The Los Angeles 100% Renewable Energy Study

Advisory Group Meeting #15

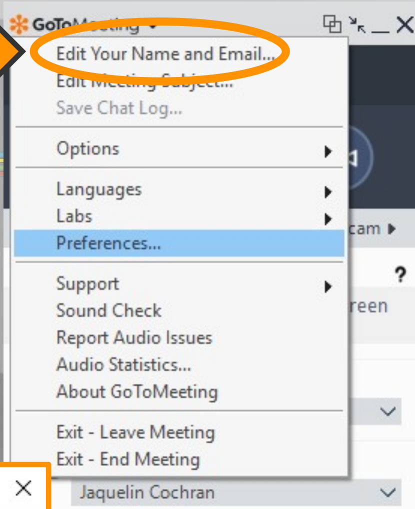
Virtual Meeting #2

Los Angeles Department of Water & Power

NREL Transforming ENERGY

The Los Angeles 100% Renewable Energy Study

Welcome to the LA100 Advisory Group meeting!
Please consider adding your affiliation to your name identification.



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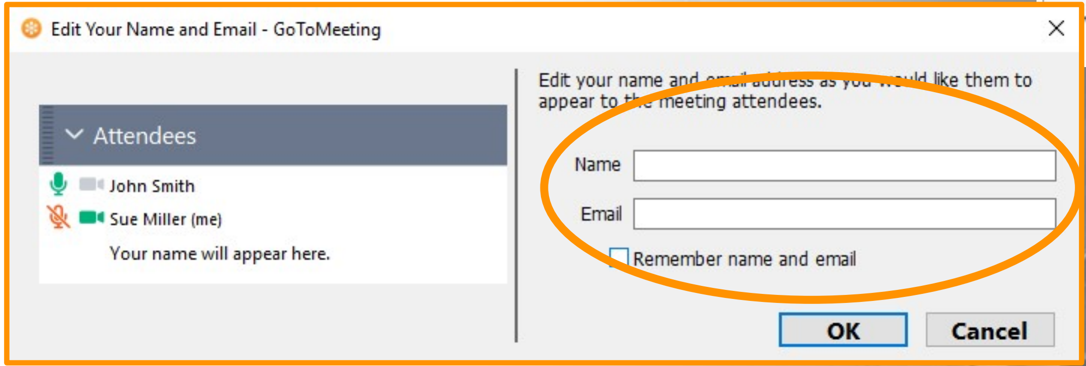


Los Angeles Department of Water & Power

NREL Transforming ENERGY

Tips for Productive Discussions

Let one person speak at a time

Keep phone/computer on mute until ready to speak

Help ensure everyone gets equal time to give input

Type "Hand" in Chat Function to raise hand

Keep input concise so others have time to participate

Also make use of Chat function

Actively listen to others, seek to understand perspectives

Offer ideas to address questions and concerns raised by others

Hold questions until after presentations

Advisory Group #15 Agenda

March 3
- Welcome
- Final Air Quality Results
- Final Public Health Results
- Discussion/Q&A

Today (March 4)
- Environmental Justice
- Discussion/Q&A

March 11
- Economic Impact Analysis
- Workforce Analysis
- Discussion/Q&A

March 18
- LA100 Results: Costs and Benefits
- Summary of Key Findings
- Discussion/Q&A

LA100

The Los Angeles 100% Renewable Energy Study

Environmental Justice:

Final Results

Advisory Group Meeting #15, Virtual Meeting #2

Garvin Heath (speaker), Jaquelin Cochran (speaker),
Emma Tome, Dylan Hettinger, Vikram Ravi

March 4, 2021

LA DWP Los Angeles Department of Water & Power

NREL Transforming ENERGY

Agenda

- Procedural Justice
- Distributional Justice
  - Customer Rooftop Solar
  - Air Quality
  - Public Health
- Actions That Could Prioritize Benefits to Environmental Justice Neighborhoods

Environmental Justice is a Core Component of LA100

City Council Motion instructions to LADWP to incorporate into LA100 research efforts (August 2017):

- CalEnviroScreen into each research area, and as the context for any analysis, study, and/or recommendation.
- Prioritization of environmental justice neighborhoods as the first immediate beneficiaries of localized air quality improvements and greenhouse gas reduction

Definitions

Environmental Justice

The fair treatment and meaningful involvement of people of all races, cultures, and incomes with respect to the development, adoption, implementation, and enforcement of environmental laws, regulations, and policies.

AB1628. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200AB1628

Clean Energy Justice

Focuses on the inequities in the energy system that may persist or worsen after sustainable energy becomes a driving goal

Welton, Shelley, Joel Eisen. 2019. “Clean Energy Justice: Charting an Emerging Agenda.” Harvard Environmental Law Review Vol. 43 308—371. https://harvardelr.com/wp-content/uploads/sites/12/2019/08/43.2-Welton-Eisen.pdf

Framing Used in LA100 (Tenets of Energy Justice)

- **Procedural justice**: the ability of people to be involved in decision-making procedures around energy system infrastructures and technologies
- **Distributional justice**: the distribution of benefits and burdens across populations

Addressed in this presentation and chapter 10

- **Recognition justice**: understanding the historical and present basis for social inequalities and the acknowledgment or dismissal of marginalized and deprived communities in relation to energy systems

Acknowledged but not addressed

Carley, Sanya, and David M. Konisky. 2020. "The Justice and Equity Implications of the Clean Energy Transition." *Nature Energy*, June, 1–9. https://doi.org/10.1038/s41560-020-0641-6.

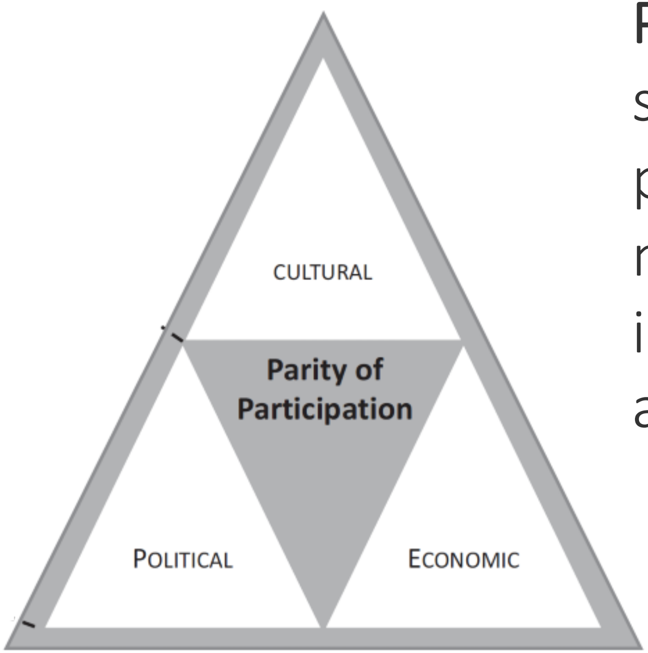
Procedural Justice

Why Procedural Justice?

- **Justice** and **equity** are often cited as objectives but have a wide range of definitions
- We include a focus on **procedural justice** as an acknowledgment that
  - How justice and equity are defined
  - How goals and decisions are made
  - How community engagement is organized
  - Who is represented, etc.

  can have a **profound impact** on outcomes, and that LA100 has played a role in this process so far.

One example definition: Justice as “parity of participation”



Parity of participation: social arrangements that permit all (adult) members of society to interact with one another as peers.

Figure: Blue, Gwendolyn, Marit Rosol, and Victoria Fast. 2019. “Justice as Parity of Participation: Enhancing Arnstein’s Ladder Through Fraser’s Justice Framework.” *Journal of the American Planning Association* 85 (3): 363–76. https://doi.org/10.1080/01944363.2019.1619476. (reproduced with permission)

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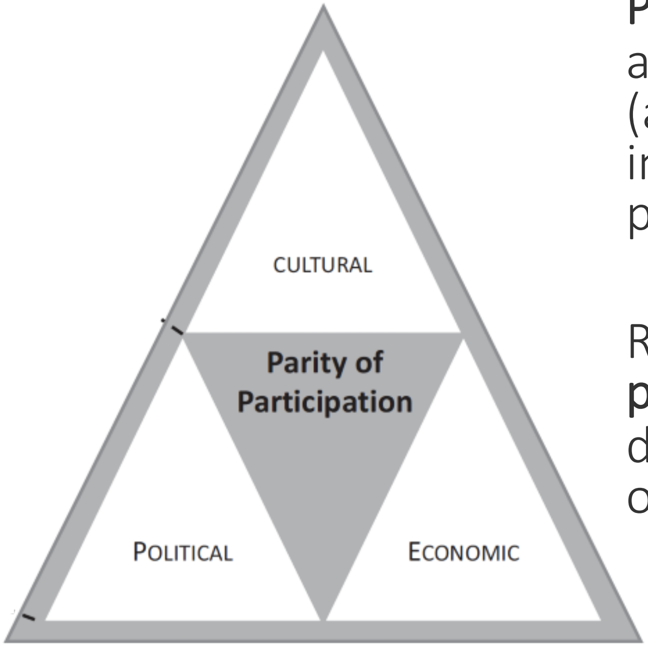


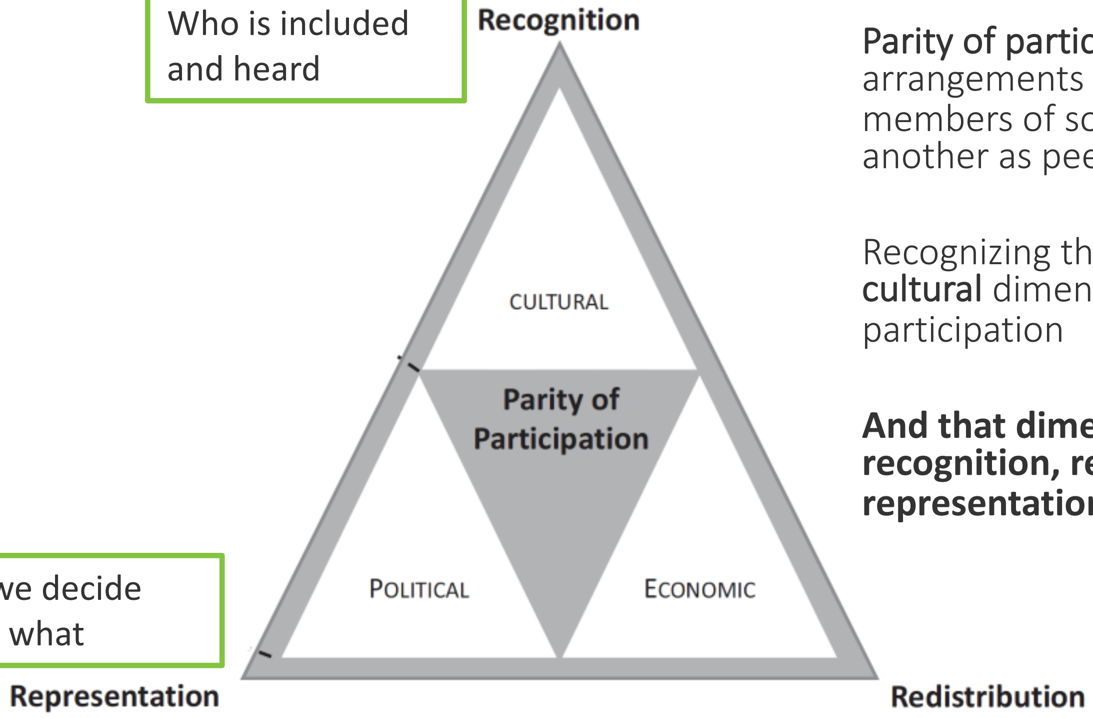
Parity of participation: social arrangements that permit all (adult) members of society to interact with one another as peers.

Recognizing the **economic**, **political**, and **cultural** dimensions of and potential obstacles to participation

Figure: Blue, Gwendolyn, Marit Rosol, and Victoria Fast. 2019. "Justice as Parity of Participation: Enhancing Arnstein's Ladder Through Fraser's Justice Framework." *Journal of the American Planning Association* 85 (3): 363–76. https://doi.org/10.1080/01944363.2019.1619476. (reproduced with permission)

One example definition: Justice as “parity of participation”

Who is included and heard



How do we decide who gets what

Who gets what

Parity of participation: social arrangements that permit all (adult) members of society to interact with one another as peers.

Recognizing the **economic**, **political**, and **cultural** dimensions of and obstacles to participation

And that dimensions of justice include recognition, redistribution, and representation

Figure: Blue, Gwendolyn, Marit Rosol, and Victoria Fast. 2019. “Justice as Parity of Participation: Enhancing Arnstein’s Ladder Through Fraser’s Justice Framework.” *Journal of the American Planning Association* 85 (3): 363–76. https://doi.org/10.1080/01944363.2019.1619476. (reproduced with permission)

Procedural justice during the LA100 study

LA100 Advisory Group → NREL and LA100 Analyses → SLTRP Decisions on Investments → City and LADWP Policy and Program Development → Implementation

- Role: Provide input and feedback
- Critical actions as relates to environmental justice:
  - Supported development of scenarios as well as definitions of technology eligibility (e.g., our hydrogen discussion)
  - Expressed desired outcomes for the study, which guided our analysis
  - Expanded scope of evaluation (e.g., monetization of benefits)
- Some AG members expressed frustrations about lack of prioritization of environmental justice:
  - Insufficient representation of EJ communities on the Advisory Group
  - Scenarios did not represent goals for EJ
  - Insufficient community outreach

Procedural justice during the LA100 study

LA100 Advisory Group → NREL and LA100 Analyses → SLTRP Decisions on Investments → City and LADWP Policy and Program Development → Implementation

- Role: Provide objective information, based on scenarios and scope decided in consultation with LADWP and the Advisory Group
- Critical actions as relates to environmental justice:
  - Analyzed a broad but not comprehensive range of scenarios
  - Supplemented core scenarios with sensitivities to capture wider range of scenario ideas
  - Made decisions early on about data and analytical approaches, which affect what questions can be addressed regarding EJ
  - Conducted outreach with EJ groups and the community to provide information and receive feedback; created materials designed to be accessible to different audiences
  - Adjusted approach and analyses to reflect Advisory Group and community discussions (next slides)

Procedural justice during the LA100 study

LA100 Advisory Group → NREL and LA100 Analyses → SLTRP Decisions on Investments → City and LADWP Policy and Program Development → Implementation

Public Feedback Themes (part 1)	Examples of public feedback	NREL's actions in response
Vision & framing	Just transition—coupling energy justice with larger themes of economic change and addressing systems of oppression; What does it look like to build an energy system that prioritizes public health?	Updated approach to modeling spinning reserves to reduce local health impacts Encouraged discussions of vision during outreach to document these for LADWP
Decision-making process	What does it mean to have broad, diverse, and robust engagement and facilitate deep understanding as part of a decision-making process? Is there a blend of scenarios that could appeal to a broader range of people, and include offramps?	Evaluated scenario blends (e.g., Limited New Transmission with 2035 target) Identified sources of risk/greatest uncertainty and possible alternatives to maintain optionality

Procedural justice during the LA100 study

LA100 Advisory Group → NREL and LA100 Analyses → SLTRP Decisions on Investments → City and LADWP Policy and Program Development → Implementation

Public Feedback Themes (part 2)	Examples of public feedback	NREL's actions in response
Community engagement	Suggested goals for outreach (e.g., start with vision; communicate how study affects people; how can people participate; how public can reduce electricity bills through energy efficiency)	Revised communication materials to incorporate suggestions Requested timely, community outreach meetings to support procedural justice
Outcomes	Affordable electricity rates Low-income efficiency programs to keep electricity affordable and accessible and keep the burden of higher electricity rates of transitioning to clean energy off low-income residents Distribution grid upgrades that account for potentially higher electricity loads in low-income areas, so that the physical system is not a barrier to more equitable electricity consumption …so many more	Documented outcomes requested by the public in the report (Chapter 10, section 3.2)

Procedural justice after the LA100 study

LA100 Advisory Group → NREL and LA100 Analyses → SLTRP Decisions on Investments → City and LADWP Policy and Program Development → Implementation

- After the study is complete, LADWP and the City of LA will determine how to continue to engage the public in choosing among energy transition pathways, and designing programs and policies to meet community needs.
- There are many potential approaches to community participation:

Participatory governance style	LADWP examples	Other examples (Fung 2003)
Educative Forum	Community meetings and presentations	Deliberative polling
Participatory Advisory Panel	Advisory Group	Oregon Health Decisions, Citizen Summit
Participatory Problem-Solving Collaboration	Community Partnership Grants Program, Neighborhood Councils	Citizen Summit, Neighborhood Planning Initiative
Participatory Democratic Governance		Participatory budgeting

Fung, Archon. 2003. “Survey Article: Recipes for Public Spheres: Eight Institutional Design Choices and Their Consequences.” Journal of Political Philosophy 11 (3): 338–67. https://doi.org/10.1111/1467-9760.00181.

Questions? Comments?

Up Next: Distributional Justice

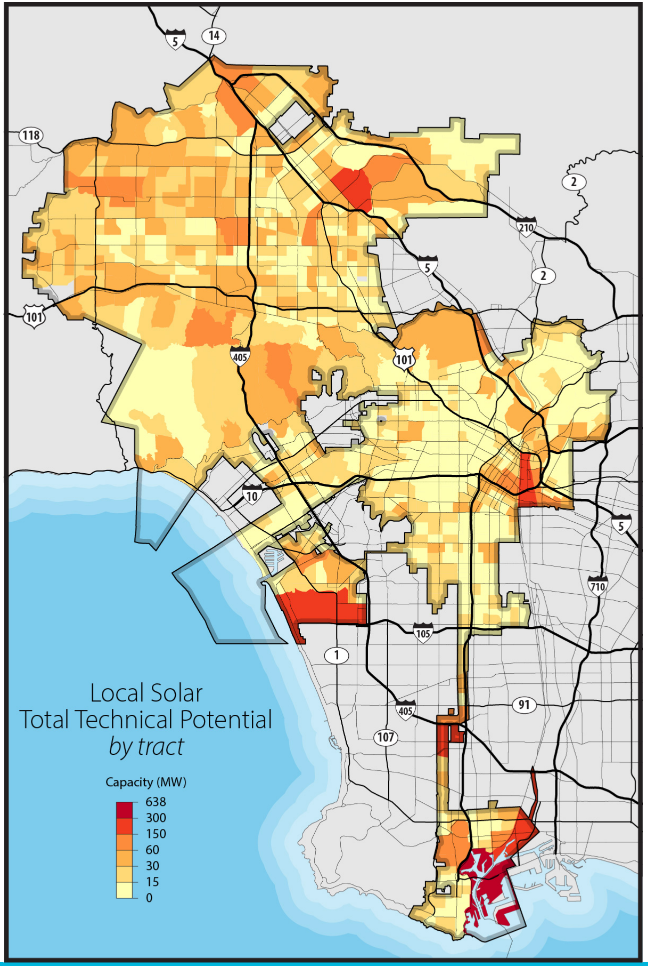
– Customer Rooftop Solar

– Air Quality & Health

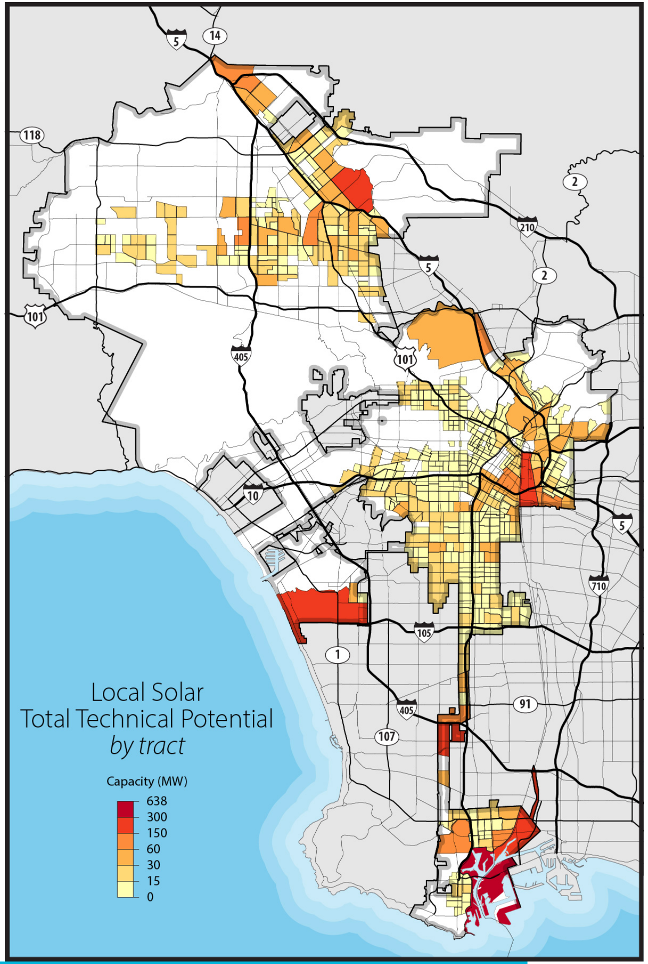
Actions that could help prioritize benefits

Local Solar Technical Potential in Disadvantaged Communities

All Local Solar Technical Potential

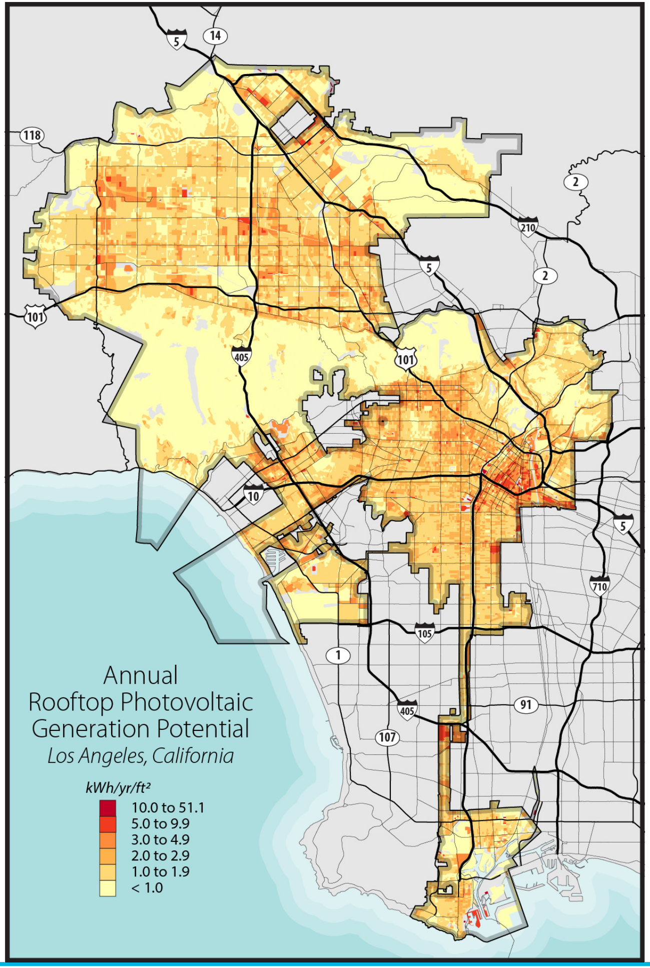


Disadvantaged Communities Only

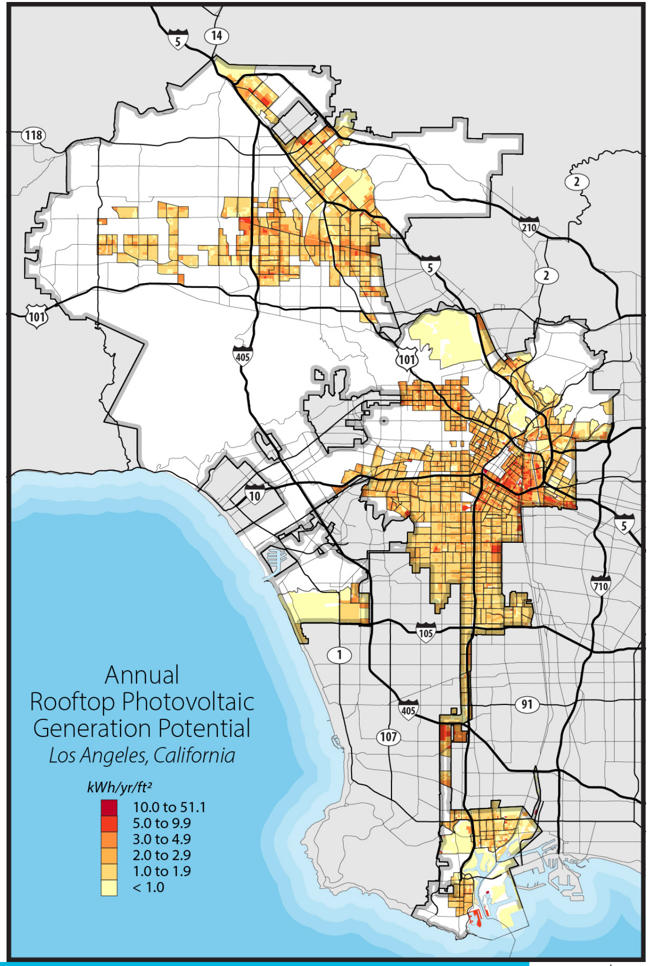


Local Solar Customer Rooftop Generation Potential in Disadvantaged Communities

Customer Rooftop Solar Generation Potential



Disadvantaged Communities Only



Distributive Justice: What are LA100 Outcomes Regarding Customer Rooftop Solar Adoption?

Share of New Customer Solar Adoption, Inside and Outside of Disadvantaged Communities, including Multifamily Buildings

	2020 Capacity (MW)			2045 Capacity (MW)			
	DAC	Non-DAC	**DAC %**	DAC	Non-DAC	**DAC %**	Increase in DAC share of solar 2020-2045
Early/NoBio & Ltd New Trans. – Moderate	115	211	**35%**	1,464	2,153	**40%**	20%
Early/NoBio & Ltd New Trans. – High				1,585	2,315	**41%**	17%
SB100 & Trans. Focus – Moderate				1,052	1,771	**37%**	5%
SB100 & Trans. Focus – High				1,171	1,952	**37%**	5%
SB100 – Stress				1,236	2,019	**38%**	8%

LA100 Findings

- LA100 modeling **shows strong potential for growth across all communities**
  - Physical infrastructure + economic value could support large growth by 2045
- However…LA100 modeling **does not capture real-world experiences and barriers to adoption**
  - Customer income levels, homeownership, access to financing, timing of electricity demand, access to competitive bids, required coupling with other upgrades (roof, home electrical system)
  - Low-income retail rates (therefore overestimating economic potential)

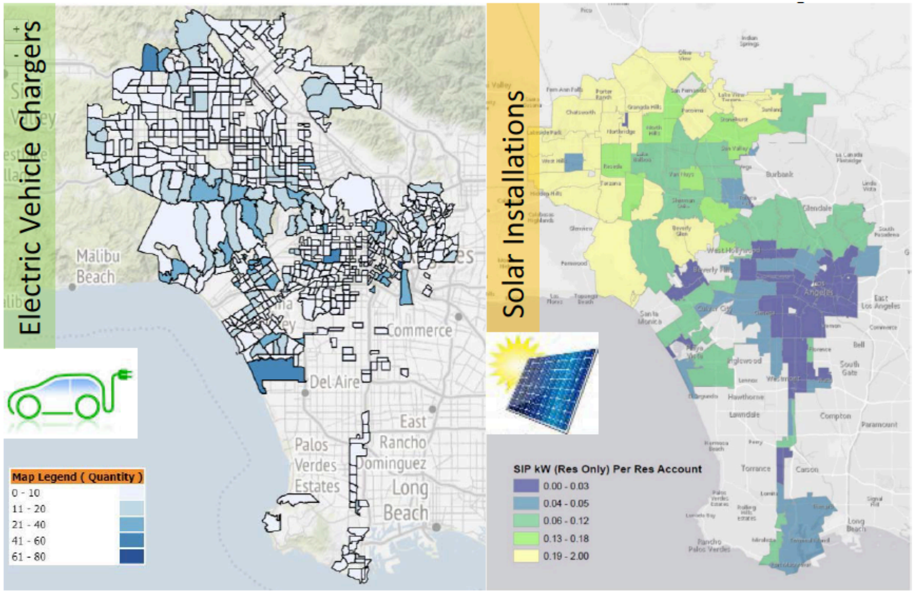
Post LA100—Policy Design

- Policy actions to prioritize EJ neighborhoods could focus on addressing factors in lowering barriers to realizing the economic benefits
- Significant research exists on this topic
  - LADWP example: Shared Solar (subscription to purchase in-basin solar at fixed rate)
  - Example policies: Solar leasing, LMI-specific incentives, virtual net metering/community shares

Cook, J. K. & Bird, L. Unlocking Solar For Low- And Moderate-Income Residents: A Matrix of Financing Options By Resident, Provider, And Housing Type. Technical Report NREL/TP-6A20-70477 (National Renewable Energy Laboratory, 2018).
"Alternate Decision Adopting Alternatives to Promote Solar Distributed Generation in Disadvantaged Communities" 2018. California Public Utilities Commission. https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M216/K789/216789285.PDF

Importance of Monitoring and Tracking

- Establishing stakeholder representation in monitoring and tracking program success
- Establishing metrics for success
  - LADWP: Equity Metrics Data initiative
- Establishing process to course-correct



Example data communicated by LADWP from its September 2020 LA Equity Metrics presentation

Beyond Rooftop Solar–Example improvements to NREL's modeling to reduce research gaps that contribute to clean energy *injustice*

Shifting from city averages to **neighborhood** averages in our buildings modeling

- Household **demographics** (average size of household, owner vs. renter, income)
- **Age** and **types** of building/appliance/vehicle and how **usage** might vary

Better characterization of **benefits** that especially impact lower-income neighborhoods

- Energy efficiency on ability to ride through outages and **extreme weather events**
- **Indoor air quality**, particularly with more information on degradation of existing equipment

Policy designs that especially affect lower-income neighborhoods

- Impacts of prioritization of benefits on potential for **gentrification**, and complementary city-level policies to address
- Potential implications for regressive **cross-subsidies** and **stranded costs** for lagging adopters (electrification, rooftop solar)

Questions? Comments?

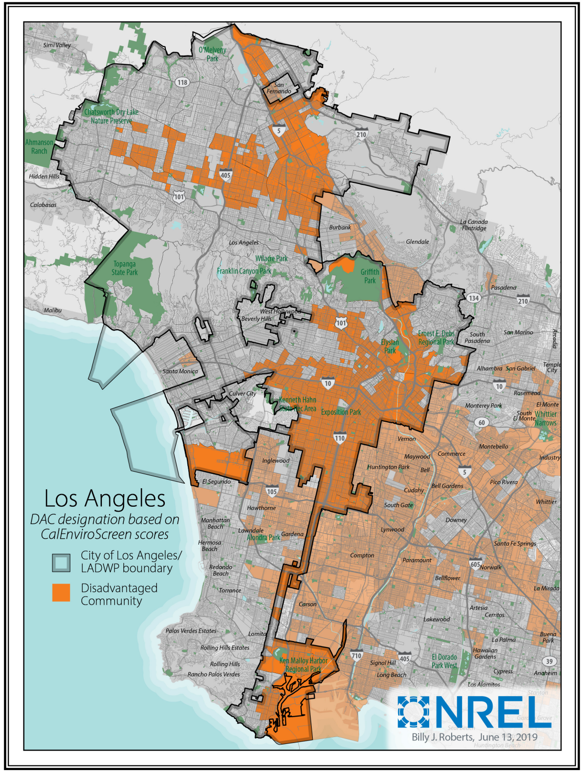
Up Next: Distributional Justice

– Air Quality & Health

Actions that could help prioritize benefits

Methods

- Analyze air quality and related public health impacts in relation to disadvantaged community (DAC) designations
  - Designations based on present-day CalEnviroScreen scores (see figure)
    - >75 is designated DAC, as per OEHHA determination
  - Half of LA's census tracts are DAC, comprising one quarter of the state's total
  - DAC and non-DAC tract groups each include ~600 data points
- Due to methodological incommensurability between CalEnviroScreen and our air quality-health impacts modeling approach, our analysis could not recreate or adjust CalEnviroScreen scores
  - CalEnviroScreen is a retrospective tool based on sparsely measured data whereas LA100 looks toward the future using highly resolved models that produce sometimes slightly different metrics than those defined in CalEnviroScreen

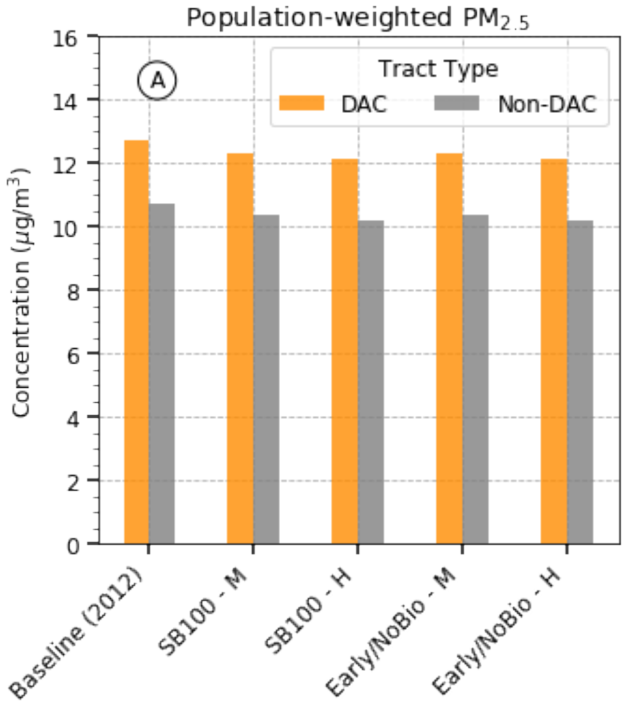


Methods (II)

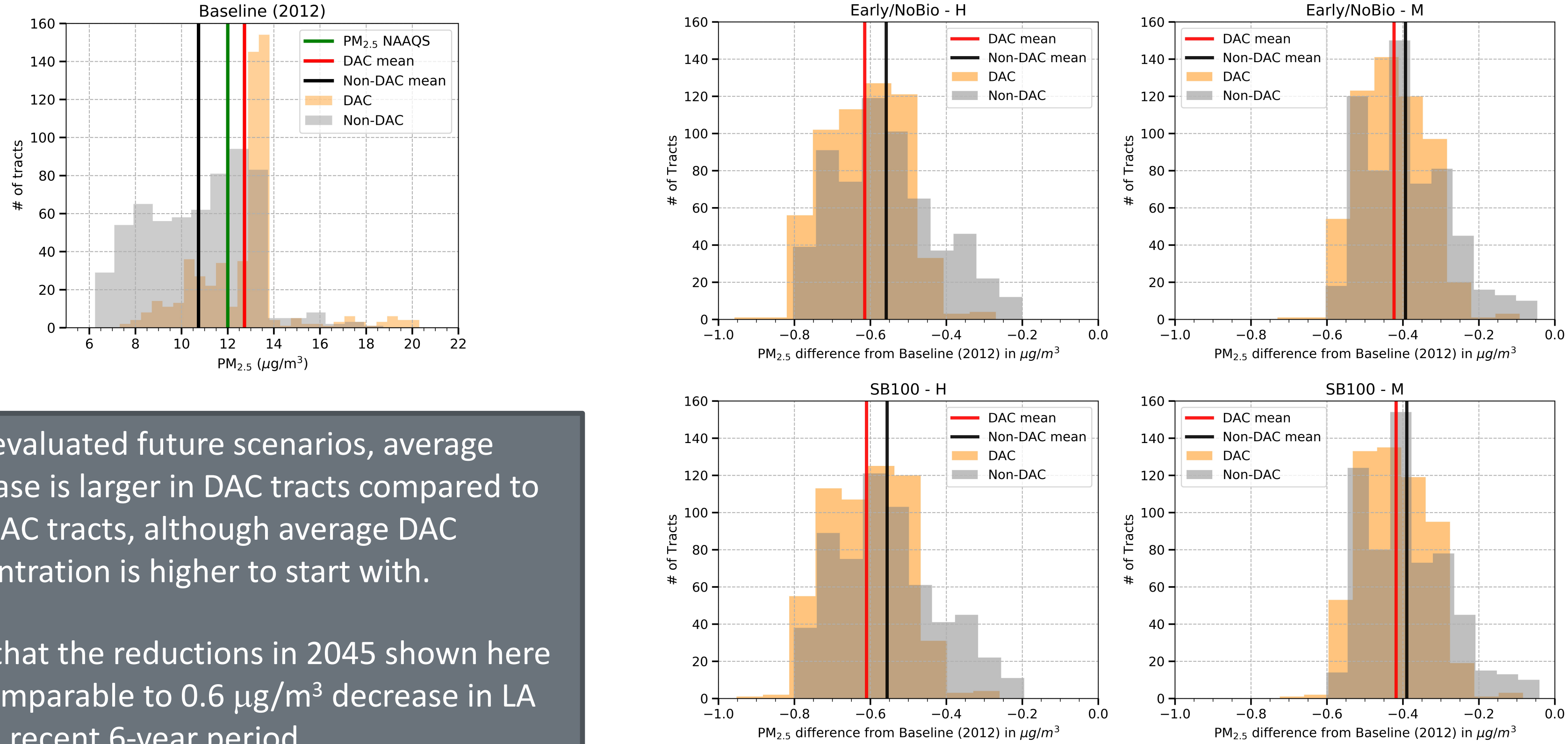
- To determine whether there is a statistically significant difference between the values of each health endpoint and each pollutant concentration in DAC and non-DAC tracts, we performed an independent t-test with census tracts as the unit of comparison
  - "Statistically significantly different" is defined as a greater than 95% likelihood that the result seen is not due to random chance.
- Concentrations are reported in absolute value but should be understood as being designed in a comparative context to other scenarios and are not a prediction of the concentrations in the future.
- Health Modeling:
  - BenMAP output is based on the *changes* in pollutant concentration between a base scenario and a control scenario
  - Thus, the health endpoints reported estimate a *change* in the incidence of the selected health endpoints, not absolute incidences.

Changes to fine particulate matter ($PM_{2.5}$) concentrations in DAC and non-DAC communities

- Lower $PM_{2.5}$ concentrations are achieved in all evaluated LA100 scenarios compared to Baseline (2012).
  - High electrification levels result in lower $PM_{2.5}$ concentration for both DAC and non-DAC compared to Moderate.
- In the 2012 Baseline and all future scenarios, DAC tracts are exposed to higher concentrations of $PM_{2.5}$ compared to non-DAC tracts.



Comparison of change in tract $PM_{2.5}$ distributions

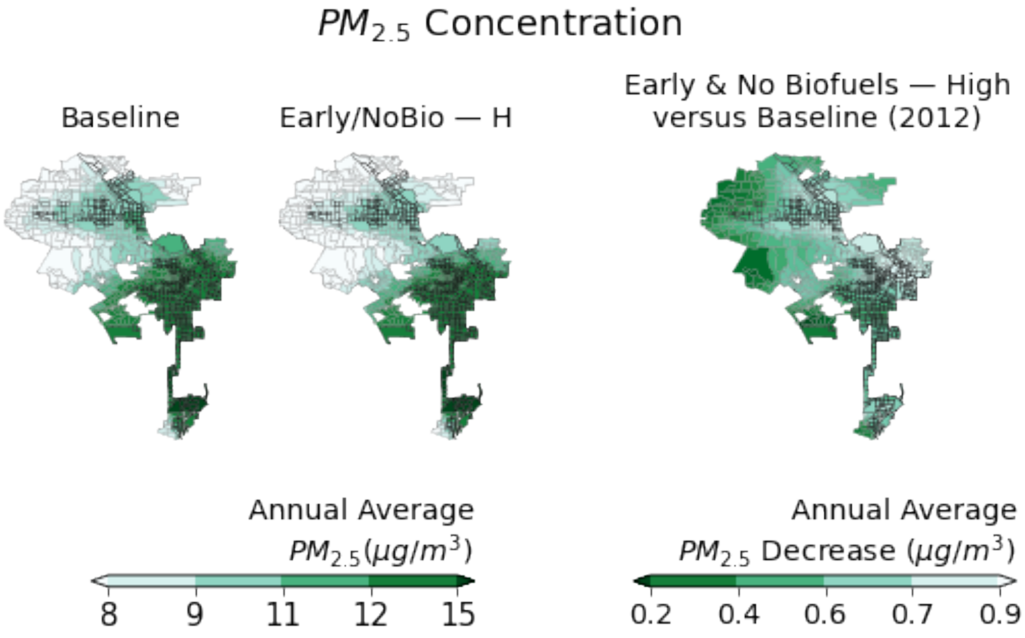


In all evaluated future scenarios, average decrease is larger in DAC tracts compared to non-DAC tracts, although average DAC concentration is higher to start with.

Note that the reductions in 2045 shown here are comparable to 0.6 μg/m³ decrease in LA over a recent 6-year period.

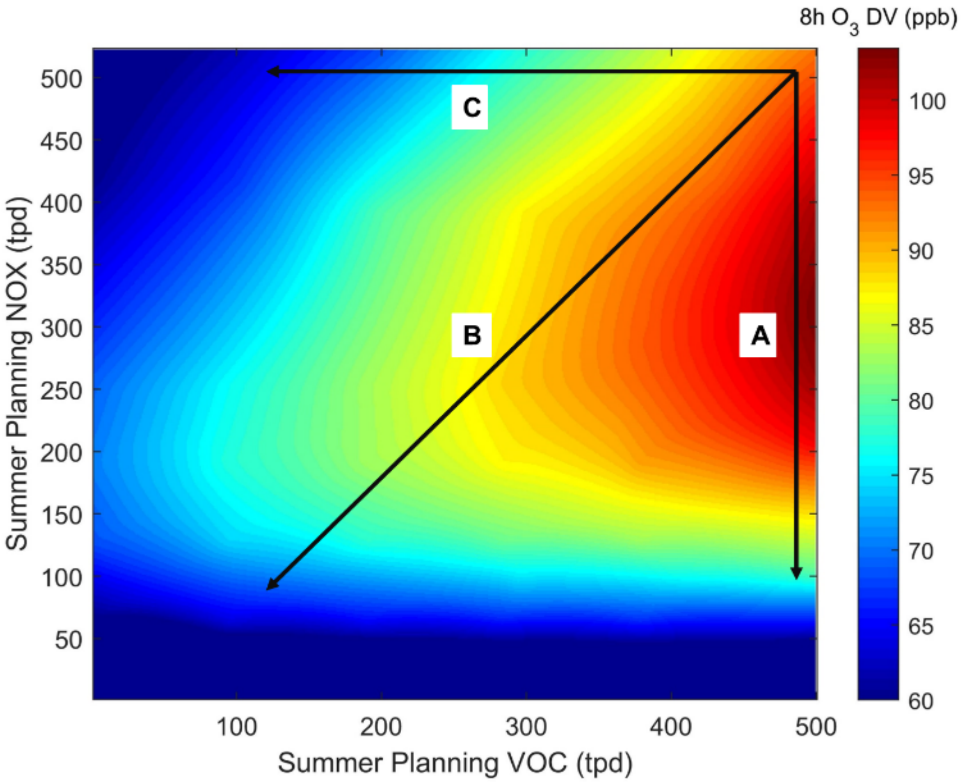
Change in Spatial Distribution of $PM_{2.5}$

- $PM_{2.5}$ concentration decreases in all LA100 scenarios in 2045 across the city
  - The largest decreases are centered on downtown Los Angeles, the port and some northern tracts, where majority of tracts are DAC.
- Spatial distribution remains the same across both the Baseline (2012) scenario and all future scenarios (example of a high electrification scenario is shown)
  - $PM_{2.5}$ concentrations are highest in tracts in South and Central L.A. in all scenarios
- All scenarios show a statistically significant difference between DAC and non-DAC tracts
  - Concentration in DAC tracts higher than non-DAC in all evaluated scenarios.



DAC tracts are outlined in black

Recap: ozone "isopleth" to illustrate how ozone concentrations change in response to decreases in NOx and volatile organic compound (VOC) emissions*

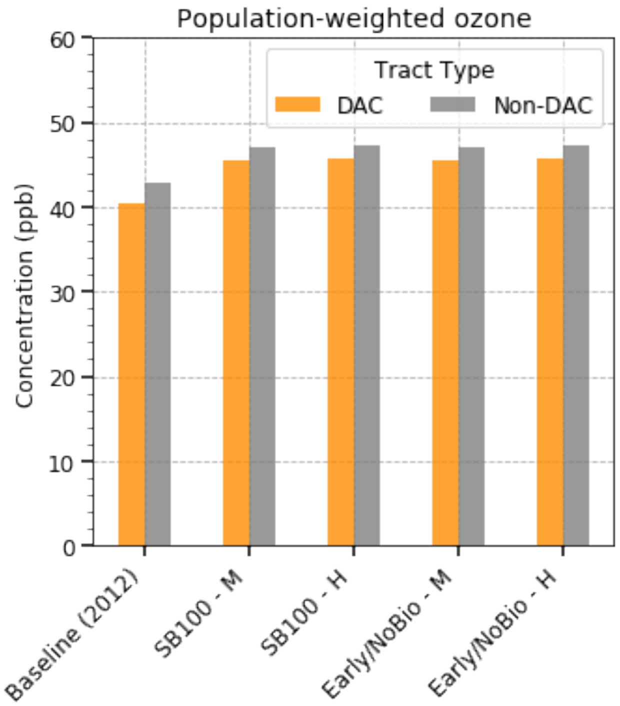


- In LA100, ozone concentration increases despite NOx emission reductions
- Pathway A: This can be thought of as temporary "growing pains". Once NOx emissions get sufficiently low, further emissions decreases will lead to ozone reductions
- Pathway B: Could avoid these ozone increases by having commensurate reductions in emissions of VOCs
- The response of ozone to emissions decreases is highly dependent on the scenarios investigated and the baseline used.

*This figure is modified from a presentation at SCAQMD Scientific Technology Modeling & Peer Review (STMPR) meeting on Jan. 27, 2021.

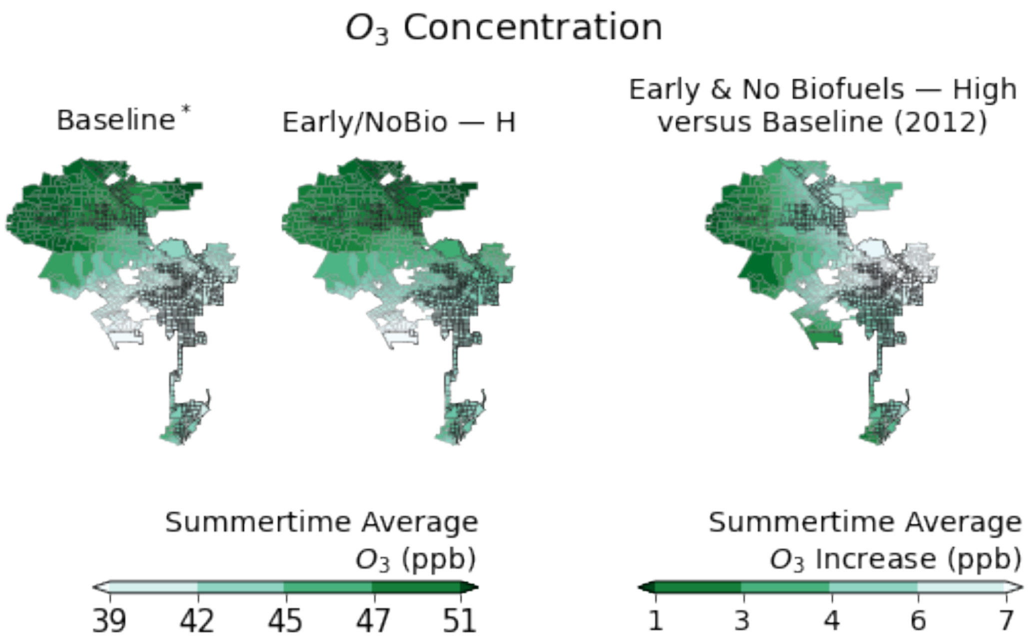
Changes to ozone concentrations in DAC and non-DAC communities

- In all evaluated scenarios, DAC census tracts have lower mean concentration of summertime ozone compared to non-DAC tracts.
- Concentration of ozone increases citywide by 10% – 12% (4.2 – 5.2 ppb) in all evaluated LA100 scenarios in 2045.
- Ozone concentration in DAC tracts increases slightly more (+12 – 13%) compared to that for non-DAC tracts (+~10%) under all evaluated LA100 scenarios.



Change in spatial distribution of ozone for DAC and non-DAC tracts

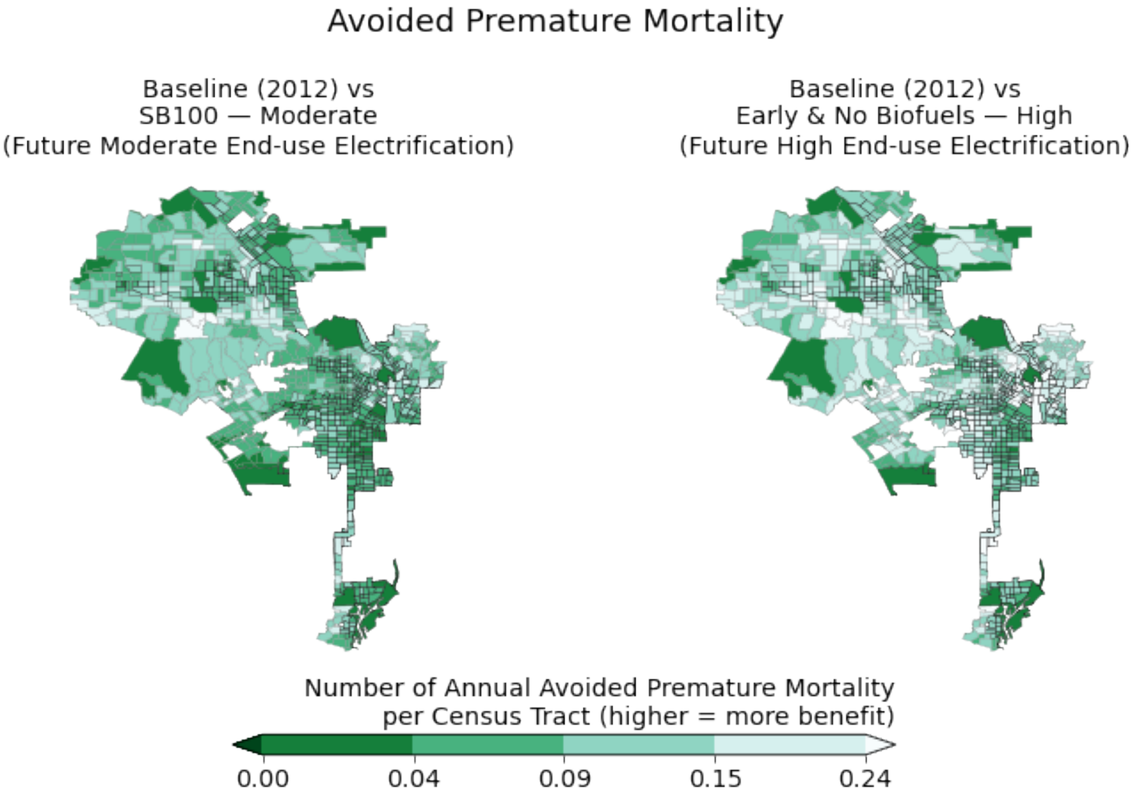
- Larger ozone concentrations are found in the northern part of Los Angeles, owing to geography, meteorology and chemistry.
- Changes from Baseline (2012) to future scenarios are relatively small (4.6 - 4.8 ppb) but do show an increase in all tracts across the city, with the largest increases centered on downtown Los Angeles.
- DAC tracts see the greatest increases in ozone concentration in all evaluated LA100 scenarios in 2045.



DAC tracts are outlined in black

Distribution of Effects on Mortality (Baseline Comparisons)

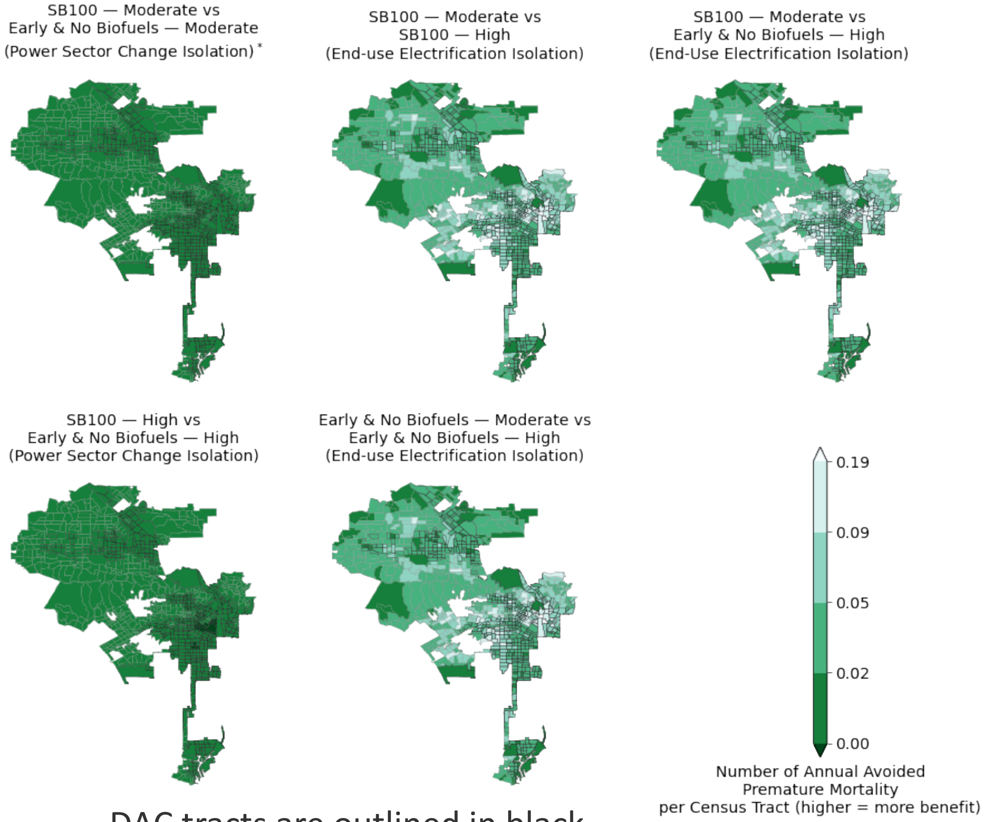
- All LA100 scenarios evaluated indicate improvements in premature mortality in 2045 over the 2012 baseline
- Changes in mortality from Baseline (2012) to future scenarios are spatially diverse, but differences average out over the city
  - Impacts are evenly distributed between DAC and non-DAC tracts
- Comparing the Baseline (2012) to Early & No Biofuels – High shows the largest decreases in mortality (134 avoided incidences city-wide)



DAC tracts are outlined in black

Distribution of Effects on Mortality (Future Comparisons)

- All LA100 future scenarios compared indicate improvements in premature mortality
- Among future comparisons, end-use electrification changes show greatest improvement with a range of 23 – 24 avoided incidences city-wide for both DAC and non-DAC tracts
- Changes in premature mortality are experienced approximately equally between DAC and non-DAC tracts
    - Except SB100 – Moderate versus Early & No Biofuels – Moderate (0.50 avoided incidences in DAC tracts city wide versus 0.32 in non-DAC tracts)



DAC tracts are outlined in black

Estimates of citywide annual avoided mortality in 2045

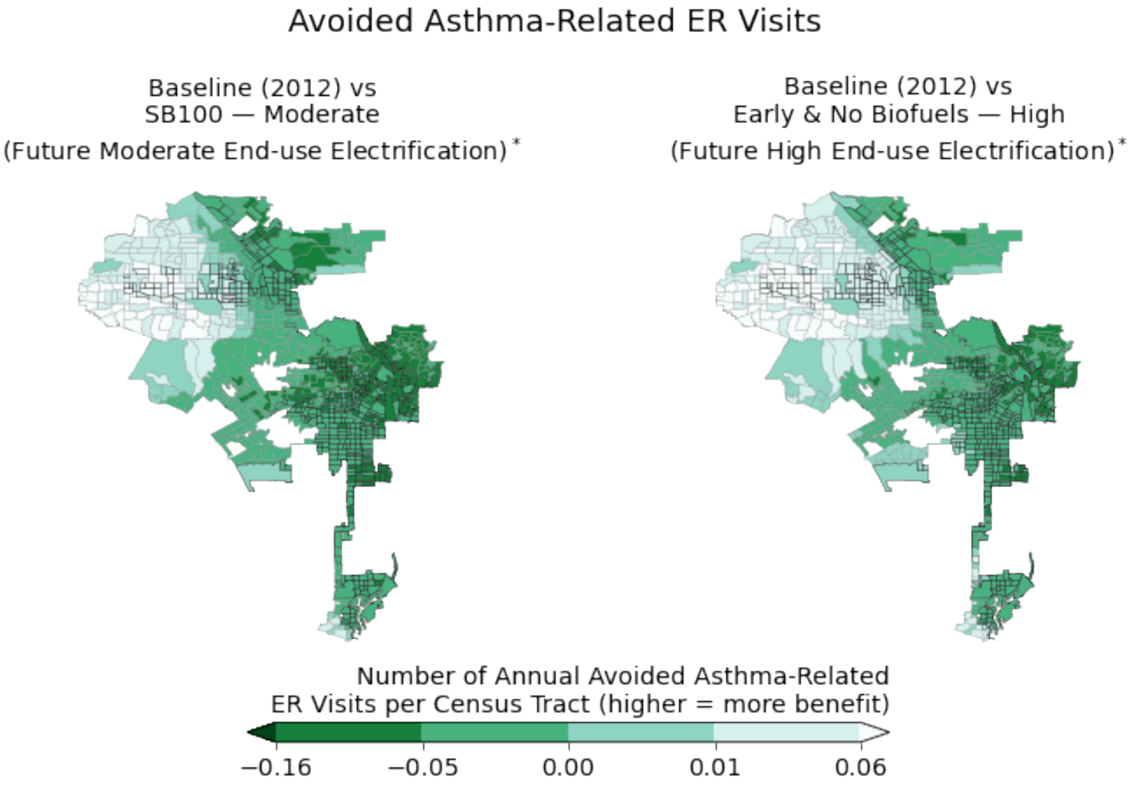
Scenario	DAC Tracts (Total)	Non-DAC Tracts (Total)	DAC Percent of Total
Comparison of future scenarios (2045) versus Baseline (2012)			
Baseline (2012) versus SB100 – Moderate	39	47	45%
Baseline (2012) versus Early & No Biofuels – High	63	71	47%
Comparison of future scenarios isolating power sector changes in 2045			
SB100 –Moderate versus Early & No Biofuels – Moderate	0.50	0.32	61%
SB100 – High versus Early & No Biofuels – High	0.29	0.24	55%
Comparison of future scenarios isolating impacts of high electrification in end-use sectors in 2045			
Early & No Biofuels – Moderate versus Early & No Biofuels – High	23	23	50%
SB100 – Moderate versus SB100 – High	24	24	50%

Both DAC and non-DAC tracts benefit from reduced deaths owing to air pollution.

Compared to the 2012 Baseline, in 2045 there is a slightly greater benefit to non-DAC tracts, though among 2045 scenarios, benefits are nearly equal with DAC.

Distribution of Effects on Morbidity – ER Visits from Asthma (Baseline Comparisons)

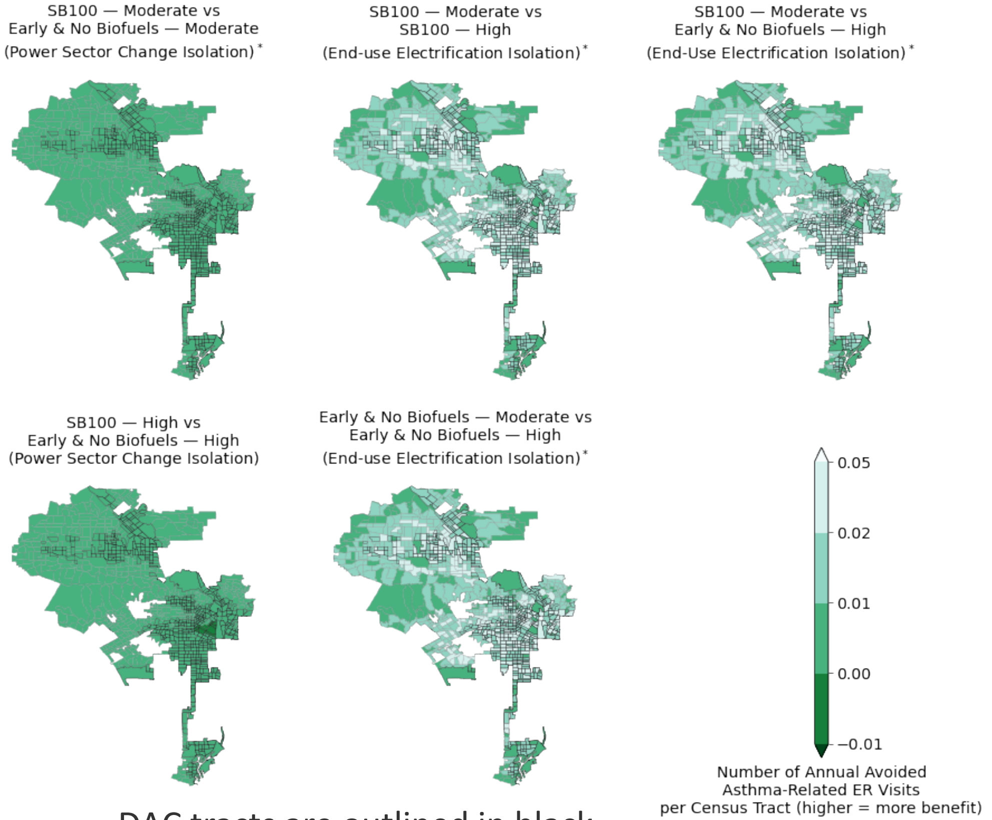
- Changes in incidence of asthma-caused ER visits are statistically significantly different between the DAC and non-DAC tracts for both Baseline (2012) to future comparisons
- DAC tracts experience greater increases between baseline and future scenarios
    - Up to 17 additional visits in DAC tracts city-wide versus up to 7 additional visits in non-DAC tracts city-wide
- Baseline (2012) versus Early & No Biofuels – High shows an overall increase in ER visits among DAC tracts compared to non-DAC tracts
    - 7.6 additional visits across all DAC tracts versus 0.24 visits *avoided* across all non-DAC tracts



DAC tracts are outlined in black

Distribution of Effects on Morbidity – ER Visits from Asthma (Future Comparisons)

- Changes in incidence of asthma-caused ER visits are statistically significantly different between the DAC and non-DAC tracts for most scenario comparisons
    - Among future scenario comparisons, DAC tracts experience greater reductions (between 0.16 and 9.0 avoided visits)
- Comparisons isolating end-use electrification changes have much larger differences
    - About 9 avoided visits city-wide for DAC tracts and about 8 avoided visits city-wide for non-DAC tracts
- Comparisons isolating power sector changes show lower differences
    - About 0.2 avoided visits city-wide in DAC tracts versus about 0.12 avoided visits city-wide in non-DAC tracts



DAC tracts are outlined in black

Estimates of annual avoided asthma-related emergency room visits in 2045

Scenario	DAC Tracts (Total)	Non-DAC Tracts (Total)	DAC Percent of Total
Comparison of future scenarios (2045) versus Baseline (2012)			
Baseline (2012) versus SB100 – Moderate	-17	-7.4	(69%)
Baseline (2012) versus Early & No Biofuels – High	-7.6	0.24	(97%)
Comparison of future scenarios isolating power sector changes in 2045			
SB100 –Moderate versus Early & No Biofuels – Moderate	0.26	0.13	66%
SB100 – High versus Early & No Biofuels – High	0.16	0.12	58%
Comparison of future scenarios isolating impacts of high electrification in end-use sectors in 2045			
Early & No Biofuels – Moderate versus Early & No Biofuels – High	8.8	7.5	54%
SB100 – Moderate versus SB100 – High	8.9	7.5	54%

Compared to Baseline, LA100 scenarios increase incidence of asthma because of increased ozone concentration.

But amongst LA100 scenarios, there is slightly larger improvement for DACs with High electrification vs. Mod.

Negative values indicate disbenefit (i.e., increased incidence)

Estimates of annual avoided heart attacks in 2045 (example of one health effect driven by $PM_{2.5}$ changes)

Scenario	DAC Tracts (Total)	Non-DAC Tracts (Total)	DAC Percent of Total
Comparison of future scenarios (2045) versus Baseline (2012)			
Baseline (2012) versus SB100 – Moderate	5.6	6.1	48%
Baseline (2012) versus Early & No Biofuels – High	8.3	8.7	49%
Comparison of future scenarios isolating power sector changes in 2045			
SB100 –Moderate versus Early & No Biofuels – Moderate	0.057	0.035	62%
SB100 – High versus Early & No Biofuels – High	0.033	0.026	56%
Comparison of future scenarios isolating impacts of high electrification in end-use sectors in 2045			
Early & No Biofuels – Moderate versus Early & No Biofuels – High	2.6	2.6	51%
SB100 – Moderate versus SB100 – High	2.7	2.6	51%

Heart attack reductions accrue approximately equally between DAC and non-DAC tracts, largely driven by difference in electrification projections.

Qualitative Assessment of EJ-related Changes at LADWP Thermal Generating Sites under LA100 Scenarios in 2045

Issue	Direction of Change Compared to Today's LADWP Thermal Generating Plants Burning NG		Notes
	H_2	Natural Gas	
LADWP thermal generating sites size	same		
Exhaust stacks on site	Y		
Stack height (compared to steam unit)	↓		Converting steam units to combustion turbines
Types of pollutants emitted (vs. NG)	↓	same	H_2 is not a carbonaceous fuel, so does not emit CO, PM, VOCs nor SOx
Combustion frequency (hrs/yr)	↓	↓	Frequency of combustion decreases significantly in all LA100 scenarios
Total stack emissions (tons/yr)	↓	↓	e.g., -72% to -97% in NOx emissions (see prior AG slides and Ch. 9)
Concentration of local pollutants	↔	↑	For emitted pollutants, when operating: same if stack is same height; higher concentrations would result if the stack is shorter
Emissions from other on-site sources	↓		e.g., maintenance vehicles
Noise	↓	↓	Especially if site operations are electrified
Odor	↓	same	For NG, likely same when operating, but for both, lower frequency
Heat island (HI)	~		Heat island is mostly from infrastructure heat retention, not exhaust heat

Qualitative Assessment of EJ-related Changes Resulting from Other Sectors under LA100 Scenarios

Issue	Direction of Change Compared to Today's Sectors	Notes
Near-road		From LDV electrification
Pollutant emissions	⬇	Proportional to electrification projection (Mod, High)
Odor	⬇	
Noise	⬇	
Ports		From electrification of Port operations
Pollutant emissions	⬇	
Odor	⬇	
Noise	⬇	
Buildings		From electrification of building appliances
Indoor combustion emissions	⬇	Ensure energy efficiency doesn't reduce indoor air quality (e.g., adequate ventilation provided)

Air Quality and Public Health-related Environmental Justice Conclusions

- All future scenarios provide health benefits to LA residents citywide on average
  - Level of benefits vary.
- Patterns of O_3 and $PM_{2.5}$ concentration in DAC vs. non-DAC tracts remain consistent from the 2012 baseline scenario through all future scenarios
  - O_3 increases in all future scenarios, with slightly higher increases in DAC tracts, though non-DAC concentration remains higher than DAC
  - $PM_{2.5}$ decreases in all future scenarios, with the largest decreases in DAC tracts in central LA and surrounding the Port. DAC concentration is higher than non-DAC.
- All comparisons among future LA100 scenarios yield higher health benefits for DAC tracts compared to non-DAC tracts for all endpoints investigated.
  - Often the 95% confidence level was not reached, though, meaning the difference might have occurred from by chance
- Differences between scenarios are relatively smaller than the changes seen from 2012 baseline to 2045.
  - Among evaluated LA100 scenarios in 2045, changes are highest when changing electrification levels and negligible for changes to power sector (holding the other constant)

Caveats

- This study underestimates the potential health benefits of LA100 and its monetary benefits, especially for nearby residents and neighborhoods
  - There are many other environmental health endpoints, and the pollutants that cause them, not modeled in this study
  - Yet qualitatively, we suggest that there are potentially significant additional benefits to citizen health and quality of life to neighborhoods local to LADWP facilities, the Ports, major roadways, and inside of homes where energy efficiency upgrades and electric appliances are implemented
- Health modeling (Chapter 9) indicates that the city as a whole benefits from the emission reduction measures, even when DAC tracts benefit less
- Our air quality-health impacts modeling approach could not follow the approach used in CalEnviroScreen
  - CalEnviroScreen is a retrospective tool based on sparsely measured data whereas LA100 looks toward the future
  - With the addition of premature mortality, the environmental health endpoints modeled in this study align with those used in CalEnviroScreen, even if slightly different metrics are model outputs than those defined in CalEnviroScreen
- Our estimates of concentrations are not predictions of future concentrations in an absolute sense
  - Should only be used in the context of comparing results among the evaluated LA100 scenarios

Questions? Comments?

Up Next:

Actions that could help prioritize benefits

Actions That Could Support Prioritization of EJ—Examples

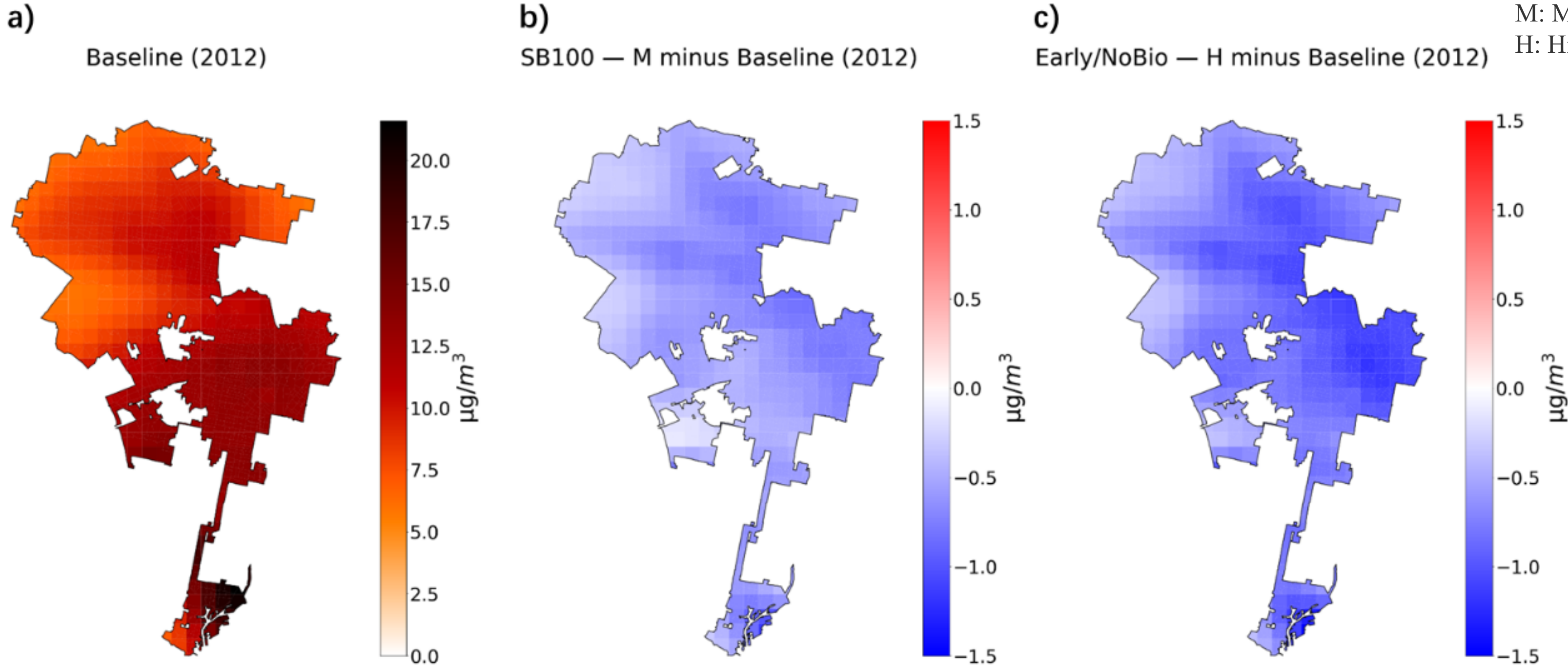
- **Participation** in decision making
- **Energy infrastructure**
  - Improved data collection to
    - Improve projections to adopt energy efficiency, electrification, demand response, and solar
    - Design incentives/regulations to better target projections to policy goals
  - More comprehensive representation of benefits
  - Improved metrics for forward-looking modeling
- Facilitate programs specific to hard-to-fill and other high-quality **jobs**
- **Health**
  - Analysis of interaction among costs of decarbonization, pace of electrification, and rate design could find pacing of electricity demand/supply change that optimizes health benefits
  - Analysis of neighborhood level impacts (positive and negative) to establish expectations and revise protocols as needed

Questions? Comments?

Supplemental Slides

Air quality results reminders

Annual-average daily $PM_{2.5}$ concentrations decrease across Los Angeles between 2012 and 2045 in all LA100 scenarios



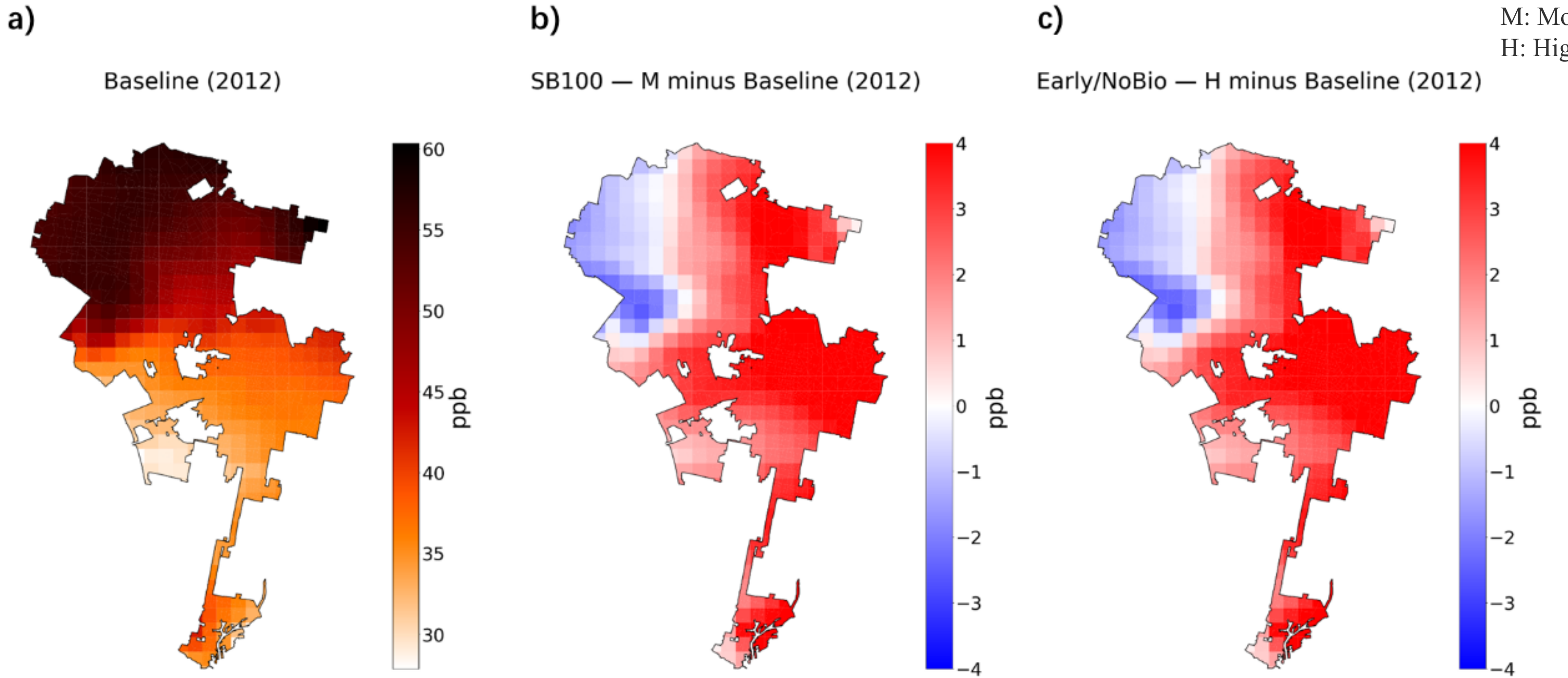
M: Moderate Electrification
H: High Electrification

Comparison to 2012 includes changes outside the scope of LA100

City Average	Baseline (2012)	SB100 – Moderate		Early & No Biofuels – High	
	10.6 μg/m³	10.0 μg/m³	-6%	9.8 μg/m³	-8%

All selected LA100 scenarios in 2045 show increases in summertime ozone concentrations for most parts of Los Angeles compared to 2012

M: Moderate Electrification
H: High Electrification



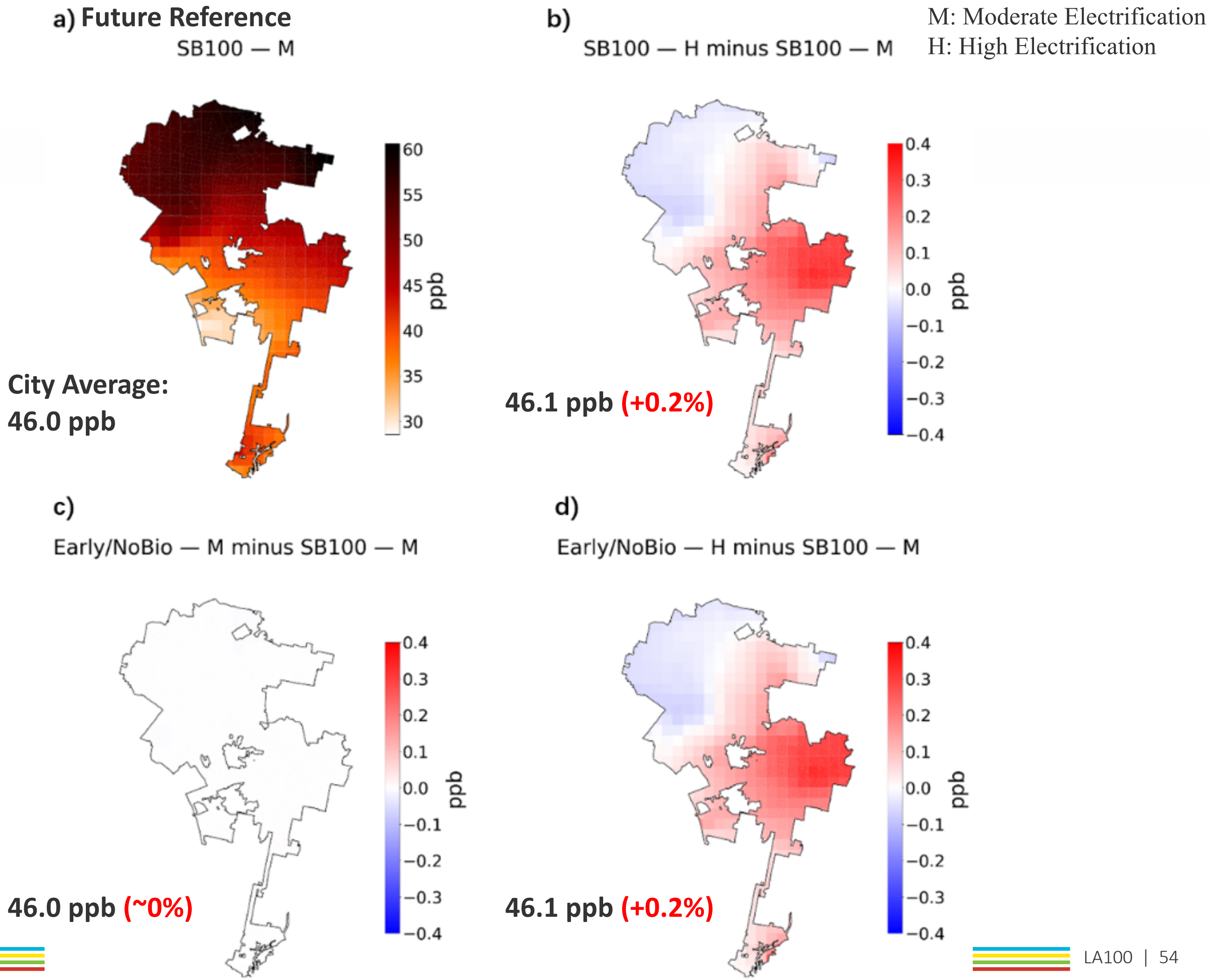
Comparison to 2012 includes changes outside the scope of LA100

City Average	Baseline (2012)	SB100 – Moderate		Early & No Biofuels – High	
	43.8 ppb	46.0 ppb	+5%	46.1 ppb	+5%

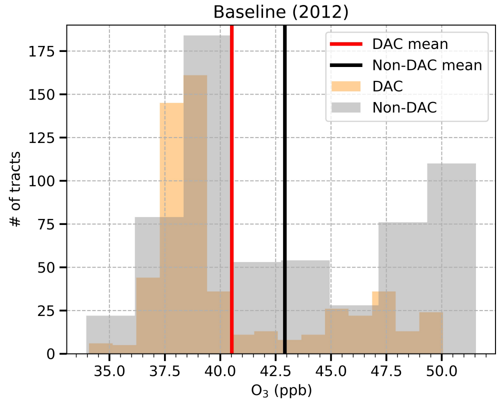
Changes in citywide ozone concentrations are dominated by increases in electrification levels in 2045 (frames b and d).

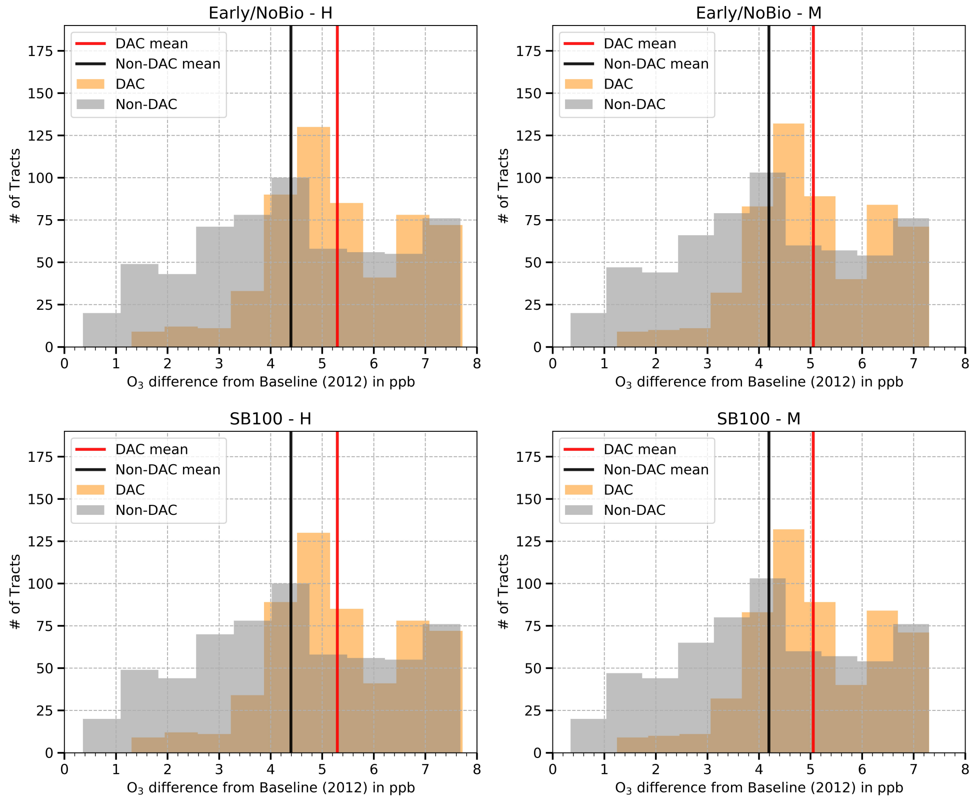
Differences between scenarios in 2045 regarding LADWP power plants (fuel use and type) does not have a noticeable impact (frame c).

Recall that all scenarios have little combustion from LADWP powerplants in 2045.



Comparison of change in tract $PM_{2.5}$ distributions





In all evaluated future scenarios, average decrease is larger in DAC tracts compared to non-DAC tracts, although average DAC concentration is higher to start with.

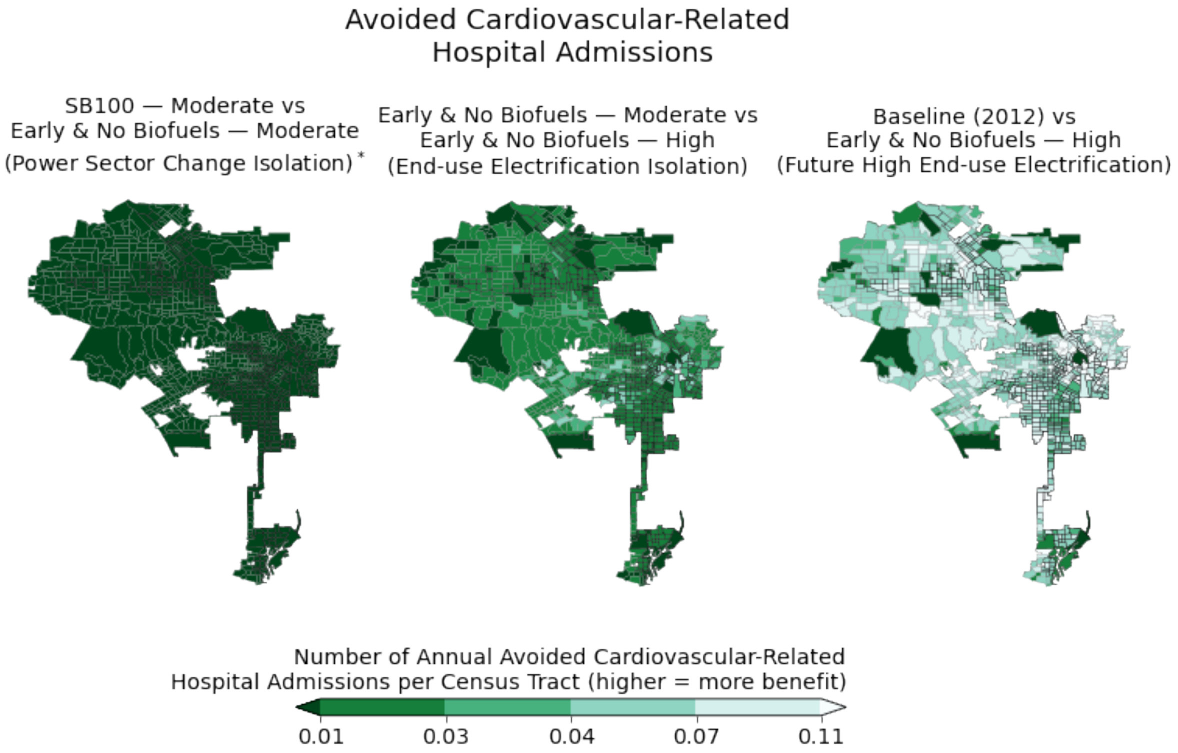
Note that the reductions in 2045 shown here are comparable to 0.6 μg/m³ decrease in LA over a recent 6-year period.

Supplemental Slides

Additional AQ/PH EJ results

Distribution of Effects on Morbidity – Cardiovascular Hospital Admissions

- Cardiovascular-related hospital admissions reduce similarly for both DAC and non-DAC tracts, leading to annual citywide reduction compared to 2012 by 21 – 31 for DAC and 23 – 33 for non-DAC in 2045
- Among future scenario comparisons, there are no statistically significant difference between DAC and non-DAC tracts
- Baseline (2012) versus Early & No Biofuels – High shows the maximum annual health benefits in 2045 (65 avoided hospital admissions citywide)



DAC tracts are outlined in black

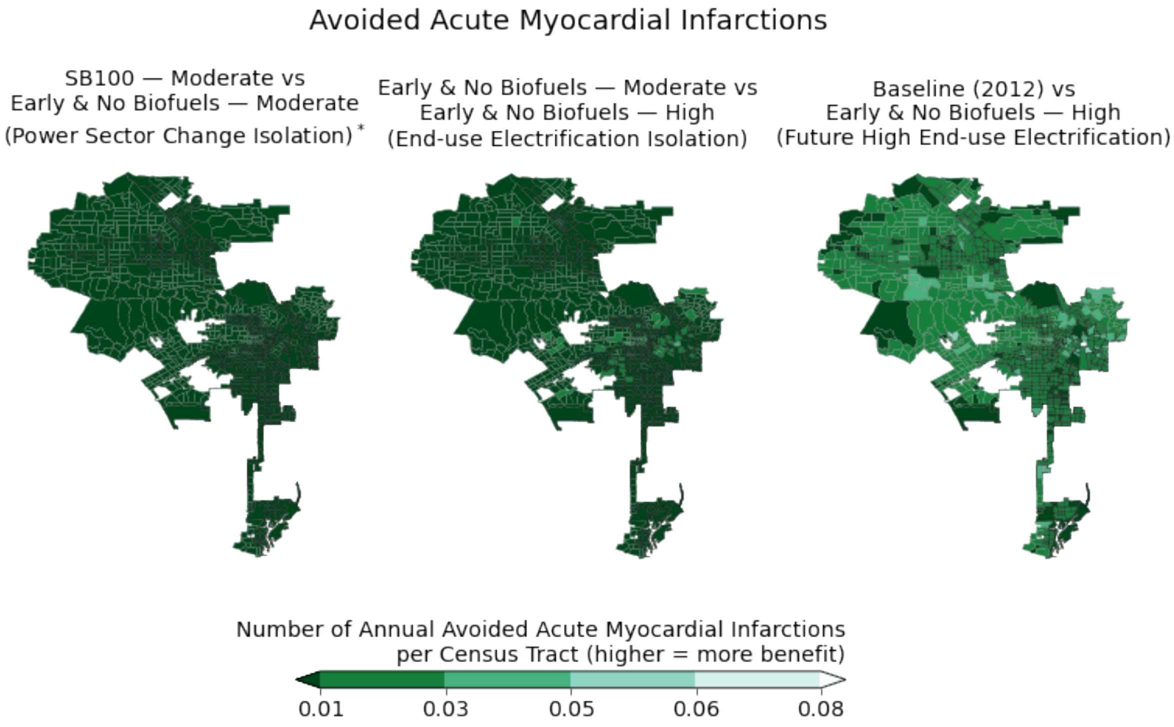
Estimates of annual avoided cardiovascular hospital admissions in 2045

Scenario	DAC Tracts (Total)	Non-DAC Tracts (Total)	DAC Percent of Total
Comparison of future scenarios (2045) versus Baseline (2012)			
Baseline (2012) versus SB100 – Moderate	21	23	48%
Baseline (2012) versus Early & No Biofuels – High	31	33	49%
Comparison of future scenarios isolating power sector changes in 2045			
SB100 –Moderate versus Early & No Biofuels – Moderate	0.22	0.13	62%
SB100 – High versus Early & No Biofuels – High	0.13	0.10	56%
Comparison of future scenarios isolating impacts of high electrification in end-use sectors in 2045			
Early & No Biofuels – Moderate versus Early & No Biofuels – High	10	9.8	50%
SB100 – Moderate versus SB100 – High	10	9.9	51%

Cardiovascular hospital admission reductions accrue approximately equally between DAC and non-DAC tracts, largely driven by difference in electrification projections.

Effect on Health Indicators – Heart Attacks (AMI)

- Avoided heart attacks between scenarios are generally evenly distributed across DAC and non-DAC census tracts (and similar between scenarios)
- Baseline (2012) versus Early & No Biofuels – High shows the greatest spatial variation and the largest decreases (a city-wide decrease of 19 heart attacks)



DAC tracts are outlined in black