e.*, within the coal] and subject to his exclusive dominion and

339. Gas owners who knew that longwall operations were in progress could drill vertical wells terminating in strata above the coal seam. When the coal below a well was removed and the upper strata collapsed to form the gob area, the vertical well would begin to produce gob gas. While the coal owner might raise objections based on interference with mining operations or mine safety, a competing gob well is unlikely to create any such problems. The borehole need not penetrate within 100 feet of the coal seam, and extra gob wells should increase the rate of methane removal, thereby enhancing rather than jeopardizing mine safety.

340. Even if the coal owners retained ownership of CBM in the gob zone, the coal owners would have no right to protest the drainage of gob gas by gas owners drilling entirely within their own tracts. Thus, assuming that the coal owners retained title to CBM in the gob zone, their rights would be qualified by a rule of capture applicable to CBM in the gob zone.

341. 468 A.2d 1380, 1383 (Pa. 1983) (emphasis deleted).

control." Having escaped from the coal, both strata gas and gob gas are beyond the exclusive dominion and control of the coal owner and become the property of the owner of the surrounding strata. Thus, the most accurate interpretation of the opinion in *Hoge* is that the court implicitly adopted Rule #5, successive ownership, rather than Rule #2 or any of the other possible common-law rules.

The plaintiff in *Pinnacle* argued unsuccessfully for a version of the successive ownership rule based on the mistaken premise that *Hoge* had awarded CBM to the coal owner under the container space theory. Pinnacle's motion for partial summary judgment asserted that CBM extracted from a gob well was the property of the oil and gas lessee because the rights of the coal owner terminated upon the completion of mining.[342] In granting partial summary judgment to defendants, the court appears to have rejected the plaintiff's argument that the defendants had no right to any of the gob gas.[343] The court did not explain the basis for its decision, however, and the ruling could be altered if the case ever proceeded to final judgment.[344] Thus, the case should not be viewed as a definitive rejection of the successive ownership rule.

In sum, the rule of successive ownership is consistent with the theoretical basis of the coal owners' claims to ownership of CBM, and it is more consistent with the *Hoge* decision than any of the other possible common-law rules. Thus, a West Virginia court might well adopt this novel solution to the ownership question.

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342. Pinnacle Petroleum Co. v. Jim Walter Resources, Inc., No. CV-87-3012 (Cir. Ct. Mobile County, Ala.) (Brief in Support of Motion for Summary Judgment by Plaintiff at 10):

> Therefore, following the reasoning of the *Hoge* decision and the line of cases initiated by *Webber v. Vogel*, the coal owners' estate must terminate upon exhaustion of the mine. Since the Defendant has depleted the estate of all marketable coal resources, the right to produce and exploit coal bed methane gas vest [sic] in the Plaintiff who has contracted for such gas with the surface owner.

See also Reply Brief of Pinnacle Petroleum Corporation, at 4-5, 25; Morgan & McClanahan, *supra* note 21, at 23.

343. According to the court's order, the factual issues remaining to be tried related only to "whether all of the gas produced by Defendants was coalbed gas and whether Defendants had a right to produce any gas other than coalbed gas . . . ." *Id.* (order dated July 28, 1989, at 1). The order is ambiguous, but the court appears to have ruled that the defendants owned all of the coalbed gas, leaving a factual dispute only as to gas produced from non-coal strata.

344. Defendants' counsel Conrad Armbrecht informed us that the matter has been stayed by virtue of bankruptcy proceedings involving the defendant, Jim Walter Resources, Inc.

6. Rule #6: Mutual Simultaneous Rights

Under Rule #6, mutual simultaneous rights, the gas owners would have title to CBM, but the coal owners would have the right to capture CBM in the process of removing methane from the mines in the exercise of incidental mining rights. The rule of mutual simultaneous rights is our own creation, derived from an amalgam of two points that have been noted by proponents of the coal owners' claims to ownership of CBM: (1) the coal owners' practical and legal obligation to remove CBM in order to ventilate the mines, and (2) the concept of implied incidental mining rights.

While the first point has been raised by many commentators, most of them simply argue on equitable grounds that the benefit should accompany the burden.[345] Fewer have mentioned the second point,[346] and none have recognized that incidental mining rights would at most establish a right to *capture* CBM on the part of coal owners but would not negate the possibility of someone else (*i.e.*, the gas owners) having *title* to CBM.[347] None of the authorities have linked these theoretical arguments with the substantial body of judicial precedent that would support the rule of mutual simultaneous rights.

Implied mining rights "may vary with changed conditions, and would seem to include whatever privileges are fairly and reasonably

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345. *See, e.g.*, Cohen, *supra* note 19, at 11, 15 ("[t]he use and marketing of mining by-products should go with the responsibilities." "It seems equitable that these obligations should be accompanied by benefits as coalbed gas becomes commercially valuable."); Cohen, Farnell & Thompson, *supra* note 22, at 199 ("It is equitable that these obligations of long standing should be turned into benefits when coalbed gas becomes commercially valuable."); McGinley, *supra* note 19, at 395 ("the grantee or lessee of coal purchased the right to, as well as the responsibility for, coalbed gas.").

346. Craig & Myers, *supra* note 20, at 784-85; Mutchler & Sachse, *supra* note 22, at 1863.

347. Craig & Myers apparently assume that the right to vent CBM must either confer absolute ownership rights on the coal owners or is merely an incidental right that would not negate the ownership rights of gas owners:

> Resolution of this question again depends on whether the right to ventilate is coextensive with that nature or degree of control which implies ownership, or whether it is merely incidental to the right to mine. If ventilation qualifies merely as an incidental right, then the extraction of the gas by a gas lessee in advance of the coal grantee's mining operations would in no way encroach on the ownership rights of the coal grantee.

Craig & Myers, *supra* note 20, at 784-85. They do not seem to consider the intermediate possibility that the coal owners' incidental right might extend beyond venting CBM and confer a right to capture it but without creating ownership rights. Similarly, Mutchler and Sachse assume that incidental mining rights could vest the coal owners with title to CBM, and they fail to consider the possibility that coal owners might have a right to capture CBM without having title to it.

necessary in order to extract the mineral."[348] The factual basis for the implied incidental mining rights theory is the coal owners' responsibility to ventilate the mines and comply with federal mine safety statutes. In many mines, degasification is absolutely necessary because it would be impossible for mining to proceed without it. Even where not strictly necessary, degasification may be "reasonably necessary" if it is "ordinarily used in the business of coal mining."[349] Accordingly, incidental to mining, the coal owners would have the right to degasify the coal in advance of mining and to capture gob gas in order to prevent it from raising methane concentrations at the mine face.

Mutchler and Sachse rely heavily on the concept of incidental mining rights in arguing that the coal owners should have title to CBM.[350] For judicial support, they emphasize the following dictum from the Supreme Court of Appeals of West Virginia: "It is a general rule of law that, when anything is granted, all the means of attaining it and all the fruits and effects of it are also granted . . . ."[351] Based on this dictum, they assert: "[T]here is a strong argument that methane gas is associated so strongly with coal that the right to produce the methane gas is part of the implied mining right of doing what is necessary to produce the coal and to benefit from 'all the fruits and affects of it. . . .'"[352]

The dictum on which they rely is taken out of context,[353] however, and does not necessarily imply that coal owners would have title to CBM or even the right to capture it. It would be entirely conceivable for the coal owners to have a right to vent CBM without

348. Donley, *supra* note 287, § 141a.

349. *Id.*

350. Mutchler & Sachse, *supra* note 22, at 1863.

351. Armstrong v. Maryland Coal Co., 69 S.E. 195, 203 (W. Va. 1910) (quoting DANIEL M. BARRINGER & JOHN S. ADAMS, THE LAW OF MINES AND MINING IN THE UNITED STATES 576 (1900)).

352. Mutchler & Sachse, *supra* note 22, at 1863.

353. *Armstrong* held that the defendants had no right to reject a tendered deed of coal rights because all of the terms that the defendants reasonably could have demanded were already implicitly included as implied mining rights as a matter of law. The quoted language appeared in conjunction with a discussion of the implied right to haul coal through the tract from other tracts. This language was reiterated in Squires v. Lafferty, 121 S.E. 90, 91 (W. Va. 1924) (right to use road on surface for ingress and to drill test holes).

liability but have no right to capture it.[354] Under such a scenario, the coal owners would at least owe a royalty to the gas owners if they captured CBM,[355] and they might be required to disgorge all of their profits.

There is persuasive authority, however, supporting the proposition that coal owners who do not own the CBM would have an implied incidental mining right to capture it without incurring any obligation to compensate the gas owner. The line of cases is quite old, and it begins with *Kier v. Peterson*,[356] a Pennsylvania case that is often cited and discussed as an intermixed-mineral case.[357] In *Kier*, the Pennsylvania court held that oil extracted along with salt water from a salt well belonged to the salt lessee and not to the surface owner. While the court did not refer to incidental mining rights, the opinion clearly is consistent with this theory.[358]

Even more closely on point are decisions from other jurisdictions, including West Virginia, which state that an oil lessee has the implied right to capture any natural gas that must necessarily escape when drilling for oil.[359] The early West Virginia case of *Wood County*

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354. Prior to the *Hoge* litigation, this was the position of the Attorney General of Pennsylvania. 53 Op. Att'y Gen. 211 (Pa. 1974).

355. Where the surface owner had leased the gas rights in exchange for a royalty, both the surface owner and gas lessee would have potential claims against the coal owner, and it is not entirely clear whether the royalty should be paid to one or the other or divided between them.

356. 41 Pa. 357 (1862).

357. *See, e.g.*, Cohen, *supra* note 19, at 7-8; Cohen, Farnell & Thompson, *supra* note 22, at 185-87; Craig & Myers, *supra* note 20, at 792-95. These authorities discuss *Kier* in conjunction with the *Erwin* and *Doster* cases, analyzed *supra* at notes 298.

358. The court stated:

> The presence therefore of petroleum or mineral oil is naturally to be expected in the salt formation west of the Allegheny Mountains, and although its great value has not been fully appreciated until within a few years, still if it comes up as in the present instance, with the brine of a well which was opened in pursuance of, and must be regularly worked by, the express stipulations of the lease, it must belong to the lessee, who must separate it from the salt, and either let it run to waste or prepare it for the market. This is the evident justice of this case, which can only form the rule for a very small number of possible cases.

41 Pa. at 361-62. A concurring opinion took the position that the surface owner could have prevailed and obtained an accounting in a suit in equity; the action at law failed because the salt lessee's incidental extraction of oil in the exercise of the right to extract the salt was not an unlawful severance. *Id.* at 362-64.

359. *See* Guffey v. Stroud, 16 S.W.2d 527 (Tex. Comm'n App. 1929); Williamson v. Jones, 19 S.E. 436 (W. Va. 1894); Wood County Petroleum Co. v. West Virginia Transp. Co., 28 W. Va. 210 (1886); Annotation, *Right to Incidental Gas or Oil Under Mining Lease*, 64 A.L.R. 734 (1929).

Petroleum Co. v. West Virginia Transportation Co.[360] held that the lessee under a lease of "carbon oil" was not accountable to the lessor for the "considerable quantity" of natural gas that escaped with the "small quantities" of oil. The opinion described the right to extract the gas as one of the "incidents essentially or naturaly [sic] pertaining to" the enjoyment of the right to extract the oil.[361]

The value of *Wood County Petroleum Co.* as precedent might appear to be undermined by the fact that the opinion is premised on the assumption that oil and gas are not subject to ownership-in-place,[362] a point on which the case effectively has been overruled.[363] Since West Virginia now regards oil and gas as subject to ownership in place, one might have thought that the case was no longer good law.

Nevertheless, the holding of *Wood County Petroleum Co.* was noted with approval in *Williamson v. Jones*,[364] a case that is recognized as one of the earliest decisions to "correctly" treat oil and gas as subject to ownership in place.[365] The Court in *Williamson* upheld an injunction forbidding appellant from pumping oil from the property of certain heirs, stating that "petroleum in place, among the strata of the earth, where it belongs, is a part of the inheritance." Instead of overruling *Wood County Petroleum Co.*, the court in *Williamson* distinguished it, and in so doing employed dictum endorsing the concept of incidental mining rights.[366] *Williamson* strongly

360. 28 W. Va. 210 (1886).

361. *Id.* at 215.

362. The court indicated that it would have ruled in favor of the lessor if the gas were "susceptible of absolute ownership":

> If the hydro-carbon or natural gas now in controversy belongs to the class of things, which are incapable of being absolute property but are the subject of qualified property only, such as those above mentioned [wild animals, percolating waters], then it is clear this gas was not the property of the plaintiff, and the appellant is not liable for its use and appropriation; but if on the other hand said gas is susceptible of absolute ownership, then it is a part of the realty of the plaintiff, to which the appellant acquired no right under said lease, and is therefore liable to the plaintiff for the value of the same. The important and decisive inquiry in this cause is, therefore: To which category does hydro-carbon gas belong?

28 *Id.* at 215-16.

363. *See* Consolidated Gas Supply Corp. v. Riley, 247 S.E.2d 712, 716 n.4 (W. Va. 1978); Boggess v. Milam, 34 S.E.2d 267 (W. Va. 1945).

364. 19 S.E. 436 (W. Va. 1894).

365. *See* Boggess v. Milam, 34 S.E.2d 267, 269 (W. Va. 1945).

366. After describing ownership of oil and gas in place, the court explained:

supports the right of coal owners to capture CBM that escapes as a "natural and inevitable incident" to the mining of coal. If the oil lessee has the right to capture natural gas that escapes with the oil, so too must the coal owner have the right to capture CBM that would otherwise be vented.

Finally, the two lower court opinions in *Hoge* would have adopted Rule #6 and allowed the coal owner to capture CBM as an incidental mining right. The trial judge held that the gas owner had title to the CBM but stated in dicta that the coal owner had the right to capture it in the course of mining:

> The right of the owner of the coal to ventilate the mine . . . creates no property right by reason thereof in the coalbed gas, except that the coal owner, if he chooses, could capture the gas released in the course of the mining operation and make separate sale of it.[367]

The Superior Court reached the same conclusion as the trial court:

> [I]f the coal owner reduces the coalbed gas to his possession as it is released incidental to mining the coal and removed from the mine pursuant to the right of ventilation rather than wasting it into the atmosphere, then he is entitled to its possession and the profits from its sale, if any, just as the chancellor held.[368]

> I do not understand the case of Petroleum Co. v. Transportation Co., 28 W. Va. 210, to lay down a different doctrine, even as to natural gas, so long as it is confined in the strata where it is found. It is only when it escapes out of the possession of the owner that the right of property is gone. This follows as an inevitable result of its fugitive nature. In that case the lease was for carbon at a fixed royalty, and the gas escaped with it, and thus ceased to be a part of the realty, and this was shown to be a *natural and inevitable incident* to the sinking of all oil wells in that region, as verified by an experience of 20 years; and, while the grant was for the specific purpose of mining and removing carbon oil, still the lease necessarily included the gas which came up with the oil as an inevitable concomitant; that it was essential that the well should be kept open in order to pump the oil, and the gas necessarily, from its nature, and by its own force, issued from it. And the court held, under the circumstances of that case, that the lessee could, in any proper manner that he might choose, appropriate and use this escaped, wild gas without accounting therefor. As to oil coming up in a salt well, see Kier v. Peterson (1861) 41 Pa. St. 357. In the case in 28 W. Va. 210, cited above, the court evidently regarded the oil as part of the realty, if not the gas also, as long as it remained in the earth, and subject to the owner's control, whether such owner be lessor or lessee; but from its nature the title of such owner is gone when the gas escapes into the land of another, and comes under his control.

19 S.E. at 442 (emphasis added).

367. United States Steel Corp. v. Hoge, No. 682, slip op. at 17-18 (C.P. Greene County, Pa. March 24, 1980).

368. United States Steel Corp. v. Hoge, 450 A.2d 162, 172 (Pa. Super. 1982). The Superior

A rule of mutual simultaneous rights, Rule #6, would permit the coal owner to extract and capture CBM in conjunction with mining activity without incurring any obligation to compensate the gas owner. These incidental mining rights would not, however, provide any basis for claiming ownership of CBM in place, nor would it restrict the gas owners' right to extract CBM. The incidental mining rights simply would allow coal owners to capture gas that they otherwise would have vented, giving rise to a regime of mutual simultaneous rights.

While common sense supports the incidental mining right of oil lessees or coal mine operators to capture methane gas released by mining activity if it otherwise would be wasted, neither logic nor justice would excuse them from compensating the actual owner of the gas. A court could hold that the coal owner had a right to vent CBM without liability but that it would owe a royalty for any CBM it captured. The concurring opinion in *Kier* advocated such an approach, stating that the salt lessee's capture of oil released in the process of extracting the brine was not a legal wrong but that the lessor should have brought an action in equity for an accounting.[369] The State of Colorado incorporates this version of the rule in its mining leases, allowing the coal lessee to capture CBM "provided that the gas is removed as a mining safety procedure prior to mining and that a royalty be paid to Lessor . . . ."[370] Recognition of the

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Court rejected U.S. Steel's argument that its right to ventilate gave it *title* to CBM in place. *Id.* at 170-72. In analyzing *Kier*, the Superior Court also considered *Erwin* and *Doster*, the two cases involving ownership of refuse from processed ore. *See supra* notes 298 & 357. The court correctly recognized that *Erwin* and *Doster* are distinguishable in that the washings were left on the landowners property and could be used by the landowner, whereas in *Kier* the oil was not left on the property and was not refuse but a separate commingled mineral that was captured as a byproduct in the extraction of the primary mineral and would have been wasted if not captured. (We are not persuaded by Craig & Myers' assertion that this distinction "does not predominate over the fundamental inconsistency between *Doster* and *Erwin* on the one hand and *Kier v. Peterson* on the other." Craig & Myers, *supra* note 20, at 795.).

369. 41 Pa. 357, 363-64 (1862).

370. Kemp & Peterson, *supra* note 22, at 268. The Colorado lease provision reads:

> COAL MINE GAS Methane Gas or other volatile gases produced, saved, and/or sold by the coal mining Lessee from minable coal measures and from roofs and floors of minable coal measures shall be the property of the Lessee provided that the gas is removed as a mining safety procedure prior to mining and that a royalty be paid to Lessor . . . Gas that is uneconomical to produce may be vented or flared . . . Methane gas or other volatile gases produced by the oil and gas Lessees from the minable coal measures and from roofs and floors of minable coal measures prior to mining shall be the property of the oil and

coal owners' incidental right to capture CBM subject to payment of a royalty would represent a hybrid of Rules #1 and #6.

Even if the incidental mining right theory embodied in Rule #6 would allow the coal owner to capture CBM without paying a royalty, it would *not* give the coal owner title to the CBM in place. To the contrary, the incidental mining right theory *presumes* that the party exercising this right has no title to the associated mineral and would have no right to remove it except in conjunction with the mining of the primary mineral. Thus, in *Guffey v. Stroud*,[371] the court recognized that the oil lessee would have the right to capture gas that must escape in the proper drilling for oil, but it held that after the oil well was a failure the oil lessee had no right to take the appellant's gas.

Thus, Rule #6 would empower the coal owner to extract and capture CBM in conjunction with mining activity, but it would not permit the coal owner to extract CBM from unminable coal. With respect to minable coal seams, Rule #6 could give rise to disputes whenever a gas owner protested that a coal owner's degasification program was not "incidental" to mining activity.[372] Conversely, al-

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gas Lessee under the terms of the oil and gas lease . . . .

Id. The Colorado lease provisions only allow the coal lessee to capture gas removed "prior to mining" and would not allow the coal lessee to capture gob gas, even though the removal of gob gas is frequently required as a safety measure.

371. 16 S.W.2d 527 (Tex. Comm'n App. 1929).

372. The rule of mutual simultaneous rights would raise two related questions. First, would the coal owner's right be limited to degasification that was a "natural and inevitable" incident of mining, or could the coal owner employ extraction techniques beyond those that would have been used for ventilation purposes? The Colorado lease provisions would only permit the coal lessee to capture gas that was "removed as a safety measure," but it is not clear how such a limitation could be enforced or whether this provision would preclude the use of techniques which extract more CBM than would be necessary for safety purposes alone. The concept of incidental rights should authorize extraction of CBM to the extent "reasonably necessary" to minimize the costs and delays associated with ventilation. In determining the limits of "reasonably necessary" extraction of CBM in disputed cases, the courts may be able to obtain guidance from existing precedent discussing the extent of incidental rights associated with extraction of coal, oil, and gas.

Second, would the coal owner's incidental rights be limited to extraction in direct temporal association with mining activity, or could a coal owner engage in degasification from surface boreholes before sinking a shaft or before even platting a mine? Under a "reasonably necessary" standard, there would be no reason to presume that advance degasification was unnecessary, so at least in some circumstances it probably would be allowable. Yet if the coal owner were not limited in the methodology or timing of degasification, then the coal owner essentially would have the same right to

though the gas owner with title to CBM would have the right to extract CBM without limitation, Rule #6 would give rise to disputes whenever CBM extraction interfered with mining activity.

D. Summary of the Possible Common-Law Rules

The discussion of the six possible common-law rules has demonstrated the indeterminacy of CBM ownership at common law. The absolute ownership claims of the gas owners and coal owners, reflected in Rule #1 and Rule #2, both rest on plausible definitional or conceptual foundations ("CBM is a gas" or "CBM is part of the coal"), and both have some support from existing authorities, but neither is clearly the predominant position.

In practice, most attorneys today believe that the courts will determine ownership of CBM on a case-by-case basis,[373] Rule #4, and there is little precedent available to aid in predicting how any given case will be decided.[374] In the face of this uncertainty, development of CBM resources today usually requires some form of negotiated compromise among gas owners and coal owners,[375] and a 50-50 split is not an uncommon arrangement.[376]

Whenever a gas owner has title to CBM, either as a matter of law or on a case-by-case basis, both principle and precedent strongly suggest these rights are qualified by the incidental mining rights of the coal owner, yielding a regime of mutual simultaneous rights, Rule #6.[377] Conversely, whenever a coal owner has title to CBM, either as a matter of law or on a case-by-case basis, both principle

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extract CBM as the gas owner, creating the potential for wasteful competitive drilling by both parties. Existing precedent on the incidental rights of mineral owners should not be of much help on this issue.

373. *See, e.g.*, Counts, *Legal Aspects*, *supra* note 22, at 30; Feriancek, *supra* note 21, at 60; Kemp & Peterson, *supra* note 22, at 270; Morgan & McClanahan, *supra* note 21, at 23; Morrow, *supra* note 20, at 6.13. *See also*, McGinley, *supra* note 19, at 395 ("the courts of each jurisdiction will, in the last analysis, determine the rights of coalbed gas ownership through a case by case analysis of the instrument of conveyance and the intentions of the parties thereto").

374. There appears to be a general sense that for practical and political reasons CBM is more likely to be awarded to coal owners in the Eastern states, where the coal is minable and coal interests predominate, and to gas owners in the Western states, where much of the coal is unminable and gas interests predominate.

375. *See* Counts, *Ownership Questions*, *supra* note 22, at 70 ("These ownership and competing

and precedent (especially *Hoge*) imply that these rights are limited to CBM in place within the coal and that the gas owner would have title to any gob gas liberated from coal and non-coal strata by high extraction mining, yielding a regime of successive ownership, Rule #5.

Moreover, it is possible for both Rule #5 and Rule #6 to apply under the following scenario. By virtue of Rule #5, the coal owners would have title to CBM in place, but the gas owners would have title to the gob gas. While the gas owners would have title to gob gas, Rule #6 would recognize the coal owners' right to capture gob gas in conjunction with mining activity, so that both coal owners and gas owners would have the right to drill gob wells.

VI. Is There an Optimal Common-Law Solution to the Ownership Question?

A. Relevant Criteria in Selecting an Optimal Rule

An optimal solution to the ownership question should satisfy two essential criteria: promotion of policy goals and fairness to the parties. The fundamental policy goal is to promote CBM development without interfering with the extraction of coal or natural gas. In economic terms, the goal should be efficient use of these resources,[378]

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estates questions must be resolved by negotiation and agreement on a project-specific basis."); Kemp & Peterson, *supra* note 22, at 277 ("[t]he coal-bed gas developer should attempt negotiations with the coal owner to provide for the orderly and equitable development of both resources."); Morgan & McClanahan, *supra* note 21, at 23 (advising agreements with surface owner and all mineral lessees). In some instances, the CBM developer reaches separate agreements with the coal and gas owners, while in others the CBM developer obtains joint agreement of the coal and gas owners for the establishment of an escrow fund from which the parties can resolve their competing claims at a later date. *See supra* note 152.

376. The authors are aware of several transactions in which a coal owner and a gas owner (who was the surface owner) split the traditional 1/8 royalty, with each receiving a 1/16 share. *See supra* note 152.

377. An intermediate alternative would be a hybrid of Rule #1 and Rule #6 that recognized the coal owner's incidental right to capture CBM but protected the ownership rights of the gas owner by requiring payment of an appropriate royalty.

378. The analysis of this criterion is illuminated by the new wave of "law and economics" scholarship that considers the efficiency of alternative legal rules. *See, e.g.*, Richard A. Posner, Economic Analysis of Law (3d ed. 1986); A. Mitchell Polinsky, An Introduction to Law and

which involves maximizing the total value of CBM, coal, and natural gas, taking into account any administrative costs and any costs imposed on third parties, such as the impact on global warming.

We concluded that our primary objective should be to encourage the capture of CBM in conjunction with mining, especially longwall mining, because the current practice of venting CBM dissipates this valuable resource and contributes to the problem of global warming. Encouragement of CBM extraction independent of mining activity is of less immediate concern, because CBM left in the ground today will be available in the future when other nonrenewable fuels have been depleted.

Longwall mining deserves special emphasis. Though relatively few in number, longwall mines are responsible for a substantial percentage of all methane emissions from mining. Longwall mining lends itself to efficient methane extraction through a combination of pre-mining vertical wells, in-mine horizontal boreholes and gob wells, and the scale of operation is large enough to justify investment in the infrastructure needed to utilize the gas on-site or transmit it to the pipeline system.

The criterion of fairness takes into account the parties' reasonable expectations and any past investments that would be affected by the determination of title to CBM.[379] Because CBM until recently was viewed as a nuisance, it is unlikely that the price paid for coal rights or gas rights in severing transactions was influenced by the

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ECONOMICS (2d ed. 1989). Ronald Coase recently received a Nobel Prize in Economics for his contribution to this literature. His two most widely-cited works are R.H. Coase, *The Problem of Social Cost*, 3 J. LAW & ECON. 1 (1960); R.H. Coase, *The Nature of the Firm*, 4 ECONOMICA (N.S.) 386 (1937). While the analysis in this section is influenced by modern law and economics, the discussion will avoid technical jargon and forego extensive citation to the relevant literature.

379. Our criterion of fairness, or distributive justice, is non-technical and is not linked with any particular philosophical school. Our conception of fairness is influenced by our understandings of the Golden Rule, the Kantian "categorical imperative," John Locke's "labor theory of value," John Rawls' notion of "justice as fairness" and Frank Michelman's discussion of utility and fairness. *See* IMMANUEL KANT, THE METAPHYSICAL ELEMENTS OF JUSTICE (1797) (John Ladd trans. 1965); JOHN LOCKE, TWO TREATISES OF GOVERNMENT 303-20 (P. Lasett ed. 1960); JOHN RAWLS, A THEORY OF JUSTICE (1971); Frank I. Michelman, *Property, Utility, and Fairness: Comments on the Ethical Foundations of "Just Compensation"* Law, 80 HARV. L. REV. 1165 (1967) [hereinafter Michelman, *Property, Utility, and Fairness*].

possible value of CBM. Because ownership today remains indeterminate, subsequent purchasers of previously severed coal or gas rights should not have had strong expectations with respect to CBM. No particular category of claimants — coal owners, gas owners, or surface owners — has a strong claim of title to CBM based on investments or expectations.

The fairness-based arguments that have been advanced on behalf of coal owners and gas owners do not conclusively favor either side. The coal owners' claims are based on CBM being part of the coal and on their having responsibility for removing CBM in order to safely mine it. The gas owners' claims are based on their expectation of a right to extract all naturally occurring gas from any strata in which it may be found, including coal seams. The surface owners' expectation of a royalty from all gas underlying the property also lends support to the claims of the gas owners, for if the coal owners had title to CBM they would not appear to owe any royalty to the surface owners.

B. Evaluation of the Six Possible Common-Law Rules

1. Evaluation of Rule #4

In selecting an optimal rule, it was evident from the outset that Rule #4, which begins with the presumption that each case must be decided on its own facts, is inferior to any of the other five rules, which treat CBM ownership as a question of law. Title to CBM remains uncertain precisely because most practitioners believe that ownership will be resolved on a case-by-case basis.

While the case-by-case approach eventually may yield a predictable pattern of sub-rules, it certainly has not yet done so nor is there is any prospect that it will do so in the foreseeable future. *Hoge* remains the sole appellate opinion, and neither *Rayburn* nor *Pinnacle* constitutes persuasive authority. The conflicting claimants seem to be reluctant to bring test cases to clarify their rights. Hence, whenever a court has the opportunity to address the issue, we recommend that it adopt a rule establishing presumptive title to CBM as a matter of law.

2. Evaluation of Rule #3

Among the five rules that create legal presumptions as to ownership of CBM, Rule #3, the priority of severance rule, has the least to recommend it. Rule #3 would create arbitrary winners and losers, for the ownership of CBM would turn on the fortuity of whose deed came first or whether the severing transaction involved a grant or a reservation — matters which seem to have nothing to do with fairness or the promotion of efficient resource development.[380]

Presumably, the criteria of fairness and efficiency should yield the same results regardless of the order or format in which the minerals were severed.[381] Application of Rule #4 could be expected to generate a non-uniform pattern of ownership, with CBM under some tracts held by gas owners and CBM under other adjacent tracts held by coal owners. Such a result would be perceived as arbitrary, and it could be expected to impede CBM development in comparison with a rule that consistently awarded CBM to either gas owners or coal owners.[382]

3. Evaluation of Rule #1 and Rule #2

A majority of the commentators have concluded that the fairest and most practical solution would be for coal owners to have title to CBM as under Rule #2.[383] Conferring ownership of CBM on the

380. While we believe priority of severance should not determine ownership of CBM, we express no opinion as to whether it should be a factor in the determination of mining rights with respect to conflicts between coal owners and gas owners when the extraction of one mineral interferes with extraction of the other.

381. Under any conception of fairness, it is unlikely that the timing or format of the severing transaction would be a relevant criterion in determining ownership of CBM. (The priority of severance rule achieves a fair result only insofar as it functions as an appropriate tie-breaker when the intentions and expectations of the parties are uncertain.) Public policy may favor either gas owners or coal owners, but it should do so consistently, without regard to the priority of severance.

382. For example, instead of employing a uniform agreement for all coal owners within the field, the CBM developer would have to negotiate one version for coal owners who also owned CBM rights and a different version for coal owners who did not own CBM rights. Moreover, in negotiating with the two groups of coal owners, the CBM developer would have to accommodate their different interests without subjecting itself to inconsistent obligations.

383. Bowles, *supra* note 20, at § 7.07[5]; Cohen, *supra* note 19, at 11, 15; Cohen, Farnell & Thompson, *supra* note 22, at 193, 199; McGinley, *supra* note 19, at 391, 395; Williams, *supra* note 2, at 224-27. *See also* Mutchler & Sachse, *supra* note 22, at 1863 (CMB in minable coal should be owned by coal owners, but CBM in nonminable coal should be owned by gas owners). *But see* Craig & Myers, *supra* note 20, at 804-08 (advocating ownership by surface owner or gas lessee); Farnell, *supra* note 19, at 539 (proposing legislation conferring ownership on surface owner absent an express conveyance of CBM).

coal owners is said to be equitable because they have always borne the responsibility for removing CBM from the mines, whereas few gas owners until recently had any reasonable expectations of commercially developing the gas in coal seams. Treating the coal owners as owners of the CBM is practical because it would avoid many of the extraction-related conflicts described in Part II, avoiding the need for regulatory solutions.

Awarding ownership of CBM to the coal owners is consistent with modern economic analysis of legal institutions. Economic theory suggests that the efficient solution to the conflicts between coal mining and CBM extraction would be for a single party to own both resources.[384] As sole owners of both the coal and the CBM, the coal owners should, in theory, seek to maximize the joint value of these two minerals, developing CBM resources to the point that marginal gains from additional CBM production did not exceed marginal losses from interference with mining.

Despite the theoretical attractiveness of the single-owner solution, the conferral of CBM ownership on coal owners may fail to optimize CBM production due to certain practical constraints. Uncertainty as to ownership is not the only reason why coal owners and operators today are venting CBM instead of capturing it. First, the CBM in a seam of coal represents only a small percentage of its value, roughly 1-3%.[385] Second, the coal industry may be reluctant to develop a resource that would compete with its primary product. Third, and perhaps most importantly, the coal owners and operators lack expertise in certain technological and regulatory matters that are es-

384. Within the field of law and economics, the decisions of a self-interested "single owner" serve as the standard against which most legal rules are evaluated. *See, e.g.*, RICHARD A. POSNER, ECONOMIC ANALYSIS OF LAW 58 (3d ed. 1986); Richard A. Epstein, *Regulation—and Contract—In Environmental Law*, 93 W. VA. L. REV. 859, 865 (1991).

385. For an industry estimate in terms of current dollar value, see *supra* note 219. In terms of heating value, a typical pound of coal may yield roughly 12,500 Btu, so a ton would yield 25,000,000 Btu. If this ton of coal contained 500 scf of CBM, the gas would yield roughly 500,000 Btu, or 2% of the heating value of the coal. (If gas content ranged from 250 scf to 750 scf, this would be consistent with the 1%-3% estimate.).

These figures do not take into account the additional value of the substantial quantities of gob gas released from other strata in conjunction with longwall mining. When gob gas is included, the heating value of methane from a longwall operation may be as great as 10% or even 15% of the heating value of the coal in the primary seam.

sential to the extraction and utilization of CBM. The development of CBM necessarily will bring "outsiders" into the mine who can be expected to impinge upon the autonomy of coal mining operations.[386] The outsiders may be employees of specialized CBM developers under contract with the mining company or personnel from other divisions of a diversified energy company. In either case, managerial personnel in the mining industry are resistant to the potential loss of autonomy that would result from a program of CBM capture.[387]

Because of the understandable tendency of coal operators to sacrifice CBM production in the interest of mining productivity, some form of regulatory program would be needed to enhance the incentives for CBM recovery if title to CBM were awarded to the coal owners under Rule #2.[388] Although a government program of financial incentives would be appropriate in any event to internalize the environmental costs of methane emissions from mining, the cost of these incentives to the public or to the coal owners could be substantially lower if the gas owners had title to CBM. Whereas coal owners naturally would tend to enhance coal production at the expense of CBM production, gas owners would have no competing goals and could be expected to zealously maximize CBM production. Also, whenever gas rights have been severed from the surface, the gas owners should be familiar with the technical and regulatory aspects of CBM development, so they should find it easier to contract with firms providing specialized CBM extraction services.

These arguments about expertise and incentives do not, however, provide an overwhelming reason for awarding CBM to the gas own-

386. For the coal mining management to preserve its autonomy in day-to-day operations, which could interfere with extraction of CBM, it would have to guarantee a minimum economic return to the CBM developer. *See* Wallace, *supra* note 132, at 2.01-2.05.

387. In theory, a diversified energy company should be expected to act as a single owner, but in practice the managerial personnel are primarily if not solely concerned with the activities and profitability of their own divisions. The head of mining operations may be reluctant to cooperate with a CBM program that could lead to adjustments and delays which would reduce the profitability of mining, especially if the gains from capture of CBM would be attributed to another sector of the company.

388. Possible alternatives include positive financial incentives (a tax credit or subsidy), negative financial incentives (a tax on methane emissions), or direct regulation (e.g., a ceiling on CBM emissions per ton of coal mined, or a prohibition of venting whenever capture was economically feasible).

ers instead of the coal owners. While gas owners undoubtedly have more expertise and more incentive to capture CBM than do coal owners, gas owners still need the active cooperation of coal owners and operators if they are to succeed in the extraction of CBM in conjunction with mining. Because Rule #1 would give the coal owners no intrinsic economic interest in cooperating, the prospects for developing CBM under this rule would not be favorable.

Supporters of the gas owners' claims to CBM also have pointed out that Rule #1 would avoid certain allocational problems that would arise under Rule #2 whenever methane was extracted from various strata having different owners.[389] These allocational problems associated with gas from multiple strata would rarely arise under Rule #1, because all of the methane, from all strata, would be owned by the gas owners.[390]

On the other hand, Rule #1 would give rise to extraction-related conflicts between CBM development and coal mining operations, the resolution of which would require the creation of a special regulatory system. While these conflicts would not be entirely eliminated under Rule #2, they would at least be amenable to unilateral resolution by the coal owner without resort to an external referee.

In sum, neither Rule #1 nor Rule #2 is clearly preferable. Either of these rules would be perceived as unfair by the losing party. The single-owner solution of Rule #2 is more efficient in theory, but Rule #1 confers title on the party that values CBM more highly and has greater expertise in its production and utilization. Rule #1 would

389. The problem would be most acute in connection with gob wells, where some of the gas may be strata gas or natural gas, and most of the gas is released from unminable coal seams in the overburden which may not be owned by the owner of the primary seam. If ownership of gob gas is based on ownership of rights with respect to the strata from which the gas was released, then complex and expensive technical analysis would be needed to determine the vertical extent of the gob zone and the relative proportions of the gob gas produced by each affected stratum. Similar allocational problems also would exist with respect to degasification in advance of mining whenever more than one person owned the coal seams involved in a multiple-seam completion.

390. The separate conveyance of gas in different strata is far less common than the separate conveyance of coal in different seams. Moreover, it is unlikely that more than one substantial gas-bearing stratum would be found in close proximity to a primary coal seam. Thus, it would be rare for more than one gas owner to assert title to gob gas under a particular tract.

generate extraction-related conflicts, but Rule #2 would create problems of allocation.

4. Evaluation of Rule #6

Rule #6, the rule of mutual simultaneous rights, is a variant of Rule #1 under which the gas owners' title to CBM is qualified by the coal owners' incidental right to capture CBM in conjunction with mining. Rule #6 is preferable to Rule #1 insofar as it gives coal owners an incentive to capture CBM instead of venting it. It may also give the coal owners a greater incentive to engage in pre-mining degasification, years in advance of mining, if for no other reason than to forestall efforts by gas owners to degasify the virgin seams. On the other hand, Rule #6 could generate additional conflicts if coal owners sought to extract CBM from coal they did not actually intend to mine. This one new area of dispute under Rule #6 should not be a significant problem, however,[391] and it would not outweigh the efficiency gains from allowing coal owners to capture CBM incidental to mining activity.

In terms of fairness, it is not clear whether Rule #1 or Rule #6 is fairer to all parties. On balance, the fairness of Rule #6 depends on one's view of the fairness of Rule #1. Those who accept the ownership claims of the gas owners will perceive Rule #6 as unfair in comparison with Rule #1, whereas those who believe that the claims of the coal owners are at least equally compelling should view Rule #6 as a fair compromise of the justice-based claims of both gas owners and coal owners.

In comparison with Rule #2, Rule #6 has both advantages and disadvantages. The primary advantage is that it gives gas owners the right to extract CBM from unminable coal which coal owners would have little incentive to develop. By allowing both gas owners

391. Disputes over whether degasification was incidental to mining could be minimized by a regulation requiring the coal owner to submit a mining plan in conjunction with any pre-mining degasification activity.

and coal owners to extract CBM from minable seams, Rule #6 would establish a rule of capture that could engender competition and increase the pace of development. Rule #6 could give rise to conflicts and wasteful duplication of effort, however, if both parties simultaneously sought to degasify the same virgin coal seams or to drill competing gob wells above the same longwall panel.[392] To resolve such conflicts, Rule #6 would require a regulatory program as elaborate as that under Rule #1.[393]

5. Evaluation of Rule #5

In terms of extraction-related conflicts, Rule #5 represents a middle ground between Rule #1 and Rule #2. Relative to Rule #1, Rule #5 would substantially reduce the area of conflict because the gas owners would have no right to extract CBM from coal seams, where the potential for interference with mining from well casings and stimulation is most acute. Relative to Rule #2, Rule #5 would preserve the autonomy of coal owners with respect to pre-mining degasification and in-mine drainage, but it would create a potential for conflict with respect to degasification of the gob zone, with possible safety problems if the coal operators do not have control

392. In theory, the parties might negotiate compromise solutions to avoid conflicts and waste, but the rule would not provide a clear baseline from which to negotiate. The gas owner would claim the greater share by virtue of having title to the CBM, while the coal owner would claim the greater share by virtue of having incurred the expense of drilling shafts and entryways associated with in-mine degasification and the expense of longwall mining associated with gob wells, and it is not obvious what percentage each should receive from a compromise.

393. These conflicts could be avoided under Rule #6 without an extensive regulatory regime only if the gas owners were required to confine their activity to unminable coal seams and left extraction from minable coal seams to the coal owners. *See* Mutchler & Sachse, *supra* note 22, at 1863. Such a result could be accomplished under Rule #6 by a supplementary regulation (or common-law rule) that prohibited degasification of minable coal seams without permission of the coal owner, which appears to be the *de facto* practice today. (Even this extreme restriction would not eliminate potential conflicts, because for some nonminable coal seams the optimal method of extraction may involve multiple seam completion in conjunction with degasification of minable coal seams or it may involve fracturing them with the overburden that collapses into the gob zone with longwall mining. If so, then any independent efforts at degasification of unminable coal seams by gas owners would be wasteful.) Such a restriction on degasification of minable coal seams would effectively destroy the nominal ownership rights of the gas owners, leaving the coal owners with the sole right to extract the CBM. To preserve the ownership rights of the gas owners, the regulatory program under Rule #6 must accommodate the right of gas owners to extract their CBM as well as the right of coal owners to mine their coal.

over operation of the gob wells.[394] Relative to Rule #2, Rule #5 does have the advantage of avoiding the allocational problems with respect to gob gas by treating all gob gas, regardless of its source, as the property of the gas owners; the gain from avoidance of allocational disputes would not, however, appear to offset the loss from creation of extraction-related conflicts over operation of the gob wells.[395]

In terms of incentives, to the extent that coal owners are less interested than gas owners in the capture of CBM, Rule #5 would reduce the incentives for the extraction of CBM in comparison with Rule #1, especially from unminable coal. In comparison with Rule #2, Rule #5 would leave the coal operators with no incentive to prevent ventilation air from contaminating the gob gas. Thus, Rule #5 would appear to create worse incentives than either Rule #1 or Rule #2.

Even more significantly, by dividing ownership sequentially, Rule #5 can be expected to increase the level of transaction costs relative to either Rule #1 or Rule #2,[396] interfering with the efficient capture and utilization of CBM. Successive ownership should make it more difficult to use a single wellbore as both a pre-mining vertical degasification well and a post-mining gob well.[397] Successive ownership

394. Gob wells should give rise to fewer conflicts than other forms of CBM extraction because the boreholes need not even penetrate the coal seam, and the coordination is simpler than with in-mine degasification. Nevertheless, the coal owners would prefer to maximize the extent of short-term degasification, even at the cost of additional wells, whereas the gas owners would prefer to maximize long-term profitability by drilling fewer wells and spacing them farther apart. The coal owners must also retain control of the fans and pumps employed with the gob wells in order to be able to increase the rate of ventilation in response to periodic increases in methane concentration at the mine face.

395. The conflicts over gob wells under Rule #5 would require regulation, albeit less extensive than that under Rule #1, but the allocational questions with respect to gob gas under Rule #2 are also amenable to regulatory solutions. Rule #5 creates disputes over safety and efficiency during mining, whereas Rule #2 creates disputes over money after CBM extraction is complete, and neither rule has a clear advantage in terms of the administrative costs associated with resolving these disputes.

396. Instead of dealing with a single party, either the gas owner or the coal owner, any potential CBM developer would have to negotiate a joint arrangement with both parties, whose interests are likely to be inconsistent.

397. The use of a single wellbore requires planning and coordination, and a rule of successive ownership would add the need for negotiations with two parties having potentially inconsistent interests with respect to the spacing and dimensions of the wells as well as having adverse interests with respect to the allocation of costs.

would also create a problem of coordinating utilization of the gas.[398] The added transaction costs under Rule #5 can be expected to offset any potential advantages of this rule in comparison with Rule #1 or Rule #2.

In terms of fairness, Rule #5 represents a compromise, but it does not represent a principled adjustment of the parties' respective claims. Those who accept the gas owners' claims would perceive no principled basis for their loss of the right to engage in degasification of virgin coal. Those who accept the coal owners' claims would protest that the gas owners are unjustly enriched insofar as Rule #5 allows them to obtain the profits from the gob gas without having incurred any of the cost of producing the "super-fracture" that released the gas into the gob zone.

6. Evaluation of Rule #5 in Conjunction With Rule #6

If it were coupled with Rule #6, many of the foregoing problems associated with Rule #5 would be eliminated. Under a combination of Rule #5 and Rule #6, coal owners would have the right to all CBM removed from coal seams and would have an incidental right to capture all of the gob gas generated by mining activity. The problem of gob gas allocation would not exist if coal owners were capturing gob gas in the exercise of an incidental right and not based on ownership of the gas itself. The transaction costs associated with sequential ownership would not exist because coal owners would have the right to contract for all phases of extraction and utilization. In effect, the combination of Rule #5 and Rule #6 would be substantially equivalent to Rule #2.

The only difference is that gas owners would have nominal ownership of gob gas, with the potential right to sink gob wells in competition with those of the coal owners. It is unlikely that the gas owners would seek to exercise such a right, but the threat of com-

398. Regardless of whether the gas was to be utilized on site or transmitted into the pipeline system, CBM development would require an advance agreement as to the allocation of costs and proceeds. An advance agreement on cost allocation may be difficult to reach, however, if the amount of gas that would be attributable to each party could not be known in advance, especially if the amount of gob gas production attributable to the gas owners would be affected by the extent of prior degasification attributable to the coal owners.

petitive drilling could be expected to provide a basis for negotiations in which the gas owners received a small royalty in exchange for relinquishment of ownership rights in the gob gas. Indeed, in lieu of supplementing Rule #5 with Rule #6, a common-law court that adopted Rule #5 and acknowledged the coal owners' right to capture gob gas as an incidental mining right could protect the ownership rights of gas owners by requiring the coal owners to pay them a royalty for the gob gas.

7. Is There an Optimal Common-Law Solution?

In terms of fairness, the optimal rule depends on one's perspective on the competing claims of gas owners and coal owners. Those who favor the gas owners would prefer Rule #1. Those who favor the coal owners would prefer Rule #2 or Rule #5 coupled with Rule #6. Those who believe coal owners and gas owners are equally deserving should favor Rule #6, which grants nominal title to the gas owners but essentially gives equal opportunity to both parties subject to a rule of capture.

In terms of the policy goal of promoting efficient resource development, none of the common-law solutions is ideal. The two leading candidates would appear to be Rule #2 and Rule #6. Rule #2 is most efficient in theory, but there are reasons to doubt whether it would be most efficient in practice because of doubts concerning the incentives of coal owners to capture CBM. Rule #6 would create better incentives than Rule #2, but it would require a regulatory resolution of the inevitable extraction-related conflicts.

Ultimately, the evaluation of the common-law rules turns on three points as to which there is no clear consensus: (1) the relative merits of the justice-based claims of gas owners and coal owners; (2) whether coal owners have sufficient incentives to develop CBM resources; and (3) the feasibility and cost of regulating extraction-related conflicts.

VII. A Possible Statutory Solution — Rule #7: Shared Ownership

In exploring the possibility of a legislative answer to the ownership question, we did not limit our consideration to the available

common-law rules. Instead, we sought to develop a rule that would best satisfy the criteria of fairness and efficiency, with secondary attention to the issues of constitutionality and political feasibility.

The result of our inquiry was the development of a novel solution to the ownership question, Rule #7, under which the coal owners and gas owners would share ownership of CBM, holding title in equal shares as tenants in common. The concept of shared ownership initially was considered as a compromise, purely on grounds of fairness, because the coal owners and gas owners seemed equally deserving.[399] Further analysis of its implications suggested that Rule #7 might also create appropriate incentives for CBM development and was more likely to withstand a constitutional challenge than the legislative adoption of any of the possible common-law rules. The equitable and practical aspects of Rule #7 are discussed below. Its constitutionality is discussed in Part VIII.

Rule #7 is arguably more equitable than any assignment of total ownership rights to either party. Both coal owners and gas owners have legitimate claims based on their expectations and responsibilities, but neither side is clearly more deserving. In addition to equitably adjusting the competing claims of coal owners and gas owners, Rule #7 would recognize the interests of surface owners who retained neither coal nor gas rights insofar as they would obtain a royalty on half of the CBM from the gas owners. Rule #7 is also the only legislative resolution that is likely to be politically acceptable, for the coal and gas industries could be expected to block any bill that gave exclusive rights to one side or the other.

In terms of efficiency, Rule #7 would create appropriate incentives for CBM development. Coal owners having an assurance of partial ownership would have greater incentives to plan for pre- and post-mining degasification than they do today. Gas owners with partial ownership would contribute their expertise and encourage the introduction of new technologies and techniques for CBM extraction and capture.

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399. *See* John E. Coons, *Compromise as Precise Justice*, 68 CAL. L. REV. 250 (1980); John E. Coons, *Approaches to Court Imposed Compromise — The Uses of Doubt and Reason*, 58 NW. U. L. REV. 750 (1964); Jeff L. Lewin, *Comparative Nuisance*, 50 U. PITT. L. REV. 1009, 1015-18 (1989).

Ultimately, the successful extraction of CBM requires the cooperative efforts of both coal owners and gas owners.[400] The most efficient means of recovering CBM is in conjunction with mining activity, especially with longwall mining. Successful CBM extraction in the course of longwall mining depends on a working partnership between those who mine the coal and those who capture and market the gas.

The best way to promote such partnerships is by creating shared ownership of CBM between the gas owner and the coal owner on each tract. Although successful partnerships could be negotiated if one party were the sole owner of the CBM, the incentive to negotiate is greatest if both parties have a stake in the outcome. A party with no ownership rights might take a hard stand in negotiations, knowing there was little to lose if negotiations failed. A party with total ownership rights might resent having to share a substantial percentage with a non-owner in order to obtain cooperation. Parties with a half interest in the CBM are more likely to see the need for cooperative bargaining and to accept the necessity of compromise of their sometimes conflicting interests.[401]

Shared ownership encourages cooperation and informal resolution of extraction-related disputes. Both parties have something to gain from cooperation, reducing the likelihood that either will take an obstructionist stance in hopes of coercing the other to capitulate. Shared ownership encourages communication. Neither party is likely to act unilaterally, without at least consulting the co-owner.

By vesting half-ownership in the gas companies, Rule #7 should reduce the need for governmental regulation to discourage wasteful venting and promote capture of CBM. The gas owners would essentially serve in place of the government regulators, as private attorneys-general. The gas owners can be relied upon to object to

400. *See* Cooper, *supra* note 87, at 6.03; Counts, *Ownership Questions*. *supra* note 22, at 10.9-.16; Robert D. Fluharty, *Drafting Agreement Terms Governing Commercial Methane Recovery Close to Mining*, 1988 SPECIAL INSTITUTE, *supra* note 11, ch. 13; von Schonfelt, *supra* note 15, at 6.

401. *Cf.* Lewin, *Comparative Nuisance*, *supra* note 399, at 1072-76 (discussing literature on dispute resolution which suggests that settlement negotiations are more likely to succeed if both parties anticipate the result at trial would be a compromise rather than an all-or-nothing solution).

venting and insist on the capture of CBM whenever this would be economically feasible. The vesting of half ownership in the gas owners would thus make it possible to substitute private market-based incentives for government regulation.[402]

Rule #7 also would reduce the administrative cost of resolving allocational questions with respect to gob gas. All of the gob gas, regardless of the strata from which is was released, would be jointly owned by the coal owner and gas owner as tenants in common. Although allocational issues would still arise whenever the relevant coal strata had different owners, Rule #7 would eliminate the question of ownership of strata gas that originated in coal but migrated to non-coal strata, and it would eliminate the problem of determining the proportion of gob gas that was natural gas originating in non-coal strata.

Rule #7 is not a panacea, however, and it may give rise to certain new conflicts. Many of these conflicts can be resolved under existing law relating to the rights of co-tenants in resources held as tenants in common. There is a well-developed body of law dealing with the rights of co-tenants, including co-tenants of mineral interests, so the regulatory system would not need to address many of the extraction-related conflicts. Nevertheless, many of the new conflicts will require novel procedural or technical solutions.

The first problem that must be confronted is the question of control over development of CBM resources. The issue of control is crucial under Rule #7, because a dissatisfied co-tenant in CBM would not be able to terminate the relationship by bringing an action for partition. When two ordinary co-tenants cannot agree on how to manage their property, either party can compel partition and obtain a physical division of the property or half of the proceeds from a public sale.[403] Neither of these options would be available,

402. Reliance on the gas owners has several related advantages over regulatory programs. First, it avoids the creation of a new bureaucracy. Second, it employs the gas owners' financial self-interest, as they would have more incentive than government regulators to be vigilant. Third, it employs the knowledge and expertise of gas owners, who presumably should be more capable than government regulators of determining whether capture of CBM is feasible in a given situation.

403. W. VA. CODE § 37-4-1 to -8 (1985).

however, to the gas owners or coal owners as co-tenants in CBM. Physical partition by dividing the tract is not a solution because the CBM would still be intermixed with the coal on the gas owner's half of the tract. Partition by sale is impractical because the coal owner is likely to be the sole bidder for CBM rights at any public auction.[404] Thus, unless one party bought out the other, the co-tenancy between coal owners and gas owners under Rule #7 would be an indissoluble marriage, requiring clear ground rules for resolution of extraction-related conflicts.

In most jurisdictions, any co-tenant in mineral property may act unilaterally to develop the resource, subject to a duty to render an accounting to other co-tenants.[405] West Virginia, however, is among the minority of jurisdictions in which a co-tenant's production of minerals without the consent of the remaining co-tenants is considered to be waste and may be enjoined.[406] In West Virginia and other jurisdictions that treat unilateral mineral production by a co-tenant as waste, development of CBM under Rule #7 could not proceed without the consent of both the gas owner and coal owner. Given their inherently conflicting interests, the likelihood of impasse is high.

In order to promote development of CBM, either the coal owner or gas owner should be empowered to proceed unilaterally, subject to appropriate restrictions to protect the interests of the co-tenant. This result could be accomplished through forced pooling provisions, such as those in Virginia or in the proposed federal and West Virginia legislation, which would enable any co-tenant to develop CBM resources and deposit the shares of non-participating co-tenants into an escrow fund.

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404. *Cf.* Consolidated Gas Supply Corp. v. Riley, 247 S.E.2d 712 (W. Va. 1978) (holding that partition by sale of gas rights was not appropriate because the gas lessee was likely to be the sole bidder for the property).

405. RICHARD W. HEMINGWAY, THE LAW OF OIL AND GAS § 5.1 (3d ed. 1991); 1 WALTER L. SUMMERS, THE LAW OF OIL AND GAS §§ 37, 38 (1959); Howard R. Williams, *The Effect of Concurrent Interests on Oil and Gas Transactions*, 34 TEX. L. REV. 519, 523 (1956).

406. Law v. Heck Oil Co., 145 S.E. 601 (W. Va. 1928); South Penn Oil Co. v. Haught, 78 S.E. 759 (W. Va. 1913); SUMMERS, *supra* note 405, at § 222; Hemingway, *supra* note 405, at 200-201; 2 Williams, *supra* note 2, at 526. *See generally* W. VA. CODE § 37-7-2 (1985) (statutory action for waste).

When the parties cannot agree on a program for CBM extraction or when disagreements arise during the implementation of such a program, a mechanism would seem to be needed for prompt and inexpensive resolution of disputes. In theory, the courts would be available as a forum for the disputants, but the circuit court judges lack the requisite technical expertise, and the rules of procedure are not suited to resolution of multiple disputes in an ongoing relationship. It would be inefficient to create a new administrative agency to handle such disputes, and the parties are understandably reluctant to subject themselves to the risk of a "home court advantage" if certain sensitive disputes were handled by existing agencies that currently regulate the coal or the gas industry and would be called upon to administer the forced pooling legislation.[407] The best dispute resolution procedure for such conflicts probably would be to employ some form of mandated negotiation or mediation that culminated in binding arbitration.[408]

Several of the extraction-related conflicts are sufficiently fundamental that they ought to be resolved statutorily rather than being left to the vagaries of agencies action or case-by-case dispute resolution. The first such conflict that must be addressed is between the gas owners' right to protest wasteful venting of CBM and the coal owners' right to ventilate the mine in the interests of mine safety and productive efficiency. Clearly, when mining activity is in progress, the gas owners should not have the right to physically intervene or to obtain an injunction that would restrict the autonomy of the mine operator. The question remains whether coal owners should be subject to damage liability for wasteful venting. Several existing and proposed statutes would exempt mine operators from liability for waste of CBM when venting was necessary for mine safety,[409] but under a necessity standard the operator still could be

407. In particular, the coal industry representatives in West Virginia have objected to resolving disputes relating to CBM development before the Shallow Gas Well Review Board.

408. Where only two parties were involved, the procedure could require each party to select an arbitrator and have these two arbitrators select the third member of the panel. The recently-proposed West Virginia legislation included a provision for binding arbitration of disputes. H.B. 4238 & S.B. 406, § 22-7A-16 (W. Va. 1992).

409. VA. CODE ANN. § 316.1 (Michie Supp. 1991) ("where necessary for safety reasons or for

held liable if it were later determined that the venting had been unnecessary. Although the issue requires further study, the best solution may be to exempt ongoing mine operations from all civil liability to co-tenants for waste of CBM, relying on the incentives of the parties to capture CBM when it would be feasible.[410]

On the other hand, gas owners should have the right to insist that mining plans include an appropriate program of CBM extraction whenever recovery would be economically feasible. To implement this right, the gas owners must be given notice of any proposed mining activity far enough in advance that they would have time to prepare their own alternative plan and obtain a permit.[411] Further details would need to be worked out concerning the timing of the filing of mining plans by coal owners, the submission of objections or alternate proposals by gas owners, and the invocation of dispute resolution procedures.[412] A related question would be whether the gas owner should be required to compensate the coal owner for any delays associated with degasification.

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the efficient testing and operation of coalbed methane gas wells"); H.R. 2998, 102d Cong., 1st Sess. § 1 (14) (1991) ("to ensure safe mine operations"); Coal Policy Act of 1991, H.R. 776, 102d Cong., 1st Sess., Title 8, § 15 (14) (1991) (as adopted by the Subcomm. on Energy and Power on July 31, 1991) (same); S.B. 63, § 22-7A-1(a)(2) (W. Va. 1991) ("to protect coal property and the health and safety of human life, or for lack of a market for recovered coalbed methane gas"); H.B. 4238 & S.B. 406, § 22A-7A-1(a)(2) (W. Va. 1992) (same).

410. The bills recently introduced in the West Virginia legislature would entirely exempt "any coal mining apparatus utilized for the purpose of venting coalbed methane gas from workable coal seams," but this would not exempt venting of gas from a permitted CBM well when necessary for mine safety. H.B. 4238 & S.B. 406, § 22-7A-3(c) (W. Va. 1992).

411. Complete recovery of methane from a coal seam by pre-mining degasification can take ten years. *See* W.P. Diamond et al., *Measuring the Extent of Coalbed Gas Drainage After 10 Years of Production at the Oak Grove Pattern*, Alabama, *in* 1989 PROCEEDINGS, *supra* note 11, at 185.

412. The bills recently introduced in the West Virginia legislature each contained a provision requiring the filing of a "mining notice" ten years in advance of the commencement of mining. H.B. 4238 & S.B. 406, § 22-7A-15 (W. Va. 1992). If the gas owner obtained a permit to extract CBM from the coal, it could obtain a delay in mining to allow recovery of CBM. If no permit application were filed within two years of the mining notice, the coal owner could proceed with mining without any further delay. During a phase-in period, the applicable time periods would be shortened by half, with a five year advance notice of mining and a one year period for submission of permit applications.

The foregoing provisions were drafted in haste, and further refinements may be appropriate. For example, it may be preferable to require that the gas owner *obtain* a permit within two years instead of just apply for one. Smaller mines could be subjected to shorter advance notice periods or exempted from the notice requirement. Given the importance of CBM extraction in conjunction with longwall mining, it may be sufficient to limit the notice of mining requirement to longwall mines, as to which a ten-year planning horizon is not unreasonable.

The two most controversial issues that must be addressed are whether gas owners should have the right to extract CBM from virgin coal seams and the right to enhance production by hydrofracturing the coal. As to the former, there is no compelling reason to deny the gas owners a right to extract CBM from coal seams. The conflict between current CBM extraction and future coal mining is already addressed by the law of nuisance, which forbids gas owners from unreasonably interfering with the property rights of coal owners. As co-owners of the CBM, the gas owners should have an implied right to penetrate coal seams to extract CBM, just as they have the right to drill through coal seams to extract gas from lower strata, provided that this can be accomplished without unreasonable interference with the rights of the coal owners.[413] Further protections can be established by statute, just as they are with respect to ordinary gas wells that penetrate coal seams.[414]

The right of hydrofracture is more uncertain. Given the current state of knowledge, it is not certain whether hydrofracture is unreasonable. The available evidence shows little or no damage to the roof from hydrofracturing, but even a small risk from a poorly executed stimulation may be unacceptable if it jeopardizes the safety of miners as well as rendering coal unminable.

In light of our preference for compromise, we are reluctant to give any party the advantage of a unilateral veto. Nevertheless, because the coal owners would share in the enhanced profits from stimulation, as well as obtaining the benefit of reduced ventilation costs, we conclude that allowing a veto to the coal owners would not seriously impede development of CBM resources under our proposal. Moreover, to the extent that a veto of stimulation prevents gas owners from extracting CBM from virgin coal seams, it means that the resource will be available for extraction in conjunction with

413. Chartiers Block Coal Co. v. Mellon, 25 A. 597 (Pa. 1893); Bowles, *supra* note 131, § 24.04[2][ii]; Snyder & Christian, *supra* note 131, § 5.02[2].

414. *See* W. VA. CODE §§ 22-7-1 to -19 & 22B-1-1 to -41 (1985 & Supp. 1991). These statutes regulate such issues as the spacing, casing and plugging of wells drilled through coal seams, and similar rules must be tailored to deal with extraction of CBM. Technical issues of this nature were resolved without substantial controversy during the course of the 1990 efforts at drafting CBM legislation for West Virginia, and they have not generated substantial controversy.

mining at some later date when the technology for extraction may be even safer and more effective. Hence, if Rule #7 were enacted, the statute should include a provision requiring consent of the coal owner as a prerequisite to stimulation of a coal seam.[415]

Finally, whenever one of the parties has acted unilaterally to extract CBM so that an accounting is necessary, special rules will be needed for computing the proportionate share of costs with respect to extraction of CBM in conjunction with mining activity. Coal owners can be expected to take the position that virtually all of the cost of mining is partially attributable to the extraction of CBM from horizontal boreholes and gob wells, because the mine shafts and entryways are necessary for in-mine degasification, and the longwall mining of the primary seam creates the super-fracture that releases the gob gas from other strata. Gas owners can be expected to take the position that most of the cost of the mining would have been borne by the coal owners in any event, including the cost of degasification, so the cost of CBM extraction should be limited to the special processors, pumps, and compressors at the surface and any local pipeline connections. (Attorneys for clients in each industry have made these arguments in our conversations.)

The controversy over accounting for the cost of CBM extraction in conjunction with mining has not yet been resolved under the Virginia statute.[416] It may be difficult to achieve a consensus on this issue, and there is no pressing need to have the accounting rules engraved in stone in the statute. The rules could be established by a regulatory agency, and if there were any question about the agency's impartiality, it would be entirely appropriate to leave the allocation question for determination on a case-by-case basis through arbitration.

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415. The permit procedures in the recently-introduced West Virginia bills required that any application for stimulation of a coal seam be accompanied by "a signed consent . . . from the coal owner or coal operator of each workable coal seam" located within 750 horizontal feet of the proposed well location or within 100 vertical feet of the target coal seam. H.B. 4238 & S.B. 406, § 22-7A-6(a)(1) (W. Va. 1992).

416. The allocation question has been raised by Ashland in its challenge to the constitutionality of the Virginia Oil and Gas Act, discussed *supra* at note 172, but it is not certain if or when the court will decide this issue.

Ultimately, the evaluation of Rule #7 turns on the same factors that precluded identification of an optimal common-law rule. Rule #7 represents a principled compromise of the competing claims of coal owners and gas owners, but it will not satisfy those who strongly favor the claims of either side. While Rule #7 creates better incentives for CBM development than any of the common-law rules, its success depends on the cost and feasibility of regulating the potential extraction-related conflicts.

VIII. The Constitutionality of Legislating CBM Ownership

Several commentators have recognized the desirability of a legislative resolution of the ownership issue,[417] but most have summarily concluded that any such statute necessarily would be unconstitutional.[418] That is, insofar as a state granted a property right in CBM to one of the competing claimants, the losers could be expected to claim that the property had been theirs and was taken from them without due process of law. The constitutional issue has been addressed in conclusory fashion, however, with little or no analysis. A closer examination suggests that our suggested statutory solution, Rule #7, could survive a challenge to its constitutionality.

The constitutional objection to a legislative resolution of the ownership problem is straightforward. The Fifth Amendment to the Constitution of the United States mandates that no person may be deprived of property without due process of law (the due process clause) and that property not be taken for public use without just compensation (the just compensation clause).[419] Both of these clauses have been applied to the states under the Fourteenth Amendment,[420] and they have been incorporated in the constitutions of most states, including West Virginia.[421] The federal and state constitutions thus

417. *See* Farnell, *supra* note 19, at 532, 541; Mutchler & Sachse, *supra* note 22, at 1866-67.

418. *See* Bowles, *supra* note 20, at 7-23; Cohen, Farnell & Thompson, *supra* note 19, at 225; McGinley, *supra* note 19, at 393-94. *But see* Farnell, *supra* note 19, at 540-41 (constitutionality not a problem because CBM had no known value and was not conveyed with coal, gas, or minerals); Mutchler & Sachse, *supra* note 22, at 1867 ("It is well within the realm of legislative action to clarify principles of ownership that may be left in doubt by the courts.") It would appear that Ms. Farnell's views changed between the time of her earlier article and her subsequent collaboration with Prof. Cohen and Mr. Thompson.

419. "[N]or shall any person . . . be deprived of life, liberty, or property, without due process of law; nor shall private property be taken for public use, without just compensation." U.S. Const. amend. V.

420. The Minnesota Rate Case (Chicago, Milwaukee & St. Paul Ry. Co. v. Minnesota), 134

forbid any legislation that would divest an owner of property rights and transfer those rights to other parties without compensation.

Under the "police power," however, a state has the authority to enact regulatory legislation to control resource use in the interest of health, safety, morals, and public welfare.[422] Under the police power, a state can regulate the rights of coal owners and gas owners to prevent waste of CBM, promote its orderly development, and minimize extraction-related conflicts.[423] While the scope of permissible regulation under the police power is quite broad, and the Supreme Court generally defers to the judgment of state legislatures, regulatory legislation that goes "too far"[424] can be treated as a taking of property that cannot be sustained without compensation.

The Supreme Court's "takings" jurisprudence continues to puzzle commentators.[425] Even its theoretical foundation remains a mys-

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U.S. 418 (1890) (deprivation of property without due process violates 14th amendment); Missouri Pacific Ry. Co. v. Nebraska, 164 U.S. 403 (1896) (taking with compensation but without a public purpose violates 14th amendment). Even without the benefit of the 14th Amendment, the Supreme Court in Calder v. Bull, 3 U.S. (3 Dall.) 386, 388 (1798), viewed this limitation on state power as arising under natural law:

> There are certain vital principles in our free republican governments, which will determine and overrule an apparent and flagrant abuse of legislative power . . . . [An] act of the legislature (for I cannot call it a law), contrary to the great first principles in the social compact, cannot be considered a rightful exercise of legislative authority . . . . [A] law that takes property from A. and gives it to B.: it is against all reason and justice, for a people to entrust a legislature with such powers; and therefore, it cannot be presumed that they have done it.

421. The just compensation and due process provisions appear in two sections of article 3 in West Virginia's constitution of 1872: "Private property shall not be taken or damaged for public use, without just compensation; . . . " W. VA. CONST., art. 3, § 9 (1872). "No person shall be deprived of life, liberty, or property, without due process of law, and the judgment of his peers." W. VA. CONST., art. 3, § 10 (1872).

422. *See* Goldblatt v. Hempstead, 369 U.S. 590, 594-96 (1962); Hadacheck v. Sebastian, 239 U.S. 394, 395-96 (1915); E. FREUND, THE POLICE POWER (1904).

423. McGinley, *supra* note 19, at 393-94. *See, e.g.*, Ohio Oil Co. v. Indiana, 177 U.S. 190 (1900).

424. Pennsylvania Coal Co. v. Mahon, 260 U.S. 393, 415 (1922) (Holmes, J.).

425. *See, e.g.*, BRUCE A. ACKERMAN, PRIVATE PROPERTY AND THE CONSTITUTION (1977); FRED P. BOSSELMAN ET AL., THE TAKING ISSUE (1973); RICHARD A. EPSTEIN, TAKINGS: PRIVATE PROPERTY AND THE POWER OF EMINENT DOMAIN (1985); Lawrence Berger, *A Policy Analysis of the Taking Problem*, 49 N.Y.U. L. REV. 165 (1974); John J. Costonis, *Presumptive and Per Se Takings: A Decisional Model for the Taking Issue*, 58 N.Y.U. L. REV. 465 (1983); Allison Dunham, *Griggs v. Allegheny County in Perspective: 30 Years of Supreme Court Expropriation Law*, 1962 SUP. CT. REV. 63; Richard A. Epstein, *Takings: Descent and Resurrection*, 1987 SUP. CT. REV. 1; John A. Humbach, *A Unifying Theory for the Just-Compensation Cases: Takings, Regulation and Public Use*, 34 RUTGERS

tery, for it is not clear whether the takings doctrine represents an extension of the just compensation clause through the use of a legal fiction that the regulation "takes" the owner's property or the persistence of "Lochnerian"[426] substantive due process analysis under the due process clause.[427]

None of the regulations at issue in the leading takings cases is sufficiently comparable to Rule #7 for their holdings to be of direct assistance. There are no reported cases in which a court has faced a challenge to a regulatory statute that purported to resolve a question of uncertainty as to ownership among competing claimants.[428]

L. REV. 243 (1982); Patrick C. McGinley, *Of Pigs and Parlors: Regulatory Takings in the Coalfields*, 5 J. MIN. L. & POL'Y 473 (1989-90) [hereinafter McGinley, *Of Pigs and Parlors*]; Patrick C. McGinley, *Regulatory "Takings": The Remarkable Resurrection of Economic Substantive Due Process Analysis in Constitutional Law*, 17 ENVTL. L. RPTR. (Envtl. L. Inst.) 10369 (1987); Michelman, *Property, Utility, and Fairness: supra* note 379; Frank I. Michelman, *Takings, 1987*, 88 COLUM. L. REV. 1600 (1988) [hereinafter Michelman, *Takings 1987*]; Gary Minda, *The Dilemmas of Property and Sovereignty in the Postmodern Era: The Regulatory Takings Problem*, 62 U. COLO. L. REV. 599 (1991); Andrea L. Peterson, *The Takings Clause: In Search of Underlying Principles, Part I — A Critique of Current Takings Clause Doctrine*, 77 CAL. L. REV. 1299 (1989); William H. Rodgers, Jr., *Bringing People Back: Toward a Comprehensive Theory of Taking in Natural Resources Law*, 10 ECOLOGY L.Q. 205 (1982); Carol M. Rose, *Mahon Reconstructed: Why the Takings Issue Is Still a Muddle*, 57 S. CAL. L. REV. 561 (1984) [hereinafter Rose, *Mahon Reconstructed*]; Carol M. Rose, *Property Rights, Regulatory Regimes and the New Takings Jurisprudence — An Evolutionary Approach*, 57 TENN. L. REV. 577 (1990); Susan Rose-Ackerman, *Against Ad Hocery: A Comment on Michelman*, 88 COLUM. L. REV. 1697 (1988) [hereinafter Rose-Ackerman, *Against Ad Hocery*]; Joseph L. Sax, *Takings, Private Property and Public Rights*, 81 YALE L.J. 149 (1971); Joseph L. Sax, *Takings and the Police Power*, 74 YALE L.J. 36 (1964) [hereinafter Sax, *Takings and the Police Power*]; William B. Stoebuck, *Police Power, Takings, and Due Process*, 37 WASH. & LEE L. REV. 1057 (1980); Arvo Van Alstyne, *Taking or Damaging by Police Power: The Search for Inverse Condemnation Criteria*, 44 S. CAL. L. REV. 1 (1970).

426. *See* Lochner v. New York, 198 U.S. 45 (1905).

427. *Compare, e.g.*, First English Evangelical Lutheran Church of Glendale v. Los Angeles County, 482 U.S. 304, 315 (1987) (application of just compensation clause), *with* Nollan v. California Coastal Commission, 483 U.S. 825, 834 (1987) (due process analysis). *See* McGinley, *Of Pigs and Parlors*, *supra* note 425, at 489-502.

428. Equitable Resources Exploration, Inc. v. Richardson, No. C88-123 (Cir. Ct. of Wise Cty., Va., Oct. 11, 1988), which construed Virginia's Migratory Gas Act, has little bearing on the constitutionality of our proposal. The statute in question declared that title to "all migratory gases, including but not limited to propane and methane, shall be conclusively presumed to be the property of the owner of the surface." VA. CODE ANN. § 55-154.1 (Michie 1986). The court held that the statute "is not applicable where there has been a prior severance of oil and gas" because a contrary construction "would result in an unconstitutional taking of property without compensation." *Equitable Resources*, No. C88-123 (Final Decree at 3) As correctly construed, the statute did not attempt to resolve an ownership dispute but simply clarified the nature of ownership rights in natural gas, establishing the ownership in place theory with regard to migratory gases. *See id.* (Complainant's Response to Defendants' Reply Memorandum at 20). Moreover, the litigation was not between two

The resolution of uncertain ownership is conceptually quite different from the question of uncertainty as to whether ownership rights have vested, so little guidance is provided by commentary on the interpretation of exemptions from regulation for parties having "valid existing rights."[429] Likewise, little guidance is provided by cases which discuss the value of a vested interest which is subject to the possibility of termination.[430]

Most of the Supreme Court's takings jurisprudence involves regulatory statutes that have the incidental effect of limiting the rights of property owners to use their property. Relatively few cases involve statutes that have the express purpose or effect of destroying or eliminating property rights. The two leading cases of the latter sort are *Texaco, Inc. v. Short*[431] and *Hodel v. Irving*.[432]

In *Texaco, Inc. v. Short*, the Supreme Court upheld the Indiana Dormant Mineral Interests Act which provided for the reversion to the surface owner of mineral rights that were not used for twenty years, but only because the Act provided a two-year grace period in which mineral owners could file a statement of claim to preserve their rights. Absent such a grace period, the Court unequivocally indicated that the Act would have deprived the owners of their property without due process.[433] In other states, courts generally have held that dormant mineral statutes may not be applied retroactively unless they provide mineral owners a procedure for protecting their interests which satisfies the requirements of due process.[434]

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parties with competing claims based on common law: the mineral owner had the right to both coal and natural gas under the deed, and the surface owner had no claim to gas rights apart from the statute.

429. *See* Jan G. Laitos & Richard A. Westfall, *Government Interference with Private Interest in Public Resources*, 11 HARV. ENVTL. L. REV. 1 (1987); McGinley, *Of Pigs and Parlors*, *supra* note 425 (interpreting the "valid existing rights" limitation to the ban on surface mining on certain federal lands under the Surface Mining Control and Reclamation Act of 1977).

430. *Compare* Alamota Farmers Elevator & Warehouse Co. v. United States, 409 U.S. 470 (1973) (compensation in eminent domain proceeding should be based on the full value of the tenant's improvements measured over their useful life, despite the fact that the tenant had no right of renewal), *with* United States v. Fuller, 409 U.S. 488 (1973) (compensation in eminent domain proceeding does not include value of lands that reflected use of adjacent federal land under revocable grazing permits).

431. 454 U.S. 516 (1982).

432. 481 U.S. 704 (1987).

433. The dissenters would have held that the grace period was not sufficient because it was not accompanied by adequate notice to the mineral owners and did not provide them with due process.

434. In several cases, statutes were upheld because they afforded adequate due process protections

In *Hodel v. Irving*, the Supreme Court struck down the Indian Land Consolidation Act, which provided for escheat to the tribe of small fractional shares of real property owned by members of the tribe that otherwise would have passed to their heirs. Although the value of the fractional shares was quite small,[435] and the statute did not deprive the owners of current use, the Court held that the deprivation of the right to pass ownership on to one's heirs was a taking of property that could not be sustained in the absence of compensation.

These two cases stand for the proposition that no matter how laudable the legislative purpose, a state may not deprive owners of their property without due process unless it provides just compensation. Thus, to withstand a constitutional challenge, any legislative resolution of the ownership issue must qualify under one of the following standards:

(1) It does not deprive the owner of a property right; or
(2) It deprives the owner of a property right but it does so for public use and with just compensation.

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for mineral owners. Short v. Texaco, Inc., 406 N.E.2d 625 (Ind. 1980), *aff'd*, Texaco, Inc. v. Short, 454 U.S. 516 (1982) (upholding statute that provided two year grace period in which to record unused mineral interests); Van Slooten v. Larsen, 299 N.W.2d 704 (Mich. 1980) (upholding statute that provided three year grace period in which to record unused mineral interests); Love v. Lynchburg Nat'l Bank & Trust Co., 140 S.E.2d 650 (Va. 1965) (upholding statute that allowed mineral owner six months from docketing of claim in which to find minerals on the property). In other cases, statutes or portions thereof were held unconstitutional for failing to provide due process mechanisms by which mineral owners could protect their interests. Contos v. Herbst, 278 N.W.2d 732 (Minn. 1979), *appeal dismissed*, 444 U.S. 804 (1979) (act was constitutional except that inadequate notice and opportunity for hearing failed to provide due process); Wheelock v. Heath, 272 N.W.2d 768 (Neb. 1978) (retroactive application unconstitutional despite two year grace period for recordation, because notice was inadequate); Monahan Cattle Co. v. Goodwin, 272 N.W.2d 774 (Neb. 1978) (same); Chicago & North Western Transp. Co. v. Pedersen, 259 N.W.2d 316 (Wis. 1977) (statutory reversion to surface owner violated due process absent either adequate procedural mechanism to preserve rights or compensation for loss of rights). One case simply held that retroactive application of the statute was unconstitutional. Wilson v. Bishop, 412 N.E.2d 522 (Ill. 1980) (retroactive application unconstitutional). In several cases, statutes were construed as prospective only in order to avoid constitutional problems. Williston Highlands Development Corp. v. Hogue, 277 So.2d 260 (Fla. 1973) (constitutional issue not raised because statute was not retroactive); Tufts College v. Triple R. Ranch, Inc., 275 So.2d 521 (Fla. 1973) (act construed as not retroactive in order to preserve constitutionality); Nelson v. Bloodworth, 232 S.E.2d 547 (Ga. 1977) (action dismissed because statute could not be retroactive). Vitauts M. Gulbis, Annotation, *Validity and Construction of Statutes Providing for Reversion of Mineral Estates for Abandonment or Nonuse*, 16 A.L.R. 4th 1029 (1982).

435. The Act only applied to fractional shares that represented less than 2% of the tract and that yielded less than $100 in income during the previous year.

Our Rule #7 arguably would satisfy the first of these standards, but if not, it almost certainly should satisfy the second.

A. Rule #7 Does Not Deprive Anyone of a Property Right in CBM

Evaluation of the constitutionality of divided ownership of CBM under Rule #7 depends on the "actual" ownership of the CBM at common law, for only the true owner could successfully claim to have been deprived of a property right. Rule #7 would clearly be constitutional if CBM were not owned by anyone, but a court is unlikely to reach this conclusion.[436] A court could conclude, however, that Rule #7 does not deprive the CBM owner of a property right based on either of two related arguments. The first emphasizes the qualified nature of property rights in CBM at common law, in comparison to which the definite and certain 50% ownership rights under Rule #7 may be seen as a protection rather than a taking of property. The second focuses upon the actual takings decisions of the Supreme Court, asserting that Rule #7 is a reasonable regulation aimed at avoiding waste and promoting development of CBM.

1. Because Common-Law Rules Provide Only Qualified Ownership of CBM, Rule #7 Does Not Deprive CBM Owners of Their Property

A court faced with a challenge to Rule #7 must determine whether the challenger was the owner of a property right and whether Rule #7 deprived the owner of that right. The court could uphold Rule #7 if it concluded that the challenger's ownership of CBM at common law was not absolute but was only a limited and qualified right that was not impaired by the rule. If ownership of CBM is only a

436. As explained *supra* at notes 254-60, a court is unlikely to find that CBM is an unowned mineral. A court is also unlikely to accept the metaphysical argument that no party can claim absolute ownership because of the universal recognition that ownership is uncertain and indeterminate. While principle and precedent may be in equipoise, so that we are unable to predict how a court will resolve the ownership question, and while the parties themselves may be uncertain of their rights, a court faced with the constitutional challenge by a particular individual could nevertheless determine with certainty that the challenger was in fact the true owner of the CBM. *Someone* must own the CBM under each tract of land, even of the owners are unaware of their rights. (The tree that falls in the forest has made a noise, even if no one has heard it.).

qualified right, then regardless of whether gas owners or coal owners have title to CBM, Rule #7 would not effect a taking of their property.

If a challenge were brought by a gas owner and the court found the gas owner had title to the CBM, the gas owner's rights would be qualified by the necessary and incidental mining rights of coal owners to ventilate the mines. Even if these incidental mining rights were not interpreted as empowering coal owners to capture CBM under Rule #6, they must at least allow the coal owners to vent CBM without liability.[437] Since the coal owners can mine the coal and destroy the ownership rights of a gas owner without incurring any liability, the gas owner's rights in the CBM are sufficiently uncertain and contingent that even a total deprivation might not be deemed a taking.

Under Rule #7, however, the gas owner would retain a 50% ownership interest in the CBM. The legislation would establish the gas owner's rights as a matter of law so that the 50% interest would be far more definite and certain than the gas owner's rights at common law today. In addition, the 50% ownership interest would be protected by a right to compel the coal owners' cooperation in reasonable degasification programs. Hence, the value of the gas owner's interest under Rule #7 would appear to exceed the value of the gas owner's interest at common law. In short, if the court were to determine that CBM was owned by the gas owners, it should find that Rule #7 did not deprive them of their property but actually enhanced its value by eliminating uncertainty and protecting against wasteful dissipation during mining.

Similarly, if a challenge were brought by a coal owner and the court found the coal owner had title to the CBM in place, the court could rule that the coal owner's rights did not extend to CBM that escaped into the gob zone. The court could do so by applying Rule #5, in which case the gas owner would have exclusive rights to the gob gas. Alternatively, by applying both Rule #5 and Rule #6, the

437. Even if the court rejected the coal owners' right to *capture* CBM under Rule #6, it is virtually inconceivable that the court would deny coal owners the right to *vent* CBM, especially in view of the federal regulations that require venting.

court could hold that the gas owner had title to the gob gas but that the coal owner had the right to capture it as an incidental mining right. Under the former approach, the coal owner would lose all rights to the gob gas; under the latter approach, the coal owner would retain the right to capture the gob gas but could not prevent the gas owner from drilling competing gob wells to drain it.[438]

In comparison with a common-law rule of successive rights, Rule #7 would deprive the coal owner of 50% of the CBM in place, but it also would grant the coal owner a right to 50% of the gob gas. Gob wells currently are more profitable than in-mine degasification, so the coal owners may gain more than they lose from the adjustment of property rights under Rule #7. On balance, the coal owner would not seem to suffer any net deprivation of property rights with respect to CBM.

Thus, regardless of whether the gas owners or coal owners are determined to have title of CBM in place, if these rights are qualified and not absolute, Rule #7 would not deprive the CBM owner of a property right. In comparison with a common-law rule of qualified rights, Rule #7 would redefine and adjust the property rights of both gas owners and coal owners, leaving the owners of the CBM in place no worse off and arguably more secure in their property rights.

2. Rule #7 Could Be Sustained as a Reasonable Regulation Under the Police Power

Even though Rule #7 purports to alter property rights and not merely control or limit their exercise, it nevertheless constitutes a regulation of property that must be evaluated according to the Court's "takings" analysis. In *Hodel v. Irving*, seven of the nine justices agreed that the constitutionality of the escheat of fractional shares in tribal land should be analyzed as a regulatory taking. Since this analysis was applied to the abolition of a property right in *Hodel*

438. Indeed, the gas owner might be able to assert that so long as the gas owner had an adequate plan for gob well degasification, the coal owner would not have any basis for asserting an incidental right to employ gob wells for ventilation purposes.

v. Irving, it should also apply to the redefinition of property rights in Rule #7.

The Supreme Court's takings opinions employ an *ad hoc* balancing test in which various factors have been identified as relevant to the determination of whether a regulation amounts to a taking.[439] As in earlier takings cases, the Court in *Hodel v. Irving* considered such factors as "the economic impact of the regulation, its interference with reasonable investment backed expectations, and the character of the governmental action."[440] Application of these factors arguably tends to support the constitutionality of Rule #7 under any of the possible common-law ownership rules that a court might apply.

An important factor in determining whether regulation works a taking is its economic impact, evaluated according to the "diminution in value" test of *Pennsylvania Coal Co. v. Mahon*.[441] In applying this factor, a crucial preliminary question is the identity of the property that will serve as the baseline for the measurement of diminution in value. The United States Supreme Court has repeatedly emphasized that whether a governmental action has effected a taking depends on its impact on the entire property of the challenger considered as a whole. For example, in *Penn Central Transportation Co. v. City of New York*,[442] the Court upheld an ordinance

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439. *See* Kaiser Aetna v. United States, 444 U.S. 164, 175 (1979):

> [T]his court has generally "been unable to develop any 'set formula' for determining when 'justice and fairness' require that economic injuries caused by public action be compensated by the government, rather than remain disproportionately concentrated on a few persons." [citation omitted] Rather, it has examined the 'taking' question by engaging in essentially ad hoc, factual inquiries that have identified several factors—such as the economic impact of the regulation, its interference with reasonable investment backed expectations, and the character of the governmental action—that have particular significance. [citation omitted]

This standard had been re-iterated in the Court's recent decisions. Hodel v. Irving, 481 U.S. 704, 713-18 (1987); Keystone Bituminous Coal Association v. DeBenedictis, 480 U.S. 470, 495 (1987). *See also* Williamson County Regional Planning Comm'n v. Hamilton Bank of Johnson City, 473 U.S. 172, 199 n.17 (1985) (quoting C. HAAR, LAND USE PLANNING 766 (3d ed. 1976)) ("The attempt to determine when regulation goes so far that it becomes, literally or figuratively, a 'taking' has been called 'the lawyer's equivalent of the physicist's hunt for the quark.'"); Penn Central Transp. Co. v. City of New York, 438 U.S. 104, 124 (1978); Rose, *Mahon Reconstructed*, *supra* note 425, at 562 n.6; Rose-Ackerman, *Against Ad Hocery*, *supra* note 425.

440. 481 U.S. at 714 (quoting Kaiser Aetna v. United States, 444 U.S. 164, 175 (1979)).

441. 260 U.S. 393 (1922).

442. 438 U.S. 104 (1978).

that limited the property owner's right to construct a tower above the Grand Central Terminal. The Court rejected the terminal owner's argument that the city had taken its "air rights," stating:

> "Taking" jurisprudence does not divide a single parcel into discrete segments and attempt to determine whether rights in a particular segment have been entirely abrogated. In deciding whether a particular governmental action has effected a taking, this Court focuses rather both on the character of the action and on the nature of the interference with rights in the parcel as a whole—here the city tax block designated as the "landmark site."[443]

In *Andrus v. Allard*,[444] the Court upheld a prohibition on the sale of avian artifacts, because the owners retained the rights to possession and use. The Court said:

> [W]here an owner possesses a full "bundle" of property rights, the destruction of one "strand" of the bundle is not a taking, because the aggregate must be viewed in its entirety."[445]

The Court most recently applied these principles in *Keystone Bituminous Coal Association v. DeBenedictis*,[446] upholding Pennsylvania's "Subsidence Act" despite the fact that it required the petitioners to leave roughly twenty-seven million tons of coal in place. Noting that this represented less than 2% of their coal, the Court cited *Penn Central* and *Andrus*, concluding:

> The 27 million tons of coal do not constitute a separate segment of property for takings law purposes. Many zoning ordinances place limits on the property owner's right to make profitable use of some segments of his property . . . . There is no basis for treating the less than 2% of petitioners' coal as a separate parcel of property.[447]

The Court also rejected the petitioners' argument that the statute deprived them of the "right of support" which the law of Penn-

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443. *Id.* at 130-31.

444. 444 U.S. 51 (1979).

445. *Id.* at 65-66. The power of this case as precedent is questionable, however, for the concurring opinions in *Hodel v. Irving* suggest that the case may be limited to its facts. *See* Michelman, *Takings, 1987*, *supra* note 425, at 1600 n.2. *Compare* 481 U.S. at 719 (Scalia, J., joined by Rehnquist, C.J. & Powell, J. concurring) ("our decision effectively limits *Allard* to its facts"), *with* 481 U.S. at 718 (Brennan, J., joined by Marshall & Blackmun, JJ., concurring) ("I find nothing in today's opinion that would limit *Andrus v. Allard* [citation omitted] to its facts.").

446. 480 U.S. 470 (1987).

447. *Id.* at 498.

sylvania recognizes as a separate interest in land, refusing to consider the support estate in isolation from the petitioners' mineral estate.

Under this "total property" approach,[448] a court should not limit its consideration to the challenger's ownership of CBM, but should also take into account the challenger's ownership rights in the gas or coal. From this perspective, the challenger's CBM rights would represent only a small fraction of that party's mineral rights, so that a 50% reduction in the CBM rights would represent a far smaller reduction in the party's total property rights.

The "total property" approach to the diminution in value test would strongly support the validity of Rule #7 if the challenge to the CBM ownership statute were brought by a coal owner. The claims of the coal owner all derive from the premise that CBM is part of the coal and is necessarily included in a conveyance of coal rights. Yet by weight the CBM constitutes only a minute portion of the coal. In terms of heating value, the CBM represents approximately 2% of the value of the coal.[449] If a court were to rule that CBM was part of the coal and had been owned by the coal owner, a statute that divided CBM ownership between the gas owner and the coal owner would deprive the coal owner of only 1% of the value of the coal.

The diminution in value test would also support the validity of Rule #7 if the challenge were by a surface owner who retained gas rights following a severance of coal rights. If the CBM were held to have been retained by the surface owner as part of the gas rights, the CBM would constitute only a portion of the gas rights, which

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448. The total property approach may be contrasted with the strategy of "conceptual severance" that Peggy Radin has attributed to Chief Justice Rehnquist:

> It [conceptual severance] consists of delineating a property interest consisting of just what the government action has removed from the owner, and then asserting that that particular whole thing has been permanently taken. Thus, this strategy hypothetically or conceptually "severs" from the whole bundle of rights just those strands that are interfered with by the regulation, and then hypothetically or conceptually construes those strands in the aggregate as a separate whole thing.

Margaret J. Radin, *The Liberal Conception of Property: Cross Currents in the Jurisprudence of Takings*, 88 COLUM. L. REV. 1667, 1676 (1988).

449. *See supra* at note 385.

would in turn represent only one of various strands in the bundle of rights retained by the surface owner.

The diminution in value test may provide less support for Rule #7 if the challenge were by a gas owner who held no other rights in the subject property, especially if little or no gas was found in other strata. In such a case, the CBM would represent virtually all of the value of the gas owner's property, so the challenger would appear to suffer a full 50% diminution in value.

On the other hand, to the extent the gas owner's rights were qualified by the coal owner's right to vent (and possibly capture) CBM in conjunction with mining, the gas owner would have had less value to begin with and would suffer a lesser degree of diminution. Moreover, if the statute that established Rule #7 included a provision granting the gas owner a right to delay mining in order to accomplish premining degasification or establish a system of gob wells, the gain from such protection would substantially offset any nominal loss of value. In this regard, the assurance of a right to develop the half interest in the CBM could be viewed as analogous to the "transferrable development rights" received by the owners of Grand Central Terminal which helped sustain the landmark preservation ordinance in *Penn Central Transportation Co. v. City of New York*.[450]

Even if the court ignored the total property rights of the parties, limited its consideration to the CBM rights, and found a 50% loss of value, this degree of diminution in value would not necessarily invalidate a regulatory statute. The United States Supreme Court frequently has upheld regulations that resulted in a far greater percentage diminution in the value of the owner's property.[451]

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450. 438 U.S. 104, 137 (1978):

> While these rights may well not have constituted 'just compensation' if a 'taking' had occurred, the rights nevertheless undoubtedly mitigate whatever financial burdens the law has imposed on appellants and, for that reason, are to be taken into account in considering the impact of regulation.

451. *See, e.g.*, Goldblatt v. Town of Hempstead, 369 U.S. 590 (1962) (property had little value in other uses after prohibition of quarrying operations); Village of Euclid v. Ambler Realty Co., 272 U.S. 365 (1926) (75% drop in value); Hadacheck v. Sebastian, 239 U.S. 394 (1915) (prohibition of operation of brick yard precluded economic use of the clay, reducing value of property from $800,000

A second important factor that has been discussed by the Court in its recent opinions is the question of whether the challenger had any "distinct investment-backed expectations"[452] associated with the regulated aspect of the property. The Court is more likely to find a taking if the government has frustrated the party's concrete expectations, and it is less likely to find a taking if the government has eliminated an option that had not been the primary basis for the party's investment in the property.

In the case of CBM, no one was likely to have had any distinct investment-backed expectations at the time the mineral rights were severed. Except in recent transactions, it would be a rare case in which coal or gas owners acquired their interest with the expectation of undertaking commercial development of CBM. From the point of view of coal owners, methane in coal was viewed as a liability and not as part of the consideration for the transaction. As for surface owners who retained gas rights after a severance of coal, they probably gave no thought whatsoever to the possibility of extracting CBM from the coal they had just transferred.

Only a gas owner without surface ownership could plausibly assert the existence of investment-backed expectations by claiming that the gas rights were acquired with the intention of obtaining natural gas from any strata in which it might be found, including coal strata. The fact that methane had been commercially produced from coal strata would be evidence supporting the reasonable expectations of the gas owner to extract CBM from coal underlying the property. Nevertheless, few gas owners could truthfully assert that they seriously considered the possibility of extracting CBM and that this was a significant factor in their investment decision. Except in rare cases, the challenging party would not have had "distinct invest-

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to $60,000). *See also* Agins v. City of Tiburon, 598 P.2d 25 (Cal. 1979), *aff'd*, Agins v. Tiburon, 447 U.S. 255 (1980) (zoning ordinance is a taking only when it deprives an owner of substantially all reasonable value). In Penn Central Transp. Co. v. City of New York, 438 U.S. 104, 131 (1978), the Court said that its prior decisions "uniformly reject the proposition that diminution in property value, standing alone, can establish a 'taking.'"

452. *E.g.* Hodel v. Irving, 481 U.S. 704, 715 (1987); Keystone Bituminous Coal Assoc. v. DeBenedictis, 480 U.S. 470, 485 (1987); Penn Central Transportation Co. v. City of New York, 438 U.S. 104, 124 (1978). *See* Michelman, *Property, Utility, and Fairness: supra* note 379.

ment-backed expectations" of profiting from CBM resources underlying the property, so this factor tends to support the constitutionality of Rule #7.

The foregoing authorities applying the criteria of diminution in value and investment-backed expectations are distinguishable, however, in that the challenged regulations in those cases only indirectly reduced the value of the challengers' property whereas Rule #7 directly deprives the claimant of half of the property itself. This distinction based on the nature of the regulation leads to consideration of the third important factor in recent Supreme Court takings cases: "the character of the regulation."

In two recent decisions the Court has emphasized the character of the regulation as a crucial factor in the determination that a regulation effected an unconstitutional taking of property. In *Nollan v. California Coastal Commission*,[453] the land-use regulation was invalidated because it was characterized as taking a public easement across the appellants' property. In *Hodel v. Irving* the Court characterized the escheat provisions as "virtually the abrogation of the right to pass on a certain type of property."[454] The statute was held to be a taking because it destroyed one "strand" in the "bundle of rights that are commonly characterized as property."[455] As applied in these cases, the "character" of a regulation appears to relate to the nature and extent of its impact and whether the subject of the deprivation could itself be conceptualized as a distinct interest in or aspect of property: an easement in *Nollan* or the right of inheritance in *Hodel v. Irving*.

From one perspective, Rule #7 is distinguishable from *Nollan* and *Hodel v. Irving* in that it does not take any distinct interest in property, but at most takes 50% of any particular interest. From another perspective, however, the character of Rule #7 is even more of a taking, for it explicitly and directly takes half of each "strand" in the "bundle of rights." Here again, the crucial question may be whether the court focuses on the challenger as the owner of CBM

453. 483 U.S. 825 (1987).
454. 481 U.S. at 716.
455. *Id.* at 716 (quoting Kaiser Aetna v. United States, 444 U.S. 164, 176 (1979)).

rights or instead takes a "total property" approach and considers all of the challenger's interests in the property as the owner of coal rights or gas rights and possibly rights to other minerals or to the surface. If Rule #7 were characterized as a total taking of half of the challenger's property right in the CBM, it is likely to be invalidated as an uncompensated taking of property. If it were characterized as only a partial and limited restriction on the challenger's overall rights as a gas owner or coal owner, this factor would not weigh so heavily against the validity of Rule #7.

In this regard, Rule #7 stands a better chance of being sustained if it is included within a forced pooling statute or some other regulation of extraction-related conflicts than if it stands alone. Standing alone as a regulation of property rights in CBM, Rule #7 is more likely to be characterized as an abrogation of half of the CBM owner's property right. Embedded in a statute regulating extraction of CBM, however, Rule #7 is more likely to be characterized as one of the various adjustments imposed on both gas owners and coal owners to facilitate CBM development, avoid waste, and minimize extraction-related conflicts.

Finally, a statute embodying Rule #7 is most likely to be upheld if it can be characterized as a regulation of nuisance-like activity. The noxiousness of the activity being regulated has often been a crucial factor in the Supreme Court's decision to uphold a regulation against a claim that it was a taking.[456] The venting of CBM could be characterized as a nuisance to the extent that it contributes to the greenhouse effect, but it is not clear to what extent this item of national and international policy could serve as a justification

456. *See, e.g.*, Keystone Bituminous Coal Assoc. v. DeBenedictus, 480 U.S. 470, 471 (1987); Miller v. Schoene, 276 U.S. 272, 280 (1928); Village of Euclid v. Ambler Realty Co., 272 U.S. 365, 387-88 (1926); Hadacheck v. Sebastian, 239 U.S. 394, 410-11 (1915). This factor essentially functions as a *per se* test under which the Court upholds any statute that can be characterized as regulation of a nuisance, though it is questionable whether it is theoretically possible to distinguish between regulations that prevent harms and those that confer benefits on the public. *See, e.g.*, JESSE DUKEMINIER & JAMES KRIER, PROPERTY 1049-51 (2d ed. 1988); Douglas W. Kmiec, *The Original Understanding of the Taking Clause is Neither Weak Nor Obtuse*, 88 COLUM. L. REV. 1630, 1633-40 (1988); McGinley, *Of Pigs and Parlors*, *supra* note 425, at 506-15; Michelman, *Takings, 1987*, *supra* note 425, at 1602-04; Michelman, *Property, Utility, and Fairness*, 81 YALE L.J. 1149, 1196-1201 (1971); Sax, *Takings, Private Property and Public Rights*, *supra* note 425.

for state regulation of property rights. Concern over the greenhouse effect may provide an additional reason for enacting Rule #7, but it is not the primary justification.

In sum, so long as the court concludes that the ownership rights to CBM in place is qualified and not absolute, the various factors identified by the Supreme Court weigh heavily in favor of the constitutionality of Rule #7. If property rights are qualified, then the diminution in value is small or non-existent, the parties' investment-backed expectations are lower, and it is harder to conceptualize Rule #7 as a taking of some distinct interest in property. Under any of the common-law rules that a court is likely to apply, a strong argument can be made for the proposition that Rule #7 does not "take" anyone's property.

If Rule #7 were challenged by a gas owner who was held to have title to the CBM, the court almost certainly would uphold Rule #7, because the gas owner's rights are qualified by the threat of total dissipation during mining. A gas owner holding title to CBM ordinarily would have little or no investment-backed expectations in the development of CBM and would suffer little or no net diminution in value.

Rule #7 also should be upheld if it were challenged by a coal owner who was held to have title to the CBM. It would be easier to sustain a legislative enactment of Rule #7 if the court treated Rule #5 as the applicable common law. Under Rule #5, the coal owner would have no title to gob gas at common law and thus would suffer no net diminution in value, for the loss of 50% of the CBM in place would be offset by the gain of 50% of the gob gas. Even if the coal owner were deemed the absolute owner of the gob gas as well as the CBM in place, Rule #7 should be sustained so long as the court takes a total property approach and treats the 50% loss of rights to CBM as only a 1% loss of the total value of the challenger's coal rights as to which there would have been little or no investment-backed expectations.

B. To the Extent Rule #7 Deprives Parties of a Property Right in CBM, It Does So for Public Use and with Just Compensation

Assuming, *arguendo*, that Rule #7 effectuated a taking of the property rights of the gas owners or coal owners who were deter-

mined to be the owners of the CBM, Rule #7 would be constitutional if it had a public purpose and provided just compensation to the deprived party. While the just compensation clause refers to property that is "taken for public use," the Supreme Court does not require that the property be *taken* by the government or that it be *used* by the public; it requires only that there be a public purpose and public benefit from the legislation.[457] In *Berman v. Parker*,[458] the Supreme Court upheld the eminent domain taking of property for urban redevelopment even though the property was to be sold or leased to private individuals. In *Hawaii Housing Authority v. Midkiff*,[459] the Court upheld Hawaii's Land Reform Act of 1967, which attempted to break up the oligopoly in land ownership and create a market in land by condemning certain land for involuntary sale to the tenants without the government ever taking title. So long as compensation is provided, the legislature may take the property of one party and give it to another for any legitimate purpose within the state's regulatory police power.[460]

With respect to CBM, the legislation clearly falls within the state's police power. The purpose of Rule #7 is to promote development of CBM, minimize wasteful venting, and avoid extraction-related conflicts. The prevention of waste and the protection of correlative rights have long been recognized as a legitimate basis for state regulation of mineral resources.[461] Assuming that Rule #7 was a taking of the rights of one party for a valid public purpose, the question

457. *E.g.*, Hawaii Housing Authority v. Midkiff, 467 U.S. 229 (1984); Berman v. Parker, 348 U.S. 26 (1954). *Compare* Thompson v. Consolidated Gas Corp., 300 U.S. 55, 80 (1937) (dictum: "one person's property may not be taken for the benefit of another private person without a justifying public purpose, even though compensation be paid"); Missouri Pacific Ry. Co. v. Nebraska, 164 U.S. 403 (1896) (compensated taking of property invalidated for lack of a justifying public purpose). *See* Lawrence Berger, *The Public Use Requirement in Eminent Domain*, 57 OR. L. REV. 203 (1978); Thomas W. Merrill, *The Economics of Public Use*, 72 CORNELL L. REV. 61 (1986); Donna P. Grill, Comment, *The Public Use Limitation in Eminent Domain: Handley v. Cook*, 82 W. VA. L. REV. 357 (1979).

458. 348 U.S. 26 (1954).

459. 467 U.S. 229 (1984).

460. "The 'public use' requirement is thus coterminous with the scope of a sovereign's police powers." Hawaii Housing Authority v. Midkiff, 467 U.S. 229, 240 (1984).

461. *E.g.*, Ohio Oil Co. v. Indiana (No. 1), 177 U.S. 190 (1899) (upholding statute prohibiting waste of oil and gas even though ban on venting of gas precluded appellant from profitably operating its oil wells).

would be whether it provided just compensation for the taking.

1. Rule #7 Provides Just Compensation if Gas Owners Are Deemed the Owners of CBM in Place

Because the gas owners' rights to CBM in place are qualified and not absolute, the legislative conferral of an unqualified right to an undivided half interest in the property constitutes ample compensation for the deprivation of a qualified right to all of the CBM in place. Regardless of whether the court accepted the incidental mining rights of coal owners to capture CBM without liability for a royalty, it must at least recognize the right of coal owners to vent CBM in conjunction with mining. For a gas owner whose common-law rights were subject to the possibility of total destruction by the exercise of coal owners' incidental mining rights, Rule #7 would provide just compensation. Any loss from the apportionment of the gas in place would be more than offset by the gain from an assured right to 50% of the CBM and the right to insist that the coal owner cooperate with a reasonable program of degasification.

2. Rule #7 Provides Just Compensation if Coal Owners Are Deemed the Owners of CBM in Place Under a Regime of Successive Rights Under Rule #5

If a court were to hold that the coal owner had title to CBM in place but had no title to the gob gas, it should have no trouble sustaining Rule #7 in the face of a challenge by the coal owner. Because of the vast quantities of methane released into the gob zone from fracture of other strata, gob gas wells appear to be more profitable than other methods of CBM extraction. For a coal owner whose common-law rights were limited to direct extraction of CBM from the coal, the gain from the grant of a 50% right to the gob gas should more than offset the loss from having to split the proceeds from degasification of the coal.

3. Rule #7 May Not Provide Just Compensation if Coal Owners Are Deemed the Absolute Owners of CBM in Place

If a court were to hold the coal owner had absolute title to the CBM and to any CBM in the gob gas, it would be more difficult

to argue that Rule #7 provides just compensation. The compensation to the coal owner from Rule #7 would be indirect, consisting of the benefits associated with the transformation of an uncertain and contingent claim of 100% ownership into a definite and certain 50% ownership interest. To hold that Rule #7 provided just compensation, a court would have to find that the net value of the coal owner's common-law rights to CBM, when discounted for uncertainty and risk, was equal to only 50% of the value of a definite and certain ownership interest in the CBM.

A plausible argument could be made that the current uncertainty over ownership results in at least a 50% diminution in the value of CBM to coal owners, especially when consideration is given to the potential expense and delay of litigation, the impact of risk aversion, and the difficulty of financing a degasification project in the face of uncertainty as to ownership of the proceeds. The negotiated settlements actually reached by coal owners with CBM developers would constitute evidence in support of the argument that uncertainty as to ownership has caused coal owners to discount the value of their claimed rights to CBM by at least 50%.

On the other hand, Rule #7 would create new problems for coal owners insofar as the gas owners' 50% interest in CBM gave them a right to challenge the operating practices of coal operators, which could lead to delays in mining while degasification proceeded. If Rule #7 were embodied in a regulatory statute that effectively ensured the right of mine operators to act unilaterally to protect the safety of miners and the efficiency of mining operations, the burden from having to accommodate the gas owners should not outweigh the benefits to coal owners from certainty and predictability in the ownership of CBM. Nevertheless, to the extent that the indirect benefits from greater certainty and predictability were offset by cost or inconvenience to coal owners, the argument that Rule #7 provides just compensation would be substantially weakened.

Thus, if a court were to find that a coal owner was the absolute owner of CBM in place and had an unqualified right to all of the gob gas, the court would be unlikely to find that Rule #7 provided just compensation. If the coal owners have absolute title to CBM, it would be far easier to sustain Rule #7 based on the argument that

the deprivation of half of the CBM did not amount to a taking of property because the CBM represented such a small portion of the coal owners' interest in the coal.

C. *Rule #7 Is Not Likely to be Declared Unconstitutional*

Wholly apart from the foregoing doctrinal analysis, as a practical matter there are several reasons why it is unlikely that Rule #7 would be declared unconstitutional. First, neither gas owners nor coal owners have much incentive to challenge its constitutionality. Given the current uncertainty over ownership of CBM at common law, which often results in the *de facto* splitting of CBM rights through negotiated compromise, the parties would have little to gain from a declaration that Rule #7 was unconstitutional. Half a loaf is often better than none. Indeed, both sides may recognize that they are better off with a definite and certain one-half interest than they would be under a common-law rule which recognized one party as the owner of CBM in place but subject to qualifications under which the other party would have a right to capture some or all of the CBM. Persons with large holdings in gas or coal rights would also fare no worse under Rule #7 than they would under the priority of severance or case-by-case rules under which they would own all of the CBM under some tracts and own none of it under others.

The fact that there has been no litigation over CBM ownership in West Virginia and very few lawsuits in other states suggests that few parties would be willing to take the all-or-nothing gamble that a constitutional challenge would entail. The only parties with a strong incentive to challenge the statute would be coal owners or operators whose primary concern would not be with their ownership rights in CBM but with the conflicts that would arise whenever gas owners having a half interest in the CBM sought to prevent the venting of CBM in conjunction with mining operations. So long as Rule #7 can be embodied in a statute that minimizes interference with mining operations, the coal owners would have little reason to raise a constitutional challenge to it.

Were the constitutionality of Rule #7 to be challenged, it could be upheld on appeal if the courts were so inclined. The fairness of Rule #7 is a strong point in favor of its being upheld on appeal.

Also, if Rule #7 were included within a more comprehensive regulatory statute that provided for forced pooling, it might be easier politically for a court to uphold this legislative compromise than to invalidate it and mandate the creation of an entirely new regulatory scheme.

Given the range of available alternative common-law rules, a court faced with a challenge to the statute could readily sustain it. For example, by deciding that the rights of coal owners and gas owners were qualified under Rule #5 or Rule #6, respectively, a court could uphold Rule #7 without definitively deciding whether the particular gas owner or coal owner who initiated the challenge had title to the CBM. Thus, a court could uphold Rule #7 without necessarily ruling on the status of CBM ownership at common law, whereas a court could not invalidate the statute without making a definitive determination of this difficult question.

Even if a court were to declare Rule #7 unconstitutional, such a ruling would at least have the beneficial effect of producing a definitive resolution of the ownership question. So long as the court adopted a presumptive ownership rule favoring gas owners or coal owners as a matter of law, such a decision would promote the development of CBM by substantially reducing uncertainty over its ownership.

A decision on the constitutionality of Rule #7 would also provide the necessary background for further regulation to encourage CBM development and reduce the extraction-related conflicts associated therewith. If Rule #7 were invalidated under a challenge by gas owners who were held to own the CBM, then any subsequent regulatory program could focus on making appropriate adjustments between the competing interests of gas owners and coal owners with respect to pre-mining degasification and gob gas capture. If, on the other hand, Rule #7 were invalidated under a challenge by coal owners who were held to own the CBM, such a ruling would eliminate many of the extraction-related conflicts uniquely associated with CBM, and the subsequent regulatory program could focus on creating appropriate incentives for capture of CBM by coal owners.

IX. Conclusion

Both coal owners and gas owners have legitimate claims to ownership of CBM, and there are valid policy arguments favoring each

side. Ownership at common law is likely to be more complex, however, as the rules having the strongest support in principle and precedent, Rule #5 and Rule #6, would leave coal owners or gas owners with only qualified ownership rights.

While Rule #7 is not necessarily superior to the possible common-law rules,[462] it may represent a workable compromise. By declaring that coal owners and gas owners share title to CBM as tenants in common, the legislature would eliminate uncertainty about the ownership of CBM and create a foundation for efficient development of this resource. Each party would have only half as much incentive to capture CBM as it would as the sole owner, but the incentives may be better because *both* parties would have something to gain from CBM development. Rule #7 cannot eliminate the potential tension between gas owners and coal owners as co-owners of CBM, but it creates the framework in which the parties can most easily negotiate for mutually beneficial economic development. And while it leaves neither party satisfied, Rule #7 may be the most equitable solution to this seemingly intractable problem.

462. In particular, Professor Peng believes that extraction-related conflicts constitute an overriding problem with any rule that to any extent confers ownership rights on persons other than coal owners.