



## Transcript of CleanLaw Episode 26: Joe Goffman speaks with Jonathan Lewis about biofuels (part two of two), September 30, 2019

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**Robin Just:** Welcome to CleanLaw from the Environmental and Energy Law Program at Harvard Law School. In this episode, our executive director, Joe Goffman speaks again with Clean Air Task Force Senior Counsel, Jonathan Lewis, about biofuels. They discuss the five lessons policymakers seeking to promote innovation can learn from the failure of the Renewable Fuel Standard, why aviation is a critical transportation market to target for emissions reductions, and the low carbon fuel standards of California and British Columbia. John joined us in August for the first of this two-part series. We hope you enjoy this podcast.

**Joe Goffman:** We're looking at this program at a time when it's almost as if we've entered a new generation of urgency about decarbonizing the economy, and a lot of the policy environment is looking not just at incremental transitional strategies, but pretty drastic technology forcing strategies. And as most people think about Renewable Fuel Standard's program, and I think as you described it previously, it's a pretty classic technology forcing program. Congress in the mid-aughts in the 2007 legislation, identified, or posited a need for cellulosic biofuels, and essentially gave EPA the remit to create an aggressive demand for it by requiring it, and relied on that demand creation to bring cellulosic fuels into existence. So the question is, in your expert capacity, John, how well did it work if at all? And what are the lessons learned? All experiments are successful if you understand their purpose to generate and teach lessons. So that's the sort of overarching question. What did we learn 10 plus years after RFS2 was enacted?

**Jon:** I think by the metric of all experiments are successful if they produce learning, the RFS has provided a lot of learning. I think there are some clear lessons to be taken from the decade since the RFS was enacted, and implemented.

**Joe:** Let me step back and say, I use the word experiment, but that's too far of a leap ahead. RFS was not intended to be an experiment. It was intended to be a policy. So let's make sure we reset the table on. But the first question is how well, if at all, has it worked as a policy? And then after answering that question, we can answer the question, what are the results of this policy experiment?

**Jon:** As a policy, I don't think it's worked very well, but that's because I assess the policy through the lens of how is it doing as a GHG reduction tool. And in that sense it's doing poorly. And the main reason is because while the program, and the environmental benefits of the program, were based on an assumption that it



would increase the production and use of cellulosic biofuel, we've seen virtually no cellulosic biofuel production. Every commercial venture in the United States so far to try to produce cellulosic biofuel at a scale that's meaningful in the US transportation fuel market, has failed. Most of the companies are bankrupt. So what we've been left with instead is essentially a corn ethanol mandate. 90%, almost 90%, of the compliance with the RFS mandates since 2010 when the program was implemented, have been met through corn ethanol.

Joe: Which is not a big GHG reduction winner?

Jon: No, according to EPA... Well, according to the statute for corn ethanol to earn RINs, which are the credits by which the RFS is administered, it has to achieve a 20% reduction as compared to gasoline. EPA did its lifecycle analysis of corn ethanol, they modeled three scenarios. One, their assumption for how corn ethanol would be produced in 2020, another one for how it would be produced in 2017, and another one for how it would be produced in 2022.

Jon: And it was the analysis that they did for 2022 in which they assumed things like ethanol biorefineries would be powered by biomass energy, as opposed to fossil fuel energy. It was in those model runs that they actually achieved that 20% reduction. The 2022 scenarios indicate that corn ethanol would produce a 21% reduction, as compared to gas. And so they just barely cleared that threshold. Other analyses, other life cycle analyses that look at corn ethanol take different views. I think based on the research that we've looked at over the years, it's probably not better than gasoline. It's hard to pin this down. There's an enormous amount of uncertainty, and that's a big problem with this program. But I think the life cycle emissions from corn ethanol, as it's produced, are roughly the same as gasoline. Not significantly better by any stretch.

Jon: So we've had this, as you said, an experiment, but actually a policy that's reordered as significant sector of the economy, with little to no environmental benefit. I would be remiss if I just focused on the greenhouse gas emissions. Corn ethanol production, corn production is very resource intensive. Lots of water was required to grow the corn, lots of fertilizer inputs are required to promote that growth, and that leads to a lot of soil degradation, water quality degradation, and an air quality impacts. And so it's not just the greenhouse gas impacts from the use of corn ethanol, under the RFS that have been problematic. It's a wider set of issues, which are balanced against the wider set of issues that petroleum extraction and refining involve. There's tradeoffs there as well, but it's certainly, even in EPA's analysis they have put out two, what they call, triennial reports that look at the overall environmental impact of the RFS. They raise a lot of concerns about their own program and its environmental impacts. So the answer to your question is, I don't think this policy is working, at least not from an environmental standpoint.



- Joe: The headline out of your statement was that 90% of compliance has been through corn ethanol. If the program had worked as Congress directed, or assumed it would, what would be the percentage at this point of corn ethanol-based fuels versus more advanced biofuels?
- Jon: Well, the program is supposed to increase the use of cellulosic biofuel from, essentially, zero gallons in 2008, to 16 billion gallons in 2022. The statutory schedule for production that use cellulosic biofuels is so different from the reality, that I've sort of forgotten what the statutory number is. But I think it should be above 10 billion gallons at this point. Instead we're a tiny, tiny fraction of that.
- Joe: 10% or less is way under achieving. Way, way under achieving what Congress had in mind when it created that schedule.
- Jon: Yeah. Where, the actual mandates that EPA enforces for cellulosic biofuel for the last couple of years is about 5% of what the statute requires.
- Joe: Now that we're seeing results that allow us to declare that the policy is not successful, is there a way we can derive some lessons so that at least we rescue the experiment?
- Jon: As you pointed out, we're in a sort of a new era of urgency that the climate crisis that we're facing is clearer than it was in 2008, the politics are different but still very complicated, but there seems to be a new appetite in Congress. For at least, drafting bills and introducing them in some instances, and in some instances, passing them. There was a bill that was passed last year, popularly known as 45Q, that incentivizes the development, deployment of carbon capture and sequestration systems. And those sort of targeted policies seem to be something that Congress is potentially interested in. So in that context, it's important to think about what lessons we can learn from the RFS, because, hopefully, we're coming up soon on an opportunity to rethink what our transportation and climate policies should be. So I think there, there's probably a lot of lessons from the RFS, and of course it depends on your perspective. I'm coming at this from someone who's thinking about how to decarbonize the transportation sector, but from my perspective, there are five lessons.
- Jon: The first one is to clarify the goal and design the policy accordingly. The RFS had a set of different goals, and was not really well designed to address any of them, as far as I can tell. The second lesson is, avoid technology lock in, by pushing innovation before creating a market pull. The third is that the incentives that policy makers create should be durable, and they should be highly certain. Investors should know what this policy is going to reward, and what it's not going to reward, and for how long it's going to offer those rewards. The fourth lesson is



that greenhouse gas reduction targets should continuously get more stringent, and should be on a trajectory to zero. And then the fifth lesson from the RFS, from my perspective, is that policy should give preference to fuel and energy technologies that deliver reductions with the highest degree of certainty. One of the problems with the RFS has been the reductions that may or may not be delivered by the program have to be modeled, and I think that programs that deliver GHG reductions that can be measured, are more valuable and should be treated as such.

Jon: In terms of the need to clarify the goal of the policy, and the need for that policy to be designed to actually achieve those goals, the RFS nominally had three goals. To provide support to the agricultural sector, price support in particular, to reduce greenhouse gas emissions, and to promote US energy security. In our last discussion, we talked about how it's fared on those three fronts. The energy security goal has gotten probably the least attention, because since the RFS was enacted and implemented, we've had this explosion and shale oil and shale gas, and so United States is long on energy these days. I'm not really well positioned to describe how it has impacted the farm economy, but I think it's got to be a pretty inefficient way of addressing that concern. If we want to support the farm economy, which seems sensible, there's got to be more efficient, better targeted tools than the RFS. As I mentioned on the on third front, it hasn't done a very good job in achieving the environmental goals, particularly the life cycle greenhouse gas reductions.

Jon: So if you're designing a policy to reduce transportation emissions, there's a bunch of different goals that you could pursue and I think the more specific you are, the better chance you'll have of succeeding. And so the RFS, for example, provides credits to biofuels that are used as transportation fuels, and then defines transportation fuels extremely broadly. It's basically everything except oceangoing vessels. A lot of those sectors, a lot of the sub sectors of the transportation market, have a handful of different options that can be used to decarbonize, particularly light duty vehicles. We don't need biofuels to decarbonize light duty vehicle segment of the transportation sector. There are other technologies that can do that.

Jon: So particularly if you are developing a policy that is perhaps biofuel focused, and you're trying to figure out what to do with it. Probably the best market to focus on is aviation. Aviation more so than pretty much any other segment of the transportation market, needs highly energy dense fuels, which makes it difficult to think about how you would decarbonize aviation with batteries, or even with hydrogen or ammonia based fuels. Biofuels are energy dense, and so to the extent that there are very low in zero carbon biofuels available to us, they should probably be used for the aviation sector. The question is how much of those low zero carbon biofuels might be available? What we've learned after a couple of



decades of experience with biofuels is that the best way to achieve those emission reductions are to use waste based feedstocks, rather than feedstocks that require farmland land to be grown.

Jon: We don't know how much of that is available to us to make biofuels, but it's not like it's going to overwhelm the aviation industry. The US Energy Information Agency projects that the energy demand from the aviation sector in mid century, in 2050, is eight times larger than the amount of energy that's in the biofuels that are currently produced around the world today. So it's impossible for me to foresee a scenario in which the biofuel industry can grow eight times without being wildly unsustainable. So I don't think by targeting the biofuel industry at the aviation sector, we're in any way hobbling their room for development. So that's a closely targeted policy for researching, developing, and then potentially deploying biofuels into that market to me makes a lot more sense, than the very broad based, amorphous lack of targeting that we see with the RFS.

Joe: Right. Maybe people were highly sensitive to this at the time, but certainly in retrospect, RFS turned out to be a bit of a blunderbuss. In the sense that it was inefficiently designed, and as it turned out, uncertainty plagued mechanism for providing subsidies to the ag sector. It was a big element of so-called energy independence that we were trying to achieve, and in RFS2 there was a greenhouse gas component. I guess you could argue, at the time that reflected the coalition that needed to be put together to support it, but it seems every time you would introduce an additional, I want to say exogenous policy objective, you're decreasing the likelihood that any one of the policy objectives in the basket is going to be well achieved or achieved at all. Just looking at how the program has been implemented in say, the last five years, it seems to be a pretty terrible way to provide ag subsidies, because there's so much uncertainty. And EPA is mandated to reshuffle the deck every year, in a full dress rulemaking process that's not necessarily well suited for speed and certainty.

Jon: I think that's exactly right. And the policy challenge is finding that coalition of support while pursuing the development of a policy that sort of appropriately targeted. That's the reason why I think the aviation sector is a potentially interesting redirection for biofuel, because it's huge.

Joe: It may be big enough so that you don't have to go find, not necessarily, allied sectors to drag into your coalition. I mean the reason that I think this is really important to pin down is, before you even get to Congress, and before you even get to a discussion of how you put a coalition together, or what a congressional coalition would look like, there's inevitably going to be, in fact, there is a lot of study, a lot of discourse about the kinds of policies, and the kinds of policy instruments that people should be thinking about before they head to the Capitol. And it seems to me that, again, the technology forcing features of RFS,



particularly the advanced biofuels and cellulosic biofuels components, are going to be a magnet for discourse about, well, can you really do technology forcing policies? So I think what you're saying is important. There's a good design in there somewhere. That's where the focus should be.

Jon: And I think that that brings me to the second lesson that I mentioned a second ago. We already discussed this to some extent, which is that you need to make sure that your policy doesn't lock in incumbent fuels, or incumbent technologies. And the problem with the RFS, is that the benefits were largely tied to the development of cellulosic biofuels. That hasn't happened. And so we've been left with biofuels that preexisted the RFS, essentially corn ethanol. It's being produced in ways that are more efficient than they were in the early two thousands, but it's essentially the same fuel with the same meager benefits, and the same problems. And the way that I think you avoid those types of problems, whether it's in the biofuels context, or some other alternative fuel development effort, is to sequence your policy making and your policy implementation so that the first thing you focus on is innovation.

Jon: You look at the landscape and you say, what are we missing? How are we going to achieve our carefully targeted goal? And then put your initial resources and focus into filling that gap and in some respects the RFS did that. They understood that to really get emission reductions we were going to have to depend on a better type of biofuels, cellulosic biofuels, but they didn't create much of a mechanism to promote what was then a non-existent technology. The program essentially depends on market pull, which has proven to be insufficient. And so what I think you need is a federally funded RD&D effort to push those fuels into reality. And there's a handful of different mechanisms you can use to do that, but essentially you're paying technology developers to build the technology, and then demonstrate that it can be deployed in relevant commercial settings. Once that's done, then your market pull policies, like the RFS, make sense because there's something to pull from. There's a roster of technologies that can achieve the goals that their broader decarbonization technologies are focused on.

Joe: Let's pause there, because there's a cheap irony. If you think back to what was going on on the Hill around climate policy in the mid two thousands, you did have co2 or greenhouse gas emissions limitation bills of the McCain Lieberman, and then Lieberman Warner ilk. In fact, Lieberman Warner came to the floor in 2007 for what amounted to three or four days of debate plus a test vote, the same year that EISA was passed.

Joe: The dodge, if I can put it like that, that the Senate was always in love with, was the supply side technology push. Regulation, putting a limit on co2 emissions, is a species of demand pull, and Congress was just politically allergic to it. So folks were always running forward saying, "No, let's just put more money on the



supply push." So it's ironic that when Congress actually enacted something, it cast itself against type by putting in a mandate that fell into the demand pull category. So the question I have about EISA 2007 is, were their supply side titles, were their technologies subsidization titles, or was it all kind of different forms of if we demand it, it shall be invented, type approaches.

Jon: That's an expansive piece of legislation, nearly all of it. I don't know of any elements of the bill of the law that were pushing the development of biofuels.

Joe: Basically we'll define the goal line, and we'll leave it to the private sector, and other incidentally implicated components of the public sector to figure it out.

Jon: Right. It understandably may have felt sufficient at the time, because it was such a big engine that they were turning on. I mean, there were 16 billion gallons of this stuff within 14 years.

Joe: It was a huge magnet. It just didn't happen to be enough metal in the landscape.

Jon: Exactly, exactly. That was the shortcoming. My view, and Clean Air Task Force's view, that the demand type, the pull type policies are easier to enact, when policymakers are comfortable with that. There's actually a pathway to meeting that demand. And so that's why we think those push technologies need to be sequenced beforehand.

Joe: I guess as a Clean Air Act lawyer, I would say Congress kind of figured that out, because it said to the EPA, you got to periodically set these technology based standards, and if you will create a demand for them by requiring sources to put them on. But the technologies that you based the standards on actually have to be adequately demonstrate to work. So Congress knew that it needed that kind of ambidextrous policy architecture. That you had to simultaneously create the demand that was reasonably well aligned with a level of confidence that the technology was there to meet the demand. And apparently the authors of EISA 2007 forgot what the authors of the Clean Air Act Amendments of 1990, apparently knew.

Jon: Ideally, policymakers will get around to actually legislating seriously about these issues. Ideally, from my perspective, you would do both at the same time. You would say, we're going to invest heavily in research development and deployment of highly innovative technologies, and the reason we're doing that is because five years from now we're going to have an LCFS, or some other pull type technology take effect. But you don't want it to take effect before you have the options that could actually get you on that trajectory down to zero. So I think signaling both at the same time probably makes sense, but there needs to be some staging.



Joe: I think that's an important lesson. Because again, from my own narrow frame of reference, you know when you have technology based standard requirements in a statute like the Clean Air Act, the legislature gives the executive branch of the government the job to actually discern that harmonization, before it can create the demand. And in retrospect, it's both totally understandable why Congress would have just attended to the demand side. On the other hand, given how much policymaking we'd already been doing in this area, generally for at least an entire generation, it's also at the same time surprising that Congress forgot to do that. Anyway. Next lesson, professor.

Jon: It flows from the conversation we were just having, because one of the flaws, perhaps, of the RFS is that despite creating this giant wheel of demand for cellulosic biofuels, Congress also built some relief valves into the program, in case the production of those cellulosic were to become too expensive. These cost containment measures, which is a really sensible thing to do in general. However, there are critics of the RFS who believe that those cost containment measures are too easily triggered, and that it allowed the regulated entities to sort of opt out of the system at a very small price. And so the lesson from the RFS, is that policy durability, and policy certainty is incredibly important because what we're talking about here is incentivizing the development of technologies that have a lot of technological risk. If they weren't risky, we wouldn't need policies to promote them. And the way you're going to get investment into that sort of product, and that sort of technology, is for the public to help partially de-risk those investments.

Jon: And to do that, the investors, the people who are moving that capital need to know that they're not going to have the rug pulled out on them, when they haven't yet paid off this massive alternative fuel refinery that they've built. And so the problem, so to speak, with the RFS was twofold. One, there were these relief valves. Essentially, these cost containment measures with respect to cellulosic biofuel, which are perhaps too easily triggered. The other is that the program was enacted in late 2007, implemented in 2010, and it creates this schedule of annual compliance volumes. That schedule only runs to 2022, in 2022 EPA is assigned with responsibility for the program, which means that essentially the president can decide what's going to happen, at that point.

Jon: And for a lot of investors that was a risk that they couldn't manage. The possibility that they would invest in something as complicated as cellulosic biofuel production, and depend on a program to create a market for it, if in 2022 that market could be ended. So that's been a big deterrent to investors putting the kind of capital that's probably needed to really figure out whether, how much, and what types of cellulosic biofuels we can produce.



Joe: I don't think this methodology could ever be brought into existence, but you can imagine one where if you're designing a program that has sunset features, and safety valve features, and you reach a point where there are so many of them that very de-risking that you're trying to achieve actually introduces other forms of uncertainty that just reshuffle the risk. Notwithstanding the fact, in some cases you're reallocating it to the public. If you have too many of those, it's like a tell that maybe over-weighted the technology forcing, or demand side part of the equation. There's probably a sweet spot where, middle range of safety valves and flexibilities, and let's say overall program expense guardrails is the just right, is the sort of Goldilocks amount.

Joe: 2022 is like a latent sunset horizon that just a few years into the program, comes before the investor's analytic horizon. If you stick something like that in a program, you're telling yourself that maybe there's a flaw in the core design, or if every single year, some third party decision maker has to revisit whether the nominal requirements can actually be implemented. If you have a profusion of safety valves maybe you have to go back to the drawing board, look at the core program.

Jon: Yeah, exactly. It suggests that you're sort of grasping in the night.

Joe: I mean it takes us back to the other lesson you identified, which is, as difficult as it is at the point of inception, the harmonization of the supply side and the demand side. It really has to be attended to. Even if it takes more work, and longer to get the program enacted.

Jon: The fourth lesson from the RFS is, I think that your policy needs to pursue continuously deepening reduction targets. The RFS sets three reduction levels for different types of biofuels. Conventional biofuels, like corn ethanol need to achieve a 20% reduction as compared to petroleum fuels. Advanced biofuels and biomass-based diesel need to achieve a 50% reduction. Cellulosic biofuels need to achieve a 60% reduction. The problem is that in the RFS, those reduction targets are static. A cellulosic biofuel facility that makes fuel that achieves a 61% reduction, as compared to gasoline, is going to get a credit for each gallon of cellulosic biofuel it produces, for as long as it can produce cellulosic biofuel, and as long as the program is in place. There's no incentive under the RFS structure for it to increase the reduction to 71% or 81% or 91%. the low carbon fuel standard, which is the model that's used in California, British Columbia, and is being looked at elsewhere, and perhaps as a national model, works differently.

Jon: Each fuel type is analyzed and given a carbon intensity score. So it's a measure of the amount of co2 emissions associated with given amount of energy delivered by that fuel or that technology. And the program requires the overall carbon intensity of California's transportation fuel to decrease over time. So that creates



two incentives for innovation. First, if you are producing a fuel that has a carbon intensity of 25 say, and your competitor is producing a fuel that has a carbon intensity that's twice as high, 50. And everything else is equal, you're going to out compete your competitor because the regulated entities can get further down the compliance path using your fuel, than they can use in your competitors fuel. The other feature of the LCFS that encourages innovation, is that each year the carbon intensity reduction is more significant, and so you can't stand still because eventually you're going to become obsolete. And that's important that we don't... It's an important way to avoid the lock in that we discussed earlier.

Jon: Fuels that provide marginal benefits in the early years, will not be able to be used as a compliance option in the later years of the program. Provided that the regulator is committed to really pursuing that trajectory. And California has struggled with that a little bit, but that's not the case with the RFS. If you're producing corn, you're continuing to get credits, even though you're nominally achieving a 21% reduction. The corn industry claims that the lifecycle emissions associated with the corn ethanol the industry produce now are considerably better than they were several years ago. There's a lot of debate about that point. But what's interesting is that a lot of, to the extent that those improvements are happening, they are often happening at facilities that are targeting the California market. Because they're actually getting paid for those improvements in California, whereas the RFS doesn't care, so to speak.

Joe: That seems like a really important point. What's the old expression? Luck is the residue of design, but really only if you have a really good design. So the last lesson is?

Jon: The last lesson is that we should be rewarding fuels and technologies that deliver actual greenhouse gas reductions with a high degree of certainty, as opposed to fuels that we think might be providing us with greenhouse gas reductions, but our sense of whether or not they are is based on highly complex modeling with a high degree of uncertainty. And so I think a program that encourages the use of low carbon fuels, and allows biofuels in particular, to serve as a compliance option, need to discount the compliance options that have high uncertainty, because a lot of that uncertainty is never going to be resolved. So we're going to have to live with it. And so my recommendation to policy makers would be let's focus on the technologies that deliver us reductions that we can actually make. That we don't have to wonder about.

Jon: It's not an either or situation with biofuels. Some biofuels provide reductions with a reasonable degree of certainty, some don't. And the ones that don't are typically the ones that are grown on farmland. And the reason there is because they're growing on farmland, they displace food production, that affects the international food market, and we're not quite sure how the food market



responds. We have models to suggest how it responds, but again, that's where the uncertainty comes in. And if it responds by increasing yields, the resulting land use change emissions are going to be reasonably small. If it responds by increasing the amount of land that's brought into agriculture, at the expense of natural ecosystems like forests, the emissions are going to be very high. And there's just a lot of assumptions that go into the answers that life cycle models produced with respect to that question, and we're never going to know.

Joe: I suspect this isn't the first time this has been said, but models are informative, but they can't be determinative. And the designers of this program cast models into the determinative role. As opposed to what you want and the determinative role, is measurement. Reliable measurement. And if you don't have that, what you may be realizing without acknowledging it is, you don't know enough yet.

Jon: And that's particularly the case with conventional farm grown biofuels, where we're not really sure what the sign is. We might be chalking it up as a reduction, but it might actually be increasing the amount of GHG that we're putting into the atmosphere, and that's not a risk that we should be willfully taking with policy.

Joe: You said something earlier that I think put the finger on it, which is the sense of urgency 10 or 12 years ago about decarbonizing various sectors of the economy, in various segments, just wasn't quite there. And so Congress members who wanted to do something about it, had to really cobble together a fairly disparate coalition, put a lot of bet hedging in, and also do some betting on the come as well, which may have made sense at the time. But now that we've had the benefit of 10, 15 years of what this looks like in practice, it sounds like, at the very least, going back to the beginning of this discussion, there's some pretty good lessons here. That now, when we get to the point of doing 21st century carbon policy, these lessons can be applied with a greater degree of discipline than could have been done 10 or 15 years ago.

Jon: I think so. I certainly hope so.

Joe: So congratulations to the Congress that enacted EISA 2007 for teaching us all sorts of wonderful valuable lessons. Now it's on us to make sure that we apply them. Well John, it's really been great to talk to you not once, but twice about this program because in some ways it was viewed as an extremely important one when it was enacted. The federal government through, at this point too, maybe you could argue three administrations is really invested a lot implementing it, and even if there's no consensus about whether it succeeded from a policy point of view, although it doesn't look like it really did. If you're thinking about greenhouse gas emissions. It certainly seems to have generated a lot of learning, and thank you so much for laying it all out for us.



Jon:                                Yeah. Well, if it doesn't kill us, it'll make us stronger. And I really appreciate the opportunity to have this discussion. Thanks.

Joe:                                Thanks.

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