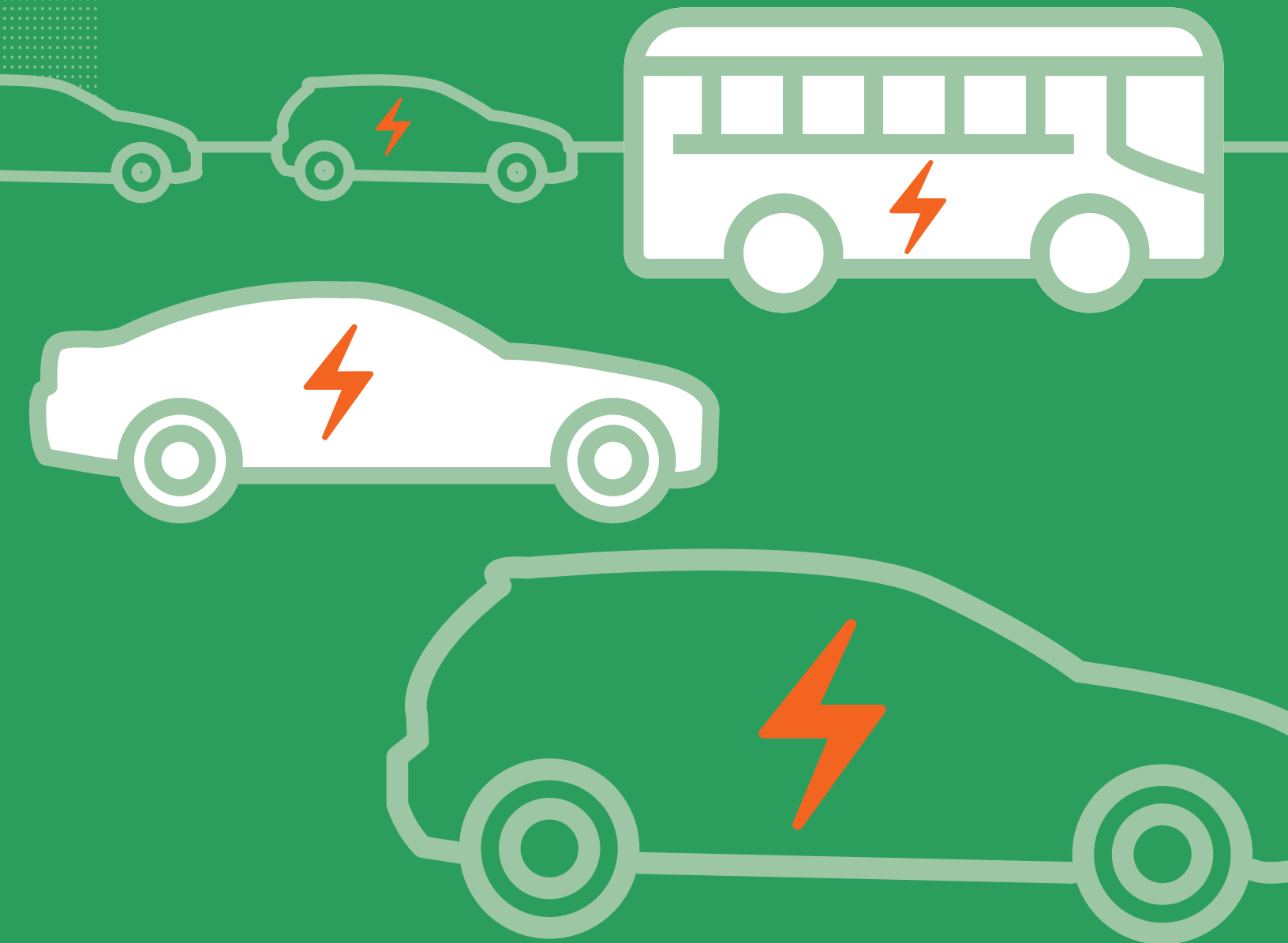




EV FOR ALL

ELECTRIFYING TRANSPORTATION IN LOW-INCOME COMMUNITIES

The ABCs of EVs Series

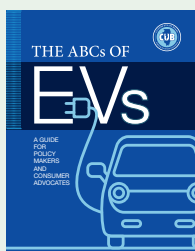


The Citizens Utility Board (CUB) was created by the Illinois General Assembly in 1983 to be an independent, nonprofit organization representing the interests of residential and small commercial utility customers in regulatory matters before the Illinois Commerce Commission, the General Assembly and in the courts. Since opening its doors in 1984, CUB has helped save consumers more than \$20 billion by challenging rate hikes and securing rate reductions and refunds, and it has been a leading voice in developing the state's clean energy policy. CUB was instrumental in negotiating restructuring of the Illinois electricity industry in 1997 and a series of subsequent statutes and proceedings that have made Illinois a leader in grid modernization, energy efficiency, and renewable resource deployment.

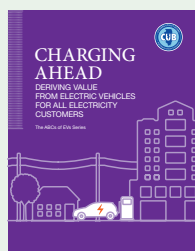
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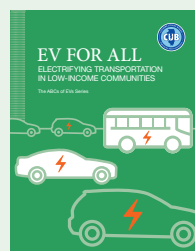
The ABCs of EVs series from the Citizens Utility Board of Illinois



Volume 1



Volume 2




Volume 3



EV FOR ALL

ELECTRIFYING TRANSPORTATION IN LOW-INCOME COMMUNITIES

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Low-Income Communities Need Electrified Transportation

The economic and social challenges facing low-income urban communities have suddenly been compounded by the COVID-19 pandemic. In Chicago, for example, zip codes with the highest numbers of deaths from the virus showed median incomes averaging \$32,505, or 41% below the city median of \$55,198.¹ One in four households in these neighborhoods were below poverty level.²

Low-income communities have suffered so severely from COVID-19 because of a compounding number of factors, including jobs that do not allow work from home, inadequate health insurance, the prevalence of respiratory diseases such as asthma, and disproportionate exposure to air pollution from transportation and industrial sources. As coal plants have begun to close and electricity production has gradually become cleaner, transportation has become the largest source of air pollution in the U.S. Petroleum-fueled

vehicles emit a toxic mix of chemicals and particulate matter, as well as 29% of the carbon dioxide that causes climate change.³

The pandemic and resulting economic crisis along with the burgeoning movement to fight systemic racism have understandably sidelined many other public issues. But the inexorable march of unchecked climate change poses long-term dangers. Overburdened and underserved communities are disproportionately vulnerable to this threat, making environmental justice an urgent concern for the post-pandemic world.⁴

Climate change is now a top public issue, with 67% of likely voters ranking it as either a “crisis” or a “significant concern” in a 2020 national survey.⁵ A similarly high percentage of voters were concerned about energy affordability.

Electrified transportation addresses both concerns. Not only does it reduce local air pollution and global climate change, it also can lower electric bills for consumers. Previous papers published by the Citizens Utility Board (CUB)—The ABCs of EVs (2017) and Charging Ahead (2019)—have described regulatory considerations and policies to support transportation electrification (TE).⁶ These reports show that well-designed electric vehicle (EV) policy aimed at maximizing grid value through system optimization will produce benefits for all consumers, not just those who drive an EV. In this follow-up report we discuss ways to quickly and efficiently bring TE benefits to the communities that need them most. Using Chicago as an example, we examine the problem of air inequality and suggest policies and programs to make TE a key part of the solution.



1 A range of \$22,992-42,019

2 Chicago Tribune, 4/11/2020, <https://www.chicagotribune.com/coronavirus/ct-viz-covid-19-cases-by-zip-code-20200407-aikakoyycje4fbqvferzjffkg4-htmlstory.html>

3 See EPA data: Greenhouse gas emissions 2018 <https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions>

4 <https://www.sfchronicle.com/opinion/article/How-electric-vehicles-can-help-advance-social-15351293.php>

5 <https://www.brunswickgroup.com/media/6780/brunswick-us-voters-perceptions-of-climate-change-and-energy-policy.pdf>

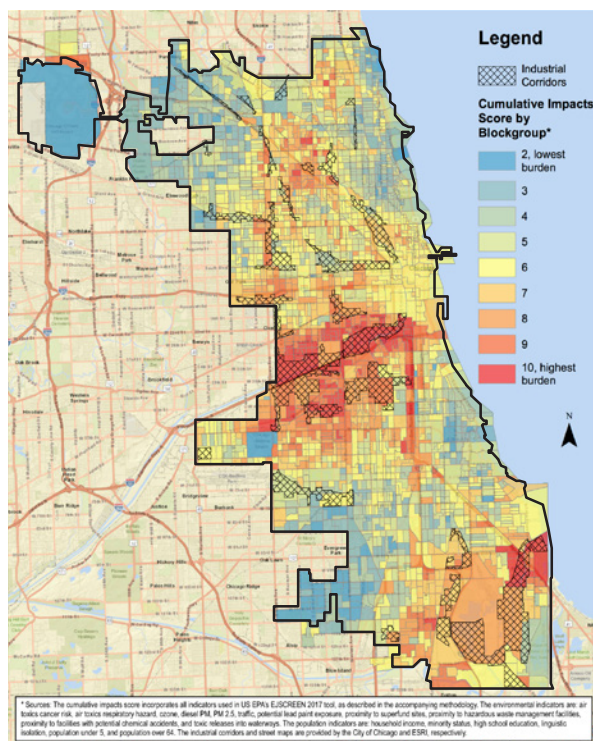
6 The ABCs of EVs: A Guide for Policy Makers and Consumer Advocates (2017): https://citizensutilityboard.org/wp-content/uploads/2017/04/2017_The-ABCs-of-EVs-Report.pdf; and Charging Ahead: Deriving Value from EVs for All Electricity Customers (2019): <https://www.citizensutilityboard.org/wp-content/uploads/2019/03/Charging-Ahead-Deriving-Value-from-Electric-Vehicles-for-All-Electricity-Customers-v6-031419.pdf>

Air Pollution—Mapping A Silent Killer

Outdoor air pollution is estimated to have caused 4.2 million premature deaths in 2016, according to the World Health Organization. The American Lung Association gave Chicago a grade of “F” for ozone pollution in its latest national “State of the Air” report.⁷ Low-income neighborhoods are disproportionately harmed because of their proximity to multiple sources of pollution, including industrial facilities, bus depots, and truck corridors.

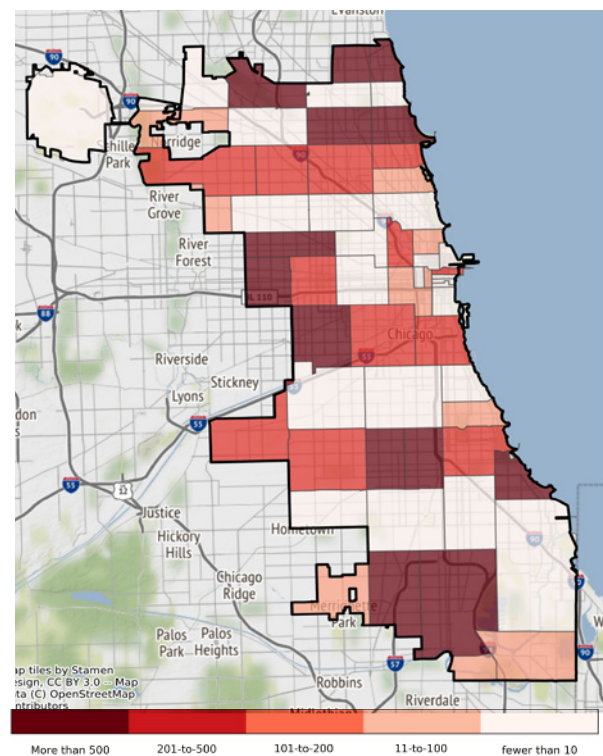
Diesel-fueled buses and trucks are among the worst urban air polluters, producing 40 hazardous chemicals, including hydrocarbons, smog-forming nitrogen-oxide (NOx), carbon monoxide, benzene and volatile organic compounds, in addition to high levels of small particulate matter (PM2.5). This pollution is a prime contributor to asthma and lung disease, which are prevalent in low-income urban communities.⁸ Excessive exposure to PM2.5 is also correlated with sub-optimal cognitive performance and learning disabilities.⁹

Figure A: Cumulative Burden of Environmental Exposures and Population Vulnerability in Chicago (NRDC map)



Source: Natural Resources Defense Council (NRDC) <https://www.nrdc.org/experts/meleah-geertsma/new-map-shows-chicago-needs-environmental-justice-reforms>

Figure B: Chicago COVID-19 death rate (per 100,000 population) as of June 6, 2020 by zip code



Source: CUB graphic, using <https://data.cityofchicago.org/Health-Human-Services/COVID-19-Cases-Tests-and-Deaths-by-ZIP-Code/yhhz-zm2v>

These maps show that areas of environmental vulnerability overlap with areas that have a high COVID-19 death rate.

⁷ <http://www.stateoftheair.org/city-rankings/states/illinois/cook.html>

⁸ Particulate Matter 2.5 (PM2.5) refers to air pollutants that are so tiny (25,000 microns per inch) that they are about 30 times smaller than a human hair. Despite their size, they are extremely dangerous to health, including children and senior citizens with chronic respiratory illnesses like asthma. <http://elpc.org/issues/clean-air/air-quality-monitoring/>

⁹ <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5499513/>

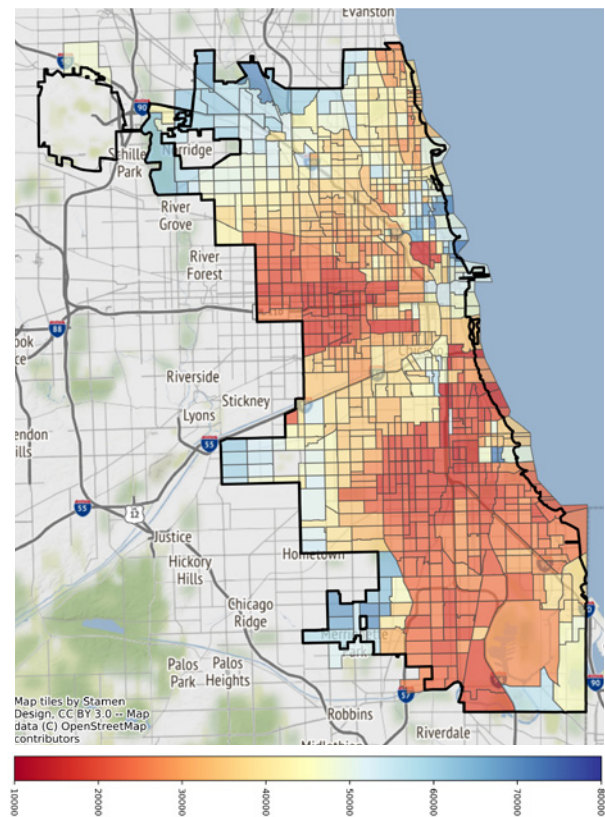
The chronic exposure of low-income Chicagoans to air pollution can be vividly seen in maps of key pollution sources. Figure A includes industrial corridors and shows the overall relative exposure of Chicago neighborhoods to vehicle pollutants, as mapped by the Natural Resources Defense Council.

Air pollution has proven to be a key factor in vulnerability to the COVID-19 virus. A study by the Department of Biostatistics at Harvard University showed the correlation between long-term exposure to air pollution and risk of death from COVID-19.¹⁰ After correcting for the effects of other variables, researchers found that a small increase in long-term exposure to PM_{2.5} is associated with a large increase in the COVID-19 death rate.

In Figure B, CUB maps COVID-19 death rates (per 100,000 population) as of June 6, 2020 by Chicago zip codes. Figure C maps income levels by Census Tracts in Chicago.

Combined, the three maps illustrate the striking correlation between living in a predominantly low-income community and being exposed to high levels of air pollution as well as a high risk of COVID-19 infection.

Figure C: Income levels by Census Tract



Source: <https://opportunityatlas.org/>



¹⁰ <https://projects.iq.harvard.edu/covid-pm> Exposure to air pollution and COVID-19 mortality in the United States. Xiao Wu, Rachel C. Nethery, Benjamin M. Sabath, Danielle Braun, Francesca Dominici. medRxiv 2020.04.05.20054502; doi: <https://doi.org/10.1101/2020.04.05.20054502>

Energy Burdens

Air pollution and carbon emissions are invisible, longer-term perils, but paying utility bills is an every-month challenge for low-income families. While consumer advocates and government officials worked to win unprecedented protections for Illinois utility customers during the pandemic—including a temporary moratorium on shut-offs and new funding to make utility bills more affordable—low-income consumers still face disproportionate energy burdens.

For low-income households, the proportion of wages spent on utility bills is three times greater, on average, than that of higher-income households.¹¹ The national Low Income Home Energy Assistance Program (LIHEAP), which helps low-income households pay energy bills, has been expanded by pandemic-relief legislation but remains far short of meeting the need.¹² Illinois also has a Percentage of Income Payment Plan (PIPP), funded by a portion of a 48 cents per month charge on electric and gas bills, but fewer than 20% of income-eligible households receive either of these energy subsidies.¹³ Applications for these programs can be anticipated to increase as the hardships grow, but limited funding would mean smaller levels of support for each household. If present levels of LIHEAP and PIPP funding were spread over all eligible Illinois households, the average annual benefit would amount to about \$160—not even enough to pay one month’s typical electric and gas bills.¹⁴

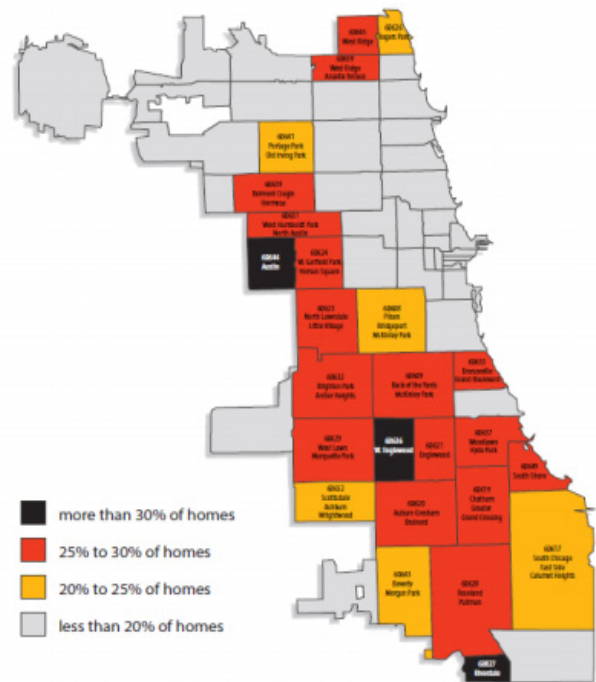
Potentially adding to that energy burden for many low-income households are two urgent threats to Illinois electric bills: Overpriced energy plans that have become pervasive in Illinois’ retail energy market and a Federal Energy Regulatory Commission (FERC) ruling.

OVERPRICED ENERGY PLANS

Attempting to reduce their monthly bills, many customers have fallen prey to false and misleading

marketing. According to annual reports by the Illinois Commerce Commission (ICC), since 2015 residential customers buying from non-utility sources have paid a total of about \$800 million in higher rates than had they remained on utility supply service. From June 2018 through May 2019, northern Illinois customers with alternative suppliers paid an average of nearly 25% more on the per-kilowatt-hour (kWh) supply charge—that’s an average of \$100 more a year for a customer who uses about 500 kWh a month.¹⁵ As shown in the

Figure D: Chicago Neighborhoods with Highest Rates of Homes Switched to Alternative Electric Suppliers (Percentage by zip code) (Illinois Attorney General’s Office)



Source: Office of the Illinois Attorney General
<https://www.citizensutilityboard.org/wp-content/uploads/2020/06/OfficeOfIllinoisAttorneyGeneral.pdf>

¹¹ See Oak Ridge National Lab report: <https://info.ornl.gov/sites/publications/Files/Pub124723.pdf>

¹² Illinois received \$42M in additional funds from the 2020 CARES Act, bringing total LIHEAP funding to \$213M—see: https://www.acf.hhs.gov/sites/default/files/ocs/comm_liheap_supplreleasedclstateres_fy2020.pdf

¹³ LIHEAP (251,421) and PIPP (30,216) served 281,637 households in 2019 out of approximately 1.5 million households at or below 150% of Federal Poverty Level.

¹⁴ See <https://wallethub.com/edu/energy-costs-by-state/4833/> and <https://www.elevateenergy.org/wp-content/uploads/Energy-Burden-in-IL.pdf>

¹⁵ Illinois Commerce Commission Office of Retail Market Development, 2019 Annual Report <https://www.icc.illinois.gov/icc-reports/report/AnnualReportOfficeOfRetailMarketDevelopment>

map on page 5 (Figure D) prepared by the Office of the Illinois Attorney General, retail marketers have captured the highest market share in neighborhoods where people can least afford higher bills. Residents in these neighborhoods are predominantly people of color.

FERC RULING

It will become even more difficult for low-income families to afford their utility bills if, in coming years, wholesale energy prices rise from today's historic lows.¹⁶ The threat of higher consumer electricity bills is exacerbated by a recent FERC order intended to prop up the coal industry. States like Illinois have chosen to make clean energy a growing part of their electricity mix. But under pressure from coal generators supported by the Trump administration, FERC ordered PJM, the regional market in which ComEd participates, to require state-mandated energy resources to bid into the PJM capacity market at high prices.¹⁷ Because

there is more than enough regional generating capacity available, these clean resources—carbon-free generators like wind and nuclear—are unlikely to “clear” the market and receive compensation for their capacity. Instead, fossil-fueled power generators would likely win those bids and the clean power generators would receive revenue only from the energy market. This would deter new clean power development and likely cause some existing zero-carbon facilities to shut down prematurely. And the costs for electric capacity—which are paid by all consumers on their monthly bills—would be driven higher. One estimate shows northern Illinois households would pay up to \$1.7 billion over the next decade.¹⁸ State legislation supported by consumer and environmental advocates (the Clean Energy Jobs Act) would prevent this. It would allow Illinois to protect both its clean energy generators and consumers by having a state agency, the Illinois Power Agency, procure capacity through a competitive process.

The Promise Of Transportation Electrification (TE)

Silver linings are difficult to find in the midst of the cloud of the COVID-19 pandemic, but throughout the country, smog has lifted and skies have cleared. In New York, emissions of pollutants were less than half the typical amount in late March 2020, and in Southern California levels of particulate matter fell by 40% in early April.¹⁹ Demand for gasoline and jet fuel in Chicago plummeted even more, and the stay-at-home regimen provided a glimpse of how air quality would improve if millions of

gasoline cars were replaced with pollution-free EVs.²⁰ However, even this temporary improvement in air quality has largely bypassed Chicago, a transportation hub where soot concentrations in April 2020 declined by only 1% from a year earlier, according to an analysis by the Chicago Tribune.²¹ Intermodal freight terminals, which produce some of the worst pollutants, are heavily concentrated in the city's low-income Black and Latinx neighborhoods.

16 PJM average wholesale costs were \$48.98/MWH in 2019, about 18% lower than the \$60.00 average in 2018, and 7% lower than the five year average of 2015-2019. See PJM presentation <https://www.pjm.com/-/media/committees-groups/committees/mc/2020/20200121-webinar/20200121-item-07a-markets-report.ashx>

17 Federal Energy Regulatory Commission Docket Nos. EL16-49-000, EL18-178-000 (Consolidated) <https://assets.documentcloud.org/documents/6589824/20191219-3124-33920957.pdf>

18 A Moving Target: An Update on the Consumer Impacts of FERC Interference with State Policies in the PJM Region, Grid Strategies. May 2020 <https://gridprogress.files.wordpress.com/2020/05/a-moving-target-paper.pdf>

19 See <https://www.washingtonpost.com/weather/2020/04/09/air-quality-improving-coronavirus/> and <https://www.wsj.com/articles/coronavirus-got-rid-of-smog-can-electric-cars-do-so-permanently-11586532988>

20 <https://www.chicagotribune.com/coronavirus/ct-viz-shelter-in-place-changes-charts-20200402-mrln2ovcvjamhm6wfkj77e3gi-htmlstory.html>

21 http://digitaledition.chicagotribune.com/infinity/article_share.aspx?guid=35ee22de-664b-484c-ac79-8f5273d22d9e

Electric cars, trucks, and buses emit no pollutants or carbon dioxide and the power to run them is generated far more cleanly than internal combustion (IC) engines.²² This is the case even where coal remains the primary fuel for electricity generation, but is especially true in Chicago, where nuclear generation predominates the energy mix, and renewable

resources such as wind and solar are the fastest growing power sources.²³ In the northern Illinois PJM region, during some overnight periods all electricity is produced without fossil fuels, making vehicle charging truly “zero-emissions” at those times.²⁴

The environmental benefits of transportation electrification are clear, and those who suffer the most from

BUILDING ELECTRIFICATION

Electrification isn't just for transportation. It's also a clean energy strategy for other applications, such as space heating. Natural gas heats 80% of homes and businesses in Chicago, but as a fossil-fuel with more than half the carbon emissions of coal, it also worsens climate change.¹ The extraction technique known as “fracking” has increased natural gas supply and kept a lid on prices in recent years, but all booms eventually have a bust. Meanwhile, Peoples Gas, the utility serving Chicago, has embarked on a multibillion-dollar pipe-replacement program that has caused gas bills to rise so rapidly that the Chicago City Council in 2020 passed a resolution urging state officials to rein in the utility's spending.²

Technologies using low-cost, off-peak electricity, such as electric thermal storage, or geothermal and air source heat pumps, are becoming clean, cost-effective alternatives to natural gas. However, as more customers switch away from gas, the monthly bills of remaining customers will go ever higher to help the utilities cover costs and make a profit, thus causing more customers to leave. An endless cycle like this can become a “utility death spiral.” It is crucial to make sure that tomorrow's low-income gas customers are not the ones left “holding the bag” and that they too have access to clean and affordable alternatives to natural gas.

1 EIA summary: https://www.eia.gov/consumption/residential/reports/2009/state_briefs/pdf/IL.pdf

2 See CUB news release: https://www.citizensutilityboard.org/wp-content/uploads/2020/05/20200422_PG-resolution.pdf



22 See fact sheet: <https://cleantechnica.com/2020/05/17/electric-vehicles-are-cleaner-than-gasoline-vehicles-new-fact-sheet/>

23 Most recent EIA data (February, 2020) show energy from power facilities located in Illinois to be 58% nuclear, 19% coal, 12% natural gas, and 11% renewable (primarily wind). Energy from the regional PJM system-wide mix in 2018/19 was 34% nuclear, 34% gas, 26% coal, 3% wind and less than 1% solar—see: https://www.comed.com/SiteCollectionDocuments/SafetyCommunity/Disclosure/Environmental_disclosure_12_months_ending_06302019.pdf

24 PJM: 2019 Illinois State Infrastructure Report. <https://www.pjm.com/-/media/library/reports-notice/state-specific-reports/2019/2019-illinois-state-infrastructure-report.ashx?la=en> Accessed 6/16/20. In 2018, there were 103 overnight hours with negative real-time LMPs in the ComEd Zone - 3.5% of those hours.

pollution have the most to gain if policy brings TE directly to those communities. What is not widely known is that TE can also reduce the cost of electricity for all customers—even for those who don’t own an electric vehicle. If the new utility revenue from EV charging exceeds the additional costs to produce

and distribute that electricity, lower rates will result. However, the only way to avoid costly system expansion to serve charging loads is to make sure that charging occurs in periods when there is ample unused distribution capacity. (See “Optimized Charging” below.)

OPTIMIZED CHARGING

The emerging electrification of transportation will improve health and reduce carbon emissions, especially in communities where we deploy that technology. And the electric system already has enough capacity at off-peak periods to charge millions of vehicles. But without the right policies and rate plans in place to encourage charging during optimal periods, EV growth could require costly new investment in electric system expansion—costs which would be passed on to all consumers through higher electric rates.

Optimized charging not only reduces the EV owner’s electricity costs, but also makes the system load shape more efficient, enhances reliability of the grid, and reduces pollution by maximizing use of clean energy. The more EVs are added to the nation’s roadways, the more electricity consumers—all of us—will see lower electric rates. In *Charging Ahead: Deriving Value from EVs for All Electricity Customers* (2019), CUB analyzed different EV market penetration scenarios and found that the combined projected value to Illinois electricity customers of optimized charging patterns ranged from \$469 million to \$2.6 billion. In that guide, CUB detailed policies designed to achieve the best outcome for all electricity consumers, whether or not they drive an EV, including:

- EV-only time-of-use (TOU) rates to home chargers,¹ with:
 - ~ Significant time price differential;
 - ~ No separate meter required;
 - ~ No extra monthly fees beyond the cost of service;
 - ~ Separate listing of EV usage on each monthly electric bill.
- Direct charging control programs on congested circuits to:
 - ~ Respond to local system conditions;
 - ~ Manage critical peak periods;
 - ~ Aggregate EV load as a Demand Response resource;

Figure E: Total Benefits of Optimized Charging



- ~ Maximize renewable energy utilization.
- Support for public charging, including alternative rate designs to encourage deployment.
- Online EV tools and apps to:
 - ~ Automate response of chargers to signals such as price, emissions and real-time renewable generation output;
 - ~ Provide shadow bills so customers can compare current and historical monthly costs under different rate plans;
 - ~ Include cost calculators to do cost comparisons between EV and internal combustion (IC) vehicles, given inputs such as miles driven, purchase price, financing, gasoline cost, electricity rate plans, and other variables.
- Outreach and education by utilities, independent groups, and regulators.
- Programs designed to ensure all customer segments benefit from EV growth, including low and moderate-income customers and communities of color that are disproportionately impacted by transportation air pollution.

¹ Time-of-use plans divide a day into three different periods with a distinct electricity rate for each. The idea is to incentivize people to put off heavy usage until off-peak times when the price is lowest. A 2019 CUB study of 2.5 million households, “Six Unique Load Shapes: A segmentation analysis of Illinois residential electricity consumers,” found that many low-income customers had a “flat load-shape”—a relatively steady usage pattern that was well-suited for time-of-use plans. Such customers were likely paying more than they should under traditional pricing, the study found. <https://www.citizensutilityboard.org/wp-content/uploads/2019/06/ClusterAnalysisFinal.pdf>

Bringing TE To Low-Income Neighborhoods

For those who own them, EVs have many advantages over internal combustion (IC) cars. First, their operating costs are significantly lower, even with low gasoline prices. The incremental cost of electricity varies widely across the country, but the cost to travel in an EV is usually less than the gasoline equivalent of \$1 per gallon.²⁵

Electric motors have only a handful of moving parts and EVs are low-maintenance, having no radiator, alternator, water pump, catalytic converter, fuel pump, or transmission to maintain and replace. They are quiet, produce no exhaust fumes, and boast generally superior performance. “Filling up” at home instead of a gas station is not only a big convenience for EV drivers, but avoids having to touch pump handles and be exposed to potential health hazards.²⁶ The EV sales experience is often entirely online, another bonus in a period when many people want to minimize face-to-face contacts. In short, the EV market is growing quickly as a result of car-buyer preferences, with less pollution and lower carbon emissions as “positive externalities.”²⁷

CONFRONTING BARRIERS TO PERSONAL OWNERSHIP

EVs are almost non-existent in low-income neighborhoods. Many households cannot afford any kind of car, or residents prefer to walk, bike or take public transportation. Those who own a car often lack a place to park where they could plug it in. And although over time the operating savings can make the cost of an EV lower than a traditional car, the initial outlay for a new EV remains beyond the reach of consumers with limited incomes. Low-income

buyers also face barriers to financing, and vital EV information can be difficult to find for those whose native language is not English.

The growing number of used EVs presents an opportunity to bring them to drivers who cannot purchase a new one. Early models of cars such as the Nissan Leaf can travel 75-80 miles on a charge, making them well-suited for daily driving around town and average commuting. Initial fears that EV batteries would degrade have proven unfounded, and electric motors last far longer than traditional engines, making EVs a good used-car option. Some pre-owned EVs are available at low prices compared to similar IC vehicles, and their low operating costs make them a clean energy bargain—provided that convenient charging opportunities are available. Combined with consumer education, creative programs like these would bring personal EVs to under-resourced communities:

- Income-based rebates for used EVs and home chargers;²⁸
- Income-based swap programs to facilitate trading-in IC vehicles for EVs or other clean energy mobility solutions;
- Geo-targeted public charge station development (with discounts for local residents).

BEYOND PERSONAL VEHICLES

Personal vehicles are only one piece of transportation electrification. Low-income communities will benefit from well-designed strategies for electrifying a range of transportation and mobility modes, including:

25 Even with gasoline at \$2.00 per gallon, a car getting 30 miles per gallon (mpg) will cost more than 7 cents per mile to fuel. In Chicago, where the incremental cost of off-peak charging on time-of-use rates averages less than 7 cents per kWh, an EV getting 3.5 miles per kWh will cost about 2 cents per mile of travel. Even at 10 cents per kWh—the average volumetric flat rate—the EV is still about 30% less expensive to fuel.

26 <https://www.reuters.com/article/us-usa-health-filth/gas-pump-handles-top-study-of-filthy-surfaces-idUSTRE79O0G820111025>

27 Electric Vehicle Market Will Keep Growing Despite COVID-19: <https://www.tdworld.com/electrification/article/21129674/electric-vehicle-market-will-keep-growing-despite-covid19>

28 A 2017 CarMax/CleanTechnica survey shows that almost 70% of EV owners make over \$75,000 per year. <https://www.carmax.com/articles/hybrid-electric-2017-survey-results>. Analyzing sticker sales data from 2017, WBEZ indicated similar demographics: Out of 1,000+ EVs in Chicago at the time, 600 of which were expensive Teslas, mostly in Zip Codes that covered wealthier neighborhoods. https://www.wbez.org/stories/_/15b7c537-95c1-40ad-afc1-111c0b7d6a21#top10 Still, interest in EVs across income brackets is evident. A 2019 analysis by the Union of Concerned Scientists found that support for incentives and tax rebates for EVs held fairly steady across income brackets, and was 75% for people who made less than \$50,000. <https://www.ucsusa.org/sites/default/files/attach/2019/07/2019-EV-Survey.pdf>

- E-Buses: Public transit buses powered by electricity have many advantages over pollution-spewing conventional diesel models, in addition to being quieter, smoother and exhaust-free:
 - ~ Estimated savings of \$458,000 per bus in fuel and maintenance costs over their lifetime;²⁹
 - ~ \$150,000 per bus in reduced annual healthcare costs due to avoided pollution, according to an analysis by Columbia University;³⁰
 - ~ Zero tail-pipe emissions instead of the average of about 117 metric tonnes per year for a typical diesel transit bus.³¹

The quantifiable benefits of e-buses outweigh their higher initial costs, which is why the Chicago City Council approved a plan to electrify the Chicago Transit Authority's entire fleet of 1,850 buses by 2040. In a test program, two e-buses saved \$54,000 per year on fuel and maintenance, and in 2018 the CTA executed an initial \$32 million contract for 20 more.³² However, deployment of charging infrastructure at bus garages and on routes is an added expense, and a dramatic decline in ridership due to the pandemic put the agency's capital budget in limbo.

At the same time, the pandemic highlights the need for policymakers to focus on electrification of the nation's 80,000 intra-city buses. While many office workers may be able to work at home, most lower-income people have on-site jobs in service, industrial, and retail sectors. Public transportation is the only way for many people to access jobs that have been shown to be as essential to the economy as they are to their livelihoods.

Initial rollout of e-buses should be targeted to environmental justice communities that are most in need of cleaner air. E-buses should be configured to meet the new safety needs of passengers—for example, to have fresh rather than recirculated air flowing through the cabin.

- Shared Mobility: Policymakers should explore clean, last-mile transportation options, including e-scooters, e-bicycles and EV car-sharing programs. Such low-cost e-mobility sharing services could begin as pilot programs in environmental justice communities.

Several cities have experimented with EV sharing programs. For example, Sacramento's "Our Community Carshare" program provides a free monthly allotment of e-carshare hours to residents in designated areas and housing developments.³³ BlueLA offers membership-based EV sharing at 30 stations in Los Angeles, with fees discounted to low-income residents.³⁴

Shared vehicles can be centrally housed in optimal locations and charged overnight. In Chicago, shared EVs could be stationed in the "transit deserts" shown on the map on the next page (Figure F) developed by the Center for Neighborhood Technology.³⁵ About 438,000 people—10% of the population of Cook County—live in these largely low-income neighborhoods that lack easy access to public transportation.

- E-School Buses: America's biggest transit system is its 485,000 school buses. Only a few hundred of them run on electricity, but e-buses are being tested in districts across the country. Illinois plans to invest up to 10% of its \$109 million share of the Volkswagen diesel penalty fees in all-electric school buses.³⁶ Their high initial costs—twice as much as an equivalent diesel bus, although that's anticipated to come down with higher manufacturing volumes—are offset over time by their fuel savings, particularly if charged at low overnight rates.

Because school buses are often idle during summer months of high air-conditioning demand, e-bus

29 https://www.apta.com/wp-content/uploads/Public_Transit_Leading_In_Transition_To_Clean_Technology.pdf

30 <http://www.columbia.edu/~ja3041/Electric%20Bus%20Analysis%20for%20NYC%20Transit%20by%20J%20Aber%20Columbia%20University%20-%20May%202016.pdf>

31 Estimate based on a Union of Concerned Scientists analysis (https://blog.ucsusa.org/jimmy-odea/electric-vs-diesel-vs-natural-gas-which-bus-is-best-for-the-climate?_ga=2.226102682.1843563386.1532023761-1843342382.1531829971) that found diesel transit buses had 2,680 grams of CO₂ emissions per mile, and an estimate by the Energy Department's Alternative Fuels Data Center that a diesel transit bus travels an average of 43,647 miles a year (<https://afdc.energy.gov/data/10309>).

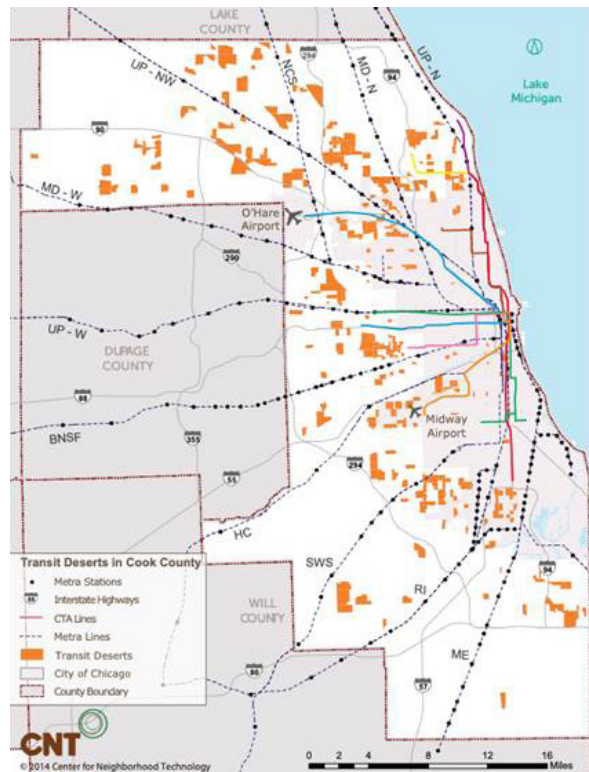
32 <https://www.transitchicago.com/cta-expands-electric-bus-fleet/>

33 <http://www.airquality.org/Our-Community-CarShare/Apply-for-Our-CarShare>

34 <https://www.bluela.com/>

35 https://www.cnt.org/sites/default/files/publications/CNT_TransitDesertsCookCounty_0.pdf

36 <https://www2.illinois.gov/epa/Documents/iepa/air-quality/vw-settlement/Illinois%20Beneficiary%20Mitigation%20Plan.pdf>

Figure F: Transit Deserts in Cook County

Source: Center for Neighborhood Technology
https://www.cnt.org/sites/default/files/publications/CNT_TransitDesertsCookCounty_0.pdf

batteries also could potentially help with grid support.³⁷ The ability to have electricity flow both into and out of plugged-in vehicles—known as “V2G”—turns school buses into potential sources of electricity during hours of peak demand. A project of Dominion Energy Virginia is putting more than 1,000 V2G-capable e-school buses in service by 2025.³⁸

- **E-Trucks:** The U.S. has 9.3 million registered commercial trucks, including 2.9 million tractor-trailers (also known as semi-trucks, or 18-wheelers), which produce 8% of the nation’s total carbon emissions.³⁹ In Illinois, trucks consume 42 billion gallons of fuel each year and cause enormous

health problems, particularly in communities close to highways and truck depots, which are often predominantly low-income areas.⁴⁰

The rollout of e-trucks is just beginning and many manufacturers have them under development. With half the fuel and maintenance costs of diesel trucks, Tesla claims its upcoming e-truck will pay for its extra initial cost in two years.⁴¹ While access to adequate charging infrastructure on the road is a big challenge, many trucks are local day carriers that can be centrally charged using low-cost overnight power after they return at the end of the day to their depots. E-truck and commercial fleet charging depots can be incentivized to locate where the existing grid has sufficient capacity for their high loads, so investment in new distribution infrastructure can be avoided. These locations are often in low-income areas where de-industrialization has occurred—exactly the neighborhoods where there is a vital need for both non-polluting vehicles and new jobs.

- **Public E-Fleets:** Electrification of public fleet vehicles is a cost-effective clean energy strategy for government at all levels. Municipal EVs would save at least 55% on fuel costs in Chicago under managed charging.⁴² The city fleet of 10,000 light, medium and heavy-duty vehicles includes 3,000 police vehicles, 300 garbage trucks, and 300 snow plows. With predictable local routes and centrally managed charging, these fleets would be perfect candidates for electrification. Cooperative fleet procurement with other governmental units has the potential to reduce acquisition costs through volume-purchasing.⁴³ This also provides a key opportunity to increase access to charging infrastructure for the general public. Imagine giving public access to fast chargers at municipal transportation hubs that are located in low-income neighborhoods where city fleets and buses also charge.

Some EV charging initiatives are appropriate for

37 See <https://electrek.co/2019/08/23/electric-v2g-school-bus-pilots-grow/>

38 <https://insidelines.pjm.com/dominion-to-roll-out-largest-electric-school-bus-deployment-in-u-s/>

39 <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2020-01/FMCSA%20Pocket%20Guide%202019-FINAL-1-9-2020.pdf>

40 https://www.eia.gov/dnav/pet/pet_cons_821usea_dcu_nus_a.htm

41 <https://www.tesla.com/semi>

42 <http://www.amplifypower.com/comparison-map/>

43 <https://www.electrificationcoalition.org/wp-content/uploads/2018/06/ElectricVehicleProcurementBestPracticesGuide.pdf>

implementation by public agencies and others through utility companies or third-party vendors. Some would require legislation and others may fit under existing state regulatory authority. All should

be evaluated in a planning process that prioritizes equity, with key input from affected stakeholders, including the low-income communities that would be most affected by these initiatives.⁴⁴

Recommendations: A Holistic Approach To TE In Low-Income Communities

- **A strategic plan at the outset is essential for bringing the benefits of transportation electrification (TE) to low-income areas.** The elements should be integrated, with each prioritized using an analysis of its projected benefits, costs, and risks—mapped to those who will pay for it, those who will derive value, and those who will bear risks. The costs of TE programs should be spread out over the timeframes of their projected public benefits, ensuring fairness for the utility customers and/or taxpayers who will pay for them.
- **Crafting a TE strategic plan requires input and participation from a wide range of stakeholders representing all perspectives, including low-income advocates, consumer, environmental, and community groups, business representatives, utilities, and government agencies.** Successful and timely implementation requires not only collaboration and communication between groups that may have little experience working with each other, but also internal coordination within public and private institutions. Too often, the “silos” in the structures of large organizations hinder effective action, and must be bridged by leadership to create common purpose.
- **Input from low-income communities is essential.** Bringing the benefits of TE to low-income communities requires a participatory

communications plan, starting with input from those communities about designing electrification policies that meet their particular needs and concerns. The Illinois Clean Jobs Coalition, a group of more than 200 consumer advocates, green businesses and community leaders, provides an appropriate model with its “Listen, Lead, Share” sessions. Beginning in 2018, the coalition held about 100 listening sessions across the state of Illinois to seek input about four policy priorities:

- ~ cutting carbon from the power sector by 2030;
- ~ 100% renewable energy by 2050;
- ~ reducing pollution from gas and diesel vehicles in the transportation sector; and
- ~ creating jobs and economic opportunity for every part of Illinois.

The sessions showed overwhelming support for these four “pillars,” which became the basis for the Clean Energy Jobs Act (CEJA), consumer-friendly clean energy legislation the coalition is striving to pass at the state capitol. The legislation, which emphasizes equity—that all Illinois consumers benefit from the clean energy economy—would be a significant step forward for delivering EV benefits to low-income neighborhoods. CEJA’s EV provisions include:

- ~ a low-income rebate for EV purchases;
- ~ a program to provide access to EVs for neighborhoods where new EV ownership is not an option; and

⁴⁴ Reply Comments of the Energy Division Staff Proposal for a Draft Transportation Electrification Framework, Before the Public Utilities Commission for the State of California, Dec. 13, 2018, The Greenlining Institute. <https://www.citizensutilityboard.org/wp-content/uploads/2020/06/REPLY-COMMENTS-OF-GREENLINING-ON-TEF.pdf>

- ~ rebates for transit agencies to electrify their diesel bus fleets, with prioritization for buses that travel through communities that have been hit hardest by pollution and environmental injustice.
- **Utility-implemented programs should be tied to performance, including incentives for the achievement of public goals.** Metrics can be designed to measure progress in:
 - ~ improving affordability of electric service;
 - ~ increasing use of electricity for transportation in low-income areas;
 - ~ improving efficient utilization of the electric grid;
 - ~ lowering peak demand, improving load shape;
 - ~ using EVs to integrate renewable and clean energy resources;
 - ~ creating jobs in low-income neighborhoods;
 - ~ reducing air pollution in low-income neighborhoods;
 - ~ reducing carbon emissions by the electric and transportation sectors;
 - ~ putting downward pressure on electricity rates.
- **Vendors receiving public or utility funding should be subject to reasonable standards and consumer protections.**

- **Progress and outcomes should be publicly and regularly reported.**
- **Plans should be evaluated and updated as conditions and public needs evolve.**

A broad consensus around principles of support for transportation electrification has been documented in a joint statement by a diverse set of industry, consumer and environmental stakeholders: Citizens Utility Board, Edison Electric Institute, Sierra Club, Natural Resource Defense Council, and National Consumer Law Center.⁴⁵ While these groups do not always see eye-to-eye on other issues, they agree that environmental, economic, public health, and consumer benefits should put transportation electrification policy high on the nation's list of priorities. The first principle on the joint statement is that "transportation electrification should benefit all utility customers, including those in communities that are burdened disproportionately by local air pollution from the transportation sector and low-income households..." (See Appendix B.)

45 Joint Statement Supporting Electric Transportation (2020) https://www.nrdc.org/sites/default/files/media-uploads/joint_statement_supporting_electric_transportation_0.pdf



Conclusion: Transportation Electrification Policies Must Benefit Everyone

With the right policies in place, transportation electrification can be revolutionary for our planet, our economy and our pocketbooks—but not if low-income communities are left in the rear-view mirror. Events in 2020—the pandemic, the economic crisis, and the rise of the racial justice movement in the face of police brutality—demand that public policy prioritize the communities that have suffered the most from economic, environmental and racial inequities.

Just as state governments took the initial steps to address COVID-19 in the absence of federal action, the urgency of our changing climate means that they must take the lead in promoting renewable energy and supportive TE policies. At least 10 states or territories have established 100% carbon-free electricity goals, and many others are likely to join this clean energy movement.⁴⁶ The Illinois legislature has the opportunity to pass the Clean Energy Jobs Act, codifying the goal of carbon-free power by 2030 and bringing benefits of TE to low-income communities.

Effective TE policy must take into account electrification potential, load forecasts, and resource adequacy at all points across the grid, while making sure that programs and policies do not place financial burdens on those who can least afford them. Beyond that, any clean energy policy development affecting low-income communities must be responsive to community needs, informed by community input and measured by demonstrable community benefits.

In his “state-of-the-state” address in January 2020, Illinois Gov. J.B. Pritzker said it was time to adopt “new clean energy legislation that reduces carbon pollution, promotes renewable energy, and accelerates electrification of our transportation sector.”⁴⁷ Multiple crises have hit Illinois since then, and some critics have suggested that now is not the time to advance clean energy legislation. But there is no trade-off between realizing clean energy goals and achieving a post-pandemic rebound. In fact, TE can be a key part of the strategy to dig us out from the current crises and move forward towards racial, economic, and environmental justice.



⁴⁶ Including California, Washington, New York, Hawaii, Virginia, Puerto Rico, New Jersey, Maine, Nevada and Washington, D.C.

⁴⁷ <https://www.citizensutilityboard.org/statement-by-david-kolata-on-jb-pritzkers-state-of-the-state-address/>

APPENDIX A:

Excerpt from the Clean Energy Jobs Act, Supported by the Illinois Clean Jobs Coalition



Beneficial Electrification: Directs utilities to spend up to \$50 million per year on “Beneficial Electrification,” which is electrification that lowers costs for consumers and reduces pollution.⁴⁸ Programs must meet a cost-benefit test similar to energy efficiency, and lead to overall cost reductions. Required components of Beneficial Electrification Plans include:

- Low-income rebate for the purchase of electric vehicles for income-qualified households.
- Electric Vehicle Access for All: Administered by the Department of Commerce & Economic Opportunity (DCEO), designed to provide access to electric vehicles for communities where new EV ownership is not an option. Creates a last mile of commutes pilot program, and an EV car sharing pilot program.
- Rebates for transit agencies to electrify their diesel bus fleets, with prioritization for buses that travel through environmental justice communities.
- Rebates for governmental, commercial, or other retail customers for the purchase and installation of electric vehicle charging infrastructure for vehicles that primarily serve or travel through Low-Income communities or environmental justice communities.
- Rebates of up to \$500 for customers to install EV charging stations, provided the customers participate in a time-of-use rate or optimized charging program.
- A rebate program to develop public charging stations to encourage mass market adoption, including stations in dense urban areas without access to home charging, and in rural communities and along highway corridors.



⁴⁸ From July 2019 draft of the Clean Energy Jobs Act.

APPENDIX B:

Joint Statement Supporting Electric Transportation (February 11, 2020)



The Edison Electric Institute, Illinois Citizens Utility Board, National Consumer Law Center, Natural Resources Defense Council, and Sierra Club find:

1. There are now more than 1.3 million plug-in electric vehicles in the United States. Numerous independent studies conclude that transportation electrification can provide widespread benefits to all utility customers, the environment, and public health; and

2. There is a need for appropriate electric company involvement to accelerate transportation electrification and to ensure that it provides benefits to all customers. The following principles should inform an electric company effort in supporting transportation electrification:

- Transportation electrification should benefit all utility customers, including those in communities that are burdened disproportionately by local air pollution from the transportation sector and low-income households that spend a disproportionate share of their income on vehicle fuel and maintenance.
- Transportation electrification should avoid placing financial burdens related to the transition to electric vehicles on those who can least afford it;
- Costs associated with utility investments designed to support transportation electrification should generally be recovered over a timeframe that corresponds to the expected realization of future economic benefits from the electrification of the transportation sector;
- Electric utilities should track metrics within their control that measure the benefits of transportation electrification, such as the following:

- ~ Success in monitoring, prioritizing, maintaining or improving the affordability of electric service for low-income households and in enhancing household energy security;
 - ~ Success in increasing access to the use of electricity as a transportation fuel in low-income and disadvantaged communities;
 - ~ Success in improving the utilization of the grid to put downward pressure on electricity rates and translating these improvements into benefits for all customers;
 - ~ Success in using the integration of variable renewable, zero-emission generating resources in meeting the growing needs of transportation; and
- Utility investments that support transportation electrification should be designed to:
 - ~ Lower household expenditures by increasing access to the use of clean and affordable electricity as a transportation fuel, including in low-income and disadvantaged communities;
 - ~ Improve local air quality in communities burdened by pollution from the transportation sector, including by supporting the electrification of buses, medium and heavy-duty trucks, and other vehicles and equipment.
 - ~ Improve the utilization of the electric grid, putting downward pressure on rates to the benefit of all customers, including low-income customers and customers in disadvantaged communities; and
 - ~ Take advantage of the flexibility and energy storage inherent in electric vehicles to facilitate the integration of variable renewable, zero-emission generating resources.

APPENDIX C: NASUCA Resolution

NATIONAL ASSOCIATION
OF STATE UTILITY
CONSUMER ADVOCATES

NASUCA



RESOLUTION 2018 - 02

URGING THE ADOPTION OF POLICIES AND REGULATIONS TO PROTECT RATEPAYERS AS ELECTRIC VEHICLE ADOPTION RATES INCREASE

Whereas, the rate of adoption of electric vehicles that utilize electricity from the grid to charge, whether at home, at a workplace, or at a charging station, is increasing;^{49 50}

Whereas, the purchase of electric vehicles may impact utilities' decisions regarding distribution system investments, the development of proposals for charging system infrastructure investment, and rate structures, and therefore may impact the electric rates paid by both electric vehicles owners and other ratepayers;

Whereas, some project that electric vehicle adoption will continue to increase rapidly, with some even projecting that 50% of new car sales in 2040 will be electric vehicles;^{51 52}

Whereas, electric vehicles add to overall electric load, but when coupled with effective consumer education, incentives, and rate design, might serve to mitigate the impact of electric vehicle charging on ratepayers through additional electric revenue and reducing the effect of electric vehicle charging on existing grid resources through peak shaving and shifting demand to times when capacity is plentiful;

Whereas, some states and municipalities have adopted goals and plans to increase the adoption rate for electric vehicles to reduce the transportation sector's contribution to greenhouse gas emissions, without specifying the nature of the role of the public

utility in electric vehicle adoption and whether ratepayers should be financially responsible for infrastructure investments;

Whereas, the core responsibilities of any public utility remain the same with the addition of any new load, including electric vehicle load, on a distribution system, which are to maintain the safety, reliability, and affordability of the electric system for the benefit of its ratepayers;

Whereas, some policymakers, utilities, and electric vehicle advocates are proposing various utility roles in order to promote electric vehicle adoption including rapid expansion in the electric vehicle charging infrastructure, potentially funded at least in part by the ratepayers;⁵³

Now, therefore, be it resolved, that NASUCA encourages states to continue to evaluate and analyze key electric vehicle adoption issues with an emphasis on the core responsibilities of public utilities, a specific focus on the efficient integration of electric vehicles and charging infrastructure into their systems, the avoidance of adverse impacts on the system from electric vehicle loads, the development of alternative rate designs if appropriate, the adaptation of distribution planning to minimize system risks and provide the opportunity for longer term system and cost benefits for their ratepayers, and the equitable sharing of any costs and benefits;

49 In this resolution, the term "electric vehicles" refers to both all-electric vehicles and plug-in electric hybrid vehicles.

50 For instance, according to the Atlas EV Hub, the amount of U.S. electric vehicles purchased has increased from about 18,000 in 2011 to about 195,000 in 2017. Based on the most recently available quarterly data, about 54,000 electric vehicles were purchased between January 1, 2018 and March 31, 2018 as compared to about 41,000 electric vehicles purchased during the same time period in 2017. See atlasvehub.com for additional information (the national EV sales data is from HybridCars.com, available at <http://www.hybridcars.com/market-dashboards>).

51 February 2018 of the Edison Electric Institute entitled "Accelerating Electric Vehicle Adoption," available at: http://www.eei.org/issuesandpolicy/electrictransportation/Documents/Accelerating_EV_Adoption_final_Feb2018.pdf

52 See, e.g., Bloomberg New Energy Finance's report entitled "Electric Vehicle Outlook 2018," which projects that 55% of new car sales in 2040 will be electric vehicles, and that at that point 33% of the global auto fleet will be electric.

53 *Id.*

Be it further resolved, that NASUCA encourages dialogue in each state among stakeholders with the goal of developing consensus policy solutions for electric vehicles that protect the interests of all ratepayers; and

Be it further resolved, that NASUCA recommends, in accordance with and to the extent allowed by federal and state laws, that neighboring states should work jointly together on developing compatible regional policies; and

Be it further resolved, that while policy design may differ between states, NASUCA maintains that managing the demand of electric vehicle owners for electricity with the goal of creating a more efficient, reliable, equitable, environmentally responsible, and less costly electric system should be at the center of all electric vehicle policy discussions; and

Be it further resolved, that NASUCA maintains, to the extent the transportation system electrifies, it will be important to recognize that charging patterns will impact system load shape and could result in costs or benefits to the utility system. Accordingly, NASUCA encourages states to consider developing tools like time-based rate options or other appropriate rate designs for customers charging electric vehicles, separate tariffs for electric vehicle charging, smart charging programs where the utility and customers coordinate to shift electric vehicle charging loads to appropriate times, load management practices, demand response, and other innovative applications, such that electric vehicle loads will be managed in the interest of all ratepayers; and

Be it further resolved, that NASUCA maintains that any rate options, rate design changes, applications developed for customer use, or any other utility-related programs for electric vehicle owners must be accompanied by appropriate consumer protections, including robust consumer education materials and data privacy requirements and to the extent they would be adversely affected additional protections for disadvantaged or Low-Income ratepayers; and

Be it further resolved, that NASUCA maintains that any utility proposals to develop electric vehicle infrastructure through ratepayer charges must be supported by a rigorous analysis of the benefits and costs for the ratepayer, including the benefits and costs for disadvantaged or low-income ratepayers,

with each state determining the type and scope of the benefits, costs and risks that are taken into account; and

Be it further resolved, that NASUCA recommends states consider whether public utility involvement in the development of electric vehicle charging stations might limit entrance or competition that might otherwise benefit consumers and whether that involvement might cause ratepayers to take on risks that could or should more appropriately and cost-effectively be borne by private enterprise; and

Be it further resolved, that NASUCA maintains that any utility proposals to promote electric vehicle adoption and/or develop electric vehicle infrastructure through ratepayer investments must leverage all related private, state and federal funding sources; and

Be it further resolved, that NASUCA recommends to protect monopoly distribution customers from subsidizing competitive services that any tariffs for electric vehicle charging should be cost-based, without reliance on cross-subsidies from other ratepayers; and

Be it further resolved, that NASUCA recommends the costs associated with the promotion and development of the electric vehicle industry be borne by the transportation sector, consistent with principles of cost causation; and

Be it further resolved, that for electric vehicle charging stations supported by utility rates, NASUCA encourages policies that ensure compatibility with all commercially available makes of electric vehicles; and

Be it further resolved, that NASUCA authorizes its Executive Committee to develop specific positions and to take appropriate actions, including litigation, consistent with the terms of this resolution. The Executive Committee shall advise the membership of any proposed action prior to taking such action, if possible. In any event, the Executive Committee shall notify the membership of any action taken pursuant to the resolution.

Submitted by the DER Committee and the Electric Committee

Adopted by the Membership

Minneapolis, Minnesota June 24, 2018

APPENDIX D:

Suggested Reading

AchiEVe: Model Policies to Accelerate Electric Vehicle Adoption, July 2019, Sierra Club and Plug In America: <https://www.sierraclub.org/sites/www.sierraclub.org/files/blog/AchiEVeModelToolkit2019.pdf>

Beneficial Electrification of Transportation, Jan. 30, 2019, David Farnsworth, Jessica Shipley, Joni Sliger, Jim Lazar, the Regulatory Assistance Project (RAP): <https://www.raonline.org/knowledge-center/beneficial-electrification-of-transportation/>

Designing an Equitable Cap and Invest Policy for Transportation, Dec. 11, 2019, Green For All: <https://www.thedreamcorps.org/resource/designing-an-equitable-cap-and-invest-policy-for-transportation/>

Electric Vehicles Are Driving Electric Rates Down, Feb. 2019, Jason Frost, Melissa Whited, Avi Allison: <https://www.synapse-energy.com/sites/default/files/EVs-Driving-Rates-Down-8-122.pdf>

Electrifying Trucks: From Delivery Vans to Buses to 18-Wheelers, Jan. 13, 2020, American Council for an Energy-Efficient Economy: <https://www.aceee.org/white-paper/electrifying-trucks-delivery-vans-buses-18>

Going electric: How everyone can benefit sooner, Oct. 2019, Chaitanya Kumar, Green Alliance: https://www.green-alliance.org.uk/resources/going_electric_how_everyone_can_benefit_sooner.pdf

Making Electric Vehicles Work for Utility Customers: A Policy Handbook for Consumer Advocates, Nov. 25, 2019, Pat Knight; Erin Camp, PhD; Divita Bhandari; Jamie Hall; Melissa Whited; Ben Havumaki; Avi Allison; Nina Peluso; Tim Woolf: <https://www.synapse-energy.com/sites/default/files/Making-Electric-Vehicles-Work-for-Utility-Customers.pdf>

Residential Electric Vehicle Time-Varying Rates That Work: Attributes That Increase Enrollment, Nov. 2019, Smart Electric Power Alliance: <https://sepapower.org/resource/residential-electric-vehicle-time-varying-rates-that-work-attributes-that-increase-enrollment/>

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Securing Safe Transit: Before & After COVID-19, June 2020, Green For All, a program of the national nonprofit Dream Corps.: <https://www.thedreamcorps.org/our-programs/green-for-all/campaigns/safetransit/>

The State of the Air 2020, American Lung Association: <http://www.stateoftheair.org/key-findings/>

U.S. Voters' Perceptions of Climate Change and Energy Policy, Feb. 2020, Brunswick Insight: <https://www.brunswickgroup.com/media/6780/brunswick-us-voters-perceptions-of-climate-change-and-energy-policy.pdf>

NOTES



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