Environmental equity & California’s efforts to address climate change

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Air pollution is unequally distributed in California

Cushing et al. (2015) AJPH 105(11): 2341-2348
Climate change is likely to worsen air quality and exacerbate inequalities

Ensemble-mean climate-induced change in annual-average ground-level 8-h-max $O_3$ and $PM_{2.5}$ from 2000 to 2100 under a business-as-usual scenario. Changes identified as statistically significant are indicated by black dots.

California’s commitment to reduce greenhouse gas emissions can improve air quality

California's Cap-and-Trade Program

• Goal is to reduce greenhouse gas (GHG) emissions from large stationary sources
• Allowance trading began in 2013
• Revenues are reinvested into mitigation projects
  • At least 25% of funds must benefit disadvantaged communities
Variable health benefits of emissions reductions

Power plant near Bakersfield, CA

Oil refinery in Torrance, CA

Both facilities emitted between 2.5-2.8 million tons of GHGs in 2014 (MT CO$_2$e)

PM$_{10}$ emissions: 42 MT

PM$_{10}$ emissions: 416 MT

Population within 6-mi radius: ~1,000

Population within 6-mi radius: ~802,700
People of color & the poor are more likely to live near regulated facilities

Number of GHG-emitting facilities near block groups by race/ethnicity and by poverty status
In-state GHG emissions have increased since trading began.
In-state GHG emissions have increased since trading began

Change in emitter covered emissions between 2011-12 & 2013-14
Large GHG emitters emit more particulates

<table>
<thead>
<tr>
<th>Industry</th>
<th>N</th>
<th>Slope</th>
<th>$R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cement Plant</td>
<td>9</td>
<td>0.4</td>
<td>0.66**</td>
</tr>
<tr>
<td>Cogeneration</td>
<td>51</td>
<td>0.4</td>
<td>0.23***</td>
</tr>
<tr>
<td>Electricity Generation</td>
<td>75</td>
<td>0.4</td>
<td>0.33***</td>
</tr>
<tr>
<td>Food and Beverage Manufacturing</td>
<td>40</td>
<td>0.5</td>
<td>0.22**</td>
</tr>
<tr>
<td>Hydrogen Plant</td>
<td>7</td>
<td>0.7</td>
<td>0.39</td>
</tr>
<tr>
<td>Metal and Machinery Manufacturing</td>
<td>11</td>
<td>0.9</td>
<td>0.42*</td>
</tr>
<tr>
<td>Oil &amp; Gas Production / Supplier</td>
<td>41</td>
<td>0.7</td>
<td>0.48***</td>
</tr>
<tr>
<td>Other Manufacturing</td>
<td>33</td>
<td>0.5</td>
<td>0.31***</td>
</tr>
<tr>
<td>Public Services</td>
<td>12</td>
<td>0.8</td>
<td>0.54**</td>
</tr>
<tr>
<td>Refinery</td>
<td>17</td>
<td>0.4</td>
<td>0.39**</td>
</tr>
</tbody>
</table>

* P < 0.05; ** P < 0.01; *** P < 0.001
Increases in GHG emissions were accompanied by increases in co-pollutant emissions

Mean % change [95% CI] associated with a 1% change in annual GHG emissions

Linear regression with a fixed effect for facility (N=256 facilities over 4 yrs.)

<table>
<thead>
<tr>
<th>Pollutant</th>
<th>Mean % Change (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>NO\textsubscript{X}</td>
<td>0.4% (0.3%, 0.5%)</td>
</tr>
<tr>
<td>PM\textsubscript{2.5}</td>
<td>0.3% (0.2%, 0.4%)</td>
</tr>
<tr>
<td>SO\textsubscript{X}</td>
<td>0.2% (0.1%, 0.3%)</td>
</tr>
<tr>
<td>VOCs</td>
<td>0.1% (0.0%, 0.2%)</td>
</tr>
</tbody>
</table>
The role of offsets

Offset Credits vs. Decrease in Covered Emissions

Offset Credits by Project Type

Origin of Offset Credits
Summary of findings

1) GHG-emitting facilities are located in neighborhoods with higher proportions of residents of color and residents living in poverty.

2) On average, in-state GHG emissions have increased for several industry sectors since the advent of California’s cap-and-trade program, with many high-emitting companies using offsets to meet their compliance obligations.

3) At the facility level, increases in GHG emissions have been accompanied by increases in hazardous co-pollutants emissions.
Recommendations

1) The public health and equity co-benefits of climate mitigations efforts could be enhanced through more localized emissions reductions in disproportionately impacted communities.

2) Harmonized emissions reporting requirements would enable us to better track progress toward climate & environmental equity goals.

AB 197 (2016) [Air pollution inventory, social costs & direct emissions reductions]
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Available at:
http://dornsife.usc.edu/pere