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# Argus White Paper: California environmental markets: Factors that affect LCFS and GHG trading

## Highlights

- California’s primary environmental markets have been gaining traction this year. Three markets created by the cap-and-trade program, Low-Carbon Fuel Standard (LCFS) and Renewable Portfolio Standard (RPS) are the state’s key tools for implementing Assembly Bill 32, which charged regulators with reducing GHG emissions to 1990 levels by the end of this decade.
- LCFS credit prices have ranged from \$20-80/t during 2013. They could remain volatile given a belief that there will not be enough low-carbon fuels to meet the 2016-2020 targets. This is encouraging entities with surpluses to bank credits, which may make the spot market appear short.
- Regulatory changes facing the LCFS program in 2014 are also causing uncertainty. These include a proposal to cap prices, and changes in mandates for federal Renewable Fuel Standards that are affecting the advanced biofuel markets.
- In contrast, California’s Carbon Allowances (CCAs) issued under cap-and-trade are expected to be less volatile over the next few years given indications that emissions may be lower than the cap. The program started formally in January 2013, but inclusion of transportation fuels and natural gas distribution to small emitters from 2015 will pull many more participants into the market.
- The interaction between cap-and-trade and the LCFS from 2015 will widen the biofuels price premium to traditional fuels, helping to lower the LCFS credit price and speed up conversion of the transportation fuel pool to electricity, natural gas and replacement biofuels.
- Argus was the first company to publish price assessments for CCAs and LCFS and has been recognized by industry leaders for providing timely market news and analysis in its Air Daily, US Products and US Ethanol reports. Argus has published federal renewable identification number (RINs) prices in the US since 2008 and has emerged as the most respected publisher of biofuels market data. Argus RIN prices are used to settle CME’s RIN futures.

## Summary of the regulations

**AB 32, the Global Warming Solutions Act of 2006**, set the 2020 greenhouse gas emissions reduction goal into law. This empowered the California Air Resources Board (CARB) to implement:

**The cap-and-trade program**, which caps emissions from large emitters (more than 25,000 t/yr) and the power sector in the first two years and grows in 2015 to include transportation fuels and small natural gas. Regulated parties can buy or sell CCAs and California Carbon Offsets to meet their obligations.

**The Low-Carbon Fuel Standard (LCFS)**, implemented in 2007, aims for a 10pc reduction in the carbon intensity of transportation fuels by 2020 from 2010 levels. LCFS credits are generated by selling low-carbon intensity fuels in California based on the amount the fuel’s carbon intensity is below that year’s target.

**California’s RPS**, established in 2002 and expanded in 2011, is the country’s most ambitious renewable energy standard with a 33pc target by 2020. Under Senate Bill 2x the program was shifted to require that the RPS be met through more bundled renewable power transactions than unbundled renewable energy credits.

Emissions

illuminating the markets

Market Reporting  
Consultancy  
Events

### Cap-and-trade's carbon market

The power sector is the most variable source of emissions in the first two years of cap-and-trade given California's use of hydropower and unpredictable water supplies. But after the program expands in 2015, the fuel sector's ability to reduce its emissions is likely to drive the market in the short term. Transportation makes up about 40pc of the state's total GHG emissions.

California's carbon market will expand in 2014 as the state links its market with Quebec's. The Canadian province's emissions profile mirrors California in many ways, with transportation fuels as the dominant source of emissions. Quebec's electric power sector is dominated by emissions-free hydropower, making up over 90pc of the province's electric supply. Quebec is expected to become a net importer of CCAs because its relatively clean economy and smaller size will give it fewer opportunities to reduce carbon emissions than California.

California has committed to finding other trading partners as federal regulators push for more carbon regulations on the power fleet and other sectors. Washington State is looking at how it will put a price on emissions, and its governor has called for a cap-and-trade program.

#### DECEMBER 2013, VINTAGE 2013 CCAs



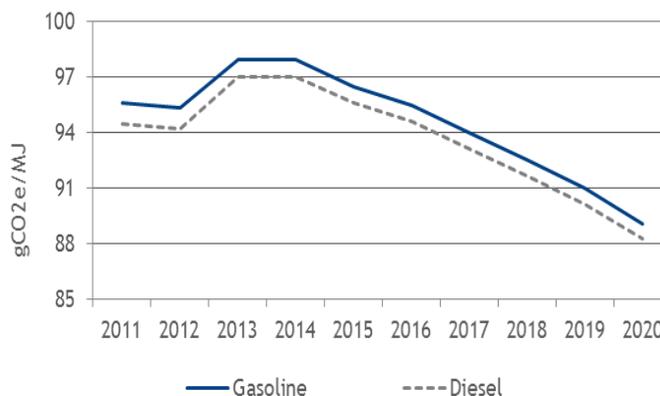
### The Low-Carbon Fuel Standard (the other CO<sub>2</sub> market)

The Low-Carbon Fuel Standard is the main driver of change for the California fuel sector. It requires a 10pc cut in the carbon intensity of fuels by 2020. The program sets annual carbon-intensity targets for gasoline and diesel and creates rewards for fuels below each target and penalties for those exceeding it.

The program applies to most fuels sold in the state although only oil-based fuels incur deficits, or compliance obligations.

The program, which becomes more aggressive after 2015 (see chart), does not distinguish between credits generated from any particular source of transportation fuel. Deficits incurred by selling gasoline and diesel can be covered with credits generated by ethanol, natural gas, biodiesel or electricity. All fuels are graded and given credits based on their carbon-intensity scores.

#### LCFS TARGETS



### The Renewable Portfolio Standard

California's RPS has become more focused on developing in-state generation and retail sellers must procure 33pc of their electricity from renewable resources by 2020. But most utilities are well underway to meeting the renewable targets, including the 25% target by 2016 and 29pc by 2018, according to the California Public Utility Commission's (PUC) second quarter 2013 report.

### How these regulations are pushing the fuels and power markets

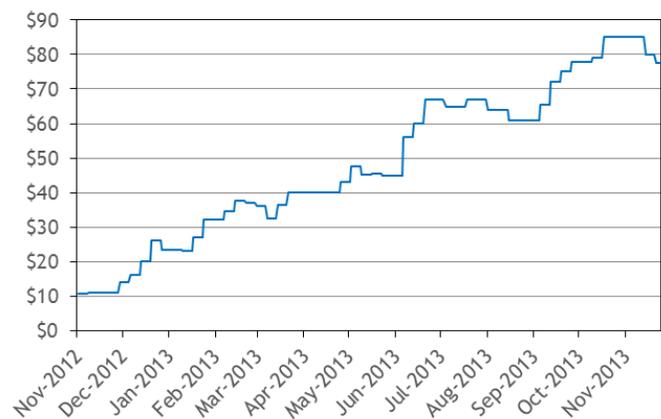
#### LCFS price pressures

##### 1) Uncertainty of fuels mix after 2016

The main uncertainty facing the LCFS is how the state's transportation fuel mix will shift to comply with the program, and which fuels at what price will solve the troublesome equation of the LCFS. In the long run, California's air quality and GHG goals make natural gas, electric and hydrogen-based vehicles necessary.

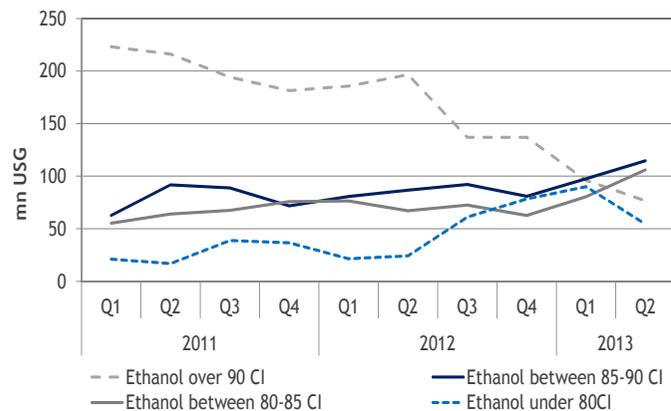
The state has many programs to promote those vehicles and aims to lower their costs and increase their market share. But LCFS compliance in the short term will likely require rapid shifts to lower carbon-intensity liquid fuels since it will take decades to turn over California’s car fleet. For this reason low-carbon biofuels, such as biodiesel, renewable diesel and sugarcane ethanol, hold much early promise for the LCFS because they can be swapped partially or entirely for gasoline and diesel in existing cars and do not require new vehicles or new infrastructure. Further incentives for biofuels are also skewed more heavily post 2015 as the cap-and-trade carbon price applies to fossil fuels but not biofuels.

**LCFS CREDIT PRICES**



The effects of the LCFS on California fuels is clearest on biofuels. Higher carbon ethanol over 90 carbon intensity points have slipped from over half of California’s ethanol mix in 2011 to less than a quarter in the first half of 2013. The state’s low-carbon biodiesel and renewable diesel imports also grew rapidly in 2013.

**LCFS SHIFTING THE ETHANOL STATE**



Data Source: California Air Resources Board

But the market has been driven by the belief that there will not be enough very low-carbon biofuels to blend the fuels market down to the program’s carbon targets in 2016-2020. The expected shortage of credits has contributed to the run-up in LCFS prices in 2013 and incentivized banking of credits by entities that have surpluses. This has made the market look undersupplied.

**2) Potential cap in LCFS prices**

In early 2013, CARB said it plans to prevent LCFS credit prices from rising high enough to harm consumers. A state court decision has prompted the board to delay instituting a price ceiling until sometime in 2014, when it will issue LCFS amendments. A recent LCFS market study by academics at UC Davis, and funded by CARB, found the LCFS credit window or alternative compliance payment approaches floated by ARB earlier this year made the most sense. In those cases, the regulator would set a price and give entities state-issued credits or recognize their payments as compliance for part of their obligation under the program.

**3) Reduced RFS mandates**

Since August, RIN prices have plunged in anticipation of EPA cutting 2014 volume obligations under the federal Renewable Fuel Standard. The proposal to reduce the ethanol and renewable fuels use to a target of 15.21bn USG, or 16pc lower than levels originally set by Congress, is driven by US infrastructure limits. This proposal called for a 60-day comment period ending on 28 January 2014. A final rule should be issued in the first half of 2014.

High RIN prices earlier this year pushed many lower-carbon fuels into profitability, but following the proposed 2014 cuts RIN values are expected to remain low, requiring LCFS credits to make up the slack if needed to meet the LCFS.

The LCFS premium of low-carbon biodiesel to the value of the fuel has overtaken the biodiesel RIN value on a per-gallon basis. Low-carbon sugar cane ethanol have been similarly affected, with LCFS premiums nearing parity with the RIN value.

But lower RIN prices may also cause biofuel producers to look to the California market for any slim profits. Since the LCFS credit adds to a RIN value, California may provide the best profit margins in the US, even with relatively low LCFS prices. That shift would attract more low-carbon biofuels to California without pushing up LCFS credit prices.

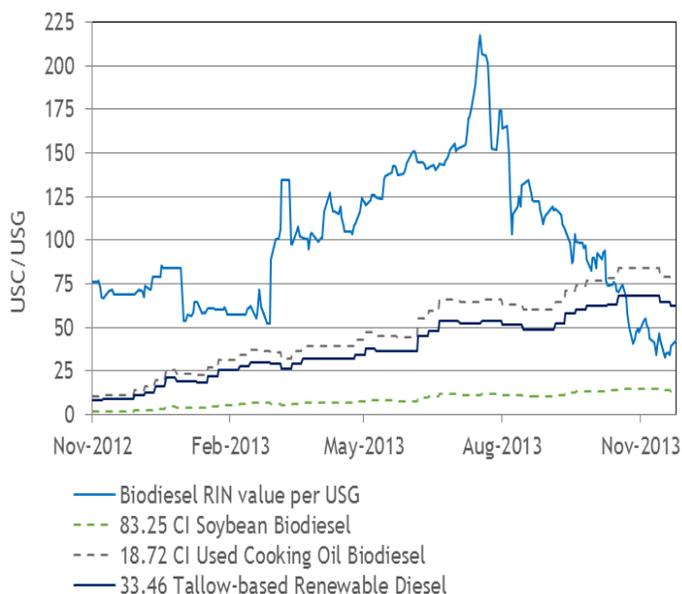
The most price-sensitive biofuels in the LCFS appear to be biodiesel and renewable diesel, which get some of the largest per-gallon premiums under the LCFS because both fuels are more energy dense than ethanol.

**ETHANOL RINS COMPARISON WITH LCFS PREMIUMS**



Sugarcane ethanol has also contributed many LCFS credits, and will likely help many gasoline marketers lower their total compliance obligation in the program’s later years. While the 10pc ethanol blendwall for gasoline will limit the use of ethanol in California, the fuel can still help companies reduce their LCFS and cap-and-trade compliance obligations.

**BIODIESEL RIN COMPARISON WITH LCFS**



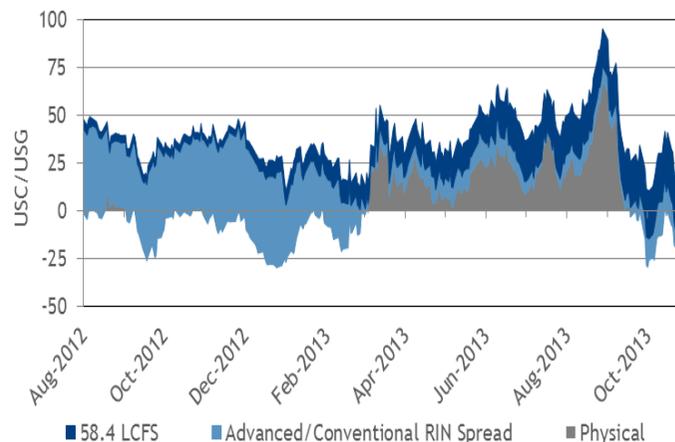
The LCFS premium for sugarcane ethanol has grown in late 2013 as the credit price has risen. But that has not been sufficient to overcome the collapse of federal incentives for advanced ethanol and the price of ethanol in the US caused by the large corn harvest in 2013. While sugarcane ethanol will

likely still come into California under longer-term contracts, the collapse of the arbitrage between Brazil and California will shift demand towards other low-carbon biofuels or push up the LCFS price to make up the gap.

Gasoline refiners and blenders will have to rely more on LCFS credits in future as a 10pc ethanol blend will not be enough to allow gasoline to meet LCFS targets later this decade. These credits will be generated from other alternative fuels such as biogas, natural gas and electric vehicles or through credit generating renewable diesel or biodiesel blends.

Renewable diesel, which has been coming into California from Neste’s Singapore biorefinery, is one of the few low-carbon biofuel replacements for traditional petroleum-based fuels produced at a large scale.

**SANTOS, BRAZIL, TO LOS ANGELES SUGARCANE ETHANOL ARBITRAGE**



California’s electric utilities are also due to get permission to sell LCFS credits they accumulate in the second quarter of 2014, which may drive them to use lower-carbon power for electric vehicles than the state’s default grid power.

**California’s cap-and-trade carbon costs to stay low**

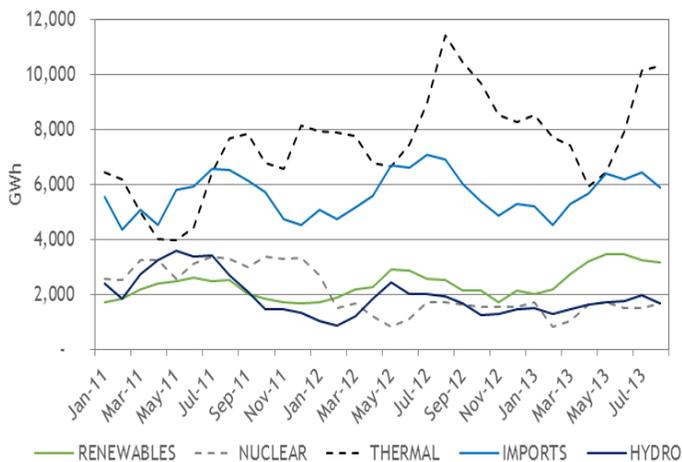
California’s cap-and-trade program may be oversupplied in the near term as the effects of the recession and California’s early action programs keep emissions levels down.

**1) Narrow scope**

But emissions from sources covered by the program in 2013 and 2014 increased by about 9mn t in 2012 to 150mn t. Much of that rise is attributable to the outage and retirement of the 2,200MW San Onofre Nuclear Generating Station and the low water year, wiping out a large share of zero-emission

power supply. Those factors led to a spike in-state generation, driven by incentives for local generation put in place by the California Independent System Operator (CAISO) to address reliability concerns after San Onofre went offline.

**POWER SUPPLIED BY CAISO: RENEWABLES INCREASE WHILE IMPORTS FLATTEN**



Data Source: California Independent System Operator (CAISO)

**2) Broad scope**

For the larger universe of sources that will be covered by the program starting in 2015, emissions were low enough in 2012 that no additional cuts may be required until 2018. If the role of offsets in California’s carbon market is ignored and the state maintains its 2012 emissions level for the rest of the decade, the program would be oversupplied by about 86mn t carbon allowances. But many of those allowances are locked up in the price containment and voluntary renewable energy allowance reserves, so once those are removed from the program it would be about 42.8mn tonnes short by 2020.

**3) Other factors contributing to oversupply of CCAs**

California’s RPS has fostered large amounts of in-state solar generation that will come online in the next four years. This solar power boom will push nearly all of California’s fossil-fired power fleet offline during the midday hours.

But it is unclear how California’s grid will deal with so much renewable generation ramping on and offline quickly during the day and how much will it cost. For reliability and to balance the state’s grid, CAISO may need to keep some gas-fired generating stations online midday. That has led to suggestions that the state, a historical importer of power,

may begin exporting power during the midday hours. California power imports have already fallen in 2013 from 2012 while thermal generation has been close to flat, suggesting that California’s renewables boom has stolen market share from out-of-state generation.

**Interaction between cap-and-trade and the LCFS**

The LCFS and the cap-and-trade program will each cover the state’s transportation fuels in 2015 and thereafter. But their carbon prices do not overlap perfectly.

The cap-and-trade program covers all fossil fuels, while the LCFS applies only to transportation fuels. As a result the cap-and-trade price signal will exaggerate the price difference between biofuels and traditional fuels by raising the cost of gasoline and diesel. That interaction may lower the LCFS credit price because part of the necessary price signal to make lower-carbon fuels economically viable will be provided by higher fossil fuel prices.

The role of LCFS in pushing consumers towards natural gas, biogas, or electric vehicles would lower demand for petroleum-based fuels. That could lower the transportation emissions side of the cap-and-trade program while increasing them in the electric and natural gas sectors.

**Argus’ role in the environmental products market**

- Argus was the first price reporting agency to publish assessments for the California Carbon Allowance Market (daily since August 2011) and the Low-Carbon Fuel Standard Credits (weekly since the summer of 2012). These appear in Argus Air Daily, US Products and US Ethanol reports.
- Argus has been publishing RINs prices in the US since 2008 and has emerged as the industry’s most respected publisher of biofuels market data. Argus RIN prices are used to settle CME’s RIN futures.
- Argus publishes the leading price index in European biofuels.
- Argus has a dedicated environmental products publication, Argus Air Daily, in circulation since 1994. The team has many contacts ranging from traditional energy companies, to those in the regulatory space as well as independent developers of new fuels and technology. This has enabled Argus to offer subscribers news and in-depth market analysis.

## Argus White Paper

- Besides our daily reports, we also provide more detailed market analysis in our regular webinars such as:

Date	Topic
10-Jan-13	California's LCFS: Economics and trade prospects
3-Oct-13	Curving down carbon
8-Oct-13	RINs and RFS2 adjustments: Insights for 2014
10-Oct-13	North American biomass: supply side outlook

- Argus' methodology is transparent. It publishes a list of Deals Done on CCAs and LCFS each day. It also provides a volume-weighted average price for California Carbon Allowances and Regional Greenhouse Gas Initiative allowances. Argus is the only price reporting agency publishing daily pricing for California Carbon Allowances.

### Argus's role in exchange and over-the-counter trade indexation

- CME Group chose Argus RINs prices as the benchmark for a series of new derivatives markets listed on CME Nymex. CME chooses a price reporting agency's data following feedback from industry players regarding the reliability of the index published.
- Market players have been incorporating Argus RIN, CCA and LCFS assessments in their transactions since last year.

#### ASSESSMENTS:

Price published	Unit	What is it?	How is it assessed?	Frequency	Published in:
California Carbon Allowance	\$/t of carbon emissions	Price for current vintage year and the following year	Reporters survey the market and publish a bid/ask assessment based on trade during the day as well as a midpoint (the arithmetic mean of bid/ask).	Daily	Air Daily, US Ethanol, US Products
	\$/t of carbon emissions	Monthly index for current vintage year	The arithmetic mean of all the daily prices during the month.	Monthly: Published on the final trade day of each month.	Air Daily (Air Index Table)
California Volume-Weighted Average	\$/t	Daily Volume-Weighted Average of all current vintage trades for December-delivery.*	California Deals Done table which lists all trades reported to Argus in the brokered or electronic markets.	Daily	Air Daily
Low-Carbon Fuel Standard (LCFS)	\$/t in carbon intensity	Weekly spot price assessment of LCFS credits for prompt delivery.**		Friday	Air Daily, US Ethanol, US Products
LCFS premium per carbon-intensity point	c/USG	The carbon-intensity point generated by the LCFS credit of ethanol and biodiesel converted to c/USG. (It provides a measure of the relative advantage of each fuel to meet carbon-intensity targets.)	The premium is calculated by multiplying the LCFS credit value by the difference between the carbon intensity of the fuel and the LCFS target for that year. ***	Friday	Air Daily, US Ethanol
REC (Category 3)****	\$/MWh	Price for current vintage year.	Reporters survey the market and publish bid/ask assessment as well as a midpoint (the arithmetic mean of bid/ask).	Daily	Air Daily
	\$/MWh	Monthly index for current vintage year	The arithmetic mean of all the daily prices during the month.	Monthly: Published on the final trade day of each month.	Air Daily (Air Index Table)

\*Also includes number of daily trades used to calculate the average and total volume of all these trades. If there are no trades on a certain day, it will be zero and number of trades month to date (MTD) reported and total volume for reference.

\*\*As liquidity increases, Argus is planning to publish a daily LCFS assessment.

\*\*\*The formula for calculating the LCFS premium per carbon-intensity point is:

$(\$/LCFS/metric\ tonne) / 1,000,000 = (\$/LCFS/g), (\$/LCFS/g) * (Energy\ Density/M) = (\$/LCFS/Ci\ point)$

\*\*\*\*Argus is planning to publish assessments for Category 1 and 2 RECs once liquidity increases.



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