Biofuels: Burning food?

On September 16, 2020, when two of the five major refiners in its region presented their plans to process biofuels instead of crude oil to the Bay Area Air Quality Management District, the District asked about fuel chain impacts associated with the new biofuel feedstock. Good question. Planned refinery biofuel projects in California could nearly triple U.S. refinery demand for oil crops and animal fats, up to as much as 67 % of total U.S. farm yield for these oils and fats, by 2024. See Chart 1.

Using vegetable oils and animal fats for biofuels taps land needed for food, ecosystems that support the biodiversity needed to grow food, and natural carbon sinks in healthy soils and forests.[1] It boosts food prices and increases pressure to use more land to grow crops. The price of U.S. soybean oil, a significant biofuel feedstock (*see* Chart 1), has been linked to deforestation for soybean plantations in the Brazilian Amazon and Pantanal[2–4] and for palm oil plantations in Southeast Asia.[5–7]

California refiners' current plans could take another 30 to 55 million acres for oil crops. See Chart 2.

Carbon emits from such land use changes, and from the fossil fuel hydrocarbons that refiners split for the hydrogen to refine biofuels. Land use and hydroprocessing impacts associated with some palm and soy oil biofuels drive their carbon intensity above that of petroleum fuels.[7, 8]

Less carbon-intensive "advanced" biofuels from non-food sources such as algae or cellulosic plants have not yet proved out in practice.[9] Meanwhile, past investments in the machinery to make, deliver, and burn liquid petroleum fuels lead oil companies to retool for liquid biofuels instead of electricity-powered transportation.[10] So adding limited supplies of food crop biofuel to the petroleum we get locked into burning along with it could lead to a dead end in our path to climate stabilization.[11]

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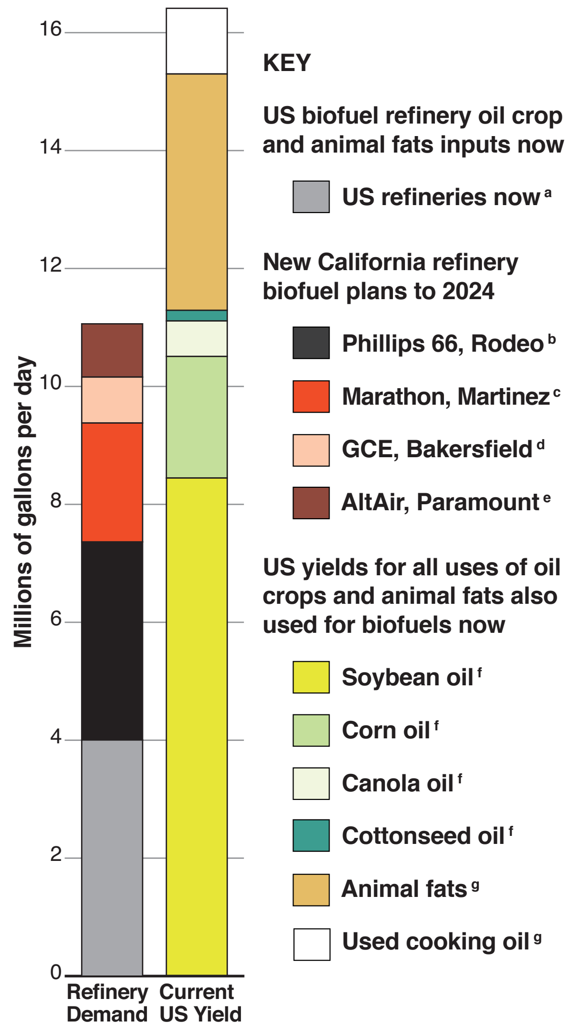

1. Oil crops and animal fats: U.S. refinery demand and California refinery plans for biofuel feedstock *v.* total U.S. yields now.

a. US refinery demand during Jan 2018–Dec 2020 from US EIA Monthly Biodiesel Production Report. Table 3; www.eia.gov/biofuels/biodiesel/production/table3.xls
b. Phillips 66 Co., 2021. Application 31157 to the Bay Area Air Quality Management District: San Francisco, CA.
c. Sep 10, 2020 Marathon Petroleum Corp. project description, Contra Costa County, CA.
d. Brelsford, R. *Oil & Gas Journal* 9 June 2020. Estimate for 80% feed conversion to biofuel capacity reported.
e. Paramount/AltAir Renewable Fuels Project Initial Study for City of Paramount by MRS Environmental.
f. US oil crop yields during Oct 2016–Sep 2020 from USDA *Oil Crops Data: Yearbook Tables;* www.ers.usda.gov/data-products/oil-crops-yearbook/oil-crops-yearbook/#All%20Tables.xlsx?v=7477.4.
g. US animal fat and "waste" cooking oil estimates to 2030 from Perlack and Stokes, 2011. *U.S. Billion-Ton Update;* US Dept. of Energy, Oak Ridge National Laboratory: Oak Ridge, TN. ORNL/TM-2011/224.
Chart excludes (non-oil-refinery) oxygenate plant ethanol.

Biofuels: Burning Food?

continued

Alternatives that power electric and fuel cell cars, trucks, trains, and ships with renewable electricity and hydrogen made from it by electrolysis—and use biofuels only where that is not possible—are both feasible and necessary to achieve California's climate goals, the state's expert advice shows.[9, 12, 13] And air pollution from burning biofuels has health costs that electric and fuel cell vehicles can avoid. Thus, other recent work shows,[14] this biofuel-light path to climate stabilization could be cheaper.

September 2020, updated October 2021
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Originally published as follow up to discussions of questions raised by directors of the Bay Area Air Quality Managment District at its 16 September 2020 Board of Directors meeting.

(1) Diaz et al., 2019. *Global Assessment Report on Biodiversity and Ecosystem Services;* Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPDES): Bonn, DE. https://ipbes.net/global-assessment

(2) Union of Concerned Scientists USA, 2015. *Soybeans;* www.ucsusa.org/resources/soybeans

(3) Lenfert, Z. M., and Börner, J., 2017. *ZEF Policy Brief No. 28;* Center for Development Research, University of Bonn; www.zef.de/fileadmin/user_upload/Policy_brief_28_en.pdf

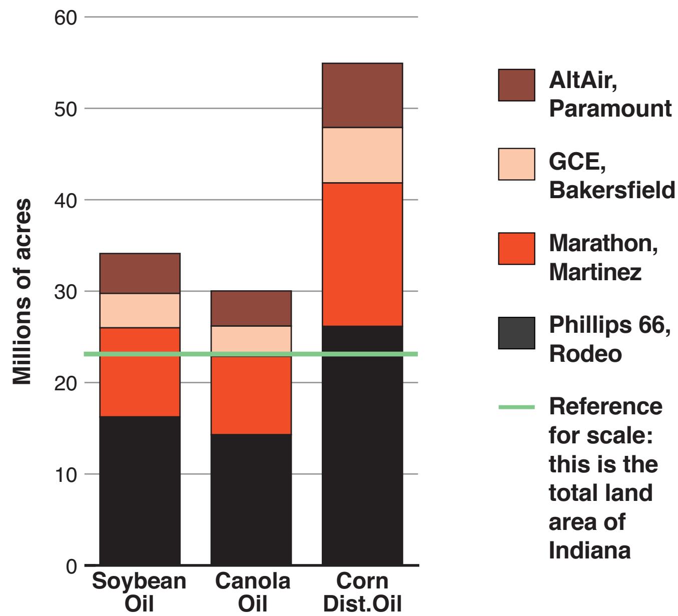
(4) Nepstad, D., and Shimada, J., 2018. *Soybeans in the Brazilian Amazon and the Case Study of the Brazilian Soy Moratorium;* International Bank for Reconstruction and Development / The World Bank: Washington, D.C. www.profor.info/sites/profor.info/files/Soybeans%20Case%20Study_LEAVES_2018.pdf

(5) Sanders et al., 2012. *Revisiting the Palm Oil Boom in Southeast Asia;* International Food Policy Research Institute; www.ifpri.org/publication/revisiting-palm-oil-boom-southeast-asia-role-fuel-versus-food-demand-drivers

(6) Santeramo, F., 2017. *Cross-Price Elasticities for Oils and Fats in the US and the EU;* The International Council on Clean Transportation: Beijing, Berlin, Brussels, San Francisco and Washington, D.C. (The ICCT); www.theicct.org/sites/default/files/publications/Cross-price-elasticities-for-oils-fats-US-EU_ICCT_consultant-report_06032017.pdf

(7) Searle, S., 2017. *How rapeseed and soy biodiesel drive oil palm expansion;* The ICCT; https://theicct.org/publications/how-rapeseed-and-soy-biodiesel-drive-oil-palm-expansion

(8) Takriti et al., 2017. *Mitigating International Aviation Emissions: Risks and opportunities for alternative jet fuels;* The ICCT; https://theicct.org/publications/mitigating-international-aviation-emissions-risks-and-opportunities-alternative-jet



2. Acreage needed for four California refinery biofuels projects based on different feedstock crops.

Estimate based on project feedstock capacities from refiners (*see* references b–e in Chart 1) and US oil crop yields during Oct 2016–Sep 2019 in gal./acre planted (soy oil: 75.5; canola: 85.8; corn distillers oil dry mill coproduction with alcohol: 46.9) from USDA data. The estimate range shown is conservative because project feedstock blends could include animal fats, which could require more acreage than vegetable oils for crop or pasture land to feed livestock.

(9) Mahone et al., 2020. *Achieving Carbon Neutrality in California: PATHWAYS Scenarios Developed for the California Air Resources Board;* Draft: August 2020. Energy+Environmental Economics: San Francisco, CA. https://ww2.arb.ca.gov/sites/default/files/2020-08/e3_cn_draft_report_aug2020.pdf

(10) Karras, G., 2020. *Decommissioning California Refineries: Climate and health paths in an oil state;* A report prepared for Communities for a Better Environment. Community Energy reSource; https://www.energy-re-source.com/decomm

(11) Karras, G., 2021. *Throwing [bio]fuel on the fire;* Community Energy re-Source. www.energy-re-source.com/latest

(12) Reed et al., 2020. *Roadmap for the Deployment and Build-out of Renewable Hydrogen Production Plants in California;* https://efiling.energy.ca.gov/getdocument.aspx?tn=233292

(13) Austin et al., 2021. *Driving California's Transportation Emissions to Zero;* U.C. Inst. Transp. Studies. DOI: 10.7922/G2MC8X9X https://escholarship.org/uc/item/3np3p2t0

(14) Zhao et al., 2019. Air Quality and Health Cobenefits of Different Deep Decarbonization Pathways in California. *Environ. Sci. Technol.* 53: 7163–7171. https://pubs.acs.org/doi/10.1021/acs.est.9b02385