Will California's greenhouse gas (GHG) cap-and-trade program meet 85% of its required reductions with offsets? That is the claim made in a complaint recently filed in a California Superior Court, seeking to throw out California's offset regulations. (*Citizens Climate Lobby v. CARB.*) The complaint cites a NY Times article from 2011, in which someone from California's Air Resources Board (CARB) says that 85% is theoretically possible under one scenario, but "the scenario under which that 85 percent would be accurate is unlikely to occur in California."

My answer: No. Taking the 2010 estimates of business-as-usual emissions for California between 2013 and 2020, I calculate the maximum ***theoretical*** number of offsets to make up approximately 50% of reductions needed under the cap-and-trade program. The 85% figure seems a bit dated. (For another somewhat dated analysis, see my post from 2010.)

Furthermore, there is good reason to believe that the ***actual*** number of offsets used in California's program will be a good deal less than that. Covered industry will only purchase offsets if those offsets represent a good value, taking into account varied transaction costs of the offset program. Simpler measures, such as energy efficiency, will likely be the cheaper option for much of the industry. Numbers and discussion below.

Fig. 1: Offsets and Business as Usual Emissions in California's GHG cap-and-trade program.

In California's cap-and-trade program, a compliance entity (businesses that have sufficiently large GHG emissions to fall under the regulation) must acquire allowances equal to their GHG emissions. For each year of emissions, eight percent of those allowances can be in the form of offsets. Offsets are generated when a registered project takes certain voluntary actions to effectively reduce GHG emissions. For example, a forest offset could be generated when someone plants a forest on former agricultural land. Some groups, such as the petitioners in the complaint mentioned above, do not believe that CARB's offset program will ensure that offset credits will represent real, additional, permanent GHG reductions.

The 85% figure cited in the complaint is simply offsets available divided by the reduction needed, over the years 2013–2020. CARB has published an estimate of business-as-usual (BAU) emissions through 2020, available here. The redline in

Figure 1, above, indicates BAU emissions. Reductions needed under the cap-and-trade program is BAU emissions minus the number of allowances available (the cap). So in Figure 1, the space between the red BAU line and the blue available allowances represents the reductions needed.

The 'Available.Allowances' is all allowances available to compliance entities. For this calculation, I omitted reserve allowances, which will not be available unless the price of allowances remains very high.

Now, any given compliance entity can emit as much GHGs as it desires, so long as it has allowances or offsets available, up to that 8% limit for offsets. But in total, compliance entities will only emit up to the total number of allowances available in a given year (including offsets) or their BAU emissions, whichever is less. Knowing this tells us that the maximum annual emissions will be either the BAU or the Available.Allowances divided by (1 – .08). In other words, assuming 100% compliance, businesses will not emit more than the total number of available allowances plus the number of allowed offsets. Thus the maximum number of offsets can be determined, as in Figure 1.

To make the reduction versus offsets comparison easier to see, I plotted these two amounts in Figure 2. As you can see, the program starts out with the potential for more offsets than needed reductions, but reductions ramp up considerably past 2015. Adding up the maximum offsets for all years gives us 206 MMT CO2e; the sum of reductions needed is 402 MMT CO2e. This comes out to approximately 50 % offsets.

Fig. 2: Maximum theoretical offsets versus reductions for California's cap-and-trade program.

There are, however, lots of reasons to believe that the actual number of offsets will be much less. First, in the early years of the program reductions may be easy to achieve, keeping the price of allowances low and offsets uneconomical. Second, compliance entities will only turn to offsets if they do not already own sufficient allowances. Some industries and utilities may receive sufficient allowances from CARB for free and thus will not turn to offsets. Third, it may take years for a strong offset market to develop. CARB must approve offset providers. CARB must also avoid losing in litigation that could delay the offset program. Also note that the theoretical capacity of an offset market doubles in 2015, but may be too small to

warrant a strong market before that point. Fourth, the offset market is limited to 8% of compliance entities’ *actual* emissions. If emission reductions are achievable for less than the $10 price floor for CARB auctions, compliance entity emissions may in fact come in below the cap, reducing the number of offsets and increasing the amount of reduction.

Code and data are available at Github. Figures created using the ggplot2 package in R.