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Corn Saves America
Episode 6 – Hitting the Wall

Sarah Mock: This is Corn Saves America, a podcast exploring agriculture’s environmental solutions, from ethanol to carbon markets. I’m Sarah Mock.

If you’re involved in the ag sector (which you probably are) you might be thinking that, after six episodes into a podcast about corn ethanol and carbon markets, it’s odd how little we’ve actually talk about, well, the market for corn.

Honestly, I was surprised by this too. Mostly because, reaching out to experts to talk about ethanol, I just kind of expected that everyone saw the RFS and the growth of the ethanol sector the way the ag industry did, as, first and foremost, an agricultural policy.

But when it came to the early years of ethanol before the RFS, to the shaping of the RFS 1 and 2, and even to the building of the sector, it seems to me that agriculture, and agricultural markets, were not at the center of the ethanol world. Scott Irwin, an ag economist from the University of Illinois, does not agree.

Scott Irwin: And from the get-go the RFS has always been to me at its core and its core political support has been demand expansion for agricultural commodities. All of these other goals were out there, but I viewed those as political posturing to attract the political support in Congress from other groups. This was always its core intent was to increase demand for corn, primarily, bring soybeans and biodiesel along for the ride - that's great too, but it was corn and grain farmers, and that's why so much energy has been devoted to it from the corn production industry.

Sarah Mock: As Scott says, it is the dream of every commodity farmer, and every group that represents them, to find some way to increase the demand for ag product. And the RFS, and the federally mandated growth of corn ethanol, got that done for corn.

And man, between 2007 and about 2012, the ethanol sector boomed. Ethanol plants were coming up fast and despite rapidly growing capacity for producing corn-based fuel, the outlook still looked good, for corn farmers, ethanol producers, and even refiners. Ain the early years of the RFS, the win-win-win was going strong. Here’s David and Brent

David Widmar: There was this sprint to sort of get to the initial capacity and the idea that gasoline is this growing piece of the economy. There had never been data prior to 2008 of the U.S. using less gallons of gasoline. As long as the economy was growing and all signs pointed to gasoline usage in 2020, 2030, 2040 being - continuing this linear upward trend, ethanol was going to be able to ride along part of that. And so, gas was growing. Let's just say 2% or 3%

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annually. Ethanol was going to be able to be part of that growth. And that was going to be perpetual growth.

Brent Gloy: If you go back and look at the energy information agencies, forecasts of where gasoline demand was going, it wasn't supposed to peak anytime soon.

Sarah Mock: But it's important to keep in mind the eternal ag truism - the cure for high prices (and high demand) is high prices. Gasoline was expensive and experiencing some all-time high demands around 2007, for context - 2006 was the peak sales year for GM's Hummer - and suddenly consumers were being confronted with unaffordable bills at the pump, while on the doorstep of an economic crisis. Hindsight is 20-20 here, but it's obvious that the RFS wasn't the only factor influencing fuel demand or supplies at the time.

David Widmar: But it's not just, you know, ethanol that came to the table as a supply response to this gasoline problem. It was domestic oil production in the U.S. We got to look back, when did fracking really start to be a thing in the United States? It was probably around 2010 and then 2012, it was starting to become really widespread, that was completely, you know, they actually reversed the flow of those pipelines in Cushing, Oklahoma, instead of pulling oil in from the south in the Heartland, we were moving it from the middle of the country back to the ports. And that was something that would have been completely unthinkable and just in 2005.

Sarah Mock: In a lot of ways, the RFS failed to acknowledge, let alone predict, this exact kind of exogenous factor, let alone that there might be more than one factor putting pressure on liquid fuels. In fact, the growth of the U.S.'s domestic oil production was far from the most impactful change that happened in the energy space at this time. Here's Dr. Aaron Smith from UC Davis:

Aaron Smith: Beginning with the Great Recession of 2008, where people stopped using fuel nearly as much and I think along with the improvements of fuel economy and other things that gasoline use just kind of plateaued and declined in fact, over a period of time.

Sarah Mock: I know Aaron makes the fact of declining fuel demand in the U.S. seem very casual, as people began trading in the Hummer's they bought in 2006 for the new Prius, but as David pointed out, this was in fact A Very Big and unusual Deal - mostly for political reasons. To understand why, remember in Episode 3, when David talked about growing the economic pie? The idea is, a policy that extracts economic rents from one group - in this case, oil refiners and importers - can be justified by policymakers as being less impactful, because the overall size of the market, the pie, will grow. So, even if a new slice has to be cut for ethanol, everyone will get a bigger piece in the end. But of course, policymakers have a real problem on their hands, when the promised pie actually gets smaller.

To understand what happens next, we've got to get into the particulars. To help me do that, I'm going to bring back Scott Irwin, from the University of Illinois.

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Scott Irwin: When the RFS was being negotiated. Rolling 10 years ahead forecast of U.S. gasoline demand - right now we were supposed to be at about 150 to 155 billion gallons a year, which what's 10% of that? 15 billion gallons. What's the conventional mandate - 15 billion gallons. That's how that's, where it came from.

Sarah Mock: You'll note that Scott's idea here doesn't really comport with what we learned from Dr. Hanna Breetz a few episodes ago, I think it's important to say directly, that the truth is complicated and perspective matters. Hanna is a researcher, a biofuels expert, a professor, and an environmentalist. Scott is an ag economist and grew up on a farm in Iowa. They, like all of us, are inevitably biased by their experiences and interpret events and facts in unique ways. The cliché that, there's always three sides to a story - yours, theirs, and the truth - is relevant here. Hanna saw one angle of the RFS origin story, and Scott focused on another. Don't forget to consider both of their perspectives and weigh them by what you know about their biases.

But back to Scott's perspective - Scott here offers some valuable insight into how the refining industry and their allies were thinking about the RFS. The oil industry, at least in part, supported the RFS because they believed that demand for oil would continue to climb, and therefore that blending ethanol wouldn't eat into their profit margins, but would instead remain, approximately, a constant percentage of their total volumes. And estimates at the time, according to Aaron, predicted that percentage would stay below 10% of the total fuel supply.

Back to Scott:

Scott Irwin: So, the projections of gasoline use really drove setting of the initial levels of the mandate. And so that you can at least have some sympathy for the refining industry because they say those were the parameters we agreed to. 10% will work, for the next 10, 12 years and with that, they knew that RIN prices would be really low. They were okay with that. Or at least they were, they could swallow that, would be a way I would put it.

Sarah Mock: We talked about RINs, those tradeable ethanol credits, in the abstract in Episode 3, but a quick refresher, oil refiners or importers can buy RINs, renewable identification numbers, instead of blending ethanol themselves, to meet their obligation under the RFS. For context, RIN prices between 2007 and 2012 stayed quite low, not rising above about \$0.20 cents per credit in those five years, and often falling all the way to about \$0.05 cents. Why was the price so low? Because most blenders were already blending more than their obligation, so excess RINS were plentiful, and ethanol did not yet represent a significant percentage of the fuel supply.

Scott Irwin: But then, due to the Great Recession, and soaring crude oil prices, we saw actual gasoline usage in the United States really take a nosedive from exactly when 2007 when it peaked. And so, we reached the 10% blend wall, starting in 2013. And no one thought that we would get there until maybe 2021, 22 or 23, almost 10 years later.

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Sarah Mock: Don't let Scott's casual mention of the blend wall undermine what a big deal this moment was, not only for the ethanol sector, but for agriculture as well. Ethanol was supposed to be a nearly infinite market for U.S. corn, at least until the then impossibly far away year of 2022. But it didn't turn out that way, and as demand for oil started to plateau, and supplies of oil grew, the RFS's inflexible blending requirement meant that ethanol was now eating directly into the oil's market share, marking a real turning point in the relationship between the energy sector and agriculture.

Scott Irwin: So, the refining industry says, "Okay, all the projections turned out to be wrong. Now we've got to revisit this thing because we only ever agreed to 10%." And so, that's from their perspective, why they're so mad about it. There was no adjustment, and I think that's a legitimate complaint from the refiner side in the RFS debates is that ag was pretty smart about and canny about writing the legislation in a way where it's extremely hard to modify the volumes.

Sarah Mock: We've talked a lot about winners and losers so far, and how policymakers predict who will reap the rewards of a given policy, and who will be saddled with the cost, but what Scott's describing here prompts us to think about a kind of worst-case scenario. What happens when lawmakers get things right, but then circumstances change in unexpected ways? That's what happened with the RFS. It didn't become controversial by way of trickery or shrewd 11th hour politicking, it became controversial, Scott argues, because the stakeholders agreed to different spirits of the law, despite agreeing to the same letter. While refiners thought they were agreeing to share a growing pie, ag agreed to move a specific volume of ethanol, and thus corn, period.

Scott Irwin: To us farmers who are used to an every four-year farm bill and those farm bill parameters are fought and hammered out before in a long process. And they are viewed as contracts. Inevitable numbers that the U.S. government has to deliver on. And pretty much that's the way we have treated what's been negotiated in the U.S. farm bill since 1936. So that's U.S. crop farmers' mentality - you signed a contract in that legislation, meet it. RFS is also a contract with corn farmers. And, you know, to say that conditions have changed and now we're not going to fulfill that contract. "Uh uh, that's not the way things work out here in Iowa." And so, I think that's a deeper insight into the different perspectives of why this is so heated politically, because the two sides look fundamentally differently at what should happen when the initial assumptions of the legislation turned out to be wrong.

Sarah Mock: From Scott's perspective, this is one of the biggest lessons to be learned from the RFS. That if all the stakeholders who might be affected by a policy don't understand and agree on what will happen if the key assumptions don't hold, in other words, if something unpredictable happens, then the policy is likely to be setting the table for an eventual showdown.

The Iron Curtain in the RFS showdown between refiners and the ag industry was embodied in the blend wall, but what exactly is the blend wall? Think of it as Scott's 10% figure - the ethanol

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sector was able to expand production until 10% of the fuel supply was constituted of ethanol, and then couldn't really advance further. That has meant that when the industry reached between 10 and 15 billion gallons of ethanol production, year-to-year growth plateaued to almost nothing.

The moment that the ethanol sector slammed into that blend wall came in 2013, when prices for corn spiked due to drought, and RIN prices spiked as refiners bristled at having to meet high blend levels despite the costly economic conditions.

I talked to Seth Meyer at USDA, who witnessed this moment from the inside, as the RFS's impacts echoed through agricultural and energy marketplaces. He's saw first-hand what Scott talked about a few minutes ago, the idea that the refining industry felt like this wasn't the policy they agreed to. Contrary to Scott's sense that these groups were justified however - Seth argues that these groups simply failed to grasp the obvious and intentional functions and assumptions of the RFS, and the tradable RIN market, it created.

Seth Meyer: A meeting, pretty high-level meeting with folks and a bunch of folks from an oil company saying, "Well, RIN prices were never supposed to be anything other than transactional costs, very low, so people can trade them so we could meet the total." That's ridiculous. That also implies that the blend wall was never going to be a problem.

The RINs are elegantly designed to kind of set the tone. To say, "Hey, is there money to be made for me to blend? Or I've got customers who are much more receptive to blending, can I get them to blend and then sell the credits off to somebody else who may have bigger challenges?" So, from that standpoint, it's really elegant in terms of it being a signal for folks to invest and to blend and push it back to let's find the lowest cost way to achieve this objective volumetrically. The problem is you got the oil company is saying, "No, it's supposed to be transaction costs." No, it was never meant to be that.

Sarah Mock: So, why would oil refiners cling to this misconception? Seth says the answer's simple. They don't want to blend more ethanol. They don't want to pay the cost of meeting the actual mandates that were set. They want to dictate the rules and determine the makeup of the fuel supply in the way that's most profitable to them.

From the agricultural perspective, this desire from refiners seems easy to dismiss, the whining of a trillion-dollar-a-year industry who doesn't want to give up a penny it doesn't have to. But considered from a political perspective, the gripes of the refining sector seem legitimate. Consider a similar hypothetical scenario in agriculture - how would farmers feel if the government mandated that 10% of all crops be grown organically? Or 10% of all harvested acres be planted to cover crops? Such a policy would likely pay some overall economic dividends and might even be desirable as environmental policy, but farmers and their advocates would fight such a plan tooth and nail, vehemently protecting their rights to make their own production decisions. It is not unreasonable that oil refiners should desire and demand the same. Especially as the cost of meeting the mandate rises over time.

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Seth will be the first to admit that there absolutely have been problems with the way the RFS and the RINs system has been implemented in recent years, in part because the price of RINs has become, almost inevitably, political, because the market for RINs is an invention of policy. But despite that politicization, Seth says it's hard for these groups to argue that the RFS is operating in a way that is intentionally unfair.

Seth Meyer: So, when certain RIN prices are very, very high, yes. Folks will say, "That's a cost to me. And I don't like that cost." Even though all of their competitors also pay that cost and all of that kind of works its way through the system. And those people that drive are the ones that do ultimately pay for some of this. They do, they ultimately pay for some of this, but they're also the people emitting the greenhouse gases, right. But those high RIN prices are also the economic signal to figure out how to blend more, or encourage people to blend more, or invest in infrastructure that eventually brings those costs back down. You know, you need that signal to say, "Okay, I can blend this, or I could blend that and oh, but I can capture these RINs." Therefore, "Hey, it's worthwhile to me in a market where RIN prices are stable for me to make an evaluation of whether or not I want to install a blender pump, offer E-85, blend more biodiesel." I can make those kinds of decisions.

Sarah Mock: From Seth's perspective, the function of the RIN market was to act as a signal to investors such that when RIN prices are rising steadily, that's a good indication that investments in renewable fuels will pay off. This is an important point, because keeping investors interested and confident was key to achieving not only the scale-up of corn ethanol production and blending but to leapfrog to the RFS's second generation of fuels. The problem is, because RIN pricing has become so political, the refining industry has put pressure on lawmakers, especially in recent years, to drive down RIN prices with policy and lift some of the burden they face from the RFS.

Seth Meyer: When you come in and you have RIN prices rising, somebody makes a decision that we're going to issue four times the number of small refinery exemptions that we did before effectively reducing the RVO. That's exactly what you're doing. So, you're reducing the blending requirement that pushes down RIN prices. Why the heck would I invest in infrastructure in order to meet a higher obligation or blend extra so I could sell those RINs, if I'm experiencing that kind of RIN price volatility?

At some point that uncertainty leads to a foregone conclusion. You introduce the uncertainty. People don't invest. It makes it harder to achieve means that once you try to get on track and achieve those numbers, RIN prices rise.

Sarah Mock: We'll talk more about small refinery waivers in a future episode, but for now, this volatility and uncertainty in the RIN markets, as Seth says, created a vicious cycle that inevitably undermined the RFS as a policy. It has done a good job scaring away would-be investors, who already saw that oil demand has declined, are now more uncertain about the future returns on

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renewable fuel investments. That's why Scott Irwin says, despite the theoretical elegance of the RIN system, it was likely a mistake.

Scott Irwin: Because it forced management of the compliance onto a relatively small handful of refiners who looked at it as a tax that they didn't want to manage and pass on. And so, they've been mad about it ever since. Economists love the idea of the RIN system, because you use the market, you allow flexibility and all that stuff that's great in the heads of economists and you can make a good argument for, that system working. But I think politically, something that has compliance costs that can, gyrate as violently as RIN prices have. And I say that arguing that the RIN market is actually quite efficient at doing what it's supposed to do that I think that politically that's a mistake.

And it's better to have the obligation spread across a lot more people that it doesn't hit their business as significantly. In other words, politically, it's easier to just have mandates and not allow something as complicated as a RIN market to do the compliance.

Sarah Mock: Scott argues that the RFS would have been able to dodge this issue with a familiar idea - one we've heard now from both Dr. Aaron Smith from UC Davis, and Aldyen Donnelley from Nori.

Scott Irwin: Something as simple as just changed the law, everybody has to use 10% ethanol. Have a blend percentage mandate, and if you're not doing that, you're out of compliance and we're going to spot check around the county. The EPA is more like the IRS doing audits then.

Sarah Mock: You'll note that all of the experts who have recommended this simpler alternative to the RIN markets, don't offer it as a way to avoid the blend wall. In fact, this idea obviates the blend wall instead, making it more of a blend finish line than a wall.

This is a powerful reframing, because it forces us to consider whether the blend wall is an artificial battleline created by a refining industry that's seen its sales flag, Or whether it's a realistic or even natural ceiling for ethanol as a market. The problem is agriculture and the ethanol sector have spent a lot of time and money over the last several years arguing that ethanol should not only compose 10% of the liquid fuel market but could easily make somewhere between 15 and 85%.

These higher blends have not become ubiquitous in the way that E10 is, for a number of reasons we'll dig into in a later episode, but it's interesting to note, as Kerry did – that Kansas farmer from last episode - that the difficulties faced by higher ethanol blends were not exclusively the fault of the oil sector, because behind the big baddie that is Big Oil or Big Energy, is the everyday consumers who need fuel, power, and heat.

Kerry Rose: When they started promoting E85, I didn't think that was going to work real good because you, it's not just in fuel, but in about anything people, yeah. They're strongly in support

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of whatever, but when it comes down to it, will you pay any more for it? And no. Most things, no. Yeah. We want green energy, or we want renewable fuel, or we want organic sweetcorn, but how much are you going to pay for it? You know, extra. That was a problem with E85.

When we first got our first, the E85 pump here locally it was a big deal. And at that time, it was cheap. It was a problem. It was enough cheaper that people were putting it in any car instead of a flex fuel. And that was a big concern of the industry that, you know, “Hey, we can't have people doing that and messing up a car and then giving us a bad name.” But then when corn got high and ethanol got high and gas got cheap later on, well you find out, yeah, everybody liked the E85, if it was cheaper, but, well, I'm not going to. I'm not going to pay well, the same price, cause you're going to lose maybe a one or two of MPG.

Sarah Mock: The timing here was pretty spectacularly bad, for corn prices to skyrocket right as blending requirements were reaching new peaks, and supply of oil was growing while demand was falling off. The locus of these four events not only created the blend wall, David argues, but locked it in and made it hugely controversial.

David Widmar: No one could have predicted in 2005 or 2007 was that the gasoline market, for the last 10 or 12 years has been flat. That was not in the cards at all. In fact, the whole idea was they were drawing lines into the future, and saying, “How are we ever going to get there?” And so, ethanol was going to be part of the solution, we were just going to add this thing that was going to help us reach our goals. And then it kind of turned into like, “Okay, now I have to tighten my belt here and I got to make decisions.” And now this mandate is forcing, gasoline that we would like to sell, but now we've got to trade it off for this ethanol. And so, I think the debate kind of got shifted there and it really became a behavior shift. I do think there was a big switch in how the argument got started or how that, how ethanol was going to be proceeded. It went from sort of a solution to a competitor.

Sarah Mock: We'll talk much more about the many public and popular arguments against ethanol that emerged during this time, but for now, how do we take all of these different perspectives - Scott Irwin's misaligned oil refiner and farmer, and Seth Meyer's intransigent blender. The investor made uncertain by RIN price volatility, the more energy conscious consumer, and the politicians that sincerely thought the pie would grow - and make sense of this situation?

According to Brent, all of these disparate perspectives and arguments come down to something, actually pretty simple. He argues that, though there are some legitimate technical issues with the way the RFS was set up, the real problem at the heart of all of this, is just the cost of compliance.

Brent Gloy: When you have a new market, it's really hard to know exactly what the cost of compliance is going to be. And probably everybody has an idea that it won't be too bad,

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otherwise they probably wouldn't get the policy through because somebody would have screamed so loud that, they couldn't push it through.

So, I think it's one of those things it's really hard to know until they do it. But economic theory would tell you that the cost of compliance should fall over time as people get more efficient and better at it and all those other kinds of things. So, I was thinking it was one of those unknowns that, it was just really hard to estimate until you actually see the market functioning.

Sarah Mock: It's notable here that the cost of compliance should fall over time because companies who have to pay the cost, will find ways to minimize it, or pay it more efficiently, in the long run. High short-term costs, in fact, create even more incentives for them to do that quickly. But what happens then, when the market is functioning, and the cost of compliance is realized? Especially when it turns out to be higher than predicted, which it often is, Brent says, people get mad.

Brent Gloy: The reality is that people don't like change and they especially don't like change that costs them money and they really like feeling good about things. And so, we love to do things that we can tell ourselves will change the world and cost us, absolutely nothing or, pennies on the dollar. It makes us feel good, but then, it's like every now and then the true believers, reality comes crashing down. I go, "Oh my gosh, cotton bags, aren't saving the world." And we're ending up in this situation that, "Oh, we're not using plastic bags anymore, but maybe cotton bags have lots of problems too." And "Oh my gosh, I can't believe that. I need to find, you know, another simple thing that's going to save the world." and my mind, but it's not really going to do it because if you really want to, change all this stuff, you've got to do things differently. And if the different thing was, cheap and easy, everybody would be doing it already.

And so, I just think there's a ton of that going on, where, you know, we find that, oh, complying with this is actually costly and that kind of stinks. We'd really like to do what we were doing before. I just think that human behavior is just that, it's, we tend to find the things that, are really cost efficient and easy and cheap and, deviating from them is usually costly and either monetarily or time or effort or whatever. And so, we don't like to go back to those things.

Sarah Mock: Brent's argument here focuses on the individual level here, but he thinks these same desires are obvious in the debate around the RINs market and the effectiveness of the RFS too.

Brent Gloy: The other issue, which is, they just cost more than they should. And that's really the cost of compliance so that I don't see as a problem. I still find it funny that, that people are upset when the RINs have value, especially if they have to buy them. So, they don't want to pay for the compliance is great when it's cheap. So then, the real problem does come in when, everybody tries to talk to their congressman to see if there's a way around it or find an EPA administrator somewhere that will offer you a way to get around them.

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But I think the RIN market, to me, has worked aside from the fact that, they're always monkeying with it - if they'd just leave it alone, you know, it's like changing the rules of the football game, halfway through that. The fact that they cost something that means that the market is actually working so that, people have to, are having to change behavior to abide by the Renewable Fuel Standard.

Sarah Mock: Brent points out again, as have others, that the point of the RIN market was to make compliance with the RFS cheaper and easier for blenders. But by continuously adjusting the policy, by granting waivers, in particular, their whole function is being undermined.

David agrees, he thinks it would be a mistake to assume that Congress simply didn't know or hadn't predicted that the RIN market might be volatile, or that ethanol might not always be cheap and easy to blend.

David Widmar: I don't think it was lost on Congress in 2005 or 2007 that, the cost of these RINs could get very high. In fact, Congress was sort of wanting to create that situation or create that market where, there was as an economic signal for producers to produce more ethanol at that point. The goal wasn't sort of to minimize compliance costs. The goal was to produce gallons of ethanol and in this scenario, if the technology or the cost of production or the returns to ethanol were low, this would be the economic incentive to get those gallons produced.

It was actually kind of a creative solution. I think it actually, it wasn't sort of this primitive, off the shelf idea. There was a lot of thought that went into this. And I think it wasn't a perfect solution, but it was a pretty clever solution.

Sarah Mock: David says that this clever mousetrap of a solution, the RINs market - inevitably had its own tradeoffs, but that in fact, the possibility of high RIN prices wasn't a bug, it was a feature, high RIN prices, he says, were to be the economic engine that would drive financing and investment into the renewable fuels space and ensure that the federal targets were met. But the problem was, when corn prices started to rise and oil prices fell, the engine was still working. And though this was still a policy making ag constituents happy, it suddenly looked pretty bad for consumers and energy interests. In essence, he says, the effectiveness of the RIN market comes down to how economically viable ethanol is, as a product, at a given time.

David Widmar: It was hard to get these plants built if corn prices were high, and the price of oil was low or gasoline was low and there wasn't a lot of economic engines for actually running these plants for the sake of running these plants, the RINs could get very, very expensive. And then that would be the economic engine or the revenue stream that was going to make it viable to run these plants.

And so, RINs get controversial when the economics of ethanol sort of by itself, are sluggish and RINs become less controversial as the economics of ethanol production are favorable on their own.

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Sarah Mock: There's no such thing as a perfect model or policy that will allow lawmakers to avoid these situations. But the aim is still to keep everyone, or their key constituents at least, happy.

But can that be done in the face of shifting global conditions? Brent would argue that this is a losing question, the price of RINs is simply the cost of compliance with the mandate as soon as it becomes costly enough to drive change - which was the whole point - people will start to fight against paying. But if policymakers allow companies to avoid those cost, they will be undermining the very policy they implemented.

So, what did we learn from the experience of hitting the blend wall? A couple of key things:

1. Both the spirit and the letter of a policy matter, especially when a policy or market brings together people and industries with competing priorities.
2. When policies create markets like the RFS did, as long as no significant change is required, things will go smoothly. But as soon as the cost of compliance rises to the point that it actually forces change, the market or policy itself is likely to become politicized and controversial.
3. A final key point - when costs of compliance rise, it's not simply the companies who participate in the markets that are affected. Affected companies will inevitably pass through the increased costs to their customers, who can then, in turn, be mobilized against a policy.

By about 2013, the blend wall was reached, and ethanol entered its troubled years, and they are ongoing, more, or less, through today. This story offers some valuable insight on what could be ahead for carbon markets. And a big takeaway is, the difficulty is not determining how a policy or market will work when it has significant and diverse support. The challenge is determining how it will work when most stakeholders don't want it, when it's expensive to participate, when prices are high, and actual change is required. So, the question remains, can ag carbon avoid hitting its own wall? That's after the break.

[[COMMERCIAL]]

Sarah Mock: If you're finding it hard to convert the idea of the ethanol blend wall into something similar in the carbon market, let David excite your imagination with a possible scenario:

David Widmar: What if it works? What if, this whole thing works? And what do we do 10 or 15 years from now, if we have dramatically reduced carbon emissions and that isn't a huge source of demand for our ag resources, right?

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What if there is no longer growth? And so maybe climate change, isn't as big of an issue 15 years from now, because maybe we solved the problem, or maybe we've learned more about a different problem?

Sarah Mock: To expand, what if we spend the next decade building out carbon markets? What if ag tech companies invest millions in measurement technologies and trading systems (which they are)? Congress spends political capital creating an inevitably imperfect standard or market backbone (which they are), and the USDA or EPA sinks countless man hours into implementation and rulemaking? What if farmers sign up (which they are), they start changing practices, carefully tracking their data, and making their businesses more transparent to create credits and earn new revenue streams? What if companies throughout the economy start spending millions, even tens of millions buying up carbon credits to offset their impact, please investors, and brag about their climate smart credentials (which they are)? But what if at the same time, as was the case with ethanol, a lot of other technologies come online that improve other avenues of carbon sequestration, what if consumers and companies simply emit less as carbon costs get passed through to them? What if the world economy acts in unpredictable ways and the worst effects of climate change are mitigated? What then will that mean for the future of ag carbon credits? At best, they look pretty uncertain.

Admittedly, David's idea is not a perfect conversion of the blend wall, as ag carbon is not oozing into an established market, and is not now, or likely to be anytime soon, subject to a mandate. But just because these ideas don't jive directly, doesn't mean we can't use our ethanol lessons to inform the future of ag carbon.

First, what Scott Irwin taught us about stakeholders agreeing to the spirit versus the letter of a policy is critical for ag carbon markets. We've talked extensively over the past few episodes about the difference between setting up ag carbon markets that actually reduces the net amount of carbon in the atmosphere, versus markets, like many that exist today, that create and sell credits when farmers change practices without rigorous proof of net, long-term carbon sequestration.

This is exactly the kind of disconnect that existed between farmers and refiners during the pinch of the early 20-aughts. And the result there teaches us that, if one day customers who have purchased carbon credits realize that what they believed they had agreed to - net carbon reduction - isn't what's happening, they could not only walk away from ag carbon markets (with no consequences, mind you, given they are not mandatory), they could become major opponents of the markets themselves, or even of ag's role in climate mitigation.

This is, in fact, exactly how a market or policy can become politicized. And when can we expect that politicization to occur? When the price, or the cost of compliance, becomes high enough to actually force companies to change.

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So, I asked some of our experts, what happens if, in 2 or 5 or 10 years, the price of ag carbon rises? Maybe because outside pressures limit supply, maybe demand grows too quickly. I asked - what if the price of a ton of ag carbon increases by 10x within a year, as RIN prices did in 2013? Will companies, especially companies participating in a carbon market voluntarily, still be interested in purchasing ag carbon credits?

Here's Scott Irwin:

Scott Irwin: Politically that's going to cause a problem. That'll become a focal point. Politically, those high carbon prices. So, I don't know what the answers are exactly, but I think that the main lesson from the RFS is you got to have a compliance system that's simpler.

Sarah Mock: Simple, from Scott's perspective, is to avoid the trading marketplace altogether. If, and this is critical, if the goal is actually to increase the cost of carbon - parallel to the RFS's goal being to actually increase the demand for corn - than a better strategy than building a voluntary market where price spikes, or really any kind of price volatility, could unseat the market, make compliance simple. For example, require top emitters to purchase some minimum amount of ag carbon offsets. But given the assumed motivation I just outlined, the idea that at least one of the purposes of a carbon market, if not the essential reason for having one, is to increase the price of carbon, is not a foregone conclusion.

Here's Aldyen Donnelly from Nori:

Aldyen Donnelly: Right now, everybody's saying, "Well, of course, no carbon markets are the great thing." Prices aren't high enough for the market to deliver value to the farmers. But the solution is, go with this really expensive way of defining a credit. And it's okay, because carbon prices are going to get up to \$200 or \$300 a ton because that's the social cost of carbon or greenhouse gas emissions.

Sarah Mock: \$200 to 300 dollars per ton? For context, Nori Removal Tonnes, are credits that represent a commitment to remove a ton of carbon from the atmosphere and sequester it in carbon for 10 years, are worth about \$15 today. The cost variation for RINs between their mid-2000 low and their mid-20-aught peak was about 11x-- about \$0.10 cents to about a \$1.10. \$15 to \$300 is about twice as big a swing. The good news for those beyond agriculture, from Aldyen's perspective is, it's unlikely anyone will ever pay \$300 for an ag carbon credit. To explain why, Aldyen uses other historical examples of emission reduction policies that have worked.

Aldyen Donnelly: That is not possibly going to happen. And it's because carbon prices will not reflect the social cost or the impact of carbon. And we saw exactly the same thing happen before when our goals were to reduce our SO2 emissions and NOx emission and get the lead out of gasoline and get the sulfur out of diesel.

In all of those precedents at this stage, all of the experts said that when we create an SO2 market, SO2 allowances or credits will trade for \$2,000 a ton, because that's what all of the analysis said.

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That's the equivalent of \$200 in the greenhouse gas story, except for after seven years of the market operating the average price, anybody paid for an SO₂ allowance was \$150 to \$250 bucks a ton.

Why? Because all of this analysis that says the price has to be really high, assumed everybody who is operating an oil refinery and selling petroleum products will continue and the modeling is reflecting a reasonable analysis of what it will cost to mitigate the greenhouse gas emissions under that baseline business as usual as operating assumption.

So, if they're going to continue to refine and sell liquid fuels, what is it going to cost to get the biofuel component in that liquid fuel offering? So, the really big \$200 to \$300 a ton numbers make sense, right now.

Sarah Mock: This is a little in the weeds, but bear with us. The reason, Aldyen argues, that researchers and economists believe that carbon will have to trade at \$200-300 dollars a ton is because that is the cost to society of the externality created by a ton of carbon.

An externality is the economic idea that there are some transactions in an economy that create affects beyond the two parties involved. Strictly speaking those effects could be positive or negative - but usually the focus is on negative externalities, like pollution. In many cases, economists can actually calculate a specific dollar figure to represent the cost of an externality on third parties. That cost, notably, is never paid by the two parties involved. When one ton of carbon is emitted into the environment it costs society somewhere between \$200 and \$300. Neither the company that emits the carbon - say an oil refiner - nor the parties that benefit - say, people who drive cars - pay that \$200-\$300 a ton cost. If they did, that would likely have vast consequences for how businesses operate and how consumers consume. That, ladies, and gentlemen, is exactly what carbon markets are meant to do. They're meant to create a financial mechanism that costs the externality into a given transaction. In short, if society bears a \$200-300 dollar burden every time a ton of carbon is emitted, the people who do the emitting or benefit from it, should pay the price, rather than having it redistributed across the rest of the economy.

But the point Aldyen is making here is a subtle one. See the assumption that the price of carbon will eventually rise to hundreds of dollars, assumes that an emitter's, be they consumers or businesses, will financially be able to absorb the cost to some significant extent, and thus they'll keep participating in the carbon market, paying to emit more and more, and creating more and more demand for carbon, driving up the price. But Aldyen says that price spike is just never what happens when we've created similar systems in the past.

Aldyen Donnelly: What's happened every time we've done this, when we're serious and we've finally moved from theory to reality - over and over and over again, it costs way less to abandon and write-off the traditional infrastructure and introduce something really, really new.

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Sarah Mock: The idea of adopting something really new is intriguing, but also, seems almost kind of - impossible? I asked Aldyen what it would look like to move the U.S. or global economy away from significant carbon emissions, how disruptive, financially, it would be, and she was ready with some surprising figures about a possible future where fossil fuel companies are paid to abandon or transition their work.

Aldyen Donnelly: I am not advocating exculpation and compensation but when I had to form an opinion about what the price will be - I started in 1999 - and I haven't updated this for a couple of years, and I need to. But annually updating what I call the expropriation compensation costs for the top 50 corporate greenhouse gas emitters in the world. So, take say British Petroleum or Exxon. Assume that you've got unlimited access to capital. So, you're going to buy the company. You're going to offer the shareholders a 50% premium over the highest price the shares have traded for in the last 24 months. Write that number down. Then you're going to pay down all of their long-term debt. Write that number down. So, all of the equity holders are whole. All of the debt lenders to the companies are whole, which means they're now sitting on huge bank accounts, full of cash, looking for how do I invest it and do something that is earning me a return? Assume that if you're going to lock in their fossil fuel reserves and shut down the fossil fuel production opportunities, you're going to have to lay off 50% of their global payrolls. Assume that you're going to lay that payroll off at full pension regardless of age. Write that number down. And assume that the money they've set aside in reserves to rehabilitate their contaminated sites is short what it's really going to cost and multiply that number by four and write that number down.

So, add up all of those costs and amortize those costs over the greenhouse gas emissions, you will have eliminated by shutting in all of those fossil fuel reserves and those assets and curtailing those operations. Amortize those costs over 20 years of the emissions that we've eliminated - that number's never been above \$48 bucks a ton when I've done the analysis every year for 20 years.

Now, again, that's not the whole cost of shifting to the green economy because there's the cost of walking away from the existing asset base and an incremental cost associated with actually getting to scale in renewables, alternatives, blended fuels, electricity storage. So just, you know, to be fair to the analysis - double it, I'm still under a hundred bucks a ton.

Why did SO₂ allowances trade for \$150 to \$250 and not \$2,000? Because it was cheaper to write off the old assets and build different infrastructure, every time. Same with lead out of gasoline, same with, ozone-depleting substances out of refrigerant chemicals. If I looked around the whole developed world, not just the U.S. and Canada, in every successful pollution reduction precedent, we actually got it done for way less than all of the experts, including me, thought it would cost to get it done before we decided to proceed. And I kept saying to myself, "What the hell are we consistently getting wrong?"

And then I learned, looking back at the history is everybody including me, was assuming we're going to bear the cost of continuing to operate those assets to the end of the expected operating

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life and we're going to pay whatever it takes to control emissions, given that assumption. But in every successful precedent, that's not what happened.

Sarah Mock: Aldyen's idea here has some tremendous implications when we think about the future of the ag carbon market. It offers some pretty solid evidence that ag carbon prices are not likely to get much higher, and certainly aren't likely to hit the farm-transforming figures of greater than \$200 dollars per credit. For the ag sector, and farmers in particular, the prospect that ag carbon prices might never be very high is a tough pill to swallow, because in some cases, investments are being made on that specific assumption, that there might be big carbon credit money coming, especially if, one day, a policy is put in place that requires companies to purchase them.

Brent offered some complementary thoughts, that remind us that despite the sheer size and scale of energy markets, they would be sensitive to high carbon prices, which will likely not make them demand more, but instead, as we saw with RINs, is likely to make them active opponents of ag carbon markets.

Brent Gloy: This just massive market, which isn't going to care what the cost, of that credit is in the grand scheme of things unless it gets really, really high in which case carbon offsets, won't be a thing. If the price gets high enough, nobody's going to use them, and we'll move on, society will move on and figure out something else to worry about because, we're never going to make, in my opinion, carbon prices so high that people actually reduce demand.

Sarah Mock: In other words, Brent argues, a potential future price increase of ag carbon markets, is likely to play out just as it did with ethanol - as the cost of compliance, or in this case, the cost of voluntary participation becomes high enough to actually bite, to actually motivate change, that will be the moment when people, companies, everyone will simply stop participating in the market. The low cost of carbon today, Brent says, is a token expense - a worthwhile expenditure for companies to be able to label themselves carbon neutral, without actually changing anything about the way they do business. In other words, greenwashing. But as soon as purchasing ag carbon credits becomes expensive enough to actually pinch into bottom lines, it'll be over.

Brent Gloy: Carbon offsets are great when they're cheap. Nobody would complain about them. If they get expensive, everybody's going to complain about them, want to find a new way to create more offsets because people really don't want to not fly on airplanes and, not have giant server farms and all this other kind of stuff that creates lots of carbon emissions.

Sarah Mock: Brent's point here gets to the third important lesson from ethanol - it's not just the companies who might buy carbon credits that are part of the equation here. The high price of carbon credits, whether the market is voluntary or not, will get passed on to end consumers. So though the group of serious carbon credit buyers may seem small and relatively wealthy in the end, farmers and the ag sector that create and support these credits, will not only be held to

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account by the customers who bought them, but are likely also to face scrutiny from the much larger cohort of consumers who are their customer's customers, who will invariably stomach the cost of credits in the end.

Though an ag carbon credit wall may not be a serious threat to the sectors future, as it were, the risks around misaligning with ag carbon credit customers, and how they might eventually politicize the price and create enemies of its advocates, are very real risks, and certainly in the realm of possibility. Interestingly, perhaps, but from Scott Irwin's perspective, the question of price in ag carbon markets is not his chief concern at the moment.

Scott Irwin: I think you'd better make sure that the science is very sound about carbon mitigation. I'm not sure if our knowledge of soil science is really good enough yet to document that somebody who's paid for X tons of carbon mitigation are really getting it on the contract of acres. So, I think that's going to be - a lot of companies and people applying technology to it, but there's a big difference between, kind of the field trials and, doing this on a widespread scale.

Sarah Mock: Scott's criticism begs the question, is the technology that's needed to measure, understand, and track carbon sequestration in soil, and to connect it to specific practices, actually ready, so to say, for primetime? According to many of the experts we spoke with, the answer is "no." But it's not like we haven't moved to make policy before, without a technology being ready to go. In fact, in some case, lawmakers have used policy specifically to motivate more investment in a technology, hoping to use the power of the public purse to get companies to invest and innovate faster. In fact, RFS 2 was sort of all about that.

Though we've pretty exclusively talked so far about the 15 billion corn ethanol gallons that were mandated, there were actually 16 billion gallons of additional mandate, not for corn ethanol, but for cellulosic ethanol, made from something other than corn starch - how did that work out?

Vonnie Estes: As far as I know, there's no cellulosic ethanol or, you know, plant anywhere that that's running.

Sarah Mock: We'll get into cellulosic ethanol and other broken promises next time, on Corn Saves America.

AEI Presents Corn Saves America is a production of AEI Premium, produced and edited by me, Sarah Mock, with special thanks to David Widmar, Brent Gloy, and Sarah Hubbard.

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