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Analyzing Affordability: Supporting Households under New York's Cap-Trade-and-Invest Policy

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About RFF

Resources for the Future (RFF) is an independent, nonprofit research institution in Washington, DC. Its mission is to improve environmental, energy, and natural resource decisions through impartial economic research and policy engagement. RFF is committed to being the most widely trusted source of research insights and policy solutions leading to a healthy environment and a thriving economy.

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About NYC-EJA

The New York City Environmental Justice Alliance (NYC-EJA) is a non-profit, 501(c)3 citywide membership network linking grassroots organizations from low-income neighborhoods and communities of color in their struggle for environmental justice. NYC-EJA empowers its member organizations to advocate for improved environmental conditions and against inequitable environmental burdens by the coordination of campaigns designed to inform City and State policies.

Sharing Our Work

1. Introduction

New York State is working to implement policies that will decarbonize the state's economy and meet the full requirements of the Climate Leadership and Community Protection Act (CLCPA). The CLCPA requires the state to reduce statewide greenhouse gas (GHG) emissions by 40 percent by 2030 and 85 percent by 2050 (relative to 1990 levels) and to achieve net-zero GHG emissions economy-wide. Additionally, the state must direct at least 35 to 40 percent of climate investments and benefits to disadvantaged communities, as defined by the Climate Justice Working Group.

Since 2023, the state has been designing a cap-trade-and-invest (CTI) program to help meet its emissions reduction requirements. CTI would encourage decarbonization by pricing emissions and increasing the costs of using fossil fuels while also subsidizing (the "invest" side) the adoption of low-carbon technologies, such as heat pumps and electric vehicles. The program would establish an auction for emissions allowances and require emitting entities to purchase allowances based on their emissions.

Analyses from the New York State Energy Research and Development Authority (NYSERDA) and Resources for the Future (RFF) offer evidence that a CTI program, alongside other emissions reduction investments and policies the state has adopted or is considering, can significantly reduce GHG and conventional air pollution emissions in New York State, compared with both a business-as-usual scenario and the historical baseline of emissions (NYSERDA and DEC 2024; Krupnick et al. 2024). Additional work by RFF has found that program guardrails like facility-specific caps can further reduce harmful emissions near disadvantaged communities and improve air quality across much of the state without adding significantly to costs (Krupnick et al. 2024; Robertson et al. 2024a, 2024b).

Despite the air quality and health improvements that could result from a CTI program (Krupnick et al. 2024; Robertson et al. 2024a, 2024b; NYSERDA and DEC 2024), some state policymakers and business groups, expressing concern about the affordability of the program and the additional costs that New York households could incur, have argued for dampening the program's ambition on emissions reductions to ensure lower costs (Marcus 2024). This paper analyzes the affordability of CTI for different income groups and communities by exploring how the program may affect the cost of fossil fuels and deliver benefits to households in the form of program subsidies and what we call "dividends"—payments not tied to particular energy-saving behaviors or investments.

We investigate how different allowance-funded investment and dividend strategies can affect transportation and residential energy costs (both gross and net) faced by New York households. We analyze two allowance price ceilings (informed by Scenarios A and C in the NYSERDA and DEC 2024 analysis) and potential strategies for distributing revenues and decarbonization incentives. Across these scenarios, we consider how different distributions from the Consumer Climate Action Account (CCAA) could affect average costs for low- and middle-income households. We find the following:

1. A CTI program can **financially benefit households** across most income groups and geographies in New York State.
2. New Yorkers across income groups could **pay less** to operate an electrified household than to operate a household that runs on fossil fuels.
3. Compared with a low allowance price (NYSERDA-DEC Scenario C), a high allowance price (NYSERDA-DEC Scenario A) could make many New Yorkers **better off** by increasing the revenue available for dividends to households.
4. Targeting dividends by geography and income can help **cover costs and create more savings** for households earning up to $200,000 per year.
5. The electrification observed in our study is largely driven by existing federal and state policies, but investment of CTI revenues can **lower costs** for households transitioning to heat pumps for heating and cooling and electric vehicles. Investments to reduce structural barriers that prevent certain households from electrifying could encourage further heat pump adoption.
6. A high allowance price (Scenario A) would result in significantly greater reductions in GHG and copollutant emissions (i.e., SO_2, NO_X, and direct $PM_{2.5}$) compared with the low allowance price scenario (Scenario C).

Overall, we find that the CTI program could result in net savings for many New Yorkers, especially when dividends are targeted by region and income. Furthermore, a high allowance price paired with a targeted dividend distribution strategy yields the greatest benefits for many New Yorkers, particularly those making less than $200,000 per year. The CTI revenue could be invested to reduce the transportation and energy cost burdens and put dollars back in New Yorkers' wallets while yielding greater emissions reductions and climate benefits.

2. What Makes a Policy Affordable?

The best practice in policy evaluation is to consider the overall costs and benefits of a policy (what economists call economic welfare effects) as well as the distributional effects (i.e., how the costs and benefits are distributed across various stakeholders and income groups). Using the welfare metric, households can be said to be "better off" as a result of one policy versus another. A welfare calculation considers the pocketbook costs of a policy but could also extend to health effects or lost value from behavior changes, like driving less or turning down the thermostat. Because this type of welfare calculation is difficult even for simple policies, a less comprehensive metric is commonly used—namely, affordability.

Although the general concept of affordability is familiar, in the context of energy, a policy's affordability is generally determined by a household's ability to pay its bills while maintaining a basic level of comfort and security. For the purposes of this paper, we use two main metrics to assess affordability. The first is overall expenditure changes: simply put, how much money a household spends on energy, fuels, vehicles, and relevant appliances (costs) compared with any payments or subsidies they receive from the CTI program (benefits). The second metric is changes in energy and transportation cost burdens. This metric also uses information about expenditure changes but contextualizes them by representing them as a share of a household's overall income.

3. Implications for a CTI Policy Context

CTI programs require emitters to purchase an allowance for each ton of covered emissions they produce. By restricting the number of allowances available for sale over time, the state can drive down emissions and generate revenues to help fund further investments to support the decarbonization of communities. Covered firms have an incentive to identify the lowest-cost ways to reduce their emissions and thus their obligation to purchase allowances. However, buying emissions allowances creates costs for firms, which they may pass on to consumers in the form of higher prices for fossil fuels. These increased costs can also affect the costs of other goods and services. Stakeholders citing affordability concerns related to CTI are usually referring to these increased costs and whether they will create hardship for consumers, particularly low- and middle-income (LMI) households.

Affordability concerns can be addressed in many ways, all of which are being considered by state policymakers:

- **Distributing proceeds from allowance sales directly to households.** A portion of proceeds from the New York CTI program are set aside for the CCAA, which will redistribute funds directly to New York households. These distributions are not directly tied to increased household costs but may vary based on region and income to provide greater assistance to those households most in need. The NYSERDA and DEC (2023) affordability study goes into detail about how these funds might be distributed and looks at comparable support programs. Distributions can provide financial support to households, but they don't necessarily further New York's decarbonization goals, since households may spend the proceeds on whatever they prefer. In this paper, we call these payments "dividends" (a term commonly used for a similar policy in California).
- **Using proceeds to support decarbonization, thereby reducing exposure to higher fossil fuel prices.** Proceeds can be used to encourage a shift to energy-efficient and low-carbon technologies and behaviors. This approach increases the emissions reductions associated with the program by increasing use of clean energy alternatives, like electric vehicles and heat pumps. As households decarbonize, they will be less exposed to the higher fossil fuel prices under CTI. However, these incentives will be used by only some households (unlike the CCAA payments, which can be distributed broadly). In this paper, we refer to this use of proceeds as "investments."
- **Setting limits on allowance prices.** Finally, the state's preproposal outline and analysis considered implementing a price ceiling on allowances: once allowances reach a certain price, firms would be able to purchase an unlimited number of "price ceiling units" at that price. Price ceilings effectively allow emissions to exceed the cap if costs get sufficiently high. Price ceilings can provide certainty about maximum costs of a CTI program, but they reduce proceeds that could be used for investments and could force the state to rely on other, less efficient programs to achieve the legally required emissions reductions outlined in the CLCPA. All existing CTI programs in the United States have a price ceiling in place, but the level of the price ceiling can affect program outcomes.

4. Methodology

This analysis leverages two energy models that estimate energy use, one for residential buildings and one for light-duty vehicles. The assumptions on allowance prices and revenues are derived from the NYSERDA and DEC preliminary analyses, which tested the effects of three price ceilings for allowances in the CTI program.

The residential model used in this study is an updated version[1] of the model presented in Poblete-Cazenave and Pachauri (2021) and Poblete-Cazenave and Rao (2023). In this discrete-continuous choice model, households choose among various technologies, fuels, and consumption levels to satisfy their heating needs based on household, dwelling, and location characteristics. Different parts of the model are estimated separately: the adoption of heating technologies is estimated on a biannual panel of households from the American Housing Survey (AHS) for the years 2019–2023 and tested on the subset of households in the mid-Atlantic region. The heterogeneous causal effects of heating appliances on expenditures are estimated with data from the Residential Energy Consumption Survey (RECS) corresponding to the year 2020 and tested on the subset of households in New York State. Finally, the models are applied to the sample of New York households in the American Community Survey of 2020, which is projected to the year 2030 in line with the assumptions and scenarios from the Annual Energy Outlook 2023. The model simulates heating appliance and fuel consumption choices for each household in the sample (approximately 75,000 households), which are then aggregated in various ways for the presentation of results.

We use RFF's light-duty transportation model to predict new vehicle sales, miles traveled, consumer expenditures, and emissions through 2030. The model distinguishes consumer groups based on income, number of household-owned vehicles, population density by zip code, and region (Leard et al. 2023). Each simulation year, consumers first decide whether to scrap their older vehicles, depending on the vehicles' expected resale value net of scrappage subsidies. Subsequently, consumers may adjust their vehicle holdings by selling remaining vehicles or purchasing new or used vehicles. Consumers make these choices to maximize their subjective well-being, based on the vehicles' prices, expected fuel costs, horsepower, size, body type (sedan, sport utility vehicle, etc.), local electric vehicle (EV) charging availability, and other attributes. Having chosen which vehicles to own, consumers decide how much to drive those vehicles, depending on the vehicles' age, fuel costs, manufacturer and whether they are classified as cars or light trucks.

New-vehicle manufacturers choose vehicle prices and attributes to maximize their profits, given consumer preferences and policies such as federal GHG standards, EV subsidies in the Inflation Reduction Act (IRA), and California's Advanced Clean Cars

1 Unlike previous iterations of the model, the model is not constrained by linearity assumptions and determines heterogeneous causal effects of different heating appliances on fuel expenditures depending on fuel prices, by taking advantage of state-of-the-art machine learning methods, particularly gradient boosting regressions and classifiers (Friedman 2001) and causal forests (Athey et al. 2019).

Program (ACC2). New-vehicle prices and attributes, as well as compliance credit prices in the GHG and ACC2 programs, are determined to balance new-vehicle supply and demand. Across scenarios, the effects of EV subsidies on vehicle purchase prices account for price negotiations between vehicle buyers and sellers as well as changes in GHG and ACC2 credit prices. Nearly all model parameters are estimated using consumer and manufacturer choices observed in the InMoment New Vehicle Customers Study from 2010–2020 and the National Household Travel Survey from 2017–2022.

With those two models, we analyze three cases to investigate the affordability of a CTI program:

- Business-as-usual (BAU) case, with no New York CTI;
- New York CTI using prices from Scenario A in the NYSERDA and DEC analysis (2024); and
- New York CTI using prices from Scenario C in the NYSERDA and DEC analysis (2024).

The BAU case has no CTI program in effect and no new emissions-reducing investments beyond current policies. The household costs in this case act as a baseline for comparing the scenarios. The BAU includes current New York and federal policies (like the IRA) that might influence emissions and household costs. We then model two CTI allowance prices using the highest and lowest prices assessed in the NYSERDA and DEC analysis (2024). In that analysis, Scenario A (our high-price case) starts at $23 in 2025 and goes up to $64 in 2030; the price in Scenario C (our low-price case) is $14 in 2025 and increases to $30 in 2030. Both cases reflect price ceiling options that are binding according to the state analysis, meaning the ceilings set the market allowance price. We assume the CTI revenue is used for investments in programs and policies such as heat pump and EV subsidies, detailed in Appendix A. We also test the effect of allowance prices alone (without investments) on households and the effect of removing IRA subsidies to reflect possible actions by the new presidential administration and provide a richer and possibly more relevant policy analysis.

For each scenario we assess effects by income group and region. We include eight income groups, which are defined consistently throughout the analysis. For regional comparison, we use Public Use Microdata Areas (PUMAs), which are designed to have a minimum of 100,000 residents. PUMAs are smaller than counties but larger than census tracts and vary in size depending on population density.

5. Results

5.1. Electrified households have lower costs than households that run on fossil fuels.

Table 1. Annual Savings for Fossil Fuel vs. Fully Electrified Households, by Scenario, 2030

Scenario	Sectoral Savings: Fossil vs. Electric	Household income (thousands)							
		$0–25	$25–50	$50–75	$75–100	$100–125	$125–150	$150–200	>$200
BAU	Transport	$427	$886	$1,164	$1,281	$1,385	$1,561	$1,531	$1,220
	Heating	–$3	$34	$70	$95	$222	$18	$174	$164
High allowance price	Transport	$466	$988	$1,297	$1,451	$1,588	$1,833	$1,844	$1,490
	Heating	$27	$70	$96	$95	$276	$77	$121	$161
Low allowance price	Transport	$430	$916	$1,194	$1,325	$1,449	$1,662	$1,648	$1,323
	Heating	–$7	$31	$68	$52	$223	$13	$99	$138

Note: Variation across income groups is due to different energy consumption patterns and number of vehicles. Only operating costs are considered; program investments or dividends are not included. In this table, "fossil households" are defined as those operating gas vehicles and a gas furnace. Negative values indicate a higher cost for operating electrified equipment.

Table 1 demonstrates that households across income groups could save hundreds of dollars a year by electrifying their transportation and home heating. In the BAU, without any additional carbon cap restrictions, households operating EVs (the number of vehicles varies by income group) and a heat pump save on average $424 to $1,706 depending on income, compared with "fossil fuel households"—those still operating gasoline vehicles and a gas furnace.[2] Most of the savings are associated with the switch from gasoline vehicles to electric vehicles, with relatively smaller savings in home heating.[3] Indeed, in the lowest income group, heat pump operation costs are

2 This table does not assess savings compared to households operating a propane or a fuel oil heating system. They are included in the rest of the analysis unless otherwise specified.

3 Our residential model uses AHS and RECS data to estimate the adoption and energy consumption of different appliances. Observed data in RECS indicates households with heat pumps in New York State have lower operating costs than households with other

roughly equivalent to gas furnace operating costs. **With a CTI program in place, savings from full electrification are higher.** In the high allowance price case, savings in 2030 are larger than in the low-price case (ranging between $492 and $1,965 per year) because the relative difference between the cost of electricity and the cost of fossil fuels is greater. These cost differences are based solely on operating expenses for existing equipment, excluding investment incentives and dividends. Irrespective of the price ceiling level, savings from electrification are relatively lower among low-income households because they tend to spend less overall on fossil fuels. They own fewer cars, for instance, so they drive fewer miles and use less gasoline (even though their cars may be older and less fuel efficient). Across all income groups, these household savings highlight the importance of supporting electrification and energy efficiency by lowering initial purchase costs for new vehicles and appliances (through subsidies like those we model), building infrastructure like charging stations, and readying homes for electrification through weatherization, electric panel upgrades, and other building "shell" enhancements.

5.2. Existing subsidies drive electrification, and new investments lower costs for households.

In our modeling, we observe that heat pump subsidies funded by the IRA drive the majority of heat pump adoption in New York State. Additional subsidies funded by CTI proceeds make the most difference in adoption in the highest income categories ($150,000 to $200,000, and over $200,000) for heat pumps. EV adoption is largely driven by the zero-emissions vehicle (ZEV) mandate in the BAU. Generally, our results indicate that most of the state funding dedicated to heat pump and EV subsidies does not catalyze additional clean technology deployment, but it lowers the upfront purchase costs for households who would already have made EV or heat pump purchases because of IRA subsidies and the ZEV mandate. For example, average annualized household spending on heat pumps decreases from $10.32 in the BAU case to 40 cents in the high allowance price case.[4]

Across the policy cases, the IRA policies invest approximately $18 billion in New York electrification between 2026 and 2030. That would amount to about 80 percent of CTI revenues in the low-price case and 40 percent of revenues in the high-price case over the same period. Due to uncertainty about whether federal subsidies will continue under the new administration, we modeled a case in which New York adopts CTI but the IRA incentives are eliminated. We found that energy costs and spending on vehicles and appliances were affected, particularly for middle- and high- income households that were taking advantage of IRA subsidies to electrify (Table 2).

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equipment. This may be in part because dwellings that currently have heat pumps are better prepared to maximize heat pump efficiency than the ones who don't. While our operating cost data is informed by home size, age, a self-reported measure of insulation quality and other factors, the cost of operating heat pumps in the remaining stock is still estimated based on costs of current heat pump owners.

4 The average annualized spending includes homes that don't buy heat pumps, those are fully subsidized (zero cost), and those who pay up to full price for a heat pump.

Table 2. Annual Household Cost Effects of Removing Federal IRA Subsidies, by Scenario, 2030

	Household income (thousands)							
Scenario	**$0–25**	**$25–50**	**$50–75**	**$75–100**	**$100–125**	**$125–150**	**$150–200**	**>$200**
High allowance price	–$3.42	–$7.10	–$5.28	$27.93	$50.59	–$ 5.46	$65.35	$91.83
Low allowance price	$21.54	$12.45	$14.54	$40.28	$60.37	$7.00	$56.65	$65.21

Note: Costs include increased spending on heat pumps and EVs as a result of reduced subsidies, as well as increased spending on fossil fuels from households that don't electrify without the IRA. Small negative values imply lower average spending by households in the absence of the IRA, which occurs because of changes in behavior in the transportation sector in the absence of IRA subsidies. Mainly, ACC targets are met with more efficient gas vehicles, which decreases fuel spending among more households, especially low income households unlikely to adopt EVs even with the IRA subsidies.

Even without the IRA, our modeling indicates that CTI encourages significant household electrification: CTI allowance prices and subsidies prompt heat pump adoption in about 3 million households in the high-price case and 2.9 million households in the low-price case.[5] This indicates that even the $5.55 billion in heat pump subsidies between 2026 and 2030 in the low allowance price case could support significant electrification. Additional funds available in a high allowance price scenario could be directed toward complementary electrification readiness policies, such as lead, asbestos, and mold removal, insulation, and electric panel upgrades, though we cannot represent those in our modeling. Appendix A offers more detail on the subsidies modeled and the amount of spending in each CTI policy case.

A limitation of our modeling is that we cannot accurately account for total construction or installation costs associated with heat pumps. Demand for heat pumps in the model is implicitly informed by these additional costs but shows up in our modeling as additional "friction" that makes certain households very unlikely to adopt heat pumps even with generous subsidies. This friction is based on observed data and represents barriers in the real world that prevent people from switching to heat pumps. Policymakers may need to address these overlooked challenges to accelerate home electrification across the state. Our model estimates that low-income households are particularly unlikely to purchase heat pumps if they have any of the following: elderly residents, a larger home with more rooms, a newer home with newer appliances, or water-heating and cooking appliances that rely on natural gas. These sources of friction offer supporting evidence that policies and additional investments beyond direct heat pump subsidies could help foster heat pump adoption.

5 These adoption rates are significantly higher than those estimated by NYSERDA and DEC (2024). We include a sensitivity that tests affordability impacts under lower heat pump adoption in Appendix B.

5.3. Expenditure changes are proportional to household spending on energy.

We calculated household costs under a CTI program across income groups before using all the CTI revenue for dividends. In general, we find that costs are not regressive, meaning that on a percentage basis, costs in 2030 relative to BAU increase more for high-income households, irrespective of the allowance price. For instance, with a high allowance price, costs for the lowest income group increase 3 percent over the BAU, whereas costs for households with income between $50,000 and $150,000 increase 5 to 7 percent (Table 3). Overall, gross household cost increases are slightly higher with the higher allowance price, as expected. However, we find that we can largely offset these higher costs with the higher revenue generated for the CCAA dividend payments, discussed below.

Table 3. Average Annual Home Expenditure Change from BAU, Including Capital Costs, 2030

	Household income (thousands)							
Scenario	**$0–25**	**$25–50**	**$50–75**	**$75–100**	**$100–125**	**$125–150**	**$150–200**	**>$200**
BAU	$3,121	$4,041	$4,407	$5,470	$6,506	$7,299	$8,430	$10,715
High allowance price	3%	3%	6%	5%	6%	7%	5%	4%
Low allowance price	2%	2%	3%	2%	3%	3%	2%	2%

We also consider how these cost changes relate to household income. Energy and transportation burdens on households are typically calculated by dividing the amount of spending on home energy and transportation fuels by a household's income. A household is considered energy burdened when it spends 6 percent or more of its income on home energy and is considered transportation burdened when it spends more than 4 percent of its income on transportation fuels (NREL 2024). In the BAU, the average household in the bottom two income groups spends a significant amount of its income on such costs and is considered burdened in both categories. Higher costs under a CTI program could increase those burdens for LMI households, absent the dividend payments. Table 4 shows how energy and transportation burdens could increase with a CTI program before dividends are distributed to households. Even though cost increases for low-income households are smaller in absolute terms, they make up a greater share of their household income, compared with the average cost increases for high-income households. When we explore options for distributing dividends in this analysis, maximizing savings for these burdened low-income groups is a top priority.

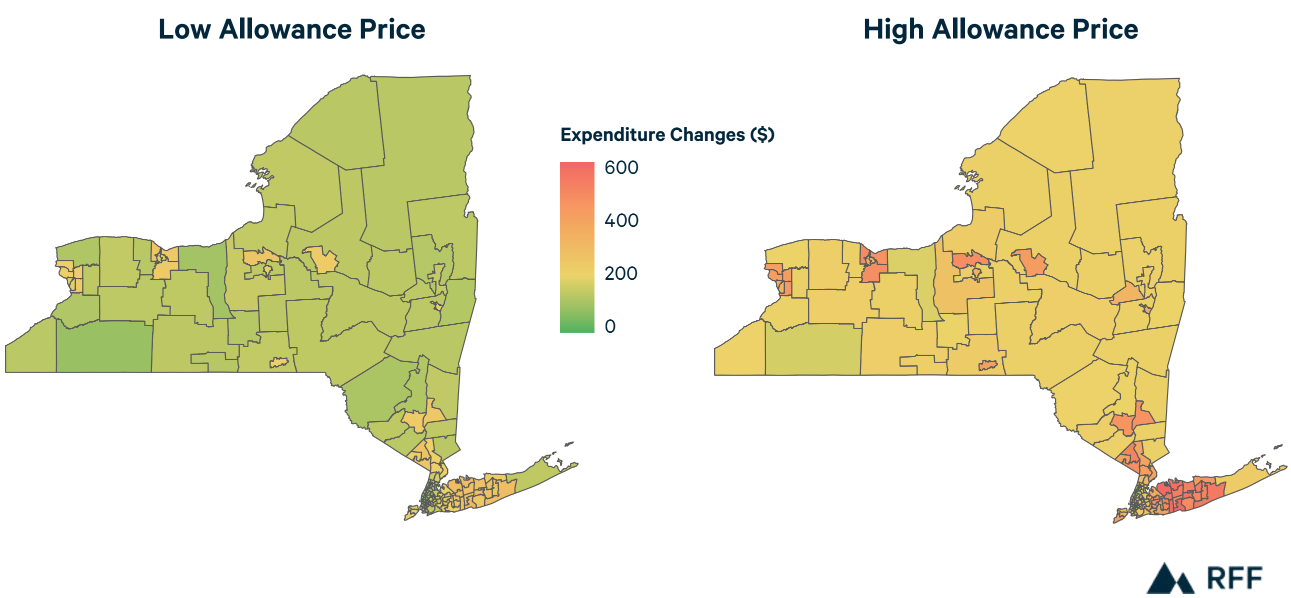
Table 4. Energy and Transportation Burdens in the BAU and Percentage Point Changes under CTI, without Dividends, 2030

	Household income (thousands)							
	$0–25	**$25–50**	**$50–75**	**$75–100**	**$100–125**	**$125–150**	**$150–200**	**>$200**
Burdens in the BAU								
Energy burden	13.8%	5.4%	3.5%	2.8%	2.3%	2.0%	1.8%	0.9%
Transport burden	9.1%	4.4%	2.9%	2.7%	2.8%	2.7%	2.5%	1.7%
Percentage point change in cumulative burden under CTI								
High allowance price	1.3	0.6	0.4	0.3	0.3	0.3	0.2	0.1
Low allowance price	0.7	0.3	0.2	0.1	0.2	0.2	0.1	0.1

5.4. Average costs for LMI households vary across the state.

Costs also vary by geography. Suburban and rural households tend to spend more on oil, natural gas, and gasoline than their New York City counterparts. Figure 1 shows the gross increases in expenditures for households making less than $125,000 a year, relative to the

Figure 1. Average Annual Expenditure Changes for LMI Households, by Scenario, 2030



Note: This figure shows average cost changes, before dividends, for households making less than $125,000 per year in each PUMA.

BAU, for high and low allowance prices before dividends are distributed. Expenditures include average spending on heating oil, natural gas, gasoline, electricity, home heating appliances (i.e., furnaces and heat pumps), and vehicles. Increased spending in downstate New York and Long Island is partly driven by the concentration of higher-income households, which tend to spend more on energy and transportation.

5.5. Dividends from the CCAA can cover costs for many households and even offer a net financial benefit.

New York State has pledged to set aside 30 percent of CTI program revenues for the Consumer Climate Action Account to "mitigate any consumer cost increases that could result from the NYCI program," (NYS n.d.). The high allowance price could generate more than $1.5 billion to distribute in 2027 and more than $3.5 billion in 2030 (NYSERDA & DEC 2024). The low allowance price generates less revenue to distribute: more than $900 million in 2027 and more than $1.6 billion in 2030. Table 5 shows the annual estimated budget for the CCAA, based on 30 percent of estimated program revenues.

Table 5. Annual Revenue for Consumer Climate Action Account (Billions), by Scenario

Scenario	2026	2027	2028	2029	2030
High allowance price	$1.53	$1.55	$3.37	$3.45	$3.52
Low allowance price	$0.91	$0.92	$1.57	$1.61	$1.65

5.6. Equal dividend payments can cover average costs for the lowest-income households.

To explore the effects of dividend distribution options, we first look at equal distributions to all households—a simple (if unlikely to be implemented) approach that gives us a baseline for comparison with other options. If funds are distributed equally among all households, the 2030 revenues are high enough to fully cover average increased costs for a New York household making less than $125,000 per year. Not only are average costs fully covered, but many LMI households even see financial gains compared with the BAU. Figure 2 shows net costs by income group and policy case in 2027 and 2030. Expenditure changes associated with energy use (red bars), procurement of home heating equipment and vehicles (orange bars), and the receipt of dividend payments (green bars) are represented. Increased costs are shown as positive numbers (above 0), and savings (household financial gains) are shown as negative numbers. The black dashes represent net expenditure. If the black dash is below zero, the program provides a net financial benefit based on the average household costs for that income group, and if the dash is above zero, the program results in a net cost increase.

As illustrated, the ability to cover the costs scales with the amount of revenue available for distribution in the form of dividend payments. For low- to middle-income groups, a higher allowance price and a larger dividend make them better off relative to the BAU (no CTI program), with the black dash for net costs well below zero, and relative to the low allowance price case. For higher-income households, the dividend payments cover a majority but not all the average price increases. By 2030, on average, LMI households are noticeably better off under the high allowance price case, with higher dividend payments outpacing cost increases. We also see evidence that investing the CTI revenue in the form of subsidies effectively lowers household spending on vehicles and home heating equipment. For low-income groups, negative orange bars show the average financial benefit of the scrappage subsidy. For high-income groups, negative orange bars show the use of heat pump and EV subsidies leveraged by those households.

Figure 2. Annual Costs and Savings with Equal Dividends, by Income Group, 2027 and 2030

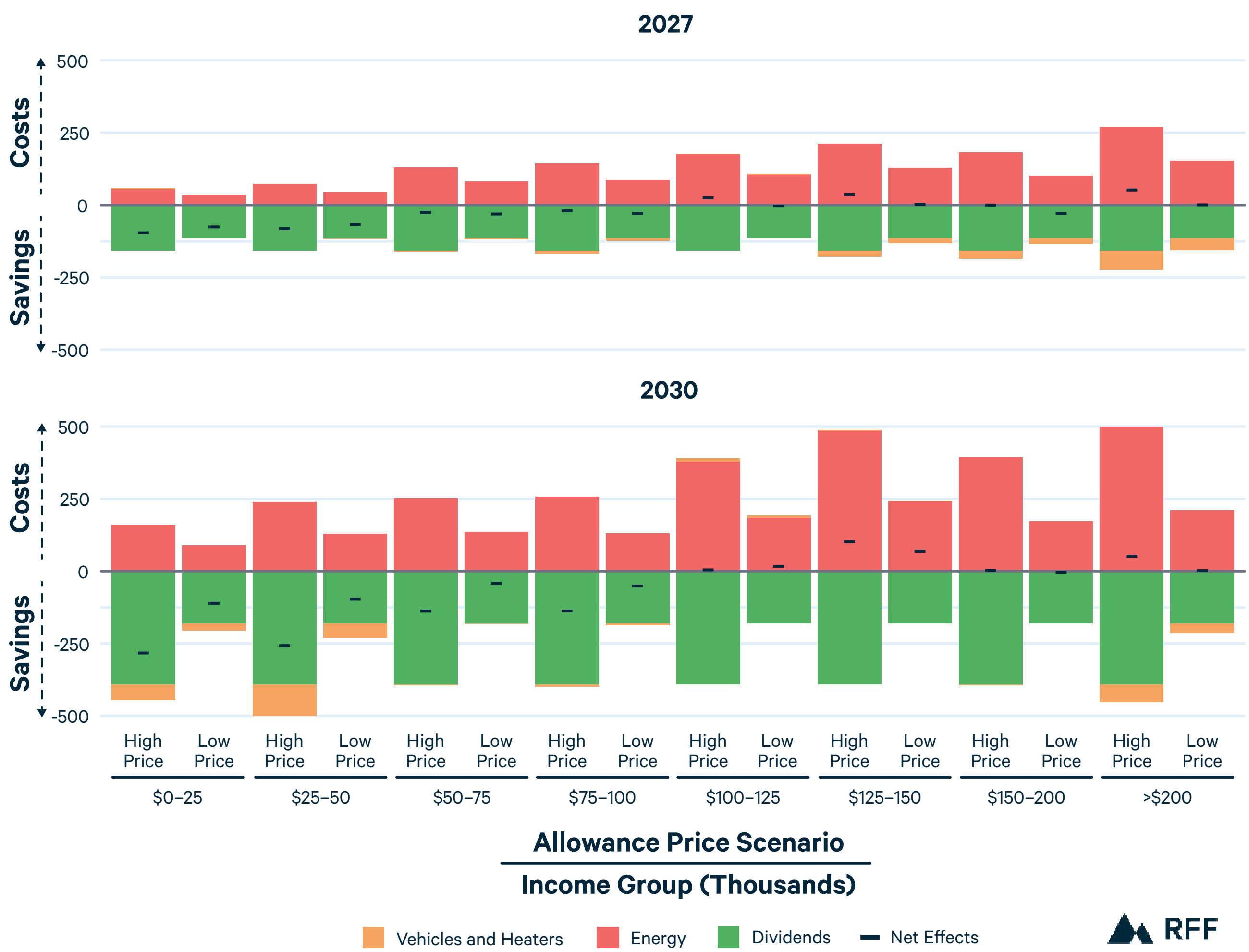
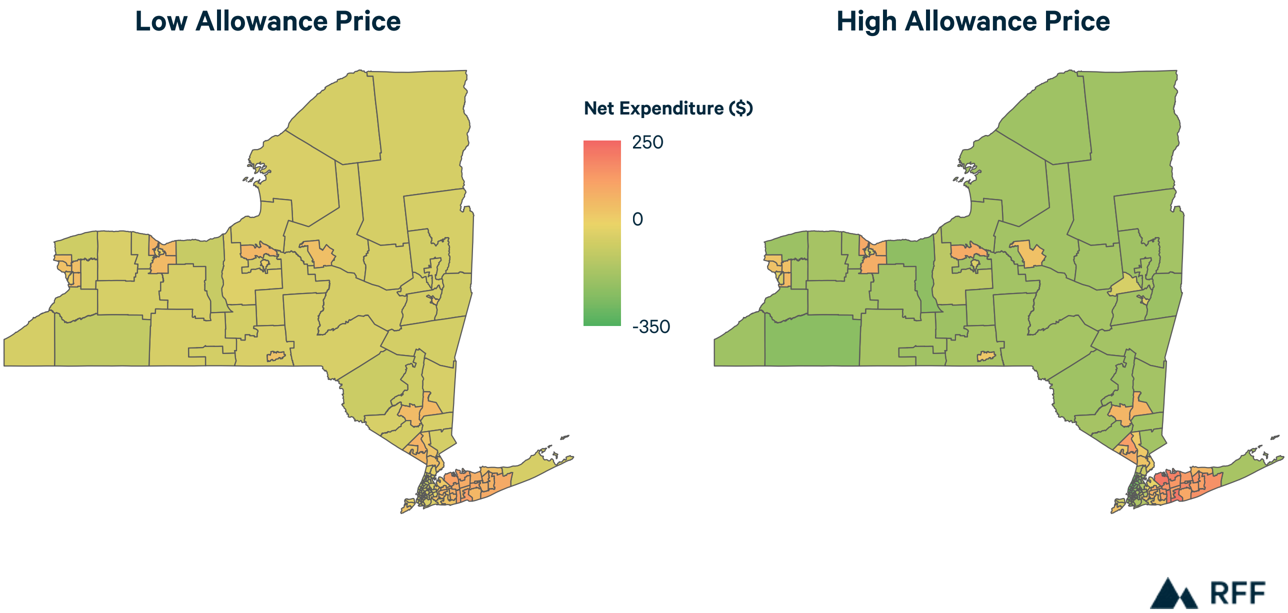


Figure 3. Average Annual Net Expenditures for LMI Households after Equal Distribution, by Scenario, 2030



Note: This figure shows average net expenditure for households making less than $125,000 per year in each PUMA. Negative numbers (green) indicate that CTI dividends exceed average increased costs in the PUMA for households making less than $125,000 per year.

The equal distribution approach could make average LMI households better off across many communities, but LMI households in certain regions could face average expenditure increases. Figure 3 shows that average households making less than $125,000 per year face different net expenditures depending on where they live. Energy spending varies geographically, so equal distribution of the dividend payments would benefit communities with lower average spending, like many areas upstate and in and around New York City. Differences in regional expenditures provide a compelling reason to distribute dividends in a targeted way that takes into account higher costs in specific regions.

5.7. Targeted distribution of dividend payments can cover increased expenditures across households more evenly, especially LMI households

Since CTI-driven expenditure changes vary by region and income group, we also evaluate household costs and savings when we target the distributions of dividend payments by region. We apply the same proportion of total CTI program revenue for dividend payments (30 percent of the overall Climate Action Fund) and distribute the funds proportionally to the 10 economic development regions in New York State (ESD

Table 6. Annual Targeted Distributions to Households Earning Less than $200,000, by Region, 2030

Economic development region	Percentage of total CTI costs	Dividend under high allowance price	Dividend under low allowance price
Capital	5.3%	$385	$174
Central	5.3%	$462	$217
Finger Lakes	8.1%	$532	$243
Long Island	20.6%	$927	$417
Mid-Hudson	13.8%	$589	$268
Mohawk Valley	2.4%	$433	$206
New York City	30.7%	$344	$170
North Country	1.5%	$319	$160
Southern Tier	3.2%	$388	$185
Western New York	9.2%	$539	$249

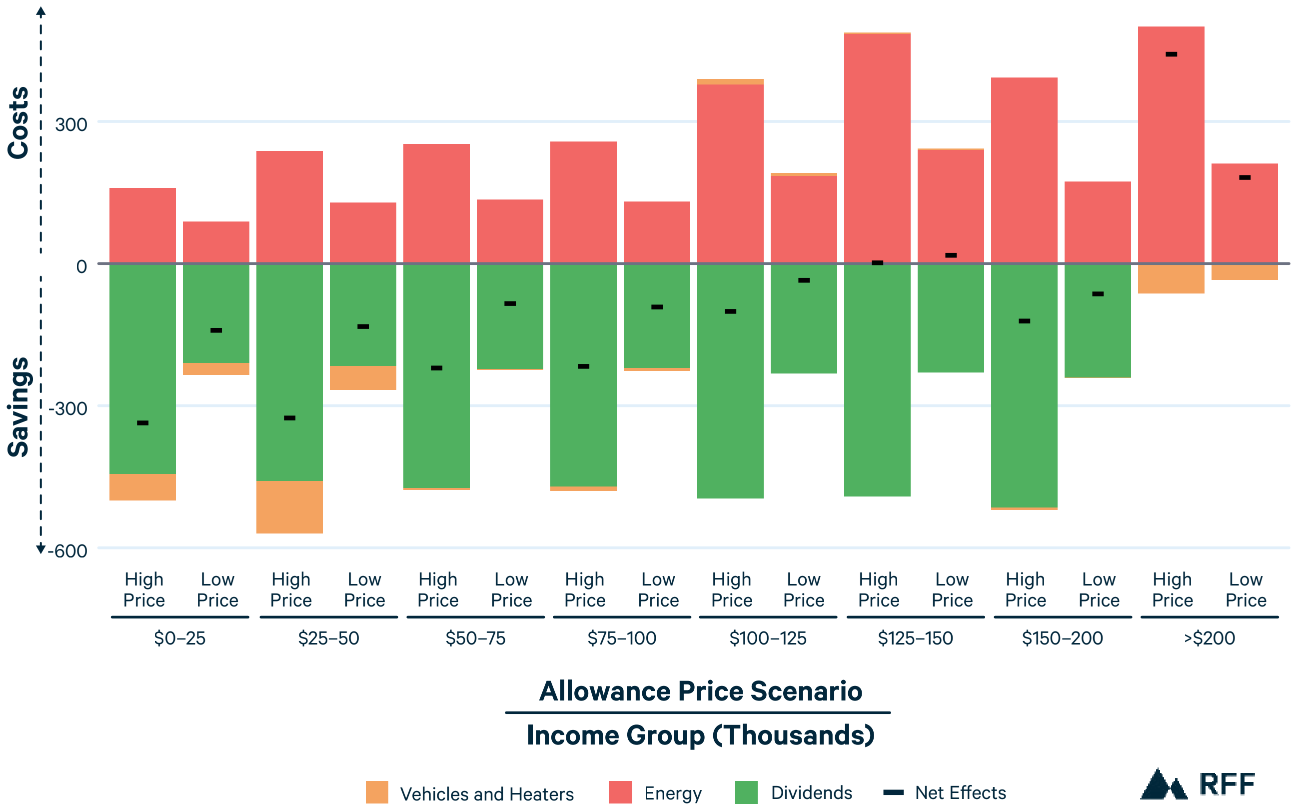
n.d.) based on the share of overall costs borne by each region for households making less than $200,000 per year. This approach weighs regional spending by the number of households and different energy consumption patterns (which reflect different household income levels).

After regional allocations are identified, the funds are distributed evenly among each region's households making less than $200,000 per year. This approach can scale with the amount of revenue raised by the program because the total dividend budget can be allocated accordingly. The resulting targeted distributions in 2030 are shown in Table 6.

Targeting the amount of the dividend payments by region and income leads to higher payments for households making less than $200,000 per year, compared with the equal distribution case. A comparison of Figure 4 and Figure 2 makes it clear that LMI New Yorkers experience a greater net benefit from the CTI revenues with a targeted dividend distribution strategy. Furthermore, although net expenditures for households making more than $200,000 per year increase (modestly,[6] relative to their income)

6 Costs are higher for the income group making more than $200,000, but it is important to put those costs in context, relative to annual income. For average households in that group, the increased expenditure on energy represents only 0.2 percent of their income in the high price case, and just 0.1 percent of their income in the low price case.

Figure 4. Annual Costs and Savings with Targeted Dividends, by Income Group, 2030

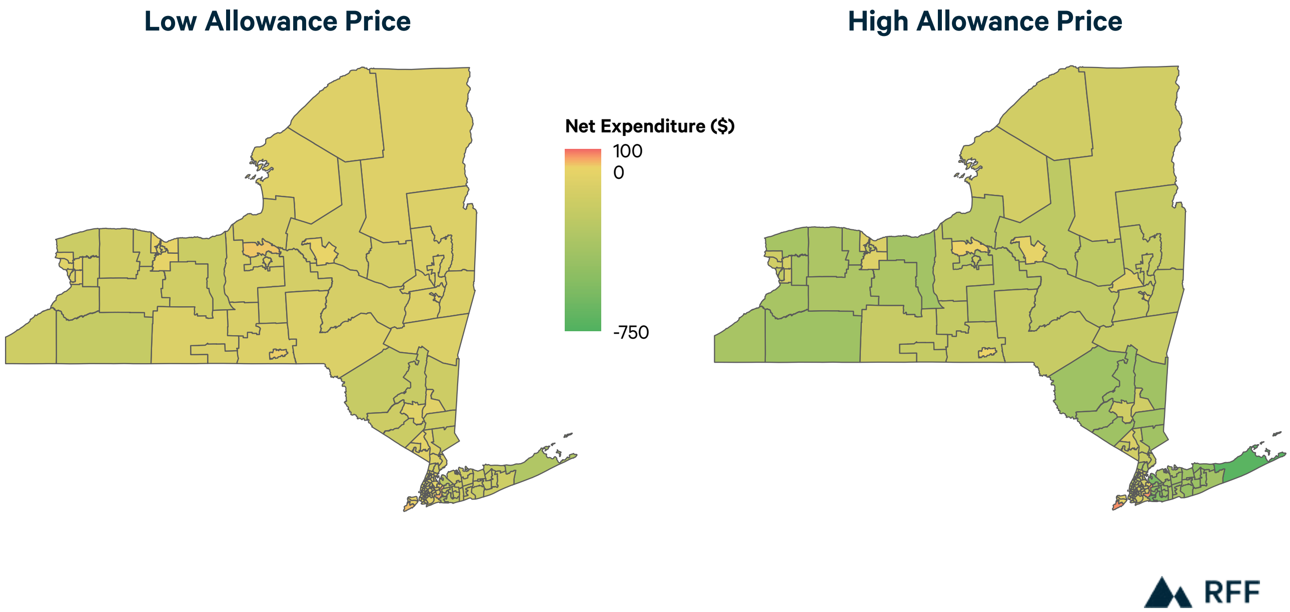


because they receive no dividends, the average costs across the lower-income groups are fully compensated or more than fully compensated (i.e., households save money) for their increased spending (black dashes below zero). This pattern holds for renters, who may have limited ability to electrify their heating systems.[7] Figure 4 also shows that if dividend distributions are targeted, average LMI households are even better off in the high-price scenario than in the low-price scenario because the former generates more revenue to distribute. When the black bars representing net expenditures are lower in the high price bars than the low price bars, that represents savings for households under a high allowance price case.

Targeting dividends based on regional costs can help households cover higher expenditures under CTI in all regions—including areas with higher home heating and transportation costs. Figure 5 shows that for households making less than $125,000 per year in each PUMA, average costs could be fully covered by a targeted rebate strategy. In contrast, Figure 3 shows that in some regions, an untargeted dividend approach leaves the same households with average net expenditure increases. Not only does targeting dividends cover costs, but in most PUMAs, the households making less than $125,000 per year experience on average a significant financial benefit from the program: dividend payments far outpace average cost increases, putting dollars

7 A version of Figure 4 that exclusively shows renters in New York State is included in Appendix B.

Figure 5. Average Annual Net Expenditures for LMI Households after Targeted Dividends, by Scenario, 2030



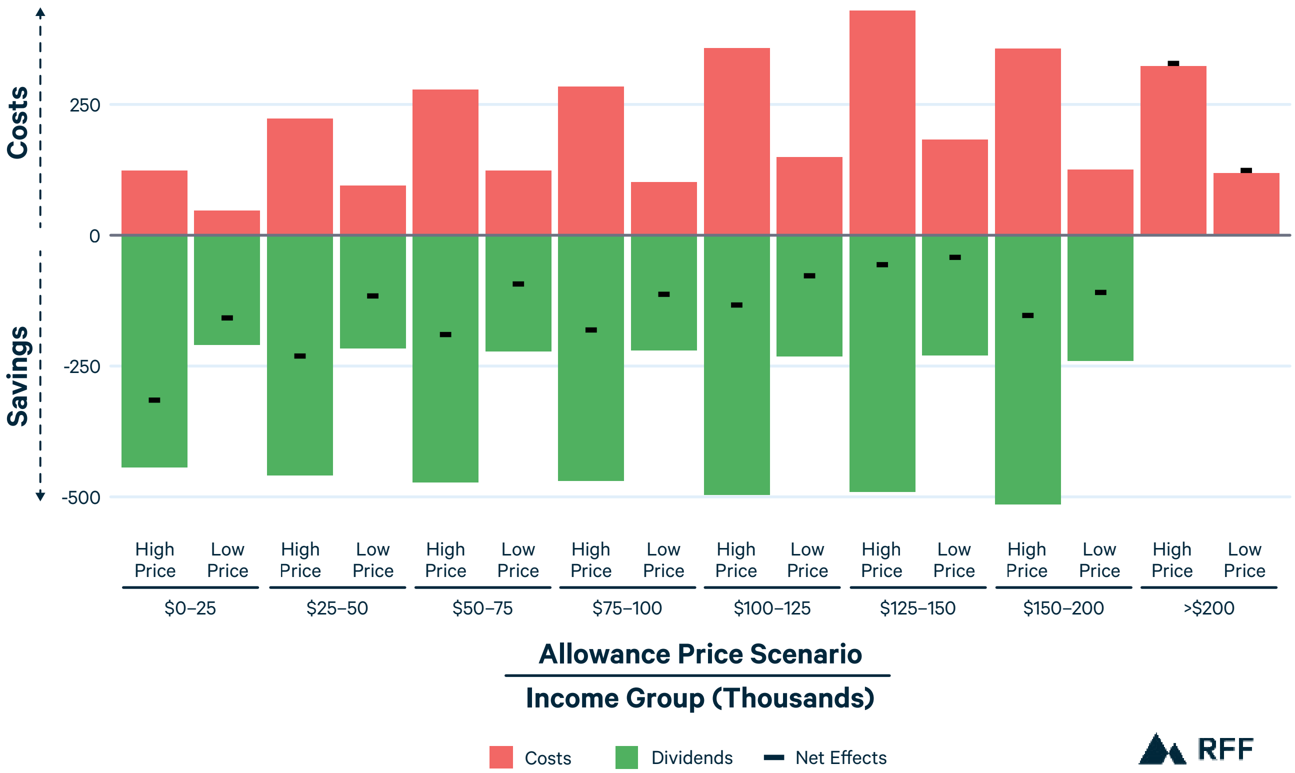
Note: This figure shows average net expenditure for households making less than $125,000 per year in each PUMA. Negative numbers (green) indicate that CTI dividends outweigh average increased costs for LMI households in most PUMAS.

in New Yorkers' wallets and generating savings for households. This is particularly true for the high allowance price case, which shows the greatest financial benefit for LMI households across the state. The pattern holds for regions with disadvantaged communities. Appendix B shows versions of these maps with disadvantaged communities highlighted.

5.8. Targeted dividends can cover costs for many households that don't electrify right away.

Figures 4 and 5 include both electrified households and those that have not electrified. Electrified households spend little to nothing on fossil fuels, so they are more insulated from fossil fuel price increases associated with a CTI program. These households may receive the full dividend but experience little to no increase in costs. Figure 6 shows average net expenditures for households that still operate gasoline vehicles and a natural gas furnace in each income group, after the CCAA dividends are applied. As illustrated by the black dashes that often sit below zero (i.e., with net savings), **for households making less than $200,000 a year, targeted dividend payments are greater than average costs even if they have not electrified by 2030.**

Figure 6. Annual Costs and Savings with Dividends for Households Dependent on Fossil Fuels, by Income Group, 2030



Note: This figure shows operating costs for gas vehicles and gas furnaces compared with average receipt of targeted dividends for each income group. Costs across income groups vary with consumption patterns, number of vehicles, and responsiveness to carbon prices.

5.9. Targeted dividends make up a greater share of income for low-income households than for high-income households.

Earlier in the report, we discussed the effect of increased costs on household energy and transportation burdens. Our modeling indicates that the dividend to households can offset much of the increase. In Table 7, we calculate the targeted dividend as a share of average income in each group. Compare the numbers in Tables 4 and 7 to see how costs compare to the targeted dividends. For the lowest income group, the dividend makes up a greater share of their income, equivalent to a 3.5 percent pay raise in the high price case and a 1.7 percent pay raise in low price case. Dividends that appear on energy bills as credits, as in California or as explored in the NYSERDA affordability analysis (2023), could also reduce household energy burdens.

Table 7. Annual Dividends to Households as Share of Income, by Scenario, 2030

	Household income (thousands)							
Scenario	**$0–25**	**$25–50**	**$50–75**	**$75–100**	**$100–125**	**$125–150**	**$150–200**	**>$200**
High allowance price dividend	3.5%	1.2%	0.8%	0.5%	0.4%	0.4%	0.3%	None
Low allowance price dividend	1.7%	0.6%	0.4%	0.3%	0.2%	0.2%	0.1%	None

5.10. A CTI program delivers important climate and health benefits.

This analysis shows how CTI allowance prices and dividend programs affect household costs. Many previous analyses, including several from this research team, have provided evidence that a CTI program delivers other critical economic and health benefits, including savings from reduced health care costs and mitigated climate damages (Krupnick et al. 2023, 2024). Here, we compare the GHG and copollutant emissions reductions in a CTI program under different allowance prices. We find that a high allowance price delivers significantly higher GHG and copollutant emissions reductions (in CO_2, SO_2, NO_X, and direct $PM_{2.5}$) than a low allowance price.

Table 8 shows the emissions levels for GHGs and major copollutants attributable to the residential and transportation sectors and the percentage reductions associated with each CTI allowance price. Copollutant reductions are greater than GHG reductions because of the substantial emissions reductions in the residential sector, which uses a significant amount of natural gas. Reductions in the transportation sector, largely driven by the ZEV mandate in the BAU, are smaller. For the building and transportation sectors more broadly (including commercial buildings and transportation besides light-

Table 8. GHG and Copollutant Emissions Effects in Residential and Light-Duty Transport Sectors, by Scenario, 2030

	GHGs		Copollutants		
	CO2	**Methane**	**SO2**	**NOX**	**Direct PM2.5**
BAU	88.41 MMT	11.22 MMT CO2e	3421.23 MT	153.89 MT	1386.32 MT
High allowance price	–15%	–3%	–32%	–38%	–48%
Low allowance price	–9%	–2%	–19%	–24%	–31%

duty vehicles), the state estimates a 7 to 9 percent GHG emissions reduction from the reference case, depending on the allowance price.[8]

Those reductions offer significant climate and copollutant-related health benefits. In the NYSERDA preproposal analysis, the state estimated that pollution reductions associated with CTI could deliver $2.5 billion to $6.5 billion in statewide health benefits in 2030 (NYSERDA and DEC 2024). Benefits from GHG reductions (CO_2 and methane) can also be quantified using the social cost of carbon. Based on the cumulative emissions reductions through 2030 associated with CTI (Table 8) and using RFF's most recent social cost of carbon estimate ($180/ton CO_2e from Rennert et al., 2022), CTI could deliver $6.6 billion to $9 billion in climate benefits (e.g., reduced peak temperatures, mitigated sea-level rise) by 2030. These benefits ought to be considered alongside the household economic effects we analyze in this brief.

6. Research Limitations

Several limitations to our research may affect the interpretation of results.

- We consider only the effects of changing fuel prices and costs of vehicles and heat pumps on household expenditures. We do not consider increased costs of other goods that might be affected by a CTI program.
- We present average expenditures by region and income group; we do not capture or report heterogeneity within these groups. Households with above average expenditures may experience higher net costs and households with below average expenditures could experience greater savings after dividends.
- The revenue estimates we use to determine investments and dividends are from the NYSERDA preproposal analysis (NYSERDA and DEC 2024), which uses different modeling, methodology, and estimates and produces different emissions results than our models. CTI program revenues are dependent on emissions reductions, so this method is imperfect. For example, our heat pump adoption (38 percent in 2030) is estimated to be much higher than the estimate produced by the state analysis (9 percent in 2030).[9] That could produce lower emissions and therefore less revenue for dividends and investments. On the other hand, we estimate lower EV adoption (8 percent in 2030) than the state analysis (25 percent in 2030). Adjusting the revenue was impractical because we did not have a precise match for our sectoral emissions to inform such an adjustment.
- We analyze changes in expenditure rather than welfare. For example, we do not assess the effects if, because of higher costs, a household uses less energy and as a result has a colder home or drives less, just as we do not include improved health or other forms of increased welfare.

8 Our modeled emissions reductions do not align with those estimated in the NYSERDA and DEC analysis, which anticipates more reductions in the transportation sector and fewer reductions in the residential sector.

9 A sensitivity analysis with lower heat pump adoption is included in Appendix B.

7. Conclusion

A CTI program can financially benefit households across most income groups and regions in New York State. Specifically, a CTI program with a high allowance price (NYSERDA Scenario A) generates more proceeds for investment and dividends, makes many New Yorkers financially better off, and drives more emissions reductions and associated public health improvements than a lower allowance price (Scenario C). Furthermore, households that electrify by 2030 spend much less on energy than those that remain on fossil fuels across all cases, including the business-as-usual case. We find that the additional revenue generated under the high allowance price case is sufficient to cover average household cost increases for those making less than $200,000 per year through a combination of investments (Climate Investment Account) and dividends (Consumer Climate Action Account) from the Climate Action Fund. Targeting dividends to regions and income groups with the greatest energy and transportation cost burdens enables low- and middle-income households to receive higher payments that in many cases outweigh the cost increases associated with CTI.

Our model estimated significant adoption of heat pumps under the IRA subsidies by 2030, with limited additional adoption if subsidies are increased under CTI. Although CTI investments work to reduce costs, many factors (e.g., installation costs and associated house retrofits) make it difficult for households to adopt heat pumps even if the cost of the equipment is fully covered. LMI households in particular may need more interventions to ready their homes for electrification (Levin et al. 2022). CTI revenue could be invested to lower these electrification barriers for households and increase heat pump adoption statewide. Similarly, EV adoption is largely driven by the requirements of the ZEV mandates, but CTI investments can be used to lower the capital costs of switching to EVs or to compensate lower-income households for scrapping older vehicles.

More detailed work could determine the optimal investment strategy for CTI revenues, but this paper illustrates that a CTI program could financially help many New Yorkers—addressing questions about the affordability of such a program. Our research shows that CTI could not only produce health and climate benefits but also generate dividends sufficient to cover or even exceed the costs for many New Yorkers.

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Appendix A. Investment Policy Description

In each CTI case, we distribute revenue to the same set of investment policies, but we change the investment budget to reflect the amount of revenue estimated for each allowance price. Table A1 shows the share of revenue that goes to each major spending category in our modeling, and the share set aside for direct dividends for households. The share for dividends is determined by state policy, and the level of spending for other investments was determined in partnership with NYC-EJA for this analysis.

Table A1. CTI Revenue Distribution

LMI heat pump subsidies	LMI shell upgrades	General heat pump subsidies	Vehicle scrappage	Personal EVs, home chargers	Household dividends
15%	5%	10%	2%	6%	30%

LMI = low- and middle-income.

Those shares account for only 68 percent of total revenue because we do not model all sectors or all potential uses of funds within a sector. Some revenues are unmodeled, assumed to be used for purposes we cannot capture in our models, such as program administration, investments in public transportation, incentives for commercial buildings, and support for residential electrification readiness (e.g., electric panel upgrades).

Table A2 shows the allowance price, revenue, and level of investment in each policy type for each policy case. Note that 2026, rather than 2025, is the first full year of the CTI program. Carbon prices and revenues are therefore delayed by one year, relative to the NYSERDA and DEC analyses.

Table A2. CTI Revenues and Investments (2022 USD), by Allowance Price, 2026–2030

	High allowance price					Low allowance price				
	2026	2027	2028	2029	2030	2026	2027	2028	2029	2030
Allowance price	$22.89	$24.03	$54.10	$57.35	$60.79	13.53	14.20	24.97	26.47	28.06
	Investments (Billions of Dollars)									
Auction revenue	$5.11	$5.18	$11.24	$11.49	$11.74	$3.02	$3.06	$5.22	$ 5.37	$ 5.51
LMI heat pump subsidies	$0.77	$0.78	$1.69	$1.72	$1.76	$0.45	$0.46	$0.78	$0.81	$0.83
LMI shell upgrades	$0.26	$0.26	$0.56	$0.57	$0.59	$0.15	$0.15	$0.26	$0.27	$0.28
General heat pump subsidies	$0.51	$0.52	$1.12	$1.15	$1.17	$0.30	$0.31	$0.52	$0.54	$0.55
Vehicle scrappage	$0.10	$0.10	$0.22	$0.23	$0.23	$0.06	$0.06	$0.10	$0.11	$0.11
Personal EVs, home chargers	$0.31	$0.31	$0.67	$0.69	$0.70	$0.18	$0.18	$0.31	$0.32	$0.33

EV = electric vehicle. LMI = low- and middle-income.

Table A3 shows details about the subsidies and incentives that we model across the residential and light-duty vehicle sectors.

Table A3. Investment Policies Modeled

Policy	All cases (BAU, CTI)	New York Cap-Trade-and-Invest policies only
Residential sector		
Heat pump subsidy	Existing NY Clean Heat program subsidy	In addition to existing incentives: • 100% heat pump cost subsidy for households with <90% of median income; • 80% heat pump cost subsidy for households with 90–150% of median income; • 60% heat pump cost subsidy for households with >150% of median income.
Fossil fuel phase-out	No fossil fuel systems in new buildings	Same as BAU
Building standards	Current building standards	Same as BAU
Shell efficiency upgrades	Baseline assumption of changes	Households with <150% of median income and low building efficiency receive subsidies to upgrade building shell; eligible homes are randomly selected until funds run out.
Light-duty vehicle sector		
Adopt California's Advanced Clean Cars 2 Regulations	68% of new light-duty vehicle sales are PEV by 2030 (expected 100% light-duty ZEV sales by 2035)	Same as BAU
Light-duty vehicle rebate for ZEVs	$7,500 federal subsidy from IRA, $2,000 for new EVs from NY Drive Clean rebate	In addition to federal and state subsidies: • $3,000 for new or used EV to households with <80% of median income; • $2,000 for new or used EV to households with 80–150% of median income; • $1,000 for new or used EV to households with >150% of median income.
Scrappage incentive	None	Subsidy for scrapping ICE vehicles 15 to 25 years old: • $3,000 per vehicle for households with >200% of federal poverty line; • $5,000 per vehicle for households with <200% of federal poverty line.
Infrastructure investments	IRA and BIL subsidies	In addition to IRA and BIL subsidies: • grants up to $2,000 for Level 2 home charger installation

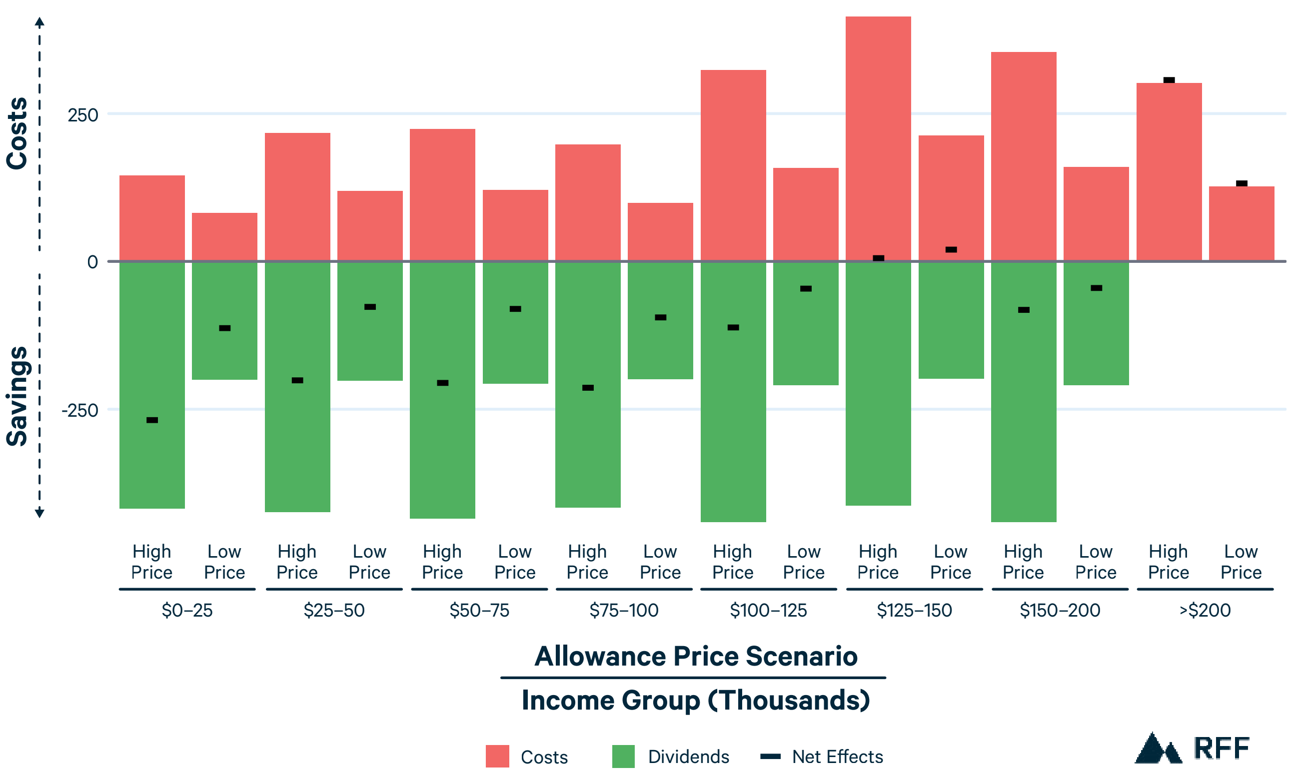
BAU = business as usual. BIL = Bipartisan Infrastructure Law. EV = electric vehicle. ICE = internal combustion engine. IRA = Inflation Reduction Act. PEV = plug-in electric vehicle. ZEV = zero-emissions vehicle.

Appendix B. Supplemental Results

B.1. Renters

Renters often have limited control over heating and air-conditioning equipment in their homes but may still be responsible for heating and cooling expenses. These households are mostly in the New York City metro area, which receives some of the lowest dividend payments in the targeted distribution strategy. We ran a test to see how the targeted dividends compare with the increased costs that renters would face under CTI. Figure B1 compares average cost increases (in red) and average dividend payments (in green) for each income group. Transportation costs are specific to the income group but not specific to renters. The general pattern from the broader results holds: for households across income groups making less than $200,000 per year, the targeted dividends generally outpace average cost increases (exceptions are the $125,000 to $150,000 group under both price caps).

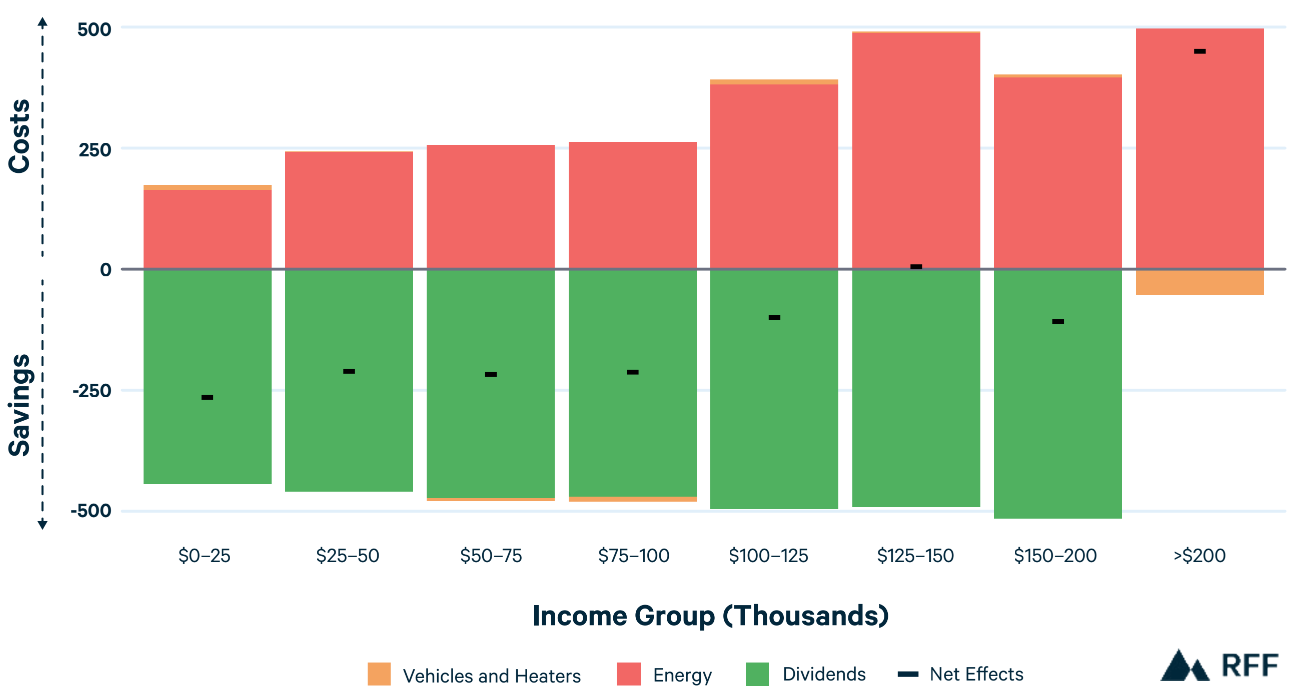
Figure B1. Annual Costs and Savings with Targeted Dividends for Renters, by Income Group, 2030



8.2. Lower Heat Pump Adoption

Our analysis estimates relatively high heat pump adoption, even in the BAU (around 38 percent) compared to the NYSERDA and DEC analysis, even with the CTI program in place (around 9 percent). A variety of assumptions and methodological differences explain this disparity, in the NYSERDA and DEC analysis, for instance, they assume 1 % heat pump adoption in 2025, although the New York RECS data show approximately a 4 percent adoption rate as of 2020. Thus, the State analysis likely underestimates future adoption from the policy. For our part, while our modeling is grounded in real-world observations on household demand for heat pumps, we also acknowledge that our model does not capture all potential barriers to heat pump adoption that the state considers (such as the need for weatherization) particularly as the population of early adopters is depleted. To assess how affordability results would be impacted if heat pump adoption was significantly lower, we ran a sensitivity analysis with heat pump prices 50 percent higher than in the core scenarios, and constrained subsidies from covering the full cost. This admittedly coarse approach to reduce adoption attempts to represent some of these uncaptured costs. Figure B2 shows that even with a significant increase in heat pump costs, and overall adoption at 25 percent in 2030 (which more closely reflects the Governor's stated target of 2 million climate friendly homes by the same date), targeted dividends could still exceed average household costs across most income groups.

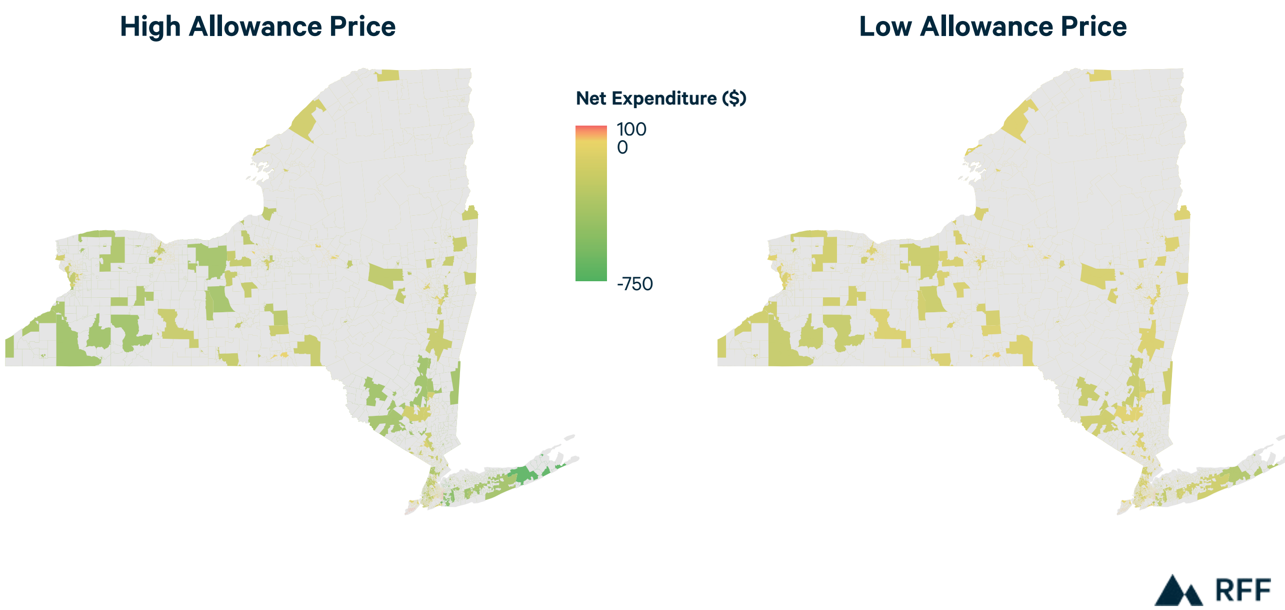
Figure B2. Annual Costs and Savings with Targeted Dividends with Limited Heat Pump Adoption, High Carbon Price Scenario, by income group, 2030



8.3. Disadvantaged Communities

The CLCPA requires the state to take special care to direct investments and reduce harm to disadvantaged communities (DACs), as defined by the Climate Justice Working Group. Figure B3 highlights DACs in the net-cost maps from Figure 5 and demonstrates that average LMI households in DACs are often better off (more green) in the high allowance price case because of the higher dividend payments. This follows the broader state trends discussed in the main text.

Figure B3. Average Annual Net Expenditures for LMI Households in DACs after Targeted Dividends, by Scenario, 2030



Note: This figure shows average net expenditure for households making less than $125,000 per year in each PUMA. Negative numbers (green) indicate that CTI dividends exceed average increased costs in the PUMA for households making less than $125,000 per year.