RINs and sulphur credit pricing and economics

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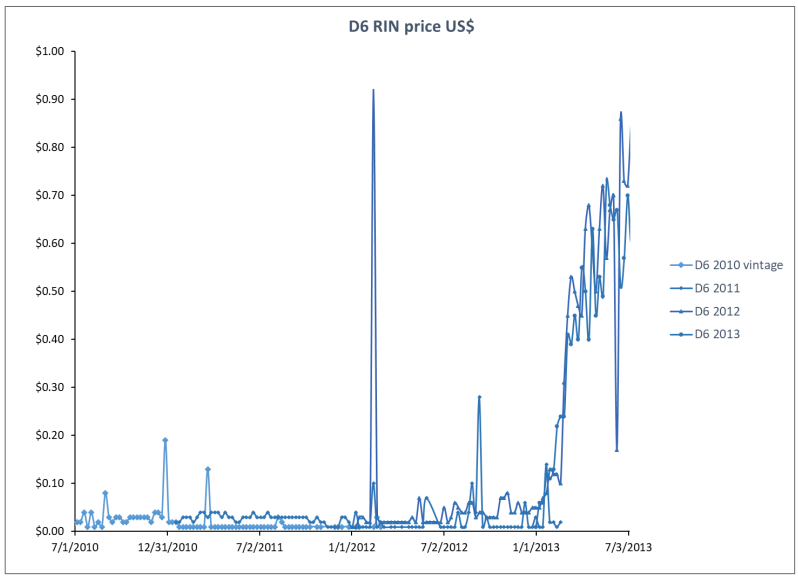
Renewable Identification Numbers (RINs) are credits used to certify compliance with the Renewable Fuel Standard (RFS) which requires certain minimum volumes of renewable fuels to be blended into fuels sold in the United States.

Sulphur credits are used to certify compliance with the Tier 3 gasoline sulphur standard which requires a maximum 10 ppm sulphur in gasoline sold in the United States.

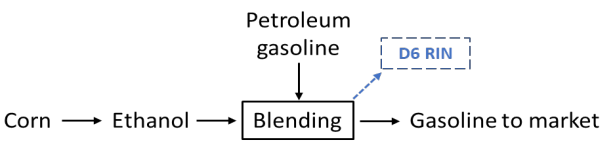
RINs and sulphur credits are traded at prices determined by market participants. The price of the credits reflects the economic forces affecting that market.



In 2013, the D6 RIN price skyrocketed sixty-fold in a matter of weeks, triggering a crisis that rocked the US refining industry and is still affecting the industry today. This article focuses on the events that led to that RIN price explosion, describes the economic factors behind it, and draws a parallel to the similar situation refiners face today with gasoline sulphur credits.

RIN credit basics

D6 is a code that refers to a category of renewable fuels called "conventional" biofuel which is made by blending corn-based ethanol into gasoline. Several other categories exist for different biofuels and production pathways.



In domestic manufacture, a D6 RIN is earned at the point of blending along the D6 pathway (*see below*).

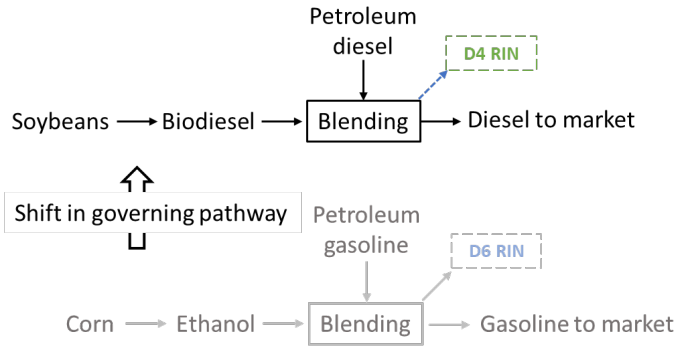
D6 RINs are acquired and retired by "obligated parties" to comply with the RFS's minimum blending mandates. By rule, refiners who produce petroleum gasoline are obligated parties.

By the nature of their business, and by RFS rules, biofuel blenders earn and tend to be long RINs, while refiners take on RIN liabilities and tend to be short RINs.

The RINs market

A secondary market exists in which RINs are traded among market participants. This market enables refiners to purchase RINs from blenders and retire them to meet their RFS obligations.

D6 RIN prices were mostly calm for their first 3½ years of trading history. Then, in February 2013, they hit the boiling point and shot up sixty-fold (not sixty percent!) in 2 months (*see above*).



The D6 RIN boil over

This boil over occurred because ethanol use, which had been increasing steadily through 2010, 2011, and 2012, reached the 10% maximum that is allowed to be blended into "E10" regular gasoline.

Before hitting the 10% limit, the D6 ethanol production path had been running on auto-pilot for years -- feeding corn, making ethanol, blending it with petroleum gasoline and selling it in E10 gasoline. The ethanol was also serving as a cheap octane booster. It was a profitable operation. The amount of ethanol in gasoline was increasing every year, and farmers, refiners, and blenders were content.

But the RFS mandates for future years demanded ever-increasing biofuels volumes. By 2013, the use of ethanol in E10 had grown to its maximum 13 billion gallons per year (this maximum is known as the blend wall), and the biofuels mandates effectively dictated a minimum 13.8 billion gallons per year. We had a 13.0 maximum and a 13.8 minimum. Something would have to change.

Possible solutions

One way to get to 13.8 was to increase production of E85 gasoline which is a conventional D6 biofuel blended with a higher ethanol percentage. Ethanol in E85 is not limited by the blend wall. Blending more of it would generate more D6 RINs, expanding conventional biofuels production and solving the blend wall problem. But this was not a feasible solution because of inadequate E85 infrastructure and end-user demand.

Another solution was to lobby, and/or sue to get the 13.8 billion D6 mandate reduced. That solution was pursued vigorously but failed.

A third solution takes advantage of RFS rules about a different category of biofuels called advanced biofuels. By rule, if advanced biofuels are produced in quantities that exceed the *advanced* biofuels mandate, then those extra advanced gallons also count toward meeting the D6 mandate.

The biodiesel solution

Looking one level deeper into RFS rules, advanced biofuels has its own sub-categories, one of which is *biomass based diesel*, which is coded D4 and generates D4 RINs. Biomass based diesel was also a well-developed business in 2012. Lots of surplus capacity was available to increase biodiesel production along the D4 pathway and blend those gallons into diesel fuel to generate extra D4 RINs. Then, by rule, those extra D4 RINs would fill the 0.8 billion gallon gap.

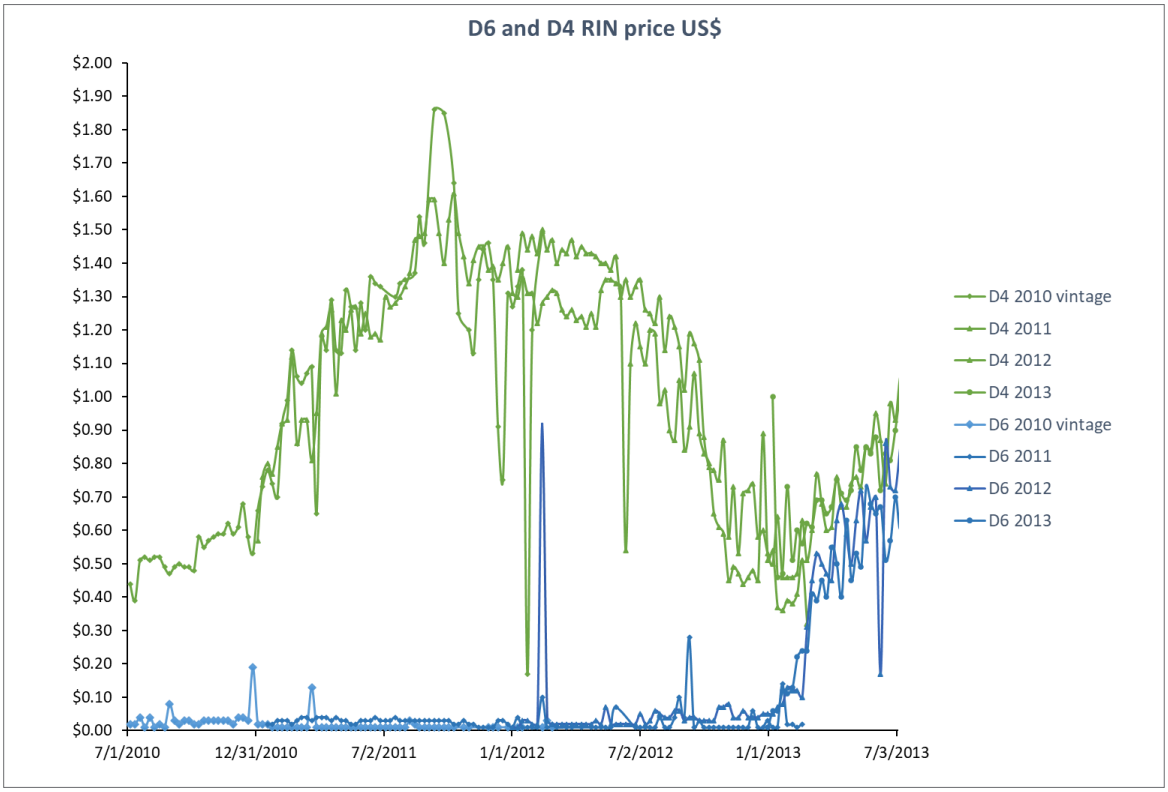
There was no D4 blend wall, and no problem with infrastructure or market acceptance of extra biodiesel volume. Furthermore, by rule, one gallon of biodiesel produces the equivalent of 1.5 D6 RINs, amplifying its effect in filling the gap.

In 2012, it was clear that, without a regulatory/legal solution, this would happen -- extra biodiesel, beyond the mandated volume, would be produced to fill the ethanol blend wall gap, and the resulting D4 RINs would substitute for D6s. And that is what happened. The price of biodiesel was bid up to generate extra biodiesel supply, and the price of D6 RINs was bid up to reflect the blender's higher cost for biodiesel versus ethanol.

Biodiesel economics

Biodiesel is made from soybeans using a different, more costly process than making ethanol from corn (*see above*).

This solution to the blend wall problem meant the pathway governing generation of D6 RINs



would now shift to the D4 biodiesel pathway, and the D6 economics would shift to D4 economics. This would cause a big increase in the price of D6 RINs.

The D6 price chart (*see above*) is seen in perspective with the D4 price. The (blue) D6 price snapped up, to just under the (green) D4 price.

It was like a phase transition where, at the boiling point, liquid water changes to a different state.

Since this price transition in February 2013, the D6 and D4 prices have continued to move in a tight relationship like on the right side of this chart. The D4 is always higher than D6 because a D6 is only worth a D4 when the D6 pathway is saturated with ethanol and the incremental pathway is the higher cost biodiesel pathway.

Is RIN pricing rational?

Research by Scott Irwin, Kristen McCormack, and James H. Stock[1,2] has shown how the D4 price and its variation over time are driven by the price of biodiesel, the price of petroleum diesel, and the status of the blender's tax credit. They are the variables that determine the blender's profit.

By modelling the D4 price from 2010 through 2018, they quantified the economic parameters and showed how movements in D4 price correctly adjust to changes in these variables and anticipate future changes like whether the (on-again-off-again) blender's tax credit will be in effect in the future.

Their research shows convincingly that D4 pricing follows basic economic and asset pricing theory, and that movements in the D4 price are well-explained by rational application of economic fundamentals.

Is D6 RIN pricing rational?

But this leaves the question, *if RIN pricing is rational, why weren't D6 RIN prices bid up sooner in 2012*?

The D6 price snapped up instantly to a new relationship with the D4. A 60-fold price snap doesn't happen in rational, efficient markets unless it is caused by an unexpected shock.

There was no unexpected shock to explain the D6 RIN boil over. The blend wall problem was well known and widely publicised in 2012. It was clear the solution would be either the regulatory/legal solution or the biodiesel solution. And the

biodiesel solution would certainly cause a huge D6 price increase. In fact, with the perspective of a D6-D4 price chart, it would not have been hard to accurately estimate the size of the coming price spike. Why didn't the market anticipate this and start bidding up D6 prices sooner?

My theory is that the parties who had most to gain from that foresight, refiners, were absent from this market in 2012. Refining executives were focused on other important issues like safety, reliability, turnarounds, costs, and ever-changing crude slates. The risk of a looming RIN crisis was not on their radar screen.

Where was the knowhow?

People outside the refining industry understood what was happening in 2012 and were writing about it in real time, questioning why D6 RIN prices were staying so low[2,3]. For example:

- from Reference 2: "*The issue of the blend wall will be evident starting in 2013 . . . the difference between the mandate and the physical ability to blend grows to 1.1 billion gallons in 2014 and 1.7 billion gallons in 2015. . . if the blend wall could not be sufficiently expanded to blend 15 billion gallons of renewable biofuels by 2015, the mandate would have to be met with discretionary blending of biodiesel.*"

- From Reference 3: *the title of the article is: "A question worth billions: Why isn't the conventional RIN price higher?*"

- From Reference 3: "*Reconciling growing mandates, RIN stock-holding, and the blend wall are an important question. FAPRI-MU baselines projected in the past that the conventional RIN prices could rise to the $0.30-0.60 per gallon range, depending on other conditions, if ethanol use is required by the mandate to push through the blend wall*"

- From Reference 3: "*Our fundamental intention is to address the discrepancy between FAPRI-MU RIN price projections that suggest sharply higher prices in the future under certain assumptions, with current conventional RIN prices in the market that appear to rest on some very different assumptions about RINs or ethanol use.*"

These were not unfounded speculations; they were convincing arguments based on hard data, deep understanding, and fundamental economic analysis.

Some consultants within in the refining industry were also following and reporting on the RINs situation[4,5].

Did refining companies have this understanding internally? I don't know. Regardless, it does not appear to have influenced executive suites until things boiled over in 2013. By then RIN expense was already a >$10 billion per year financial crisis that would draw lots of attention, dominate earnings conference calls, and weigh on industry profits for years to come.

A missed opportunity

The data, analysis, and understanding of this issue were available in 2012 for an astute refiner to grasp what was happening and foresee the coming RIN boil over. With that understanding and foresight, refining executives would have acted sooner, implementing strategies to reduce their risk and gain competitive advantage.

I believe the best way for them to access that kind of understanding today is to get it directly from outside experts who are studying the technologies and markets in real time.

The financial consequences of the RIN boil over were offset by the fact that RIN cost is mostly recouped in the price of the petroleum fuels refiners sell to blenders. But that does not diminish the opportunity that was available and could have been captured by accessing readily available knowhow.

Parallels with sulfur credits

The Tier 3 sulphur credit story is like this RINs story but displaced eight years in time.

Refiners were heavily involved with the Tier 3 issue when the rules were developed in 2011 to 2013. Soon after, they considered their compliance options and made decisions on capital investments. Since then, it has been, at best, a back-burner issue throughout the industry.

So far, low sulphur gasoline has been easy for refiners. The production pathway has been on auto-pilot. Credits have been cheap, and the credit market has been quiet.

Gasoline has acceptable profitability, and market participants are content with how the production pathway is running.

Except for a brief awakening of interest in the 3rd quarter of 2019, Tier 3 gasoline has not been on executives' watch lists.

But to shift from 30 to 10 ppm sulphur gasoline, and then make 10 ppm consistently and reliably forever is a big new challenge for North American refiners. Gasoline and octane production pathways will shift in ways that increase costs, impose new constraints, and expose hidden bottlenecks. Opportunities for high-return capital investments will be exposed. This transition is happening now. The shift from the old to a new state can be anticipated, and astute refiners can make better decisions by acting before a crisis hits.

Anticipating Tier 3 economics

As always, refining executives are dealing with important and urgent issues (like safety, reliability, turnarounds, and survival!). The industry is shedding thousands of experienced people, and internal planning capabilities are not what they were.

No longer can every refiner have its own proprietary expertise on everything. For those who don't, it is increasingly valuable to tap into third-party knowhow to help with special issues like this. Such knowhow is readily available and underutilised by refiners who have been accustomed to going it alone.

Hoekstra Trading has a different take on Tier 3. It has been a major focus for us since 2015. Our client group uses shared resources and external networks to dig deep, get critical data, and develop understanding that enables fast, well-informed decisions.

None of our Tier 3 knowhow is proprietary. Our multi-client reports are available immediately to anyone at negligible cost[6,7,8]. They enable refining executives to check their understanding, ensure they are well-informed on the issue, and help their companies anticipate and act before things boil over in a crisis.

References

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2) Irwin, S. and D. Good. "The Impending Collision of Biofuels Mandates with Market Reality." farmdoc daily (2):187, Department of Agricultural and Consumer Economics, University of Illinois at Urbana-Champaign, September 26, 2012.

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7) Hoekstra Trading offer letter Research Report 7, "Gasoline desulfurization for Tier 3 compliance", November 1, 2016.

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