Grandfathering Coal: Power Plant Regulation Under the Clean Air Act

Summary

In their book *Struggling for Air: Power Plants and the "War on Coal,"* Richard Revesz and Jack Lienke detail the history of the Clean Air Act and the political compromises that led to exempting existing power plants from significant portions of the Act's regulatory authority. They explain that the Act's ambitious health-based goals fell short due to this "grandfathering," which disincentivizes utilities from updating existing power plants or constructing new ones; and they examine attempts by the executive branch to address its impacts, including the Obama Administration's Clean Power Plan. Coal proponents claim these efforts aim to significantly reduce coal's share of the electricity market, leading some to talk about a "War on Coal." But does the reality live up to the critics' fears? On January 27, 2016, the Environmental Law Institute convened Revesz, Lienke, and other experts in the field to discuss the degree to which the Clean Power Plan reduces pollution, and the interaction between grandfathering and pollution reduction. Below we present a transcript of the discussion, which has been edited for style, clarity, and space considerations.

Richard Revesz (moderator) is Lawrence King Professor of Law and Dean Emeritus at New York University Law School and co-author of *Struggling for Air*.
William M. Bumpers is a Partner at Baker Botts LLP.
Jack Lienke is a Senior Attorney at New York University Law School's Institute for Policy Integrity and co-author of *Struggling for Air*.
David Doniger is Director of the Climate and Clean Air Program at the Natural Resources Defense Council.
William Rosenberg was Assistant Administrator for EPA's Office of Air and Radiation in the George H.W. Bush Administration.

Richard Revesz: The focus of our Dialogue today is a book I coauthored with Jack Lienke, *Struggling for Air.*[1] The book deals with a problem that I had been interested in as an academic for a long time, which is the problem of grandfathering. Grandfathering is a typical move in regulatory policy: a regulator sets stringent standards for new sources but exempts existing sources from those standards. You can understand why this would happen: It helps to buy the support of existing sources, or at least to blunt the opposition.

However, grandfathering leads to some perverse incentives, such as that existing sources have an incentive to stay in operation a lot longer than would otherwise have been the case. Generally, what makes existing sources close down to be replaced by new sources is that the existing sources are less efficient, so, after some period of time, it's worth the investment to have a new source replace the existing source. But if you impose a very high cost on new sources and no comparable cost on existing sources, then you've made it economically desirable to operate the existing sources a lot longer. This doesn't necessarily mean that new sources and existing sources should be subjected to the same standards. It is typically much more expensive to retrofit existing sources than to build new sources with the standards in mind. The question is how big the disparity in the regulations between existing and new sources is going to be, and will there be an end time for that disparity.

Our book is an effort to analyze 45 years of development under the Clean Air Act[2] through that lens. In 1970, when the U.S. Congress enacted the Clean Air Act, it was a hugely important undertaking. It imposed standards on new sources—the new source performance standards (NSPS)—and the U.S. Environmental Protection Agency (EPA) quickly went about its job of coming up with standards for categories of new sources. But there were no comparable federal requirements on existing sources. The states under their state implementation plans (SIPs) had to do whatever it took to meet the national ambient air quality standards (NAAQS). But there were no existing source standards that were comparable to the NSPS.

Part of the reason that Congress imposed standards on new sources but not on existing sources was that many existing power plants were approaching the end of what was then considered to be roughly a 30-year useful life, so why expend a lot of time and energy and incur political opposition when the plants of concern were close to the

1. Richard Revesz & Jack Lienke, Struggling for Air: Power Plants and the "War on Coal" (2016).

2. 42 U.S.C. §§7401-7671q, ELR Stat. CAA §§101-618.

end of their useful life and would probably be out of business relatively soon anyway?

However, that anticipated obsolescence didn't happen, for predictable reasons. If you require new power plants to spend upwards of $100 million on scrubbers, but you don't impose any comparable cost on existing plants, suddenly it becomes much more attractive to continue operating existing plants. Even now, 45 years into the Clean Air Act, we have in operation plants that were deemed to be close to the end of their useful life back in 1970 when the statute was enacted.

Then a second thing happened. Once you have this advantage for existing sources, they have, understandably, a huge incentive to expend large amounts of resources to protect their grandfathering and, if possible, to expand its scope and temporal reach. We see that happening under the Clean Air Act. The new source standards don't only apply to new sources; they also apply to modifications. Modification is defined as a "physical change" that increases emissions. Routine maintenance is exempted from the definition of physical change, but what counts as routine maintenance is in the eye of the beholder to a large extent. Increase in emissions is also a very unclear concept, and dependent on the baseline it's measured against. In all of these concepts, there was huge pressure to extend and expand the scope of the grandfathering.

My coauthor Jack Lienke and I think of this grandfathering as a tragic flaw of the Clean Air Act. The statute is clearly a good thing but it could have been better without grandfathering. This is not a problem that we just discovered yesterday. The problem has been well understood for quite some time. Since 1990, administrations of both parties have tried to remedy the more pernicious effects of grandfathering, beginning with the 1990 Amendments to the Clean Air Act, which established acid rain controls and a nationwide trading scheme, and then continuing with regulations that date back almost 20 years in three principal areas.

The subtitle of our book is *Power Plants and the "War on Coal."* The war on coal is one of these things that gets mentioned a lot, often right before elections. The gist of it is an accusation that President Barack Obama has engaged in a war on coal and is trying to destroy this important industry that's been a mainstay of our economy, and that this is some kind of new invention of the current administration.

Our book shows that each of the three regulations that are typically thought to be most emblematic of the war on coal has antecedents that date back to prior administrations of both parties. The three regulations conceptualized as the war on coal are the Cross-State Air Pollution Rule (CSAPR),[3] which seeks to limit the interstate impacts of air pollution; the Mercury and Air Toxics Standard (MATS),[4] which controls mercury and air toxic emissions; and the Clean Power Plan.[5]

The CSAPR is part of an effort going back to the Clinton Administration and the administration of President George W. Bush to limit the adverse impacts of interstate pollution that essentially is responsible for the inability of states on the eastern seaboard to meet the Clean Air Act's NAAQS. The approach has been quite similar across administrations to try to set up broad trading schemes as a way to reduce the cost of meeting these standards.

The MATS had an antecedent in the George W. Bush Administration in the Clean Air Mercury Rule, which was ultimately struck down by the U.S. Court of Appeals for the District of Columbia (D.C.) Circuit,[6] not on the grounds that there was a substantive problem in the rule, but on the grounds that it was promulgated under the wrong provision of the Clean Air Act.

The Clean Power Plan is somewhat more novel, in that it is the first effort to control greenhouse gas (GHG) emissions from stationary sources. Arguably, however, there wasn't an enormous amount of discretion for the administration after *Massachusetts v. EPA*, where the U.S. Supreme Court held that GHGs are air pollutants.[7] The administration made a finding that GHGs endanger public health, but that finding was actually made initially by the Bush EPA Administrator. It didn't become effective during the Bush Administration for various bureaucratic reasons; nonetheless, the Bush Administrator had made the endangerment finding, and early in the Obama Administration, a final endangerment finding was made.

We now have a GHG regulation on cars. If the president hadn't also regulated stationary sources, there would have been litigation and who knows what the courts would have ultimately decided in terms of the administration's obligation to implement standards of this sort. So, we see the Obama Administration's three regulations that are pilloried as a war on coal are in fact part of a 20-year effort by administrations of both parties to try to undo the tragic flaw of the Clean Air Act, that is, the pernicious effect of a dual regulatory structure of grandfathering existing sources while regulating new sources.

One last point I want to give you by way of background is that we are observing retirements of coal plants now. But there are serious questions as to what portion of this retired capacity is the result of the three rules (and some of it clearly is); what portion is the result of low natural gas prices (some of it clearly is that as well); and what portion is the result of the *combination* of the three rules plus low natural gas prices.

3. U.S. EPA, Federal Implementation Plans: Interstate Transport of Fine Particulate Matter and Ozone and Correction of SIP Approvals, 76 Fed. Reg. 48208 (Aug. 8, 2011).
4. U.S. EPA, National Emission Standards for Hazardous Air Pollutants From Coal- and Oil-Fired Electric Utility Steam Generating Units and Standards of Performance for Fossil-Fuel-Fired Electric Utility, Industrial-Commercial-Institutional, and Small Industrial-Commercial-Institutional Steam Generating Units, 77 Fed. Reg. 9304 (Feb. 16, 2012).
5. U.S. EPA, Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662 (Oct. 23, 2015).
6. U.S. EPA, Standards of Performance for New and Existing Stationary Sources: Electric Utility Steam Generating Units, 70 Fed. Reg. 28606 (May 18, 2005).
7. 549 U.S. 497, 37 ELR 20075 (2007).

William Bumpers: I want to talk about the Clean Air Act's grandfathering issue in the perspective of its role in the statute, how it has evolved over time, and what is to a large extent a misunderstanding of what grandfathering meant and how critical it was to the development of the clean air policy and actually clean air in this country.

In 1970, Congress passed the Clean Air Act the first time, with the goal of eliminating man-made air pollution. They set up the NSPS. The idea was that we're going to be technology-forcing: We're going to try to make all of the new power plants and all of the other major sources, as they come online, be equipped with the best state-of-the-art control devices that are out there. But the decision to grandfather that mandate, that is, not to require every major source in America to put on controls in a short amount of time, was not a bad idea. I mean, you can imagine that that would have been politically impossible in 1970. We're not just talking about coal plants; we're talking about every major source having to put on controls.

I believe that environmental progress and economic development go hand-in-hand. One complements the other. But imposing those kinds of billions or even trillions of dollars in costs on the American economy for all of the major sources to put on controls in 1970 would have been a disaster. Congress was aware of that and so they said, no, we're not going to do that. There was probably a strong assumption that, as Ricky said, over time, a lot of older facilities would be either retired or retrofitted. Indeed, that has happened, but not at the pace that a lot of people expected.

But what grandfathering didn't do was exempt any of these units from NAAQS. The states were supposed to develop their SIPs imposing controls on the sources that were causing problems in order to meet NAAQS. Keep in mind that NAAQS are supposed to be set with an ample margin of safety for human health and the environment, so presumably they are fully protective. The standards are continually tightened, which is an indication that the original was not quite as helpful as expected. But those facilities should have been subject to control requirements if they were contributing to NAAQS violations.

The flipside is that if they had required every major source in America to put on controls immediately, that would have been an economically idiotic thing to do because you would have been over-controlling many sources. The evidence of that today is that, even with dramatically tighter NAAQS, there are still a lot of uncontrolled facilities across the country that are not causing or contributing to violations of those standards. That's not to say that we don't ultimately want to get those facilities in control too. We do. But economically, it would not have been a rational decision in 1970 to say let's control everything now if the goal is to ensure that we're meeting NAAQS.

What did grandfathering not do? One, it didn't exempt existing plants from NAAQS. Two, it didn't exempt existing plants from NSPS or new source review (NSR) if there was a modification. (The fact that that was really not enforced until 1990 and that there's even today still a questionable amount of enforcement and questionable enforcement tactics is not really telling, except that they weren't grandfathered from it.) Three, existing plants weren't exempt from the transport requirements. As the result of a lot of legal challenges we are, starting this year, operating under the CSAPR that covers some 27 states. That rule addresses issues and steps that EPA rejected 20 years ago. The major sources should have been subject to more effective steps many years ago. However, through a lot of political and regulatory wrangling at both the state and federal level, that didn't happen.

Fourth, it didn't exempt them from the air toxics standards. Keep in mind that there were air toxics standards starting in 1978, but EPA was unable to achieve much under that version of the Act. Interestingly enough, when the Clean Air Act was amended in 1990 and the air toxics requirements were drastically expanded, there was indeed a partial exemption for power plants. Because they were going to be subject to the acid rain trading program, many people assumed that a lot of these facilities would be scrubbed and that the scrubbing would take care of a lot of the air toxics. So, Congress passed §112(n), which requires EPA to study whether it is "necessary and appropriate" to regulate power plants under §112. That has wound its way through the courts and we are just now starting to look at whether it's going to be fully implemented. However, it's clear that implementation of the MATS rule will have a dramatic impact on the survivability of many power plants.

I have a chart that I created from EPA data around 2010, so it's dated, but it's still pretty indicative. It's a plot chart of all the coal-fired power plants in the country. The chart shows that in the category of 35- to 40-year-old plants under 250 megawatts, there are a lot of power plants that have not undergone any level of sulfur dioxide (SO_2) scrubbing. Those plants are being retired, if they're not already gone. There are multiple reasons. One is you can't justify putting a half billion dollars' worth of SO_2 scrubbers on a plant this size because they're not very efficient and they don't have any amortized value left. These plants are all going to be gone in the next 10 years (with a few exceptions in some small municipalities where this sub-250-megawatt plant is their only source of supply). A lot of them have been announced as retirements already. I represent about eight of these and I know they have been announced for retirement. My prediction is that by 2025, roughly 100 gigawatts, out of 330 total gigawatts today, of coal-fired generation will be retired.

Retirement of these plants is driven by multiple things. One is the MATS rule, to the extent that they are facing an obligation to put on scrubbers, which are immensely expensive. For a 600-megawatt coal-fired power plant, you're talking about $500 million. Unless that plant is incredibly efficient or is in an area where that load is needed, it's really difficult to justify that kind of an investment when you're competing with brand-new natural gas combined-cycle units that have incredibly low heat rates,

meaning that they're very efficient and they've got 10-year gas supply contracts at $3. Nothing can compete with $3 gas. (One of the problems we have is that renewable energy doesn't compete well with $3 gas either.)

Between the regulatory drivers—controls, allowance costs under the CSAPR, direct controls as a result of the MATS, or because of the new one-hour SO_2 standard (some of these units will have to have controls to meet one-hour NAAQS)—a lot of these plants are going to go away. There's a theory that the Clean Power Plan is going to force a lot of the retirements. My conjecture is that the Clean Power Plan might accelerate retirements a bit, but it's not going to do a lot more. If the number of plants that I predict are going to retire as a result of inefficiency, age, existing regulatory drivers, and $3 gas is right, then we will have already accomplished the retirement step that the Clean Power Plan thinks it's projecting. So, we'll see where that ends up.

The administration has no choice but to promulgate the existing source performance standard. They are legally obligated to do it. That's a different question, though, from whether they were obligated to regulate it as they have done in a manner that is, even according to them, unprecedented.

Jack Lienke: Our book has an entire chapter on NAAQS and the idea that grandfathering wouldn't have been such a problem if NAAQS had worked as expected. Early in the writing process, Ricky had an interview with Leon Billings, Sen. Edmund Muskie's (D-Me.) longtime chief of staff, who was very closely involved in the drafting and passage of the 1970 Clean Air Act. His perspective was that Congress didn't see itself as giving old plants a pass; it thought that those sources would be covered by NAAQS. But NAAQS didn't work as expected. As of 2010, about 40% of the U.S. population was living in an area that was out of attainment for at least one NAAQS pollutant.

We explore multiple reasons why NAAQS didn't work as expected. One reason was inadequate enforcement, in that states lacked either the resources or the political will to control their existing sources. There were a lot of SIPs that put stringent limits on old power plants, nominally stringent limits, but when the plants didn't comply, the states didn't enforce. And in the few cases where states did sue noncompliant plants, the courts just assigned the plants new, later deadlines. So, the punishment for missing a deadline was to get an extension of that deadline.

Another reason was that plants were allowed to engage in creative ways of satisfying NAAQS. There was a lot of substitution of what were known as dispersion-enhancement techniques for actual controls. One of these dispersion techniques was the building of tall stacks. The idea was that, since NAAQS are concerned with the concentration of pollution at ground level, we'll just release our pollution farther up and then the concentration at ground level will be lower. That was true in the area immediately surrounding the plant, but, of course, the pollution didn't just disappear: It went to another state and made it more difficult for that state to meet its NAAQS. In 1977, Congress amended the Clean Air Act to try to limit use of dispersion-enhancement techniques, which led to another series of courtroom battles. But plants that had already built tall stacks were never required to take them down, so those remained a problem for a very long time.

Finally, even if NAAQS *had* been implemented as anticipated, they weren't well-suited to dealing with the problem of interstate pollution. The Clean Air Act's good-neighbor provision,[8] which bars sources in one state from contributing significantly to another state's inability to attain or maintain NAAQS, wasn't added until 1977, and EPA didn't use it until 1996. There were many cases in which states that couldn't attain NAAQS tried to force EPA to use the good-neighbor provision. They petitioned EPA to use it, but one of their problems was limitations in modeling capabilities. It was very hard for a state to prove that power plant XYZ in another state was preventing it from attaining NAAQS, because pollution molecules don't carry passports. A state can't say definitively that a particular SO_2 molecule comes from, say, the Gallagher plant in Indiana, and the burden was on the states to show that, at least as courts interpreted the provision at the time.

It wasn't until the Clinton Administration in 1996 adopted a statewide emissions trading approach to the good-neighbor provision that the provision was used by EPA. And that approach ended up in litigation until the Supreme Court's 2014 decision in *EPA v. EME Homer City Generation, L.P.*[9] So, that was another very long battle.

In the end, we don't see this as an either-or question of whether grandfathering was the problem or NAAQS implementation was the problem. Grandfathering was, in our opinion, a mistake, and it was exacerbated by the failure to implement other aspects of the Clean Air Act.

Defenders of grandfathering argue that it was politically infeasible for Congress in 1970 to impose controls directly on existing sources. But one example we cite in the book for the opposing view is the Clean Water Act,[10] passed a couple years after the Clean Air Act, which did impose controls on existing sources. The Clean Water Act's existing source standards weren't as stringent as its controls on new sources, but there was no outright exemption. The Clean Water Act standard for existing sources started out as "best practicable technology," which was much less stringent than the new source standards, and then seven years later, it became "best available technology," which was much closer to the new source standards. That has actually proven very effective in cleaning up point source pollution under the Clean Water Act. If it was possible in the Clean Water Act, why not in the Clean Air Act?

The one final point I'll make is that we don't suggest in the book that Congress should have immediately subjected new and existing sources to the same standards. We

8. CAA §110(a)(2)(D)(i); 42 U.S.C. §7410(a)(2)(D)(i).
9. 134 S. Ct. 1584, 44 ELR 20094 (2014).
10. 33 U.S.C. §§1251-1387, ELR Stat. FWPCA §§101-607.

acknowledge that existing sources do face higher costs in retrofitting to install controls, but we think there were other options. Congress could have subjected existing sources to a lenient standard that kind of scaled up over time, or it could have put a sunset provision on grandfathering. The permanent exemption we got in the Clean Air Act didn't work out very well.

David Doniger: I want to reflect a bit on the long arc of history on the Clean Air Act and carbon pollution. A law like the Clean Air Act is a crystallization of a political consensus at a moment in time. Some of these crystals are pretty robust, but all crystals can shatter and break. So, over time, you have to maintain that political consensus for the underlying purposes and objectives. One of the things that was recognized with the failure of the Waxman-Markey Bill[11] in 2010 is that the general public had sort of lost the narrative about what were the dangers from air pollution, what the Clean Air Act had accomplished, and why we still needed it. We at the Natural Resources Defense Council engaged in a concerted effort with the American Lung Association and many other partners to revive people's understanding that air pollution is a threat to our health, to our children's health, to our grandparents' health. It turned out not to be that hard to tap that wellspring and restore people's sense that the Clean Air Act is here to protect our health.

The Waxman-Markey bill was an attempt to amend the Clean Air Act to address the threat of climate change and to strengthen clean energy policies. After the bill failed, there were immediate attempts to go backwards, to repeal large parts of the current Clean Air Act. The proponents of those steps backwards hit a public opinion buzz saw, which is still a major obstacle for them. The Clean Air Act turned out to be a very robust law, as well as a very powerful one. It was designed to deal not just with the problems that were right in front of Congress in 1970—problems that they could see, taste, and feel—but also to equip EPA with the tools and the responsibility to deal with new problems as they came up.

The tools adopted in 1970 were not perfectly adapted to the problems that did come up, so there have been big amendments twice, in 1977 and 1990. There was a great deal of discussion in the formulation of the 1990 Amendments, especially the acid rain provisions, about new ways of thinking about it and implementing these controls.

But I want to go back to the origins of the authority to curb the carbon pollution driving climate change. In 1965, President Lyndon Johnson sent a message to Congress on air and water pollution legislation, accompanied by a scientific report. The presidential message and the scientific report both identified CO_2-induced warming as one of the kinds of air pollution that needed to be dealt with.

So, it's no surprise to me that in 1970, the authors of the Clean Air Act included plenary authority to deal with any kind of dangerous air pollution that came along. The definition of public welfare in §302(h) includes a long list of the bad things that should be considered adverse effects on welfare, and those bad things explicitly included adverse effects on the "weather" or the "climate." So, the authority to address climate change has been there since 1970, even though EPA focused first on the public health-related pollutants and the acid rain-related pollutants. There was a sort of quiet period in the 1970s when there wasn't much attention paid to global warming.

Then, when we got into the late 1980s and1990s, the focus turned again to climate change. As the need to address carbon pollution became clearer, the tools were there. As a member of EPA staff during the Clinton Administration, I wrote a memo on how the Clean Air Act could and should be used to meet this threat. We were in an interagency battle about what should go into an electricity regulatory reform bill, which was expected to drive electricity prices down. EPA's view was, why don't we deal with the pollution problems of the electric sector at the same time? We noted that we had the authority under the Clean Air Act to deal with all four of the air pollution problems from power plants—SO_2, nitrogen oxides (NO_x), mercury, and CO_2. But we noted that we didn't have clear authority to deal with CO_2 through a mechanism as flexible as the Acid Rain Program. We should ask Congress to clarify that flexibility, I suggested. That was the gist of my memo.

The memo was quickly leaked to a publication called *Inside DOE*. A few days later, Congressman Tom DeLay (R-Tex.) demanded a legal opinion from then-EPA Administrator Carol Browner. She supplied the legal opinion, the so-called Jon Cannon memo, that explains that the Clean Air Act includes the authority to regulate any air pollutant that endangers public health or welfare.[12] The Bush Administration reversed that finding. The Supreme Court, however, reversed the Bush Administration. *Massachusetts v. EPA* held that carbon dioxide is an air pollutant under the Clean Air Act, and that EPA has the authority and responsibility to curb that pollution if the Agency determines that it endangers public health or welfare. This is the authority that the Obama Administration has used to set standards for climate-changing pollution from cars, trucks, power plants, and the oil and gas system.

So, we have these tools in the Clean Air Act to combat new problems without having to go back to Congress. If we had a working Congress, it would be helpful to get more precise tools and to have a congressional imprimatur on specific schedules for action, and so on. But the tools are there and the responsibility is there for the administration to tackle newly recognized problems. To paraphrase former Defense Secretary Donald Rumsfeld, you fight climate change with the Clean Air Act you have, not with the Clean Air Act you wish you had.

11. American Clean Energy and Security Act of 2009, H.R. 2454, 111th Cong., *available at* https://www.congress.gov/bill/111th-congress/house-bill/2454.

12. Memorandum from Jonathan V. Cannon, EPA General Counsel, to Carol M. Browner, EPA Administrator, on EPA's Authority to Regulate Pollutants Emitted by Electric Power Generation Sources (Apr. 10, 1998), *available at* http://www.eenews.net/features/documents/2008/08/04/document_gw_05.pdf.

I'd like to take issue with a claim being made in litigation over the Clean Power Plan. The petitioners argue that there's never been a power-sector program like this before under §111(d). They obscure the fact that we've seen power-sector programs like this before all over the Clean Air Act. The transport rules—from the original NO_x SIP call to the current Cross-State Rule—take the form of cap-and-trade programs, and this approach was blessed by the Supreme Court in *EME Homer City* as within EPA's authority to craft a program that meets emerging air pollution problems in an economically efficient and reasonable way.

I think the Supreme Court's opinion *FERC v. EPSA,* in January 2016, upholding the Federal Energy Regulatory Commission's "demand response" authority[13] is really interesting, because six Justices, the same six who were on the *EME Homer City* decision, demonstrated a clear understanding of how the grid works. You produce electricity that goes into the grid from a variety of sources, lowest cost to highest cost, and you can also substitute for generation with measures to reduce demand, the lowest cost versus higher cost. And you can balance supply and demand through a mix of electricity production and consumption reductions.

These are the sort of fundamental factual premises underlying the Clean Power Plan, and I think the D.C. Circuit and the Supreme Court are going to find the Plan fully within the tradition of these sensible market-based approaches to regulating the power sector. I think the courts are going to find that the Clean Power Plan is fully authorized by §111(d), which references authority in §110 sanctioning use of economic instrument approaches to regulation. And I think the Clean Power Plan is in the spirit of the opinion by Justice Ruth Bader Ginsburg in *EME Homer City*, saying that the Clean Air Act provides a toolbox with which EPA has the discretion to fashion reasonable and responsible cost-effective solutions to air pollution problems as they come up.

So, I'm very optimistic about the Clean Air Act's capacity to deal with the carbon problem and to deal comprehensively with power plants' pollution. The Clean Air Act also can deal with other sectors. It's already dealt very effectively with the motor-vehicle sector.

I hope that we will come to the day when Congress is once again a functioning institution capable of grappling with real problems and fine-tuning the tools that are added to EPA's toolbox. But if that doesn't happen for a while, we can continue to make progress with the tools previous Congresses gave us.

William Rosenberg: I'm going to make one small comment about the book, and then I'm going to talk about something else. My comment about the book is, if you leave aside the CO_2 issue for a moment, the Clean Air Act has worked very well with grandfathering. Now, that means that it is necessary from time to time to make new regulations, get new authorities, do something such as the acid rain title, and continue to make progress just as we have done on motor vehicles. Cars today are a whole lot different than the cars in 1970, but we're still using cars. If you set aside the CO_2 issue for a moment, the Clean Air Act has worked beautifully.

Now, we're focusing on CO_2. I have a proposition, and that is that these sources of hydrocarbons, coal and petroleum coke, have a place in clean energy strategy. (Petroleum coke, or pet coke, is the bottom of the barrel of oil; from a climate and pollutant point of view, it's almost like coal. It's sulfur and carbon, and we don't allow it to be combusted in the United States. So, we ship it to Mexico where they put it in their cement plants, and their power plants, and all that schmutz comes back over to California and Arizona.)

I am a developer of industrial gasification projects. My view is that pollution is related to how fossil fuel is processed, not necessarily its out-of-the-ground chemical composition. When natural gas comes out of the ground, we process that natural gas. We take out a whole bunch of things, including sulfur, toxics, and liquefied natural gas (LNG). It's much less of a process than with oil where we send it to a refinery.

We don't put the same oil in the cars that they used to do years ago in the steamships. We actually send it to a refinery and subsequently chemical plants, the world of petrochemical engineering, to take out almost all of the pollution. Not all of it, but a lot of it. One of the things we did in the 1990 Clean Air Act was to recognize the significance of clean automotive fuels, as well as the importance of the catalyst and other technology of the car.

So, the oil is very different from gasoline or other refined products. Take, for example, plastic bottles of water or plastic cups: The bottles of water come from coal and that plastic almost entirely comes from a gasification project using coal run by Eastman Chemical in Tennessee. It really depends on how you process what's in the original composition rather than whether it's coal or oil or gas.

I'd like to talk about the industrial gasification field. The history of gasification started in Germany during World War II when the allied navies prevented the Germans from collecting oil from the Middle East. The Germans started refining coal. As with gasification, there's essentially a coal refinery. They made diesel fuel and other fuels for their war machine. After the war, during the Arab oil embargo that was very stringently enforced against South Africa by the Arab countries, that technology was upgraded by a company called Sasol to produce better, more-efficient, and cleaner fuels, again from coal because South Africa had a lot of coal.

Then, in a probably little-known negotiation at the end of the 1990 Clean Air Act debates, Sen. Robert C. Byrd (D-W. Va.) went to the president (I was the intermediary), and said, "You can pass this bill by two-thirds, but you can get an overwhelming vote if I release the coal interest, whether they be states or coal companies or coal utilities, to support the president's proposal." The

13. No. 14-840, 46 ELR 20021 (U.S. Jan. 25, 2016).

bill passed by a vote of 91 to 9 in the U.S. Senate. I think it was the same percentage, about 400 to 23, in the U.S. House of Representatives. That number wouldn't have been so high if Senator Byrd and the White House had not engaged in negotiations.

Senator Byrd said that what was needed was a clean coal technology research and development program through the U.S. Department of Energy, a $5 billion commitment, made concurrently with the 1990 Clean Air Act to find a way to use coal as a clean fuel, which essentially means refining the schmutz out of the coal. Coal is like oil except there's rock, and the rock makes the particulates and silicon. So, there's no real difference between crude oil and coal in the raw state except the silicon in the rock. It's relatively easy and we have done this very well. You don't want to see dirty smokestacks because the particulates are not coming out of the power plants anymore.

The president agreed, and the Clean Coal Technology Program was set up with a $5 billion loan guarantee and billions in grants and tax credits. Three major plants were constructed: one in Indiana, one in Tampa, Florida, and one in North Dakota. I'm going to talk about the North Dakota one because that will get us into the CO_2 topic.

North Dakota was using a very poor quality of coal. It was essentially lignite. It was using industrial gasification technology and creating synthesis gas (syngas) and in the process separating out the CO_2 that would otherwise have been emitted into the atmosphere. That CO_2 is compressed and shipped about 300 miles north into Canada to an oilfield, the Weyburn oilfield, which is still operating and actually doubling capacity. This was one-third of the CO_2 and it was injected in the ground to do something called an enhanced oil recovery (EOR).

What is EOR? When you drill a well, you poke a pipe in the ground and you get a gusher that gets everybody dirty and looks kind of cool. Over the time of the oil production, the pressure in the well that might come from natural gas or might just come from geological pressure pushes the oil out because the oil is stuck in crevices in the ground. At some point the pressure feed is used up. That point includes generally leaving 70% of the oil molecules still in the ground, but they don't come out because there's no more pressure.

What EOR using CO_2 does is it captures CO_2 in this industrial gasification process and compresses it into 3,000 pounds per square inch, then pipes it down to the old oilfields in Texas, Louisiana, and Mississippi. (It could be done in Pennsylvania; it could be done in the Midwest; it could be done in California. There's been a lot of production over the last 100 years.) And it re-pressurizes the well.

EOR using CO_2 isn't fracking. It doesn't break up the stone in the ground; it just re-pressurizes the well. When the well gets re-pressurized to about what it was before you put the pipe in the ground, then it starts to produce almost as much oil the second time as it produced the first time, at a much lower cost in production. Not zero cost, but a much lower cost. When oil was in the $60-100 range, companies invested billions of dollars to recapture the old pipelines and buy access to the old depleted wells and create storage facilities. That is what EOR is.

There are two fundamental advantages to EOR. It takes the CO_2 and puts it back in the ground where it came from. So, whether it was oil to start with and became pet coke or it was coal and that was mined, the carbon that otherwise we would worry about is captured and stored in the ground. Now, we don't know for sure if it's stored forever. We think so. But forever is something you have to test. In any event, it's stored for a long time. That's the history. We actually produce 3-4% of our oil in the United States this way already using CO_2 that's in a compressed state, already in the ground like natural gas.

What products come from industrial gasification? Well, you could make syngas and use that to drive a turbine that's been modified and make power. In today's world, as Bill Bumpers said, with $3 gas that won't look so great. But you can do other things. You can make plastics. You can make methanol and hydrogen industrial chemicals, which is very important to making reformulated gasoline and many other cleaner chemical engineering products. You can make hydrogen, which is necessary for a fuel cell car. You can make fuels.

You're taking the coal or the pet coke, stripping everything out of it and ending up with a collection of molecules called carbon, hydrogen, and oxygen: hydro chemicals. Whether that carbon, hydrogen, and oxygen came originally from crude oil or natural gas or coal doesn't make any difference. You can process that into whatever you want to.

It's kind of interesting because if you take a coal plant and do 90% recovery of the CO_2 that otherwise would be emitted and compare it to the emissions of a natural gas combined-cycle plant, which is half as much as a conventional coal plant, you're actually going to emit less CO_2 with an industrial gasification plant than you will in a combined-cycle natural gas plant.

The magic attributed to all this is the availability in the United States of EOR capacity. We have gigantic capacity in oil wells that have been producing for the last 100 years. The reserves are not spread around the whole country, but there are pipelines to do the spreading. We have high oil reserves in these depleted fields and the value of the oil that's extracted more than covers the capture and storage of the CO_2, so it enhances the economics of the plant. I think the economics can work with the proper support of the government and with existing laws, but you can make them more enticing if you really believe that this is a strategic option that the country needs. It isn't a question of doing nothing with the coal; it's a question of refining the coal, just like we refine oil. So, to sum up, I believe coal and pet coal have a place in clean energy strategy.

Richard Revesz: Getting back to the grandfathering issue, I think we panelists all agree that the combination of grandfathering plus other failings of the Clean Air Act meant that it didn't work out so well. It is possible that if

we had been able to get existing sources to do whatever it is they needed to do for the states to comply with the SIPs by the deadlines that Congress initially set, it wouldn't have mattered much whether they were grandfathered or not. But, even though over a long period of time significant advances have been made, we're still fighting the nonattainment question. And if you look at the last deadline that's in the statute, we need to figure all this out again.

I also think it is the case that no one is arguing for imposing the same standards on existing plants and on new plants from the start. And there are many ways to go—for example, a Clean Air Act approach that had some differentiated standards. You can imagine a scheme under which the existing sources have been fully grandfathered for a certain period of time: the useful life they would have had at the time the statute was enacted, not the useful life that they came to have because of the grandfathering. You could also tie limits on grandfathering to depreciation periods. So, there is clearly room for a bifurcated provision, but it's also clear that the dial was struck too far.

One of the problems with grandfathering is that once you create this benefit, you create a focal point for activity to take place to protect and expand that benefit because it's so valuable. We've seen that history, and my hope is that we'll learn something from history because this is not the last regulatory program that we will be seeing with this feature.

William Rosenberg: I don't agree. Let's put CO_2 aside for a moment to set the issue. We weren't trying to deal with CO_2 for most of the time that the Clean Air Act has been in existence, but the conventional pollutants that come from power plants, including the 1990 Clean Air Act Amendments and other regulatory activities. So, if you set aside the CO_2 issue, the Clean Air Act is working amazingly well. For someone to take the position that the Clean Air Act is a problem overstates the problem. I think the Clean Air Act is a solution. It's a brilliant public policy solution that's not perfect. Now, we need to go forward and have a clean energy strategy, but I don't think we need to say it's been a failure simply because we haven't solved every problem associated with making power in the past. Power is a lot cleaner now than it used to be, and that's a winner rather than a loser.

David Doniger: I was struck by Bill Bumper's comment that a lot of these plants will be gone by 2025. If we stop and think for a minute, that's 55 years after the enactment of the Clean Air Act. It's 60 years after President Johnson asked for clean air legislation. These things take time, I know, but if you are trying to make policy for the future, you want to try to develop a structure that won't require so much time. Now, some of that time is needed. Transition times are needed, and that's why the Clean Power Plan looks out over a decade and a half. But there are other dynamics, such as where you get strategic combat, a strategic advocacy, and laws can be built in ways that encourage or discourage that. The acid rain program has had far less contentious regulatory battling in litigation than most of these other programs. It originated in a time when we could put a whole big compromise, with a lot of problems worked out already, in front of Congress and get Congress to enact it. It took 10 years, but in the end there was legislation passed.

William Rosenberg: I think it's also another thing that you and David Hawkins representing the Natural Resources Defense Council, and Bill Bumpers who was with EPA, could come to the table with many other interested parties to work out the details.

David Doniger: A fair amount of that still goes on, although less so because so many battle lines are drawn. You want to try to structure laws in the future, for any kind of program that needs to apply to existing sources and new sources at the same time, in a way that doesn't create a strategic opportunity to argue that this plant that has been modernized from stem to stern is still an existing source and exempt from regulation that applies to a new source. There are a lot of these battles.

Additionally, with the exception of the first half of the first Bush Administration, the Clean Air Act has seen rather sharp swings in the propensity of the administration in power to use it, to enforce it. You find that when one party is in control, the accelerator is pressed; in other administrations, the brakes are pressed. You have whole periods of eight years, in the second Bush Administration in particular, in large parts of the Reagan Administration, where the effort was to undo the Clean Air Act either by ignoring it or by actually repealing parts of it. The Clean Air Act has done pretty well considering the rough political ride it's had during swings in administrations.

William Bumpers: I think David's optimism on the Clean Air Act's durability is a little rosy. But I agree with Bill Rosenberg in that the Clean Air Act has been phenomenally successful. It does take time. We are a country of laws and we go through the legal process, and we expect people to vindicate their rights in courtrooms. We've seen many court cases with different results—challenging rules, upholding rules, challenging a power plant with the activities they've undertaken, and defending the rights to keep those power plants going.

In the time period that we're talking about, we had unprecedented growth in the demand for electricity. Electricity is the most important power source in the world; there's nothing even remotely close. Some say that burning natural gas is cool, while burning coal is bad. But however you get electricity, it is the ultimate power source. We panelists are zealous advocates for addressing climate change. But we do have to honor the rule of law. David and I had a fundamental disagreement over whether the Clean Power Plan honors that requirement, and we're going to debate that in the courtrooms.

But I think it's important to understand that this is a very large expansion of what most people perceive EPA to be. I like the flexibility they should have in addressing environmental problems. I want EPA to address climate change. I really wish Congress would address climate change. That's where it ought to happen, as we did in 1990 with the acid rain title, a wonderful market-based program that addressed a huge problem with minimal problems. I don't think there is a more effective regulatory action in the last 15-20 years than implementing the acid rain title.

One last thing to understand is that power plants aren't the only boogeyman out there. Jack found that 40% of people are still in an area with some form of nonattainment. Most of that, you should understand, was driven by mobile sources. The contribution of transported pollution from power plants to the vast majority of the nonattainment areas, which are overwhelmingly in the Northeast, are not from power plants. They're a relatively minor contributor to the total problem. Their contribution is a problem, but so are the local emitters and the mobile sources. I think we all share that objective, but I think the pathways that we tread may be a little different.

Jack Lienke: I agree that transportation is a major contributor to emissions, but mobile sources are for the most part controlled and have been for a long time because people turn over their cars a lot more often than we turn over our power plants. The CSAPR, by imposing controls on plants that were not controlled, is going to bring areas that were not in attainment into attainment by virtue of those controls.

I also absolutely agree that the Clean Air Act has been incredibly successful and has saved hundreds of thousands of lives. But it's important to note that it's taken about 45 years since the Clean Air Act's enactment, as David said, to get around to controlling these plants. There is a real human cost to that delay. The CSAPR was projected to prevent something like 13,000 premature mortalities per year. That's a big number, and if the rule had been implemented sooner, we could have prevented even more deaths.

We're highlighting this problem because we think it's important to avoid it in the future. We can honor what is great about this law and learn from things that maybe weren't so great about it. EPA does have opportunities to repeat this mistake, and I think one of the contexts in which that could happen is the control of methane emissions from oil and gas operations. EPA recently proposed performance standards for new oil and gas operations, but does not currently have plans to control existing oil and gas operations, and that dichotomy could create some problematic incentives.[14] Even if we solve the power plant problem, the concept of grandfathering will continue to be something that we need to think about going forward.

Audience Member: My question is about the implementation process. Do you think it informs and can inform the state planning process currently ongoing under the Clean Power Plan? There are similarities and dissimilarities to those processes. To what extent do those change or hamper or encourage problems or solutions that might be available?

David Doniger: The SIP process has been at its worst where it turns on air quality modeling that relates source emissions to ambient outcomes. Those are certainly malleable and the subject of argument. At the Natural Resources Defense Council, we found that historically states made and EPA approved totally optimistic projections that the air quality standards would be met with a given suite of usually minimal emission controls. They weren't, and so you have to go back and do it again and again.

The state planning process for the Clean Power Plan is much simpler because it's either going to focus on emission rates or tonnage of mass emissions. A plan will have to show that the emission rates, if that's the way chosen, will be met on average through the credit system and so forth. And the same with the mass-based system, where the plan will have to show that the number of allowances is consistent with the state's target and that nobody is going to be able to operate if they don't have the requisite number of allowances by initial distribution or auction or trade. So, it's a much simpler thing. Using the analogy of a car, the engine is tightly connected to the wheels, whereas with the ambient standards process, there was this nebulous something, the black box between the engine and the wheels, and it was the subject of a lot of the problems.

ELI President Scott Fulton: Thank you all very much for coming and being with us in a provocative, interesting exchange. For me, it brought to mind a lot of the discussion that we have underway with some folks in various parts of the Chinese government who were deeply interested in the question of how to reconcile near-term environmental improvement with continued economic advances. Of course, they have some ambitious and, as they see it, necessary growth targets for themselves that drive their interest in that regard. But they've raised the question about constructing programs that recognize the economic distinction between new sources and existing sources as a way of helping walk that tightrope.

So, I have a question and an observation. The question is: In the thinking that you've done about this and in the U.S. experience of working with grandfathering writ large, this recognition of the distinction between parts of the regulated community, what can we take from that that's transferrable and useful to the folks in China who are in the midst of this struggle right now? My observation

14. Subsequent to this event, EPA finalized methane standards for new sources in the oil and gas industry. It also announced that it is developing standards for existing sources. For the new source standards, see https://www3.epa.gov/airquality/oilandgas/may2016/nsps-finalrule.pdf. For the announcement of the planned existing source standards, see Gina McCarthy, *EPA Taking Steps to Cut Methane Emissions From Existing Oil and Gas Source*, EPA Connect, Mar. 10, 2016, *at* https://blog.epa.gov/blog/2016/03/epa-taking-steps-to-cut-methane-emissions-from-existing-oil-and-gas-sources/.

concerns the extent that as part of your own analysis and review you can think about that transferability question. It may also draw out, perhaps more starkly, what lessons we take away from the experience here in the United States.

Richard Revesz: One of the interesting things about your question (and we address it in our book) is that grandfathering is not a topic on which the academic experts all had a view, back in 1970 or even a lot later, as to the right approach. So, this is not a situation in which the politicians got it wrong simply because they were not smart enough or because they were being pushed by people they shouldn't have been pushed by. In fact, the academic literature on this topic until very recently basically mirrored what the political process did.

The academic literature would first seek to determine the best new source standards, abstracting for a moment the fact that we have all these existing sources. And then the academic literature would say, well, given the fact that we have these new standards, what's the best transition rule for the existing source?

The problem with that is it ends up giving you very stringent standards for the new sources and then very lax transition rules for the existing sources. Because you have very stringent standards for new sources that are very expensive, you want to give the existing sources a break, for good reason.

The problem is that the economy doesn't divide in these two categories and these decisions can't be made sequentially. When I started writing in the academic literature about this issue, it became clear that what we have to do is maximize the standards and the transition rule jointly. You need to look jointly at what the right new source standard is and what the right transition rule is because otherwise, if you end up with a new source standard that's too stringent, you create a very strong disincentive for the transition to take place. That depresses demand for the new sources so you don't get the benefit of the program, and it keeps in operation plants that are actually very inefficient. Leaving aside the emission controls, they're just producing their product inefficiently. They're creating more pollution per unit of the product than a more efficient plan would do.

There's really no alternative but to look at these things in conjunction. To the extent that there is a kind of theoretical move that underlies this work, it's that: you have to jointly maximize these two things as opposed to doing it sequentially. This problem doesn't matter so much if you have an economy that's growing a lot. Maybe it's less of a problem in China than it is here because they're growing faster. But if you already have some sort of an industrial base, you have to worry about it and you have to look at both of these things.

One lesson is that there probably has to be some temporal limit to the grandfathering. We tried to do that through the modification provision. I think the history of our experience shows that that's not a good way to do it. Some temporal limit would make sense. Some phased-in program of the sort that we have for point sources in the Clean Water Act seems, as Jack said, to have worked better in terms of the transition of old to new. So, I think there are lessons from the United States. There are some theoretical lessons and there are some practical applications that work better than others.

David Doniger: The acid rain system, the idea of the mass-based approach covering new and existing sources, has a lot of appeal if you're starting fresh. When you're setting the caps that are appropriate, you consider the cost that you expect the existing sources and the new sources to face to be levelized by the trading system. It really comes down to one figure (I'm oversimplifying): How much reduction can you get at a given allowance price? Again, the marginal cost of control. And you probably are designing a system from scratch. It can drive the reductions down faster within any given cost constraint with that system than any other.

William Rosenberg: A very good point. I'm in complete agreement.

David Doniger: Soon, you've got the continuous emission monitoring on a tight basis and a willingness to play that straight and a fear on the part of the source operators that if they screw around with the measurements, they will face worse penalties than if they exceed the limits, which is basically how the system works. If the Chinese can create those kinds of incentives for themselves and the operators, then they would have a good strong baseline. I would not want them to follow an air quality modeling phase halfway like we did.

William Rosenberg: One point I want to make is that as long as we're going to insist on renewable sources and subsidize them in many ways, it's going to make it even more uneconomic for the existing sources to clean up because they have to sell the power or the community has to bear the cost and that can change where plant sources or users of power locate. I'm not saying we shouldn't subsidize the use of renewables to a point, but it has a cost. If we want the gas and coal industry to be robust to meet clean energy requirements in an economic way, it becomes very difficult if you're on the board of directors of a potential emitter to bear all the cost while your competitors are being subsidized.

For example, we don't count against the emissions of gasoline and petroleum coke that are going to occur in Mexico. If we burn that in a power plant in the United States, we probably would count it. But instead, we sell it and it is burned in Mexico to make cement and the emissions come back to us. For any of these internal subsidies, if they're not consistent across the board, then you have a problem.

Richard Revesz: I have a couple of comments. First, on David's point, if you have a trading system that includes

both new and existing sources, a lot of the grandfathering problem goes away, though you still have a question of how the initial allocation is done and so on. That's a huge virtue of having a broad trading scheme that includes both new and existing sources.

My second point is about the subsidy. The real question is what should be the baseline for the subsidy. Jack mentioned that the CSAPR avoided more than 10,000 premature deaths a year. That's a subsidy. If dirty energy can do that without having internalized that externality, that is a subsidy they're getting. It's not a subsidy that's paid for in taxpayer money; it's paid for in taxpayer lives. But there is no reason to believe that that's not a significant consequence.

Audience Member: So, what will happen next? The panel addressed the idea that starting from scratch may not be the most effective way to handle these issues, but are there ways that the next program could be more effectively implemented?

William Bumpers: The process is one in which EPA reviews scientific data and sets a national ambient air quality standard. EPA recently, in 2010, set a new one-hour SO_2 standard. (By the way, there are multiple standards: There's a one-hour standard, an eight-hour, and 24 hours. To comply with all of them, because there are different requirements, requires the states to go out and look at what sources are causing these things.) It is incredibly cumbersome in the regulatory process for developing the substance. It's cumbersome and it is long and drawn out. But by the same token, you want to ensure that you're setting standards that are helpful.

Is there a way to improve on that process? We're a nation of laws and we want people to have the opportunity to challenge and vindicate their rights. That slows things down, but I'm not sure I'm prepared to say that I don't want it to happen. So, I don't have a suggestion on the next improvement process. I think EPA has, by and large, done a good job of putting together the right scientific panels to figure out what is the best standard to set and how to set them. If they could consolidate and reduce and have fewer standards that give assurance of protectiveness, that would probably help the compliance process.

David Doniger: I guess we're intervenors on the EPA side in defending their current ozone standard, the most recent one, against attacks that it's too stringent. But we're very sympathetic to the petitioners who have attacked it as not being particularly protective. There's supposed to be an adequate margin of safety and, man, it's…

William Bumpers: It's not possible because there is no margin. They show morbidity at every exposure level.

David Doniger: So, it calls into question the adequacy of the standards. But as was said earlier, we fight dirty air with the Clean Air Act we have, not with the Clean Air Act we wish we had, and we're all trying to make that system work. I do think that the structure of the Clean Power Plan, to reduce emission rates or to reduce emission masses, as much as you can within reasonable economic constraints, is a durable way to go. The more we can get the states to opt the new sources into a mass-based program, the more rational an overall implementation program we will have.

I would also note that the Clean Air Act calls for a regular updating of the standards, §111 standards, every eight years at the max. So, if Congress doesn't come back to life, we will have the opportunity to review the standards. For example, the motor vehicle standards that were set for carbon pollution in 2012 are subject to review and a potential strengthening, potential weakening, or potential extension in the next couple of years. The Clean Air Act process is dynamic and we'll keep coming around with this.