UC studies suggest how California can finally decarbonize its transportation sector

California has a history of leading on climate policy and has increased its ambition in recent years. Greenhouse gas emissions from transportation account for almost half of all emissions in the state (including emissions from oil refineries), but have been challenging for the state to address. The Budget Act of 2019 (AB 74) funded the following two studies, administered by the California Environmental Protection Agency, to: 1) identify strategies to reduce emissions from transportation energy use, and 2) identify strategies to manage the decline in fossil fuel production and associated emissions in parallel with reductions in demand. The first study was conducted by the University of California Institute of Transportation Studies at four campuses, UC Davis, UC Berkeley, UC Irvine, and UCLA. The second study was conducted by UC Santa Barbara. This joint summary identifies common themes and findings shared by the studies and also identifies policy implications of the two studies when taken together.

California is a large consumer of petroleum, but produces only 30% of the petroleum it consumes, making it a large net importer. California consumes 1.2 million barrels per day of petroleum for transportation, with vehicles emitting 174 million metric tons of CO_2 equivalent per year, 41% of the state's total greenhouse gas emissions[1]. An additional 47 million metric tons, 11% of the state's total, comes from the production and refining of petroleum for transportation fuels. On the production side, California was an early producer of crude oil. Although its production has fallen by more than half[2] since its peak in 1985, the state is still the seventh largest producer of crude oil among the 50 states[3].

Both the use and production of transportation fuels have highly negative effects on the underserved and overburdened communities of the state. Trucking, ports, and freeways, as well as oil production and refining facilities have been predominantly located in or adjacent to communities of color and poorer communities, causing disproportionate harm to them.

In 2018, California's then-Governor Brown established a statewide goal of carbon neutrality as soon as possible, and no later than 2045. This cannot be accomplished without addressing transportation, including both the demand and supply of fuels. More than 70% of demand for transportation comes from personal vehicles (mostly cars and light trucks).

Study 1 (UC ITS) explored potential policy mechanisms to reduce fossil fuel demand. The primary strategy is an accelerated transition to zero-emission cars, trucks, and buses, coupled with renewable low carbon fuels, and the expansion of low-carbon transportation choices that would reduce motor vehicle use. Study 2 (UCSB) explored policies to manage parallel reductions in emissions from oil extraction and refining, such as oil production quotas, increased setback distances from wells, and refinery decarbonization policies.

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[1] https://ww2.arb.ca.gov/ghg-inventory-data

[2] https://www.eia.gov/dnav/pet/hist/LeafHandler.ashx?n=pet&s=mcrfpca1&f=a

[3] https://www.eia.gov/state/?sid=CA#tabs-2

Both studies identified significant potential to reduce carbon emissions, with the overall finding that reductions in both demand and supply are needed if California is to meet its carbon neutrality goals. The first study, regarding vehicles, fuels, and mobility, found that the transition would incur significant costs to the economy until about 2030, but thereafter would provide increasingly large economic benefits—on top of climate and health benefits—mostly because zero emission vehicles will become increasingly less costly to own and operate than fossil-fueled combustion engine vehicles.

Figure 1 shows total emissions reduction from the two studies, combining demand and supply. The aggregated business-as-usual scenarios are on the left, and the aggregated low carbon scenarios are on the right. As shown, total emissions are reduced to near zero by 2045.

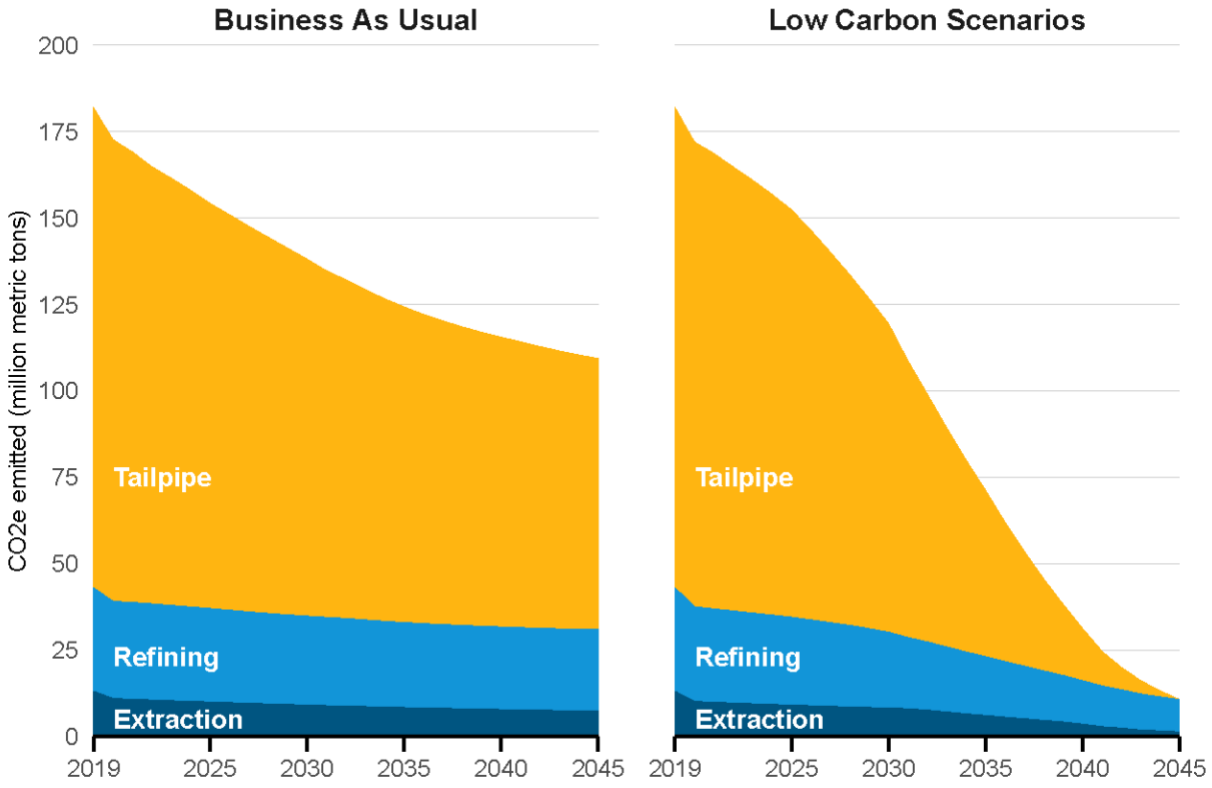

Figure 1. Projected greenhouse gas emissions under the business-as-usual scenarios (left panel) and low carbon scenarios (right panel). Projected emissions are shown for the following: tailpipe emissions (yellow), refining (light blue), and extraction (dark blue). The refining and extraction projections correspond to R-BAU and E-BAU (left panel) and LCR2 and LCE2 (right panel), respectively. Note that these projections include refinery emissions associated with both fossil fuels and biofuels, but exclude upstream emissions from imported crude oil and tailpipe emissions associated with biofuels. (MMT = million metric tons; CO2e = carbon dioxide equivalent)

Each study identified important policy considerations. Study 1 found that strong transportation decarbonization policies will result in cost savings starting in 2030, and identified opportunities to bring lower

emitting vehicles and options to communities that have borne the highest impacts of transportation pollution. Study 2 found that policies which reduce oil production through auctioned production quotas (or an equivalent excise/severance tax) will provide proportionately larger air quality benefits to disadvantaged communities. Under the LC1 decarbonization scenario and relative to the business as usual (BAU) scenario, Study 1 identified health benefits of $35.3 billion for the state in the year 2045, $26.1 in 2040, $13.8 in 2035, and $5.2 in 2030 from progressively electrifying the transportation sector. In the Study 2 decarbonization scenarios relative to baseline (LCE2 and LCR2, for extraction and refining), the cumulated and discounted health benefits are $1.6 bil (LCE2) and $13.2 (LCR2) from 2019 to 2045. All health benefits are in 2019 dollars.

The two studies also found that the transition to a low carbon fuel and transportation system will cause disruption, but also create economic and employment opportunities. Study 1 found opportunities for significant overall job growth, although the skills, locations, and characteristics of these additional jobs will likely be very different from disrupted ones. The state has many policy options to shape a just transition.

While the two studies identify multiple pathways to decarbonize transportation demand and supply, the details remain uncertain. For instance, what is the cost of an accelerated transition to low carbon liquid and gaseous fuels? Existing refineries and fuel infrastructure could potentially be adapted to produce and serve low-carbon fuels, but only with significant industry investment.

In summary, California will need to pursue a variety of policies to decarbonize transportation. These policies will be implemented by different agencies and will need to be carefully coordinated.