Achieving Public Health Co-benefits from Climate Change Policy

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Issue

California became a leader in climate change policy when it enacted Assembly Bill 32 (AB 32), setting greenhouse gas (GHG) emission targets for 2020 to 1990 levels. The activities that release carbon dioxide and other GHGs also release criteria pollutants, such as particulate matter and ozone, which contribute to California’s air pollution, resulting in poor visibility, adverse health effects and early mortality. Since most policies are designed to reduce GHGs and criteria pollutants separately, the complex linkages between long-lived greenhouse gases and short-lived criteria pollutants, are often poorly characterized or ignored. Hence, the overall air quality and public health co-benefits of climate policies are often underestimated, particularly with regard to criteria pollutants.

Policy Implications

Over the past four decades, California’s environmental regulations have succeeded in improving air quality and reducing the public health burden despite increasing population and economic activity. The air pollution co-benefits of GHG policy can be significant: This study estimates that AB 32 policies are expected to prevent an estimated 880 premature air pollution deaths in 2030—dropping from an estimated 14,000 to 13,120, translating to a monetary benefit from avoided mortality of $5.4 billion.

In the next decade, California has plans to meet the latest National Ambient Air Quality Standards (NAAQS) for its non-attainment pollutants such as ozone and particulate matter with diameter less than 2.5μm (PM$_{2.5}$). Well-designed GHG mitigation policies should complement these objectives and minimize potential air quality tradeoffs while reducing costs.

A comprehensive approach that reduces emissions for both GHG and particulate matter can minimize unintended emission tradeoffs. Armed with overall benefits and real costs, policymakers and regulators can then design, prioritize and implement optimum policies to achieve both climate and public health objectives.

Research Findings

This study conducted air quality simulations for California in the year 2030 to quantify the air pollution reductions from multiple measures and sectors as described by AB 32. The AB 32 Scoping Plan includes many measures to reduce GHG emissions that encompass sectors across the entire economy. Examples include increased renewable energy resources (Renewable Portfolio Standard) for electricity generation, reduced fuel carbon intensity (Low Carbon Fuel Standard), improvement of efficiency and fuel economy for light duty vehicles (LDVs) (Pavley Standards), increasingly efficient building standards, and electrification of sources that typically relied on fossil fuel (ship electrification at ports, hybrid or battery electric vehicles).

Many of the AB 32 Scoping Plan measures reduce CO$_2$ emissions by improving efficiency (i.e. consuming less fossil fuel) or using lower carbon energy sources. These new sources have variable effects on the emissions of criteria pollutants such as PM$_{2.5}$, oxides of nitrogen (NO$_x$), oxides of sulfur (SO$_x$), reactive organic gases (ROG), and ammonia (NH$_3$) (see Figure 1).

GHG regulations have variable effects on criteria emissions from different sources because some sources, such as trains, are relatively uncontrolled while other sources such as power plants and passenger vehicles are already heavily regulated and have after treatment controls. The environmental impact and energy reports written in support of several AB 32 scoping plan measures were used to calculate the change in regulated criteria pollutant emission that was then applied to the regulated pollutant emission inventory. An air quality model was then used to simulate future pollutant concentrations for an extreme stagnation episode and an annual average.

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Diesel trucks, trains and ships—sources with few existing controls—are projected to contribute substantially to California’s future criteria pollutant emissions. Consequently, ship electrification, heavy duty truck emission standards, and other GHG mitigation measures targeting these sources account for the largest PM$_{2.5}$ reduction and health co-benefits (5.5 µg m$^{-1}$, about a 6 percent reduction from business-as-usual). These sources are concentrated around the ports of Los Angeles/Long Beach and Oakland which are receiving and distribution hubs for international goods (see Figure 2).

Not all GHG measures were found to provide a PM$_{2.5}$ reduction benefit. California’s large dairy industry currently emits high levels of methane that could be captured and used for electricity generation. If the state takes advantage of this renewable resource, methane emissions could be displaced with combustion emissions including NO$_x$ and actually could produce an increase in PM$_{2.5}$ in the San Joaquin Valley (shown in magenta in Figure 2). However, there are alternative opportunities for this biomethane resource: this biomethane can instead be used in fuel cell applications, avoiding the air pollution caused from combustion.

Overall, there was a ~6 percent reduction of PM$_{2.5}$ exposure associated with all AB 32 measures, reducing air pollution mortality by 6.2 percent, and avoiding roughly 880 premature deaths. Using the Value of a Statistical Life (VSL) approach this equates to a monetary benefit from avoided mortality of $5.4 billion for the year 2030.

The PM$_{2.5}$ benefits from GHG mitigation policies such as AB 32 for California are unique and are attributable to California’s pre-existing emissions controls and use of clean fuels in the state. Other states, countries, or nations may find larger air pollution co-benefits associated with GHG strategies. These co-benefits depend on jurisdictions’ energy resource portfolios (e.g. coal), pre-existing pollution controls, and contribution of different emissions sources to their criteria pollutant and GHG emission inventory.

Further Reading