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REASSESSING CALIFORNIA'S CAP-AND-TRADE PROGRAM THROUGH AN ENVIRONMENTAL EQUITY PRISM

Berkeley UNIVERSITY OF CALIFORNIA College of Natural Resources

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CAP & TRADE (C&T) OVERVIEW

CA has a cap on CO_2 emissions that declines each year. It is based on consumption as well as production; electricity importers, for example, are part of the system.

Those GHG emitters that meet goals can sell allowances in auctions. Those that don't meet goals can purchase allowances so they can emit more.

CAP & TRADE OVERVIEW

Because trades take place, Cap and Trade (and any market system, including a carbon fee) is inherently unequal – if it wasn't, trades would not take place.

Indeed, for the market to work, some firms will reduce GHGs while others will pay to not have to, resulting in unequal landscape of emissions cuts.

This isn't a problem for GHGs – when they are reduced (regardless of where), we all get a global benefit.

BUT CONCERN ABOUT CO-POLLUTANTS

Most GHGs do not directly harm health in communities where they are emitted. But, accompanying pollutants, like particulate matter can harm the health of nearby residents.

Oil Refinery in Wilmington, CA

GHG emissions: ~ 1.9 million metric tons

PM_{10} emissions: ~ 140 metric tons

Population within 6-mi radius: ~ 551,000

Power Plant in Victorville, CA

GHG emissions: ~ 1.6 million metric tons

PM_{10} emissions: ~ 117 metric tons

Population within 6-mi radius: ~ 58,400

PREVIOUS RESEARCH

Cushing, et al. (2018)

a) There is a pattern in the location of Cap and Trade facilities that reflects racial and, to a lesser extent, income disparities.
b) There is a correlation between GHGs & localized co-pollutants.
c) Comparing 2011-2012 to 2013-2015:
   - In-state GHG emission actually rose (likely due to swapping in of in-state electricity generation).
   - Pollution levels rose most in neighborhoods of color and low-income neighborhoods.
   - Offsets were a particular problem with the leakage of benefits.
d) Not clear that these patterns would persist into the future but we called for safeguards, some of which have been adopted.

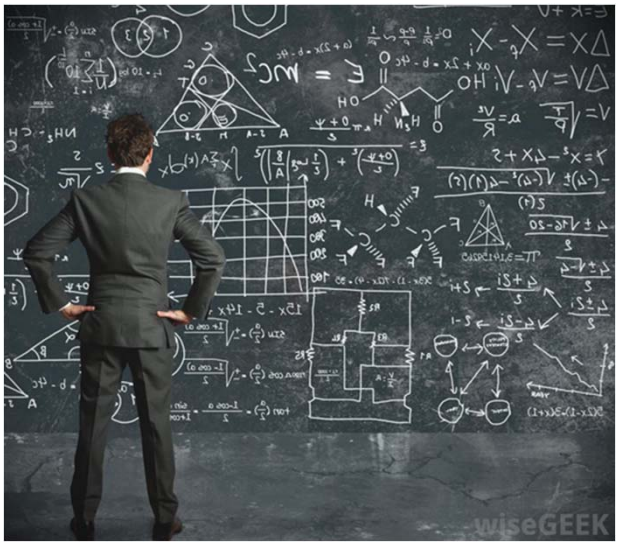
RESEARCH SO FAR

Hernandez-Cortes and Meng (2020) (as interpreted in press)

a) There is a cross-sectional pattern in the location of Cap and Trade facilities that reflects racial and income disparities.
b) Looking over 2008 to 2017:
   - Cap and Trade (regulated facilities) saw a shift toward reducing emissions.
   - Those emissions reductions were most pronounced in CalEnviroScreen disadvantaged neighborhoods.
   - As a result, the "EJ gap" declined, suggesting less (but not no) reasons for equity concern.
c) Considered a "better" approach because it compares regulated to non-regulated facilities (isolating Cap & Trade effect) & because it accounts for wind patterns by modeling emission plumes.

RESEARCH UNDER WAY

We were already working on updating the previous study to cover up to 2017, partly because we had indicated that the patterns of disparity found earlier might or might not persist.



DATA & METHODS

In this work, we were combining:

- GHG emissions and co-pollutant data from CA's Mandatory Reporting of Greenhouse Gas Emissions (MRR) program, 2011-2017.
- Data on neighborhood demographics from the 2018 5-year American Community Survey estimates.
- Cumulative impact scores from the Cal-EPA's CalEnviroScreen 3.0 tool.
- Information from the CA Air Resources Board (CARB) about the geographic location of oil and gas facilities in MRR.

UNDERSTANDING HCM

Hernandez-Cortes and Meng also use GHG emissions and co-pollutant data from CA's Mandatory Reporting of Greenhouse Gas Emissions (MRR) program, combining 2011-2016 with a data slice from 2017.

One of the biggest innovations is that they try to estimate the Cap and Trade effect through a novel technique – which requires an explanation but is quite important.

UNDERSTANDING HCM

Let pollution (which is actually logged) be P. They gather actual data and estimate this equation:

P = f(CnT x time, CnT x time_post2012, facility, year)

And what they will actually use is an estimated P (let's call that *P**) after stripping out the year impacts (let's call that P**

*P** = f(CnT x time, CnT x time_post2012, facility, year)

P** = *P** - [estimated year effects)

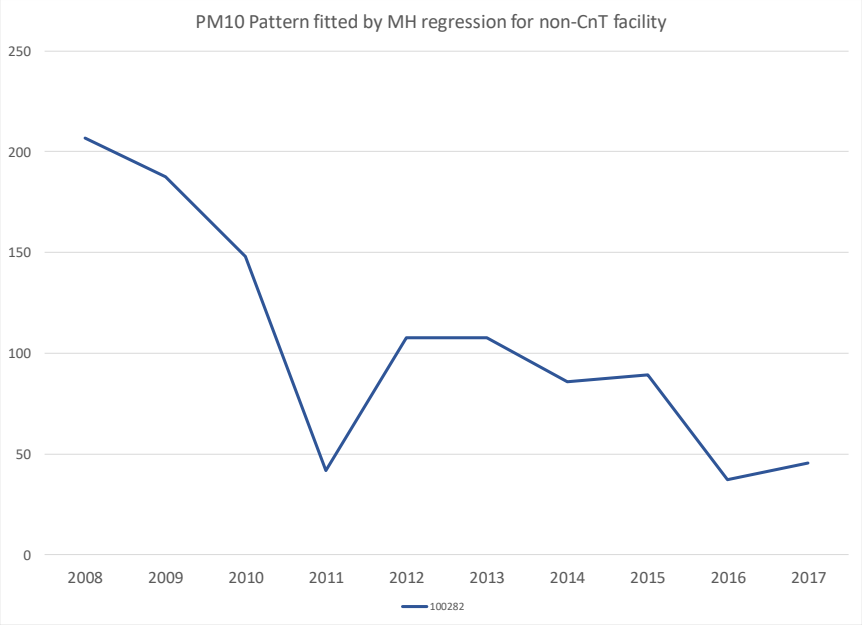
UNDERSTANDING MENG AND HERNANDEZ (MH)

Sound confusing? No doubt . . .

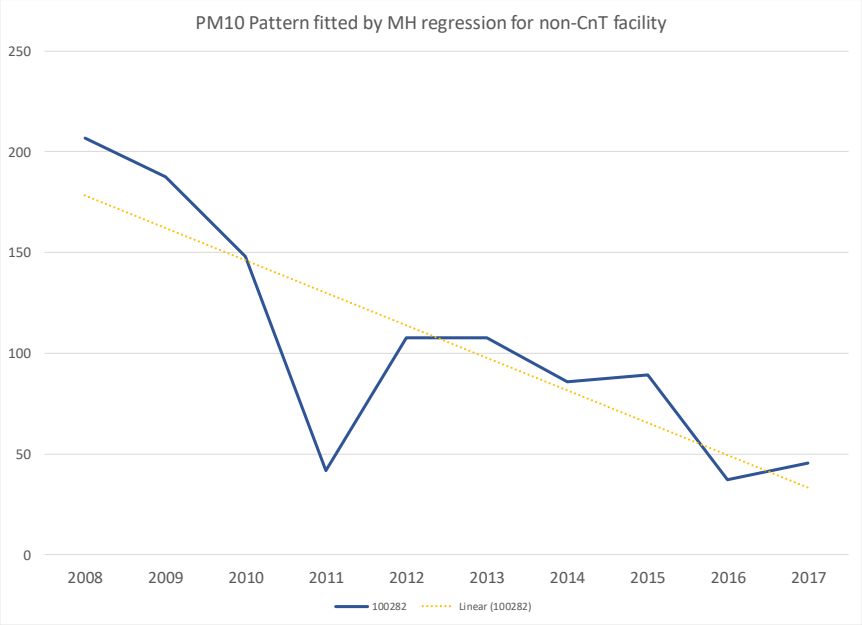
Let's focus first on for non-cap and trade facilities:

*P** = f(CnT x time, CnT x time_post2012, facility, year)

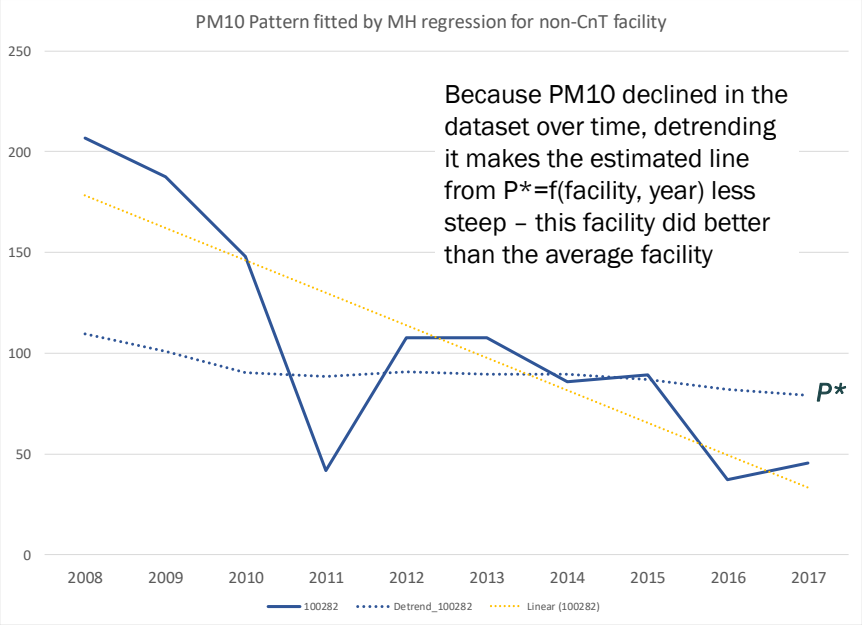
ACTUAL PM10 FROM A NON-C&T FACILITY



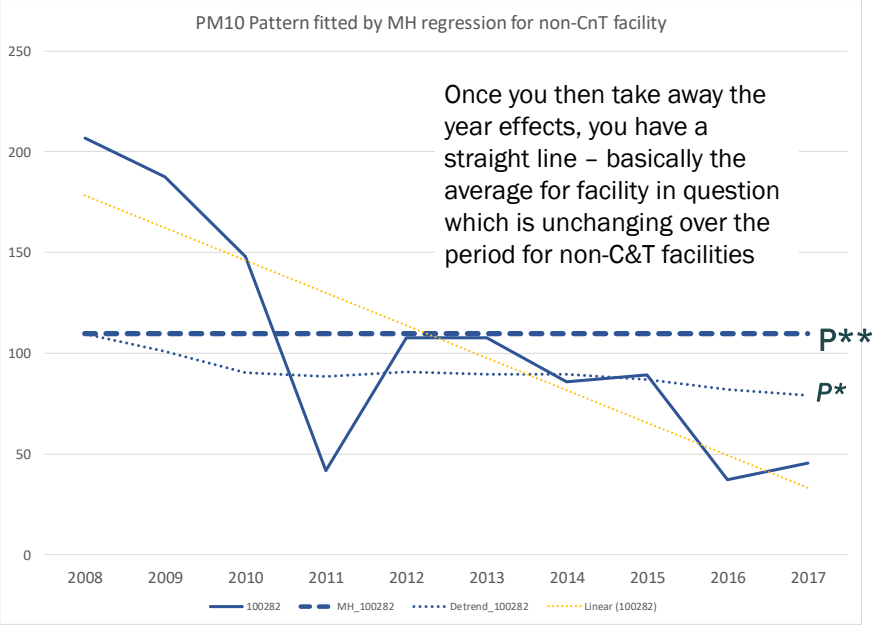
TIME TREND PM10 FROM A NON-C&T FACILITY



DETRENDED PM10 FROM A NON-C&T FACILITY



ESTIMATED P** FOR A NON-C&T FACILITY



UNDERSTANDING HCM

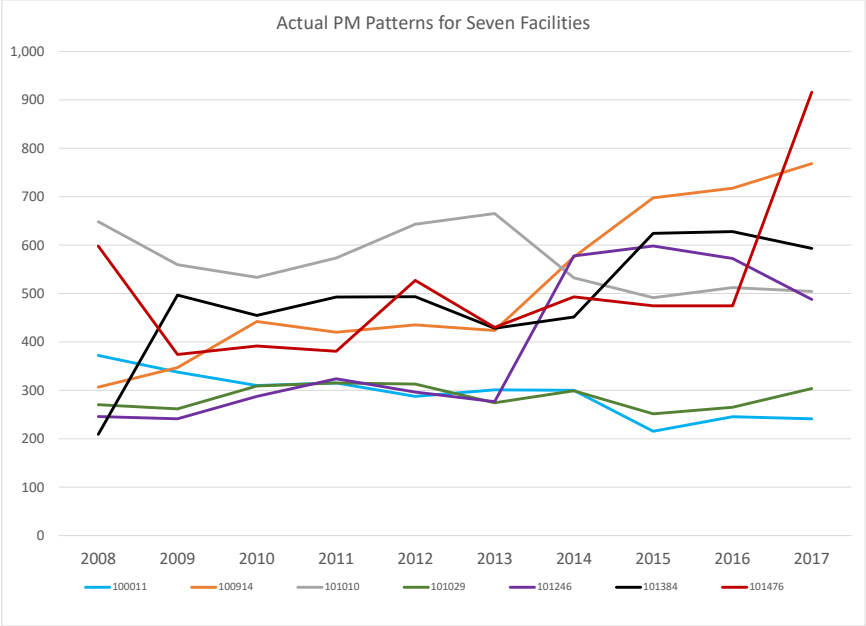
What does that mean for the cap and trade facility estimates?

*P** = f(CnT x time, CnT x time_post2012, facility, year)

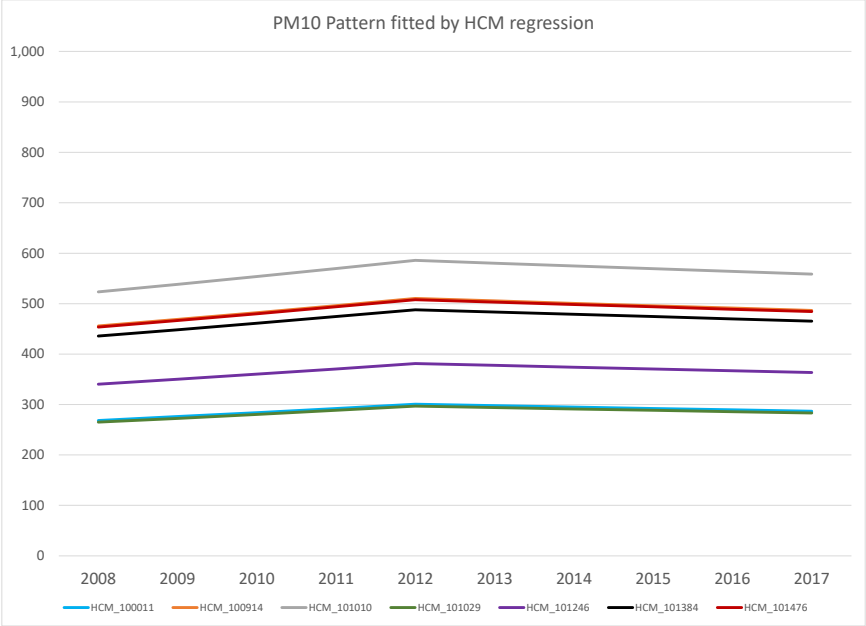
P** = *P** - [estimated year effects]

So every facility is going to share the trend line before and after the imposition of cap and trade

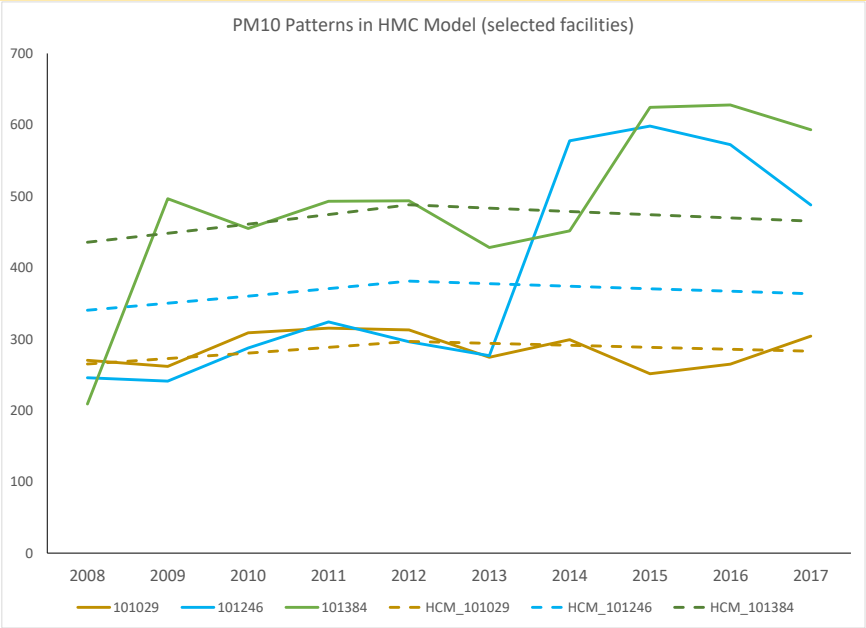
ACTUAL PM & TRENDS FOR SELECT C&T FACILITIES



HCM P** FOR SELECT C&T FACILITIES



ACTUAL PM10 AND HCM P** FOR A FEW C&T FACILITIES



UNDERSTANDING HCM

The key thing to realize (which you just saw):

- HCM are estimating a common percentage increase over 2008-2012 & a common percentage decrease over 2013-2017

After estimating equation (1), we construct facility-by-year emissions of pollutant p that is driven solely by the C&T program (relative to California-wide determinants of pollution), by applying an exponential transformation to $\widehat{\kappa}_1^p[C_j \times t] + \widehat{\kappa}_2^p[C_j \times \mathbf{1}(t \geq 2013) \times t] + \widehat{\phi}_j^p$, where the hat notation indicates estimated parameters. Because facilities vary by average emission levels within our sample period, the inclusion of facility-level fixed effects, $\widehat{\phi}_j^p$, allows us to generate heterogeneous C&T-driven abatement across regulated facilities despite estimating a common percentage effect across regulated firms.[9] Figure S1 shows this abatement heterogeneity, displaying the distribution of facility-level predicted abatement driven by the C&T policy between 2012-2017 for NO_x, SO_x, $PM_{2.5}$, and PM_{10}.[10]

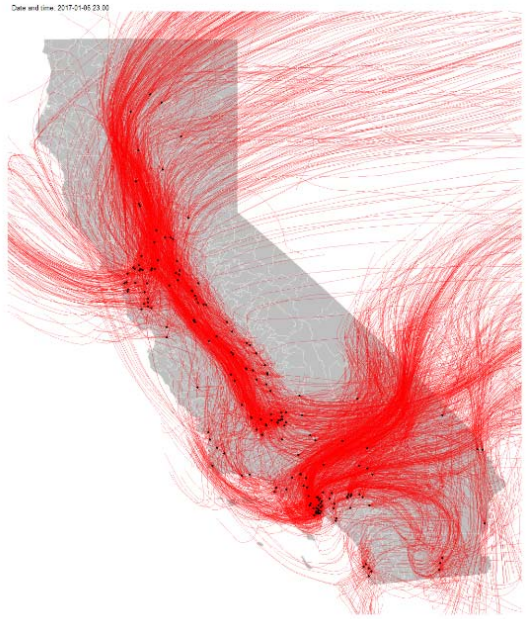
[9] For example, a 10% abatement effect implies 10 tons of abatement for a facility with 100 tons of average annual emissions and 5 tons of abatement for a facility with 50 tons of average annual emissions.

UNDERSTANDING MENG AND HERNANDEZ (MH)

The key thing to realize:

- HCM are estimating a common percentage increase over 2008-2012 & a common percentage decrease over 2013-2017
- What their research shows is that the regulated sector did better than the non-regulated sector
- This does not clarify the pattern within the regulated sector since all are assumed to go up and down by the same percent

UNDERSTANDING HCM



They then take *P*** and run it through an air model and look at where the estimated pollution went (according to the model) and analyze the neighborhood demographics

UNDERSTANDING HCM

A few methodological notes:

- A share of the facilities they analyze are not located in the locations MH use for mapping
- These are oil and gas facilities that have a centralized reporting location for a range of actual production sites
- These are less than ten percent of the 310 facilities but they include 274 emission locations that are not correctly located
- To see this in a modest case . . .

UNDERSTANDING HCM

UNDERSTANDING HCM

A few other methodological notes:

- They include 2008-2010 data; there was a methodological change in 2011 and 2011-2012 was the initial trading benchmark period
- They require that facilities have two years before and after the policy shift – reducing data set from 310 reporting facilities to 272 reporting facilities
- Among those 272 are 17 of the reporting facilities we mentioned with mis-located oil and gas facilities; accounting for those actual locations there are 235 facilities mapped to the wrong location vs. 255 (272 minus 17) mapped correctly.

MP1

UNDERSTANDING HCM

A few other methodological notes:

- Much of the PM10 and PM2.5 data is unevenly reported for the "control" group of non-regulated facilities, with at least twice the share of non-changing observation in the "control" as in the "treatment" (cap and trade) group, rendering statistical comparison suspect
- They focus on zip codes when most analysts – and CalEnviroScreen – work at the census tract level

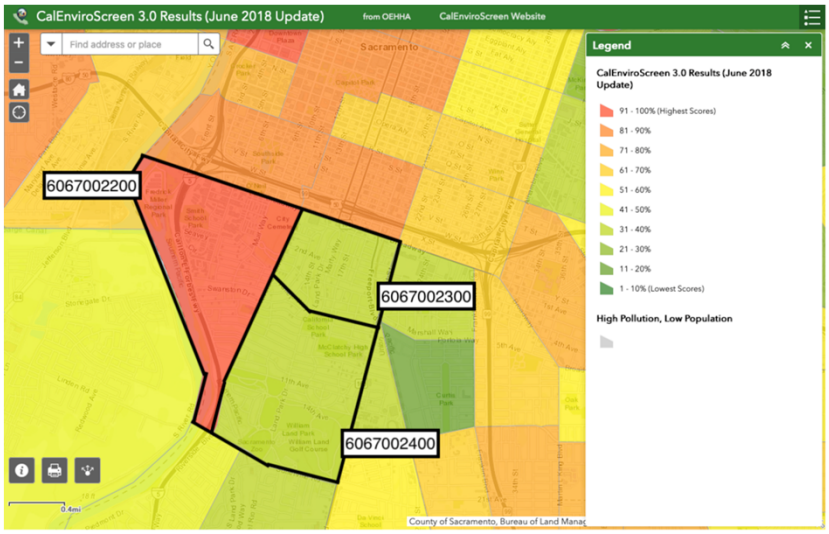
Slide 25

EM1 I modified the language of bullet point 3 a litte because it was confusing to me.
Edward Muna, 1/22/2021

MP1 Need to check this number.
Manuel Pastor, 5/31/2021

UNDERSTANDING HCM

Cullenward and Valenzuela point out the issues:



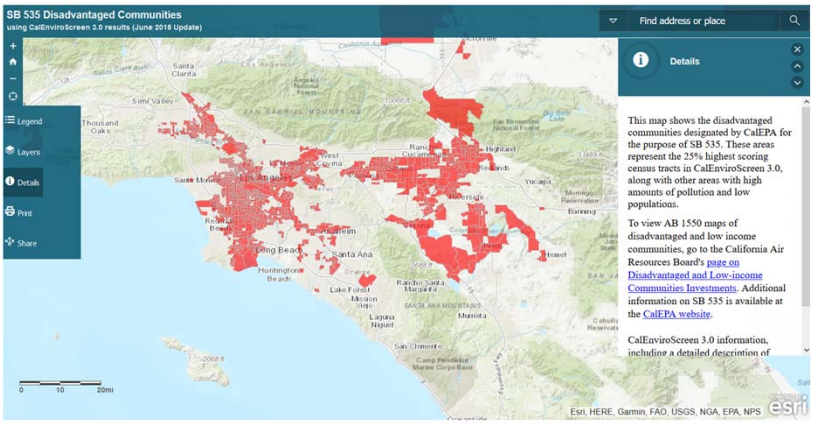
UNDERSTANDING HCM

- The zip code designation is used because HCM suggest that this is an official way of designating an EJ area – one that is a Disadvantaged Community (DAC) by virtue of being above the 75th percentile on a CalEnvironScreen 1.1 ranking

- But the state does not actually use zip code level scores and the methodology of CalEnviroScreen 3 and 4 are different and scored at the tract level

UNDERSTANDING HCM

- Comparing the two, nearly 30 percent of the tracts are mis-assigned by HCM as DACs based on zip codes and 29 percent of the zip codes called "DACs" do not contact a DAC census tract



OUR FINDINGS AND A COMPARISON

FINDING #1

Photo Credit: Nick Fullerton see: https://www.flickr.com/photos/18203311@N08/

Many of California's residential communities are within 2.5 miles of more than one GHG-emitting facility.

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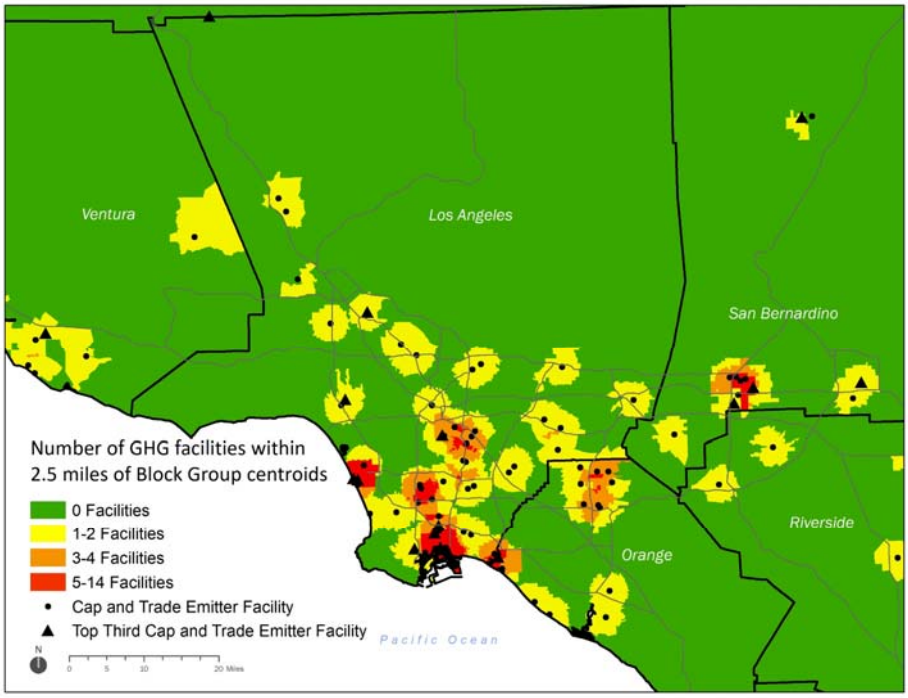
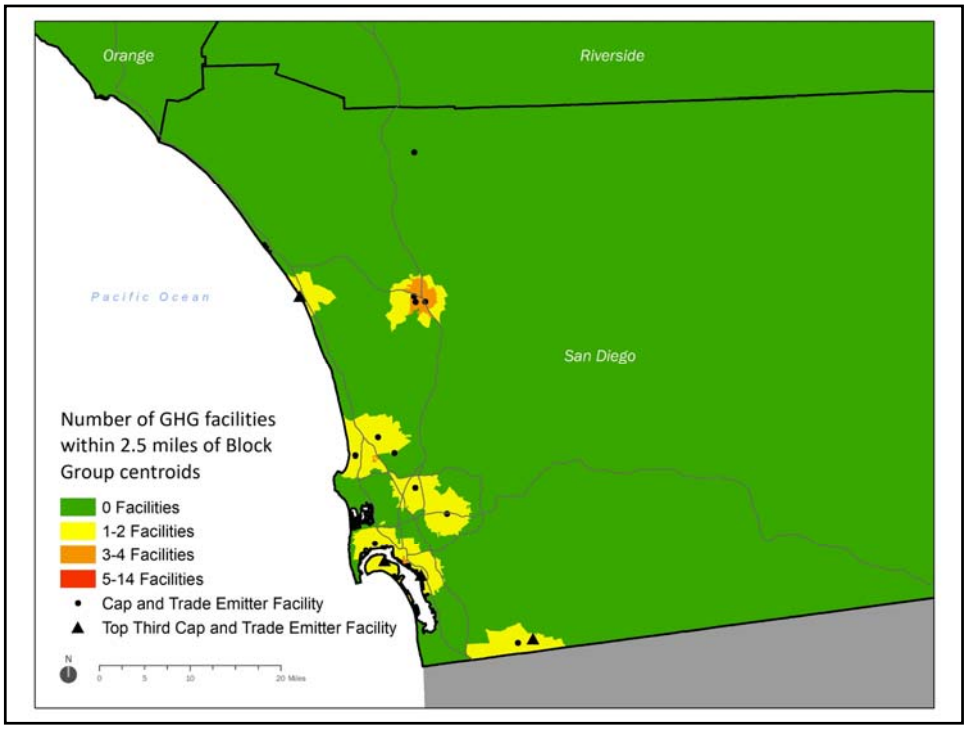
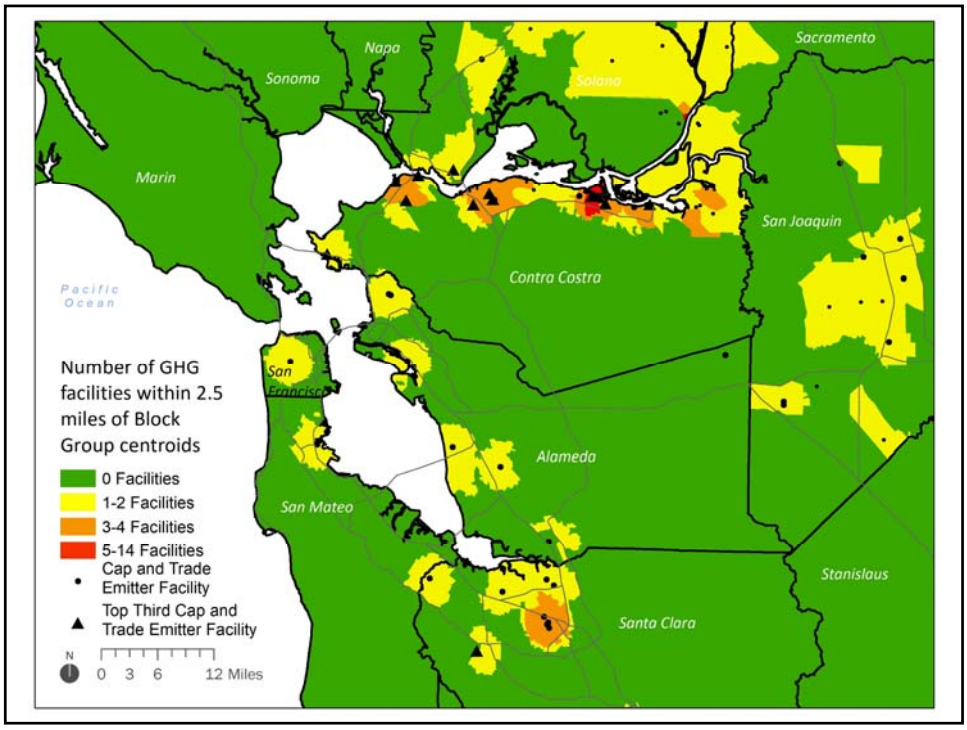
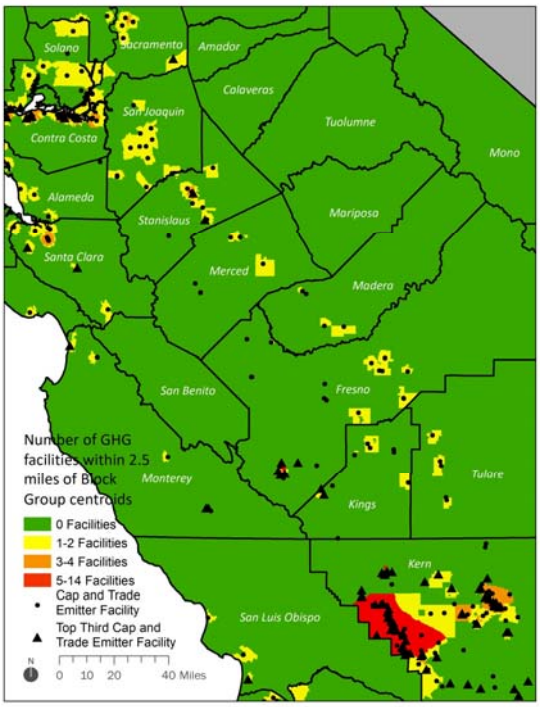



Orange
Riverside
Pacific Ocean
San Diego
Number of GHG facilities within 2.5 miles of Block Group centroids
0 Facilities
1-2 Facilities
3-4 Facilities
5-14 Facilities
Cap and Trade Emitter Facility
Top Third Cap and Trade Emitter Facility
N
0 5 10 20 Miles


Napa
Sonoma
Sacramento
Solano
Marin
San Joaquin
Contra Costra
Pacific Ocean
San Francisco
Number of GHG facilities within 2.5 miles of Block Group centroids
0 Facilities
1-2 Facilities
3-4 Facilities
5-14 Facilities
Cap and Trade Emitter Facility
Top Third Cap and Trade Emitter Facility
Alameda
San Mateo
Stanislaus
Santa Clara
N
0 3 6 12 Miles



FINDING #2

The likelihood of having one or more localized emitters is higher for communities of color and low-income communities.

Photo Credit Peg Hunter/ flickr; Craig Kohlruss/Fresno Bee; Joe Moore/ Valley Public Radio

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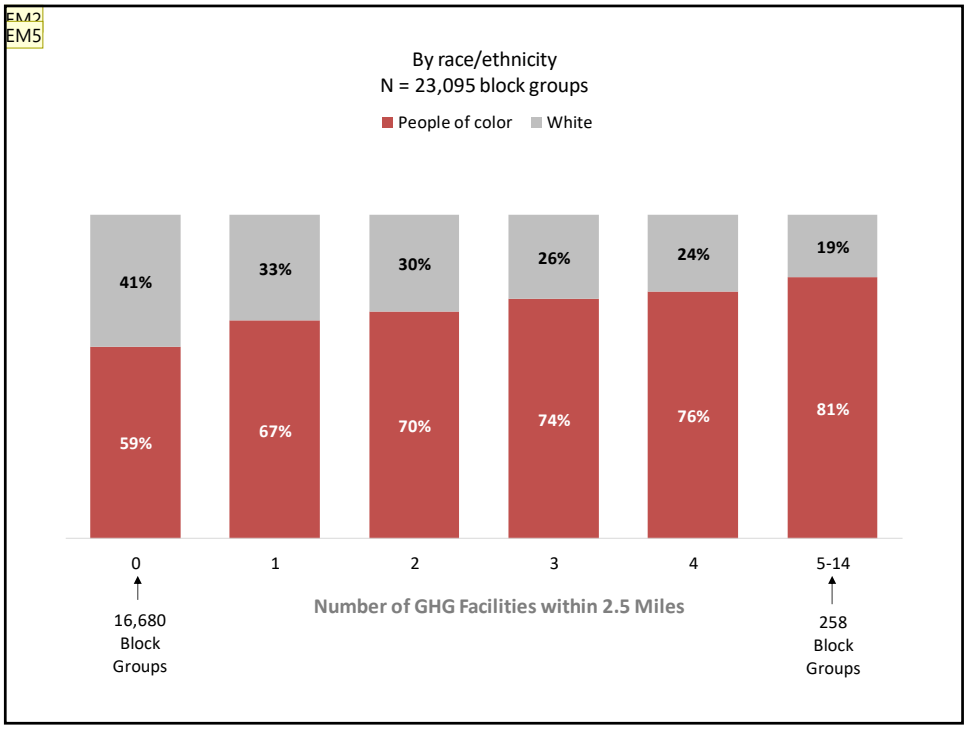
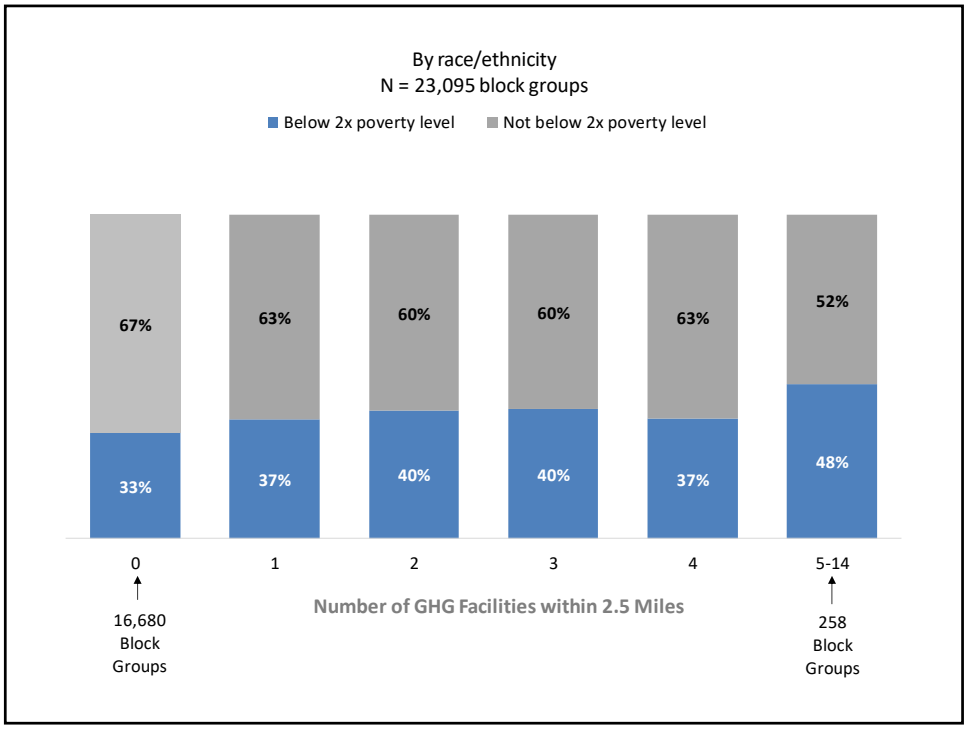
EM2
EM5


By race/ethnicity
N = 23,095 block groups
People of color
White
41%
33%
30%
26%
24%
19%
59%
67%
70%
74%
76%
81%
0
1
2
3
4
5-14
16,680 Block Groups
Number of GHG Facilities within 2.5 Miles
258 Block Groups


By race/ethnicity
N = 23,095 block groups
Below 2x poverty level
Not below 2x poverty level
67%
63%
60%
60%
63%
52%
33%
37%
40%
40%
37%
48%
0
1
2
3
4
5-14
16,680 Block Groups
Number of GHG Facilities within 2.5 Miles
258 Block Groups

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EM2 Make line up
Edward Muna, 1/22/2021

EM5 DONE
Edward Muna, 1/22/2021

EM3
EM4

Table 1-All Emitter Facilities	Block groups with at least one facility within 2.5 miles (N=6,415)	Block groups with no facilities within 2.5 miles (N=16,680)
Mean % people of color	69%	59%
Mean % people living in poverty (below 2x federal poverty level)	38%	33%
% of block groups in a "Top 10%" CalEnviroScreen tract	20%	6%
% of block groups in a "Top 25%" CalEnviroScreen tract	39%	20%

FINDING #3

There were differential improvements in emissions between 2011-12 and 2016-17 – and these show an uneven pattern by race, income, and other variables .

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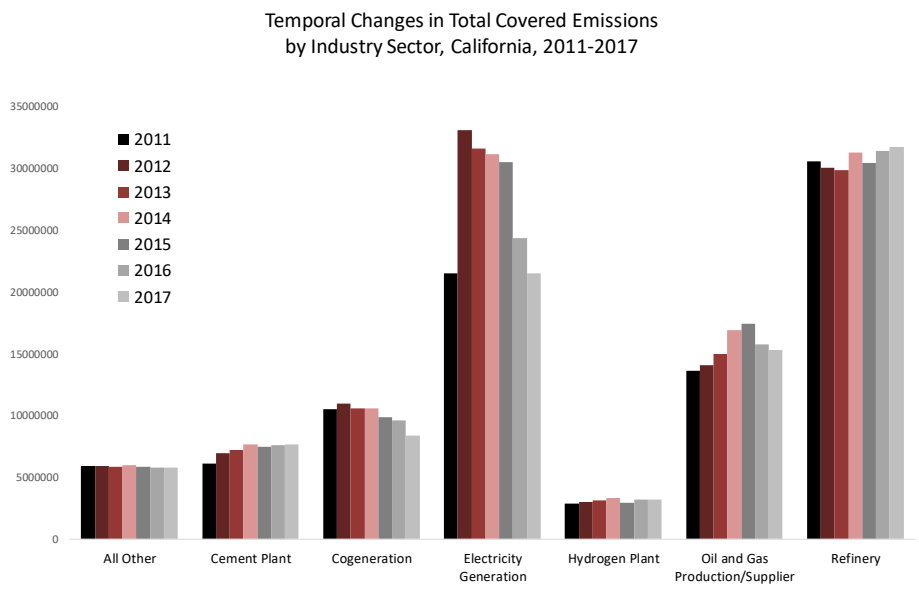
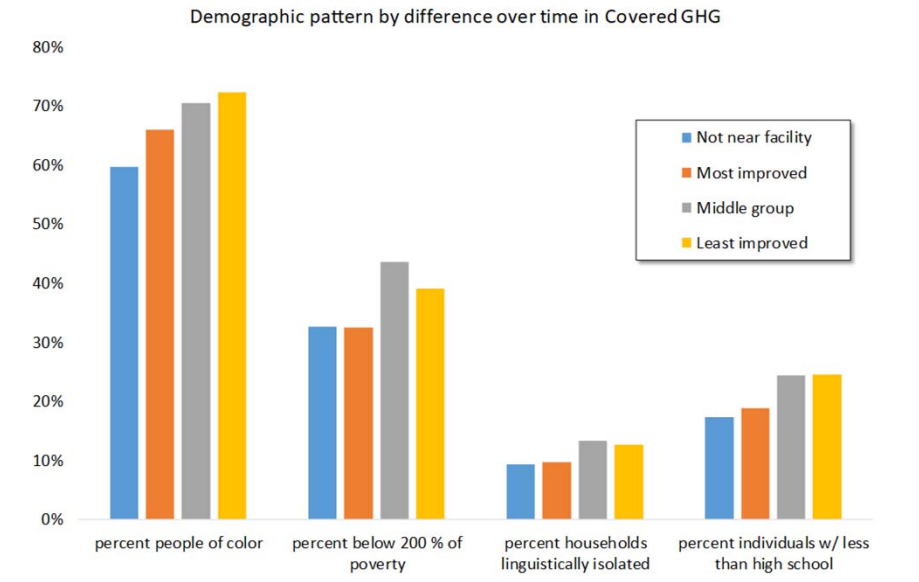
EM3 make line up
Edward Muna, 1/22/2021

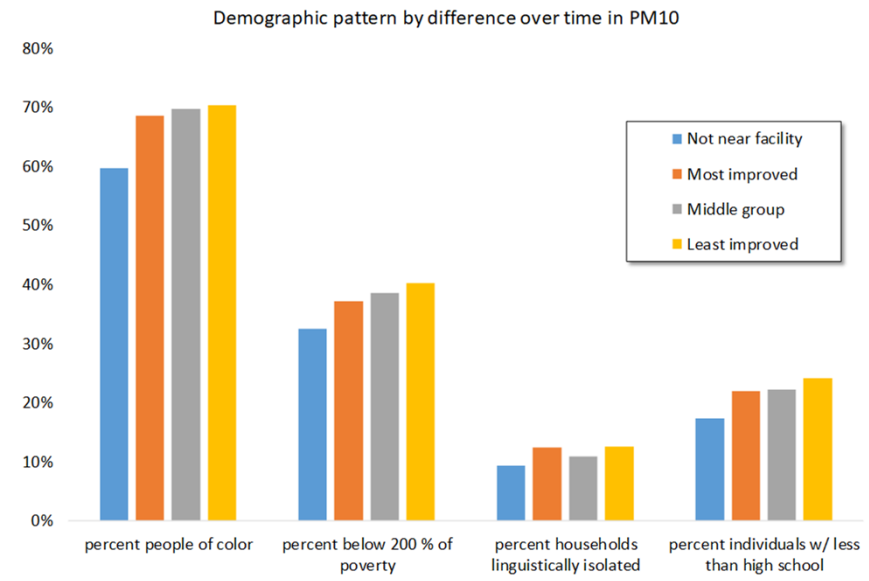
EM4 DONE
Edward Muna, 1/22/2021



PATTERN LOOKING AT RATES OF COVERED GHG



PATTERN LOOKING AT RATES OF PM10



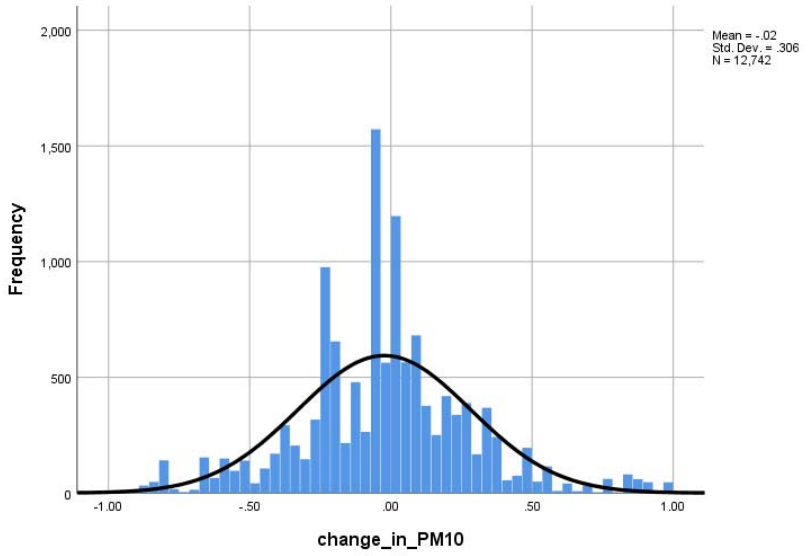
QUESTION . . .

Why then do Meng and Hernandez find improvement in the "EJ Gap" in their work?

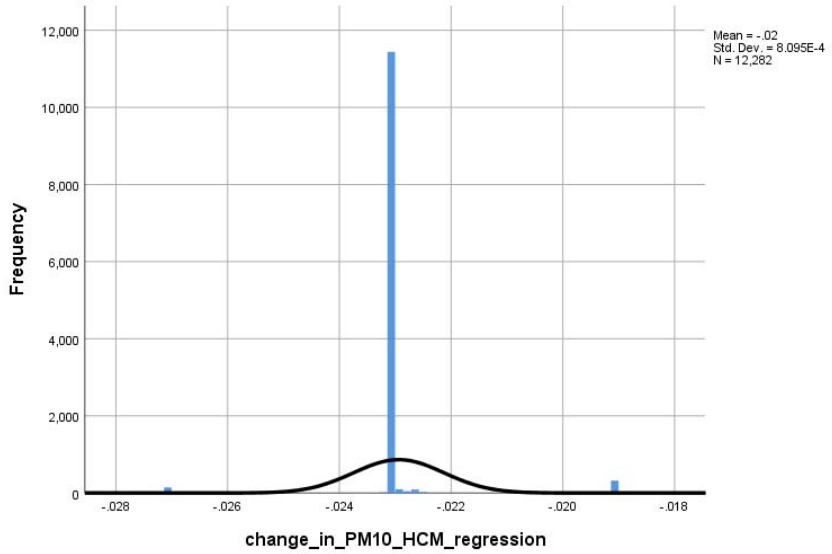
Recall that they are assuming a common percent effect across all facilities – which means that nearly all neighborhood will get the same percentage reduction.

To see this . . .

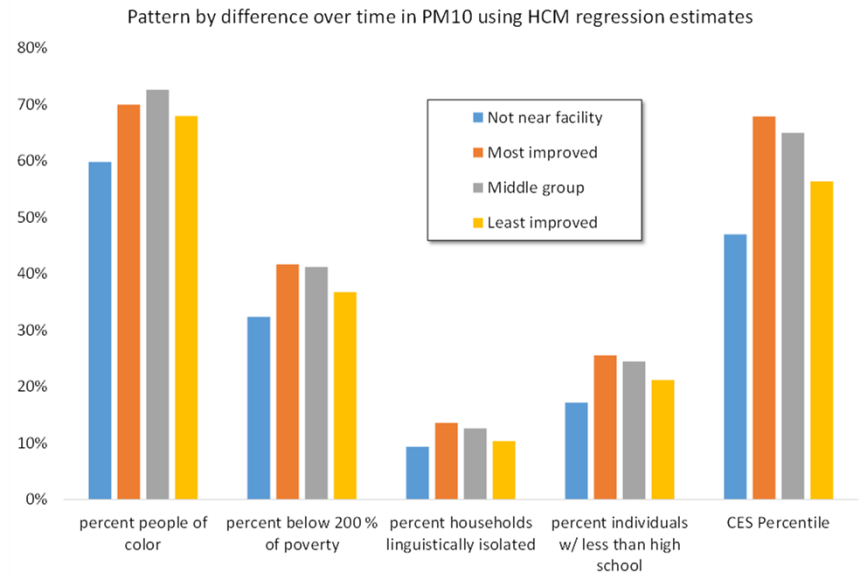
CHANGE IN NEIGHBORHOOD PM10, 2011-12 / 2016-17



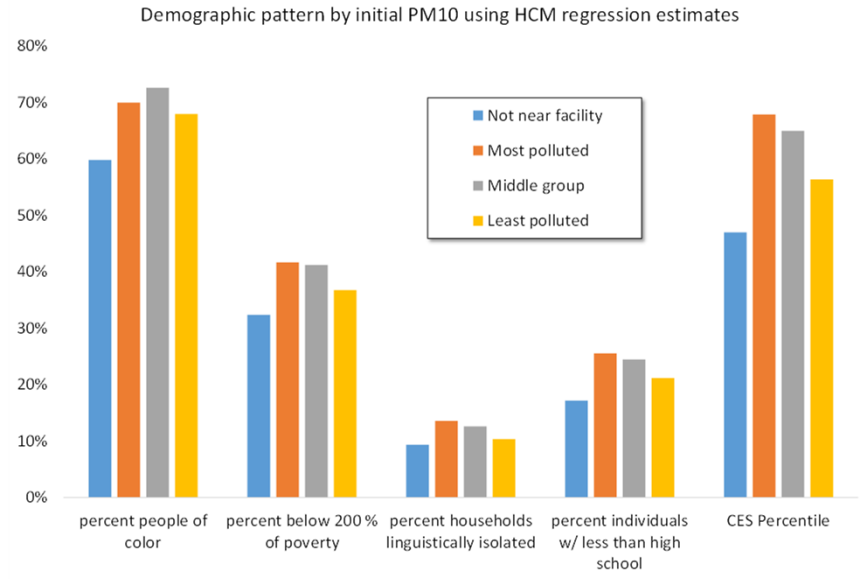
CHANGE IN NEIGHBORHOOD HCM PM10 ESTIMATES



NEIGHBORHOOD DIFFERENCE IN PM10 OVER TIME IS . .



SAME PATTERN AS INITIAL DUE TO COMMON % EFFECT



ONE POSSIBLE EXPLANATION

Why might that be so?

- If you apply the same percentage reduction, then the biggest improvements will occur where you originally had the worst pollution.

ONE POSSIBLE EXPLANATION

Why might that be so?

- If you apply the same percentage reduction, then the biggest improvements will occur where you originally had the worst pollution.

- Of course, the thing about Cap and Trade is that the same percentage results are not in the design and that's been one of the concerns of EJ advocates.

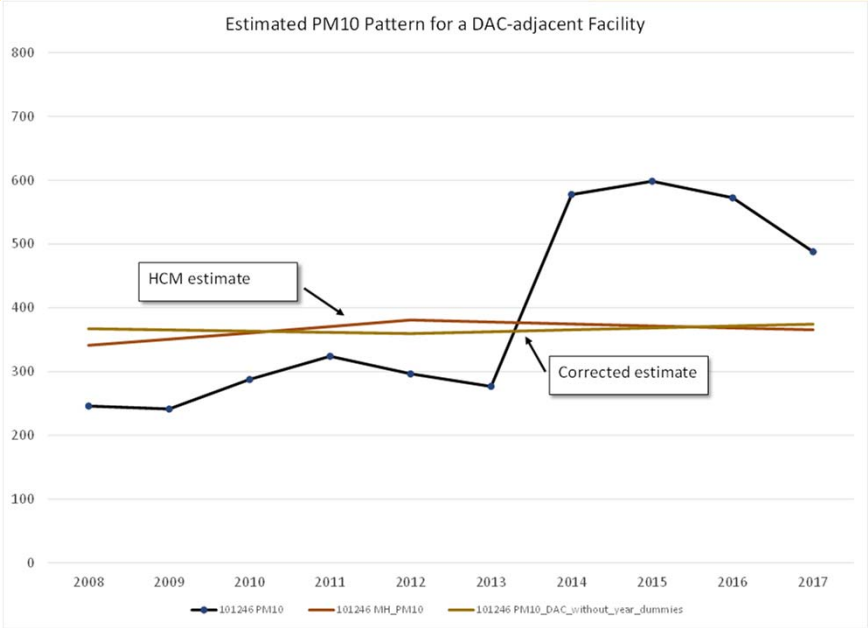
ONE POSSIBLE OPTION FOR REGRESSION

*P** = f(CnT x time, CnT x time_post2012,
CnT x time x DAC, CnT x time_post2012 x DAC,
facility, year)

P** = *P** - [estimated year effects]

So what does that look like?

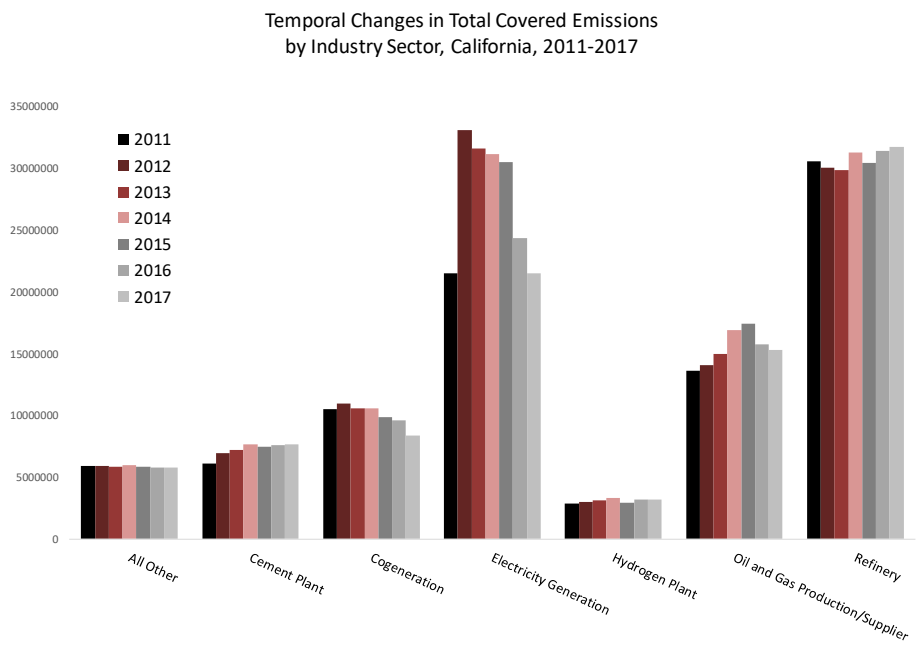
WHICH ACTUALLY SHOWS A COMMON INCREASE

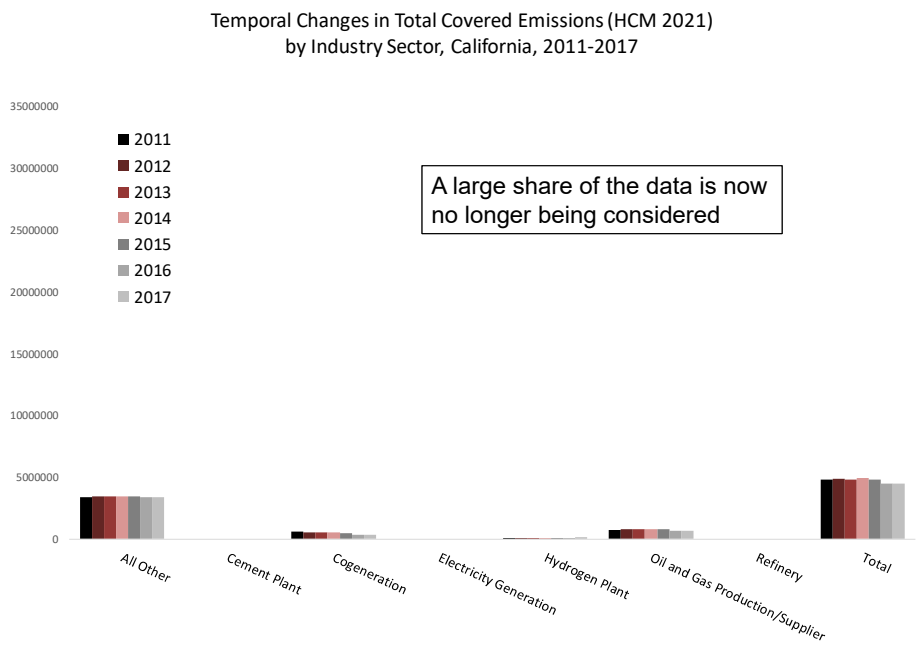


HCM 2021

In a 2021 version of their paper, HCM seek to obtain a more precise cap and trade effect by removing refineries and electrical generators (because they are covered by other regulations) and to remove the largest polluters

What does the resulting data look like?





SUMMARY: PRELIMINARY FINDINGS

- Regulated GHG-emitting facilities—including those that emit the highest levels of both GHGs and PM—are located in neighborhoods with higher proportions of residents of color and residents living in poverty.

Public health and equity co-benefits of Cap and Trade could be enhanced if there were more emissions reductions among the larger emitting facilities that are located in disadvantaged communities.

SUMMARY: PRELIMINARY FINDINGS

- The most recent era of Cap and Trade has likely seen some improvements as caps have been more binding and there have been additional safeguards put in place (less offsets, more community monitoring).
- While the evidence does point to some degree of disparity in the pattern of improvement within the regulated sector, things may be getting better.
- More research (as always!) is needed.

RECOMMENDATIONS

Things that would help research:

- Build better linkages between state facility-level databases on GHG and co-pollutant emissions (i.e., harmonize facility ID codes between relevant data sources);
  - this could be built into facility emissions reporting requirements.
- Publicly release data on facility- and company-specific allowance allocations.
- Track and make data available on facility- and company-specific allowance trading patterns.

RECOMMENDATIONS

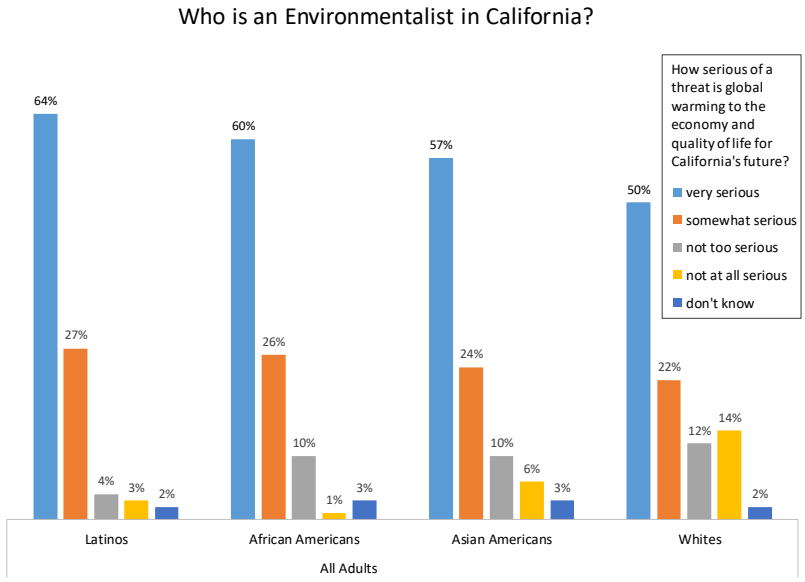
Things that would help policy:

- Continue to acknowledge community concerns about carbon trading and other environmental measures
- Adopt broad "just transition" goals that center equity, building trust with fence line communities left and kept behind
- Understand that the good will and environmental support is there to build on in such communities

https://grist.org/politics/how-environmental-justice-fared-in-2014-and-the-outlook-for-2015/

http://www.theinclusionsolution.me/dei-beyond-the-boardroom-environmental-justice-is-racial-justice/

ENVIRONMENTAL JUSTICE & ENVIRONMENTAL ALLIES



Source: Public Policy Institute of California, July 2015.

TOGETHER WE CAN BUILD A SUSTAINABLE CALIFORNIA

- Understand that the good will and environmental support is there to build on in such communities

THANK YOU!

Questions?