

Beyond the New Deal: Reply

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I

We should be clear about what we have *not* been saying. At no point have we suggested that the courts should take primary responsibility for the development of substantive policy under the Act. Instead, the objective of judicial review remains as it was under the classical New Deal conception—to assure a full and focused airing of plausible policy options before officials make decisions of consequence.¹

Apparently, we have not been clear enough. Smith and Randle read into our article the very message we were at such pains to disclaim. They suppose us intent on convincing the court of appeals to second-guess the EPA on the merits of the scrubbing controversy. It is only on this premise that they can think that their attack on five factual assertions could be “central”² to our argument for judicial reversal of the EPA decision.

Far from being “central,” these five factual points are entirely irrelevant. Rather than encourage courts to second-guess the EPA on the facts, we aimed to encourage judges to guard against serious breakdowns in the administrative process. At the center of our argument for judicial intervention was a distinctive legal creature we called the agency-forcing statute:

Agency forcing provides a means for removing an issue from the general run of agency discretion, directing policy in a particular direction. At the same time, however, it signals a congressional recognition that, after all, the issue requires the exercise of expert judgment that cannot be applied directly from Capitol Hill. Thus, rather than setting down regulatory policy in explicit statutory terms, the agency-forcing statute contemplates careful policy reappraisal by the agency before the congressional initiative gains the force of law.³

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1. Ackerman & Hassler, *Beyond the New Deal: Coal and the Clean Air Act*, 89 YALE L.J. 1466, 1565 (1980) [hereinafter cited by page number only]. See B. ACKERMAN & W. HASSLER, CLEAN COAL/DIRTY AIR 115 (1981) (book-length version) [hereinafter cited without cross-reference as CLEAN COAL/DIRTY AIR].

2. Smith & Randle, *Comment on Beyond the New Deal*, 90 YALE L.J. 1398-1401 (1981) [hereinafter cited without cross-reference as Smith & Randle].

3. P. 1556; see CLEAN COAL/DIRTY AIR 104.

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Agency forcing, we believe, provides a promising legal technique by which a democratic legislature may deal creatively with the transparent dangers of uncontrolled technocracy.⁴ Like any other legal technique, however, it generates potential abuses of its own:

Simply put, it is the old Alphonse-Gaston problem: one player, Congress, enacts an agency-forcing statute with the expectation that the other will subject a particular policy to hard-headed consideration. The other player, the agency, thinks that Congress has already made the policy judgment and confines its policy review within narrow bounds. As a consequence, each player allows the other to drop the ball: an important policy is adopted without the hard thinking that should be required of a sound law-making enterprise.⁵

Now our thesis is precisely that the Alphonse-Gaston story has been reenacted in the scrubbing controversy. We tried to show that Congress did not in fact make a considered judgment on the scrubber's environmental merits when in 1977 it passed a statute that forced the scrubbing question onto the EPA's agenda.⁶ Yet, when the issue was considered by the EPA in 1978 and 1979, the agency did not attempt to subject the scrubber to a full inquiry. Not once in the course of the EPA's multimillion-dollar computer analysis did the agency seriously consider whether it was wiser to modify its existing standards in ways that did not force *all* new power plants to scrub their smokestacks.⁷ It is this decision to exclude, without analysis, all non-scrubbing options that justifies judicial intervention.

To avoid such breakdowns, the court must adapt a classic function of judicial review to the agency-forcing context. . . . Agency-forcing statutes should be read in the light of the *principle of full inquiry*—requiring the fullest possible agency inquiry into competing policy approaches consistent with the text of the agency-forcing statute.⁸

Although the courts have no business deciding the environmental merits of scrubbing, they can play a useful role by forcing *somebody* to take this job

4. P. 1567; see CLEAN COAL/DIRTY AIR 121-23.

5. P. 1556; see CLEAN COAL/DIRTY AIR 104-05.

6. Pp. 1487-1514; see CLEAN COAL/DIRTY AIR 26-58.

7. Pp. 1536-56, 1559; see CLEAN COAL/DIRTY AIR 79-103, 107.

A definitional clarification is in order. Our critics define "forced scrubbing" restrictively to embrace only a program that forces everyone to scrub 90% of the sulfur dioxide out of their smokestacks. Smith & Randle at 1399 n.10. This has never been our definition of the term; whenever the EPA forces polluters to scrub despite the availability of cheaper cleanup options, it is engaged in "forced scrubbing" as we define it. See note 43 *infra* (discussing 1979 standard).

8. Pp. 1556-57; see CLEAN COAL/DIRTY AIR 104-05.

seriously before tens of billions of dollars are spent in the name of clean air.

Since Smith and Randle seem to miss this argument completely,⁹ it is hardly surprising that they say nothing to refute it. They do not point to the place at which the EPA's multimillion-dollar computer study seriously considers the many different ways we can clean the air without forced scrubbing. Indeed, they are good enough to say that our "process critique . . . makes a contribution" to environmental law.¹⁰ Yet *only* this "process critique" justifies judicial intervention in an effort to prevent agency forcing from degenerating into an Alphonse-Gaston burlesque.

II

If our substantive analysis of forced scrubbing was not intended for the courts, for whom *was* it intended?

Congress—or more precisely, those congressional staffers, Washington lobbyists, environmental bureaucrats, and academic commentators on whom Congressmen rely when they try to make sense of the Clean Air Act. Our goal was to convince Congress that it has overwhelmed its own institutional capacities in its eagerness to clean the air. Congress must abandon the pretense that it can function effectively as a supertechnocrat—passing judgment on the merits of particular technological means (the scrubber) of achieving environmental ends (controlling acid rain). Rather than indulging in pseudotechnocratic judgments, Congress should take far more seriously the task of defining the ultimate ends that putatively justify our enormous national investment in a healthier environment. The congressional goal should be to set well-defined environmental targets and challenge the EPA to meet them in a cost-effective fashion by a date certain, at which point future goals might be defined in the light of past experience.¹¹

Our substantive analysis of the scrubber was part of this effort to persuade Congress to shift its attention from means to ends. By contrasting the erratic way Congress considered the issue of forced scrubbing with the

9. In this they are not alone. In their arguments before the Court of Appeals for the District of Columbia Circuit, none of the lawyers for any of the parties challenged the EPA's assumption that the 1977 amendments restricted the agency to forced scrubbing solutions to the power plant problem. The court itself took note of the central issues in a lengthy footnote, *Sierra Club v. Costle*, No. 79-1565, slip op. at 18-20 (D.C. Cir. Apr. 29, 1981), and called them "significant." It refused to confront them, however, "because no party has raised them." *Id.* at 18. As a consequence of this failure in advocacy, the court was induced to write a 253-page opinion that spends much energy on issues that could well have been mooted by requiring the agency to give non-scrubbing options the hard look required by the principle of full inquiry.

10. Smith & Randle at 1399.

11. Although these themes were sketched in our article, pp. 1566-71, they are developed more fully in the concluding chapter of our book, *CLEAN COAL/DIRTY AIR* 116-28, 180-83.

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hypothetical deliberations of a competent policy analyst, we tried to show just how poorly Congress was discharging the function of technological assessment. In attempting this analysis, however, we were handicapped by the failure of the EPA's multimillion-dollar study to confront the many alternatives to a forced scrubbing policy. Moreover, it was clear to us that two lawyers, working alone, could hardly fill this analytic gap with original research on the host of questions required by a broader view of the problem. The best we could do was to scavenge among existing EPA documents in search of the scattered data and analyses relevant to the critical questions slighted by the EPA and Congress.¹² Our aim was to assess the inadequate data haphazardly generated by the administrative process.¹³ Only in this way could we show how far Congress' pseudotechnocratic pretensions allowed the EPA to avoid the hard work needed to shape a cost-effective response to environmental realities.

Unfortunately, our critics' failure to grasp the institutional point of our substantive analysis distorts their critique from the outset. In their view, we were "attacking a straw man"¹⁴ in scrutinizing the simple proposal to force *all* new coalburners to scrub ninety percent of the sulfur out of their smokestacks. But it was just this "full scrubbing" program that gained the support of the bizarre coalition of environmentalists and dirty coal producers responsible for amending the Clean Air Act in 1977.¹⁵ And "full scrubbing" retains the support of organizations like the Sierra Club even today,¹⁶ when the Clean Air Act is once more the subject of systematic congressional amendment. Given our concern with statutory reform, it would have been a serious mistake to ignore the program that has thus far dominated the congressional agenda.

Moreover, in criticizing "full scrubbing," we were seeking to undermine an even more basic element in the existing statutory structure—the requirement that all new plants install "the best technological system of continuous emission reduction"¹⁷ in the name of clean air. By showing how this statutory command ultimately generated the forced scrubbing fiasco, we sought to loosen the hold that high technology solutions have had on the congressional imagination during the past decade. Congress must rid itself of the notion that high technology solutions always provide

12. See pp. 1538-39; CLEAN COAL/DIRTY AIR 80-84.

13. See p. 1515; CLEAN COAL/DIRTY AIR 59-60.

14. Smith & Randle at 1402.

15. Pp. 1492-1511; see CLEAN COAL/DIRTY AIR 29-54. See notes 43-47 *infra* for a discussion of the standard the EPA actually adopted.

16. For example, the Sierra Club has taken the extraordinary position that § 111 requires the EPA automatically to embrace full scrubbing and ignore analyses suggesting that competing cleanup programs would have a superior environmental impact. For the reaction of the court of appeals to this argument, see *Sierra Club v. Costle*, No. 79-1565, slip op. at 45-52 (D.C. Cir. Apr. 29, 1981).

17. 42 U.S.C. § 7411(a)(1) (Supp. III 1979).

the best way out of our environmental dilemmas. The goal must be to clean the air in cheap and effective ways; this goal is often ill-served by building fragile science fiction technologies into the exhaust pipes of industrial civilization.¹⁸

Apart from its importance in congressional decisionmaking, "full scrubbing" also served as a heuristically convenient place to begin a more comprehensive analysis. Conceptually, "full scrubbing" is the simplest form of forced scrubbing—it forces *every* new plant to scrub away the *same* percentage of sulfur dioxide regardless of the availability of cheaper cleanup methods. By beginning with "full scrubbing," we could introduce some of the fundamental issues raised by *any* policy of forced scrubbing without immediately distracting the reader with a host of secondary complexities.

To begin with the basics, Smith and Randle seem to think that we oppose forced scrubbing because we wish to impose some *other* technology—for example, coal washing—on all utilities.¹⁹ Nothing could be further from the truth:

Rather than imposing a high technology requirement on the utility industry, the goal should be to force utility executives to seek out the cheapest way of achieving further cutbacks. If reductions can be achieved more cheaply by altering the operation of old plants or by buying low sulfur coal, then it is these strategies that should be pursued A host of market-like schemes have been proposed to force polluters to recognize the social costs of their emissions and take efficient steps to control further discharges. Under these systems, the burden of designing a cost-effective response is placed where it belongs—on the polluters themselves, not on some government bureaucrat.²⁰

Rather than forcing all coalburners to clean up the same way—be it by scrubbing or washing or burning low sulfur coal—we hoped to persuade Congress to let each utility mix these and other cleanup measures in the way that was cheapest given its particular circumstances.²¹ If a coalburner

18. A similar story, we fear, can be told concerning the other triumph of technology-forcing—the catalytic converter. See Mills & White, *Government Policy toward Automotive Emissions Control*, in *APPROACHES TO CONTROLLING AIR POLLUTION* 342 (A. Friedlaender ed. 1978).

19. They list several of our alternatives to forced scrubbing, Smith & Randle at 1400 n.15, including "market-like schemes," but the rest of their critique assumes that we favor forcing utilities to use specific technologies. See *id.* at 1406-08, 1410.

20. P. 1525; see *CLEAN COAL/DIRTY AIR* 69.

21. We agree, of course, that in making this decision, utilities should be forced to consider the second-order environmental costs generated by competing cleanup approaches. Yet it is hardly clear that this factor strengthens the case for scrubbing, as our critics imply. The problem here is the millions of tons of sludge that scrubbers will generate annually. Under the computer simulations made by government consultants, the 1979 standard will generate between 14.4 and 26.7 million tons of extra sludge a year by 1995. ICF INC., *THE FINAL SET OF ANALYSES OF ALTERNATIVE NEW SOURCE*

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will emit the same amount of sulfur dioxide by scrubbing high sulfur coal or burning low sulfur coal, it should be permitted to choose the cheaper option. Environmentalists have nothing to gain—and much to lose—if they insist on adding billions of dollars to the cost of clean air for no sound *environmental* reason. Of course, the producers of dirty coal will have a vested interest in forcing utilities to scrub dirty coal rather than burn a cleaner product.²² But one aim of good statutory design should be to make it as difficult as possible for the dirty coal lobby to appropriate clean air symbols for its own purposes.²³

Smith and Randle have not confronted this central argument. Their comment does not even try to refute our claim that billions of dollars can be saved by allowing new plants to comply with clean air standards by burning cleaner coal, rather than scrubbing dirtier products.²⁴ Nor do they question our claim that for the next twenty years, the bulk of sulfur oxide pollution will be contributed by existing coalburners that are often allowed to pollute three or four times more heavily than comparable new facilities.²⁵ Instead, they devote an entire section to an analysis of only one of the ways that old plants can become cleaner—coal washing. By insisting that their suppliers wash their coal at the mine site, old plants may eliminate much of the pyritic sulfur that would otherwise be discharged from their smokestacks.

PERFORMANCE STANDARDS FOR NEW COAL-FIRED POWERPLANTS C-II-18, C-IV-18 (June 1979) (wet scrubbing cost figures) [hereinafter cited as ICF-IV]; *id.* at C-I-18, C-III-18 (dry scrubbing cost figures). Moreover, a recent academic study reports, “since the sludge is neither biodegradable nor firm enough to support structures, the end result is the permanent removal of land.” Navarro, *The 1977 Clean Air Act Amendments: Energy, Environmental, Economic, and Distributional Impacts*, 29 PUB. POL’Y 134 (1981). Although increased use of low sulfur coal will increase strip mining in the West, *see* p. 1535 n.254; CLEAN COAL/DIRTY AIR 78, at least the stripped land is not irredeemably lost.

Turning from clean coal to other forms of pollution control, our critics rightly emphasize that the comparative environmental impact of stack scrubbing and coal washing deserves far greater attention than it has been given. Indeed, we said the same thing in our earlier discussion. P. 1524 n.231; *see* CLEAN COAL/DIRTY AIR 157 n.32. We suspect, however, that a closer study of second-order effects will only suggest the folly of forcing all new power plants to meet their cleanup obligations in the same way, without regard to ecological realities in the power plant’s immediate neighborhood.

22. Pp. 1483-85; 1497-1501; *see* CLEAN COAL/DIRTY AIR 17-19, 31-33.

23. P. 1514; *see* CLEAN COAL/DIRTY AIR 57.

24. As we explained, *see* p. 1413 *supra*, the agency failed to consider any program that permitted new plants to meet more stringent emission requirements by relying exclusively on low sulfur coal. As a consequence, agency modelers never estimated the full cost savings that could be obtained if utilities were allowed to engage in efficient cleanup measures. Pp. 1538-39; CLEAN COAL/DIRTY AIR 80-84. At the very most, some computer simulations estimated the savings possible under partial scrubbing options that permitted utilities to scrub less than 90% of the sulfur from their smokestacks. Some of these options would save \$800 million a year over full scrubbing by 1995 while achieving the same—or greater—reductions in overall emissions. Pp. 1545 & n.324, 1528; *see* CLEAN COAL/DIRTY AIR 89-90, 169. Fully cost-effective approaches would result in much greater savings because they would allow utilities to escape or defer the formidable capital costs involved in scrubber construction. *See* note 47 *infra*.

25. Pp. 1522-23; *see* CLEAN COAL/DIRTY AIR 66-67.

In exploring the gains to be obtained from coal washing, we were very pleased when our detective work uncovered two unpublished papers on coal washing that the EPA's leading expert, James Kilgroe, presented at conferences only months before our essay went to press.²⁶ It is our presentation of these findings that has generated our critics' fire.²⁷ We do not understand, however, precisely what they wish to criticize. We reported that one of these recent papers estimated that "the cost of washing high sulfur coals ranges from two to nine cents a pound of sulfur dioxide removed, compared to a cost range of seven to forty-five cents a pound for a ninety percent scrubbing system." Our critics do not contest the accuracy of this report, for the simple reason that this *is* what Mr. Kilgroe *did* write.²⁸ Nor can they deny that we placed this estimate in context with an accompanying footnote which takes note of less optimistic estimates in the very TVA study they emphasize:

Although Kilgroe and Strauss's optimistic assessment of coal washing [reported in the text] seems generally supported by the studies they cite, there are studies that suggest a smaller cost advantage in favor of washing. For example, a recent TVA study suggests that average cost of scrubbing at 85% is only slightly greater than washing at about 35% Kilgroe, however, does not reconcile this study's conclusions with the work that supports the cost comparison cited in the text. More generally, the data base on washing costs seems weak—reflecting the low institutional priority given the question until very recently.²⁹

Randle and Smith do not explain why Kilgroe was mistaken in deciding to deemphasize the TVA study and focus on other findings. Nor do they deny that he is the leading EPA expert on these matters. What, then, are they complaining about?

Rather than calling our attention to any study we ignored at the time we wrote our article, Smith and Randle merely report that Kilgroe has come up with new estimates during the past year. These unpublished numbers do not suggest that we were wrong about coal washing. Apparently Kilgroe now believes that washing high sulfur coal, at its cheapest,

26. Pp. 1481 n.55, 1523 n.229; see CLEAN COAL/DIRTY AIR 136 n.3.

27. Smith & Randle at 1406.

28. P. 1523; see CLEAN COAL/DIRTY AIR 67. Our critics correctly point out that, in making this comparison, Kilgroe did not include the exorbitant costs—ranging up to \$2800 a ton—of washing low sulfur Western coal. Kilgroe's omission, we think, was quite understandable because nobody—to our knowledge—has seriously suggested coal washing at such high prices, especially when the extent to which low sulfur Western coal can be washed is not even clear. By using Kilgroe's cost estimates, then, we were simply reporting the costs involved in the range of options that seemed feasible to all informed students of the subject. Cf. Smith & Randle at 1407 n.60.

29. P. 1524 n.231; see CLEAN COAL/DIRTY AIR 156 n.32.

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can remove sulfur dioxide for as little as \$200 a ton, while the cheapest scrubber can remove sulfur dioxide at a rate of \$330 a ton.³⁰ Why, then, should the EPA insist on forcing all utilities to scrub their new smokestacks if they can sometimes achieve an equivalent gain at a lower cost by burning washed coal in their old plants?³¹

Moreover, there is no reason to stop the economic logic at the point at which the marginal cost of old plant washing equals that of new plant scrubbing. Even washed coal can be very dirty, and utilities may cut back sulfur dioxide substantially by shifting suppliers and buying cleaner coal for their old plants.³² They should be encouraged to take this and other cleanup measures until the marginal cost of reducing emissions from dirty, old plants equals the cost of making clean, new ones even cleaner.³³

Indeed, there are heartening indications that agency decisionmakers are

30. Smith & Randle at 1406 nn.55-56 (reporting coal washing costs ranging from \$200 to \$2800 a ton and scrubbing costs ranging from \$330 to \$1030 a ton). The high range of the coal washing estimates reported by Smith and Randle merely emphasizes the exorbitant costs involved in washing low sulfur Western coal—a project that no one, to our knowledge, has seriously proposed. See note 28 *supra*.

31. Consultants for the Business Roundtable have estimated that substantial savings can be achieved nationwide by the adoption of more cost-effective air quality regulations. The Business Roundtable study predicts that if the EPA set regional emission ceilings for old and new plants together at the levels which will be attained under the current regulatory scheme, but allowed utilities to reduce emissions as efficiently as possible from either old and new plants, total annual control costs could be reduced by 36% from \$6.6 billion to \$4.2 billion per year by 1990. NATIONAL ECONOMIC RESEARCH ASSOCIATES, COST-EFFECTIVENESS AND COST-BENEFIT ANALYSIS OF AIR QUALITY REGULATION 7-14 to 7-17 (1980). Although we are generally familiar with the NERA model underlying these predictions, we have not probed it deeply enough to make a considered judgment on the reliability of these particular projections. See also J. Bromberg, *Bubbling New Sources With Existing Sources: An Examination of the Environmental and Economic Benefits of an Integrated Approach to Emission Control 1*, Table 0-1 (Dec. 1980) (on file with *Yale Law Journal*) (substantial cost savings available by trading off new plant emission reductions for old plant controls).

32. As we explained in our earlier work, pp. 1483-84, 1551-52; see CLEAN COAL/DIRTY AIR 17, 98-100, 138-39, 172-74, there is no reason to anticipate long-run problems in supplying utilities with all the low sulfur coal they can use. Roughly 200 billion tons of the nation's demonstrated coal reserve base has less than 1% sulfur content and produces less than two pounds of sulfur dioxide per MBTU. NATIONAL COAL ASSOCIATION, COAL DATA 1978 (1980). In contrast, total utility coal consumption in 1980 was 568 million tons. Bituminous and Lignite Coal Consumption, Production, Imports and Inventory, Preliminary, 1980 (not yet published figures provided by National Coal Association, Washington, D.C.) (on file with *Yale Law Journal*). During the past decade Western coal production, primarily low sulfur coal, has increased dramatically from 9% of national production in 1971 to 30% in 1980. P. 1484 n.66; CLEAN COAL/DIRTY AIR 138 n.12; Coal Production by State and Type of Mining, 1980 (final) (not yet published figures provided by National Coal Association, Washington, D.C.) (on file with *Yale Law Journal*). An EPA consultant states that excess capacity currently afflicts coal mine operators and concludes that, given the substantial reserve base noted above, no shortages will hinder the use of low sulfur coal from approximately 1986 onward. Interview with coal supply analyst, ICF Inc., Washington, D.C. (Aug. 14, 1981). Most new plants subject to the EPA's 1979 NSPS requirement will become operational during or after that year.

33. See p. 1523; CLEAN COAL/DIRTY AIR 67. This point is ignored by our critics whenever they compare old plant washing with new plant scrubbing on the basis of each technology's cost of removing a ton of sulfur. See Smith & Randle at 1406-07. Such calculations fail to take account of the fact that by shifting to lower sulfur coal, an old plant can lower the number of tons of sulfur dioxide it will be obliged to remove by washing or other means, thus reducing total cost even if there is an increase in the cost per ton of sulfur dioxide removed.

at long last acting on this basic point. EPA modelers are now preparing a comprehensive estimate of the savings that are possible when utilities are allowed to substitute old plant cleanup for new plant scrubbing. Although these numbers have not been officially released at the time of this writing, we are reliably informed that the savings are "substantial."³⁴ Precisely this analysis was conspicuously absent in the rulemaking process our critics seek to defend. At the very most, they have proved something we have never denied—that *some* new plant scrubbing may sometimes be the cheapest way of meeting clean air requirements. When this is true, we are happy to let the scrubbers keep scrubbing.³⁵ Our only complaint is with the agency's effort to force scrubbing when there are cheaper ways of cleaning the air.³⁶

This basic point also eluded our critics in their discussion of the relative speed with which non-scrubbing alternatives will clean the air. Rather than considering the speed with which the supply of cleaner coals can be expanded for use in old and new plants, our critics restrict their analysis to the speed with which coal washing may be introduced. Once again, we are criticized for relying on the only estimate that had been proffered by knowledgeable EPA researchers at the time of our study: that coal washing could reduce Eastern sulfur dioxide emissions by "1 to 2 million tons" and that new facilities could be built in three to five years.³⁷ According to Smith and Randle, "[t]his estimate did not include the time needed for the EPA to develop, to propose, to promulgate, and to implement regulations that would require universal washing practices, a process that could take more than five years."³⁸

But we do *not* advocate a universal washing requirement, let alone its implementation through the time-consuming techniques of command-and-control regulation that put such a premium on foot-dragging. Our point was simply this: if the EPA had spent the 1970s forcing utilities to meet clean air targets in a cost-effective manner, substantial gains could have been obtained from coal washing as early as 1985, five to ten years before equivalent gains can be expected from new plant scrubbing.³⁹ Rather than

34. Interviews with confidential sources, EPA Office of Policy and Resource Management, Washington, D.C. (July 1981); see note 31 *supra* (citing NERA report).

35. Pp. 1525-26; see CLEAN COAL/DIRTY AIR 68-70.

36. P. 1524; see CLEAN COAL/DIRTY AIR 67-68.

37. *Id.* (citing J. Kilgroe, Coal Cleaning for Sulfur Oxide Emission Control 22, 28 (Apr. 8-9, 1980) (unpublished paper presented at Acid Rain Conference, Springfield, Va.) (on file with *Yale Law Journal*)).

38. Smith & Randle at 1407.

39. P. 1525; see CLEAN COAL/DIRTY AIR 68. Although Kilgroe's estimate, see note 37 *supra*, was the only one available at the time we wrote our article, our critics point to a 1981 report by the Environmental Law Institute predicting that coal washing requirements might take as long as 11 years to yield their full environmental benefit. Smith & Randle at 1408 n.67. But the report reaches this conclusion only because its authors allow up to eight years for regulators to promulgate and

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responding to this point, our critics unwittingly demonstrate the irrationality of the present system when they note that as much as “twenty percent of the additional capacity needed to clean all utility coal east of the Mississippi” presently exists but is going unused.⁴⁰ Why do we let such opportunities for immediate sulfur reduction go ignored at the same time that we insist on spending billions for scrubbers?⁴¹

Our critics’ discussion of coal washing, moreover, should not permit the reader to ignore their even more pregnant silence. Whatever the truth about using washed coal in old plants, our principal claim had to do with the money that can be saved by allowing *new* plants to meet clean air targets by burning low sulfur coal or by applying one of several forms of technological treatment to dirtier products.⁴² Until *this* claim is addressed, Smith and Randle have failed to consider, let alone to answer, the basic charge of inefficiency we have leveled against the scrubber. Their protestations to the contrary, they have not even begun to address the assertions that are “central” to our argument about cost-effectiveness.

III

But, our critics rightly point out, the EPA did not impose a simplistic full scrubbing program on the utility industry. Rather than forcing every new coalburner to scrub ninety percent of the sulfur dioxide out of its smokestacks, the agency allowed some coalburners to scrub somewhat less compulsively. Under the EPA’s “partial scrubbing” regulations, a utility may be allowed to scrub as “little” as seventy percent of the sulfur dioxide from its smokestacks if it promises to burn coal in the lower sulfur grades.⁴³ According to Smith and Randle, we devote almost no attention to

implement a forced washing requirement—poignant evidence of the cumbersome nature of command-and-control regulation. G. Weistone & P. Reed, *Institutional Aspects of Transported Pollutants: An Examination of Strategies for Addressing Long Range Air Pollution Problems* 46 (1981) (on file with *Yale Law Journal*). In contrast, the Institute thinks it will take coal mines and utilities “0 to 3 years” to bring their coal-washing equipment into operation, *id.* at 47, and lists coal washing among the programs that “would pay off most quickly,” *id.* at ix. Even at their most pessimistic, the Institute estimates are not inconsistent with our earlier claims. An EPA program begun in the mid-1970s would have been fully implemented by the mid-1980s.

40. Smith & Randle at 1408. Although the estimates are of poor quality, it seems that 40% of Eastern coal is presently washed. *Id.*; p. 1523; see CLEAN COAL/DIRTY AIR 67, 156. Thus, by our critics’ account, currently excess capacity may be able to wash at least one-fifth of presently unwashed production.

41. Smith and Randle do not report, and we do not know, whether the use of unused equipment represents a cost-effective way of achieving additional sulfur dioxide reductions. Since the equipment is already in the field, however, there can be no doubt that it provides one of the fastest ways of cleaning the air.

42. P. 1526; see CLEAN COAL/DIRTY AIR 69-70.

43. EPA regulations allow utilities to remove as little as 70% of the sulfur from their coal if they achieve a 0.6 pound/MBTU emission level. 45 C.F.R. § 60.43c (1980).

Although the Clean Air Act explicitly forbids the Administrator to force a particular technology on the utility industry, 42 U.S.C. § 7411(h)(2) (Supp. III 1979), there can be no doubt that agency officials believed that without scrubbers, coalburners could not effectively satisfy their demand for 70%

this decision.⁴⁴ This omission, it is claimed, undermines the value of our substantive critique.

We are puzzled by these charges. Rather than ignoring the EPA decision, twenty pages of our article (and thirty-four of our book) are devoted to an analysis of the EPA's decision to abandon "full scrubbing" in favor of "partial scrubbing."⁴⁵ Moreover, it should be plain that the arguments presented in the preceding section, and developed at greater length in our previous work, apply in principle to *all* forced scrubbing programs, including the one adopted by the EPA. To put the point in its general form: it is inefficient to force coalburners to scrub away X percent of the sulfur oxide produced by high sulfur coal if the utility finds it cheaper to cut back emissions the same amount by burning unscrubbed low sulfur coal. This is no less true when the X is set at seventy percent for some coalburners than when it is set at ninety percent for all. Of course, partial scrubbing will be somewhat less inefficient than full scrubbing, because coalburners can avoid the high marginal costs of ninety percent scrubbing if they can buy low sulfur coal more cheaply. But the fact remains that EPA regulations forbid any plant to reduce the multibillion-dollar costs of seventy percent scrubbing even when it is cheaper to clean the air through non-scrubbing techniques.

Once again, then, Smith and Randle have only proved something we explicitly asserted—that partial scrubbing will be less inefficient than full scrubbing.⁴⁶ Yet simply because this is true, it hardly follows that the EPA cannot achieve its environmental goals more cheaply by other means. To the contrary, so long as the agency merely permits some new plants to scrub somewhat less assiduously, the EPA will cut only a fraction of the needless cost imposed by its commitment to forced scrubbing.⁴⁷

to 90% sulfur dioxide removal. See *Sierra Club v. Costle*, No. 79-1565, slip op. at 104-07 (D.C. Cir. Apr. 29, 1981). Our critics also point out that "the use of a number of new technologies and anthracite coal is deliberately encouraged." Smith & Randle at 1402. But anthracite accounted for 0.7% of national coal production in 1980. Coal Production by State and Type of Mining, *supra* note 32. And none of the experimental technologies have begun to establish their cost-effectiveness or reliability, with the exception of dry scrubbing, to be discussed below. See pp. 1423-24 *infra*.

44. Smith & Randle at 1399.

45. Pp. 1536-56; see CLEAN COAL/DIRTY AIR 79-103.

46. See pp. 1554-56. Indeed, when we expanded our *Yale Law Journal* article into book form, we took special pains to construct a table that clearly showed the cost savings claimed for the partial scrubbing program selected by the EPA compared to its full scrubbing competitor. CLEAN COAL/DIRTY AIR 102.

47. How small a fraction is a matter of some dispute. At the very least, the EPA's partial scrubbing dispensation will allow some plants to avoid the extra costs involved in pushing their wet scrubbers to the limit of their sulfur removal capacities. But since the EPA's partial scrubbing program still requires *all* plants to shoulder the heavy capital costs of scrubber construction, the fraction saved will not be very large. As Smith and Randle note, see Smith & Randle at 1405 n.50, total operation and maintenance cost does not exceed the annualized capital cost of scrubber construction, and the operating cost of 70% scrubbing remains substantial. ICF-IV, *supra* note 21, at B-11. Insofar as dry scrubbing is a feasible alternative, *but see* pp. 1424-25 *infra*, somewhat greater savings are possible.

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Turning from costs to benefits, it is best to define the precise area in dispute. We have never denied that the EPA's forced scrubbing program will result in modest reductions in sulfur dioxide loadings in most areas of the country by 1995⁴⁸—albeit at a needlessly high cost. Our claim was that “the agency action is so inept that some of the nation's most populous areas will enjoy a *worse* environment than would have resulted if the new policy had never been put into effect.”⁴⁹

As our article made clear, the most threatened region is a five-state area in the industrial Midwest that presently accounts for about one-quarter of the nation's entire sulfur dioxide loadings.⁵⁰ The problem arises because the EPA's forced scrubbing program only applies to new plants, and not to old ones. Because forced scrubbing can add up to fifteen percent to the cost of a new plant, the program gives utilities a strong incentive to delay building clean, new plants and to rely on power from dirty, old plants for as long as possible. In aging industrial regions, this “old plant effect” can more than offset any gains obtained by new plant scrubbing for the next fifteen to twenty years. After a study of all the available evidence, we concluded that this was the likely fate of the Midwest.

In countering this pessimistic conclusion, our critics do not contest the reality of the old plant effect.⁵¹ Instead, their only rebuttal consists of a single computer run predicting that, despite the old plant effect, Midwestern sulfur dioxide emissions will be reduced by three percent in 1995 as a result of the adoption of the EPA's forced scrubbing program.⁵² Computer output, however, can be no better than computer input. The simulation upon which our critics rely depends upon an overly optimistic model and utterly speculative data.

Turning first to the data, our critics' computer scenario assumes that a substantial percentage of utilities will abandon relatively familiar wet

Moreover, even if we restrict our attention to the partial scrubbing programs considered by the EPA, it is not clear that the agency selected the least inefficient one. Our critics fail to comment, for example, on a proposed standard that promised to achieve slightly greater emission reductions in Eastern regions, along with slightly smaller nationwide reductions, at reduced nationwide costs, by easing percentage reduction requirements and lowering the permissible emission ceiling. ICF-IV, *supra* note 21, at 4, A-4a, A-6a (Alternative G) (0.55 pounds/MBTU ceiling; 33% reduction; dry scrubbing cost assumptions).

48. Explicit statements to this effect may be found at p. 1555 & n.373, *see* CLEAN COAL/DIRTY AIR 101-02 (1979 standard), and at pp. 1524, 1535-36, 1540-41, *see* CLEAN COAL/DIRTY AIR 68, 77-78, 84-85 (1978 proposed standard).

49. P. 1469; *see* CLEAN COAL/DIRTY AIR 2 (*italics in original*).

50. *See* pp. 1521, 1522 n.226, 1524, 1540 n.307, 1545; CLEAN COAL/DIRTY AIR 66 n.28, 68, 85, 90, & 166 n.11.

51. The EPA itself has formally acknowledged the potentially counterproductive impact of this effect. *See* 44 Fed. Reg. 33,580, 33,607 (1979) (promulgation of 1979 NSPS, stating in part that “[o]ne finding that has been clearly demonstrated by the two years of analysis is that lower emission standards on new plants do not necessarily result in lower national SO₂ emissions when total emissions from the entire utility system are considered”).

52. Smith & Randle at 1403 n.40.

scrubbing methods and install new "dry scrubbing" technology to take advantage of the EPA's partial scrubbing regulation.⁵³ It is hoped that dry scrubbers: (1) will be cheaper than wet scrubbers; hence (2) will reduce the financial penalty associated with forced new plant scrubbing; hence (3) will encourage utilities to replace old plants with new ones more quickly;⁵⁴ and hence (4) will ameliorate the "old plant effect" that especially afflicts the Midwest.

In appraising this argument, however, we emphasized that "there is no dry scrubber operating on a full-sized power plant anywhere in the United States."⁵⁵ Moreover, we happened to be on the scene at the EPA just at the time the dry scrubber came to the forefront of agency attention. Our face-to-face interviews gave us no reason to place great weight on the dry scrubbing data hastily conjured up by agency personnel during the last weeks of decisionmaking.⁵⁶ Rather than taking our critics' uncritical approach to the dry scrubbing computer scenario, we thought it far more enlightening to explore the bureaucratic politics that led the agency to embrace such weak data in the final weeks of agency deliberation.⁵⁷

Smith and Randle fail to convince us that our approach was mistaken. They do not direct us to the hard engineering data that putatively supported the EPA's dry scrubbing projections. Although they claim that a 1981 EPA report contains "more recent cost estimates [which] continue to support the projected cost savings from dry scrubbing,"⁵⁸ an inspection of the document they cite reveals a different story. Rather than reporting any new data, the new document blandly observes:

For new powerplants, the dry scrubber cost assumptions were those used previously by EPA in their analysis of revised New Source Performance Standards (NSPS). These were documented in an ICF report entitled *The Final Set of Analyses of Alternative New Source Performance Standards for New Coal-Fired Powerplants*, June 1979.⁵⁹

In other words, no published EPA document indicates that the agency has

53. See ICF-IV, *supra* note 21, at C-I-3a, C-III-21.

54. Old plants need not be completely eliminated from the utilities' power systems before their adverse effect on pollution may be reduced. So long as new plant scrubbing costs are not too high, utilities may find new plants cheaper to run. As a consequence, they may operate older plants only during periods when the power system experiences peak load demands and rely on clean, new plants to provide energy during other parts of the daily consumption cycle.

55. P. 1555; see CLEAN COAL/DIRTY AIR 102-03.

56. Pp. 1553-56; see CLEAN COAL/DIRTY AIR 101-03.

57. Pp. 1550-56; see CLEAN COAL/DIRTY AIR 97-103, 172-76 (more elaborate treatment); note 46 *supra*.

58. Smith & Randle at 1403 n.39.

59. ICF INC., INTERIM RESULTS OF ACID RAIN MITIGATION STUDY, app. III, at III-5 (1981) [hereinafter cited as ARMS REPORT].

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done anything to improve its cost estimates since the hectic days of decision in 1979.⁶⁰ Rather than new data, all our critics have to report is that “utilities have begun to build three full-scale plants” and “full-page advertisements are now appearing in trade publications.”⁶¹ This is hardly the stuff upon which to build serious estimates of operating costs and reliability.

In contrast, our doubts about dry scrubbing are shared by the United States Court of Appeals for the District of Columbia Circuit. In its recent review of the EPA decision, the court found that “it would be premature to conclude that dry scrubbing is adequately demonstrated technology.”⁶² Noting that only data from pilot plants were available to the agency, the court wrote:

EPA does not attempt to explain how these results may be used to predict performance in full scale plants throughout the industry Furthermore, there is no test data at all available for the performance of dry scrubbers burning low alkaline coal, which comprises roughly half of the supply of lower sulfur coal, and is more difficult to clean than low sulfur coal with high alkalinity.⁶³

Yet the last-minute modeling runs based on the EPA’s unsupported dry scrubbing extrapolations provide the sole support for Smith and Randle’s optimism about the Midwest. It is *only* when these undocumented hopes are fed into the computer that the model predicts a three percent decline in sulfur dioxide loadings in the Midwest in 1995. If, however, the dry scrubber proves disappointing, and utilities are forced into wet scrubbing, the EPA model bears witness to the “old plant effect” by predicting a three percent increase in 1995 Midwestern loadings.⁶⁴

Our pessimism about the Midwest, moreover, was hardly grounded upon this single pessimistic computer run.⁶⁵ Indeed, we think it very wrong to make much of the difference between the model’s prediction of a three percent decrease in Midwestern sulfur dioxide (assuming dry scrubbing) and a three percent increase (assuming wet scrubbing). At the present stage of its development, the EPA model can be sensibly used only to gain a rough sense of the order of magnitude of the scrubber’s environ-

60. We are reliably informed, however, that the EPA is now attempting to place its dry scrubbing estimates on a firmer foundation. Interviews with confidential sources, EPA Office of Policy and Resource Management, Washington, D.C. (July & Aug. 1981). We applaud this initiative and await the new estimates with great interest.

61. Smith & Randle at 1402 n.38.

62. *Sierra Club v. Costle*, No. 79-1565, slip op. at 73 n.158 (D.C. Cir. Apr. 29, 1981).

63. *Id.* at 72 n.158.

64. Compare ICF-IV, *supra* note 21, at C-I-3a, C-III-21 (using dry scrubbing cost assumptions) with *id.* at C-II-3a, C-IV-21 (using wet scrubbing cost assumptions).

65. Compare p. 1524 with pp. 1526-28; see CLEAN COAL/DIRTY AIR 68, 70-72.

mental impact. When read in this way, the computer printout contains an important message that is obscured by undue reliance on trivial percentage changes. It suggests that, *regardless of the wet-dry controversy*, the EPA's "partial scrubbing" program will not substantially improve the environment in the heavily populated five-state region that presently accounts for about one-quarter of the nation's entire sulfur dioxide load. This conclusion should be more than enough to cast grave doubt upon the environmental value of the EPA's multibillion-dollar program. Surely we can do better than this after spending billions of dollars?

Yet even this is to give the EPA's program too much credit. There is every reason to fear that all the model's predictions are overly optimistic—not by a percentage point or three, but by a lot. The critical point involves the model's unrealistic treatment of EPA enforcement. Quite simply, the model assumes that the EPA will systematically detect and effectively deter scrubber malfunction,⁶⁶ thereby guaranteeing that plants will continuously meet the seventy to ninety percent removal that the law requires. We are entirely unpersuaded by Smith and Randle's effort to minimize the difficulty of enforcing scrubbing requirements on a day-to-day basis. Their claim that "utilities must continue to pay for [scrubbers] once they are built, whether or not they are used"⁶⁷ is only half true. We agree, of course, that utilities must borrow billions when they build scrubbers and that they must repay their debts regardless of the extent to which the machines actually clean the air. It hardly follows, however, that utility executives will delight at the prospect of spending an extra billion or so a year by 1995 to keep the scrubbers scrubbing at high performance levels.⁶⁸ If they can cut hundreds of millions out of operating budgets without detection, there is reason to fear that this will happen. Also there is no reason to believe that they will divert many of their best employees away from moneymaking tasks to scrubber superintendence. Yet without high-quality personnel, the money spent on scrubbing will fail to yield high-quality performance.

In making these points in our earlier work,⁶⁹ we did not suggest that they cannot be surmounted by a costly EPA enforcement effort that takes full advantage of sophisticated monitoring systems. We emphasized only

66. P. 1539; CLEAN COAL/DIRTY AIR 82.

67. Smith & Randle at 1405.

68. Smith and Randle support their claim about operating costs by citing to the recently published ARMS REPORT, *supra* note 59; we therefore generated our billion-dollar estimate using numbers from this document. *Id.*, app. III, at III-12, 3-6. To be conservative, our calculations assume a 50% capacity factor. We emphasize that we are speaking here only in the roughest terms. Finally, we note that despite its 1981 date, the ARMS Report contains no new data on dry scrubbing costs, *see id.*, app. III, at III-5; pp. 1424-25 *supra*, and that the need for better data on this subject remains acute.

69. P. 1528; *see* CLEAN COAL/DIRTY AIR 71.

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that neither the EPA nor the states have shown any indication of making the intensive enforcement effort required to keep the scrubbers scrubbing at peak performance levels.⁷⁰ And so long as this remains the case, it seems plain that a strategy that emphasizes low sulfur coal burning will place a lesser strain on the limited enforcement resources likely to be forthcoming.

This is so for at least three reasons. First, a low sulfur coal strategy does not rely nearly so heavily on sensitive machines that deteriorate over time. So long as the low sulfur coal gets to the power plants, regulators need not be concerned with the way aging equipment is operating ten, twenty, or thirty years after the first scrub. Second, a low sulfur coal strategy can be enforced in a way that does not rely so heavily on a complex effort to keep in constant touch with the nation's smokestacks:

When a utility decides to build a new plant, it either builds a "captive" mine or contracts for a guaranteed long-run supply [of coal]. It is at this point—years before the first coal is burned—that enforcement agents may intervene. To the extent possible, steps should be taken to assure that the "captive" mine site will yield coal that will uniformly satisfy the Clean Air Act's requirements.⁷¹

Compared to constant smokestack surveillance, an intensive one-time scrutiny of the proposed mine site seems a more manageable way for regulators to reduce the amount of sulfur dioxide discharged by the power generating system. Of course, this early regulatory intervention at the "captive" mine is hardly foolproof; coal from "low sulfur" sites can sometimes vary substantially in sulfur content when it is actually mined.⁷² Nonetheless, an early regulatory check promises a sensible way of limiting the overall amount of sulfur introduced into the system, and so limits the total discharge that will occur if later, more complex, regulatory controls break down. In contrast, forced scrubbing increases the demand for high sulfur coal and so increases total emissions in the event of a breakdown in subsequent stages of the control system.⁷³

70. See p. 1527 n.243; CLEAN COAL/DIRTY AIR 159 n.42 (even before widespread use of scrubbers, 71% of "complying" sources in EPA study experienced incidents of excess emissions; excess emissions of plants not in compliance averaged 25% of amount allowed by legal emission standard); p. 1482 n.59; CLEAN AIR/DIRTY COAL 137 n.6 (1978 survey of scrubber operation over two-month period showed half of systems had less than 50% reliability during at least one month). EPA reports published since our article suggest the existence of a continuing problem. See EPA, EPA UTILITY FGD SURVEY: OCTOBER-DECEMBER 1980 at xvii-xix (1981) (EPA Pub. No. 600/7-81-012b) (1980 survey of scrubber operation over three-month period showed one-quarter of systems had less than 50% reliability during at least one month, based on 54 plants for which complete figures available; 30 other plants reported incomplete or no data).

71. Pp. 1531-32; see CLEAN COAL/DIRTY AIR 74.

72. Pp. 1483 n.65, 1532 n.268; see CLEAN COAL/DIRTY AIR 138 n.11, 161 n.58.

73. Pp. 1526-28; see CLEAN COAL/DIRTY AIR 70-71.

A final aspect of the power business generates a third enforcement advantage for the low sulfur coal strategy. Smith and Randle ignore the common engineering practice of designing new plants to take advantage of the particular properties of the coal they are expected to burn. By planning ahead for coal containing a predetermined sulfur and fly ash content, new plants may be engineered to minimize corrosion and maximize boiler efficiency.⁷⁴ This means that a utility cannot cheaply cheat on its low sulfur commitments by secretly substituting low cost, dirty coal for the more expensive low sulfur product. Because such substitutions will increase the cost of power plant operations, the utility must accept a penalty for its illegal conduct. In contrast, the malfunction of a scrubber does not automatically reduce utility profits. Thus, under the low sulfur coal option, utilities directly bear at least part of the cost of illegal operation; under scrubbing, all of this cost is externalized onto the people who breathe the air.

This is not to say, of course, that a low sulfur coal strategy makes it unnecessary for state officials to find out what is actually going on in the plants under their supervision. And, despite our critics' contrary suggestion, we are very much in favor of automatic monitoring and computerized data collection.⁷⁵ Our point is simply that, until the great day when the EPA and the states have the resources and ability to put such a system into effective operation, there is good reason to fear that forced scrubbing will overwhelm the system's capacity to keep in touch with the nation's smokestacks, and that over time, this enforcement failure will lead to relatively low levels of scrubbing performance.⁷⁶ Rather than confront this problem realistically, the EPA model assumes it away. But even without a realistic treatment of enforcement, the EPA model fails to predict a significant improvement in Midwestern air quality. There is thus every reason to fear that "some of the nation's most populous areas will enjoy a *worse* environment than would have resulted if the new policy had never been put into effect."⁷⁷

Indeed, despite Smith and Randle's effort to contest our claim, we do not really believe that it is particularly controversial. Even at the time of our original article, independent scholars had recognized that forced

74. Interview with Professor Gary Haller, Yale University Department of Chemical Engineering, New Haven, Ct. (Aug. 14, 1981).

75. Our critics seem to have missed a passage in which we express our preference for sophisticated monitoring equipment. Pp. 1526-27; CLEAN COAL/DIRTY AIR 70.

76. P. 1528; see CLEAN COAL/DIRTY AIR 71. Moreover, as Smith and Randle point out, Smith & Randle at 1405 n.48, existing regulations do not even force utilities to police their own scrubbing performance because the regulations fail to require utilities to report the data they collect on scrubbing efficiency directly to their own employees operating the plant.

77. P. 1469; see CLEAN COAL/DIRTY AIR 2.

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scrubbing had more to do with protecting dirty coal than assuring cleaner air.⁷⁸ And while we were writing this reply, yet another academic report concluded: “Although there is a modest decline in national SO₂ emissions, the cost of achieving that reduction more than doubles; emissions rise in the Midwest and sludge production increases dramatically.”⁷⁹

IV

Our critics voice a variety of other complaints. Treating each at length, however, would be more tedious than instructive.⁸⁰ We shall restrict ourselves to those points where further dialogue might play a useful role in defining the future agenda for research and policy discussion.

Begin with our critics' treatment of the impact of coal burning on Western air quality. There is more common ground here than meets the

78. ENERGY: THE NEXT TWENTY YEARS 378-81 (Ford Foundation 1979); Badger, *New Source Standard for Power Plants I: Consider the Costs*, 3 HARV. ENV'T'L L. REV. 48, 58-59 (1980); Navarro, *The Politics of Air Pollution*, PUB. INTEREST, Spring 1980, at 36. All of these sources were cited in our earlier work. P. 1469 n.7; CLEAN COAL/DIRTY AIR 130 n.7. Even those most committed to forced scrubbing have recognized the need to grapple with the impact of the “old plant effect” in the Midwest. See Ayres & Doniger, *New Source Standard for Power Plants II: Consider the Law*, 3 HARV. ENV'T'L L. REV. 63, 80-81 (1979) (advocating use of standards far more stringent than EPA's 1979 requirements in effort to reduce effect).

79. Navarro, *supra* note 21, at 143. Although Navarro's reading of the EPA's modeling results accords with our own, he buttresses his conclusions further by presenting predictions generated by National Economic Research Associates (NERA) on behalf of the utility industry. We have not examined NERA's work carefully enough to make an informed evaluation of these particular predictions.

80. Our lawyerly pride, alas, cannot allow four legal quibbles to pass unnoticed. First, there is the complaint, Smith & Randle at 1400-01, that we fail to discuss the relevance of *National Lime Ass'n v. EPA*, 627 F.2d 416 (D.C. Cir. 1980), to our problem. As Smith and Randle note, the opinion in this case was delivered by the D.C. Circuit on May 19, 1980. Since our article was to appear in the *Journal's* July issue, we did not think it necessary or appropriate to attempt a last-minute analysis of this decision. Moreover, the court's intensive scrutiny of the EPA's substantive findings in that case was hardly inconsistent with our view that the court should undertake a parallel judicial effort to scrutinize the EPA's factfinding processes in the present case.

Second, there is the claim, Smith & Randle at 1401, that we ignored *Alabama Power Co. v. Costle*, 606 F.2d 1068, 1081 (D.C. Cir. 1979). We find this complaint puzzling, because Smith and Randle themselves point to the very place in our article where *Alabama Power* is cited. Compare Smith & Randle at 1401 n.25 with p. 1568 n.404; CLEAN COAL/DIRTY AIR 181 n.7.

Third, there is the charge, Smith & Randle at 1400, that we “completely ignore[d]” the PSD program. Yet the relationship between forced scrubbing and PSD was in fact a centerpiece of our analysis of the 1977 amendments to the Clean Air Act, see pp. 1493-96, 1501; CLEAN COAL/DIRTY AIR 29-33, 39-41, and PSD also figured in our proposals for statutory reform, see p. 1567; CLEAN COAL/DIRTY AIR 123. See also p. 1431 *infra* (discussion of PSD).

Fourth, rather than “ignore statutory limitations and existing case law” in arguing that polluters should be allowed to offset emission reductions between old and new plants, see Smith & Randle at 1401, we quite specifically referred the reader to § 111(b)(2) of the Clean Air Act, 42 U.S.C. § 7411(b)(2) (Supp. III 1979) (administrator may distinguish among sources within given category of sources), and to opinions such as *ASARCO, Inc. v. EPA*, 578 F.2d 319, 330-31 (D.C. Cir. 1978), which interpret that section in a way consistent with our arguments. See p. 1568 n.404; CLEAN COAL/DIRTY AIR 181 n.7. We reject our critics' implication that any section of the Clean Air Act restricts the modification of an old source when the modification results in reduced emissions. See 42 U.S.C. §§ 7411(a)(4), 7479(2)(C) (Supp. III 1979); *Alabama Power Co. v. Costle*, 606 F.2d 1068, 1081 (D.C. Cir. 1979) (modification restricted only where increased emissions result).

eye. Smith and Randle do not deny our basic point: in contrast to the Northeast, coal burning in the West does *not* impose a significant risk to human health or ecological integrity. Given the very low sulfur oxide concentrations presently prevailing in the West, scrubbing can serve only a single social interest—it can reduce the risk that coal burning may impair visibility and hence damage some of the awesome vistas that make the Southwest and Rocky Mountain regions such special places.

Moreover, in assessing this threat, our critics do not dispute EPA reports that power plants contributed only 430,000 tons of sulfur dioxide to this region in 1976, compared to the 2.48 million tons imposed by smelters in the same year.⁸¹ Instead, Smith and Randle urge a refinement in the way the EPA has modeled the power plant's impact on future Western visibility. They note that the EPA's present model treats an eight-state region—running from Arizona and New Mexico in the south to Montana in the north—as if it could be considered as a single unit called the Rocky Mountain region. They contend that if Arizona and New Mexico were reserved for separate treatment, a computer analysis of the remaining six-state Rocky Mountain region would reveal that power plants pose a more serious threat to visibility. Without the benefit of such a study, we cannot assess Smith and Randle's claim that forced scrubbing will significantly reduce the "risk of creating regional haze problems" in their newly defined region. We are, though, very much in sympathy with their main point. As our earlier work emphasized,⁸² much more work must be done before we can gain an adequate sense of the power plant's impact on Western visibility.

Indeed, our only problem with Smith and Randle's proposal is that it does not go far enough. Even a *six*-state Rocky Mountain region is far too vast to obtain more than a rough and ready understanding of visibility effects. This region of 630,000 square miles should instead be divided into a number of zones. The aim should be to locate those areas where, thanks to wind and mountains, coal burning can proceed without seriously impairing important scenic vistas. Such a technical effort provides the indispensable foundation for a mature struggle with the ultimate value questions raised by the energy crisis. Given the weakness of present analysis,

81. P. 1534-35 & n.284; see CLEAN COAL/DIRTY AIR 77, 163 n.66. If the EPA had done nothing to change the old NSPS, the agency's modelers predict that power plants would increase their emission to 1.2 million tons in 1995. ICF-IV, *supra* note 21, at C-I-3b. Given the smelting industry's successes in convincing Congress to defer their cleanup obligations, 42 U.S.C. § 7419(c) (Supp. III 1979) (smelter cleanup can be deferred until 1988), it seems likely that power plants will still be generating less than half the region's sulfur dioxide fifteen years from now.

82. P. 1535; see CLEAN COAL/DIRTY AIR 77. Indeed, our book-length treatment explicitly states that the model's "regionwide figures are too aggregative to be very revealing as to the effects on western visibility." CLEAN COAL/DIRTY AIR 168 n.26.

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we also advocated requiring Western coalburners to design their plants to permit cheap scrubber retrofits.⁸³ This strategy will allow an effective regulatory response if real world experience reveals serious visibility problems that are now obscured by overly aggregative modeling.

In making these points, we did not, as our critics suggest, ignore Clean Air programs—notably the effort to protect pristine areas against deterioration (PSD)—that do try to locate plants in places that will minimize aesthetic damage. Although PSD does share the Act's fixation with high technology solutions, we believe that it “promise[s] lasting environmental gains over the long run.”⁸⁴ Unfortunately, however, the PSD program has yet to become an effective tool for the prevention of visibility impairment. The program has not yet tried to control total regional loadings of sulfur oxides, which produce regional haze. Instead, the program concentrates on effects measurable within thirty miles of power plants—even though sulfur oxide, a colorless gas, typically travels fifty to one hundred miles before transforming itself into visibility-impairing sulfates.⁸⁵ Continued congressional concern with visibility resulted in the passage of section 169A of the Clean Air Act in 1977, which orders the Administrator to take a series of steps to protect visibility in key areas such as national parks.⁸⁶ Although the EPA has since proposed regulations,⁸⁷ none has yet been promulgated. Nevertheless, this kind of program deserves the highest priority. Rather than spending billions on forced scrubbing, we should be spending tens or hundreds of millions on the scientific and regulatory foundations of present efforts, like the visibility aspects of the PSD program, to force polluters to locate in places where they will do the least aesthetic harm.

A similar effort should inform the regulation of power plant design. Once again, there is a good deal of common ground here. Smith and Randle do not challenge our basic point that building tall smokestacks increases the percentage of a plant's sulfur dioxide (SO₂) that remains airborne, thereby increasing the amount of SO₂ transformed into sulfates (SO₄) as the wind carries it to places hundreds of miles away from the point of origin. Nor do we deny that shorter smokestacks will increase SO₂ concentrations in each power plant's immediate vicinity. The difference comes only in how we trade off nearby SO₂ against long distance SO₄.⁸⁸

83. P. 1535; see CLEAN COAL/DIRTY AIR 77.

84. This quotation is from CLEAN COAL/DIRTY AIR 163 n.71. We deleted a similar sentiment from pp. 1533-35 of our article in the cause of brevity.

85. P. 1534 n.282; see CLEAN COAL/DIRTY AIR 76-77, 162 n.64.

86. See 42 U.S.C. § 7491 (Supp. III 1979).

87. 45 Fed. Reg. 34,762 (1980) (to be codified in 40 C.F.R. § 51).

88. See pp. 1518-20, 1531; CLEAN COAL/DIRTY AIR 62-64, 74.

Smith and Randle view lower smokestacks with alarm, reminding us that a concern with SO₂ concentrations has monopolized the "attention of Congress, the agency, and industry over the past decade."⁸⁹ In contrast, we view this fixation on SO₂ as the problem, not the solution. Even when the first sulfur dioxide objective was established under the Act, researchers were perfectly aware that a concern with SO₂ hardly did justice to the risks imposed by other sulfur oxides.⁹⁰ And by 1978, the National Academy of Science could report: "The notion that ordinary concentrations of sulfur dioxide alone are not likely to injure the lung is commonplace."⁹¹ In contrast, the past decade of research has focused upon the risks imposed by the acid rain and haze generated by the long distance transport of sulfates.⁹² Rather than cling rigidly to a single obsolete policy goal, the challenge is to redirect bureaucratic energies in a more fruitful direction.⁹³

We have called the problem the "freezing of hard variables."⁹⁴ Once a particular indicator of program success has gained acceptance, it can long outlive the scientific case originally made for its adoption. Not only will high policymakers find it embarrassing to admit that billions have been spent in the pursuit of a doubtful objective, but lower level officials will resist the massive changes in bureaucratic procedures that may be required to pursue a new, and scientifically more plausible, goal.⁹⁵ Yet, despite bureaucratic embarrassment and inertia, is it not past time to redirect the billion-dollar effort—from nearby SO₂ to long-range SO₄?

Not that we have ever advocated a completely laissez-faire approach to SO₂. "Although . . . conventional wisdom now belittles the effect of low-level concentrations of SO₂, nonetheless there is a point where higher con-

89. Smith & Randle at 1410.

90. P. 1516 n.198; see CLEAN COAL/DIRTY AIR 61, 152 n.6.

91. NATIONAL ACADEMY OF SCIENCES, SULFUR OXIDES 133, 166-71 (1978). In its recently published report, the National Commission on Air Quality describes some very "recent clinical research" that "may provide more support for the current sulfur dioxide standard." NATIONAL COMMISSION ON AIR QUALITY, TO BREATHE CLEAN AIR 75 (1981). Unfortunately, however, the Commission did not attempt to assess the quality of these studies; nor can we attempt to do so on our own.

92. P. 1517; see CLEAN COAL/DIRTY AIR 61-62.

93. Indeed, it may well be that our proposal for shorter stacks was overly cautious, rather than unduly iconoclastic. In a recent editorial, a leading chemist argues that coalburners should entirely dispense with smokestacks and discharge emissions directly into the land surrounding the plant: "[m]onitoring a single lake or conditioning one or two square miles of soil should be cheaper than operating a pollution control plant or repairing half a continent." Schuerch, *Why build smokestacks?* 15 ENVTL. SCI. & TECH. 721 (1981).

94. P. 1569. Our label is intended to complement Laurence Tribe's discussion of a related phenomenon in Tribe, *Ways Not To Think About Plastic Trees: New Foundations for Environmental Law*, 83 YALE L.J. 1315, 1317-22 (1964). Tribe considers the way in which technocrats in search of "harder data" may ignore unquantifiable values. Our point is that bureaucracies will find it difficult to abandon one hard variable for another hard variable, even when the evolving facts indicate that this second parameter is more relevant in policy formulation.

95. See p. 1521; CLEAN COAL/DIRTY AIR 65.

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centrations will begin to affect asthmatics and other sensitive groups.”⁹⁶ Moreover, we also noted that “shorter stacks will increase local concentrations of other pollutants coming out of smokestacks—notably nitrogen oxides and particulates. Thus, the final policy on stack size must be set with a complex set of trade-offs in mind.”⁹⁷ These complexities, however, make it all the more important to confront the policy problem directly, rather than invoke the older fixation upon SO₂ as an excuse for thought.

V

Although we have not been persuaded by any of our critics’ arguments, we cannot close without thanking them for taking the time and effort to retrace our steps. In attempting our original substantive analysis, we were constantly haunted by the fear that somewhere in the EPA’s vast filing cabinets lurked the comprehensive study of non-scrubbing alternatives that was so obviously lacking on the surface of deliberations. Given the absence of a neatly organized data set, we would not have been surprised if we had missed an important document in our canvass of the files.

But despite their intimate acquaintance with EPA sources, Smith and Randle have failed to produce a single relevant document that escaped our attention at the time we completed our research fifteen months ago.⁹⁸ Nor have they reported any new findings that call any of our major conclusions into question. If anything, their critique suggests that the EPA remains unaware of the hard scientific and regulatory work needed to shape a cost-effective response to environmental realities.

Yet this continuing agency failure is merely a symptom of a larger institutional malaise. So long as Congress imagines that it can play supertechnocrat, it will get the kind of analyses worthy of its pretensions. The critical questions raised by forced scrubbing are not scientific but institutional. Will Congress continue to pretend to a technocratic competence it fails to possess? Or will it encourage the EPA to confront environ-

96. P. 1531; see CLEAN COAL/DIRTY AIR 74.

97. CLEAN COAL/DIRTY AIR 155 n.21; see p. 1531 n.266.

98. Although our critics suggest that we “ignored” the Teknekron Report managed by Mr. Smith on behalf of EPA’s Office of Research and Development, see Smith & Randle at 1402 n.35, we were quite aware of this report’s existence and discussed it with a number of agency officials, including Mr. Smith. We did not cite the document only because we concluded that it played an insignificant role in the EPA’s rulemaking process. Rather than relying on Teknekron, agency decisionmakers looked to the model developed by the EPA’s Office of Planning and Management in collaboration with the ICF consulting firm. Thus, all the modeling results the EPA published in the *Federal Register* are grounded exclusively in the ICF model. See p. 1537 n.298; CLEAN COAL/DIRTY AIR 164 n.4 (listing these publications). Similarly, all the key decisionmakers and analysts we interviewed treated the ICF model as the core of the analytic effort. We continue to believe that an elaborate treatment of the Teknekron study would have pointlessly complicated an already complicated discussion of the agency’s rulemaking effort. For the same reason, we generally avoided detailed consideration of the studies developed by the utility industry’s consultants.

mental realities in a cost-effective fashion and focus on the questions only a legislature can answer: What *are* our environmental goals anyway? Which ones should be given the highest priority? In what ways should the air be cleaner ten years from now than it is today?

When we set out to write this reply, it was under the express condition that our critics' commentary would remain unchanged. After reading our reply, however, Messrs. Smith and Randle decided to add a new concluding section^a containing entirely new—and completely undocumented—complaints. Since this material was forwarded to us just as our manuscript was to go to the printer, a skeletal rejoinder must suffice.

So far as we can tell, there are three new charges. First, our work is said to suffer from a “glaring lack of consideration of serious long-term supply limitations in the low sulfur coal market.”^b But footnote 32 of this reply not only explicitly considers this problem,^c but points the reader to lengthier discussions in our original article. Second, we are said to “ignor[e] the serious effects of nitrogen oxides on both acid rain and visibility.”^d Once again, the reader need only return to the text of this reply to falsify this claim. Rather than ignoring nitrogen oxides, our discussion of smokestack height emphasizes that “‘shorter stacks will increase the local concentrations of other pollutants coming out of smokestacks — notably nitrogen oxides and particulates. Thus, the final policy on stack size must be set with a complex set of trade-offs in mind.’”^e Indeed, if our critics had referred to the index to *Clean Coal/Dirty Air*, they would have found several places in the book where the role of nitrogen oxides was thought relevant.^f

Third, our critics deride our advocacy of “market-like schemes” for pollution control as a “masquerade for serious analysis.”^g But such cavalier treatment does an injustice to an enormous body of sophisticated literature. Our initial essay provided an introductory bibliography on the subject of cost-effective regulation^h—which we had hoped would have been of greater interest to EPA officials concerned with the agency's future.

a. Smith & Randle at 1410-11.

b. *Id.* at 1410.

c. See p. 1419 *supra*.

d. Smith & Randle at 1411.

e. See p. 1433 *supra*.

f. CLEAN COAL/DIRTY AIR 190.

g. Smith & Randle at 1411.

h. P. 1525 n. 237; See CLEAN COAL/DIRTY AIR 158 n.38.

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