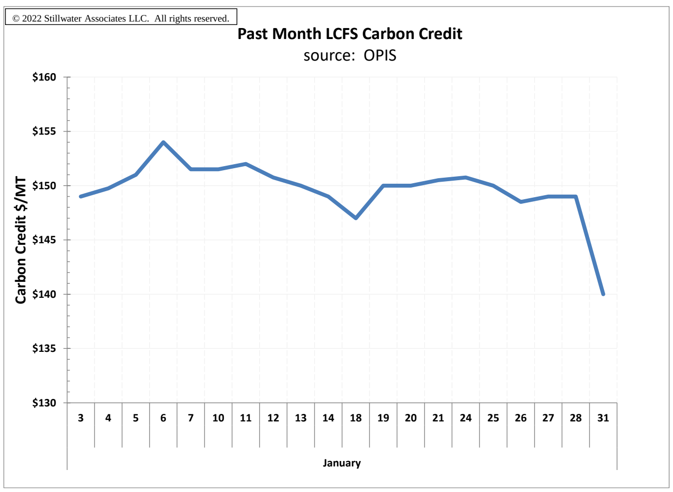
™ Stillwater Associates LLC
Energy Policy | Technology Development | Economics | Mergers and Acquisitions | Litigation Support
...experience runs deep

California Low Carbon Fuel Standard (LCFS)
Monthly Newsletter
January 2022

In this monthly edition…

- **Market:** Credit price decreased to $140/MT; number of trades and volume of credits traded both increased
- **News:** A wave of renewable fuel investment announcements and offtake agreements publicized as the new year opens + New Mexico's LCFS Bill SB 14 passed the Senate and moved to the House
- **Analyses:** 3Q2021 Credit Bank Distribution & 2022 Credit Price Outlook (per Carnac the Magnificent)

LCFS Credit Price Trend

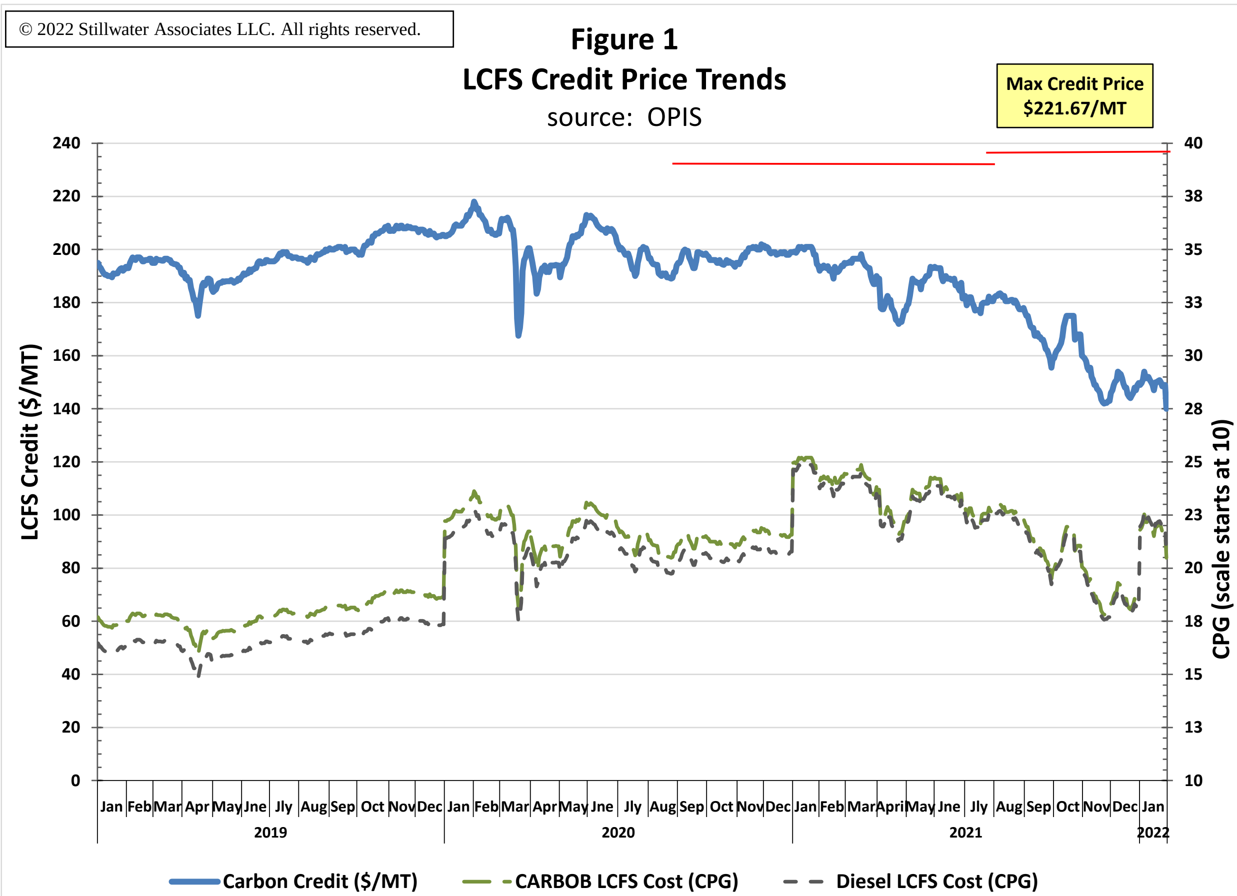


For January, LCFS credit prices ranged from $154 to $140 per metric ton (MT) of carbon dioxide equivalent (CO_2e). The month closed out at $140/MT – $9.75/MT (~7%) lower than December's closing price. The credit price fell sharply on January 31 from $149/MT to $140/MT when CARB released 3Q2021 data showing the credit bank increasing 0.44 million MT for that quarter. For the month of January, prices averaged $150/MT compared to an average of $199/MT for the same month last year. Based on the 2022 benchmark, a credit price of $140/MT correlates to 18.9 cents per gallon (CPG) for CARBOB and 18.9 CPG for ULSD.

In addition to the direct cost of LCFS fuel deficits, starting in 2020 the LCFS program's incremental crude CI provision was triggered, adding additional deficits to all CARBOB and ULSD in California. At a credit price of $140/MT, the January 2022 added cost of the incremental crude provision for CARBOB is 1.54 CPG. For ULSD, the January 2022 incremental crude cost is 1.73 CPG. Given the cost of this additional deficit, the total added cost of the LCFS program for January 2022 is 20.5 CPG for CARBOB and 20.6 CPG for ULSD.

Long-Term LCFS Credit Price Trends

During 2022, LCFS credit prices have averaged $150/MT, reaching a high of $154/MT on January 6th and a low of $140/MT on January 31st. For 2021, the year-average price was $178/MT. With the 2019 amendments to the LCFS program, a maximum credit price (or price cap) was established at $217.97 effective July 1, 2020, matching the 2020 CCM maximum price. On June 1, 2021, the price cap increased to $221.67/MT and will remain at that level until June 1, 2022. Credit price trends for the past three years are displayed in Figure 1 below. Beginning with 2020, the LCFS cost for CARBOB and ULSD displayed includes the cost of the incremental crude provision.



LCFS Credit Trading

Table 1 displays the number, volume, and average price of credits as reported in the California Air Resources Board (CARB) Monthly LCFS Credit Transfer Activity Reports.

Table 1
LCFS Credit Trading Reported by CARB

Time Period		Total Transfers (number)	Total Volume (credits-MTs)	Avg. Price ($ per Credit) Per ARB Report	Price Range ($ per Credit)	Ave Transaction Size - MT	Transactions per Week
CY 2012		24	164,000	$17		6,833	0.5
CY 2013		202	887,000	$55		4,391	3.9
CY 2014		304	1,667,000	$31		5,484	5.8
CY 2015		578	2,852,000	$62		4,934	11.1
CY 2016		929	5,343,000	$101		5,751	17.8
CY 2017		1226	8,875,000	$89		7,239	23.5
CY 2018		1725	13,334,000	$160		7,730	33.1
CY 2019		1656	14,146,000	$192		8,542	31.8
CY 2020		2461	21,728,000	$199		8,829	47.1
Q1 2021		729	6,685,000	$198		9,170	56.7
Q2 2021		616	6,119,000	$191		9,933	47.4
Q3 2021		488	4,352,000	$185		8,918	37.1
Oct-21		434	3,782,000	$182	$148 - $215	8,714	98.0
Nov-21		128	1,125,000	$174	$141 - $200	8,789	29.9
Dec-21		269	3,217,000	$172	$141 - $208	11,959	60.7
Jan-22		358	3,389,000	$167	$140 - $209	9,466	80.8
TOTALS		12,127	97,665,000	$110		8,054	23.0

Number of RPs	Selling	Buying	Both
	185	25	152

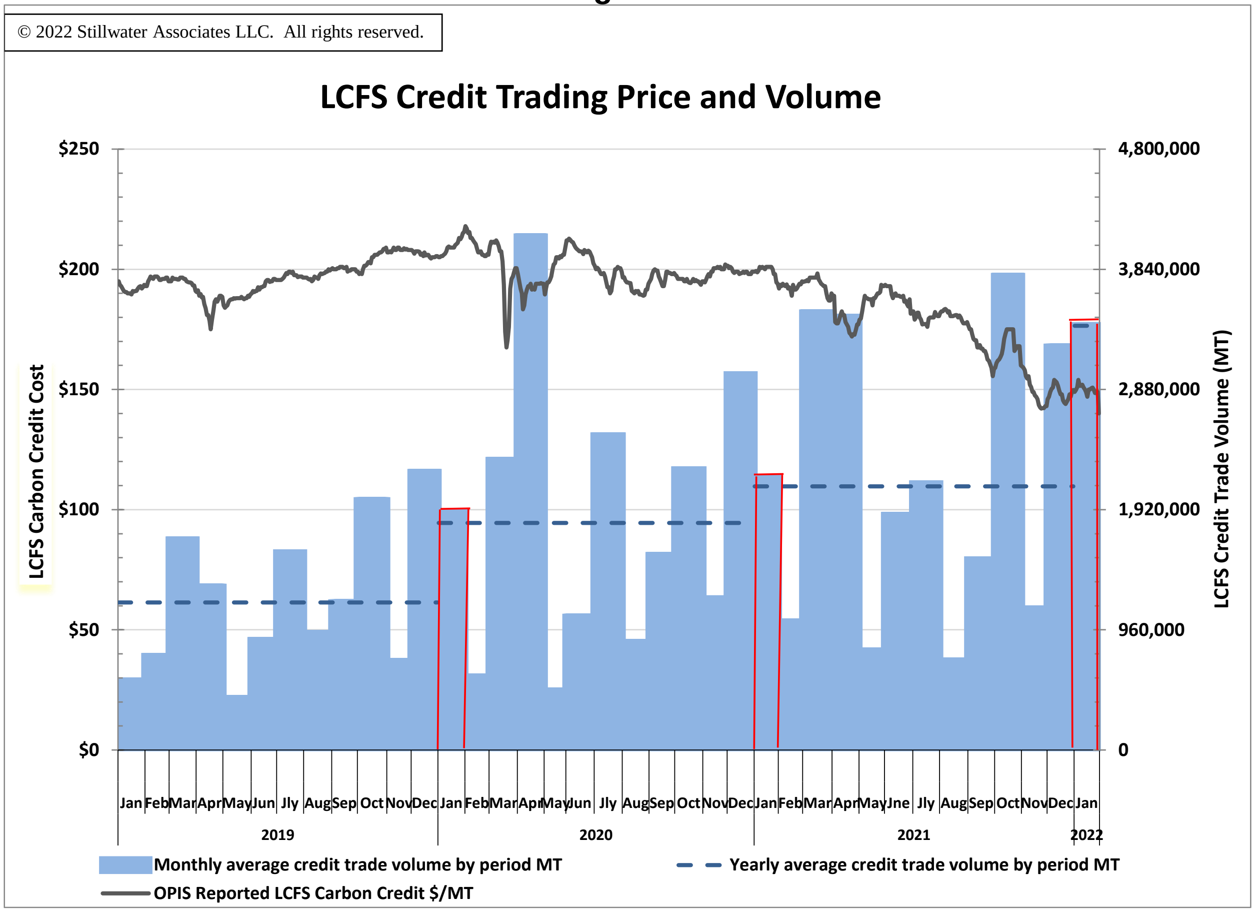
The number of reported transactions increased by ~33%, from 269 in December 2021 to 358 in January 2022. The volume of credits also increased by ~5%, from 3,217,000 MT in December 2021 to 3,389,000 MT reported in January 2022. CARB's reports may include some related party transactions.

The January volume-weighted average price reported by CARB was $167/MT, which is ~11% higher than the $149/MT average calculated by daily spot price reports. At a price of $167/MT, the credits traded in the month of January amount to nearly $566 million changing hands.

LCFS Credit Trading Price and Volume

Figure 2 below graphically illustrates the monthly average transaction values and the volume of credits traded, as reported by CARB, and shows the LCFS credit price reported daily by OPIS. For ease of comparison, the January volumes for each of the past three years are highlighted in red.

Figure 2

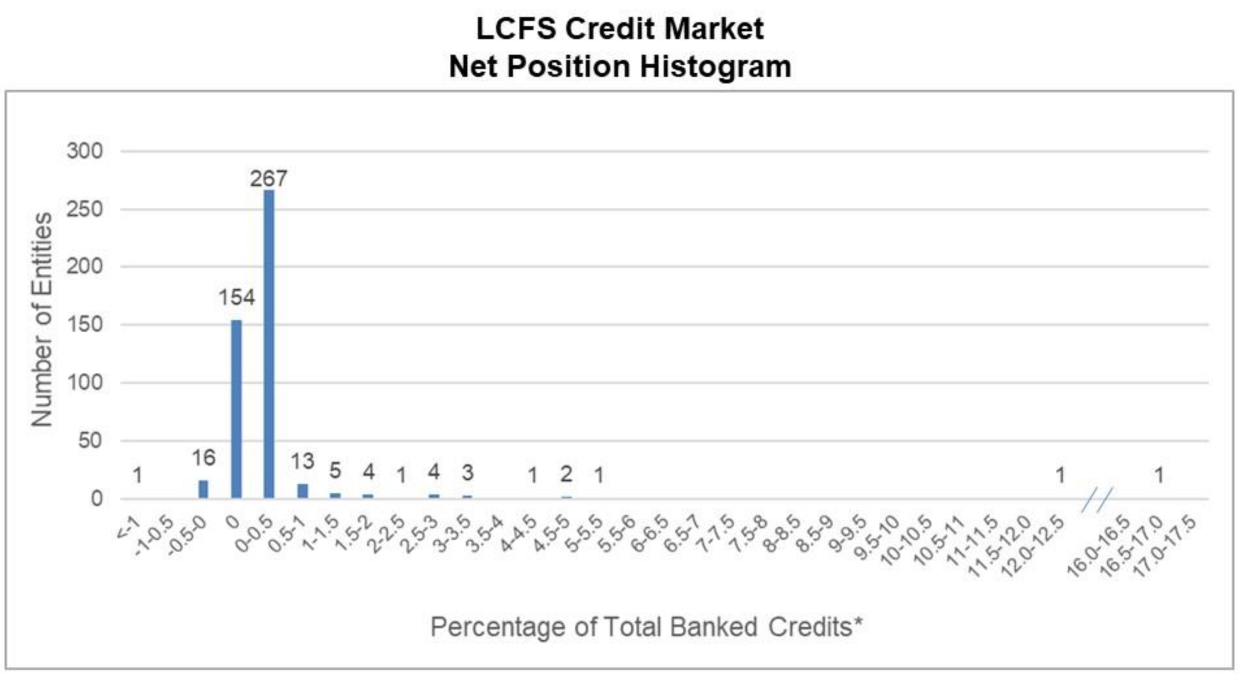


Highlight 1: Third Quarter 2021 Credit Bank Distribution

By Kendra Seymour & Leigh Noda

CARB reports twice yearly (with the issuance of their reports for the first and third quarters for each compliance year) on the distribution of credit holdings. The latest information from the third quarter of 2021 is shown in Figure 3 below. This histogram indicates that credit holdings were highly concentrated with just one entity holding 16.5-17.0 percent of outstanding credits, another sole entity holding 12.0-12.5 percent of the bank, and 95% of participating entities holding less than 1% of outstanding credits. (CARB also reported that 17 entities had deficit positions as of this date, a decrease from the 23 entities holding deficit positions at the end of 1Q2021 but up slightly compared to the 15 entities holding deficit positions at the end of 3Q2020).

Figure 3. LCFS Credit Market – Net Position Histogram (holdings as of 3Q2021)



Last Updated 01/31/22

This frequency plot indicates the number of entities that hold a given percent stake in the overall LCFS credit bank as of the last compliance period. The horizontal axis indicates the percentage of the total bank of credits, while the vertical axis shows the number of entities holding a given credit position. As of Q3 2021, 95% of participating entities hold less than 1% of credits each.

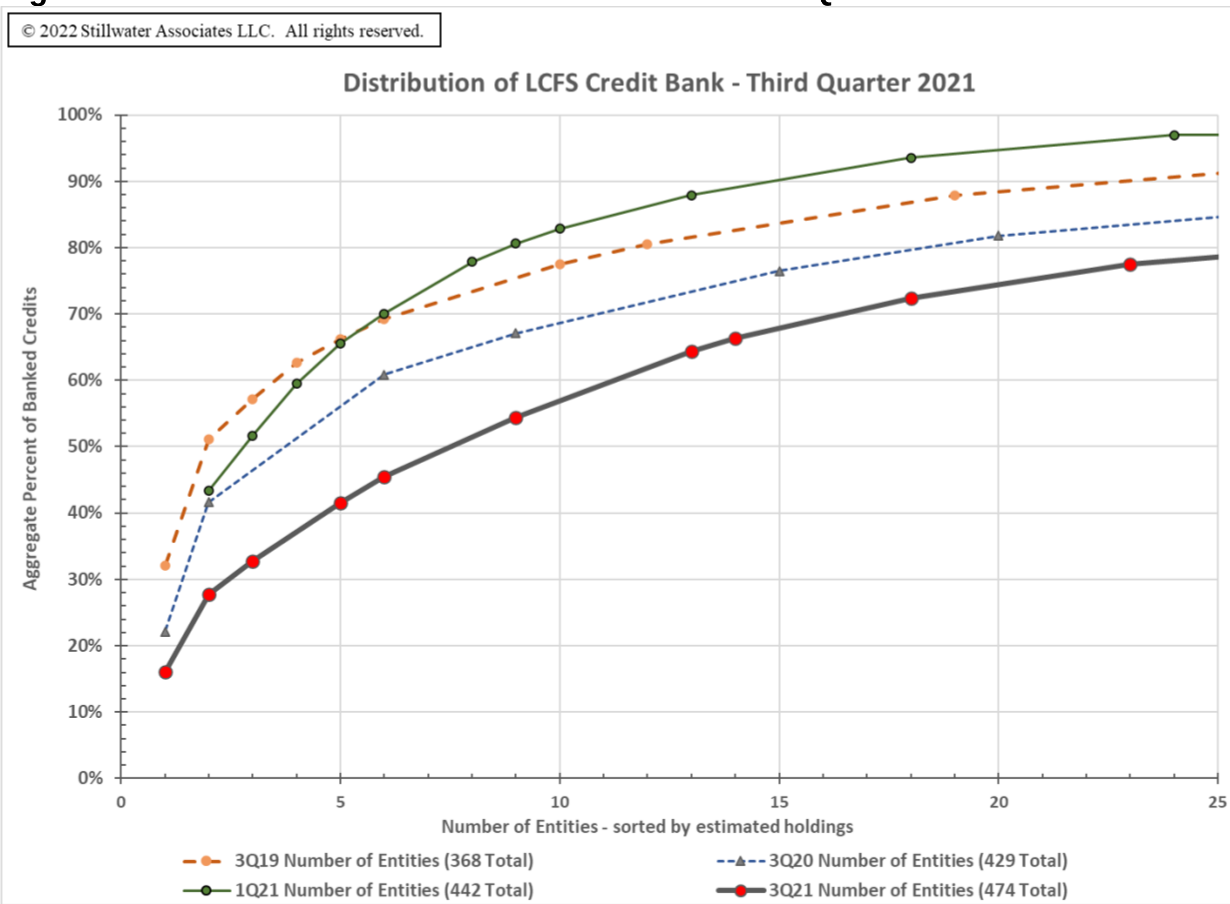
*This represents the percent of the total available credits (that could be used in the future to demonstrate compliance) that is held by a regulated party. Each position is calculated by looking at the total number of credits currently banked across all parties and dividing each party's current credit bank by the total credit bank.

Source: *CARB (https://ww3.arb.ca.gov/fuels/lcfs/dashboard/dashboard.htm)*

At 8.36 million MT of banked credits at the end of 3Q2021 and a price of $150/MT, the credit bank would have been valued at about $1.25 billion. Each of the 457 entities that holding positive credit positions has a portion of this significant sum.

In Figure 4 below, we interpolate the histogram and combine with other information to develop a picture of the credit holdings distribution each published quarter, illustrating the distribution of the credit bank for the third quarters of 2019, 2020, and 2021. A flatter and lower curve illustrates a bank that is more distributed. One that is curved upward and to the left represents a more concentrated credit bank. LCFS deficit generation is concentrated in perhaps a dozen entities with the top five entities generating 75% of the deficits under the LCFS. Correspondingly, we would expect to see a similar concentration in credit bank holdings as these entities accumulate credits to cover their obligations and remain in compliance with the program over time.

Figure 4. Distribution of the LCFS Credit Bank - Third Quarter 2021 and Prior Years



Source: *CARB, Stillwater analysis*

The 3Q2021 credit distribution curve shows a rather dramatic flattening of the curve as there is a sharp falloff of holdings by the top five credit bank positions. Compared to 1Q2021, the cumulative percent of the credit bank held by the top five entities in 3Q2021 fell from 66% of the credit bank to 42%. The 42% in the third quarter of 2021 is also over 20% less than the cumulative top holdings in the third quarter of 2020, 61% for the top six, and 66% in the third quarter of 2019. Note that the majority of the change occurred in the top two position holders' percentages.

A probable reason behind this flattening is that Marathon, Phillips 66, and Chevron began generating LCFS credits through renewable diesel (RD) projects, decreasing their need to hold historically high levels of banked LCFS credits. In addition to these RD projects, some deficit generators also began producing credits through other pathways such as renewable natural gas from dairy and swine digesters.

Highlight 2: 2022 Credit Prices? – Our Third "Carnac" Moment

In our November 2020 Monthly Newsletter, we published "Our 2020 LCFS Scenario – A Carnac Moment" in which we offered a forward view of LCFS credit and deficit performance in the first half of the 2020 pandemic year. In our February 2021 Monthly Newsletter, we published "Our 2020 LCFS Scenario – A Second Carnac Moment" which offered a review of our initial credit and deficit performance projection nine months after publication. This month, we are providing our third "Carnac" moment – this time, looking at LCFS credit ***prices****. In preparing each of our Carnac articles, we follow this Stillwater proverb:*

When you make a forecast, you must realize that it is wrong.
You just don't know in what direction.

With that background … on with the show!

On the screen, sidekick Ed McMahon hands the mystic character Carnac the Magnificent (played by Tonight Show host and personality Johnny Carson) an envelope that had been hermetically sealed in a mayonnaise jar with a question that Carnac is to answer. [1,2,3] Carnac holds the envelope to his forehead and says the following: "$145.92, $143.92, $148.08, and $151.81." The audience is silent and puzzled as they cannot fathom what these numbers mean as McMahon repeats the answers. With the appropriate comic drama and flair, Carnac tears open the envelope, pulls out the enclosed paper, and reads the question to which he had already divined the answer: "The 2022 quarter-ending LCFS credit prices from a survey of Stillwater Associates!!" And the audience roars in laughter. (Just kidding.)

Armed with just the recent and long-term price history, an understanding of the LCFS program, their knowledge and experience with fuels and regulation-based markets, and familiarity with the market and commercial behaviors of market participants, a set of our

[1] "Carnac the Magnificent was a recurring comedic role played by Johnny Carson on The Tonight Show Starring Johnny Carson. One of Carson's most well-known characters, Carnac was a "mystic from the East" who could psychically "divine" unknown answers to unseen questions. The character was introduced in 1964. As Carnac, Carson wore a large, feathered turban and a cape." https://en.wikipedia.org/wiki/Carnac_the_Magnificent

[2] "The Tonight Show Starring Johnny Carson is an American late-night talk show hosted by Johnny Carson on NBC, the third iteration of the Tonight Show franchise. The show debuted on October 1, 1962 and aired its final episode on May 22, 1992." https://en.wikipedia.org/wiki/The_Tonight_Show_Starring_Johnny_Carson

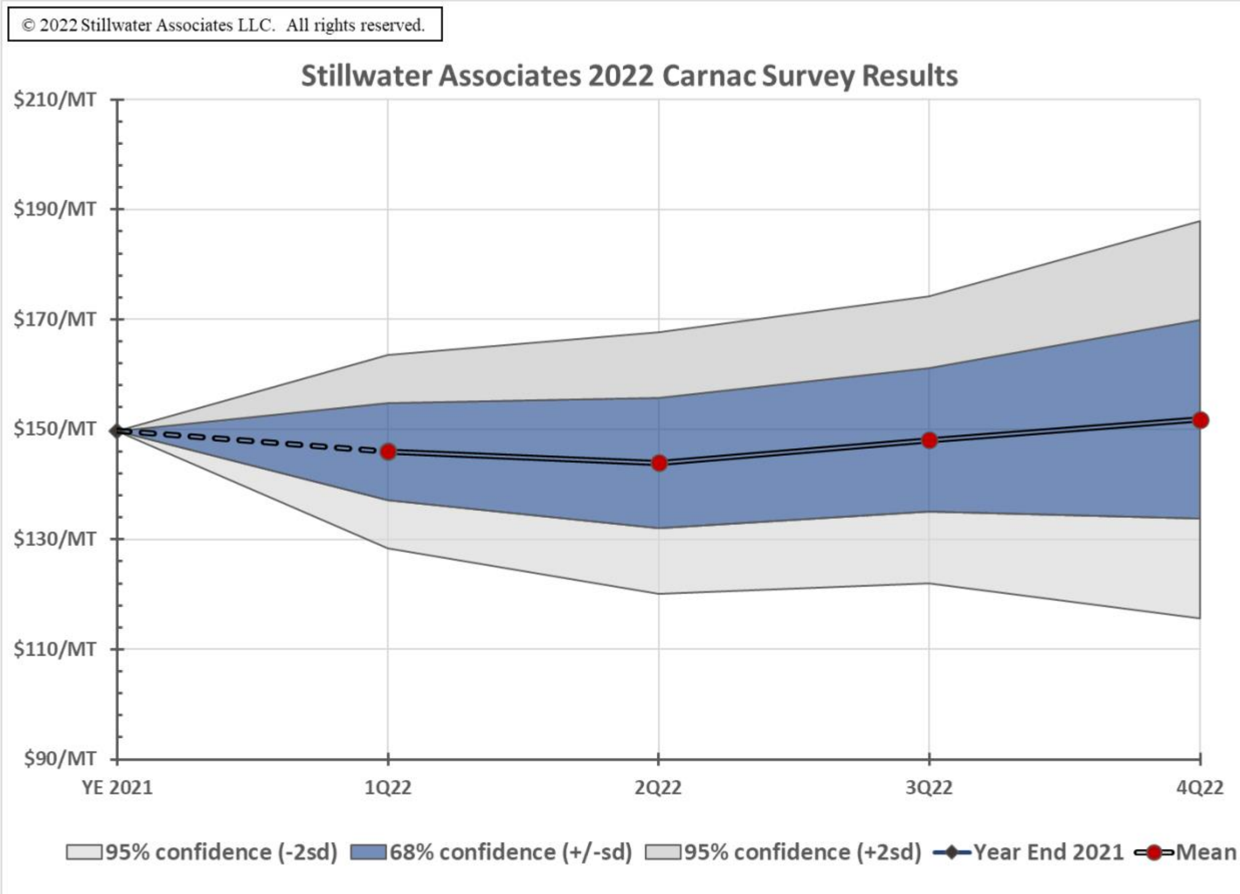
[3] https://en.wikipedia.org/wiki/Johnny_Carson

Associates were asked to derive their own forecasts of what the LCFS credit price would be at the end of each quarter of 2022. The answers that Carnac gave above are the averages of the answers provided for each quarter by the eighteen Associates participating in the survey.
Without a deep quantitative analysis that projects supply and demand of credit and deficit generation by quarter for 2022, a survey like this represents the "gut" feel of our team that is weighted toward the current market. With the potential for significant new credits from more RD and RNG, and deficits from the more stringent benchmarks and the incremental crude CI, a deep quantitative analysis may give better insight. Or maybe not. These things are hard to predict! In any event, 2022 should be an interesting year for the LCFS program and its credit market.

Back to our Carnac results: At face value, the average shows a pretty flat curve from the \$149.75/MT 2021 year-end through 2022. That indicates that we, as a group, feel that current market conditions and supply/demand of LCFS credits will be sustained through 2022. However, not everyone surveyed feels the same. In our survey, some Associates predicted prices as high as \$195/MT, and others foresaw prices dropping as low as \$114/MT. This divergence illustrates that our thinking is not monolithic. Even though our sample size is far smaller than the 30 that is nominally considered the minimum for statistical significance, we do not hesitate to apply statistical analysis to our survey despite what a statistical purist might demand. In Figure 5 below, the average or mean of our survey results is plotted along with a 68% and 95% confidence band. The 68% band is plus or minus one standard deviation from the mean. One standard deviation is generally thought to represent a 68% probability that an outcome would fall within that band. The 95% band is plus or minus two standard deviations from the mean. Two standard deviations are generally thought to represent a 95% probability that the outcome would fall within the band.

In Figure 5, the probability bands are fairly broad and grow broader with each quarter, representing the diversity of views from our Associates even though the averages are flat.

Figure 5. Stillwater Associates 2022 Carnac Survey Results



So, Stillwater's inner Carnac has spoken. We will review how LCFS credit prices progress from time to time in 2022 against this Carnac curve.

Note: We use Carnac to discuss our views of what is difficult to project. For a more rigorous analysis of LCFS credit and deficit trends plus a 10-year credit price outlook, contact us to learn more about our Quantitative LCFS Credit Price Outlook.

Stillwater sees things others miss. We have been tracking developments in California's LCFS and Oregon's CFP and the corresponding credit and fuels markets since the programs' inceptions. Our Associates leverage decades of experience in the transportation fuels industry to provide the insights offered in this newsletter. We are also available to provide more in-depth and personalized analysis and outlooks for our consulting clients. If you find yourself wanting a deeper dive on the subjects we've covered in this newsletter, contact us to learn how we can help.

LCFS in the News – January 2022

- On January 3rd, Argus offered a viewpoint on the shift of the Canadian refinery formerly known as the Come-by-Chance refinery toward biofuels in 2022. According to Argus, Newfoundland and Labrador's Braya Renewable Fuels "will move to capture rising demand of sustainable aviation fuel (SAF) and renewable diesel as it reinvents itself from a boutique gasoline producer."
- On January 4th, Renewable Energy Group (REG) announced that it has acquired Amber Resources, LLC, a Southern California full-service distributor of diesel, gasoline, lubricants, other transportation fuel components, industrial services and additives. According to REG's press release: "This acquisition builds upon REG's downstream participation, growing the company's footprint in one of the most renewables-focused regions in the world. Amber Resources will add over 60 million gallons/year of diesel sales to the company's portfolio and a significant lubricants business as a Shell® Prestige distributor." According to S&P Global, "REG is not alone in looking to add logistic and transportation assets to its asset mix. As demand for renewable fuels grows, more producers have been aligning with transportation and logistics companies to capture the full value chain margins."
- On January 4th, S&P Global reported that Calumet Specialty Products Partners is "moving forward with construction of the renewable hydrogen plant at its Great Falls, Montana, refinery, putting its renewable diesel project one step closer to completion." Calumet's ability to produce renewable or green hydrogen will lower the CI of the RD project and increase the value of the accompanying LCFS credits in California.
- On January 4th, the Weekly Credit Transfer Report for Dec 27 - Jan 2 was posted on CARB's website.
- On January 5th, AEGIS Hedging Solutions announced that it has acquired Emission Advisors, an industry leader that works with companies across multiple sectors to understand, purchase, sell, and retire voluntary and compliance offsets in multiple environmental markets, including California's LCFS.
- On January 7th, CARB released several Tier 2 Pathways for Public Comment. Pathway summaries and all related supporting documents are available on the Tier 2 Comment Website.
- On January 11th, the Weekly Credit Transfer Report for Jan 3-9 was posted on CARB's website.
- On January 12th, the American Coalition for Ethanol (ACE) announced that along with the Great Plains Institute, Low Carbon Fuels Coalition, the National Biodiesel Board (now known as Clean Fuels Alliance America), and Canadian Oilseed Processors Association it had recommended (via a cosigned letter) that CARB recognize the climate benefits of farming practices in the LCFS program. ACE Board Member Ron Alverson separately submitted comments to CARB in response to information requests on land use change.
- On January 13th, S&P Global Platts reported that LanzaJet has "received $50 million in financing from the Microsoft Climate Innovation fund toward the construction of its alcohol-to-jet sustainable fuel production plant in the state of

Georgia as it seeks to meet growing demand for cleaner fuel for the hard-to-decarbonize air travel sector." According to Platts, the total layered value of federal and California LCFS credits brought the average price of SAF to $6.80/gal in 4Q2021.

- On January 13th, Waste360 published a comparison of anaerobic digestion in the EU vs the U.S. (with a special focus on California given the incentives offered there). According to the article: "Prices for electricity generated from AD in the U.S. have historically been far less than in the EU and have not provided comparable incentive for the development of AD projects. However, the financial picture is quite different for producing renewable natural gas (RNG). Recent projects in California are producing RNG and injecting it into the public utility grid. With incentives such as EPA's Renewable Fuel Standards and California's Low Carbon Fuel Standard, the resulting revenues are considerably higher than for electricity sales. These incentives lead to a much stronger business case for biogas production, and if they remain in place and are supported by states and local governments, the long-term growth for AD projects in the U.S. will be comparably strong."
- On January 17th, Hydrocarbon Engineering reported that "Indaba Renewable Fuels will build two greenfield refineries in California and Missouri, US, to produce sustainable aviation fuel (SAF) utilising Topsoe's HydroFlex™ technology."
- On January 18th, Reuters reported that "U.S. refiners and biofuel companies are likely to reach less than half the renewable diesel production projected by the U.S. government for 2025 due to policy and feedstock constraints, according to a study released Tuesday from consultancy Cerulogy."
- On January 18th, the Weekly Credit Transfer Report for Jan 10-16 was posted on CARB's website.
- On January 20th, Brightmark RNG Holdings LLC – a joint venture partnership between Chevron and Brightmark Fund Holdings LLC – announced plans to construct an anaerobic digestion project at Vlot Calf Ranch in Chowchilla, California. The RNG produced at the facility could earn LCFS credits, offsetting a portion of Chevron's deficit position.
- On January 20th, Reuters published an article highlighting a November study published by CARB indicating that newer engines emit more oxides of nitrogen (NOx) – a harmful pollutant that contributes to ozone deterioration and causes respiratory problems – when running on RD, especially when blended with 35% BD or more, compared with conventional diesel. According to Reuters, "these findings could affect the way regulators revise the LCFS, which spurred investment in renewable diesel, made from fats and vegetable oils."
- On January 24th, CARB posted the 2022 annual update to the CIs of grid electricity used as a transportation fuel in California and electricity supplied under the smart charging or smart electrolysis provision. Prior to certification, the updated pathway CI values have been posted for 45 days for public comment. You can submit comments here. The Executive Officer will review and respond to relevant comments received during this period. Once certified, the updated pathway CI values are expected to be available for quarterly fuel reporting for the first quarter (Q1) of 2022.

- On January 25th, the Weekly Credit Transfer Report for Jan 17-23 was posted on CARB's website.
- On January 27th, Argus reported that, according to Valero senior vice president of alternative fuels, Martin Parrish, decreased transportation demand and growing off-road low-carbon fuel use outweighed RD in lowering LCFS credit prices in 2021.
- On January 27th, OPB and the Hermiston Herald reported that Food and Water Watch, an environmental watchdog group, had petitioned CARB to nullify the LCFS credits for RNG produced from dairy manure at Oregon's Threemile Canyon Farms. The environmental watchdog group claims Threemile Canyon was committing air quality violations in Oregon, arguing that this should disqualify the facility from earning LCFS credits in California. On January 31st, however, Agri-Pulse reported that CARB had turned down the petition, arguing that petitions are not a legal mechanism for changing the regulations, which the board adopted through a public rulemaking process.
- On January 31st, Gevo, Inc. announced that it has begun the process of bringing its dairy manure-based RNG project located in NW Iowa online. The project is expected to produce approximately 355,000 MMBtu of RNG per year which may earn LCFS credits in California.
- On February 1st, the Weekly Credit Transfer Report for Jan 24-30 was posted on CARB's website.

LCFS News Beyond California

- On January 6th, New York Assembly Bill 862 (NY A00862) which would establish a clean fuel standard to reduce the CI of on-road transportation by 20% by 2030 was reintroduced into the Assembly Environmental Conservation Committee. An identical companion bill was reintroduced in the state senate. The bill text is currently very brief but indicates that the program would be implemented within two years of enactment, would include opt-in clause for aviation fuels, and would seek to harmonize with California's LCFS and other programs in the northeast states.
- On January 7th, Canada's National Observer published an article highlighting Ottawa's forthcoming clean fuel standard. According to the National Observer: "Ottawa's incoming clean fuel standard is being designed to help curb transportation sector emissions, but critics say the existing draft text waters down climate targets and will lock in years of fossil fuel use."
- On January 10th, the Washington state Senate re-introduced SB 5231, the companion bill to HR 1091 which passed and was signed into law by Governor Inslee last year. In the 2021 legislature, amendments were introduced to make implementation of the law contingent on passing a 5-cent-per-gallon gas tax. When signing, Governor Inslee invoked an amendatory veto, removing the gas tax sub-section of the law so that the bill was no longer contingent on the gas tax. That veto has since been struck down by the state supreme court. This version of SB 5231 seems to be the clean fuel standard bill with the gas tax provision removed.

- On January 10th, Tidewater Renewables Ltd. announced a second sale agreement with a second investment-grade company to sell British Columbia Low Carbon Fuel Standard credits at an average price of $478 per credit that it will receive through the construction of the Renewable Diesel & Renewable Hydrogen Complex at Prince George, BC, at values higher than previously budgeted. Tidewater Renewables also announced that it recently closed a strategic acquisition of a used cooking oil supplier, providing certain feedstock supply for a portion of its renewable fuels production.
- On January 12th, Environment and Climate Change Canada announced its Fuel LCA Model pre-publication package for the proposed Clean Fuel Regulations.
- On January 13th, EnergyWire reported that New Mexico Gov. Michelle Lujan Grisham floated a bill to “require all industries in the second-biggest U.S. oil-producing state to reduce their greenhouse gas emissions, including carbon dioxide and methane, to 50 percent of 2005 levels by 2030. The bill would have the state cut emissions to the equivalent of zero emissions by 2050, using a combination of actual reductions and offsets.”
- On January 13th, the Oregon DEQ announced that, as part of the CFP Expansion 2022 Rulemaking, DEQ will be hosting a series of workshops for targeted discussions around: Electricity, GREET, Biogas and RNG, and Reporting. Stakeholders and the public are welcome to attend. Feedback received during these workshops will be used by DEQ staff to determine whether to move forward with modifications to the existing regulation. The first workshop will be held Thursday, Jan. 20, 2022 1:00 pm – 4:00 pm. You can register to attend here.
- On January 14th the office of New Mexico Gov. Michelle Lujan Grisham published a press release outlining the governor’s agenda for the 2022 session, including: “Setting a clean fuel standard: The Clean Fuel Standard Act will reduce the carbon footprint of New Mexico's transportation sector while contributing $470 million in capital investments to New Mexico's economy and creating more than 1,600 permanent jobs and 4,100 construction jobs by 2030. By 2030, the Act will result in the cumulative reduction of transportation emissions by an estimated 18.5 million metric tons of CO2 equivalent - the equivalent of taking over 570,000 gas powered cars off the road for one year.”
- On January 18th, Advanced Biofuels Canada (ABFC) announced the release of updated detailed expert modelling of Canada’s Clean Fuel Standard (CFS).
- On January 18th, Biodiesel Magazine reported that “Canada could have 3.27 billion liters (863.84 million gallons) of renewable diesel production capacity in place within the next four years, according to a report recently filed with the USDA Foreign Agricultural Service’s Global Agricultural Information Network.”
- On January 20th, the Albuquerque Journal published an article highlighting environmental bills to watch in this year’s congressional session in New Mexico. Included in the roundup is SB 14, New Mexico’s version of the LCFS called the Clean Fuel Standard Act. A similar measure was passed in the Senate last year but stalled in the House. Last year’s version (SB 11) targeted a 10% CI reduction by 2030 while this year’s version (SB 14) targets a more ambitious 20% reduction by 2030 and 30% by 2040.

- On January 27th, Ag Week reported on the exploration of a clean fuel standard in Minnesota and an agriculture pushback.
- On January 28th, The Santa Fe New Mexican reported that New Mexico's SB 14 – the Clean Fuel Standard bill under consideration in the legislature – had been voted out of the Senate Tax, Business, and Transportation Committee. On February 1st, The Carlsbad Current Argus reported that the bill had also been voted out of the Senate Finance committee. The bill then headed to the Senate Floor where it passed.

The California Low Carbon Fuels Standard (LCFS) Monthly Update is a publication of Stillwater Associates LLC. It is scheduled to be published the third Tuesday of every month. Stillwater Associates is a transportation fuels consulting firm specializing in helping our clients navigate the confluence of traditional and renewable fuels.

Stillwater Associates LLC also publishes weekly and quarterly on LCFS covering credit trading and analysis, and program trends respectively (subscription required). For more information, please visit our website http://www.stillwaterpublications.com.