The Green Infrastructure For Tomorrow (GIFT) Portfolio

The Greater Good Initiative

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Directors: Ishyan Veluppillai, Jacob Ellis
Fellows: Ike Okereke, Cristiana Flores, Mike Massingill, Achraf Azzaoui, Neha Krishnakumar, Aaron Vickers, Sakthi Packiaraj, Agustin Orozco, Avery Lenihan, J.J. Sandhu, Ishanvi Malayanil

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The Problem

Climate change is one of the most pressing issues of today. The impacts of climate change are all-encompassing, both for the planet and the organisms who call it home. The true effects of climate change impact every aspect of human activity. The United States is at a crossroads where the options are clear: Address climate change head-on and reduce greenhouse gas emissions to slow and revert climate change, or let the devastating effects of climate change become irreversible. This effort requires entirely new approaches to be taken by the various departments of the executive branch.[1] The American people agree with the message that climate change should be, and is, a priority, with increasingly more Americans believing that protecting the environment and dealing with global climate change should be top priorities for the new administration, congress, and global leaders.[2]

The proof of climate change and global warming is clear. Global temperatures have risen "about 2.12 degrees Fahrenheit since the late 19th century, a change driven largely by increased carbon dioxide emissions into the atmosphere and other human activities."[3] In the last century, coastal areas have experienced rising sea levels as a result of melting polar ice sheets and glaciers. Each geographical region of the United States has experienced climate change in different ways. For example, the Southeast has not just suffered from an increase in the number of hurricanes, but the overall strength and size of the hurricanes as well.[4] This results in

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[1] Mitchell, E. (2021, January 27). Pentagon declares climate change a 'national security issue'. TheHill. https://thehill.com/policy/defense/536188-pentagon-declares-climate-changes-a-national-security-issue

[2] Funk, C., & Kennedy, B. (2020, April 21). *How Americans see climate change and the environment in 7 charts*. https://www.pewresearch.org/fact-tank/2020/04/21/how-americans-see-climate-change-and-the-environment-in-7-charts/.

[3] NASA. (n.d.). "Climate Change: How Do We Know?" https://climate.nasa.gov/evidence/

[4] Berardelli, J. (2019, July 8). How climate change is making hurricanes more dangerous » Yale climate connections. Yale Climate Connections. https://yaleclimateconnections.org/2019/07/how-climate-change-is-making-hurricanes-more-dangerous/

increased recovery and preparation costs, which all taxpayers bear the brunt of. In California, prolonged droughts will "foster wildfires and increased competition for scarce water resources for people and ecosystems." Great Plains states are needing more water and energy to properly sustain their agricultural industries.[5] This results in increased recovery and preparation costs, which all taxpayers bear the brunt of. In short, every region of the US will be impacted by climate change.

The Solution

The Greater Good Initiative proposes a portfolio of seven policies to both address the cause of climate change and work towards a more environmentally friendly future. These policies highlight specific issues and regions that should be most considered in future infrastructure plans. Infrastructure is a bipartisan agenda that both parties should be willing to partake in the near future, as upgrading public works will foster a safer and more efficient environment for all citizens. The recently released American Jobs Plan addresses several of the causes of climate change and has multiple policies designed to create a more sustainable infrastructure network; however, this large package noticeably omits several essential steps in addressing climate change and creating a path forward.[6] In this portfolio, the Greater Good Initiative proposes a seven different policy approaches: a program to install solar panels on the homes of individuals whose incomes are less than or equal to 80 percent of the area's median income level; a program to install green roofs in Title IX Department of Housing and Urban Development housing; a program to develop environmentally friendly public transportation

[5] Melillo, Jerry M., Terese (T.C.) Richmond, and Gary W. Yohe, Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 pp.
[6] The White House. (2021, March 31). FACT SHEET: The American Jobs Plan. https://www.whitehouse.gov/briefing-room/statements-releases/2021/03/31/fact-sheet-the-american-jobs-plan/

routes in localities nationwide; a tax incentive to develop and implement carbon capture technologies to reduce the amount of CO_2 in the air; a tax credit for installing Electric Vehicle Fast Charging stations, three new Amtrak routes designed to both increase transportation to rural communities and serve as engines of economic development; and a Department of Energy advisory board to develop policies to accelerate renewable energy production growth. The policies within this portfolio are all essential to promoting a cleaner and more environmentally friendly nation and future. Climate change is a large and complex issue with no one solution. This is why the Green Infrastructure For Tomorrow (GIFT) package serves to compliment the American Jobs Package. GIFT is not an alternative plan, nor is it the only plan; rather, it will enhance key issues within the national effort to promote climate-conscious infrastructure.

LOW-INCOME SOLAR SUBSIDY PROGRAM

Written by Mike Massingill

POLICY BRIEF

The Problem

Over the coming decades, climate change threatens to increase the prevalence of food insecurity, species extinction, severe drought, and more.[7] Over a quarter of the greenhouse gas emissions that cause climate change come from burning fossil fuels like coal and natural gas to generate electricity.[8] Increasing the use of solar panels, which generate electricity using light from the Sun, is an ideal solution for reducing the reliance on fossil fuels, thereby alleviating the effects of climate change. A 2018 study from the National Renewable Energy Laboratory found that about half of all the residential rooftop solar potential in the United States exists on top of low to moderate income households, meaning that low-income households must be included in the American adoption of solar panels if the country is to transition away from using fossil fuels.[9] Unfortunately, most low-income households still struggle to afford this otherwise convenient green energy solution, making it difficult to effectively begin such a transition. Furthermore, there are questions of equity that must be considered; if wealthy, white, suburban neighborhoods are allowed to be the only ones to reap the benefits of green energy, there is an immediate risk of exacerbating environmental injustice and socioeconomic inequality.

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[7] *Assessing and managing the risks of climate change*. (2014). Intergovernmental Panel on Climate Change. https://www.ipcc.ch/site/assets/uploads/2018/03/WGIIAR5_SPM_Top_Level_Findings-1.pdf

[8] *Sources of greenhouse gas emissions*. (2020, December 4). United States Environmental Protection Agency. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[9] Sigrin, B., & Mooney, M. (2018, April). *Rooftop solar technical potential for low-to-moderate income households in the United States*. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy18osti/70901.pdf

The Solution

To ensure that low-income households and communities of color have access to the benefits of innovative green technology, a $1.5 billion fund must be created to subsidize the installation of solar panels. The money should be distributed over the course of ten years, meaning that no more than $150 million should be given out in a year. Any households making below 80 percent of the area median income (AMI) are eligible to apply for the subsidy, as are any local housing associations that manage affordable housing units. The fund should be managed by the Department of Energy (DOE), with specifics for the application process to be determined by DOE. This fund should provide a $2,000 rebate for every kilowatt (kW) of solar energy installed — up to a maximum of 5 kW for individual households, but no limit for local housing associations so that a few households do not hoard the subsidies. The $1.5 billion figure was chosen as a rough estimate of initial need based on current solar installation costs. If only individual households received the subsidy and each household installed the maximum of 5 kW, then the fund can successfully service 150,000 households before running out of money, subsidizing the installation of about 750 megawatts of green energy, enough to power 142,500 homes.[10] This program has a number of advantages. American reliance on fossil fuels will be dramatically reduced while subsidizing the installation of solar panels, effectively raising property values for low-income households and serving as a boon to the housing market. Furthermore, in states that allow net-metering — a practice in which local utility companies compensate households for the electricity their solar panels generate — these solar panels will provide a continuous stream of financial benefits for low-income Americans, leading to some much-needed upward mobility for the American poor and communities of color.

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[10] *What's in a megawatt? Calculating the number of homes powered by solar energy*. (n.d.). Solar Energy Industries Association. https://www.seia.org/initiatives/whats-megawatt

PRELIMINARY REPORT

What is the problem at hand, and who are the stakeholders?

The availability of rooftop solar panels has skyrocketed in recent years as the price has fallen, allowing total solar energy generation to increase by as much as 35-fold since 2008.[11] Unfortunately, low-income Americans have not shared in the benefits of this green energy boom. There are many reasons for this phenomenon, the primary one being that low-income households simply have less disposable income to spend on a relatively expensive amenity like solar panels. A similar problem exists for local public housing authorities across the nation; there are too many problems and too little cash to warrant the installation of rooftop solar.[12] As a result of these issues, consequences persist. First, if solar panels continue to be unaffordable for tens of millions of American households, the United States will be forced to endure a much slower transition away from fossil fuels. Many prominent scientists believe that the United States will have less than a decade before catastrophic global warming becomes inevitable, meaning that low-income households' inability to access green energy poses a serious environmental risk and puts those families in grave danger.[13] Furthermore, it's also a problem for racial and class equity. Communities of color are overrepresented among the American poor,[14] meaning that if low-income residents continue to rely on fossil fuels while wealthier, whiter communities are able to complete the transition to green energy, the racial equity gap would be exacerbated to unforeseen levels. In summary, low-income households, local public housing authorities, solar

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[11] *Solar energy in the United States*. (n.d.). Department of Energy. https://www.energy.gov/eere/solar/solar-energy-united-states#:~:text=Solar%20power%20is%20more%20affordable,million%20average%20American%20homes1

[12] *Low-and moderate-income solar policy basics*. (n.d.). National Renewable Energy Laboratory. https://www.nrel.gov/state-local-tribal/lmi-solar.html

[13] Watts, J. (2018, October 8). *We have 12 years to limit climate change catastrophe, warns UN*. The Guardian. https://www.theguardian.com/environment/2018/oct/08/global-warming-must-not-exceed-15c-warns-landmark-un-report

[14] *The population of poverty USA*. (n.d.). Poverty USA. https://www.povertyusa.org/facts

energy companies, fossil fuel companies, and local electricity providers all have a stake in this issue. Excluding fossil fuel companies, all of these stakeholders would benefit greatly from government intervention in this area of policy.

Why is this an issue that requires a government response?

While the price of solar panels has dropped significantly in recent years, the cost, which rests anywhere from $15,000 to $25,000 for the average 5kW system, is still too high for the majority of low-income households to afford.[15] Though the price will continue to decrease as technology improves,[16] the cost will likely still be prohibitive for the American poor for some time. This fact, coupled with the urgency of reversing the onset of climate change, means that government intervention is necessary in order to make solar panels immediately accessible to those with low incomes. Indeed, there are numerous studies that assert the inability of the free market to contain the effects of climate change on its own.[17] Additionally, from an equity standpoint, as long as people of color are worse off financially compared to white people, there will always exist a racial green energy gap. Thus, in order to rectify this situation, the government is needed. The federal government already offers a nonrefundable tax credit that allows households to deduct 26 percent of their solar installation costs from their taxes.[18] However, low-income households with little to no tax liability cannot access this benefit due to the credit's nonrefundable nature. In this way, though the government has tried to address the

[15] Schwahn, L. (2020, March 12). *What do solar panels cost and are they worth it?* NerdWallet. Retrieved April 25, 2021, from https://www.nerdwallet.com/article/finance/solar-panel-cost
[16] Feldman, D., & Robert Margolis. (2020, December 8). *Q2/Q3 2020 solar industry update*. National Renewable Energy Laboratory. https://www.nrel.gov/docs/fy21osti/78625.pdf
[17] Karlsson, K. (2019, November 4). *The free market won't free us from our collective challenges, especially global warming*. The Roosevelt Institute. https://rooseveltinstitute.org/2019/11/04/the-free-market-wont-free-us-from-our-collective-challenges-especially-global-warming/
[18] *Solar investment tax credit (ITC)*. (n.d.). Solar Energy Industries Association. https://www.seia.org/initiatives/solar-investment-tax-credit-itc

high cost of solar systems in the past, no previous programs have successfully served the needs of low-income Americans.

Why can't this be addressed at the state or local level?

In many ways, this problem is already being addressed at the state and local level. Programs to encourage low-income adoption of solar panels exist in places like Minnesota, Washington DC, and Colorado. In fact, this policy is partly based on California's SASH (Single-Family Affordable Solar Homes)[19] and MASH (Multi-Family Affordable Solar Homes)[20] programs. However, the number of states that provide no incentives or lackluster incentives to low-income households to adopt solar energy is certainly greater than those states which d*o* provide sufficient benefits.[21] If the goal is to provide the poorest Americans access to solar energy, people of all states must have access to government help.

[19] *CSI single-family affordable solar homes (SASH) program*. (n.d.). California Public Utilities Commission. https://www.cpuc.ca.gov/general.aspx?id=3043
[20] *CSI multifamily affordable solar housing (MASH) program*. (n.d.). California Public Utilities Commission. https://www.cpuc.ca.gov/General.aspx?id=3752
[21] Zientara, B. (2020, November 3). *Low-income solar incentives in the US*. SolarReviews. https://www.solarreviews.com/blog/free-solar-panels-for-low-income-families

POLICY ANALYSIS

What is the solution proposed?

To make rooftop solar panels more accessible to low-income households, The Greater Good Initiative proposes the creation of a $1.5 billion fund which will subsidize the installation of rooftop solar systems for households making less than 80 percent of the area median income and for local public housing authorities. The money should be distributed over the course of ten years to give all eligible Americans a fair shot to receive the subsidies; to that end, no more than $150 million should be distributed each year. The fund should provide a $2,000 tax rebate for every kilowatt of solar energy installed up to a maximum of 5 kW for individual households to ensure that a few people do not obtain a large portion of the subsidies, though there is no maximum for local public housing authorities. The fund should be managed by the Department of Energy, which should be allowed to add additional eligibility requirements for the subsidies if demand is too high, with the stated goal of ensuring that the subsidies always go to those who need them most (i.e. the poorest households). If only individual households received the subsidy and each household installed the maximum of 5 kW, then the $1.5 billion fund can successfully service 150,000 households before running out of money, subsidizing the installation of about 750 megawatts of green energy, enough to power 142,000 homes.[22] Of course, if more or less than $1.5 billion were given out, then more or less solar energy would be installed, making this policy very flexible to the changing budgetary restrictions of the federal government.

[22] *What's in a megawatt? Calculating the number of homes powered by solar energy*. (n.d.). Solar Energy Industries Association. https://www.seia.org/initiatives/whats-megawatt

What resources will be necessary to implement this policy?

Besides the price tag of $1.5 billion over the course of ten years, the fund will require a relatively small amount of money from the Department of Energy's budget to be spent on administrative services. In federal low-income programs such as Medicaid and SNAP, federal administrative costs account for less than 0.5 percent of total program spending.[23] Given that the proposed fund is much smaller than these other programs, The Greater Good Initiative is confident that administrative costs will be minimal. Specifically, these costs will cover general oversight of the program's rollout to the public, including compensating people to coordinate with the Department of Treasury, the Internal Revenue Service, and the Department of Housing and Urban Development whenever deemed necessary; and people to oversee the writing of an annual report on the program's performance. These tasks require manpower, though these jobs could probably be accomplished by no more than fifteen officials. Thus, the program is not expected to add any significant burden to the federal bureaucracy.

What criteria will determine the project's success?

The project's success will be measured by the extent to which the fund helps low-income communities access solar panels. Thus, data such as the number of households served and the amount of solar energy installed will all be valuable metrics when determining the project's success. The Department of Energy should track this data and release an annual report on the program's impact. With $150 million distributed each year for ten years, it can be expected that the fund will subsidize the installation of around 75 megawatts of solar energy each year —

[23] Greenstein, R. (2012, January 23). *Romney's charge that most federal low-income spending goes for "overhead" and "bureaucrats" is false*. Center on Budget and Policy Priorities. https://www.cbpp.org/research/romneys-charge-that-most-federal-low-income-spending-goes-for-overhead-and-bureaucrats-is

assuming that all the money goes to individual households installing the maximum of 5 kW.[24] Achieving or approaching this target will indicate a successful program rollout.

Which organizations will be involved in administering this program?

As previously stated, the program will be administered by the Department of Energy. State and local governments will not be involved in administration, though local public housing authorities will likely be some of the program's most enthusiastic customers. As a result, DOE officials may wish to consult with the Department of Housing and Urban Development (HUD) when crafting program guidelines. Coordination with HUD will also become necessary because the department is generally responsible for releasing data on area median income, which will be one of the primary determinants of an individual household's eligibility.[25] DOE officials may also wish to coordinate with the Internal Revenue Service if questions about an individual household's income should arise.

Are there alternative responses that should be taken into account?

The federal government already offers a nonrefundable tax credit to households that install rooftop solar panels.[26] Unfortunately, because the credit is nonrefundable, many low-income households simply do not have enough tax liability to take advantage of this incentive. By offering a direct subsidy, low-income households will finally be included in the government's effort to encourage solar energy. This dedicated fund for solar subsidies is better than any potential additional tax credits for a few reasons. First, this fund is more flexible than a

[24] *What's in a megawatt? Calculating the number of homes powered by solar energy*. (n.d.). Solar Energy Industries Association. https://www.seia.org/initiatives/whats-megawatt
[25] McCabe, B. (2016, September 1). *The area median income (AMI), explained*. Greater Greater Washington. https://ggwash.org/view/42671/the-area-median-income-ami-explained
[26] *Solar investment tax credit (ITC)*. (n.d.). Solar Energy Industries Association. https://www.seia.org/initiatives/solar-investment-tax-credit-itc

tax credit by its very nature. The Department of Energy can tweak application specifics in order to ensure the money is getting to those who need it the most. In addition, a dedicated fund will attract more attention than simple tax solutions; tax deductions and credits are frequently overlooked by many Americans,[27] a problem that will be less apparent with this fund. After all, low-income households cannot take advantage of an incentive if they don't know it exists. Finally, it is worth noting that only 39 percent of low-income households own their own home, compared to the national average of 64 percent,[28] meaning many low-income households won't have access to this subsidy. That being said, this policy does make subsidies available to public housing utilities, which will allow some non-homeowners to take advantage of the program. Indeed, if there is great demand for subsidies, a follow-up program should be considered to address the needs of non-homeowning low-income households.

What will happen if this problem is not addressed?

It is difficult to overstate the danger of allowing climate change to accelerate and worsen. Increasingly extreme heat waves, which are known to kill tens of thousands of people, are only part of the problem.[29] Indeed, Americans have already witnessed a growing number of natural disasters such as wildfires and hurricanes, a trend that is likely to continue. Even though subsidizing solar panel installation for those with low-incomes will not fix climate change by itself, it will set poor communities on track to seriously reduce fossil fuel reliance, thus helping the country and planet in the long-term. Given that by 2030, direct damages to health by climate

[27] Menton, J. (2020, March 6). *What tax deductions and credits can I claim? Here are 9 overlooked ones that can save you money*. USA Today. https://www.usatoday.com/story/money/personalfinance/2020/03/06/taxes-2020-9-overlooked-deductions-credits-can-save-you-money/4954852002/

[28] *Housing of lower-income households*. (1994, September). Bureau of the Census. Retrieved April 25, 2021, from https://www.census.gov/prod/1/statbrief/Sb94_18.pdf

[29] *Heatwaves*. (n.d.). World Health Organization. Retrieved April 25, 2021, from https://www.who.int/health-topics/heatwaves#tab=tab_1

change are expected to cost two to four billion dollars each year,[30] implementing this program at the cost of $150 million a year represents a very cost-effective solution. Furthermore, since solar panels will still be prohibitively expensive to low-income households for some time, failing to enact this program would run the risk that solar panels become yet another symbol of American class divide. Allowing the inequality of access to green energy to worsen would thus be a major detriment for marginalized communities.

How will this solution impact the environment and the economy?

This solution is expected to increase American solar energy capacity by around 750 megawatts, enough energy to power almost 142,000 homes. As a result, many households will no longer need fossil fuels to meet their energy needs, reducing the overall use of nonrenewable energy. As a result, air pollution will decrease and, as has already been stated, the effects of climate change will be slowed. Furthermore, solar panels will raise property values. In states that allow net-metering (wherein private households sell their solar panels' electricity to local power companies),[31] households and public housing authorities can actually receive compensation from their utility company in exchange for the energy their panels generate. By targeting benefits at those with low-incomes, the program will also help mitigate the wealth inequality gap. Thus, this policy has many advantages with little to no burden on any major stakeholder outside of fossil fuel companies — who already need to transition to carbon-neutral production. Not only does it help the environment and reduce inequality, but it can actually save money in the long-term. The $1.5 billion in the program will be given out over the course of ten years to ensure an equitable

[30] *Climate change and health* [Fact sheet]. (2018, February 1). World Health Organization. Retrieved February 21, 2021, from https://www.who.int/news-room/fact-sheets/detail/climate-change-and-health
[31] Pickerel, K. (2020, March 27). *Which states offer net metering?* Solar Power World. https://www.solarpowerworldonline.com/2020/03/which-states-offer-net-metering/

and consistent rollout of funds. Once these ten years have expired and the fund has run empty, Congress and the Secretary of Energy should re-evaluate the need to subsidize low-income installation of solar panels. Administrative costs should be quite low, meaning one should not be concerned with such costs making the program unsustainable.

CONCLUSION

The proposed federal solar grant program will allow low-income Americans to access solar systems by providing a $2,000 per kW subsidy to households making below 80 percent of the area median income and to local public housing authorities with a 5 kW maximum for individual households. This subsidy should be administered through a $1.5 billion fund managed by the Department of Energy, which will have the power to implement additional qualification restrictions should demand for the funds become too high. The $1.5 billion should be distributed over the course of ten years, with no more than $150 million given out each year. These features ensure that everyone has a fair chance to access the subsidies.

In the status quo, rooftop solar panels are too expensive for most low and medium-income households. Though there is a nonrefundable tax break to ease the cost burden of solar installation, many poor households do not have enough tax liability for these programs. As a result, low-income communities find themselves cut off from green energy technologies that are increasingly necessary as climate change progresses. Moreover, the inaccessibility of solar systems for poor households is exacerbating the disparity in energy equity, with impoverished communities having to rely on fossil fuels while the wealthy can enjoy the benefits of clean energy. Though there are similar programs in a few states, a federal response is required if all Americans are to have a fair chance at transitioning to green energy. This will be the first solar subsidy program that low-income people can easily access without having to worry about tax liability. Considering the benefits of solar energy itself — be it cheaper and potentially free electricity, higher property values, or lower carbon emissions — it is difficult to see potential detriments to such a program, especially given the reasonable price tag.

GREEN ROOF INFRASTRUCTURE PROGRAM

Written by Cristiana Flores

POLICY BRIEF

The Problem

Climate change is the cause of the deadliest and most expensive natural disasters over the last decade, increasing with frequency and magnitude year-after-year. From damaged local flora and fauna to unpredictable weather patterns and adverse health complications, climate change poses a significant threat to human life. The contaminants and toxic fumes from pollution and other carbon emissions have increasingly taken a deadly toll on the American population. Air pollution in the United States accounted for 107,000 premature deaths in 2011.[32] Approximately a decade later, the Environmental Protection Agency (EPA) states the number of deaths increased to 200,000 Americans dying every year of toxic emissions.[33] These fatalities include heart attacks, strokes, lung cancer, asthma and even preterm births, all of which can easily be triggered by constant breathing of pollutants.[34] Out of all the states and territories, California has the worst air pollution rates, followed by Pennsylvania, Delaware, and Oregon.[35] Unfortunately, air pollution disproportionally affects marginalized communities.[36] These groups include African Americans, Hispanics, Asians, and individuals of low socioeconomics status. Additionally, families in urban areas are more prone to life-threatening conditions due to the surrounding

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[32] United Health Foundation. (2021). *Public Health Impact: Air Pollution,* America Health Rankings. https://www.americashealthrankings.org/explore/annual/measure/air/state/ALL

[33] Caiazzo F, Ashok A,Waitz I,Yim S, Barrett S. (2013, January 2). *Air pollution and Early Deaths in the United States.* Science Direct. https://www.sciencedirect.com/science/article/abs/pii/S1352231013004548

[34] Huzar, T.(2020, March 30). *.Air Pollution May Be a Leading Cause of Death,* Medical News Today. https://www.medicalnewstoday.com/articles/air-pollution-may-be-a-leading-global-cause-of-death#8.8-million-predicted-deaths

[35] United Health Foundation. (2021). *Thematic Map: National Air Pollution,* America Health Rankings. https://www.americashealthrankings.org/explore/annual/measure/air/state/ALL

[36] American Lung Association. (2020, April 20). *Disparities in the Impact of Air-Pollution.* https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities

effects of outdoor and indoor pollution. Outdoor pollution includes greenhouse gases, transportation emissions, and nearby industrial emissions, while indoor pollution includes the usage of heaters and air conditioners — which in turn drives energy costs to families of low socioeconomic income. Families who do not have the luxury to live in suburban or rural communities are forced to reside in crowded neighborhoods that are vulnerable to high levels of carbon emissions. Unlike other demographic groups who can afford housing at a higher cost and further away from carbon emissions, these families are forced to confront the effects of climate change head-on. Professor Thoms Munzel, a member of the Department of Cardiology at the University Medical Center in Germany, states air pollution and its adverse effects should be categorized as a "pandemic," all while revealing that the majority of emissions are started by humans.[37] Studies show the United States oil and gas industries release about 9 million tons of toxic chemicals into the atmosphere every year.[38] Unfortunately, African Americans are disproportionately affected by the toxic oil and gas industry pollutants. Over 1 million African Americans reside within a half-mile of an air pollutant company. In total, Black Americans are 75 percent more likely to be exposed to pollution than of White Americans.

The Solution

The Greater Good Initiative proposes a grant program to install "green roofs" in states with the worst air pollution rates and target communities of low-socioeconomic status. A "green" roof is one that is covered in vegetation and built on top of a waterproof barrier. In order to improve living conditions and the health of civilians who are at the highest risk, the proposed

[37] Huzar, T.(2020, March 30). *.Air Pollution May Be a Leading Cause of Death,* Medical News Today. https://www.medicalnewstoday.com/articles/air-pollution-may-be-a-leading-global-cause-of-death#Air-pollution-and-human-health

[38] Patnaik A, Son J, Feng A, Ade C. (2020, August 15). *Racial Disparities and Climate Change.* Princeton University. https://psci.princeton.edu/tips/2020/8/15/racial-disparities-and-climate-change

policy will provide a significant stepping stone to resolve the issue of high urban temperatures and help eliminate carbon emissions in the air. For instance, Washington, D.C. recorded a total of 1 million square feet of green roofs in 2017 with an air quality index (AQI) of 34. Compared to cities like Bakersfield, California, where there is limited green infrastructure implementation, AQI levels can be extremely high — the average AQI of Bakersfield is 67 and a high of 548 AQI was recorded in 2019.[39] According to an article by Center for American Progress, researchers state that if enacted renewable energy technologies can reduce carbon emissions by approximately 830 metric tons by 2030. In combination with a variety of tactics to eliminate air-pollutants, green roofs will serve as one of the most significant tools to produce sufficient air quality in urban cities due to its ability to adapt to its surrounding environment and the given infrastructure at hand.[40]

Additional positive externalities of implementing a green roof grant program include reducing the electrical costs of homeowners and providing long-lasting sewer systems. The benefits of incorporating these projects is that they will decrease a neighborhood's overall temperature by reflecting the majority of solar radiation that would otherwise be absorbed by the infrastructure. Knowing this, green roofs will help end the Urban Heat Island effect where temperatures in urban areas rise considerably when compared to rural localities. According to an article by Scott Lowe on Science Direct, there are an extra 1.1 million deaths caused by the Urban Heat Island effect in the southern part of the United States.[41] Research reveals that green

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[39] *Bakersfield Has The Fourth Worst Air Quality Amongst US Metros of 500,000 Residents or More.* https://www.turnto23.com/news/local-news/bakersfield-has-the-fourth-worst-air-quality-in-the-us

[40] Costa K., Goldfuss C., DeGood K. (2019, September 3). *Reducing Carbon Emissions Through Infrastructure.* Center for American Progress. www.americanprogress.org/issues/green/reports/2019/09/03/473980/reducing-carbon-pollution-infrastructure/

[41] Lowe, S. (2016, January). *An Energy and Mortality Impact Assessment of the Urban Heat Island in the US.* Science Direct. https://www.sciencedirect.com/science/article/abs/pii/S0195925515001043#:~:text=In%20the%20south%20there%20was,4.0%20deaths%20per%20million%20people.

roof temperatures are 30 to 40 degrees lower than the average conventional roof and its sustainability rate is approximately 30 to 50 years.[42] Moreover, as green roofs help reduce the overall temperature of the surrounding city, they also provide insulation for homeowners. This will ultimately decrease the rate of emissions created by air-conditioners and lower electricity costs in the winter months. Statistics indicate that a person could save up to 75 percent of their air-conditioning bill using a green roof compared to a conventional roof. Studies show that green roofs can reduce greenhouse gas emissions by integrating nature with architecture, thus stimulating photosynthesis which replaces carbon dioxide with oxygen. In order to provide the necessary assistance to communities that are drastically below the recommended air quality levels set by the EPA, the Green Roof Grant Program would need an estimated total of $22 million to finance a single project. This calculation is based off of a 2015 green roof project in Buena Park, California for a four-story, 70 unit, 22,00 square ft apartment complex.[43] Taking into consideration the type of building and green roof, large cities and apartment complexes generally will use an intensive green roof with an irrigation system that would be priced roughly at $20 to $40 per square foot, while regular housing would likely require an extensive green roof priced at $10 to $20 per square foot.[44]

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[42] United States Environmental Protection Agency. (2019, June 11). *Using Green Roofs to Reduce Heat Islands.* https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands#:~:text=Green%20roofs%20provide%20shade%2C%20remove,roof%20surface%20and%20surrounding%20air.&text=Green%20roof%20temperatures%20can%20be,up%20to%205%C2%B0F.

[43] Building Enclosure. (2015, January 20). *Affordable Housing Topped With a Green Roof.* https://www.buildingenclosureonline.com/articles/84873-affordable-housing-topped-with-a-green-roof

[44] Home Advisor. (2021). *How Much Does a Green Roof Cost?* https://www.homeadvisor.com/cost/roofing/green-roof/

PRELIMINARY REPORT

What is the problem at hand?

Air pollution has an extensive and lethal track record in the context of modern industrial history. For example, London's Great Smog of 1952 — the result of constant emissions from factories and fireplaces — filled the air with deadly toxins and a blinding fog, leading to an estimated 4,000 fatalities within a several-day window.[45] A few years prior to the Great Smog, industrial air pollution left a total of 20 civilians dead and at least 7,000 residents severely ill in Donora, Pennsylvania. Compounded with the consequences of air pollution, abnormal temperatures can exacerbate dangerous situations. According to NASA and the National Snow and Ice Data Center (NSIDC) at the University of Colorado Boulder, the Arctic Sea Ice decreased in size last year at its fastest metlating rate for a second time since data recording in the 1970s.[46] Statistics show a total of 1.44 million square miles of ice were disintegrated which resulted in a subsequent increase in average sea level.[47] Moreover, frequent heat waves and air pollution have led to the emergence of unpredictable wildfires in western states, most notably California. Scientists referred to 2020 as the "record-setting" year of wildfires for California's 9,639 fires burned 4,397,809 acres of land, reducing air quality and visibility to the lowest levels seen in years and blocking off sunlight from reaching the surface of towns and cities for days.[48]

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[45] History.com. (2009, November 6). *Water and Air Pollution*. https://www.history.com/topics/natural-disasters-and-environment/water-and-air-pollution#:~:text=The%20Industrial%20Revolution,-In%20the%20latter&text=The%20resulting%20smog%20and%20soot,residents%20of%20growing%20urban%20centers.&text=A%20few%20years%20earlier%2C%20in,and%20made%207%2C000%20more%20sick.

[46] Ramsayer, K. (2020, September 21). *2020 Arctic Sea Ice Minimum at Second Lowest on Record – Climate Change: Vital Signs of the Planet*. https://climate.nasa.gov/news/3023/2020-arctic-sea-ice-minimum-at-second-lowest-on-record/.

[47] Ramsayer, K. (2020, September 21). *2020 Arctic Sea Ice Minimum at Second Lowest on Record – Climate Change: Vital Signs of the Planet*. https://climate.nasa.gov/news/3023/2020-arctic-sea-ice-minimum-at-second-lowest-on-record/.

[48] California Department of Forestry and Fire Protection. (2021). *2020 Incident Archive*. https://www.fire.ca.gov/incidents/2020/.

Why is this an issue, and who are the stakeholders?

For decades, climate change has been neglected by those in positions of power. Many legislators and fossil-fuel companies have failed to respond in an effective and timely manner to the consequences of industrial air pollution. With each passing day of inaction, the sense of urgency grows as poverty-stricken families and marginalized groups living in urban centers bear the brunt of pollution. In fact, due to the Urban Heat Island effect, African Americans are disproportionately affected by air pollution.[49] The main sources of air pollution are power plants, transportation, generators, and the overall surrounding infrastructure of the land. During peak winter and summer months, residents utilize generators to prevent heat exertion or hyperthermia. In turn, this usage drives up the overall costs of utility bills for residents, leaving individuals and families of low socioeconomic status vulnerable to the health effects and financial burden of air pollution.

Segregationist policies from a century ago divided neighborhoods and forced marginalized populations to reside in areas with poor-living conditions. According to an article by the Scientific American, the cities of Los Angeles, Pittsburgh, St. Louis, and Fresno have some of the highest levels of carbon emissions in the country.[50] Each of these cities also have significant minority populations, as shown in analysis conducted by Kyle Funck, Co-Coordinator of Research and Review at The Greater Good Initiative (*see the first appendix*). This association is rooted in the way that each city's infrastructure was built with the intent to shift the burden of poor-living conditions onto minority populations. Moreover, these communities are constantly inhaling a toxic fume called soot which consists of emissions from power plants, diesel engines,

[49] American Lung Association. (2020, April 20). *Disparities in the Impact of Air-Pollution.* https://www.lung.org/clean-air/outdoors/who-is-at-risk/disparities

[50] Harvey, C. (2021, February 3). *U.S. Cities Are Underestimating their Greenhouse Gas Emissions.* https://www.scientificamerican.com/article/u-s-cities-are-underestimating-their-greenhouse-gas-emissions/

and refineries. Constant exposure to these poisonous particles leads to underlying health issues such as heart attacks, asthma, strokes, and lung cancer.[51] Scientists predict that over 6.6 million people will die each year due to carbon emissions by the year 2050.[52] This staggering number of 200,000 Americans dying from air pollution complications every year.[53]

[51] Katz, C. (2012, November 1). *People in Poor Neighborhoods Breathe More Hazardous Particles*. https://www.scientificamerican.com/article/people-poor-neighborhoods-breate-more-hazardous-particles/.
[52] Kelland, K., & Heavens, A. (2015, September 16). *Air pollution could kill 6.6 million people a year by 2050*. https://www.reuters.com/article/us-health-air-pollution/air-pollution-could-kill-6-6-million-people-a-year-by-2050-idUSKCN0RG2CO20150916.
[53] Caiazzo, F., Ashok, A., Waitz, I. A., Yim, S. H. L., & Barrett, S. R. H. (2013, November). *Atmospheric Environment: Air pollution and early deaths in the United States. Part I: Quantifying the impact of major sectors in 2005*. Science Direct. https://www.sciencedirect.com/science/article/abs/pii/S1352231013004548.

POLICY ANALYSIS

What is the proposed solution?

The Greater Good Initiative proposes a grant program to fund the installation of green roofs in marginalized communities with severe carbon emission rates. A total of $264 million in funding will be needed in order to implement green roofs in Department of Housing and Urban Development (HUD) units and communities living in areas with the worst pollution level. In addition, an amount of $110,400,000 to fund any repairs to existing roofs designated to be transformed into green infrastructure and approximately $3,000,000 in administrative fees. A significant portion of the 1.2 million low-socioeconomic families that live in HUD housing are located in proximity to major American cities,[54] which can suffer from poor air quality and high temperatures. By installing green roofs on former and new HUD establishments, this proposal will alleviate health and financial burdens, help raise the standard of living conditions and improve air-quality to or above the level set by the EPA. Green roofs are proven to cut severe air-pollution rates as fresh greenery absorbs excess carbon dioxide from the air. Research also reveals that green roofs act as an effective barrier to incoming sunlight, as temperatures are 30 to 40 degrees lower than the average conventional roof with a sustainability rate of 30 to 50 years.[55] Integrating nature with architecture would be a worthy investment for the government and would help marginalized communities confront climate change head-on.

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[54] Department of Housing and Urban Development. *HUD's Public Housing Program/U.S. Department of Housing and Urban Development (HUD): HUD.gov / U.S. Department of Housing and Urban Development (HUD)*. HUD's Public Housing Program. https://www.hud.gov/topics/rental_assistance/phprog#:~:text=There%20are%20approximately%201.2%20million,at%20rents%20they%20can%20afford.

[55] United States Environmental Protection Agency. (2019, June 11). *Using Green Roofs to Reduce Heat Islands.* https://www.epa.gov/heatislands/using-green-roofs-reduce-heat-islands#:~:text=Green%20roofs%20provide%20shade%2C%20remove,roof%20surface%20and%20surrounding%20air.&text=Green%20roof%20temperatures%20can%20be,up%20to%205%C2%B0F.

How will this program be administered? What processes will be necessary to meet the program's intended purpose?

Once the proposed policy is implemented, HUD will need to set up a process for hiring contractors to build the green roofs in selected locations. After partnering with private companies, the next step would be to contact a structural engineer to inspect the infrastructure for the overall stability of the roof to withstand the excess load of the newly installed materials.It is vital to have every housing unit inspected prior to building green roofs to ensure the safety and well-being of homeowners. If the rooftops are unable to sustain the additional weight of a green roof, an alternative solution would be to target a future roof installation when the structure of the HUD unit is restored or the building is rebuilt. After verifying the reliability of the roof, homeowners will need to decide if their rooftop is flat or sloped. This will determine the type of green roof that will be built, choosing between the two most common designs: an extensive or intensive rooftop. An extensive green roof is typically used for family housing and is the easiest to install. The intensive green roof is usually implemented onto corporate buildings and requires a greater depth of planting medium than of an intensive green roof. In addition, a roof steeper than 15 degrees will need additional reconstructive planning due to the safety concern of plants sliding off the roof with no reinforcement.[56] The location for the green roof is another important factor as it has to be in direct sunlight. Once the proper location is decided, a layer of resin or barrier needs to be placed before installing the greenery to prevent roots from penetrating the original material of the roof. Typically the layer of resin needs to be at least ¼ inch per foot of pitch.[57] After implementing the layer of resin, protective edging is essential to prevent the

[56] Green Roof Technology: Form and Function. (2013, April). *First Steps to Planning a Green Roof.* http://www.greenrooftechnology.com/green-roof-blog/first-steps-to-planning-a-green-roof
[57] Climate Action Business Association. (2018, April 17). *Green Roofing: Everything You Need to Know.* https://cabaus.org/2018/04/20/green-roofing-everything-need-know/

products from falling off the roof and creating additional safety hazards. Once the edging is completed, the trays can be installed to the preference of the homeowner with the guidance of the contractor. The plant trays need to have grown for at least four months and are occasionally selected by the contractor of choice. The minimum four month period of plant growth is necessary in order to help regulate the surrounding air quality and temperature. Subsequently, the soil elevators — devices used to measure the height of the plants before they are installed — need to be removed to allow water and nutrients to circulate between plants. Once the trays are set, and the edging is secured, it is recommended to water the flora at least once a week for a month to help the plants settle into their new environment.

What resources will be required of this program?

While green roofs are more expensive than the average conventional roof, the sustainability and benefits outway the overall costs. For instance, a similar project constructed in Orange County, California — a 70 unit 22,000 square foot apartment complex — cost approximately $22 million. Contractors used an intensive green roof which is roughly $20 to $40 per square foot; with its heavier material, the intensive green roof is more common in large cities with flat rooftops and requires an irrigation system. Extensive green roofs can be built at a cost of $10 to $20 per square foot. Extensive green roofs are lighter permissible with sloped roofs, and are the easiest type of green roof to install. The cost of installing a green roof is between $12,00 and $40,000 for most homeowners, though expenses may increase if a roof needs to be replaced which costs $1 to $5 per square foot. A crucial component of an extensive or semi-intensive green roof is the tray system which prevents root penetration into the original roofing material. Tray systems on average are $10 to $30 per square foot including the overall

roof installation. Additionally, a green roof barrier — a rolled-up mat — that provides proper drainage typically totals $170 to $1,390 or more with measurements between 100 and 14,000 square feet or more. Another financial factor to consider is the overall maintenance of the greenery. On average the annual maintenance price is $0.75 to $1.50 per square foot and growing a green roof costs $22,000 to $24,00 considering plants usually require at least three years to fully grow. The value of necessary human labor will depend on the overall size and type of green roof to be implemented on the infrastructure which is typically determined by the contractor. Research shows that HUD provides financial assistance to approximately 3,350 public and indigenous housing authorities and in total of 1.2 million homes.[58] In order to set an attainable goal, the Greater Good Initiative proposes to target at least 10 percent of the overall HUD housing units which accounts for 120,000 households. An important cost determinant for HUD to calculate is the square footage of such households' roofs. After taking the total average to install a green roof of $20,000 to $22,000 — and multiplied by the 120,000 households that should be targeted — a total of $264 million in funding will be needed in order to implement green roofs in communities battling the highest rates of air pollution. In addition, an amount of $110,400,000 to fund any repairs to existing roofs designated to incorporate green infrastructure and approximately $3,000,000 in administrative fees should be allocated.

What criteria should be used to determine if the proposed policy is successful?

Chicago, which led the way in the "Green Roof Revolution," could serve as historical precedence for this potential program. In 1995, a major heat wave resulted in at least 700 fatalities due to the urban heat island effect and caused low-income African American

[58] U.S. Department of Housing and Urban Development. (n.d.). *Public Housing.* https://www.hud.gov/program_offices/public_indian_housing/programs/ph#:~:text=There%20are%20approximately%201.2%20million,managed%20by%20some%203300%20PHAs.

neighborhoods to be disproportionately affected.[59] In the aftermath, the city implemented a project called the Urban Heat Island Initiative Pilot Project to reduce inland temperatures and improve the overall air quality. Research revealed the implementation of green roofs in Chicago decreased summer surface temperatures by 30 degrees celsius.[60] This dramatic drop in temperature saved over $75,000 in air conditioning costs, which was a vital benefit to low-income families who suffered the consequences of man-made climate change. An additional externality of green infrastructure is its ability to deter stormwater runoff of 60 percent within the city. Average summer surface temperatures, average air conditioning costs, and stormwater runoff are all measurable metrics to compare year-over-year to assess the benefits of installing green roofs on buildings.

What jurisdictions will need to be involved in this policy?

HUD will have primary oversight over the proposed program. Since these grants are for HUD units, local and state officials will have little to no involvement in the implementation of green roofs. In terms of current policies that could affect grant and roof rollout, there are no specific building regulations regarding the installation of green roofs, although there are a few building regulations concerning the load capacity and drainage of water. Protocols to consider when incorporating green roofs include wind uplift, fire hazards, and root burrowing. Wind uplift could cause severe damage to the green roof and the original structure of the home. Therefore, to prevent wind uplift it is recommended to refer to the RP14 Wind Design Standard for Vegetable

[59] Living Architecture Monitor. (2020, July 8). *Chicago Green Infrastructure: A History and Moving Forward. i*https://livingarchitecturemonitor.com/news/2020/7/8/chicago-green-infrastructure-a-history-and-moving-forward

[60] Ramboll Group A.S. (n.d.). https://ramboll.com/projects/group/chicago-green-rooftops#:~:text=Data%20on%20the%20Chicago%20City,USD%2075%2C000%20in%20cooling%20costs.

Roofing System which is a guide to assist individual buyers.[61] Secondly, to avoid the potential of a natural fire hazard contractors should review the VF-1 Fire Design Standard for Vegetative Roofs focused on the design and maintenance of green infrastructure to prevent a disastrous situation. Additionally, to prohibit root burrowing into the individual home, the VR-1 Procedure for Investigating Resistance to Root Prevention gives homeowners a short-term guideline to safely inspect the conditions of the barriers and determine if they need to repair or remove it. In order to ensure that a building is permissible to incorporate a green roof, it is recommended that individuals contact their local planning office or a reputable installer to conclude if there are any outstanding building regulations.

Are there alternative responses that should be taken into account?

An alternative response to address the issue includes implementing ground-level green roofs, brown roofs, cool roofs, or a combination of all. Ground-level green roofs could be placed in a variety of locations such as a courtyard or above an underground parking garage. Brown roofs, also known as biodiverse green roofs, are designed to provide a biodiverse habitat for plants and animals; they also rely on recycling building materials, soil, and spoil from the designated location. The purpose of biodiverse green roofs is left to be naturally colonized by flora and fauna. Lastly, cool roofs are made with highly reflective material and provides the benefits of reducing building temperatures, lowering energy bills, and being sustainable. The issue with a cool roof is that it is not suited for all climates. It will mostly benefit those who reside in areas of high temperatures.

[61] The Renewable Energy Hub.(n.d.). *Planning Permission For Green Roofs.* (https://www.renewableenergyhub.us/green-roof-information/planning-permission-for-green-roofs.html

What would happen with the problem if no action is taken and the problem was to continue on unchanged and undisturbed?

If the implementation of green infrastructure were to be delayed or avoided, pollutants would continue to wreak havoc on human health and biodiversity in-and-around major American cities. Since 2016, there has been an increase of 5.5 percent of air pollution caused by natural gas and transportation.[62] According to Carnegie Mellon researchers, it was estimated that at least 10,000 lives could have been saved in 2018 if there had been a decrease in toxic emissions. Unfortunately, 43 percent of those fatalities occurred in California due to wildfires and campfires that contributed to 1,400 deaths. Further carbon dioxide and greenhouse gas pollution will result in extreme heat waves that will disproportionately affect low-socioeconomic families and the elderly. Overall city temperatures will increase due to solar radiation leading to several health issues such as heart attacks, and heat exhaustion. Carbon emissions will only worsen air quality, making it an endless suffering for many families who cannot relocate due to financial barriers.

[62] Ingraham, C. (2019, October 23). *Air Pollution Is Getting Worse, and Data Show More People Are Dying.* The Washington Post. https://www.washingtonpost.com/business/2019/10/23/air-pollution-is-getting-worse-data-show-more-people-are-dying/

CONCLUSION

With each passing day, tons of toxic chemicals are released into the atmosphere, harming the surrounding environment while negatively impacting the air quality. Air pollution is an invisible enemy that will continue to damage human health and biodiversity unless necessary measures are taken by the federal government. If the government takes immediate action, a large number of severe health issues can be avoided such as heart attacks, heat exhaustion, strokes, and asthma. The Greater Good Initiative's policy will promote the funding and implementation of green roofs in HUD housing units in areas with the worst air quality or highest greenhouse gas emissions. If implemented, the proposed program will help to regulate air pollutants in the short-term, while decreasing the overall energy costs to homeowners in the long-run. Installed green roofs would absorb the solar radiation and air pollution that a regular conventional roof could not. This type of architecture will act as a temperature regulator for the entire housing unit with the goal of returning surrounding air quality levels to those set by the EPA. All things considered, green infrastructure will be a vital factor for the future of clean air, balanced temperatures, and ensure the overall health of American communities. It will not solve the issue of climate change alone, but it is a necessary step towards accomplishing much-needed reform.

URBAN TRANSPORTATION RENEWAL GRANT PROGRAM

Written by Ike Okereke

POLICY BRIEF

The Problem

As the consequences of climate change continue to affect the lives of millions of Americans, policymakers should target a significant contributor to this growing crisis: transportation in urban areas. The United States is a car-centric society, as 91.4 percent of housing units have at least one vehicle available,[63] and as of 2016 85.3 percent of Americans commute to work alone.[64] Car ownership has grown in major cities over the previous decade.[65] The Energy Information Administration (EIA) notes that the transportation sector as a whole is the largest emitter of carbon dioxide in the economy,[66] and passenger vehicles comprised 59 percent of carbon emissions in 2018.[67] Although gas-powered vehicles are sources of individual empowerment and physical mobility, they are an inefficient means of transportation that impose many negative externalities on cities and the public at-large. Americans spend an average of 54

[63] United States Census Bureau. *Why We Ask Questions About... Vehicles Available*. United States Census Bureau. https://www.census.gov/acs/www/about/why-we-ask-each-question/vehicles/.
[64] Tomer, A. (2017, October 3). *America's commuting choices: 5 major takeaways from 2016 census data*. Brookings. https://www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.
[65] Schaller, B. (2019, January 7). *In a Reversal, 'Car-Rich' Households Are Growing*. Bloomberg CityLab. https://www.bloomberg.com/news/articles/2019-01-07/despite-uber-and-lyft-urban-car-ownership-is-growing.
[66] U. S. Energy Information Administration. (2021, January 26). Figure 11.2 Carbon Dioxide Emissions From Energy Consumption by Sector. Monthly Energy Review.
[67] Environmental Protection Agency. (2020, July 29). *Fast Facts on Transportation Greenhouse Gas Emissions*. EPA. https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.

hours annually in traffic, wasting $8 billion and 3.8 billion gallons of fuel. This average increases to 83 hours per year in the 15 most congested metropolitan areas.[68]

The poor design and implementation of urban roadways over the last century have adverse effects on surrounding communities and minority groups. Many modern highways were built through neighborhoods, sectioning off parts of cities from other areas. In turn, this creates a more difficult — and potentially dangerous — commute for residents. Tom Ellington, former chair of Macon's Pedestrian Safety Review Board described the situation best saying, "We've spent decades building a transportation system that's designed for cars and not for people." In 2018, the Governors Highway Safety Association reported that 6,227 pedestrians were killed in traffic accidents — the highest number in nearly 30 years — and that many of these deaths occurred in large cities like Houston and Miami.[69] Urban neighborhoods in proximity to highways also suffer from poor living conditions. Road traffic in large cities creates extensive noise and air pollution that harm nearby residents on a daily basis; 74 million Americans have been exposed to transportation noise 45 decibels and above, which can pose health risks in the long-term.[70] When observing the National Transportation Noise Map published by the Department of Transportation, neighborhoods next to busy streets, highways, and airports in major U.S. cities have distinctively higher 24-hour average decibel levels than rural or suburban counterparts.[71] These same areas also suffer from higher air pollution, the result of heavy traffic.

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[68] Willingham, A. J. (2019, August 22). *Commuters waste an average of 54 hours a year stalled in traffic, study says*. CNN. https://www.cnn.com/2019/08/22/us/traffic-commute-gridlock-transportation-study-trnd/index.html.
[69] Stachura, S. (2019, March 28). *Why Pedestrian Deaths Are At A 30-Year High*. NPR. https://www.npr.org/2019/03/28/706481382/why-pedestrian-deaths-are-at-a-30-year-high.
[70] United States Department of Transportation. (2020, November 18). *Under a Quarter of Population Exposed to Office-Type Transportation Noise*. Bureau of Transportation Statistics. https://www.bts.gov/newsroom/under-quarter-population-exposed-office-type-transportation-noise#:~:text=The%20U.S.%20Department%20of%20Transportation's,below%2050%20decibels%20or%20roughly.
[71] United States Department of Transportation. (2020). National Transportation Noise Map. https://maps.dot.gov/BTS/NationalTransportationNoiseMap/.

A 2010 review conducted by the Health Effects Institute found that traffic pollution causes asthma attacks in children and an increased risk of premature death across all age groups.[72]

The Solution

The Greater Good Initiative proposes the expansion of the amount appropriated to the Capital Investment Grants Program each year from $2.3 billion[73] to $10 billion for municipalities across the country with the purpose of developing, expanding, and improving public transportation systems. In an effort to foster safer, environment-oriented, and equitable modes of human and commercial transport, this proposal seeks to kickstart a nationwide transition towards revitalizing urban infrastructure. The program, administered by the Federal Transit Administration (FTA), is a competitive grant to municipalities who present qualified project proposals that will establish, expand, or improve upon public transportation services. For the grant approval process, projects must meet several criteria and qualifications which are defined as: extending existing systems and services into new or underserved areas, reducing scheduled wait times, increasing maintenance or overhauls, or developing better safety guidelines and protocols. If approved, grants would fund projects such as the adoption of new transportation modes, increasing the number of personnel or vehicles, restructuring existing lines and stations, or changes to fare policy. The benefits of expanding this federal grant program go beyond mitigating the aforementioned issues of carbon emissions, noise and air pollution, and infrastructure discrimination. The economic opportunities that could be generated from public

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[72] Health Effects Institute. (2010, January 17). *Health Effects Institute Panel on the Health Effects of Traffic-Related Air Pollution, Traffic-Related Air Pollution: A Critical Review of the Literature on Emissions, Exposure, and Health Effects*. https://www.healtheffects.org/publication/traffic-related-air-pollution-critical-review-literature-emissions-exposure-and-health.

[73] United States Department of Transportation. (2020, March 31). *Capital Investment Program | About the Program*. Federal Transit Administration. https://www.transit.dot.gov/funding/grant-programs/capital-investments/about-program.

transportation are significant, as every dollar invested returns an average of $4, and every billion dollars invested can create over 50,000 jobs.[74] The American Public Transportation Association (APTA) recommended to Congress in 2019 to increase federal public transit funding from the 2012 level of $7.4 billion to $33.7 billion by 2026, a growth rate of about $7 billion per year, which they estimated would impact around $35 billion of annual GDP growth. However, even with a modest increase to $10.8 billion, the APTA estimates an economic impact of $14 billion per year.[75] As well, the FTA requested $5.7 billion in their 2019 Budget Submission for "common-sense" investment in public transportation in both urban and rural areas.[76] Therefore, a $10 billion allocation to the grant program would be suitable. Climate change is an existential threat to citizens, communities, and the country, and the automobile has helped to further its destructive magnitude. Now, during a time of economic anxiety and hardship, the nation should use this opportunity to design transit systems that are safe, inclusive, and efficient for all of its people and the environment.

[74] American Public Transportation Association. *Public Transportation Benefits*. American Public Transportation Association. https://www.apta.com/news-publications/public-transportation-benefits/.
[75] American Public Transportation Association. (2020, April). Economic Impact of Public Transportation Investment: 2020 Update.
[76] Federal Transit Administration. (2018, February 13). Budget Estimates Fiscal Year 2019.

PRELIMINARY REPORT

What is the problem at hand?

For millions of people, a car is the only reliable mode of transport despite its inefficient nature, environmentally destructive emissions, and high cost of maintenance. As of 2016, 85.3 percent of Americans drove to work for their commute, and 76.3 percent specifically drove alone.[77] The average commute in 2018 was just over 27 minutes, meaning that a commuter would have spent 225 hours commuting to work, 17 hours more than a decade ago.[78] A significant portion of these hours are caused by standstill traffic, as one 2019 study found that commuters waste 54 extra hours a year in traffic delays.[79] Meanwhile, a typical passenger vehicle produces over 4.5 metric tons of carbon dioxide per year.[80] While this may not seem that substantial, considering that 115 million automobiles hit the road everyday as of 2016,[81] daily commuting would emit 517.5 million metric tons of carbon dioxide every year. These emissions are costly, not only because of their contribution to extreme weather events, greater water saracity, and violent conflicts and refugee movements caused by climate change, but because it's the largest source of pollution — 59 percent — in the largest sector of greenhouse gas emissions

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[77] Tomer, A. (2017, October 3). *America's commuting choices: 5 major takeaways from 2016 census data*. Brookings. https://www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.

[78] Ingraham, C. (2019, October 7). *Nine days on the road. Average commute time reached a new record last year.* The Washington Post. https://www.washingtonpost.com/business/2019/10/07/nine-days-road-average-commute-time-reached-new-record-last-year/.

[79] Willingham, A. J. (2019, August 22). *Commuters waste an average of 54 hours a year stalled in traffic, study says*. CNN. https://www.cnn.com/2019/08/22/us/traffic-commute-gridlock-transportation-study-trnd/index.html.

[80] Environmental Protection Agency. (2018, May 10). *Greenhouse Gas Emissions from a Typical Passenger Vehicle*. EPA. https://www.epa.gov/greenvehicles/greenhouse-gas-emissions-typical-passenger-vehicle.

[81] Tomer, A. (2017, October 3). *America's commuting choices: 5 major takeaways from 2016 census data*. Brookings. https://www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.

in the country — transportation at 28 percent.[82] With all of these factors, it's no wonder why transportation is the second highest expense after housing for Americans today.[83]

Why is this an issue, and how are stakeholders affected?

Between the 1950s and 1970s, the United States built over 48,000 miles of highway, forming what now is known as the Interstate Highway System. Revolutionizing transportation across the country, the new roadways connected communities and made shipping goods more efficient. However, the socioeconomic damage inflicted onto urban centers is immeasurable. Auto industry leaders and highway engineers aligned with local politicians who sought to provide for the growing population of suburbanites and enact the racist policies of "urban renewal," which established highways through areas considered "blight." Often though, these neighborhoods were demographically diverse and economically active places; for instance, Detroit's predominantly black neighborhoods of Black Bottom and Paradise Valley were destroyed to make way for I-375. These actions splintered communities and tore down businesses, dismantling wealth held by minority and lower-income residents as they were forced to live in poor conditions. Meanwhile, people with the means to relocate, usually affluent white families, left cities to move into the suburbs, creating a cycle of white flight which devastated city tax bases and furthered urban decline.[84] Nevertheless, federal, state, and local governments have continued to spend significant amounts of money on the maintenance and expansion of road networks, neglecting other modes of transportation. For example, from 2010 to 2019, while the

[82] Environmental Protection Agency. (2020, July 29). *Fast Facts on Transportation Greenhouse Gas Emissions*. EPA. https://www.epa.gov/greenvehicles/fast-facts-transportation-greenhouse-gas-emissions.
[83] Tomer, A. (2017, October 3). *America's commuting choices: 5 major takeaways from 2016 census data*. Brookings. https://www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.
[84] Stromberg, J. (2016, May 11). *Highways gutted American cities. So why did they build them?* Vox. https://www.vox.com/2015/5/14/8605917/highways-interstate-cities-history.

nation built around 1,203 miles of public transit of any kind, an estimated 28,500 of new roadways were built — 24 times more than transit. When compared with peer nations such as France or Canada on the amount of mileage added to public transit per million inhabitants over the last decade, the United States has produced one-fifth the amount of the former and half the amount of the latter.[85] Furthermore, compared to its counterparts in the Organisation for Economic Co-operation and Development (OECD), the United States invests significantly more in roads rather than in rail.[86] This imbalance of investment occurs despite the fact of the existence of the Downs-Thomson Paradox, discovered by researchers John Michael Thomson and Anthony Downs, which postulates that between spending on private car networks or public transit systems, choosing the road network would lead to longer commute times, even in the case of expansion because it leads to a feedback loop. Adding new roads would reduce commute times when compared to public transport, which incentives more people to abandon public transit to drive cars to work, causing governments to support those systems less, which increases their commute times, which forces more people to drive to work, ultimately escalating road congestion.[87] In context, the Katy Freeway in Houston, which after being named "the second worst traffic bottleneck in the nation" by the American Highway Users Alliance (AHUA), Texas spent more than $2.8 billion to expand the Katy to 23 lanes, making it the widest highway in the world. However, between the project's conclusion in 2011 to 2014, the morning commute on the Katy Freeway grew by 25 minutes or 30 percent, and the afternoon commute grew by 23 minutes or 55 percent.[88]

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[85] Freemark, Y. (2020, January 7). *Too little, too late? A decade of transit investment in the U.S.* The Transport Politic. https://www.thetransportpolitic.com/2020/01/07/too-little-too-late-a-decade-of-transit-investment-in-the-u-s/.
[86] OECD. (2018). Infrastructure investment. OECD ILibrary. https://doi.org/10.1787/b06ce3ad-en.
[87] Inglis-Arkell, E. (2013, August 16). *How the Downs-Thomson Paradox will ruin your commute*. io9. https://io9.gizmodo.com/how-the-downs-thomson-paradox-will-ruin-your-commute-1152573927.
[88] Cortright, J. (2015, December 16). *Reducing congestion: Katy didn't*. City Observatory. https://cityobservatory.org/reducing-congestion-katy-didnt/.

POLICY ANALYSIS

What is the proposed solution?

The Greater Good Initiative proposes the expansion of the amount appropriated to the Capital Investment Grants Program with the purpose of developing, expanding, and improving public transportation systems. The program, administered by the Federal Transit Administration, is a competitive grant to municipalities who present qualified project proposals that will establish, expand, or improve upon public transportation services. For the grant approval process, projects must meet several criteria and qualifications which are defined as: extending existing systems and services into new or underserved areas, reducing scheduled wait times, increasing maintenance or overhauls, or developing better safety guidelines and protocols. If approved, grants would fund projects such as the adoption of new transportation modes, increasing the number of personnel or vehicles, restructuring existing lines and stations, or changes to fare policy.

Why was this specific issue chosen, and how would the proposed program solve it?

The way that Americans travel is increasingly becoming an important and divisive topic in public policy spaces. A growing number of Americans now live in cities; compared to 2012, 2.3 million more people were located in metro areas, and only 92 of the country's 381 metropolitan areas lost population.[89] 21 of the 50 most populated cities in the nation have seen significant drops in driving rates in the past decade, including Seattle's resident single-passenger driving rate dropping to below 50 percent, and Nashville, Washington, D.C., and Oakland experiencing decreases in driving rates of 3 percent. These new non-drivers have adopted other

[89] Westcott, L. (2014, March 27). *More Americans Moving to Cities, Reversing the Suburban Exodus*. The Atlantic. https://www.theatlantic.com/national/archive/2014/03/more-americans-moving-to-cities-reversing-the-suburban-exodus/359714/.

forms of getting around, which coincides with the sharp jumps in the cycling rate and transit commuting rates in some cities.[90] Nevertheless, specific factors and issues with the U.S. public transit system have hampered its potential and growth. Therefore, if the United States is to effectively combat carbon emissions and make more interconnected, safer, and inclusive cityspaces, future planning must include the development and expansion of transit networks. For example, among urban residents as of late 2015, 34 percent of Black and 27 percent of Hispanic Americans have reported using public transport on a daily or weekly basis, compared to 14 percent of White Americans, while native residents are 20 percent less likely to do so than foriegn-born residents (18 percent and 38 percent, respectively). Along with that, young people too are more likely to use transit, with 21 percent of Americans aged between 18 to 29 using it on a daily or weekly basis, compared to 12 percent of American aged between 30 to 49.[91] Marginalized communities — who tend not to own automobiles, live farther away from their workplaces, and rely on public transit to commute to work — would benefit greatly from the greater efficiency and options that the proposed policy will implement within these systems. Improved service would also help with the needed economic recovery after the end of this pandemic. Case in point, every dollar that is invested into public transportation returns an average of 4 dollars, and every billion dollars invested could create over 50,000 jobs.[92] Additionally, a Harvard study on upward mobility found that commute time was the single greatest factor in escaping poverty, meaning the longer the average commute in a given county,

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[90] Tomer, A. (2017, October 3). *America's commuting choices: 5 major takeaways from 2016 census data*. Brookings. https://www.brookings.edu/blog/the-avenue/2017/10/03/americans-commuting-choices-5-major-takeaways-from-2016-census-data/.

[91] Anderson, M. (2016, April 7). *Who relies on public transit in the U.S.* Pew Research Center. https://www.pewresearch.org/fact-tank/2016/04/07/who-relies-on-public-transit-in-the-u-s/.

[92] American Public Transportation Association. *Public Transportation Benefits*. American Public Transportation Association. https://www.apta.com/news-publications/public-transportation-benefits/.

the less likely that lower-income families can rise up the ladder.[93] Finally, as Americans contribute 3.6 times more carbon emissions per capita compared to peer nations like France — and emissions have only dropped by 21 percent between 1980 and 2014 compared to France's 50 percent drop[94] — support for public transportation systems would help to further the development of America's climate-friendly future.

What are the resources and organizations that the proposed program will require?

As previously stated, the Capital Investments Program is administered by the Federal Transit Administration, an agency under the jurisdiction of the Department of Transportation with an annual budget of $2.3 billion. Since the agency was appropriated $13 billion in 2020,[95] this would be a 177 percent increase in funding for this particular agency, a massive surge in a short time. A very small portion of this spending would be used on administrative services and personnel, such as compensation for individuals coordinating with local and state transit authorities in the financing, development, and regulations of projects receiving these grants; coordinating with the Treasury Department, Department of Commerce, the Internal Revenue Service, and the Census Bureau; data collection through individual project and local officials; establishment of a outreach and communications offices to inform transportation administrators and other stakeholders of the opportunities possible through this grant program; and the drafting of a yearly performance report. These tasks, however, only require a nonsignificant amount of people to do them, meaning that the proposed program isn't expected to greatly expand the federal bureaucracy.

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[93] Bouchard, M. (2015, May 7). *Transportation Emerges as Crucial to Escaping Poverty*. The New York Times. https://www.nytimes.com/2015/05/07/upshot/transportation-emerges-as-crucial-to-escaping-poverty.html.
[94] Freemark, Y. (2020, January 7). *Too little, too late? A decade of transit investment in the U.S.* The Transport Politic. https://www.thetransportpolitic.com/2020/01/07/too-little-too-late-a-decade-of-transit-investment-in-the-u-s/.
[95] Chao, E. L. (2020, February 10). FY 2021 Budget Highlights. U.S. Department of Transportation.

What criteria should be used to determine the success of the proposed program?

The success of the grant program can be determined by analyzing several different impacts, all of which reflect the proposal's theme of building an efficient, inclusive, and safer transit system within cities. Principally, a reduction in car ownership within urban areas would suggest a move toward less environmentally-destructive modes of transport like walking, cycling, or public transit, a great accomplishment which can be measured through household surveys such as the Census Bureau's (CB) American Community Survey. Vehicle traffic and associated negative externalities, decreases in the amount of carbon emissions and other air pollutants, average decibels heard near roadways, the number of motor-vehicular accidents, and vehicle miles traveled per capita would be additional metrics that could quantify the success of the proposed program. Moreover, calculating transit ridership is important since increases in daily ridership would demonstrate that people have substituted their cars with public transit methods. If public transportation systems that have received grants see an overall increase in ridership, or expansion projects have high levels of daily ridership, these would be significant benefits. Furthermore, because of the exceeding costs and long delays that U.S. transit projects suffer in comparison to other nations,[96] the review process will rate projects based on timeliness and budget overruns, which will affect the ability of cities to receive funding in the future. Finally, because these grants are meant to assist transit systems in supporting minority communities in their efforts in general commerce and employment, growth in the average household income in a low-income or majority-minority neighborhood would best bolster the successfulness of the proposed policy. These metrics will be compiled in a yearly impact report

[96] Bradford, B. (2019, April 11). *Why are subways in the U.S. so expensive?* Marketplace. https://www.marketplace.org/2019/04/11/subways-us-expensive-cost-comparison/.

published by the Federal Transit Administration, in coordination with other agencies mentioned beforehand.

Are there alternative responses that should be taken into account?

Local governments can implement taxes for car usage, and there have been two main types that are typically proposed. The most popular of these are congestion pricing, which is a way of charging users of a public good which are subject to cycles of excess demand, causing build up within the network that creates congestion. There are several different methods of designing these charges in relation to road traffic, but the ones most often used in urban areas are cordon charges. Under this system, to enter or move through a designated "congestion" area, drivers would need to pay a fee. Cordon charges have been adopted in Singapore and London,[97] and in 2019, New York City became the first city in the United States to approve of a congestion charge scheme.[98] The second, vehicle miles traveled taxes charge motorists on the distance that they travel using their car. This is currently implemented in Germany and Illinois for trucks, and Oregon has tested it as a volunteer program.[99] While VMT taxes have mostly been suggested as a way to replace fuel taxes as the primary revenue generator for highway maintenance,[100] it can also serve as a way to disincentivize car use. Nevertheless, these taxes suffer from two distinct problems that the proposed policy would address. Firstly, these policies would be a significant financial burden to low-income families whose only option of getting to work, transporting their children, or shopping for basic necessities would be through the automobile they own. Secondly,

[97] Federal Highway Administration. (2019, April 5). *What Is Congestion Pricing?* Federal Highway Administration. https://ops.fhwa.dot.gov/publications/congestionpricing/sec2.htm.
[98] Durkin, E., & Aratani, L. (2019, April 1). *New York becomes first city in US to approve congestion pricing*. The Guardian. https://www.theguardian.com/us-news/2019/apr/01/new-york-congestion-pricing-manhattan.
[99] Federal Highway Administration. *Vehicle-miles Traveled (VMT) Fees*. Federal Highway Administration. https://www.fhwa.dot.gov/ipd/tolling_and_pricing/defined/vmt.aspx.
[100] Wehrman, J. (2020, February 10). *Is a tax-by-mile system ready to replace fuel taxes?* Roll Call. https://www.rollcall.com/2020/02/10/is-a-tax-by-mile-system-ready-to-replace-fuel-taxes/.

these alternatives do not address the structural issues at the heart of American public transportation — that it doesn't go where people want to and it does not operate at the times people need it to. For example, when comparing maps of present-day network bus and rail lines that operate at least every 30 minutes, from morning to midnight, seven days a week in five American metro areas (Charlotte, Washington D.C., Portland, Denver, and Columbus) to the Toronto metro system, huge swaths of urban areas in the U.S. cities remain untouched by transit service, contrasted with the Canadian city. Considering that the vast majority of American metro transportation systems do not even operate at those schedules, have generally slow service during the weekday, more limited operation hours on the weekend, transportation policy has failed to provide adequate service for those living in urban areas. The proposed policy plans to solve this crisis by increasing frequencies and operation on existing services, and expanding into underserved areas, thereby driving up demand as more citizens have the option of using public transit instead of their cars. Research shows that frequencies of 15 minutes or less increases ridership,[101] empowering lower-income and minority residents living in urban areas efficient access to other points in the city. Nevertheless, congestion pricing and VMT taxes could provide metropolitan areas a way to disincentivize car usage, as well as a way to fund transit authorities.

What would happen with the problem if no action is taken and the problem were to continue on unchanged and undisturbed?

With the worsening severity of extreme weather events and natural disasters — such as hurricanes, droughts, forest fires, tornados, heat and cold waves, and flooding — climate change would affect the livelihoods and endanger the lives of millions of Americans. These effects will

[101] English, J. (2018, August 31). *Why Did America Give Up on Mass Transit? (Don't Blame Cars.)*. Bloomberg CityLab. https://www.bloomberg.com/news/features/2018-08-31/why-is-american-mass-transit-so-bad-it-s-a-long-story.

cause great migration and conflicts due to the increasingly unequal distribution of resources, the cost of maintaining infrastructure social safety nets may be too great a strain for nations across the globe. Urban areas will be the most harmed, due to their tendency to be placed in low-lying areas close to the coasts, places that will experience the most level sea level rise in the coming century. Therefore, carbon emissions from motor vehicles must be reduced to ensure a more stable future. However, without significant investment into transit infrastructure, this policy will be close to impossible. Americans are simply driving more often, with an uptick of 3.5 percent between 2014 and 2015, the largest jump seen within the previous decade. This resulted with 3.15 trillion driven miles and corresponded with several adverse externalities. According to the EPA, emissions from the transportation sector grew 16 percent between 1990 to 2013, which reflected a 35 percent rise in miles driven.[102] Since 2000, more than 624,000 people have died in car crash, far more than the 535,000 military personnel who were killed in both World Wars,[103] and pedestrian deaths due to vehicle collisions are at a 30-year-high, with 6,227 individuals killed in 2018.[104] A 2013 study found that 53,000 people in the United States die prematurely every year because of automobile pollution, compared to the 34,000 annually who die in traffic accidents.[105] The proliferation of the car may very well cause greater inequality in the future. According to a 2017 study, researchers found that income inequality declined once the percentage of commuters using anything other than single-occupancy vehicles increased.[106]

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[102] Kaenel, C. von. (2016, February 22). *Americans Are Driving More Than Ever*. Scientific American. https://www.scientificamerican.com/article/americans-are-driving-more-than-ever1/.
[103] Halsey, A. (2019, July 21). *More Americans have died in car crashes since 2000 than in both World Wars*. The Washington Post. https://www.washingtonpost.com/local/trafficandcommuting/more-people-died-in-car-crashes-this-century-than-in-both-world-wars/2019/07/21/0ecc0006-3f54-11e9-9361-301ffb5bd5e6_story.html.
[104] Stachura, S. (2019, March 28). *Why Pedestrian Deaths Are At A 30-Year High*. NPR. https://www.npr.org/2019/03/28/706481382/why-pedestrian-deaths-are-at-a-30-year-high.
[105] Mims, C. (2013, October 15). *More Americans die from car pollution than car accidents*. Quartz. https://qz.com/135509/more-americans-die-from-car-pollution-than-car-accidents/.
[106] Rice University. (2017, November 13). *The Link Between Cars and Income Inequality*. The Kinder Institute for Urban Research. https://kinder.rice.edu/2017/11/13/the-link-between-cars-and-income-inequality.

Therefore, to create a safer, inclusive, and efficient future for cities, the United States must reduce the usage and impacts of cars in urban areas.

What impacts on climate change, the environment, and the economy would this program have, and how would it sustain itself?

The proposed program will have a wide and varied effect on the way that Americans travel across their home communities, by introducing more sustainable, affordable, and efficient modes of transport to communities that have underserved for so long, compared to traditional car ownership. Because of this, car usage is expected to decline in the areas with subsidized transit systems, and therefore much of the negative externalities discussed previously, such as carbon emissions, air and noise pollution, traffic accidents, extended commute times, and the feedback loop of lack of transit investment will be reduce as a result of these changes. However, the ramifications of public transportation improvement could go beyond these basic outcomes. According to a 2005 study of the 2001 National Household Travel Survey, 29 percent of respondents could achieve 30 minutes of daily exercise walking to or from public transit, and a 2013 study found that between 2001 to 2009, the estimated number of people whose public transportation-associated walking time equaled to 30 minutes or more jumped from 2.6 million to 3.4 million, a 31 percent spike.[107] Along with tackling crises like the rising rates of obesity, transit investment could also help to restart the economy after the COVID-19 pandemic. The American Public Transportation Association found that every billion dollars invested could create over 50,000 jobs,[108] and by simply increasing the amount of federal spending on public

[107] U.S. Department of Transportation. (2015, August 24). *Expand Public Transportation Systems and Offer Incentives*. U.S. Department of Transportation. https://www.transportation.gov/mission/health/Expand-Public-Transportation-Systems-and-Offer-Incentives.
[108] American Public Transportation Association. *Public Transportation Benefits*. American Public Transportation Association. https://www.apta.com/news-publications/public-transportation-benefits/.

transportation by $3.4 billion, it could hold an GDP impact of $14 billion annually.[109] Transportation systems are incredibly self-reliant, as shown with the APTA finding that for every dollar invested, an average return of $4 occurs.[110] Finally, public transit could provide a psychological benefit to commuters. A 2014 survey of British commuters released by the University of East Anglia found that people who used public transportation reported feeling more satisfied with their journeys than car drivers, likely due to the opportunity transit gives to relax and socialize with others, and to walk to and from a stop.[111] Public transport would be an efficient, safe, economic growth generating, and physically and mentally healthy method of combating climate change.

[109] American Public Transportation Association. (2020, April). Economic Impact of Public Transportation Investment: 2020 Update.
[110] American Public Transportation Association. *Public Transportation Benefits*. American Public Transportation Association. https://www.apta.com/news-publications/public-transportation-benefits/.
[111] Montgomery, C. (2014, September 28). *Commuting for happiness*. Happy City. https://thehappycity.com/commuting-happiness/.

CONCLUSION

People in cities across the United States heavily rely on their cars as a mode of transportation to commute to work, despite motor vehicles being a severely inefficient, environmentally-damaging, potentially-dangerous, and historically-destructive form of transport. Though cars contribute to climate change due to the high amount of carbon emissions, they also generate significant amounts of air and noise pollution, cause thousands of deaths every year from car crashes and pedestrian traffic accidents, and push the divide between racial and social groups further through high maintenance costs. As well, Americans spend more time commuting or being stuck in traffic jams annually, as government spending on road projects continues to increase or stay at high levels. These policies can be traced back to the highway boom of the 1960s and 70s, which paved over low-income and minority urban neighborhoods, while facilitating "white flight" from cities, contributing to current issues of inequality and disparity in metropolitan areas. Paradoxically, because highway spending neglects funding for public transportation, it would lead to an increased feedback loop of greater demand for roads, forcing governments to spend more on roads and neglecting public transit systems further.

Therefore, to reverse these trends, Congress must expand federal support for public transportation. Transit systems have proven to be an effective way of reducing the number of cars on city streets and efficient in getting people where they need to go in a timely manner. This would facilitate a reduction in negative externalities to car usage and it could also create greater benefits for urban communities. Investment in public transportation can bring in bigger returns for both governments and local businesses, connect impoverished households with more job opportunities, and enable more residents to pursue a healthier lifestyle of walking daily. With all

of these positive effects, and the chance to redesign public systems after a public health crisis, the country should commit to expanding and improving public transportation service for all.

SECTION 45Q CCS TAX INCENTIVE REFORM

Written by Achraf Azzaoui and Neha Krishnakumar

POLICY BRIEF

The Problem

The United States' environmental footprint has risen to increasingly unmanageable levels over the last few decades. The average carbon footprint for an individual living in the U.S. is approximately 16 tons, over four times the global average and over eight times the maximum output per person needed to avoid a two degree Celsius increase in global temperatures.[112] Fossil fuel usage in households is one of the primary contributors to this unsustainable per capita carbon dioxide emissions figure; approximately 20 percent of all greenhouse gas emissions in the United States result from the constant heating, cooling, and powering households.[113] Because carbon dioxide emissions are a primary catalyzer of the acceleration of global warming worldwide, it is imperative that measures be taken to transition infrastructure to carbon-neutral status.[114]

Energy is multi-purposed in the average American household, whether it be as a cooling and heating mechanism or as a source of electricity. As of 2015, over half of American household energy consumption stems from heating and air conditioning.[115] With the country

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[112] The Nature Conservancy. *What is your carbon footprint?* The Nature Conservancy. https://www.nature.org/en-us/get-involved/how-to-help/carbon-footprint-calculator/.

[113] Goldstein, B., Gounaridis, D., & Newell, J. P. (2020, August 11). *The carbon footprint of household energy use in the United States*. PNAS. https://www.pnas.org/content/117/32/19122.

[114] Stocker, T. F., Midgley, P. M., Bex, V., Xia, Y., Nauels, A., Judith Boschung, S. K., … Qin, D. (2013). *Climate Change 2013: The Physical Science Basis*. https://books.google.com/books?hl=en&lr=&id=o4gaBQAAQBAJ&oi=fnd&pg=PR1&ots=Whkv6OAsQn&sig=3Kfa2fhQ28NGMiTbCcYc-r9WYNw#v=onepage&q&f=false.

[115] U.S. Energy Information Administration. (2020, August 4). *Use of energy explained: Energy use in homes*. Use of energy in homes. https://www.eia.gov/energyexplained/use-of-energy/homes.php#:~:text=Natural%20gas%2C%20which%20was%20used,use%20energy%20consumption%20in%202019.&text=Natural%20gas%2C%20fuel%20oil%2C%20and,and%20many%20more%20end%20uses.

projected to increase its cooling unit stock from 399 million units to over 500 million units by 2040,[116] and building temperature regulation accounting for 10 percent of total emissions in the United States, this will only exacerbate the adverse effects of climate change.[117] The growing need for energy, coupled with existing investments in fossil-fuel-supporting infrastructure, hinders attempts to reduce carbon emissions and creates a "carbon lock-in" effect.[118] As a consequence, private firms are likely not to switch to renewable energy unless it is proven to be financially viable based on a cost-benefit analysis.

The Solution

The Greater Good Initiative proposes the implementation of tax incentives for the purpose of encouraging the development and usage of carbon-neutral or carbon-negative households and buildings. Net carbon emissions by homes and corporate buildings can be reduced in three ways: increasing efficiency of energy usage, reducing reliance on fossil fuels and substituting for renewable energy sources, and implementing technology to offset unavoidable emissions. The latter proves to be the most feasible through the incentivization of carbon capture technology. Most carbon capture technology, which uses Direct Air Capture (DAC), sends air through a filter where carbon dioxide is absorbed by a solid or liquid sorbent and is subsequently isolated into a stream of pure carbon dioxide that is ready for use. After storage, pure carbon dioxide can be repurposed as a growth stimulator for indoor crops, a component of dry ice, and reactant of an artificial photosynthesis process which creates

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[116] International Energy Agency. (2018, May). *The Future of Cooling: Opportunities for energy-efficient air conditioning*. https://www.iea.org/reports/the-future-of-cooling.
[117] Roberts, D. (2018, June 20). *Most American homes are still heated with fossil fuels. It's time to electrify.* https://www.vox.com/energy-and-environment/2018/6/20/17474124/electrification-natural-gas-furnace-heat-pump
[118] Seto, K. C., Davis, S. J., Mitchell, R. B., Stokes, E. C., Unruh, G., & Ürge-Vorsatz, D. (2016, September 2). *Carbon Lock-In: Types, Causes, and Policy Implications*. https://www.annualreviews.org/doi/full/10.1146/annurev-environ-110615-085934.

hydrocarbon liquid fuels.[119] Carbon dioxide extraction through carbon capture technology can nullify some of the reductions needed in energy demand to avoid a two degree increase in global temperatures and the socioeconomic effects of climate change.

The current Section 45Q federal tax credit is the primary incentive for carbon capture utilization and storage technology investment; however, expansions on this policy are necessary to accelerate the long-run trend of growth in the sector. The Greater Good Initiative proposes implementing a tax credit of 30 percent for DAC technology investments, extending the DAC project eligibility date to 2030, and increasing the tax credit redemption period from twelve to thirty years. In conjunction, measures such as increasing the value of the credit for geologic storage to $180 per ton and lowering the minimum capture and use thresholds to 10,000 tons per year should also be undertaken by the federal government. Every possible measure needs to be considered in order to combat techno-institutional lock-in effects caused by previous and current government subsidies on fossil fuels. After all alterations to the Section 45Q federal tax credit have been made, government expenditures on it would reach approximately $1.5 billion, a figure that is roughly half of government expenditures on solar photovoltaic tax credits.[120]

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[119] Bryan, Harvey & Ben Salamah, Fahad. (2018). Building-integrated Carbon Capture: Development of an Appropriate and Applicable Building-integrated System for Carbon Capture and Shade. Civil Engineering and Architecture. 6. 155-163. 10.13189/cea.2018.060305.

[120] Larsen, J., Herndon, W., Kolus, H., & Hiltbrand, G. (2019, December 12). *Can tax credits tackle climate?* https://rhg.com/research/can-tax-credits-tackle-climate/?stream=top&utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosgenerate

PRELIMINARY REPORT

How do fossil-fuel powered buildings contribute to the effects of global warming and climate change?

Energy use in residential households and buildings compromises another significant portion of carbon emission totals, accounting for approximately 20 percent of total greenhouse gas emissions in the country. Production of ozone-depleting chlorofluorocarbons in air conditioners was discontinued in 1995, but this effort led to chlorofluorocarbons being replaced by hydrofluorocarbons and hydrochlorofluorocarbons — both of which are up to 13,850 times more potent in their contribution to global warming than carbon dioxide.[121]

The United States electric system has made considerable efforts to reduce the impact that energy use in buildings has on greenhouse gas emissions, with the carbon intensity of the U.S electrical system steadily declining from a figure of 1,388.811 lbs/MWh in 2001 to 939.0027 lbs/MWh in 2018.[122] However, this figure varies greatly among different states; even though eight out of the top ten states and territories in proportion of energy sector emissions from fossil fuel use in buildings have committed to 80 percent decarbonization by 2050, this target will be rendered unreachable without reducing the net impact on greenhouse gas emissions from buildings.

Failing to reduce this net impact will result in a negative feedback loop that would lead to a necessity for more intense energy use in buildings, as a result of prior emissions exacerbating the greenhouse effect. The effects of carbon emissions and the greenhouse effect can range from reduced crop yield to increased occurrence of natural disasters, but the most scientifically studied

[121] BBC. *How your fridge is heating up the planet*. BBC Future. https://www.bbc.com/future/article/20201204-climate-change-how-chemicals-in-your-fridge-warm-the-planet.
[122] RMI. (2019). *The Impact of Fossil Fuels in Buildings*. https://rmi.org/insight/the-impact-of-fossil-fuels-in-buildings/

effect is an increase in temperatures.[123] Various confounding variables such as the rate of population development, population size, and consumer behavior prevent drawing a direct causation between warming temperatures and energy demand, but even a moderate level of warming will increase global energy demand by 25 to 58 percent.[124] The conclusion remains logically consistent, as warming temperatures increase the need for appliances such as air conditioners, which release excessively harmful particles such as hydrofluorocarbons into the atmosphere.

Who are the stakeholders affected?

The most prominent stakeholders of the climate change issue are those from lower-income families, both uniquely in rural or urban areas. It is a well-known fact that climate change increases the frequency and intensity of severe weather storms. According to a 2018 study, over 8.6 million Americans already live in locations prone to coastal flooding as part of hurricanes.[125] The increased occurrence of such hurricanes will only make it harder for these families who are economically unable to relocate to higher elevations. Furthermore, the occurrence of these natural disasters exacerbate wealth inequities between racial groups. After natural disasters, predominantly-white counties show higher levels of reinvestment than predominantly-non-white counties, and black families living in areas with about $10 billion dollars in damage see wealth *decreases* of $27,000.[126] Apart from the prominence of natural disasters, black households will also face even more disproportionate health risks than in the

[123] NASA. (n.d). *The Causes of Climate Change*. https://climate.nasa.gov/causes/
[124] van Ruijven, B., De Cian, E., and Wing, I.S. (2019). *Amplification of future energy demand growth due to climate change*. Nature Communications. https://www.nature.com/articles/s41467-019-10399-3
[125] 27, R. C. |D., Cho, R., 8, T, B., Parmer, Z., Rob, … Klein. (2020, January 2). *10 Climate Change Impacts That Will Affect Us All*. State of the Planet. https://blogs.ei.columbia.edu/2019/12/27/climate-change-impacts-everyone/.
[126] Rice University. (2018, August 20). *Natural disasters widen racial wealth gap*. EurekaAlert! https://www.eurekalert.org/pub_releases/2018-08/ru-ndw082018.php

status quo because of the climate crisis. 68 percent of African Americans live in proximity to fossil-fuel power plants, and smog and ozone generated by these plants put nearby residents at higher risk for conditions such as asthma, chronic bronchitis, and heart attacks, while also increasing the likelihood of premature death.[127]

In addition to accounting for income and racial disparities, it is important to craft climate policy that takes into account the unique climate change concerns of the constituents of both rural and heavily urbanized areas. Rural areas are prone to disproportionately higher energy burdens, with a median energy burden of 4.4 percent of household income, compared to the national average of 3.3 percent.[128] Meanwhile, residential and commercial power expenditures are projected to increase at a rate of 18 percent by 2040 if additional measures are not taken to limit greenhouse gas emissions.[129] In addition, as people continue to use electricity during excessive heat and stormy weather, electrical grids can be overworked, resulting in dangerous blackouts. This, combined with the relatively low winter resistance of electric and natural gas infrastructure,[130] leads to an energy crisis similar to what occurred in Texas over February of 2021. Therefore, it is critical to incentivize energy efficiency measures in rural areas, whose constituents are disproportionately low-income and unable to afford the high upfront capital costs of energy efficiency improvements.

Although urban areas have less households that are classified as low income — one-third compared to 41 percent for rural areas — they too have unique needs to take into consideration

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[127] NAACP Environmental and Climate Justice Program. (n.d). *Coal Blooded Action Toolkit*. NAACP. https://www.naacp.org/wp-content/uploads/2016/04/Coal_Blooded_Action_Toolkit_FINAL_FINAL.pdf

[128] Ross, L., Drehobl, A., and Stickles, B. (n.d.) *The High Cost of Energy in Rural America: Household Energy Burdens and Opportunities for Energy Efficiency*. American Council for an Energy-Efficient Economy. https://www.aceee.org/sites/default/files/publications/researchreports/u1806.pdf

[129] German, B. (2018, November 27th) *Global warming could increase power costs by billions*. Axios. https://www.axios.com/climate-change-energy-costs-trump-administration-report-39f3fc01-d489-4490-b745-db51349e8005.html

[130] Ball, J. (2021, February 19). *The Texas Blackout Is the Story of a Disaster Foretold*. Texas Monthly. https://www.texasmonthly.com/politics/texas-blackout-preventable/.

when crafting climate policy. While rural areas face greater energy expenditures as a result of climate change, urban areas face direct impacts of fossil fuel production, such as decreased air quality due to higher particulate matter ($PM_{2.5}$) and nitrogen dioxide levels.[131] This is a direct result of peaker power plants, often powered by gas and oil, being predominantly located in large metropolitan areas. The impacts of decreased urban air quality manifest themselves already in the status quo. While accounting for confounding variables, small increases in $PM_{2.5}$ levels were shown to have a strong positive association with COVID-19 death rates.[132] As the link between living in urbanized areas and climate vulnerability becomes more socially understood, adverse negative effects on urban residents will follow, especially in the real estate market. Uncertainty over future regional climate change issues has been linked with lower property values, as well as lower capital appreciation.[133] This can have massive effects on the quality of life of urban resident stakeholders, as lower property values will decrease quality of education, as well as cause a lack of job opportunities in the area.[134]

What measures have been taken against climate change, and why are these measures ineffective?

Energy Policy Act of 2005 and Energy Independence and Security Act of 2007

The Energy Policy Act was established to provide incentives for businesses to develop technologies that could help curtail greenhouse gas emission. As a law, it addresses multiple

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[131] Mullendore, S. (2020, May 27). *Why We Must Close Polluting Urban Power*. U.S. News. https://www.usnews.com/news/cities/articles/2020-05-27/its-time-to-shut-down-polluting-urban-power-plants

[132] Wu, X., Nethery, R., Sabbath, M., Braun, D., Dominci, F. (2020, April 5). *Exposure to air pollution and COVID-19 mortality in the United States: A nationwide cross-sectional study*. https://www.medrxiv.org/content/10.1101/2020.04.05.20054502v2.full

[133] Lewis, R. (2019, March 8). *Factoring the effects of climate change into real estate investments*. Washington Post. https://www.washingtonpost.com/realestate/factoring-the-effects-of-climate-change-into-real-estate-investments/2019/03/07/aa60f186-3f7f-11e9-a0d3-1210e58a94cf_story.html

[134] Manhertz, T. (2019, February 21). *Where Home Values Are Lower, Residents Perceive Worse Access to Education & Jobs*. Zillow. https://www.washingtonpost.com/realestate/factoring-the-effects-of-climate-change-into-real-estate-investments/2019/03/07/aa60f186-3f7f-11e9-a0d3-1210e58a94cf_story.html

avenues including energy efficiency, renewable energy, tribal energy, oil and gas, coal, nuclear matters, vehicles and motor fuels, hydrogen, geothermal energy and hydropower, and climate change technology.[135] This law and several of its specific provisions started America's growing interest in biofuels coupled with the Energy Independence and Security Act of 2007. It solidified the congressional approval of biofuels by mandating that 36 billion gallons of biofuel would be incorporated into common gasoline by 2022.[136] However, Congress has not established effective limits or regulations on how the biofuel should be produced. The only requirement involved, that biofuels made after 2007 should decrease life-cycle emissions by 20 percent compared to traditional fossil fuels,[14] was effectively meaningless considering that Congress exempted the current biofuel producers from it. Additionally, considering that biofuels produce more harmful greenhouse gas emissions than traditional fossil fuels, this area should not be focused on in terms of environmental policy.

Renewable Energy Tax Subsidies and Credits

Since 1978, Congress has attempted to accelerate innovation in the renewable energy industry through modifying the tax code to include credits and deductions for companies that use renewable energy, or giving loan and cash subsidies to said companies. One of the main examples of this is the Renewable Energy Investment Tax Credit, which allows for energy producers to deduct up to thirty percent of costs related to purchasing solar and small-scale wind technology. One of the main drawbacks of prior tax incentives in the renewable industry is their lifespan; instead of requiring proactive removal, they expire periodically and must be renewed.

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[135] Environmental Protection Agency. (2019, December 13). *Summary of the Energy Policy Act*. EPA. https://www.epa.gov/laws-regulations/summary-energy-policy-act.

[136] The Regulatory Review. (2020, September 24). *Are Biofuels Doing More Harm Than Good?* The Regulatory Review. https://www.theregreview.org/2020/06/11/dequarto-are-biofuels-doing-more-harm-than-good/.

Tax incentives are an effective way of increasing investor confidence in an industry; however, due to their inconsistent availability in the renewable energy industry, private funds continue to be limited.

California Low Carbon Fuel Standard

One of the major measures taken to make carbon capture technology more economically viable at the state level is the California Low Carbon Fuel Standard, which originated from the Global Warming Act of 2006. Initially, it was enacted to reduce greenhouse gas emissions related to transportation fuels and reduce reliance on carbon dioxide by 20 percent by 2030 — relative to 2010 levels. Every year, carbon intensity benchmarks are set as targets for gasoline and diesel fuels, and fuel providers are rewarded with credit balances for landing under this benchmark. Corporations that have accumulated credit deficits from using carbon intensive practices can buy credits from other fuel providers, change production methods, or increase imports of low carbon intensity fuels. However, since its enactment, it has been revised to include a Carbon Capture and Sequestration (CCS) Protocol, which declares CCS projects eligible to receive credits. Although this measure is a good step forward, progressive measures that are not standardized across all states will fail to realize significant impacts on carbon emission reductions. Thus, an amendment to the Federal Section 45Q tax credit is necessary.

POLICY ANALYSIS

What is the proposed policy?

The Greater Good Initiative proposes a policy response consisting of tax incentives for encouraging the maintenance of carbon-neutral or carbon-negative households and buildings. The maintenance of carbon-neutral and negative households and buildings requires the use of carbon capture and storage (CCS) technologies, with the most prominent being direct air capture (DAC) technology. The specific proposal is a tax credit of 30 percent for all DAC technology investments, along with measures to increase the tax credit redemption period from 12 to 30 years and to extend project eligibility dates for DAC to 2030.

What justifications exist for allocating resources towards the proposed policy?

Tax incentives have garnered a negative reputation in recent years for being ineffective at fostering innovation, but referring to the history of U.S. energy technology tax incentive policy reveals a distinct trend. Tax incentives were argued to be ineffective at spurring the growth of the solar and wind power industries in their infancy in 1978 and 1992, but as of 2018, non-hydropower renewables provide 10 percent of utility scale electricity services in the United States.[137] The DAC carbon capture technology sector is currently in the growth phase of the industry life cycle, and increased tax incentives would allow it to transition from the early adopters to the takeoff phase of the technology adoption "S" curve. This is because tax incentives can help increase the internal rate of return of the DAC industry past its standard "hurdle rate," making the industry more appealing to potential investors.[138]

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[137] Hart, D. and Noll, E. (2019, December 2). *Less Certain Than Death: Using Tax Incentives to Drive Clean Energy Innovation*. Information Technology & Innovation Foundation. https://itif.org/publications/2019/12/02/less-certain-death-using-tax-incentives-drive-clean-energy-innovation

[138] Forstater, M. (2017, October 16). *The Good, the Bad, and the Ugly: How Do Tax Incentives Impact Investment?* Center for Global Development. https://www.cgdev.org/blog/good-bad-and-ugly-how-do-tax-incentives-impact-investment

In just the past ten years, DAC technology has proved to be a promising industry. At the beginning of last decade, megaton scale DAC costs were over $1,000 per ton, but have since decreased to about between $250 to $600, depending on the technology choice, low-carbon energy source, and the scale of their deployment. In context, these figures exaggerate the true cost of DAC technology, as most DAC projects in the status quo do not benefit from economies of scale due to their rather small size. However, although the industry has shown promising developments, federal intervention is still necessary in order to lower initial capital costs to promote large scale adoption. At least nine million tons of DAC capacity need to be operational in 2030 for the U.S. to be on track to meet 2050 carbon removal targets, and as of now, only ten large-scale carbon capture and sequestration plants have been fully constructed in the U.S. However, corporation 1PointFive is on track to begin constructing a DAC facility located in Texas capable of capturing 1 million metric tons of carbon dioxide annually, paving the way for the United States to spearhead innovation in this industry going forward.[139]

What criteria should be used to determine if the proposed policy is successful?

The performance of the DAC technology industry, as well as annually tracking increases in the amount of functional tons of DAC capacity, should be key metrics of success. As previously mentioned, reaching 2030 and 2050 carbon removal targets serves as the main motivation for pursuing this policy; due to techno-institutional carbon lock-in, many present day facilities are predicated on the use of fossil fuels, so removing existing carbon dioxide from the atmosphere is critical for keeping global warming under 2 degrees celsius.[140] Thus, the necessary

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[139] *Worley awarded FEED contract for direct air capture project in Permian Basin*. oilfieldtechnology.com. https://www.oilfieldtechnology.com/hse/23022021/worley-awarded-feed-contract-for-direct-air-capture-project-in-permian-basin

[140] Institute for Carbon Removal Law and Policy. (2018). *Why talk about carbon removal?* American University. https://www.american.edu/sis/centers/carbon-removal/upload/crbp001_why_talk_about_carbon_removal_icrlp.pdf

goal of 26 to 31 percent compound annual rate of growth of Direct Air Capture with Sequestration deployment between 2020 and 2050 was set. By 2030, a minimum of seven to nine million tons of DAC capacity should be in place in the United States.

From an economic standpoint, it is crucial that these tax incentives help reduce barriers to entry in the DAC carbon capture industry, reduce initial cost of investment, and set up the industry for a future not reliant on federal intervention. Thus, it is hopeful to see a tangible downward trend in the cost of carbon dioxide removal per ton. Considering the breadth of this policy, The Greater Good Initiative expects to see a price of $124 to $325 per metric ton of carbon dioxide removed from the atmosphere for solid-sorbent DAC technology, and $173 to $290 for liquid-sorbent DAC technology.[141] However, this figure would only be for the first DAC plant capable of capturing a megaton of carbon dioxide, without accounting for R&D efforts, economies of scale, increased efficiency of practice over time, etc. For 2030, the goal should be to reach a carbon dioxide capture price per ton of $85 to $261, and a price of $46 to $164 by 2050. Although this policy response will increase the viability of the DAC carbon capture industry, expectations for prices of carbon dioxide removal per ton are susceptible to fluctuations based on the progression of carbon pricing, whether instantiated through a cap and trade program or carbon tax program.

[141] Larsen, J., Herndon, W., Grant, M., and Marsters, P. (2019, May) *Capturing Leadership*. *Policies for the US to Advance Direct Air Capture Technology*. Rhodium Group. https://rhg.com/wp-content/uploads/2019/05/Rhodium_CapturingLeadership_May2019-1.pdf

What jurisdictions will need to be involved in the proposed policy?

As this proposed policy would reform Section 45Q of the Internal Revenue Code, the Department of the Treasury and the Internal Revenue Service (IRS) will need to coordinate the implementation of the tax incentive. After carbon dioxide is captured through Direct Air Capture, it is often sequestered underground. Thus, as stated by Section 45Q(f)(2) the Secretary of the Department of the Treasury, along with the administrator of the Environmental Protection Agency (EPA), the Secretary of the Department of Energy, and the Secretary of the Department of the Interior must continue to establish and enforce regulations ensuring that safely sequestered carbon dioxide is not inadvertently leaked into the atmosphere[142]. The EPA, as outlined in the Greenhouse Gas Reporting Program (GHGRP), must require that firms which inject carbon dioxide underground and are recipients of the Section 45Q tax credit implement an EPA-approved site-specific monitoring, reporting and verification plan, as well as accurately report the amount of carbon dioxide sequestered annually[143]. Firms that fail to comply with these regulations may be ruled as exempt from receiving the Section 45Q tax credit. The EPA will also play a role in future policy recommendations regarding DAC technology. Using statistics compiled by the EPA regarding carbon sequestration and the likelihood of reaching crucial carbon removal targets, future adjustments to the Section 45Q tax credit may be considered.

Are there alternative responses that should be taken into account?

Other policy pathways to making DAC carbon capture technology more viable in the future could include bolstering research and development (R&D) efforts. The current cumulative

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[142] McGinley, E. L. M. G., & Recchia, M. A. R. (2021, January 28). *Treasury Releases Final Regulations on 45Q Carbon Capture Credits*. Natlawreview.Com. https://www.natlawreview.com/article/treasury-releases-final-regulations-45q-carbon-capture-credits

[143] Environmental Protection Agency. (2021, March 3). *Greenhouse Gas Reporting Program (GHGRP)*. Epa.Gov. https://www.epa.gov/ghgreporting

amount of government funding for DAC R&D pales in comparison to other applied energy R&D programs at about $11 million annually, under 0.27 percent of average expenditures annually by the Department of Energy over the past decade.[144] According to an influential study conducted by the National Academies of Sciences, Engineering, and Medicine, increasing funding for DAC-related research to an average annual level of $240 million is necessary to reach carbon emission reduction milestones.[145] This research would entail comparing the efficiency of liquid solvent and solid sorbent direct air capture systems.

Other methods of decreasing initial costs of investment in DAC technology should also be considered to complement increasing the federal tax credit to 30 percent. A loan guarantee program could be instituted towards DAC investment, which would obligate the government to cover borrower debt from private institutions in the case of a default on a loan. This would have the effect of reducing interest rates associated with debt financing for DAC projects; based on previous loan guarantees for renewables and biofuels as highlighted in the American Recovery and Reinvestment Act, enacting this measure would cause a nine-percent decrease in the levelized cost for the first DAC plant.[146] Enabling DAC projects to be eligible for Private Activity Bond financing would also decrease the initial cost of investment. Private Activity Bonds are tax exempt investment securities that would allow the private sector to have cheaper debt financing for DAC projects. Assuming that 50 percent of capital financing for a DAC plant would come from private activity bonds, this measure would result in a two-percent reduction in

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[144] Larsen, J., Herndon, W., Grant, M., and Marsters, P. (2019, May) *Capturing Leadership. Policies for the US to Advance Direct Air Capture Technology*. Rhodium Group. https://rhg.com/research/capturing-leadership-policies-for-the-us-to-advance-direct-air-capture-technology/

[145] National Academies of Sciences, Engineering, and Medicine. 2019. *Negative Emissions Technologies and Reliable Sequestration: A Research Agenda.* Washington, DC: The National Academies Press. https://doi.org/10.17226/25259.

[146] Rhodium Group. (2019, December 12). *Can Tax Credits Tackle Climate?* Rhg.Com. https://rhg.com/research/can-tax-credits-tackle-climate/?stream=top&utm_source=newsletter&utm_medium=email&utm_campaign=newsletter_axiosgenerate

levelized costs. These measures prove to have tangible impacts on reducing barriers to entry in the DAC market, but none are effective enough by themselves to make DAC plants economically viable in the current market climate.

What would happen with the problem if no action is taken and the problem were to continue on unchanged and undisturbed?

Inaction in implementing sufficient incentives for carbon-neutral technology in buildings will lead to stagnated growth in the industry, and reduce the likelihood of the U.S. meeting the 2025 Paris Climate Agreement emission reductions — whereas decarbonizing the electrical grid would enable the residential housing sector to meet the 28 percent greenhouse gas emission reduction target.[147] The effects of excessive carbon dioxide emissions are widely studied; a few consequences of the greenhouse effect include degraded air quality, extreme heat waves, and an increase in natural disasters such as intense floods and hurricanes.[148] However, the effects of the increased presence of carbon dioxide are not limited to change in weather patterns and the environment, but also economic losses as well. It is crucial to account for all negative externalities of carbon dioxide emissions, such as the costs of taking measures to mitigate future natural disasters that will happen because of global warming and health effects. Through this methodology, a comprehensive social cost of carbon metric can be calculated for the purpose of policy recommendations.

If no action is taken to reduce the uncontrolled presence of greenhouse gases in the atmosphere, the consequences and social cost will be immense, especially on the most vulnerable

[147] Goldstein, B., Gounaridis, D., & Newell, J. P. (2020, August 11). *The carbon footprint of household energy use in the United States*. PNAS. https://www.pnas.org/content/117/32/19122.
[148] National Institute of Environmental Health Sciences. (2019, October 31). *Climate and Human Health*. https://www.niehs.nih.gov/research/programs/geh/climatechange/health_impacts/index.cfm

populations in the status quo. This social cost will come in various forms: increases in energy use, changes in net agricultural productivity, human health effects, and property damages from increased natural disaster risk as a result of global warming to name a few. Without preemptive action soon, a figure of four-degrees Celsius of global warming by 2100 could be reached, which would bring some harsh ramifications. In the Intergovernmental Panel on Climate Change's Representative Concentration Pathway 8.5, which has been labeled as a worst-case scenario for global warming, the U.S. will face a negative 2.32 percent deviation in gross domestic output from 2020 to 2050, and a negative 3.81 percent reduction in agricultural sector output.[149] Both of these effects will disproportionately affect low-income stakeholders — since low-income earners suffer more employment losses during recessions than high-income earners and agricultural workers due to them having a median hourly wage of $13.95, compared to the median hourly wage for all occupations of $20.17.[150]

[149] McKibbin, W. J. M. (2021, March). *GLOBAL ECONOMIC IMPACTS OF CLIMATE SHOCKS, CLIMATE POLICY AND CHANGES IN CLIMATE RISK ASSESSMENT*. Brookings Institute Center for Economic Research. https://www.brookings.edu/wp-content/uploads/2021/03/20210331_CEEP_FernandoLiuMcKibbin_ClimateRisk_FINAL.pdf

[150] U.S. Bureau of Labor. (2021, March 19). Summary table B. Establishment data, seasonally adjusted: U.S. Bureau of Labor Statistics. https://www.bls.gov/ces/data/employment-and-earnings/2020/summarytable_202012.htm

CONCLUSION

Carbon dioxide emissions are the largest source of global warming and climate change.[151] The burning of fossil fuels unquestionably creates an excess amount of carbon dioxide in the atmosphere that the earth cannot be able to handle naturally through the perfectly balanced cycles that developed millions of years ago. These cycles could not take into account millions of tons of excess carbon dioxide being poured into the atmosphere annually, especially with large carbon sinks such as the Amazon rainforest being destroyed. As a result, the Earth is in desperate need of a new, innovative way of removing this excess carbon dioxide from the environment. Scientists estimated in March 2019 that in 11 years, the effects of climate change would be irreversible.[152] Thus, it is imperative that excess carbon dioxide be removed from the atmosphere at a widespread level as fast as possible. The Section 45Q tax reform as proposed would accelerate the DAC industry's path to becoming economically viable to investors, and incentivizes companies to reduce their net carbon footprint through carbon capture and sequestration. Should this proposal not be enacted, reaching 2030 carbon removal targets will prove to be increasingly improbable, and the United States will largely forgo incorporating carbon capture and sequestration technology as a part of the fight against climate change. Experts and politicians on both sides of the political spectrum agree that Section 45Q revisions are imperative to mitigating the effects of carbon emissions.

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[151] Environmental Protection Agency. (n.d.). Sources of greenhouse gas emissions. US EPA. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions

[152] United Nations. (2019, March 28). Only 11 years left to prevent irreversible damage from climate change, speakers warn during General Assembly high-level meeting. Welcome to the United Nations. https://www.un.org/press/en/2019/ga12131.doc.htm

GROUND-UP ELECTRIC VEHICLE INFRASTRUCTURE DEVELOPMENT PLAN

Written by Neha Krishnakumar and Achraf Azzaoui

POLICY BRIEF

The Problem

Global warming has continued to be an issue throughout the year of 2021, even in the midst of a global pandemic. In January 2021, worldwide land and ocean temperatures were almost 1.5 degrees Fahrenheit (0.8 degrees Celsius) higher than their average temperature throughout the 20th century. According to the National Oceanic and Atmospheric Administration (NOAA), 2021 will most likely rank as one of the top ten warmest years on record, even in the presence of the typical global cooling of La Nina.[153] Since global warming is an issue that is primarily caused by human carbon dioxide emissions, these emissions should be curtailed to create a carbon-negative industrial atmosphere which will help mitigate, and eventually halt, the effects of climate change.[154]

Recently, scientific and technological innovations have been made, allowing humans to begin reducing the carbon footprint. One such innovation is electric vehicles, which provide an economically-sound long-term approach to decreasing direct and life cycle carbon emissions through their manufacturing, usage, and disposal phases.[155] Additionally, electric vehicles contribute to a decrease in "smog-forming pollutants" including nitrogen oxides and volatile

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[153] "Global Climate Report, January 2021", *NOAA,* https://www.ncdc.noaa.gov/sotc/global/202101#:~:text=The%20January%202021%20global%20land,the%20142%2Dyear%20global%20records.&text=However%2C%20there%20is%20an%20over,10%20warmest%20years%20on%20record.

[154] NASA. (n.d). "The Causes of Climate Change." https://climate.nasa.gov/causes/

[155] Office of Energy Efficiency & Renewable Energy. "Reducing Pollution with Electric Vehicles." https://www.energy.gov/eere/electricvehicles/reducing-pollution-electric-vehicles

organic compounds.[156] In fact, with the combination of electric vehicle use and rising carbon prices, a study has estimated that annual greenhouse gas emissions could be reduced by 77 percent by 2050.[157] Even the use of plug-in hybrid electric vehicles (PHEVs) contribute less emissions because of their higher efficiencies.[4] However, there are not enough incentives to convince consumers to buy electric vehicles. Currently, people are given up to a $7,500 tax credit for a hybrid or fully electric vehicle,[158] but they are still expensive to buy; while the average price of a traditional car is roughly $37,000,[159] the *cheapest* price of an electric vehicle is $30,000.[160] This poses a significant threat to state governments who seek to make a full transition to electric vehicles within the coming two decades.[161] Additionally, while the costs of maintaining an electric vehicle are slightly lower than that of a conventional vehicle, many people fear that they will run out of electric charge during a long ride and no sources of electricity will be available, what has become increasingly known as "range anxiety."[162] In fact, range anxiety is what, unfortunately, contributes to more gas vehicle usage as people are tempted to buy or rent gas-powered vehicles for long trips, defeating the purpose of electric vehicles in the first place. This worry is firmly grounded, because electric charging stations purely are not as common as gas stations. There are less than 50,000 public electric charging stations in the United States, each of which only service one vehicle, whereas the amount of gas stations present in the US is

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[156] "Reducing Pollution with Electric Vehicles." *Energy.gov*, www.energy.gov/eere/electricvehicles/reducing-pollution-electric-vehicles.
[157] Tonachel, Luke. "Study: Electric Vehicles Can Dramatically Reduce Carbon Pollution from Transportation, and Improve Air Quality" *NRDC,* https://www.nrdc.org/experts/luke-tonachel/study-electric-vehicles-can-dramatically-reduce-carbon-pollution
[158] Federal tax credits for electric and plug-in hybrid cars. (n.d.). https://www.fueleconomy.gov/feg/taxevb.shtml
[159] Financial Samurai, Lc, Mehoff, J., Justin, David, Df, . . . Brad, F. (2021, January 14). *The average new car price is unbelievably high*. https://www.financialsamurai.com/average-new-car-price/
[160] Research, H. (2020, November 13). *How much is an electric car?* https://www.caranddriver.com/research/a31544842/how-much-is-an-electric-car/
[161] Office of Governor Gavin Newsom. (2020, September 23). *Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California's Fight Against Climate Change*.
[162] Wardlaw, Christian. "What is Range Anxiety for Electric Vehicles?", *JDPower,* https://www.jdpower.com/cars/shopping-guides/what-is-range-anxiety-with-electric-vehicles

more than 3 times that amount, each servicing multiple vehicles.[163] Individual charging stations may be reliable in a residential setting, but infrastructure comparable to that of gas stations needs to be present for electric vehicles to be a feasible consumer product for everyone. It is clear that changes must be made to the infrastructure of electric vehicles, in both the production and recharging levels, to encourage more electric vehicle usage.

The Solution

The Greater Good Initiative proposes the implementation of tax incentives directed toward businesses that produce electric vehicles and businesses that manage charging stations for the purpose of encouraging electric vehicle consumption and decreasing the overall costs to operate an electric vehicle. Currently, businesses who seek to transition to electric vehicle production may receive loans from the government as part of the Advanced Technology Vehicles Manufacturing (ATVM) program.[164] However, one of the stipulations of the program is that it must be likely that these loans could be repaid. Considering the fact that electric vehicles may continue to cost 9 percent more than traditional vehicles in 2030,[165] it would not be economically feasible for many automobile manufacturers to make the switch to electric vehicle production even with the help of current subsidies. Creating a tax credit for production costs for automobile manufacturers, both current electric vehicle producers and those interested in making the switch, will help directly decrease the cost of producing electric vehicles, and thus decrease the costs of consumption later on.

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[163] McDonald, Loren. "Stop Comparing the Number of Gas Stations to EV Charging Stations", *CleanTechnica,* https://cleantechnica.com/2018/03/07/stop-comparing-number-gas-stations-ev-charging-stations/

[164] "Advanced Technology Vehicles Manufacturing Loan Program", *Energy.gov,* https://www.energy.gov/lpo/products-services/advanced-technology-vehicles-manufacturing-loan-program

[165] Edelstein, Stephen. "Study: EVs Will Still Cost More to Make, Even As Batteries Get Cheaper", *GreenCarReports,* https://www.greencarreports.com/news/1129461_evs-cost-more-to-build-even-after-batteries-get-cheaper.

It is crucial to address the location and presence of charging stations as well. Because many prospective electric vehicle owners have range anxiety, charging stations should become as accessible as gas stations throughout the country. Currently, there is a tax incentive of up to $30,000 for the purchase and installation of an electric vehicle charging station for businesses.[166] While the cost of purchasing an electric vehicle charging station is relatively low for houses, these small charging stations will not service large numbers of people, especially when they are on the road. The tax incentive for installing an electric vehicle charging station should increase to $50,000, considering that fast-paced public charging stations can cost anywhere from $50,000 to $100,000 to install.[167] The form used to apply for the current tax credit for installing an electric vehicle should also be updated with a new tax credit on top of it for gas stations, so that they could easily make the switch to being hybrid gas/electric stations that would be reliable for electric vehicle users and prospective buyers. This tax credit should be 20 percent on top of the up to $50,000 now offered by this policy. By helping businesses dealing with electric vehicle production and charging infrastructure, the United States can become fully carbon-neutral on the roads, bringing stability back to the environment.

[166] Baunsgard, Neil. "4 Things You Need to Know About the EV Charging Tax Credit". *The Environmental Center.* https://envirocenter.org/ev-charging-tax-credits-explained/.
[167] Agenbroad, Josh, Holland, Ben. "EV Charging Station Infrastructure Costs", *RMI,* https://cleantechnica.com/2014/05/03/ev-charging-station-infrastructure-costs/

PRELIMINARY REPORT

How do gas-powered vehicles contribute to the effects of global warming and climate change?

Gas powered vehicles provide a significant source of carbon emissions, accounting for almost 20 percent of all emissions in the United States. For every gallon of gas, 24 pounds of fossil fuels are emitted, not only carbon dioxide. Almost 80 percent of the carbon dioxide is produced during a vehicle's usage, not purely from the production of the fuel.[168] Advancements have been made to decrease the amount of greenhouse gas emissions made by fuel-powered vehicles. For example, researchers at the Washington State University have developed solid oxide fuel cells (SOFCs) that can convert gasoline to electricity, decreasing the amount of pounds of fossil fuels emitted by a car's tailpipe.[169] However, fuel cells using gasoline tend to build up carbon, which prevents the conversion from occurring properly. Technologies such as these will require time, and could eventually become obsolete as electric vehicles continue to grow in popularity, decrease in cost, and effectively become mainstream.

People have touted the use of biodiesels or biofuels instead of traditional fuels as an environmentally safe alternative. However, the use of biofuels generates a new source of greenhouse gases, coming from feedstock production — such as the cultivation of soybeans and corn. Because farmers intend on producing a high yield per acre, many nitrogen fertilizers are used, which tend to be environmentally damaging in both the direct sense of its usage and the indirect sense of its production, transportation, and maintenance.[170] In general, biofuels may be a

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[168] *Car Emissions and Global Warming*. Union of Concerned Scientists. (n.d.). https://www.ucsusa.org/resources/car-emissions-global-warming.
[169] ScienceDaily. (2020, June 8). *Researchers advance fuel cell technology*. ScienceDaily. https://www.sciencedaily.com/releases/2020/06/200608092956.htm.
[170] *Renewable Fuel Standard: Potential Economic and Environmental Effects of U.S. Biofuel Policy*. National Academies Press: OpenBook. (n.d.). https://www.nap.edu/read/13105/chapter/7.

possible transitory technology to consider as the United States continues toward fully carbon-neutral vehicles, but it should only serve that purpose.

Who are the stakeholders affected by the problem?

The stakeholders affected by the problem include people who live in urban and suburban areas and those with preexisting medical conditions. The effects of carbon emissions are felt by people of all ages. In California, school bus commutes account for 33 percent of a child's exposure to pollutants every single day, even though most routes take less than 10 percent of their time. These effects are felt regardless of whether or not the windows are open. With the windows closed, children experience up to 2.5 times higher amounts of diesel particulate pollution, though this amount varies based on each school bus.[171]

Being in a location near a major roadway contributes to asthma, cardiovascular disease, lung issues, and even premature death. These effects are heightened for those in lower socioeconomic groups. In North America, research has shown that lower socioeconomic communities are consistently exposed to higher amounts of particulate matter, nitrogen dioxide, and ozone.[172] Carbon emissions also have heightened effects in Black Americans throughout the United States, where hospitalizations of Black Americans due to asthma occur at the highest rate of all racial demographics in both urban and suburban settings.[173] In inner cities, in particular, the difference is the most prominent — Black Americans receive 50 percent more hospitalizations than the next leading group, Hispanic Americans, and almost 450 percent more hospitalizations

[171] *California Air Resources Board*. Children's School Bus Exposure and Mitigation Studies | California Air Resources Board. (n.d.). https://ww2.arb.ca.gov/resources/documents/childrens-school-bus-exposure-and-mitigation-studies.
[172] Hajat, A., Hsia, C., & O'Neill, M. S. (2015, December). *Socioeconomic Disparities and Air Pollution Exposure: a Global Review*. Current environmental health reports. https://www.ncbi.nlm.nih.gov/pmc/articles/PMC4626327/.
[173] Katz, D. T. (n.d.). *The Interstate Highway System and Environmental Justice: Disproportionate Environmental Impacts on Low Income and Minority Communities*. Fordham Research Commons. https://research.library.fordham.edu/environ_2015/6/.

than White Americans. In addition, mainstream environmental initiatives typically only target well-to-do white consumers instead of targeting the groups most affected by pollution — black and lower-income communities. For example, initiatives that promote sustaining a vegan lifestyle or riding bicycles to work are great, but do not address the societal activities that cause pollution in the first place.[6] Thus, it is essential to craft policies that will focus directly on green infrastructure, instead of offering incentives to consumers. This also ties in directly with President Biden's promise of creating jobs in a renewed America. Focusing on increasing the amount of electric vehicle charging stations and offering incentives to growing businesses looking to expand into the electric vehicle industry will also offer jobs to lower-income Americans in addition to decreasing the conditions that would cause them health issues in the status quo.

What policy measures have been taken to promote environmentally-safe vehicles, and why are these ineffective?

Alternative Fuel Infrastructure Tax Credit

Currently, fueling equipment that contains at least 20 percent biodiesel receives a tax credit of 30 percent up to $30,000.[174] This is targeted toward fueling station owners, thus supporting green infrastructure instead of targeting consumers. The issue with this policy is that it is too much of an incentive to use biodiesel, which is ultimately harmful to the environment, and should instead serve as a possible transitory avenue from fuel-powered vehicles to fully-electric vehicles.[3]

[174] *Electricity Laws and Incentives in Federal.* Alternative Fuels Data Center (n.d.). https://afdc.energy.gov/fuels/laws/ELEC?state=US

Federal and State Tax Credits for Electric Vehicles

Currently, people are given up to a $7,500 tax credit for a hybrid or fully electric vehicle,[175] but they are still expensive to buy; while the average price of a traditional car is roughly $37,000,[176] the *cheapest* price of an electric vehicle is $30,000.[177] The lack of a significant tax incentive for electric vehicle consumption places the use of electric vehicles purely in the hands of those wealthy enough to afford one. This poses a significant threat to state governments who seek to make a full transition to electric vehicles within the coming two decades.[178] Additionally, the approach of offering a tax incentive toward consumers fails to recognize the importance of electric vehicle infrastructure on keeping the costs of electric vehicles low. With enough charging stations and lower production costs, electric vehicle development will speed up and enough competition would be established in the electric vehicle industry to automatically keep costs lower for all consumers, not just the wealthy.

Advanced Technology Vehicles Manufacturing Loan Program

Authorized by the Energy Independence and Security Act of 2007, the Advanced Technology Vehicles Manufacturing Loan Program (ATVM) has $17.7 billion in loan authority to support the development of fuel-efficient, hybrid, and electric vehicles.[179] Three famous recipients include the Ford Motor Company, Tesla Motors, and Nissan North America. However, this program has quite a lot of unused money and dubious previous ventures. For example, Fisker Automotive

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[175] Federal tax credits for electric and plug-in hybrid cars. (n.d.). https://www.fueleconomy.gov/feg/taxevb.shtml
[176] Financial Samurai, Lc, Mehoff, J., Justin, David, Df, . . . Brad, F. (2021, January 14). *The average new car price is unbelievably high*. https://www.financialsamurai.com/average-new-car-price/
[177] Research, H. (2020, November 13). *How much is an electric car?* https://www.caranddriver.com/research/a31544842/how-much-is-an-electric-car/
[178] Office of Governor Gavin Newsom. (2020, September 23). *Governor Newsom Announces California Will Phase Out Gasoline-Powered Cars & Drastically Reduce Demand for Fossil Fuel in California's Fight Against Climate Change*.
[179] *ADVANCED TECHNOLOGY VEHICLES MANUFACTURING LOAN PROGRAM*. Energy.gov. (n.d.). https://www.energy.gov/lpo/products-services/advanced-technology-vehicles-manufacturing-loan-program.

received almost $530 million to work on Karma, a luxury vehicle that eventually failed in American markets, and money has not been recovered since.[180] Instead of rejecting many ventures and focusing on a venture that is unrealistic, the ATVM should instead allow small companies the opportunity to help transition into electric vehicle production through tax incentives on manufacturing. This would decrease the cost for taxpayers and ensure the smooth and proper expansion of electric vehicle manufacturing.

[180] Kaeding, N. (2014, April 14). *Close the Advanced Technology Vehicles Manufacturing Program*. Cato Institute. https://www.cato.org/blog/close-advanced-technology-vehicles-manufacturing-program.

POLICY ANALYSIS

What is the proposed policy response?

In order to develop the necessary electric vehicle infrastructure to make the United States achieve carbon-neutral roadways, The Greater Good Initiative proposes a two-fold policy approach. First, the United States federal government should create a new federal tax incentive for companies working on electric vehicle development, specifically that of fully electric vehicles. This should come in the form of a tax credit of $30,000 per year in its initial stages with proof of sufficient electric vehicle development through inspection four times a year. This tax credit will be decreased overtime and will eventually be eliminated for businesses who are able to decrease the price of their fully-electric vehicles to equal $40,000, a value slightly above the average price for a traditional automobile.[181] Next, the federal government should create a tax credit that caters toward the creation of large-scale electric vehicle charging stations. This tax credit would be up to $20,000 per year, catered toward currently existing gas stations for the purpose of the creation and installation of vehicles. Similar to the first section of the policy approach, the tax incentive would be eliminated once an equal number of charging stations have been made alongside gas stations for each individual gas station. This approach will decrease range anxiety in those worried about utilizing an electric vehicle for long-distance road trips, improving electric vehicle infrastructure to ensure a carbon-neutral future.

What justifications exist for allocating resources towards the proposed policy?

While electric vehicles are not completely carbon-neutral in terms of life-cycle emissions, they prove to play a crucial role in combating climate change because electricity generation

[181] Financial Samurai, Lc, Mehoff, J., Justin, David, Df, . . . Brad, F. (2021, January 14). *The average new car price is unbelievably high*. https://www.financialsamurai.com/average-new-car-price/

produces far less emissions than burning gasoline or diesel.[182] As the United States continues to decarbonize electricity generation to meet future emission reduction targets, EV-related emissions will continue to fall and approach carbon-neutral. President Biden has made achieving net-zero emissions by 2050 a core component of his platform — but to achieve this milestone, it is imperative to address and reduce the carbon footprint of the transportation sector, which contributes 29 percent of total greenhouse gas emissions annually.[183]

In recent years, the electric vehicle industry in the United States has shown promise, outpacing the international trend by rising 80 percent from 2017 to 2018. However, the long-term viability of the industry was called into question after the industry experienced only a 9 percent rate of growth in 2019, and a 25 percent reduction in sales in the first quarter of 2020.[184] However, it is important to consider that this stunted growth was a direct result of the Trump Administration's phase out of the federal tax credit and loosening of fuel economy standards, in addition to a drop in oil prices. Given that oil prices continue to rise due to the Organization of the Petroleum Exporting Countries limiting petroleum exports, demand for electric vehicles will be revitalized, which calls for increased affordability through reducing production costs.[185] In addition to rising oil prices, corporations such as General Motors have

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[182] Office of Energy Efficiency and Renewable Energy. (2019). *Reducing Pollution with Electric Vehicles*. Energy.Gov. https://www.energy.gov/eere/electricvehicles/reducing-pollution-electric-vehicles

[183] U.S. Environmental Protection Agency. (n.d.). *Sources of Greenhouse Gas Emissions*. https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions#transportation

[184] McKinsey & Company. (2021, April 15). *McKinsey Electric Vehicle Index: Europe cushions a global plunge in EV sales*. https://www.mckinsey.com/industries/automotive-and-assembly/our-insights/mckinsey-electric-vehicle-index-europe-cushions-a-global-plunge-in-ev-sales

[185] U.S Energy Information Administration. (2021, March 17). *EIA expects crude oil prices to rise through April because of lower OPEC production - Today in Energy - U.S. Energy Information Administration (EIA)*. Eia.Gov. https://www.eia.gov/todayinenergy/detail.php?id=47176

announced plans to increase funds dedicated towards electric vehicle production by $2 billion, which marks the ideal time to incentivize rapid development.[186]

How will the proposed policy be implemented? What administrative changes must be made for it to become successful?

Since both policy proposals will involve tax credits for businesses, these will be given their own separate forms for implementation. Each form will be similar in structure to Form 8911, the Alternative Fuel Vehicle Refueling Property Credit Form.[187] However, these forms will not involve percentages similar to that of the aforementioned tax credit. Additionally, these forms will be reported with an added section to Form 1120, the U.S. Corporate Income Tax Return form.[188] Specifically, a new section would be added to the Schedule K section enabling businesses to detail the use of their earnings.

For each charging station installed, the tax credit will decrease from $20,000 for electric vehicle charging in a percentage that directly corresponds to the amount of electric vehicle charging stations installed, for all charging stations, and that quantifiably corresponds to the progress made by electric vehicle developers. The percentage decrease approach will also be implemented for the tax credit for electric vehicle production, decreasing from $30,000 for electric vehicle production in the first year to a small amount based on the progress of electric vehicle production. Since evaluating the progress of electric vehicle production may be more difficult, an independent authority of seven board members will be established to evaluate such

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[186] Shepardson, D. T. B. (2020, October 21). *Less carbon, more electric vehicles: automakers prepare for potential Biden win*. Reuters.Com. https://www.reuters.com/article/us-usa-election-autos-biden-idUSKBN2752RR?taid=5f8f89466d83730001dc84aa&utm_campaign=trueAnthem:+Trending+Content&utm_medium=trueAnthem&utm_source=twitter

[187] Internal Revenue Service. (2021, February). Form 8911: Alternative Fuel Vehicle Refueling Property Credit. https://www.irs.gov/pub/irs-pdf/f8911.pdf

[188] Internal Revenue Service. (2020). Form 1120: U.S. Corporation Income Tax Return. https://www.irs.gov/pub/irs-pdf/f1120.pdf

progress. Delegated as the Electric Vehicle Progress in Production Authority (EVPOP), this will comprise of two scientists, three unaffiliated engineers, and two environmental policy representatives. Without sufficient progress altogether, a business will stop receiving the incentive, helping to prevent disasters such as the Fisker Automotives incident associated with the Advanced Technology Vehicles Manufacturing Loan Program, which lost taxpayers $529 billion.[189] It is necessary to emphasize that this policy approach is intended to be cautious, minimizing taxpayer loss while promoting job creation and environmental sustainability.

Finally, as previously mentioned, the implementation of the electric vehicle production tax incentive will rely on a mandatory inspection period over each quarter to analyze the value and environmental safety of the vehicles being produced as a result of this incentive. This is especially necessary because the incentive is large compared to the money offered by other electric vehicle loan programs such as the Advanced Technology Vehicles Manufacturing Loan Program, which still contains unused taxpayer money and rejects much of its own offers.[190]

Are there any alternative responses that should be taken into consideration?

One alternative response that should be taken into consideration is increasing the federal tax incentive for electric vehicles and plug-in hybrid electric vehicles. Increasing the federal tax incentive for electric vehicles from $7,500 to a cap of $15,000 would decrease the cost of the average electric vehicle by 25 percent, making it more affordable to regular citizens. However, this fails to adequately address the root of current environmental stagnation. In a conversation with Dr. Deborah Lawrence, the director of the Environmental Thought and Practice program at

[189] Kaeding, N. (2014, April 14). *Close the Advanced Technology Vehicles Manufacturing Program*. Cato Institute. https://www.cato.org/blog/close-advanced-technology-vehicles-manufacturing-program.
[190] *ADVANCED TECHNOLOGY VEHICLES MANUFACTURING LOAN PROGRAM*. Energy.gov. (n.d.). https://www.energy.gov/lpo/products-services/advanced-technology-vehicles-manufacturing-loan-program.

the University of Virginia, noted the necessity for the government to address the business side of infrastructure, rather than the consumer side. Businesses have the resources and the financing necessary to develop current infrastructure; therefore, there should be a focus towards promoting businesses that will further the transition towards green infrastructure.

What would happen to this problem if no further steps were taken to attempt to solve it?

If no further steps were taken to address electric vehicle infrastructure, the costs will remain extremely high for ordinary consumers to purchase electric vehicles. According to a report by Oliver Wyman, although the prices of batteries are declining, electric vehicle manufacturing costs will still be 9 percent higher than those of their gas-powered counterparts.[191] Declining electric vehicle manufacturing costs may be inevitable, but this should be ramped up in order to avoid irreversible climate change.[192]

How will this project sustain itself in the long term?

This project will sustain itself in the long-term through President Biden's American Jobs Plan; in particular the sections that correspond to electric vehicle research and development and electric vehicle tax credits will further promote electric vehicle infrastructure and provide a sustained effort that will reduce pollution from the transportation sector. Another way that this project can be sustained is through using the funds associated with the Advanced Technology Vehicles Manufacturing Loan Program. Since the program has almost $18 billion of funding,

[191] Edelstein, S., (2020, September 2). "Study: EVs will still cost more to make, even after batteries get much cheaper." Green Car Reports. https://www.greencarreports.com/news/1129461_evs-cost-more-to-build-even-after-batteries-get-cheaper

[192] United Nations. (2019, March 28). "Only 11 Years Left to Prevent Irreversible Damage from Climate Change, Speakers Warn during General Assembly High-Level Meeting." https://www.un.org/press/en/2019/ga12131.doc.htm

which is largely not being used for new ventures, this would be an avenue to explore for sustaining long-term work with this policy.

CONCLUSION

Electric vehicles are often touted as incredible innovations that will decrease carbon emissions and establish carbon-neutrality. However, progress in electric vehicle development is often slow, and the cheapest electric vehicles cost from $30,000 to $40,000.[193] The Greater Good Initiative proposes the implementation of tax incentives targeting both the production and maintenance of electric vehicles, by establishing a tax incentive allowing for the production of industrial electric vehicle charging stations alongside current gas stations and creating a tax incentive to spur electric vehicle production. The production tax incentive would start at $30,000 per year, while the charging tax incentive would start at $20,000 a year. Each year, as more progress is made, an appropriate amount would be deducted from the tax incentive. As part of this policy's implementation, an independent board of seven scientists, engineers, and policy-makers will determine the progress of electric vehicle production each year. This two-pronged policy approach will improve existing policy surrounding electric vehicle production, such as the Advanced Manufacturing Technologies Vehicle Loan Program (ATVM). With the introduction of this policy, costs of electric vehicle development and maintenance will decrease. Additionally, many vehicle owners worry about "range anxiety," the sentiment that electric vehicles will need to be charged and no charging stations will be available. This forces many vehicle owners to choose fuel-based vehicles for long drives. The charging tax incentive introduced to support large-scale charging infrastructure will combat "range anxiety" and will aid in ushering a new age of electric vehicle development in the United States. Electric vehicles are seen as technologies of the future, and with the right policy approach, this future will be coming to the United States and all citizens.

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[193] *Cheapest Electric Cars - Most Affordable EVs for 2020*. Edmunds. (n.d.). https://www.edmunds.com/electric-car/articles/cheapest-electric-cars/.

THE AMTRAK INTERLOCKING-AMERICA PLAN

Written by Avery Lenihan and Agustin Orozco

POLICY BRIEF

The Problem

Currently, millions of Americans do not have access to public rail. Outside of the Northeast, Midwest, and West Coast corridors, reliable and sufficient Amtrak or private passenger rail is simply not an option due to the low frequency of passing trains or the lack of routes serving these communities. In fact, Amtrak has just four transcontinental rail services, none of which start on the East Coast. Consequently, several states either have no rail services or only a single route. This problem is seen in western states with low population densities, as well as the Southeastern corridor. Kentucky, Alabama and Tennessee each have one Amtrak route, while Mississippi and Georgia have two. These states are noticeably left behind by the federal government.

Passenger rail provides a cheap and reliable method of transportation for many areas of the country, although some of the poorest areas in the country have been denied the ability to access this. As a result of not having an option, communities are forced to turn to personal modes of transportation including gasoline-powered vehicles. In turn, this exacerbates climate change by contributing greatly to the overall amount of carbon dioxide emissions; unsurprisingly, personal transportation comprises one of the largest pollutant sectors in the United States. Following the decline of complex private railroad networks in the mid 1960s, rural citizens have had to rely on cars more than urban citizens to travel further and longer. Consequently, these residents repair their vehicles more frequently, produce more carbon emissions per capita, and

spend more money on gasoline.[194] Therefore, not only is their use of cars polluting the environment, it is a financial burden to them. While an overreliance on cars is a financial burden and a source of pollution for all, it also furthers a geographical, economical, and cultural divide between urban citizens and their rural counterparts. Many urban residents do not even own cars that would allow them to travel out of the city easily. This greatly decreases the possible customer market for rural businesses. Therefore, a solution needs to be proposed that is less carbon intensive, offers more flexibility to rural residents, and makes rural communities more accessible to urban residents.

The Solution

The Greater Good Initiative proposes that Amtrak, under the Department of Transportation's direction, focuses on adding or extending service to three routes in its system: Louisville to Nashville, Atlanta to New Orleans (through Birmingham and Jackson), and extending existing Amtrak Piedmont service to Atlanta (through Spartanburg, Clemson, Greenville, and Gainesville). All of these routes would have extensive mileage through some of the most impoverished localities in the country while still traveling through major urban areas. It has been shown that a stop in a rural area can have an economic impact as far 70 miles away from the stop itself.[195] Bringing new consumers to a community increases the quality of life. When all of the 25 poorest counties in the country are rural, their poverty can not be ignored.[196] The Brookings Institute says, "access to cities — and their markets, specialized industries, and

[194] Gatti, D. (2019, February 15). *Union of Concerned Scientists: Rural Drivers Have Most to Gain from Clean Vehicles*. The Daily Yonder. https://dailyyonder.com/union-concerned-scientists-rural-drivers-can-save-clean-vehicles/2019/02/18/

[195] Carpenter, A. (2016, July 26). *Outside of the Northeast, Amtrak plays an overlooked role in connecting communities*. Mobility Lab. https://mobilitylab.org/2016/07/26/amtrak-plays-overlooked-rural-role/

[196] Stebbins, S. U. T. (2019, January 25). *Poorest counties in the US: A state-by-state look at where median household income is low*. WLST. https://eu.usatoday.com/story/money/2019/01/25/poorest-counties-in-the-us-median-household-income/38870175/

capital — increases rural prosperity."[197] Additionally, there are subtle benefits to connecting urban and rural areas such as more cultural interaction, which is needed now more than ever in such a partisan era. In terms of climate change, according to the 2019 U.S. Department of Energy Data Book, Amtrak is 47 percent more energy efficient than traveling by car and 33 percent more energy efficient than domestic air travel.[198] Amtrak also takes pressure off of highways that take both time and carbon emissions to repair when they are overused. Getting people out of individual vehicles and onto public transportation is a way to decrease carbon emissions without burdening commuters or causing them to change their way of life. Embarking on an infrastructure project of this scale will reap benefits for all stakeholders in the surrounding areas.

[197] Downs, A. (2018, July 3). *Traffic: Why It's Getting Worse, What Government Can Do*. Brookings. https://www.brookings.edu/research/traffic-why-its-getting-worse-what-government-can-do/
[198] U.S Department of Energy. (2019). *Travel Green with Amtrak*. Amtrak. https://www.amtrak.com/travel-green

PRELIMINARY REPORT

What problem can Amtrak solve?

The current state of Amtrak within the Southeast corridor of the United States has brought forth several key issues that must be resolved in order to make one of the effective methods of reducing greenhouse gas emissions viable. Such issues negatively affect the region, along with the nation as a whole, and must be addressed immediately. The first problem facing the nation as a whole is the irreversible damage brought forth by carbon emissions released within the Southeast region of the United States due to a lack of passenger rail and environmentally friendly transportation infrastructure. Being a region with a lower overall population density and fewer urban areas, transportation in the Southeast is often a patchwork system of highways and backroads that is outdated and causes more environmental and financial harm than benefits. Rural communities, with their longer commutes and high dependence on vehicles, have immense potential to decrease their carbon footprint.[199] This larger distance for rural citizens increases the total emissions released, which further exacerbates the climate change problem. The lack of connection within the Southeast has left the developing areas within the region in stagnation and has halted any potential economic growth in the region.

The economic potential within this corridor is far greater than the economic output in the status quo. The producer and consumers of the region are facing economic limitations due to a lack of public transportation to nearby cities. This lack of transportation has led to a weakening of economic and cultural connections between rural communities and its neighboring cities. The Southeast will not be able to fulfill its true economic potential unless the transportation gap between urban and rural areas is properly abridged. Infrastructural improvement is necessary to provide the residents far and wide with reliable and sustainable ways to decrease their carbon

[199] USDA. (2005). https://www.ers.usda.gov/webdocs/publications/42593/30151_aib795full_002.pdf?v=41262

footprint while maintaining a low financial burden on each resident. Amtrak presents the opportunity to solve the disconnect between rural and urban economies by creating direct networks for individuals to travel.

What is the problem at-hand?

Carbon emissions are creating immense socioeconomic repercussions in the country. The Energy Information Administration estimates that in 2019, the United States emitted 5.1 billion metric tons of transportation carbon dioxide, while the global emissions of energy-related carbon dioxide totaled 33.1 billion metric tons.[200] This high level of emission leads to a high cost. The social cost of carbon is a measure of the economic harm from those impacts, expressed as the dollar value of the total damages from emitting one ton of carbon dioxide into the atmosphere. The current central estimate of the social cost of carbon is over $50 per ton in today's dollars and may continue to rise unless broad action is taken. In the best interest of the citizens of the United States and the environment, it is necessary for a proposal centered around lowering carbon emissions and promoting economic growth to be pursued.

More apparent to the Southeast corridor is the aforementioned economic disconnect between population centers and rural areas. This issue has many roots; the people within these two different communities don't see eye-to-eye. According to the Pew Research Center, 46 percent of urban dwellers say most people in rural areas have values that are similar to theirs, while 53 percent say the values of rural Americans are very or somewhat different. 52 percent of

[200] United States Geological Survey. (n.d). "How much carbon dioxide does the United States and the World emit each year from energy sources?" https://www.usgs.gov/faqs/how-much-carbon-dioxide-does-united-states-and-world-emit-each-year-energy-sources?qt-news_science_products=0#qt-news_science_products

urban adults say people in the suburbs generally share their values, 47 percent say they don't.[201] Isolation from surrounding communities is not only causing a divide in ideals and values between communities but it is an exacerbator to poverty in disconnected communities. While urban poverty is also an issue, it is distinctly different from rural poverty. The poorest counties in the United States during 2018 were largely rural. Rural poverty could be decreased by bringing more economic stimulus to rural communities in a lasting way. By making rural businesses more accessible to urban residents via public transport, rural communities will see an increased amount of disposable income which can be used to increase quality of life, which is lower amongst rural residents. When observed collectively, states in the Southeast tend to have the lowest median incomes,[202] have been in a state of prolonged economic decline,[203] and tend to be highly dependent on cars for transportation due to large rural populations and lack of infrastructure.[204]

Presently, Amtrak has just six routes operating in the South, which it defines as Louisiana, Arkansas, Tennessee, Mississippi, Alabama, Florida, Georgia, South Carolina, North Carolina, and Virginia.[205] 28 percent of greenhouse gas emissions in the US are due to transportation, and these states, which are predominantly rural, are highly dependent on cars for all distances of travel, something not seen in the Northeast region of the United States, Europe, or East Asia — all of which have sophisticated passenger rail networks. 32 of the 50 counties or

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[201] Parker, K., Menasce Horowitz, J., Brown, A., Fry, D., and Igielnik, R. (2018, May 22). "Urban, suburban and rural residents' views on key social and political issues." Pew Research Center. https://www.pewresearch.org/social-trends/2018/05/22/urban-suburban-and-rural-residents-views-on-key-social-and-political-issues/

[202] Knueven, L. (2019, August 19). *The typical American household earns $61,000 a year. Here are 15 states where the typical resident earns even less*. Business Insider. https://www.businessinsider.com/personal-finance/poorest-states-in-the-us-by-median-household-income-2019-8

[203] Sauter, M. B., Stebbins, S., & Comen, E. (2018, August 27). Which state tops list for having the best and worst economies? USA TODAY. https://www.usatoday.com/story/money/economy/2018/08/27/states-best-and-worst-economies/37490453/

[204] McLaughlan, N. (2020, November 9). The most car-dependent states. US Insurance Agents. https://www.usinsuranceagents.com/car-dependency-by-state/

[205] Amtrak. (2021). "South Train Routes." https://www.amtrak.com/south-train-routes

parishes with the lowest median income are all within this specific corridor.[206] Economic revitalization and transportation is of the essence to move these counties forward economically. Long-term, sustainable, reliable, and affordable transportation is not only the most viable option to get people out of these counties and to high paying areas, but also to bring investments and people to these areas as well.

Who are the stakeholders affected by this issue?

Rural residents are massively affected by the lack of connective infrastructure within the United States, the southeast region especially, and see a lower quality of life due to it. Farmers within rural areas suffer extreme levels of unproductivity due to the lack of infrastructure. Rural infrastructure, like other public investments, raises agricultural productivity. Electricity and roads that facilitate and are significant determinants of agricultural productivity. Having proper infrastructure facilitates the creation of markets and expands the consumer base for a product by connecting two different communities. This connectivity induces growth in the rural areas, bringing about higher agricultural wages and improved opportunities for nonfarm labor.[207]

Higher education is an engine for upward mobility; students who attain higher levels of education are more likely to engage in upward class mobility. Access to education is vital to decrease poverty in the United States, higher education is a key way for poor Americans to find opportunities to engage in upward mobility.[208] With rising inequality and low social mobility, improving access to education is vital to decreasing the divide between communities. However,

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[206] Lenze, David G., and Jeff Newman. "Personal Income by County and Metropolitan Area, 2019." U.S. Bureau of Economic Analysis (BEA). https://www.bea.gov/sites/default/files/2020-11/lapi1120_1.pdf

[207] Llanto, G. (2012, December). "The Impact of Infrastructure on Agricultural Productivity." Philippine Institute for Developmental Studies. https://www.econstor.eu/handle/10419/126883

[208] Greenstone, M., Looney, A., Patashnik, J., and Yu, M. (2013, June 26). "Thirteen Economic Facts about Social Mobility and the Role of Education." Brookings Institute. https://www.brookings.edu/research/thirteen-economic-facts-about-social-mobility-and-the-role-of-education/

to increase access there must be an increase in investment within the area. Students in rural areas suffer due to the lack of infrastructure and investment. Rural students have lower literacy rates than urban and suburban students, which is likely a reflection of the high levels of poverty often found in rural areas. Students in rural schools have access to fewer advanced classes than urban students. To level the playing field there must be investment in infrastructure to make these communities economically desirable. With a more desirable destination and proper infrastructure in place, the community fosters its economic potential by allowing for opportunities to emerge within the area.

POLICY ANALYSIS

What is the proposed solution?

The solution proposed is the creation of three new routes operated by Amtrak: Louisville, KY to Nashville, TN (via Bowling Green and Gallatin on CSX lines); Atlanta, GA to Birmingham, AL (via Oxford, AL on Norfolk Southern Lines) to Jackson, MS (via Tuscaloosa, MS on KCS lines) to New Orleans, LA (on CN lines); and extending the existing trice-daily Piedmont train to Atlanta (via Spartanburg, Clemson, Greenville, and Gainesville on NS lines). Since the Piedmont route is a state-supported route, extending this route would require the states of Georgia and South Carolina to also provide state funding. However, no new infrastructure would need to be built for this as the Crescent train already runs this route three times a week on its journey from NYC to New Orleans. For the Louisville to Nashville route, stations would need to be constructed and leases for the lines would need to be signed. For the Atlanta, Birmingham, Jackson-New Orleans route, the only new infrastructure would need to be a rail lease between Meridian, MS and Jackson.[209]

Why was this specific issue and solution chosen?

Rural residents are often overlooked in the public transport conversation due to public transport being more closely associated with cities. However, rural residents' commutes are often longer and more polluting than their urban counterparts. Additionally, their communities often suffer from being removed from more urban communities as this cuts their businesses off from a large pool of consumers. Amtrak is a form of public transport that has already experimented with running its lines through rural communities like Montana. Therefore, there is quantitative

[209] Menzies, Anthony. "Freight Rail Map of Class I Carriers in North America." Aberdeen Carolina & Western Railway Company: "The Carolina Route" - ACW Railway Company. https://www.acwr.com/economic-development/rail-maps/class-i-freight-carriers.

evidence that a passenger high-speed rail line running through more rural communities is an economic boon to those communities. Amtrak has also already done research to show that their lines are less polluting than other options like air travel. Even more research could easily be done to specifically evaluate the carbon emissions reduced by replacing rural commutes.

How would the proposed policy solve the issue?

This would solve both the economic issue of the isolation of rural communities and the environmental issue of the carbon emissions of rural commutes. Economically, making it easier for consumers to get to a business will cause that business to reach more consumers. This stimulation of local businesses will spread to business owners and eventually out to their community. A stop in a rural community has been shown to have an economic stimulus as far as 70 miles away. Additionally, it will cut rural spending on car maintenance and gas fees, which are much greater for rural citizens than for urban citizens. This will increase rural residents' quality of life and may even have the effect of rural residents spending more in the urban areas, making the economic stimulation a two-way effect. Environmentally, condensing a commuter population into one high-speed train is less carbon emitting than each commuter taking their own car. This effect is increased by the fact that rural residents tend to own older and/or more carbon-emitting cars. Therefore, the proposed policy would bridge the partisan gap by easing issues that are valuable to both sides.

What processes will need to be implemented in order to executive the proposed policy?

The policy's implementation will begin with an increase in federal incentives for Amtrak construction in order to maintain and develop the system across the states. Individual states will increase funding for Amtrak railways by reallocating funds from the state's existing transportation budget. Amtrak, as the company selected by the policy will act under the federal government to place functional and high quality trains in selected lines (as outlined by the policy). The Department of Transportation of the United States will oversee separate contracts between railway companies, the states, and national government. The contracts will be given out to companies to develop long-lasting and high quality railways across the US. The Department of Transportation shall oversee the training, regulation and administration of jobs involved with the creation of these railways.

The proposed policy calls for state legislatures to increase funding for the development of Amtrak passenger rail. A more specific explanation of the specific budget needed for the project is explained below. Amtrak would then use this money to implement functional trains that would run on the lines already outlined. The Amtrak CEO has shown the desire to expand by publishing the "Amtrak Connect US" plan. Amtrak was formed by Congress and has access to any current infrastructure. Funding remains the key barrier rather than any administrative restrictions.

Amtrak has a model already in place that has been successful when it comes to administration. It has consistent customer satisfaction across the board. The many skilled jobs that would be created by this proposal are filled by those trained in a program that is run by both Amtrak and the Federal Railroad Association (FRA). Since Amtrak was formed by the Rail Passenger Service Act of 1970, this trend of Amtrak being closely intertwined with the FRA is quite consistent across the board, and this makes regulation a bit easier.

What are the resources that will be needed to execute the proposed policy?

To carry out the implementation of Amtrak within the southeast there must be precise and accurate planning to maximize the efficiency of this system. Rails, on average, cost $1 million to $2 million per mile, depending on who is constructing it and what kind of land. On top of start up costs there is a need for labor, to implement and maintain the rail. The necessary labor, first, comes through implementation. There will be job training necessary for workers in maintenance, service, and construction. Most workers will be necessary for construction and maintaining the rails in a safe condition to travel, service requires very little labor compared to other areas.

Maintenance labor will take up the majority of the cost of maintenance, but labor is just a fraction within the whole maintenance. For rail transit to be functional there must be a proper supply of electricity; the cost would vary state-to-state. In addition to electricity, the cost of maintenance on underground sections of the rail transit requires a larger cost than transit at the surface level. Subway stations require heating, cooling, and station attendants that may not be required in stations on the surface.

What criteria should be used to determine if the proposed policy is successful?

Tangible progress towards a more eco-friendly region would be deemed a success. There is a lack of proper infrastructure and an overreliance in cars that exacerbates solvency of the issue. Direct metrics could include, but are not limited to: a decrease in vehicle emissions; increase in rail passengers by region; decrease in carbon emissions by region; decrease in car commuters; and decrease in suburban traffic. Moreover, basic economic measurements like increases in regional gross domestic output and employment could be signs that an implemented policy is helping to expand the economy for a specific area.

What jurisdictions will need to be involved in this policy?

There are several state legislatures that would work together to make this a successful policy. The state legislatures of South Carolina, Kentucky, Alabama, Tennessee, Mississippi, Louisiana and Georgia would play a vital role in the implementation of this policy. The legislatures would approve increased funding for Amtrak and allow for the creation of rail lines within their state. Once funding has been approved, the Department of Transportation would map out where lines would be located and establish training programs to train workers to be employed within the newly established lines. The Federal Railroad Administration and the Federal Transit Administration could potentially aid in the implementation of this policy. Further, once the state legislatures approve an increased funding for Amtrak the Department of Infrastructure would aid the state legislatures in creating necessary buildings to ensure the success of these lines.

There are many alliances in support of widespread, affordable, passenger rail through the United States. As these new routes are primarily targeted towards residents of more rural and less densely populated urban areas, their role throughout the process of further studying, opening, and maintaining these routes would be invaluable as they stand to both be the ones to use and benefit the most from these routes. As the operator of the routes, Amtrak will also be a primary stakeholder, as proper funding needs to be allocated to ensure the stations, trains, and staff will all be prepared for and able to service the new routes. Therefore, Congress and the representatives who's districts are served by these routes will also have a significant role in securing the lasting funding for Amtrak to make them possible.

As the main beneficiaries and users of these routes are the local communities, their input and involvement is a foremost priority. It is imperative to both the long-term success of the

community and the routes themselves that the symbiotic relationship be maintained. Therefore, these communities along the route will need economic incentives, as well as need to potentially work with Amtrak in a state partnership to fund more extensive rail services. The people in the areas surrounding these stations would benefit greatly from their development, as passenger rail service consistently proves its positive economic impact should the lines be opened.[210] It is imperative that local communities and governments have a stake in this development, as to ensure a consistent and invested ridership market who will ensure its long-term survival and financial viability.

The implementation of rail is a great step forward to improving infrastructure by the connection it creates between different communities with different demographics that can help one another prosper. The proposed policy has the potential to positively benefit several different groups with different interests by providing them with foundations to attain success. The potential growth for industry allows for rural communities to step further towards equitable infrastructure.

Are there alternative responses that should be taken into account?

To improve the Southeast without rail, state legislatures must find ways to incentivize a decrease in the reliance on cars or make the environmental impact of cars less than that in the status quo. Improving the infrastructure that connects urban and rural areas establishes a more reliable network, connecting these areas through facilitating travel is vital for success to be found if rail fails to be implemented. Establishing new improved infrastructure will incentivize investment in rural areas, due to facilitated travel, and lead to major economic growth. The more

[210] Sperry, B. R., Taylor, J. C., & Roach, J. L. (2013). Economic Impacts of Amtrak Intercity Passenger Rail Service in Michigan: Community-Level Analysis. Transportation Research Record, 2374(1), 17–25. https://doi.org/10.3141/2374-03

consumers travel and interact with developing areas the more revenue will be made to allow these areas to develop into areas with opportunities for people to invest and grow. With the goal of decreasing the total emissions by vehicles, legislatures have the option to invest in the auto market and incentivize the further development of low or no-emission vehicles, "Legislative incentives include measures that provide high-occupancy vehicle (HOV) lane exemptions, financial incentives for purchasing electric vehicles or electric vehicle supply equipment (EVSE), vehicle inspections or emissions test exemptions, parking incentives and utility rate reductions."[211] With incentives to create an environmentally friendly market (Electric, High MPG, Hybrid) there would be a massive decrease towards emissions along with a decrease in cost for consumers within the area. Consumers who adopt these technologies will use less money on fuel which saves them money.

What would happen with the problem if no action is taken and the problem were to continue on unchanged and undisturbed?

This proposal aims to solve the climate issue by reducing the impact of transportation on the environment. Developing rural areas is vital to decreasing the nation's carbon footprint, it will create opportunities for these areas to suit themselves to tackle the issue at hand. By connecting rural areas to urban areas there would be many developments in investment, infrastructure, and quality of life. By failing to implement this proposal the division between rural and urban within the southeast would grow and the urban areas would be heavily impacted by the climate crisis. The United States Department of Agriculture Economic Research Service found, in 2018 over 16 percent of people living in rural areas had an income below the federal

[211] Hartman, K. and Shields, L. (2021, March 12). "State Policies Promoting Hybrid and Electric Vehicles." National Conference of State Legislators.
https://www.ncsl.org/research/energy/state-electric-vehicle-incentives-state-chart.aspx

poverty line, while those living in urban areas had a poverty rate of only 12.6 percent. This difference between rural and urban areas is due to location, connection, and their infrastructure. Rural poverty is often a product of poor infrastructure that hinders development and mobility. Rural areas tend to lack sufficient roads that would increase access to agricultural inputs and markets. Without roads, the rural poor are cut off from technological development and emerging markets in more urban areas. Isolation hinders integration with urban society and established markets, which could result in greater development and economic security.

What impacts on the environment and the economy would the proposed policy have?

The proposed policy creates a new network that would effectively connect much more communities within the Southeast corridor, establishing a foundation for economic growth. To unlock the economic potential of the Southeast, there must be a viable mode of connectivity to create and establish new markets. The Center for American Progress reported in 2015, "Passenger rail service support[s] economic development, connects rural communities to the nation, and helps reduce roadway congestion in major metropolitan regions." This network creates the possibility for firms to interact and sell to a whole new base of consumers. Rural areas lack businesses and customers; with rail, consumers will be drawn into these areas, which has been proven to provide an economic stimulus that "reaches over a 70-mile radius at every stop." This economic stimulus showcases the potential of rail along with the prosperity that will be felt within rural areas if the network is successfully established. The Brookings Institute states "Access to cities — and their markets, specialized industries, and capital — increases rural prosperity," and adding that "proximity to cities can contribute to rural communities' well-being due to the spillover benefits that cities generate."

How will this project sustain itself in the long-term?

Amtrak has a clear source of revenue in the form of ticket sales. However, it often receives federal aid that allows it to make these ticket prices cheaper than they might be if the agency was a private business. Since 2003, the FRA has had a large amount of oversight over the spending of Amtrak. It uses this oversight to administer these federal grants. These routes will be supported politically due to their further connection of metropolitan areas. Even if Amtrak needs to be subsidized to create artificial demand with cheaper tickets, the externalities on both the environment and economy is enough to motivate both the state and federal government to continue to provide subsidies, whether this be through the FRA or by other means. These grants will only become smaller as the demand grows for tickets and prices are able to be raised once consumers configure new routes into their daily lives.

CONCLUSION

Rural communities are over-reliant on cars and separated from their neighboring urban communities[212]. Over-reliance on cars leads to pollution and expenses for both the car owner and the federal government. Rural owners spend more on average on cars, and they are less likely to have less polluting vehicles like electric cars as they are more likely to buy used cars. Rural households spent 62 percent of their car and truck budget on used cars and trucks, whereas 50 percent of the urban household's car and truck budget was spent on used cars and trucks. Rural households spent $3,115 on gasoline and motor oil, compared with the $2,613 spent by urban households.[213] This compounds the already pervasive issue of rural poverty, which is often overlooked. Separation from urban communities leads to cultural divides and a lack of customers for rural businesses. Implementing a reliable mode of public transport between rural and urban will have economic, environmental, and cultural advantages. Public transportation with low carbon emissions is especially preferable given the crisis at hand.

Amtrak already has a proven track record of connecting communities to each other, as displayed in heavy traffic corridors such as the Northeast. The service already has plans to expand lines through more rural areas like Montana, and this will have positive economic effects for the localities around each stop. Amtrak offers a way to transport both urban consumers and rural commuters. Additionally, its carbon footprint is smaller than air travel or car travel. Being 47 percent more energy efficient than traveling by car and 33 percent more energy efficient than domestic air travel, rail travel is the most environmentally friendly mass transit option available.[214] Less reliance on cars eases wear on already worn highways, and eases the financial burden on commuters to maintain their cars. Not only will these rural residents save money on

[212] Pucher, J., & Renne, J. (2004, April). *URBAN-RURAL DIFFERENCES IN MOBILITY AND MODE CHOICE: EVIDENCE FROM THE 2001 NHTS*. Rutgers University. https://vtc.rutgers.edu/wp-content/uploads/2014/04/Articles.Urban-Rural_differences.pdf
[213] Hawk, William. (2013, February 25). Expenditures of urban and rural households in 2011. Bureau of Labor Statistics. https://www.bls.gov/opub/btn/volume-2/mobile/expenditures-of-urban-and-rural-households-in-2011.htm
[214] U.S Department of Energy. (2019). *Travel Green with Amtrak*. Amtrak. https://www.amtrak.com/travel-green

car bills, they will also have more disposable income as a result of the stimulus that local businesses receive from being near an Amtrak stop. These three routes would create a lasting positive economic effect in the region that traditional transit methods such as highways or airports would not be able to do at such a low cost. Rail passenger transport is the most viable and affordable method to expand valuable transportation to these underserved and underpopulated regions.

GRID RENEWABLE ENERGY COUNCIL

Written by Aaron Vickers and Sakthi Packiaraj

POLICY BRIEF

The Problem

Due to the lack of incentives, energy companies currently have no reason to advance their technologies to produce energy in environmentally-friendly ways. This lack of an incentive causes sustained contribution to global pollution and climate change. Energy utilities are among the slowest industries to decarbonize and reduce their carbon footprint. With the newly announced zero carbon power sector initiative, President Biden wants to make energy 100 percent clean by 2035, but energy utilities are projected to only begin transitioning by 2040 or as late as 2050.[215] Waiting two decades or more to undergo this necessary action undermines the President's much-needed climate agenda and allows the effects of climate change to continue undisturbed.[216] In addition, the little regulation placed upon these corporations allow them to go back on decarbonization promises, use accounting tricks to falsify emission numbers, and even invest further in nonrenewable energy assets like gas and coal plants.[217] Moreover, another issue pertains to a unified American response. With the Biden administration taking an aggressive stance on climate change, having different regulations and processes across the country does not demonstrate initiative. Taking a nationwide position on this issue, especially when it comes to energy, would demonstrate America's unified effort to deter climate change. While a few states have taken the initiative to encourage the development of renewable energy sources, climate

[215] Carpenter, S. (2021, January 27). *Executives Question Whether Biden's 2035 Zero-Carbon Target Is Achievable*. https://www.forbes.com/sites/scottcarpenter/2021/01/27/executives-question-whether-bidens-2035-zero-carbon-target-is-achievable/?sh=6c4cf50f54eb.
[216] Pomerantz, D., & Kasper, M. (2020, December 1). *Emissions goals show many utilities continue to move slowly in critical next decade*. https://www.energyandpolicy.org/utilities-carbon-goal-biden-climate-plan/.
[217] Kraus, C. (2020, September 21). *U.S. and European oil giants go different ways on climate change.* https://www.nytimes.com/2020/09/21/business/energy-environment/oil-climate-change-us-europe.html

change and its socioeconomic effects transcend state borders. When compared to many other countries around the world, America is behind in many aspects of energy grid development and climate change deterrence. Having a federal push towards reaching a carbon neutral grid would massively contribute to America's effort on fighting global warming, and bring America back to the forefront of global climate leadership.

The Solution

In order to remedy the outlined issues, the Greater Good Initiative recommends that President Biden authorize the establishment of a national board under the Department of Energy to prioritize the encouragement and development of renewable energy in state energy markets. An executive order of this manner would create a panel of experts and stakeholders, chosen at the President's discretion, who would examine such markets and determine how best to encourage innovation and conversion to green energy. This panel, the Grid Renewable Energy Council (GREC), would operate in a far different manner than existing boards, such as the Federal Energy Regulatory Commission or the Grid Modernization Initiative. Rather than seeking to maintain the status quo, this new commission would function in a manner of seeking development and innovation in the US electrical grid. The GREC would consist of grid experts (engineering and technology advisors), federal and state policy makers, state experts (representatives from different states that will change depending on which state grid is being focused on at that time), representatives from major energy utilities in each states (to protect private interest), and finally an appointed representative from the Biden Administration to connect the board directly to the executive branch. In order to encourage this kind of change,

states would be incentivized by future federal grants issued through the Department of Energy or tax credits issued by the Treasury Department to follow the suggestions of this panel.

PRELIMINARY REPORT

How does the energy sector contribute to climate change?

Climate change refers to the increase in global temperature due to the emissions of carbon dioxide and other greenhouse gasses. The majority of these carbon dioxide emissions come from the burning of fossil fuels,[218] and most notably in the production of energy. In 2019 the US energy sector alone produced 1810 million tons of carbon dioxide alone. This constitutes 27 percent of total US carbon dioxide emissions, a staggering number when the United States' global contribution is taken into account.[219] With energy holding such a dominant share of American emissions, reducing the emissions in this sector is a crucial step in curbing the damage of climate change.

The effects of climate change are broad and far reaching. Scientists predict that humans only have 11 years until the effects of climate change become irreversible.[220] Climate change events include glacier melt and a rise in sea level, stronger and more intense hurricanes causing a larger magnitude of damage, droughts and heatwaves, etc.[221] These disasters would displace and endanger the lives of millions as well as endangering access to resources and supplies. The standard for effective climate change benchmarks claim that global temperatures need to be prevented from rising 1.5 to 2 degrees Celsius higher than normal.[222] In 2019, the global average temperature was 1.1 degrees higher than normal, thus requiring a threshold of 7.6 percent

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[218] Environment Programme. (n.d). "Facts About the Climate Emergency." United Nations. https://www.unep.org/explore-topics/climate-change/facts-about-climate-emergency
[219] Environmental Protection Agency. (n.d). "Sources of Greenhouse Gas Emissions." https://www.epa.gov/ghgemissions/sources-greenhouse-gas-emissions
[220] Letzter, R. (2019, September 26). "Are We Really Running Out of Time to Stop Climate Change?" Live Science. https://www.livescience.com/12-years-to-stop-climate-change.html
[221] NASA. (n.d.). "The Effects of Climate Change" https://climate.nasa.gov/effects/
[222] Rammer, W., Seidl, R. (2020, April 17). *Climate change causes critical transitions and irreversible alterations of mountain forests.*" Wiley Online Library https://onlinelibrary.wiley.com/doi/full/10.1111/gcb.15118

decrease in emissions every year until 2030 to stop humans from reaching the point of no return.[223]

Who are the stakeholders in this issue?

With an electrical grid so heavily reliant on fossil fuels, there are many that are adversely affected by the energy sector. Workers in the non-renewable energy industry face adverse health conditions due to their occupation. Coal miners, for example, have significantly elevated risks of lung cancer and other respiratory issues.[224] Civilians throughout the country suffer from respiratory disease caused by pollutants spewed out from non-renewable power plants. Coal alone kills an estimated 13000 people annually here in the US.[225] Furthermore, many of those who suffer from illnesses from carbon-polluting energy creation live in majority-minority communities. President Biden campaigned to fix these "fence lines," and improve the health of these communities as a whole.[226] The physiological impact of climate change is not isolated to one specific community or a region, but is becoming a growing crisis nation-wide. To combat this effectively on a stage as large and diverse as the entire country, the proposed energy board must be made up of a multitude of key members.

Since the GREC will have jurisdiction on local, state, and national levels, the board will consist of many different members chosen to best suit the varying challenge of energy innovation. Firstly, the board will consist of grid experts such as engineering and technology

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[223] Environment Programme. (n.d). "Facts About the Climate Emergency." United Nations. https://www.unep.org/explore-topics/climate-change/facts-about-climate-emergency

[224] CDC. Mining Topic: Respiratory Diseases. (2020, October 16). https://www.cdc.gov/niosh/mining/topics/respiratorydiseases.html#:~:text=Miners%20are%20at%20risk%20of,of%20dying%20from%20lung%20cancer

[225] Health. End Coal. (n.d.). https://endcoal.org/health/#:~:text=In%20the%20United%20States%20coal,annually%2C%20and%2023%2C300%20in%20Europe

[226] The Biden plan to secure environmental justice and equitable economic opportunity. (2020, October 30). https://joebiden.com/environmental-justice-plan/

advisors whose primary purpose is to advise specific technological improvements that need to be made to the section of the grid that is being analyzed at that time; for example, this could take the form of recommending new technology, discovering places where infrastructure needs to be simplified or fixed, or even the restructuring and implementation of carbon neutral energy systems. Essentially, this group on the board will handle the hardware aspect of the board, and will provide the majority of technical recommendations to the rest of the board. Next, there will be federal and state policy makers who serve to implement these recommendations into their respective areas through legislation. On the board, there will also be a rotating state infrastructure expert that will change depending on the state that is currently being analysed for recommendations in order to have someone who is familiar with the needs and details of that specific area. To ensure the infrastructure process does not become solely public, the board will also have representatives from the major energy utilities of each state in order to include their feedback into the recommendations as well as protect private interest when these changes are being implemented. Finally, in order to make this board efficient and in line with the Biden infrastructure plan, there should be an appointed representative from the Biden administration to sit on the board to connect them directly to the executive branch. This will make alignment with similar infrastructure goals a possibility, ensure that implementation is much easier, and will reduce bureaucracy regarding the board's operation heavily.

Why is a change needed in the US electrical grid?

One of America's biggest modern technological failures is the lack of modern infrastructure in the power sector of the country. According to the American Society of Civil

Engineers, the United States received a D+ ranking of their energy grid.[227] It is outdated, prone to failure, and environmentally unfriendly; thus, making the necessary improvements is vital to the future of the country and the health of the planet at large.[228] Citizens should not have to worry about losing their power when they need it most. Texas suffered a severe snowstorm in February 2021, which rendered their entire power grid unusable due to the abnormal temperatures and rapid increase in consumption.[229] Over 4.5 million homes and businesses were left without power simply because Texas refused to update their power grid to the standards laid out by the state power authority because it was either too costly or private utilities thought it was unnecessary,[230] thus exemplifying the need for a change in the public-private partnership.[231] This directly endangered citizens' lives with almost 200 deaths caused by the Winter Storm Uri and corresponding Texas blackouts.[232] The crisis in Texas is just one example to show how important a strong infrastructure grid is, and many other areas around the country are facing similar issues with electrical grid reliability such as West Virginia, New Hampshire, and Arkansas.[233] Each of these states highlight the need for an upgraded electrical grid due to their low reliability and their reliance on fossil fuels. Resolving issues with grids such as these requires a focused effort to innovate.

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[227] Pushkin, M. (2019, November 19). "America's Power Problem." Brown Political Review. https://brownpoliticalreview.org/2019/11/americas-power-problem/

[228] Chrobak, U. L. A. (2020, August 17). The US has more power outages than any other developed country. Here's why. Popular Science. https://www.popsci.com/story/environment/why-us-lose-power-storms/

[229] Team, T. (2021, April 15). The 2021 Texas power crisis: A timeline. https://www.chooseenergy.com/news/article/the-2021-texas-power-crisis-a-timeline/

[230] Collier, K., Davila, V., & Schwartz, J. (2021, February 22). "Power companies get exactly what They want": How Texas repeatedly failed to protect its power grid against extreme weather. https://www.texastribune.org/2021/02/22/texas-power-grid-extreme-weather/

[231] Bazilian, A. (2021, February 19). The Texas electricity crisis and the energy transition. https://www.utilitydive.com/news/the-texas-electricity-crisis-and-the-energy-transition/595315/

[232] Rosenthal, A. (2021, April 02). Nearly 200 people died in Texas winter storm, Houston Chronicle reports. https://www.chron.com/news/houston-texas/article/Winter-storm-uri-death-toll-texas-16072232.php

[233] These U.S. states have the best energy ratings. (n.d.) U.S. News. https://www.usnews.com/news/best-states/rankings/infrastructure/energy

What are some of the current threats to the electrical grid?

Climate change and weather have had a detrimental toll on the state of the grid. As weather phenomena have become increasingly more volatile, it is now especially imperative to account for potential disasters. In February 2021, much of the Midwest and Central United States experienced a winter storm that shut down much of their electrical grids. Texas in particular, notable for having a grid separated from the rest of the United States, suffered mass blackouts and utility outages. These grids failed in large part due to the lack of energy capacity within the grids as well as outdated technology. Much of the energy being produced in these states came from natural gas, a non-renewable energy source that frequently uses pipelines to be transported to power plants. In the case of these grids, the gas froze within the pipelines, preventing much needed fuel from arriving at its destination.[234] If the grids were modernized with anti-weather technology as well as based on renewables — which performed better throughout the crisis than their non-renewable counterparts — much of this blackout could have been avoided.

Climate change is not the only threat to the grid. Existing challenges with disrepair and general wear across the electrical infrastructure of the United States is ever-present. The widespread electrical failures in Texas are just one example of what could happen if the United States continues using an outdated grid. Wear-and-tear are not the only concerns that policy makers should be aware of. Researchers state that the United States power grid is increasingly vulnerable to foreign cyber attacks, with Russia even launching small-scale cyber attacks on the American grid in 2018.[235] A full assault on the US electrical grid by an adversary could prove

[234] Koenig, D. (2021, February 17). EXPLAINER: Why the power grid failed in Texas and beyond. AP NEWS. https://apnews.com/article/why-texas-power-grid-failed-2eaa659d2ac29ff87eb9220875f23b34

[235] Smith, R., & Barry, R. (2019, January 10). America's electric grid has a vulnerable Back Door-and Russia walked through it. https://www.wsj.com/articles/americas-electric-grid-has-a-vulnerable-back-doorand-russia-walked-through-it-11547137112

absolutely devastating, causing widespread economic, health, and societal damage. Threats such as these demand grid innovation.

How does the United States' energy grid compare to others?

In many aspects, the United States' energy sector is dwarfed by other countries. When compared to neighboring Canada, for example, they are much more energy efficient and carbon neutral than the United States is. Over 60 percent of Canada's energy comes from renewable hydroelectric sources.[236] In addition, over 80 percent of their total energy comes from renewable energy.[237] For comparison, only around 19 percent of America's total energy comes from renewable sources.[238] When compared to China, the American grid is behind in terms of technological advancement, as China is currently developing their power grid to be resilient to the threats of the future. They are "future-proofing" their power grid to keep up with the development of smart cities and the evolving technological warspace, all supported by a heavy implementation of renewable energy.[239] In comparison, America's energy sector is outdated and lacks the ability to keep up with America's growing energy needs, thus causing strain and leading to outages.[240] While these other countries transition to clean energy and innovate their energy sector, the United States remains reliant on limited natural resources that heavily pollute the environment.

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[236] Baytek, D. (2020, November 03). Canada's largest electricity sector. https://waterpowercanada.ca/
[237] 468. (n.d.). Energy resource guide - canada - renewable energy. https://www.trade.gov/energy-resource-guide-canada-renewable-energy
[238] U.S. Energy Information Administration.(n.d.). https://www.eia.gov/energyexplained/us-energy-facts/
[239] China utility plans to upgrade grid with Internet of things technologies. (2019, October 26). https://www.scmp.com/news/china/society/article/3034684/chinas-largest-utility-plans-national-power-grid-integrating
[240] America's vulnerable energy grid. (n.d.). Council on Foreign Relations. https://www.cfr.org/backgrounder/americas-vulnerable-energy-grid

POLICY ANALYSIS

What is the proposed policy?

The Greater Good Initiative proposes an executive order from President Biden to establish an advisory board under the Department of Energy that encourages the adoption of green energy platforms through analysis and grants. These grants would be determined and executed by the Department in the future at the discretion of the Secretary of Energy and under the advisory board's guidance. This board and subsequent grants would promote a positive incentive for the adoption of green energy. In addition, the GREC would compile an analysis upon which it would provide recommendations to how the energy grid could be improved and tuned to be more efficient and carbon neutral. The Greater Good Initiative believes that a policy such as this would see state markets rapidly undergo shifts towards cleaner energy sources.

What process will the proposed policy take once implemented?

The executive order will begin by implementing a board of experts to work under the Department of Energy. This board will have the job of analyzing state power sectors to find ways to improve quality in terms of climate impact, infrastructure weakness, and cost efficiency. The board will review power grids of each state independently, then compare them to make sure a unified effort is being made to innovate the power sector of the United States. Once the board has analyzed the weaknesses of various state power company infrastructure, they can propose a plan to the company to help correct that. This can involve project recommendations, financial analytics, or government grant programs to help the power grid transition towards cleaner and more efficient modes of energy production. In addition, the board would factor in the various costs needed to help transition the company and grid towards solely relying on renewable energy

and phasing out fossil fuels. Finally, the board would recommend and authorize federal grants that will be provided to the companies to help stimulate the transition to green energy. The size of this total grant allocation shall be determined at the Secretary of Energy's discretion using the annual budget of the Department. The unique quality of these grants is that as companies shift more and more toward clean energy, not only will a percentage of costs be covered through subsidies, but their tax rate will be lowered as well. This, in turn, lowers the amount of money the government will have to offer in subsidies, but it will not be needed as the transition to clean energy should already be well under way.

Why is now a perfect time to implement the proposed policy?

President Biden has not only made combating climate change a top priority of his administration, but has specifically committed to rebuilding the country's infrastructure to phase in renewable energy.[241] Currently, energy corporations have a vested interest in the maintenance of fossil fuels as the primary energy base. Their assets are tied up in old power plants based on non-renewable sources. If the President were to issue this proposed executive order to establish a federal board on the analysis and subsidization of renewable energy, these same corporations would have an incentive to invest in renewable energy sources. The world faces an imminent threat from global climate change, and should investment not steer towards renewable sources, the US will fail to hit its climate target by 2050. As President Biden has noted, the country is at a

[241] The White House. (2021, January 27). "FACT SHEET: President Biden Takes Executive Actions to Tackle the Climate Crisis at Home and Abroad, Create Jobs, and Restore Scientific Integrity Across Federal Government." https://www.whitehouse.gov/briefing-room/statements-releases/2021/01/27/fact-sheet-president-biden-takes-executive-actions-to-tackle-the-climate-crisis-at-home-and-abroad-create-jobs-and-restore-scientific-integrity-across-federal-government/

pivotal moment in its modern history.[242] An executive order would help ensure that a broader transition towards clean energy is being overseen by experts in the field.

Why is this an executive order rather than a public policy?

The Greater Good Initiative strongly believes that a broader solution can be executed under the Department of Energy. The proposed executive order would direct the Department to form a panel on the adoption of green energy in state electrical markets. This panel would then analyze, advise, and subsidize the shift from fossil fuel-based power to renewable energy. Since this is within the realm of the Department, a lot of legislative overhead could be reduced by issuing an executive order. A public policy, on the other hand, would require far more political capital to be exhausted for similar results. The only aspect of this policy that would need to go through Congress would potentially be an increase to the Department's annual budget to accommodate for future grant programs, as would be determined by the proposed advisory board.

What existing programs are there that are similar to the GREC, and what makes the GREC different?

Some of the federal programs most similar to the proposed board are the Federal Energy Regulatory Commission (FERC)[243] and the Grid Modernization Initiative (GMI).[244] These two are similar in that they both handle the regulation and the modernization of the grid, respectively. However, they are also very different from the GREC. The GREC is, at its core, a public-private

[242] The White House. (2021, January 27). "Executive Order on Tackling the Climate Crisis at Home and Abroad." https://www.whitehouse.gov/briefing-room/presidential-actions/2021/01/27/executive-order-on-tackling-the-climate-crisis-at-home-and-abroad/
[243] Home Page. Federal Energy Regulatory Commission. (n.d.). https://www.ferc.gov/
[244] Grid Modernization Initiative. Energy.gov. (n.d.). https://www.energy.gov/grid-modernization-initiative

partnership underneath the DOE that uses expert analyses and financial incentives to examine and improve electrical grids throughout the country in order to encourage a shift towards a modern, renewable electrical grid. It uses the technology developed from the GMI and applies it in a practical manner. It takes the advice from experts such as those on the FERC and implements the needed changes. In many ways, it is a fusion of the two councils with incentives to give it authority and tangible improvement potential.

CONCLUSION

The current status quo in the energy industry is not enough to satisfy President Biden's goal of being carbon neutral by 2050. Corporations have financial reasoning for continuing the use of fossil fuels due to previous investment in these energy sources. It will require federal action and new economic incentives in order to change this stagnant system into one that is rapidly progressing towards 100 percent clean energy. In order to move in the right direction, The Greater Good Initiative proposes that President Biden create an advisory board as part of the Department of Energy through the issuance of an executive order. This council would be composed of experts in the field and stakeholders from industry, small government, and civic groups. This group would provide analysis, recommendations, and positive incentives for the adoption of renewable energy sources into state electrical grids. Due to the current amount of vested capital in contemporary energy sources, the Great Good Initiative recommends the use of financial incentives in order to convince both state governments and industry partners to move towards modern, greener energy sources. Such incentives would come in the form of subsidizing the construction of these projects through potential grant programs administered by the Department. Funding for such subsidies would stem from a small portion of the Biden infrastructure plan, specifically the clause detailing energy grid modernization and maintenance. This proposed order would result in a significant benefit towards the US climate goals, as companies would have a positive incentive towards the construction of green energy sources. With this positive incentive, corporations would be able to forgo the vested capital that is contained in current investments in fossil fuels and engage in green energy production for the grid of tomorrow. Because of this, it is the belief of the Greater Good Initiative that the adoption

of this policy is key to kickstarting the decarbonization of the energy sector well ahead of current projections and place America at the forefront of the battle against climate change.

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APPENDIX

ENVIRONMENTAL INTERSECTIONALITY ANALYSIS

Conducted by Kyle Funck, Co-Coordinator of Research and Review

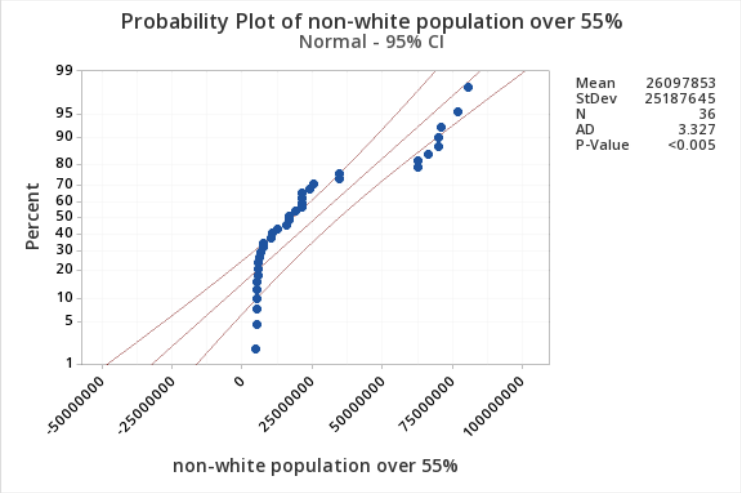

Figure 1. Probability plot of non-white population over 55%

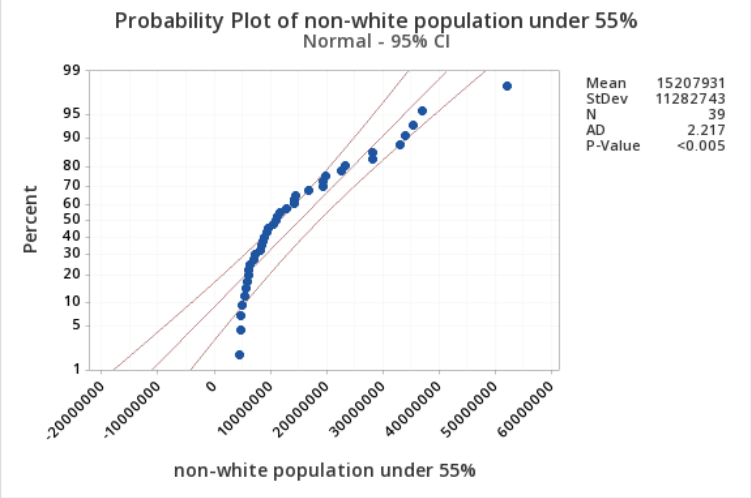

Figure 2. Probability plot of non-white population under 55%

Analysis:

After computing a 2 sample t-test, the results show that we can reject the null hypothesis (there is no difference between the two groups) because the test yielded a p-value, p, of 0.011 which is less than $\alpha = 0.05$. Thus, we can conclude that the two groups are different and therefore the natural question arises: which group is purportedly larger than the other, and why, since they cannot be considered different by chance alone. To find which group is larger, a confidence interval must be created following the steps listed in the methods section. This will give us a result that allows one to state with 95 percent confidence, that the true difference in mean emissions between cities with non-white populations above 55 percent and cities with a population below 55 percent is between the interval 1,932,310 and 19,847,533. Because this interval does not contain any negative or null values, *there is sufficient evidence that non-white communities experience an environment that is plagued with more emissions than white communities*.

Discussion:

The data the analysis is based on have certain characteristics that may be misleading. The city emissions footprints contain averages that have in and of themselves a margin of error. This margin of error was not accounted for in the calculation or analyses of the hypothesis in question. Due to the large numbers, though, it is suspected that the unaccounted margin of error would not adversely affect the results of the analysis. Another issue that presents itself is that of data collection. The data that the analysis is based off of does not use the official city limits as its boundaries for population and emissions, instead it includes a slightly wider area. In some sense this might make our data more accurate because it includes the grey area between urban and suburban areas.

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