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Next Generation Compliance:

Environmental Regulation for the Modern Era

Part 4: Preventing Widespread Violations that Threaten Climate Goals

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Part 4: Preventing Widespread Violations that Threaten Climate Goals 3

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We cannot afford to repeat the regulatory mistakes that have hobbled so many environmental rules in the past. Time's up. What we do next to tackle climate change must work. We know now that the dual assumptions at the foundation of nearly all environmental regulations – that most companies comply, and that it is up to enforcement to take care of the rest – are wrong. In fact, serious violations are widespread. And the principal driver of outcomes isn't enforcement, it's whether the regulations are tightly structured to make compliance the path of least resistance, so compliance is good even if enforcement never comes knocking. These essential truths are the difference between a rule that is great in theory, and one that delivers emission reductions in real life.

This series on Next Generation Compliance has shown how some rules deliver terrific compliance results, but many more don't.[1] The difference isn't a nice-to-have, at the margins we could do better. In program after program, serious widespread violations have undermined the entire purpose for which the rules were written, achieving only a fraction of the intended gains, or in some cases creating the possibility that we are actually headed in the wrong direction. This is untenable for climate rules. Climate regulations with serious violation rates of 25% to 50% or higher – all too common in many environmental programs – are the difference in climate between we have a chance, or we don't.

This article applies the lessons of Next Gen, hard won from decades of experience, to the most pressing issue of our time. It focusses on the three key areas for urgent immediate action – electricity generation, transportation, and methane from oil and gas production – and outlines both how government is struggling to implement rules effectively, and what choices could greatly improve the odds. It is a compliance analysis of both regulatory and legislative options, understanding that some of the suggested strategies will be difficult or impossible without legislative changes.

There has been a shift in the policy discussion about government's approach to climate change. Setting a price on carbon is no longer the one ring to rule them all.[2] It has been replaced with the realization that we

1 The Introduction and the first three articles in the series (Part 1 – Rules with Compliance Built In, Part 2 – Noncompliance with Environmental Rules is Worse Than You Think, and Part 3 – The Ideologues: Performance Standards and Market Strategies), are posted at https://eelp.law.harvard.edu/2020/09/next-generation-compliance-environmental-regulation-for-the-modern-era/.

2 Benjamin Storrow and Adam Aton, *Burned by Carbon Pricing, Dems Chart New Course on Climate*, E&E News (Feb. 2, 2021) https://www.eenews.net/stories/1063723981; Matto Mildenberger and Leah C.

have to start by setting the goal for emissions cuts where science tells us it has to be: 45% reduction by 2030, and a 100% clean energy economy by 2050. Something remarkably close to a consensus now exists that the first order of business is to focus directly on the biggest carbon emitting sectors where the solutions are known, clear, and affordable, and set aggressive regulatory standards. Those are electric generation, transportation, and oil and gas production.

> "There is too much at stake to put all the chips on strategies where our best knowledge predicts compliance collapse."

That's why this article digs into the compliance problems for these top emitters. It isn't an exploration of all the many policy implications of the choices for these sectors. It asks just one question: will the regulation actually reduce emissions? In the real world, which is where implementation happens, can we achieve something close to the desired outcome? Sometimes the answer is a qualified yes, it probably can, if the necessary guardrails are built into the rule. But for some, the hoped-for policy strategy can never achieve a good enough result.

There is no way to assure broad compliance, or sometimes to even know how close we are. There is too much at stake to put all the chips on strategies where our best knowledge predicts compliance collapse. It is far too late in the game to figure on taking a shot, seeing what happens, and hope to adapt if it doesn't work. Any program with a real chance of catastrophic breakdown isn't a viable option.

Next Gen isn't the band aid that can make any policy successful. Regulators can't just slap Next Gen ideas on top of an already designed program and call it done. Sometimes Next Gen approaches can plug into policy and considerably strengthen outcomes without unraveling basic design. But the unfortunate reality is that there will be times when a Next Gen analysis concludes that it isn't possible to achieve the desired result with this policy strategy. You just can't get there from here. This is when it is good to remember that it is better not to get too enamored with one policy approach. Sometimes one has to gaze fondly at the desired policy design and then kiss it goodbye, because the goal is reliable emission reductions, it isn't a particular policy scheme.

Both situations occur in the climate regulations discussed here. Some of the currently used strategies can achieve compliance with strengthened emissions standards, as is true for vehicle emissions. Some cannot, such as renewable fuels. It's better to know that now, and face the facts, before the failure to achieve the emissions reductions becomes all too apparent.

Being realistic about compliance is also essential for environmental justice. Widespread violations of environmental rules have fallen much more heavily

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Stokes, The Trouble with Carbon Pricing, Boston Review (Sept. 24, 2020) http://bostonreview.net/science-nature-politics/matto-mildenberger-leah-c-stokes-trouble-carbon-pricing; Frederick Hewett, *Putting A Price On Carbon: It Was Hot, Now It's Not*, WBUR (Aug. 3, 2020) https://www.wbur.org/cognoscenti/2020/08/03/carbon-pricing-tax-climate-change-policy-frederick-hewett.

on minority and low-income communities. It is almost never feasible to remedy a bad regulatory compliance design through enforcement, and as we have recently seen, some governments aren't interested in enforcement anyway. Incorporating Next Gen into rules is one of the most important things we can do to protect overburdened communities, because it shields them from high rates of violation and is less dependent on the unreliable commitment of regulators to protect the most vulnerable. While government tackles the existential crisis of climate change, it also has to ensure that there are no disproportionate burdens or benefits.

I am not arguing that compliance considerations are the only marker of effective rules. Nor am I suggesting that a rule should aim for no violations. That's not realistic or achievable. But what we can't have is a climate program where violations overwhelm regulators' ability to accomplish the mission, or a rule that makes it impossible to know how close we are to the necessary emission reductions. Some popular climate policies teeter on the edge of those chasms. Some have already fallen in.

This article acknowledges that the rule writing process is messy, and compromises are often needed to get something done. Sometimes political reality requires the suboptimal choice. If regulators go in with eyes open to the risk, and constrain it as best they can, that may produce an acceptable, if not preferred, result. What government cannot do is adopt regulations that will, due to predictable, even inevitable, compliance failures, fall far short of the emissions goal. There are enormous compliance deficits in many programs now, with rules that are nowhere close to achieving the intended objectives. This will get dramatically worse with tightened standards and a lot more money in the game, unless the regulations create deliberate and thoughtfully designed strategies to prevent that.

> "Incorporating Next Gen into rules is one of the most important things we can do to protect overburdened communities."

This article looks through a Next Gen compliance lens at the three top areas for regulatory action to tackle climate change. It concludes that zero carbon electricity generation can be a compliance winner, but not if energy efficiency is allowed to create a big compliance gap. Strong compliance with vehicle emission standards is also possible, but conventional transportation biofuels face insurmountable compliance barriers. Finally, the article explains why controlling methane from oil and gas development is a daunting compliance challenge, but also offers many Next Gen strategies that can significantly alter the compliance odds.

It is worth remembering that electricity generation, transportation, and oil and gas production are comparatively easy ones in the array of dramatic actions necessary to address the threat of climate disaster. Government needs to save its resources for the problems that don't have such obvious answers. That means counterproductive but politically convenient loopholes, ambiguities, and complexities

are out. Those only burden government with impossible and useless regulatory tasks. Strategies that depend on stringent government oversight are doomed too; government won't have the resources, ability, or in many places the political will, to make that happen.

> "In writing climate rules, government needs to accept the reality that heavy regulatory pressure leads to widespread serious violations."

In writing climate rules, government needs to accept the reality that heavy regulatory pressure leads to widespread serious violations. Wishful thinking about companies' compliance or the ability of enforcement to plug gaping holes will run climate regulations into a ditch. But even as we acknowledge that there are programs with discouraging performance and large obstacles, we can see that there are pathways to yes. Next Gen is about finding those solutions. We can do this. But it requires jettisoning the old assumptions and rejecting the ideas that look great on paper but don't stand a chance in the real world.

Electricity: Clean energy can work, but only if we keep it simple

Electric power generation is one of the two largest sources of carbon dioxide in the United States.[3] Any plan to achieve our climate goals has to include regulatory standards that will get as close as possible to zero-carbon electricity by 2035. The electric generation and transportation goals are tightly linked and work together: as transportation is increasingly powered by electricity, that power must rapidly become much cleaner.

State leadership in cleaning up the energy supply has shown how regulatory standards can effectively push for cleaner energy. There is a spirited debate about the details, and some of the options have serious compliance issues, as is discussed below. But here's one thing nearly all of the recently proposed climate policies agree on: the federal legislative strategy should include something very much like the Renewable Portfolio Standards that many states have already adopted.[4]

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3 EPA, Overview of Greenhouse Gases, https://www.epa.gov/ghgemissions/overview-greenhouse-gases (last visited Feb. 17, 2021).

4 See Majority Staff of H. Select Comm. on the Climate Crisis, 116th Cong., Solving the Climate Crisis: The Congressional Action Plan for a Clean Energy Economy and a Healthy, Resilient, and Just America, at 37 (2020), https://climatecrisis.house.gov/sites/climatecrisis.house.gov/files/Climate%20Crisis%20Action%20Plan.pdf; Center for Climate and Energy Solutions (C2ES), *Clean Energy Standards: State and Federal Policy Options and Considerations*, C2ES at ix-x (2019) https://www.c2es.org/site/assets/uploads/2019/11/clean-energy-standards-state-and-federal-policy-options-and-considerations.pdf; David Roberts, *At Last, a Policy Platform That Can Unite the Left*, Vox (May 27, 2020, updated July 9, 2020), https://www.vox.com/energy-and-environment/21252892/climate-

Renewable Portfolio Standards (RPS) are named for the mix of energy sources required in utilities' "portfolios," which require an increasing percentage of electricity sales to come from renewable sources.[5] Thirty states have some version of such standards.[6] Here's what we have learned: they work. RPS are credited with driving about half of the increase in renewable generation and capacity since 2000.[7] The developing consensus suggests that the best way to accelerate these trends, driving electricity generation toward clean renewable energy as quickly as possible, is to create a national standard that provides both certainty and cost cutting opportunities for power generators. Such a national standard can be the backbone of the plan to get to 100% clean electricity by 2035.

The great news from a compliance perspective is that it is not that hard to develop a national RPS that will have very high compliance rates. The amount of power that any source generates is easily – and already – measured. The amount of power sold by a utility, likewise. Because the compliance obligation is measured by the amount of clean power over the amount sold, determining compliance is straightforward. There are a lot of details to iron out of course, but the experience of states can guide the way. There are many compliance strengths of this approach: there are a limited number of regulated parties (the electric utilities), a common metric (units of electricity), and an established and reliable measurement system. Ensuring widespread compliance under these circumstances is Next Gen 101. It takes careful and thoughtful design of course, and there are lots of difficult choices to make. But if regulators resist the temptation to insert too many loopholes and escape hatches, setting a renewable energy standard that achieves high rates of compliance using Next Gen principles is something we know how to do.

The further good news is that a renewable portfolio standard can be both ambitious and allow for growth. Every climate policy requires increased electricity generation; as we move more polluting activities to electric power, the need for electricity will increase. At the same time, we will be cutting the amount of carbon and other pollutants emitted from electricity generation because it will be increasingly clean. Renewable portfolio standards are structured to build in necessary growth in demand while also cutting carbon.

The much harder part from a compliance perspective is what else, in addition to a renewable portfolio standard, is included. The desire to add more ways of complying and to reduce costs through trading has resulted in a new name for this approach: a Clean Energy Standard. The difference, implied by the name, is what is included. A Clean Energy Standard

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5 *See* Robert Freedman, Monica Lamb & Claire Melvin, Financing Large Scale Projects, in Legal Pathways to Deep Decarbonization in the United States 129, 143 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

6 Solving the Climate Crisis, *supra* note 4, at 37. For a map of the states showing existing programs, see Galen Barbose, *U.S. Renewables Portfolio Standards: 2019 Annual Status Update*, Lawrence Berkeley National Laboratory, at 8 (2019), https://eta-publications.lbl.gov/sites/default/files/rps_annual_status_update-2019_edition.pdf.

7 Barbose, *supra* note 6, at 4; C2ES, Clean Energy Standards, *supra* note 4, at 23.

isn't limited to renewable energy, as Renewable Portfolio Standards are. It potentially includes other zero carbon sources.[8] States that already have Clean Energy Standards vary in what they allow in the definition of clean: some include nuclear, or fossil fuel with carbon capture, or energy efficiency, for example, while others don't.[9]

> "Next Gen operates not in the rarified world of ideology but in the gritty and messy on-the-ground reality of implementation. It asks just one question: will it work?"

This article does not address the policy merits of including, or omitting, these additional types of energy in a Clean Energy Standard. It focuses only on compliance, and the implications of an expanded definition of clean energy for assuring that we actually achieve the zero-carbon objective. Next Gen operates not in the rarified world of ideology but in the gritty and messy on-the-ground reality of implementation. It asks just one question: will it work?

Viewed through this lens, there is one candidate for inclusion in a clean energy definition that stands out: energy efficiency. Energy efficiency – using less energy to accomplish the same task – is a pillar of every climate strategy. It is a must-have, can't-live-without component for getting our emissions down to where they have to be. It includes both reducing the total amount of energy needed to do something, and changing the times when that energy is needed, to reduce dependence on peak power sources. We know energy efficiency reduces demand and there is no question that we have to ramp up at a breakneck pace.

But – you knew there was a but coming here – including energy efficiency in a clean energy standard is fraught with peril. There is a world of difference between committing to as much energy efficiency as possible and including it in standard for achieving zero carbon from electric generation. Here's why.

The idea of a clean energy standard is to allow electric generation utilities to make their own decisions about how to achieve the continuously tightening standard. The right mix of renewable and other clean power sources will be up to them. That allows differently situated utilities to select the power portfolio that works for their circumstances and achieves compliance at as a low a cost as possible. Regulators define what the acceptable sources are – what is really zero carbon – and then the utilities buy as much of those sources as they need to comply. The market for clean energy favors the cheapest zero carbon sources, allowing us to achieve the zero-carbon goal at reasonable cost.[10]

8 C2ES, Clean Energy Standards, *supra* note 4 at 23-27.

9 *Id*.

10 Such market-type approaches are all about efficiency and reducing costs. They are less good at addressing equity, which is why the climate justice movement questions use of such strategies. That's an important consideration and is touched on later in this discussion of energy

Nearly all power generation can be measured by reliable and well-established methods and we know how clean they are. Utilities can buy one unit of solar power, or one unit of wind power, and we can be certain that both are actually zero carbon. How the utility elects to design their portfolio does not affect the climate outcome. Nearly perfect compliance can be built in; we can have confidence that we are getting the necessary emissions outcome.

But energy efficiency isn't like that. It's about changing how something is done or built with a goal of reducing the amount of energy it consumes. It is complex, extremely hard to measure, impossible to monitor closely, and expensive to evaluate robustly. The built-in incentives encourage participants at every level to overstate the benefits in ways that are hard to detect. And compliance needs to happen at millions of facilities of widely varying types distributed everywhere around the country. Next Gen predicts that in these circumstances, compliance will be poor. The available data tell us that's what's actually happening in energy efficiency; it isn't achieving as much energy savings, and thus carbon reduction, as everyone hoped.

So what? Why worry about the measurement difficulties? We know energy efficiency works and we know we need more. Any program that achieves that is good, right? Actually, no. The problem isn't the merits of efforts to drive investment in energy efficiency. It's the impact of including such a difficult to measure source of power savings in a market for clean energy.

efficiency and clean energy standards.

WHY IS MEASURING THE IMPACT OF ENERGY EFFICIENCY SO DIFFICULT?

The idea of energy efficiency is at base pretty simple: do the same thing, but use less energy doing it.[11] When we use energy efficient appliances, swap incandescent for LED bulbs, or upgrade insulation so that less energy is needed to heat a building, we are being more energy efficient. We still get the desired end point – refrigerated food, light, heating in the winter – but we use less energy to get there. But how much energy do we save by deploying those energy efficiency measures? There's the rub.

Conceptually, the energy savings is what energy use is after energy efficiency measures, compared to what it would have been without those actions. You can see the squishiness already creeping in. The savings depend on what you project would have happened in the alternate universe where the efficiency project didn't occur. It isn't something observable in the world; it requires assumptions and creation of a so-called "counter factual," from which the actual energy use after energy efficiency measures is subtracted. That difference is the savings from energy efficiency.[12] It's nowhere near as

11 Of course, it is also possible to reimagine the thing itself, so you get where you are going but in an entirely different way, also reducing energy use. My more colloquial use of the term energy efficiency here is not meant to exclude these more creative approaches to cutting energy demand.

12 *See* American Council for an Energy Efficient Economy, Evaluation, Measurement, & Verification (Feb. 5, 2020) https://www.aceee.org/toolkit/2020/02/evaluation-measurement-verification; Noah Kaufman & Karen L. Palmer, *Energy Efficiency Program Evaluations: Opportunities for Learning and Inputs to Incentive Mechanisms*, 5 Energy Efficiency 243, 244 (2012).

simple as comparing energy use before and after the project. To throw in some of the complications that happen in real life: what if after I install more energy efficiency measures, I have another child, and also decide to purchase an electric car? Maybe a warming climate means I need less energy in the winter, but because I know I am doing a good thing by improving my energy efficiency, I decide it's OK to buy two big energy-draining TVs.[13] How clear is it now how much energy I saved through more efficient appliances, more insulation, and a switch to LED lights? This is just a small sampling of the mess and complications that enter into figuring out how well energy efficiency projects work. Even experts say they are extremely difficult to measure.[14]

An entire industry has grown up around trying to figure this out, called Evaluation, Measurement and Verification (EM&V).[15] To give you some idea of how complicated this is, California's Evaluation Framework for appraisals of California's energy efficiency programs is 500 pages long.[16] And that's just the framework. Even in the perfect world, figuring out energy savings from efficiency investments is inherently complex.

And, as you may have noticed, we don't live in a perfect world. We cannot devote infinite hours and dollars to building reliable measurement and verification systems. Simplifying assumptions are necessary. So, informed by research, engineers have estimated the level of expected energy savings from certain activities. For ease of administration, these assumptions are the most commonly used way to estimate energy savings from energy efficiency investments, especially in non-industrial settings. They are commonly referred to as "deemed savings," which is the amount of energy you can assume is saved by undertaking a specific type of energy efficiency work.[17] Deemed savings might tell you how much energy savings are deemed to occur from installing an additional two inches of insulation in your attic, just to pick one of hundreds of examples.[18] Deemed savings are universally used to calculate

13 This really happens. It is called the rebound effect and has been measured and documented. *See, e.g.,* Kenneth Gillingham, Amelia Keyes & Karen Palmer, *Advances in Evaluating Energy Efficiency Policies and Programs*, at 5, available at https://environment.yale.edu/gillingham/Gillinghametal_18_ARRE_EnergyEfficiency.pdf.

14 Kaufman, *supra* note 12, at 243. *See also* Energy Efficiency Program Impact Evaluation Guide: Evaluation, Measurement, and Verification Working Group, State & Local Energy Efficiency Action Network, DOE/EE-0829 at 3-5 (Dec. 2012), https://www4.eere.energy.gov/seeaction/system/files/documents/emv_ee_program_impact_guide_0.pdf (diagram of conceptual framework for measurement of energy efficiency savings).

15 For a relatively concise summary of EM&V *see* ACEEE, EM&V, *supra* note 12. *See also What is EM&V?* Department of Energy https://www.energy.gov/sites/prod/files/2014/05/f16/what_is_emv.pdf Martin Kushler, Seth Nowak & Patti Witte, *A National Survey of State Policies and Practices for the Evaluation of Ratepayer-Funded Energy Efficiency Programs*, American Council for an Energy-Efficient Economy, Report No. U122 *passim* (2012) *https://www.aceee.org/sites/default/files/publications/researchreports/u122.pdf*.

16 The California Evaluation Framework, Prepared for the California Public Utilities Commission and the Project Advisory Group, Project Number: K2033910, June 2004, rev. 2006 https://www.cpuc.ca.gov/uploadedFiles/CPUC_Public_Website/Content/Utilities_and_Industries/Energy/Energy_Programs/Demand_Side_Management/EE_and_Energy_Savings_Assist/CAEvaluationFramework.pdf.

17 ACEEE, EM&V, *supra* note 12 (deemed savings).

18 *See, e.g., Arkansas Deemed Savings, Installation & Efficiency Standards*, TRM Version 4.0 Volume 2: Deemed Savings, at 64 (2014) http://www.apscservices.info/pdf/10/10-100-R_118_3.pdf. Note that the Arkansas Deemed Savings Standards are 451 pages long.

the amount of energy savings claimed for particular energy efficiency measures; 95% of states use deemed savings to determine energy savings.[19]

How do those deemed savings stack up against real world measurement? The data aren't encouraging. A 2017 review of the economics literature concluded that energy savings are often smaller than implied by utility-reported results and that deemed savings in particular tend to overestimate energy savings.[20] The good news is that nearly all studies have found that there was some energy savings from the energy efficiency measures.[21] But some of the few rigorously designed studies find that the actual savings fell far short of what the engineering estimate predicted, possibly delivering only 25% of the promised savings.[22] For lighting upgrades, which account for the majority of energy savings from utilities' residential efficiency programs, there is a "glaring lack of empirical evidence."[23]

On top of this many-factorial engineering and measurement problem that makes the topic inherently complex, there are a wide variety of self-serving motivations and conflicting incentives that further muddy the waters. Efficiency installers don't always do a good job, because they are poorly trained, rushed, or trying to cut costs.[24] The unscrupulous simply cheat.[25] Just because energy efficiency is good doesn't mean that all the mess and confusion of real life don't apply. They do.

19 American Council for an Energy Efficient Economy, National Survey of State Policies and Practices for Energy Efficiency Program Evaluation, at 26 (Oct. 15, 2020), https://www.aceee.org/research-report/u2009.

20 Gillingham, *supra* note 13, at 8.

21 *Id*. at 16.

22 *See, e.g.*, Meredith Fowlie, Michael Greenstone & Catherine Wolfram, *Do Energy Efficiency Investments Deliver? Evidence from the Weatherization Assistance Program*, NBER Working Paper 21331, at 34 https://www.nber.org/papers/w21331 (2015) (randomized controlled trial finding that retrofits on average only achieved about 25% of the expected savings predicted by a widely used efficiency audit tool). *See also* Gillingham, *supra* note 13, at 12-13 (discussing studies of energy savings from efficiency building codes, which produced conflicting results); Cathryn Courtin, *Sacred Cow Gets Controversial, Closer Look: Energy Efficiency*, Women's Council on Energy and the Environment, (undated) https://www.wcee.org/page/SacredCowGets. *See also* Lauren Giandomenico, Maya Papineau & Nicholas Rivers, *A Systematic Review of Energy Efficiency Home Retrofit Evaluation Studies*, Carleton Economic Papers 20-19, at 13, 16, Carleton University, Department of Economics (2020) https://ideas.repec.org/p/car/carecp/20-19.html (finding that actual savings for residential retrofit programs ranged from 25% to 85% of predicted savings, with the more rigorous studies finding less energy savings); Fiona Burlig, Christopher Knittel, David Rapson, Mar Reguant, & Catherine Wolfram, *Machine Learning from Schools about Energy Efficiency*, NBER Working Paper 23908, at 4 (2017) (finding that efficiency upgrades at California schools delivered only 24% of the expected savings) https://www.nber.org/papers/w23908.

23 Gillingham, *supra* note 13, at 15.

24 *See, e.g.*, Louis-Gaetan Giraudet, Sebastien Houde and Joseph Maher, *Moral Hazard and the Energy Efficiency Gap: Theory and Evidence,* https://hal.archives-ouvertes.fr/hal-01420872v2, at 22 (2018) (finding that for hard to observe efficiency measures like insulation, the gap between projected and actual energy savings is particularly pronounced when the efficiency measure is installed on a Friday, *i.e.,* workers cut more corners on Fridays).

25 *See, e.g.*, Joshua A. Blonz, *The Welfare Costs of Misaligned Incentives: Energy Inefficiency and the Principal-Agent Problem*, Finance and Economics Discussion Series 2019-071, at 34, Washington: Board of Governors of the Federal Reserve System, https://doi.org/10.17016/FEDS.2019.071 (finding that many contractors intentionally misstated the age of replaced refrigerators in a large efficiency program, resulting in 50% less energy savings than claimed, and noting that such gaming of the system during implementation may be part of the explanation for the widespread failure of energy efficiency programs to deliver promised savings).

Government has created additional incentives for over-claiming energy savings from energy efficiency. In some places electric utilities are given financial incentives to reduce energy demand through energy efficiency programs. If you want utilities to commit to more energy efficiency, financial incentives are one obvious way to do it. But anyone who has been paying attention to prior articles in this Next Gen series knows what will happen when financial incentives exist for companies to do something, but it is difficult to measure if they actually did it: many will claim better performance than they actually had. That's what has happened in energy efficiency – utilities routinely overstate the energy savings from their energy efficiency programs.[26]

A 2012 study of energy efficiency in California by Noah Kaufman and Karen Palmer reveals that the problem of overestimating and overreporting energy savings is systemic.[27] The Kaufman and Palmer study compared the results from rigorous third-party evaluations of a year's worth of energy efficiency programs with both the energy savings projected for those programs, and savings reported by utilities once the programs were done. The study had an unusually robust data set for an entire year's worth of energy efficiency programs: projected savings (estimated before the project was done), the utility reported savings (based on performance after the fact), and evaluated savings (third party after-the-fact reviews of savings). California has an energy efficiency performance incentive mechanism where utilities are rewarded with increased profits the more energy savings they obtain, so the amount of verified energy savings has direct financial consequences for the utilities.[28]

Kaufman and Palmer's research revealed that actual energy savings were 30% to 40% less than had been projected. In addition, utilities overstated the actual savings by 15% (electricity) and 53% (gas).[29] This study shows that not only were the projections for energy savings inflated – a point made in other studies – but the utilities were systematically overstating the savings, even when they did their own after-the-fact reviews. This is exactly what a Next Gen analysis would predict in a setting where higher reported energy savings produces greater financial rewards.

These findings are particularly notable because they occurred in California, which has one of the strongest energy efficiency programs and one of the most rigorous evaluation, measurement, and verification systems in the country. And the utilities knew in advance they would be subject to third party review. If utilities significantly overstate the energy savings

26 Gillingham, *supra* note 13, *passim*.

27 Kaufman, *supra* note 12.

28 *Id.*, at 245.

29 *Id.*, at 250. The utilities' after-the-fact reports acknowledged that the actual savings were lower than had been projected in advance. But they still over-stated the actual savings. For example, utilities reported that implemented programs only achieved 87% of the projected MWh savings. But the third-party evaluations found that those programs only achieved 67% of the savings that had been projected for those programs. *Id* at 252. The report also notes that utilities overstated peak savings by about 9%. The report authors find that the relatively better reporting performance by utilities in peak savings (total megawatts) is likely due to the limited time duration of peak demand periods and thus limited potential to deviate from engineering-based estimates. *Id*. at 250. They further note that peak shaving is inherently harder to measure, so the estimates of peak savings are relatively less precise. *Id*. at 249.

when they expect regulators are strict and know in advance that an outside party will be carefully scrutinizing their work, what is likely happening when neither of those things is occurring?[30]

> "When it is next to impossible to check, and everyone knows it, self-serving behavior will be widespread."

None of this is surprising. Anyone who has studied what has happened with environmental rules over the past decades would expect it. Hard-to-measure programs make it tough to ensure that the desired result is occurring. Everyone involved responds to what is in their best interest and makes close calls – and sometimes nowhere near close – in their own favor. Some companies will just cheat. When it is next to impossible to check, and everyone knows it, self-serving behavior will be widespread.

WHY DOES IT MATTER?

The net result is that we don't really know how effective energy efficiency is. We know it works – we have seen collective energy consumption go down despite growth in population, corresponding with implementation of energy efficiency programs.[31] But we can't really say with confidence how much energy is saved by specific energy efficiency programs. The band of uncertainty is wide. And with a lot of money to be made under a souped-up Clean Energy Standard, the incentives that push against greater accuracy will get much worse.

That's why inserting energy efficiency into a Clean Energy Standard creates such a big problem. This is how including it would work: an energy efficiency program projected to save a defined amount of energy would earn one clean energy credit. That credit could be used by the utility to meet its mandatory clean energy percentage. Its worth in the market is exactly the same as a clean energy credit from, say, solar energy. But actually, they aren't equal. We know how much clean energy is created by the solar project, but don't really know how much energy savings is reflected in the energy efficiency

30 Another interesting finding from the Kaufman and Palmer study was confirmation that third-party review does not necessarily ensure accuracy. The largest outside auditors were far more likely to find larger discrepancies in utility reports than smaller auditing companies did. *Id* at 259. The authors speculate that the larger firms have less financial dependence on individual clients, and thus a weaker incentive to please any single client, possibly resulting in more honest evaluations. That would be consistent with other studies finding that the financial incentives for third party auditors selected by the regulated firm can distort audit findings. Esther Duflo, Michael Greenstone, Rohini Pande & Nicholas Ryan, *Truth-telling by Third-party Auditors and the Response of Polluting Firms: Experimental Evidence from India* (Sept. 21, 2012), https://economics.mit.edu/files/10713 (auditors selected and paid by the regulated firm are far more likely to report the plant in compliance); Jodi L. Short & Michael W. Toffel, *The Integrity of Private Third-party Compliance Monitoring*, Administrative & Regulatory Law News, Vol. 42, no. 1, 22-25 (Fall 2016) (describing factors that lead to third party auditor bias in reporting), https://www.hbs.edu/faculty/Publication%20Files/ShortToffel_2016_ARLN_13fe8ba5-cb72-482b-b341-5c7632f7c164.pdf; Gillingham, *supra* note 13, at 8; Justin Marion and Jeremy West, *Dirty Business: Principal-Agent Problems in Hazardous Waste Remediation*, http://conference.nber.org/conf_papers/f132544.pdf (finding that third party hazardous waste site evaluators manipulated scoring to favor their clients, facilitating lower quality remediation of hazardous waste sites).

31 See Kit Kennedy, Lighting, Appliances, and Other Equipment, in Legal Pathways to Deep Decarbonization in the United States 217, 218 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

credit. There are some energy savings in the energy efficiency credit, probably, but it is almost certainly not as much as is being claimed. It might be a lot less. There's no way to know for sure. But that shaky energy efficiency credit is used to justify the release of more actual, real, we-know-it-is-happening CO2. Because energy efficiency credits are likely a lot less expensive than renewable energy credits – that's one of the reasons that energy efficiency is so attractive as a climate solution – the market presses for more energy efficiency, leading to a plethora of dubious clean energy credits. The more of those doubtful credits there are, the less likely it is we will achieve the desired carbon reductions.

> "Government accomplishes nothing by writing a rule that isn't compliance resilient and then focusing on who is to blame for violations."

The conventional narrative that this Next Gen series is seeking to overturn – that most companies comply, and that noncompliance can be handled though enforcement – is just obviously wrong here. Energy efficiency has all the hallmarks of a program where those assumptions will be potentially fatal. Nearly all the characteristics that led to widespread violations in the rules described in Part 1 exist here. It is complicated to figure out, lots of activity goes on behind closed doors that is hard to monitor, checking on compliance is expensive and difficult, requires both expertise and good judgement, and just about everyone involved benefits by overstating savings. In addition, the activities will be happening at millions of locations across the country. What are the chances that compliance will be good? Tiny. And the chances that enforcers will be able to fix rampant noncompliance after the fact, never mind prevent it from occurring in the first place? Literally zero.

The fact that there will be widespread violations isn't something to bemoan and berate companies for; it is just acknowledging reality. Government accomplishes nothing by writing a rule that isn't compliance resilient and then focusing on who is to blame for violations. Regulators' obligation is to build a program that will achieve the goal. That is the animating principle of Next Gen: will the program work in the real world, or not? It's on the regulators to make sure it does.

Enforcement can't possibly turn this around. In part, that's because the problem is inherently complex. Even among people of good will, trying their best, there is likely to be a mismatch between projected and actual efficiency savings. Lots of programs that fail to deliver will be tough to classify as violations. The complexity also means it will be incredibly time consuming to investigate even a single case, which requires checking all the data and the assumptions used in the evaluation and conducting field work to compare reports to reality. Many states don't have the expertise or interest in doing such investigations. None have the resources. On top of that, nearly all the interests of the many players involved push in the direction of overstating savings. These will run the gamut from outright fraud to looking on the bright side when making assumptions, but the incentives mean that it will be common, and inevitable, that lots of projected savings will never be realized.

Enforcement needs to be part of the mix, but it cannot be our principal strategy for closing the gap between what is required and what actually happens. Pretending we can solve this problem through enforcement is just throwing in the towel.

These are the reasons that including energy efficiency in a clean energy standard will result in more carbon emissions than intended – possibly a lot more. That's the kind of insight that a Next Gen analysis, done in advance, contributes to policy. Here it tells us unambiguously that allowing energy efficiency credits into a Clean Energy Standard will mean both more carbon emissions than desired and much greater uncertainty about how close we are to achieving the necessary declining trajectory. There may be ways to hedge, and modestly reduce that negative impact, but it can never be "fixed."[32]

The same cautions, plus a few more, apply to including energy efficiency in a regulation-only approach to clean energy. That's because a regulatory strategy necessarily leaves all the implementation challenges to individual states. The existing 50 state strategy for energy efficiency evaluation has been described as a "mess."[33] Supercharging the existing problematic system, and then layering on state authority to create tradable energy efficiency credits – as the Clean Power Plan did, for example – makes the already overwhelmingly complex problem much worse.[34] We aren't doing a credible job of measuring energy efficiency savings now. Adding a market for credits created under 50 different systems encourages states to be even less demanding so their credits can compete in the energy market. Such a regulatory strategy has all the problems with energy efficiency measurement already described plus the drawbacks of operating extremely complicated programs through 50

32 One strategy that has been considered is limiting the percentage of credits that can come from energy efficiency, although usually that is proposed to ensure that the push for renewable energy remains strong. See, e.g., C2ES, Clean Energy Standards, *supra* note 4 at 37. Another option is reducing the relative value of EE credits (e.g., defining credits so that, for example, it takes 3 EE credits to equal one RE credit). Attempting to address the problem this way is really just an admission that we don't know how much EE credits are worth and is more about limiting the damage than solving the problem. We would still have clean energy credits in the market of uncertain value, and probably would see a lot more of them with an aggressive CES. But note that even without energy efficiency credits a CES contains a natural incentive for utilities to promote energy efficiency; because CES defines the obligation as a percentage of the total, reducing demand through effective energy efficiency reduces the amount of clean energy needed to meet the CES obligations. *See* C2ES, Clean Energy Standards, *supra* note 4, at 32-33. One Next Gen advantage of relying on this natural incentive is that it puts the risk of energy efficiency not achieving its energy reduction goals on the utilities, aligning the private interest of the utilities with the public interest in energy efficiency that actually reduces demand.

33 A survey of state approaches to energy efficiency evaluation confirmed that states have a "sometimes distressing amount of variability and inconsistency," and from a national perspective the situation might be regarded as a "mess.") Kushler, *supra* note 15, at 34, 39. Forty-four percent of states reported, for example, that they do not even have written rules for conducting evaluations. *Id* at 11.

34 The Clean Power Plan finalized in 2015 allowed use of deemed savings to develop energy efficiency credits, despite the reality that such projected savings are rarely realized. Carbon Pollution Emission Guidelines for Existing Stationary Sources: Electric Utility Generating Units, 80 Fed. Reg. 64662, 64909 (Oct. 23, 2015) https://www.govinfo.gov/content/pkg/FR-2015-10-23/pdf/2015-22842.pdf (describing EPA's draft guidance as containing best practices for evaluation, measurement and verification for energy efficiency under the Clean Power Plan). That draft guidance allowed use of deemed savings. EPA, Draft Evaluation Measurement and Verification (EM&V) Guidance for Demand-Side Energy Efficiency (EE), at 15-16 (Aug. 3, 2015), https://archive.epa.gov/epa/sites/production/files/2015-08/documents/cpp_emv_guidance_for_demand-side_ee_-_080315.pdf.

different governments, all under-resourced, and many actively opposed to the climate objectives of the rule. That would be a Next Gen disaster waiting to happen: a near-impossible problem being exclusively administered by state governments whose every incentive is to look the other way. More carbon emissions are inevitable as utilities are allowed to increase emissions by purchasing overstated and unverifiable energy efficiency credits.

Some people who concede that the measurement challenges of energy efficiency are daunting nevertheless still push to include these programs in a clean power approach, whether that is legislative or regulatory, because allowing energy efficiency credits has another important objective: stimulating investment in energy efficiency. If utilities can buy energy efficiency credits to meet their clean energy compliance obligation that's a source of cash for the vital work of energy efficiency. Some think this is actually the primary purpose of energy efficiency credits.[35] How can we achieve that critical investment in energy efficiency without undercutting the zero-carbon electricity plan?

Fortunately, states have shown us the way. Instead of mixing energy efficiency with electric generation, to the detriment of both, we can address energy efficiency directly, through an Energy Efficiency Resource Standard (EERS).[36] An EERS would direct utilities to accomplish the maximum achievable level of energy efficiency. Twenty-six states already have an EERS.[37] An aggressive federal energy efficiency standard could cause the leap forward in energy efficiency we need without putting it in competition with renewable energy.[38] We can insist on both. A separate strategy for energy efficiency also makes it easier to improve on measurement of efficiency savings, so while we move up the energy efficiency learning curve we can do better without putting carbon reductions in the electric generating sector at risk.

Separating energy efficiency from a clean power standard also makes it much easier to include other important goals in the work, like equity. Designing markets so they address environmental justice is not a simple problem. A standard solves that; it can require energy efficiency investment and specifically require that it occur in EJ communities.[39] In this case,

35 The dual and often competing objectives – funding for desired projects and achieving the regulatory goals – are also what fuels the drive for offsets in larger carbon markets, to often dismal result. *See, e.g.*, Kenneth R. Richards, *Environmental Offset Programmes*, *in* Policy Instruments in Environmental Law, 325-351 (Kenneth R. Richards & Josephine van Zeben eds., Edward Elgar Publishing 2020).

36 This is the strategy that the House Select Committee on the Climate Crisis recommended in June 2020. See Solving the Climate Crisis, *supra* note 4, at 34.

37 *Id. See also* Rachel Gold, Annie Gilleo & Weston Berg, *Next-Generation Energy Efficiency Resource Standards*, American Council for an Energy-Efficient Economy, Report U1905 at iv (August 2019), https://www.aceee.org/research-report/u1905#:~:text=Now%20states%20are%20looking%20to,those%20with%20the%20highest%20need. For information on each state's EERS, see American Council for an Energy-Efficient Economy, Energy Efficiency Resource Standards, https://database.aceee.org/state/energy-efficiency-resource-standards, (last accessed Feb. 17, 2021).

38 A national energy efficiency strategy has the additional benefit of addressing the wide variability in state energy efficiency programs. See *supra* note 33.

39 *See, e.g.*, Maryland's proposed legislation to add a low-income

as is so often true, it is far more straightforward to go directly at the desired outcome, rather than try to torque an ill-fitting method in an attempt to force it to achieve something that it is not well-designed to do.

Another benefit of an energy efficiency standard is it removes the distortions that a clean energy market can create for investments. In a market system, money will flow to the lowest-cost options. That's its main purpose. But for the kinds of dramatic changes that are needed in energy efficiency investment, maybe low cost today isn't the be-all and end-all. Although it makes sense to grab the low-hanging fruit, maybe the bigger pay off in the long run will come from strategies that can't compete now but might produce huge gains in the future. Market credits don't invite that kind of deliberate and strategic thinking.

A bill introduced in the US Senate in 2019 suggests ways this can work; it proposes a national standard, with states allowed to have a more stringent approach, and nationally consistent evaluation, measurement and verification requirements.[40] It directs the National Academy of Sciences to evaluate measurement methods and to incorporate more state-of-the-art experimental approaches, and directs that an evaluation database be made public.[41] Through strategies like this we can ramp up energy efficiency and figure out how to improve measurement, without undercutting the integrity of a clean power standard.[42] This approach also gives government the option to conclude, as seems eventually likely, that while measurement can greatly improve, it might never be possible to have real certainty about energy savings from energy efficiency. At some point it might not be cost effective to obtain that last degree of clarity.[43] We are nowhere near that point yet. But keeping efficiency

investment target to the state's energy efficiency resource standard. Robert Walton, *Maryland Efforts for Low-income Energy Efficiency Target Stalled by COVID-19*, Utility Dive (March 19, 2020), https://www.utilitydive.com/news/maryland-efforts-for-low-income-energy-efficiency-target-stalled-by-covid-1/574406/.

40 S. 2288, American Energy Efficiency Act of 2019, 116th Cong. (2019) https://www.congress.gov/bill/116th-congress/senate-bill/2288/text.

41 *Id*. at section 610(d). There are many potentially useful approaches that have not yet been applied at scale, like new technologies for real time measurement, and randomized controlled trials. *See, e.g.*, Northeast Energy Efficiency Partnership (NEEP), *The Changing EM&V Paradigm,* (2015) (potential for advanced data analytics and automated data availability to improve evaluation), https://neep.org/changing-emv-paradigm.

42 Separating energy efficiency (EE) into its own bucket, as an EERS would do, creates opportunities for trading. Trading EE credits for other EE credits has potential to reduce costs while posing less risk of undercutting carbon reduction than allowing trading across EE and renewable energy. The overall quality of EE credits will improve nationally as the investments in measurement bear fruit, improving the reliability of the traded credits over time, without imperiling the necessary gains toward renewable energy. S. 2288 also has a number of interesting Next Gen type ideas for incentivizing energy efficiency measurement that is as accurate as possible, like excluding energy savings that are not adequately documented and setting fixed civil penalties for each unit of energy claimed but not delivered. S. 2288, *supra* note 40, at section 610(e).

43 *See, e.g.*, discussion of the tradeoffs between certainty and cost in energy efficiency evaluation in Gillingham, *supra* note 13, at 17. *See also* Steven R. Schiller, Charles A. Goldman & Elsia Galawish, *National Energy Efficiency Evaluation, Measurement and Verification (EM&V) Standard: Scoping Study of Issues and Implementation Requirements*, State & Local Energy Efficiency Action Network, at v-vii (2011), https://www7.eere.energy.gov/seeaction/system/files/documents/emvstandard_scopingstudy.pdf (discussing issue of "how good is good enough" in measuring energy efficiency savings).

separate from other measures to cut carbon frees us from the necessity of pushing for energy efficiency measurement that isn't cost effective and limits the damage to our climate change objectives that could result from mixing poorly measured actions with measurement-certain activities.

Energy efficiency shouldn't be included in a clean energy standard because it inserts a high degree of uncertainty into one of the central climate solutions we can otherwise be confident about achieving. For all the same reasons it should not be allowed as an offset under any other approach to cutting carbon in electric generation, whether that's a Clean Power Plan 2.0, a market approach like cap and trade or a carbon tax, or any other market-type strategy. Dramatic improvements in energy efficiency are indispensable for any climate plan, but the uncertainties of energy efficiency savings cannot be allowed to undercut the also absolutely essential reductions in CO2 from electric generation. If we were starting this plan in 1980, maybe we would have been willing to gamble on creating more uncertainty in carbon reduction in exchange for possibly reducing costs. We don't have that luxury anymore. We have to cut carbon from electric generation to zero or close to it as fast as we can, and we can't use any strategy that makes achieving that goal significantly less certain.

It is worth remembering, when regulators make policy choices about ways to cut carbon to zero in electric generation, that this is the easy one. We can already see the pathway to zero. We know how to do this; we just need to summon the political will. Many of the other programs to achieve necessary carbon reductions will be much harder. There isn't as yet a clear solution for the industrial sector, agriculture, and making the cuts global, to name just some of the more formidable issues. Those are genuinely complicated and will require action in a highly uncertain environment. Injecting all the uncertainty and complexity of energy efficiency into a clean power strategy makes it both unnecessarily convoluted and less likely to succeed. We have to move fast on energy efficiency, but not by undercutting clean power. Zero carbon electricity can be a sure thing. Let's keep it that way.

> "Zero carbon electricity can be a sure thing. Let's keep it that way."

Transportation: Don't double down on past mistakes

Any plan to address climate change has to put transportation emissions front and center. Transportation – passenger and freight vehicles including cars, trucks, planes, and ships – is currently the largest contributor to human caused US greenhouse gas (GHG) emissions.[44] The biggest

44 EPA, Fast Facts on Transportation Greenhouse Gas Emissions (2018), https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions. Senate Democrats Special Committee on the Climate Crisis, *The Case for Climate Action: Building A Clean Economy for The American People*, at 45 (Aug. 25, 2020), https://www.schatz.senate.gov/imo/media/doc/SCCC_Climate_Crisis_Report.pdf; Amy L. Stein & Joshua P. Fershée, Light Duty Vehicles, in Legal Pathways to Deep Decarbonization in the United States, 353 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

share of that is from passenger cars and trucks.[45]

There is widespread agreement that the way to cut carbon from passenger vehicles is to shift them to electric power at the same time that we take action to make that electricity as low carbon as possible.[46] The transition plan is to make passenger vehicles as efficient as they can be while we shift toward electrification. It isn't simple to do, but at least the path is clear.

Other types of transportation, like long distance trucks, ships, and planes, are harder. At present most of these still require some form of liquid fuel.[47] For these essential modes of transportation, most climate plans propose to ratchet up efficiency and at the same time reduce the carbon intensity of fuels, through low carbon fuel standards.[48]

Climate isn't the only reason to push for changes in transportation emissions. The fossil fuel combustion that powers vehicles creates a lot of other dangerous air pollution too so cutting climate emissions also addresses a key public health threat.[49] Vehicle pollution is a big part of the urgent calls for environmental justice because transportation emissions disproportionately affect already overburdened communities.[50]

What is the biggest compliance challenge in transportation emissions? Despite what you probably think, it isn't clean car standards. Volkswagen certainly opened a lot of people's eyes to the problem of companies' flouting these standards; it is Exhibit A for the fact that big companies do cheat. It is the one-word response to the unsupportable but oft-repeated notion that big companies are all trying to comply. EPA learned a valuable lesson that its otherwise strong vehicle compliance program needed to block the pathways for fraud.[51] But with that change, the compliance provisions in the rules for new cars and trucks are actually quite resilient. The vehicle pollution limits need to be considerably strengthened; we were headed in the

45 EPA Fast Facts, *supra* note 44; Stein, *supra* note 44, at 354; Solving the Climate Crisis, *supra* note 4, at 87. The next largest share is medium and heavy-duty trucks, which contribute about 25%. EPA Fast Facts, *supra* note 44.

46 Solving the Climate Crisis, *supra* note 4, at 86-100; Stein, *supra* note 44, at 356, 373; *Resetting the Course of EPA: Reducing Air Emissions from Mobile Sources*, Environmental Protection Network at 2, 3 (Aug. 2020), https://www.environmentalprotectionnetwork.org/reset/reducing-air-emissions-from-mobile-sources/. *See also* The Biden Plan for a Clean Energy Revolution and Environmental Justice, https://joebiden.com/climate-plan/ (last visited on Feb. 17, 2021).

47 The Case for Climate Action, *supra* note 44, at 57.

48 Solving the Climate Crisis, *supra* note 4, at 101; Andrea Hudson Campbell et. al., *Heavy-Duty Vehicles and Freight*, in Legal Pathways to Deep Decarbonization in the United States 384, 389 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

49 The Case for Climate Action, *supra* note 44, at 52.

50 Research on Near Roadway and Other Near Source Air Pollution, EPA, https://www.epa.gov/air-research/research-near-roadway-and-other-near-source-air-pollution (last visited Feb. 17, 2021).

51 It's not just Volkswagen of course. As a result of the investigation EPA did after the Volkswagen cheating was uncovered, other diesel car manufacturers have also been tagged for having defeat devices. *See* Press Release, EPA, In Civil Settlements with the United States and California, Fiat Chrysler to Settle Allegations of Cheating on Federal and State Vehicle Emissions Tests (Jan. 10, 2019), https://archive.epa.gov/epa/newsreleases/civil-settlements-united-states-and-california-fiat-chrysler-settle-allegations.html; Press Release, EPA, U.S. Reaches $1.5 Billion Settlement with Daimler AG Over Emissions Cheating in Mercedes-Benz Diesel Vehicles (Sept. 14, 2020), https://www.epa.gov/newsreleases/us-reaches-15-billion-settlement-daimler-ag-over-emissions-cheating-mercedes-benz.

right direction until progress on that was abruptly halted by the Trump EPA.[52] Once we have more ambitious standards though, the rules as presently designed can achieve good compliance. This industry has a strong profile for Next Gen effectiveness. There are a limited number of easily identified auto and truck makers, who are sophisticated and knowledgeable. There are reliable tests to know how much pollution will be emitted from each vehicle and these have been considerably improved by changes post-Volkswagen. EPA has world class engineers and testing that easily go toe to toe with the manufacturers. Every new vehicle has to be pre-certified by EPA, based both on manufacturer and independent EPA testing.[53] If the vehicle doesn't clear the emissions hurdle, it isn't approved. This is the compliance gate that EPA used to eventually force Volkswagen to admit its deceit. Are there still violations? Yes. Can the regulations' compliance strategies be improved? Absolutely.[54] But overall, this is a solidly designed program. If it receives adequate funding, it can achieve quite good emissions compliance without constant enforcement attention.[55] New technologies hold promise to make it even better.[56]

LOW CARBON FUELS

The big compliance challenge in transportation is low carbon fuels. To call it a challenge understates; the

52 *See Corporate Average Fuel Economy Standards / Greenhouse Gas Standards,* Harvard Environmental and Energy Law Program Regulatory Rollback Tracker, https://eelp.law.harvard.edu/2017/09/corporate-average-fuel-economy-standards-greenhouse-gas-standards/ (last updated Feb. 8, 2021) (detailing the history of the Trump administration pull back on vehicle emissions standards). President Biden has directed EPA and NHTSA to consider establishing ambitious new fuel economy standards. *Id*.

53 This is the big lesson of Volkswagen: don't trust the company's testing and don't let the companies know what testing EPA will do. EPA now does less predictable and more variable testing, which inspires companies to design their vehicles to achieve standards in actual operation in the real world, instead of "teaching to the test." *See* Cary Coglianese & Jennifer Nash, *The Law of the Test: Performance-Based Regulation and Diesel Emissions Control*, 34 Yale J. on Reg. 33 (2017).

54 Among the improvements that could strengthen compliance: stronger requirements to limit emissions deterioration over time, roadside monitoring of emissions to spot vehicle types that appear to have more emissions than allowed, and enhanced "in use" testing, to find the vehicle models that show declining emissions performance over the life of the vehicle. We also need new regulatory strategies to address the scourge of the so-called after-market defeat devices, which eliminate or reduce emissions controls. These are not in the new vehicle when sold, but are added later, in plain violation of the law and with serious pollution consequences. More than 15% of diesel trucks in the US are estimated to have had emission control systems removed through such tampering, adding 570,000 tons of nitrogen dioxide pollution to the air over the life of the vehicles. Coral Davenport, Illegal Tampering by Diesel Pickup Owners Is Worsening Pollution, E.P.A. Says, N.Y. Times (Nov. 25, 2020), https://www.nytimes.com/2020/11/25/climate/diesel-trucks-air-pollution.html. *See also* EPA Enforcement Alert, Aftermarket Defeat Devices and Tampering are Illegal and Undermine Vehicle Emissions Controls (Dec. 2020) https://www.epa.gov/sites/production/files/2020-12/documents/tamperinganddefeatdevices-enfalert.pdf. This is an important subject that calls out for Next Gen solutions but is beyond the climate focus of this article.

55 Note that the small number of automakers, and the extensive mandatory testing and reporting, also make this a program where enforcement can make a big difference for compliance. The cases are large and complicated, but the significant chance of getting caught, and the recent record of serious consequences for violations, make enforcement a bigger deterrent in this program than it is in many others. Enforcement isn't practical as a systemic answer to other issues in this sector, but the stars align to make it one of EPA's powerful tools to deter violations of vehicle emission standards for new cars and trucks.

56 *See, e.g.*, Felipe Rodríguez & Francisco Posada, Future Heavy-Duty Emission Standards: An Opportunity for International Harmonization, International Council on Clean Transportation White Paper (Nov. 2019), https://theicct.org/sites/default/files/publications/Future%20_HDV_standards_opportunity_20191125.pdf.

compliance problems are daunting. The compliance landscape is global, extremely complex, and strewn with political land mines. There are compliance barriers in every direction, with huge implications for our ability to reduce climate-forcing emissions through low carbon fuels. This is not for the faint of heart.

The theory of low carbon fuels is very appealing. They are mostly made from plants, unlike the oil-based fuels we have traditionally used for transportation. When fossil fuels like gasoline and diesel are burned, they release a lot of carbon into the atmosphere that would otherwise have remained underground. That's why fossil fuels are the central problem for climate change. Plants, on the other hand, capture carbon as they grow.[57] They release carbon when they are used, but a lot of carbon can be recaptured when more plants are grown. That's why these are often called "renewable" fuels; the carbon is recycled, so we can use the fuels for transportation with far less carbon burden.[58] That's the theory.

So, what's the problem? Plants as fuel are only lower carbon if we don't chew up a lot of land to grow them.[59] Undisturbed lands, like forests and grasslands, store a lot of carbon, both above ground in the biomass of the plants, and below, in the soil. Cutting down a forest or a grassland and plowing that land for crops releases that carbon, and it keeps emitting carbon for decades.[60]

> "Plants as fuel are only lower carbon if we don't chew up a lot of land to grow them."

The quantity of carbon released when undisturbed land is converted to agriculture is surprisingly big. Carbon is emitted when the forests or grasslands are cut down and the vegetation either decays or is burned.[61] But the largest source of carbon from converting land to crops in the United States is the soil itself. Plowing under US grasslands releases a significant amount of carbon, 90% of which originates in the soil.[62] Carbon in biomass accumulates over years to decades, but soil carbon accumulates slowly, over decades to centuries; releasing the carbon in soils is thus effectively irreversible over human time scales.[63] The climate impacts of cutting down perennial vegetation and replacing it with annual commodity crops dwarfs the

57 Timothy Searchinger et al., *Use of U.S. Croplands for Biofuels Increases Greenhouse Gases Through Emissions from Land-Use Change*, 319 Science 1238 (2008).

58 *Id.*

59 Blake Hudson & Uma Outka, Bioenergy Feedstocks, in Legal Pathways to Deep Decarbonization in the United States 648, 650 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019). The energy used in production and transportation of biofuels also add to its carbon footprint, but induced land use change is the largest source of greenhouse gas emissions associated with biofuels.

60 National Research Council, *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy*, The National Academies Press, at 4, 191 (2011), https://doi.org/10.17226/13105.

61 Seth A. Spawn, Tyler J. Lark & Holly K. Gibbs, *Carbon Emissions from Cropland Expansion in the United States*, 14 Environ. Res. Lett. at 1 (2019), https://iopscience.iop.org/article/10.1088/1748-9326/ab0399.

62 *Id.* at 5.

63 *Id.* at 7.

other climate issues for biofuels.[64] That's why the National Academy of Sciences says that land use changes can have profound effects on greenhouse gas emissions and that the carbon impact of biofuels depends on the changes to land use and land cover. The carbon released from land use changes alone can wipe out any climate benefit from biofuels.[65]

You might think 'OK that's not an insurmountable barrier; just require that biofuels only be grown on land already in farming. Don't convert any undisturbed land for renewable fuel crops. Problem solved.' Putting aside for a moment the practical problems with implementing that, it has a major conceptual flaw: many of the crops pushed off existing farmland in favor of biofuels will go somewhere else. Where? Obviously, on currently non-farmed land. The demand for biofuels increases the value of biofuel crops, and that itself can provide economic incentive for additional land use change.[66] In the jargon of biofuels these are called indirect land use changes; even if the biofuels themselves aren't grown on converted land, the demand for biofuels inevitably leads to undisturbed land being plowed under.[67] For this reason, requiring that biofuels be grown only on land already in farming doesn't solve the climate problem, it just pushes it around. The net effect of the demand for renewable fuels is more natural areas turned under for farming. More carbon released. Whether the effect is direct (forest and grassland land converted to grow crops for renewable fuels) or indirect (forest and grassland converted for other crops) doesn't matter for the climate. More land disturbance causes more carbon release causes more climate change.

The problem is complicated by the reality that efforts to tackle biofuels' exceedingly difficult land use implications run headfirst into a political buzz saw. Land use in the United States has traditionally

64 NAS, *supra* note 60, at 4.

65 *Id*. at 4, 192. *See also id*. at 245 (in many cases land use change is the variable with the greatest effect on greenhouse gas emissions from biofuels); EPA, EPA/600/R-18/195, Biofuels and the Environment: Second Triennial Report to Congress at 20, 53 (June 2018), https://cfpub.epa.gov/si/si_public_record_Report.cfm?Lab=IO&dirEntryId=341491 (land use change has been identified as one of the primary drivers affecting environmental impacts); Searchinger, *supra* note 57, at 1238; Government Accountability Office, GAO-19-47, *Renewable Fuel Standard: Information on Likely Program Effects on Gasoline Prices and Greenhouse Gas Emissions*, at 22 (2019). Land use change is the largest but not the only factor in assessing climate impacts of biofuels. Other factors include how the land is farmed and how much fertilizer is used. No till farming has promise to reduce soil carbon losses, but its impact is uncertain (NAS, *supra* note 60, at 186) and some think it only matters when land is permanently no till (Spawn, *supra* note 61, at 8-9, noting that intermittent tillage probably doesn't have much climate benefit and observing that permanent no-till management is relatively rare). Fertilizer is another significant climate issue, because fertilizer releases nitrogen dioxide, a potent greenhouse gas. *Id*. at 9. Growing more crops on the same land, sometimes called intensification, usually requires more fertilizer. Tyler J. Lark et al., *Impacts of the Renewable Fuel Standard on America's Land and Water Resources*, Research summary presented at the American Academy for the Advancement of Science (AAAS) Annual Meeting, at 4-5 (Feb. 15, 2019), http://www.gibbs-lab.com/wp-content/uploads/2019/05/RFS-synthesis-report-5.17.2019.pdf. New land converted to grow crops is usually less productive, so also requires – surprise! – more fertilizer. EPA, Second Triennial Report, *supra* note 65, at 54. Climate is not the only environmental concern raised by biofuels. There are also many other environmental impacts of increasing demand for biofuels not addressed in this article, such as air and water pollution and wildlife habitat loss. For a description of these other impacts, see NAS, *supra* note 60, and EPA Second Triennial Report, *supra* note 65 (finding that the environmental and resource conservation impacts of biofuels are, on balance, negative). *Id*. at x.

66 NAS, *supra* note 60, at 5.

67 *Id*. EPA, Second Triennial Report, *supra* note 65, at 21.

been a state or local governance issue.[68] Apart from federally owned lands, the federal government has not had a lot to say about land use. The few places where it has – for example, in protecting wetlands because of their central role in clean water – have been controversial. Many local and state governments, which have the legal authority to impose restrictions to prevent low carbon fuels from becoming carbon multipliers, don't have the interest or the political will to do that.[69] Using the authority of the federal government to prevent climate-damaging land use changes is politically fraught.

It isn't just land use that is a political minefield. Farming – choosing which crops are grown where and in what way – has long been the third rail in environmental politics. Some of the most contentious policy debates in environmental protection resulted from the farming industry working hard to make it impossible to regulate farm activities.[70]

This is the tricky situation Congress confronted when it enacted the expanded Renewable Fuel Standard (RFS) as part of the Energy Independence and Security Act of 2007:[71] how to get the potential climate benefits of biofuels without causing new land use change or detonating a political bomb.

The updated RFS law mandated that US transportation fuels, mainly gasoline and diesel, be blended with biofuels, made primarily from agricultural feedstocks. The statute, and mandated annual EPA regulations, specify how many gallons of biofuels must be included in transportation fuels sold in the United States each year. The law describes two basic types of biofuels: conventional and advanced. Conventional biofuels must be at least 20% lower carbon intensity than the petroleum-based fuels they replace.[72] Advanced biofuels, such as fuel from algae, must have a much greater carbon benefit: 50% or better reduction in greenhouse

68 Hudson, Bioenergy Feedstocks, *supra* note 59, at 650.

69 *See id*. at 660, 662 (noting that state and local governments face pressure to keep land use regulations flexible, even lax, so as not to drive out economic development).

70 One recent example is the so-called Waters of the United States rule. *See, e.g.*, News Release, EPA, (Des Moines Register) EPA, Army Finalize Repeal of Controversial 'Waters of the U.S.' Rule, (Sept. 12, 2019), https://www.epa.gov/newsreleases/des-monies-register-epa-army-finalize-repeal-controversial-waters-us-rule. Here are the actual first two sentences of an article written by the Trump EPA Administrator: "Today, EPA and the Department of the Army will finalize a rule to repeal the previous administration's overreach in the federal regulation of waters and wetlands. This action officially ends an egregious power grab and sets the stage for a new rule that will provide much-needed regulatory certainty for farmers, home builders, and property owners nationwide." Notice where the op ed was placed. Farming is politics with a small p, except every four years when Iowa has the first voting of the presidential primary season, turning farming issues into national "capital P" politics. The Renewable Fuel Standard has been a perennial player in Presidential elections, including 2020. *See* Rebecca Beitsch, *EPA Delivers Win for Ethanol Industry Angered by Waivers to Refiners*, The Hill, Sept. 14, 2020, https://thehill.com/policy/energy-environment/516364-epa-delivers-win-for-ethanol-industry-angered-by-waivers-to.

71 Energy Independence and Security Act (EISA) of 2007, 42 U.S.C. § 17001 et seq. EISA replaced an earlier version enacted in 2005. The 2007 RFS statute is sometimes called RFS2.

72 42 U.S.C. § 7545(o)(2)(A)(i). The 20% threshold was significantly undermined elsewhere in the law; facilities that existed or were in construction by 2007 are exempted from meeting the 20% better-than-fossil-fuel requirement. 42 U.S.C. § 7545(o)(2)(A)(i). In 2017, 89% of all RFS blending volume was exempt from the 20% improvement standard. GAO, *supra* note 65, at 7, n. 7, and at 20, n. 29; EPA Regulation of Fuels and Fuel Additives: Change to Renewable Fuel Standard Program, 75 Fed. Reg. 14670, 14677 (March 26, 2010) (to be codified at 40 C.F.R. pt. 80). *See also* discussion accompanying notes 111 to 115 *infra*.

gas emissions.[73] Congress directed EPA to analyze the total climate forcing emissions related to each fuel type; these lifecycle analyses determine which biofuels meet the mandatory percentage reduction threshold.

The hope and the goal of RFS was to spark a big increase in advanced biofuels. The vast majority of the expected climate benefits were projected to come from these advanced fuels.[74] Unfortunately, that isn't what happened. The program has produced several orders of magnitude less advanced biofuels that was set forth in the 2007 legislation.[75] Almost 90% of biofuels produced in the United States are conventional ethanol, which is made nearly entirely from corn; advanced biofuels comprise less than 10%, most of which is biodiesel from soybeans.[76] This falls far short of the 60% share for advanced biofuels that Congress envisioned in the updated RFS.[77]

In an effort to ensure the climate benefits of biofuels, Congress included two provisions to limit conversion of undisturbed land to biofuel crops: 1) it directed EPA to consider land conversion in its lifecycle analysis of the climate impacts of biofuels, so land use change would be included in EPA's decisions about which fuels meet the emissions reduction thresholds, and 2) it declared that biofuel crops grown on converted land were not eligible.[78]

"The hope and the goal of RFS was to spark a big increase in advanced biofuels. Unfortunately, that isn't what happened."

As Congress instructed, EPA's lifecycle analyses contained a thorough evaluation of land use change. Those analyses included robust consideration of how much land was likely to be converted as a result of the new standard, and the expected carbon emission impacts of that conversion. EPA found that the land already being farmed in the United States as of 2007 was likely sufficient to support both the new biofuels and other crop products, so there would be no need

73 42 U.S.C. § 7545(o)(1)(B) Definition of Advanced biofuel. See also GAO, *supra* note 65, at 6-7. There are a variety of advanced biofuels, including fuels from algae or cellulose in crop residue. *Id* at 7.

74 Joseph E. Aldy, *Promoting Environmental Quality Through Fuels Regulations*, in Lessons from the Clean Air Act: Building Durability and Adaptability into U.S. Climate and Energy Policy, 159, 185 (Ann Carlson & Dallas Burtraw, eds., Cambridge Univ. Press 2019).

75 *Id*. at 198.

76 EPA, Second Triennial Report, *supra* note 65, at 7. US Energy Information Administration, Biofuels Explained: Biomass-based Diesel Fuels, https://www.eia.gov/energyexplained/biofuels/biodiesel.php (percent of biodiesel from soybean oil) (last visited Feb. 18, 2021). *See also Jonathan Lewis on BioFuels, Part 2*, Harvard CleanLaw podcast, transcript at 2 (Sept. 30, 2019), http://eelp.law.harvard.edu/wp-content/uploads/CleanLaw-26-Joe-Jon-Lewis-biofuels-2.pdf.

77 U.S. Dept. of Energy, Alternative Fuels Data Center, Legislated Renewable Fuel Standard (RFS) Volume Requirements, https://afdc.energy.gov/data/10421 (last visited Feb. 18, 2021).

78 42 U.S.C. § 7545 (o) (1)(H) (definition of lifecycle greenhouse gas emissions, including direct and indirect emissions from land use change); 42 U.S.C. § 7545 (o) (1)(I) (definition of renewable biomass, which includes only crops and other feedstocks from land in farming before the law was enacted in December 2007).

to clear and cultivate additional land.[79] As a result, EPA predicted no additional climate forcing emissions from domestic land use change.[80] However, EPA also found that the RFS would cause shifts in agricultural markets worldwide, leading to significant greenhouse gas emissions associated with land conversion in other countries; EPA's analysis attributed 40% of the total lifecycle greenhouse gas emissions for corn ethanol to international land use change.[81] Some commenters suggested that international land use change was too unpredictable to be included. EPA had the opposite reaction. Although predicting land conversion is inherently uncertain, the impact of land use change on greenhouse gas emissions is large. Therefore, EPA concluded, if it's impossible to determine that carbon emissions from likely land use change are small enough to meet the threshold, then the fuel would have to be excluded from the program.[82]

Based on significant carbon emissions predicted from land use changes overseas, but virtually no land use change emissions here at home, the dominant biofuel – corn ethanol – barely squeaked by the 20% threshold, with a 21% benefit rating for new ethanol plants.[83]

What about the second prong of the law's attempt to limit emissions from land conversion: Congress' prohibition on using biofuel crops grown on newly farmed land? EPA rule writers wrestled with how to ensure that biofuels weren't produced on land not in farming as of 2007 (the year the law was enacted), as the statute required. EPA's proposed regulation suggested putting the burden of making sure lands met the 2007 cut-off on the biofuel producer or importer.[84] Producers and importers would be required to certify that the crops they used didn't come from newly farmed land, and to maintain records to support that claim, including maps or electronic data identifying the boundaries of the land where each type of feedstock was produced, and other documents, traceable to the specific land used, proving that each such tract of land was eligible under the rules.[85]

There are limited options for how this proposed compliance regime could play out: 1) growers admit to the biofuels producer or importer that the crops the farmers are selling violate the 2007 cut-off, 2) the records required to prove compliance are missing or wrong so it is difficult to impossible to figure out if the crops complied with the rule, or 3) the producer or importer says everything is hunky dory and EPA attempts to verify that claim by looking at decades-old records about what was in farming in prior to 2007, and brings an enforcement case if it turns

79 EPA 2010 RFS regulations, supra note 72, at 14682.

80 *See id.* at 14788 (corn ethanol); *id*. at 14789-14790 (soy biodiesel).

81 *Id*. at 14788.

82 *Id*. at 14679.

83 *Id*. at 14786-14788. The reason EPA only analyzed the lifecycle GHG emissions from new ethanol plants is that biofuels from pre-2007 ethanol plants are exempt from the 20% reduction standard. See discussion accompanying notes 111 to 115 *infra*.

84 EPA Regulation of Fuels and Fuel Additives: Changes to Renewable Fuel Standard Program; Proposed Rule, 74 Fed. Reg. 24904, 24911 (May 26, 2009).

85 *Id*. at 24933 (recognizing that "it may be difficult" to determine qualification with the 2007 cut off using some of the documents identified as supporting compliance determinations).

out some crops were ineligible. Everyone who thinks #1 is likely, raise your hand. Here's what would really happen: EPA would find that fuel producers' or importers' records are incomplete or inaccurate, so EPA couldn't determine if the crops they used complied with the 2007 cut-off. Where records do exist, EPA would be faced with the impossible task of verifying that the specific crops sold were actually grown on the precise land claimed and that land was eligible.[86] Many of the (usually paper) records would likely be missing or ambiguous. And these investigations would provoke a firestorm of political pushback. See politics 101 above. Not to mention that EPA doesn't have the staff to conduct such inquiries at even one in a thousand locations; there are about 90 million acres of corn in the US, about 40% of which are dedicated to biofuels.[87] If by some miracle EPA did identify a few violators, the biofuel made with ineligible crops would be long since sold. In the unlikely chance that a violation by a producer or importer were proved, they could easily, and probably truthfully – since knowing is not in their interest – claim they had no idea the purchased crops weren't compliant. As a result, the chance of persuading a court to impose penalties that have deterrent punch would be extremely low. The entire enterprise is totally unworkable. File this under enforcement: your worst nightmare.

Anyone tracking the Next Gen indicia for rules likely to have widespread violations will recognize them in EPA's proposal. The regulated companies have strong incentives not to hassle their suppliers with demands for hard-to-find records or to scrutinize those records too closely. The farmers who are supposed to provide the records are regulation resistant and have little interest in meeting what likely feel like intrusive requests for business information. And both know that it is unlikely to impossible that EPA will be able to sort out which feedstocks meet the 2007 cut-off requirement.

Here's the creative idea that EPA finalized in 2010 in place of the initial proposal. EPA would monitor land in farming in the US through satellite data and other means, to see if there had been a net increase in farmland since 2007. If not, EPA would assume that the land use restrictions were being met, and none of the record keeping obligations would be triggered.[88] EPA called this "aggregate compliance." In theory it assured that biofuels would not cause undisturbed lands to be farmed – protecting the climate benefits of biofuels – at the same time it reduced implementation burden for EPA and for industry. As of 2020, EPA continues to find that

86 Note that this is not as simple as looking at a satellite image and comparing pre- and post-2007 land use. For example, land in conservation status is eligible too, even if not being actively farmed. Determining eligibility is therefore a records-intensive exercise, not knowable from just looking at a photograph. There are many other compliance challenges too, including that the same eligible land could be used repeatedly as the claimed origin of crops that actually were grown other places. That couldn't be spotted without a complete data base for all the fuel producers and importers that could compare every piece of land claimed for compliance to every processor, a very demanding task.

87 EPA Second Triennial Report, *supra* note 65, at 10 (acres of US land in corn production in 2016), and at 53 (40% of corn grain produced nationally goes to biofuels).

88 40 C.F.R. § 80.1454(g) (aggregate compliance approach). See 40 C.F.R § 80.1454(c) (importers), and (d) (domestic producers), 40 C.F.R. § 80.1451(g) (records required if EPA determines that total land in farming has increased and record keeping obligations are therefore triggered); 40 C.F.R. § 80.1401 Definition of existing agricultural land (what records are required to demonstrate that land was in farming as of 2007).

there has been no net increase in farmland in the US, so government is not checking if newly farmed land in the US is the source of biofuel feedstock and industry doesn't have to keep any records.[89] Unfortunately, EPA's creative idea didn't work.

The prediction that land conversion would be limited in the US and the backstop of the aggregate compliance approach have both been proven wrong. In fact, a huge amount of additional land has come under the plow in the United States since 2007. EPA estimates that by 2012, 4 to 7.8 million acres of new farmland were added – an area the size of New Jersey.[90] The RFS is responsible for 2.8 million acres of additional US land farmed, all land that but for RFS would have been busy storing carbon but is instead emitting carbon in large quantities.[91] The amount of carbon being released from converted land in the US eliminates the modest carbon savings that EPA had predicted for corn ethanol back in 2010.[92] The bottom line is that neither strategy – lifecycle analysis that included land use change, or prohibitions on using biofuels grown on land newly converted to farming – prevented significant land conversion and the resulting large carbon emissions.

Citing this evidence, some have called for EPA to withdraw the aggregate compliance approach and enforce the prohibition on biofuels grown on post-2007 farmland.[93] Is it possible to ensure compliance

89 *See* EPA Renewable Fuel Standard Program: Standards for 2020 and Biomass Based Diesel Volume for 2021 and Other Changes, 85 Fed. Reg. 7016, 7053-7054 (Feb. 6, 2020) (to be codified at 40 C.F.R. pts. 79 and 80).

90 EPA Second Triennial Report, *supra* note 65, at 37-38, 44. There is clear scientific consensus on the extensive cropland expansion that has occurred in the US over the last decade. Tyler J. Lark et al., *Cropland Expansion in the United States Produces Marginal Yields at High Costs to Wildlife*, Nature Communications, at 5 (2020), https://doi.org/10.1038/s41467-020-18045-z; EPA Second Triennial Report, *supra* note 65 at 39. Corn is the predominant crop planted on newly cultivated land. Lark, Cropland Expansion, *supra* note 90, at 3. How can there be so much post 2007 land conversion to farming in the United States but also no net increase in farmed land? One reason is development. If I am farming 100 acres, sell 10 of those acres to a developer for a subdivision, and start farming 10 new acres, I have not increased the net land in farming; it is still 100 acres. But the subdivision isn't storing carbon, and my ten newly farmed acres are releasing a lot of carbon, producing a net increase in carbon emissions even though there is no net increase in acres farmed. That is happening all over American today. Between 2001 and 2016, 11 million acres of farmland and ranchland were lost to development. Julia Freedgood et al, Farms Under Threat: The State of the States, American Farmland Trust, at 4 (2020), https://s30428.pcdn.co/wp-content/uploads/sites/2/2020/09/AFT_FUT_StateoftheStates_rev.pdf.

91 Lark, Impacts of RFS, *supra* note 65, at 9. Lark's preliminary analysis found that between 2008 and 2016, RFS caused 1.6 million acres of cropland expansion and resulted in 1.2 million acres of cropland remaining in production that would otherwise have transitioned to natural cover, for a total of 2.8 million acres of cropland compared to what would have occurred without RFS. *Id*. at 8-9. The study estimates the carbon flux from these changes in land use at 219 MMT CO2e (27.1 MMT CO2e/year). *Id*. That is equivalent to the GHG emissions from 7 coal fired power plants or nearly 6 million passenger vehicles per year. EPA Greenhouse Gas Equivalencies Calculator, https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last visited Feb. 18, 2021). The cause-and-effect relationship of RFS2 to US land conversion is supported by a study showing that the rate of land conversion for corn production is significantly higher close to facilities making biofuels. *See* EPA, Second Triennial Report, *supra* note 65, at 54. *See also id.* at xi (noting that there are "strong indications" that biofuel feedstock production is responsible for some of the observed changes in land used for agriculture since enactment of RFS.)

92 Compare Lark's preliminary analysis of GHG emissions from RFS induced land use change (Lark, Impacts of RFS, supra note 65, at 9) with EPA's calculation of the lifecycle GHG emissions benefits of corn ethanol in 2010 (EPA 2010 RFS regulations, supra note 72, at 14788). This comparison shows that carbon emissions associated with land use change caused by RFS eliminate the climate advantage that EPA predicted for ethanol.

93 *See, e.g.*, National Wildlife Federation at al., Amended Petition

with that obligation? And if we could, would that help? No and no.

It is completely impractical to implement the check-every-parcel idea using paper records that are increasingly unavailable or ancient, for all the reasons already explained. Next Gen teaches that regulatory obligations running directly counter to a company's self-interest – like expecting biofuel producers and importers to scare away their customers through rigorous compliance checks – won't happen unless there are robust real-time countermeasures that make that hard to avoid. Relying on the dubious proposition of enforcement after the fact will never work. Next Gen, and a huge body of compliance evidence, tells us that in a situation like this, where all the incentives line up against compliance, and it is virtually impossible to check, serious violations will be widespread.[94] Holding the line for the 2007 cut-off isn't feasible.

Even if it were possible to perfectly enforce the prohibition on biofuels grown on farmland converted after 2007 that doesn't solve the problem. At best it forces biofuels onto existing cropland and pushes other crops to go elsewhere. Undisturbed land is still plowed under, resulting in significant carbon releases.[95] The climate doesn't care if we label land use conversion as direct or indirect. The relentless logic of science can't be gamed in that way. The demand for biofuels is causing – direct, indirect, call it whatever you want – more carbon emissions from land use change.

If you think it is hard to sort this out in the United States, consider how much more complicated it is for imported renewable fuels, made from crops grown in other countries. The largest sources of imports to the US have been Brazil, Argentina, and Indonesia.[96] The same discouraging data about expansion of farming in the US are evident around the world. Cropland expansion and deforestation have been documented in these major exporters of biofuels to the US.[97] EPA's 2018 assessment acknowledges that increased biofuel production has contributed to these international land use changes, including in the three countries that are the major exporters of biofuels to the US.[98] Unlike in the United States, where the vast majority of new farmland is converted from grasslands, in other countries more of the newly disturbed area is at the expense of even

to the United States Environmental Protection Agency to Amend Its "Aggregate Compliance" Approach to the Definition of "Renewable Biomass" Under the Renewable Fuel Standard in Order to Prevent the Conversion of Native Grassland (Jan. 18, 2019), https://earthjustice.org/sites/default/files/files/Amended-Aggregate-Compliance-Petition_1-18-19.pdf.

94 *See* Cynthia Giles, *Part 2: Noncompliance with Environmental Rules is Worse Than You Think,* Next Generation Compliance: Environmental Regulation for the Modern Era (2020) https://eelp.law.harvard.edu/2020/01/next-generation-compliance-environmental-regulation-for-the-modern-era/.

95 Searchinger, *supra* note 57, at 1240: "Because emissions from land use change are likely to occur indirectly, proposed environmental criteria that focus only on direct land-use change would have little effect. Barring biofuels produced directly on forest or grassland would encourage biofuel processors to rely on existing croplands, but farmers would replace crops by plowing up new lands." *See also* NAS, *supra* note 60, at 5.

96 EPA Second Triennial Report, *supra* note 65, at 48.

97 *Id.*

98 *Id*. at 48, 52, 111. EPA also notes that some recent studies showing international corn ethanol land use change trending downward are based on models that tend to understate land use change. *Id* at 50.

more intensively carbon-storing land, like forests. Increased biofuel production for the US market has contributed to these climate-damaging international land use changes.[99]

> "Land use change turns out to be the Achilles heel of the push for biofuels as a climate solution."

The sheer complexity of the biofuels land impact problem makes it much harder to solve. Lots of things affect farming choices, including crop prices, international trade agreements, development pressures and, ironically, changing weather due to climate change.[100] Because there are so many factors that influence when, where and how crops are grown, there isn't a straight line from the Renewable Fuel Standard to changes in farming. It's not possible to "measure" the land use impacts of biofuels. The only way to try to figure that out is through a combination of land use data and sophisticated economic models that try to separate the causal patterns.[101] Anyone who would rather not take this on, or wants to challenge government's conclusions, will find ample cover behind the curtain of uncertainty and real or manufactured difference of opinion. As the evidence mounts that this well-intentioned program might actually be making things worse, the intricacies of modeling give lots of room for claims of conflicting evidence and ambiguity.

Land use change turns out to be the Achilles heel of the push for biofuels as a climate solution. For good reason, the National Academy of Sciences describes land use change as the variable with the highest uncertainty and greatest effect.[102]

Why the long recitation of the sorry state of land use change in the biofuels program in an article about compliance?

The first reason is to explain why enforcement cannot ride to the rescue. The problem is not that we are unable to restrict biofuels to lands in farming as of 2007, although we are unable to do that. It's that even if we could, all it would do – after huge regulatory and political resources were devoted to a probably hopeless task – is change which crops are planted on newly disturbed land. Just as much land would be plowed under, just as much carbon released. Preventing that kind of indirect land use change is unachievable for a compliance program. There is no way to design anything enforceable that would accomplish that. In the United States it is impossible, and in rest of the world it is impossible squared. Doubling down on the 2007 cut-off would only be pretending to do something.

The second is to underscore that we cannot expect to solve the climate challenge by piling new demands for biofuel production on top of the existing rickety structure. We are not getting the job done now.

99 *Id*. at 115.

100 *Id*. at 45.

101 *Id*. at 51-52; NAS *supra* note 60, at 190; GAO, *supra* note 65, at 19.

102 NAS, *supra* note 60, at 245.

Ratcheting up the demand and raising the economic stakes, as many climate proposals suggest we do, is likely to do far more harm than good under RFS as it is designed today.[103] No one wants this to be true. We all hoped we had found a climate solution that was also a political winner. There is, alas, no free lunch.

> "The only way not to risk going deeply into the red on our carbon accounts is to bet on renewable fuels that are much farther away from the breakeven line."

The third is to show how stunningly difficult this is. Smart, well-intentioned people tried their best to find a way through the thicket. Yet they failed. Some problems are so daunting that they demand a little humility. In that spirit, what might we do to make low carbon fuels a reality, so that transportation that can't be electrified can still significantly cut carbon emissions?

Reset the level of carbon benefit required to qualify as a biofuel. Given the levels of ambiguity that are inherent in determining the impact of low carbon fuel standards on land use emissions and the limits of our ability to quantify those impacts, encouraging biofuels that only seek to achieve a 20% improvement over fossil fuels is not sufficient. The band of uncertainty is so wide that what regulators think is a 20% benefit could in reality be causing harm.[104] Many scientists think we are in negative territory already, pursuing a policy that is making the climate worse, rather than better.[105] If we set our sights higher – requiring all biofuels to achieve at least a 50% reduction in carbon emissions – we give ourselves a fighting chance of knowing that we are helping rather than hurting. The only way not to risk going deeply into the red on our carbon accounts is to bet on renewable fuels that are much farther away from the breakeven line.

Redo the cost benefit and lifecycle analyses. We

103 *See, e.g.*, Solving the Climate Crisis, *supra* note 4, at 102, 131, 137 (recommends growth for low carbon fuels "with guardrails to prevent conversion of any non-agricultural lands into cropland.")

104 *See* NAS, *supra* note 60, at 192 (noting that the range of estimates for greenhouse gas emissions from indirect land use change is wide so the precise value is highly uncertain) and 202 ("Food based biofuels such as corn-grain ethanol have not been conclusively shown to reduce GHG emissions and might actually increase them.") *See also*, Lewis, Biofuels Part 2, *supra* note 76, at 10-11 (noting that we should discount the biofuel options whose benefits are highly uncertain).

105 *See, e.g.*, GAO, supra note 65, at 19 (noting that half the experts interviewed for their report thought RFS had a net negative impact on greenhouse gas emissions, and half said it was net positive), and *id*. at 22 (scientists who think that corn ethanol does not meet the 20% emission reduction standard almost all pointed to land use change as the reason). *See also* Hudson, Bioenergy Feedstocks, *supra* note 59, at 656-57; NAS, *supra* note 60, at 199 (noting that corn ethanol might not have lower greenhouse gas lifecycle values than petroleum and that there are plausible scenarios in which the greenhouse gas emissions from corn ethanol are much higher than those of petroleum-based fuels); and *id*. at 201 (finding that EPA's own analysis suggests that RFS2 might not achieve the intended greenhouse gas reductions). *See also* Gal Hochman & David Zilberman, *Corn Ethanol and U.S. Biofuel Policy 10 Years Later: A Quantitative Assessment*, 100 Amer. J. Agr. Econ. 570, 582 (Feb. 13, 2018) (finding a miniscule 0.23% benefit for ethanol compared to gasoline based on a meta-analysis of studies quantifying GHG impacts of ethanol).

have learned a lot since 2010. About land use change, direct and indirect, and many other facets of biofuels. Let's apply that knowledge to the law. The 2010 EPA analyses, despite best efforts, don't align with what we know now. EPA can revisit the lifecycle analyses so that, despite the many flaws and unbridgeable gaps, EPA can bring the current findings up to date with science since 2010. Congress should consider requiring an independent body – like the National Academies – to verify the analyses, to ensure that the outcome has the external credibility to withstand the inevitable political firestorm. And they need to be regularly updated, so that new science can be incorporated. Keeping current with the science supports investment in the lowest carbon strategies, because close-to-the-line approaches won't be economically attractive. And it encourages new rigorous science about the impacts of biofuels because scientists know their work will be used.

Focus on the truly carbon-improving biofuels. The bright spot in the gloom is that some researchers think there may be truly renewable biofuels. Sustainable grasses and waste biomass, for example, when grown on marginal lands, in the right way, might be close to the holy grail of significantly reduced carbon fuels.[106] But – remember the no free lunch problem? – they cost a lot of money.[107] Way more than fossil fuels or the vast majority of plant-based fuels used today. We haven't cracked that nut yet, perhaps because so far there has not been sufficient sustained incentive to do so. The economics of these potentially climate-beneficial fuels are tough, and so are the politics, but we haven't committed sufficient economic or policy resources to know if the problems are solvable.[108]

Consider shifting from a volume standard to a carbon intensity standard. California has adopted a different strategy for reducing carbon in fuels, called a low carbon fuel standard. Instead of the approach used in the RFS – defining renewable fuels based on how their emissions compare to fossil fuels (20%, 50%, 60% emissions reduction from comparable fossil fuels) and mandating volumes – a low carbon fuel standard sets a standard for carbon intensity in fuels, with the standard getting increasingly stringent over time. There are many theoretical benefits to this approach, including that it continues to incentivize improvements beyond the static thresholds in RFS.[109] However, the foundational problem of defining the carbon impact of the fuel remains; both RFS and the California low carbon fuel standard require a lifecycle analysis to figure out how much carbon a fuel is responsible for emitting. If a low carbon fuel standard causes a lot of land use change, it isn't helping. That's why restricting eligibility to fuels with less potential for climate damage and rigorous

106 See EPA, Second Triennial Report, *supra* note 65, at 108; NAS, *supra* note 60, at 202; Searchinger, *supra* note 57, at 1240.

107 *See* GAO, *supra* note 65, at 10.

108 *See* Lewis, Biofuels Part 2, *supra* note 76, at 3, 8 (noting that incentives for advanced biofuels have to be durable and certain to incentivize investment). The other benefit of lower carbon biofuels is that they generally also have fewer of the other damaging environmental impacts. *See* EPA, Second Triennial Report, *supra* note 65, at 108.

109 Hudson, Bioenergy Feedstocks, *supra* note 59, at 665-666. James M. Van Nostrand, Production and Delivery of Biofuels, in Legal Pathways to Deep Decarbonization in the United States 692, 698-699 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019); Lewis, Biofuels Part 2, *supra* note 76, at 9-10.

science-driven lifecycle analysis will continue to be essential no matter which regulatory model is used.[110]

"The 20%-less-than-fossil-fuel standard is already far too low; we can't be waiving the obligation to meet even that modest expectation for improvement."

Eliminate exemptions. The 20%-less-than-fossil-fuel standard is already far too low; we can't be waiving the obligation to meet even that modest expectation for improvement. The RFS law exempted the existing production facilities from the 20% standard.[111] In 2017, 89% of the RFS blending volume was exempt from the obligation to achieve a 20% improvement in greenhouse gas emissions.[112] As bad as this is in the US, it is even worse internationally. For example, EPA refused to approve palm oil as a renewable fuel feedstock because it doesn't clear the 20% climate improvement hurdle, but because of the exemption, palm oil based biofuels continue to be imported to meet RFS compliance.[113] The exemption for existing facilities not only reduced climate benefits from ethanol but also likely contributed to depressing investment in lower carbon-intensity fuels.[114] The waiver provisions have another downside too: they make already difficult compliance and enforcement strategies that much harder. Even if regulators spot what appears to be ineligible fuel, they still have to engage in a complicated and paperwork-heavy research project to determine if the fuel is nevertheless eligible because it is exempt. Enforcement of these rules is hard enough without deliberately inserting more confusion. All exemptions should be phased out.[115]

Use Next Gen ideas to ensure that we only use truly renewable fuels. After we clear away the obstacles

110 *See* Van Nostrand, *supra* note 109, at 700-701 (describing lifecycle analysis under California's Low Carbon Fuel Standard). The dangers of establishing an accurate carbon intensity for biofuels, given huge but challenging-to-measure induced land use change, are a warning flag to states that are now moving toward what they hope will be clean fuel standards as part of their push toward lower carbon transportation. *See, e.g.*, the New Mexico Clean Fuel Standard Act, S.B. 11, 55th Leg., Reg. Sess. (NM 2021).

111 42 U.S.C. § 7545(o)(2)(A)(i). *See also* 40 C.F.R. § 80.1403(b), (c) and (d) (biofuels from facilities that commenced construction by 2007 are exempt). *See also* EPA 2010 rule, *supra* note 72 at 14682; Aldy, *supra* note 74, at 196.

112 GAO, *supra* note 65, at 7 n. 7 and at 20 n. 29 (amount of biofuel exempt from the 20% standard).

113 *See* EPA, Second Triennial Report, *supra* note 65, at 104, 107 (noting that Indonesia is the U.S.' second largest biodiesel import country of origin, where palm oil is the dominant feedstock, and stating that although EPA found that palm oil biodiesel didn't meet the 20% threshold, because of the exemption palm oil biofuels are nevertheless eligible). *See also* EPA, EPA-420-R-19-018, EPA Renewable Fuel Standard Program - Standards for 2020 and Biomass-Based Diesel Volume for 2021 and Other Changes: Response to Comments, at 71 (December 2019) (noting that increased demand for feedstocks in the biodiesel market likely has increased use of palm oil in other markets, evidenced by the dramatic increase in imports of palm oil to the US since 2007). *See also* EPA, Notice of Data Availability Concerning Renewable Fuels Produced from Palm Oil Under the RFS Program, 77 Fed. Reg. 4300, 4313 (Jan. 27, 2012) (finding that land use change emissions account for over half the GHG emissions associated with palm oil biofuels).

114 Aldy, *supra* note 74, at 196.

115 *See also* Hudson, Bioenergy Feedstocks, *supra* note 59, at 665.

that hobble our ability to ensure compliance with the lower carbon purpose of biofuels, through the steps outlined above, we will confront the challenge of ensuring that the approved biofuels meet the standards. The only way to assure that the eligible fuels are actually climate beneficial requires that we be sure about where the feedstock comes from and how it is grown. How can we know if what's claimed is what actually happens? Some of that is inherent in choices about qualifying feedstock; algae and waste oils aren't grown on crop land, so we know without having to check that undisturbed land wasn't farmed to make them. This feature makes such biofuels much more attractive than others. But some fuels will need an origin confirmation strategy. The fact that the same verification methods used in the United States also have to work around the globe means that the compliance plan will have to be both automatic and unusually resilient. It will take hard work to figure out if a minimally acceptable compliance verification strategy is possible for a redesigned low carbon fuel program. It certainly would require innovation and maximum use of technology and satellite imagery, and a relentless focus on simplicity and no exemptions. But here's the catch: low carbon fuel producers and importers would have to accept a level of accountability that is much higher than they have now. It can't be a make-the-government-chase-it-down, labor-intensive way of doing business. If companies want to be in this industry, they will have to accept that real-time verification will be required because tracking it down after the fact will not prevent the harm and is in any event impossible. Even with these improvements, there is likely to be a lot of fraud, as we have already seen in this sector, as discussed further below.

Fraud reduces the emissions benefits of the law and undermines the market. Our best bet to keep it within reasonable bounds is creative and rigorous strategies that effectively shift the burden to industry to show that they are compliant before they can register or sell the fuel, making them partners in finding a workable solution.

Save biofuels for the sectors with no other option. Given the huge inherent uncertainty about the climate benefits of biofuels, it makes no sense to use them in sectors that have a known and verifiable low/zero carbon alternative. Like passenger vehicles. Electrification is a much more attractive approach for this largest portion of transportation emissions. Biofuels, if the approach is changed as noted here, might help reduce carbon emissions for transportation sectors that can't be electrified, like aviation.[116] Because biofuels have the potential of causing more harm than good, for climate as well as many other issues, we should reserve them for the climate challenges where we really have no other choice.

RENEWABLE FUEL STANDARD FRAUD

Sometimes companies deliberately cheat. It isn't that they just don't try hard enough or fail to make compliance a priority. They intentionally and deliberately violate. They cross the line into clear criminal territory. The Renewable Fuel Standard

116 Solving the Climate Crisis, *supra* note 4, at 102; Hudson, Bioenergy Feedstocks, *supra* note 59, at 650, 654; Van Nostrand, *supra* note 109, at 694, 710; *Jonathan Lewis on BioFuels, Part 1,* Harvard Clean Law, transcript at 9 (Aug. 16, 2019), http://eelp.law.harvard.edu/wp-content/uploads/Joe-and-Jon-Biofuels-1-transcript.pdf; Lewis, Biofuels Part 2, *supra* note 76, at 4-5.

unfortunately provides a powerful example.

Why include criminals in a Next Gen story? Aren't they just bad guys who deserve prosecution? They are, but focusing on defendants' moral culpability is looking for a solution in the wrong place. We know companies cheat. It happens all the time. Lift your head up and look around. If regulators design a program where significant money can be made and there is virtually no check on fraud, criminals will run rampant. It isn't a question of maybe or it's possible, it's definite: fraud will happen. Let's not pretend we don't know that when we design rules.

Market programs have the biggest fraud risk. That's because markets are trading something of value, i.e., there is money to be made, and often the thing being traded is separated from the thing regulators really care about. That's what happens in the RFS. So not only is RFS fraud something to focus on for any future low carbon fuels program, it is also illustrative of the challenge of using markets for environmental problems.

So far in this discussion of RFS the focus has been on the renewable fuels themselves, and whether those fuels – assuming they are made exactly as claimed – do or don't achieve the climate benefits ascribed to them. But what if the whole thing is a scam and there is actually no fuel made at all? That's the fraud issue.

To understand the story of fraud in biofuels, you need the short version of how we get from wet biofuels to the numbers on a computer that are actually traded, which is where the fraud occurs. RFS is set up as a requirement to blend biofuels into transportation fuels. Compliance isn't achieved by making biofuels; RFS only cares about substituting biofuels for traditional oil-based fuels, because that's where the greenhouse gas emissions savings occur. There are a lot of players in the system for producing transportation biofuels: farmers who grow the crops, companies that produce biofuels, blenders who combine biofuels with petroleum fuels, and companies that sell the finished product at a gas station near you, along with many brokers and dealers up and down the chain. The choice in RFS was to place the legal obligation on the relatively small number of oil companies that sell finished transportation fuels – a smart Next Gen choice – and create a market for buying and selling biofuel credits.[117]

"Market programs have the biggest fraud risk."

Each gallon of biofuels that is blended into transportation fuel creates credits, called Renewable Identification Numbers (RINs). At the end of the year the large oil companies have to buy and retire the number of RINs that the RFS requires. The theory is each RIN reflects an actual gallon of biofuel blended into transportation fuels, so if you have the right number of RINs in total, the fuel supply contains the

117 For a description of the biofuels program and an explanation of the market that was created, see EPA, Overview for Renewable Fuel Standard, Compliance Program Basics, https://www.epa.gov/renewable-fuel-standard-program/overview-renewable-fuel-standard (last visited Feb. 18, 2021). *See also*, Congressional Research Service, R43325, The Renewable Fuel Standard (RFS): An Overview, at 4 (April 14, 2020), https://crsreports.congress.gov/product/pdf/R/R43325.

expected quantity of biofuels.

At the initial stages, a gallon of biofuel is "attached" to its RIN. They travel together. But once that gallon of biofuel is blended into petroleum-based fuel, through the magic of the market the gallon and the RIN are separated. The RIN has value, because the oil companies must have a defined number of them every year, but the wet gallon of biofuel is somewhere else. Maybe. In this system, RINs have all the value, biofuels have very little. The criminally minded among you will immediately see the problem: life would be much easier, not to mention more lucrative, if a company could just produce RINs for sale and avoid the expense and mess of actually making fuel. And that's what happened.

What kind of fraud went on? Here's a sampling:

Skip making the biofuel, and just print money. Some fraudsters didn't make any biofuel at all. They just pretended to make biodiesel, claimed the RINs, then sold them. A wide variety of sham transactions helped to hide the truth. The title of an article about one of these companies says it all: The Fake Factory that Pumped Out Real Money.[118]

Pretend your fuel is biodiesel when it isn't. Instead of going to the bother of producing eligible fuel, make a cheaper one instead, but claim it's biofuel and sell the RINs. Just one example: the nearly 5 million invalid biodiesel RINs sold by New Energy Fuels and Chieftain Biofuels.[119]

Reuse and recycle. Why make three batches when one will do the trick? Some companies created or purchased biodiesel, sold the RINs, and then through complicated paperwork maneuvers, claimed that the same fuel was newly made, generated new RINs, and sold that second set of RINs. Rinse and repeat. Here's one example: Gen-X sold 60 million RINs for which there was no actual fuel, or the same fuel was "reprocessed."[120]

Export the fuel, keep the RINs. When biodiesel is exported, the producer is required to retire the RINs, because that is fuel no longer available to the US market. But you can make more money by unlawfully selling the RINs in the US instead, a practice so common that it even has its own name: "strip and ship." That's what Chemoil did, to the tune of over 70 million RINs.[121]

118 *See* Mario Parker, Jennifer A. Dloughy & Bryan Gruley, *The Fake Factory that Pumped Out Real Money*, Bloomberg Businessweek (July 13, 2016), https://www.bloomberg.com/features/2016-fake-biofuel-factory/.

119 *See* EPA Notice of Violation to New Energy Fuels and Chieftain Biofuels, July 28, 2015, https://www.epa.gov/enforcement/notice-violation-new-energy-fuels-inc-and-chieftain-biofuels-llc.

120 EPA, Summary of Criminal Prosecutions (search for Gen X or Richard Estes 2017), https://cfpub.epa.gov/compliance/criminal_prosecution/index.cfm. For another example of this type of RINs fraud, *see* Press Release, EPA, NGL Crude Logistics, LLC Agrees to Pay Civil Penalty of $25 Million and to Retire $10 Million in Renewable Fuel Production Credits Under Settlement with United States (Sept. 27, 2018) https://archive.epa.gov/epa/newsreleases/ngl-crude-logistics-llc-agrees-pay-civil-penalty-25-million-and-retire-10-million.html.

121 Press Release, DOJ, Chemoil Agrees to Pay Civil Penalty of $27 Million and to Retire a Total of More Than $71 Million in Credits from Renewable Fuels Market Under Settlement with United States (Sept. 29, 2016), https://www.justice.gov/opa/pr/chemoil-agrees-pay-civil-penalty-27-million-and-retire-total-more-71-million-credits. For a summary of some of the other fraud cases, see Doug Parker, White Paper Addressing Fraud in the Renewable Fuels Market and Regulatory Approaches to Reducing this Risk in the Future, E&W Strategies, at 7-10 (Sept. 4, 2016),

These are prime examples of why this market was viewed as "rife with fraud."[122] A former head of the EPA Criminal Investigation Division explained that the publicly-known fraud was only a fraction of the total, and that the initial fairly crude fraud in the early years of the program has given way to much more complex fraud schemes, with signs that organized crime is becoming involved.[123] Congress held a hearing specifically on the topic of RINs fraud.[124]

All this fraud was possible because of a design decision made at the outset of the program. At the urging of the oil companies and many other players, the RFS was set up as a market program. Instead of fixing a direct blending requirement, the program allowed trading of RIN credits. The RINs market, like most markets in environmental programs, was intended to increase compliance flexibility and reduce costs.[125] How would this market ensure the integrity of the credits? EPA embraced an economist's approach to compliance as well. The rule was crystal clear that it was up to the obligated parties to make sure the RINs they used for compliance were valid. If the obligated party – generally the oil company – didn't check before buying, too bad for them. They bear the risk if it turns out the credits are no good; they would be required to replace the bad RINs and pay a penalty to boot.[126] Appropriately, this strategy was known as "buyer beware." EPA would not be checking on the validity of the credits, that's up to the obligated parties. Proceed at your own risk. The theory was that the obligated parties would at least do some minimal checking because they faced potentially significant financial losses should the credits prove invalid, and that would keep the market honest.

Except they didn't check. As a result, the fraudulent companies looking to cash in knew that the chances of being discovered were small and so they went to town. When EPA did uncover invalid RINs, it demanded that the obligated parties replace the bad RINs and pay a penalty, just as the rules clearly stated. Then came the uproar. The obligated parties complained that they didn't know the RINs were bad.

https://www.earthandwatergroup.com/wp-content/uploads/2016/09/Expert-Report-Fraud-in-the-RFS-9-4-16-.pdf.

122 David Alexander et al., *U.S. Says Glencore Unit to Pay Record $27 Million for Biofuels Compliance,* Reuters (Sept. 29, 2016), https://www.reuters.com/article/chemoil-usa-idAFL2N1C521I. *See also* Mike Newman, The Problem of Invalidated RINs in the Renewable Fuel Standard, Stillwater Associates (Nov. 14, 2018) (stating that although EPA has prosecuted millions of dollars' worth of fraudulent RINs transactions, fraud continues to be a significant risk), https://stillwaterassociates.com/the-problem-of-invalidated-rins-in-the-renewable-fuel-standard/; Press statement, American Fuel and Petrochemical Manufacturers, The RINsanity Continues (Oct. 7, 2016), https://www.afpm.org/newsroom/blog/rinsanity-continues.

123 Parker, *supra* note 121, at 8.

124 *RIN Fraud: EPA's Efforts to Ensure Market Integrity in the Renewable Fuels Program, Hearing before the H. Comm. on Energy and Commerce,* 112th Cong. (2012) https://www.govinfo.gov/content/pkg/CHRG-112hhrg81890/html/CHRG-112hhrg81890.htm.

125 EPA Office of the Inspector General, Report No. 13-P-0373, The EPA Should Improve Monitoring of Controls in the Renewable Fuel Standard Program, at 1-2 (Sept. 5, 2013), https://www.epa.gov/sites/production/files/2015-09/documents/20130905-13-p-0373.pdf.

126 40 C.F.R. § 80.1431(b)(2): "Invalid RINs cannot be used to achieve compliance with the Renewable Volume Obligations of an obligated party or exporter of renewable fuel, regardless of the party's good faith belief that the RINs were valid at the time they were acquired." *See also* OIG, EPA Should Improve, *supra* note 125, at 1-2.

The market seized up because now everyone was nervous about buying RINs. And the small biofuel producers had trouble finding buyers, who were electing to limit their purchases to companies with deep pockets to cut financial risk.

Everyone was hollering and demanding that EPA do something. In response, EPA promulgated the Quality Assurance Plan (QAP) regulations.[127] The QAP regulations set up a voluntary private program designed to provide more assurance of RIN integrity. Biofuel producers could elect to have an independent third-party auditor monitor their facilities to ensure these facilities were producing qualifying renewable fuel and generating valid RINs. Companies who wanted some financial insurance could buy those certified RINs and reduce their liability should the RINs turn out to be bad.

Did that help? Well, it turns out the assurance of being fraud-free that QAPs were supposed to provide wasn't so reassuring: the QAP auditor Genscape certified Gen-X's fraudulent RINs, for which Gen-X's President was criminally convicted. EPA found that the RINs auditor Genscape "ignored and failed to follow through on glaring signs of RIN fraud," including trucks that visited alleged delivery locations without unloading fuel, or locations alleged to be fuel suppliers that had no equipment. Genscape ignored these obvious indicia of fraud and verified the RINs anyway.[128]

Why was there so much fraud in RFS? DOJ itself inadvertently identified the heart of the problem in announcing one RINs fraud criminal conviction: "Like many government programs, the EPA's renewable fuel initiative was designed with the assumption that people would act in good faith and actually produce renewable fuel before collecting the subsidy for it."[129] As one law firm explained: "...the entire system floats on a sea of good faith...."[130] This is the deeply flawed compliance assumption that is at the heart of so many rules with terrible compliance performance.[131] As was previously explained in all too painful detail, the assumption that most companies will comply

127 EPA, RFS Renewable Identification Number (RIN) Quality Assurance Program, 79 Fed. Reg. 42078 (July 18, 2014). *See also* EPA, Quality Assurance Plans under the Renewable Fuel Standard Program, https://www.epa.gov/renewable-fuel-standard-program/quality-assurance-plans-under-renewable-fuel-standard-program (describing the QAP program).

128 *See* EPA Final Determination in the Matter of Genscape, Inc., Option A Quality Assurance Plan Auditor Under the Renewable Fuel Standard Program, at 2-3 (May 31, 2019), attached as Exhibit A to Genscape's Petition for Review, filed with the Sixth Circuit Court of Appeals on July 26, 2019, https://www.epa.gov/sites/production/files/2019-07/documents/genscape_19-3705_pfr_07262019_0.pdf. *See also* Todd Neeley, Genscape Must Replace RINs, Progressive Famer (Aug. 7, 2019), https://www.dtnpf.com/agriculture/web/ag/news/business-inputs/article/2019/08/07/biodiesel-fraud-identified-early-epa; Parker, *supra* note 121, at 6 (noting that the QAP program has not been successful at preventing fraud).

129 Press Release, DOJ, Owner of "Clean Green Fuel" Convicted of Scheme to Violate EPA Regulations and Sell $9 million in Fraudulent Renewable Fuel Credits (June 25, 2012), https://www.epa.gov/sites/production/files/2015-09/documents/20120625-clean_green_fuel.pdf.

130 Andrew S. Levine, Criminal Liability for Abuse of Renewable Fuel Credits, Stradley Ronan, https://www.stradley.com/insights/publications/2019/06/white-collar-insider-june-2019.

131 *See* Cynthia Giles, *Introduction*, Next Generation Compliance: Environmental Regulation for the Modern Era, at 1-4 (2020); Cynthia Giles, *Part 1: Rules with Compliance Built In*, Next Generation Compliance: Environmental Regulation for the Modern Era (2020), https://eelp.law.harvard.edu/2020/01/next-generation-compliance-environmental-regulation-for-the-modern-era/

is unfounded.[132] A rule that defines a compliance obligation and then just hopes for the best will not succeed.

EPA has also learned the hard way in the RINs fraud experience that it is risky to put the burden of keeping the system honest on the regulated parties. Yes, that's a great market-embracing idea in theory, but when push comes to shove companies aren't willing to shoulder the accountability that comes with market flexibility. Companies liked the idea of buyer beware for its cost cutting potential, until the beware part became real.[133] Then they wanted EPA to regulate.[134] A significant lesson from RFS is that an ad hoc private system for deterring fraud in a complicated market is unlikely to withstand the inevitable political pressure from companies wailing about the consequences. And it isn't likely to work.[135]

So what if companies cheat? Why do we care? At the values level we care because a democratic society depends on the rule of law. That's what sets us apart from autocracies. Widespread flouting of the law undercuts this foundational premise of our society. But you don't have to get so lofty to see why fraud matters at a much more practical level: if lots of companies are not doing what the law requires, we aren't getting the health and environmental benefits. In the case of biofuels, that's carbon reductions that will slow the advance of climate disruption. We can debate whether some kinds of biofuels actually accomplish that, as the preceding section does. But this is definite: when no biofuels are produced at all, there's no climate benefit. Once we cross the threshold of a non-trivial amount of fraud, as we have in RFS, we aren't going to achieve the purpose of the law.

"Companies liked the idea of buyer beware for its cost cutting potential, until the beware part became real. Then they wanted EPA to regulate."

That is why regulators in all programs – but especially market programs – need to ask themselves before finalizing a regulation: can someone willing to flout legal standards readily get around this? If the answer is yes, watch out. Why especially market programs? For the reasons that are evident in RINs fraud. Most environmental markets attempt to increase efficiency and liquidity by trading a piece of paper that is supposed to reflect a ton of pollutants or a gallon of biofuel or

132 *See* Giles, Part 2 (Noncompliance with Environmental Rules is Worse Than You Think), *supra* note 94.

133 *See "Buyer Beware" is EPA's Response to Fraud in the Renewable Identification Number (RIN) Market*, Seyfarth Shaw LLP (Oct. 12, 2012), https://www.seyfarth.com/news-insights/buyer-beware-is-epa-s-response-to-fraud-in-the-renewable-identification-number-rin-market.html.

134 *See* EPA, Amended Second Interim Enforcement Response Policy-Violations Arising from the Use of Invalid 2012 and 2013 Renewable Identification Numbers, at 1 (Feb. 2014), https://www.epa.gov/sites/production/files/2014-02/documents/amendedsecondierp020514_0.pdf (noting that after the RINs fraud came to light, the regulated community wanted EPA to impose regulations to assure that RINs entering commerce are valid).

135 *See* Government Accountability Office, GAO-17-94, Renewable Fuel Standard: Program Unlikely to Meet Its Targets for Reducing Greenhouse Gas Emissions, at 16 (Nov. 2016), https://www.gao.gov/assets/690/681252.pdf.

whatever is being regulated. If oil companies only got compliance credit when they purchased an actual gallon of biofuel, they would not be easily deceived. Try selling them an empty tanker and see how far you get. It's the separation of the thing being regulated from what's being traded that introduces a host of problems. Compliance fails when the traded thing does not reliably reflect the thing regulators actually care about. The market in the Acid Rain Program worked so well primarily because an ingeniously designed regulatory program made it a sure thing that a traded credit reflected an actual ton of emission reductions.[136] That's where the RINs market fell apart. A RIN might reflect a real gallon of biofuel, or it might not. Once the RIN went forth into the world on its own, stripped of the wet fuel, there was virtually no way to tell. Policing each and every gallon of biofuels to be certain is impossible. There is no chance that enforcement can discover and rectify every incident of fraud, or even a significant fraction. Private policing might just introduce new avenues for collusion, as the RINs example proves.

Zero fraud is usually not a reasonable goal. There isn't a way to prevent every possible violation, nor can we afford that in most cases. Some bad actors will find a way. That's one reason why we have to have a strong criminal enforcement program. But fraud has to be rare. When it does happen, criminal enforcement is a way to say, 'Hey we're not kidding.' We punish the malefactors both because they deserve it and because it signals to the rest of the players that compliance is a good choice. But the measure of a solid compliance program is how good compliance will be even if there is little enforcement. What is the default setting? Designing a program so the default setting is strong compliance has a double benefit: it pushes toward actually achieving the goals that were the reason for the program in the first place, and it makes it easier to find the now much smaller number of serious violators and take enforcement action.

> "Rules get implemented here in the real world. In the real world there is fraud."

I am not suggesting that markets don't work for environmental problems. They certainly can, and have. But they create new and difficult issues that need to be addressed. Fraud is one of them. Rules get implemented here in the real world. In the real world there is fraud. Let's spend less time being shocked and more time figuring out how to make it close to impossible. If there really isn't a way to do that, maybe a market isn't the best strategy. Some market challenges may be solvable, but only before the market is launched. Once fraud permeates the market, it will be extremely difficult to root it out or even know how extensive it is. RINs fraud is both a problem that must be fixed in any redesigned low carbon fuels program and a cautionary tale as we consider creating additional environmental markets.

136 Cynthia Giles, *Part 3 – The Ideologues: Performance Standards and Market Strategies*, Next Generation Compliance: Environmental Regulation for the Modern Era, at 16-18 (2020), https://eelp.law.harvard.edu/2020/01/next-generation-compliance-environmental-regulation-for-the-modern-era/.

Oil and gas: Innovative strategies are the only way to get there

Climate change is primarily a carbon problem. It results from the rapidly increasing concentration of carbon in the atmosphere, which is largely the result of the combustion of fossil fuels releasing carbon dioxide.[137] Fossil fuels contribute to climate change in another way too; getting them out of the ground also produces methane, which is a far more potent greenhouse gas than carbon dioxide. Methane in the atmosphere traps 84 times as much heat as carbon dioxide over the first 20 years after it is released.[138] So even though there is less methane than carbon dioxide emitted each year, methane packs a big climate punch in the near term. The largest source of anthropogenic methane in the US is fossil fuel production and transportation.[139] For this reason, a climate strategy must include controlling methane releases from oil and gas.

Methane, the main component of natural gas, is naturally under pressure in the tight spaces underground. When a well is punched deep below the surface by drilling for gas or oil, it creates a pathway for that gas to escape. In this way, oil and gas drilling bring a lot of methane to the surface.[140]

There are three main ways methane gets into the air during production of oil and gas. The first is venting. That means the company just lets the pressurized gas escape into the air. It isn't captured or stored; they just let it go. That puts the methane directly into the atmosphere, along with its 84-times-carbon heat capture ability. The second is flaring. Sometimes oil and gas companies direct the escaping methane to a structure with a flame, where the methane is burned, just like on a gas stove. When it works perfectly, this converts the methane to carbon dioxide. Of course, carbon dioxide is also a greenhouse gas, so flaring exchanges the more powerful greenhouse gas of methane for another one that lasts much longer in the atmosphere. Needless to say, flaring doesn't always work perfectly, so flares often end up releasing methane along with the carbon dioxide. And sometimes the flare doesn't work at all and ends up being identical to venting.[141] The third pathway for release of methane is leaking. Even after the methane is captured, all the equipment to hold, store and transport it can leak. Undersized tanks, leaky

137 James H. Williams et al., *Technical and Economic Feasibility of Deep Decarbonization in the United States*, in Legal Pathways to Deep Decarbonization in the United States 21, 22 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

138 Steven Ferrey & Romany M. Webb, Methane and Climate Change, in Legal Pathways to Deep Decarbonization in the United States 879 (Michael B. Gerrard & John C. Dernbach, eds., Environmental Law Institute 2019).

139 *Id*. at 879-880. A close second is agriculture, and third is landfills. *Id*.

140 *Id*. at 883.

141 *With Initial Data Showing Permian Flaring on the Rise Again, New Survey Finds 1 in 10 Flares Malfunctioning or Unlit, Venting Unburned Methane into the Air*, Environ. Defense Fund (July 22, 2020), https://www.edf.org/media/initial-data-showing-permian-flaring-rise-again-new-survey-finds-1-10-flares-malfunctioning (new aerial survey finds that in the Permian Basin more than one in every 10 flares surveyed were either unlit — venting uncombusted methane straight to the atmosphere — or only partially burning the gas they were releasing). *See also* Jonah M. Kessel & Hiroko Tabuchi, *It's a Vast, Invisible Climate Menace. We Made It Visible*, N.Y. Times (Dec. 12, 2019), https://www.nytimes.com/interactive/2019/12/12/climate/texas-methane-super-emitters.html.

relief valves, hatches left open, cracks in pipes – the list of places from which leaks can happen is long. And they do leak. A lot.

> "There is mounting evidence that all this venting, flaring, and leaking is much worse than initial estimates guessed."

There is mounting evidence that all this venting, flaring, and leaking is much worse than initial estimates guessed.[142] Conclusively quantifying the amount of methane released is challenging, but here's one thing that is definite: a lot more methane is being emitted than government reports claim.[143]

The amount of methane released to the air during gas production and transportation is at the heart of the debate about whether natural gas can be an effective "transition" fuel in the fight against climate change. When natural gas is burned at a power plant it produces less carbon dioxide than would be generated making the same amount of power with coal.[144] That's why the switch from coal to gas has reduced greenhouse gas emissions from electric power generation.[145] But if a significant chunk of powerfully climate-altering methane escapes into the air during production and transportation, the climate benefits of gas-fired power are lost. Experts say that the crossover point is about 3.2%; if more than that percentage of total gas production escapes due to venting and leaks, then the climate impacts of natural gas will be worse than coal.[146] Some experts believe we have already crossed that threshold; others say we are close.[147] Either way, it is incredibly

142 *See, e.g.*, Yuzhong Zhang et al, *Quantifying Methane Emissions from the Largest Oil-Producing Basin in the United States from Space*, Science Advances, Vol. 6, No. 17 at 4 (April 22, 2020), https://advances.sciencemag.org/content/6/17/eaaz5120. The Environmental Defense Fund has an interesting website presenting the methane data from the Permian Basin, including maps and operator specific information at https://www.permianmap.org/. *See also* Methane Advisory Panel, Convened by New Mexico Environment Department and New Mexico Energy, Minerals and Natural Resources Department, at 38-39 (Dec. 19, 2019) https://www.env.nm.gov/new-mexico-methane-strategy/wp-content/uploads/sites/15/2019/08/MAP-Technical-Report-December-19-2019-FINAL.pdf

143 Zhang, *supra* note 142, at 1, 3 (measured methane emissions in the largest producing basin are more than twice EPA estimates); Ramón A. Alvarez, et. al., *Assessment of Methane Emissions from the U.S. Oil and Gas Supply Chain*, Science, Vol. 361, at 186 (July 2018) (annual methane emissions from the oil and gas supply chain are 60% higher than official estimates); NM Methane Advisory Panel, *supra* note 142, at 38-40; Nicholas Kusnetz, *Is Natural Gas Really Helping the U.S. Cut Emissions?*, Inside Climate News, Jan. 30, 2020, https://insideclimatenews.org/news/30012020/natural-gas-methane-carbon-emissions; Carlos Anchondo, Study: Methane Emissions in Central U.S. Twice EPA Estimates, E&E News (Jan. 30, 2020), https://www.eenews.net/stories/1062205045.

144 US Energy Information Administration, *How Much Carbon Dioxide is Produced When Different Fuels Are Burned?* https://www.eia.gov/tools/faqs/faq.php?id=73&t=11 (last visited Feb. 19, 2021).

145 Gas also produces less pollution of other types when combusted, a big benefit to public health. Emanuele Massetti et. al., *Environmental Quality and the U.S. Power Sector: Air Quality, Water Quality, Land Use and Environmental Justice*, Oak Ridge National Laboratory, ORNL/SPR-2016/772, at 7 (Jan. 4, 2017), https://info.ornl.gov/sites/publications/files/Pub60561.pdf.

146 Ferrey, *supra* note 138, at 883. Others say the crossover point is lower. *See* Benjamin Storrow, *Is Gas Really Better Than Coal for the Climate?*, E&E News (May 4, 2020) https://www.eenews.net/stories/1063041299, (EDF says that 2.7% leakage negates the climate benefits of natural gas).

147 Ferrey, *supra* note 138, at 883. Zhang, *supra* note 142, at 4

bad news.

And it gets worse. Methane emissions and flaring are both increasing dramatically.[148] The United States is among the worst offenders globally.[149] The Trump administration made a bad situation worse by rolling back rules to cut methane and other pollutants from oil and gas production.[150]

We know what to do to dramatically reduce methane releases and cut back flaring. The solution isn't uncertain or untested, or the cost astronomical. We could make big cuts very quickly using known, already deployed technologies.[151] Experience in the Permian basin that straddles Texas and New Mexico makes this crystal clear. Operators limit flaring in

(finding that 3.7% of the gas produced in the Permian Basin – the highest producing basin in the country – was being released to the atmosphere through venting and flaring); Alvarez, *supra* note 143, at 186-188 (estimates percent leakage at 2.3%). The authors of the Alvarez 2018 study note that the 2.3% estimate was based on data from companies willing to cooperate and may be an underestimate because worse performers would have likely opted out of the study. Steven Mufson, *Methane Leaks Offset Much of the Climate Change Benefits of Natural Gas, Study Says*, Wash. Post (June 24, 2018).

148 Robert B. Jackson, et. al., *Increasing Anthropogenic Methane Emissions Arise Equally from Agricultural and Fossil Fuel Sources*, Environ. Res. Lett., Vol. 15, No. 7, at 6 (2020), https://iopscience.iop.org/article/10.1088/1748-9326/ab9ed2; *See also Natural Gas Annual 2019*, US Energy Information Administration, at 1 (2020), https://www.eia.gov/naturalgas/annual/pdf/nga19.pdf (significant increase in reported oil and gas venting and flaring in both 2018 and 2019); News Release, New Mexico Environment Department, Significant Emission Increases from Oil and Gas Operations Confirm Need for Stronger Rules and Enforcement, Greater Industry Compliance (Dec. 20, 2020) (noting that leak rates in New Mexico's Permian Basin increased 250% in 12 months) https://www.env.nm.gov/wp-content/uploads/2020/12/2020-12-21-Flyovers-reveal-high-leak-rates-in-Permian.pdf; Kristina Marusic, Babies Born Near Natural Gas Flaring are 50 Percent More Likely to be Premature: Study, Environ. Health News (July 16, 2020) https://www.ehn.org/fracking-preterm-births--2646411428.html (US responsible for highest number of flares of any country); Hiroko Tabuchi, *Despite Their Promises, Giant Energy Companies Burn Away Vast Amounts of Natural Gas*, (Oct. 16, 2019) https://www.nytimes.com/2019/10/16/climate/natural-gas-flaring-exxon-bp.html (flaring and venting both significantly increasing, despite oil and gas companies' public commitments to address climate change).

149 Jackson, *supra* note 148 at 4; Marianne Kah, *Columbia Global Energy Dialogue: Natural Gas Flaring Workshop Summary*, Columbia Center on Global Energy Policy, (April 30, 2020) https://www.energypolicy.columbia.edu/research/global-energy-dialogue/columbia-global-energy-dialogue-natural-gas-flaring-workshop-summary (United States is the fourth largest source of flared gas in the world).

150 *See* Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources Review, 85 Fed. Reg. 57018 (Sept. 14, 2020); Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources Reconsideration, 85 Fed. Reg. 57398 (Sept. 15, 2020). *See also* Coral Davenport, *Trump Eliminates Major Methane Rule, Even as Leaks Are Worsening*, NYTimes (Aug. 13, 2020), https://www.nytimes.com/2020/08/13/climate/trump-methane.html. President Biden has directed EPA to review the Trump methane roll back and consider proposing a new methane rule by September, 2021. Exec. Order No. 13990, 86 Fed. Reg. 7037 (Jan. 20,2021).

151 Ferrey, *supra* note 138, at 883-884. *See* NM Methane Advisory Panel, *supra* note 142, at 59-60 (methane reduction strategies known and cost effective); Storrow, *supra* note 146; *Comprehensive Control Standards*, Env. Defense Fund, https://www.edf.org/nm-oil-gas/ComprehensiveControl.pdf (last visited Feb. 29, 2021) (showing that standards to dramatically cut emissions from new and existing wells are already in place in a number of oil and gas producing jurisdictions); EPA Compliance Alert, EPA Observes Air Emissions from Controlled Storage Vessels at Onshore Oil and Natural Gas Production Facilities (Sept. 2015) https://www.epa.gov/sites/production/files/2015-09/documents/oilgascompliancealert.pdf (describing existing technologies to reduce emissions at the wellhead); EPA Enforcement Alert, EPA Observes Air Emissions from Natural Gas Gathering Operations in Violation of the Clean Air Act, (Sept. 2019) https://www.epa.gov/sites/production/files/2019-09/documents/naturalgasgatheringoperationinviolationcaa-enforcementalert0919.pdf (describing existing approaches to reduce emissions during pigging operations at gathering lines). *See also* David C. McSweeney, *Don't Be a Pig: EPA Focuses Enforcement Alert Against Mid-Stream Gas Gathering Operations*, Hunton Andrews Kurth, The Nickel Report (Oct. 17, 2019) https://www.huntonnickelreportblog.com/2019/10/dont-be-a-pig-epa-focuses-enforcement-alert-against-mid-stream-gas-gathering-operations/.

New Mexico, where regulations are more stringent, but flaring is skyrocketing in Texas, where regulations are lax.[152] Oil and gas companies know how to cut greenhouse gas emissions using currently available technologies, they just aren't doing it.

This situation has led to the growing consensus that quickest and most direct way to dramatically reduce methane emissions and flaring in the oil and gas industry is through strong federal regulations. Recent climate plans recommend that approach.[153] That's what candidate Joe Biden promised, and what he ordered on the first day of his presidency.[154] Some of the country's methane problems – like emissions from agriculture, the second largest source of human-caused methane – don't have such clear-cut answers and will take a little more time.[155] Oil and gas isn't like that; as climate challenges go, this is one of the easier ones. We have to move fast on these obvious and near-term opportunities, so emissions decline quickly while we figure out what to do for the tougher problems. This section focusses on the compliance challenges for EPA rules to significantly reduce climate forcing emissions from oil and gas.

"Oil and gas companies know how to cut greenhouse gas emissions using currently available technologies, they just aren't doing it."

THE TECHNICAL CHALLENGES ARE COMPARATIVELY EASY; THE COMPLIANCE CHALLENGES ARE NOT

Unfortunately, regulating methane and flaring from oil and gas production presents the classic situation in which compliance is likely to be bad. There are well over a million oil and gas wells in the US, with new ones being drilled all the time. The wells are scattered around the country and are often in remote places. (Of course, they are also sometimes right next to where people live, presenting a serious pollution threat to neighborhoods.[156]) Once a well

152 See Jennifer Hiller, *Crossing State Lines? Oil Firms Flare Texas Gas as Investors Vent on Climate*, Reuters (March 12, 2020), https://www.reuters.com/article/us-climate-change-flaring-analysis/crossing-state-lines-oil-firms-flare-texas-gas-as-investors-vent-on-climate-idUSKBN20Z23C (some drillers flare at 6 times the rate in Texas as they do in New Mexico; regulation is the difference). Forty percent of flaring in the Permian Basin in 2025 is avoidable at no cost to operators. Permian Basin Flaring Outlook, Rystad Energy and EDF, slide 38 (Jan. 2021) http://blogs.edf.org/energyexchange/files/2021/01/20210120-Permian-flaring-report.pdf.

153 *See, e.g.*, Solving the Climate Crisis, *supra* note 4, at 197-199 (2020). *See also* Environmental Protection Network, Resetting the Course of EPA, Reducing Air Emissions from Stationary Sources, at 4 (Aug. 2020), https://www.environmentalprotectionnetwork.org/reset/.

154 The Biden Plan to Secure Environmental Justice and Equitable Economic Opportunity in a Clean Energy Future, https://joebiden.com/climate-plan/ (last visited Feb. 16, 2021) (Day 1 executive actions listed include: "Requiring aggressive methane pollution limits for new and existing oil and gas operations."); Exec. Order No. 13990, *supra* note 150.

155 Ferrey, *supra* note 138, at 890-895.

156 See Julia Rosen, *Study Links Gas Flares to Preterm Births, With Hispanic Women at High Risk*, NYTimes (July 22, 2020), https://www.nytimes.com/2020/07/22/climate/gas-flares-premature-babies.html (study finds that pregnant women who lived near frequent flaring had 50% greater chance of preterm birth); Janet Currie, Michael Greenstone

is completed and is producing there are usually no personnel routinely on site, so no one to keep a daily eye on failing or leaking equipment.

And, just to make things more complicated, emissions are unpredictable. Sometimes a site has small methane releases at a fairly constant rate; these still matter because even small emissions at a fraction of a million or more sites quickly add up. But most of the methane comes from eye-poppingly big methane releases at a relatively small number of sites with malfunctions or other abnormal operating conditions.[157] Robust surveys have shown that methane emissions in oil and gas have what's known in statistics world as a fat tail; 90% of emissions at any given moment comes from just 10% of emitters at the far end of the distribution curve.[158] It would make life easier if we could just find those 10% and consider it done, but no: the really big emitters change over time. On any given day, a different 10% can be the super-emitters, and it has proven close to impossible to predict which ones it will be.[159]

There are many possible sources of emissions at any given site. Leaks are what is known as "fugitive" emissions: they don't come from one discrete place, like pollution from a stack. Leaks can happen at many different places: the well itself, an undersized tank, an open hatch, or malfunctioning equipment such as valves, pumps, or flares.

In a situation like this – a gigantic number of potential sources at which emissions are collectively huge but individually sporadic and unpredictable – what you would want is a robust monitoring system that could continuously keep an eye on things, find the serious problems, and prompt companies to immediately fix them. Alas, we don't have that. Methane is invisible to the naked eye, so even massive releases can't be spotted without specialized monitoring equipment. The most dependable monitoring in wide use today is a person on site with the appropriate equipment.[160] That's a definitive and reliable way to not only find leaks but also determine exactly where they are coming from so that action can be taken. Of course a person with sophisticated monitoring equipment can't be present at each of the over one million locations every day. And that's just the well pads: there are also plenty of other places between well pad and consumer, including about three million miles of pipelines, that also have to be monitored for leaks.[161] A great

& Katherine Meckel, *Hydraulic Fracturing and Infant Health: New Evidence from Pennsylvania*, Science Advances, Vol. 3, No. 12 (Dec. 2017) https://advances.sciencemag.org/content/3/12/e1603021 (negative impacts on infant health when mothers live close to fracking sites).

157 Alvarez, *supra* note 143, at 187, 188 (large spatial and temporal variability in methane emissions, large emission rates from a small subset of sites at any single point in time)

158 *Id*. at 186. NM Methane Advisory Panel, *supra* note 142, at 39. *See also* Kessel, *supra* note 141; Hiroko Tabuchi, *A Methane Leak, Seen From Space, Proves to Be Far Larger Than Thought*, NYTimes (Dec. 16, 2019), https://www.nytimes.com/2019/12/16/climate/methane-leak-satellite.html.

159 NM Methane Advisory Panel, *supra* note 142, at 39.

160 *Id*., at 40; David Lyon et al., *Pathways for Alternative Compliance*, Environmental Defense Fund & Environmental Council of the States Shale Gas Caucus, at 13-14 (April, 2019), https://www.edf.org/sites/default/files/documents/EDFAlternativeComplianceReport_0.pdf

161 *Natural gas explained: Natural gas pipelines*, Energy Information Administration, https://www.eia.gov/energyexplained/natural-gas/natural-gas-pipelines.php (last visited Feb. 19, 2021)(miles of natural gas pipelines in the US).

deal of effort is being directed at this daunting monitoring challenge and there are hopeful signs that improvements may be coming soon – through low-cost screening monitors at the well pad, wide area scanning monitors, and mobile monitors on drones, vehicles, aircraft, and even satellites. But we are not there yet.[162]

The economic incentives also push against compliance. Avoiding venting, flaring, and leaking costs money. The technology to do this exists and we know it works. The good news is that the natural gas that is captured can be sold, so many of these strategies pay for themselves or are low cost. But equipment must be purchased and installed, people have to track how well it is working, and it needs to be monitored, maintained, and operated correctly. Sometimes the lowest cost way to capture the gas at the wellhead – putting it into a pipeline – isn't available, so the company would have to defer production until a gathering line is installed, probably not their first choice. The challenge is that often the cheapest approach from the oil or gas company's perspective is dumping the "waste" gas or burning it off. They save money by making it the public's problem.

Before national rules were adopted by EPA in 2016 – and again today, because the Trump EPA has pulled back the 2016 rules – this regulatory challenge was almost entirely in the hands of the states. That has played out exactly as it has for many other environmental problems. Some states stepped to the plate and made serious attempts to address it. Colorado, for example, adopted the first methane rules in the nation, and New Mexico has recently proposed rigorous new standards.[163] Some other states have been lax. Texas is infamous for having among the weakest rules in the nation despite being by far the largest producer.[164]

This is our current situation: millions of widely dispersed sources; emissions that are hard to observe or measure; industries that know government's chances of figuring out they are in violation are low; and many states that are unwilling to hold operators accountable. You know what happens. If we set out to create a situation in which violations would be rampant, it would look a lot like this. Even under the current less stringent standards, violations are common.[165] Methane emissions and

162 See sources cited at *infra* note 173.

163 Matt Garrington, *Colorado Adopts Stronger Rules to Protect Health and Climate from Oil and Gas Pollution*, Environ. Defense Fund (Dec. 19, 2019), https://www.edf.org/media/colorado-adopts-stronger-rules-protect-health-and-climate-oil-and-gas-pollution; Natural Gas Waste draft rules, New Mexico Oil Conservation Division (July 20, 2020), http://www.emnrd.state.nm.us/OCD/documents/NaturalGasWasteDraftRules-July202020.pdf (methane); New Mexico Environment Department Ozone Precursor draft rule (July 20, 2020), https://www.env.nm.gov/new-mexico-methane-strategy/wp-content/uploads/sites/15/2020/07/Draft-Ozone-Precursor-Rule-for-Oil-and-Natural-Gas-Sector-Version-Date-7.20.20.pdf (ozone precursors VOCs and NOx)

164 *See* Hiller, *supra* note 152. *See US Overview, State Total Energy Rankings*, US Energy Information Administration (2018), https://www.eia.gov/state/?sid=US (Texas is largest producer). As one example, Texas approved every flaring request it received in the last seven years. Rebecca Elliott, *Texas Showdown Flares Up Over Natural-Gas Waste*, Wall St. Journal (July 17, 2019), https://www.wsj.com/articles/texas-showdown-flares-up-over-natural-gas-waste-11563361201.

165 *See EPA New Owner Clean Air Act Audit Program for Upstream Oil and Natural Gas Exploration and Production Facilities, Questions and Answers*, at 1 (March 29, 2018), https://www.epa.gov/sites/production/files/2018-06/documents/qaoilandnaturalgasnewowner auditprogram.

flaring are on the rise.[166] Even industry recognizes that this is an untenable situation. So long as this irresponsible behavior continues, the largest companies understand that their social license to operate is in jeopardy.[167]

All of these challenges, and some states' well-established aversion to serious action to address them, have led to the obvious conclusion that federal rules are necessary. EPA finalized a rule for new and modified sources in 2016; a strengthened rule needs to be reinstated and another rule for existing sources adopted.[168] Those rules must mandate significant cuts in methane and other health threatening pollution. We can save the more nuanced incentive programs for issues that don't have an obvious answer; for methane and other greenhouse gas releases from oil and gas production we know what has to happen and we know who has to do it. There are probably many creative new approaches that could make the capture of gases at the wellhead and along the transportation chain cheaper and easier. Those aren't being explored now because there is little economic incentive to do so with regulation being so lax. Tough new regulations will provide that incentive.

The federal rules will necessarily be what is commonly, and usually derisively, referred to as command and control. A rule that depends on the ability to reliably measure escaped pollution – as most performance standards and market strategies do – can't work here. That's because there is currently no way to dependably measure the emissions. A performance standard, which defines what outcome the rule wants to achieve but does not tell the regulated how to do it, can't be used when there isn't a way to measure performance. That is why most oil and gas rules mandate the use of particular types of equipment, and why standards are expressed as a % capture rate. Likewise, there can't be a market when the thing to be traded – in this case greenhouse gas emissions – can't be quantified. Even the most vigorous advocates for performance standards and market strategies acknowledge they can't work where reliable measurement isn't possible.[169]

Given the compliance-challenged situation of oil and gas, how can federal rules be designed to be as effective as possible at curbing emissions? There

pdf (EPA has seen "significant excess emissions and Clean Air Act noncompliance" at upstream oil and natural gas exploration and production facilities). *See also* two compliance alerts issued by EPA about widespread violations in the oil and gas sector: EPA Compliance Alert Onshore O&G Production, *supra* note 151; EPA Enforcement Alert Natural Gas Gathering Operations, *supra* note 151.

166 *See supra*, note 148.

167 Oil companies have acknowledged that the extensive flaring in the Permian Basin has given the oil industry a "black eye." *Parsley Energy CEO calls out industry for shale gas flaring*, Reuters (Feb. 5, 2020) https://www.reuters.com/article/us-parsley-egy-flaring/parsley-energy-ceo-calls-out-industry-for-shale-gas-flaring-idUSKBN1ZZ2ZK.

168 Oil and Natural Gas Sector: Emission Standards for New, Reconstructed, and Modified Sources, 81 Fed. Reg. 35824 (June 3, 2016) (final New Source Protection Standards rule by Obama EPA); Trump EPA rules: https://www.epa.gov/controlling-air-pollution-oil-and-natural-gas-industry/epa-issues-final-policy-and-technical, and *supra* note 150 (new rules pulling back the 2016 NSPS regulation). The Biden administration has clearly stated its intention to reverse course and impose effective standards for methane and other pollutants from oil and gas. Exec. Order No. 13990, *supra* note 150.

169 See Giles, Part 3 (The Ideologues: Performance Standards and Market Strategies), *supra* note 136, at 7-9.

are three overarching issues to remember in making these choices.

First, if ever there were a context for remembering the central ideas of Next Gen, this is it. The widespread and faulty assumptions that most companies comply, and that enforcement can take care of the rest, are obviously incorrect here. The belief that most companies comply is wrong even in the programs that have tough regulations, a limited number of sources, good monitoring, and vigilant regulatory agencies.[170] If it is incorrect under these favorable conditions, you know it's wrong when noncompliance is close to impossible to discover and the sources number over a million. Widespread violations are going to be the norm unless we take deliberate action to prevent that. It is equally obvious that a handful of government regulators can't force compliance on literally millions of sources and miles of pipelines, many of which are far from roads or human observation. That's especially true when violations are intermittent, unpredictable, and currently impossible to monitor continuously. Pretending otherwise is laughably unrealistic.

"More reliable and continuous monitoring is the lynchpin."

Second, noncompliance is going to get much worse. Today's regulatory environment for oil and gas is relaxed. The incentives to cut corners are comparatively modest because the expectations are already so low. Which isn't to say that companies aren't currently avoiding regulatory obligations.[171] When we ramp up expectations through more stringent regulation, and real money is on the table, the pressure to find another way out will increase dramatically. That's how it almost always works. It's a reminder that the regulatory structure has to be designed to be resilient to far more compliance pressure than it faces today.

Third, more reliable and continuous monitoring is the lynchpin. Even with today's intermittent-at-best monitoring, we can cut emissions across the board much more than we are doing now.[172] But we cannot achieve all the necessary pollution

170 See Giles, Part 2 (Noncompliance with Environmental Rules is Worse Than You Think), *supra* note 94.

171 *See, e.g.*, Press Release, Environmental Protection Agency, EPA Settlement with Gulfport Energy to Reduce Emissions from Oil and Natural Gas Operations by 313 Tons Per Year (Jan. 22, 2020) (Ohio), https://www.epa.gov/newsreleases/epa-settlement-gulfport-energy-reduce-emissions-oil-and-natural-gas-operations-313-0; Press Release, Environmental Protection Agency, The U.S. Government and Pennsylvania Settle with MarkWest for Air Emission Violations at Natural Gas Facilities (April 24, 2018), https://www.epa.gov/enforcement/reference-news-release-us-government-and-pennsylvania-settle-markwest-air-emission; Press Release, Environmental Protection Agency, Slawson Exploration Company, Inc., to Make System Upgrades and Undertake Projects to Reduce Air Pollution in North Dakota (Dec. 12, 2016), https://www.epa.gov/enforcement/reference-news-release-slawson-exploration-company-inc-make-system-upgrades-and; Press Release, Environmental Protection Agency, Noble Energy Inc. agrees to make system upgrades and fund projects to reduce air pollution in Colorado (April 22, 2015), https://archive.epa.gov/epa/newsreleases/noble-energy-inc-agrees-make-system-upgrades-and-fund-projects-reduce-air-pollution-0.html. *See also supra*, note 151 (EPA compliance alerts about widespread O&G violations).

172 See Methane Advisory Panel, *supra* note 142, at 34-67 (describing evidence from multiple states that use of existing monitoring technologies significantly and cost effectively reduces methane emissions); *see also* EPA 2016 NSPS final rule, *supra* note 168, at 35827-35828.

reductions without a much better way to quickly spot violations, especially the super emitters. There are many promising monitoring strategies currently being explored, from onsite 24/7 methane monitors to mobile monitors that can scan larger areas more rapidly, to systems that merge satellite monitoring with big data analytics to find the largest sources.[173] These all have promise, but they are likely years away from at-scale deployment. And no single one of these is an all-purpose solution; it is far more likely that it will take a combination of all of these, plus on the ground close up monitoring, to provide a consistent enough answer. Government should be exploring all these options and others, as quickly as possible, because a longer-term solution depends on it. Once industry appreciates government's resolve, they might be motivated to help.

"When a regulation is clear and opportunities to obfuscate or avoid complying are few, compliance will be better."

NEXT GEN STRATEGIES FOR FEDERAL OIL AND GAS REGULATIONS

In the meantime, we need federal regulations that will be effective at dramatically cutting emissions, using today's technologies. Listed below are some Next Gen ideas that might make those rules more likely to succeed.

Aim for clarity and simplicity. When a regulation is clear and opportunities to obfuscate or avoid complying are few, compliance will be better. The fewer exceptions and special conditions it contains, the less likely a regulation is to give companies a chance to confuse the matter and thereby evade or delay compliance. Obligations that depend on individual discretionary judgment on a site-specific basis create loopholes that undercut compliance. Numeric, straightforward, measurable obligations are likely to produce better environmental results than more nuanced and theoretically stringent requirements that are not actually implemented. Simplicity is an under-appreciated powerhouse in the regulatory toolbox. Regulators should ask themselves this question: "Are there a lot of ways to avoid complying?" If there are, there will be a lot of violations. Compliance simplicity can be completely consistent with technical complexity; it just requires regulatory design that translates complicated issues into an easy-to-understand and hard-to-avoid compliance answer.[174]

Minimize exemptions. In any regulatory context,

173 *See* NM Methane Advisory Panel, *supra* note 142, at 51-54 (describing many new strategies being piloted); Isabel Mogstad, *Buckle Up: Methane Monitoring is Going Mobile*, Environ. Defense Fund (Sept. 10, 2019), http://blogs.edf.org/energyexchange/2019/09/10/buckle-up-methane-monitoring-is-going-mobile/ (describing the rapidly developing technologies for mobile methane monitoring by drones, trucks and plane-mounted sensors); European Space Agency, *New Space Satellite Pinpoints Industrial Methane Emissions*, PHYS.ORG (July 29, 2020), https://phys.org/news/2020-07-space-satellite-industrial-methane-emissions.html (describing ability of new satellites to identify large methane leaks at specific industrial facilities). *See also* Tabuchi, Methane Leak Seen from Space, *supra* note 158 (satellites).

174 Simple does not mean simplistic. The Acid Rain Program is an excellent example of a complex program that had a simple overall compliance design. See Giles, Part 1 (Rules with Compliance Built In), *supra* note 131, at 4-7.

smaller businesses will object to the costs of regulation, claiming that they are less affordable for more cash-strapped companies. That manifests for a methane rule in pressure to exempt so-called "low production" wells. Next Gen teaches us that whenever regulators draw a line and say on this side you are regulated and on that side you aren't it creates powerful incentives for more companies to find a way to be – or claim to be – on the unregulated side of the line.[175] Exempting lower-producing wells is also tough to justify from a pollution control perspective; low-production wells can leak just as much as higher producing ones.[176] It also creates a compliance black hole by motivating companies to improperly claim the exemption, while at the same time eliminating the monitoring and reporting that would allow regulators to know what is going on. Multiply that by over a million wells and you see why this kind of exemption creates both pollution and compliance trouble.

Require frequent monitoring. The best available monitoring today is on-site use of photoionization equipment, or comparable technology, which allows the operator to "see" emissions of VOCs and methane that are invisible to the naked eye. Aiming those monitoring devices at individual pieces of equipment allows the operator to identify not only that there is a release at the site, but where it is coming from, along with a rough idea of the rate of release. This kind of monitoring is presently the only way to accomplish the level of granularity necessary to remedy the problem. You can't fix a leak if you don't know its source. If you only do such inspections every six or twelve months, you might miss a significant emissions event that occurred in between visits. The more frequent these visits are, the more likely it is that serious problems will be found, and the less time that they can continue until repaired. It isn't economically feasible to have people present on site every day – that's the kind of regular screening that satellite data or other innovative technologies might eventually make feasible – but once a quarter is currently best practice for wellhead monitoring in state rules.[177]

Embrace innovation. New monitoring strategies are on the way. In addition to requiring today's state-of-the-art monitoring, new rules should encourage innovation in monitoring for leaks to spur faster and better technological development. Any new federal rules should include a robust alternative compliance approval process. Tough standards will motivate innovation. Rules need to encourage that by creating a pathway for innovators to bring rigorously tested

175 Small quantity generators of hazardous waste, for example, face fewer regulatory requirements than do larger generators. EPA's experience is that many companies therefore claim to be small quantity generators when in reality they are not. Giles, Part 2 (Noncompliance with Environmental Rules is Worse Than You Think), *supra* note 94, at 18. In the absence of easily verifiable information to reliably classify exempt operators, this kind of distinction will likely inspire widespread violations that are almost impossible to find.

176 EPA final rule 2016, *supra* note 168, at 35856; Jean Chemnick, *Trump's Climate Dismantling Complete with Methane Rollback*, E&E News (Aug. 14, 2020) https://www.eenews.net/stories/1063711683 (quoting Peter Zalzal from the Environmental Defense Fund that most wells in the US are low producing, and they have emission rates that are as high, or higher, than high-producing wells).

177 New Mexico Methane Advisory Panel, *supra* note 142, at 66. Protective oil and gas regulations also commonly include additional, more frequent, Audio, Visual, Olfactory (AVO) Inspections.

new approaches to market.[178]

Automate everything that can be. One way to avoid serious problems is to be less dependent on human intervention to spot and fix them. So, make some operations automatic. Automated pilot lights, which reduce the times when there is no flame at the flare for combustion of the gas, and automated thief hatches, so they aren't accidentally left open, are two examples.[179]

Require electronic reporting. We are in the 21st century. All reporting should be electronic. It is faster, more reliable, and less prone to errors. A federal rule should create a consistent reporting format, with data shared between EPA and states. We have seen the uneven and unreliable data that are generated when essential information comes in only through the states; the way to go is direct electronic reporting by the regulated companies to a common data system.[180] Electronic reporting makes the information more accessible for the companies, increasing the chances that they use it to improve their operations. And it allows for automated compliance checks to avoid incomplete or obviously impossible answers. More importantly, it makes the information available to regulators, and potentially also the public, in as close to real time as possible, helping them to spot problems, and making companies wonder if their violations are more likely to be noticed. The more likely they think that is, the better for compliance.

> "One way to avoid serious problems is to be less dependent on human intervention to spot and fix them."

Impose data substitution requirements. Conducting on-site inspections is a hassle for companies and also costs money. Cost-cutting zeal, or just personnel problems, could result in companies' not doing the required inspections. Usually, the regulatory consequences for failing to inspect or report are less severe than the consequences of admitting a violation of emissions obligations. That kind of regulatory set-up can create perverse incentives, motivating companies to skip inspections when the results are expected to be unfavorable. One way to bypass this tangle is to create a powerful motivation to do inspections. A rule can require the company to assume that missed inspections would have produced negative results and impose the consequences that go along with that. EPA's air office has employed these kinds of data

178 That's what Colorado's alternative approved instrument monitoring methods (AIMM) strategy does. See Pathways for Alternative Compliance, *supra* note 160, at 9.

179 See NM draft oil and gas rule for ozone precursors, *supra* note 163, at 20.2.50.15(C) (flares), and 20.2.50.23(B) (thief hatches).

180 The 2016 EPA methane rule required electronic reporting. EPA final rule 2016, *supra* note 168, at 35869-35870. *See also* National Pollutant Discharge Elimination System (NPDES) Electronic Reporting Rule, 80 Fed. Reg. 64063 (Oct. 22, 2015), https://www.federalregister.gov/documents/2015/10/22/2015-24954/national-pollutant-discharge-elimination-system-npdes-electronic-reporting-rule (example of requiring electronic reporting to a system shared by EPA and states, in this instance for Clean Water Act dischargers). *See also*, Part 2 (Noncompliance with Environmental Rules is Worse Than You Think), *supra* note 94, for a discussion of data quality problems with state reporting, at 21-23 (drinking water) and 23-28 (stationary air sources).

substitution requirements to good effect in other air emissions programs.[181] Automatic data substitution requirements can inspire greater adherence to inspection and reporting obligations.

Crowd source compliance monitoring. Electronic reporting makes it easier to increase transparency. Posting emissions and compliance data online creates multiple pressure points for better performance. Companies, especially publicly traded companies, are loathe to look bad in the eyes of the public, so transparency about violations motivates them to do better. Competitors might be inspired to either learn from high performing companies or spot the ones whose public reports are not credible and let regulators know. Companies claiming to be green, a quality that investors increasingly value, will be encouraged to have results that match their assertions. Enterprising citizens might be motivated to dig into the data and compare it to other sources of information to test its validity or to see how wells in one state compare to wells elsewhere. Neighbors certainly are keenly interested in keeping a close eye on sources that affect them. Government is primarily responsible for overseeing compliance monitoring, but all these other avenues for shining a light can help.

Set the stage for robust data analytics. With data in common formats received electronically, government can perform data analytics to see what comparisons across reports reveal, and spot anomalies that require more investigation. Incoming electronic reports can also be compared to external sources of information, including other government reports, like royalty payments or SEC filings for example, to identify problematic information that suggests the need for follow up. It may eventually be possible to use the data to develop predictive analytics to flag in advance the locations most likely to cause serious problems. The rules themselves shouldn't mandate specific government analytics, but likely analytic approaches need to be investigated before regulations are finalized, so the rules require the right information in the right format to make such analytics possible.[182]

Require an engineer to certify that the design will work. Under-design of emissions control equipment has been a ubiquitous problem in the oil and gas industry, leading to significant emissions.[183] If the tank isn't big enough or the pipe is too small for the expected pressures, that gas has to go somewhere so it is released to the air. Requiring engineer-certified plans reduces the chances that the company is unaware they have a flawed design.[184] Independent reviews are best – because research confirms intuition that independent experts provide more accurate reports than auditors who have an

181 *See* EPA, Plain English Guide to the Part 75 Rule, section 9.0 Missing Data Substitution Procedures at 78-84 (June, 2009), https://www.epa.gov/sites/production/files/2015-05/documents/plain_english_guide_to_the_part_75_rule.pdf.

182 As one example, the rules could require data that make it easy for government to match satellite images with permitting data bases, to help spot unpermitted facilities.

183 *See* EPA Compliance Alert re Onshore Oil and Natural Gas Production Facilities, *supra* note 151.

184 EPA's 2016 methane rule included a requirement to have designs approved by an engineer. EPA final rule 2016, *supra* note 168, at 35871.

incentive to agree with the regulated company.[185]

Make the most of available technologies. Documenting inspections of specific pieces of equipment at particular locations can be a time-consuming exercise, fraught with opportunities for error. Why not make use of commonly available techniques used at even mom and pop grocery stores: QR codes? If every piece of equipment is marked with a QR code, an inspector can scan the code, do the measurement, and quickly move on, making inspections more consistent.[186] These types of easy ID systems make the data more reliable, and therefore more useful for both the company and regulators, and have the not-incidental benefit of increasing the perceived probability that violations will be caught, motivating companies to try harder.

Design reports to highlight violations. Sending in reams of spreadsheets to regulators from which one could, with investigation and calculations, deduce that there was a violation doesn't have much deterrent kick. This is regulation 101. A form that requires companies to state, for the most important data, 'is this a violation, yes or no? check here [cannot be left blank]' carries more clout than a report of numbers only. And it's more likely to get the attention of company management. There's some incentive to answer honestly because a false answer is another violation. Reporting obligations should make it hard to obfuscate and easy to spot serious problems.

Create automatic consequences. One of the reasons that enforcement lacks credibility as the principal compliance driver for oil and gas rules is the glaring mismatch between the huge number of regulated facilities, companies and activities and the tiny number of enforcers. Using traditional approaches, companies know that government has to catch them, prove a case likely to involve highly technical evidence that is held almost entirely by the company itself, and prevail in a lengthy enforcement process in which companies can throw up procedural roadblocks. The enterprise is doomed before it begins. A rule that short circuits this process by imposing automatic consequences stands a better chance. Fixing high, and automatic, penalties for serious self-reported violations is one idea, but there are others that could be considered, such as limits on transferring ownership after self-reported violations. As long as the consequences are undesirable from the companies' perspective, proportional to the violation, and most importantly, imposed without the need for government intervention, they could be expected to provide more motivation than the uncertain to unlikely prospect of eventual individualized enforcement.

Shift the burden of proof. Part of what makes enforcement particularly fraught in this sector is the reality that the number of potential violators

185 See Duflo, *supra* note 30 (auditors selected and paid by the regulated firm are far more likely to report the plant in compliance); Short & Toffel, *supra* note 30 (describing factors that lead to third party auditor bias in reporting). *See also* Kaufman, *supra* note 12, at 259 (auditor bias in energy efficiency audits).

186 These types of ID systems are increasingly used in the oil and gas industry. *See, e.g.,* IoT in Oil & Gas: Asset tracking with RFID, GPS, and QR Codes, Softengi, https://softengi.com/projects/iot-in-oil-gas/ (describing the benefits of RFID tags, QR codes and GPS trackers for the oil and gas industry)(last visited Feb. 22, 2021). New Mexico's proposed new regulations require use of scannable Equipment Monitoring Information and Tracking Tags. *See* NM proposed VOC rules, *supra* note 163, at 20.2.50.12(A).

dwarfs regulators' capacity to investigate. However, there is a strategy for identifying violators without the impossible-to-execute necessity of having a government inspector on site with the necessary equipment at the exact moment that significant leaks occur. Mobile monitoring has already proved its power to scan broad areas to identify the worst emitters, and these technologies are likely to improve rapidly.[187] This is a perfect opportunity for shifting the burden of proof. New technologies like remote sensors in planes or sophisticated analysis of satellite data can provide credible evidence of noncompliance. A regulation can then shift the burden of proof to the regulated firm to provide credible evidence of compliance.[188] If experts determine that there is a large amount of regulated pollution coming from a particular location, it makes sense that the firm operating the site should have to figure out the cause. They're the ones that have access to the site and to the necessary information. The simple regulatory tool of shifting the burden creates a virtuous feedback loop; outside experts who know how to look for pollution will be motivated to do it when it is more likely to lead to corrective action, and regulated firms will figure out that they are not so invisible as they may have thought, so will put more effort into complying.

These ideas are not mutually exclusive: they can be combined into a single rule. The goal of all these ideas is to increase the alignment between the companies' incentives and the public interest in reduced emissions. There will always be a certain level of cat and mouse between regulators and the regulated. The idea of Next Gen is to cut that way back by building compliance drivers into the rule, so that the system is as close to self implementing as it can be.

> "Part of what makes enforcement particularly fraught in this sector is the reality that the number of potential violators dwarfs regulators' capacity to investigate."

THE ROLE OF ENFORCEMENT IN OIL AND GAS COMPLIANCE

This series of articles on Next Gen argues that rule design is the most important driver of compliance outcomes. A tightly designed rule can deliver strong compliance results if it makes compliance the path of least resistance. That is especially true where there are millions of geographically scattered sources, and the worst violations are intermittent.

The unavailability of reliable and continuous measurement for oil and gas emissions mean that the best and most effective regulatory compliance solutions aren't currently possible. We can make significant improvements – and the above suggestions include ways to do that – but we cannot get all the way there through a regulation alone.

187 *See supra* note 173.

188 New Mexico is proposing to adopt a rule with this presumption shifting approach. *See* New Mexico proposed VOC regulations, *supra* note 163, at 20.2.50.27.

It's unavoidable that this is one problem where enforcement will have to play a higher profile role. Government resources are extremely limited, so we can't have many problems where enforcement must be front and center. Oil and gas production is an exception because it is essential to the climate imperative, and the options to avoid a central role for enforcement aren't likely to be wholly effective due to the monitoring gap.

What that means for oil and gas regulation is that it has to create a bigger deterrent by making enforcement easier. When violations are hard to find, and enforcement is long, drawn out and complicated – as happens now – enforcement loses its power to motivate. Cases cannot be brought against every violator, or even one in a thousand. Assuming regulators can even identify the violators. The threat of enforcement will only motivate better behavior if companies think it is likely they will get caught and that the consequences will be swift. This only underscores how essential Next Gen provisions are in the rule. The regulation must require currently state-of-the-art monitoring to spot the worst problems, regular electronic and common format reporting that quickly flags the worst issues, public availability of data to make the most of crowd sourcing the search for violators, and automatic consequences that avoid opportunities for delay. Strategies that can be included in regulations to increase deterrence punch include shifting the burden of proof, limiting the number of compliance options available to companies so enforcement doesn't get bogged down in complicated compliance or applicability determinations, and imposing mandatory minimum penalties so companies know the consequences in advance and time spent negotiating is reduced. Rules could also do a lot to increase accountability by limiting the constant churn in ownership and operation of wells that can create ambiguity about legal responsibility and send enforcement down the rabbit hole of forensic accounting. Enforceability is important for every rule, but never more so than in situations like this, where the implementation challenges dwarf regulators' resources but a credible deterrence presence is nevertheless necessary.

THE PROBLEM OF ABANDONED WELLS

Once a well stops producing oil or gas, the emissions problem is not over. The owner/operator may lose interest, but the well can keep belching methane and other pollutants into the air (and water) until it is carefully plugged.[189] This kind of structural mismatch – the action needed to protect the public is a low priority for the responsible company, and the government has virtually no leverage to insist – underlies some of our most vexing environmental problems. It is what created the Superfund program. And it challenges government's ability to control pollution from oil and gas wells.

There are millions of abandoned wells in the United States.[190] Often there is no one for government

189 GAO, Bureau of Land Management Should Address Risks from Insufficient Bonds to Reclaim Wells, GAO-19-615, at 1-2, 6 (Sept. 2019); Mary Kang, et. al., *High Methane-Emitting Abandoned Oil and Gas Wells*, Proc. Natl. Acad. Sci., at 13636 (Nov. 2016), https://www.pnas.org/content/pnas/113/48/13636.full.pdf.

190 EPA estimates that there are over 2 million abandoned unplugged oil and gas wells in the United States. United States Environmental Protection Agency, Report on Inventory of U.S. Greenhouse Gas Emissions and Sinks 1990-2018, EPA 430-R-20-002 (2020), https://www.epa.gov/sites/

to pursue to fix it; all the players with money have walked away or gone bankrupt. The amount of methane released from abandoned wells is significant. A researcher in one state estimated that abandoned wells were the source of between 5% and 8% of the state's total annual human-caused methane emissions.[191] EPA estimates it at 281,000 metric tons of methane nationwide in 2018.[192] Since methane has 84 times the global warming power of carbon dioxide over the next 20 years, that's a lot of climate change.[193] There is a robust discussion about how to fund the plugging of all these abandoned wells through taxing systems and government programs; that isn't addressed here.[194] The compliance issue is how to avoid creating new ones.

State and federal regulations require oil and gas companies to properly close their wells, and to set aside the funds necessary to accomplish that. The challenge is that the obligation to plug the well may not arise until decades after the well is originally permitted.[195] By that time, the well may be years past its productive period, and parties viable enough to perform the shutdown may have disappeared.[196] So yes, there is a regulatory obligation to conduct proper plugging and other remediation, but long experience with the oil and gas industry shows that many companies don't do that. That's how we end up with what are called orphan or abandoned wells.

production/files/2020-04/documents/us-ghg-inventory-2020-main-text.pdf, at 3-101 to 3-104.

191 Kang, *supra* note 189, at 13640.

192 EPA, GHG Emissions and sinks, *supra* note 189, at 3-102. This estimate is acknowledged to be highly uncertain. *Id* at 104. It could be substantially more. *See* Nichola Groom, *Millions of Abandoned Oil Wells Are Leaking Methane, a Climate Menace*, Reuters (June 16, 2020) https://www.reuters.com/article/us-usa-drilling-abandoned-specialreport/special-report-millions-of-abandoned-oil-wells-are-leaking-methane-a-climate-menace-idUSKBN23N1NL

193 EPA's report converts the 281,000 metric tons of methane in 2018 to 7 million metric tons of CO_2 equivalent (7 MMT CO_2e) using the outdated methane multiplier of 25. *Id.* at 3-103. The current commonly used 100-year methane multiplier is 34; the 20-year multiplier is 86, reflecting the much greater global warming impact of methane in the near term, and resulting in a CO_2 equivalence for the estimated methane leakage from abandoned wells in 2018 of roughly 24 million metric tons (24 MMT CO_2e). Reclaiming Orphaned Oil and Gas Wells: Creating Jobs and Protecting the Environment by Cleaning Up and Plugging Wells, Virtual Forum Before the Subcommittee on Energy and Mineral Resources, US House Committee on Natural Resources, 116th Cong (2020)(statement of Daniel Raimi, Senior Research Associate, Resources for the Future) at 3 n.2. Using EPA's carbon equivalence calculator, that's equal to the annual climate forcing emissions from more than 6 coal fired power plants. Greenhouse Gas Equivalencies Calculator, EPA https://www.epa.gov/energy/greenhouse-gas-equivalencies-calculator (last visited Feb. 21, 2021). *See also* Understanding Global Warming Potentials, EPA https://www.epa.gov/ghgemissions/understanding-global-warming-potentials (describing current knowledge on the global warming potential of methane, including the 84-87 range for the 20-year methane multiplier) (last visited Feb. 21, 2021).

194 *See, e.g.*, Virtual Forum on Reclaiming Orphaned Oil and Gas Wells, *supra* note 193. Note that the better monitoring necessary for preventing emissions from active wells is also essential for solving the problem of wells already abandoned. The funds don't exist to close every orphaned well; regulators need a much better way to spot the ones with the worst methane and other serious contamination issues so government can focus on them first. Kang, *supra* note 189, at 13639. President Biden has included plugging leaks in abandoned oil and gas wells as among the job opportunities that should be emphasized as part of the effort to "Empower Workers Through Revitalizing Energy Communities," Exec. Order No. 14008, Sec. 217, 86 Fed. Reg. 7619, 7626 (Jan. 27, 2021).

195 GAO, *supra* note 189, at 6.

196 *Id*. at 10; *See also* Hiroko Tabuchi, *Fracking Firms Fail, Rewarding Executives and Raising Climate Fears*, N. Y. Times (July 12, 2020) https://www.nytimes.com/2020/07/12/climate/oil-fracking-bankruptcy-methane-executive-pay.html.

Assuring widespread compliance is challenging in any circumstance, as the data proving extensive violations for all kinds of environmental programs shows,[197] but particularly so when the problem government is seeking to prevent does not go away when the company closes down. Government's leverage in many environmental protection programs comes from the company's desire to continue to operate. If the environmental problem continues after the company shuts down, government's leverage is gone. The company saves money by walking away, and the public is left holding the bag. Under those circumstances Next Gen predicts that violations will be common.

"Regulators know that the point of maximum ability to prevent abandoned wells is at the time the well is originally permitted."

Regulators know that the point of maximum ability to prevent abandoned wells is at the time the well is originally permitted. The company wants something of value (the permit) so is motivated to address the long-term problem. The obvious solution, and one that most states and the federal government have adopted, is to require bonds or similar assurance before a well can be permitted. Once the well is properly plugged, the bond or other assurance is released back to the company. The theory is that the company will be motivated to remediate the well and thereby recoup its financial instrument, but if it abandons the well, regulators can still protect the public by using the financial assurance to pay for the well to be properly closed.

It is a great idea, but it isn't working. The reason is that the value of most required bonds is nowhere near sufficient to cover the cost of plugging the well. For oil and gas leases on federal lands, 84% of the bonds, covering over 99% of the wells, would not cover closure costs even at the low end of the possible range; less than 1% of bonds would be sufficient if closure costs turned out to be higher.[198] States are facing large shortfalls to address the wells already abandoned, with many more wells at serious risk of becoming orphaned.[199] Even this dire scenario might be understating the risk.[200]

197 Giles, Part 2 (Noncompliance with Environmental Rules is Worse Than You Think), *supra* note 94.

198 GAO, *supra* note 189, at 15. GAO found that over 99% of wells on federal lands were covered by bonds worth less than $20,000 per well. *Id*. GAO notes that the regulatory minimum bond – which is still what BLM uses today – has not been adjusted for inflation since the 1960s. *Id*. at 16.

199 *See, e.g.*, Virtual Forum, *supra* note 193 (statement of Adrienne Sandoval, Oil Conservation Division Director, New Mexico Energy, Minerals & Natural Resources Department) at 3. *See also* Ellie Potter, *State Officials Call for Federal Funds to Plug Orphaned Wells Amid Pandemic*, S&P Global Market Intelligence (June 1, 2020), https://www.spglobal.com/marketintelligence/en/news-insights/latest-news-headlines/state-officials-call-for-federal-funds-to-plug-orphaned-wells-amid-pandemic-58874155.

200 The average plugging cost per well is over $70,000 in some well-intensive states like North Dakota and Pennsylvania. *Idle and Orphan Oil and Gas Wells: State and Provincial Regulatory Strategies*, Interstate Oil & Gas Compact Commission (2019), at 25 https://iogcc.ok.gov/sites/g/files/gmc836/f/2020_03_04_updated_idle_and_orphan_oil_and_gas_wells_report_0.pdf. Carbon Tracker estimates that the cost for plugging more recent vintage wells is substantially more; they estimate that the

This system sets up the wrong incentives. The company isn't motivated to close the well properly to get its bond back, because the cost of the bond is substantially below the actual cost of plugging the well. The company's best financial move is giving up the bond and walking away, because that is far cheaper than paying to close the well properly.[201] Some companies with a large number of wells know that government might find a way to come after them if they fail to plug, and they may continue to want new permits to drill from those regulators, so conclude that it makes financial sense to do the right thing. But for many companies, it doesn't.

This problem is likely to get a lot worse. Newer wells are much deeper and use horizontal drilling, making them more complicated and expensive to close.[202] Many experts are predicting that we will see a surge in abandoned wells as a result of the current difficult financial circumstances in the oil and gas industry.[203]

This is not rocket science. Oil and gas is a boom-and-bust business.[204] It has ever been thus. We see the evidence of that in front of us at the present minute. Blithely counting on compliance, despite the extensive evidence to the contrary, has gotten us to the plight we are in today. Enough already. It is time to require financial assurance that covers the actual costs of properly shutting down the well. In God we trust, all others pay cash.

Conclusion

This article focuses on the three top priority climate regulatory topics for EPA – electric generation, transportation and oil and gas production – and examines the most prominent compliance issue each presents. All of these regulatory areas have many more challenging implementation design problems than are discussed here. The purpose of this analysis isn't to provide an exhaustive list of either the compliance difficulties or the solutions for these sectors. It's to show how complicated and important those issues are. And to explain why implementation and compliance cannot be an afterthought, appended to the rule after the design is completed.

> "If a beautiful-on-paper rule doesn't cut it in the real world, we have failed."

cost of plugging a typical 10,000-foot shale well is about $300,000. Robert Schuwerk and Greg Rogers, *It's Closing Time: The Huge Bill to Abandon Oilfields Comes Early*, Carbon Tracker (June 18, 2020) https://carbontracker.org/reports/its-closing-time/. And even supposedly plugged wells can continue to leak methane. Kang, *supra* note 189, at 13639.

201 GAO, *supra* note 189, 14-15. In many states it is too easy for operators to insulate themselves from liability by selling aging wells before they are officially abandoned. See IOGCC, *supra* note 200, at 21. There is often no fail safe; usually it is up to over-worked and under-resourced government staff to find the companies likely to bail and try to take action to increase bonds before it is too late. That's a structure that experience shows doesn't work. See GAO, *supra* note 189, at 3.

202 GAO, *supra* note 189, at 17.

203 Tabuchi, *supra* note 197; Matt Egan, *A Wave of Oil Bankruptcies is on the Way*, CNN Business, April 2, 2020 https://www.cnn.com/2020/04/02/business/oil-crash-bankruptcies-whiting/index.html; GAO, *supra* note 189, at 17-18; Carbon Tracker, *supra* note 200 (explaining the incentives that drive companies to delay the day of reckoning and to sell older wells to weaker companies).

204 GAO, *supra* note 189, at 1.

Implementation is the foundation. If a beautiful-on-paper rule doesn't cut it in the real world, we have failed. Next Gen design must be front of mind when the rule is being crafted and seen as a central obligation throughout. When Next Gen analysis shows regulators that the approach they had in mind when they started out has little to no chance of success once it meets the rough and tumble of gritty reality, rule writers have to be willing to reconsider. And they have to fight just as hard for the necessary-for-effective-implementation provisions as they do for the standards the rule sets. There will be strong external resistance from companies who recognize that Next Gen approaches mean they might actually have to comply. There are also many internal government barriers to building compliance into regulations. Sticking by the implementation-necessary provisions and rejecting popular ideas that will not get us there will require tenacity and commitment.

We are out of time to address climate change. The rules EPA develops now have to work. The famous sage Yoda's advice should be our touchstone for climate rule effectiveness: "There is no try. There is only do or not do."

AUTHOR NOTES

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