Integrating Air Quality and Environmental Justice into the Clean Energy Transition

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Decarbonization + air quality: Key issues

- Decarbonization is a global problem but implementation will necessarily be local (technical and political)
- Local: Co-pollution and co-benefits
  - Air pollution co-benefits of decarbonization as large as decarbonization benefits (double dividend!)
  - Large reductions in co-pollutant damages can be baked into decarbonization at **modest additional cost**.
- Distributional: Where, who, and when?

Decarbonization + air quality: Key issues

- Measuring the local co-benefits
  - How tight the coupling between carbon and co-pollutants?

Effects of Carbon Mitigation on Carbon Monoxide-pollutants at Industrial Facilities in Europe

Klara Zwickl, *Simon Sturn*, *James K. Boyce*

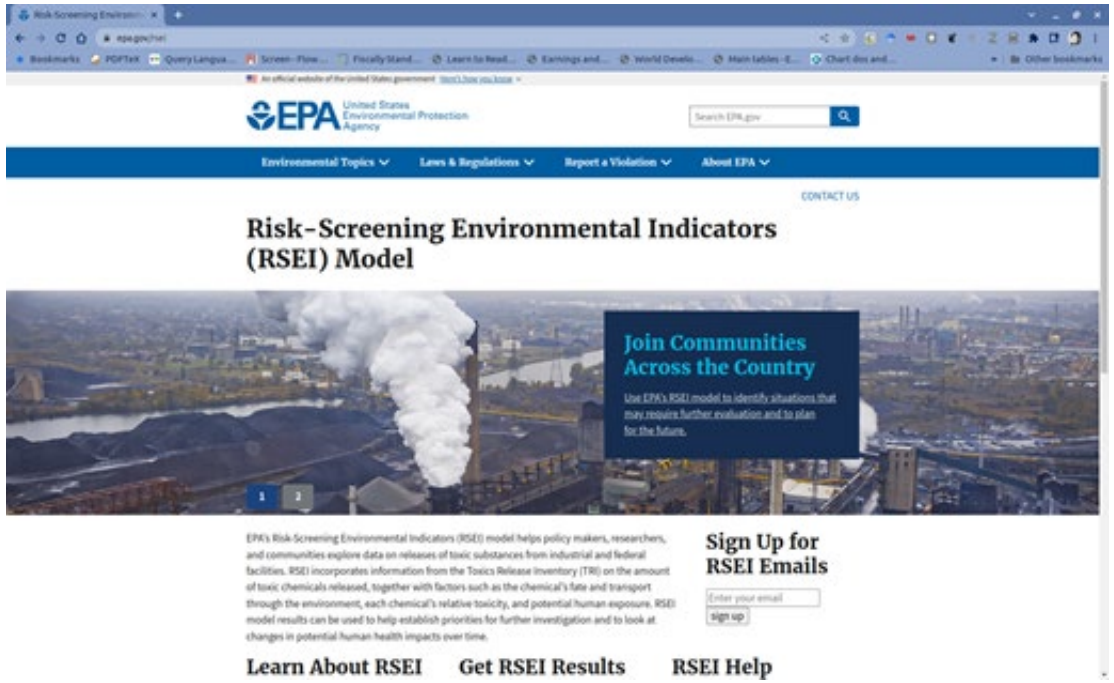
Energy Journal Best Paper Award for 2021

Elasticities of co-pollutant reduction for carbon reduction are rarely less than 1.

"conventional estimates of carbon damages that omit co-benefits significantly underestimate the benefits of carbon mitigation"

Decarbonization + air quality: Key issues

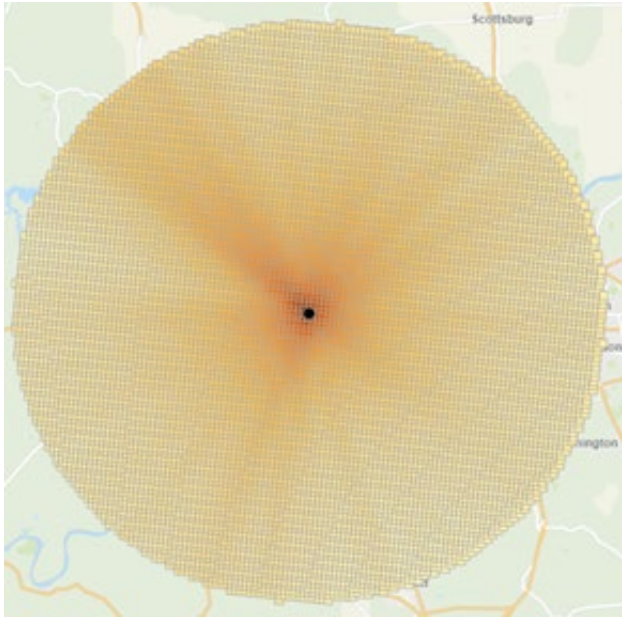
- Measuring the local co-benefits
  - Crucial role of integrative tools (Risk-Screening Environmental Indicators (RSEI))



RSEI incorporates information from the Toxics Release Inventory (TRI) on the amount of toxic chemicals released, together with factors such as the chemical's fate and transport through the environment, each chemical's relative toxicity, and potential human exposure.

Decarbonization + air quality: Key issues

- Distribution of local co-benefits
  - RSEI Geographic Microdata



Integrated RSEI hazard “values for each release and each potentially impacted grid cell.

“Using the RSEI Geographic Microdata, you can trace back the potential impacts from the grid cells to the facility that released the chemical(s).”

Or stopped releasing the chemical.

Decarbonization + air quality: Key issues

- Distribution of local co-benefits
  - Who benefits, who pays?
  - Corporate Environmental Justice (EJ) Performance with RSEI

Toxic 100 Air Polluters Index (2021 Report, Based on 2019 Data)

(Click on column headers to re-sort table: current sort is by Toxic 100 Air Rank.)

Toxic 100 Air Rank	Corporation	Toxic score (pounds released x toxicity x population exposure)	Millions of pounds of toxic air releases	Millions of pounds of toxic incineration transfers	EJ: Poor Share	EJ: Minority Share	% of toxic score from a single facility
1	Boeing	21,105,144	0.25	0.01	14%	36%	100%
2	LyondellBasell	12,599,132	5.15	3.14	16%	68%	70%
3	Huntsman	11,137,063	0.69	6.68	14%	45%	54%
4	Linde	9,615,218	0.37	<0.01	15%	48%	78%
5	BASF	8,834,947	5.02	7.32	19%	36%	40%
6	Dow Inc.	6,858,422	5.89	9.03	19%	49%	45%
7	Celanese	5,791,002	0.83	7.32	14%	61%	100%
Assa Abloy, previously ranked at number 8 among the Toxic 100 Air, has submitted data to the U.S. E.P.A. revising its 2019 TRI reporting. Based on the revision, Assa Abloy is ranked 98th on the Toxic 100 Air. The next edition of the Toxic 100 will reflect the most current information from the E.P.A.							
8	Baker Hughes	3,747,413	0.65	0.03	17%	46%	41%
9	Eastman Chemical	3,440,587	4.88	1.50	20%	44%	80%
10	Ecolab	3,247,008	0.06	1.35	16%	79%	97%

Decarbonization + air quality: Key issues

- Size and Distribution of local co-benefits

  Integrating carbon and local pollutants (and challenges)

Combined Toxic 100 / Greenhouse 100 Indexes (2021 Report, Based on 2019 Data)

(Click on column headers to re-sort table: current sort is by Toxic 100 Air Rank.)

Parent Entity or Corporation	Toxic 100 Air Rank	Greenhouse 100 Rank	Toxic 100 Air EJ: Poor Share	Toxic 100 Air EJ: Minority Share	Toxic 100 Water EJ: Near Poor Share	Toxic 100 Water EJ: Minority Share	Greenhouse 100 EJ: Poor Share	Greenhouse 100 EJ: Minority Share	Toxic 100 Water Rank
Boeing	1		14%	36%	39%	70%			81
LyondellBasell	2	74	16%	68%	16%	31%	18%	77%	3
Huntsman	3		14%	45%					
Linde	4	87	15%	48%			20%	68%	
BASF	5	153	19%	36%	25%	12%	15%	49%	10
Dow Inc.	6	39	19%	49%	35%	48%	16%	48%	2
Celanese	7		14%	61%	16%	30%			4
Baker Hughes	8		17%	46%	26%	49%			82
Eastman Chemical	9	105	20%	44%	43%	17%	15%	20%	9
Ecolab	10		16%	79%	31%	87%			188

Combined Toxic 100 / Greenhouse 100 Indexes (2021 Report, Based on 2019 Data)

(Click on column headers to re-sort table: current sort is by Greenhouse 100 Rank.)

Parent Entity or Corporation	Toxic 100 Air Rank	Greenhouse 100 Rank	Toxic 100 Air EJ: Poor Share	Toxic 100 Air EJ: Minority Share	Toxic 100 Water EJ: Near Poor Share	Toxic 100 Water EJ: Minority Share	Greenhouse 100 EJ: Poor Share	Greenhouse 100 EJ: Minority Share	Toxic 100 Water Rank
Vistra Energy	159	1	14%	26%	18%	3%	12%	39%	26
Duke Energy	129	2	14%	32%	19%	8%	14%	29%	6
Southern Company	170	3	14%	41%	36%	38%	15%	48%	39
Berkshire Hathaway	14	4	15%	38%	27%	38%	14%	36%	17
American Electric Power	67	5	13%	10%	41%	7%	16%	19%	18
U.S. Government		6					15%	43%	
Xcel Energy		7					13%	39%	
Energy Capital Partners		8			43%	30%	15%	66%	13
NextEra Energy		9			25%	21%	14%	53%	29
Exxon Mobil	25	10	21%	70%	38%	78%	15%	55%	38

GREEN FOR ALL

POLITICAL ECONOMY RESEARCH INSTITUTE
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Integrating Air Quality and Environmental Justice into the Clean Energy Transition

BRIDGET DIANA • MICHAEL ASH • JAMES K. BOYCE

Scenario 1
Carbon-alone

Policy narrowly focused on the goal of a **20% reduction of carbon dioxide emissions.**

Scenario 2
Carbon plus air quality

Policy that targets the dirtiest power plants by **imposing an added constraint of reducing the damages from co-pollutants by 50%.**

Scenario 3
Carbon and air quality plus environmental justice

Scenario that additionally requires attainment of the same **50% reduction in co-pollutant damages for Black, Hispanic, and low-income populations.**

Carbon-only scenario: Key findings

- **In several regions**, co-pollutant damages do not decline as much as carbon emissions.
- **In all regions**, co-pollutant damages increase in some locations.
- **In California**, co-pollutant damages increase substantially for the region as a whole.
- **Blacks and Hispanics may be disproportionately impacted** by ***increases*** in co-pollutant damages.

Table S-10: Regional Changes in Co-Pollutant Damages

Percent change from a 20% decarbonization relative to baseline

Region		All	Black	Hispanic	Low-income
CAMX	(California)	156.7%	219.8%	186.5%	168.0%
MROE	(e Wisconsin)	5.7%	5.2%	5.6%	5.7%
MROW	(n Midwest)	-6.1%	-1.5%	-8.2%	-7.7%

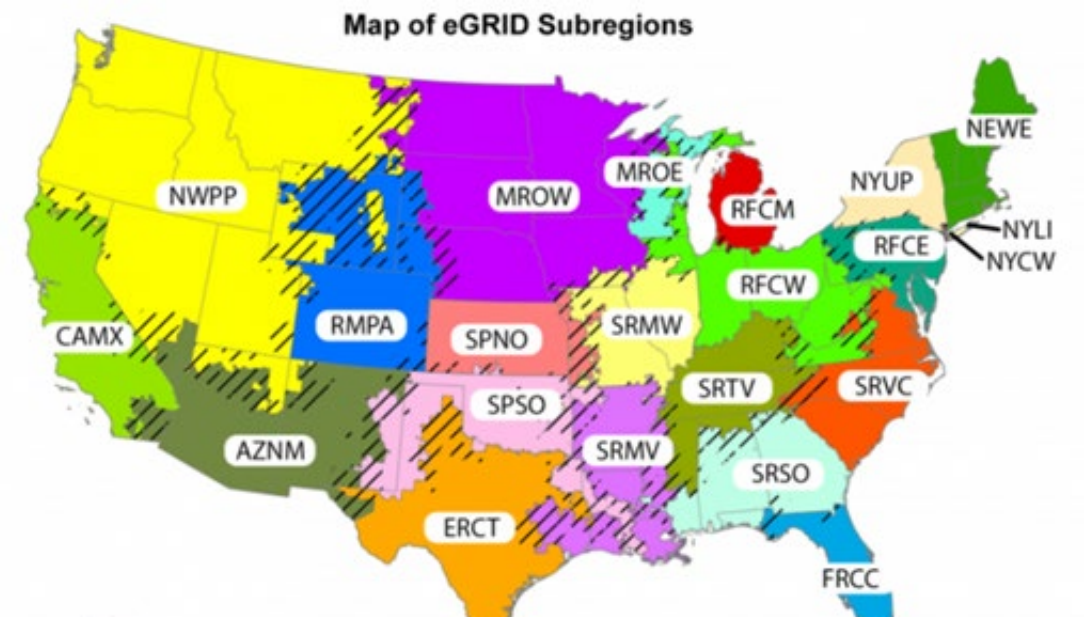


Table 4. Annual Benefits and Costs of Including Air Quality and Environmental Justice in Decarbonization Program

	Adding Air Quality	Adding Air Quality and EJ
Benefit	$9.56 bn	$10.61 bn
Cost	$4.81 bn	$4.84 bn
Net benefit	$4.75 bn	$5.77 bn

Carbon + air quality + EJ scenario: Key findings

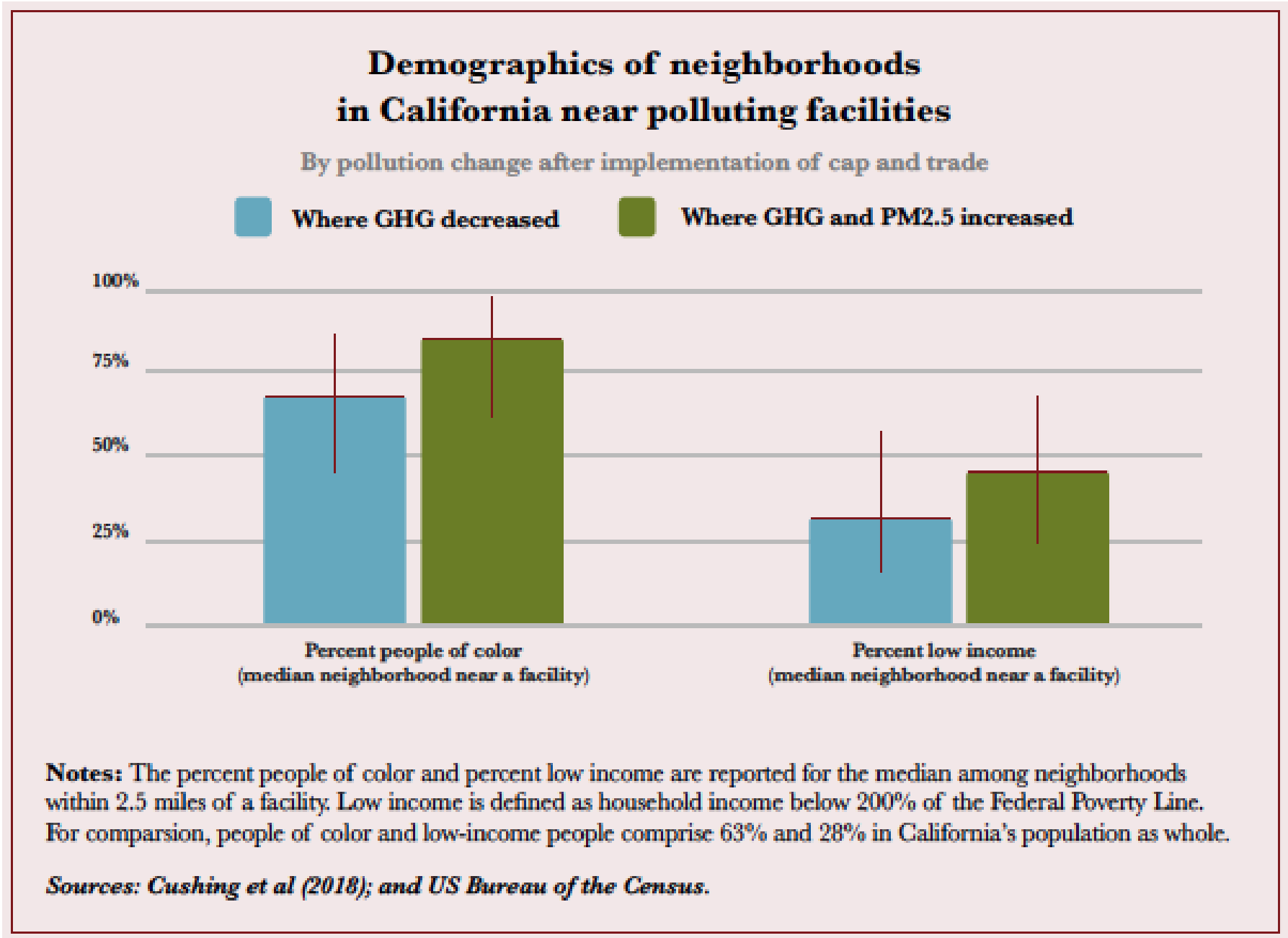
- Adding the EJ goal results in **further changes** in plant-by-plant distribution of electricity generation.
- The EJ goal can can be baked into the policy at **very modest additional cost**.
- When monetized by conventional United States Environmental Protection Agency (EPA) valuation techniques, the **benefits substantially exceed the cost**.

Coal vs. Natural gas: Examples from Georgia

A tale of two fuels: highly toxic coal-burning electrical generation units have historically been situated in lower density areas; natural gas-burning plants, still toxic, tend to be located closer to urban and suburban populations.

On the left, the nation's highest-CO_2 coal plant, Scherer (Monroe Co., Georgia), is surrounded by a population of 2,324 people, of whom 20% are Black, 13% are Hispanic, and 48% are low income.

On the right, the second highest CO_2-emitting natural gas plant, McDonough-Atkinson (Cobb Co., Georgia), is surrounded by 60,340 people of whom 40% are Black, 8% are Hispanic, and 25% are low income.



Cushing et al (2018) found that a number of neighborhoods across the state experienced increases in greenhouse gas and co-pollutant emissions from regulated facilities, and that these were disproportionately inhabited by people of color and low-income residents.

- Cushing, L., Blaustein-Rejto, D., Wander, M., Pastor, M., Sadd, J., Zhu, A., & Morello-Frosch, R. (2018). Carbon trading, co-pollutants, and environmental equity: Evidence from California's cap-and-trade program (2011–2015). *PLoS Medicine*, 15(7), e1002604.
- Boyce, J. K., & Ash, M. (2018). Carbon pricing, co-pollutants, and climate policy: Evidence from California. *PLoS Medicine*, 15(7), e1002610.

Science-Based Targets

More than 1,000 companies have adopted Science Based Targets (SBTs), pledging to reduce greenhouse gas (GHG) emissions in ways consistent with meeting the 1.5-2 degrees Celsius target needed to prevent catastrophic climate changes.

Partnership Organizations

CDP
DISCLOSURE INSIGHT ACTION

United Nations Global Compact

WORLD RESOURCES INSTITUTE

WWF

For more: https://sciencebasedtargets.org/

Top Air Polluters Based on US EPA RSEI Air Score

Rank in the PERI Toxic 100 Air Polluters	*Company Adopting Science-Based Target*	*Nonwhite share (US EPA RSEI Toxic Score)*
8	CLARIANT	**58.2**
11	CRODA	**49.7**
14	TERUMO	**32.4**
17	ECOLAB	**78.7**
35	klöckner & co	**59.2**
50	AkzoNobel	**70.3**
62	ArdaghGroup	**43.1**
74	Linde	**47.6**
77	SOLVAY	**57.2**
97	Kingspan	**18.1**

*Integrating **Clean Air + EJ** in **Climate** legislation*

- **EJ Screening and Mapping Tool** to identify vulnerable communities that bear disproportionate cumulative impacts, to be developed by EPA with participation from NEJAC and others.

- **Air Monitors** to be placed in all EJ communities, providing real-time data to the public as well as agencies.

- **Clean Air and Electrical Generation:** mandated reduction in co-pollutant intensities (emissions of sulfur dioxide (SO2), nitrogen oxides (Nox) and particulate matter 2.5 (PM2.5) per kilowatt hour) of electric power generation with concrete timeline.

- **EJ Guarantee:** mandated reduction in co-pollutant emissions (tons of SO2, NOx and PM2.5, RSEI Hazard) **near EJ communities to match or exceed national carbon reductions**

NB: *Language could be inserted in clean energy standard or carbon pricing bills – any bill that specifies targets for carbon emission reductions.*

Thank you!