

Cleaning Up California's Fuels: Technologies To Reduce The Oil Industry's Carbon Footprint And Meet The Low Carbon Fuel Standard

Since the adoption of the first-in-the-nation Low Carbon Fuel Standard (LCFS) in 2009, California continues to successfully reduce the carbon pollution of transportation fuels. The production and use of petroleum-based fuels are responsible for approximately half of the state's entire carbon emissions.¹ While the substitution of cleaner energy sources for crude oil, like advanced biofuels made from agricultural waste, is a key strategy to reduce carbon pollution, it is also important to employ technologies that can directly reduce the pollution generated from crude oil extraction and refining. A new report from Tetra Tech and NRDC, *Carbon Reduction Opportunities in the California Petroleum Industry*, looks at significant, concrete steps that the California oil industry can adopt today to curb its carbon emissions. These ready-to-deploy technologies could also go a long way to meeting the industry's responsibility under the LCFS.

The LCFS is a major component of California's Global Warming Solutions Act of 2006, known as A.B. 32, and requires the oil industry and other fuel providers to reduce the carbon footprint of transportation fuels by 10 percent by 2020. As a performance-based standard, the LCFS allows industry flexibility to invest in the most cost-effective technologies to reduce carbon pollution from fuels.



Solar thermal facility developed by BrightSource, Coalinga, California.

Source: tech.fortune.cnn.com/2012/04/17/yergin-gas-solar-wind

EVEN MORE OPPORTUNITIES TO REDUCE CARBON POLLUTION

Five approaches to reducing carbon pollution directly from the petroleum supply chain include:

- **Renewable steam generation:** using solar power to generate steam for enhanced oil recovery, rather than combusting fossil fuels for that purpose.
- **Steam generation with carbon capture and sequestration (CCS):** capturing and storing the flue gas emissions from once-through steam generators used in enhanced oil recovery.
- **Refinery energy efficiency:** enabling refineries to use less energy in their operations.
- **Refinery CCS:** capturing and storing carbon emissions resulting from the energy-intensive hydrogen processes needed for refining crude oil.
- **Renewable refinery feedstocks:** displacing part of the refinery's crude oil with renewable-based oils and waste oils.

The new report shows that modest adoption of the five carbon reduction technologies identified above could reduce emissions by nearly 3 million to 6.6 million metric tons annually in 2020. For a reference point, the full potential of these technologies—if adopted across the board—would result in 20 million metric tons of reduction annually, equivalent to the removal of nearly 5 million passenger vehicles from the road. Additional opportunities—such as



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renewable electricity and hydrogen use at refineries, use of other cleaner technologies at oil production operations, and efficiency improvements at crude oil production facilities—could help reduce emissions even further.

MEETING THE LOW CARBON FUEL STANDARD

Even moderate adoption of these technologies could help refiners meet the goals of California’s LCFS. The standard requires oil companies to reduce their carbon intensity by 10 percent, or approximately 17 million metric tons, by 2020. Overall, the potential of the oil industry to directly reduce carbon emissions is sizable, and the technologies to do so are available and viable. Moreover, in addition to reducing carbon pollution, many of these technologies can reduce other air pollutants, providing further benefits to public health.

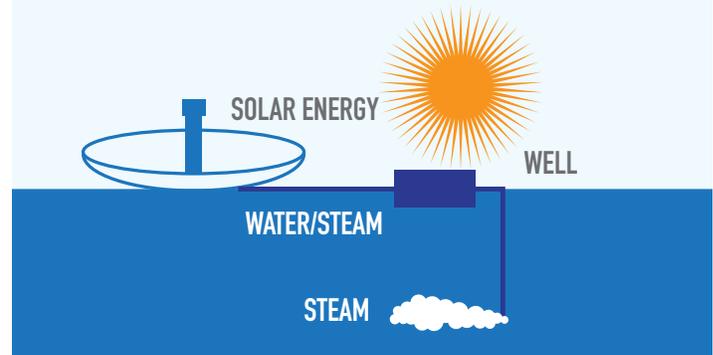
CLEANING UP EXISTING FUEL SUPPLIES

Despite claims to the contrary, there is no shortage of opportunities for the fuel industry to shrink the carbon footprint of transportation fuels. While the use of low carbon, advanced biofuels and the use of cleaner electricity remain key strategies to reduce emissions overall, cutting emissions from the production of petroleum, by far the largest portion of the market, is also important. Ninety five percent of California’s transportation fuel supply is derived from crude oil. The oil industry operates more than 50,000 active oil wells and 18 refineries in the state, and the combined carbon emissions from these facilities account for more than 10 percent of the state’s emissions, or an estimated 48 million metric tons of carbon dioxide annually.

Fortunately, the LCFS can provide a strong investment signal for existing petroleum facilities to deploy carbon reduction technologies. Meeting the state’s air pollution and carbon reduction goals will ultimately require not only that we turn to new, cleaner fuels, but also that our current fuel supplies get cleaner over time. Fortunately, there exist hundreds of ways to accomplish both.

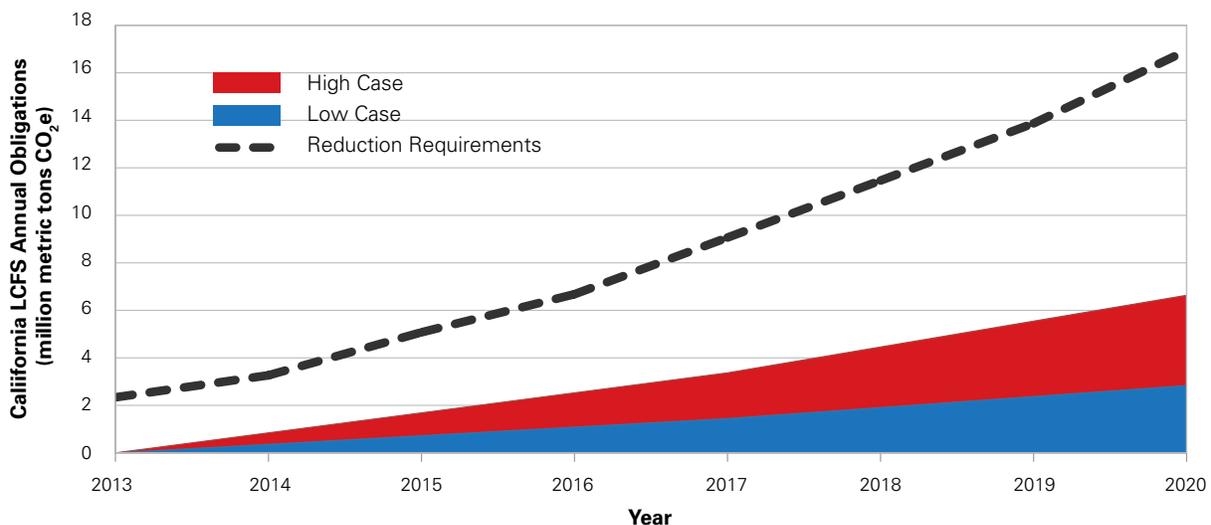
Using Solar Energy to Generate Steam

To generate steam renewably, mirrors and reflective surfaces are arranged to concentrate sunlight. The solar energy is directed at a central tube or tower containing water, which is heated and turned into steam. The steam is injected into oil wells to improve recovery rates



This renewable steam generation technology is currently being deployed commercially by BrightSource in Coalinga, California, and by GlassPoint in McKittrick, California, and Amal, Oman.

By adopting existing carbon reduction technologies and other cost-effective reduction strategies, refiners can meet a significant portion of their LCFS compliance obligations.



1 Estimates based on California’s 2011 Greenhouse Gas (GHG) emissions inventory by the California Air Resources Board. Direct combustion emissions in the transportation sector account for approximately 38% of statewide emissions. The inclusion of GHG emissions from upstream crude oil production, refining, and transport increases the total carbon footprint to roughly half of statewide emissions. (www.arb.ca.gov/cc/inventory/inventory.htm)